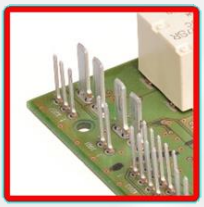
Föhrenbach®
Application Tooling

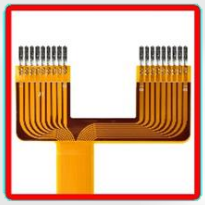
Application Machines and Tools for Connectors

Connector Mounting Machines

Whether standard

or customised





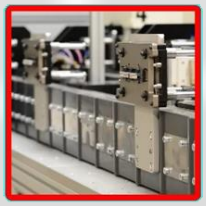
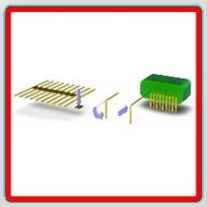




Table of Contents

Introduction page: 3

Application machines and tooling page: 4

Press- Fit page: 5

The UNIPRESS family page: 5

Insertion tooling page: 9

How UNIPRESS ensures quality and improve productivity page: 9

The ASPIM family page: 11

Flexible Circuits page: 13

Crimp quality page: 15

Crimping machines page: 16

Plug insertion tooling page: 19

Flex-to- flex or flex-to-wire applications page: 19

Clinch machines page: 20

IDC discrete wire or flat cable page: 21

Crimp – to – wire page: 24

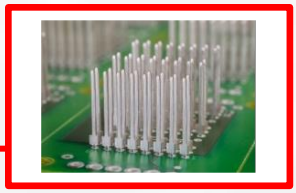
Direct attach page: 25

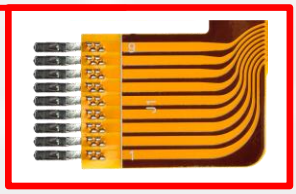
Connector mounting machines page: 26

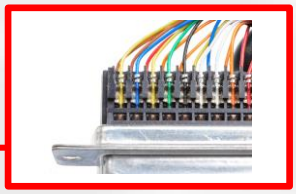
Single-head semi-automatic assembly station page: 27

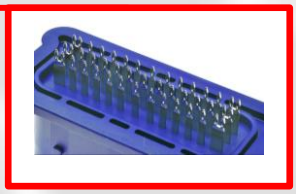
Multi-head semi-automatic assembly station page: 27

Fully automatic mounting machine page: 27









Föhrenbach Application Tooling N.V. is an independent Belgian company that is part of the Föhrenbach Group.

The Föhrenbach Group was established in 1975 and has facilities in Germany, Switzerland, Ireland and Belgium. The German, Swiss and Irish branches of the company specialise in the development and production of high-quality mechanical positioning slides.

Föhrenbach Application Tooling N.V. is located in a modern industrial building in Lier's Duwijck industrial zone where its administrative headquarters, development, lab, and production facilities are housed.

Föhrenbach Application Tooling N.V. is privately owned and is completely independent. This frees up our hands to put all our knowledge and experience at the unlimited service of our customers.

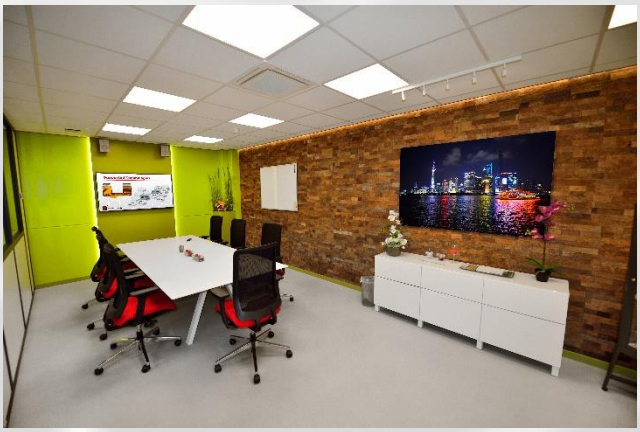
Föhrenbach Application Tooling N.V. has more than 36 years of experience in designing and manufacturing complex machines and tools for the interconnection industry. Our activities are based on two pillars: the design and production of application machines and tools, and the design and production of connector mounting machines.

The versatility of our mostly custom-made machines allows us to supply the following industries: telecom, data communication, white and brown goods, automotive, aerospace, the medical sector, public mass transportation such as trains and trams, cable manufacturers, connector manufacturers …

Our broad customer base is globally distributed across all continents. Many of them are reputable OEMs and CEMs. Smaller and simpler tools find their way to the market through an extensive international distributor network.

Starting from an embryonic idea, up to and including service of the production lines and equipment we supply, Föhrenbach Application Tooling N.V. is able to guide the entire economic life cycle of a project. We have also developed in-house disciplines including engineering support as well as the design, production, assembly and service of mechanical systems, software, computerized control systems, image processing and robotics. In many cases we are also involved in the production of prototypes and pre-series before actual mass production on our installations.

Föhrenbach Application Tooling N.V. - One step ahead



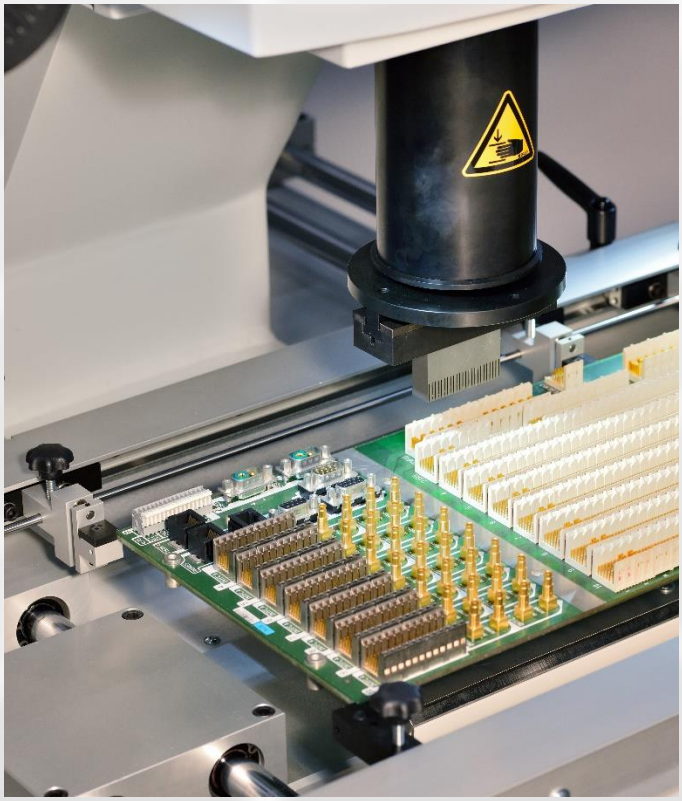
Application machines and tooling

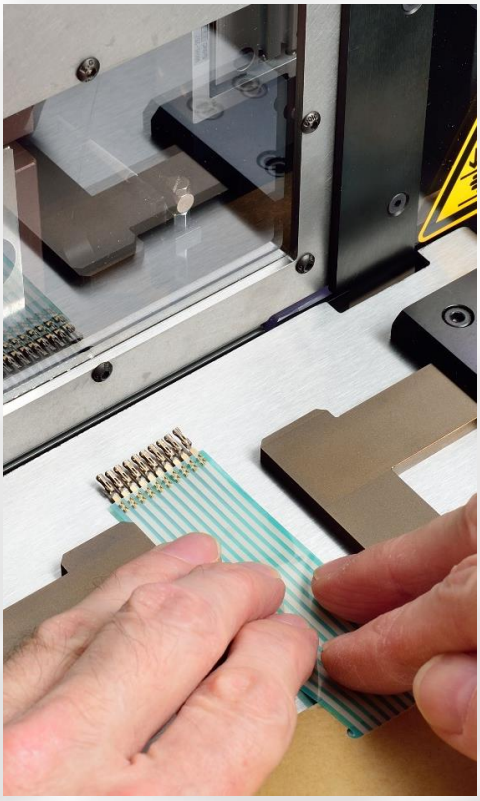
These machines and tooling are designed to attach connectors or contacts to wires, cables, flexible circuits, printed circuit boards, glass fibres …

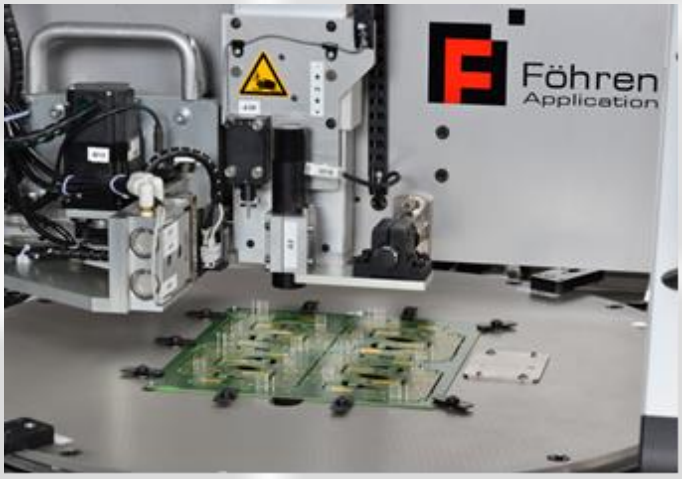
We support the following connection technologies:

- Single-pin press-fit
- Pre-assembled press-fit
- Crimping and clinching on flexible circuits
- IDC discrete wire and flat wire
- Crimp-to-wire
- Direct attach (soldering and welding)
- Riveting (hot and cold stacking)
- Fibre optic
- Cable prep

Since every application is different, we offer multiple levels of automation for these connection technologies such as fully automated machines, semi-automatic machines, hand tools and repair tools.



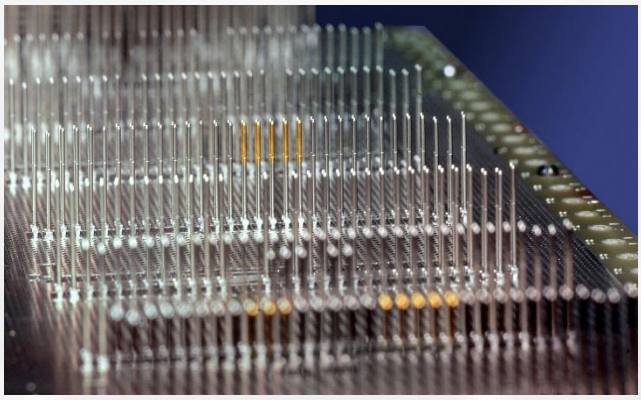




Press- Fit

Föhrenbach Application Tooling N.V. has more than 35 years of experience in processing press-fit contacts. For us, it started with the insertion of single-pin press-fit contacts into telecom backplanes.

These boards were selectively loaded with between 5,000 and 7,000 single-pin press-fit contacts. During the process, our machines would insert the contacts into the boards, one by one, using a pattern programme.



It was important that no process failures result in missing pins or a pin pattern error. Due to the many operational steps on a single backplane, each process step had to be checked and be nearly fail safe.

It was then that we developed our state-of-the-art press-fit insertion algorithms. These were increasingly optimised during the past decades.

With the introduction of SMD components and the miniaturisation of electronics, the line density of telecom systems quickly increased. As a result, the selective loading of single-pin press-fit contacts was no longer needed. On the contrary, suddenly there was a desperate need for higher density press-fit connectors.

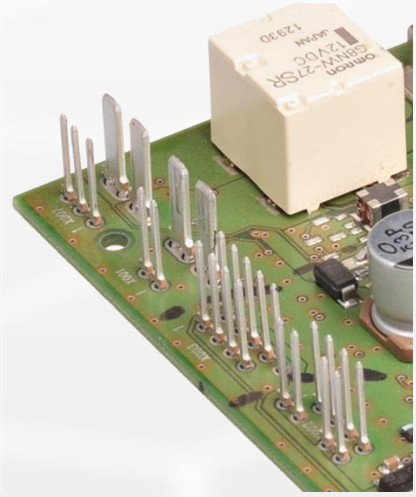
In the late eighties, connector manufacturers introduced a 2-mm pitch connector system.

