

# Generation X



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## XS / X / XT models compared with ES / E / ED

This information is based on the previous training documents dealing with the cutting machine generations ES / E / ED. We will introduce the new facts step by step. Please understand that it is not possible to have everything complete from the very start.

### Installation and alignment

Since the new machine differs hardly from the previous line of models as far as the mechanical setup is concerned, the installation instructions of the E / ED machines remain very much the same and can be applied here as well.

The way how to transport the frame remains also unchanged, i.e. either with a crane by means of the lifting brackets in the frame, or by a fork lift which moves the forks under the pressure clamp or by placing rollers under the frame pillars.

**Attention !** There is a risk that the frame may overturn, especially on machines with Autotrim. It is recommendable to anchor the frame by pinning it to the ground. Anchoring is indispensable for machines which are equipped with lifts, or Autotrim and on interlinked systems, such as gripper loading systems, Transomat units and cutting systems. The necessary fastening elements for these systems are included in the delivery.

The cutting machine table still consists of one single part (except on Autotrim). It is suspended on the sides by means of eye bolts and carefully installed in the frame opening.

A machine spirit level helps to adjust and straighten it. Use machine cardboards as support plates to ensure a perfect stability and cutting accuracy.

**Warning !** The electrical connection must be carried out by a person skilled and authorized to do so! Please observe absolutely that the transformer must be adjusted to the mains on the installation site.

When adjusting the frame, the table surface in the cutting stick area and the front side of the knife bar should be taken as a reference.

The table can be best adjusted after the knife has been installed. There must be a certain angle between the rear of the knife which has been wound downwards, and the table surface. This angle is measured with a hairline square. An air gap of min. 0.05 mm in the upper part of the knife rear is ideal. Please observe! Always make this measurement without the cutting stick installed!

You should also measure and adjust the table diagonally to make sure that it is not twisted.

After that, install the side gauges. Check if the gauges are perfectly aligned. Measure their positions to the table surface with a hairline square and their alignment in longitudinal direction using a gauge. Please notice that these side gauges may be distorted due to inexperienced handling.

The basic cutting settings on the machine are performed in the following steps.

1. Angular cut to the right-hand side gauge, to verify if the table and the knife are positioned at right angles and readjust them, if necessary.
2. Parallel cut: Turn upper part of the cutting result to verify if backgauge and knife are in parallel position and readjust them, if necessary.
3. Overcut and undercut, to check the correct position of the backgauge with regard to the knife and readjust it, if necessary.

It is absolutely important to make the basic cutting settings with the type of paper which your customer processes most frequently. An absolutely sharp-edged knife is of particular importance.

Make sure to carry out a knife change with the operator. **Attention !** The safety regulations must be observed absolutely!

To ensure a trouble free operation of the machine, instruct the staff in the operation.

Once the basic cutting settings have been made, check the items on the check list, and have the customer confirm the acceptance of the machine by his/her signature.

One copy, each, of this check list is meant for the agency and for Polar.

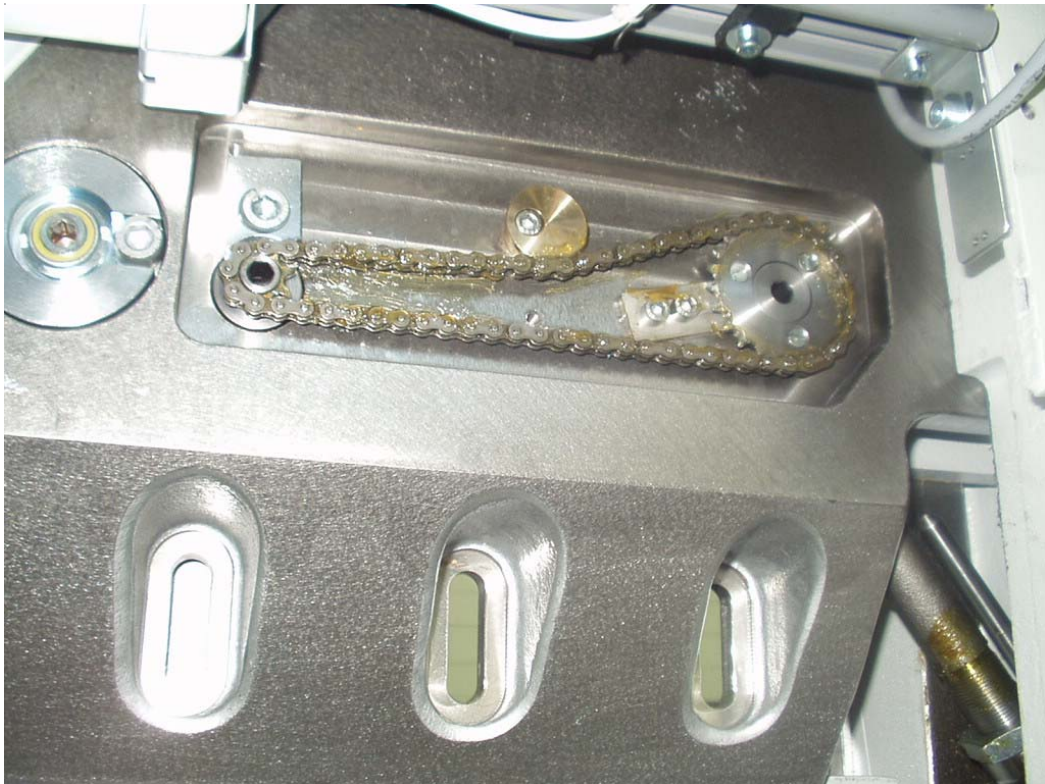
**Please note!** For any warranty decisions, the confirmed installation date is the decisive one.

Before the machine is handed over, carry out a safety functions test.

## Mechanical and Hydraulic Systems

Up to now, there are hardly any major differences in the mechanical setup of the machine compared with the present ES / E / ED models. Only the knife lift is still used for all of the machines. So there is no difference between the 78 and 92 machines on one hand, and the 115 to 176 machines on the other hand, as far as the knife change is concerned.

Ideally, in the future all of the machines will be provided with a knife change with eccentric adjustment from the front. In this case a less complicated connecting rod would do; i. e. a clasp nut is not needed any longer, just the safety bolt in the con-rod.



The conventional knife change with con-rod adjustment will still be available as an optional equipment. The eccentric adjustment has been redesigned and, with a chain drive, can now be adjusted much more precisely.

## The Hydraulic System

The hydraulic system used in the new machine generation is still the same as the hydraulic systems of the S / E / ED generations. (Hydraulic system 91 with 25-V d. c. valves)

P1: The clamping pressure is still adjusted with the hand wheel beneath the main switch. On 78 machines, this is done with the slide rod, on all of the other machines with a Bowden cable.

Only for the options „programmable clamping stages“ or „automatic clamping pressure regulation“ are the clamping pressures controlled by a proportional valve.

P2: All of the settings for the clutch pressures on machines 92 to 176 are taken over from the E / ED models.

### There are considerable modifications to the electrical control

The sheet-metal housing which contains the control unit has been redesigned. The left part houses the power module. The control unit is in the center of the housing, while the control units for the motors are located in the right-hand part of the housing: The star-delta contactor combination, the frequency converter for the backgauge drive and the electronic reversing contactors for the Autotrim table motor as well as the motors of the swivel and tilting backgauges.

On the machines of the 78 and 92 lines, the contactor K1M or the soft starter are also housed in the left part of the sheet-metal housing, next to the Power Module.

The cooling fans already known to you are also located beneath the CU to cool the computer.

A new fresh-air blower is installed on the side of the housing and ensures that filtered fresh air cools the control unit in the sheet-metal housing which is closed in accordance with IP54. The filters can be easily taken out when they need to be cleaned or must be replaced. If the room where the control unit is located warms up beyond a certain temperature, the display will indicate the message „clean the filter in the cooling system“.

The main connection for the machines is now located in the rear left part of the sheet metal housing.

The main motors are switched in the same way as the latest generation.

Once the main switch has been turned on, the main motor 78 is switched on by actuation of the twin key S292 via contactor K1M. The contactor is sealing home.  
(see circuit diagrams 424746; 424747; 424762)

On 92, the soft starter is used for switching the main motor (see circuit diagram 424820) and on machines 115 to 176 we use the automatic star-delta contactor combination (see circuit diagram 424745). In these machines, the main motors are also started and/or switched off with the twin key S292.

Main switch  
Main switch

On the 78 XS machines, the main switch connects the power supply units and the voltage supply for the frequency converter, the optical cutting-line indicator and the front-table lamp via the mains filter (Z1).

On the 92 to 176 machines, the main switch turns on the transformer directly via the mains filter (PM.Z1).

## Main drive unit 78

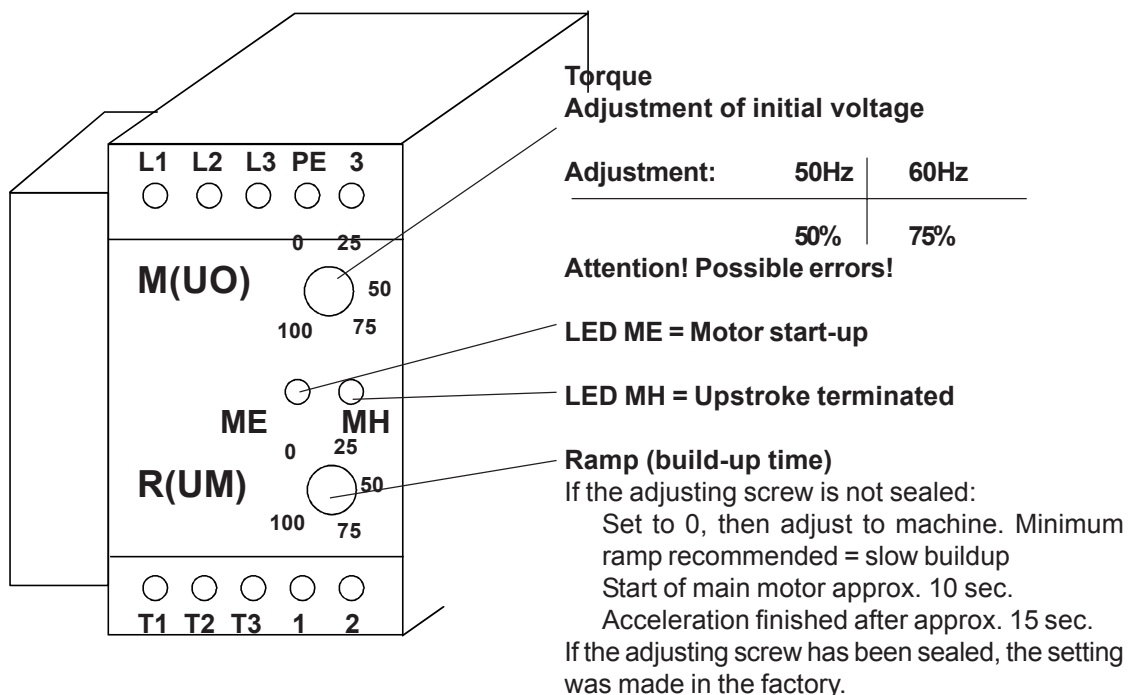
The +24-V voltage supplied by the power supply unit (.....) turns on the K1M contactor via the thermal insulation contact M3/WSK and the ON/OFF switch S292. The K1M contactor is sealed via contact 13/14. The K1M contactor also connects the main motor. If required, Q3 can be employed to disconnect the K1M contactor in order to protect the main motor.

## Main drive unit 92

The voltage of +24 V stabilized on the AC-IN board can be used for turning the soft starter on. The startup system is composed of the thermal insulation contact M3/WSK and the ON/OFF switch S292.

## Soft starter

The soft starter is switched on via relay K305. Depending on the preadjustment of the potentiometer M(UO), the main motor is supplied with power and slowly starting up. As soon as the main motor has reached its standard speed (nominal speed) the soft starter can be switched off. First of all the startup time is adjusted by means of the potentiometer R(UM) according to the presetting. During machine startup, the main motor is supplied with a reduced power for this period (startup time). As soon as the startup period is terminated relay K0 is switched on. It bypasses the soft starter switching it off in this way.



## Main drive 115 to 176 with star-delta connection

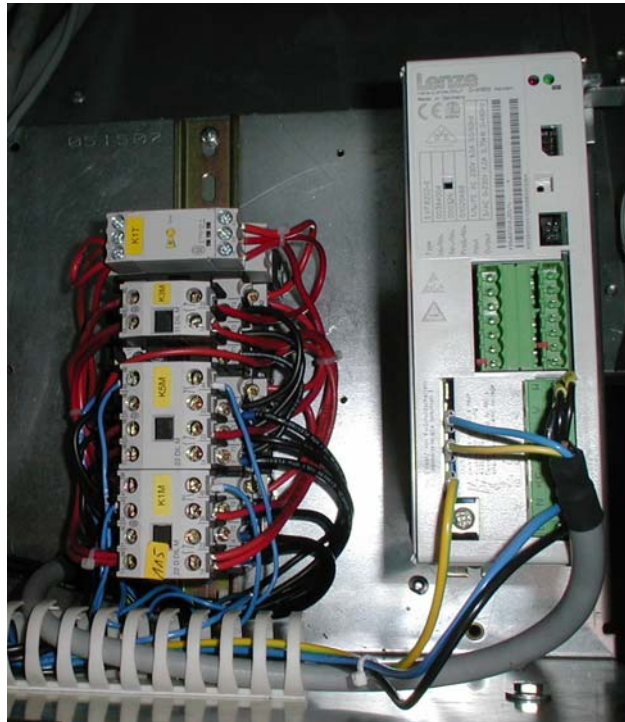
The machine series 115 ... 176 are fitted with a main switch and are turned on via the automatic star-delta starter already known.

To allow a correct functioning of the star-delta-connection the following conditions must be met.

1. Mains voltage available
2. Main switch is switched on.
3. SDS.F2 is switched on
4. Fuses SDS.FL1 and SDS.FL3 are okay
5. M3/WSK is not triggered

Once the key S292 - NO 13/14 has been pressed (star, delta connection and control voltage „ON“) time-delay relay K1T is energized via K1M - NC 35/36.

