

# Technical Training

## **POLAR Machines 78 S, E, ES, ED 92 - 176 S, E, ED**

### **basic course**

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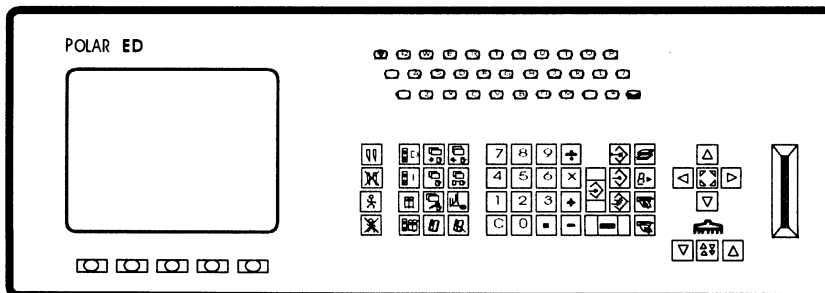
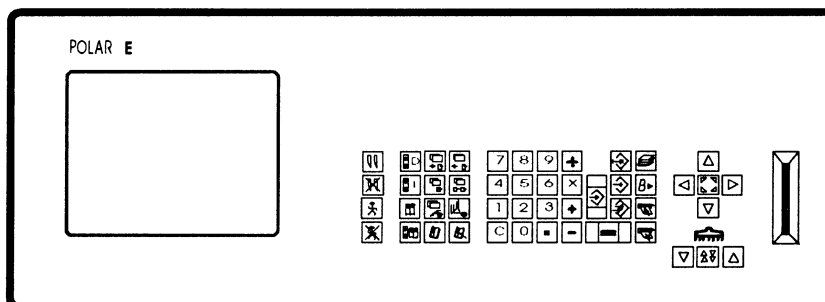
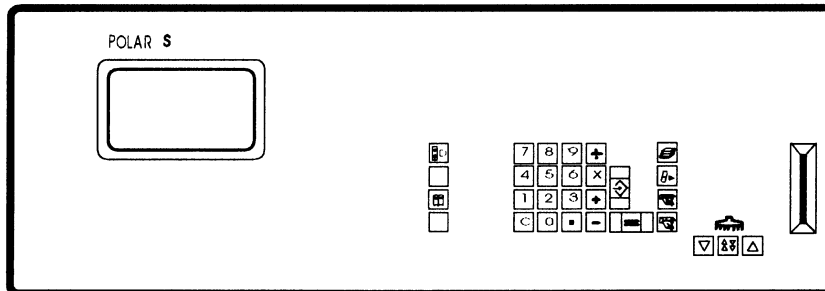
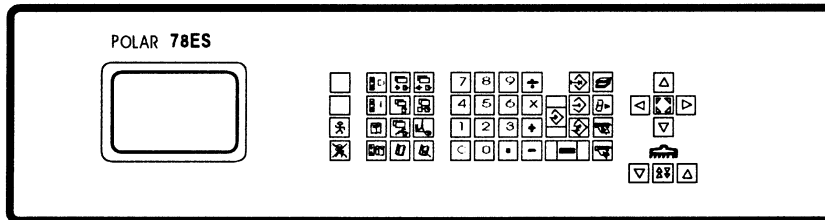
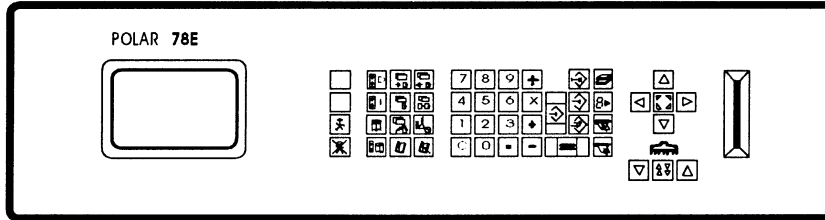
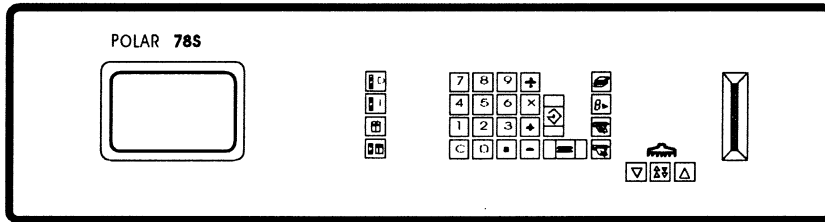
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
















































### Keyboard 78 S, 78 E, 78 ES and 92 - 176 S, E, ED



until Oct. 97

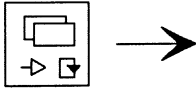
since Oct. 97

## Control keys

	Automatic knife ON		Enter
	Automatic knife OFF		Insert; subsequent insertion of data
	Automatic ON		Delete
	Automatic OFF		Correction (of stored data)
	Basic display "Program Data"		Key without function
	Basic display "Program Information"		Transfer key: Transfer backgauge pos. into input field
	Basic display "Main Menu (Function Survey)"		Calculator memory
	Basic display "Program Survey"		Memory Read
	Multi-function-key "Additional Functions"		Backgauge movement: slow advance
	Multi-function-key "Program Functions"		Backgauge movement: slow reverse
	Multi-functions-key "Programm - Parameter" (not at the moment)		Additional pushbutton: Backgauge fast
	Program selection		Cursor
	Multi-function-key "External Additional Functions"		Preselection key: "Tilting backgauge"
	Multi-function-key "Auxiliary Program Functions"		Preselection key: "Swivel backgauge"
	Production report		Preselection key: Fixomat / Holding-down clamp
	Step selection		Tilting backgauge "0 - position"
	Numerical keyboard		Tilting backgauge "Undercut"
	Division		Tilting backgauge "Overcut"
	Multiplication		Swivel backgauge "0 - position"
	Addition		Swivel backgauge "angle correction left"
	Subtraction		Swivel backgauge "angle correction right"
	Equal key		Holding-down clamp "Resting position" / Fixomat "O - position"
	Clear input field		Holding-down clamp "Final position" / Fixomat "sidemark"
	Decimal point		Holding-down clamp "Working position" / Fixomat "frontmark"
			Rotary knob "Cut correction"
			Rotary knob "Distortion correction"

### Multi-function-keys - V1.4

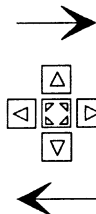
**Multi-function-key**



**Additional functions**

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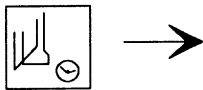
1. Automatic knife ON
2. Automatic knife OFF
3. Clamping without cut
4. Jogging mark
5. Air front table ON
6. Complete air table ON
7. Complete air table OFF
8. Ejector OFF
9. Autotrim



Page 2/2

1. Backgauge forward slow
2. Lay guide I
3. Lay guide II
4. Swivel backgauge
5. Tilting backgauge
6. Fixomat side mark guide / Holding down clamp activ
7. Fixomat front mark guide / Holding down clamp passiv
8. Side gauge left down
9. Side gauges both down

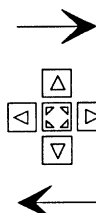
**Multi-function-key**



**Machine - Parameter**

Page 1/2

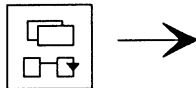
1. Pressing time before cut
2. Pressing time no cut
3. Pressure force level
4. Pressure force sensors
5. Clamp forces
6. Forward acceleration
7. Forward deceleration
8. Advance speed



Page 2/2

1. Smooth stop at position
2. Optimization of clamp
3. Clamp light barrier
4. Smooth prepressure
5. Highspeed cutting
6. Autotrim blowing air
7. START Autotrim blowair
8. STOP Autotrim blowair

**Multi-function-key**



**Auxiliary program functions**

Manual

1. Program when cutting
2. Difference of positions
3. Set program protection
- Simulation without cuts
- Correktion of cut position
- Warning skip cutting

Automatic

- Program when cutting
- Difference of positions
3. Set program protection
4. Simulation without cuts
5. Correction of cut position
6. Warning skip cutting

**Multi-function-key**



**Program functions**

1. Nominal position
2. PE Programmable ejector
3. LZ Label size
4. LQ Label quantity
5. TC Total cuts
6. PL Program loop
7. C: Selection of comment
8. C: Input of comment

**Multi-function-key**



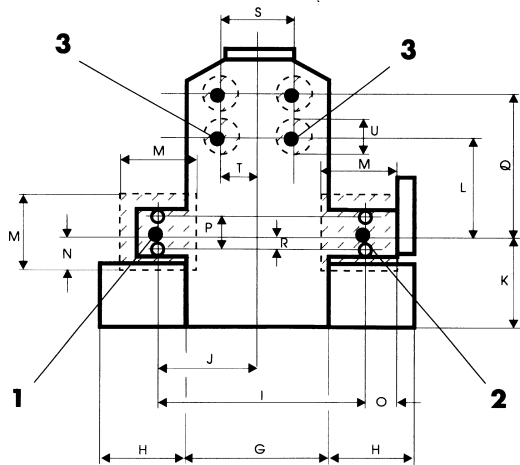
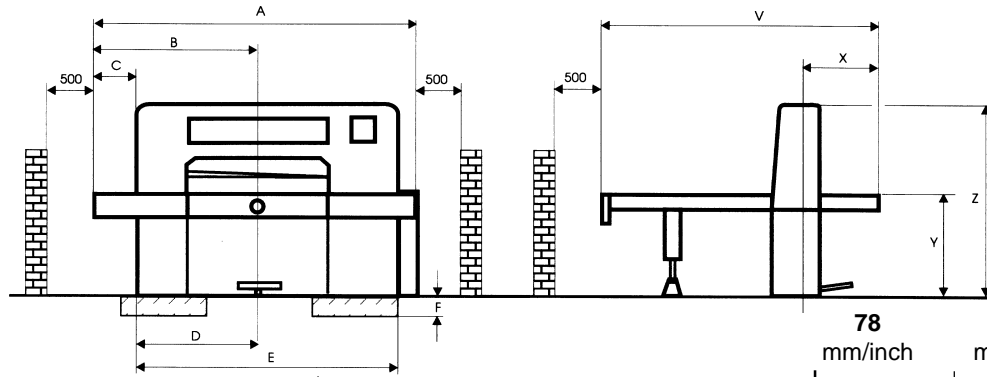
**External additional functions**

- 1 EXT. FUNC. 1 START
- 2 EXT. FUNC. 2 START
- 3 EXT. FUNC. 3 START
- 4 EXT. FUNC. 4 START

---

- 5 EXT. FUNC. 5 START
- 6 EXT. FUNC. 6 START
- 7 EXT. FUNC. 7 START
- 8 EXT. FUNC. 8 START

## Measurements Polar 78 - 176



**Weight at position "1":**

78	4270 N
92	6870 N
115	10000 N
137	13730 N
155	16480 N
176	17660 N

**Weight at position "2":**

78	6620 N
92	8593 N
115	15890 N
137	20410 N
155	23840 N
176	26450 N

**Weight at position "3/4":**

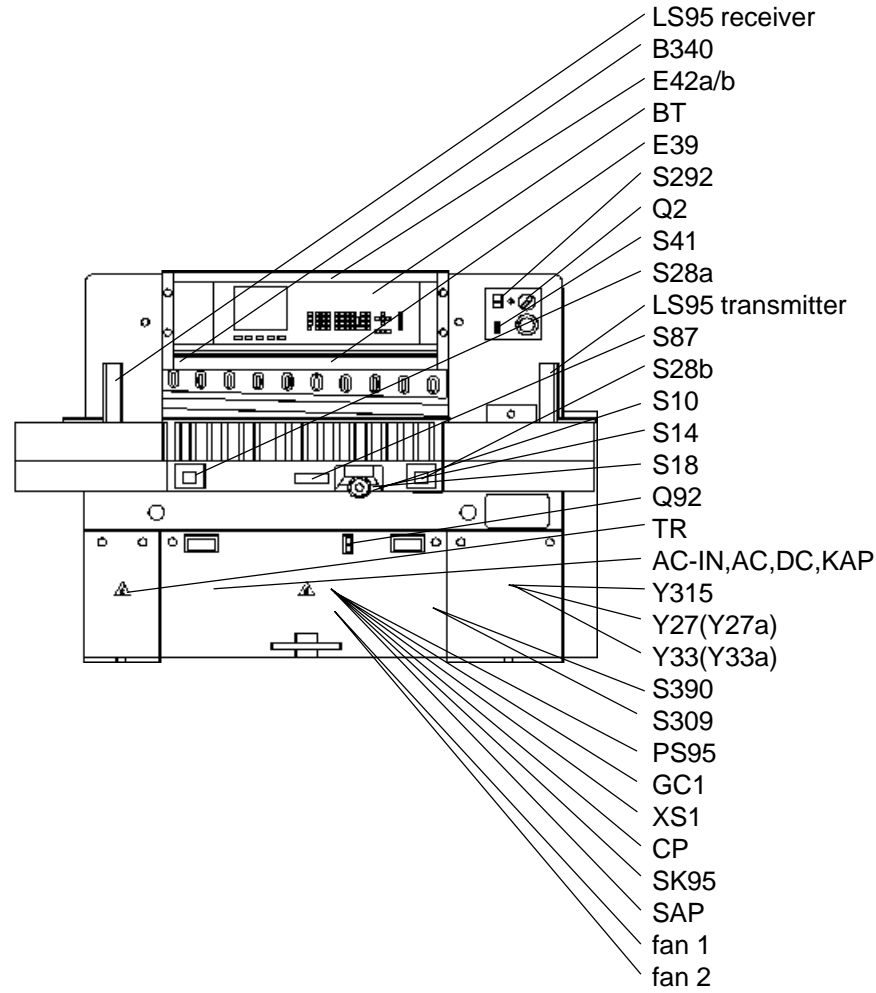
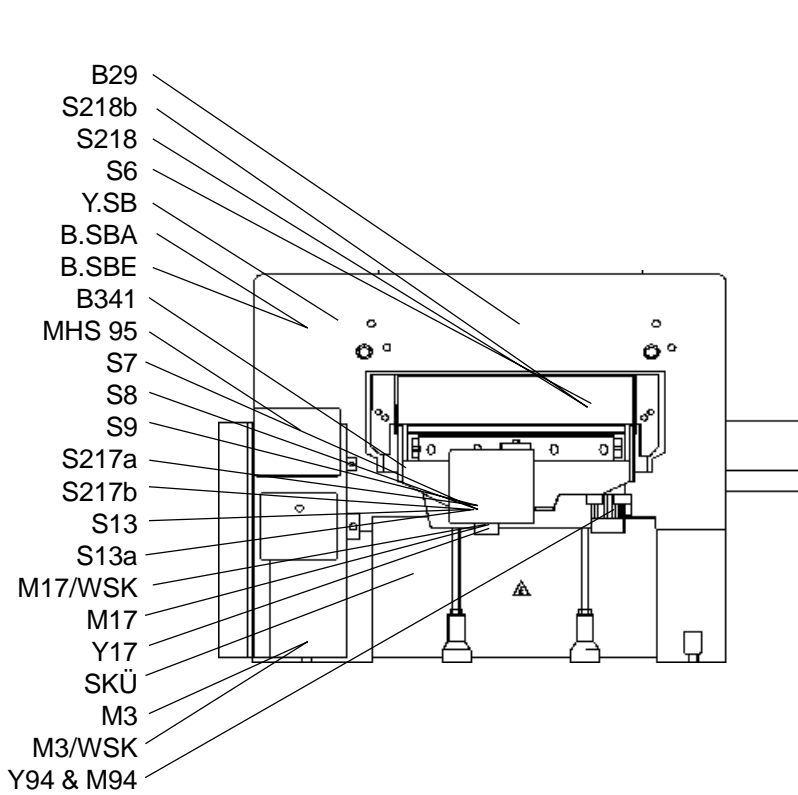
78	930 N
92	1620 N
115	2750 N
137	3140 N
155	4120 N
176	1470/5890 N

	78 mm/inch	92 mm/inch	115 mm/inch	137 mm/inch	155 mm/inch	176 mm/inch
A	1980/77 <sup>61/64</sup>	2120/83 <sup>15/32</sup>	2712/106 <sup>49/64</sup>	2932/115 <sup>7/16</sup>	3410/134 <sup>1/4</sup>	3620/142 <sup>33/64</sup>
B	990/38 <sup>31/32</sup>	1060/41 <sup>47/64</sup>	1325/52 <sup>11/64</sup>	1435/56 <sup>1/2</sup>	1778/70	1883/74 <sup>9/64</sup>
C	359/13 <sup>9/64</sup>	350/13 <sup>25/32</sup>	344/13 <sup>35/64</sup>	344/13 <sup>35/64</sup>	653/25 <sup>45/64</sup>	653/25 <sup>45/64</sup>
D	631/24 <sup>27/32</sup>	710/27 <sup>61/64</sup>	981/38 <sup>5/8</sup>	1091/42 <sup>41/64</sup>	1125/44 <sup>19/64</sup>	1230/48 <sup>27/64</sup>
E	1408/55 <sup>7/16</sup>	1630/64 <sup>11/64</sup>	2151/84 <sup>11/16</sup>	2363/93 <sup>1/32</sup>	2540/100	2750/108 <sup>17/64</sup>
F	120/4 <sup>23/32</sup>	200/7 <sup>7/8</sup>	200/7 <sup>7/8</sup>	200/7 <sup>7/8</sup>	200/7 <sup>7/8</sup>	200/7 <sup>7/8</sup>
G	780/30 <sup>45/64</sup>	920/36 <sup>7/32</sup>	1150/45 <sup>9/32</sup>	1370/53 <sup>15/16</sup>	1550/61 <sup>1/32</sup>	1760/69 <sup>19/64</sup>
H	600/23 <sup>5/8</sup>	600/23 <sup>5/8</sup>	750/29 <sup>17/32</sup>	750/29 <sup>17/32</sup>	1003/39 <sup>31/64</sup>	1003/39 <sup>31/64</sup>
I	-	1267/49 <sup>29/32</sup>	1653/65 <sup>5/64</sup>	1873/73 <sup>47/64</sup>	2001/78 <sup>25/32</sup>	2211/87 <sup>3/64</sup>
J	-	570/22 <sup>7/16</sup>	821/32 <sup>21/64</sup>	931/36 <sup>21/32</sup>	965/37 <sup>63/64</sup>	1070/42 <sup>1/8</sup>
K	650/25 <sup>19/32</sup>	635/25 <sup>19/32</sup>	715/28 <sup>5/32</sup>	730/28 <sup>47/64</sup>	750/29 <sup>17/32</sup>	750/29 <sup>17/32</sup>
L	940/37 <sup>1/64</sup>	750/29 <sup>17/32</sup>	1020/40 <sup>5/32</sup>	1110/43 <sup>45/64</sup>	1160/45 <sup>43/64</sup>	980/38 <sup>37/64</sup>
M	-	600/23 <sup>5/8</sup>	650/25 <sup>19/32</sup>	650/25 <sup>19/32</sup>	650/25 <sup>19/32</sup>	650/25 <sup>19/32</sup>
N	-	300/11 <sup>13/16</sup>	260/10 <sup>15/64</sup>	260/10 <sup>15/64</sup>	260/10 <sup>15/64</sup>	260/10 <sup>15/64</sup>
O	-	300/11 <sup>13/16</sup>	400/15 <sup>3/4</sup>	400/15 <sup>3/4</sup>	400/15 <sup>3/4</sup>	400/15 <sup>3/4</sup>
P	-	255/10 <sup>3/64</sup>	360/14 <sup>11/64</sup>	360/14 <sup>11/64</sup>	360/14 <sup>11/64</sup>	360/14 <sup>11/64</sup>
Q	-	-	-	-	-	2010/79 <sup>9/64</sup>
R	-	104,5/4 <sup>7/64</sup>	137,5/5 <sup>13/32</sup>	137,5/5 <sup>13/32</sup>	172,5/6 <sup>51/64</sup>	172,5/6 <sup>51/64</sup>
S	580/22 <sup>53/64</sup>	600/23 <sup>5/8</sup>	700/27 <sup>9/16</sup>	700/27 <sup>9/16</sup>	1090/42 <sup>29/32</sup>	1090/42 <sup>29/32</sup>
T	290/11 <sup>27/64</sup>	300/11 <sup>13/16</sup>	350/13 <sup>25/32</sup>	350/13 <sup>25/32</sup>	545/21 <sup>29/64</sup>	545/21 <sup>29/64</sup>
U	200/7 <sup>7/8</sup>	400/15 <sup>3/4</sup>	400/15 <sup>3/4</sup>	400/15 <sup>3/4</sup>	400/15 <sup>3/4</sup>	400/15 <sup>3/4</sup>
V	1975/77 <sup>3/4</sup>	2185/86 <sup>1/32</sup>	2563/100 <sup>29/32</sup>	2845/112	2981/117 <sup>23/64</sup>	3455/136 <sup>1/32</sup>
W	-	-	-	-	-	-
X	653/25 <sup>45/64</sup>	653/25 <sup>45/64</sup>	718/28 <sup>17/64</sup>	733/28 <sup>55/64</sup>	753/29 <sup>41/64</sup>	753/29 <sup>41/64</sup>
Y	900/35 <sup>7/16</sup>	900/35 <sup>7/16</sup>	900/35 <sup>7/16</sup>	900/35 <sup>7/16</sup>	900/35 <sup>7/16</sup>	900/35 <sup>7/16</sup>
Z	1452/57 <sup>11/64</sup>	1545/60 <sup>53/64</sup>	1660/66 <sup>23/64</sup>	1660/65 <sup>23/64</sup>	1745/68 <sup>45/64</sup>	1745/68 <sup>45/64</sup>

## Technical Data

	<u>Polar 78</u>	<u>Polar 92</u>	<u>Polar 115</u>	<u>Polar 137</u>	<u>Polar 155</u>	<u>Polar 176</u>
Cutting width	78 cm/30 11/16"	92 cm / 36 1/4"	115 cm / 45 1/4"	137 cm / 54"	155 cm / 61"	176 cm / 69 5/16"
Clamp opening	12 cm/4 11/16"	13 cm / 5 1/8"	16,5 cm / 6 1/2"	16,5 cm / 6 1/2"	16,5 cm / 6 1/2"	16,5 cm / 6 1/2"
Feed depth	78 cm/30 11/16"	92 cm / 36 1/4"	115 cm / 45 1/4"	145 cm / 57"	155 cm / 61"	200 cm / 78 3/4"
Power requirement (main drive)	3,45 kW/4,63 H.P.	4,45 kW / 5,97 H.P.	5,7 kW / 7,64 H.P.	6,6 kW / 10,46 H.P.	8,2 kW / 12,6 H.P.	8,2 kW / 12,6 H.P.
Net weight (without special equipment)	1300 kg/2867 lbs	1900 kg / 4190 lbs	3200 kg / 7055 lbs	4120 kg / 9083 lbs	4950 kg / 10913 lbs	6000 kg / 13228 lbs
Width without side tables	155 cm/61"	177 cm / 70"	233 cm / 91 3/4"	254 cm / 100"	279 cm / 109 3/4"	300 cm / 118 3/8"
with side tables	198 cm/77 11/16"	212 cm / 83 1/2"	265 cm / 104 3/16"	288 cm / 113 3/8"	355 cm / 139 3/4"	376 cm / 148 1/16"
Length	191,5 cm/75 3/8"	216 cm / 85"	254 cm / 100"	282 cm / 111 1/16"	295 cm / 116 1/8"	343 cm / 135 1/16"
Height	145 cm/57 1/16"	154 cm / 60 5/8"	165 cm / 64 15/16"	165 cm / 64 15/16"	173 cm / 68 1/8"	173 cm / 68 1/8"
Front table length	65 cm/25 9/16"	65 cm / 25 19/32"	71,5 cm / 28 1/4"	73 cm / 28 3/4"	75 cm / 29 1/2"	75 cm / 29 1/2"
Table height	90 cm/35 1/2"	90 cm / 35 1/2"	90 cm / 35 1/2"	90 cm / 35 1/2"	90 cm / 35 1/2"	90 cm / 35 1/2"
Clamp pressure min.	150 daN/330 lbs	150 daN* / 330 lbs	150 daN* / 330 lbs	150 daN* / 330 lbs	150 daN* / 330 lbs	150 daN* / 330 lbs
max.	3000 daN/6630 lbs	3500 daN* / 7700 lbs	4500 daN* / 9920 lbs	5500 daN* / 12100 lbs	6000 daN* / 13200 lbs	7000 daN* / 15400 lbs
Knife thickness	11,75 mm/7/16"	11,7 mm / 7/16"	13,75 mm / 9/16"	13,75 mm / 9/16"	13,75 mm / 9/16"	13,75 mm / 9/16"
Grinding reserve, max.	2,5 cm/1"	3 cm / 1 3/16"	6 cm / 2 3/8"	6 cm / 2 3/8"	6 cm / 2 3/8"	6 cm / 2 3/8"
Smallest cut, without false clamp, min.	2 cm/13/16"	2,5 cm / 1"	2,5 cm / 1"	2,5 cm / 1"	3,5 cm / 1 3/8"	3,5 cm / 1 3/8"
with false clamp, min.	7 cm/2 3/4"	9 cm / 3 1/2"	9,5 cm / 3 3/4"	9,5 cm / 3 3/4"	12 cm / 4 23/32"	12 cm / 4 23/32"
Backgauge speed advance	0 - 20 cm/sec.	0 - 20 cm/sec.	0 - 30 cm/sec.	0 - 30 cm/sec.	0 - 30 cm/sec	0 - 30 cm/sec
Static floor load	525 daN/ 114 lbs/sq. ft.	628 daN/m <sup>2</sup> / 131 lbs/sq.ft.	706 daN/m <sup>2</sup> / 142,8 lbs/sq.ft.	756 daN/m <sup>2</sup> / 153 lbs/sq.ft	761 daN/m <sup>2</sup> / 154 lbs/sq.ft	755 daN/m <sup>2</sup> / 153lbs/sq.ft
Specific pressure on surface	1,35 daN/cm <sup>2</sup> 19,9 lbs/sq. in.	1,6 daN/cm <sup>2</sup> / 23,16 lbs/sq.in.	1,6 daN/cm <sup>2</sup> / 22,7 lbs/sq.in.	2 daN/cm <sup>2</sup> / 28,4 lbs/sq.in.	2,4 daN/cm <sup>2</sup> / 34,3 lbs/sq.in.	2,65 daN/cm <sup>2</sup> / 37,9 lbs/sq.in.
Dynamic surcharge	20%	20%	20%	20%	20%	20%
Supply voltage 190-240V Fusing	16A	25A	25A	35A	35A	35A
Supply voltage 340-440V Fusing	10A	20A	20A	25A	25A	25A
Supply voltage 500-600V Fusing	10A	20A	20A	25A	25A	25A
Attention!	The wire cross section of the main power supply according to the countrys regulations. Use the same regulations for plug connectors.					
Noise emission	(according DIN 45635, part 27) 83 dB (A) T with 1152 cuts per hour (80% automatic operation)					
77 dB (A) T with 300 cuts per hour (manual feeding)						

rear and front elevation



### Main switch, main drive unit

The machines of line **78 E** and **78 ED** are fitted with main switches for directly switching the main motor on. Control voltage is started by key button S292 and auxiliary contactor K304.