To support our customers and lead the way in the industry, we had already developed the first members of our UNIPRESS machine family in the early nineties.

Our flagship UNIPRESS 2000, a fully-automated pre-assembled press-fit in-line connector insertion machine, was the first member of that family. All the know-how we gathered during the single-pin press-fit “era” was transformed and applied to the pre-assembled press-fit connector presses that then became popular.

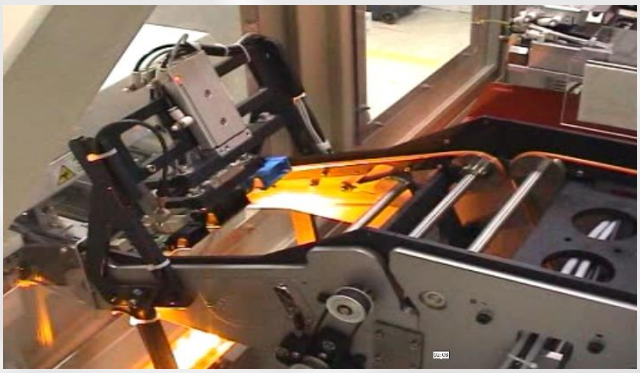
Since not every customer needed a fully equipped UNIPRESS 2000 line, our family of servo-controlled presses developed into the extensive range on offer today.

In parallel with the growth of applications of pre-assembled press-fit connectors, we saw a revival of single-pin press-fit applications in the automotive industry. Single-pin press-fit technology is used in safety electronics, power distribution, fuse boxes, sensorics, …



Depending on the level of automation required, we offer both single-pin press-fit and pre-assembled press-fit connector machines in stand-alone or in-line formats.

Whether standard or customised to individual requirements, the machines are equipped with an optical board-error correction system, component-error connection system, integrated AOI system, traceability system, ERP system, …



Since Föhrenbach Application Tooling designs all machines and tools in-house, we have the flexibility needed to meet specific customer requirements.

The UNIPRESS family

Ranging from a manual bench press with a flat bed to a fully automated in-line pick-and-press machine, the UNIPRESS family covers the full range of presses required for the insertion of pre-assembled press-fit connectors into boards.

When designing the UNIPRESS family, the following three requirements were central:

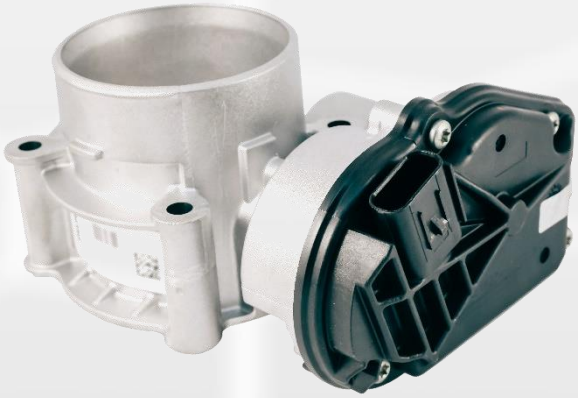
Support for multiple connector types: Pre-assembled press-fit connectors must be available in all possible

models. Intelligent design makes it possible to successfully process all of these connector models.

Support for multiple connector suppliers: Most applications contain connectors from different suppliers. UNIPRESS machines support almost all connectors, regardless of manufacturer or brand.

Support for random placement: Connectors must be able to be used in an infinite number of applications. Our press machine is designed to ensure that the connectors are inserted with a minimum of obstruction.

The machines are not limited to processing only press-fit connectors: metal shields, springs and diverse components can be also inserted. In short, everything that falls within the press capacity of the machine can be processed.



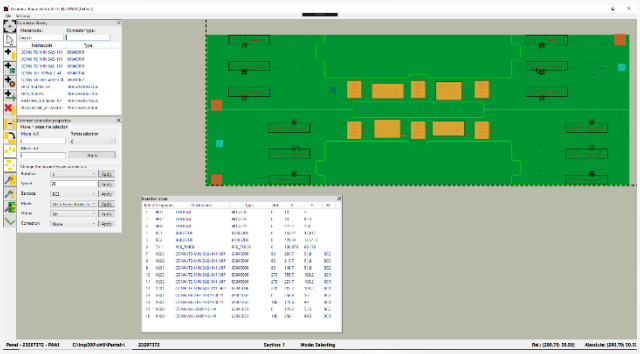
Press-fit usually refers to backing board, daughterboard and midplane applications. The applications supported are also much broader than simply processing printed circuit boards. Connectors or parts can also be pressed into metal housings. In fact, our intelligent presses are able to connect almost all parts.

The UNIPRESS family can be divided into two groups: manual presses and servomotor-controlled presses. Manual presses are used for prototyping, small series work, and repairs. The servomotor-controlled presses are available in different levels of automation: manual, semi-automatic or fully automated.

A force-stroke monitoring system is available as an option on manual presses while an integrated force-stroke analysis system is standard on servomotor-driven presses.

In the case of manual presses, at the end of the pressing cycle the force-stroke monitoring system will assess whether the force curve followed the correct path. Servo-controlled presses, on the other hand, use the force-stroke analysis to adjust the pressing process. As a result, servo-controlled presses can handle limited tolerances on the processed parts, and the end result is still within tolerance.

All machines with a programmable board positioning system can be programmed by applying the available ODB ++ data for the specific board. A modern graphic board editor is available.



The UNIPRESS family overview

Manual presses

The UNIPRESS 500M features a throat depth of 300 mm and a maximum pressing force of 32 kN. The press is available with a flat bed or an x-y table. A force-stroke monitoring system is available as an option. The UNIPRESS 500M is available with a flat-top tool or a quick-change tooling interface.

Servo-controlled presses

The UNIPRESS 500E features a C-frame with a throat depth of 320 mm and a maximum pressing force of 50 kN. The press is available with a flat bed or an x-y table. To support the board being processed, the machine is available with a fixed anvil or a rising post.

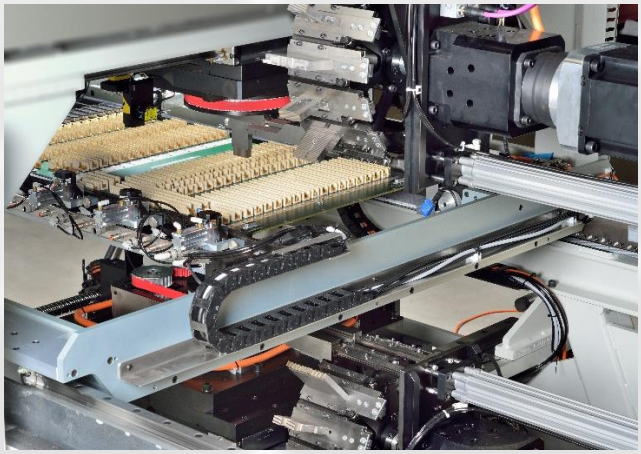
The optional state-of-the-art LMT system is able to guide the operator through the sequence of pressing cycles on a single product. The operator is automatically guided to successive target positions by small motors in the manual x-y table. This allows the operator to position the board under the press ram much more quickly and accurately.

The UNIPRESS 500E Compact features an H-bridge with 600 mm between the side posts and a maximum pressing force of 50 kN. The press is equipped standard with a flat bed.

The UNIPRESS 500E Portal is an H-bridge press specifically made for processing ‘long’ or ‘high’ products. For example, die-cast housings with a height of up to 600 mm can be processed. This press is capable of a maximum pressing force of 20 kN.

The UNIPRESS 1000 Compact is actually an UNIPRESS 500E equipped with a position-programmable automatic x-y table. This allows a sequence of different press positions to be automatically performed.

The UNIPRESS 1000 is a semi-automatic step-and-repeat press machine with a maximum pressing force of 80 kN. Minimum board size is 50 mm x 50 mm; maximum board size is 800 mm x 800 mm.

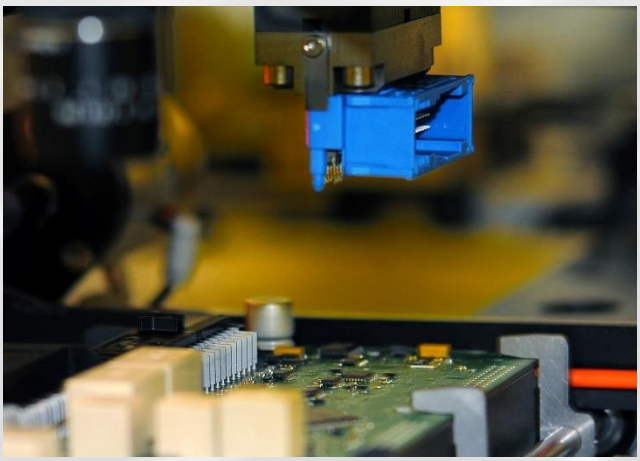


The following options allow the machine to be customised to your needs.

- Motor-controlled rotary head that allows automatic orientation of both insertion head and anvil.
- Automatic tool-exchanging unit that accepts up to 16 insertion tools.
- Automatic tool-exchanging unit that accepts up to 16 anvils.
- Automatic optical board-thickness measurement system.
- Board-error correction system that corrects for possible tolerances in the drilling pattern.
- RFID coding of both insertion tools and anvils.
- SMEMA-compatible in-line automatic pass-through conveyor system.
- Automatic adjustment of board width.
- Data-matrix scanning of board in process.
- Servo-controlled anvil mechanism.

The UNIPRESS 2000 is a fully automated pick-and-press machine with a maximum pressing force of 22 kN. The machine is available in two versions: with automatic tool-exchanging units for insertion tools and anvils, or an indexing tool head. The machine features a modular approach.

The UNIPRESS 2000 automatically populates the boards with connectors and simultaneously inserts them.



Since connectors are packaged in different ways, we offer diverse connector feed systems for tubes, trays, tape and reel, and bulk.

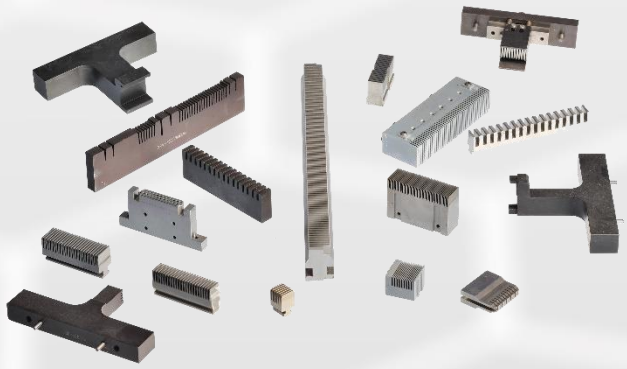
The UNIPRESS 2000 is equipped standard with a board-error-correction system that corrects for possible tolerances in the drilling pattern. The optical component-error-correction system corrects for possible tolerances on the applied connectors.

The following options allow the machine to be customised to your needs.

- Motor-controlled rotary head that allows automatic orientation of both insertion head and anvil.
- Automatic optical board-thickness measurement system.
- RFID coding of both insertion tools and anvils.
- SMEMA-compatible in-line automatic pass-through conveyor system.
- Automatic adjustment of board width.
- Data-matrix scanning of board in process.
- Automatic component rejecting system.

