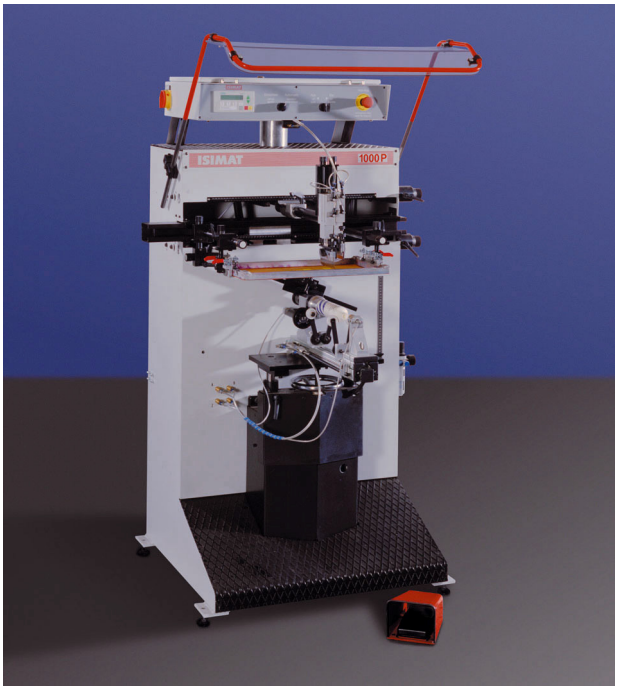
Operating manual

screen printing machine
1000 P



Year of manufacture: 2007

Machine Number: 10226 / 10227

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In the footer you will find the version number of this operating manual which is required for any communication with the manufacturer.

Keep for future use!

TABLE OF CONTENTS:

1 Introduction

This operating manual is intended to help you become familiar with the machine and its proper use.

It contains important information on how to operate the machine safely, properly and economically. Compliance with this information will help avoid hazards, repair costs and downtime and increase the reliability and working life of the machine.

1.1 General

Each person working with or performing work on the machine must follow the information contained in this operating manual.

The prerequisite for this is that only trained specialists will be operating the machine.

This operating manual provides information about all life phases of the machine:

- Transport and commissioning
- Description
- Operation
- Maintenance and disposal
- Faults

ISIMAT GmbH Siebdruckmaschinen will not assume responsibility for

- Accidents
- Damage or
- Production losses

resulting from non-observance, ignorance or disregard of the operating manual.

1.2 Intended use

The screen printing machine 1000 P is a semi-automatic universal screen printing machine. Substrates can be printed on the 1000 P using different printing methods with the corresponding, optional auxiliary facilities:

Article materials	Printing method
• Plastic • Glass • Porcelain • Wood • Metal	• Cylindrical printing • Flat printing • Oval printing • Cone printing

Solvent, dual component, UV and thermoplastic inks can be printed using the 1000 P. See section 1.7 Subdivision of printing inks, page 26.

The substrate must be pre-treated depending on the article material. See section 1.6 Pre-treatment of substrates, page 20.

The machine is equipped with a printing station. The substrate is inserted into the receptacle by hand; the print process is triggered by a foot switch. Then the substrate is removed again by hand.

Changing over from cylindrical printing to flat printing only takes a few minutes. Fine settings are carried out using rotary knobs and micrometer screws: Screen and squeegee carriages, screen holder, squeegee and flood bar. Multi-color printing is possible by repeated laying in of the substrate.

Maintain the values indicated in section 3.1 Technical data.

The machine is intended solely for contractually specified use.

Any other use or any use going beyond this will be considered non-intended usage. The manufacturer / supplier assumes no liability for damage resulting from such use. The user solely bears this risk. This also applies to subsequent changes and modifications to the machine.

Intended use also includes observance of the operating manual and keeping the inspection and maintenance schedules.

1.2.1 Obvious misuse

Operate the screen printing machine 1000 P only within the framework of its intended use. Any other use of the machine or any use going beyond this may result in hazardous situations.

⚠ WARNING

Injuries and damage to the machine caused by misuse of the machine!

Impermissible use of the machine may result in hazardous situations.

- Never use inks or paints which can form an explosive atmosphere while drying or evaporating.
- Only print substrates which are intended for the machine.
- Only conduct production procedures for which the machine is intended.

1.3 Print processes - overview[1]

Printing is a process for reproducing information made up of texts or images in any desired quantity. The essential component in printing is the forme. The forme is a tool constructed in such a way that a printed image can be created on a substrate from the print template using ink. The forme is a print image storage device. The printing template is an image or text to be reproduced in a printing process.

The mechanical print processes are sub-divided into four main processes according to the characteristic features of the formes.

Print process	Printing forme features	Allocation
Relief	The image elements to be printed are raised above the non-image areas	Letterpress Flexography Letterset printing
Gravure	The image elements to be printed are below the non-image areas.	Rotogravure printing Recess printing Pad transfer printing
Flat printing	The image and non-image areas are almost on the same level	Lithography Offset printing Collotype
Through printing	The image elements to be printed are pervious to inks whereas the non-image elements are impervious	Screen printing Film printing

Table 1-1: Overview of the main mechanical printing processes

Following the printing principle, the four main print processes are sub-divided into direct and indirect printing.

Whereas in direct printing the forme transfers the ink directly to the substrate, indirect printing involves an intermediate carrier for transferring the ink.

Letterpress and flexography are direct relief processes. In pad transfer printing, a flexible pad made of silicon putty takes the ink from the gravure carrier and transfers the image to the substrate. This makes pad transfer printing an indirect process.

Screen printing is used predominately as a direct through-printing process.

[1] *Source: Scheer, Siebdruckhandbuch [screen printing manual], ISBN: 3-925402-41-1*

1.3.1 Letterpress

Letterpress is the oldest printing process, but it has lost its significance in recent times.

As a direct printing process, the letterpress forme transfers the image directly to the substrate. Characteristic of letterpress printing is the variety of forme combinations possible. It can consist of various elements, such as manual and machine letterset, cut, etched or stamped clichés or entire relief plates made of metal or plastic.

The following printing principles are used in letterpress printing:

- Platen printing, whereby the flat forme is pressed against a flat impression piece (platen).
- Cylinder printing, whereby the flat forme is pressed against a cylindrical impression piece.
- Rotary printing, whereby a cylindrical forme is pressed against a cylindrical impression piece.

Now that offset printing has displaced letterpress printing from its last domain, namely newspaper rotary printing, letterpress printing is now used mainly for commercial printing (small runs and specialty printing).

1.3.2 Flexography

Flexography is a relief process based on the configuration of the forme. The flexible forme, compared with a letterpress plate, allows printing on rough surfaces. Consequently, flexography is used mainly in printing packaging materials such as packing papers, corrugated cardboard, etc. This process is equally suited to very large runs of paper, plastic, metal films, etc.

Rubber formes (post-formed from original relief plates) were used initially. But the quality of the printed images from large area subjects and coarse line drawings was relatively poor. The use of high-quality photopolymer plates, modified inking units and improved inks has significantly improved the print quality in recent times. Flexographic printers are generally multi-color rotary roller machines.

The wide field of packaging printing is the domain of flexography. This process is also used however for printing forms and, more recently, for newspaper printing.

1.3.3 Pad transfer printing

The forme used in pad transfer printing is an etched steel or washed plastic plate. As in the case of the gravure plate, the print image elements are recessed in the non-printing surface. During the printing process, ink is spread over the plate to fill up the image on it. A squeegee cleans the surface of the plate of any excess ink. The remaining ink stays in the recesses. A soft, elastic, silicon rubber pad transfers the ink from the forme recesses onto the substrate.

Pad transfer printing is an indirect gravure process. Due to the elasticity and shape, the pad can be adjusted to the type and shape of the object to be printed. Pad transfer printing allows very fine text and images to be rendered on objects such as car and train models, photographic and video equipment, keyboards, electronic components, etc.

1.3.4 Screen printing

Screen printing is a process which has established itself firmly in the world of printing as a fourth printing procedure.

In contrast to the formes used in traditional relief, gravure and planographic processes where the image elements are inked and then transferred to the substrate, the screen printing forme consists of areas some of which allow ink through and some of which do not. In the printing process, a squeegee presses the ink through the porous image elements onto the substrate.

The screen forme can be flat, cylindrical or be adapted to the geometry of the substrate.

Screen printing can be performed according to four different printing principles:

Flat-bed printing

The forme and substrate are both flat.

Flat-bed cylinder printing

The forme is flat but the substrate is wound over a cylinder. For this process, the cylinder and the forme move synchronously beneath a fixed squeegee.

Cylindrical printing

The forme is either flat or adapted to the shape of the substrate and is moved in one direction synchronous with the substrate. The squeegee is not moved and can, like the forme, be adapted to the geometry of the substrate.

Rotary screen printing

The cylindrical forme moves in one direction synchronous with the flat substrate. A fixed squeegee is arranged inside the cylindrical forme.

Screen printing is used similarly for hobbies, commercial and industrial purposes. It offers many application possibilities unlike any other printing process.

The main applications for screen printing are in advertising and sales promotion, and in industries such as packaging, cosmetics, electronics, glass, ceramics and textiles. The chief advantage lies in its ability to deal with printing tasks that appear nearly impossible.

1.4 Screen printing - printing principles[2]

Screen printing is the fourth main printing process along with relief, planographic and gravure printing. The principle is simple and easy to understand initially: The screen forme consists of a screen frame, a screen, consisting usually of a cloth mesh, and a stencil. The screen which is stretched over the frame is applied with a stencil. The stencil covers parts of the screen. The covered parts represent the non-image, impermeable parts of the image and the non-covered parts represent the ink-permeable image parts.

In the printing process, a squeegee presses the ink through the ink pervious parts of the screen forme onto the substrate lying below the forme.

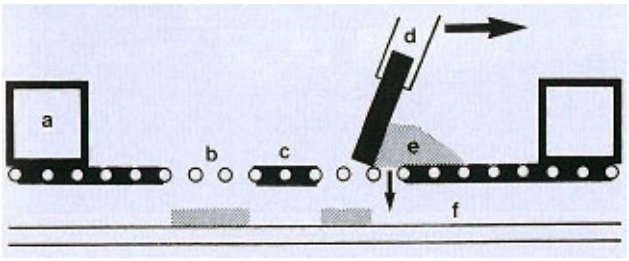


Figure 1-1: Principle of screen printing

(a) Screen printing frame
(b) Screen
(c) Stencil
(d) Squeegee
(e) Ink
(f) Substrate

With its advantageous ability to print virtually any material type and substrate shape and the wide variety of mat, semi-glossy and glossy colors in various coat thicknesses and for special requirements, screen printing is used where other printing processes come up short due to application-technical reasons.

We are surrounded every day by a variety of screen printed products without even being aware of it. Whether in the form of domestic and clothing textiles, cosmetics packaging, decorated porcelain, stone products or glass, as printed circuits in domestic, electronic appliances, in the form of rear window defrosters in our car, watch dials and decoration, automobile labeling, advertising products, CD labels, etc.

The virtually unlimited possibilities with the widest variety of printing tasks and criteria mean that screen printing is significantly more complex than it appears at first glance. Every printing task makes particular demands on the forme, the ink and the printing conditions. Meeting these various requirements necessitates great variability in the material components of the forme, in the type of ink and in the printing conditions.

[2] *Source: Scheer, Siebdruckhandbuch [screen printing manual], ISBN: 3-925402-41-1*

With its multiplicity of variables, screen printing is the most complex of all printing processes.

The broad range of possible applications for screen printing brings with it a wide range of printing equipment and accessories. Every printing device can be assigned to one of the four main printing principles:

- Flat-bed screen printing (flat printing)
- Cylindrical printing or round body screen printing
- Flat-bed cylinder printing
- Rotary screen printing

1.4.1 Flat-bed screen printing (flat printing)

With this printing type, the forme and substrate are both flat. For printing, the flat substrate configured as a sheet, plate or body lies beneath the forme. Between the forme and the substrate is a small gap called ***snap off distance*** in the profession.

During printing, the squeegee makes line contact with the substrate. The snap off distance causes the forme to lift directly off the substrate behind the forward moving squeegee, allowing the ink to be released. Screen printing is the only printing process in which the forme does not remain in constant contact with the substrate.

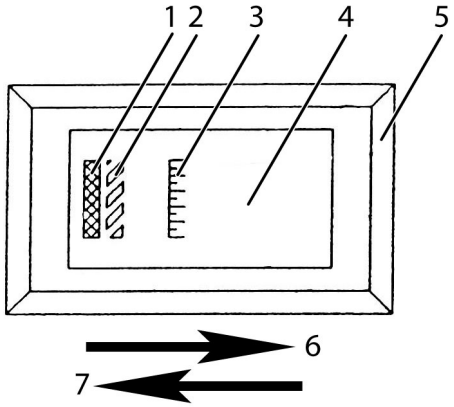


Figure 1-2: Flat printing - principle

(1) Squeegee
(2) Flood bar
(3) Print area
(4) Substrate
(5) Screen forme, fixed
(6) Squeegee movement during printing
(7) Squeegee movement during flooding

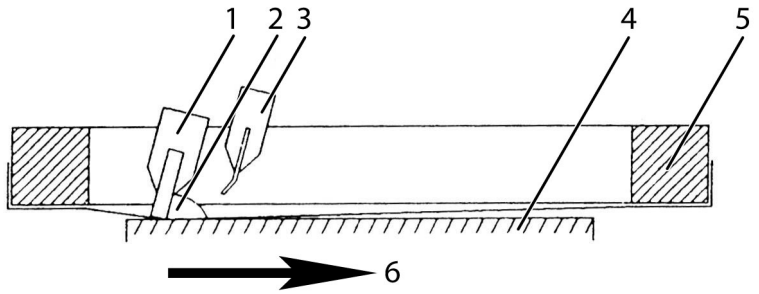


Figure 1-3: Flat printing - print process

(1) Squeegee
(2) Ink
(3) Flood bar lifts
(4) Substrate
(5) Screen forme, fixed
(6) Squeegee movement during printing

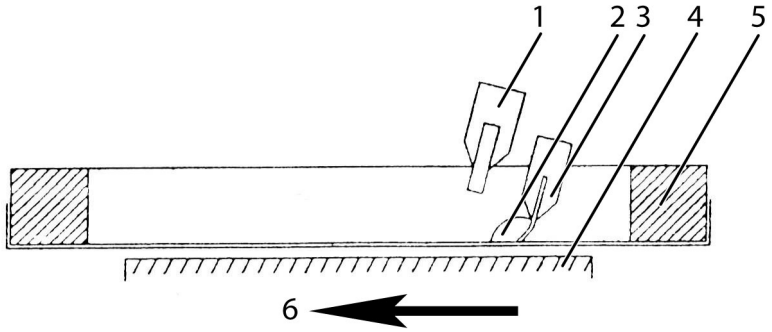


Figure 1-4:Flat printing - flooding

(1) Squeegee lifts
(2) Ink
(3) Flood bar
(4) Substrate
(5) Screen forme, fixed
(6) Squeegee movement during flooding

Printing can be performed using manual printing tables of various kinds or with flat-bed screen printers with various levels of automation up to fully automatic screen printing lines.

1.4.2 Cylindrical printing or round body screen printing

Solid or hollow bodies such as rods, canisters, glass and plastic containers, etc. are printed using a forme which is either flat or conforming to the substrate. The forme moves below a fixed squeegee, synchronous with the substrate, in one direction.

To print a ball-shaped product the forme is arched to conform to the cross-section of the half-sphere. The geometry of the squeegee conforms to the arch of the screen.

Cylindrical screen printing may be manual, semi-automatic or with multi-color, fully automatic machines. Main areas of application are in the packaging and glass industry (plastic containers of all kinds, bottles and glasses).

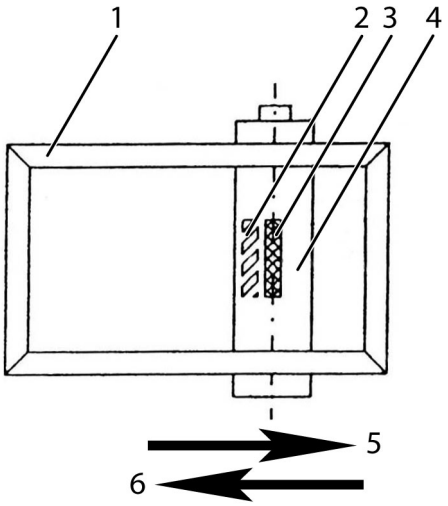


Figure 1-5: Cylindrical printing - method

(1) Screen printing forme
(2) Floodbar, fixed
(3) Squeegee, fixed
(4) Substrate
(5) Forme movement during printing
(6) Forme movement during flooding

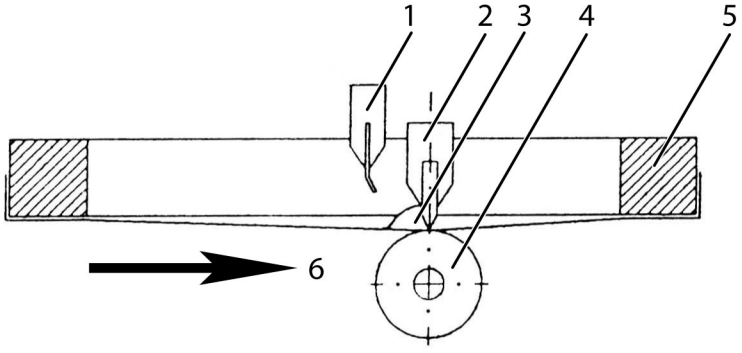


Figure 1-6: Cylindrical printing – print sequence

(1) Flood bar lifts
(2) Squeegee, exactly above the axis of the substrate
(3) Ink
(4) Substrate
(5) Screen printing forme
(6) Forme movement during printing

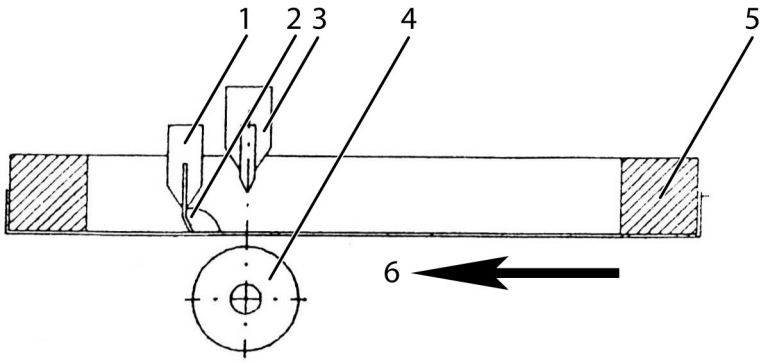


Figure 1-7: Cylindrical printing - flooding sequence

(1) Flood bar
(2) Ink
(3) Squeegee lifts
(4) Substrate
(5) Screen printing forme
(6) Forme movement during flooding

1.4.3 Process advantages

The uniqueness of the forme gives screen printing decisive advantages over all other printing processes. This can be characterized in three ways.

- The forme can be adapted for substrate materials and surfaces of all kinds. It is also a fast, economical and versatile form of printing.
- The forme allows ink to be dispensed in a way that controls the coating thickness of the ink application, which means that this print process surpasses others many times over. This ability to control is determined by the material and thickness of the various meshes combined with the selection of squeegee hardness.
- The forme allows for very different color combinations because it places no other requirements on the ink than sufficient fineness to pass through the screen printing mesh to the print article. This means that the other color properties on the substrate can be oriented towards the desired effects. This also explains the variety of typical colors available for screen printing. You can also integrate special properties into the inks for all substrates and application purposes. By combining the range of control with the ability to multiply the coating thickness, screen printing is able to offer effects not possible with other printing processes: optimum color effect, brilliance, light-resistance, wear resistance and conductivity!

No other process can meet such a variety of surface finishing challenges in all areas of industry and give advertising articles such forceful color and long-lasting effect as screen printing! Substrate options for screen printing are virtually unlimited, ranging from paper and cardboard to metals, paints, hard fibers, plastics, glass and ceramic. Screen printing is the only process to be characterized by two decisive factors which make it ideal not only for outdoor advertising: series production with weather-resistant inks. Screen printing is indispensable to advertising when optimum and long-lasting color effect is desired, when time is of the essence, when versatility and quick readiness are needed. Regardless of which branch, whether packaging, sports articles or electronics, all of today's industries use screen printing in limitless applications. The reproduction limits for screen printing keep expanding, with no end in sight. The economic potential of screen printing has increased so much through automated screen printing lines that the number of reproductions possible keeps going up. Screen printing technology is being continually refined, screen printing is being constantly promoted and new uses discovered.

1.4.4 Selection of squeegee material

The squeegee is one of the most important components in screen printing. The squeegee ensures good, elastic application. The selection of squeegee material is therefore decisive for good printing results. The more even the surface is, the harder the squeegee material can be. However, with uneven surfaces a softer squeegee material must be

selected to compensate the unevenness. To do justice to these different demands, squeegee materials are divided into three different degrees of hardness:

Soft:	65 - 70° Shore
Medium:	70 - 75° Shore
Hard:	75 - 80° Shore

1.5 Principle of UV curing systems

Liquid UV curable inks and paints respond to the influence of UV radiation in seconds to form a hardened ink film.

The cross-linking is generated (initiated) by a defined UV radiation, resulting in a chain reaction which in turn creates a firm, highly resistant ink film after the components have reacted. This curing process is chemically based, whereby short molecule chains are cross-linked with long, three-dimensional molecular structures. This reaction mechanism is called radical polymerization.

The reaction speed of the ink in the curing process depends essentially on factors which are established in the recipe and in the components used in a UV ink. The most important components of a UV screen printing ink can be described as follows:

- **Prepolymers/oligomers = viscous resins**
  These represent the basis of a UV ink and assume the function of the binder in the ink system. They determine important properties of the ink such as adhesion, resistance and flexibility.
- **Monomers = reactive thinners**
  These influence the curing time and give the ink the necessary viscosity for printing. They determine and control the cross-linking density of a UV ink due to their functionality. The use of prepolymers and monomers therefore determines whether an ink system is flexible or hard.
- **Photoinitiators = reaction starters**
  These absorb infalling UV light and break down into so-called free radicals. Radicals are highly reactive molecules which can accumulate on unsaturated double bonds and lead to polymerization of the acrylate. Fine-tuning the photoinitiators to the ink system essentially controls the curing process.

1.6 Pre-treatment of substrates

Pre-treating plastic articles

The surfaces of plastic articles must be pre-treated if they are to be printed or painted.

Pre-treatment is necessary, because the majority of plastics used are non-polar materials which have little or no tendency to provide adhesion for paints or printing inks. This means that the surfaces in question need to be activated in order to achieve sufficient surface wettability and therefore good adhesion on the surface.

Pre-treatment of glass articles

Surfaces of glass articles must be pre-treated if they are to be printed or painted with e.g. UV inks.

Surface energies of various materials

The surface energy stated in mN/m is a measure for the wettability of a surface. The higher the surface energy value, the better the wettability.

Material	Designation	Surface energy in mN/m
Polytetrafluoroethylene	PTFE	18.5
Polypropylene	PP	29
Polyethylene	PE	31
Polymethyl methacrylate	PMMA	33 ... 44
Polystyrene	PS	33 ... 35
Polycarbonate	PC	40
Polyvinyl chloride	PVC	38 ... 41
Polyethylene terephthalate	PETP	41 ... 45
Polyamide 11	PA	43
Elastified PP	PP-EPDM	21 ... 23
Powder coating (polyester based)		34 ... 44
Epoxy resin		47
Aluminum	Al	1200
Iron	Fe	2550
Copper	Cu	1850
Water		72.8

Table 1-2: Surface energies of various materials

Minimum surface energies for treatment

Ink/paint system	Surface energy in mN/m
2-component	38 ... 40
Solvent	40 ... 42
UV inks	44 ... 46
Water-based	min. 48, target 72

Table 1-3: Minimum surface energies for treatment

1.6.1 Flame pre-treatment

- for substrates made of plastic

In flame pre-treatment, the gas flame is used to break up the molecule chains on the surface of the substrate as a result of the heat effect and to bind oxygen components contained in the flame to these break points. In this way polar molecules are created in the originally non-polar material to which inks or paints can bind. Flame pre-treatment is thus a chemical pre-treatment process in which the heat of the flame is only required to set the process in motion.

For oxidation of the surface, a gas-air mixture must be introduced into the burner whose composition provides an excess of oxygen during combustion. This excess oxygen can then be deposited on the surface molecules.

One of the most important criteria is therefore correctly setting the gas-air mixture ratio, whereby in normal cases there should always be an excess of oxygen of 10 - 15 %.

The burner capacity also has an effect on the pre-treatment result. Low burner capacity results in only a slight increase in wettability. Too high a burner capacity on the other hand results in over-heating of the material, which means that the surface energy drops again to a low level.

Furthermore, the result of the pre-treatment is also affected by the working speed as well as the distance between burner and product.

The working speed has a similar effect to the burner performance. Too high or low a speed likewise yields poor pre-treatment results.

The final important factor in flame pre-treatment to be mentioned is the burner itself. The burner needs to be adapted to the width and shape of the workpiece surface. A configuration of one or more rows of individual nozzles has proven to obtain an even distribution of the flame over the respective burner length, whereby the number, length and cross-section of these rows can be used to adapt the flame characteristics to a wide range of requirements for the respective application.