The machines of line **78 ES** are fitted with main switches for directly switching the main motor on. Control voltage is automatically given by the transformer and the power supply units G1 and G2.

The machines of series **92** are also furnished with a main switch. Only after control voltage has been switched on via S292 and auxiliary contactor of K304 closes does the **soft start device** activated by relay K305 start the main motor. As soon as the „acceleration“ of the main motor has been terminated the soft start unit switches on contactor KO which supplies the motor directly with three phases.

An auxiliary contact of KO (13-14) signals to the computer „**acceleration terminated**“. After that, the machine is ready for operation. The soft start unit (KIMODUL) is a compact device which controls the main motor start up.

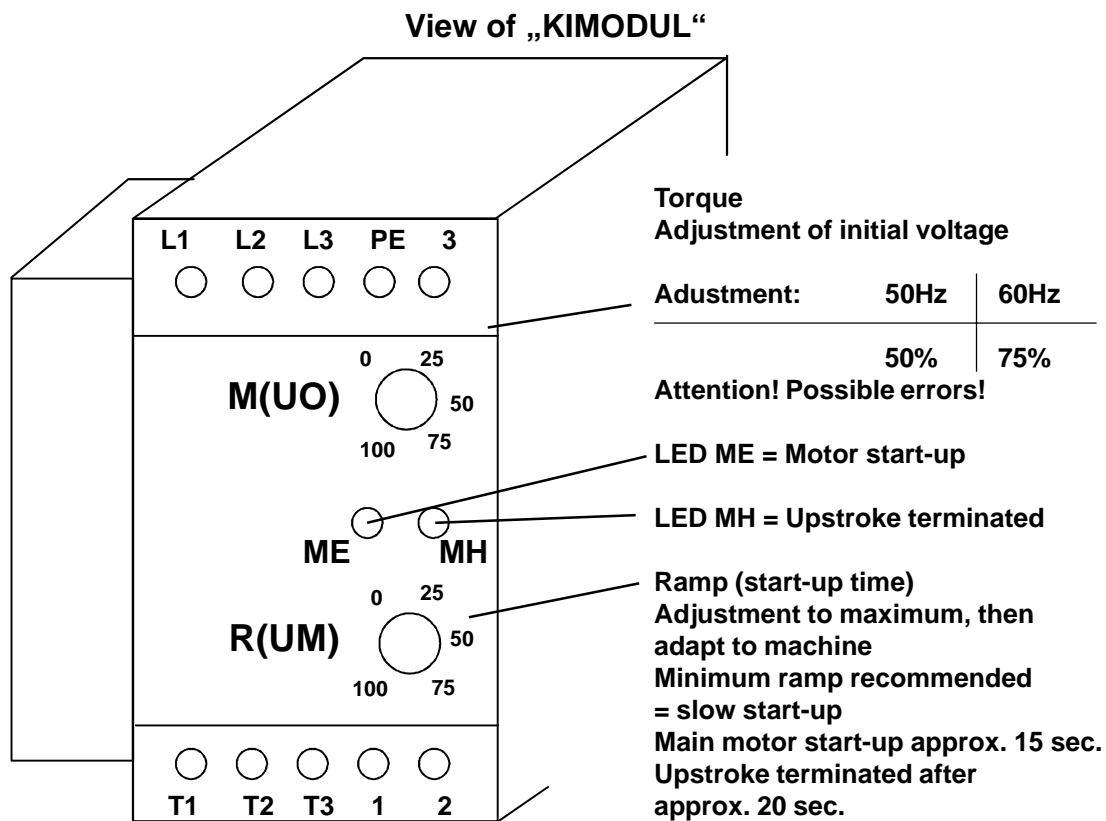
The machines series **115 ... 176** are provided with a main switch and are switched on via the automatic **star- delta switch** already known. Control voltage is activated by auxiliary contact 13-14 of K5M and auxiliary relay K304 as soon as delta operation has been established. An auxiliary contact of K5M (43-44) signals to the computer that the start-up of the main motor has been terminated.

The cutting machines since december 1998 do not need a neutral (MP) any more, because the transformer is supplied with two phases L1 and L3. The relays K304 and card AC-IN is no longer existing. The relays K305, now with self holding contact in card AC-IN, is still used to activate the soft start unit (92 only). On the card AC-IN is now a voltage stabilizer 24V D.C. to protect the soft start unit against to high operating voltage.

The star delta combination (115 ... 176) has now contactors with 24V A.C. coils!

The machines type 78 ES have a additional transformer (T2) when the mains is 400V ~ to supply the power units G1, G2, T1, the frequency converter and lights with 230 V~.

**Attention:** New diagrams for Power on circuit without K304

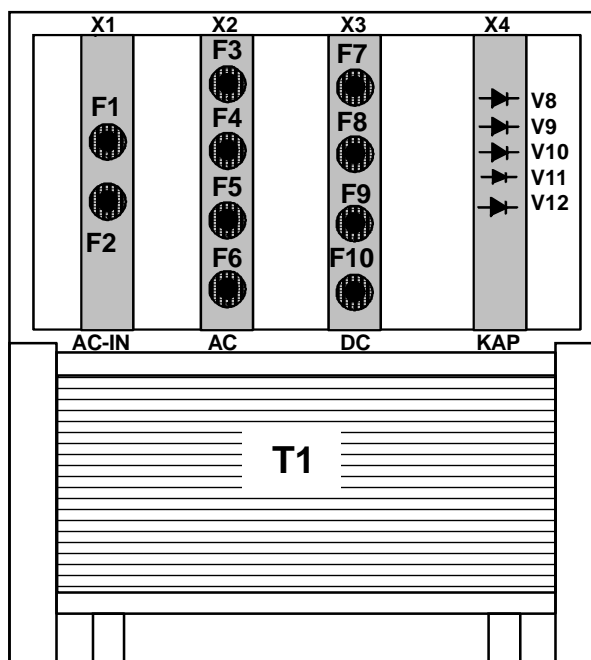


## Voltage Supply

The power module is composed of control transformer and four power module boards combined in one block.

The control transformer is designed in such a way that it can be supplied by one phase and neutral (Mp), or, by the two phases L1 and L3 if the machine is supplied only by three phases and a protective earth conductor (PE).

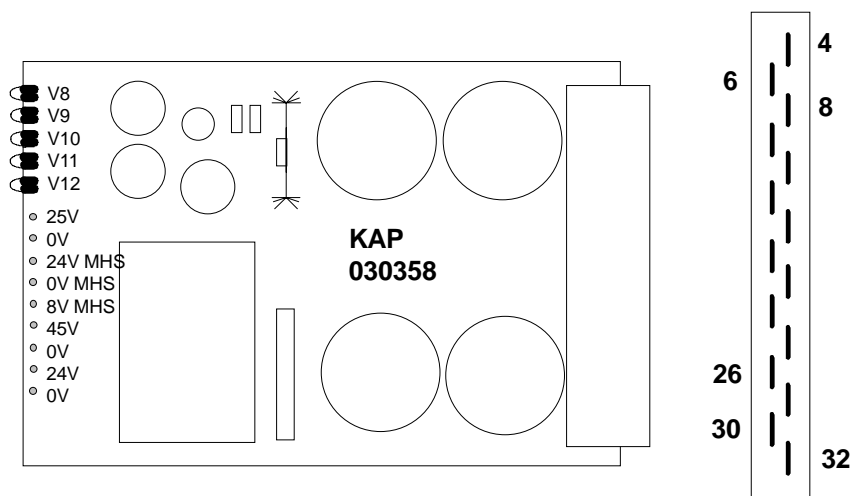
**Power module board AC IN (X1)** comprises the two fuses F1 and F2 (miniature circuit breakers) and auxiliary relay K304 for the primary supply to the control transformer. Furthermore, the board has a rectifier and relay K305 (soft start-up device 92). Since January 1999 the board AC IN does no more contain the relay K304. The circuit breakers F1 and F2 are now mechanically connected to T1. Because the transformer is now in all machines supplied with two phases. The control voltage for the soft start-up device (92) is stabilized to 24V d.c. The new board AC IN without relay K304 cannot be used in older S, E and ED machines.



**Power module board AC (X2)** is fitted with fuse F3 for rectification and stabilization 24 Vd.c. / 8 Vd.c. (knife upstroke control), fuse F4 with rectification 25 Vd.c., fuses F5 and F6 for 15 Va.c./30 Va.c. Fixomat.

**Power module board DC (X3)** is fitted with fuses F7 with rectifier (24 Vd.c. for operating unit), F8 (230 Va.c. for frequency converter and illumination), F9 (spare) and F10 with rectifier (32 Vd.c. for PS95).

**Power module board KAP (X4)** is composed of transformer, rectification and stabilization 24 Vd.c./8 Vd.c. for knife upstroke control, various capacitors as well as light emitting diodes for voltage control.



The LED's on power module board KAP indicate the following supply voltages:

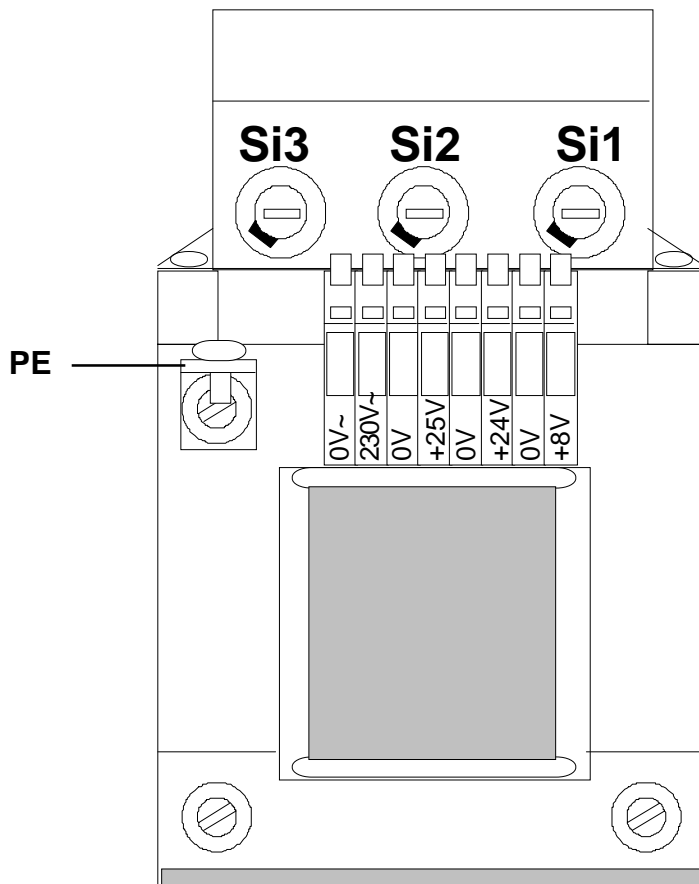
LED	Voltage	Fuse	Use	Measurement at
V8	24V=	F7 (4A)	for keyboard KC	PMX415.3 - PM X415.1
V9	45V=	F10 (6A)	for stabilisation board PS 95	PM X404.2 - PM X404.1
V10	24V=	F3 (1,5A)	for knife upstroke control MHS	PM X416.8 - PM X416.9
V11	8V=	F3 (1,5A)	for knife upstroke control (SAP)	PM X416.8 - PM X416.7
V12	25V=	F4 (10 / 16A)	for solenoids and solenoid valves	PM X403.1 - PM X403.5 PM X416.1 - PM X416.5
	30V~	F5 (2A)		PM X402.1 - PM X402.7
	15V~	F6 (2A)	for Fixomat	PM X402.1 - PM X402.5
	230V~	F8 (5A=78-137 6A=137-176)	for Frequency Converter (FU), table light and optical cutting line	PM X413.4 - PM X413.5 PM X411.6 - MH X411.5

### Power module 78 ES

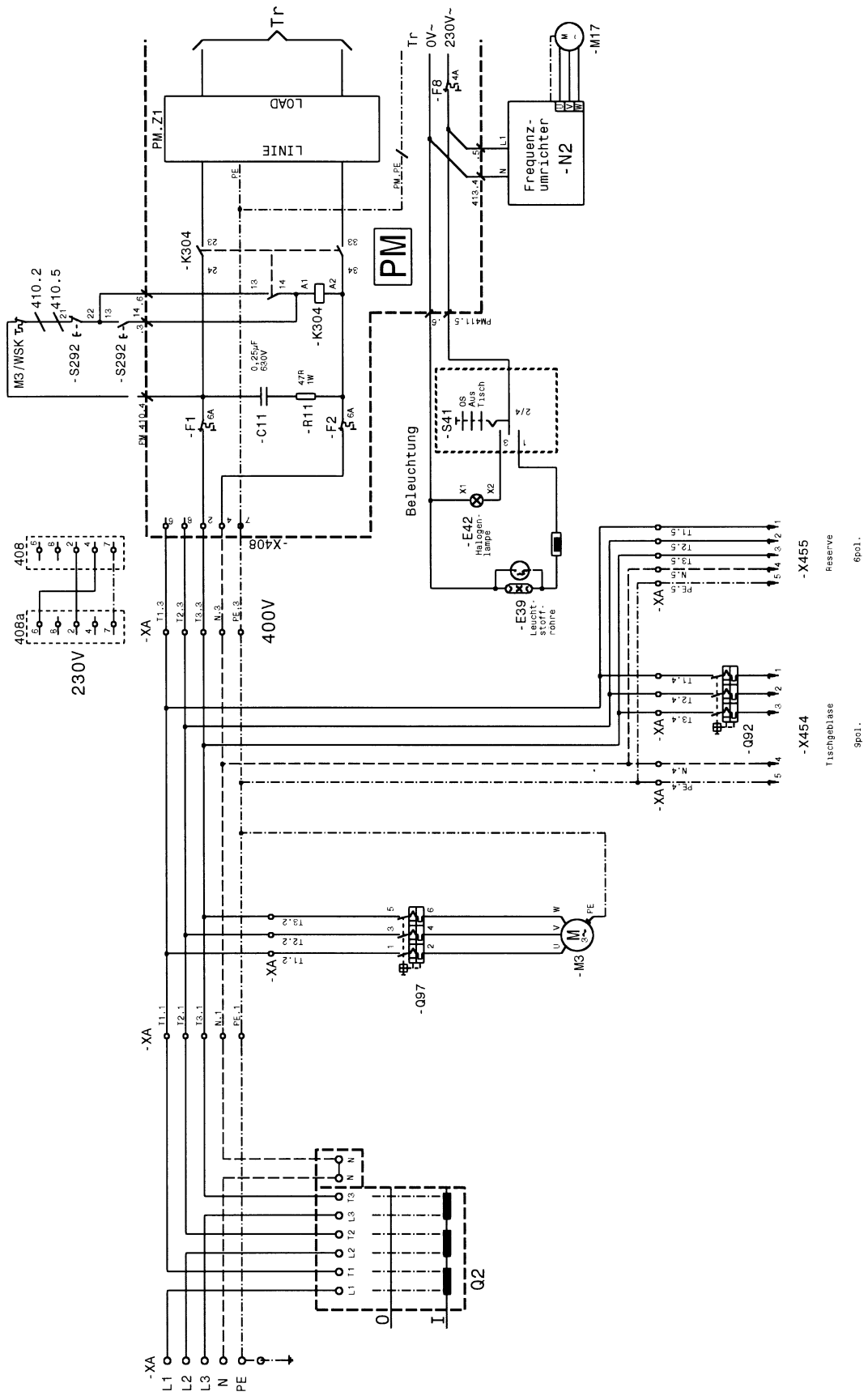
The Powermodul for the machine 78ES is a transformer with three different secondary windings and integrated rectifiers for the voltage:

- + 8V = (Si1 1AT)
- + 25V.= (Si2 5AT)
- + 24V = (Si3 1AT)

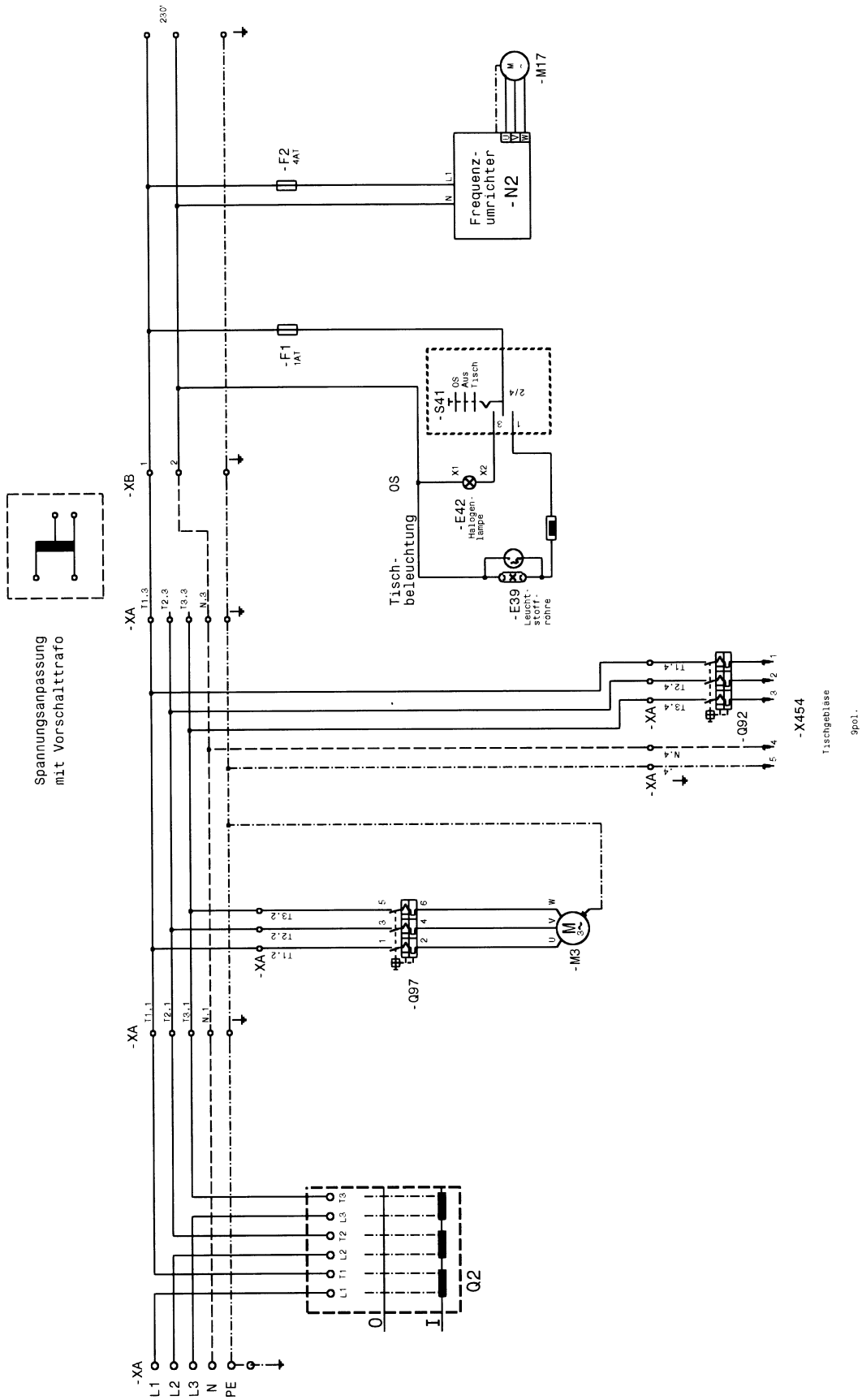
The power supply unit G1 supplies + 5V =, + 12V = and G2 supplies +24V =