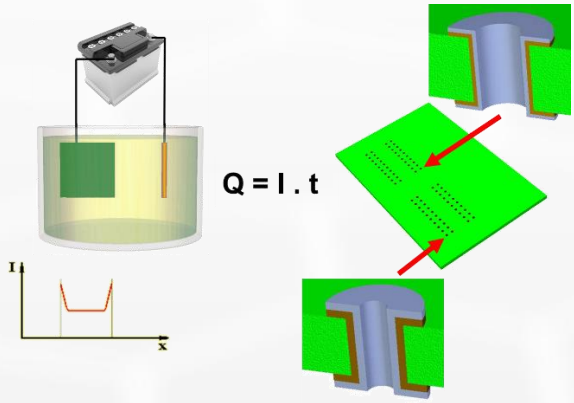
Insertion tooling

Föhrenbach Application Tooling offers an extensive range of support (-anvils) and insertion tools for almost all available connectors. These tools can be equipped with the UNIPRESS tool interface or that of a third party (we support the TE, ept, ERNI, ... tooling interfaces).

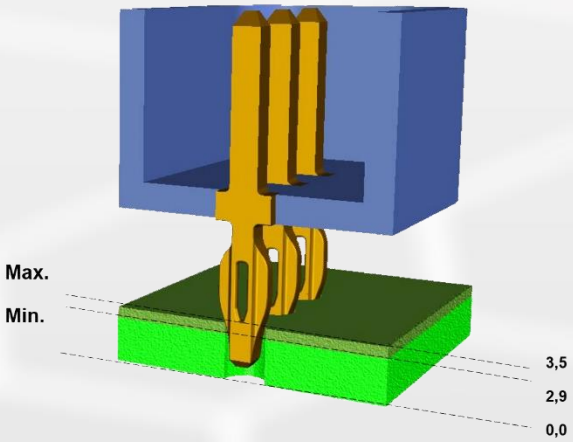


How UNIPRESS ensures quality and improves productivity

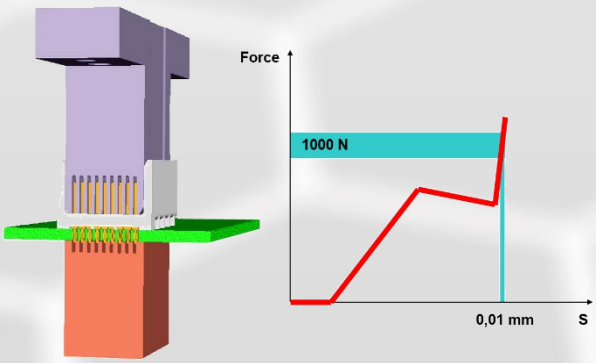
There are always three players in a press-fit application: PCBs, connectors and machine. Of these three, the PCBs exhibit the most tolerances. Through-hole metallisation is done using a galvanic process. This is characterised by non-linear current distribution over the PCB surface. Since the amount of deposited metal depends on the current and time, the metal thickness in the holes of the PCB depends on the location of the hole on the PCB. This is the first area where the quality of the PCB can influence the press-fit process.



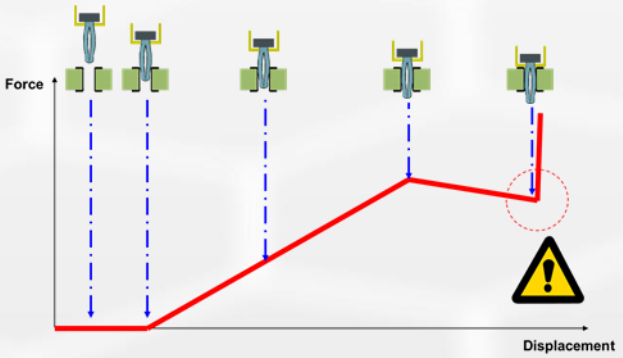
In many cases, the PCBs used are multilayer boards. It is difficult to control for thickness in their production process. Tolerances of ± 5% to 10% are possible. This is the second area where the quality of the PCB can influence the press-fit process.



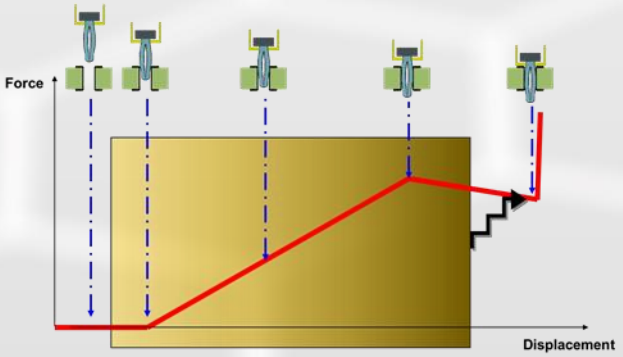
Almost all applications specify that the connector must be pressed flush against the surface of the PCB. Due to the thickness tolerances on the PCBs used, you need an intelligent press system that is able to anticipate the thickness variations of the PCB. When using standard FR4 material, the increase in force is about 1,000 newtons per 0.01 mm of overpressure. These forces can damage fragile connectors: one more reason to opt for a controlled press process.



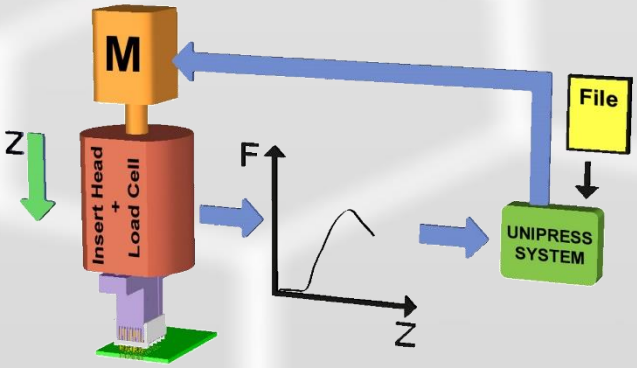
The following graph describes the process of making a press-fit connection. In the first step, the contact moves to the PCB. Here we observe only movement and no force. This continues until the contact touches the edge of the hole. Then the contact slides into the hole and the force increases. After reaching the first maximum value, the force will decrease again due to relaxation of the material, deformations, ... When the connector touches the PCB surface, the force increases strongly. This represents a risk to the integrity of the process, and excess force must be avoided.



Past experience taught us that the tolerances on the dimensions of the PCBs can influence the press-fit process. The curve just analysed indicates that the shape and amplitude of the curve depend on the PCB and connector used. Analysing this curve allows us to predict the point where the connector will hit the surface of the PCB.



This algorithm is called the closed-loop system and is used in servo-controlled UNIPRESS machines.

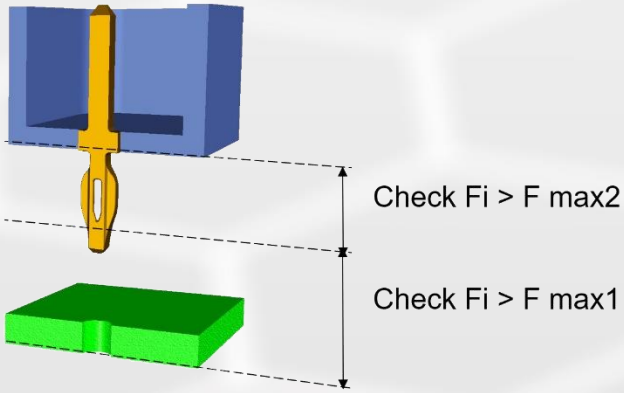


The machine is equipped with a library containing a number of dimensional characteristics of a connector. These are used during the pressing of the particular connectors.

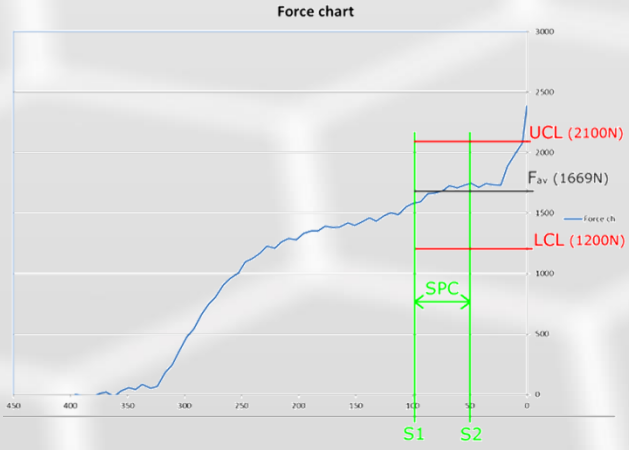
One of these parameters is press speed. It can be set for any connector type. This makes it possible to flawlessly process the most fragile nano press-fit connectors.

In addition, during the start of the pressing cycle, actual pressing force is measured in function of the position of the pressing ram. If contact occurs prematurely, the pressing will stop. If the force becomes too high during pressing, the pressing will also stop. These precautions protect PCB, connector and machine.

At the end of the pressing cycle, the machine will compare the measured pressing force with a minimum and a maximum. These give an indication of possible under- or overpressure, which can reveal possible delamination of the PCB, collapsed contacts and connections that are not gas-tight.



Since many measurements are taken during each pressing cycle, all information is available for an integrated statistical process control (SPC).



The ASPIM family

Ranging from manual contact insertion tools to a fully-automated in-line single-pin press-fit machine, the ASPIM family covers the full range of equipment required for inserting single-pin press-fit contacts into boards.

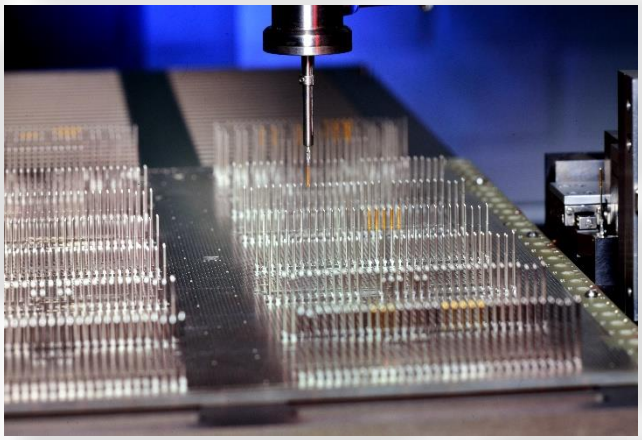
Single-pin press-fit contacts are available in bulk, in bandoleer format, and as stamped and formed contact strips. We are able to process all these versions by means of a modular tooling concept.

Contact insertion is not limited to printed circuit boards; applications in which contacts are pressed into housings and busbars are also common.

The ASPIM family overview

ASPIM and PSPIM

The ASPIM and PSPIM are both single-head selective-pin insertion machines. They are available in standalone formats and as SMEMA-compatible in-line machines.



PSPIM is a pick-and-place machine that can insert on average 2 contacts/sec, while the ASPIM is a revolver-head based machine that on average is able to insert 6 contacts/sec. Depending on the machine being used and the installed feed and cut units, one machine can insert up to 4 styles of contacts. The ASPIM and PSPIM are able to accept both stamped and formed contacts as well as contacts in bandoleer format.

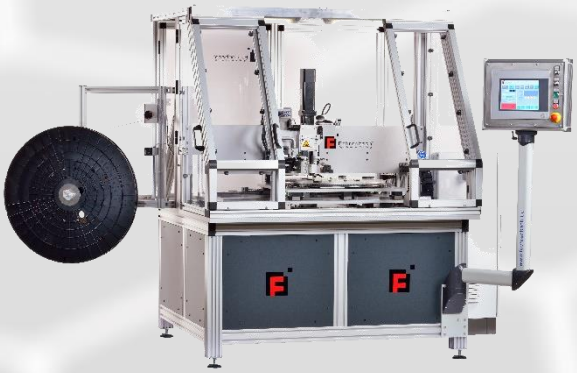
The machines feature state-of-the-art in-process control. Each insertion cycle is force-stroke controlled. The force data collected can be saved for traceability. In order to cope with position tolerances regarding the holes in the PCBs, the machines are equipped with an optical board-error correction system.

A turntable is available as an option to determine the orientation of the contacts. An optional data matrix scanner makes it possible to save the data collected under the unique serial number of the manufactured PCB.