To summarize, the following points are critical for optimum pre-treatment using the gas flame:

- Determination and precise adjustability of the gas-air mixture ratio.
- Adaptation and precise adjustment of the burner capacity in conjunction with distance and working speed.
- Adjustability of the flame length on the burner.

Mixing ratio

Mixture type	Designation	Mixing ratio	Practice
Air to methane (natural gas)	CH_4	10:1	8:1 (8.5:1)
Air to propane (LPG)	C_3H_8	25:1	26:1 (27:1)
Air to butane	C_4H_{10}	32:1	28:1

Table 1-4: Mixing ratio

After carrying out flame pre-treatment trials these settings may need to be slightly modified. Too rich a setting (greenish flame) will also result in an extremely non-homogenous flame. The outflow speed of the gas from the flame grid is now higher than the burner speed (depending on the gas temperature), so that the flame diminishes and goes out.

1.6.2 Corona pre-treatment

- for substrates made of plastic

Corona pre-treatment is a high-voltage discharge between two electrodes. This accelerates and ionizes the free electrons present in the air. If the discharge is very strong, the collision of very fast electrons with gas molecules results in no loss of kinetic energy and an electron avalanche is created. If a plastic part is introduced into the discharge zone, the electrons generated in the discharge collide with two to three times as much energy on the surface as is necessary in order to separate the molecular bonds on the surface of most substrates. This generates highly reactive free radicals. These free radicals can react quickly in the presence of oxygen to form various chemical function groups on the substrate surface. Function groups which result from this oxidation reaction contribute most effectively to increase the surface energy and improve the chemical bond with the resin matrix. These contain carbonyl, carboxyl, hydroperoxide and hydroxyl groups. The surface treatment using high-voltage discharge modifies only the surface properties without negatively affecting the volume properties of the material.

The technology of three-dimensional electrical surface treatment is based on the high-voltage/high-frequency discharge in air. Three-dimensional objects are moved through a discharge area between two electrodes. The discharge is maintained at a broad distance between the electrodes through generation of a high difference of potential between the electrodes. The use of high voltage is only one condition for effective surface treatment. Uniform treatment of parts which are moving at high speed requires a very efficient energy conversion from current source to discharge area. A corona discharge at frequencies of 15 – 25 kHz causes an efficient energy conversion with electrons oscillating in the area between the electrodes. It has been shown that the higher the

frequency, the less power is required in order to achieve a given level of treatment.

This technology enables uniform treatment of surfaces on three-dimensional objects on high-speed lines by maintaining a voltage difference between the electrodes of up to 80 kV at frequencies of over 20 kHz. Under these conditions objects with cross-sections of up to 100 mm can be treated while continuously passing through a treatment station. Electrical surface treatment consists of a high frequency generator, a high-voltage transformer and treatment electrodes. The generator creates an output signal whose frequency is automatically adjusted depending on the load over a range of 15 – 25 kHz, thereby optimizing the power available for treatment. The high-voltage transformer boosts the output signal from the generator to the level required in order to generate a discharge of the desired intensity. The treatment station is designed around two electrodes: a treatment electrode and a counter-electrode (normally at earth potential).

1.6.3 UVitro® surface treatment

- for substrates made from glass, metal, ceramics, plastic

With UVitro® surface treatment, a thin (20 - 40 mm) but very dense and adherent silicate layer with high surface energy is created on the coating or print substrate as a result of flame pyrolisis of a silicium organic compound.

This pre-treatment method is particularly suited to metals, glass, ceramics and most plastics.

In this case, further processing can be implemented up to a week after surface treatment.

1.6.4 Use of test inks

The use of test inks makes it possible to determine the surface energy of plastic or glass surfaces. This is critical for the adhesion of print inks or paints. In general, the higher the surface energy of a material, the better the adhesion of a material applied to its surface. The procedure is a purely visual one which is evaluated by the respective user.

The most practical approach is to first select a test ink in the middle of the measuring range, e.g. 38 mN/M (former unit: dyn/cm). If the applied line remains for approx. 2 s without shrinking, then the surface energy of the material is either just as high as the surface tension of the test ink or higher.

In this case the test ink with the next higher value, e.g. 40 mN/m, is applied. This test is continued by always using the next higher surface tension value, until shrinkage occurs within 2 s.

If shrinkage already occurs within 2 s using the 38 mN/m test ink, then the test should be continued using test inks with increasingly lower values.

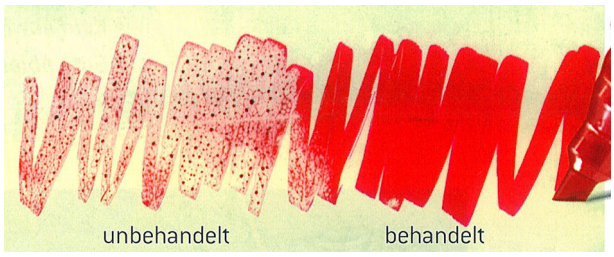


Figure 1-8: Test inks on the surface, untreated on left, treated on right

As a point of reference for the surface energy, a value of around 38 mN/m is often given, however, if the surface energy is lower, poor adhesion must be assumed, and if it is higher, good adhesion may be assumed. It is, however, recommended that you determine the actual limit value for each particular application on a case-by-case basis.

NOTE:
OBSERVE THE MANUFACTURER'S SPECIFICATIONS!

Flame pre-treatment parameters

Various parameters need to be set for pre-treatment to be effective and to ensure that the ink adheres well to the substrate. Two decisive factors are the treatment speed and flame intensity.

Check the surface energy of a substrate after pre-treatment and modify the treatment parameters according to the following table:

Surface energy	Parameter	Setting
too low	treatment speed	reduce
too low	flame intensity	higher flame
very high	treatment speed	increase
very high	flame intensity	lower flame

Table 1-5: Surface energy parameters

NOTE:
AT A VERY HIGH SURFACE ENERGY, THE TREATMENT SPEED FOR EXAMPLE CAN BE INCREASED IN ORDER TO PRE-TREAT A LARGER QUANTITY OF SUBSTRATES. IF THIS IS UNNECESSARY, NO SETTINGS NEED TO BE MADE AT VERY HIGH SURFACE ENERGY LEVELS.

1.7 Subdivision of printing inks

Printing inks are made up of ink pigments, binders and additives. The process of drying or curing the printing ink varies depending on which components the binder and additives are made of.

Ink	Drying / curing	Process / procedure
Solvent ink	Physical drying	Ink dries under normal ambient conditions Solvent and thinning agents evaporate
2-component ink (2C)	Physical and chemical drying	Ink dries under normal ambient conditions or under the effect of IR rays (drying is accelerated)
UV inks	Chemical drying	Ink dries (polymerizes) under the influence of UV rays, see section 1.5 Principle of UV curing systems, page 19
Thermoplastic ceramic ink	Ceramic baking process	Ink must be heated for the print process (melting or liquefaction of the ink) Ink dries (solidifies) under normal ambient conditions but must be ceramized in the burning-in oven

1.8 Signs, symbols and abbreviations

1.8.1 Signs and symbols

The following signs and symbols are used in this operating manual:

1. Procedure instructions are sequentially numbered.
2. Perform these steps in their given order.
   ⇨ The result of an action or procedure is indicated by this arrow.

☝ ***NOTE:***
THIS IS A NOTE. HERE YOU ARE GIVEN ADDITIONAL INFORMATION OR TIPS. NOTES ARE WRITTEN IN ITALIC AND SMALL CAPS, LIKE THIS PARAGRAPH.

Operating elements are in boldface and italic: "...press the ***Setup*** button ..." or "...the ***Run*** lamp comes on...".

1.8.2 Symbols and warnings

Warnings used in this document describe various serious hazards. The degree of danger is indicated by the signal words Danger, Warning and Caution. The following distinctions are made:

⚠ DANGER

- High risk
- Lethal hazards
- Serious injuries

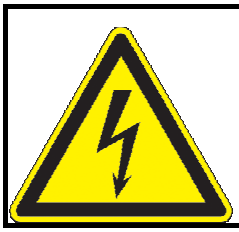
⚠ WARNING

- Moderate risk
- Injury
- Significant material damage

CAUTION

- Slight risk
- Material damage

The following symbols warn against special hazards:



ELECTRICAL VOLTAGE!

POISONOUS!

AUTOMATIC START!

CRUSH HAZARD!

ENTANGLEMENT HAZARD!

FLAMMABLE PROCESS MATERIALS!

EXPLOSIVE PROCESS MATERIALS!

SUSPENDED LOADS!

1.8.3 Abbreviations

The following abbreviations are used in this operating manual:

Abbreviation	Explanation
AC	Alternating Current
W	Width
DC	Direct Current
DIN	*Deutsche Industrie-Norm* (German industrial norm)
H	Height
IPA	Isopropyl alcohol
ISO	International Organization for Standardization
L	Length
LED	Light-emitting diode
NL	Normal liter
UV	Ultraviolet
VDE	*Verband der Elektrotechnik Elektronik Informationstechnik e. V.* (association of electrical engineering, electronics and information technology)

2 Safety

This section describes the general safety regulations for the operation of machines. After this we explain the special hazard sources which can occur while operating this machine. In addition to this, the safety equipment associated with this machine is described.

2.1 Safety requirements

Operating safety of the machine and of its components is only ensured when it is used as intended.

To ensure safe handling of the machine, the complete documentation must be carefully read by all persons who work on or perform work on the machine. To ensure this, the complete documentation must be kept at the site where the machine is used.

ISIMAT is not liable for damage arising from disregard of the complete documentation.

Changes and modifications to the machine and its components are only permitted with written permission from ISIMAT. Only spare parts approved by ISIMAT may be used. The same applies to accessories. ISIMAT is not liable for damages arising from non-compliance with these requirements.

Persons who are working with or performing work on the machine must wear appropriate personal protective gear which meets the prevailing regulations (e.g. safety shoes, ear defenders, protective gloves, work clothing).

In addition to this operating manual and the supplier's documentation, the legal and other safety and accident prevention regulations, the EC Directives 98/37/EC as well as the standards and directives applicable in the operating country must be observed. This applies in particular to the Accident Prevention Regulations VBG 5 Powered Work Equipment dated 01.10.1985 and VBG 7i Print and Paper Processing dated 01.10.1985.

The machine and its components may only be operated when in technically faultless condition. All safety equipment must be in place and functioning. The function of safety equipment must be rechecked after commissioning, after fault elimination and after maintenance work.

Prior to commissioning / power-up of the machine, ensure that nobody is inside the hazardous area of the machine.

Only start the machine if operators are aware of the location and function of fire extinguishing devices!

Signs and symbols (such as warning symbols, hazard symbols, instruction and prohibition symbols) must never be removed from the machine or its components and must be observed at all times.

The safety supervisor is responsible for ensuring that every person working with or performing work on the machine takes part in an annual

safety review. The safety review is to include, among other things, the safety requirements and safety equipment on the machine.

Observe the notes concerning process materials in the respective DIN Safety Data Sheets.

2.2 Personnel selection

Work on or with the machine is to be performed only by reliable persons who are technically and personally suitable. Minimum ages requirements must be observed for work which specifies a minimum age (generally >18 years old). Other physical requirements and the current constitution of the person must be taken into consideration.

When there is more than one employee, the owner must assign a work supervisor and make this known to the work group or team. This person is responsible for monitoring and guaranteeing safe performance of work in accordance with the work safety regulations and prevailing standards. He is the local supervisor for the work group with corresponding authority to issue instructions as part of the work to be performed.

He assigns responsibilities to persons, such as operation or repair of the machine.

Work on the machine is to be carried out only by specially trained technicians.

Work on the electrical system is to be carried out only by skilled electricians or persons instructed in electrical engineering.

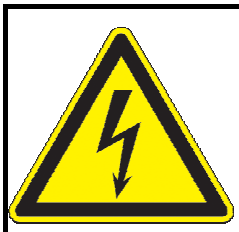
2.3 Process materials

Various process materials are used in the operation of the machine. These may include:

- UV inks
- Print inks
- Paints
- Cleaning agents
- Solvents
- Preservative agents
- Fuels
- Oils
- Lubricants

☝ ***NOTE:***
OBSERVE THE NOTES CONCERNING PROCESS MATERIALS IN THE RESPECTIVE DIN SAFETY DATA SHEETS.

2.4 Hazard sources



⚠ DANGER

Live parts (up to 400 VAC)!

Risk of fatal injury by shock or contact with parts under voltage.

- Disconnect the machine from the mains supply when
  performing maintenance or cleaning work,
  performing repairs,
  opening the enclosure, or
  hanging the work location.
- Protect the mains plug and mains cable from damage.
- Work on the electrical system is to be carried out only by skilled electricians or persons instructed in electrical engineering.
- Observe the five safety rules according to VDE 0105.

⚠ DANGER

Exiting hydraulic oil!

Cut off body parts and severe injuries.

- Work on hydraulic systems may only be carried out by persons with special knowledge of and experience in hydraulics.
- Check the hydraulic lines, hoses and
  screw connections regularly for leaks and externally recognizable damage.
- Before carrying out servicing and maintenance work, de-pressurize the hydraulic system.

⚠ WARNING

Explosive process materials!

Risk of injury and burns to the body.

Machine damage.

- The flash point of process materials must be at least 15 K higher than the process temperature.
- Only use process materials which cannot form explosive atmospheres.
- Look up the flash point in the current DIN Safety Data Sheet.
- Observe all requirements in the DIN Safety Data Sheet.

⚠ WARNING

Toxic process materials!

Health risks.

- Wear your personal protective gear.
- Wash your hands after any contact with process materials.
- Follow the notes in the corresponding, valid DIN Safety Data Sheet.
- Observe all requirements in the DIN Safety Data Sheet.

⚠ WARNING

Moving machine parts!

Injuries to hands, arms and head.

- Do not reach in between the squeegee unit and screen forme in setup mode.
- Do not reach in between the screen forme and substrate in setup mode.
- Wear close-fitting clothing which cannot be caught in moving parts.
- Wear a hair net.
- Carry out changeover and setup work in ***Setup*** mode.
- Turn the machine off when performing maintenance work (disconnect supply voltage and compressed air supply).
- Make sure that the safety bow is correctly positioned.

⚠ WARNING

Moving and rotating machine parts!

Danger of catching limbs, clothing, jewelry and long hair.

- Never grab moving or rotating machine parts.
- Wear close-fitting clothing which cannot be caught in moving parts.
- Wear a hair net.
- Remove jewelry.
- Turn the machine off when performing maintenance work (disconnect supply voltage and compressed air supply).
- Make sure that the safety bow is correctly positioned.

CAUTION

Machine starts automatically!

Risk of injury!

Machine starts automatically when the foot switch is operated.

- Ensure that there are no persons inside the hazardous area of the machine when it is started.
- Turn the machine off by the main switch when performing maintenance, repair or cleaning work.
- Secure the machine against prohibited switching on.

CAUTION

Decommissioned safety equipment!

Damage to health and injuries, e.g. as a result of subsequent attachments.

- Do not operate the machines without safety equipment.
- After adding ancillary equipment, check that the safety equipment on the machine is functioning properly.
- E-Stop switches must remain freely accessible.

CAUTION

Health hazards from process materials!

- Wear appropriate protective gear when working with process materials.
- Change your work clothing immediately after coming into contact with UV inks or solvents (UV inks do not dry on clothing, only after exposure to UV radiation).
- Provide adequate ventilation.
- Immediately wash your hands / skin after contact with process materials.
- Observe the notes concerning process materials in the respective DIN Safety Data Sheets.

CAUTION

Machine damage caused by unsupervised machine!

- Never leave the machine unsupervised while running, so that you can react in hazardous situations.
- Turn the machine off when work is interrupted (disconnect supply voltage and compressed air supply).

CAUTION

Stepper motor works as a generator and creates voltage!

Machine damage to electronics and controller.

- Do not turn the stepper motor by hand if
  - the main switch is turned off
  - the power supply has failed
  - the control voltage has failed.

2.5 Safety equipment

This section describes the safety devices the machine is equipped with.

2.5.1 E-Stop switch

The machine is equipped with an E-Stop switch on the control console within reach of the operator.

The E-Stop switch is actuated in hazardous situations in order to minimize injury to the operator and damage to the machine as far as possible.

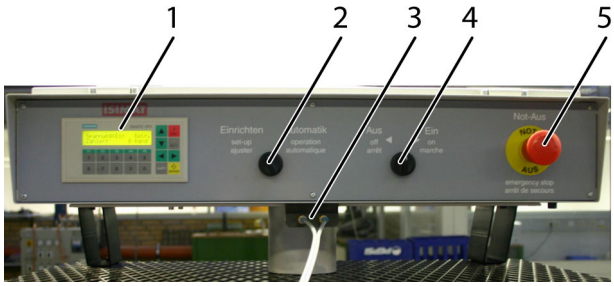


Figure 2-1: E-Stop switch on control console

(1) Control unit TD 200 / OP 3
(2) Operating modes switch (setup / automatic)
(3) Compressed air connections for squeegee head
(4) Operating switch (off / on)
(5) E-Stop switch

Pressing the E-Stop switch has the following effects:

- You have pressed the E-Stop switch.
  ⇨ The machine stops.
  ⇨ Emergency stop relay drops (power supply is interrupted, control system remains active).
  ⇨ All cylinders are depressurized or fixed
  ⇨ Control unit displays an error message.

To get ready for operation:

1. Eliminate the hazardous situation or fault.
2. Pull out the E-Stop switch.
3. Close the safety bow.
4. Set the operating switch to ***On***.
   -or-
   Acknowledge the error message by pressing ***ENTER*** on the control unit.
   ⇨ E-stop relay starts up.
   ⇨ The machine is ready for operation.
   ⇨ Automatic mode: Compressed air cylinder is pressurized. Machine moves to home position.

2.5.2 Safety bow

The machine has a safety bow. This protects the operator against injuries in automatic mode. The machine can only be operated in automatic mode when the safety bow is closed. In setup mode the safety bow can be opened so the operator can carry out settings on the machine.

The safety bow secures the work area in automatic mode. Make sure that the safety bow is correctly positioned: The lower edge of the safety bow must be beneath the screen forme.

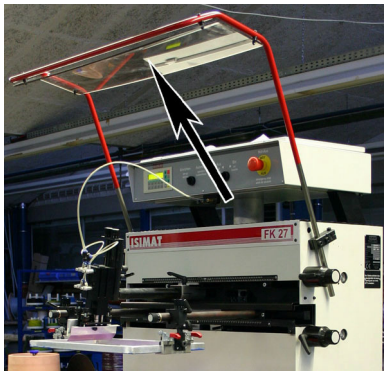


Figure 2-2: Safety bow, open

Opening the safety bow in automatic mode has the following effects:

- You have opened the safety bow.
  - ⇨ The machine stops.
  - ⇨ Emergency stop relay drops (power supply is interrupted, control system remains active).
  - ⇨ Squeegee, flood bar and lift table return to home position.
  - ⇨ Compressed air cylinder on the printing system (squeegee head and screen holder) is de-pressurized and can be shifted by hand.
  - ⇨ Control unit displays an error message.

To get ready for operation:

1. Eliminate the hazardous situation or fault.
2. Close the safety bow.
3. Set the operating switch to ***On***.
   -or-
   Acknowledge the error message by pressing ***ENTER*** on the control unit.
   - ⇨ E-stop relay starts up.
   - ⇨ The machine is ready for operation.
   - ⇨ Automatic mode: Compressed air cylinder is pressurized. Machine moves to home position.

2.6 Personal protective gear

Wear your personal protective gear.

WEAR EYE PROTECTION!

Wear appropriate eye protection

- when handling process materials (spray hazard)

WEAR SAFETY GLOVES!

Wear safety gloves

- when handling UV inks to prevent direct skin contact.
- when handling process materials.

WEAR HAIR NET!

Wear a hair net

- when working on moving parts.

2.7 Warning signs

The following warning signs are directly attached to the machine:

Warning sign	Location on machine
	right side, beneath type plate
	on the right, below the lift table option: • optical registration unit • neck bottom support with mechanical mark registration

Table 2-1: Warning signs on machine

NOTE:

REPLACE ILLEGIBLE OR MISSING WARNING SIGNS IMMEDIATELY! WARNING SIGNS CAN BE OBTAINED FROM ISIMAT.

2.8 Operation modes

The screen printing machine can be operated in two different modes with different safety levels. The mode is set on the control console using the operating mode switch.

“Setup” mode:

In ***Setup*** mode, the safety bow has no function. The machine can be set up. Functions such as ***Raise / lower lift table*** or **Screen to the left / right** can be operated manually.

Work that may be performed in setup mode:

- Cleaning work
- Maintenance work
- Setup work
- Retrofitting

In setup mode, there are particular dangers as the protective function of the safety bow is deactivated. The operator can reach unprotected into moving machine parts.

"Automatic" mode

In order to work in ***Automatic*** mode, the safety bow must be closed.

The machine runs automatically. After pressing the foot switch, a production cycle is carried out.

2.9 Work stations

The work place for the operator is in front of the machine. Article receptacle, control console and squeegee unit with screen forme are accessible from the front. This applies for automatic mode. In setup mode, work can be carried out with the safety bow open. To changeover from flat to cylindrical printing, the housing door on the back of the machine must be opened. The compressed air and speed of the printing system can be set on the right housing side.

3 Transport and commissioning

3.1 Technical data

General

Power connection: with vacuum unit	1/PEN / 230 VAC / 50 Hz / 16 A 3/PEN / 400 VAC / 50 Hz / 16 A
Capacity:	< 0.5 kVA
Pneumatic connection:	6 bar constant, dry air
Dimensions (L x W x H):	1,000 mm x 1,000 mm x 1,800 mm
Weight (unpacked, without options):	420 kg
Paint color:	Light grey, RAL 7035
Flat printing Length: Width:	 520 mm 400 mm
Cylindrical printing: Print image length, maximum: Substrate, height:	 500 mm 400 mm
Height of substrate:	max. 300 mm when the substrate is lying on the printing table plate
Capacity:	up to 2,000 cycles / hours, adjustable

Table 3-1: Technical data, general

Vacuum unit (on the vacuum print table plate, optional)

Capacity	0.7 kVA

Table 3-2: Technical data, vacuum unit

3.2 Transport

Before transporting, check whether the required lifting gear and transport equipment are sufficient for the weight and dimensions of the machine.

For transportation, the machine must be properly attached and raised as well as correctly strapped into place.

⚠ WARNING

Suspended loads when transporting!

Injury and machine damage.

- Do not step or stand under suspended loads.

⚠ WARNING

Injury and machine damage when transporting!

- Never remain in the hazardous area while moving the machine.
- Support and brace the machine during transport so that parts cannot become loose due to jolts or vibration and parts cannot break.
- Fasten the machine for transport so that it can neither move nor tip over.
- During transport keep the machine covered with tarpaulins so that it does not get dirty and no moisture can enter the machine.
- Only use sufficiently dimensioned lifting gear.
- Work with care and attention.

Transporting with a forklift truck / manual lift truck

Observe the pick-up points for transporting with forklift truck or manual lift truck.

⚠ WARNING

Machine damage to lift table during transport!

Lift table is located beneath the machine cladding.

- Pick up the machine on the outside at the machine feet points (see picture below).

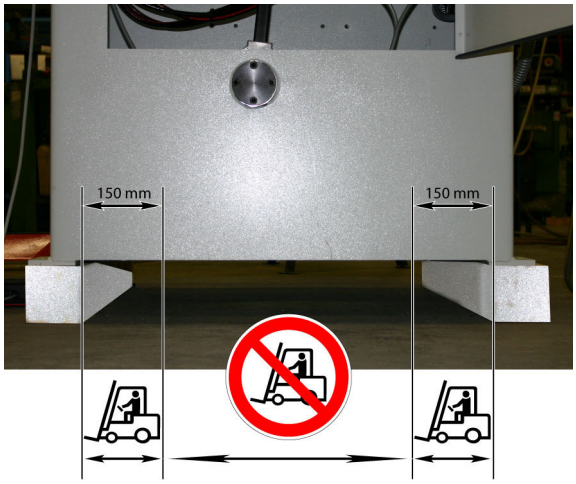


Figure 3-1: Pick-up points for transport

3.3 Installation

3.3.1 Pneumatic connection and compressed air preparation

The screen printing machine 1000 P requires a pneumatic connection with 6 bar (constant, dry air). When doing this, note the following points:

CAUTION

Unclean or incorrectly oiled compressed air shortens the service life of pneumatic components, such as e.g. valve islands.

Operation with unoiled compressed air

CAUTION

If the residual oil content in the compressed air is too high, it can shorten the service life of pneumatic components, such as e.g. valve islands.

- When using bio-oils (oils based on synthetic ester or native ester, e.g. rape seed oil methyl ester), the residual oil content of max. 0.1 mg/m^3 must not be exceeded (see ISO 8573-1 Class 2).
- When using mineral oils (e.g. HLP oils as defined in DIN 51524 Parts 1 to 3) or corresponding oils based on poly alpha-olefins (PAO), the residual oil content of max. 5 mg/m^3 must not be exceeded (see ISO 8573-1 Class 4).

This will help you avoid malfunctions of the pneumatic components, such as e.g. valve islands.

Irrespective of the compressor oil, a higher residual oil content is in principle not permitted as otherwise the basic lubricant is washed out over time.