Contact K3M is switched on via normally open contact K1T – NO 17/18 which is now closed, as well as contact - K5M NC 21/22. The star-type connection is prepared now. Via contact K3M - NO 14/13, contactor K1M is energized. K1M and K1T are self-maintaining via the closed contacts K1M - NO 13/14 and 47/48. The main motor starts running in star-type connection.



Once the time of relay K1T has expired, its contact K1T – NO 17/18 is opened. Contactor K3M drops out. The star-type connection is switched off.

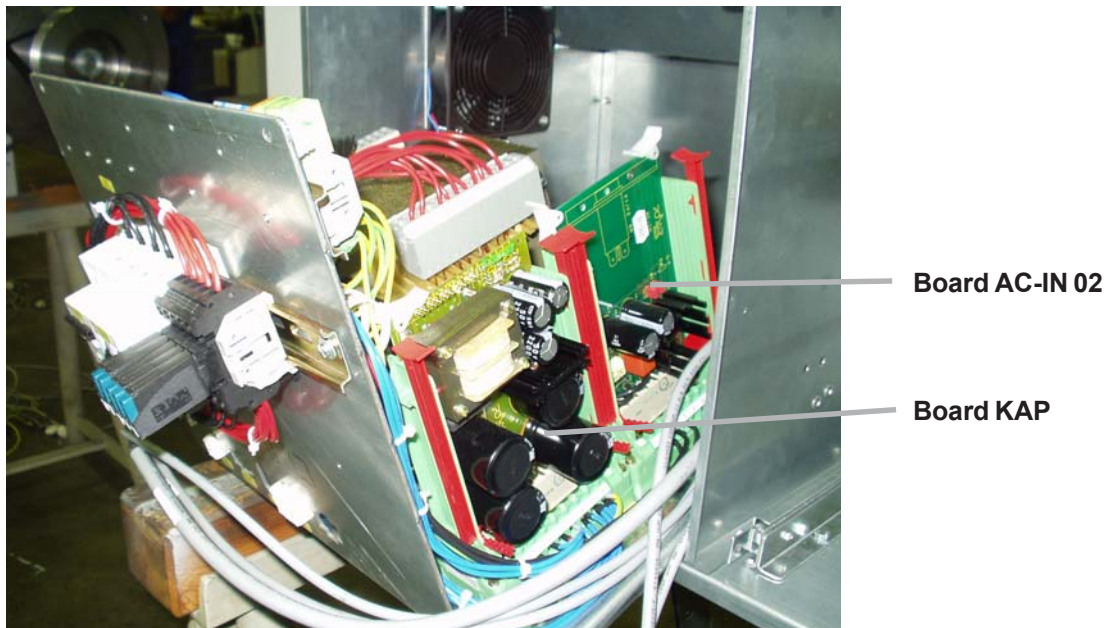
After that contact K1T – NO 17/28 is connected with a time delay. Via contact K3M - NO 21/22, contactor K5M is energized. The main motor is turned over to delta-type connection.

Another contact of K5M signals to the machine control system that the start-up of the main motor is terminated.

When the star-delta connection is switched off via key S292 - NC 21/22 the power supply and, consequently, the sealing home of K1M and K5M are switched off. The main motor is switched off.

An auxiliary contact of K5M (43-44) signals to the computer, that the startup of the main motor has been terminated.

## The Power Module



There are two racks available for the **AC-IN 02** and **KAP** boards.

The AC-IN 02 (X1) board has been modified. It now includes the power supply for the soft starter of the main motor on types 92. The primary supply of the transformer is also provided via this board.

The plug-in cards AC (X2) and DC (X3) are no longer used.

The rectifiers are fastened to the metal guarding, near the transformer, which serves also as a cooling plate

The KAP (X4) board is the same type as on the E / ED machines. It serves also as a supplementary power input in the knife upstroke control.

All the fuses (automatic circuit breakers) and overload switches are arranged on the front side of the metal sheeting, which makes them easily accessible.

The control transformer, protected by the double automatic circuit breaker F1, is supplied with phases T1 and T3. In primary circuit, this transformer must be adapted to the power input on site. Although this is taken into account when producing the machines, it must be checked in any case!

We take a voltage of 230 Va.c. from the primary circuit of the transformer, protected by the double automatic circuit breaker F2. This voltage is required for the frequency converter and the lighting of front table and optical cutting-line indicator.

The first secondary voltage of 24Va.c., protected by F3, is supplied to board AC-IN 02, then it is rectified and stabilized to 24Vd.c.

On the 78 machines, this voltage is necessary to switch the K1M motor contactor.

On the 92 machines, this voltage is required to operate the soft starter.

On the machines 115 to 176 only the voltage of 24Va.c. is required to feed the star-delta contactors.

The second secondary voltage of 19 Va.c., protected by F5 is rectified, smoothed and serves as a supply voltage for the assembly composed of control panel and keyboard computer (BFR).

The third secondary voltage of 20 Va.c., protected by F8, is rectified, smoothed and serves to control the solenoids, valves, relays and brakes (**25Vd.c. actuator voltage**).

The fourth secondary voltage of 23 Va.c., protected by F4, is rectified on the KAP board and stabilized to 24Vd.c.. At the same time, approx. 8Vd.c. are generated, too from the 23 Va.c. These voltages are required as a second input for the knife upstroke control.

The fifth secondary voltage of 35 Va.c., protected by F7, is rectified, smoothed and it supplies the PS10 board. (refer to the chapter „PS10“)

The voltages described above are smoothed by the capacitors on the KAP board, where they are indicated by green light-emitting diodes. Besides, these voltages can also be measured at the assigned test pins.

**Warning, Risk of Short Circuit!**

The sixth secondary voltage of 21 Va.c., protected by F6, is rectified, smoothed and serves to control the motors for the Fixomat and the hold-down clamp in front of the backgauge. This secondary winding is only present in machines 115 to 176 (see chapter on DNF)

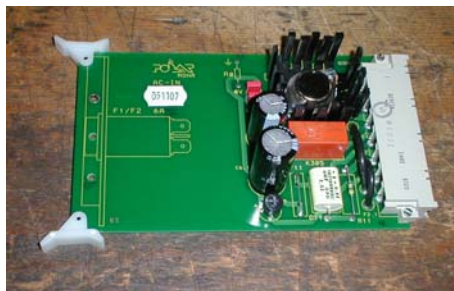
The star-delta contactors and the frequency converter are accommodated in the right-hand compartment of the sheet metal housing of the machines 115 to 176. The frequency converter is meant to operate the backgauge motor. This compartment contains also the electronic contactors for the motors of the swivel backgauge, tilting backgauge and Autotrim.

On the 78 and 92 machines, the frequency converter and the soft starter are arranged next to the transformer in the left-hand section of the sheet-metal housing.

We will change the cabling within the table in such a way that all the sensors and limit switches will be conducted via one junction box (only on 115 ... 176). A cable with a Sub-D plug will connect the junction box with the CU motherboard. The supply voltages for the individual switches and sensors are conducted to the junction box only once. except for the paper sensors for the optional automatic clamping pressure regulation (PDR)

The cabling and air hoses to the backgauge are conducted in single channels within a power chain.

### Board AC-IN02



The AC-IN 02 board is equipped with the required components for a +24-V voltage stabilization necessary for the control of the soft starter in 92 machines.

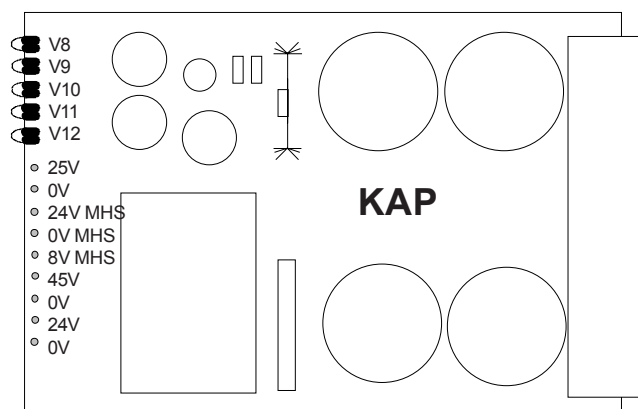
## Board KAP



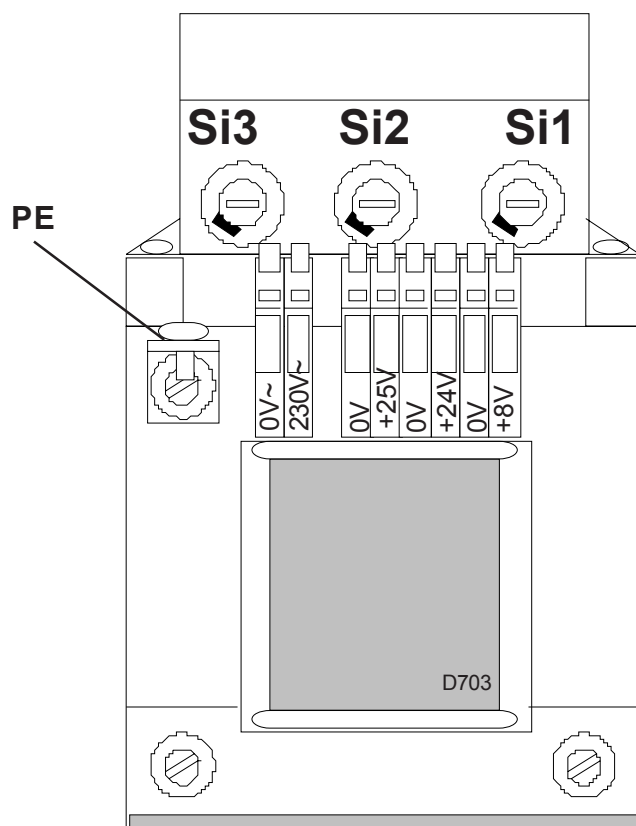
Power module board KAP (X4) includes the transformer, rectification and stabilization 24Vd.c. / 8Vd.c. for the knife upstroke control, various capacitors as well as LEDs for the power check.

The LEDs located on power module board KAP indicate the following supply voltages:

LED	Voltage	Fuse	Application	Measuring point (possibility)
V8	24Vd.c.	F5 (4A)	Supply BT	X415.2 - X415.1
V9	45Vd.c.	F10 (8A)	Supply PS10	X416.3 - X416.2
V10	24Vd.c.	F4 (1.5A)	Supply for MHS	X416.12 - X416.11
V11	8Vd.c.	F4 (1.5A)	Supply for MHS (SAP)	X416.10 - X416.11
V12	25Vd.c.	F8 (10 / 16A)	Supply for solenoid valves	X416.7 - X416.5
	24Vd.c.	F6 (2A)	Supply Fixomat	X402.1 - X402.2
	230Va.c.	F2 (6A)	Supply for frequ.conv. (FU)	XA 230V - XA 0V
		F2 (6A)	and illumination	X411.2 - X411.3



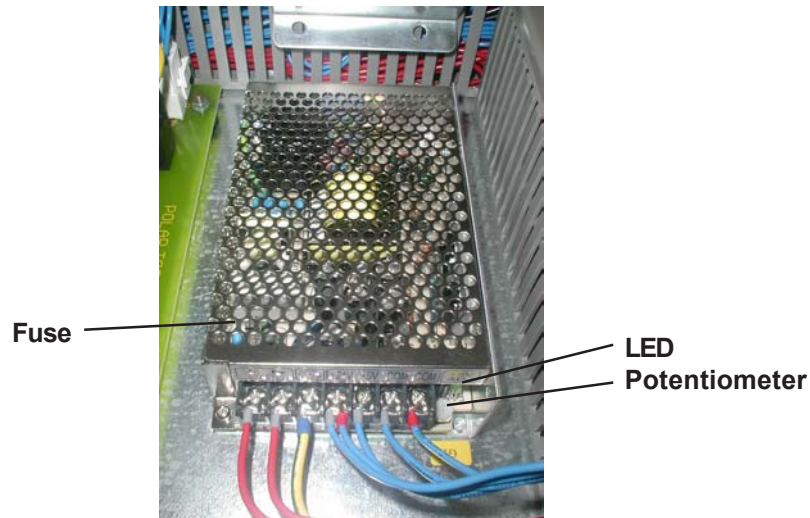
### Power Module 78 XS



The machines of the 78 XS series are equipped with two different types of voltage supply. In the 190 - 240V mains, the TR1 transformer is supplied with two phases in primary circuit (L1 + L3). On mains of 380 - 440 volts, the machines of this series are fitted with a transformer that supplies the 230Va.c. for the TR1 transformer, the power supply units G1 and G2, the lighting and the frequency converter. The TR1 transformer is furnished with three secondary windings with integrated rectifiers for the following voltages:

8V d.c.	(Si1 1AT)
25V d.c.	(Si2 5AT)
24V d.c.	(Si3 1AT)

## Power Supply Units



The power supply units employed in the cutting machines are basically furnished with the same protection functions.

The power supply unit has a fuse which can be checked in case of a malfunction and replaced, if necessary. Another feature identical with all power supply units is the shut-off if the power supply to the power supply unit is not correct. The power supply must be within the tolerance range indicated on the label of the power supply unit.

Besides, the power supply units are provided with a short-circuit protection through a thermal contact. If there is a short circuit at any of the outputs, the thermal contact switches the power supply unit off. This is indicated by a very dim lighting of the green LED. When the thermal contact has cooled down after some minutes, the power supply unit is again ready for operation. The LED is lit in the usual way.

The G1 power supply unit supplies the + 5V d.c. and + 12V d.c. voltages. The +5 voltage can be set at the potentiometer.

Permissible variation 5.08 to 5.12 V d.c.

The G2 power supply unit supplies the +24V d.c. voltage. On this power supply unit the +24 voltage can be set at the potentiometer.