A graphical board editor accepts the Gerber data of the PCB being processed, making it possible to quickly develop complex pin-insertion patterns.

ASPIM 14

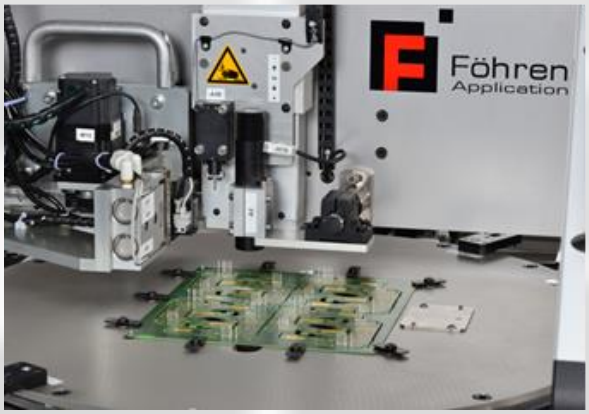
Based on clearly specified automotive needs, Föhrenbach Application Tooling developed the ASPIM 14, a state-of-the-art semi-automatic pin insertion machine.



The ASPIM 14 is equipped with a replaceable insertion nozzle as well as a feed and cut unit. As such, the machine can easily accept different types of reeled contacts.

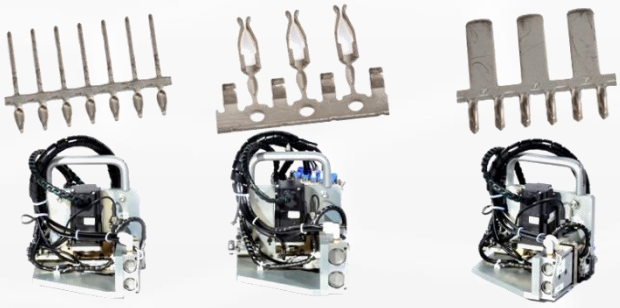
The machine features:

- An active insertion area of 350 mm x 350 mm.
- A quickly replaceable insertion head. So almost all conceivable single-pin contacts can be inserted with the same machine.
- A servo-controlled insertion axis that provides at least 500 newtons of insertion force. This makes it easy to adjust the insertion depth of the contacts.
- A minimum insertion speed of one contact per second.
- Force-stroke insertion with registration.
- An optical board-error correction system to compensate for any hole position errors on the boards.
- The machine is universal. The PCB being processed can be attached to the positioning table of the machine using a dedicated work board holder.
- The machine is equipped with a rising anvil that supports the PCB locally at the insertion point. As such, both sides of the PCB can be populated with components (ICs, capacitors, resistors, …), prior to press-fitting.
- The machine is freely programmable by means of a graphical board editor that accepts the PCB's Gerber data as input.
- A barcode or data matrix reader is available to store the collected insertion data related to the unique serial number of the PCBs.
- Management information, including process timers and counters, is available.
- The machine is available in standalone format (island) or as a SMEMA-compatible in-line machine.
- A rotary table is available as option. This allows the contacts to be inserted in the PCB at any angle.



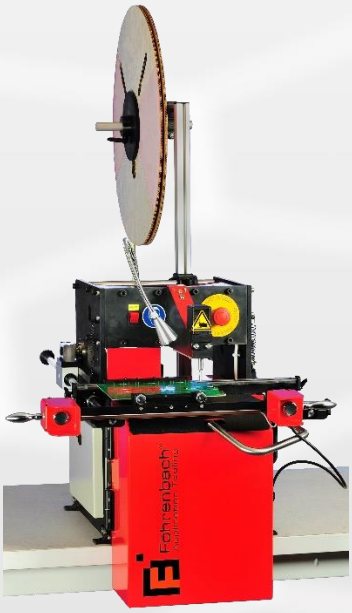
- A twin-head machine is available for specific applications.

An insertion head is available for each contact type.



Manual pin-insertion machine

This machine accepts contacts in bandoleer format. The contacts can have a solid or flexible press-fit zone.



An easy-to-replace tool kit makes it possible for the machine to accommodate different bandoleer formats. Insertion nozzles are available for different contact sizes.

Using a manual XYZ-table, the operator can easily select the holes in the PCB that are to receive a contact. As a result, selective insertion of contacts is possible. The table can be adjusted to the size of the PCB being processed, up to 300 mm x 600 mm. To protect the operator, the machine is equipped with two-hand safety operation.

A sensor detects the correct position of the hole in the PCB with respect to the insertion axis. The operator is able to fire the insertion mechanism only when the position is correct. After each insertion, a new contact is automatically loaded into the contact inserter.

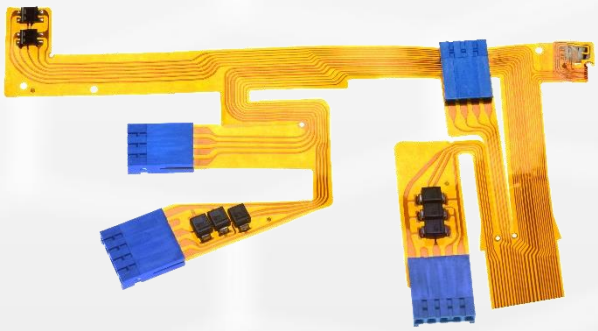
A LED spot illuminates the insertion position.

Feed-and-cut units that accept stamped and formed contacts are available as option.

Flexible Circuits

Flexible circuits can be compared to printed circuit boards and offer similar advantages. They offer high levels of repeatability and reliability as well as the potential for high density. In addition, they are highly flexible and vibration resistant.

Designers are encouraged to use flexible circuits because they can be used three-dimensionally. They also save space and weight.



Since the flexible circuit production process is easy to automate, total installation costs are lower, especially in the case of volume production.

Two groups of flexible circuits can be distinguished: laminated foil circuits (FFC) and printed circuits (FPC).

Flex Foil Circuit:

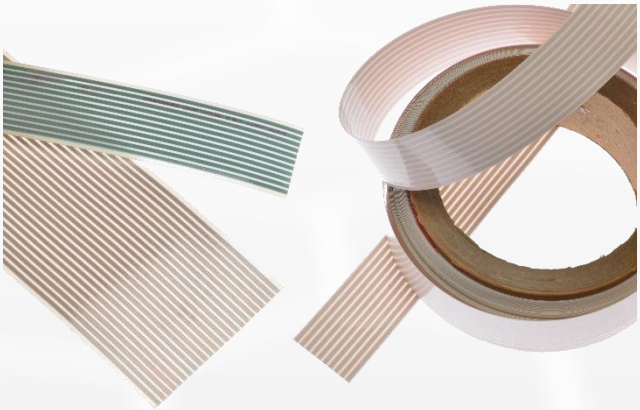
FFCs are flexible flat cables containing tinned or bare copper conductors with different cross-sections laminated between two high-quality insulating foils.

The copper alloy conductors can have the following thicknesses: 35 µm, 50 µm, 76 µm, 100 µm, 125 µm, 200 µm. A good reference value for the minimum width of the conductors is 0.28 mm.

Depending on the application, (PET) polyethylene terephthalate or (PEN) polyethylene naphthalate insulating foils of varying thicknesses are used.

FFCs are sold by the metre on spools. The number of conductors can vary between 2 and 50. The pitch falls between the standard values of 1.27 mm and 2.54 mm.

FFCs are characterised by their ribbon form.



Flex Printed Circuit:

FPCs are printed circuits. Using a photochemical or screen printing process, the conductors are applied to an insulating foil.

When using a photochemical process, common thicknesses for the copper conductors are: 18 µm, 35 µm, 50 µm, 71 µm and 105 µm. Minimum conductor width is 100 µm. To improve solderability, the copper conductors can be tinned.

In a screen printing process, a silver print or chemical copper technique is used, possibly in combination with a graphite layer.

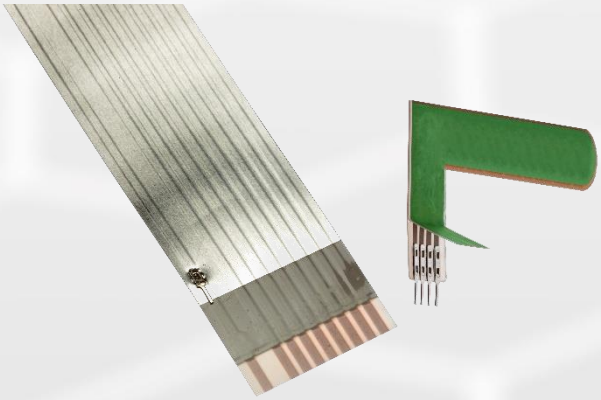
Depending on the application, (PI) polyimide, (PET) polyethylene terephthalate or (PEN) polyethylene naphthalate insulating foils of different thicknesses are used. Common sizes are 25 µm to approx. 100 µm.

In certain applications, a cover foil is laminated on the printed circuit (foil). This provides electrical insulation, moisture protection and reinforcement.

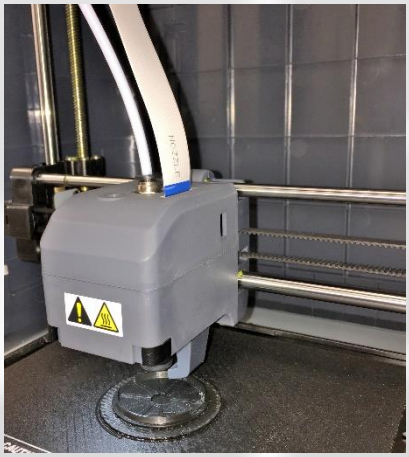
Since FPCs are based on the concept of a classic printed circuit (FR4 base), electronic and mechanical components can be mounted on them.

As a rule, there are no restrictions on the forms an FPC can take. They can be punched or cut out by a tool-less laser process.

Both FFCs and FPCs can be equipped with EMC shielding foils.

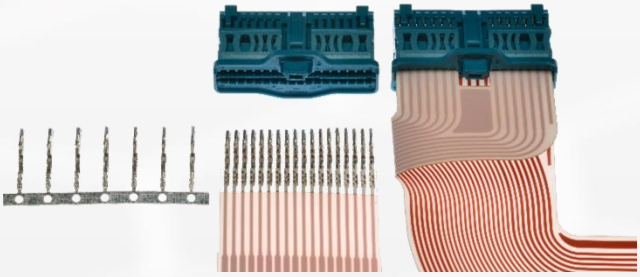


The applications of flexible circuits are innumerable. Examples include elevators, membrane switches, control panels, touch screens, cockpit technology, exterior and interior lighting of vehicles, battery electronics, antennas, heating, sensors, medical applications, graphics and 3D printers, …

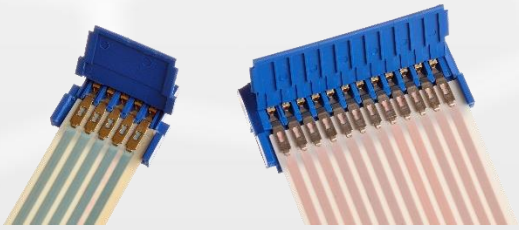


The flexible circuits can be connected to the external electronics by means of connectors. The crimp or clinch contacts used for this make gas-tight electrical connections with the conductor on the flexible foil.

Crimping and clinching are two different techniques. During crimping, the contacts are separated from a carrier strip and crimped onto the foil. Afterwards, the insulating housing of the connector is slid over the contacts on the foil.