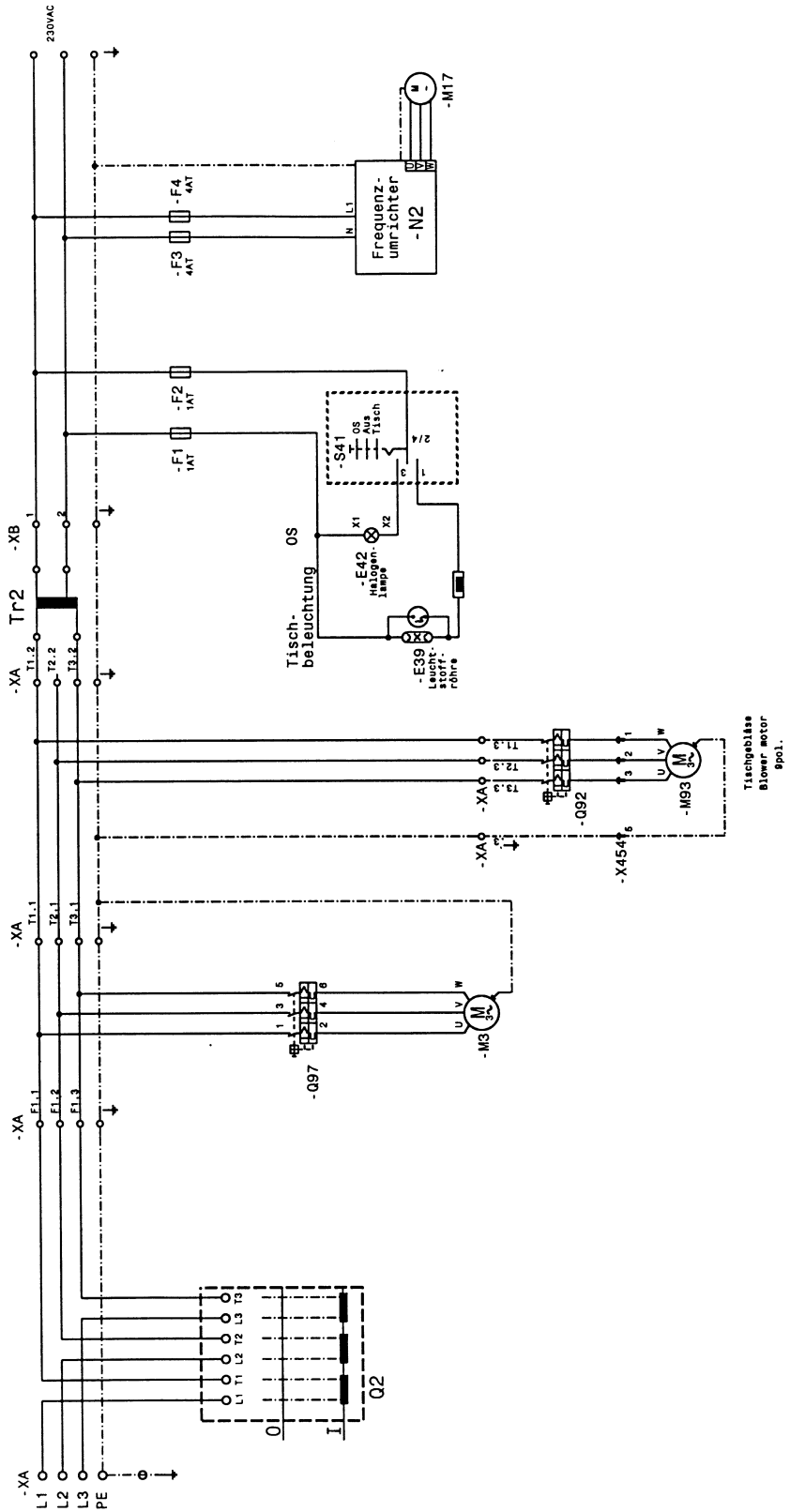
# Main drive 78 E



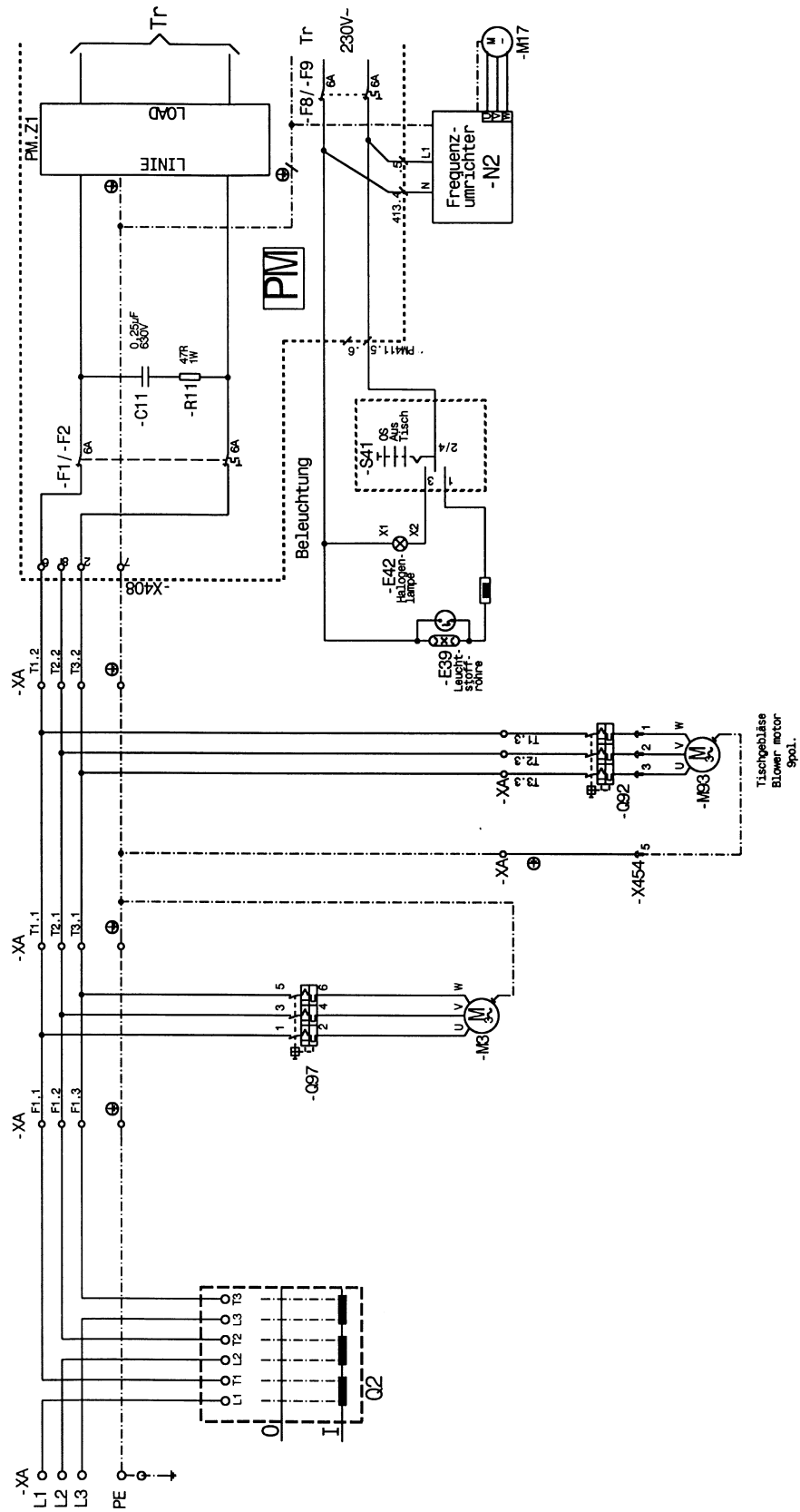
# Main drive 78 ES with neutral



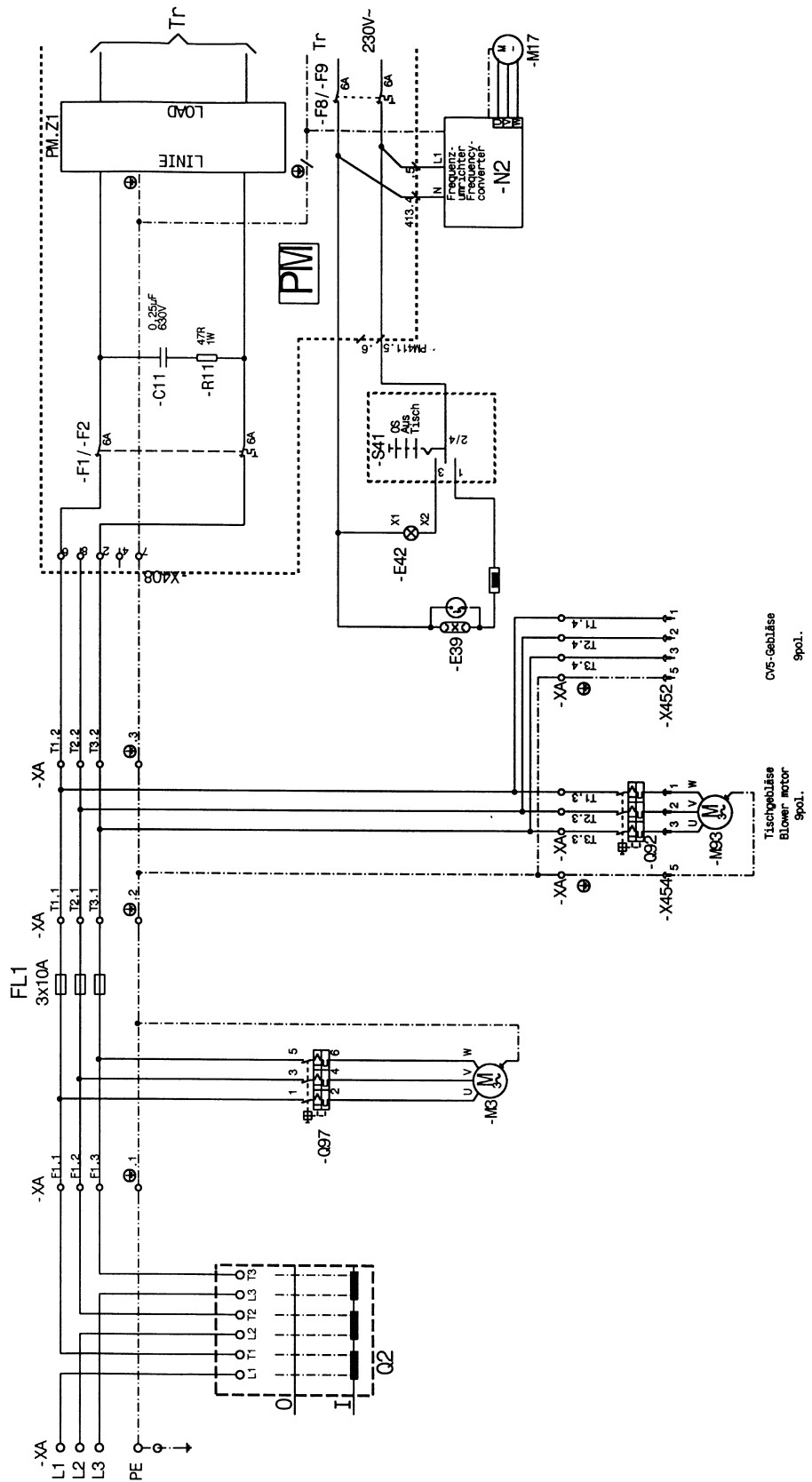
Main drive 78 ES without neutral



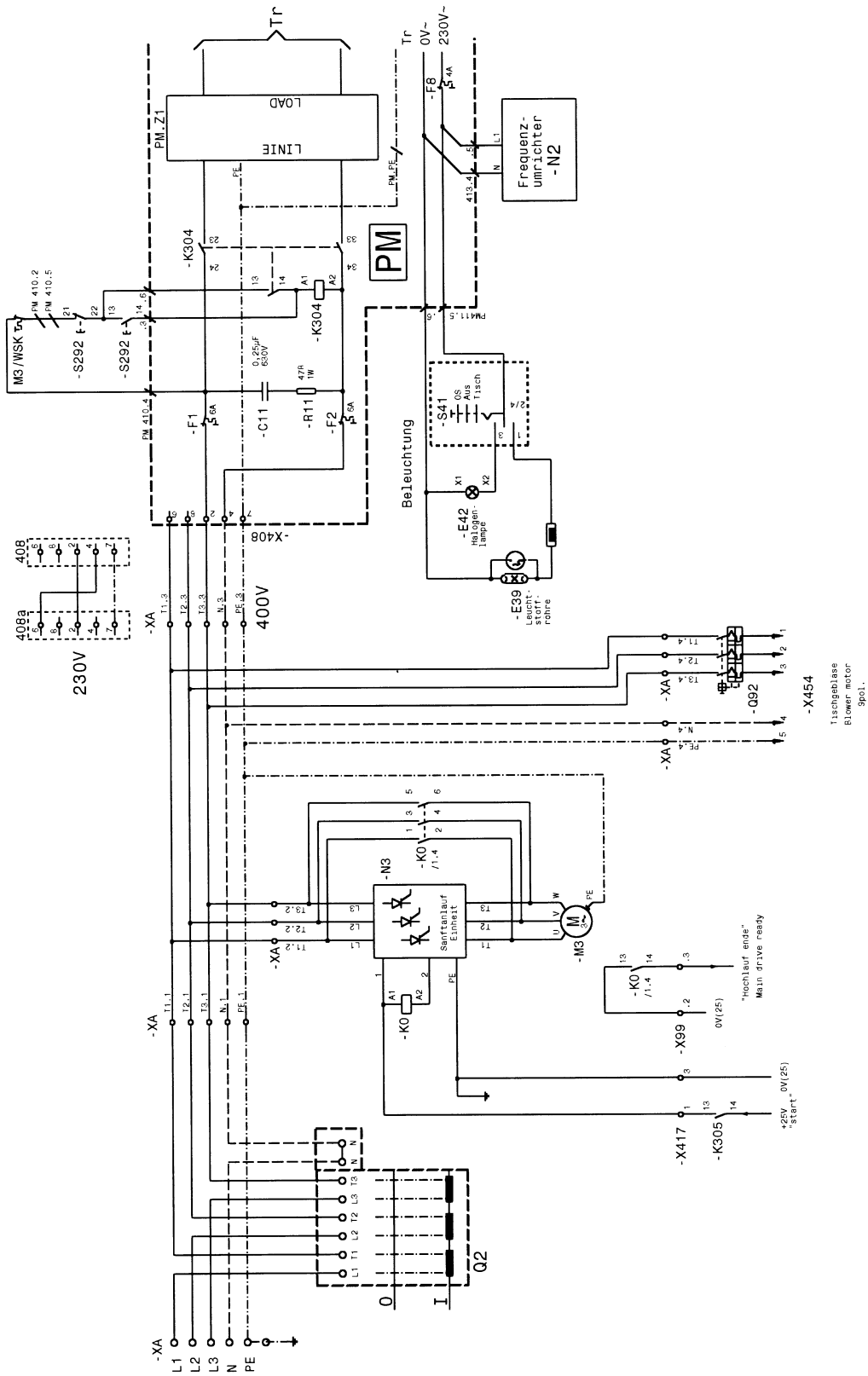
Main drive 78 ED without neutral



Main drive 78 ED without neutral USA / CSA

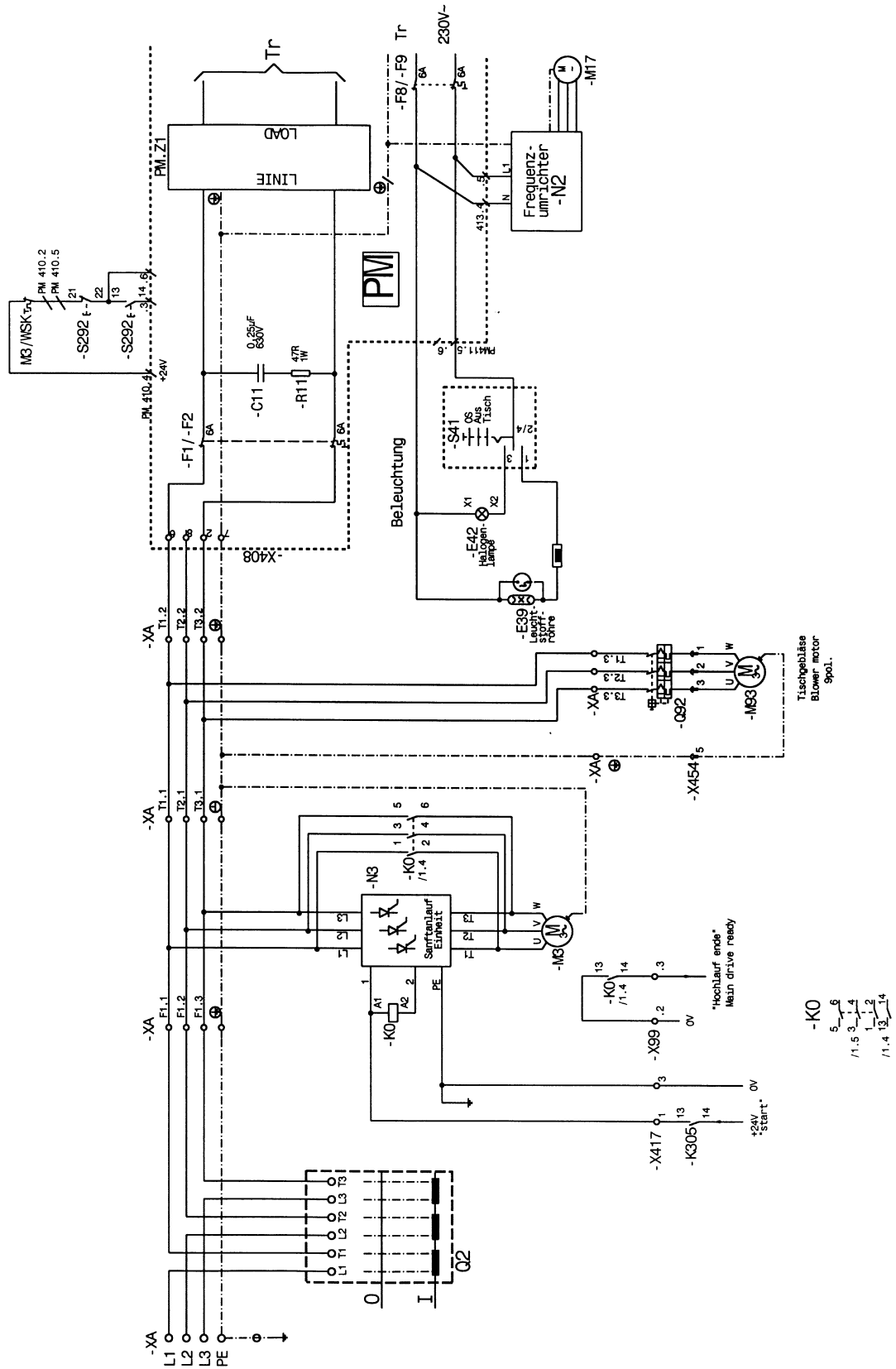


Main drive 92

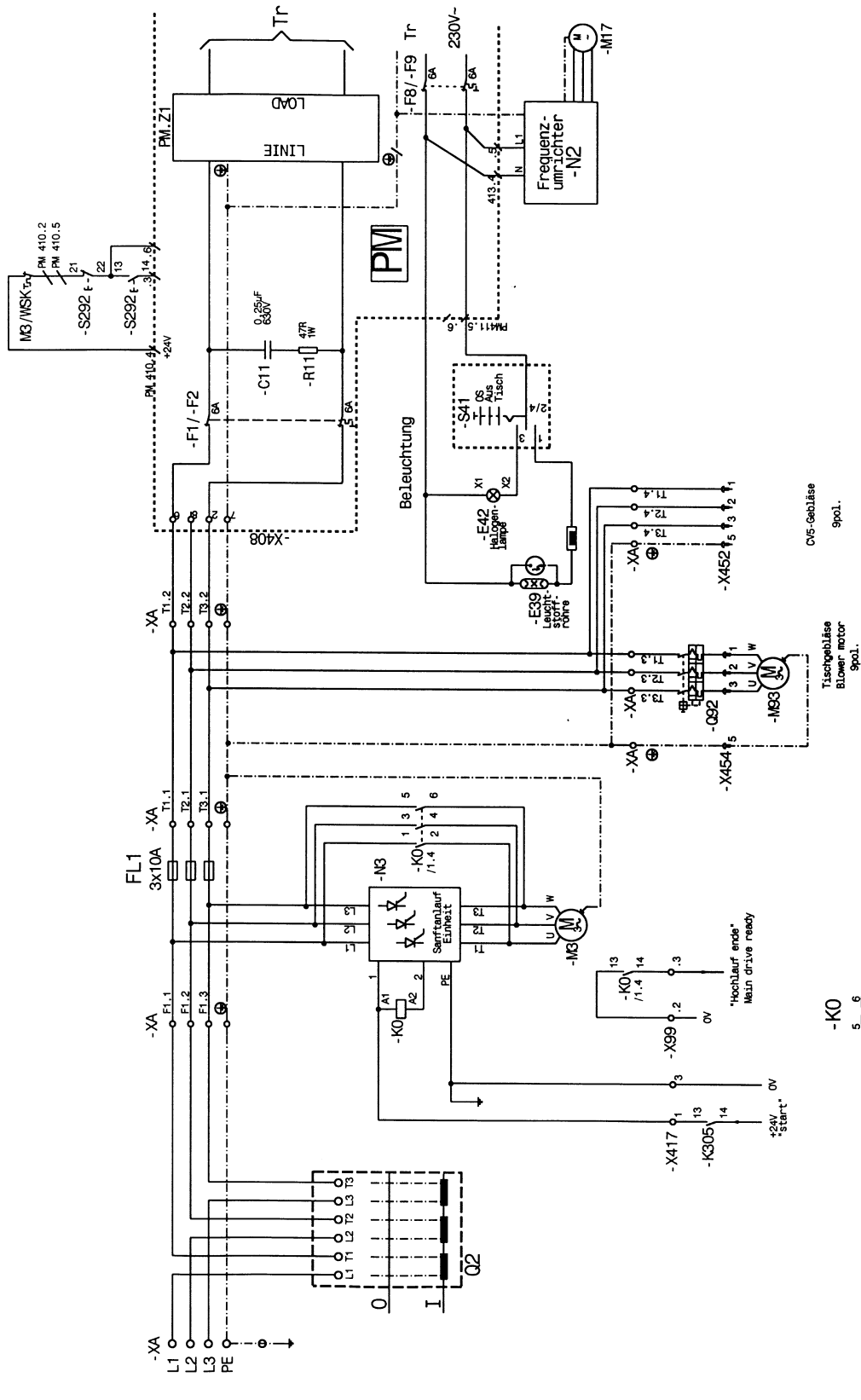


-X454  
Tischblase  
Blower motor  
Spol.