NOTE:
ISIMAT ASSUMES THAT YOUR COMPRESSED AIR SUPPLY MEETS CURRENT TECHNICAL STANDARDS, I.E. THAT NO CONDENSED WATER CAN FORM AND THAT THE COMPRESSED AIR SUPPLY IS OIL-FREE. TAKE WHATEVER MEASURES ARE NECESSARY TO ENSURE THAT THESE CONDITIONS ARE MET.

3.3.2 Setting up the machine

1. Remove the transport packing from the machine.
2. Place the machine in a clean and dry location.
3. Align the machine horizontally (use a spirit level and adjust as needed).
4. Remove any conserving agents (grease or oil) from the machine.
5. Ensure that the main switch is in ***O*** / ***OFF*** position.
6. Connect the mains cable to the mains network (see section 3.1 Technical data, page 40).
7. Connect the main valve on the compressed air unit with the compressed air supply network (6 bar constant, dry air).

☝ ***NOTE:***
A CONSTANT ROOM CLIMATE WILL HELP TO ENSURE CONSISTENT PRINTING RESULTS.

4 Machine description

This section provides an overview of the screen printing machine 1000 P. Machine components and control elements are described.

The screen printing machine 1000 P can be equipped with various, optional accessories. These options are described in this instruction manual. Observe the information relating to the options with which your screen printing machine 1000 P is equipped.

4.1 Machine overview

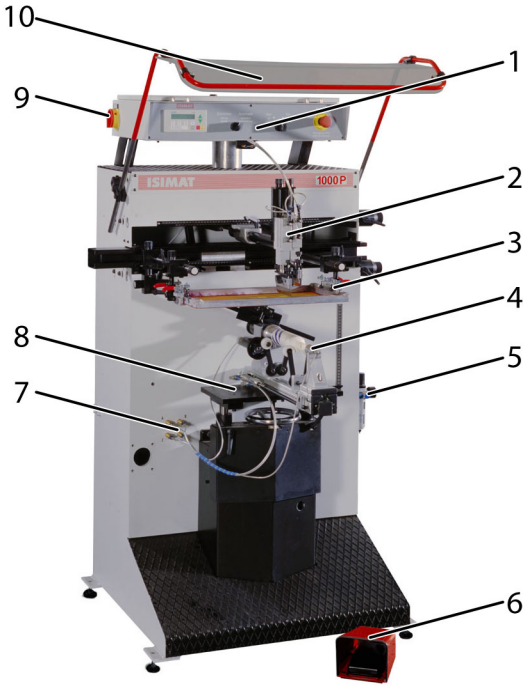


Figure 4-1: Overall view screen printing machine 1000 P

(1) Control console
(2) Squeegee unit
(3) Screen holder
(4) Article receptacle
(5) Compressed-air unit
(6) Foot switch
(7) Pneumatic connections
(8) Lift table
(9) Main switch on control cabinet
(10) Safety bow

4.2 Control console

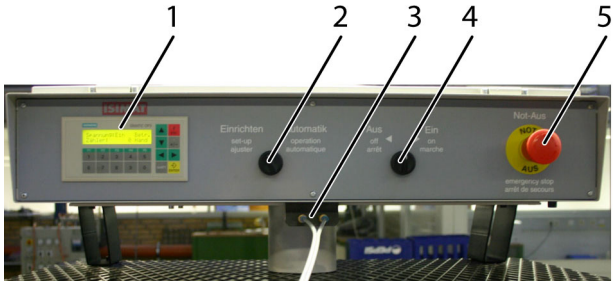


Figure 4-2: Control console

(1) Control unit TD 200 / OP3
(2) Operating modes switch (setup / automatic)
(3) Compressed air connections for squeegee head
(4) Operating switch (off / on)
(5) E-Stop switch

Compressed air connections for squeegee head

The compressed air connections for squeegee and flood bar are beneath the control console. If the printing method is changed, e.g. from cylindrical printing to flat printing, then the squeegee and flood bar must be swapped. Accordingly, the compressed air hoses for the squeegee and flood bar must also be swapped.

- Squeegee: left compressed air connection
- Flood bar: right compressed air connection

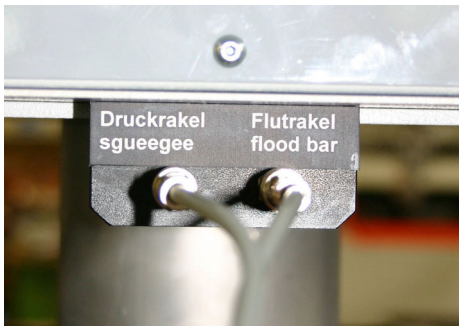


Figure 4-3: Compressed air connections for squeegee and flood bar

4.3 Machine framework

The printing method is changed over in the inside chamber of the machine, e.g. from flat printing to cylindrical printing. The drive arm is driven by a maintenance-free hydraulic cylinder. The printing method depends on whether the drive arm is mounted to the carriage for flat printing or the carriage for cylindrical printing.

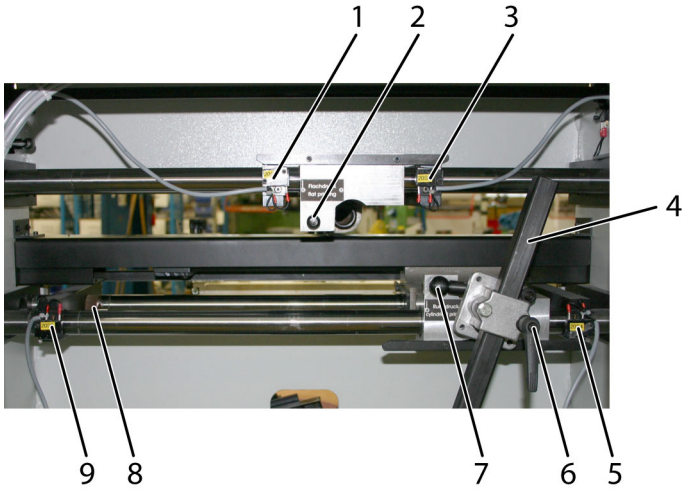


Figure 4-4: Inside chamber of machine

(1) Flat printing limit point
(2) Cone on carriage for flat printing
(3) Flat printing limit point
(4) Drive arm
(5) Cylindrical printing limit point
(6) Clamping lever for drive arm
(7) Socket and threaded spindle on carriage for cylindrical printing
(8) Shock absorber with rubber buffer
(9) Cylindrical printing limit point

4.4 Squeegee unit

The squeegee and flood bar are mounted onto the squeegee head.

NOTE:
IN THE ILLUSTRATION BELOW, SQUEEGEE AND FLOOD BAR ARE MOUNTED FOR FLAT PRINTING. IF THE MACHINE IS SET UP FOR CYLINDRICAL PRINTING, THE SQUEEGEE AND FLOOD BAR MUST BE SWAPPED. ACCORDINGLY, FOR EXAMPLE, THE ROTARY KNOB FOR SQUEEGEE PRESSURE IS THEN AT SQUEEGEE POSITION NUMBER (2).

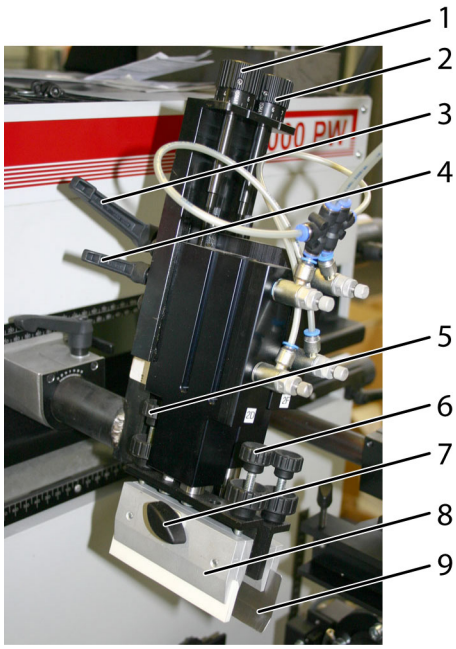


Figure 4-5: Squeegee unit

(1) Squeegee pressure rotary knob, squeegee
(2) Squeegee pressure rotary knob, flood bar
(3) Clamping lever for squeegee unit
(4) Clamping lever for squeegee
(5) Adjusting screw, parallelism of squeegee
(6) Adjusting screw, parallelism of squeegee
(7) Locking device for squeegee
(8) Squeegee
(9) Flood bar

Squeegee head holder

The following settings can be made:

- swivel the squeegee head
- set the distance (between squeegee head and machine

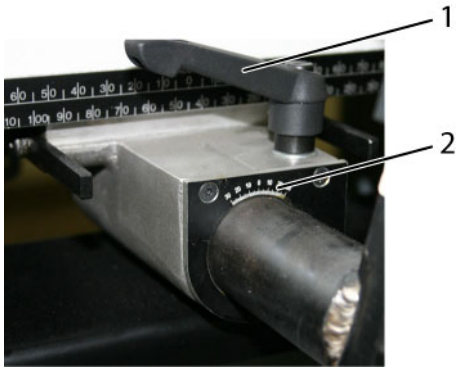


Figure 4-6: Squeegee head angle setter

(1) Clamping lever for angle setter
(2) Angle setter scale

4.5 Squeegee head carriage

- Carriage for flat printing

For flat printing, the squeegee head carries out the printing motion; for cylindrical printing, the squeegee head carriage is fixed.

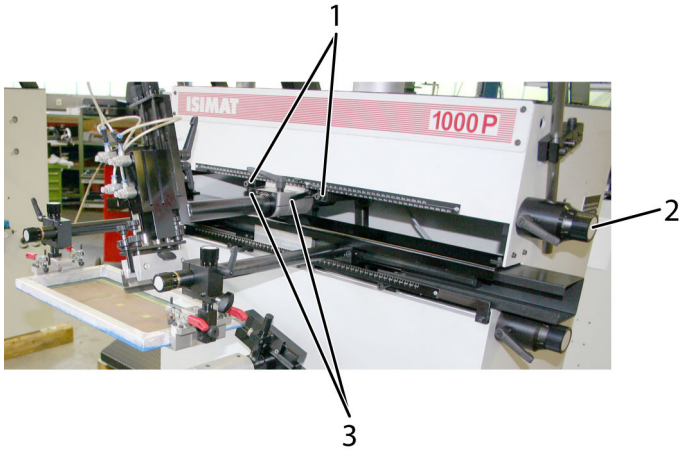


Figure 4-7: Setting elements on the squeegee head carriage

(1) Limit points
(2) Horizontal fine setting
(3) Flat metal tongues

The printing path can be set via the left and right limit points (1). The corresponding end position of the squeegee head carriage is reached at the limit points.

In order to fix the position of the squeegee head carriage, both flat metal tongues (3) must be pressed down to move with both limit points to the squeegee head carriage.

The squeegee head can be set horizontally using the fine setting (2).

4.6 Screen carriage

- Carriage for cylindrical printing

For cylindrical printing, the screen holder carries out the printing motion; for flat printing, the screen carriage is fixed.

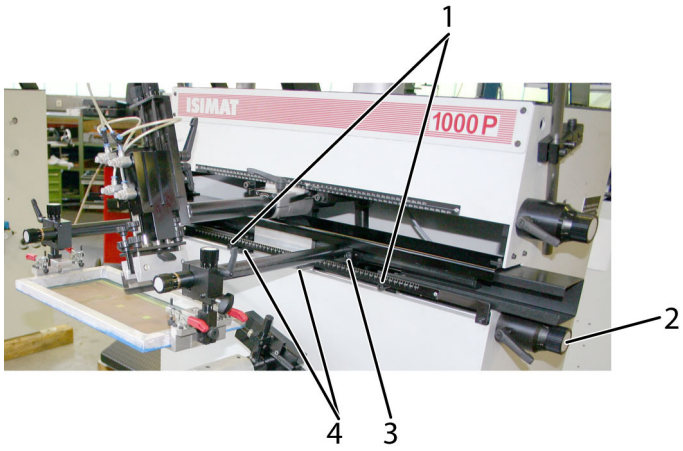


Figure 4-8: Setting elements on the screen carriage

(1) Limit points
(2) Horizontal fine setting
(3) Setting the length of screen formes, right locking device
(4) Flat metal tongues

The printing path can be set via the left and right limit points (1). The corresponding end position of the screen carriage is reached at the limit points.

In order to fix the position of the screen carriage, both flat metal tongues (4) must be pressed down to move with both limit points to the screen carriage.

The screen holder can be set horizontally using the fine setting (2).

The screen holder is set to the length of the screen forme by releasing and adjusting the right-hand locking device (3) and the left-hand locking device.

4.7 Screen holder

The screen forme (1) is fixed to the screen holder with 4 tension clamps (7).

The position of the screen forme can be fine-set:

- horizontally
- vertically
- parallelism to the substrate

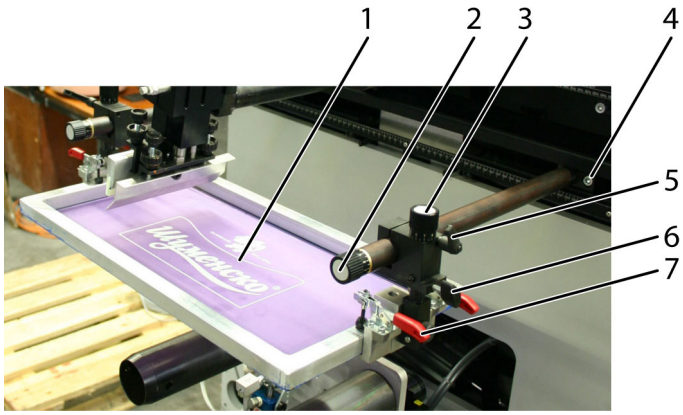


Figure 4-9: Screen holder

(1) Screen printing forme
(2) Rotary knob for fine setting the screen forme horizontally
(3) Rotary knob for fine setting the screen forme vertically
(4) Screen holder locking device
(5) Clamping lever, horizontal
(6) Locking device, vertical
(7) Screen holder tension clamp

Setting the parallelism of screen forme to substrate:

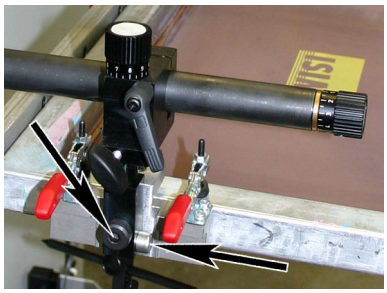


Figure 4-10: Setting elements to swivel screen forme

4.8 Rack and pinion drive

The article receptacles are usually driven by a rack and pinion drive with the cylindrical printing method. The rack and pinion drive is mounted to the screen holder and to the article receptacle.

The rack and pinion drive comprises the following main components:

- Rack
- Rack guide
- Gear wheel
- Holder for rack and pinion drive

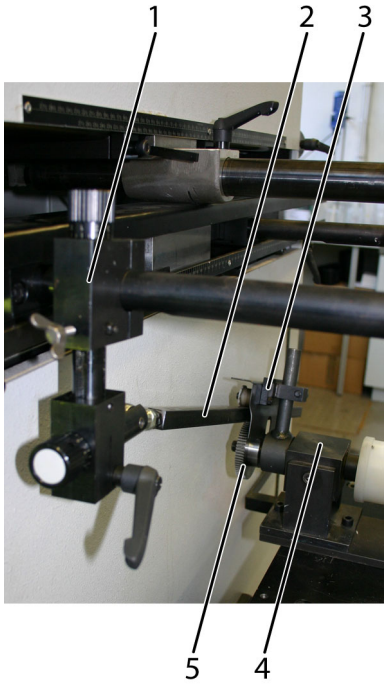


Figure 4-11: Rack and pinion drive

(1) Holder for rack and pinion drive
(2) Rack
(3) Rack guide
(4) Article receptacle for cylindrical printing
(5) Gear wheel

4.9 Article receptacles

The screen printing machine 1000 P can be equipped with various, optional accessories. These options are described in this instruction manual. Observe the information relating to the options with which your screen printing machine 1000 P is equipped.

The article receptacles are mounted to the lift table.

Pneumatic connections

Next to the lift table are 6 pneumatic connections. These are required depending on which optional receptacle is mounted.

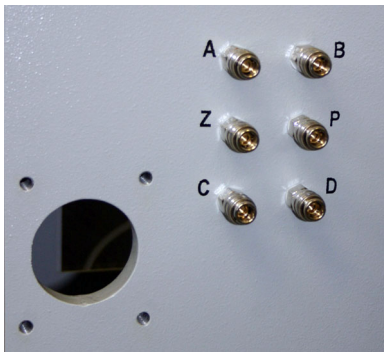


Figure 4-12: Pneumatic connections

Pneumatic connection	Function
A and B	Pneumatic connections A and B are switched via Valve 1.3 A is switched when the lift table moves up B is switched when the lift table moves down e.g. for neck bottom support, substrate is clamped when the lift table moves up and is released when the lift table moves down
Z	Pneumatic connection Z is switched by the controller via Valve 5.3
P	Permanent compressed air, not switched
C and D	Pneumatic connections C and D are switched by the controller via Valve 6.3 on D, compressed air in un-switched status, on C, compressed air in switched status

NOTE:
SEE PNEUMATIC PLAN

4.9.1 Dolly

- For non-positioned cylindrical printing (single color printing)
- Friction drive

Figure 4-13: Dolly

4.9.2 Neck bottom support

- For bottles and cylindrical substrates
- Rack and pinion drive

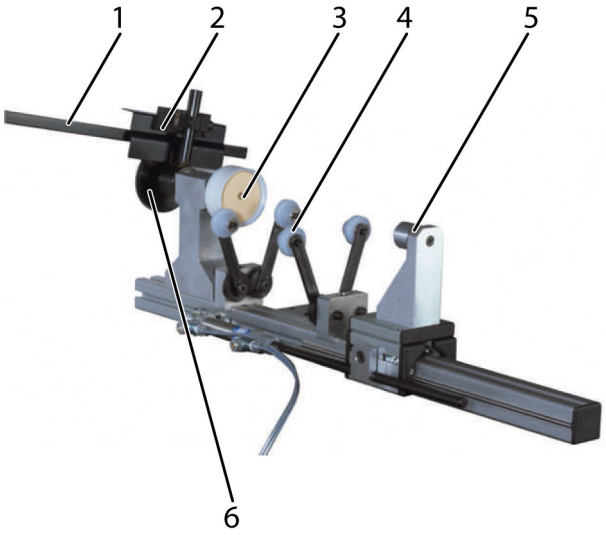


Figure 4-14: Neck bottom support

(1) Rack
(2) Rack guide
(3) bottom receptacle
(4) Dolly
(5) Neck receptacle
(6) Gear wheel

Neck bottom support with registration device

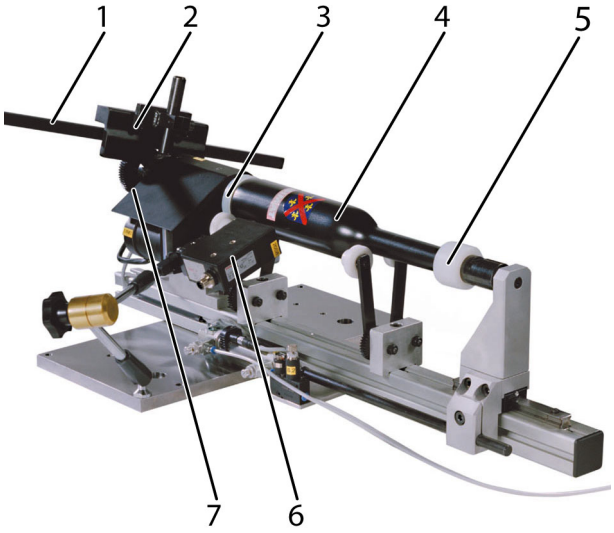


Figure 4-15: Neck bottom support with registration device

(1) Rack
(2) Rack guide
(3) Bottom receptacle
(4) Bottle on dolly
(5) Neck receptacle
(6) Optical sensor
(7) Gear wheel

4.9.3 Optical registration unit

Using the optical registration unit, a print image can be positioned precisely if mechanical registration is not possible because the substrate has an undercut or notch (e.g. drinking glass) or the material is too soft (e.g. candle wax). The optical registration unit rotates the substrate until the registration mark has been found. Then the print process starts.

The reproducibility of the printing process and the precision of registration for multi-color printing make half-tone printing possible.

- Multi-color printing of a substrate
- Rack and pinion drive
- With optical sensor for automatic registration

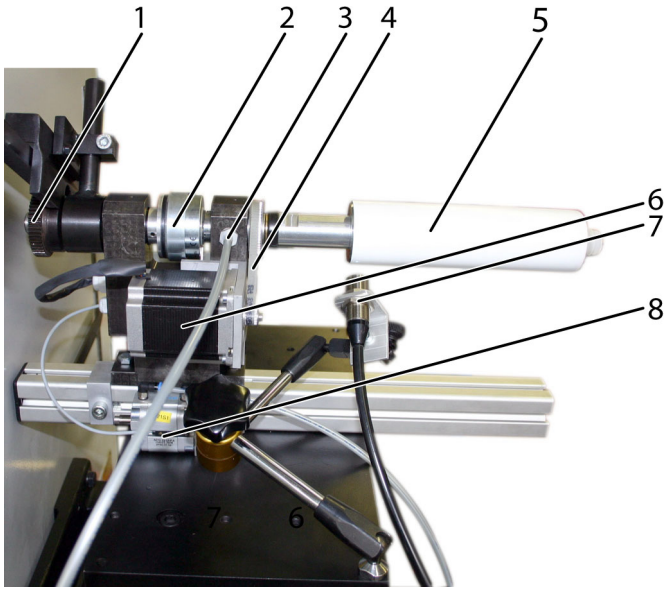


Figure 4-16: Optical registration unit

(1) Gear wheel for rack and pinion drive
(2) Electro-magnetic coupling
(3) Vacuum connection for article receptacle
(4) Toothed belt
(5) Article receptacle (mandrel with plastic tube)
(6) Stepper motor for registration device
(7) Registration unit sensor
(8) Cylinder on neck bottom support

The sensor for the registration unit (7) is taught to a color mark. If the print process is started, the electro-magnetic coupling (2) is decoupled. The cylinder on the neck bottom support (8) closes. The stepper motor for the registration unit (6) drives the mandrel (5) via the toothed belt (4) until the color mark has been found. The mandrel stops at this position. The electro-magnetic coupling is coupled, the lift table moves to printing position and the print process is carried out.

Registration unit sensor

The sensor is secured to the lift table with a holder. The position of the sensor is set using the holder. The control unit on the sensor is connected with the controller of the screen printing machine.

Figure 4-17: Fiber optic color sensor with control unit and holder

The fiber optic color sensor LC2001 is from ELTROTEC. For additional information please refer to the supplier documentation.

Electrical components of the registration unit

The electro-magnetic coupling and the stepper motor on the registration unit are connected with the controller via an additional plug.

Figure 4-18: Electrical connection via plug

With this option, an additional switch (arrow) is attached to the control console. This controls the speed of the stepper motor in 5 stages: Position ***0*** is the lowest speed, position ***4*** is the highest speed.

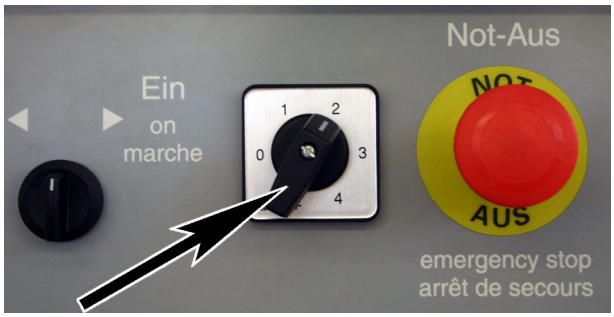


Figure 4-19: Switch, registration speed

4.9.4 Neck bottom support with mechanical mark registration

- For mechanical, automatic half-tone printing on a base undercut/notch

The mechanical mark registration can be switched on or off using the control unit, see section 5.7 Operating the TD 200 control unit, page 92. In ***Automatic*** mode, the print process proceeds as follows:

1. Substrate is inserted into the neck bottom support.
2. Foot switch is pressed.
   - ⇨ Neck bottom support closes.
   - ⇨ Motor on the friction wheel drive (1) turns for a set duration.
   - ⇨ Half-tone pen (5) clicks into the base notch.
   - ⇨ Lift table moves up.
   - ⇨ Print run is executed.