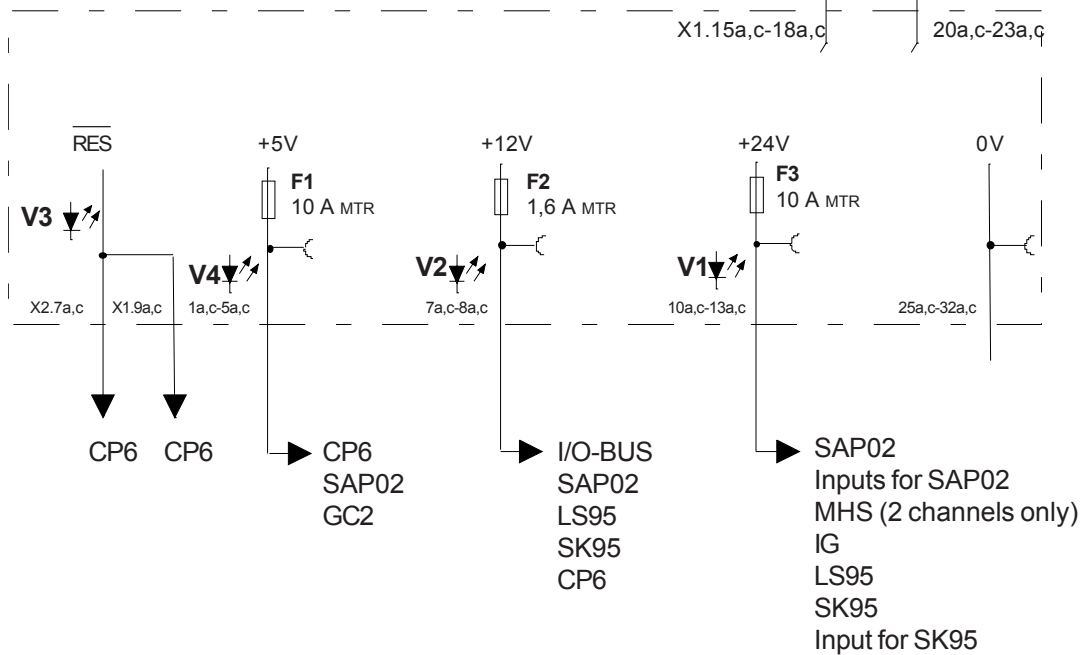
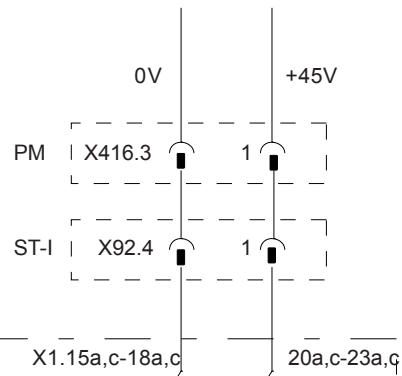
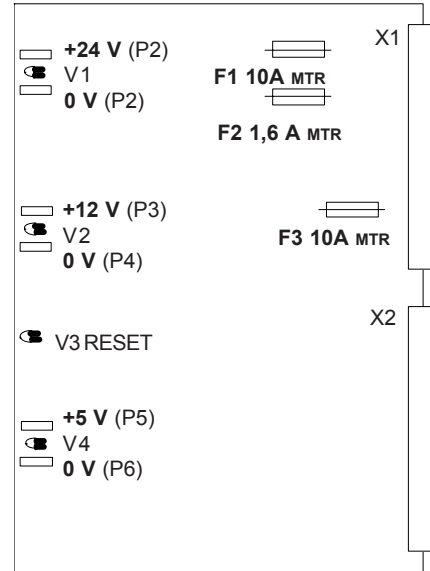
Permissible variation 23.7 to 24.3 V d.c.

### Board PS10

We start with the right-hand plug-in board: PS10 (Power Supply). On this board, the +5V, +12V and +24V voltages are stabilized and the reset signal for the CP6 board is generated. This board is designed for a higher output. Retroactive installation in E/ED machines will be possible. (see E / ED).

Fuse		Voltage
F1	10 amp	+5V
F2	1.6 amps	+12V
F3	10 amps	+24V

The supply of + 5V (precisely 5.08V to 5.12V) is required to operate the computer and the integrated components as well as the uP bus (micro processor bus), except for the boards SK95 and LS95. A supply of +12V is necessary for the I/O bus and the cutting circuit operation (SK95 and LS95). All of the sensors (limit switches, proximity switches, reed contacts, micro switches, ...) are supplied with +24 V. Consequently, the voltage of stabilized +24 V is the **sensor voltage**



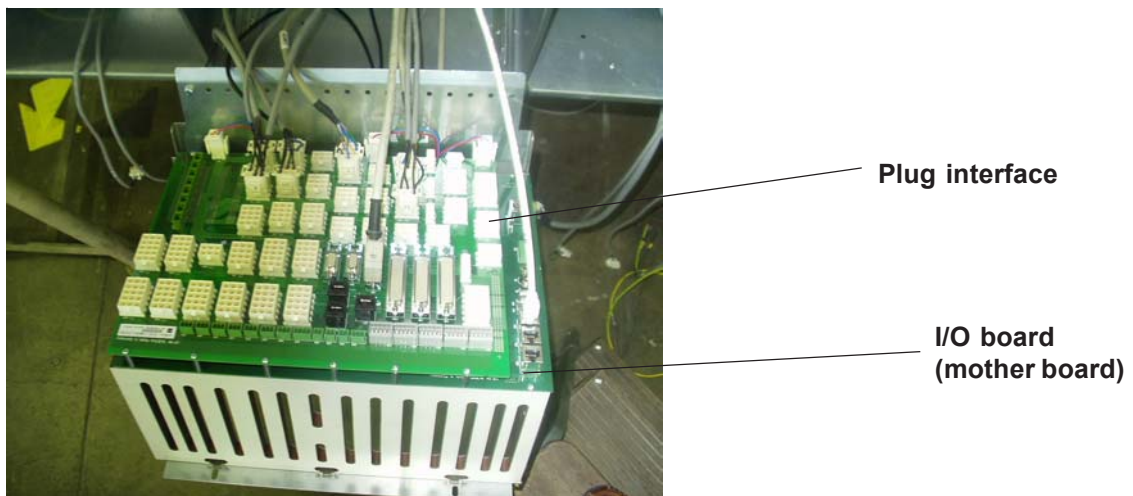
### CU control unit

The CU control unit is arranged in the center of the sheet-metal housing. It has a total of 13 card slots. There are sufficient card slots to ensure that future developments are possible. On the left side, a 96-pin plug connector is installed which can be used for extending the I/O bus, if any further I/O boards will be required, similar to the expansion unit in the ED machines.

The CU is composed of two single p.c. boards. The plug interface holds another board which is meant to accommodate plug-in cards or to serve as an I/O bus connection and microprocessor bus connection which can be extended, as mentioned above.

The five unassigned slots are meant as spare connections for future expansions, e. g. when the control system is interlinked.

Two views of the CU module, rear side and front side with card placement



I/O-P      SAP02      SK95      CP6      GC2      PS10

## The CP6 Board

The CP6 board has been redesigned and changed to SMD technology. The use of higher-scale integrated flash PROMs and RAM has made this board much faster and more versatile, providing it with a significantly higher storage capacity.

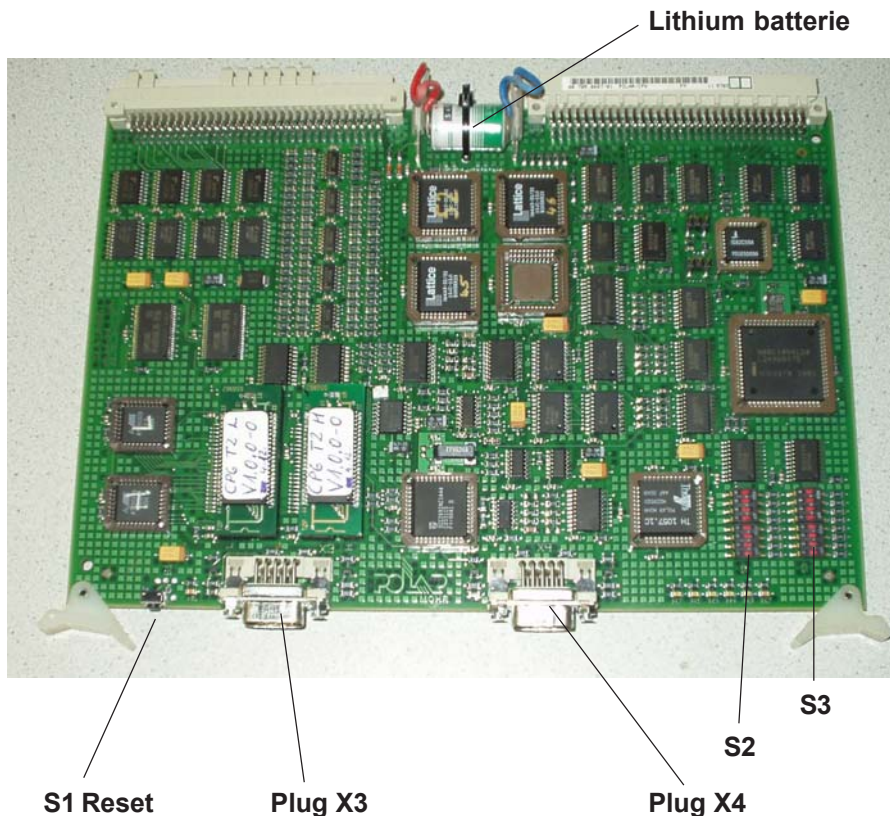
A 3.6-V d. c. lithium battery backs up the data stored in the RAMs (cutting programs and variable machine data) when the machine is switched off. Polar guarantees a minimum hold time of 5 years.

The board is linked via the I/O bus with the SK95, SAP02, I/O-P function boards and the I/O. The microprocessor bus connects the CP board with the GC2 board.

As we know from the previous CP boards, the front side holds the X3 plug which forms the serial interface to the BFR X/XT keyboard computer, and the X4 plug, which is user definable.

The touch screen operation is enabled by the serial interface of plug X4, therefore no additional computer is required.

View of CP6



The light-emitting diodes on the front side of this board indicate the following functions:

- V6 (H6) = computer is active
- V1 (H1) = reference point
- V2...5 (H2...5) = various statuses in the data transfer
- V7 (H7) = .....

On the front side of the CP board there is an S1 reset key and two DIP switches S2 and S3. The preselection functions serve to inform the computer, in the case of a battery failure, about the type and equipment of the machine.

The meanings of the DIP switches have changed as follows:

Type/Function	SW 2.1	SW 2.2	SW 2.3	SW 2.4	SW 2.5	SW 2.6	SW 2.7	SW 2.8
<b>XS</b>	ON							
X / XT		ON						
<b>Touch screen</b>			ON					
Service-information				ON OFF				
Cut optimization					ON OFF			
Pogrammable clamp pressure						ON OFF		
automatic clamp pressure							ON OFF	
Knife change "con-rod"								ON
Knife change "eccentric adjustm."								OFF

Type/Function	SW 3.1	SW 3.2	SW 3.3	SW 3.4	SW 3.5	SW 3.6	SW 3.7	SW 3.8
Swivel Backgauge	ON							
Tilting Backgauge		ON						
VL left side			ON					
VL right side				ON				
down-holder in front of knife					ON			
Autotrim						ON		
down-holder in front of rakes							OFF	
DBR-board plugged in								OFF

The language preselection is no longer defined via DIP switches. When the lithium battery suffers a failure, the information displayed after the machine is reconnected will be in English.

Various jumpers on the CP6 board which have not been used by now are intended for certain application functions.

The CP6 board includes also the two memories for the cutting programs, i. e. 2 x 99 programs.

The cutting programs will no longer be copied by means of a PMS card, but by networking with the Compu-cut system.

A still unassigned base for an ASIC component allows to extend the polling to even more axes (positions). The new CP6 board is now equipped to download programs via a personal computer. The software and language downloads are secured by the use of boot flash PROMs. This means if there is a malfunction or power failure while the system is downloading programs, the machine can be restarted at any time. A download will be made possible via the serial interface plug X4 on the CP6 board. In the case that this interface is already assigned to the touch computer, remove the plug, connect the download PC and restart the machine. It will be recognized that there is no touch computer connected and the corresponding message will be displayed on the screen. A miniature boot is carried out which permits the download. Once the download has been finished, switch the machine off. Reconnect the touch computer and turn the machine on.

**Please note!** In the downloading mode, no other machine functions are permitted. We intend to employ this board also retroactively for S / E / ED machines. In this case, the corresponding flash PROMs and RAMs need to be used. The functions of the DIP switches are the same as on the E / ED machines.

**Attention ! An incorrect pre-adjustment of functions which does not match the type of machine will cause malfunctions and may only be used for service purposes, i.e. for checking individual limited sub functions of the machine.**

## SK95 / LS95 / MHS

The **SK** board and the 20-channel **LS** can be taken over without change from the E/ED. At the red measuring position on the SK95 board, you can measure the non-stabilized 25-V d.c. actuator voltage.

The light barrier, which is composed of a transmitter and receiver, is an independent circuit. For test purposes it can be operated without any other board (except for PS10).

The **MHS** knife upstroke control is also unchanged. But it is not interchangeable because the X25 plug has been modified.

Although **SKÜ 2** is still the same as on the E / ED machines, as far as the switching is concerned, its output power has been increased. New: The inputs to SKÜ 2 are still connected via plug 52. The outputs to the valves and the magnetic clutch in the 78 machine are connected from the p.c. board SKÜ 2 directly to plug 6. They are no longer connected via the CU motherboard, a fact which reduces the loss of potential. We intend to use this arrangement also retroactively in the S / E / ED machines.

The SK95 bus and the remaining boards on the left-hand side of the CP board are controlled by the microprocessor bus of the computer.

Consequently, the input information contained in the individual boards is transmitted to the computer via this bus. And it is also this bus through which the computer issues the information corresponding to the software as output commands to the individual function boards.

### Cutting Circuit (SK 95)



LED's for outputs      LED's for inputs      measurement point +25V=

Troublefree operation of the cutting cycle is ensured by the cutting circuit board. The hardware logic of this board together with the software of central processor CP generates the energizing of hydraulic valves and safety lever (SB) during pressing and cutting. Board SK95 is internally divided into three parts. One part contains the control logic for the cutting circuit as a pure hardware control system. A second part is constantly linked with board CPxx and constantly enables board CPxx in this way to prevent or abort a cut (or the clamping process). The third part compares the work performed by the above mentioned parts. If these two parts show any discrepancy, no new cut (clamping) will be admitted, or the active cut (clamping) will be aborted.