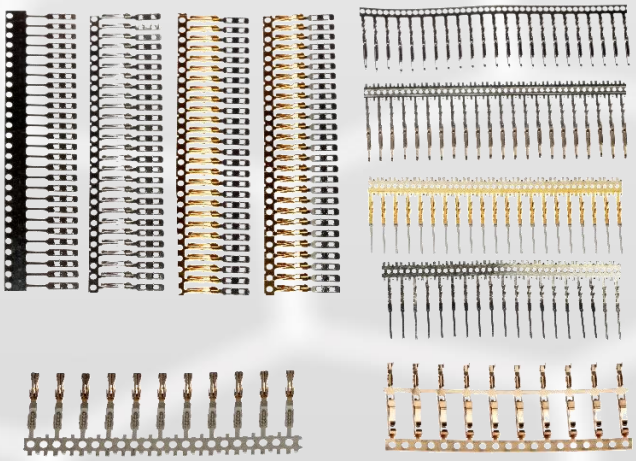
In the case of clinching, the contacts are already pre-assembled in the insulating housing of the connector. During clinching, the foil is slid into the connector and all contacts are simultaneously clinched. Each technique has specific applications.



Foil crimp contacts are marketed by the following manufacturers: TE, Nicomatic, Click Dome Systems, Amphenol, Molex, Delphi, Lear, Memcon, …

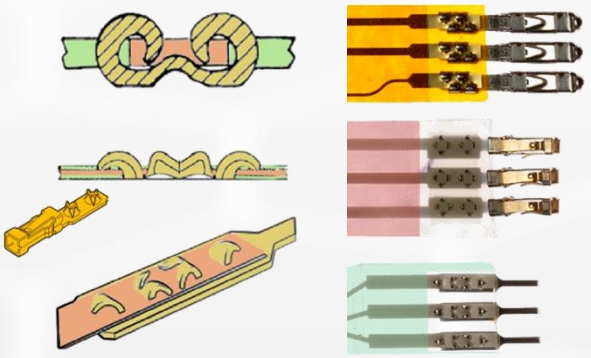
Popular contact types are: MQS, nano MQS, AMPMODU .100, AMPMODU .050, edge contact, Crimpflex, Duflex, StarCrimp, MTS, …

Commonly used pitches for the crimp connectors are 1.27 mm, 1.8 mm and 2.54 mm.



Male or female contacts as well as solder tab contacts are available. For more specific applications there are flex contacts with a standard crimp-to-wire connection, a press-fit end or a welding plate. There are also flex-to-flex contacts for connecting two flexible circuits together.

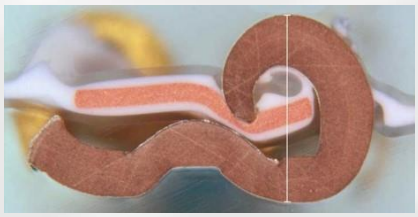
Depending on the manufacturer, different crimp-contact geometries have been developed over the years. The following diagram gives an overview of the most common types.



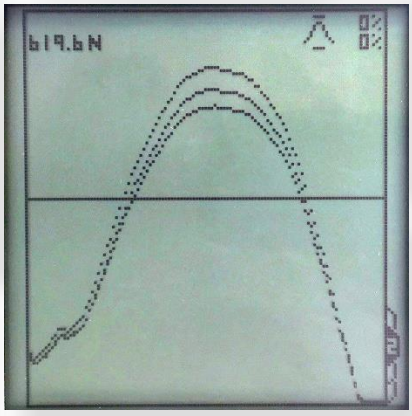
When using it, always follow the guidelines of the respective manufacturer.

Crimp quality

The quality of the crimp connections is assessed by means of a visual inspection, a cross-section, crimping force monitoring, and measuring the contact resistance.

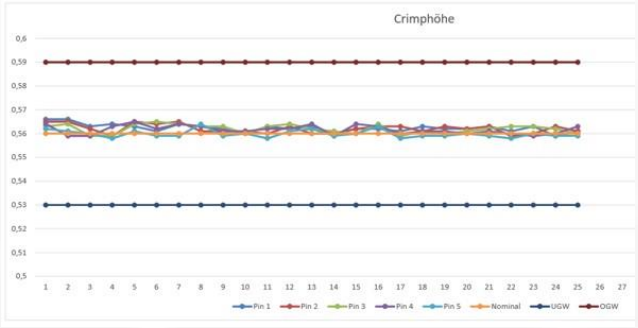


Crimping force monitoring is a non-destructive test that can be built into the crimping machine. The following diagram shows the force curve of a crimping cycle.



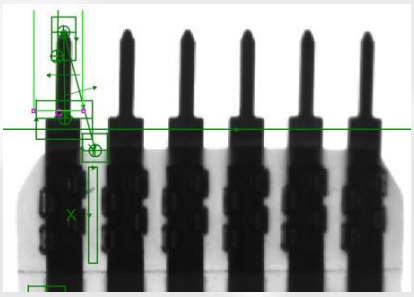
This allows the machine to calculate the labor required to make this crimp. The labor and slope of the measurement curve are compared with that of a good connection.

Since the crimp height is a decisive measure of the quality of the connection, it is usually subjected to a Cpk analysis. As the following example shows, when using the right machines, crimping is a very stable, automotive-compatible process.

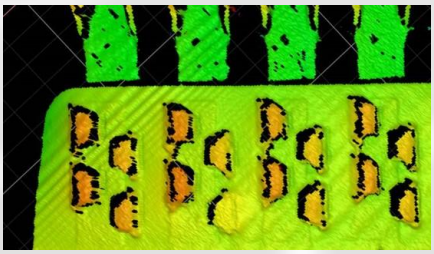


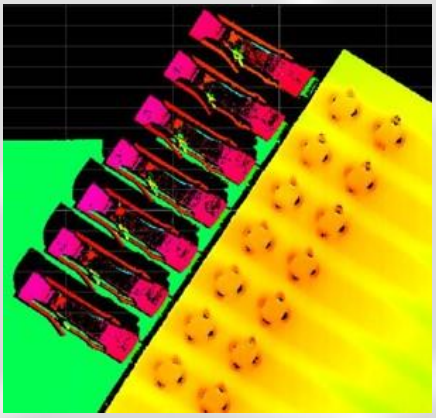
Average	0,562	0,562	0,562	0,562	0,560	0,562	Alle Messdaten
STDEV	0,00166	0,00188	0,00184	0,00185	0,00159	0,00195	
Min	0,559	0,559	0,559	0,559	0,558	0,558	
Max	0,566	0,565	0,565	0,565	0,564	0,566	
OGW	0,59	0,59	0,59	0,59	0,59	0,59	
UGW	0,53	0,53	0,53	0,53	0,53	0,53	
OGW-Averag	0,028	0,028	0,028	0,028	0,030	0,028	
Average-UG	0,032	0,032	0,032	0,032	0,030	0,032	
Toleranz	0,06	0,06	0,06	0,06	0,06	0,06	
x-kritisch	0,0276	0,0280	0,0280	0,0284	0,0299	0,0284	
cm	6,0412	5,3149	5,4447	5,4100	6,2911	5,1328	
cmk	5,57	4,95	5,09	5,12	6,27	4,86	

The assessment of whether the contacts are correctly placed in relation to the edge of the foil and the conductors can also be properly automated by means of cameras and the appropriate image processing.



Even 3D scanners can be used. These also provide additional information concerning the height.



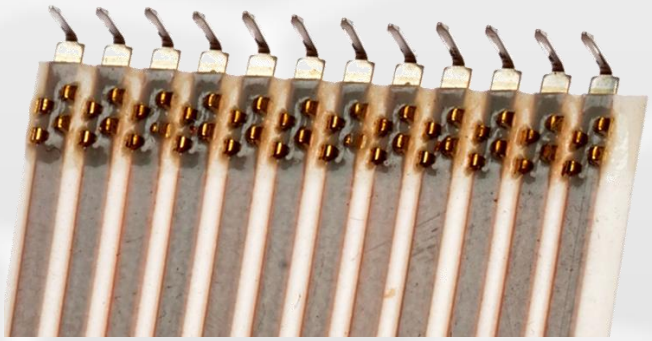


Crimping machines

Due to the multitude of different contact types, Föhrenbach Application Tooling machines are equipped with a quickly exchangeable applicator. This makes it possible to switch very quickly from one contact type to another when needed. The applicator ensures that the contacts are fed perfectly. Then the contacts are separated from the carrier strip and crimped.

In order to adapt the crimp height of the contacts to the thickness of the processed flexible circuit, the applicator is equipped with a fine adjustment.

Applicators that also bend the contact are also available.



From a manual machine to fully automated production lines: Föhrenbach Application Tooling has all the solutions.

Manual flexible circuit terminator

For crimping a small number of contacts, Föhrenbach Application Tooling developed the manual flexible circuit terminator. It is a table model based on a manual toggle press.

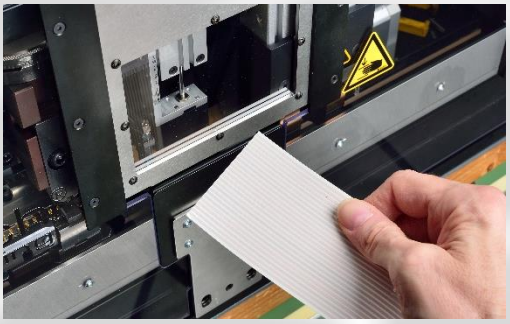
It is equipped with an applicator that feeds and separates the contacts. In addition, the applicator crimps the contacts one at a time on the flexible circuit being processed. This can be an FFC or FPC.

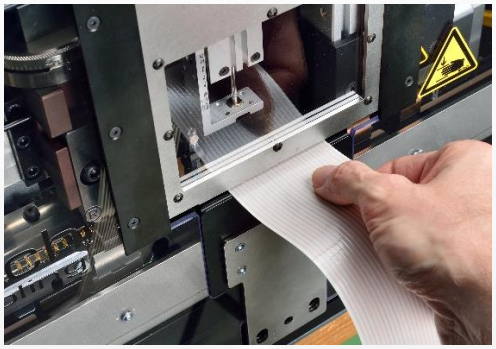
The flexible circuit can be easily positioned by means of a semi-automatic index table. After each crimp cycle, the table will automatically advance by a fixed pitch. The table features a spring-loaded clamp that holds the circuit in place. The table's indexing system can be adjusted for pitches of 1.27 mm, 1.8 mm or 2.54 mm. Other pitch sizes are available on request.

For special applications, the manual flexible circuit terminator is also available with a flat table.

Semi-automatic flexible circuit crimping machine

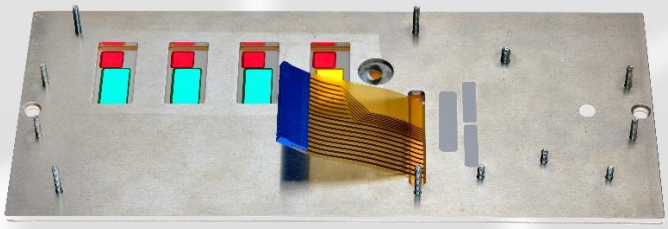
Semi-automatic flexible circuit crimping machines make it possible to easily crimp contacts on both FFCs and FPCs. The following diagrams illustrate the process.

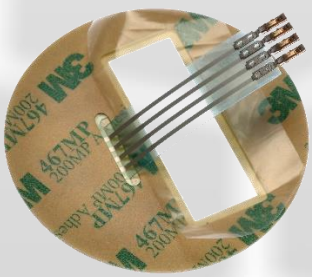




With a maximum speed of four contacts per second, the machine crimps one contact per cycle. While the flexible circuit is being held, the crimping head moves step by step over the conductive paths of the flexible circuit.

Due to the unique concept of the machine, it accepts short flexible circuits that for example emerge from the centre of a rigid panel.





The flexible circuit is held in place during crimping by means of an automatic clamp.

With the help of a simple editor, mounting patterns can be created that can contain up to 98 contacts per circuit. The positional accuracy of the contacts is 0.01 mm. This makes it possible to program common pitches such as 1.27 mm, 1.8 mm and 2.54 mm, but also any other values. Even complete off-pitch programming of contacts is possible. This is necessary with multi-tail and multiple rows connectors.

20 mounting patterns can be stored in the controller memory.