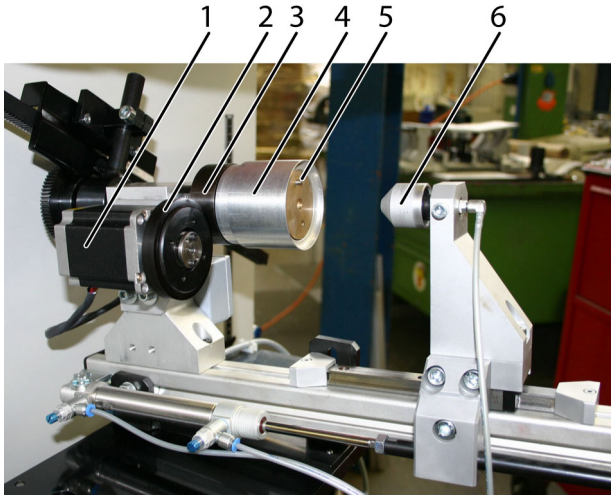


Figure 4-20: Article receptacle with friction wheel drive

(1) Motor on friction wheel drive
(2) Friction wheel
(3) Shaft on base receptacle
(4) Base receptacle
(5) Half-tone pen
(6) Neck receptacle

The friction wheel drive can be mounted deeper if another neck bottom support is used which is not to be driven by the friction wheel:

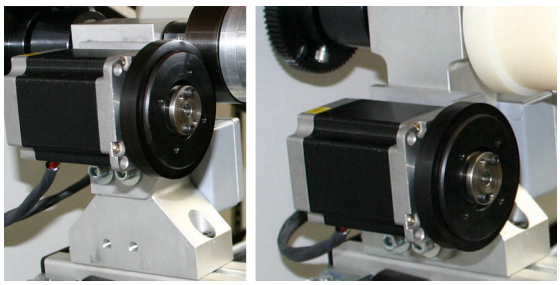


Figure 4-21: friction wheel drive
left : base receptacle is driven by the wheel drive
right: wheel drive is lower mounted, article receptacle is not driven by wheel drive

Figure 4-22: Electrical connection via plug (similar to illustration)

4.9.5 Angle setter for article receptacles

The angle of an article receptacle can be adjusted using the angle setter for article receptacles. This means, e.g. that slightly conical substrates (approx. 5 - 7°) can be printed using cylindrical printing. The article receptacle can also be adjusted on the cone printing unit using the angle setter.

The angle of the article receptacle can be set at (3). The gear wheel is set slanted due to the incline of the article receptacle. For this reason, the rack guide is positioned on springs (2) and the mount for the gear rack is rotatable (1).

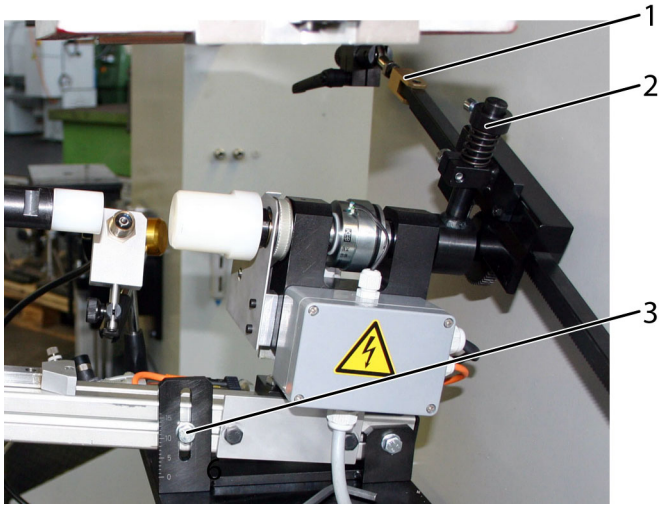


Figure 4-23: Angle setter for article receptacles

(1) Mount for the gear rack, rotatable
(2) Rack guide, positioned on springs
(3) Set angle of article receptacle

NOTE
DISMANTLE THE ANGLE SETTER FOR ARTICLE RECEPTACLES IF YOU DO NOT NEED THEM. OHTERWISE IT IS POSSIBLE THAT IT COMPLICATES THE ASSEMBLING OF OTHER COMPONENTS, E.G. IF ROLLER CARRIAGES ARE TO BE MOUNTED ON THE ALUMINIUM PROFILE.

4.9.6 Receptacle mandrel

- For pluggable, cylindrical substrates such as cups or beakers
- Rack and pinion drive

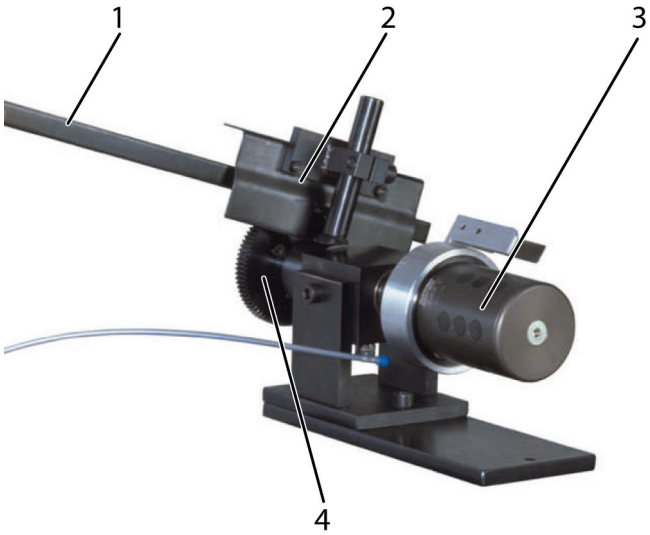


Figure 4-24: Receptacle mandrel

(1) Rack
(2) Rack guide
(3) Receptacle mandrel
(4) Gear wheel

4.9.7 Receptacle mandrel for plastic tubes

- For cylindrical plastic tubes
- Rack and pinion drive

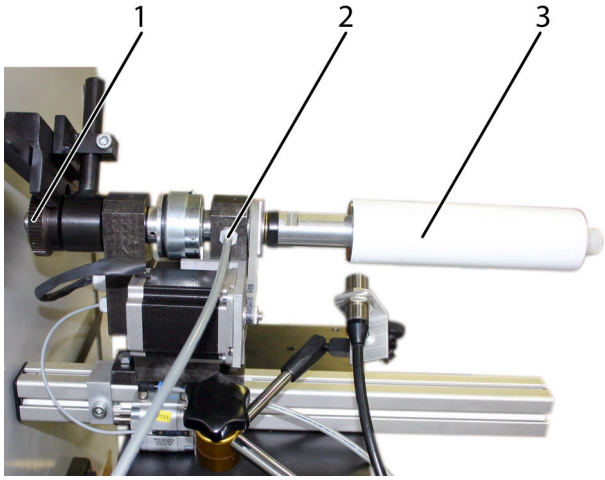


Figure 4-25: Receptacle mandrel for plastic tubes

(1) Gear wheel
(2) Vacuum connection for vacuum mandrel
(3) Mandrel with plastic tube

4.9.8 Oval printing unit

- For oval substrates
- Rack and pinion drive

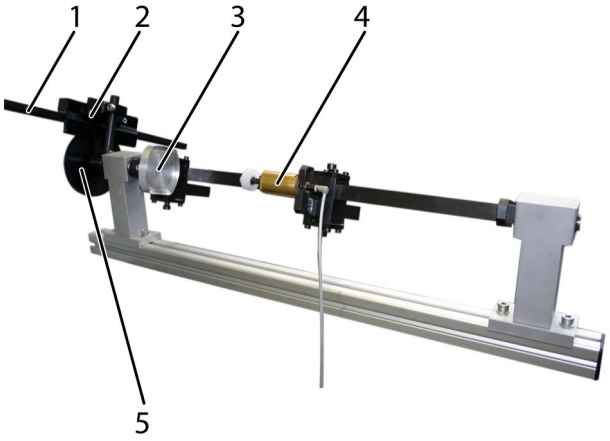


Figure 4-26: Oval printing unit

(1) Rack
(2) Rack guide
(3) Base receptacle
(4) Neck receptacle
(5) Gear wheel

4.9.9 Printing unit for gas bottles

- For gas bottles
- Friction rubber drive
- Sliding table

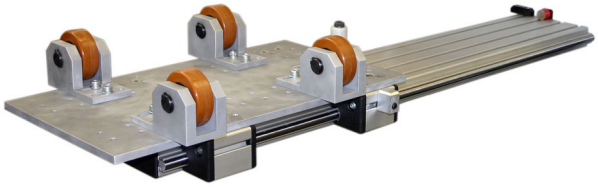


Figure 4-27: Printing unit for gas bottles

Figure 4-28: With gas bottle

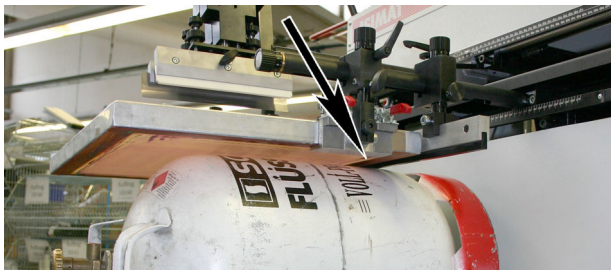


Figure 4-29: Friction rubber drive

4.9.10 Cone printing unit

- For conical substrates with cone printing screen

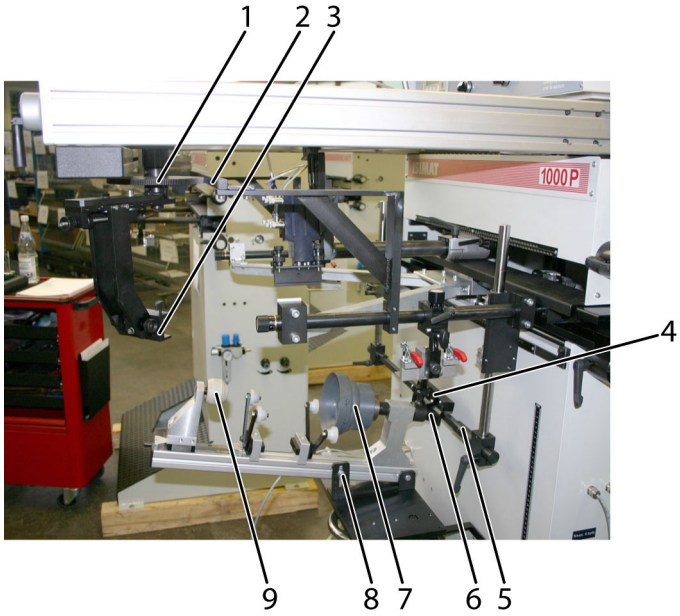


Figure 4-30: Cone printing unit

(1) Gear wheel for screen forme
(2) Screen forme rack
(3) Screen forme holder
(4) Rack guide
(5) Base receptacle rack
(6) Base receptacle
(7) Angle setter for neck bottom support
(8) Neck receptacle

Pulled forward control console

The control console on the cone printing unit is pulled forward to simplify operation.

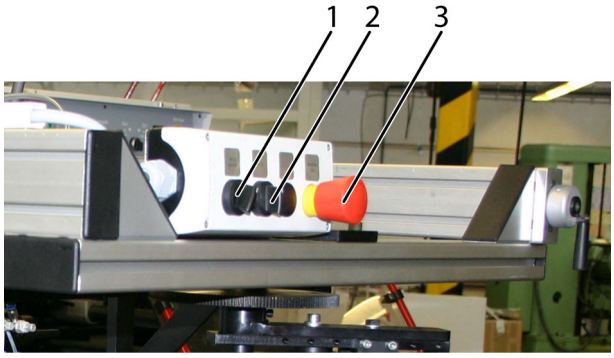


Figure 4-31: Pulled forward control console

(1) Operating modes switch (setup / automatic)
(2) Operating switch (off / on)
(3) E-Stop switch

4.9.11 Sliding table

- For simple insert laying of flat substrates
- Pneumatically operated

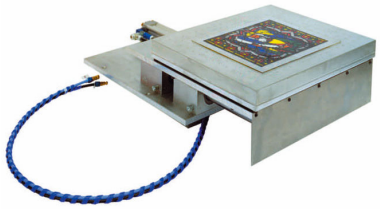


Figure 4-32: Sliding table (shown here with vacuum printing table plate)

4.9.12 Vacuum printing table plate

- For precise positioning and fixing of flat substrates, such as foil, paper or thin flat pieces
- Highly precise setting using dial gages

Figure 4-33: Vacuum printing table plate

Vacuum unit

The vacuum is created using a vacuum unit. This sits in the framework of the machine.

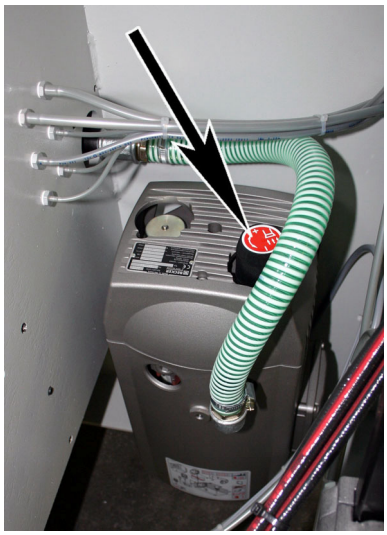


Figure 4-34: Vacuum unit

The strength of the vacuum can be set on the regulator (arrow).

The vacuum unit is from BECKER. For additional information please refer to the supplier documentation.

The vacuum unit is switched on via a separate main switch.

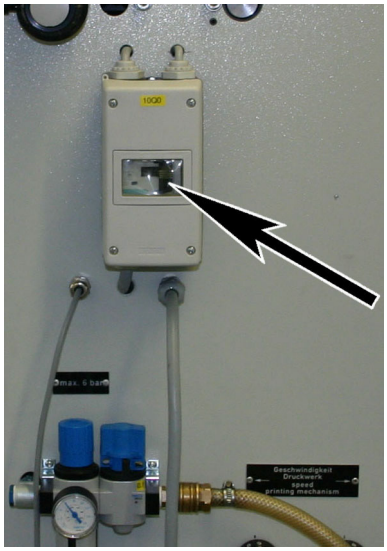


Figure 4-35: Vacuum unit main switch

4.9.13 Cube printing unit

- For paper cubes or note boxes
- Automatic turning device for one- to four-side printing (only 1000 PW)

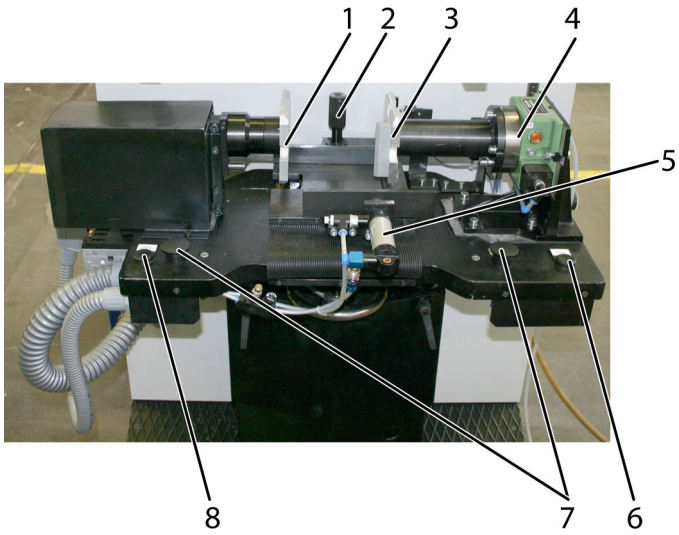


Figure 4-36: Cube printing unit

(1) Left-hand holder
(2) Height adjustment
(3) Right-hand holder
(4) Turning device
(5) Cylinder, bring paper cube into position
(6) Cycles switch (turning device)
(7) Start switch (two-hand mode)
(8) Release switch (clamping of substrates)

4.9.14 Inflation device

- Compressed air support to stabilize thin-walled substrates
- With pressure control valve

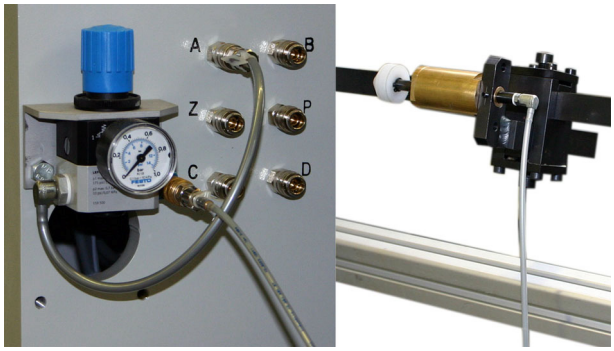


Figure 4-37: Inflation device

left: Pressure control valve of inflation device
right: inflation device (shown here on an oval printing unit)

4.9.15 Screen and squeegee heating

- For use of thermoplastic, ceramic inks

4.9.16 Article receptacle for buckets

- For cylindrical and slightly conical buckets
- Rack and pinion drive
- Mechanical mark registration

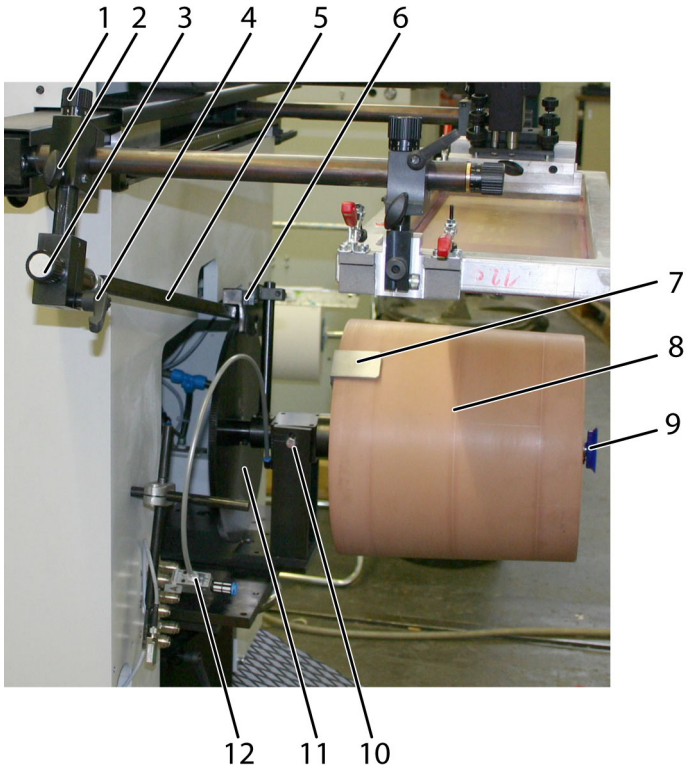


Figure 4-38: Receptacle for buckets

(1) Rack rotary knob, vertical
(2) Locking device
(3) Rack rotary knob, horizontal
(4) Clamping levers
(5) Rack
(6) Rack guide
(7) Mechanical mark registration
(8) Receptacle
(9) Vacuum suction
(10) Setting the angle of the receptacle
(11) Gear wheel
(12) Pneumatic connection for vacuum suction

4.9.17 Receptacle cross-holder for bottle crates

- With swivel unit
- Screen printing machine FK 27

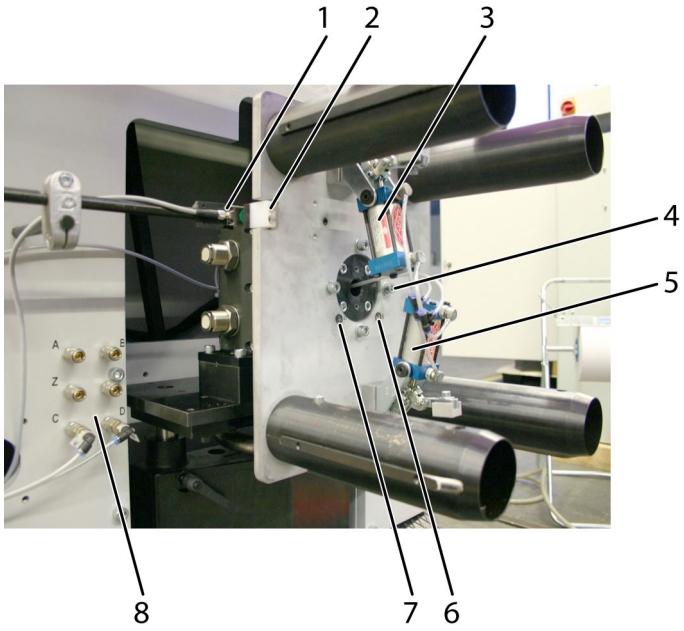


Figure 4-39: Receptacle cross-holder for bottle crates

(1) Proximity switch
(2) Mechanical contact
(3) Box tension clamp
(4) Allen head screws (total of four)
(5) Pneumatic connections

4.10 Squeegee head reinforcement

The squeegee head reinforcement is available as an option. The squeegee head is stabilized. This is necessary if the squeegee head is extended especially far (with long substrates).

This option is only possible with cylindrical printing.

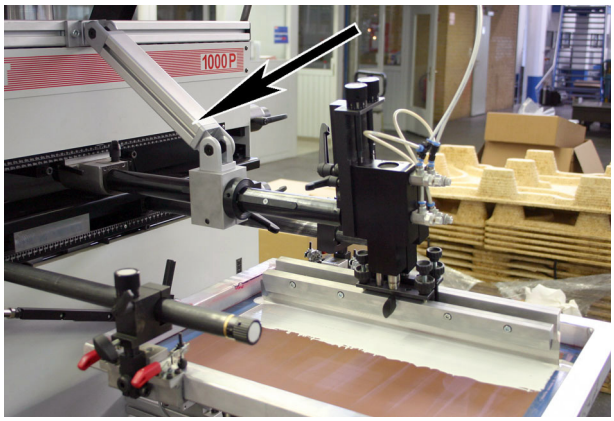


Figure 4-40: Squeegee head reinforcement

4.11 Lift table

- 100 mm lift

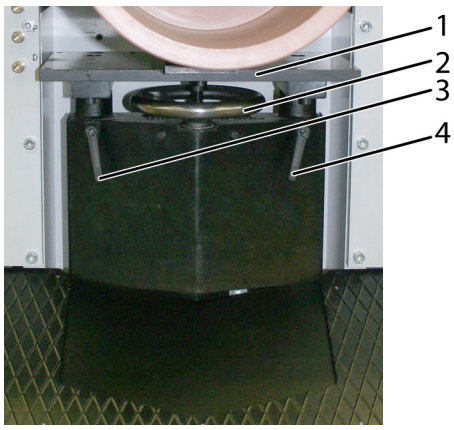


Figure 4-41: Lift table

(1) Printing table plate
(2) Manual wheel
(3) Clamping levers
(4) Clamping levers

4.12 Compressed air unit and speed control

The pneumatic connection to the machine is created on the compressed-air unit. The operating pressure can be set on the pressure control valve and checked on the pressure gauge.

The speed during the print process (2) and during the flooding process (2) can be set using the speed control.

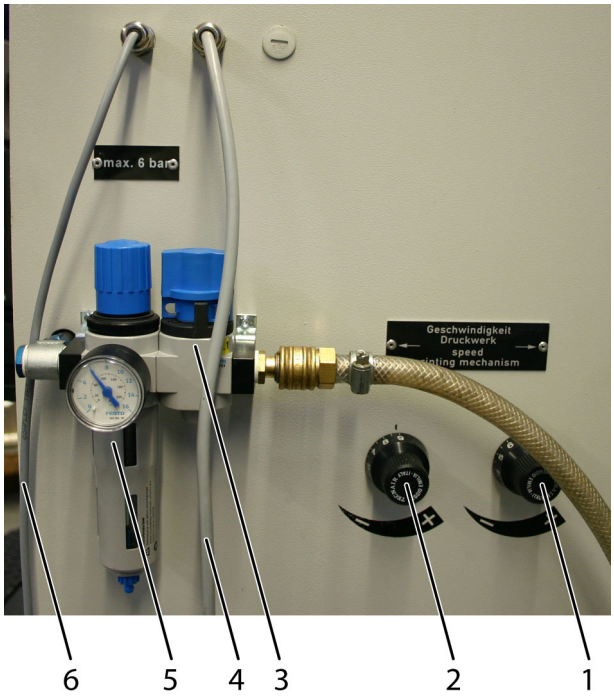


Figure 4-42: Compressed air unit and speed control

(1) Speed of print process
(2) Speed of flooding process
(3) Main valve
(4) Power cable
(5) Pressure control valve with filter and pressure gage
(6) Connection line for foot switch

The compressed-air unit is from FESTO. For additional information please refer to the supplier documentation.

4.13 Control unit TD 200

The TD 200 control unit is used on the 1000 P.

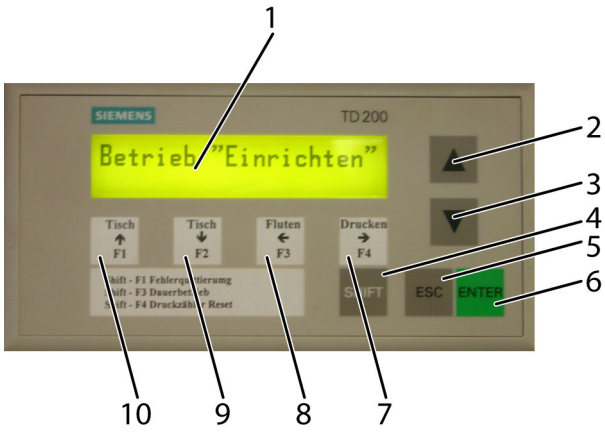


Figure 4-43: Control unit TD 200

(1) Display, 2 lines x 20 characters
(2) ▲ arrow pointing up
(3) ▼ arrow pointing down
(4) SHIFT
(5) ESC
(6) ENTER
(7) Print (to the right) F4
(8) Flood (to the left) F3
(9) Table (move downwards) F2
(10) Table (move upwards) F1

4.14 Control unit OP 3

The OP 3 control unit is used on the 1000 PK, 1000 PW and FK 27.