Board SK 95 is not compatible with board SK used in previous monitor machines!

The control states are indicated by the following LEDs on the front side of board SK 95:

LED	Colour	Meaning	Basic condition
V83	red	Safety lever (YSB)	off
V84	„	Cycle f. cutting circ. transformer - press.-Y27, Y27a	off
V85	„	Light barrier test terminated positively	off
V86	„	Cut buttons actuated correctly (within 0.5 sec.)	off
V87	„	Control signal for safety lever (nom. condit.)	off
V88	„	Logic error in cutting circuit (reset)	off
V89	„	Cycle f. cutting circ. transf. -cutting- (Y33, Y33a)	off
V71	yellow	Safety lever in blocking position (B SB e)	on
V72	„	Safety lever unblocked (B SB a)	off
V73	„	NC contact right-hand cut button	on
V74	„	NC contact left-hand cut button	on
V75	„	NO contact right-hand cut button	off
V76	„	NO contact left-hand cut button	off
V77	„	Knife upstroke (UTH = lower dead center upstroke) from SAP	off
V78	„	Knife descending (UTH neg.) from SAP	on
V79	„	Clamp at upper position (B29)	on
V80	„	spare	off
V81	„	Pedal switch (S309)	off
V82	„	„Table air“ key „ON“	off

### SK

- V83
- V84
- V85
- V86
- V87
- V88
- V89

- V71
- V72
- V73
- V74
- V75
- V76
- V77
- V78
- V79
- V80
- V81
- V82

### +25V



At the measuring socket at the lower edge of the SK 95 board the non stabilized voltage of +25 Vd.c. (approx. +25V - +28V d.c.) can be measured.

## Light Barrier (LS 95)



The light barrier consisting of a transmitting and a receiving unit has a new design and is accommodated in a new type of housing. The two p.c. boards form one spare part, each, which means that no replacement of individual transmitters or receivers is possible.

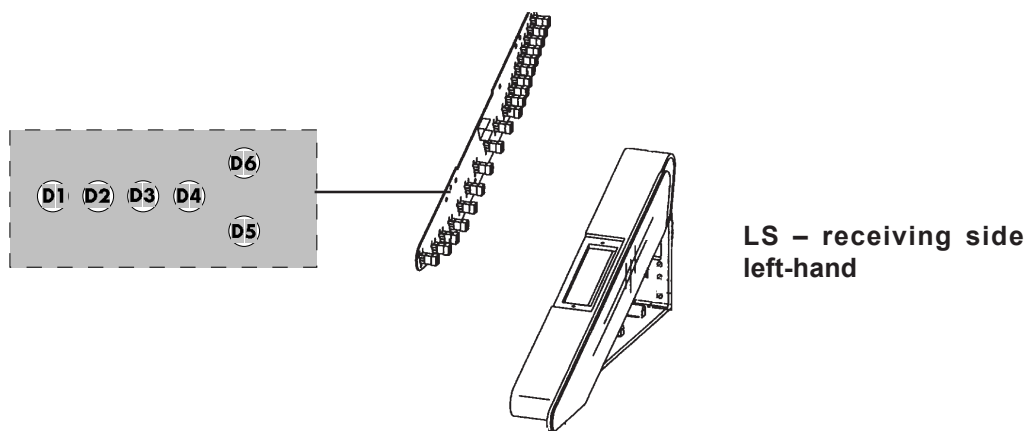
When installing the light barriers care must be taken that the two light barrier (LS) housings are aligned and fastened onto the adapter plates of the front side at right angles to the front table. Calibration can be made by means of the indicator panel located in the left-hand LS housing.

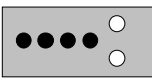
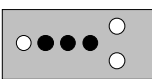
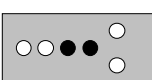
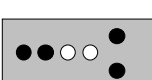


The light barrier is supplied with 24 Vd.c. on the transmitter side and 24 Vd.c. as well as 12 Vd.c. on the receiver side. The LS 95 is an independent unit. The two exclusive OR outputs „LS high“ and „LS low“ are linked with board SK 95 via plugs 600.8 and 600.9. When the cut is released the cutting cycle generates test signal LST1 and board SAP generates one more test signal, LST2 as soon as the knife has reached the lower dead center or the cut or pressing process has been interrupted.

In order to ensure troublefree functioning of this safety device, two different test sequences have been integrated into the control system.

Situation	LS-Test1	LS-Test2
before every cut	active	
every time the machine is switched on		active
every time the LS95 was interrupted		active
when LS Test 2 is requested		active

Meaning of light emitting diodes of the display panel



	D1	D2	D3	D4	D5	D6	Meaning
	on	on	on	on	off	off	Protect. area „unobstructed“, light reception excellent
	off	on	on	on	off	off	Protect. area „unobstructed“, light reception good
	off	off	on	on	off	off	Protect. area „unobstructed“, light reception just sufficient
	on	on	off	off	on	on	Protect. area obstructed or test being performed If test is not carried out clear LS95
	off	off	off	off	on	on	Protect. area was never „unobstructed“ since „Voltage ON“. Clear LS95
	flashing	flashing	off	off	on	on	Malfunction detected by internal control of LS95. Check voltage supply, replace receiver and/or transmitter

When the two D1 and D2 LEDs flash eight times, the operator should verify the initialization of the second light-barrier test with the knife in its BDC.

## Cut buttons

The cut buttons are the only components of the machine you can start the cutting cycle with. Every cut button has two contacts. One normally closed contact (cut button not actuated) and one normally open contact which is usually open. the machine control system monitors both contacts. Before any cut is permitted, the basic conditions must be met. When the cut buttons are pressed, the input signals of both cut buttons must be supplied to the board SK95 as inverted signals. If these conditions are not met, the system will output error messages.



## Electromagnetic clutch

As against the hydraulic clutches used with machines 92 to 176, the clutches employed with the 78 machines have an electromagnetic control.

When you have to perform any work a this electrical clutch, consider that there will probably be no further inspections of this assembly for years, and to proceed in total awareness of the importance of safety. Only a properly performed work allows the machine to function correctly, especially when taking into account that the cutting performance of the high-speed cutters is expected to increase.

Let's have a look at some major subjects:

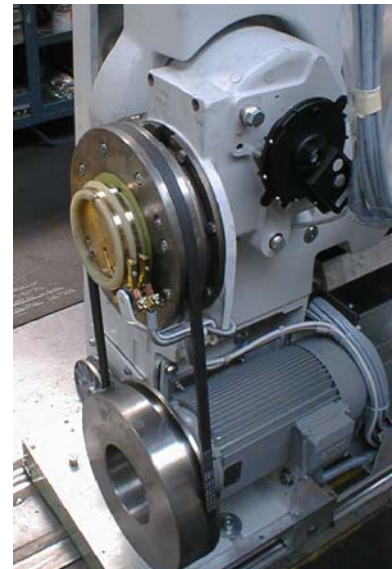
1. Correct positioning of all carbon brushes. The carbon brushes must run on the center of the collector rings with a sufficient pressure. If the carbon brushes have no proper contact, this may cause malfunctions difficult to diagnose.
2. The air core must not be smaller than 0.1 mm. Based on the machine application after the current inspection of the air core, the latter must be between 0.2 mm and 0.3 mm but not greater than 0.3mm. If the air core is not sufficient, the clutch linings must be supported by the official foil or replaced. The overall lining thickness is
 

new	13 mm
min.	12 mm

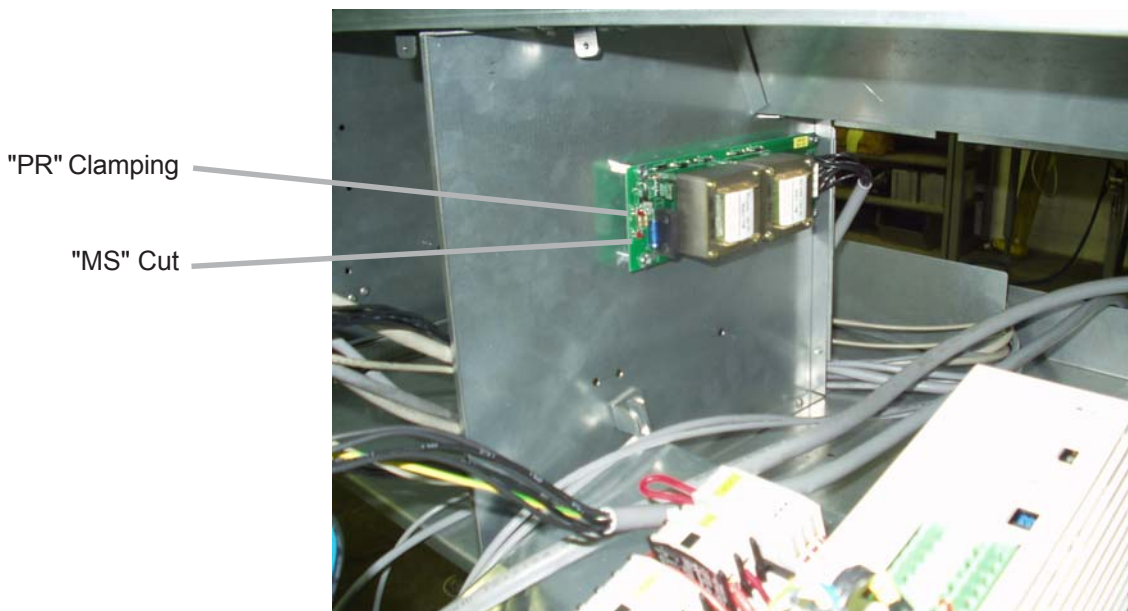
The air core is quite simple to be checked. Switch the machine off and secure it. Paying regard to the safety instructions, the clutch handles must be firmly screwed into the brake disk through the drive wheel. In this way, the brake disk is pulled towards the drive wheel. When the brake disk is close to the driving wheel, the brake air gap can be measured.

A thickness gauge is pushed between the clutch linings into the gap between coil former and brake disk.

3. Tight fit of clutch and brake linings



## Cutting circuit transformer (SKÜ 02)



The three respective outputs of board SK95 for clamping and cutting are converted by the cutting circuit transformers (push-pull converters) into a control voltage of approx. 24 V for the hydraulic solenoids Y27 and Y27a for clamping as well as Y33 and Y33a for the clutch, or only Y33 on the model-78 machines. Board SKÜ has two light-emitting diodes „PR“ and „MS“. These LED indicate if the outputs of board SK95 are switched correctly. In this way, the service technician can be sure that all the conditions for cutting are really met.

Example:

When a usual cut is made, board SK95 will first of all activate the solenoid valves for clamping. When LED „PR“ on board SKÜ is lit, you can be certain that the following functions have been carried out successfully.

1. preliminary tests before cutting
2. simultaneity test
3. light barrier test

The solenoid valves Y27 and Y27a are activated. Once the clamp has been lowered, the cutting circuit transformer for the cutting procedure is activated from board SK95. When LED „MS“ on board SKÜ becomes active, the following functions have been carried out successfully in addition to those mentioned above.

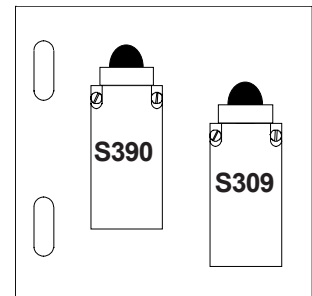
4. B29 enabled
5. Activation SB correct

So by means of the two LED, the service technician can make a clear separation on board SKÜ between the function of a cut up to the board SK and behind it.

## Pedal switch

The pedal switches are generally underrated. Both switches S309 and S390 must be adjusted correctly to ensure a proper functioning of the cutting machine. A proper condition of the switching cams is of the same importance. Regarding the function of switch S309 you have not only the general functions to deal with but also need to consider safety aspects. Any existing national safety regulations must be observed absolutely.

When the pedal is actuated, two switches are enabled. The following functions can be performed according to the operator's wishes:



Switch	Function
S309	Energizing of Y315 to lower the clamp by means of safety clamping pressure.
S390	Function modification of backgauge start after a cut.

Adjust the pedal limit switches in such a way that

1. both limit switches are pressed when the pedal is not actuated. (Indication in I/O picture under „Service“: both OFF)
2. S390 releases first, then S309
3. in case of a cutting interruption and actuation of the pedal (S309) the clamp will not move upward.

If one or both switches or the corresponding switching cams are badly adjusted or the switching cams are not in a proper state, the following malfunctions may be caused:

Switch	Malfunctions
S309	Clamp moves up in case of a cutting interruption Clamp moves up when the function „clamping without cut“ is interrupted Clamp moves up instead of down, when pedal is actuated after a cutting interruption.
S390	Backgauge starts too late after the cut, and produces a delay of the production



View of pedal switches from the rear



Front view of pedal switches

## Adjustment of Foot Pedal Switches

The correct function of both S309 and S390 is imperative for safe operation of the clamp locking function.

When the pedal is in its upper most position both switches must be activated correctly. This means the micro switch plungers must be sufficiently depressed but not beyond their mechanical stop. To confirm both switches signals use the input output check in the service menu.

Check that when the pedal is fully operated both switches are released.

Once the above conditions have been established the switching sequence and the P1 control cam can be adjusted.

1. The pedal is actuated very slowly.
2. After a small amount of travel the switch S390 is the first released. These signals can be checked in the Service I/O display.
3. Continuing with the slow downward movement of the pedal, the „Slide Valve“ for P1 circuit is actuated. This enables the safety pressure to build up behind conical valve Y315.
4. Further downward movement releases the switch S309, and opens the Conical valve Y315 to allow the oil to flow into the Cylinder. The delay between the actuation of the slide valve and S309 releasing must be sufficient for the safety clamping pressure to have reached its maximum (as controlled by safety pressure safety relief valve).

To check the sequence is correct carry out the following test:

- Release a cut.
- When the clamp has reached halfway down, interrupt the cutting cycle.
- This leaves the clamp locked halfway down and protecting the tip of the knife.
- Warning the next action may expose the Cutting edge of the knife!
- Press the Clamp pedal down very slowly to the floor then back up to its upper most position.
- If at any point during the clamp pedals travel the clamp suddenly rises to top dead centre then either S309 is being released too soon or the safety clamping pressure has not reached full safety pressure when Y315 is activated.