Main drive 92 beginning with 6911001

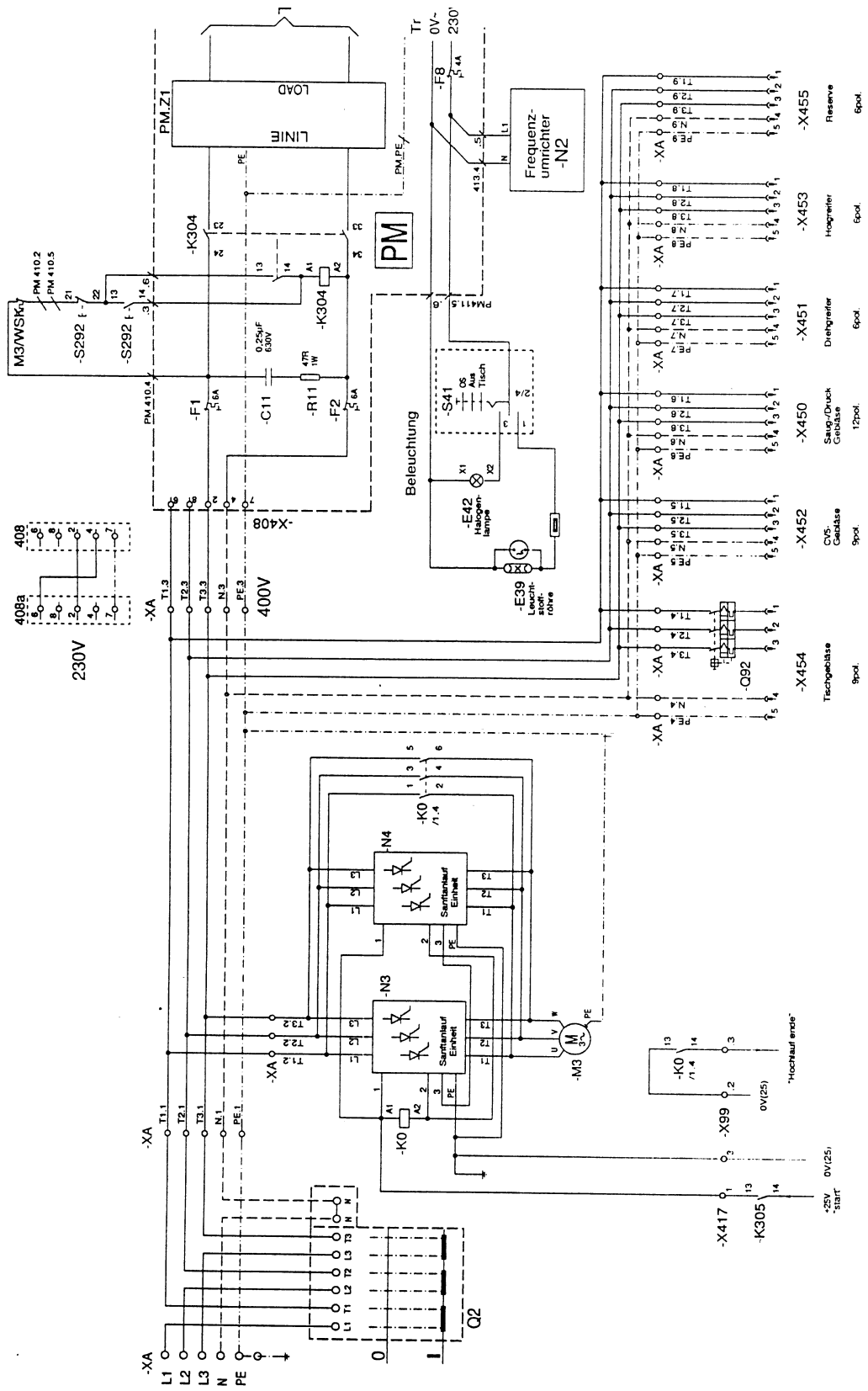


Main drive 92 USA/CSA beginning with 6911001

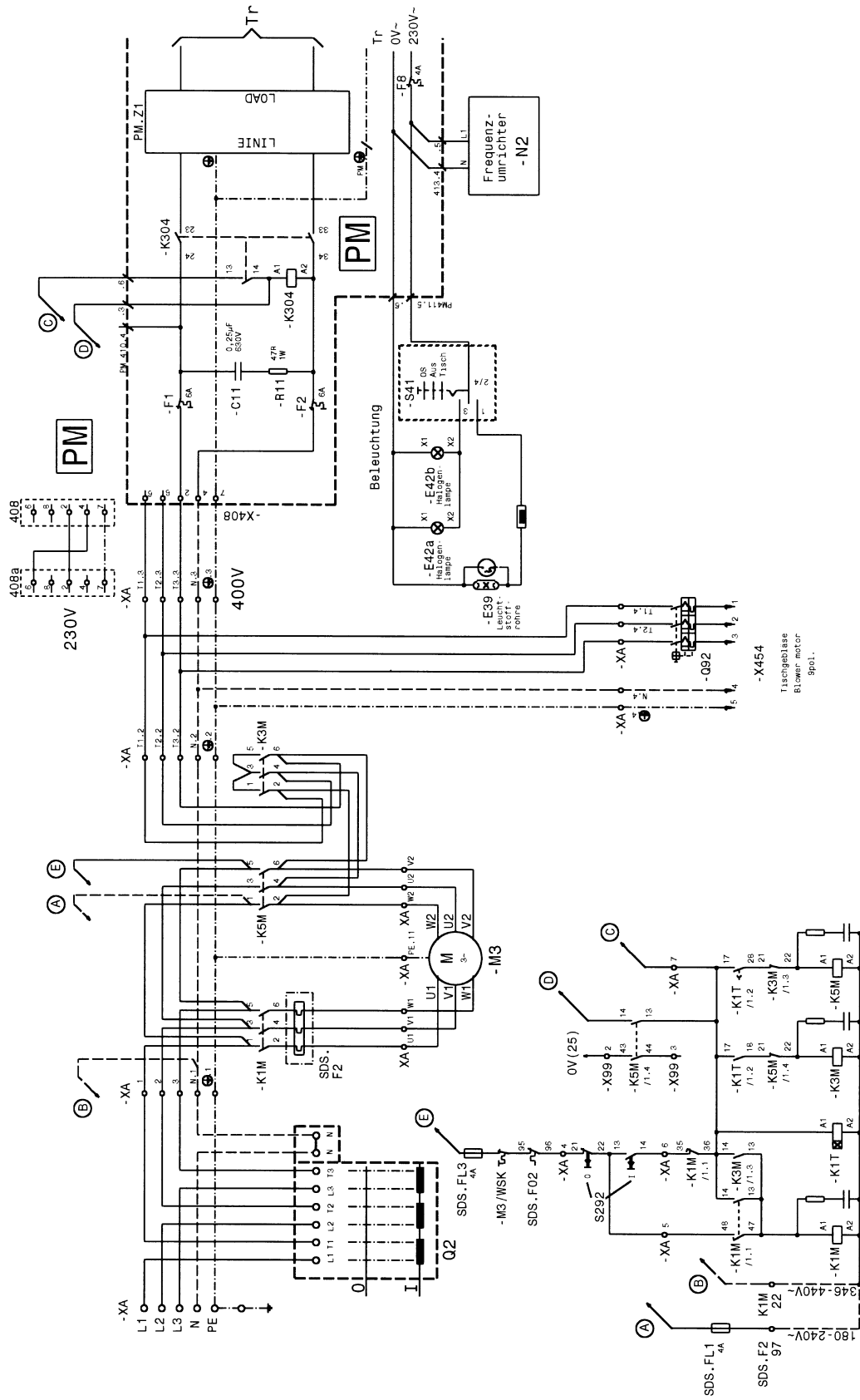


- KO 5, 6
- 1, 5 3, 4
- 1, 1, 2
- 1, 4 13, 14

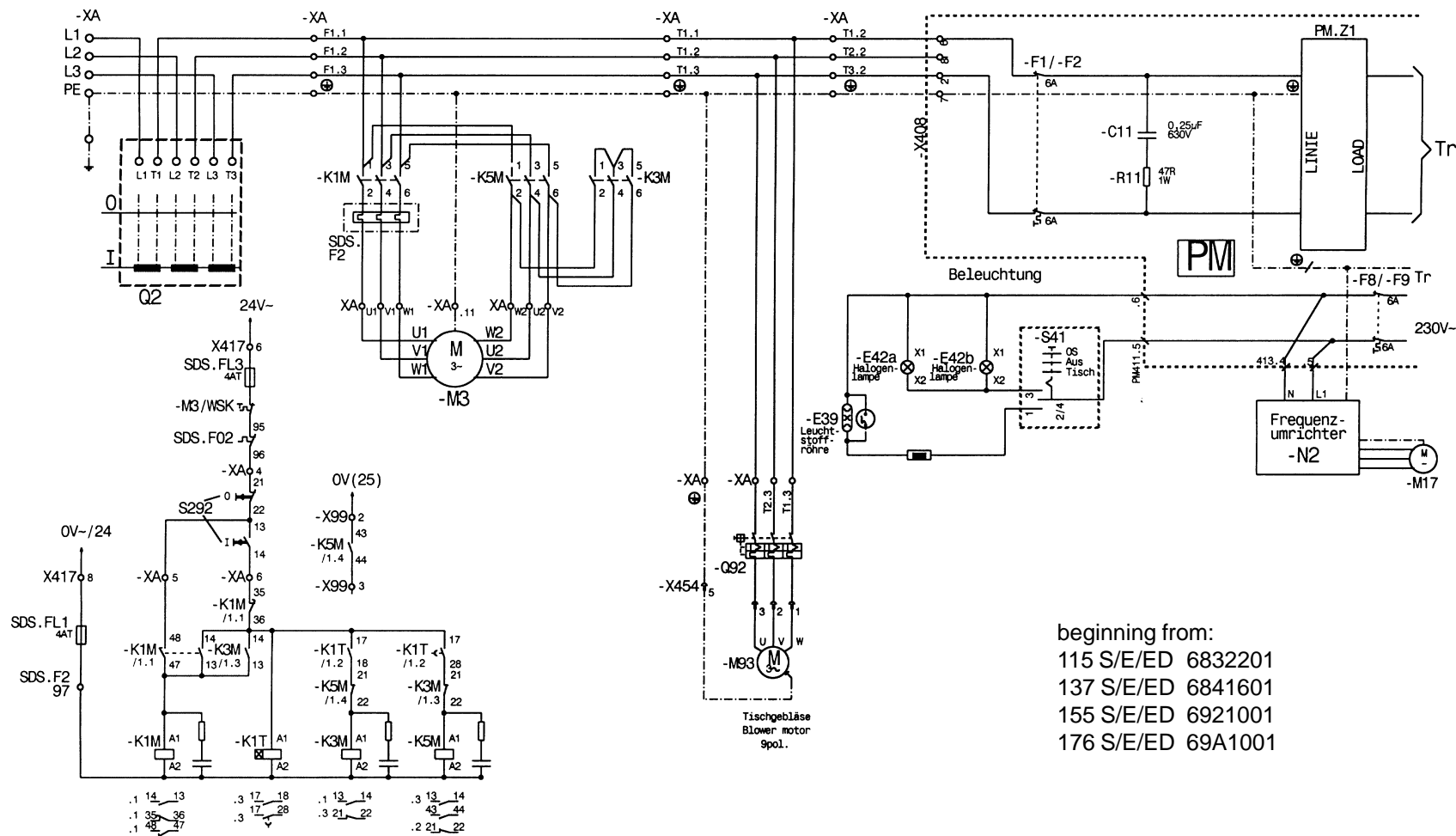
# Main drive 115 with Kimodul



Main drive 115 - 176 with star-delta-switch

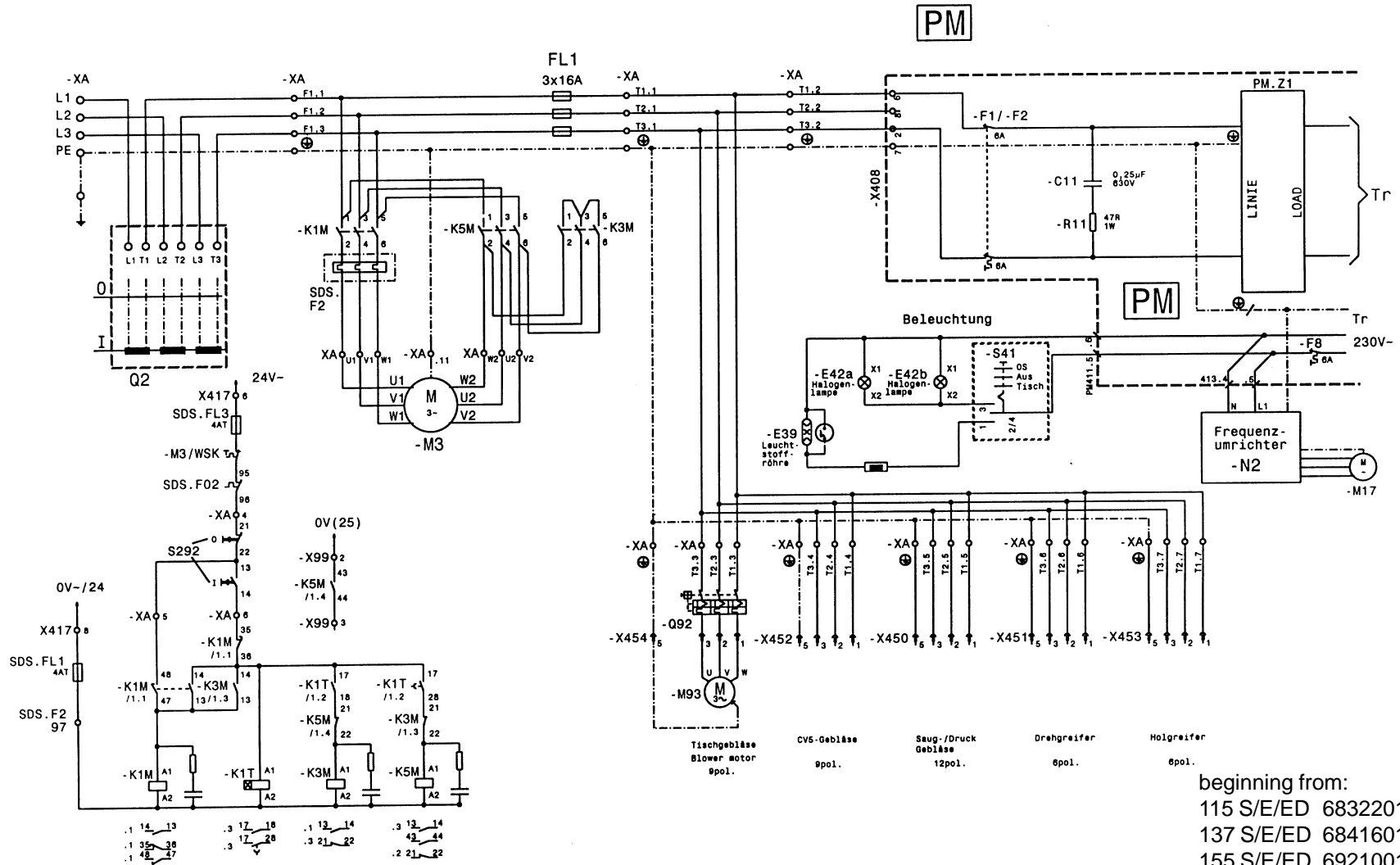


# Main drive 115 - 176 with star-delta-switch without neutral



beginning from:  
 115 S/E/ED 6832201  
 137 S/E/ED 6841601  
 155 S/E/ED 6921001  
 176 S/E/ED 69A1001

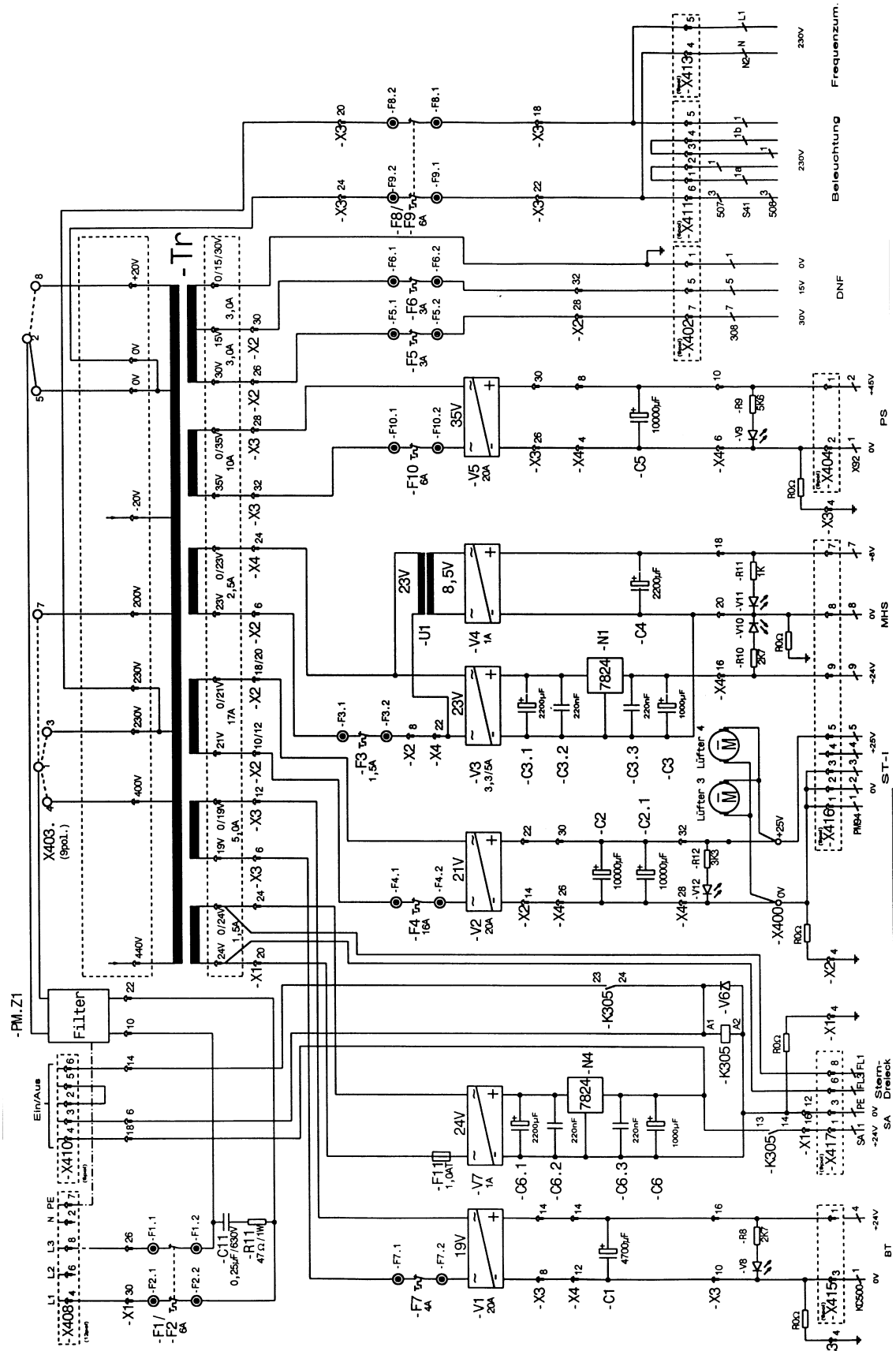
### Main drive 115 - 176 with star-delta-switch without neutral USA / CSA



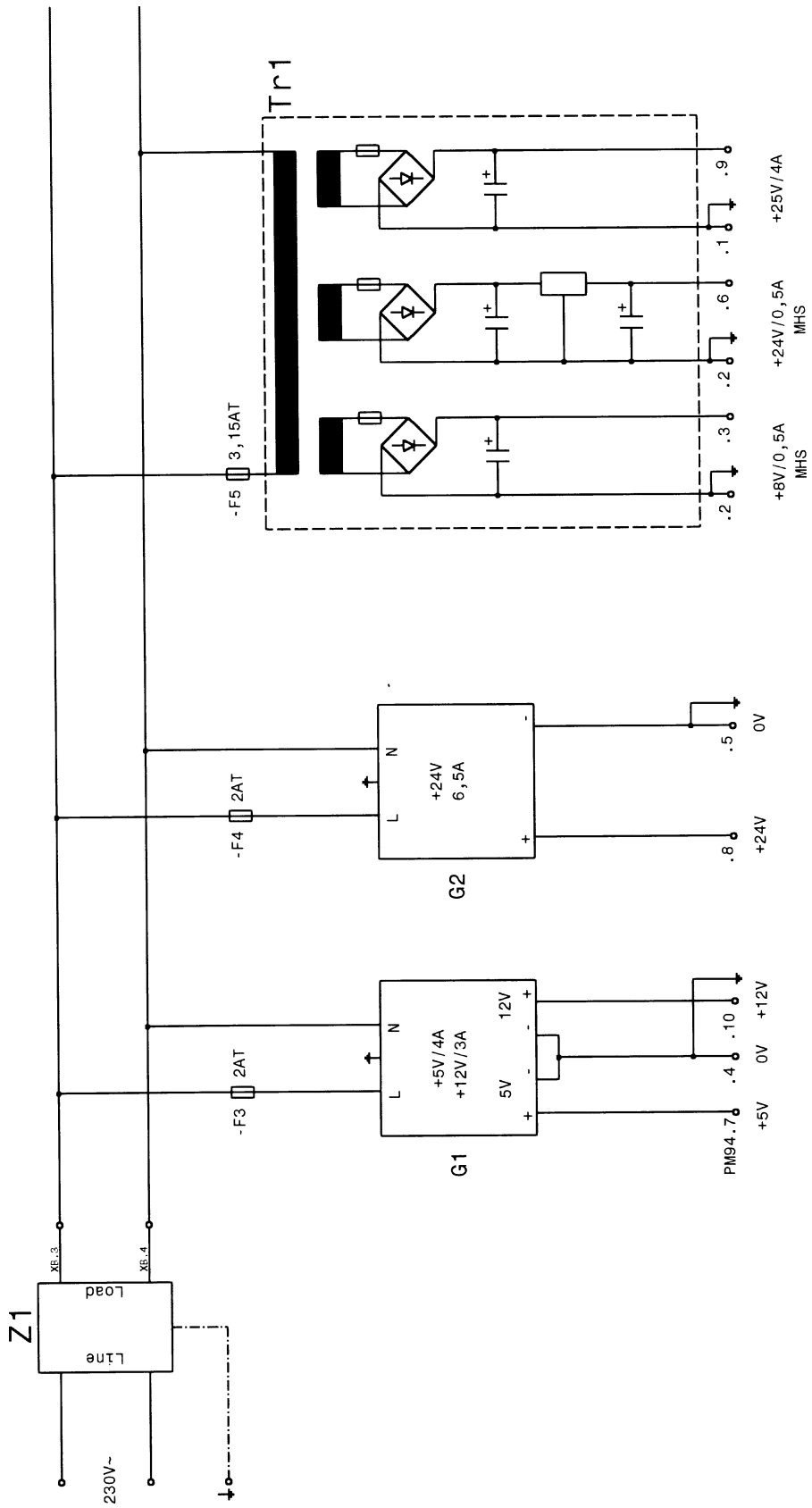
beginning from:  
 115 S/E/ED 6832201  
 137 S/E/ED 6841601  
 155 S/E/ED 6921001  
 176 S/E/ED 69A1001



Power modul 78 E, 78 ED and 92 - 176 without K304



**Power modul 78 ES**



### Power Supply 95 (PS95)

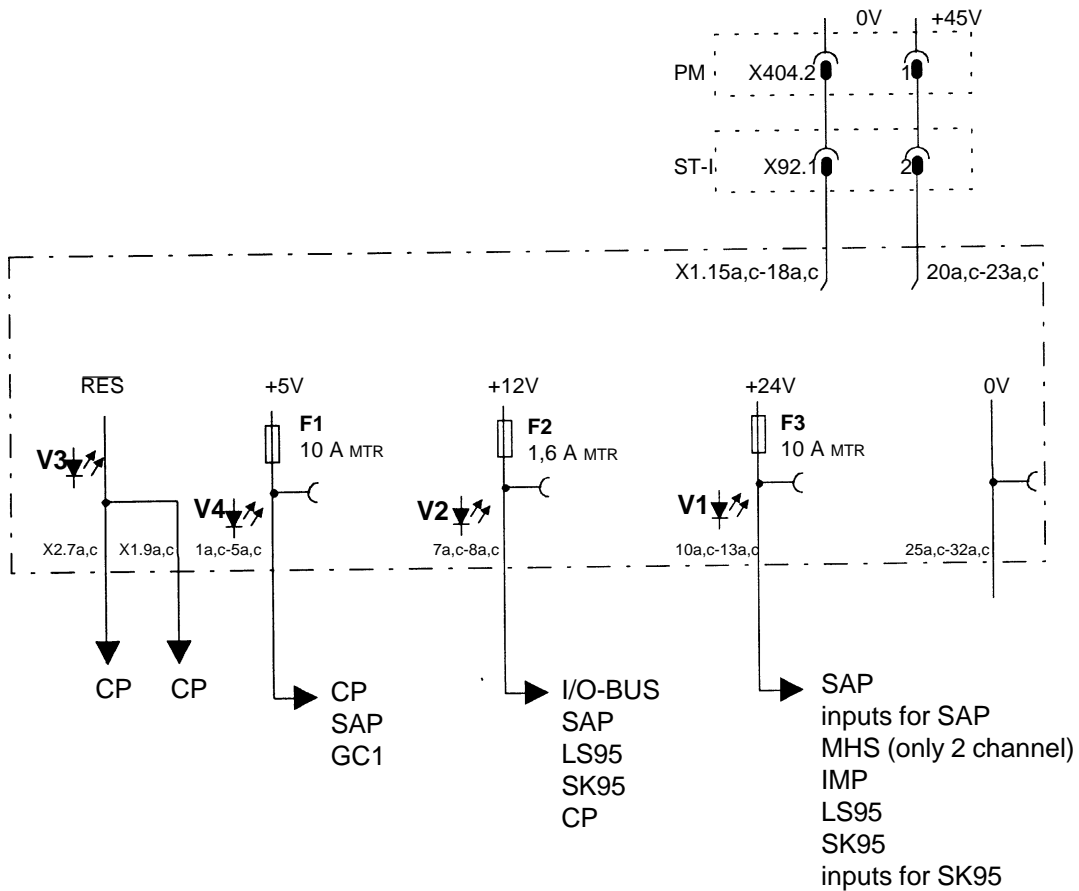
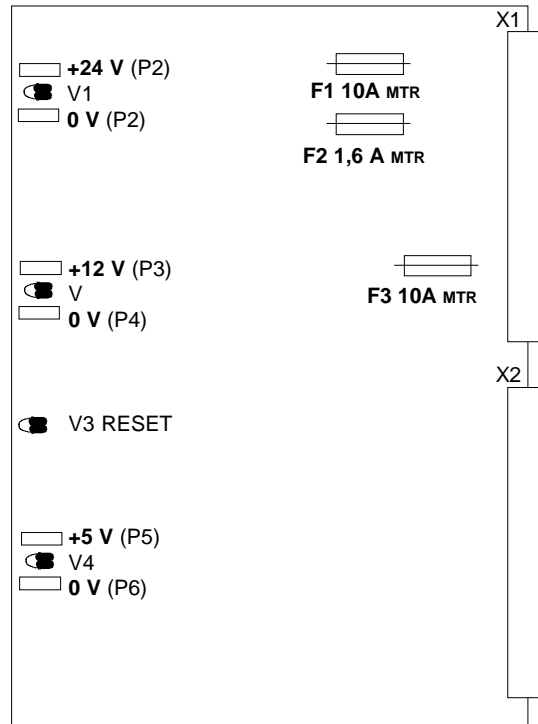
The power supply board PS95 supplies three stabilized voltages:

- +24 Vd.c. Tolerance 23.7 to 24.3 Vd.c.
- +12 Vd.c. Tolerance 11.4 to 12.6 Vd.c.
- +5 Vd.c. Tolerance 5.08 to 5.12 Vd.c.

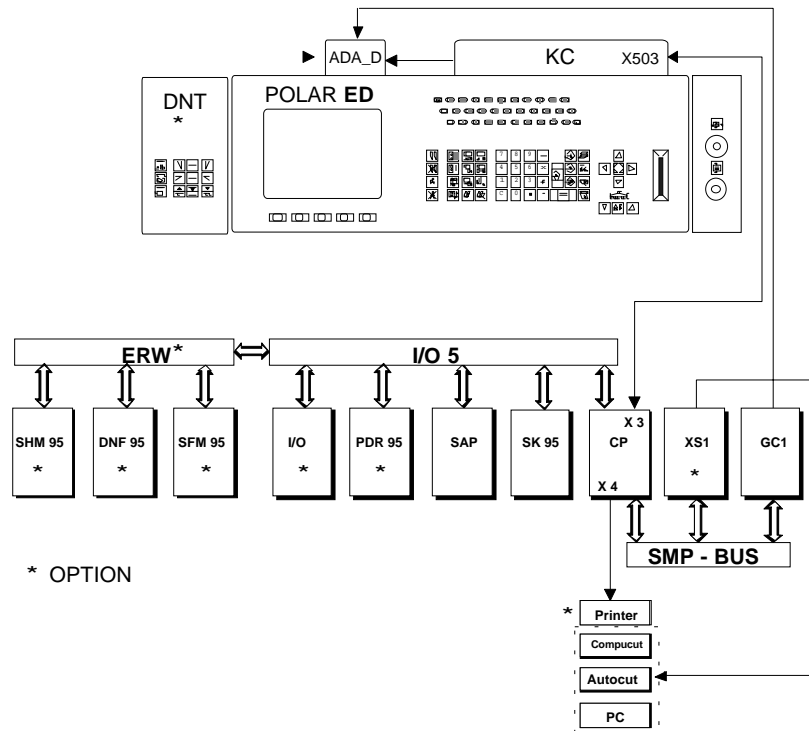
**The voltages cannot be adjusted!**

While the control voltage is switched on or off the board generates a reset signal to ensure a defined computer function. The reset signal can be noticed by a brief flash of red LED V3.

**Attention! This board is not compatible with the PS board from the monitor machine!**



### Structure of Controls

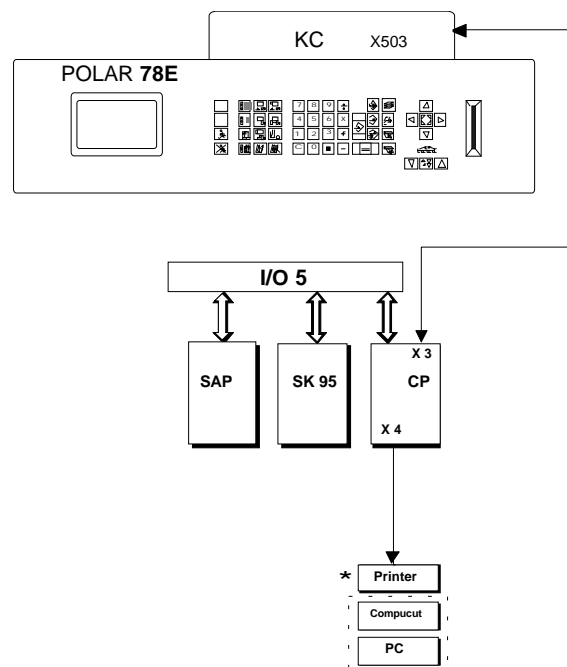


### Block diagram POLAR 92 - 176 E, ED (and 78 ED)

The block diagram illustrates the structural setup of controls of machine types 92 - 176 E and ED. Series 78 - 137 S and 78 E correspond to the right illustrated structure.

As specified in the block diagram, computer board CP is the core piece of the control system. The remaining plug-in boards are linked with the computer via two independent bus systems (I/O and SMP, resp.). Data is exchanged with the keyboard computer via serial interface X3 at the front side of the CP board. The second serial interface X4 of CP is deliberately configurable and allows the connection of any of the peripheral equipments indicated. Should any other serial connections or additional RAM storages be required, use board XS 1 (option).

Program data and information is indicated on three different types of display. The machines of lines „S, 78 E and 78 ES“ are fitted with an LCD display (240 x 128), types E and ED can be equipped with a plasma panel or a TFT colour display. These two displays have a resolution of 640 x 480 pixels.



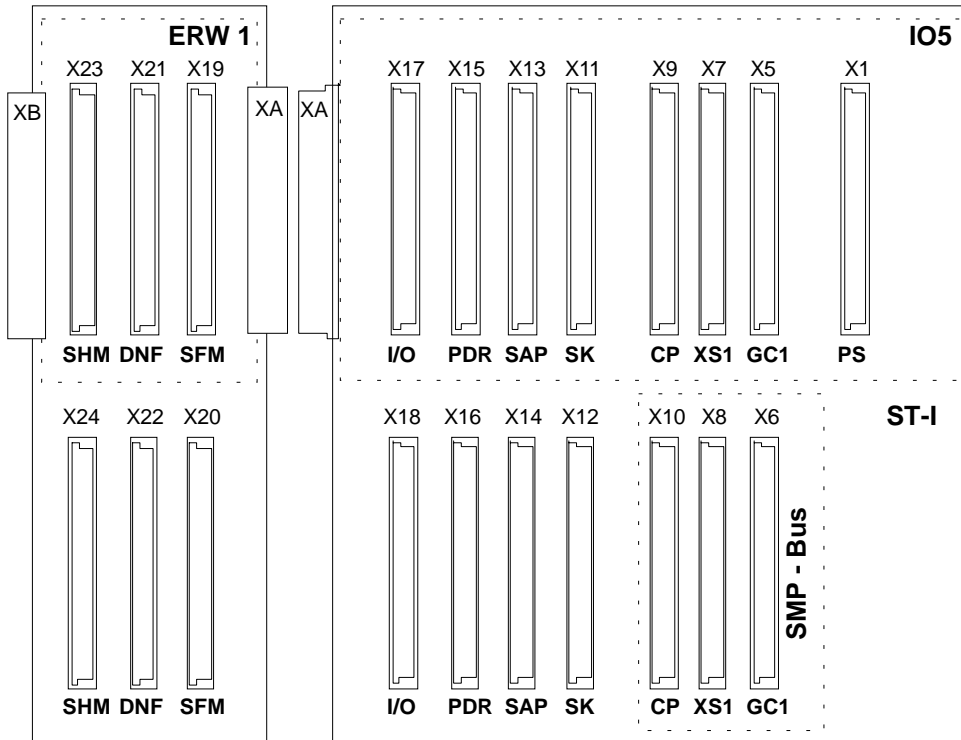
### Block diagram POLAR 78 E, 78 ES

### Control unit with extension 1 for Polar 78 - 176 S, E and ED

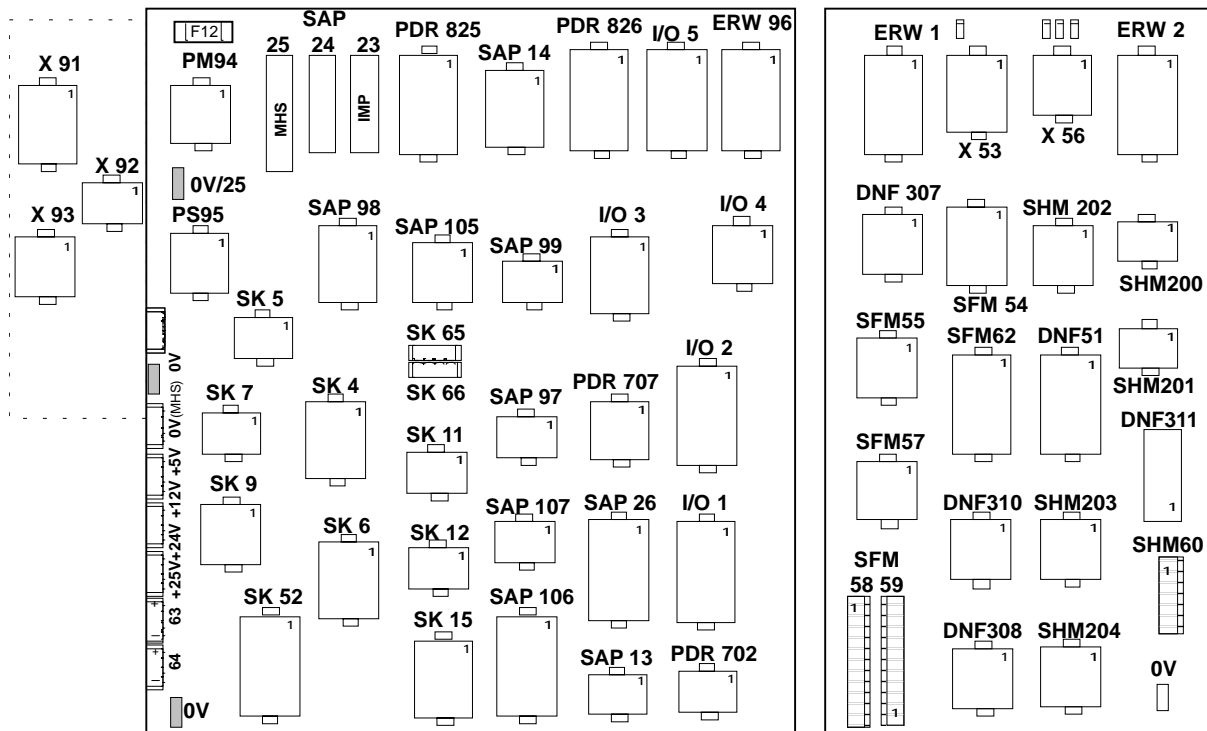
plug in board side

Extension 1

Control unit

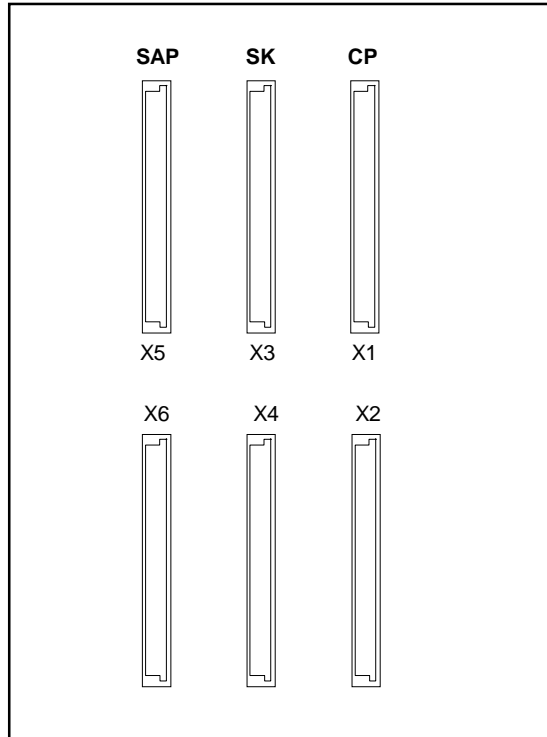


plug side

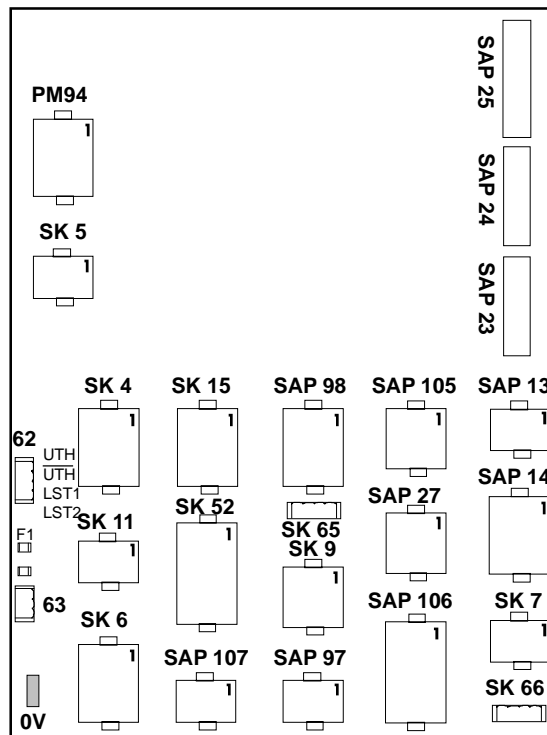


### Control unit Polar 78 ES

The control unit CU 78ES has the plug in spaces for CP, SK95 and SAP.  
**plug in board side**