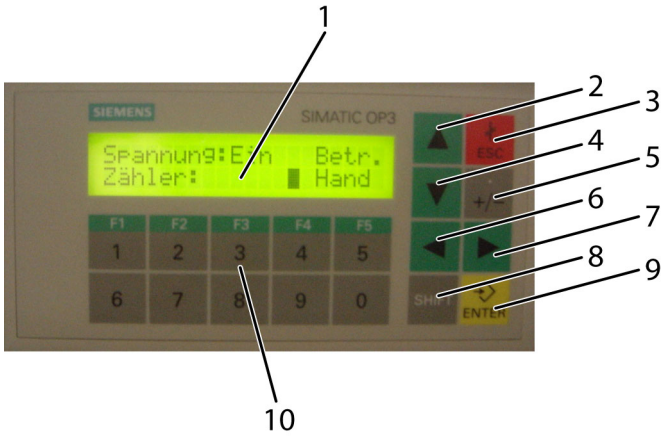


Figure 4-44: Control unit OP 3

(1) Display, 2 lines x 20 characters
(2) ▲ arrow pointing up
(3) ESC
(4) ▼ arrow pointing down
(5) + / -
(6) ◄ arrow pointing left
(7) ► arrow pointing right
(8) SHIFT
(9) ENTER
(10) Number field (1 to 0), function keys (F1 to F5)

5 Operation

This section describes how to operate the screen printing machine 1000 P. This includes conversion and setup work.

NOTE:
IF YOU CARRY OUT FINE ADJUSTMENTS TO THE ROTARY KNOBS OR MICROMETER SCREWS, FIRST LOOSEN THE CORRESPONDING CLAMPING LEVER (OR CLAMPING SCREW). THEN LOCK THE CLAMPING LEVER (OR CLAMPING SCREW) INTO PLACE AGAIN.

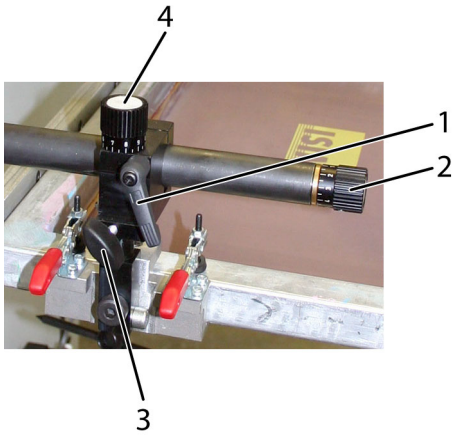


Figure 5-1: Example of rotary knob with clamping lever, screen holder

(1) Clamping lever of rotary knob (2), horizontal setting
(2) Rotary knob, horizontal setting
(3) Clamping screw of rotary knob (4), vertical setting
(4) Rotary knob, vertical setting

Setting up the machine

Setting up the screen printing machine 1000 P includes conversion and setup.

If the machine is being set up for another substrate, various assemblies have to be changed. After conversion, mechanical settings still have to be undertaken on the machine.

5.1 Making ready for operation

1. Press down the main cock on the main valve and rotate it clockwise 90°.
   ⇨ The pressure gage on the compressed air unit shows the operating pressure.
   ⇨ The machine is supplied with compressed air.
2. On the pressure control valve, adjust the operating pressure to 6 bar.
3. Set the main switch to the ***I /ON***.
   ⇨ The control unit carries out a self-test.
   ⇨ The display on the control unit shows error messages or the machine status e.g. ***Control voltage OFF***.
4. Close the safety bow (***Automatic*** mode).
5. Select
   Setup
   -or-
   Automatic on the mode selector switch
6. Set the mode switch to ***On***.
   ⇨ Control voltage is switched on.
   ⇨ The machine is ready.

NOTE:
IN ORDER TO SWITCH OFF THE MACHINE COMPLETELY, PROCEED IN THE SAME WAY AS DESCRIBED ABOVE BUT IN REVERSE ORDER.

5.2 Dismantling the article receptacle

The article receptacles are mounted to the lift table, see also section 4.11 Lift table, page 69. Proceed as follows for dismantling:

1. Make sure that
   ⇨ The machine is ready.
   ⇨ The machine is in setup mode.
   ⇨ The lift table is lowered.
2. Loosen all pneumatic and electrical connections on the article receptacle.
3. Loosen the screws with which the article receptacle is mounted to the lift table.
4. Remove the article receptacle.
   ⇨ Article receptacle is dismantled from the lift table.
   ⇨ Lift table is prepared for mounting a new article receptacle.

5.3 Setting up for cylindrical printing

Complete changeover from flat printing to cylindrical printing and making adjustments to the new substrate are described in this section.

For cylindrical printing, the screen holder carries out the printing motion, the squeegee head carriage is fixed.

It is possible that in individual cases you can jump stages if, for example, you do not have to changeover the printing method. On the stages that you skip, check whether the settings on the machine are still correct.

⚠ WARNING

Moving machine parts!

Injuries to hands, arms and head.

- Do not reach in between the squeegee unit and screen forme in setup mode.
- Do not reach in between the screen forme and substrate in setup mode.
- Wear close-fitting clothing which cannot be caught in moving parts.
- Wear a hair net.
- Carry out changeover and setup work in ***Setup*** mode.
- Turn the machine off when performing maintenance work (disconnect supply voltage and compressed air supply).

⚠ WARNING

Moving machine parts!

Injuries to hands, arms and head.

- The safety bow must secure the work area, i.e. the lower edge of the safety bow must be lower than the lower edge of the screen forme.
- Set the safety bow correspondingly.

CAUTION

Dry printing without ink!

Damage to squeegee and stencil.

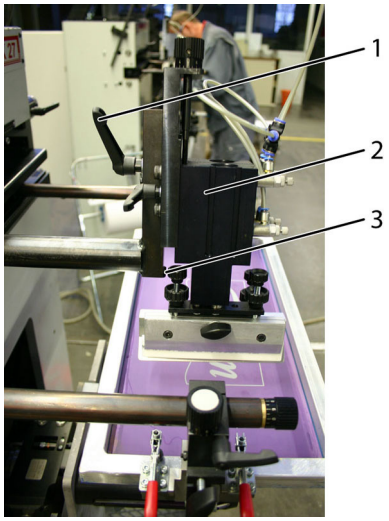
- Be sure that the squeegee unit is raised in setup mode.
- Do not move the squeegee dry over the stencil.
- Make sure that there is always sufficient ink in the forme. The entire area of the printed image should be covered with sufficient ink so that the squeegee does not pass over the stencil in a dry state.

Complete changeover from flat printing to cylindrical printing and making adjustments to a new substrate are complex processes. For this reason, the following description is divided by sub-headings into individual action sequences and explanatory sections.

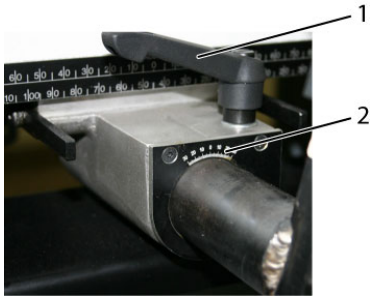
Preparing the squeegee head for setup

1. Make sure that
   ⇨ The machine is ready.
   ⇨ The machine is in ***Setup*** mode.

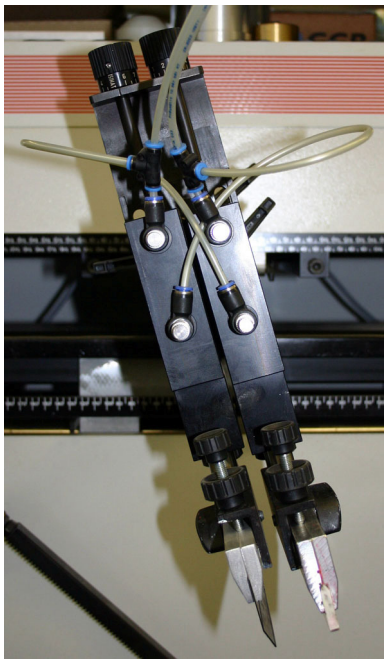
2. Release the clamping lever (1) on the squeegee head and shift the entire squeegee head (2) upwards.
3. Lock the clamping lever into place again.
   ⇨ Squeegee head is positioned up.



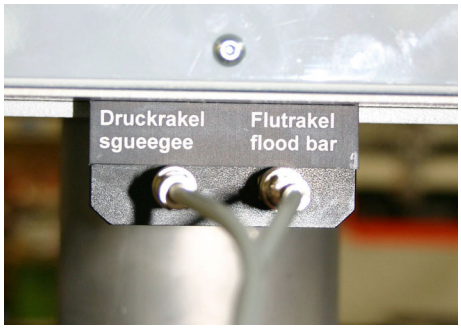
4. Release the clamping lever on the angle setter (1) and turn the squeegee head to the left (15° angle).
5. Lock the clamping lever into place again.
   ⇨ Squeegee head is turned to the left for cylindrical printing (angle: 15°).



6. Move the squeegee and flood bar up on the rotary knob.
7. Mount the squeegee to the right squeegee holder.



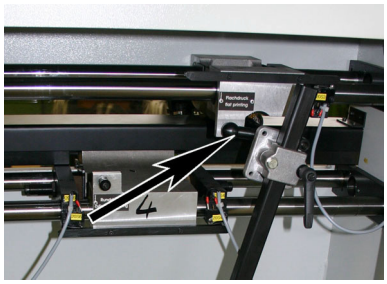
8. Connect the compressed air hose of the squeegee to the (left) compressed air connection ***Squeegee*** (beneath the control console).



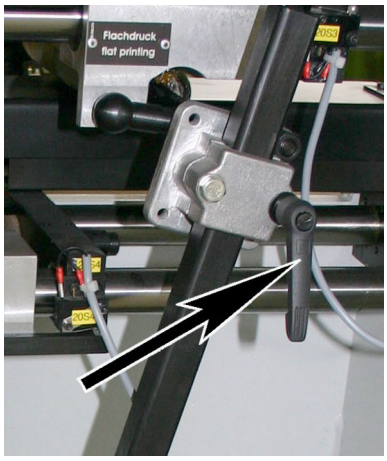
9. Mount the flood bar to the left squeegee holder.
10. Connect the compressed air hose of the flood bar to the (right) compressed air connection ***Flood bar*** (beneath the control console).
    ⇨ The squeegee head is prepared for setup.

Setting the drive arm for the printing method

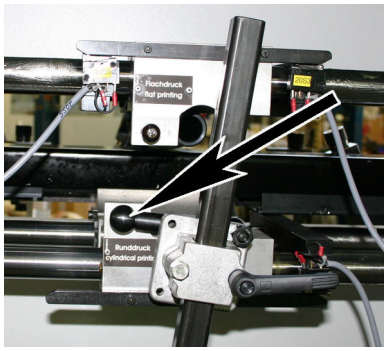
1. Make sure that
   ⇨ The carriage for flat printing is de-pressurized (can be shifted by hand).
   ⇨ The machine is in ***Setup*** mode.
2. Open the door at the back of the machine so that the machine framework is accessible.
3. Pull or lever the socket from the ball (***flat printing***).



4. Release the clamping lever from the drive arm.



5. Push the socket onto the ball (***cylindrical printing***).

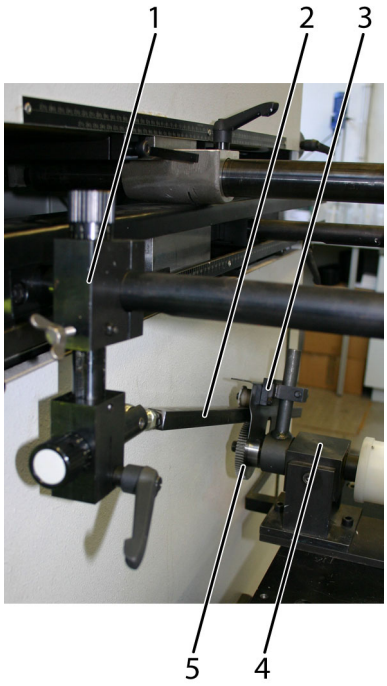


6. Lock the clamping lever into place again.
   ⇨ Drive arm is set for printing method (cylindrical printing).

Mounting the cylindrical printing device

1. Make sure that
   ⇨ The flat printing device has been dismantled from the lift table.
   ⇨ The lift table is lowered (control unit).
2. Mount the cylindrical printing device to the lift table.
3. Move the lift table down using the manual wheel.
4. Mount the article receptacle (e.g. base receptacle) to the cylindrical printing device.

5. Mount the gear wheel (5) to the cylindrical printing device.
6. Mount the holder (1) for the rack (2) to the screen holder.
7. Mount the rack guide (3) to the gear wheel.
8. Move the lift table up (control unit).

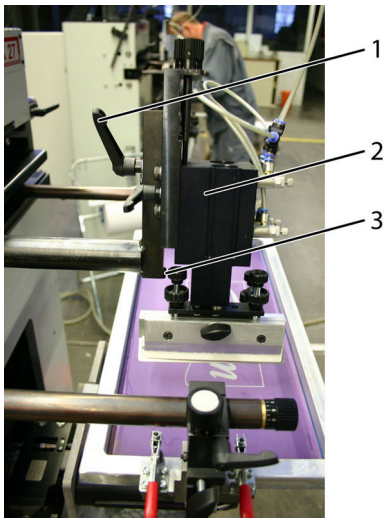


9. Set the rack parallel to the machine:
   Set holder (1) to screen holder.

10. Lower the lift table (control unit).
    ⇨ Cylindrical printing device is mounted.

Setting the machine for the substrate

1. Make sure that there is a substrate on the article receptacle.
2. Move the lift table up (control unit).
3. Tension the screen forme in the screen holder. If necessary, set the screen holder to the length of the screen forme.
4. Using the manual wheel on the lift table, set the snap off distance (distance from the article surface to the underside of the screen forme).
5. Set the screen forme parallel to the surface of the article.
6. Set the rack parallel to the screen forme.
7. Remove the screen forme from the screen holder.
8. Lower the squeegee head (2) to the stop point (3).
9. Lower the squeegee (control unit).
10. Shift the squeegee head to the side so that the squeegee is positioned over the axis of the article.
11. Set the squeegee on the rotary knob in such a way that the substrate is touched centrally (over the axis point).
12. Align the squeegee parallel to the substrate.
13. Move the squeegee down by another ½ rotation (squeegee pressure).



14. Fix the squeegee head carriage:
    Release left and right limit points on the squeegee head carriage.
    Press down flat metal tongues and shift limit points to the squeegee head carriage.
    Lock limit points.
15. Set the position of the squeegee head carriage on the squeegee head carriage fine-setting.
16. Shift the entire squeegee head upwards.
17. Tension the screen forme in the screen holder.
18. Lower the flood bar (control unit).
19. Lower the squeegee head to the stop point.
20. Lower the flood bar until it touches the screen forme.
21. Set the flood bar parallel to the screen forme.
22. Move the squeegee head up (away from the lower stop point).
23. Set the printing path:
    Release left and right limit points on screen carriage.
    right limit point to printing start
    left limit point to printing end
24. Set the position of the screen carriage on the screen carriage fine-setting.

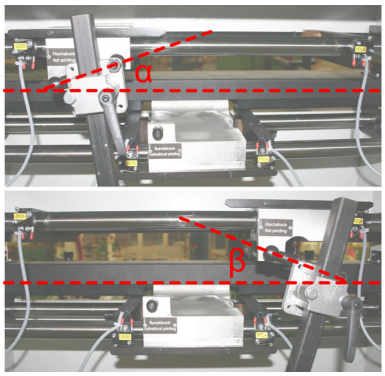
Position of squeegee head

Printing start: Squeegee and flood bar are at printing start

Printing end: Squeegee and flood bar are positioned after printing end

25. Check that the drive arm runs centrally:
    Threaded spindle must have the same inclination in the left-hand end position as in the right-hand end position.

    α = β



26. Check all settings over the entire printing process once again:

- Tension substrate
- Raise lift table
- Lower squeegee
- Screen/squeegee to the right
- Lower flood bar
- Screen/squeegee to the left
- Lower lift table
- Remove substrate

☝ ***NOTE:***
CARRY OUT TEST PRINT RUNS TO IMPLEMENT FINE SETTINGS (E.G. SETTING THE SQUEEGEE PRESSURE).

5.4 Setting up for flat printing

Complete changeover from cylindrical printing to flat printing and making adjustments to a new substrate are described in this section.

For flat printing, the squeegee head carries out the printing motion, the screen carriage is fixed.

It is possible that in individual cases you can jump stages if, for example, you do not have to changeover the printing method. On the stages that you skip, check whether the settings on the machine are still correct.

⚠ WARNING

Moving machine parts!

Injuries to hands, arms and head.

- Do not reach in between the squeegee unit and screen forme in setup mode.
- Do not reach in between the screen forme and substrate in setup mode.
- Wear close-fitting clothing which cannot be caught in moving parts.
- Wear a hair net.
- Carry out changeover and setup work in ***Setup*** mode.
- Turn the machine off when performing maintenance work (disconnect supply voltage and compressed air supply).

⚠ WARNING

Moving machine parts!

Injuries to hands, arms and head.

- The safety bow must secure the work area, i.e. the lower edge of the safety bow must be lower than the lower edge of the screen forme.
- Set the safety bow correspondingly.

CAUTION

Dry printing without ink!

Damage to squeegee and stencil.

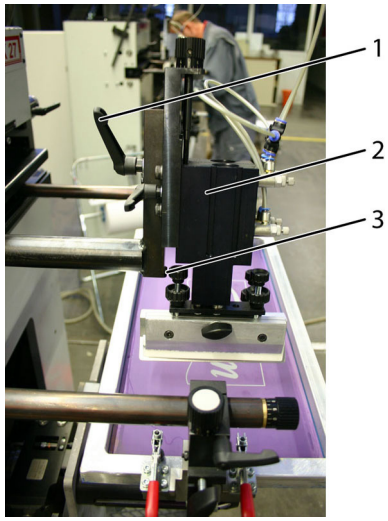
- Be sure that the squeegee unit is raised in setup mode.
- Do not move the squeegee dry over the stencil.
- Make sure that there is always sufficient ink in the forme. The entire area of the printed image should be covered with sufficient ink so that the squeegee does not pass over the stencil in a dry state.

Complete changeover from flat printing to cylindrical printing and making adjustments to a new substrate are complex processes. For this reason, the following description is divided by sub-headings into individual action sequences and explanatory sections.

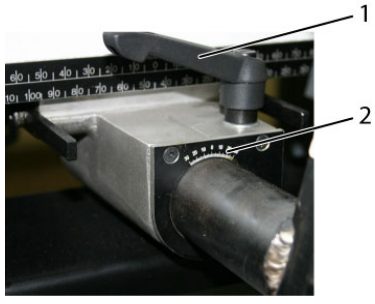
Preparing the squeegee head for setup

1. Make sure that
   ⇨ The machine is ready.
   ⇨ The machine is in ***Setup*** mode.

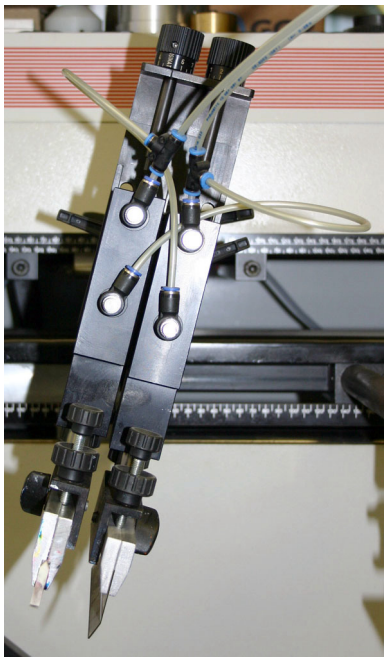
2. Release the clamping lever (1) on the squeegee head and shift the entire squeegee head (2) upwards.
3. Lock the clamping lever into place again.
   ⇨ Squeegee head is positioned up.



4. Release the clamping lever on the angle setter (1) and turn the squeegee head to the right (15° angle).
5. Lock the clamping lever into place again.
   ⇨ Squeegee head is turned to the right for flat printing (angle: 15°).



6. Move the squeegee and flood bar up on the rotary knob.
7. Mount the squeegee to the left squeegee holder.

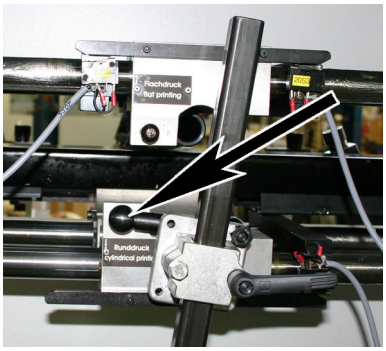


8. Connect the compressed air hose of the squeegee to the (left) compressed air connection ***Squeegee*** (beneath the control console).

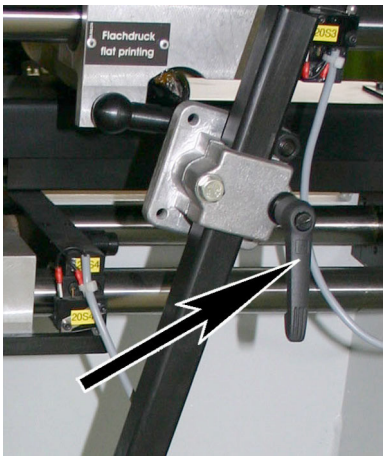
9. Mount the flood bar to the right squeegee holder.
10. Connect the compressed air hose of the flood bar to the (right) compressed air connection ***Flood bar*** (beneath the control console).
    ⇨ The squeegee head is prepared for setup.

Setting the drive arm for the printing method

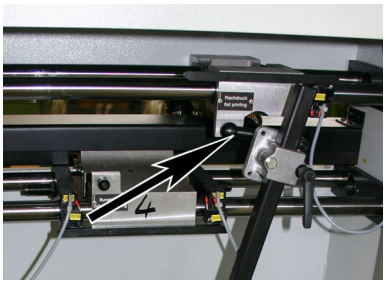
1. Make sure that
   ⇨ The carriage for cylindrical printing is de-pressurized (can be shifted by hand).
   ⇨ The machine is in ***Setup*** mode.
2. Open the door at the back of the machine so that the machine framework is accessible.
3. Pull or lever the socket from the ball (***cylindrical printing***).



4. Release the clamping lever from the drive arm.



5. Push the socket onto the ball (***flat printing***).



6. Lock the clamping lever into place again.
   ⇨ Drive arm is set for printing method (flat printing).

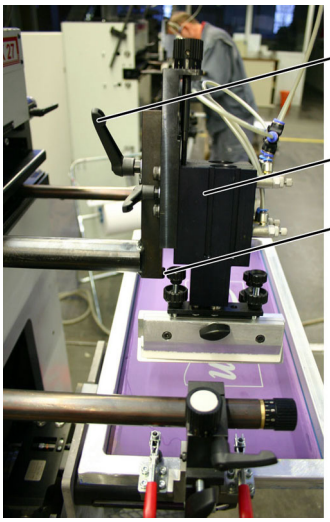
Mounting the flat printing device

1. Make sure that
   ⇨ The cylindrical printing device has been dismantled from the lift table.
   ⇨ The lift table is lowered (control unit).
2. Mount the flat printing device to the lift table.
3. Move the lift table down using the manual wheel.
   ⇨ Cylindrical printing device is mounted.

Setting the machine for the substrate

1. Make sure that there is a substrate on the article receptacle.
2. Move the lift table up (control unit).
3. Tension the screen forme in the screen holder. If necessary, set the screen holder to the length of the screen forme.
4. Using the manual wheel on the lift table, set the snap off distance (distance from the article surface to the underside of the screen forme).
5. Set the screen forme parallel to the surface of the article.
6. Remove the screen forme from the screen holder.

7. Lower the squeegee head (2) to the stop point (3).
8. Lower the squeegee (control unit).
9. Align the squeegee parallel to the substrate.
10. Move the squeegee down by another ½ rotation (squeegee pressure).
11. Shift the entire squeegee head upwards.
12. Tension the screen forme in the screen holder.
13. Set the position of the screen forme in such a way that the print image is correctly positioned to the article.
14. Fix the screen carriage:
    Release left and right limit points on the screen carriage.
    Press down flat metal tongues and shift limit points to the screen carriage.
    Lock limit points.
15. Set the position of the screen carriage on the screen carriage fine-setting.
16. Lower the flood bar (control unit).
17. Lower the squeegee head to the stop point.
18. Lower the flood bar until it touches the screen forme.
19. Set the flood bar parallel to the screen forme.
20. Move the squeegee head up (away from the lower stop point).
21. Set the printing path:
    Release left and right limit points on squeegee head carriage.
    right limit point to printing start
    left limit point to printing end



Position of squeegee head

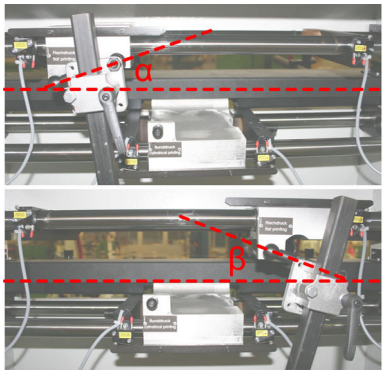
Printing start: Squeegee and flood bar are at printing start

Printing end: Squeegee and flood bar are positioned after printing end

22. Set the position of the squeegee head carriage on the squeegee head carriage fine-setting.

23. Check that the drive arm runs centrally:
Threaded spindle must have the same inclination in the left-hand end position as in the right-hand end position.