Three Important rules must be observed!

1. When the pedal is not operated, both switches must be activated.
2. As the pedal is operated S390 is released first, then S309.
3. When the cut cycle is interrupted or when the pedal is operated the clamp must never move upwards.

## Knife change

The knife change function changes the machine functions in order to make working with the knife change safer. No matter if you change to this mode via the „survey of functions“ or by opening the knife change flap, all the functions will be cut off which are not required for the knife change. The clamp will remain in a lowered position whenever possible.

As soon as the knife change flap is opened, any cut will be locked. This is done by the switching flag interrupting the light barrier. If a tool would be left in the movement range of the knife bar by chance, and the flap would not be closed, the release of a cut would not be possible.

Moreover, switch B340 is no longer actuated. When switch B340 is not active, the machine control system automatically changes over to the „knife change“ function.

## Safety lever

The safety lever is often called safety bolt. This is due to the shape of the previously used safety levers.

This safety lever is an important element in the safety concept of the POLAR cutting machines with gearbox.

Immediately before the clutch is activated, the safety lever is pulled out of the knife bar area. When the cut is continued, the safety lever is switched off in the bottom dead center of the knife bar. This early reset of the safety functions is necessary to ensure that the top dead center will not be passed over.

The cutting control circuit checks all the possible conditions by means of two proximity switches B.SBE and B. SBA. Only three states are permitted in the respective situation.



Position of switch	State	Comment
B.SBE active and B.SBA not active B.SBE and B:SBA not active	Knife bar is interlocked Position of safety lever undefined	Condition for another cut This condition is only permitted while the knife moves up, because the safety lever catches again in the knife bar at that time
B.SBA active and B.SBE not active	Unlock the knife bar	The downward movement of the knife bar has been released shortly before the clutch was activated.

## B29



Proximity switch B29 signals to the machine control system the top final position of the clamp. When the clamp is in its top position you can make the basic setting, i.e. a distance of 4 mm to the clamp. Switch B29 has consequences for the following functions:

- Cut is only possible after clamp has been lowered
- Correct operator prompting in the knife change mode
- forward movement of backgauge after cut, with activated pedal or clamp optimizing in step 1
- Clamping pressure setting on machines with PDR

## Knife Upstroke Control (MHS 95)

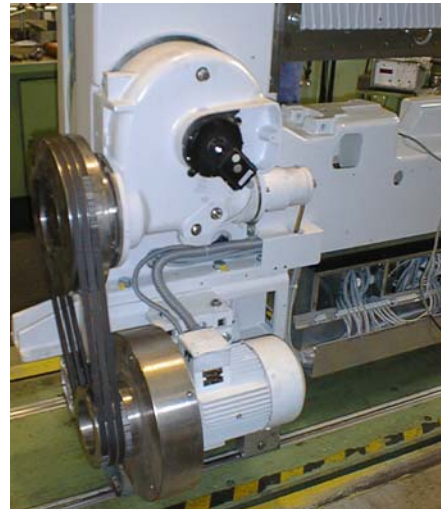
Knife upstroke control unit constitutes a closed unit which is fastened onto the crankshaft journal of the gearbox by means of a screw. The unit is fastened by means of a fixed centering bolt at the gearbox housing to secure it against twisting.

Mechanical adjustment is not possible!

The knife upstroke control unit has an arrangement of infrared transmitting and receiving diodes which scan a punched disk. The signals are led through an integrated cable via plug no. 25 to the plug interface board and conditioned in plug-in board SAP02 for SK 95 as well as the CP6 computer.

The complete MHS 95 unit with connecting cable constitute one single spare part.

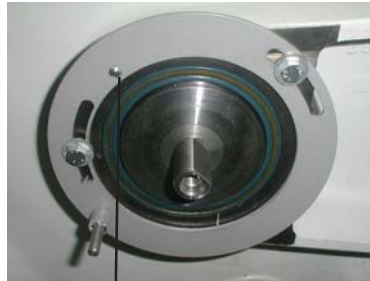
The same knife upstroke control is used for machines (78 - 176).



## Adjusting disk for the knife upstroke control



Adjusting disk



Pin



MHS on the adjusting ring

In order to compensate for mechanical tolerances, some machines are delivered with an adjusting disk which serves as a carrier plate for the knife upstroke control unit. This adjusting disk is not intended for setting the knife upstroke control at the customer's. The adjusting disk is fine-tuned and pinned together at the factory. Since it is regarded as a part of the gearbox and must not be modified.

## Inspection of knife upstroke control

The knife upstroke control is inspected in the following way:

Switch machine off .

Remove the fastening screw of the MHS (knife upstroke control) from the gear shaft.

Take the MHS off the gear shaft.

But do not unplug the connector 25 from the ST-I.

Switch the machine on, paying regard to the safety instructions.

When the control voltage is switched on, the signals can be checked.

The axis of the MHS is turned with a finger during a cut considering the direction of rotation of the shaft and paying regard to the safety instructions. Have a look at the LEDs on board SAP.

The LEDs V26 to V29 on board SAP show the inputs of the four channels of the MHS.

The LEDs V24 and V25 on board SAP show the counting pulses.

If the inputs on board SAP are in order, you can perform another test.

The axis of MHS is turned further on. Have a look at the LEDs on board SK95 while doing so.

The light-emitting diodes V77 and V78 on board SK95 show the conversion of the four channels of the MHS into two channels UTH and UTH for board SK95. This conversion is done via board SAP.

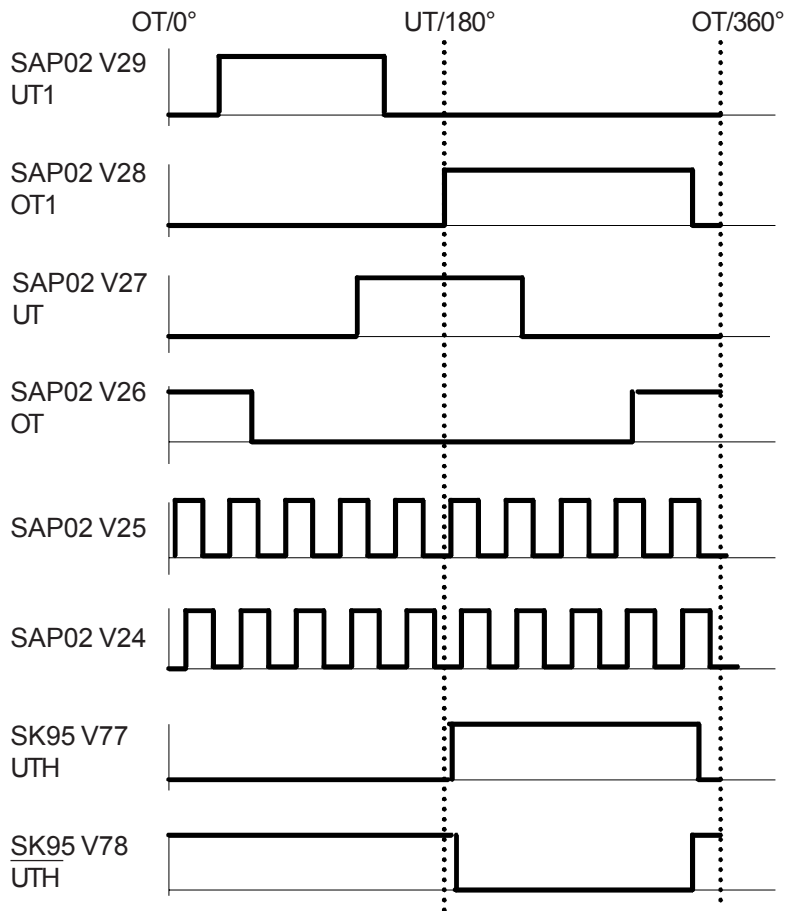
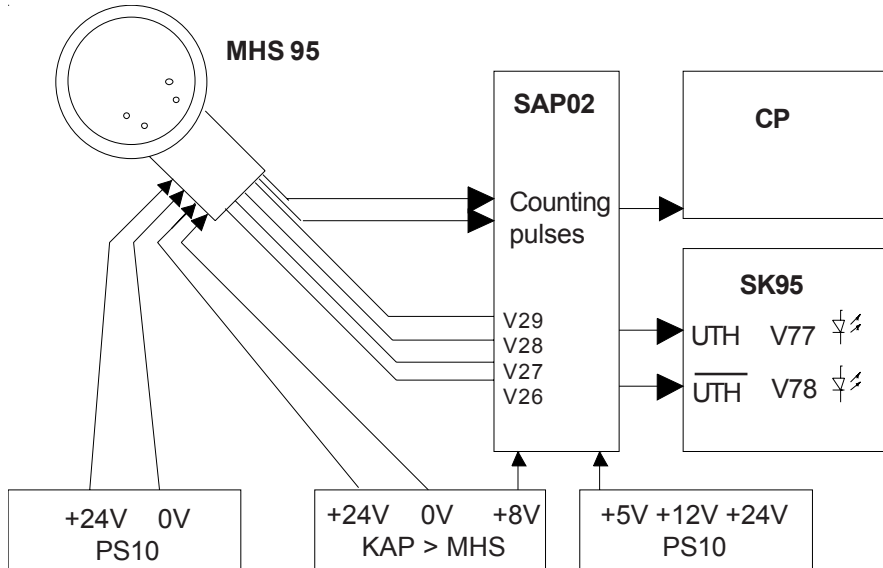
Switch machine off .

Install the knife upstroke control correctly.

Assemble all the guards and perform a function test.

The correct input of the counting pulses on board CP6 can be checked in „Service“ under „Trace knife pulses“ .

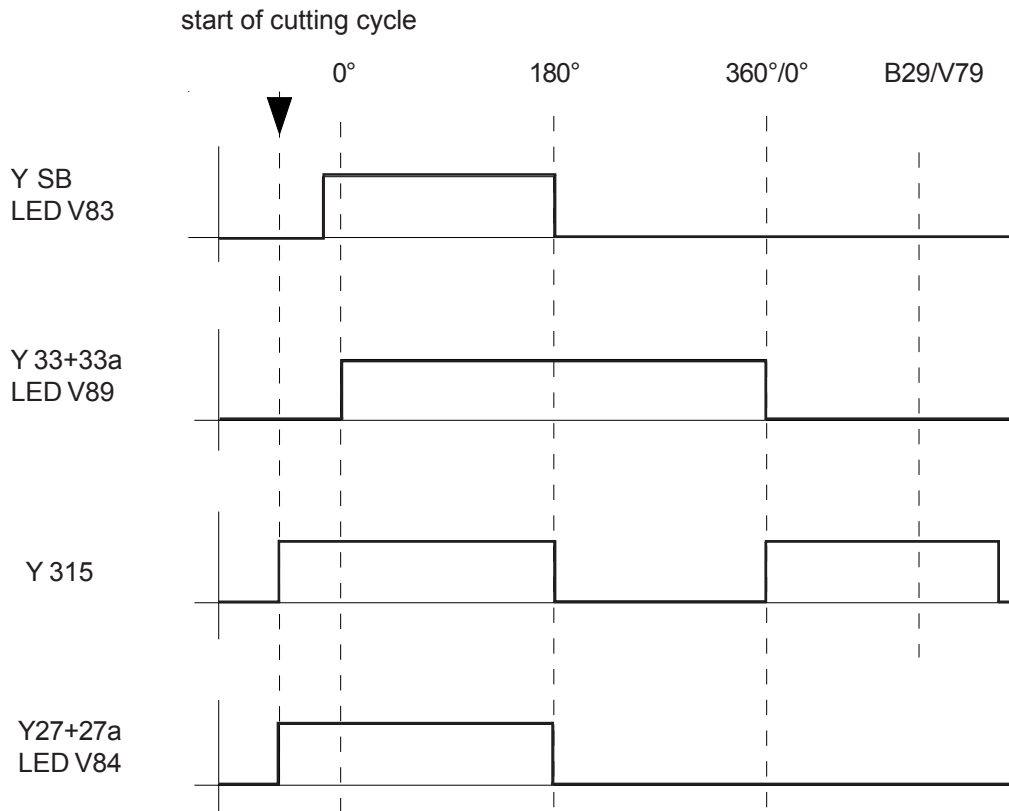
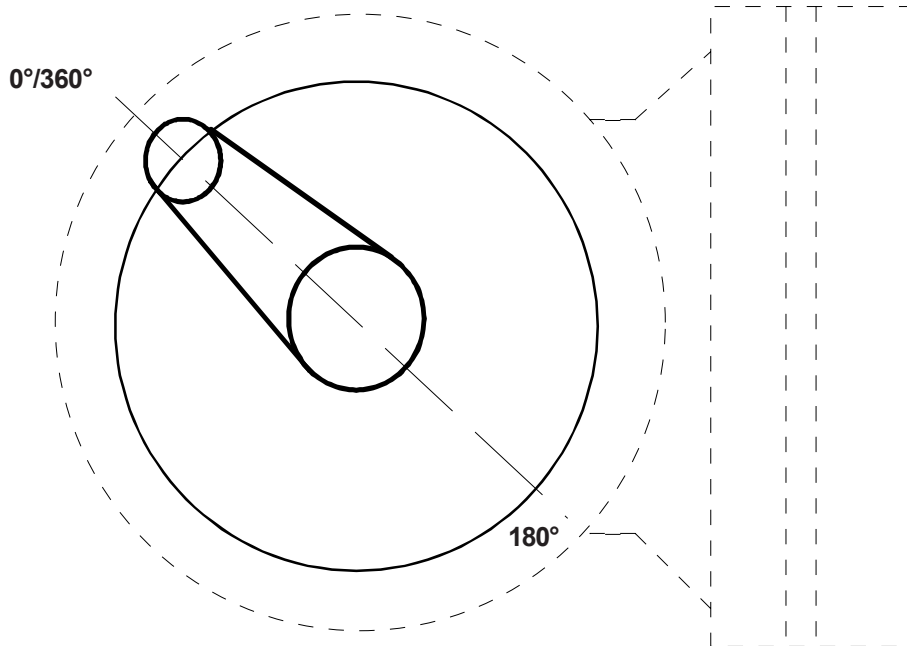
The knife upstroke control (MHS 95) supplies the SAP02 board with the following signals:  
 The graphic shows the light emitting diodes' indication on boards SAP02 and SK95 during the cutting cycle.