plug side



### Central Processor CP

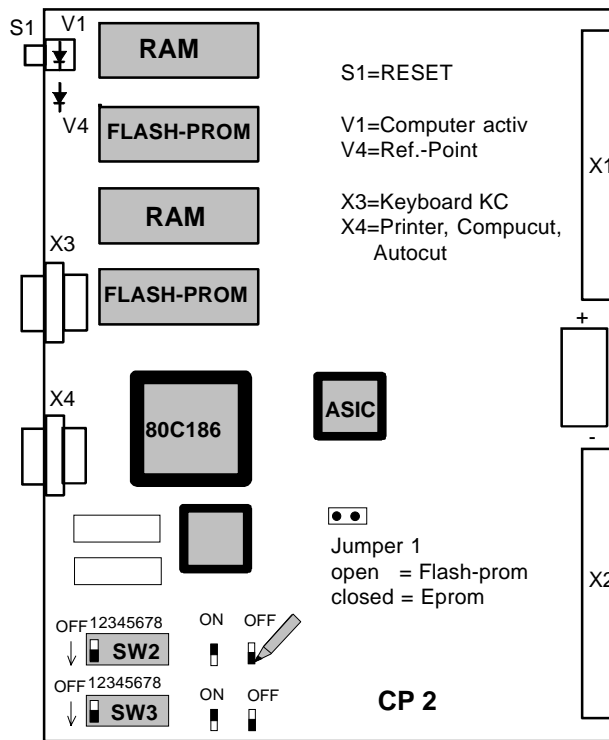
Computer board CP is fitted with a microprocessor type 186 which determines the complete machine cycle by means of two independent bus systems as well as two serial interfaces.

The software is stored in EPROMs or Flash-EPROMs. The use of Flash-EPROMs offers the advantage to install new software programs very easily by using the Download Card (Download CP and/or KC).

Board CP is linked with the boards on the left-hand side (SK 95; SAP; PDR 95; I/O; SFM 95; DNF 95; SHM 95) by the I/O bus.

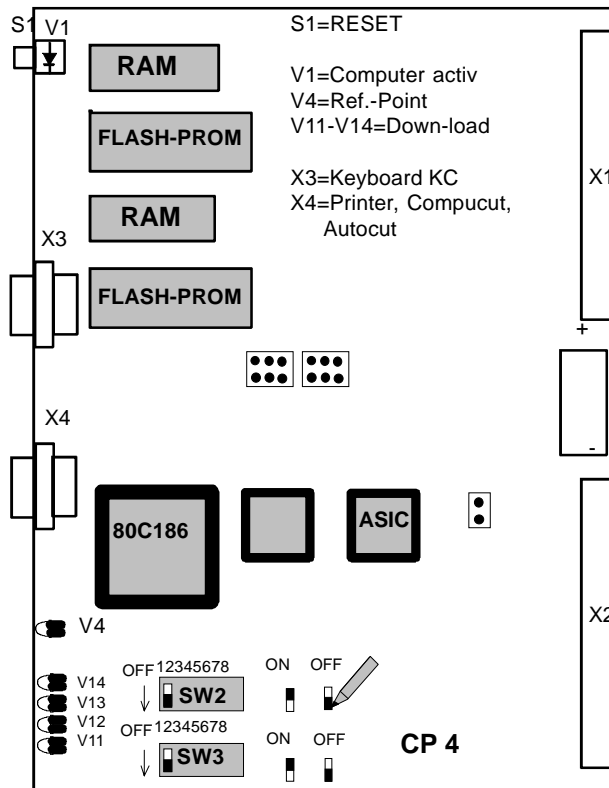
Linkage with the right-hand side (XS 1 and GC 1) is established by the SMP bus (µP bus).

The board accommodates also RAM components buffered by a 3.6 Vd.c. lithium battery which contain cutting program memories „A“ and „B“ as well as the variable machine data.



**The front side of the board comprises:**

1. A reset key with integrated LED V1 „LED - ON = computer active“
2. LED V4 which indicates recognition of a reference point for backgauge positioning by briefly lighting up
3. Plug X 3 for serial interface of keyboard controller (KC) on the keyboard
4. Plug X 4 is the second serial interface and can be configured via DIP switch SW 2.
5. The Dip - Switch SW 2 serves for the adjustment to the machine versions as well as the display version (see table).
6. The Dip - Switch SW 3 serves for the selction of the default language, measurement unit and beginning with V4.0 the preselection of the options autotrim and down-holder in front of the knife (see table).



The program memory capacity: 99 programs per memory. Memory utilization is indicated in %.

**The following information is part of the variable machine data:**

Backgauge position, brake afterrun, creepage distance, table end, knife position, knife afterrun, selected language, selected measuring unit, selected program as well as cut, cut counter etc.

The counting signals from backgauge positioning as well as the knife position are evaluated by a special component (Asic) accommodated on board CP.

### Software-Version

CP	KC	Changings
CP2 - Datum	KC2 - V1.0	February 1995 to April 1995
CP2 - V1.0	KC2 - V1.0	April 1995
CP2 - V1.3	KC2 - V1.3	Window-Technique
CP2 - V1.3c	KC2 - V1.3	Light barrier Test changed
CP2 - V1.3d	KC2 - V1.3	new Display
CP2 - V1.4.0	KC2 - V1.4	new languages, new functions, new GC1 necessary
CP2 - V1.4.2	KC2 - V1.4	changed counting function of MHS-signals
CP2 - V1.4.3	KC2 - V1.4	custom made programm-versions
CP2 - V1.4.4	KC2 - V1.4	custom made programm-versions
CP2 - V1.4.5-13	KC2 - V1.4	changed handling of error message 608
CP2 - V2.1.	Bed66 - V2.1	for 66E only
CP4 - V3.0	KC4 - V3.0 Bed66 - V3.0 Bed78 - V3.0	78 ED and 92 E/ED to 176 E/ED for 66E only for 78 ES only
CP4 - V3.0-13	KC4 - V3.0 Bed66 - V3.0 Bed78 - V3.0	changed handling of error message 608 78 ED and 92 E/ED to 176 E/ED for 66E only for 78 ES only
CP5 - V4.0	KC5 - V4.0 Bed66 - V4.0 Bed78 - V4.0	78 ED and 92 E/ED to 176 E/ED for 66E only for 78 ES only

### DIP - Switch SW2 and SW3 at CP

**Preset of SW 2:**

- Machine type
- Display version
- Service program
- optimized cut
- presetting of plug X4
- Selection of knife change version

**Preset of SW 3:**

- Language selection
- Option down-holder in front of knife
- Option Autotrim installed
- Measuring unit

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
66	ON	ON	ON					
S 78-137 LCD-Display	OFF	OFF	OFF					
78 E, ES, ED LCD / TFT	ON	OFF	OFF					
E 92-176 mono Display without Alphakeys	OFF	ON	OFF					
E 92-176 color Display without Alphakeys	ON	ON	OFF					
ED 92-176 mono Display with Alphakeys	OFF	OFF	ON					
ED 92-176 color Display with Alphakeys	ON	OFF	ON					
Service-Information				ON OFF				
Cutting optimization					ON OFF			
Interface Printer						OFF	OFF	
Interface Compucut						ON	OFF	
Interface Autocut						OFF	ON	
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
Language Nr. 1	OFF	OFF	OFF	OFF				
Language Nr. 2	ON	OFF	OFF	OFF				
Language Nr. 3	OFF	ON	OFF	OFF				
Language Nr. 4	ON	ON	OFF	OFF				
Language Nr. 5	OFF	OFF	ON	OFF				
Language Nr. 6	ON	OFF	ON	OFF				
Language Nr. 7	OFF	ON	ON	OFF				
Language Nr. 8	ON	ON	ON	OFF				
Language Nr. 9	OFF	OFF	OFF	ON				
down-holder in front of knife					OFF ON			
autotrim installed						OFF ON		
Measuring unit cm							OFF	OFF
Measuring unit mm							ON	OFF
Measuring unit inch							OFF	ON
Measuring unit Sun							ON	ON

### Available text versions for software version V1.x.x (CP2)

Text1	Text2	Text3	Text4	Text5	Text6
D German	D German	D German	D German	D German	D German
GB English	GB English	GB English	GB English	GB English	GB English
F French	F French	F French	F French	F French	F French
E Spanish	E Spanish	E Spanish	E Spanish	E Spanish	E Spanish
I Italian	I Italian	H Hungarian	IL Hebrew	<u>A Arabic</u>	J Japanese
DK Danish	P Portuguese	PL Polish	<u>A Arabic</u>	T Tagalog	<u>ROC Korean</u>
SF Finnish	TR Turkish	CZ Chzech		PTM Bahasa	<u>T Thai</u>
S Swedish	<u>GR Greek</u>			PI Bahasa	<u>CHI Chinese</u>
N Norwegian				NL Dutch	<u>RC Chinese</u>

The textversions that have been **marked** are **NOT** available for Modell 78.

### Available text versions for software version V1.4.x.x (CP2)

Text1	Text2	Text3	Text4	Text5	Text6	Text7	Text8
D German	D German	D German	D German	D German	D German	D German	D German
GB English	GB English	GB English	GB English	GB English	GB English	GB English	GB English
F French	F French	F French	F French	F French	F French	F French	NL Dutch
S Spanish	S Spanish	S Spanish	S Spanish	S Spanish	S Spanish	S Spanish	<u>CHI Chinese</u>
I Italian	I Italian	H Hungarian	IL Hebrew	<u>A Arabic</u>	J Japanese	<u>CHI Chinese</u>	RP Tagalog
DK Danish	NL Dutch	PL Polish	<u>A Arabic</u>	RP Tagalog	<u>ROK Korean</u>	<u>T Thai</u>	PTM Bahasa
SF Finnish	P Portuguese	CZ Chzech	RP Tagalog	<u>IR Farsi</u>		<u>RC Chinese</u>	RI Bahasa
S Swedish	TR Turkish	RUS Russian					<u>RC Chinese</u>
N Norwegian	<u>GR Greek</u>	RO Romanian					

The textversions that have been **marked** are **NOT** available for Modell 78.

### Available text versions for software version V3.x.x (CP4)

Text1	Text2	Text3	Text4	Text5	Text6	Text7	Text8
D German	D German	D German	D German	D German	D German	D German	D German
GB English	GB English	GB English	GB English	GB English	GB English	GB English	GB English
F French	F French	F French	F French	F French	F French	F French	NL Dutch
S Spanish	S Spanish	S Spanish	S Spanish	S Spanish	S Spanish	S Spanish	CHI Chinese
I Italian	I Italian	H Hungarian	IL Hebrew	A Arabic	J Japanese	CHI Chinese	RP Tagalog
DK Danish	NL Dutch	PL Polish	A Arabic	RP Tagalog	ROK Korean	T Thai	PTM Bahasa
SF Finnish	P Portuguese	CZ Chzech	RP Tagalog	<u>IR Farsi</u>		RC Chinese	RI Bahasa
S Swedish	TR Turkish	RUS Russian					RC Chinese
N Norwegian	<u>GR Greek</u>	RO Romanian					

The text versions that have been **marked** are **ONLY** available for color-displays.

### Available text versions for software version V4.x.x (CP5)

Text1	Text2	Text3	Text4	Text5	Text6	Text7	Text8	Text9
D German	D German	D German	D German	D German	D German	D German	D German	D German
GB English	GB English	GB English	GB English	GB English	GB English	GB English	GB English	GB English
F French	F French	F French	F French	F French	F French	F French	NL Dutch	H Hungarian
S Spanish	S Spanish	S Spanish	S Spanish	S Spanish	S Spanish	S Spanish	CHI Chinese	CZ Chzech
I Italian	I Italian	H Hungarian	IL Hebrew	A Arabic	J Japanese	CHI Chinese	RP Tagalog	RUS Russian
DK Danish	NL Dutch	PL Polish	A Arabic	RP Tagalog	ROK Korean	T Thai	PTM Bahasa	RO Romanian
SF Finnish	P Portuguese	CZ Chzech	RP Tagalog	<u>IR Farsi</u>		RC Chinese	RI Bahasa	YU Serb
S Swedish	TR Turkish	RUS Russian					RC Chinese	CRO Croatian
N Norwegian	<u>GR Greek</u>	RO Romanian						SLO Slovenian

The text versions that have been **marked** are **ONLY** available for color-displays.

## Backgauge Drive Positioning (SAP)

The SAP board is linked with computer CP via the I/O bus. The information input is signalled to the computer via this bus. The same bus is used for sending the output commands of the computer which are then transferred as output signals by the SAP board to the machine. The board also accommodates the decoding circuitry of the knife upstroke control (MHS 95) at the worm wheel shaft.

The SAP board includes the following functions which are indicated by LED's:  
yellow LED's indicate Inputs - red LED's indicate Outputs

LED	Colour	Meaning	Basic condition	SAP
V29	yellow	UT1(lower dead centre) of MHS 95	off	<input type="checkbox"/> MP1
V28	„	OT1(upper dead centre) of MHS 95	off	<input type="checkbox"/> MP2
V27	„	UT (lower dead centre) of MHS 95	off	<input type="checkbox"/> P1/0V (Offset)
V26	„	OT (upper dead centre) of MHS 95	on	<input type="checkbox"/> V29
V6	red	Backgauge motor brake Y17 on (free)	off	<input type="checkbox"/> V28
V5	yellow	End posit. at front, with false clamp plate and Fixomat	off	<input type="checkbox"/> V27
V4	red	not used	off	<input type="checkbox"/> V26
V3	„	Control signal backgauge return for frequency converter	off	<input type="checkbox"/> V6
V2	„	Control signal backgauge advance for frequency converter	off	<input type="checkbox"/> V5
V1	„	Enabling signal for FU*	off	<input type="checkbox"/> V4
V25	yellow	0° signal from MHS 95	on/off	<input type="checkbox"/> V3
V24	„	90° signal from MHS	on/off	<input type="checkbox"/> V2
V23	„	Limit switch front (S9)	on	<input type="checkbox"/> V1
V22	„	Fixomat active	off	<input type="checkbox"/> V25
V21	„	Limit switch rear (S 13)	on	<input type="checkbox"/> V24
V20	„	Handwheel precision adjustment (S 18)	off	<input type="checkbox"/> V23
V19	„	„ „ „ (S 14)	off	<input type="checkbox"/> V22
V18	„	„ „ „ (S 10)	off	<input type="checkbox"/> V21
V17	„	Pedal switch (S390)	off	<input type="checkbox"/> V20
V16	„	False clamp detection 3 (S 218b)	off	<input type="checkbox"/> V19
V15	„	False clamp detection 2 (S 218)	off	<input type="checkbox"/> V18
V14	„	False clamp detection 1 (S 6)	off	<input type="checkbox"/> V17
V13	„	Limit switch front slowly (S 7)	on	<input type="checkbox"/> V16
V12	„	Limit switch rear slowly (S 13a)	on	<input type="checkbox"/> V15
				<input type="checkbox"/> V14
				<input type="checkbox"/> V13
				<input type="checkbox"/> V12

### The following input and output signals are not indicated by LEDs:

(indicated on the display in the „Service“ section)

Input	from switch B 340 for knife wrench (cover plate in front of knife lift)
Inputs	from pulse generator = 0° signal, 90° signal and reference point
Input	from „mechanical“ reference point B 341 (proximity switch below table)
Input	error signal from FU
Input	error signal from table motor (thermal protection contact)
Input	„upstroke terminated“ from control unit of main motor (SDS or KIMODUL)
Input	„Backgauge advance“ movement blocked by external device“ (Transomat 3BL, gripper systems)
Output	Control signal to FU (0 to +10 Vd.c.)
Output	UTH from knife upstroke control to SK 95
Output	UTH neg. from knife upstroke control to SK 95
Output	Counting pulses from knife upstroke control to CP (knife position)

## Calibration Instructions for SAP Board during Operation with Frequency Converter

(Valid for all machines with frequency converter)

1. Connect a digital multimeter to measuring points MP1 (+) and MP2 (-).
2. Activate one time the backgauge movement
3. Use potentiometer P1 to set a voltage of 0.0 V (+/-0.1) (offset) with the control system switched on.
4. Perform a reference run.

### Activation of frequency converter by card SAP

The frequency converter is activated by card SAP 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> FU	manual slow approx. +3.3 V	manual fast approx. +6.6 V	position analogue approx. +10V
--------------------------------------	-------------------------------	-------------------------------	-----------------------------------

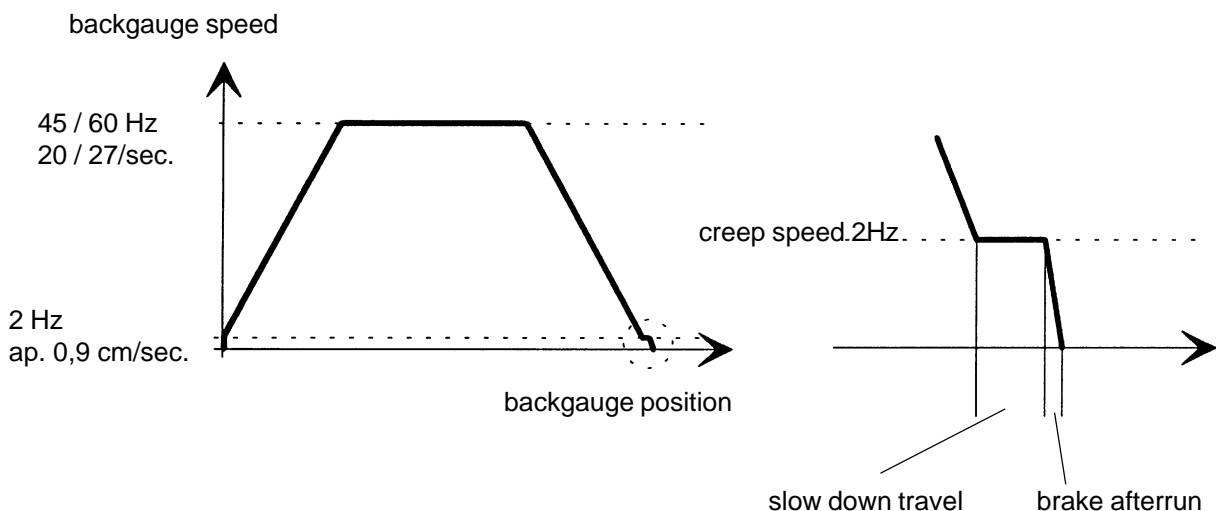
The control of the direction of rotation is also performed by card SAP and indicated by LEDs V3 (return movement) and V2 (advance movement), resp.

### 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 Vd.c. and supplies the SAP 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 board and supplied to computer card CP.

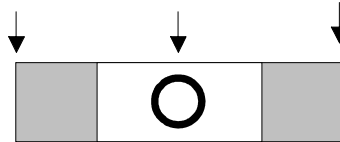
### Illustration of Backgauge Movement (Ramp)



### 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  
 B341 ON          IMP          B341 OFF

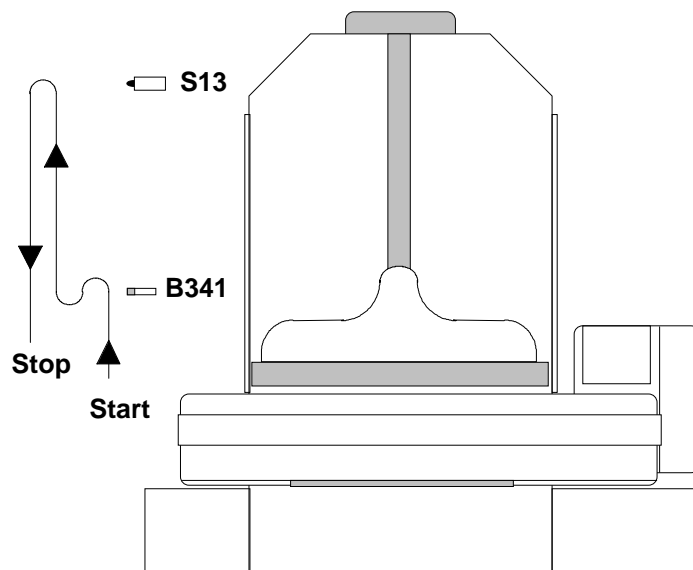


The left-hand number (53.635 cm) describes the connection of proximity switch B341 by the switching flag at the sledge. The number in the centre, (e.g. 54.256 cm) indicates the signal given by the pulse generator. The right-hand number (e.g. 54.671 cm) specifies the disconnection of proximity switch B341 by the switching flag at the sledge. The second (medium) number should be in the centre 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.

### 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 case, 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.



### 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. Direction 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.

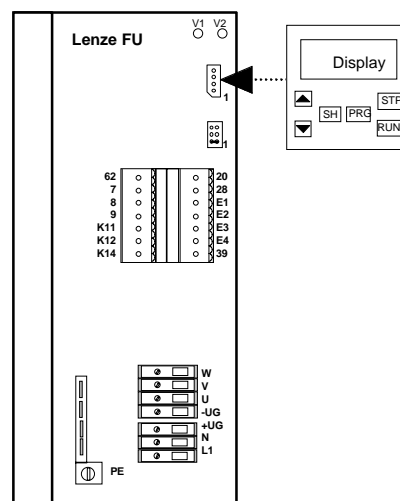
The backgauge motor brake (24 Vd.c.) is also activated from board SAP and indicated by LED V6. (The brake is the same type as on EMC and monitor machines.)

## 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 an 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 activ
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
<b>PRG+SH</b>	Attention! use only parameter 1 (PAR1) storing off adjusted parameter
<b>▼ / ▲</b>	scrolling in porgramming 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 SAP-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 Vd.c. from board SAP 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

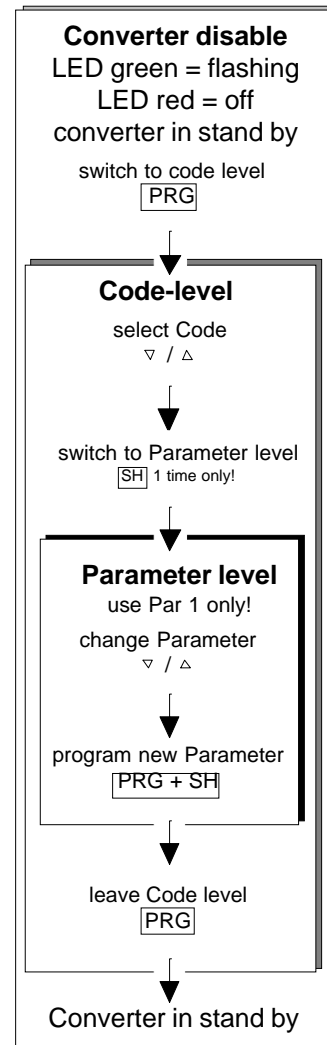
1. Press key „PRG“ of programming unit (switches from operating level to code level).
2. Use key „▼“ or „▲“ to select step C002.
3. Key „SH“ switches over to the display of the current value (parameter level).
4. Use any of keys „▼“ or „▲“ to select value 1.
5. Press keys „SH“ and „PRG“ simultaneously.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

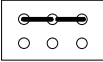
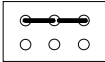
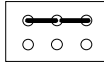

### Procedure for setting the parameter for POLAR cutters

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“.

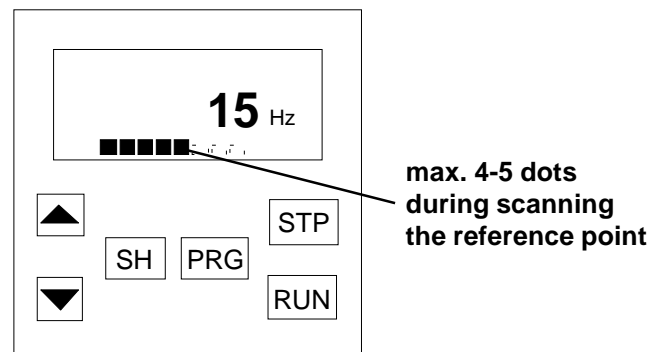


Depending upon field application and Polar cutter type, the parameter values have to be set at the frequency converter according to the following table.