Before crimping, the machine scans the flexible circuit by means of an optical sensor. This allows the machine controller to know the number of conductive paths and their position. This ensures perfect positioning of the contacts in relation to the centre line of the conductive paths.

When using non-translucent circuits, we optionally provide a reflection sensor that can detect the bright copper or tinned conductive traces.

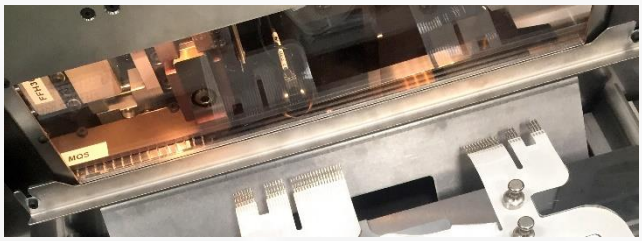
The machine accepts contacts with both left-to-right and right-to-left unwinding directions.

An integrated cutting unit cuts the contact carrier strip into short pieces of scrap.

The machine is equipped with a removable support table with adjustable circuit guide.

Integrated timers and counters provide valuable production information.

Maximum flexible circuit width is 100 mm. A machine that can handle circuits up to 300 mm wide is also available.

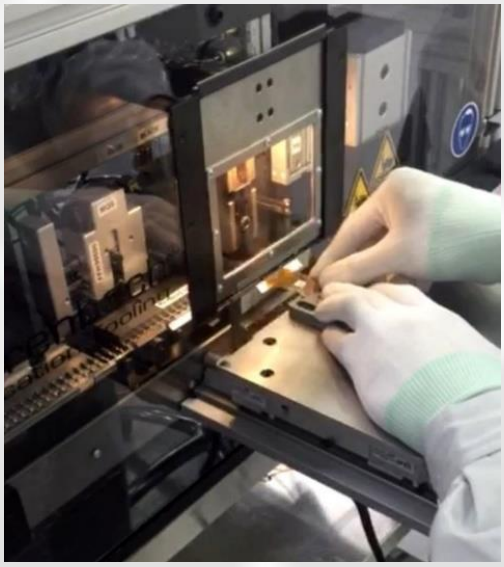


Minimum flexible circuit length is 27 mm. Depending on the type of contact used, we have optional, custom clamping systems that accept flexible circuits with a minimum length of approx. 12 mm.

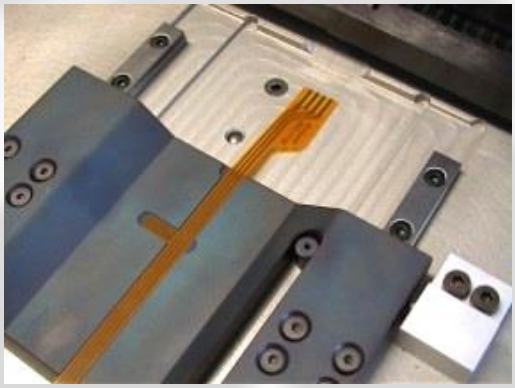
Options:

- Automatic de- reeling of the reel of contacts. This ensures a flawless feed of the contact strip.

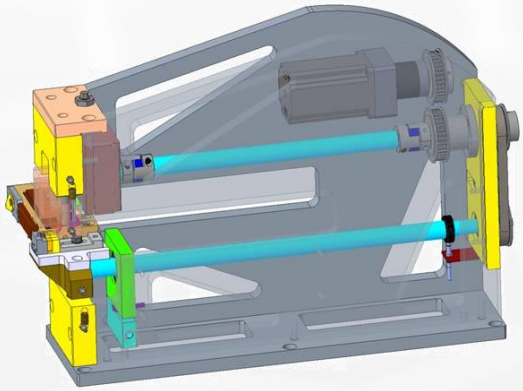
- Sliding tables and automatic sliding tables. These can improve the accuracy with which the circuits are presented to the machine. When using the automatic sliding table, the operator no longer has to give start signals to the machine, which increases the machine discharge rate.



- All possible masks and jigs can be custom made to define the inlay position of the circuits.



Semi-automatic flexible circuit crimping machine with XY positioning capability



For the previous machines, we assume that the contacts are aligned in the x direction. However, there are applications where the contacts must be positioned in both the x and y directions. Since the machine is equipped with an additional positioning spindle in the y direction, the contacts can be placed in a specific xy location.

In order to have sufficient reach in the y direction, the machine is equipped with a C-frame head with a throat depth of 300 mm. Otherwise, it behaves the same as the above-mentioned semi-automatic flexible circuit crimping machine.

Semi-automatic flexible circuit crimping machine with pallet conveyor system

This machine is particularly well suited to series work. We distinguish the following steps in the production process of a flexible circuit: inserting the circuit, crimping, optical inspection, labelling, testing … and removing.

With this machine, the foils are placed in a mask on a palette. The pallets are transported from one station to another by means of an automatic conveyor system. In one station, for example, an operator can place a circuit in each mask, while in the other stations the aforementioned process steps are carried out automatically. As a pallet is transported, the circuit it carries undergoes all the production steps.

The heart of this machine is the semi-automatic flexible circuit crimping machine.

Fully-automatic flexible circuit crimping machine

In these production cells, the entire process runs without the intervention of an operator. The flexible circuits are supplied to the machine on pallets, while the finished circuits also leave the process on pallets.

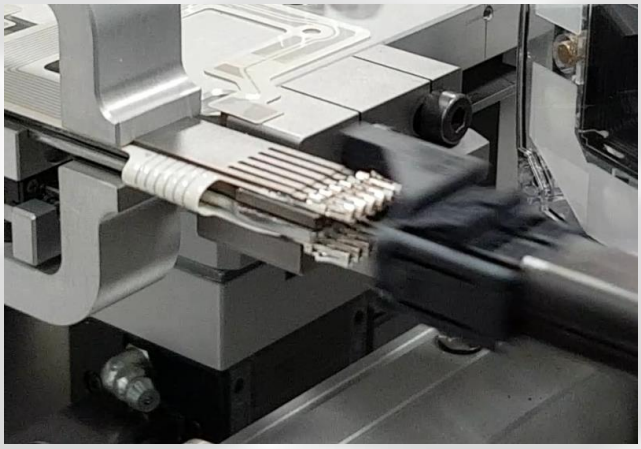
A one-piece-flow system can also be chosen according to customer wishes.

In the production cell, the flexible circuits are transported from one station to another by means of robots. Possible process steps include: picking up a circuit, crimping, optically verifying/measuring the position of the installed contacts, attaching labels, folding the flexible circuit, and automatic controlled installation of the connector housing, visual inspection of the finished product … and collecting the finished product.

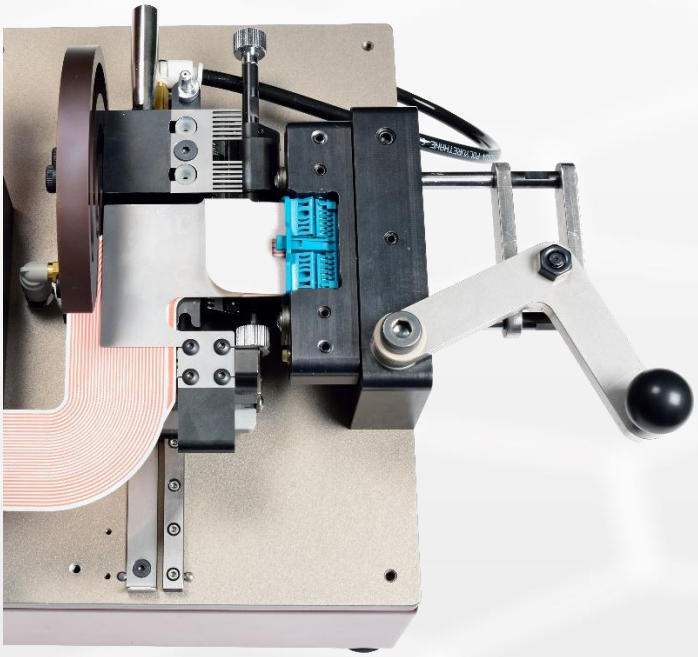
In the manufacture of these automatic production cells, we configure our mostly existing building blocks into a tailor-made production process.

Plug insertion tooling

If necessary, we equip our fully-automatic production cells with a station that automatically slides the connector housing over the contacts on the flexible circuit.

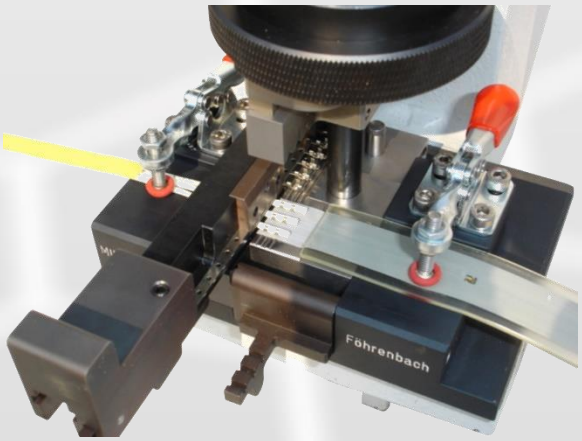


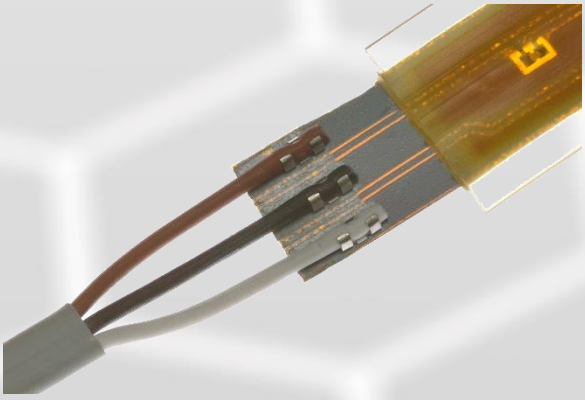
For non-automatic production lines, we offer a range of insert tooling. Depending on the application, these devices combine folding the circuit and installing the connector housing, or just installing it.



Flex-to-flex or flex-to-wire applications

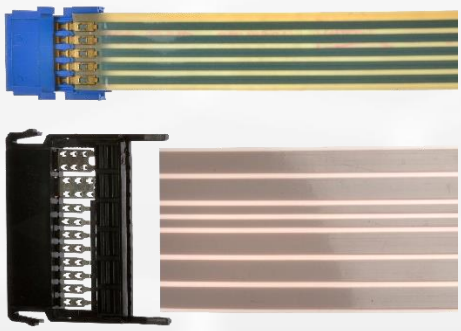
Föhrenbach Application Tooling makes appropriate tools and machines for specific applications in which flex-to-flex or flex-to-wire contacts are used.





Clinch machines

In the case of clinch connectors, the contacts are already pre-assembled in the connector's insulating housing. During clinching, the foil is slid into the connector and all contacts except for those requiring manual pliers are simultaneously clinched.

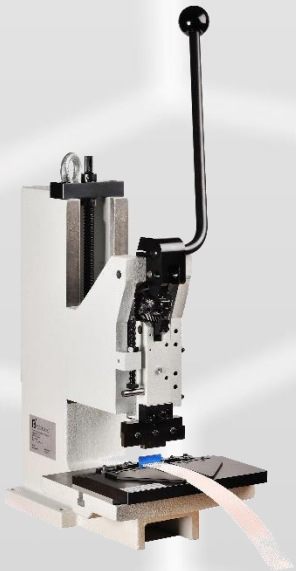


Clinch hand pliers

This HT 270.02 hand tool is designed to connect both male and female Amphenol ICC clincher connectors (including the interlocked version) to 2, 3 or 4 pole flexible circuits.

It is possible to clinch a larger clincher connector with these hand pliers, but this must be done in multiple steps. This is only recommended for prototype series.