α = β



24. Check all settings over the entire printing process once again:

- Tension substrate
- Raise lift table
- Lower squeegee
- Screen/squeegee to the right
- Lower flood bar
- Screen/squeegee to the left
- Lower lift table
- Remove substrate

☝ ***NOTE:***
CARRY OUT TEST PRINT RUNS TO IMPLEMENT FINE SETTINGS (E.G. SETTING THE SQUEEGEE PRESSURE).

5.5 Setting up for cone printing

Optional

5.6 Setting up the optical registration unit

The sensor must be set mechanically to the substrate (e.g. to a color mark) and taught to the color mark.

If you are printing the substrate with several inks, then the first ink is printed without an optical registration unit. Before printing with the second ink, the sensor must be taught to the first ink. This means that the print image of the second ink will be exactly aligned to the print image of the first ink on each printing process.

CAUTION

Stepper motor works as a dynamo and creates voltage!

Machine damage to electronics and controller.

- Do not turn the stepper motor by hand if
  - the main switch is turned off
  - the power supply has failed
  - the control voltage has failed.

Mechanical setting

Before the sensor can be taught, the substrate must be aligned in the article receptacle to the print image.

1. Make sure that the machine is in ***Setup*** mode.
2. Make sure that the entire squeegee head is up.
3. Insert the screen forme with the print image for the second ink into the screen holder.
4. Insert the substrate into the article receptacle.
5. Move the lift table up.
6. Lower the squeegee.
7. Turn the substrate in the article receptacle so that the positions of both print images (first ink and second ink) fit together.
   If necessary, shift the screen carriage to achieve this.
8. Lower the flood bar.
9. Move the screen holder left to home position.
10. Move the lift table down.

11. Set the sensor with the holder in such a way that the lens points vertically onto the surface of the substrate.
    For color recognition, you should select e.g. a prominent point at the start of the print image.
    The article receptacle turns clockwise to register.
12. Set the distance from the sensor to the surface of the article in such a way that the point is small with a sharp outline.
13. Teach the sensor.

☝ ***NOTE:***
CARRY OUT TEST PRINT RUNS TO MAKE FINE ADJUSTMENT SETTINGS.

☝ ***NOTE:***
DEPENDING ON THE PRINT IMAGE, THE SUBSTRATE MUST BE INSERTED ROUGHLY PRE-POSITIONED IN THE ARTICLE RECEPTACLE SO THAT THE OPTICAL REGISTRATION UNIT REGISTERS THE CORRECT POSITION.

In order to achieve the best possible function on shiny surfaces, incline the sensor from the normal positions by approx. 20°.

Teaching (electrical settings)

ISIMAT recommends the following basic setting:

- Light conductor choice ***FPCF***
- Color differential tolerance ***1*** = small tolerance
- Output signal ***Lo*** = Light ON = light-switching

Proceed as follows to carry out basic settings and to teach the sensor:

1. Press the ***FPCF*** button.
   ⇨ LED (FPCF button) flashes
   ⇨ Light conductor is set to FPCF (FPCF light conductors have a spot of 1 mm at a distance of 18 mm / switching frequency is 1 kHz)
2. Press the ***1/+*** key to set the color differential tolerance.
   ⇨ Small tolerance is set
   ⇨ LED (FPCF button) shows steady light
3. Make sure that the LED next to the ***Lo/Do*** key is illuminated
   -or-
   press the ***Lo/Do*** key for 4 s.
   ⇨ LED (Lo/Do button) shows steady light
   ⇨ Output signal is set to light-switching
4. Position the sensor spot on the color mark to which it should be registered.
5. Press the ***Teach*** button.
   ⇨ LED (Teach button) lights up until the teach process is successfully completed
   ⇨ Optical registration unit is set up for the color mark

NOTE:
IF THE LED (TEACH BUTTON) IS FLASHING, THE TEACH PROCESS HAS NOT BEEN COMPLETED SUCCESSFULLY. CARRY OUT THE TEACH PROCESS AGAIN.

The fiber optic color sensor LC2001 is from ELTROTEC. For additional information please refer to the supplier documentation.

5.7 Operating the TD 200 control unit

The TD 200 control unit is used on the 1000 P.

After switching on the main switch, the control unit carries out a self-test. If the control unit is ready, it shows the current operating status or error messages.

general functions

Button	Function
SHIFT + ***F1***	Error acknowledgement

Procedure for removing error messages:

- Remedy the fault.
- Acknowledge the error message with ***SHIFT*** + ***F1***.
- Switch control voltage off and on again, operating switch.

See also section 7.1 Error messages on control unit TD 200, page 127

Functions in Setup mode

In setup mode, the print process can be run through manually, step by step. The following functions are available for this:

Button	Function
F1	Lift table moves up
F2	Lift table moves down
F3	Flooding: • Flood bar moves down • Squeegee head moves left and/or screen moves left
F4	Printing: • Squeegee moves down • Squeegee head moves right and/or screen moves right

Functions in Automatic mode

In automatic mode, the control unit displays the print counter.

Button	Function
SHIFT + ***F3***	Continuous operation
SHIFT + ***F4***	Reset print counter

Print counter:

- Set the print counter to zero by pressing ***SHIFT*** + ***F4***.

Set print counter to a particular value:

1. Press ***ENTER***.
   ⇨ Currently set numerical value flashes.
2. Change the value using the ▲ or ▼ keys.
3. Confirm with ***ENTER***.
   ⇨ Value is changed.

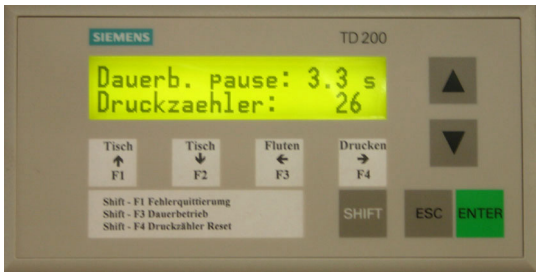
Down-counter:

The machine is equipped with a down-counter. This means you can set negative values. The machine carries out as many printing cycles as have been set. Once the value 0 is reached, the machine stops.

NOTE
THE FUNCTION OF THE DOWN-COUNTER IS NOT POSSIBLE WITH THE NECK BOTTOM SUPPORT WITH MECHANICAL MARK REGISTRATION OPTION.

Continuous operation:

If you select continuous operation, then the machine automatically starts the print process. The control unit displays the value ***Contin. op. pause*** and the ***Print counter***.



The value ***Contin. op. pause*** displays how long the pause is between the print cycles in order to change the substrate (in this case 3.3 s).

Change ***Contin. op. pause*** value:

1. Press ***ENTER***.
   ⇨ Currently set numerical value flashes.
2. Change the value using the ▲ or ▼ keys.
3. Confirm with ***ENTER***.
   ⇨ Value is changed.

End continuous operation:

- Switch the control voltage on the operating switch to ***OFF***.

-or-

- Select the ***Setup*** mode on the mode switch.

Neck bottom support with mechanical mark registration

This function can be selected in ***Set-up*** mode and in ***Automatic*** mode.

The following settings can be made:

- Switching mechanical mark registration on or off.
- Setting the duration of the half-tone printing process.

Proceed as follows to carry out settings:

1. Press ***SHIFT*** and ***F2*** keys.
   ⇨ Mechanical mark registration menu appears:

```
Cont.Registert.          1/0
Registertime                    2.0s
```

   ⇨ 1: Mechanical mark registration is switched on.
   ⇨ 0: Mechanical mark registration is switched off.
   ⇨ 2.0s: Duration of half-tone process
2. Press ***SHIFT*** and ***F2*** keys.
   ⇨ Mechanical mark registration is switched on or off.
   ⇨ Value is set to ***1*** or ***0***
3. Press the ***ENTER*** button.
   ⇨ Currently set numerical value flashes.
4. Change the value using the ▲ or ▼ keys.
5. Confirm with ***ENTER***.
   ⇨ Value is changed.

5.8 OP 3 - 1000 PK control unit

Using the ***ENTER*** key, you can confirm a choice or acknowledge error messages.

Using the ***ESC*** key, you can exit from a sub-menu to a level higher.

Enter numerical values (1, 2, 3, …, 9, 0):

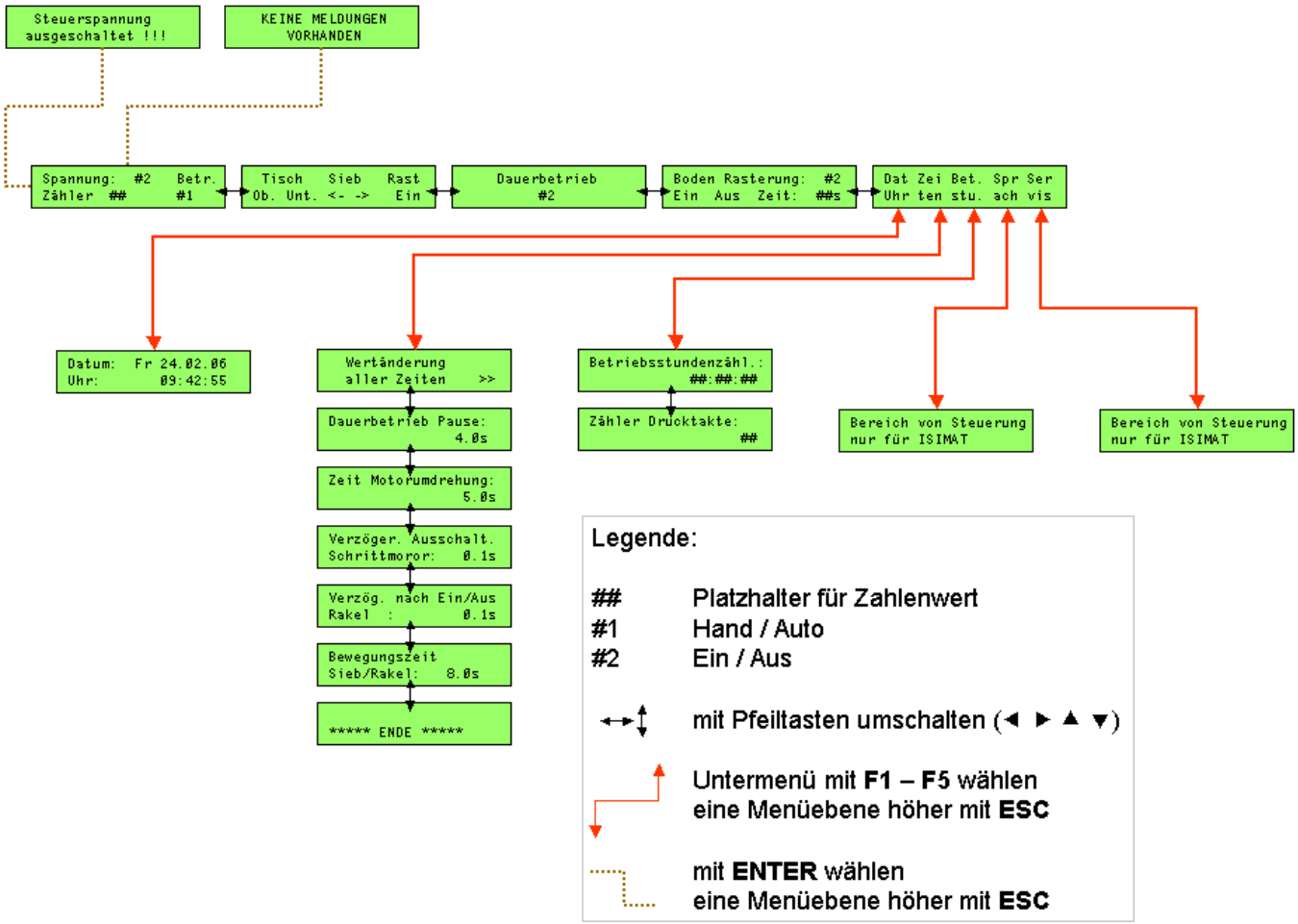
- Push simultaneously the numerical button and ***SHIFT***. For 3 e.g.: ***SHIFT*** + ***3***.

Choose a function shown on the display:

- Push the corresponding function button, e.g. ***F1***.

Menu structure

Siebdruckmaschine 1000 PK / Bediengerät SIEMENS OP3 schematische Darstellung



5.8.1 Error messages display

The OP 3 control unit carries out a self-test after the machine has been switched on. Then it displays error messages or the message ***NO MESSAGES AVAILABLE***.

If there are several error messages, they can be displayed one after the other using ▲ or ▼. One error message, for example, is ***S9: E-Stop relay dropped***.

In order to work with the machine or to set it up, error messages must first be removed. Proceed here as follows:

1. Remedy the correspondingly described fault.
2. Set the mode switch to ***On***.
   ⇨ Control voltage is switched on.
3. Acknowledge the error message by pressing ***ENTER*** for approx. 1 s while the error message is on the display screen.
   ⇨ Error message is acknowledged

Once all faults have been removed, the message ***NO MESSAGES AVAILABLE*** will appear.

5.8.2 Basic menu

The basic menu is called up from the error message display screen:

1. Press the ***ENTER*** button.
   ⇨ The first basic menu is displayed

You can return to the error message display screen from the basic menus by pressing the ***ESC*** key.

There are five basic menus:

- Operating status display
- Controller for lift table / screen holder / registration
- Continuous operation
- mechanical mark registration
- Sub-menus

You can change between these sub-menus by pressing ◄ or ►.

5.8.3 Operating status display

This basic menu gives information about the operating status of the machine:

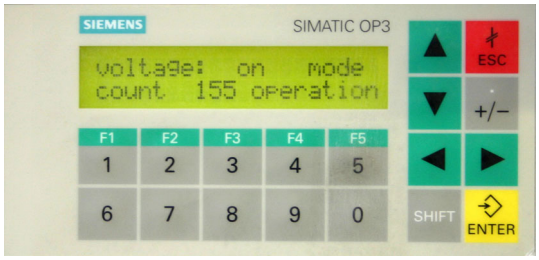
Voltage:On
Control voltage is switched on (or ***Off*** for switched off)

Manual mode
Manual mode (setup) (or ***Auto*** for automatic mode)

Counter: ▓
Counter display

The counter display shows how many prints have been made. You can set the counter display to a particular value or reset it to 0:

1. Enter any number using the numerical field.
2. Use the **+ / -** key to enter a negative number.
3. Confirm your entry with ***ENTER***.
   ⇨ The counter is preset to a value.



5.8.4 Controller for lift table / screen holder / registration

In this basic menu, when in ***Setup*** mode, you can manually control the lift table and the screen holder (or squeegee head). Switch the optical registration unit On or Off.

You can run through the printing sequence of the lift table:

1. Press ***F1***.
   ⇨ Cylinder on neck bottom support closes
2. Press ***F1***.
   ⇨ Lift table moves up
3. Press ***F2***.
   ⇨ Lift table moves down
   ⇨ Cylinder on neck bottom support opens

You can run through the printing sequence of the screen holder (cylindrical printing) or the squeegee head (flat printing):

1. Press ***F4***.
   ⇨ Flood bar lowers
2. Press ***F4***.
   ⇨ For cylindrical printing: screen holder moves to the right
   ⇨ For flat printing: squeegee head moves to the right
3. Press ***F3***.
   ⇨ Flood bar lowers
4. Press ***F3***.
   ⇨ For cylindrical printing: screen holder moves to the left
   ⇨ For flat printing: squeegee head moves to the left

You can switch the optical registration unit on or off:

1. Please be sure that the function „mechanical mark registration“ is switched off.
2. Press ***F5***.
   ⇨ off: registration is switched off
   ⇨ on: registration is switched on

5.8.5 Continuous operation

In this basic menu, you can switch continuous operation on and off.

If you select continuous operation, then the machine automatically starts the print process.

1. Make sure that the machine is in ***Automatic*** mode.
2. Press ***F3***.
   ⇨ Continuous operation is switched on
   ⇨ Machine carries out a printing cycle
   ⇨ Machine stops for the duration which is set under ***Times*** / ***Continuous operation pause:*** .
   ⇨ The machine carries out the next printing cycle

Switch off continuous operation:

1. Press ***F3*** or the foot switch.
   ⇨ Continuous operation is switched off.
   ⇨ The machine completes the current printing cycle.

5.8.6 Mechanical mark registration

In the main menu you can switch on and off the mechanical mark registration and you can set up parameters of this unit. See also paragraph no. 4.9.4 Neck bottom support with mechanical mark registration, Seite 58.

Mechanical mark registration ON	F1
Mechanical mark registration OFF	F2
Setting of the half tone process duration	Number field

In order to set the parameters of this unit, please follow these instructions:

1. Be sure, that the optical mark registration is OFF.
2. Push the button ***F1***.
   ⇨ Mechanical mark registration is ON

`Mech. Registr.: ON`

3. Push the button ***ENTER***.
   ⇨ The numerical value actually setted is blinking
4. Modify the value using the number field.
5. Confirm pushing ***ENTER***.
   ⇨ The value is modified!

5.8.7 Sub-menus

In this basic menu, you can select the sub-menus:

Dat clo (set date and time)

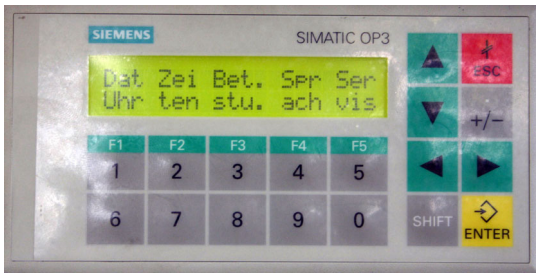
Times (set times)

Op. hour (counter for operating hours and print cycles)

Language (only for ISIMAT service personnel)

Service (only for ISIMAT service personnel)

Select a sub-menu using the function key below.

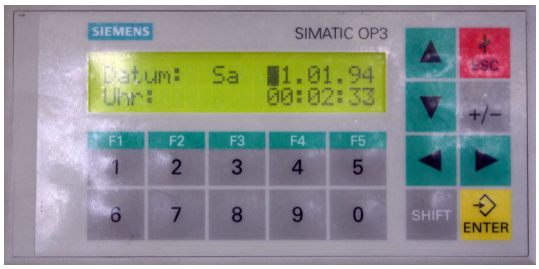


Sub-menu dat clo

In this menu, you can set the date and time.

In order to select the sub-menu ***dat clo*** you have to enter a password:

1. You have selected the ***dat clo*** sub-menu.
   ⇨ You are requested to enter a password.
2. Enter the password:
   Enter the numbers ***3 5 0 3*** using the numerical field.
3. Confirm with ***ENTER***.
   ⇨ ***Dat clo*** sub-menu is displayed.



4. Set the cursor ▒ using the arrow keys ▲ / ▼ / ◄ / ►) to the position where you would like to change a value.
5. Enter the value using the numerical keyboard.
6. Confirm your entry with ***ENTER***.
   ⇨ Value is changed.

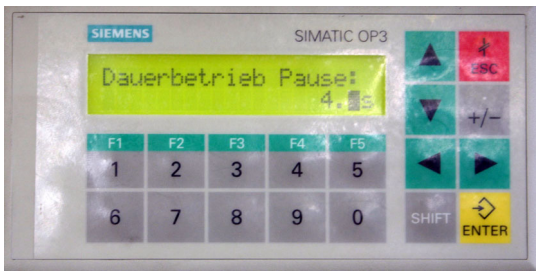
Sub-menu times

In this sub-menu, you can set the times. You can switch between the different time values using the arrow keys ◄ and ►.

1. Enter the value using the numerical keyboard.
2. Enter the decimal sign using ***SHIFT*** + **+/-** (**.**).
3. Confirm your entry with ***ENTER***.
   ⇨ Value is changed.

Set the time for continuous operation (***Continuous operation pause:***) : The machine stops between two print cycles for this duration before a new print cycle automatically starts.

- Range limits: 0.2 to 10 s
  Recommendation: 4.0 s

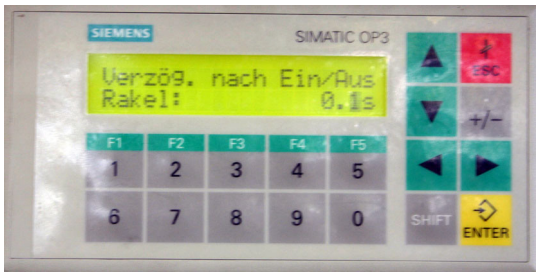


Set the time for stepper motor (***Time for motor revolutions:***) for registration: The registration unit stepper motor turns maximally for this duration. If the registration unit sensor does not locate the color mark within this time then the print cycle is interrupted.

- Range limits: 0.5 to 7 s
  Recommendation: 5.0 s

Specified check time for stepper motor: 0.1 s (delay of stepper motor switch-off)

Specified time delay after on / off cycle: 0.1 s (delay after on/off squeegee)



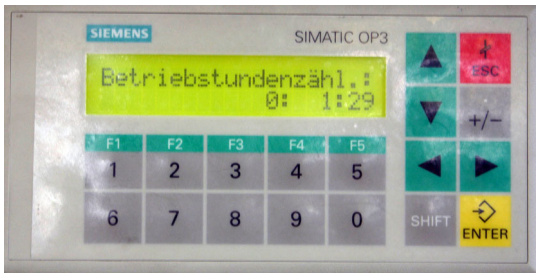
Specified check time for screen carriage / squeegee head carriage: 8.0 s (movement time for screen/squeegee)

End of time settings:

Sub-menu op. hour

In this sub-menu, you can choose between the counter for operating hours and print cycles (switch between them using the arrow keys ◄ and ►):

- ***Operating time indicator:***
  Displays the operating hours which the machine has already worked.
  Display format: HH:MM:SS



- ***Print cycles counter:***
  Displays the print cycles.

Sub-menu languag

This sub-menu is exclusively reserved for use by service personnel from ISIMAT only. Do no undertake any settings here.

Service sub-menu

This sub-menu is exclusively reserved for use by service personnel from ISIMAT only. Do no undertake any settings here.

5.9 Operating the OP 3 control unit

The OP 3 control unit is used on the 1000 PW and FK 27.

Using the ***ENTER*** key, you can confirm a choice or acknowledge error messages.

Using the ***ESC*** key, you can exit from a sub-menu to a level higher.

Enter numerical values (1, 2, 3, …, 9, 0):

- Push simultaneously the numerical button and ***SHIFT***. For 3 e.g.: ***SHIFT*** + ***3***.

Choose a function shown on the display:

- Push the corresponding function button, e.g. ***F1***.

The menu structure differs between the 1000 PW and FK 27.

Menu structure of OP 3 / 1000 PW:

Menu structure of OP 3 / FK 27:

5.9.1 Error messages display

The OP 3 control unit carries out a self-test after the machine has been switched on. Then it displays error messages or the message ***NO MESSAGES AVAILABLE***.

If there are several error messages, they can be displayed one after the other using ▲ or ▼. One error message, for example, is ***S9: E-Stop relay dropped***.

In order to work with the machine or to set it up, error messages must first be removed. Proceed here as follows:

1. Remedy the correspondingly described fault.
2. Set the mode switch to ***On***.
   ⇨ Control voltage is switched on.
3. Acknowledge the error message by pressing ***ENTER*** while the error message is on the display screen.
   ⇨ Error message is acknowledged.

Once all faults have been removed, the message ***NO MESSAGES AVAILABLE*** will appear.

5.9.2 Basic menu

The basic menu is called up from the error message display screen:

1. Press the ***ENTER*** button.
   ⇨ The first basic menu is displayed.

You can return to the error message display screen from the basic menus by pressing the ***ESC*** key.

There are four basic menus:

- Operating status display
- Controller for lift table / screen holder / squeegee head
- Function choice
- Sub-menus

You can change between these sub-menus by pressing ◄ or ►.

5.9.3 Operating status display

This basic menu gives information about the operating status of the machine:

Voltage:On
Control voltage is switched on (or ***Off*** for switched off)

Manual mode
Manual mode (setup) (or ***Auto*** for automatic mode)

Counter: ▒
Counter display

The counter display shows how many prints have been made. You can preset the counter display to a value (e.g. reset to 0 or to -100, so that the machine counts backwards to 0):

1. Enter any number using the numerical field.
2. Use the **+ / -** key to enter a negative number.
3. Confirm your entry with ***ENTER***.
   ⇨ The counter is preset to a value.

5.9.4 Controller for lift table / screen holder / squeegee head

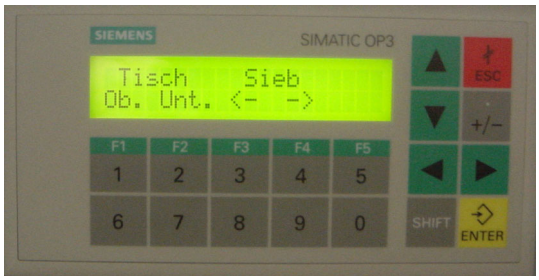
In this basic menu, when in Setup mode, you can manually control the lift table and the screen holder (or squeegee head).