Code	Meaning	78	92	115-137	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	accelration ramp	0.05	0.05	0.05	0.05
C013	decceleration ramp	0.05	0.05	0.05	0.05
C014	C/M	0	0	0	0
C015	U/F	50Hz	50Hz	50Hz	80Hz
C016	min. Voltage	8-15%	10-20%	10-20%	10-20%
	motor wiring				


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 overcurrent and following error messages. The setting is o.k. if you do not have more than four up 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 programm with to 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 cheching the function push twice the key „PRG“.

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

Code	Meaning	78	92	115-137	137-176
C050	actual frequency in Hz	2-45	2-45	2-60	2-60
C052	Power supply for Back gauge motor	40-220	40-220	40-220	40-220
C054	act. output in A	<2,6	<4	<4	<7
C061	internal temperature	<90°C	<90°C	<90°C	<90°C

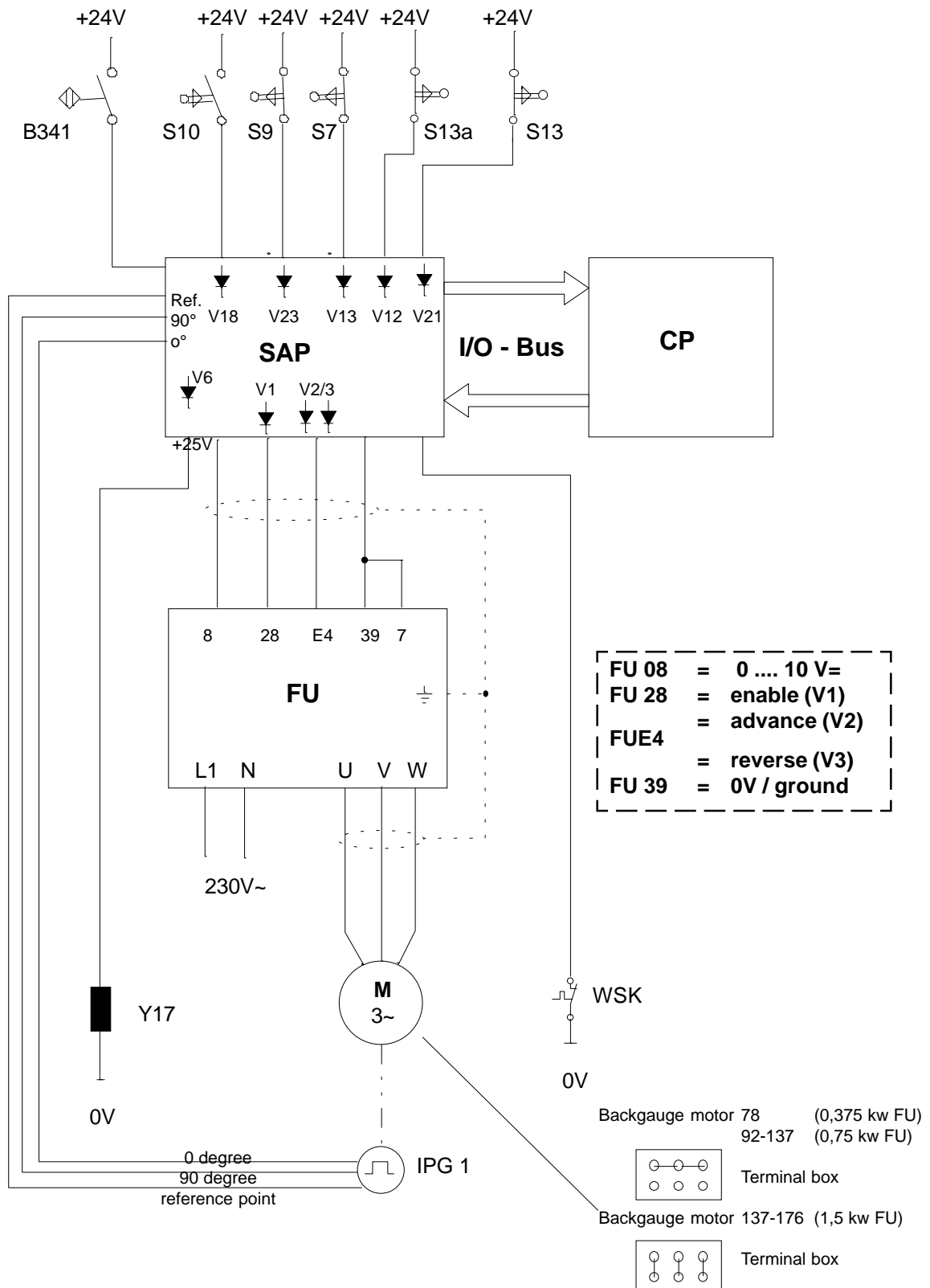
**the max. output can be 150% for one second**

### Error messages issued by the frequency converter

(displayed on programming unit 8201BB)

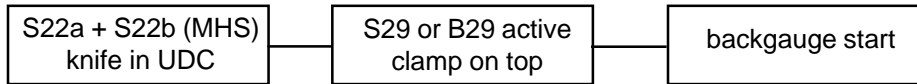
<b>C161</b>	Actual error
<b>C162</b>	Last error
<b>C163</b>	One before last error
<b>C164</b>	Two before last error
<b>LU</b>	Supply voltage too low: check supply voltage; correct transformer tapping, if necessary.
<b>OV</b>	Supply voltage too high: check supply voltage; correct transformer tapping, 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

### Block Diagram of Backgauge Drive by Frequency Converter (sample - backgauge advance manually)

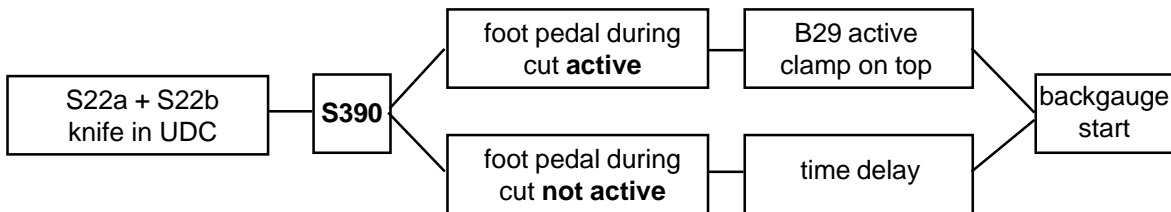


### Backgauge start after cut and Function of S390

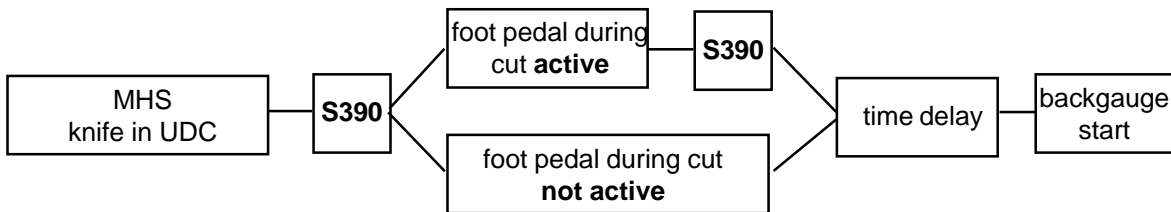
**EL, CE, EMCI, EMCII V1.0 and  
S, E, ES, ED if clamp optimization is used in level 1**



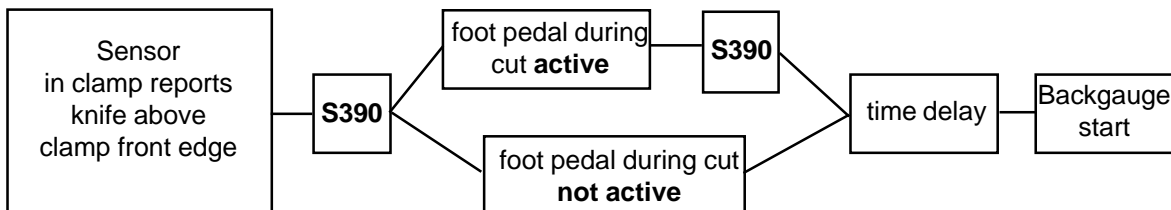
**EMCII V2.0 ....., S, SD, SD-P, EM, EM-Monitor, EMC-Monitor**



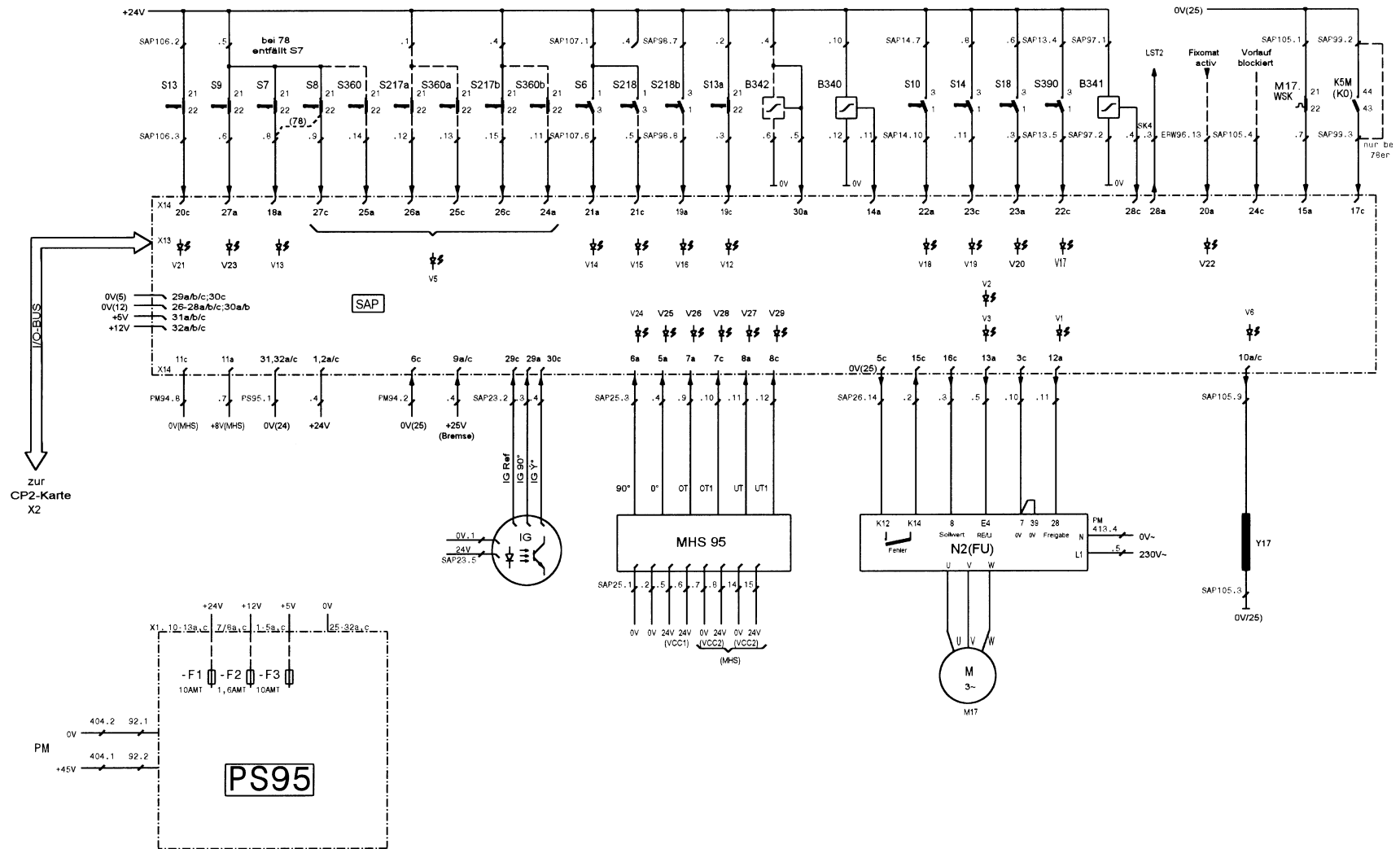
**S, E, ES, ED if clamp optimization is used in level 2 ... 9**



**ED if cut optimization is activ**



# Diagram SAP and backgauge positioning 78 - 176 S/E/ED



45

zur CP2-Karte X2

## Cutting Circuit (SK 95)

Trouble free 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 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	SK
V83	red	Safety lever (YSB)	off	<input type="radio"/> V83
V84	„	Cycle f. cutting circ. transformer - press.-Y27, Y27a	off	<input type="radio"/> V84
V85	„	Light barrier test terminated positively	off	<input type="radio"/> V85
V86	„	Cut buttons actuated correctly (within 0.5 sec.)	off	<input type="radio"/> V86
V87	„	Control signal for safety lever (nomin. condit.)	off	<input type="radio"/> V87
V88	„	Logic error in cutting circuit (reset)	off	<input type="radio"/> V88
V89	„	Cycle f. cutting circ. transf. -cutting- (Y33, Y33a)	off	<input type="radio"/> V89
V71	yellow	Safety lever in blocking position (B SB e)	on	<input type="radio"/> V71
V72	„	Safety lever unblocked (B SB a)	off	<input type="radio"/> V72
V73	„	NC contact right-hand cut button	on	<input type="radio"/> V73
V74	„	NC contact left-hand cut button	on	<input type="radio"/> V74
V75	„	NO contact right-hand cut button	off	<input type="radio"/> V75
V76	„	NO contact left-hand cut button	off	<input type="radio"/> V76
V77	„	Knife upstroke (UTH = lower dead centre upstroke) from SAP	off	<input type="radio"/> V77
V78	„	Knife descending (UTH neg.) from SAP	on	<input type="radio"/> V78
V79	„	Clamp at upper position (B29)	on	<input type="radio"/> V79
V80	„	spare	off	<input type="radio"/> V80
V81	„	Pedal switch (S309)	off	<input type="radio"/> V81
V82	„	„Table air“ key „ON“	off	<input type="radio"/> V82
				<b>+25V</b>
				<input type="checkbox"/>

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.

## 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.

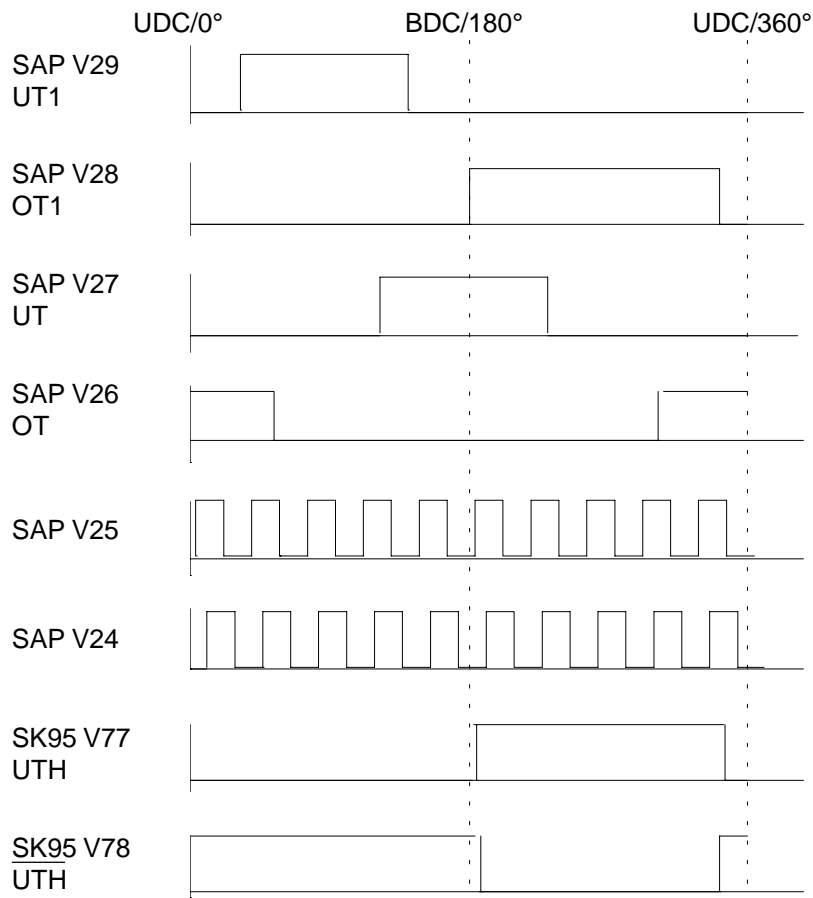
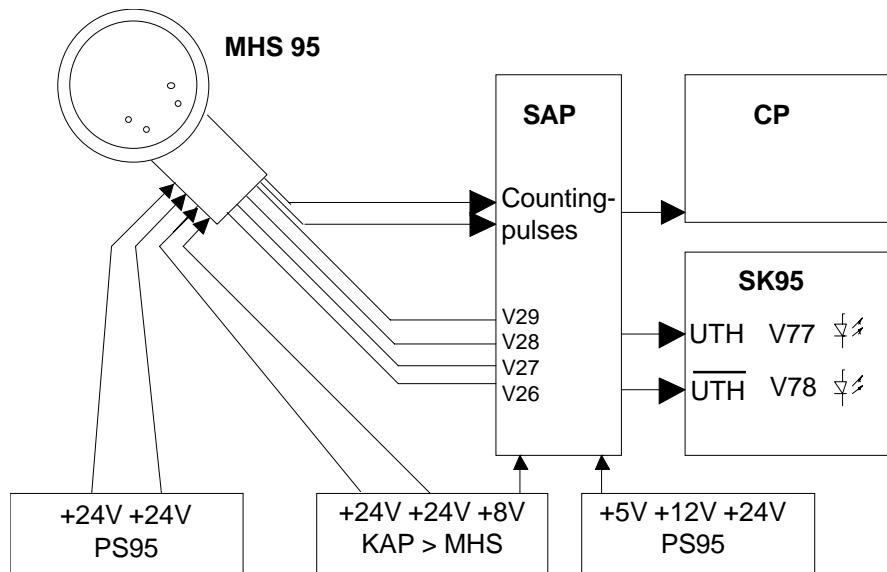
**Mechanical adjustment is not possible!**

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 SAP for SK 95 as well as the CP computer.

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

The knife upstroke control (MHS 95) supplies the SAP board with the following signals:

The graphic shows the light emitting diodes' indication on boards SAP and SK95 during the cutting cycle.

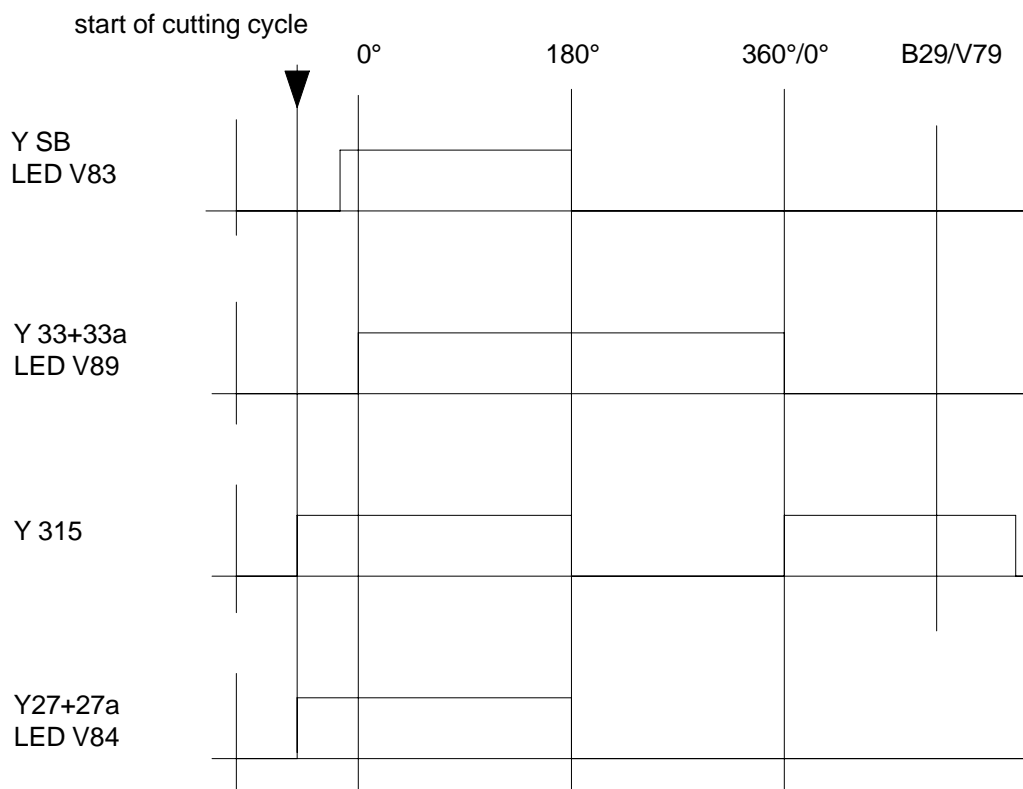
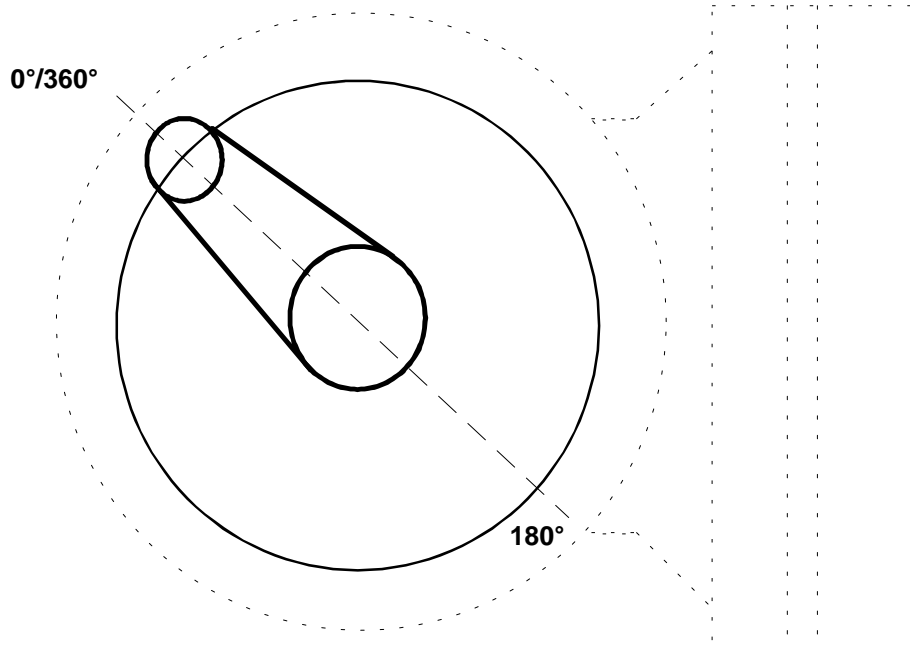


### Cutting circuit

function	reaction	LED SK-board
Reset of SK board Check of inputs	SK-Reset OFF BSB.E BSB.A S28a - S28b  Y315  MHS (SAP)	V88 OFF or I/O in service V71 ON V72 OFF V73 and V74 ON V75 and V76 OFF  V77 OFF V78 ON
activate cut buttons check disabling of clamp by CP2 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	V73 and V74 OFF V75 and V76 ON  V86 ON  V85 ON
activate Clamp pressure  internal delay plus operator setting recording to different software-version B29 deactivated check disabling of cut by CP activate SB including time control	Y315 activ Y27 activ and Y27a activ  YSB activ BSB.E change to low BSB.A change to high	V84 ON  V79 OFF  V87 ON V71 OFF V72 ON
activate clutch feedback of counting pulses from MHS from V1.4: 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 activ and Y33a activ  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	V89 ON  V77 ON V78 OFF V87 OFF  V84 OFF  V77 OFF V78 ON
deactivate clutch check knife afterun release clamp Clamp at the top deactivat Y315 after time delay	Y33 + Y33a OFF V89 OFF  Y315 activ B29 activ Y315 OFF	V79 ON

### Cutting operation

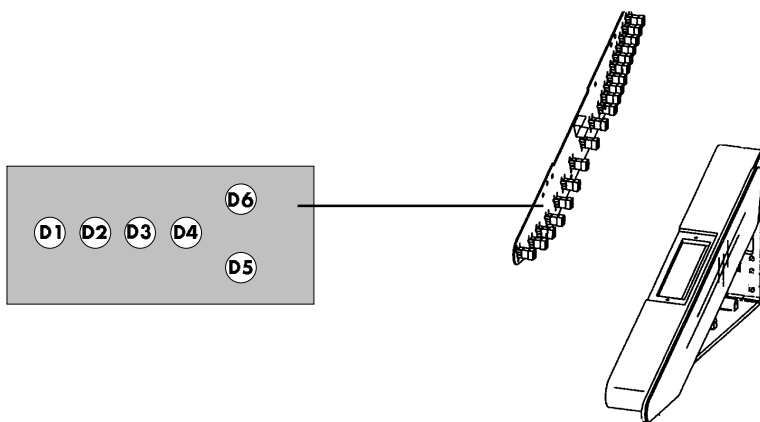
The illustration below shows the function (LED indication on board SK95) of hydraulic valves and safety lever (SB) during the cutting cycle.



## Light Barrier (LS 95)

In accordance with the „Berufsgenossenschaft Druck und Papier“ (German employer`s liability insurance association) as well as the mechanical engineering regulations of the European Union we developed an infrared light barrier with nineteen (since Nov. 96 twenty) channels which is employed as of machine types S, E, ED, .. This 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.