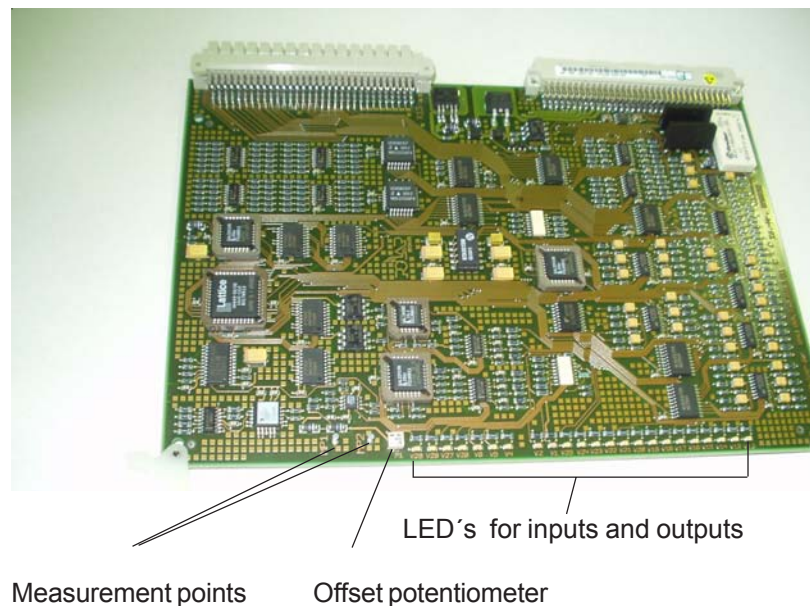
**Cutting circuit (SK95)**

Function	Reaction	LED
Reset of SK board Check of inputs	SK-Reset OFF BSB.E BSB.A S28a - S28b  Y315 MHS (SAP / SAP-M)	SK V88 OFF or I/O in service SK V71 ON SK V72 OFF SK V73 and SK V74 ON SK V75 and SK V76 OFF SK V77 OFF SK V78 ON
activate cut buttons check disabling of clamp by CP6 simultaneously using of cut button 480 msec. LS-Test  LS-Test o.k.	S28a + S28b  LS                    change to low LST                   change to high LS-NOT               change to high LS                    change to high LST                   change to low LS-NOT               change to low	SK V73 and SK V74 OFF SK V75 and SK V76 ON  SK V86 ON  SK V85 ON
activate clamp pressure  internal delay plus operator setting recording to different software-version B29 deactivated check disabling of cut by CP6 activate SB including time control	Y315 active Y27 active and Y27a active  YSB active BSB.E                change to low BSB.A                change to high	SK V84 ON SKÜ „PR“ ON  SK V79 OFF  SK V87 ON SK V71 OFF SK V72 ON
activate clutch  feedback of counting pulses from MHS:                   max. 0.5 sec. checking of counting pulses time out control during downstroke TDC > BDC:           max. 2sec.  time out control during upstroke BDC > TDC:           max. 1.4 Sec.	Y33 active and Y33a active  UTH                   change to high UTH not               change to low YSB OFF Y315 OFF Y27 + Y27a OFF  UTH                   change to low UTH not               chnge to high	SK V89 ON SKÜ „MS“ ON  SK V77 ON SK V78 OFF SK V87 OFF  SK V84 OFF SKÜ „PR“ OFF  SK V77 OFF SK V78 ON
deactivate clutch  check knife afterun release clamp Clamp at the top deactivate Y315 after time delay	Y33 + Y33a OFF  Y315 active B29 active Y315 OFF	SK V89 OFF SKÜ „MS“ OFF  SK V79 ON

The illustration below shows the function (LED indication on board SK95) of hydraulic valves and safety lever (SB) during the cutting cycle.



## SAP 02 Board



### The SAP 02 board includes the following functions

1. Polling of limit switches for the backgauge movement and control signals for the frequency converter
2. Interface between the signals of the knife upstroke control (MHS) and the cutting circuit board (SK).
3. Input of the counting pulses issued by the sleeve shaft pulse generator on the spindle for backgauge positioning and the proximity switch B341.
4. Control signals for the amplifier which connects the proportional valve used with the clamping pressure regulation and the programmable clamping stages.
5. All controls which are known as the „cut optimization“, i. e. pressure clamp light barrier, knife sensor in the clamp, smooth clamping valve, high-speed cutting.

### Setting of potentiometer on board SAP02

With regard to 1): the control signal for the frequency converter 0...10V can be measured at the two measuring pins on the front side of the SAP 02 board. When a board needs to be replaced, make sure to measure the offset voltage at these measuring points and readjust it with a miniature potentiometer, if necessary. Re-adjustment is performed in the following way:

1. After the new board has been installed, connect a digital multimeter.
2. Switch the machine on and check the backgauge movement.
3. With the backgauge at standstill, a value of 0V (+ 0.01V DC) must be measured at the measuring points. If necessary, re-adjust the value with a very small potentiometer.
4. Depending on the backgauge speed, you can measure values up to 10V DC. This constitutes the control signal sent to the frequency converter.
5. As a general rule, initiate a reference run of the backgauge every time you have performed any actions relating to the backgauge movement. This is necessary for the computer to store any new machine data. This data can be viewed in the „Service“- „Machine Data“ function.

The following inputs and outputs on the SAP02 are indicated by light-emitting diodes:

Yellow LEDs = inputs; red LEDs = outputs

LED No.	Color	Meaning	Ground state
29	yellow	MHS UT1 Position signal	off
28	yellow	MHS OT1 Position signal	off
27	yellow	MHS UT Position signal	off
26	yellow	MHS OT Position signal	on
6	red	Backgauge motor brake Y17	off
5	yellow	Limit switch Backgauge movement	off
4	yellow	Fixomat front lay mark	off
2	red	Backgauge movement reverse	off
1	red	Enabling for frequency converter	off
25	yellow	Counting signals 0° from MHS	off/on
24	yellow	Counting signals 90° from MHS	off/on
23	yellow	LS 9 backgauge front stop	on
22	yellow	Fixomat side lay guide	off
21	yellow	LS 13 backgauge rear stop	on
20	yellow	Manual precision adjustment brake released	off
19	yellow	Manual precision adjustment backgauge return stroke	off
18	yellow	Man. precision adjustment backgauge advance movement	off
17	yellow	Pedal switch S 390	off
16	yellow	Detection of false clamp plate S 219	off
15	yellow	Detection of false clamp plate S 218	off
14	yellow	Detection of false clamp plate S 6	off
13	yellow	LS 7 backgauge front slowly	on
12	yellow	LS 13a backgauge rear slowly	on

The following inputs are not indicated by LEDs:

B 341	Proximity switch reference point
S 461	Switch „lubrication sufficient“
B 340	Detection of knife change flap
S HY	Indication change of hydraulic filter
S Bilo	Backgauge start from an external system (e. g. made by Bilomatik)
WSK M17	Thermal insulation contact in backgauge motor
K5M (K0)	Main drive ready
K12/K14	Error signal by frequency converter
IG	Sleeve shaft pulse generator on the spindle
IG	Pulse generator „electronic hand wheel“
	Clamping pressure sensors 1 - 8

The following outputs are not indicated by LEDs:

N2	Analog output 0....10V for frequency converter N2
Y316	Analog output 0....10V for amplifier of proportional valve Y316
Y370	front table blown air
Y373	front table suction air

## Programmable clamping stages and automatic clamping pressure regulation

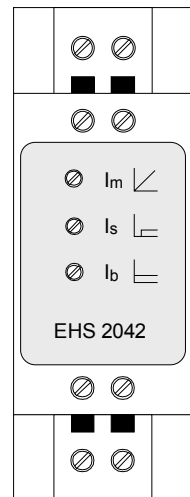
With regard to 4: According to the clamping stage adjustment in the corresponding table included in the „machine parameters“, the SAP 02 board supplies an analog output signal of 0...10V DC which generates the usual clamping pressures in the amplifier (N4), after the corresponding adaptation by means of the proportional valve in the hydraulic system. This amplifier is installed in the right-hand part of the metal sheet housing. It is supplied with 24V DC. The amplifier output is connected to the proportional valve in the P1 hydraulic circuit for the clamping pressure.

### The amplifier can be adjusted in the following way:

1. Turn the center potentiometer (**Is**) to the very left!
2. In order to adjust the clamping pressures, connect a pressure gauge to the P1 measuring connection. Select the function „clamping without cut“. Of course, the settings can only be made while the clamping function is performed.
3. When the **clamping stage 0** is selected, the minimum pressure can be adjusted with the lower potentiometer (**lb**) in a way that the following values are met during the clamping action.
 

92	30 bar
115	34 bar
137	34 bar
155	34 bar
176	34 bar
4. When the **clamping stage 9** has been selected in the „machine parameters“, the maximum pressure can be adjusted with the upper potentiometer (**Im**) so that the following values are met during clamping.
 

92	115 bar
115	102 bar
137	125 bar
155	135 bar
176	145 bar.
5. The adjustment described in points 3 and 4 has to be repeated several times, until the values are stabilized.
6. The pressures to be adjusted can be read from the tables relating to the various machine models.
7. A tutorial is no longer necessary!



On machines fitted with automatic clamping pressure regulation the 8 paper sensors are additionally connected with board SAP 02 via plugs 825 and 826. Each time a cut is made, the CP6 computer polls the number of the sensors covered by the cutting material. On the basis of the preselected clamping stage it calculates the proper analog voltage for the N4 amplifier. This amplifier converts the analog voltage into the output for the proportional valve.

The paper sensors are capacitive sensors which no longer require any separate amplifiers and therefore can do without the sensitive fiber-optic cable.

## Backgauge motor

The backgauge motor is an asynchronous 220-V a.c. motor with one winding for one speed only. Speed is controlled by means of a frequency converter. The following points must be observed in order to ensure a safe transmission of the motive force on one hand, and the braking force from the backgauge motor to the spindle.

The sledge of the backgauge motor must be movable. If necessary, loosen the nuts slightly. The spring is then able to tense the V-belt.

The pulleys must be mounted on the motor shaft or spindle free from play. Otherwise, there will be differing brake reactions during the positioning process.



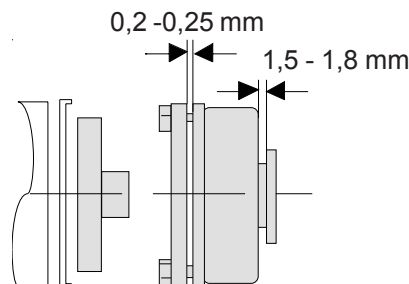
## Backgauge motor brake

This backgauge motor brake has two functions. It stops the backgauge during the halt. Besides, it enables a precise and even positioning of the backgauge. Various rules must be observed to meet these requirements. The brake must be screwed down level with the motor housing. To check this, the distance between brake disk and coil former (with the brake switched off) or the distance between brake disk and steel disk at the motor housing (with brake switched on) is measured with a thickness gauge at the adjusting screws.



- fastening and adjusting screws
- coil former
- set collar for spring tension
- brake disk

The distance should be 0.2 to 0.25 mm. To make sure that the brake has the necessary force, the set collar for the spring tension must also be checked. The distance between coil former and set collar must be set to 1.8 mm.



## Backgauge Drive Unit with Frequency Converter

On all machines with standard equipment backgauge motor control is performed by a frequency converter. The motor in question is a standard three-phase motor with a brake flanged onto it. Power supply of 230 Va.c. for the frequency converter is picked off the primary side of the control transformer protected by fuse F8 on power module board DC (X3). The frequency converter is activated from board SAP by an analogue signal between 0 V and 10 Vd.c. corresponding to the backgauge speed preset by the computer. Di-rection of rotation is also controlled by board SAP and indicated by light emitting diodes V3 (reverse movement) and V2 (advance movement).

The frequency converter drives the backgauge motor by means of a three-phase current within a frequency range of 2 to approx. 65 Hz, depending upon the machine size.

The backgauge motor brake (24 V d.c.) is also activated from board SAP 02 and indicated by LED V6. (The brake is the same type as on EMC, Monitor and ED machines.)

## Activation of frequency converter by card SAP 02

The frequency converter is activated by card SAP 02 and consists of an analogue signal between 0V and +10Vd.c. corresponding to the backgauge speed preset by the computer. In standard operation the analogue signal is identical for both directions (advance and return movement of backgauge).

backgauge movement signal SAP 02 > FU	manual slow approx. +2.5 V	manual fast approx. +5V	position analog approx. +10V
--	-------------------------------	----------------------------	---------------------------------

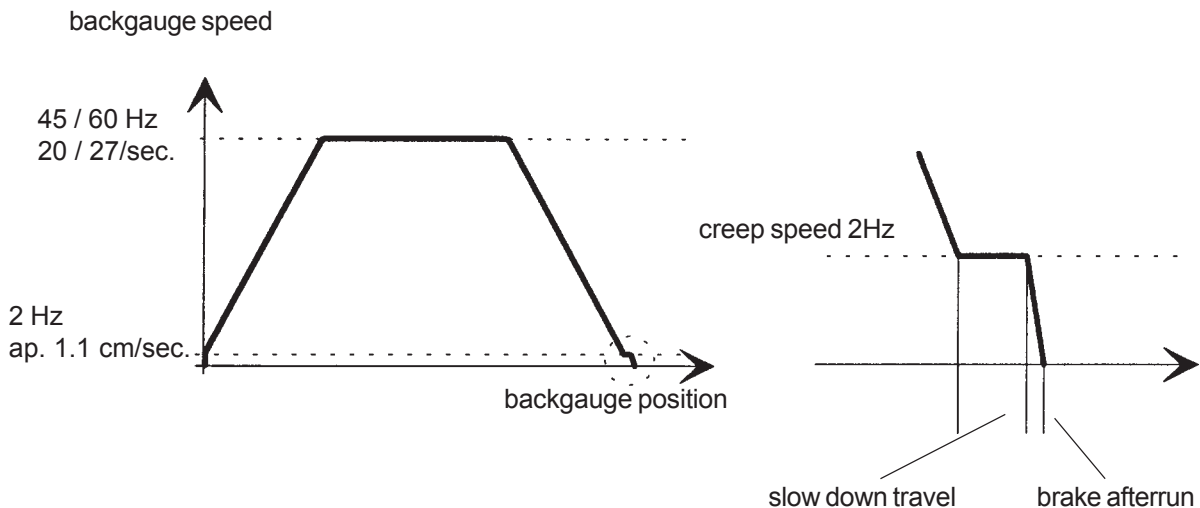
The control of the direction of rotation is also performed by card SAP 02 and indicated by LEDs V2 (return movement).