You can move the lift table up or down:

- ***Table up***
  press ***F1*** key
- ***Table down***
  press ***F2*** key

You can move the screen holder (cylindrical printing) or the squeegee head (flat printing) to the left or right:

- ***Screen*** ←
  press ***F3*** key
- ***Screen*** →
  press ***F4*** key



5.9.5 Function choice

In this sub-menu, you can set the type of printing. Select between:

Normal printing
Select normal printing if the print process should be triggered with the foot switch, e.g. for cylindrical printing.

Crate one side
Select this type of printing if you have mounted a receptacle cross-holder for bottle crates which has a contact switch which automatically triggers the printing process. The bottle crate is printed on one side.

Crate two sides
Select this type of printing if you have mounted a receptacle cross-holder for bottle crates which has a swivel unit and a contact switch which automatically triggers the printing process. The bottle crate is printed on two (opposite) sides.

This is how you select the type of printing:

1. Press the ***SHIFT*** and ▲ or ▼ at the same time.
   ⇨ The display changes between the three printing types.
2. Confirm the selected type of printing with ***ENTER***.
   ⇨ The display shows the selected type of printing.

5.9.6 Sub-menus

The sub-menus are selected from this basic menu:

Manual (manual control of different functions)

Op. hours (operating hour indicator)

Language (select language)

Service (service)

Select a sub-menu using the function key below.

Sub-menu manual

This sub-menu enables manual control of all important functions:

- ***Lower / lift squeegee***
  Squeegee is lowered / lifted
- ***Screen/squeegee to the left / right***
  Screen holder (cylindrical printing) or squeegee head (flat printing) moves to the left / right end position.
- ***Release/clamp screen/squeegee***
  Screen holder (cylindrical printing) or squeegee head (flat printing) is released (can be shifted by hand) / clamped.
- ***Lower / raise lift table***
  Lift table is lowered / raised
- ***Clamp / release crate***
  Bottle crate is clamped / triggered
- ***Swivel forwards / backwards***
  Swivel unit is swiveled forwards / backwards
- ***Valve Z ON / OFF***
  Valve Z on the pneumatic connections is pressurized / unpressurized

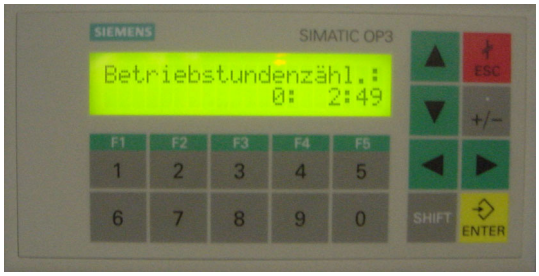
You can change between the individual functions by pressing the ◄ or ► keys or either of the function keys under the double arrows **<<** (***F1***) or **>>** (***F5***).

You select one function (e.g. ***lower lift table***) by pressing the function key below that (***F4***).

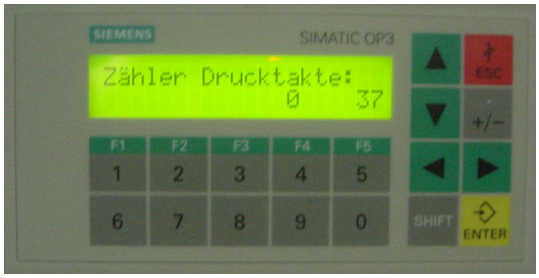
Sub-menu op. hours

In the operating hour indicator sub-menu, you can select between three displays:

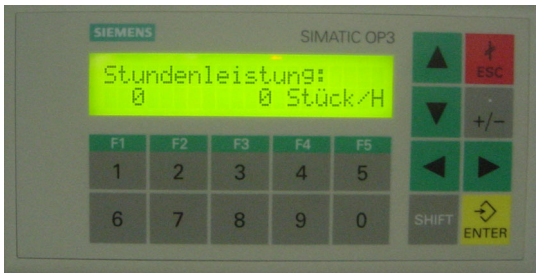
- ***Operating time indicator:***
  Displays the operating hours which the machine has already worked.
  Display format: HH:MM:SS



- ***Print cycles counter:***
  Displays the print cycles.



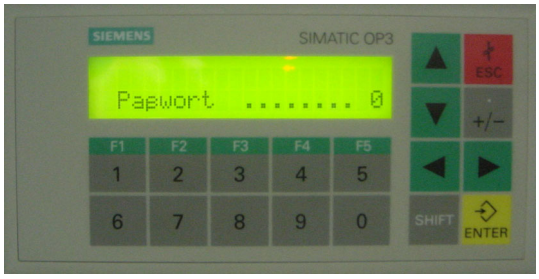
- ***Hourly output:***
  Shows the theoretical hourly output. The value is calculated based on the printed piece number within one minute.



Language sub-menu

In this sub-menu, you can set the language (German or English).

1. You have selected the ***language*** sub-menu.
   ⇨ You are requested to enter a password.



2. Enter the password:
   Press the ***SHIFT*** key and hold this pressed down.
   Enter the password ***3 5 0 3*** using the numerical field.
3. Release the ***SHIFT*** button.
4. Confirm with ***ENTER***.
   ⇨ The choice of languages are displayed:
   German or ***English***

5. Select German with ***F2*** or English with ***F4***.
   ⇨ The language has been changed.

Service sub-menu

This service sub-menu is exclusively reserved for use by service personnel from ISIMAT only. Do no undertake any settings here.

5.10 Operating in automatic mode

CAUTION

Dry printing without ink!

Damage to squeegee and stencil.

- Be sure that the squeegee unit is raised in setup mode.
- Do not move the squeegee dry over the stencil.
- Make sure that there is always sufficient ink in the forme. The entire area of the printed image should be covered with sufficient ink so that the squeegee does not pass over the stencil in a dry state.

The print process is triggered by the foot switch.

1. Make sure that
   ⇨ The machine is ready.
   ⇨ You have carried out the practical instructions from section 5.3 Setting up for cylindrical printing, page 75.
   -or-
   you have carried out the practical instructions from section 5.4 Setting up for flat printing, page 83.
   -or-
   you have carried out the practical instructions from section 5.5 Setting up for cone printing, page 90.
   ⇨ A screen forme has been inserted into the screen holder.
   ⇨ The screen forme is always sufficiently filled with printing ink.
2. Close the safety bow.
3. Select ***Automatic*** using the mode selector switch.
4. Set the mode switch to ***On***.
   ⇨ Control voltage is switched on.
   ⇨ Machine moves to home position (lift table lowered, squeegee head / screen holder to the left).
5. Fit the article receptacle with a substrate.
6. Operate the foot switch.
   ⇨ A print cycle is automatically implemented.
   ⇨ The substrate is printed.
7. Remove the substrate from the article receptacle.

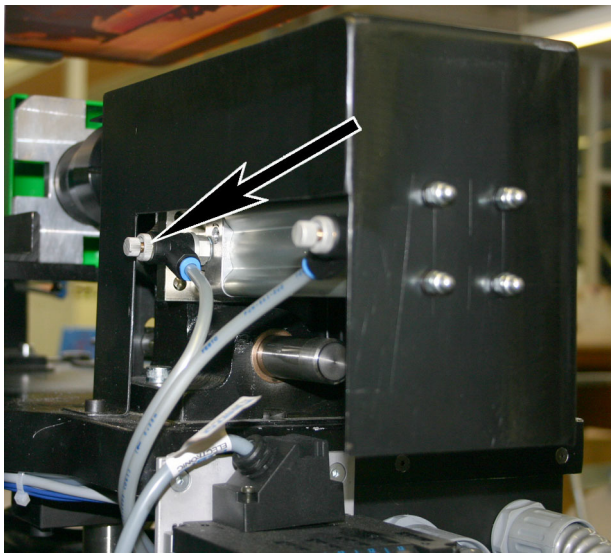
5.11 Options

5.11.1 Printing on notes boxes

Observe the following settings (see illustration) when printing note boxes:

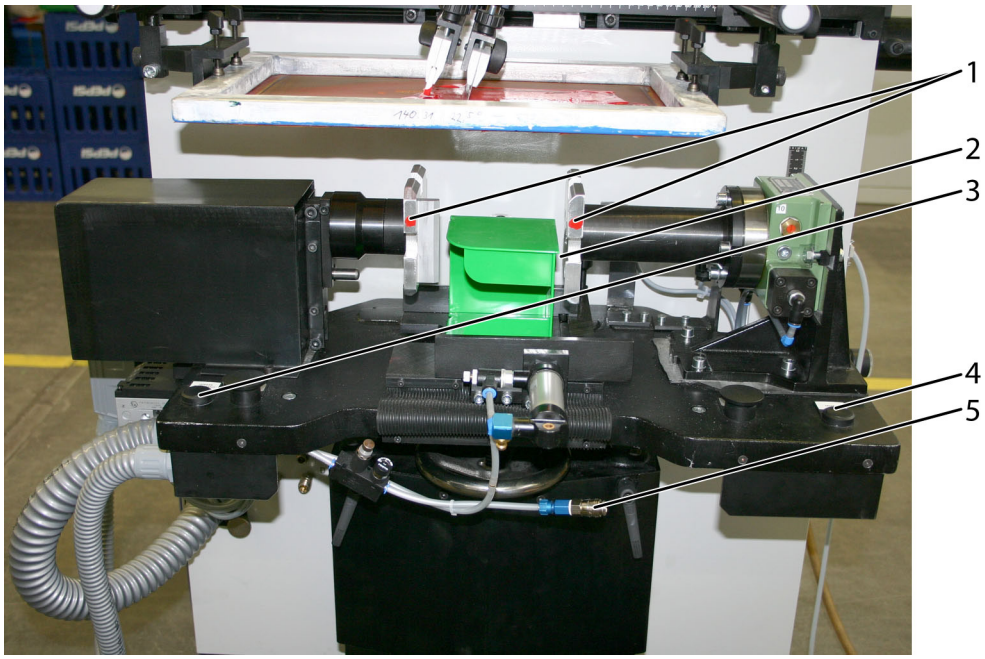
Set a lower clamping speed on the left-hand press plate:

- Turn the pressure control valve (arrow) to slow down the clamping speed



Pressure control valve for clamping speed

- Before starting with printing, the press plates must be aligned, red point to the front (1), see picture
- Remove pneumatic connection (5) to print note boxes
- Press plate with angle connector on left, see picture
- Insert note box as shown
- Approx. 5 mm distance (2) between note box and right press plate
- After a print cycle, bring the press plates back to starting position with the ***cycle completed*** button (4)



Printing on notes boxes

(1) Press plates, marking at front
(2) Distance between note box and press plate, approx. 5 mm
(3) "Release the tension“ button
(4) "Cycle completed" button
(5) pneumatic connection

5.11.2 Vacuum printing table plate with sliding table

Turn the main switch of the vacuum unit on when starting up.

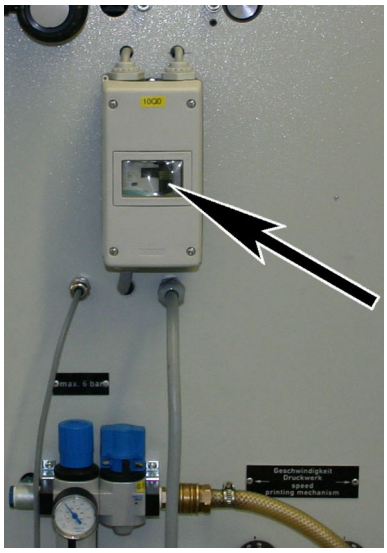


Figure 5-2: Vacuum unit main switch

You can monitor the power of the vacuum on the pressure gage (arrow).

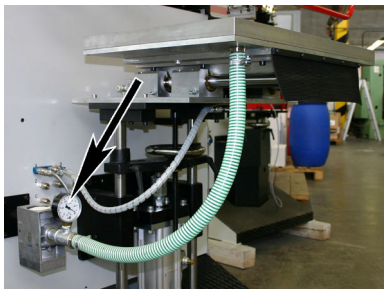


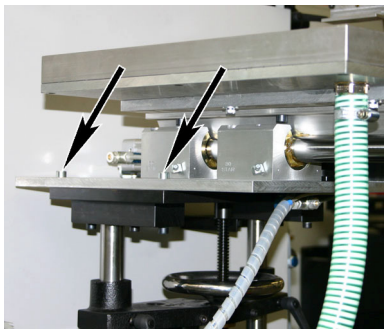
Figure 5-3: Pressure gage

The lift table moves up for the print procedure. At the same time, the vacuum printing table plate moves through the sliding table to the front.

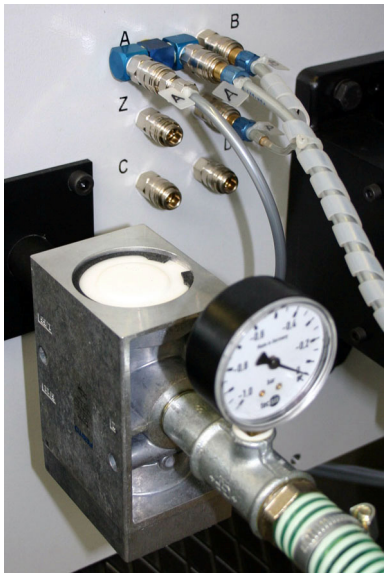
Mounting the article receptacle

In order to mount the vacuum printing table plate, proceed as follows:

1. Secure the vacuum printing table plate to the lift table using a total of four screws (arrow).

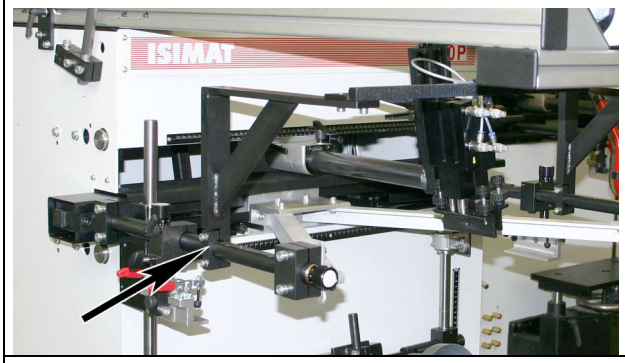
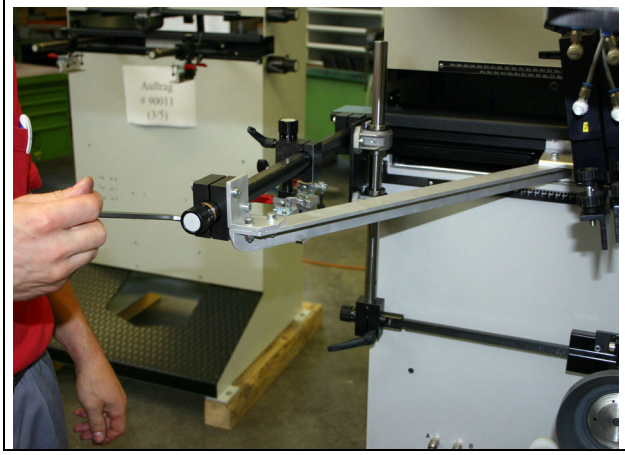


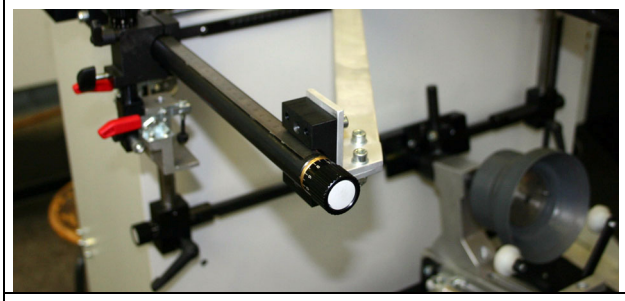
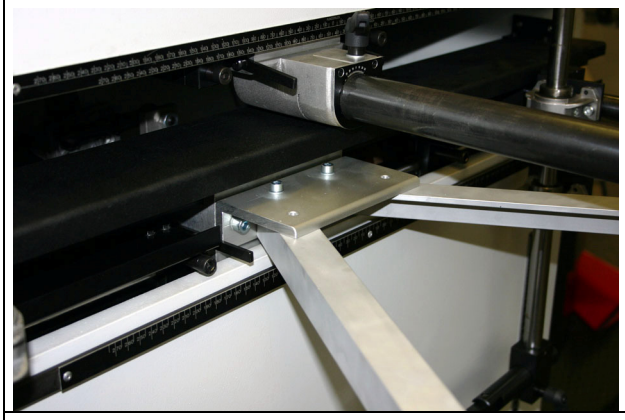
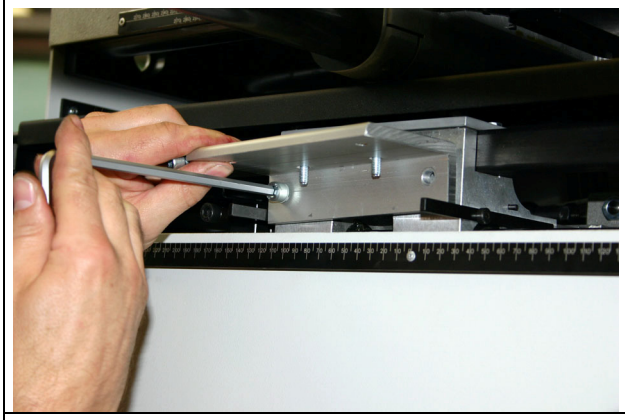
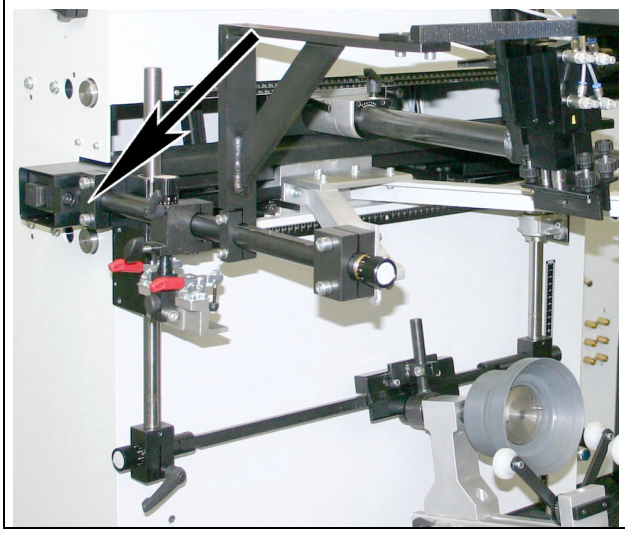
2. Connect the vacuum printing table plate with the pressure gage connection using a vacuum hose.
3. Connect the pneumatic connections according to the labels (see picture).

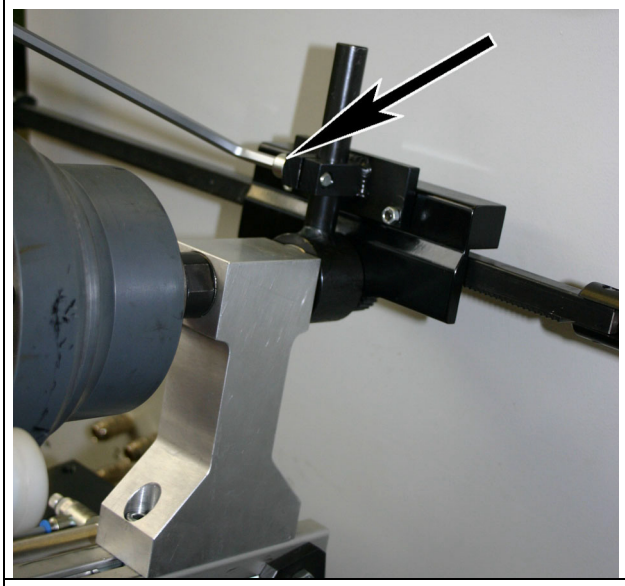
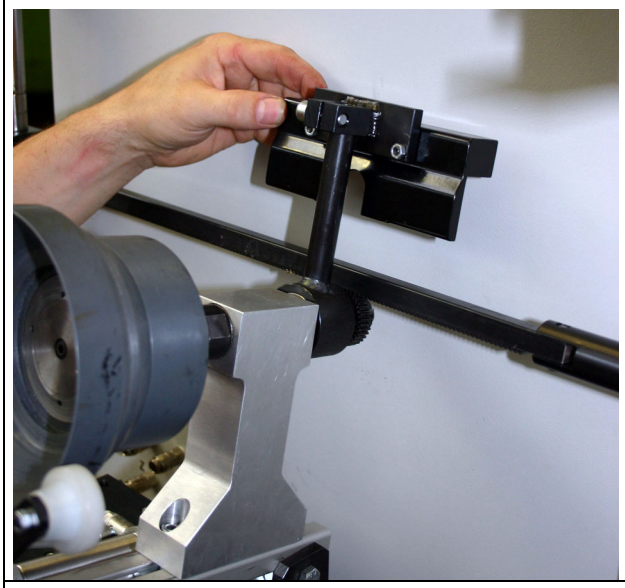
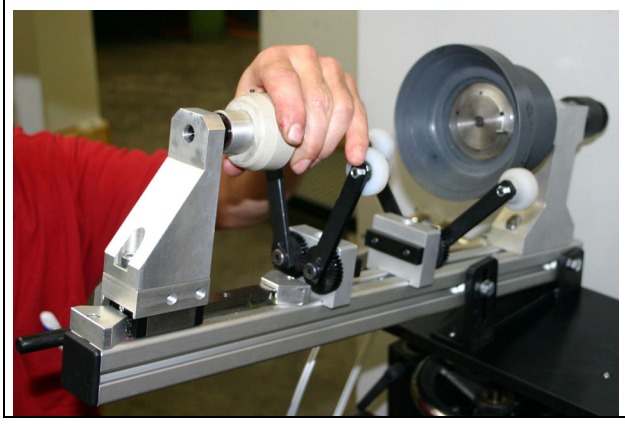


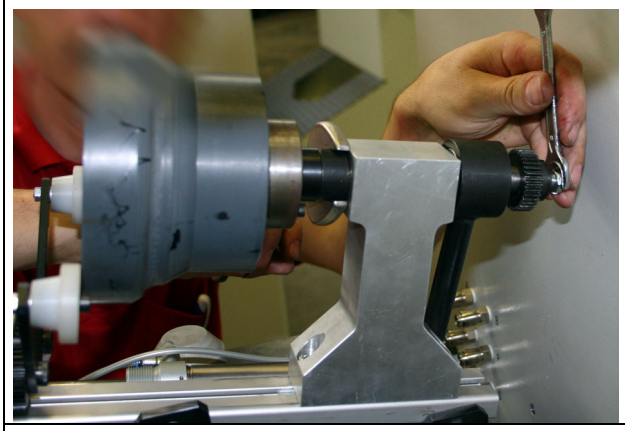
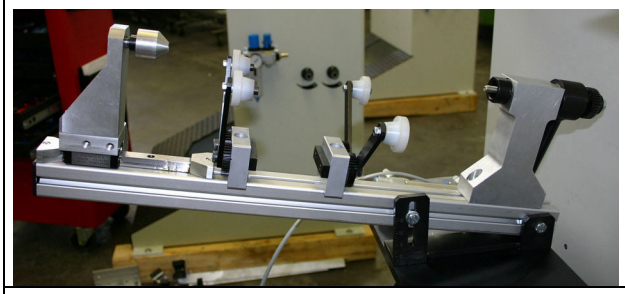
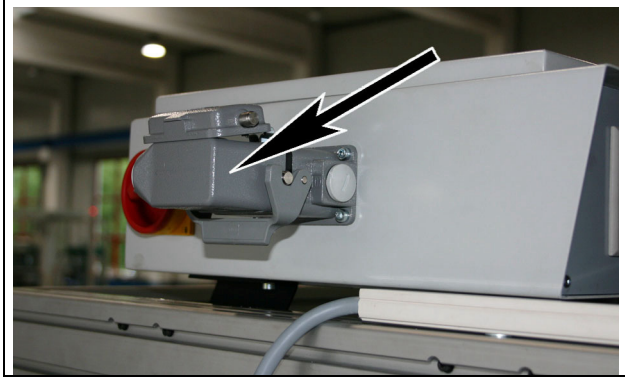
5.11.3 Changing over the machine: from cone printing to cylindrical printing

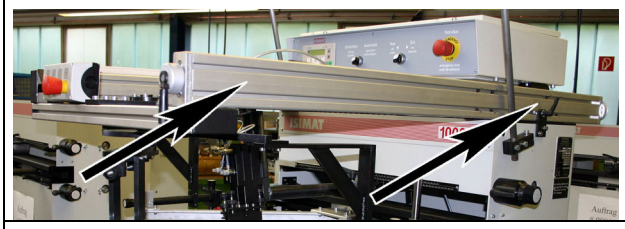
Carry out the following practical steps:

Picture		Comment / practical step
		1000 P cone printing system
		• Loosen the screws on both sides of the machine • Remove the holder
		• Loosen the screws on both sides of the machine

Picture		Comment / practical step
		
		Holder
		• Dismantle the holder
		• Remove the screws on both sides of the machine

Picture		Comment / practical step
		• Loosen the screw
		• Remove the rack guide
		• Dismantle the neck bottom support

Picture		Comment / practical step
		
		• Dismantle the cylindrical printing unit
		• Remove the plug
		• Plug in the dummy plug

Picture		Comment / practical step
		• Dismantle the cone printing unit
		• Carry out the practical steps mentioned in section 5.3 Setting up for cylindrical printing, page 75

5.11.4 Mounting the receptacle cross-holder for bottle crates

1. Make sure that
   ⇨ The article receptacle was dismantled as described in section 5.2 Dismantling the article receptacle.
2. Place the receptacle cross-holder on the lift table.
3. Secure the receptacle cross-holder with four Allen head screws on the lift table.
4. Open the door on the back of the machine.
5. Connect the electrical (two) and pneumatic (***A*** and ***B***) connections to the swivel unit.