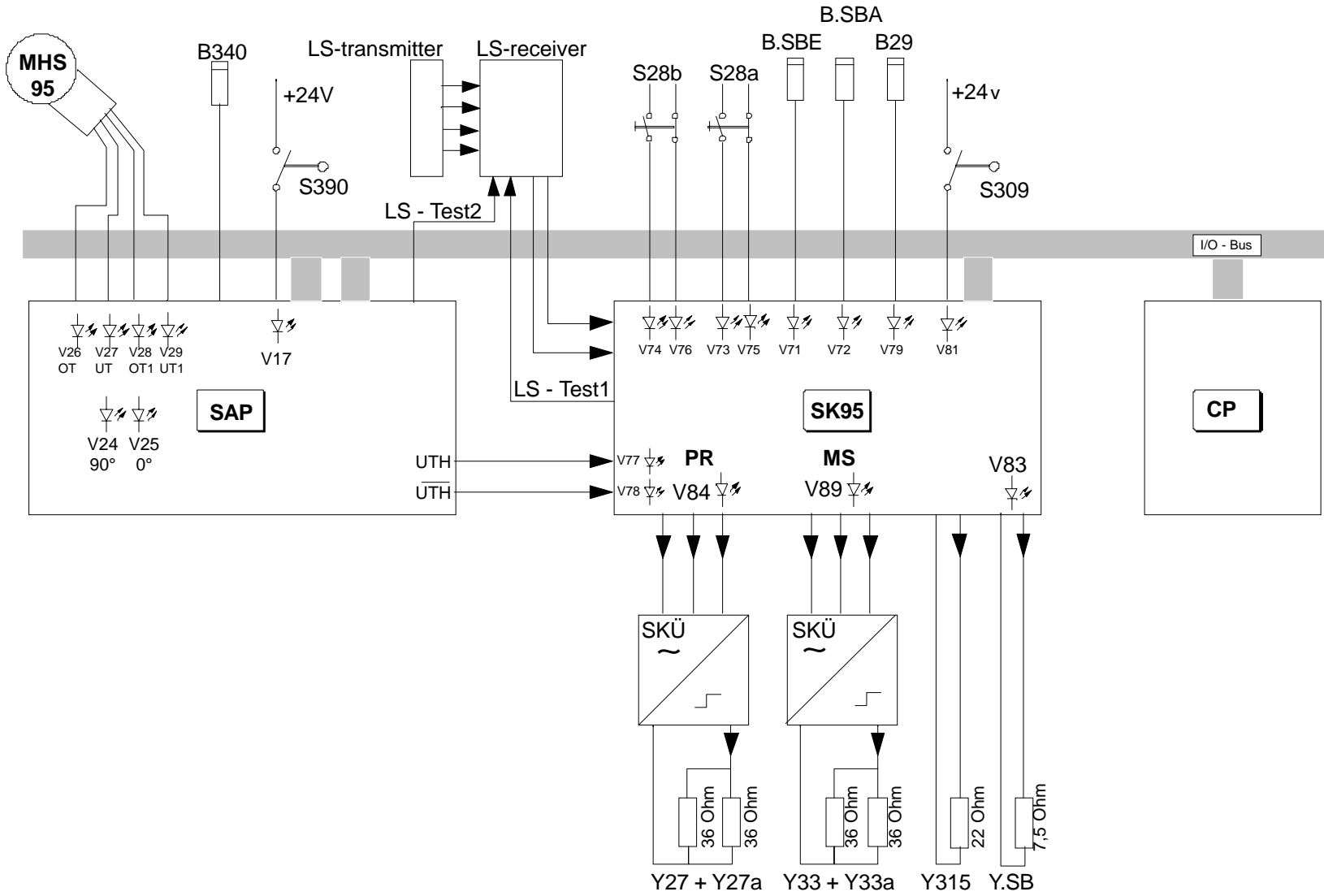
The light barrier is supplied with 24 Vd.c. on the transmitter side and 24 Vd.c. as well as 12 Vd.c. on the receiver side. The LS 95 is an independent unit. The two exclusive OR outputs „LS high“ and „LS low“ are linked with board SK 95 via plugs 600.8 and 600.9. When the cut is released the cutting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

### Indicator Panel of Light Barrier

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
	OFF	OFF	OFF	OFF	ON	ON	Protect. area was never „unobstructed“ since „Voltage ON“
	flashing	OFF	OFF	ON	ON		Error

### Block diagram Cutting circuit



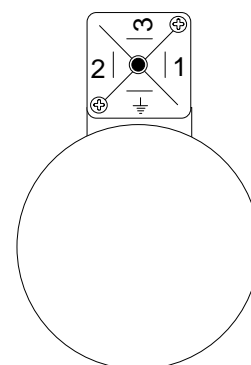


## Hydraulic System 92 -176 S, E, ED (Hydraulic System 91)

The hydraulic system 91 installed on all S, E ED models differs essentially from the hydraulic systems of the former models.

It comprises the following devices:

- 1 gear pump
- 1 control unit P1
- 1 conical valve P1 (Y315)
- 2 ball type magnetic valves P1 (Y27 + Y27a)
- 1 working cylinder
- 1 control unit P2
- 2 ball type magnetic valves P2 (Y33 + Y33a)
- 1 additional flow governor P1 (only 92)



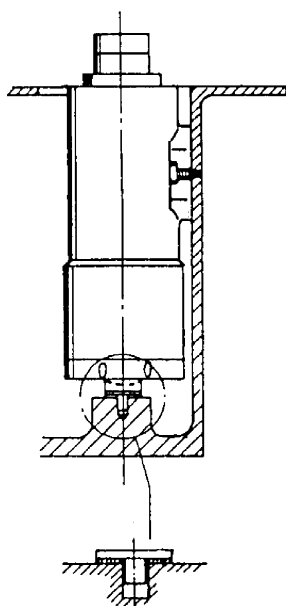
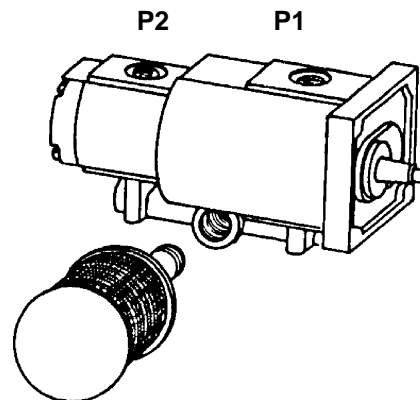
### Arrangement

The entire system is located in the right frame pillar which serves also as Oil tank. Since may 1996 the valves are supplied with new style plugs.

### The Pump

The pump is a gear pump with one inlet through which the oil is sucked in via a filter. The pump has two outlets, i.e. **P1** (= clamping) and **P2** (= clutch). It is driven by the main motor by means of a V-belt.

Care should be taken that the pump does not run dry, as this will result in its breakdown. Also the direction of rotation must be as prescribed as otherwise the pump will fail.



### The Working Cylinder

On system 91 the working cylinder is mounted vertically and screwed to the rear side of the pillar. When exchanging a cylinder please see that there will be no gap between cylinder and cylinder support. If necessary, insert spacer discs.

The working method of the cylinder is the same as described for the preceding version.

## Control units

Flow circuit **P1** (= clamping) comprises devices which can be exchanged separately in case of possibly arising malfunctions. Flow circuit **P2** (= clutch) has only one control unit.

The control unit P1 comprises the following valves and slide valves:

1. Control unit P1
  - a) pressure relief valves for safety pressure
  - b) control slide valve
  - c) pressure regulating valve
  - d) flow governor
  - e) switch piston for high- and low pressure range
  - f) manometer connection P1
2. conical valve (Y315) / M1
3. ball type magnetic valves (Y27 + Y27a) / M3

The control unit P2 comprises the following components:

1. Control unit P2
  - a) pressure relief valve for clutch pressure
  - b) manometer connection P2
2. ball type magnetic valves (Y33 + Y33a) / M2

### Pipe fitting

The hydraulic pipes fitted within the frame pillar, are connected to the cylinder via the base-plate to which the control units and valves are mounted.

The complete base-plate with the control units and valves, can be taken off by dismantling four screws. Sealing between the cylinder, base-plate, control units (P1 and P2) and valves is achieved with "O" rings.

### Additional flow governor (only 92)

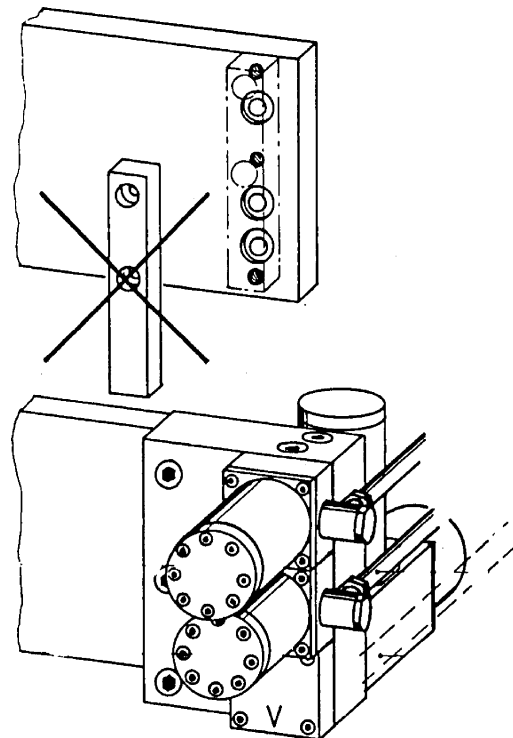
The additional flow governor reduces the speed of the clamp descent when the cut buttons are actuated. It is located within the oil flow line P1 and connected above the pump by means of a T-piece.

### Control unit for special hydraulics

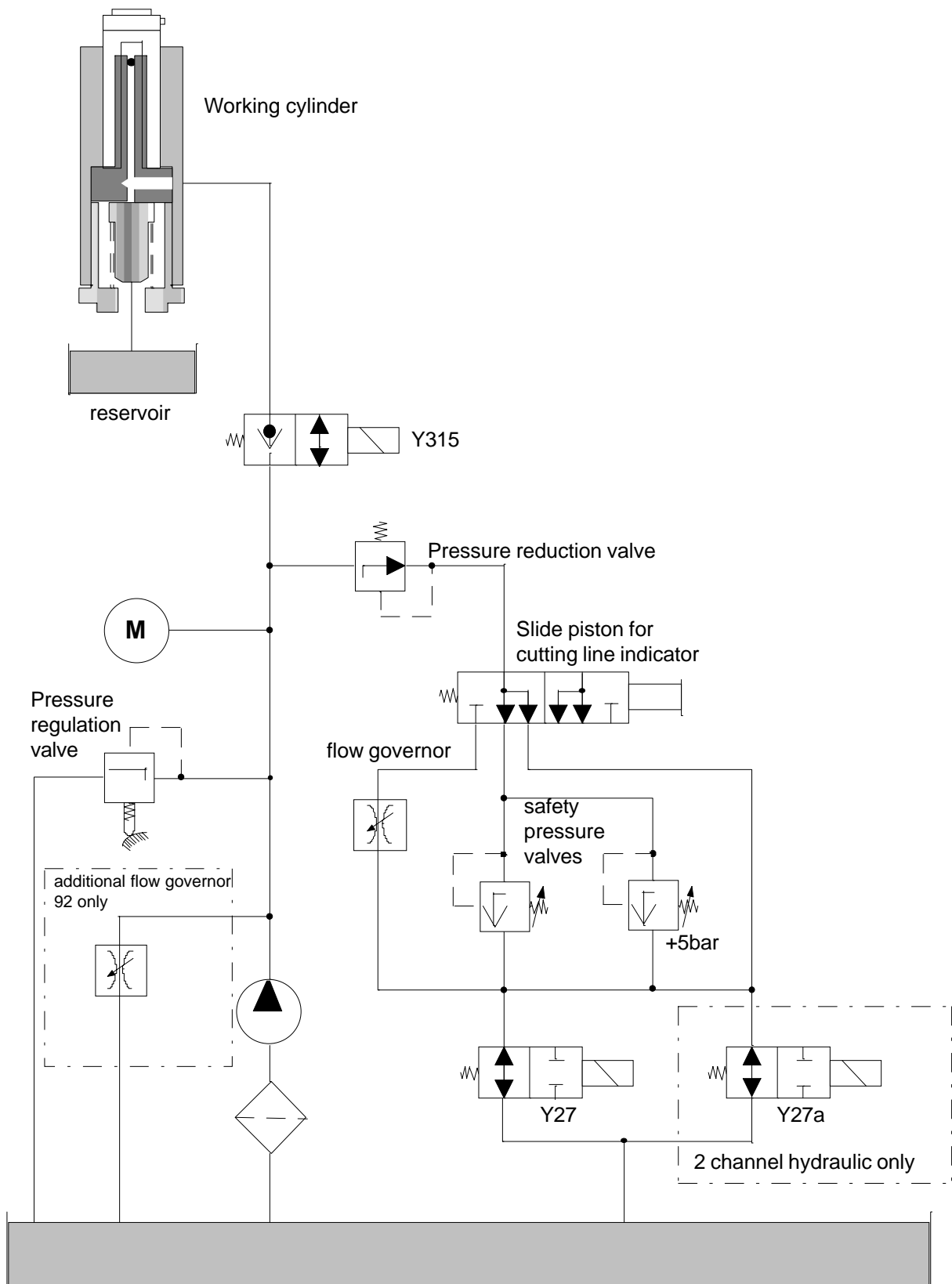
On machines equipped with hydraulically controlled optional equipment (stacklifts and retractable sidegauges) an additional control unit is required which is mounted to the base plate by means of flanges. Sealing is achieved by O-rings.

The control unit for optional hydraulics comprises the following components:

1. switch over valve (Y330)
2. pressure relief valve for optional hydraulics
3. conical valves
4. blind plates for not used functions



### P1 - Oil Flow Circuit



## Description of functions

On the hydraulic system 91 the two oil flow circuits **P1 (= clamping)** and **P2 (= clutch)** are designed in such a way that they do not influence each other in their function. This is achieved through the use of two separate control units for **P1** and **P2**.

The clamp pressure is now adjusted by means of a turnknob located at the upper right side of the front plate. Via a cam it actuates a bowden wire which controls the pressure regulating valve.

### Circulation

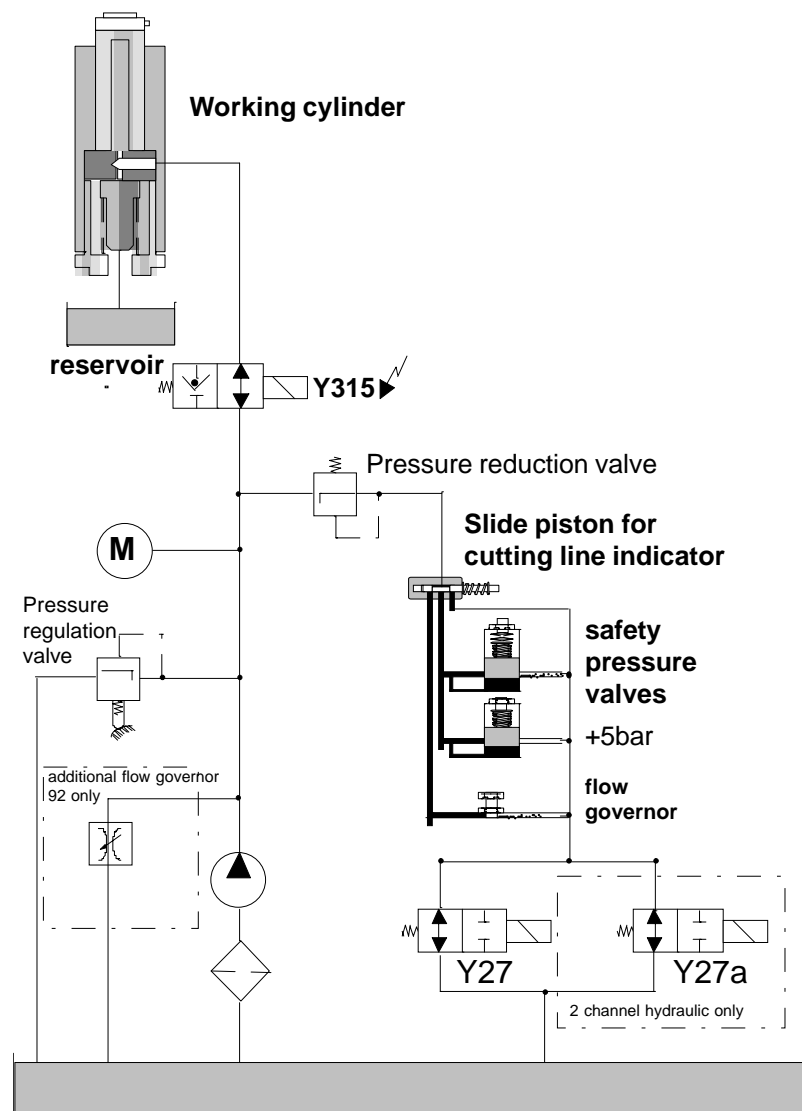
When the main motor is switched on and the V-belt put on, the pump is delivering oil. The pump transfers the oil through the two oil flow circuits **P1 (= clamping)** and **P2 (= clutch)** via the control units back to the tank with a circulation pressure of **1 - 2 bar**.

### Actuation of the mechanical cutting line indicator

Upon actuation of the pedal a cam presses the slide-valve into control unit **P1**, thus interrupting the connection of **P1** to the tank.

Switch **S309** is actuated via a second cam. Thereby the plug-in-board "**SK**" (Cutting circuit) energizes the conical valve **Y315** to open the line to the working cylinder so that the oil can flow in. In **P1** the pressure pre-adjusted at the relief valve for safety pressure builds up and the clamp moves down. The speed of its downward movement depends on the value adjusted at the flow governor of control unit **P1**.

When the pedal is released, the control slide valve moves back to its initial position restoring the connection of **P1** to the tank. Now the spring draws the clamp upwards and the oil in the working cylinder is pressed back to the tank via conical valve **Y315** and the control slide valve. The Cutting circuit **SK95** keeps conical valve **Y315** energized until the clamp has returned to its resting position and proximity switch **B29** is activated.



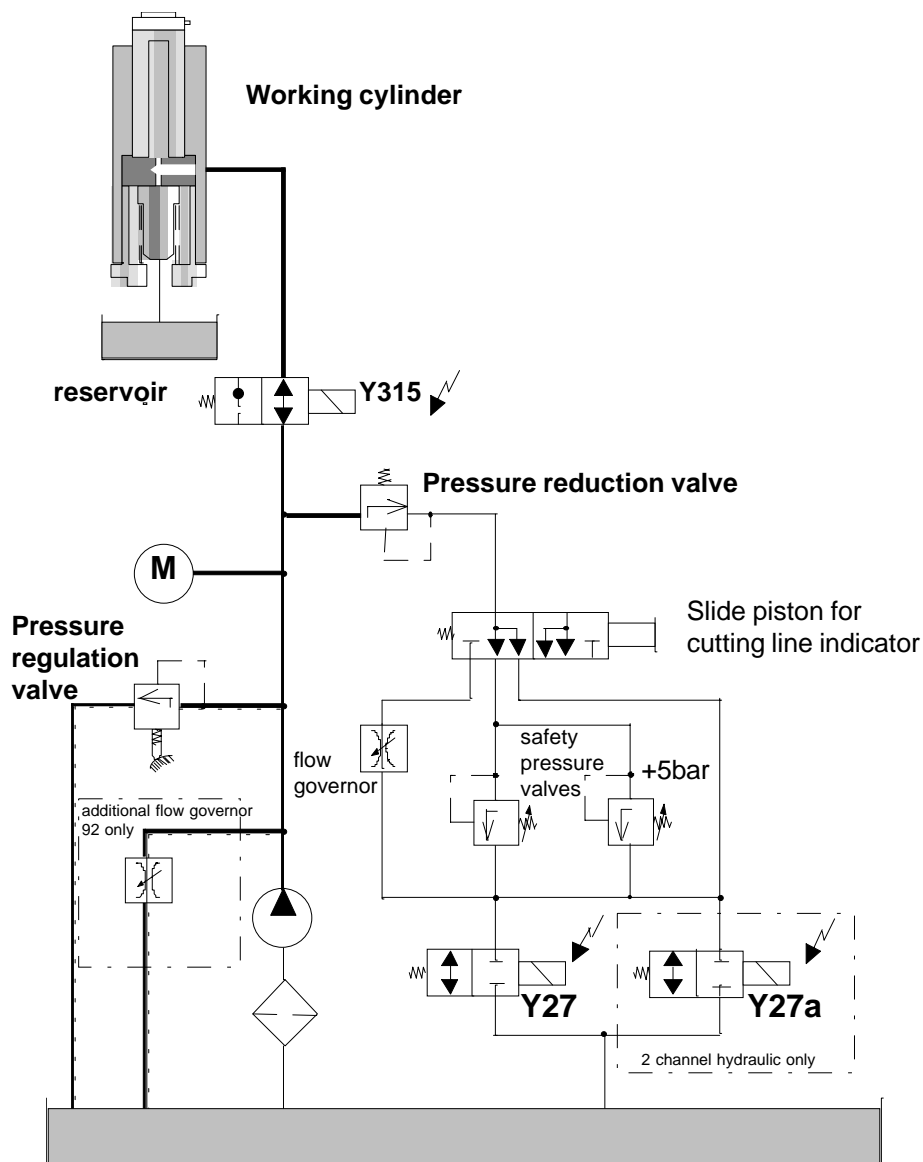
## Clamping without cut

The function “**clamping without cut**” is initiated by actuating the cut buttons which causes the magnetic valves **Y27**, **Y27a** and **Y315** to become energized. Magnetic valves **Y27 + Y27a** block the oil circulation to the tank whereas magnetic valve **Y315** opens the line to the cylinder.

The pressure within **P1** rises and the piston rod is driven out of the cylinder. As soon as the clamp hits the material or the table surface, the pressure within **P1** rises further. At an oil pressure between **20 and 40 bar** the switching piston for high- and low pressure-range reacts.

**Its function is as follows:**

If a pressure of **40 bar** is gained, the switching piston will divide **P1** into a high-pressure circuit which is supplied by the pump and appears at the pressure regulating valve, the conical valve, and within the cylinder (- this pressure corresponds with the adjustment at the turn-knob) and a low pressure circuit with a maximum pressure of **40 bar**. This pressure appears at the ball type magnetic valves **Y27 + Y27a** which block the oil circulation to the tank. With cut buttons released ball type magnetic valves **Y27 + Y27a** becomes deenergized opening the line for the oil of **P1** to flow back into the tank. The conical valve **Y315** remains energized until the clamp has returned to its upper position and **B29** is activated.



### Cut function

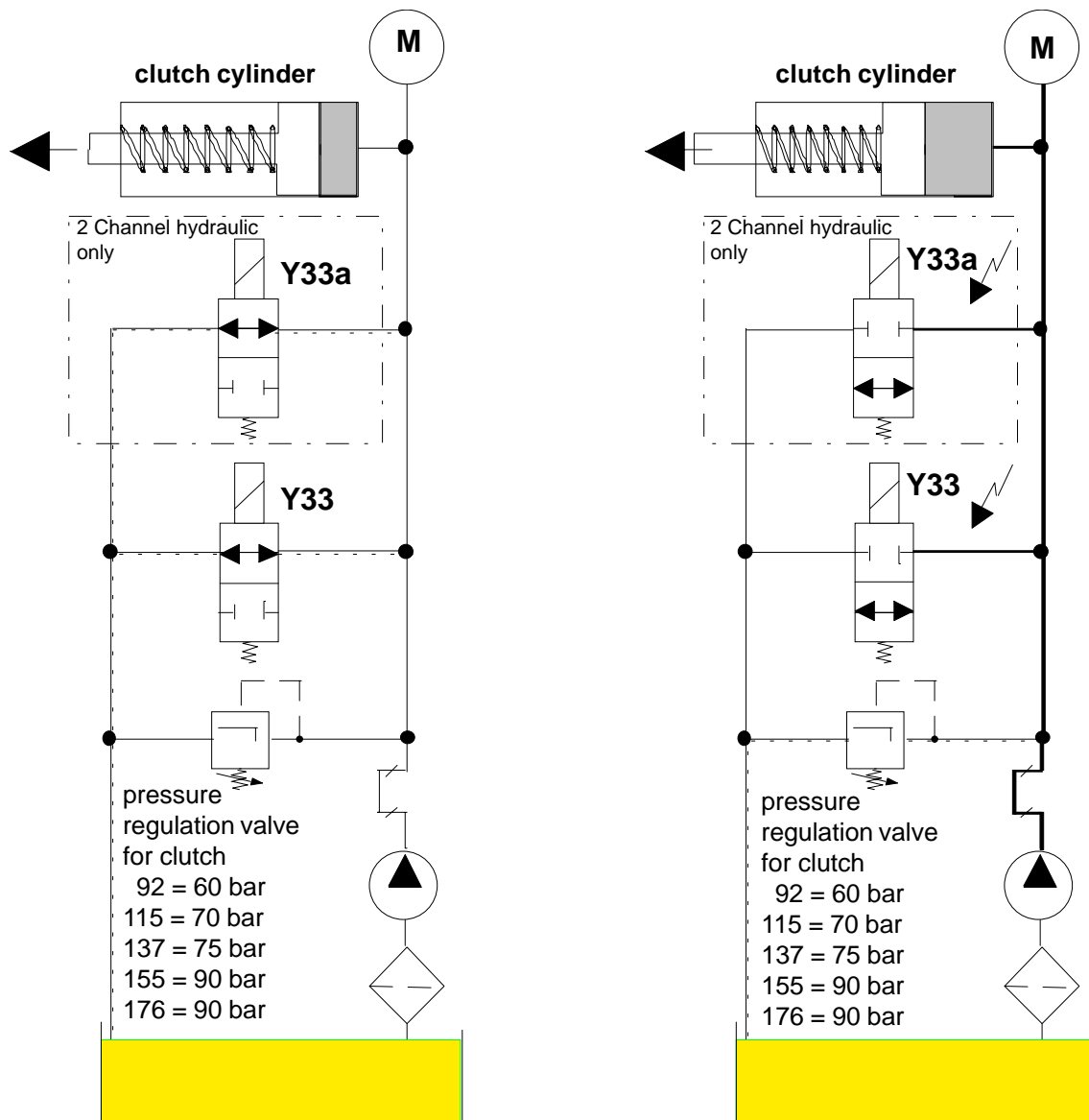
Upon actuation of the cut buttons the two valves **Y27, Y27a** and **Y315** of circuit **P1** become energized first as described above. With time delay after the valves of **P1**, ball type magnetic valves **Y33 + Y33a** of **P2** is energized. The delay time for **Y33 + Y33a** may be varied by the operator.

After magnetic valves **Y33 + Y33a** has been energized, the knife moves down. When the knife has passed bottom dead centre the two valves **Y27 + Y27a** and **Y315** become de-energized by the MHS and the control circuit, which leaves the clamp in its lowered position, as the de-energized conical valve **Y315** blocks the line from the cylinder to the tank.

Controlled by the MHS at the gear the knife moves upwards. After having returned to top dead centre, the ball type magnetic valve **Y33 + Y33a** of circuit **P2** becomes de-energized and the knife stops.

At the same time the conical valve **Y315** becomes energized again and the clamp returns to its upper resting position. At the end conical valve **Y315** becomes de-energized when **B29** is activated.

**In case a down-stroke of the knife is interrupted, all three magnetic valve instantly become deenergized. Knife and clamp will stop immediately.**



## Optional hydraulics

All optional hydraulics are arranged within oil circuit **P2**. If pressure is required for operation of one of the optional hydraulic functions, the **PC-board SHM** first energizes the magnetic switch-over valve **Y330** and thereafter the respective conical valve.

The switch-over valve then connects the optional hydraulic with the pump while the conical valve opens the line for the respective cylinder into which then the oil is pressed.