## Position Measurement

On machines of lines S, E, ED ... position measurement is performed by means of a hollow-shaft pulse generator which is fixed directly onto the end of the spindle. This arrangement offers the advantage that the spindle rotation is directly transferred into counting pulses, i.e. there are no further offsets which might constitute possible sources of error. The pulse generator housing is fastened onto the machine table by means of a spring. The shielded connecting cable is directly linked with the base plate (plug interface ST-I) via plug X23.

The pulse generator is fed with 24 V d. c. and supplies the SAP 02 board with 0° and 90°-signals during spindle rotation and with one reference pulse per rotation. Since the pulse transducer supplies one reference signal during each rotation, this signal together with the signal from proximity switch B341 „mechanical reference point“ is conditioned to an AND-operation on board SAP. All signals are converted in the SAP 02 board and supplied to computer card CP.

## Illustration of Backgauge Movement (Ramp)



## Secondary operation

The secondary operation serves to inspect the manual backgauge functions without any indication of the position. When the secondary operation has been selected, the backgauge can be moved slowly forward and backward in manual operations. The following situations can be checked:

- manual slow advance via buttons on the programming unit
- manual slow return via buttons on the programming unit
- manual high-speed advance via buttons on the programming unit
- manual high-speed return via buttons on the programming unit

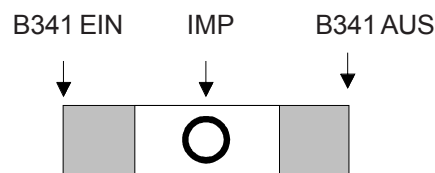
Besides, you can verify the functions of the individual table limit switches.

- front stop
- front stop with false clamp plate
- front slowly (with changeover of speed, if manual high-speed operation had been selected previously)
- rear slowly (with changeover of speed, if manual high-speed operation had been selected previously)

Positioning according to a position input and processing of programs is not possible.

## Reference point

In the new machine generation the reference point is composed of two signals. During every rotation the pulse generator generates a signal. To specify only one of these signals a proximity switch B341 is located beneath the table. The reference point is recognized by card CP when both signals are given simultaneously. The result is displayed in the „service“ menu under „machine data“:



Example: 53.635 cm / 54.256 cm / 54.671 cm

The left-hand number (53.635 cm) describes the connection of proximity switch B341 by the switching flag at the sledge. The number in the center, (e.g. 54.256 cm) indicates the signal given by the pulse generator. The right-hand number (e.g. 54.671 cm) specifies the disconnection of proximity switch B341 by the switching flag at the sledge. The second (medium) number should be in the center between the connection and disconnection points of B341. To make the setting, position the number indicated in the service section (e.g. 54.256 cm) for the signal of the pulse generator. Center the switching flag directly over the proximity switch.

## Test instruction for checking the reference point

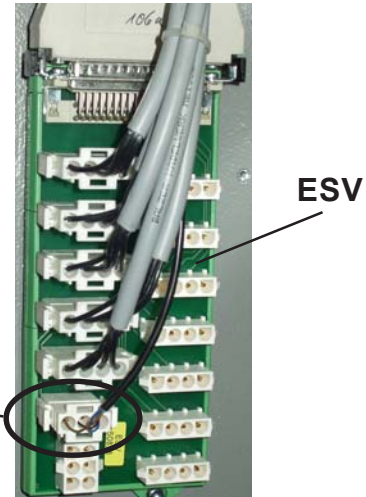
**Preparation:** Verify correct voltage supply (+24V, +12V, +5V, +25V, 230V for frequency converter)

### Test of proximity switch B341

Activate proximity switch B 341 with some iron object (for instance an open-jawed wrench) The integrated LED is lit. Verify input of +24-V signal at ESV connector B341.2 to B341.3. If the connector does not become active, it must be faulty or the cabling between proximity switch B 341 and ESV board is defective.

proximity switch B 341:

+24V	= Pin 1
0V	= Pin 3
+24V Signal	= Pin 2



### Test of reference point signal from sleeve shaft pulse generator



Activate the proximity switch B341 continuously with iron. Adjust the distance between proximity switch B341 and the switching flag at the sledge to a max. of 0.5 mm.

Use the manual precision adjustment to move the backgauge by more than 10 mm forward or backward. The LED V4 on the CP6 board lights up while the backgauge is moved. If the LED does not light up, the sleeve shaft pulse generator or CP6 board or ST-I is defective.

### Test for reference signal of B341 together with sleeve shaft pulse generator.

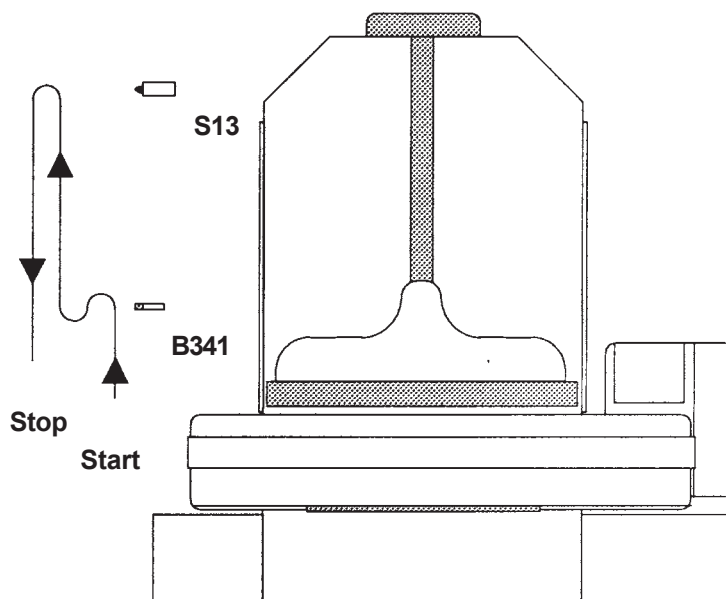
Stop activating the proximity switch B341 with the iron. Move the backgauge forward or backward to make the switching flag activate at the sledge activate the proximity switch. The LED V4 on the CP6 board lights up while the backgauge is moved. If the LED does not light up, dismount the sleeve shaft pulse generator, turn the sleeve shaft by 180° and re-mount the pulse generator.

Make the test again.

### Final adjustment of switching flag with regard to proximity switch B341.

After the reference point search has been made, scan the position of the reference point in the Service. Note down the middle number out of the three numbers. Switch back to the standard data image. Move the backgauge to the position you noted down. The switching flag at the sledge should be in the center opposite the proximity switch.

### Reference run



To determine the current position the central processor must be given a reference. This is generated by linking the active proximity switch B341 and the reference signal given by the pulse generator. The reference point can be determined by calling the function „reference run“ automatically or from the menu „preset of functions“. In this cause, the backgauge is automatically moved forward and backward searching the travel distance to find the reference point. Besides the reference point other information is also recorded for the operation of the machine, such as maximum backgauge position, slow-down travel, brake afterrun and max. velocity.

If no reference point has been found you can work in secondary operation.

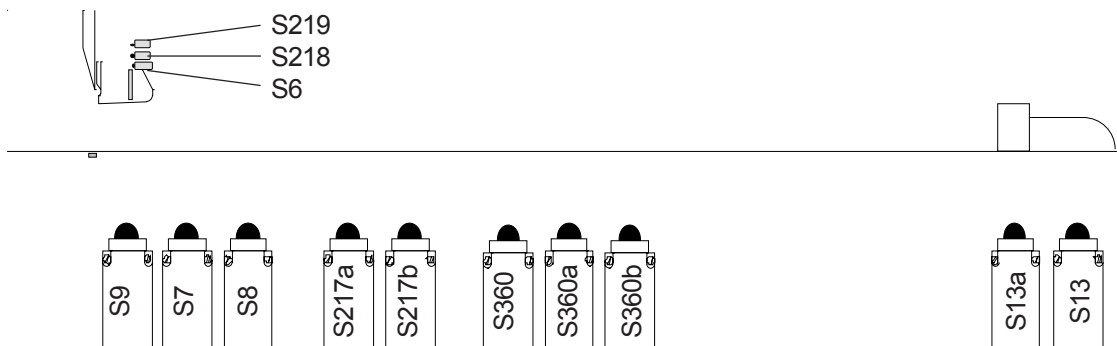
### Table limit switch



rear limit switch  
 limit switches for optional equipment  
 front limit switch  
 special switch at second level



Depending on machine size and equipment, the backgauge movement is limited by different limit switches. The individual limit switches are:



Switch	Function	LED (SAP02)
S9	forward movement of backgauge stop	V23
S7	forward movement of backgauge slow	V13
S8	forward movement of backgauge stop with false clamp plate inserted On machine type 78, this function is carried out by switch S8, if no false clamp plate has been inserted.	V5
S217a	forward movement of backgauge stop with first special false clamp inserted	V5
S217b	forward movement of backgauge stop with second special false clamp inserted	V5
S360	forward movement of backgauge stop, with Fixomat / hold-down clamp active	V5
S360a	forward movement of backgauge stop, with Fixomat / hold-down clamp active and first special false clamp	V5
S360b	forward movement of backgauge stop, with Fixomat / hold-down clamp active and second special false clamp	V5
S13a	backgauge movement reverse slowly	V12
S13	backgauge movement reverse stop	V21

As you can see from the list, the backgauge advance movement with inserted false clamp plate, or Fixomat / hold-down clamp is indicated by LED V5. The reason is, that the machine control system does not distinguish between these individual positions. On board SAP these various advance movement limit switches are combined to one single hardware delimitation.

Limit switches S360 and S360a are only necessary when the special false clamps are longer than the standard false clamp plates.

If the special false clamps are shorter than the standard ones, no additional switch needs to be installed and the limit stop is carried out by switch S360 with active Fixomat (or hold-down clamp). Since the false clamp plate limit switches (S6, S218 and S219) always activate the corresponding advance movement limit switch. Therefore, it may be necessary to insert a cable link. The two special cases can be described as follows:

If the first special false clamp is shorter than the standard false clamp plate and the machine is equipped with hold-down clamp or Fixomat, a cable link must be inserted between 106.14 and 106.13.

If the second special false clamp is shorter than the standard false clamp plate and the machine is equipped with hold-down clamp or Fixomat, a cable link must be inserted between 106.14 and 106.11.

If no link is inserted in these cases, the functions of Fixomat or hold-down clamp cannot be performed correctly.

	78		92		115		137		155		155 (2m)		176	
	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch
screw	14.9	0.59	19.8	0.78	19.8	0.78	19.8	0.78	29.8	1.175	29.8	1.175	29.8	1.175
S9	18.5	0.73	24.5	0.96	24.5	0.96	24.5	0.96	34	1.34	34	1.34	34	1.34
S8	67	2.64	89	3.5	89	3.5	89	3.5	119	4.685	119	4.685	119	4.685
S360					250	9.84	250	9.84	250	9.84	250	9.84	250	9.84
S13	795	31.3	935	36.81	1165	45.87	1465	57.68	1565	61.61	2015	79.3	2015	79.3
screw			945	37.2	1175	46.26	1475	58.07	1575	62	2025	79.72	2025	79.72

The position for switches S217a and S217b:

Width of special false clamp + 1 cm safety clearance.

The position for switches S360a and S360b:

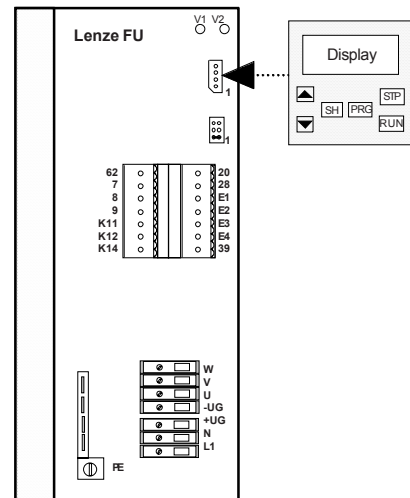
Width of special false clamp – standard width of false clamp plate + position of S360 (approx. 25 cm)

## Frequency Converter Lenze 8200

Three different frequency converters are employed with the cutting machines. Backgauge drive units of machines 78 are fitted with an 0.375-kW converter, 92 to 115 are fitted with a 0.75-kW converter, whereas machines 137 to 176 are equipped with 1.5-kW units. The devices are precalibrated at the producer's, precision adjustment is made during machine final acceptance at POLAR Mohr.

In the case that a device must be replaced at the customer's, calibration must be checked and performed again, if necessary. This requires the use of a detachable programming unit (Id. no. 229709). This device with the respective operating instructions can be purchased from Lenze company and must be available as an auxiliary tool at any of our agencies.

The programming unit can be connected to, or disconnected from, the frequency converter with the power on or off.



## Operating and adjustment instructions for LENZE converter 8200

The control states are indicated by the following LEDs on the front:

LED	green	red	Meaning
	flashing	off	stand by
	active	off	converter active
	off	flashing (1s)	Error
	off	flashing (0.4s)	check power supply
	off	off	programming mode

For all settings of the converter use the key pad (key board 8201 BB)

The button functions are:

<b>STP</b>	Stop frequency converter
<b>PRG</b>	switch over to programming mode
<b>SH</b>	show parameter
	Attention! use only parameter 1 (PAR1)
<b>PRG+SH</b>	storing off adjusted parameter
<b>▼ / ▲</b>	scrolling in programming mode and selecting of parameter
<b>RUN</b>	switch unit to stand by

For pre-adjustment of the frequency converter unit use:

- jumper for input level (1 and 2 has to be connected for input from SAP02-board 0V up to +10V)
- setting of defaults from manufacturer LENZE
- setting of parameters for POLAR equipment

### Presetting of Jumper

In case a frequency converter must be replaced at the customer's, the jumper position must be corrected. Jumper position 1-2 for signal 0 to +10 V d.c. from board SAP02 to FU is required.