Manual clinch machine



The FFY 23012 clinch machine is built around a manual toggle press. This allows the Amphenol ICC clincher connectors to be clinched to the flexible circuit in one clinching cycle.

The machine is equipped with an anvil that can support up to 32 clincher contacts.

Depending on the number of contacts used in the connector, the appropriate upper clinch tools are available as option.

The machine is also equipped with an adjustable connector holder and adjustable guides for the flexible circuits used.

Pneumatic clinch machine

The FFY23037 pneumatic clinch machine is built around a 20 kN pneumatic toggle press.

The integrated sliding table makes the machine easily accessible for installing the connector and inserting the flexible circuit.

The machine is equipped with a quick clinch tool interface. No tools are required when changing the clinch tool.

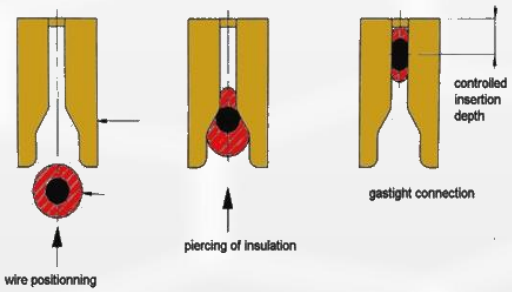
A finger-safe light curtain protects the operator.

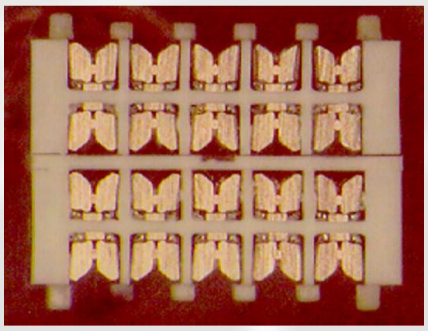
For the rest, this machine has the same functionality as the type FFY 23012 manual clinch machine.

IDC discrete wire or flat cable

For over 37 years, Föhrenbach Application Tooling has been designing and manufacturing tools and machines for processing IDC connectors.

An IDC connector is designed to be connected to the electrical conductor(s) of an insulated cable. The contacts have parallel-shaped blade contacts or parallel contacts equipped with protrusions. The purpose of the blades or protrusions is to cut through the insulation of the conductor, thus creating an electrical connection with the conductor.





If the contact is properly made and matches the wire used, a theoretically reliable gas-tight connection is created between the contact and the conductor.

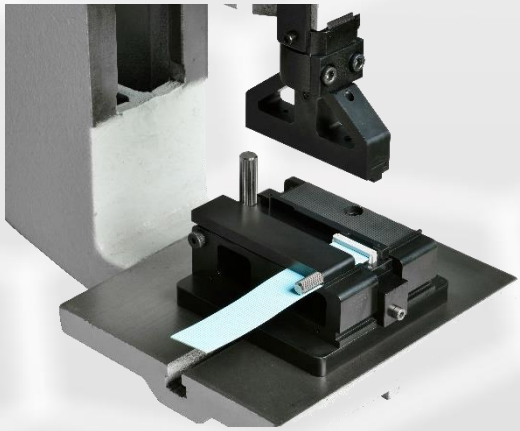
The IDC technique makes it unnecessary to strip the wires. Depending on the connector type and application, the wires can be connected one by one or together.

Thus, IDC connectors lend themselves extremely well to the cost-effective, mass manufacturing of electrical connection cables.

Föhrenbach Application Tooling supports the processing of almost all IDC connectors on the market, regardless of manufacturer. We distinguish between connectors that are connected with discrete wire and those that are mounted on a flat cable.

Below follows an overview of the machines and tools available. All are designed to correctly position the wires with respect to the IDC contact.

Manual flat cable press



A modular concept makes it possible to use virtually all types of IDC flat cable connectors. A base unit guides the flat cable being used and accepts a connector-related adapter.

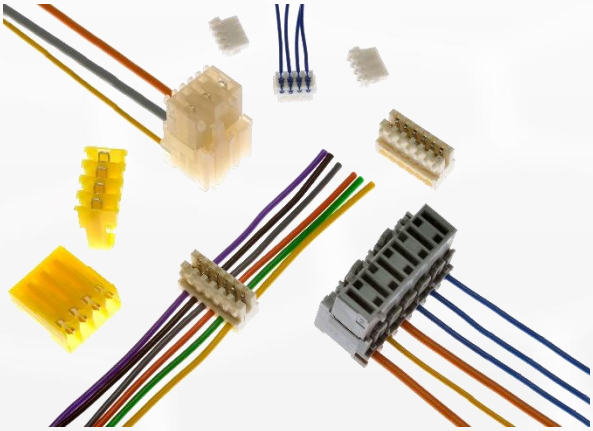
Flat ribbon cables are available in different pitches (1 mm, 1.27 mm, 0.635 mm,…): Föhrenbach Application Tooling offers the right basic unit for all these types of cables. A connector adapter is available on request for almost all IDC flat ribbon cable connectors. The connector adapters are easily interchangeable by means of a smart interface.

To make daisy chain cables or to position the flat cable flush with the side of the connector, the connector adapters can be equipped with a fixed cable stop.

A manual flat cable press is available with or without an integrated quality control system. This system measures the force-distance curve of each press cycle. You can adjust the GO/NO GO criteria to ensure quality. Optionally, the force-stroke measuring system can be connected to a separate PC for easy processing of the data collected.

All presses are equipped with a fine adjustment for the press stroke.

For processing single-wire connectors such as RAST and Mascon-like connectors, Föhrenbach Application Tooling has designed a dedicated basic unit.



Manual tools for processing flat cables

We offer different hand tools suitable to the intended production volume.

Pistol-grip hand tool

The tool supports product adapters tailored to the type of connector being processed. This tool can be used with a table clamp.

Simple hand tools

Multi-functional tool, handles a variety of flat cables and IDC connectors.

Flat cable scissors

The HT 209.02 hand tool is designed for cutting flat ribbon cables with a maximum width of 56 mm. The blade is replaceable and it also has a replaceable cutting foot.

Fully automated termination machines

These are fully automated production machines that work with flat cables on a reel and IDC connectors in their original packaging. The machine can be programmed to produce cables fully automatically.

Here is an overview of its features and options:

- Speed: 5 sec/wire
- Double or single ended finish
- Printing with inkjet or laser
- Force-stroke quality control of the installation of the connector on the cable as well as the pressing
- Cable length: 40 - 800 mm
- Multiple types and sizes of IDC connectors
- Electrical connection control. Optional high voltage test
- Camera control
- Automatic packing

These machines are tailored fully to customer requirements.

Manual tools for processing discrete wire cables

Pistol-grip hand tool

A whole range of pistol grip hand tools is available in order to cover the application of numerous IDC discrete wire connectors.

Repair tooling

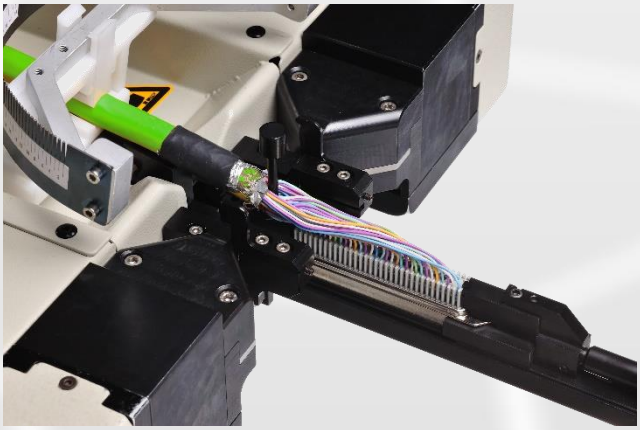
In order to cover prototype work and very small series, the repair tools can help you to insert the wires into the IDC slots of the connectors.

In case that the applied connectors allow repairability, the repair tooling is a great help in order to remove the contacts from the connector and replace them by a new one.

Semi- automatic cable terminators

In order to cover mass- production, Föhrenbach Application tooling provides a wide range of semi-automatic cable terminators.

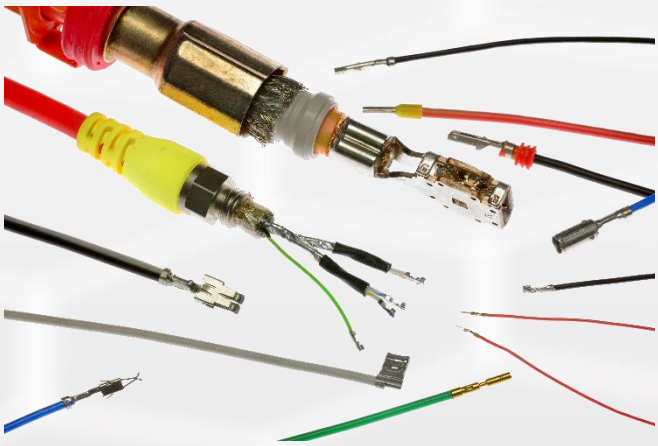
Machines are available for single- double- and multiple row connectors.



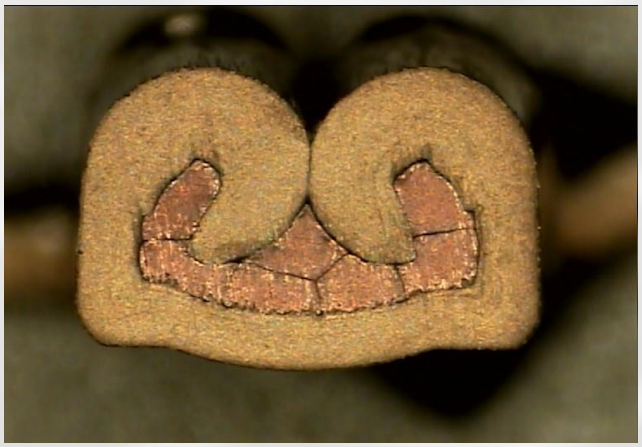
Crimp-to-wire

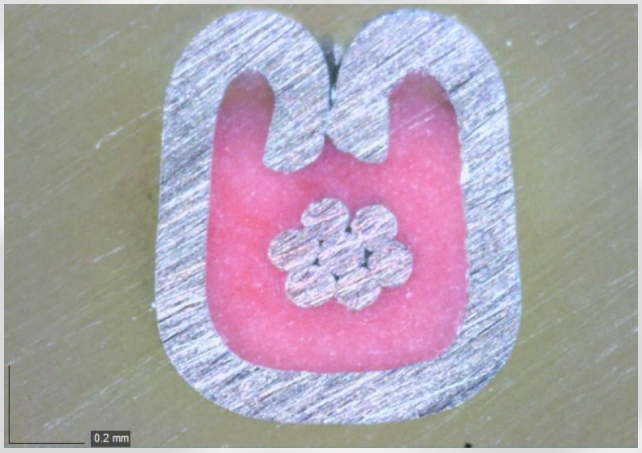
Crimping is used widely in almost all branches of the electrical and electronic industry, e.g. all types of cables, wire harnesses, aircraft wiring, car wiring, trains, buses, consumer products, white goods, telecommunications, ...

Depending on the required connection quality, stamped and formed or turned contacts are used. Stamped and formed contacts are often processed from a contact strip. The most commonly used surface finishes are tin, gold and silver. Cable lugs come in various designs such as ring lugs, fork lugs, connectors and the like.



Föhrenbach Application Tooling has the experience and a fully equipped laboratory to design and test crimping tools.





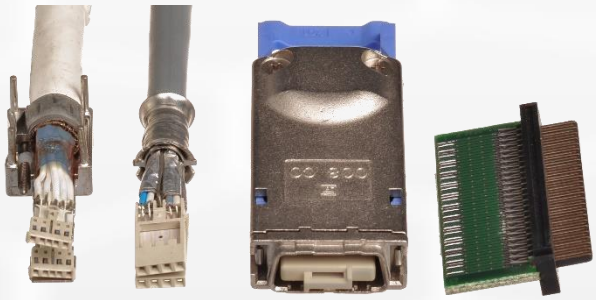
We can supply mini applicators, hand pliers, crimping presses and stripper-crimper presses as required. Repair tools are also available.