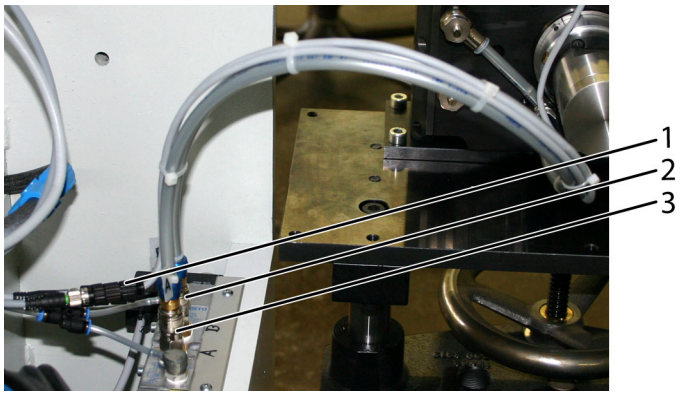


Figure 5-4: Electrical and pneumatic connections on the swivel unit

(1) Electrical connections, two plugs

(2) Pneumatic connection **B**

(3) Pneumatic connection **A**

6. Connect the pneumatic connections on the crate tensioner using the connections ***C*** and ***D*** on the front of the machine.
   ⇨ The receptacle cross-holder is mounted and connected.
7. Carry out the practical steps mentioned in section 5.4 Setting up for flat printing, page 83

Changing the receptacle cross-holder from edgeways to crossways

The receptacle cross-holder must be changed over from edgeways to crossways if the large lateral surface area of a bottle crate is to be printed. To do this, proceed as follows:

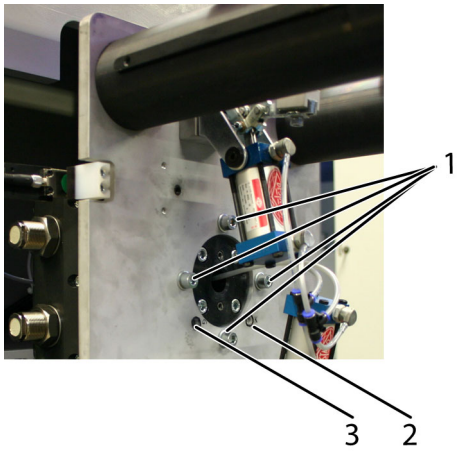


Figure 5-5: Changing over the receptacle cross-holder

(1) Allen head screws (total of four)
(2) Mark for edgeways, small side (K)
(3) Mark for crossways, large side (G)

1. Remove the four Allen head screws (1).
2. Remove the receptacle cross-holder from the holder.
3. Turn the receptacle cross-holder counterclockwise by 90°.
4. Place the receptacle cross-holder onto the holder again. When doing this, make sure that the bolt is inserted into mark ***G*** (3).
5. Insert the four Allen head screws and tighten them so that the receptacle cross-holder lies flush with the holder.
   ⇨ The receptacle cross-holder has been changed from edgeways to crossways.

☝ ***NOTE:***
IN ORDER TO CHANGE THE RECEPTACLE CROSS-HOLDER FROM CROSSWAYS TO EDGEWAYS, PROCEDURE IN SIMILAR FASHION AS DESCRIBED ABOVE.

6 Maintenance and disposal

Note the following:

Before carrying out maintenance and repair work

- Clean machine, terminals and threaded fittings of process materials
- Do not use aggressive cleaning agents
- Use lint-free cleaning cloths

After maintenance and cleaning work

- Retighten loose screw connections
- Reapply removed process materials (such as lubricants or conserving agents)

⚠ WARNING

Unintentional startup of the machine!

Risk of injury.

- Switch off the machine completely before starting maintenance and repair work.
- Secure the machine against unintentional restarting.
- Install a padlock and apply a warning sign to the main switch.

⚠ WARNING

Machine damage caused by improper lifting of individual parts and sub-assemblies!

- Use only appropriate lifting gear and transport equipment for lifting individual parts and sub-assemblies.

⚠ WARNING

Risk of injury from disassembled safety equipment!

- Reinstall safety equipment immediately after completing maintenance and repair work.
- Check for proper function of the safety equipment.

6.1 Personnel selection

Maintenance work requires special knowledge. Persons who carry out maintenance work must be technically qualified.

6.2 Maintenance

Wear parts are subject to maintenance intervals recommended by us and are part of the applicable warranty claims. The life expectancy of wear parts (e.g. ball bearings, belts or filters) depends on the number of operating hours, the load and other factors such as temperature, etc.

All work areas require maintenance and repair work at specified intervals to be performed by specially trained experts.

NOTE:
TIMES FOR MAINTENANCE INTERVALS ARE BASED ON SINGLE-SHIFT OPERATION WITH 3 WORKING HOURS/DAY. ADJUST THE MAINTENANCE INTERVALS ACCORDINGLY, E.G. IF YOU WORK TWO-SHIFT OPERATION.

⚠ WARNING

Injury and machine damage caused by damage or defects!

- Immediately repair any detected damage or defects.

⚠ WARNING

Injury and machine damage caused by safety defects!

The manufacturer should be commissioned every five years to carry out a safety inspection of the machine.

6.2.1 Maintenance materials

The maintenance materials and their ISIMAT item No.s are listed in the following table:

Maintenance materials	ISIMAT item No.
Tunfluid H/A	10 00 47 42
Tunclean 895	10 98 45
Tunsulid TE 812	10 98 44
UV- and ozone-resistant grease	10 50 74
Hydraulic oil GWA 500 ISO 10 4053	5 63 10 00
Tungrease DAB (TUNAP) use for all standard applications, e.g. linear guides, friction bearings or antifriction bearings (replaces: Grease fill, DIN 51825 K2K)	11 96 06

Further information about lubricants and manufacturers:

TUNAP: http://www.tunap.de

Divinol: http://www.divinol.de

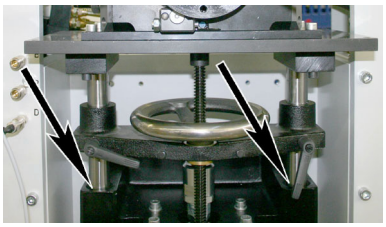
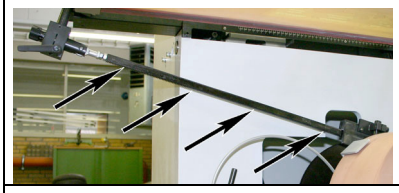
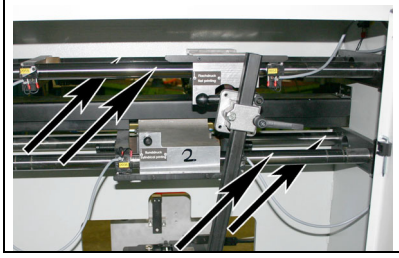
6.2.2 General

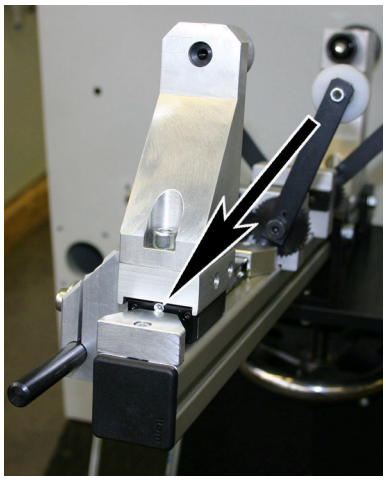
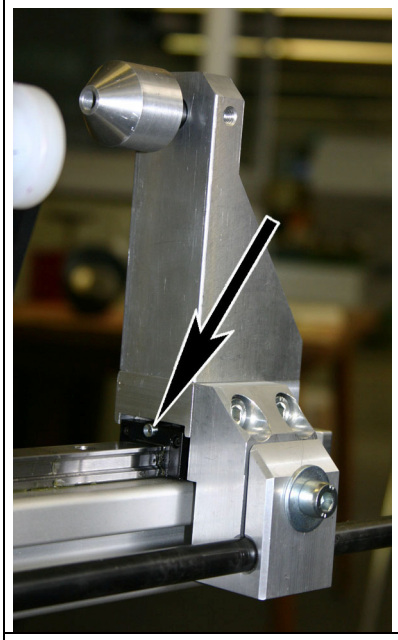
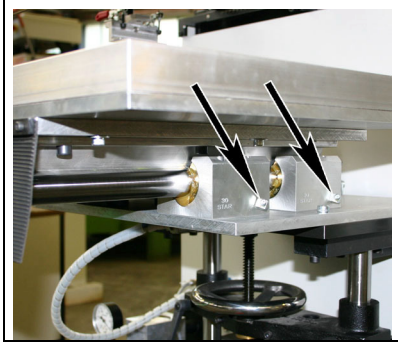
Where?	What?	When?
Machine in general	Check for visible damage and defects Observe operating behavior Any changes should be reported immediately to the responsible department or person! If necessary, shut down the machine immediately and secure it!	Once per shift
Compressed-air unit	Check operating pressure	Once per shift
Electrical equipment	Inspect (loose connections, scorched cable, …)	Once a week

6.2.3 Machine framework

Only use a clean, soft, lint-free cloth moistened with a little IPA for cleaning the machine framework.

6.2.4 Lubrication

Where?	What?	When?
Lift table 	Maintenance medium: Hydraulic oil GWA 500 ISO 10 4053 Item No.: 5631000 Number: 2 Action: oil Op. mode: Switched off Note: Dismantle the cover from the lift table.	Monthly
Rack 	Maintenance medium: grease Action: grease, lubricate Op. mode: Switched off	Monthly
Guide rods for cylindrical and flat printing 	Maintenance medium: Hydraulic oil GWA 500 ISO 10 4053 Item No.: 5631000 Number: 4 Action: oil Op. mode: Switched off Note: The guide rods are located inside the machine framework.	Every 6 months

Where?	What?	When?
Neck bottom support (optional) Guide  	Maintenance medium: Grease fill DIN 51825 K2K Number: 2 Action: Grease Tool: Grease gun Op. mode: Switched off	Every 3 months
Sliding table, guide 	Maintenance medium: Grease fill DIN 51825 K2K Number: 4 Action: Grease Tool: Grease gun Op. mode: Switched off	Monthly

6.2.5 Supplier Components

The following table shows maintenance work required for third-party components. Always observe the notes on maintenance work in the individual supplier documents. This table only states the maintenance work and the maintenance intervals!

Where?	What?	When?
Compressed-air unit See also documentation from FESTO	• Drain condensation	When the condensation level is approx. 10 mm below the filter element
	• Change filter cartridge	1,000 h
Vacuum unit optional See also supplier documentation from BECKER	• Check filters Note: Replace filters depending on their condition and dirtiness The filter can be cleaned 2 - 3 times with compressed air. The maintenance interval can be longer or shorter depending on the strain and environment.	3,000 h / as necessary
	• Check rotor blades as recommended by manufacturer	3,000 h

6.3 Cleaning

The following cleaning work should be carried out following each production cycle:

- Clean all machine parts that have been dirtied by printing ink (e.g. screen stencil, squeegee) with a suitable cleaning agent.
- Clean the sensor lens on the optical registration unit (option).

6.4 Disposal

6.4.1 Mechanical and electrical components

Dispose of disassembled mechanical and electrical machine components in accordance with prevailing legal regulations.

6.4.2 Process materials

Dispose of process materials (such as cleaning agents or lubricants) in accordance with prevailing legal regulations. Observe the disposal instructions in the DIN safety data sheets.

7 Faults

7.1 Error messages on control unit TD 200

7.1.1 Setup mode

Error message	Effect	Troubleshooting →Position
Error table!!! "Setup" mode	Table does not stay up	Signal Sensor 20S1 missing Signal Sensor 20S2 missing →Lift table
Control voltage OFF Error table	Machine not functioning	Signal Sensor 20S2 missing →Lift table
Machine completely off, no display	Machine not functioning	Fuse 10F1 →switchbox
Control voltage OFF	Machine not functioning	Fuse 10F2, 10F3 →Switchbox Compressed air not ok →Check compressed air unit E-Stop switch pressed →Control console
“Setup” mode	Machine not functioning	Fuse 13F1 →switchbox

7.1.2 Automatic mode

Error message	Effect	Troubleshooting →Position
Error table!!! Print counter: ▒ ▒	Table moves up, machine stops, table moves down	Signal Sensor 20S1 missing →Lift table
Control voltage OFF Error table!!!	Machine not functioning	Signal Sensor 20S2 missing →Lift table
Machine completely off, no display	Machine not functioning	Fuse 10F1 →switchbox
Control voltage OFF	Machine not functioning	Fuse 10F2, 10F3 →Switchbox Switch signal 13S2.1 missing →Machine framework E-Stop switch pressed

		→Control console Compressed air not ok →Check compressed air unit
Error table!!! Print counter: ▒ ▒	Machine not functioning	Fuse 13F1 →Machine framework
Screen/squeegee not ← Print counter: ▒ ▒	Machine not functioning	Switches 20S3, 20S4 not switched →Machine framework
Error screen/squeegee Print counter: ▒ ▒	Machine stops between cycles	Switches 20S5, 20S6 not switched →Machine framework
S-Bow operated! Print counter: ▒ ▒	Machine not functioning	Switch 13S5 not switched →Machine framework
Control voltage OFF S-bow operated	Machine not functioning	Safety bow open →Safety bow

7.2 Error messages on control unit OP3

Error message	Effect	Troubleshooting →Position	Error remedying
Bow open !!!	Machine not functioning	Safety bow open → Safety bow	Close the safety bow and switch the control voltage on.
Error table (sensors ?!)	Machine not functioning	Lift table has not reached upper or lower end position Sensors are defective or wrongly positioned → Sensors on lift table	Check the sensors on the lift table cylinder.
Error screen (sensors ?!)	Machine not functioning	Screen carriage or squeegee head carriage have not reached end position Limit switches are defective or wrongly positioned → Limit switches on screen carriage of squeegee head carriage	Check screen carriage of squeegee head carriage. Check the limit switches on screen carriage or squeegee head carriage.
Error centering unit (sensors ?!)	Machine not functioning	Cylinder on neck bottom support has not reached end position Sensor is defective or wrongly positioned Cylinder is defective → Cylinder or sensor on cylinder of neck bottom support	Check the neck bottom support Check the sensor on cylinder of neck bottom support Sensor registering: when the cylinder has run in (the neck-bottom support is closed) the

Error message	Effect	Troubleshooting →Position	Error remedying
			sensor has to have contact(LED is ON). Check the cylinder of neck bottom support
E-Stop operated !!!	Machine not functioning	E-Stop switch was operated → Control console	see section 2.5.1 E-Stop switch, page 35.
Control voltage switched off !!!	Machine not functioning	Control voltage is switched off → Operating switch on control console	Set the mode switch to On.
Motor breaker failed !!!	Machine not functioning	Overload of stepper motor → Motor breaker in switch cabinet	Check the stepper motor. Check the motor breaker.
Compressed air not OK !!!	Machine not functioning	Operating pressure too low. Compressed air supply interrupted. → Compressed air unit	Check the operating pressure. Check the compressed air supply.

7.3 Electrical system

Faults in the electrical system are to be remedied only by electrical technicians or persons instructed in electrical technology.

⚠ DANGER

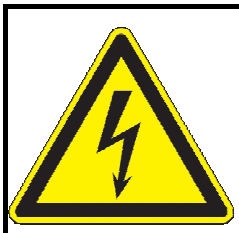
Live parts (up to 400 VAC)!

Risk of fatal injury by shock or contact with parts under voltage.

- Disconnect the machine from the mains supply when performing maintenance or cleaning work, performing repairs, opening the enclosure, or changing the work location.
- Protect the mains plug and mains cable from damage.
- Work on the electrical system is to be carried out only by skilled electricians or persons instructed in electrical engineering.
- Observe the five safety rules according to the VDE 0105.

7.4 Setting the safety bow

Proceed as follows to set the safety bow:



⚠ DANGER

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Risk of fatal injury by shock or contact with parts under voltage.

- Disconnect the machine from the mains supply when
  performing maintenance or cleaning work,
  performing repairs,
  opening the enclosure, or
  changing the work location.
- Protect the mains plug and mains cable from damage.
- Work on the electrical system is to be carried out only by skilled electricians or persons instructed in electrical engineering.
- Observe the five safety rules according to the VDE 0105.

- Make sure that the machine has been switched off.

1. Move the safety bow up.
   ⇨ Gas pressure spring is extended (Fig. 1).
2. The Allen head screw on the fastening (gas pressure spring) must be tightened securely (Fig. 1, arrow).

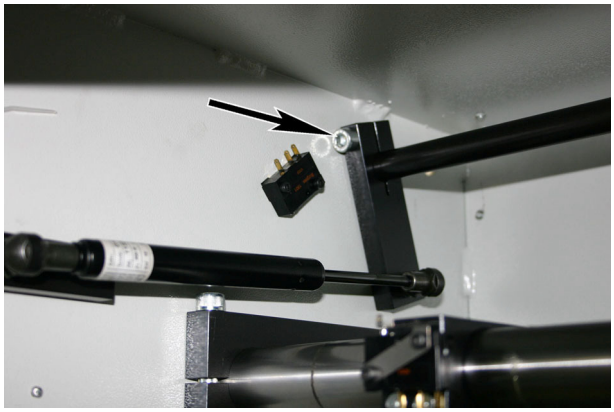

Fig. 1

3. Put the safety bow down.
   ⇨ Fastening (gas pressure spring) fits on the limit switch (Fig. 2, arrow).
   ⇨ Gas pressure spring is retracted (Fig. 2).

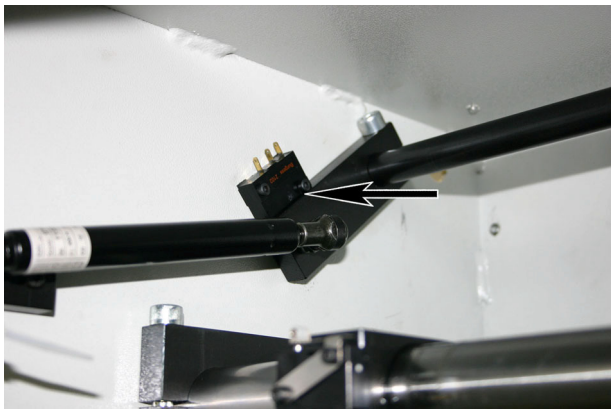

Fig. 2

4. Loosen the Allen head screw on both sides of the safety bow (only loosen slightly, Fig. 3, arrow).
5. Set the safety bow so that it is horizontal (when folded down).

   Safety bow is too far up:
   Lightly press the safety bow down until it is horizontal.

   -or-

   Safety bow is too far down:
   Put the safety bow up and shift it further back with slight pressure. Put the safety bow down again (now it is too far up). Lightly press the safety bow down until it is horizontal.
6. Tighten the Allen head screw again (on both sides of the safety bow, Fig. 3, arrow).
   ⇨ Safety bow is set.

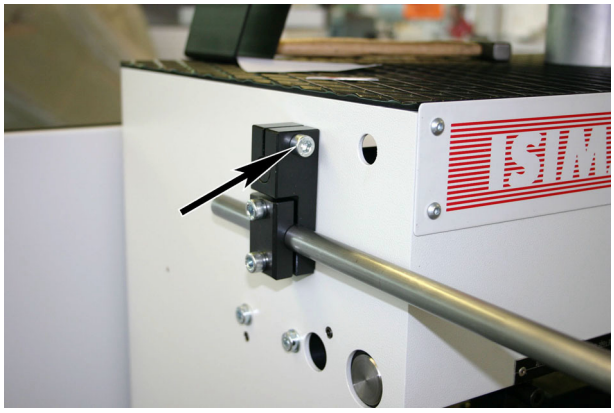

Fig. 3

7. Loosen the headless screw (inside machine framework, right side, Fig. 4).

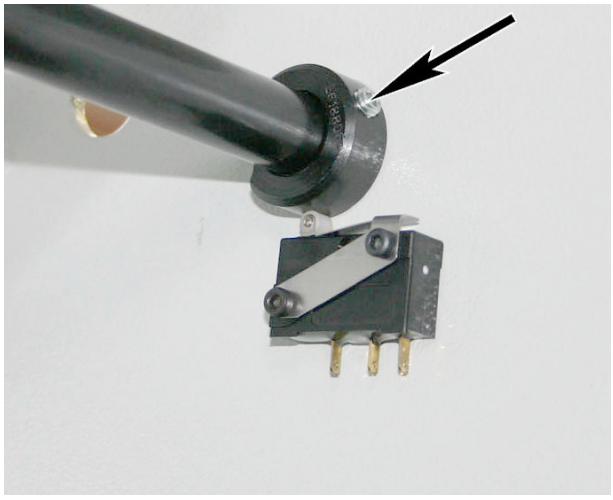

Fig. 4

8. Turn the metal ring until the end switch grips the notch in the metal ring (safety bow is closed, Fig. 5, arrow).
9. Tighten the headless screw
   ⇨ Safety bow is set.

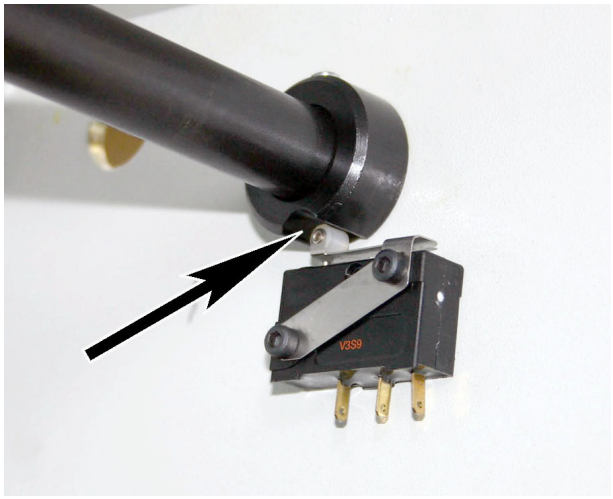

Fig. 5

7.5 Troubleshooting

☝ ***NOTE:***
PROCEED SYSTEMATICALLY WHEN PERFORMING TROUBLESHOOTING!

- Is the surface of the print article flat and even?
- Is the correct print article receptacle installed?
- Is the surface to be printed parallel to the squeegee?
- Is the squeegee pressure correct?
- Is the snap off distance correct over the entire print area?
- Is the stencil parallel to the print surface of the object?
- Has the stencil been properly produced?
- Are all limit switches correctly actuated?
- Is the print path correctly set?
- Are all clamps tightened?
- Are the switches in the operating panel correctly secured?
- Is the maintenance unit in order and is the operating pressure correct?
- Is the machine in the start position?
- Are the connections correct?
- Is the squeegee parallel above the object?
- Is the controller enabled (contactor)?
- Are the speed regulators open?

If you have additional questions, just give us a call; our technicians will be happy to assist you. We would also be glad to hear from you if you notice any discrepancies during normal operation.

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7.6 Problems with the screen stencil

Stencil cannot be washed out (developed)

- Stencil is over-exposed. Reduce exposure time.
- The stencil was dried too hot: Dry it at an even temperature which does not exceed 40° and avoid hot spots.
- The stencil has been stored too long or hot before exposure and/or development.
- The maximum storage capability of the sensitized emulsion or of the coated stencil was exceeded.

Stencil can only be partially washed out (developed)

- The stencil has been coated irregularly. Check, if the screen is loaded tightly and if the edge of the coating groove or squeegee is OK.
- Use the same film and the right exposure for the complete scheme area.
- The exposure time is too long for the fine details of the pattern: Use colored mesh or a shorter exposure time.
- Irregular or insufficient contact between positive and coated mesh: Inspect the copy frame (vacuum).

Apparently open stencil parts do not print

- Insufficient development (washing out): Dry surplus water on stencil using buckskin or paper.

Exposed stencil (coat) is washed away

- Exposure time too short: Colored and multifile mesh, stainless steel mesh and multiple coatings with direct emulsion require longer exposure times.
- Emulsion not sensitized sufficiently: Make sure that the sensitizer has been dissolved totally and mixed completely with the emulsion.

Stencil shows excessive sawtooth formation

- The stencil has been washed out with a too high water pressure. Immerse the screen before development and reduce water pressure.
- Scattered light or under-radiation: Use colored mesh.
- Irregular or insufficient contact during exposure: Ensure evenly good contact between positive and stencil.

Fish eyes

- The screen has been pre-treated insufficiently: Observe the notes of the manufacturer regarding mistakes during coating of the direct emulsion.
- Coat the screen in a room which is as dust-free as possible and dry it with warm air, so that the dust does not have enough time to settle.

Needle holes in the stencil

- Dirt from the glass or positive during exposure.
- Contamination of the coat: Inspect the coating groove for dirt before filling in the emulsion.

Premature breakdown of the stencil

- Insufficiently tensioned screen: Tension it again according to the recommendations of the mesh manufacturer.
- Underexposed stencil: Water in the ink or solvent.
- The mesh is pre-treated insufficiently and degreased.