### Procedure for bringing the converter back to basic settings (default)

The frequency converters 8200 supplied through POLAR have been factory adjusted. The presetting serves to provide a faster adaptation of the frequency converter to the needs of POLAR cutters. The factory adjustment can be taken over into the first parameter set (PAR1) in the following way:

Plug in key pad

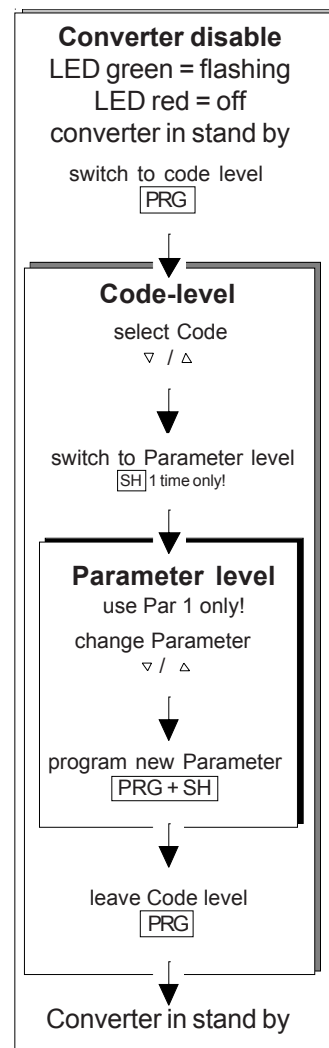
1. Press key „PRG“ of programming unit (switches from operating level to code level).
2. Use key „▼“ or „▲“ to select **step C002**.
3. Key „SH“ switches over to the display of the current value (parameter level).
4. Use any of keys „▼“ or „▲“ to select **value 1**.
5. Press keys „SH“ and „PRG“ simultaneously. Changeover is acknowledged by „SET 1“.
6. Press „RUN“ key.

Attention! Continue with the following instruction for the setting of parameters for POLAR Cutters, by adjusting of step C008, C010, C011, C012, C013, C015 and C016.

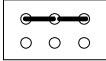
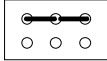
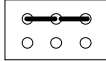

### Procedure for setting the parameter for POLAR cutters

The current set of parameters (PAR1) can be checked and modified manually.

1. Clip programming unit „8201BB“ onto frequency converter
2. Press key „STP“.
3. Use key „PRG“ to switch over to code level.
4. Use key „▼“ or „▲“ to preselect the desired parameter set.
5. Press key „SH“ (Changeover to parameter level)
6. Modify the current value (parameter) by means of key „▼“ or „▲“.
7. The new parameter is stored by pressing keys „SH“ and „PRG“, simultaneously. Indication „STO“ acknowledges the procedure.
8. Return to operating level by pressing key „PRG“.



Depending upon field application and Polar cutter type, the parameter values have to be set at the frequency converter according to the following table.

Code	Meaning	78	92	115	137 - 176
	frequency converter	8201	8202	8202	8203
	KW	0.375	0.75	0.75	1.5
C001	operating mode	0	0	0	0
C007	wiring configuration	0	0	0	0
C008	relais configuration	9	9	9	9
C010	min. frequency	2Hz	2Hz	2Hz	2Hz
C011	max. frequency	45Hz	45Hz	65 Hz	65 Hz
C012	acceleration ramp	0.05	0.05	0.05	0.05
C013	deceleration ramp	0.05	0.05	0.05	0.05
C014	C/M	0	0	0	0
C015	U/F	50Hz	50Hz	50Hz	87Hz
C016	min. voltage	8-15%	10-20%	10-20%	10-20%
	motor wiring				

### Setting the parameter C010

The official setting of 2 Hz may be exceeded and set to 3 Hz. This should be made when there are starting problems of the backgauge in the front section (with switch S7 „advance slowly“). Please note, that this modification will increase the brake afterrun.

### Setting the parameter C011

The max. speed should not be set to a value higher than the official value. The backgauge motor may loose power when poorly adjusted.

### Setting the parameter C014

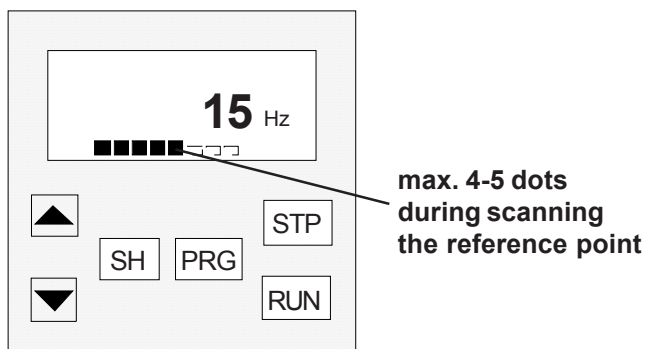
Two different preadjustments need to be made to adapt the motor type. The motor made by Lenze (big connector box, only used in 78) must be set to „2“. The motors made by „ATB“ or „Flender“ (small connector box, used in 92 – 176) runs with setting „0“.

### Setting the parameter C016

Parameter C016 must be adapted to the machine. The higher the value in parameter C016 the higher is the power consumption upon the start of the backgauge and during extremely slow backgauge movements.


An excessive power consumption may cause the backgauge movement to be cut off with an error message being issued.


The parameter C016 affects the current output during the backgauge start. If the output is too high you may get a stop because of an overcurrent and following error messages. The setting is o.k. if you do not have more than four to five dots in the display shown during scanning of the reference point. Which is the most stressful situation for the backgauge motor.



## Using key pad for showing output level of the frequency converter

1. Plug keypad „8201BB“ into the frequency converter.
2. Prepare a program with two steps

PE 70.000 

PE 20.000 

and activate in automatic mode the backgauge movement.

3. Push „PRG“ of the keypad „8201BB“.
4. Select for example code C050 by using the scroll buttons.
5. Key „SH“ Key „SH“ switches over to the display of the current value.
6. After checking the function push the key „PRG“ twice.

During active backgauge movement (automatic) the display of the frequency converter show:

Code Meaning	78	92	115	137-176
C050 actual frequency in Hz	2-45	2-45	2-60	2-60
C052 power supply for backgauge motor	40-220	40-220	40-220	40-220
C054 act. output in A	<2.6	<4	<4	<7
C056 Loading in %				
C061 internal temperature	<90°C	<90°C	<90°C	<90°C

the max. output can be 150% for one second

## Error messages issued by the frequency converter (displayed on programming unit 8201BB)

<b>C161</b>	Actual error
<b>C162</b>	Last error
<b>C163</b>	One before last error
<b>C164</b>	Two before last error
<b>LU</b>	Supply voltage too low: check supply voltage; correct transformer tapping, if necessary
<b>OV</b>	Supply voltage too high: check supply voltage; correct transf. tapping, if necessary
<b>OC1</b>	Short circuit at motor output: check motor cable for short circuit, check back gauge motor
<b>OC2</b>	Earth fault at motor output: check motor cable for earth fault, check back gauge motor
<b>OC3 to OC6</b>	Overloading of devices: adjustment of parameter sets, check motor and cabling
<b>OH</b>	Excessive heat sink temperature: check ambient temperature, clean heat sink
<b>PR to PR2</b>	Error in data transfer: transfer data again or load factory setting before controller is enabled, use other programming unit

## Graphic Board GC2



This is a redesigned board which provides a higher screen resolution, because the display is much larger than the screens on E / ED machines. There is now a resolution of 1024 x 768 (XGA format). This board cannot be installed retroactively in E / ED machines. Please note! Do not use the cable previously used in E/ED machines to connect the graphic board and the ADA-D!

## Display and Keyboard



XT



X

The display (XGA format , 1024 x 768 pixels) is much larger than the displays on the E/ED machines. The XT machine is equipped with an additional touch screen which is arranged in front of the display. This device assumes a major part of the pushbutton functions.

The display and background lighting have a metal framing. The ADA-D 03 board installed behind this metal framing serves as an interface between the GC2 graphic board and the display. The connection via another panel to the touch screen is also made via the ADA-D board.

The data from the touch screen is supplied via this connection panel to the keyboard computer BFR XT where it is processed by a special processor. Then it is transferred to the CP6 computer via plug X4 on the front side.

The keyboard controller ensures the voltage supply to both the ADA-D board and the background lighting.

The keyboard controller employed in the new machine is designated BFR XT or BFR X, resp. This keyboard computer includes the remaining keys and supplies the display unit with + 5 V d.c. and +24 V d.c., resp.

Some of the plug numbers are still the same as on the ED machine.

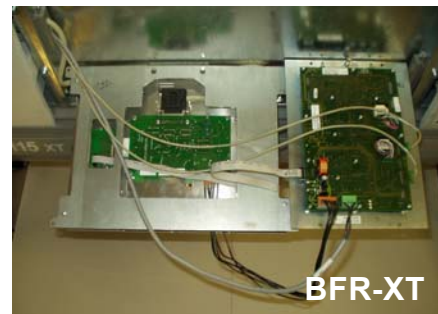
The two boards BFR X and BFR XT differ in so far as the BFR X has no processor for the touch screen, but an interface for an LCD display which is employed on the XS line of machines.

The keyboard differs in so far as the pushbutton functions on the machines of the X and XS lines are still performed by the usual multi-function keys.

The XT machines, however, are equipped with a control panel which has only a few keys, because most of the functions can be selected by touching the pictographs on the display. This has one big advantage: The operator can be guided much better, because the information on the display varies according to the preselected function. Besides, the distance between the display and the touch keys shown on the screen is very close and makes the operation very convenient.



XS



BFR-XT

## Calibration of Touch

To synchronize the display with the touch screen this adjusting mode needs to be activated first.

When the „backgauge movement "**express**" key and the "+“ key on the numerical keypad are actuated at the same time, the display on the screen changes to a white box and a red cross in the lower left-hand section (see fig.1). The center of the cross must be touched with a pointed object. This is acknowledged by a sound signal.

The red cross is now shown in the upper right-hand section (see fig.2). Another centering causes a double sound signal.

The display on the screen returns to the standard mode.

**This adjustment has to be made absolutely, every time a display or the CP6 board has been replaced, or when the battery on the CP6 board is no longer able to hold the data contained in the RAM components.**



fig.1

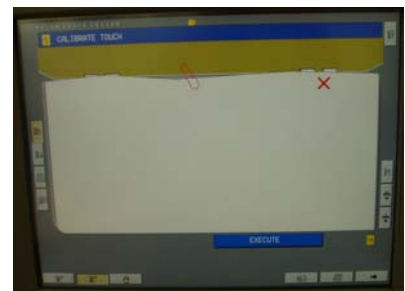


fig.2

When the „backgauge movement "**express**" key and the "-“ key on the numerical keypad are actuated at the same time, the activated sections on the touch screen are indicated.

**It is only possible in the „Service mode“ (S2.4 on the CP6 board).**

Before starting any work at the display and control panel / computer, make sure to switch off the control voltage, because of the danger of accidental ground!

## The I/O-P Board (Peripheral Systems)

This board includes the functions of SFM (special functions, monitor), DNF (swivel and tilting backgauge, Fixomat and hold-down clamp at the backgauge) and SHM (special hydraulic system, monitor)!

As a new feature, all Autotrim functions are now software-controlled. Consequently, the I/O P board houses the control system, but all of the cycles are monitored by the CP6 computer. One function has been changed: When the Autotrim table is opened, the „lifting“ process is only made during the movement.

After that, the function is switched off, to readjust the front table to the height of the side tables. The opening and closing of the Autotrim table is monitored by the machine light barrier LS95 and stopped immediately when the light barrier is obstructed. From this position the table must be opened and than closed manually. The light barrier is checked every time the Autotrim table is closed, similar to the check before each cut.

Since a new type of electronic contactor is used for the motor drive the ATR unit is no longer required.

The functions of swivel backgauge, tilting backgauge, Fixomat and hold-down clamp are also controlled via the I/O P board. The swivel and tilting backgauges have the same mechanical setup as before. The motors are still controlled via electronic contactors. The SER unit is omitted.

The swivel and tilting backgauges can be adjusted much easier now. Move the swivel or tilting backgauge, to its zero position (parallel cut or overcut - undercut). Make sure that the precision potentiometers indicate a mean value on the display. Store this position, similar to the storage of the reference point for the current position. An operator guidance on the display will then ensure the proper adjustment of the limit switches.

The electronic reversing contactor (reversing load switching relay) is an assembly which reverses the three-phase motors contact-free, i. e. by bidirectional triode thyristors (triacs) in the electronic stage. It is installed in a housing. The internal electronics is supplied with 24 V d. c. There are two drive inputs, i.e. „clockwise rotation“ and „counter-clockwise rotation“.

There are the L1....L3 connections and the U1, V1 and W1 outputs for the motor to be controlled.

The electronic reversing contactor offers the advantage that the motor to be controlled is controlled contact-free and in a phase voltage crossover. Consequently, there is no risk of sparking at the relay contacts nor are there any interference peaks which have to be trapped by screening units. The switching speed is 20 ms, i. e. on the following phase passage through zero.

The switching of this electronic reversing contactor can be learned from the circuit diagram, Autotrim or swivel and tilting backgauge (see basic circuit diagram ELR W 3/9-400).

The swivel and tilting backgauges can be adjusted much easier now. Move the swivel or tilting backgauge to its zero position (parallel cut or overcut - undercut). Make sure that the precision potentiometers indicate a mean value on the display. Store this position, similar to the storage of the reference point for the „current position“. An operator guidance on the display will then ensure the proper adjustment of the limit switches. This „mean value“ is +12V +/- 0.5 for the swivel backgauge and +6.8V +/- 0,5 for the tilting backgauge. Since the I/O P board has no measuring points, we presently have to make the measurements at the potentiometer connections. Later on the voltage will be indicated on the display.

The hold-down clamp at the backgauge is also controlled via the I/O P board,

The Beck Twin Computer Board (DBR) Die Doppel Beck Rechner Karte (DBR)

This board is intended as an additional computer which has to assume certain functions, such as the remote diagnosis ....