A variant of crimping is the ferule crimp. These are usually toggle press oriented tools in which a single or double (inside and outside) ferule is crimped onto a cable. Our 360° crimping system provides very good EMC shielding and strain relief.

Tools for making a hex crimp are also available.

Direct attach

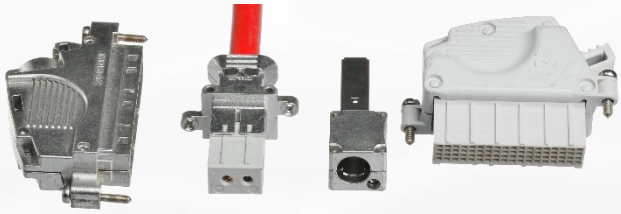
Föhrenbach Application Tooling supports the production of high speed cable assemblies, with an emphasis on the following connectors: SFP+, QSFP, InfiniBand, DensiShield, CXP, …

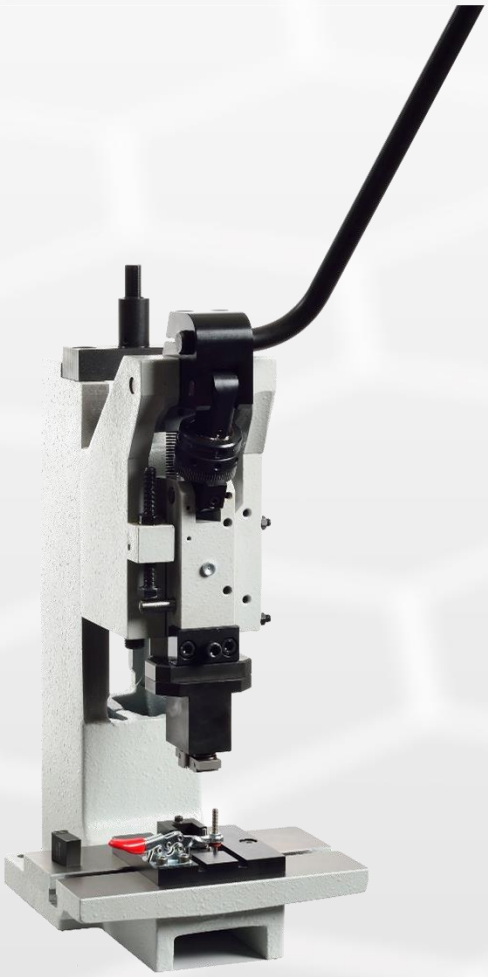


For the aforementioned connectors, the Twinax cable elements are soldered directly to the PCB in the connector. We support this process with systems ranging from simple jigs for hand soldering to automatic hot-bar soldering machines with integrated 2D and 3D camera control.

The production of high speed cable assemblies can be divided into cable prep, cable termination and post processing. At the customer's request, we are also able to offer full support for the cable prep and post processing steps. In this, the following techniques are addressed: cutting the cables to length, printing on the cables, stripping the cables, coiling, high pressure over-moulding of strain reliefs, gluing (UV curing), low pressure over-moulding of the soldered PCB, continuity and high voltage electrical testing, cover closing, …

Cover closing is not only used with direct attach connectors. Depending on the type of connector, we make tools for riveting or hot or cold stacking the covers.

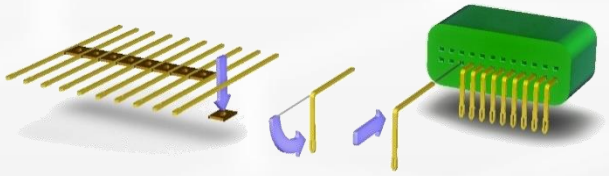




Hot-bar soldering is also used for soldering flexible circuits on, for example, a PCB. We also support these applications.

Connector mounting machines

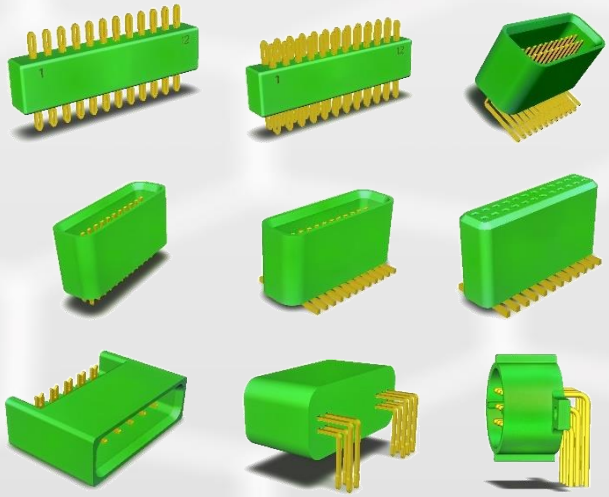
Connectors are made of plastic and metal parts. Our connector mounting machines are able to accurately combine these different parts into a functional connector.



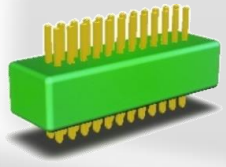
Connectors come in all possible shapes and designs. All common connectors can be mounted using our modular machine concept.

We roughly make the following classification:

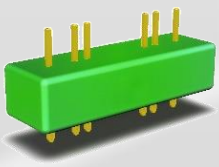
- Board-to-board connectors
- Right-angle connectors with bended terminals
- Circular connectors
- Straight connectors
- SMD connectors
- IDC connectors
- Other connectors



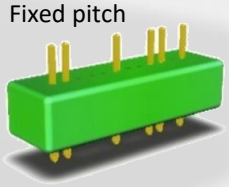
All the aforementioned connectors can have a fixed or variable pitch. They can be fully or selectively loaded with contacts. These can also be hybrid connectors with different contact types on a single connector such as combinations of signal and power contacts, coaxial contacts …



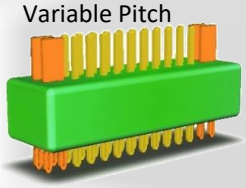
Fixed pitch



Variable Pitch



Selectively loaded

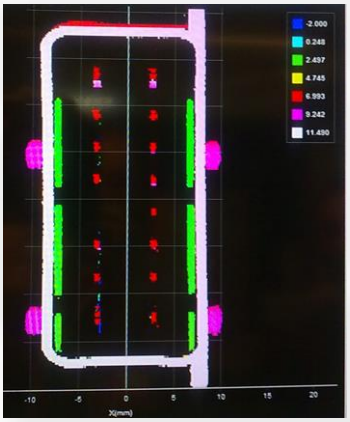


Multiple contact types

To handle the necessary production speed and volumes, we offer mounting heads for both single contact insertion (stitching) and gang insertion.

In order to ensure that the assembled connectors are properly mounted, the mounting machines can be equipped with the following test systems:

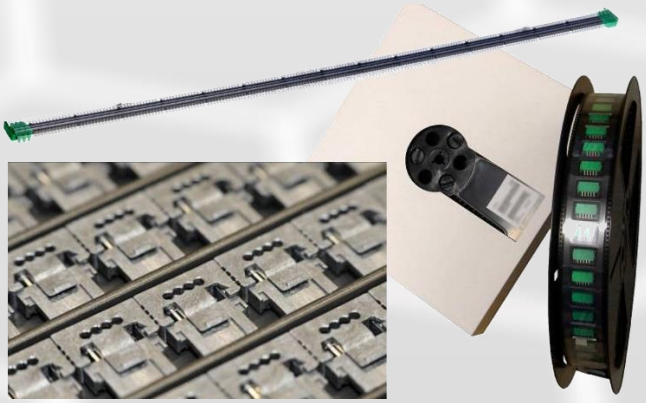
- Electrical continuity test
- Short circuit test
- High voltage test
- Optical true positioning and co-planarity check on mating side and/or PCB side
- Body colour check
- Polarity check of the housings
- Tightness



If there are requirements concerning the cleanliness of the assembled connectors, we can also install cleaning stations.

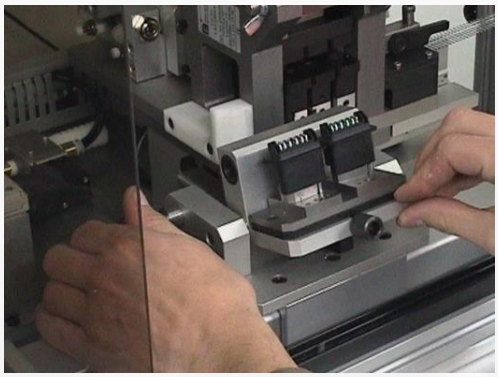
The mounted connectors can also be marked using inkjet or laser printing.

We also offer automatic packaging modules upon customer request and depending on the packaging used. We support packaging such as tape and reel, tube, tray and bulk.



Due to the very large number of different connectors in combination with widely varying production volumes, connector manufacturers need flexible connector mounting machines. We offer this flexibility through a range of different mounting platforms.

Single-head semi-automatic assembly station



In this system, the operator loads the machine with empty connector housings, while the mounting head automatically inserts the contacts into the connector. The operator removes the completed connector when it is finished. Depending on the connector type used, the machine can be equipped with different insertion heads and connector holders.

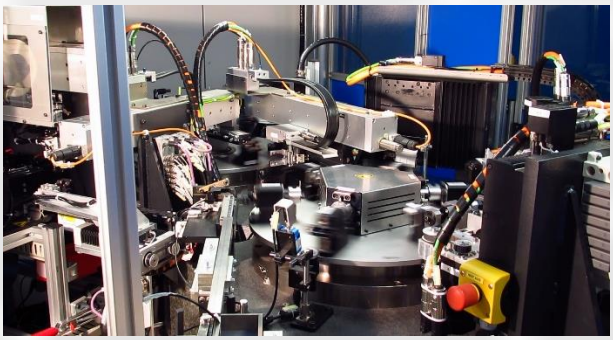
Multi-head semi-automatic assembly station

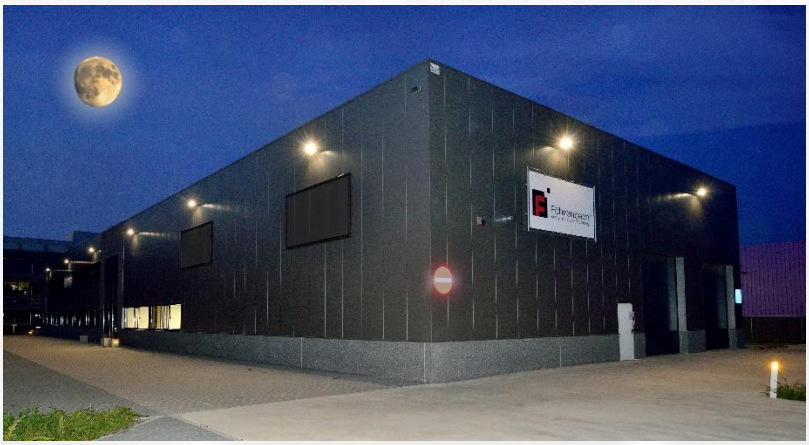
In general, this machine type is the same as the ‘single-head semi-automatic assembly station’. In this machine concept, a turntable or a transport system transports the connector holders to the different stations. Each station can be equipped with a mounting head or a test unit. As a result, this machine can finish a complete connector with multiple rows/mixed contact types during each cycle. With this machine concept, the operator removes the finished connectors from the machine and places one or more unassembled housings in the connector holder per cycle.

These machines can be more fully automated by replacing the operator with a manipulator or robot.

Fully automatic mounting machine

These are our flagship machines. This machine concept allows for the automation of connector housing feed, contact feed, the mounting of accessories, marking, testing, cleaning and packaging. These assembly machines are designed for very specific applications.





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