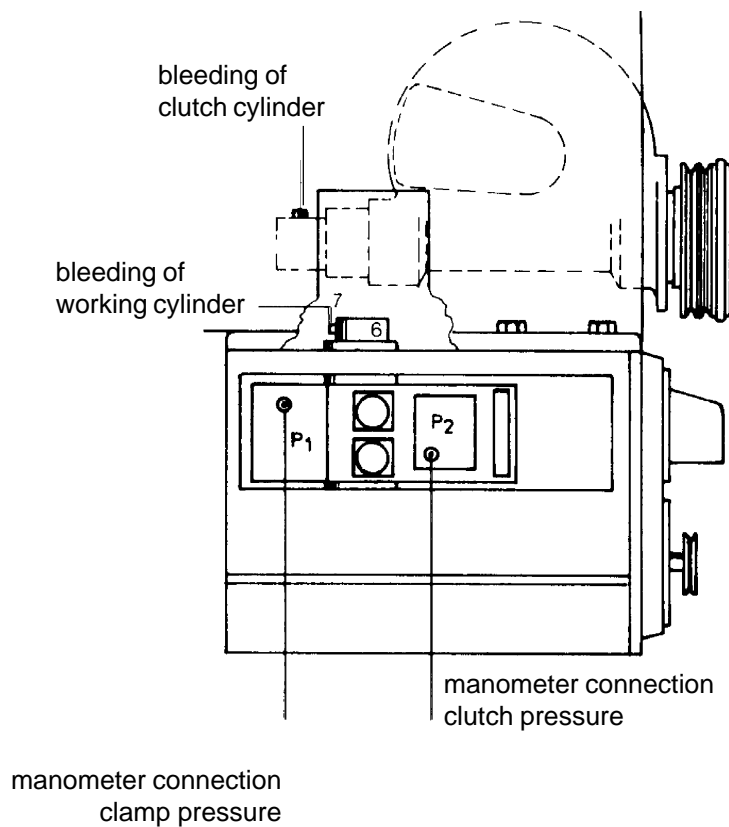
At the same time cutting and clamping operations are blocked electrically and hydraulically.

If for an operation to be performed by the optional hydraulic system no pressure is required, only the respective conical valve is energized. The switch-over valve **Y330** remains de-energized.

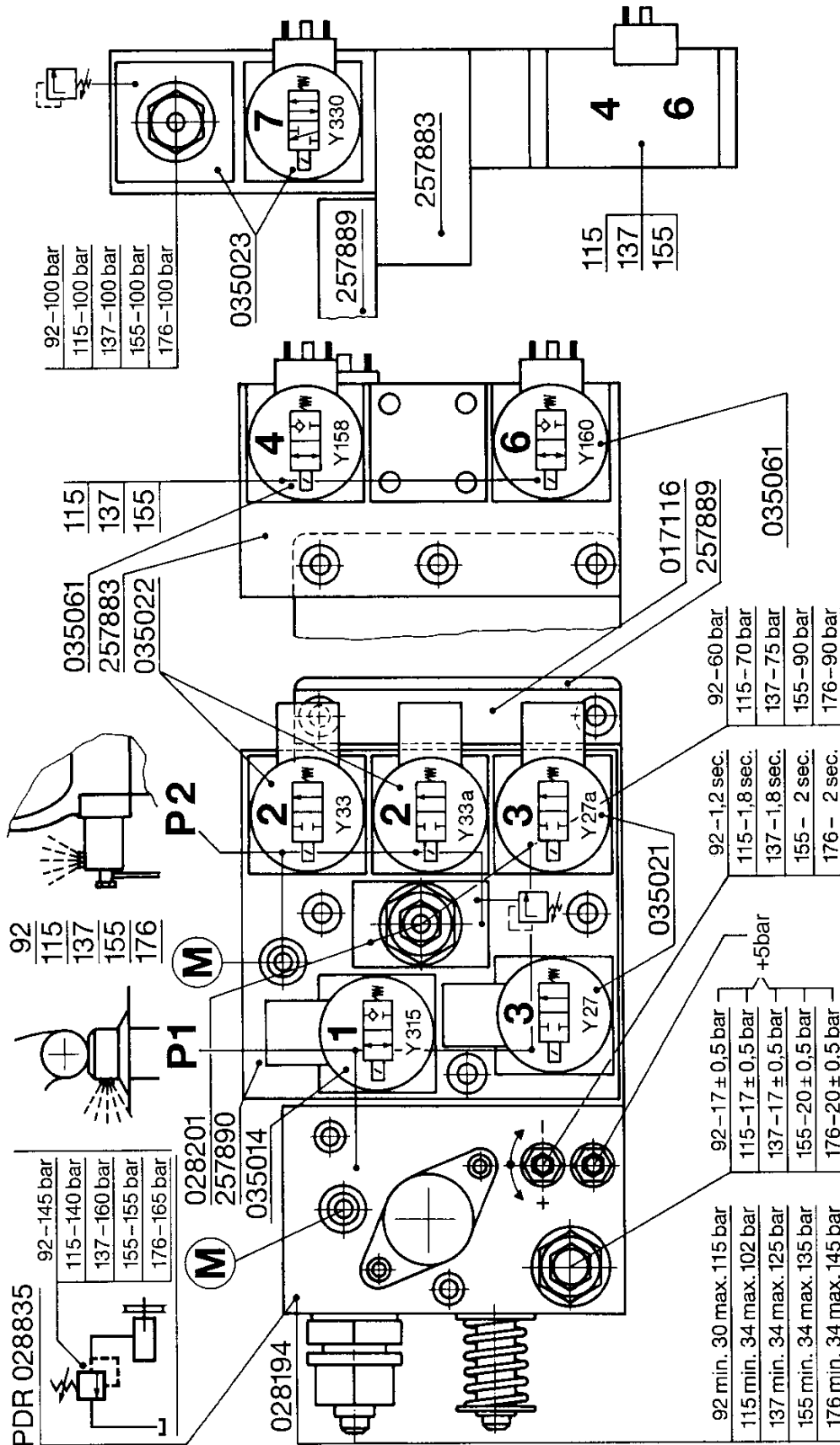
## Bleeding the hydraulic system

### **Caution!**

The slightest amount of air in the hydraulic system may cause malfunctions.



Reservoir label 2 channel hydraulics 92 -176





## Hydraulic System 78 S, E, ES, ED

The complete hydraulic system is located inside the right frame pillar. The pillar is also the hydraulic oil tank. All individual components of the hydraulic system, except the pump, are mounted above the oil level. The hydraulic cylinder is mounted upright within the frame pillar. The hydraulic pump transfers the oil from **P1** through the cylinder back to the tank with a circulation pressure of **1-2 bar** as soon as the machine has been turned on. Engaging the two cut button will activate the valves in the P1 circuit and the clamping pressure is applied.

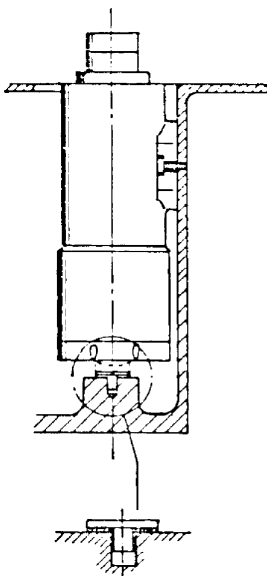
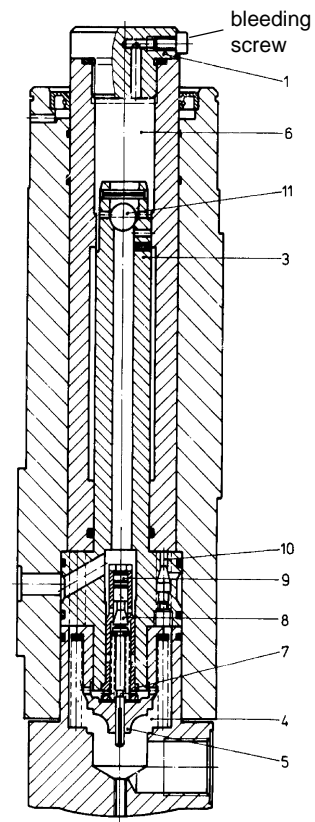
The cut will be controlled by a electro-magnetic clutch. The necessary clamping pressure can be set by a turn knob.

### Hydraulic cylinder

The working cylinder has two working chambers with a piston with 2 different diameter of working surfaces. To achieve a fast down motion of the clamp, the oil flow is directed first to the smaller piston chamber. The piston will move out and by the creation of vacuum, additional oil from the tank is pulled in the larger chamber. Within the center section of the cylinder is located a pressure reduction valve, which at a pressure of **32 - 35 bar** (depending on the type of machine), moves the spring tensioned change over piston closing the oil intake from the tank. The pressure increases in the small cylinder area, as the difference in pressure between the two chambers exceeds **38 bar**, the spring tensioned conical seal in the pressure reduction valve opens and the selected clamp pressure will now take effect in both cylinder areas.

The pressure will subside as soon as the cutting cycle is complete. The relief valve at the center section of the working cylinder opens up and the oil from the large cylinder area can flow back into the reservoir via **P1**.

When the pressure diminishes to **34 bar**, the change over piston opens and the oil can now also flow back through the suction opening. The clamp reverse spring pushes the working cylinder piston back to the initial starting position. Cross boring in the center section of the working cylinder in conjunction with a ball valve, make possible a smooth return and stop of the clamp. During the inward movement of the piston within the last third of the travel, more and more cross bores become closed and with it the ball valve. The oil return from the small cylinder area (6) is restricted and a soft clamp return is accomplished.



### Attention !

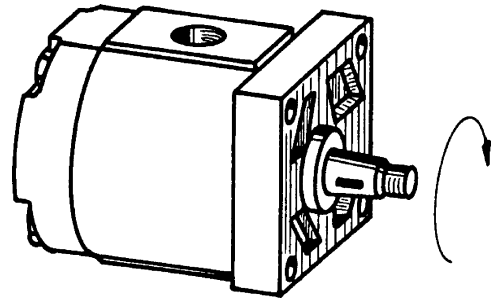
If a hydraulic cylinder is being exchanged, make sure that no airgap exist between cylinder and cylinder support pillar. If necessary fill up with spacers.

## Hydraulic pump

Tooth wheel pumps are used on POLAR machines, which are reliable and simple in design. The pump used on Model 76 has only one oil flow circuit P1. The pump is located below the oil level and is being driven from the main motor by a V-belt.

It is very important to have the pump never run dry, as otherwise the pump will be damaged.

It is equally important that the correct direction of rotation is observed.



## Control unit

The complete control block is fixed at the cylinder by means of two screws and is aligned by two dowel pins. Sealing is achieved using "O" rings.

The complete P1 control comprises:

- Clamp pressure regulating valve
- Conical valve Y315
- Ball safety valve Y27 and Y27a
- Manometer connector

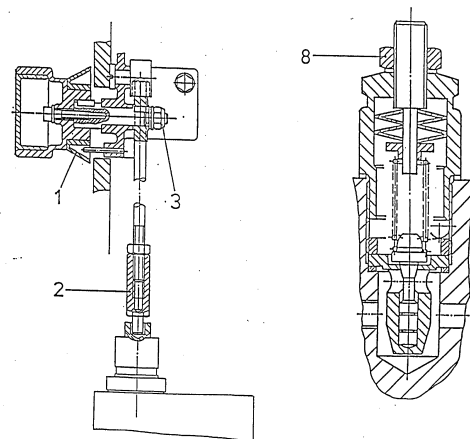
## Clamp pressure regulating valve

The clamp pressure regulating valve (adjustable relief valve), is connected to the P1 oil flow line.

By turning the pressure knob (1), the stepless adjustment is transmitted to the clamp pressure regulation via an adjustable rod (2).

### Attention !

The pressure can only be checked during the cutting cycle.



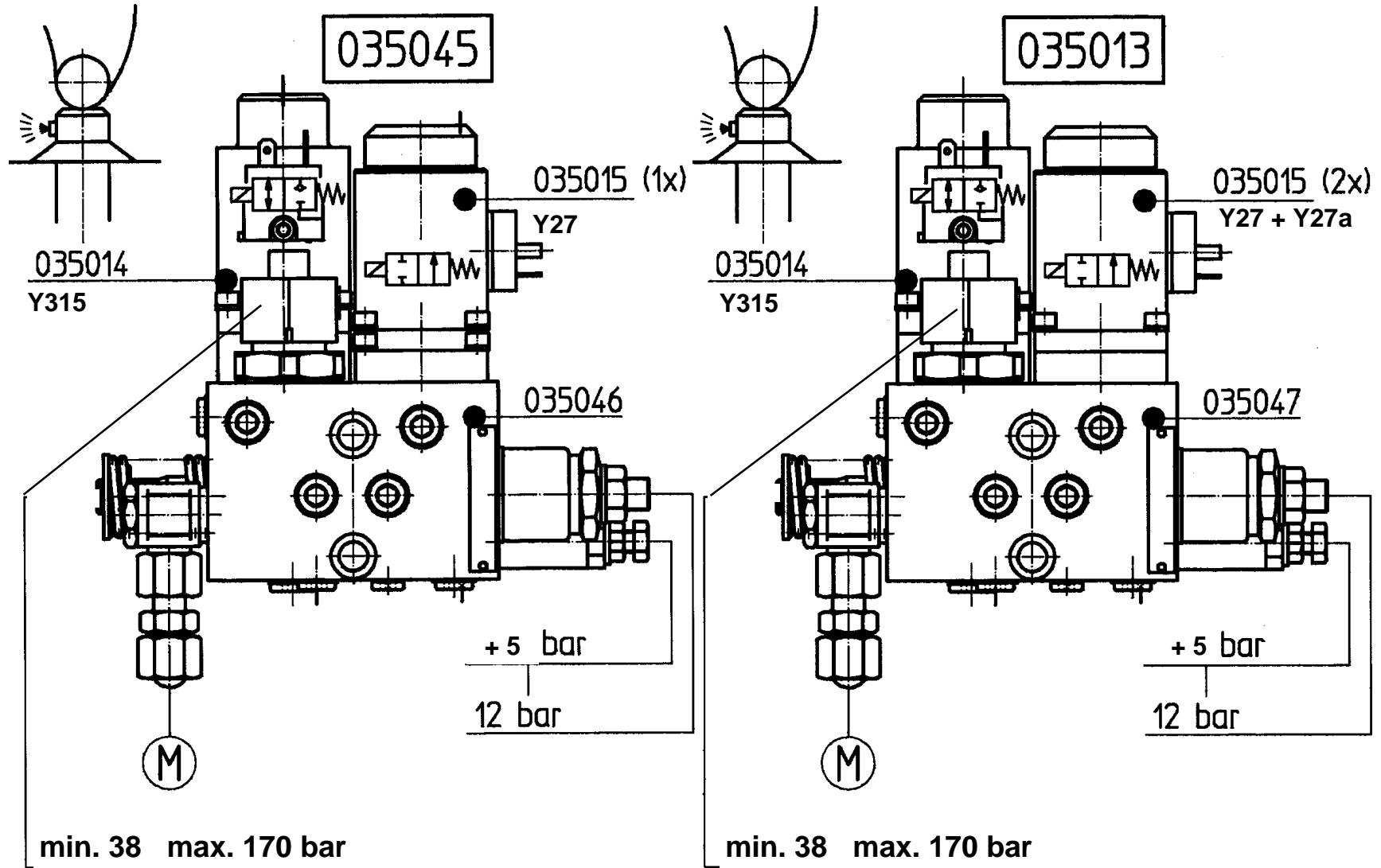
## Cut interruption

If the clamping motion is interrupted by releasing the cut buttons, breaking the light beam of the light barrier or power failure, both ball valve and conical valve become deenergized. By this the clamp is stopped immediately at the present position i.e., the lower clamp edge remains below the knife edge.

If after the cutting has been interrupted, is necessary to have a down movement of the clamp, than in actuating the foot pedal a contact of switch **S309** energizes the conical valve **Y315** allowing the clamp to move down as done in the function "Mechanical Cutting Line Indicator".

The return of the clamp to the upper resting position takes place after the cut cycle is completed and the knife is resting in its upper position.

### Reservoir label 1 and 2 channel hydraulics 78



## Graphic Controller (GC 1)

The 16-bit graphic card GC 1 is linked with CP by means of the SMP bus. It generates the contents of display for both 10.4" displays. Via the 25-pole plug (RS 422) at the front side of the card the video data (RGB, HSYNC, VSYNC) are supplied to display adapter ADA\_D. Adapter ADA\_D is available in two different versions for plasma panels and TFT displays (see block diagram, page 59).

In the case of the monochrome version the adapter supplies +24 Vd.c. for the additional power supply unit, in the case of the colour display unit it generates the voltage for background illumination (approx. 450Va.c.).

Graphic card GC 1 is supplied with a voltage of 5 Vd.c., the card is equipped with a processor of its own (TMS 34010) and a V-RAM of 512 KB as well as a D-RAM of 2 MB. For service purposes the machine can be operated without video card.

Attention!

The machine type has to be selected as an "S" or "78E" at board CP (dip switch 2).

The functions of the machine can be inspected without display function in such case.

## Keyboard Computer KC

The keyboard computer monitors the keys and switches of the keyboard. Any activation of a key or switch is signalled to the CP - X3 computer via serial interface -X503-.

Keyboard computer KC can be employed with any machine type from 78 S to 176 ED.

The RAM memory located on the board serves for relocating variable data of the program during machine operation. When the machine is switched off these memories are cleared.

The keyboard computer is supplied with a voltage of 24Vd.c. which is fed to plug X 500 at KC via connector X 415 of the power module.

The internal operating voltage of 5 Vd.c. is generated on KC from the 24 Vd.c. supplied.

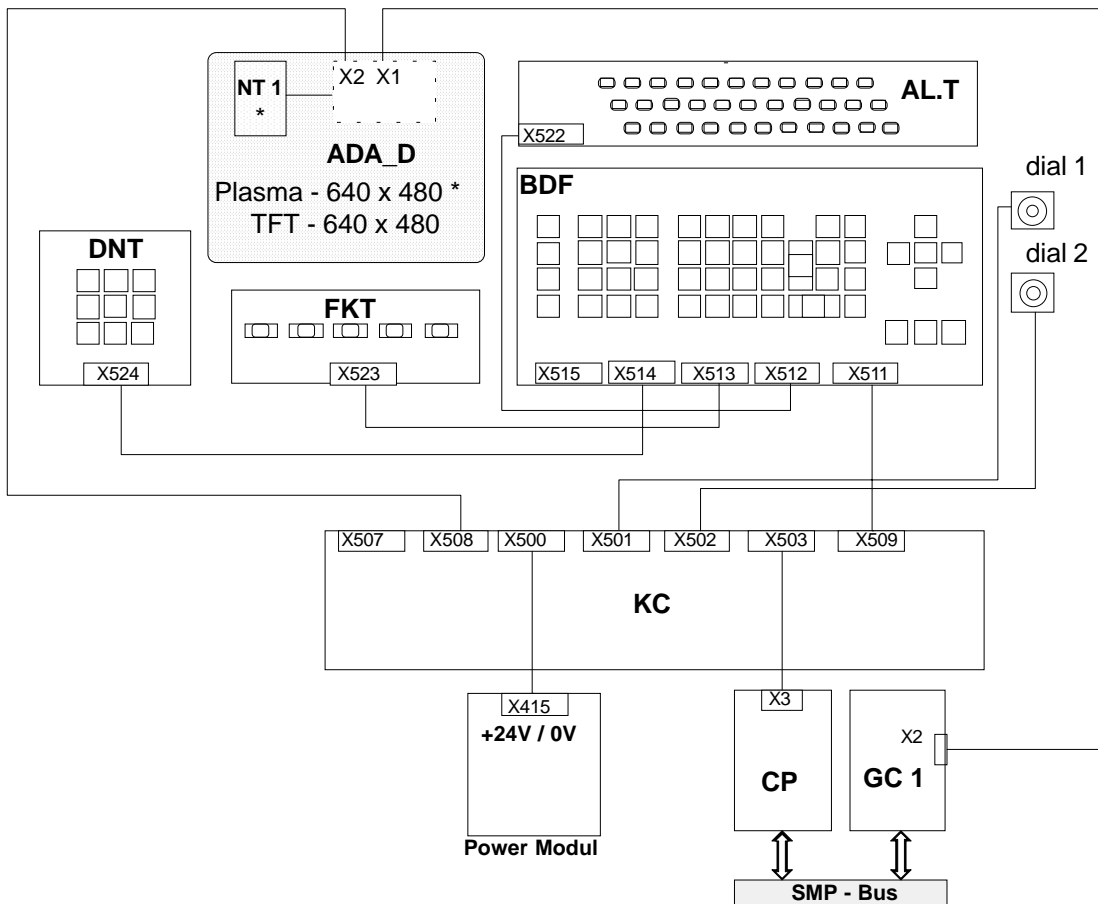
The voltage is indicated and monitored by the green LED V6 and the two measuring points P1 and P2 on that board. The voltage of 5 V at KC is no longer adjustable.

For service purposes the keyboard and KC components can be separated at the serial interface of CP. In that case, the machine can be operated manually by means of the handwheel and the cut buttons.

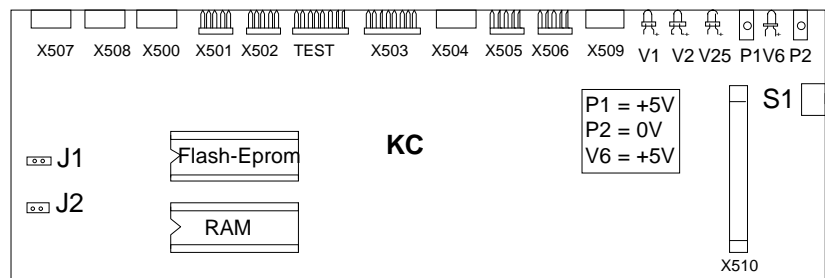
The keyboard test already known from the monitor machines has been taken over.

A message of stage is given by the speaker of the KC board:

Beep	function
1 x	KC active
3 x	Communication between CP and KC is trouble free
10 x	Graphic controller is not recognized (not 78 ED)

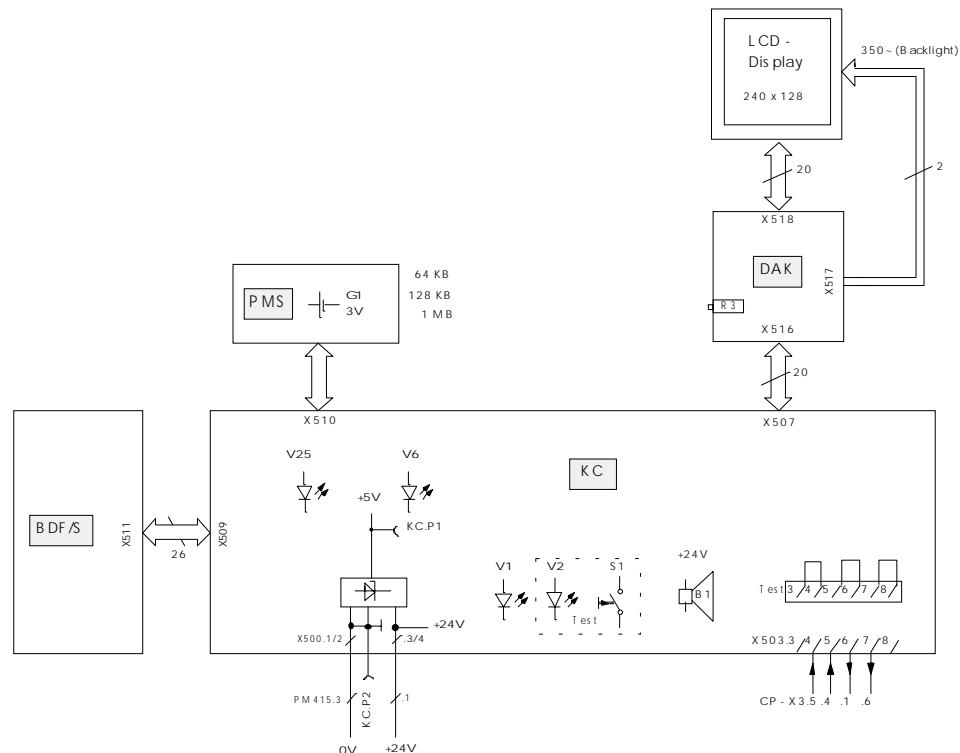


## Indicators, Plugs and Keys on KC



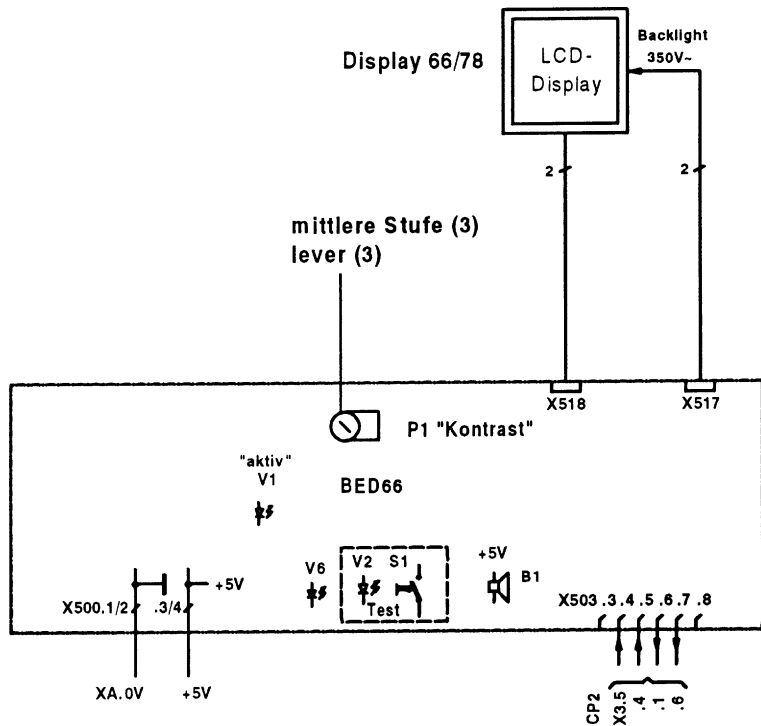
- LED V1 Computer active, flashes every second during operation
- LED V2 lights up when keyboard test has been started, V1 is off at that time
- LED V6 indicates operating voltage of +5 V for KC
- LED V25 lights up during data exchange between PMS card and KC
- Key S1 Start keyboard test
- Jumper J4 Connection of external LED for indicating data exchange PMS / KC
- Plug X Test Jumper plug for keyboard test (parking position)
- Plug X 501 Connection for dial - cut correction
- Plug X 502 Connection for dial - variations in print
- Plug X 503 Serial interface to CP plug X3
- Plug X 504 not assigned
- Plug X 505 not assigned
- Plug X 506 not assigned
- Plug X 507 Linkage to DAK (adapter for small display)
- Plug X 508 Linkage to ADA\_D (adapter for plasma panel / TFT display)
- Plug X 509 Linkage to keyboard
- Plug X 510 Plug connector for PMS card

## Keyboard and Display 78 S - 137 S, 78 E, 78 ES

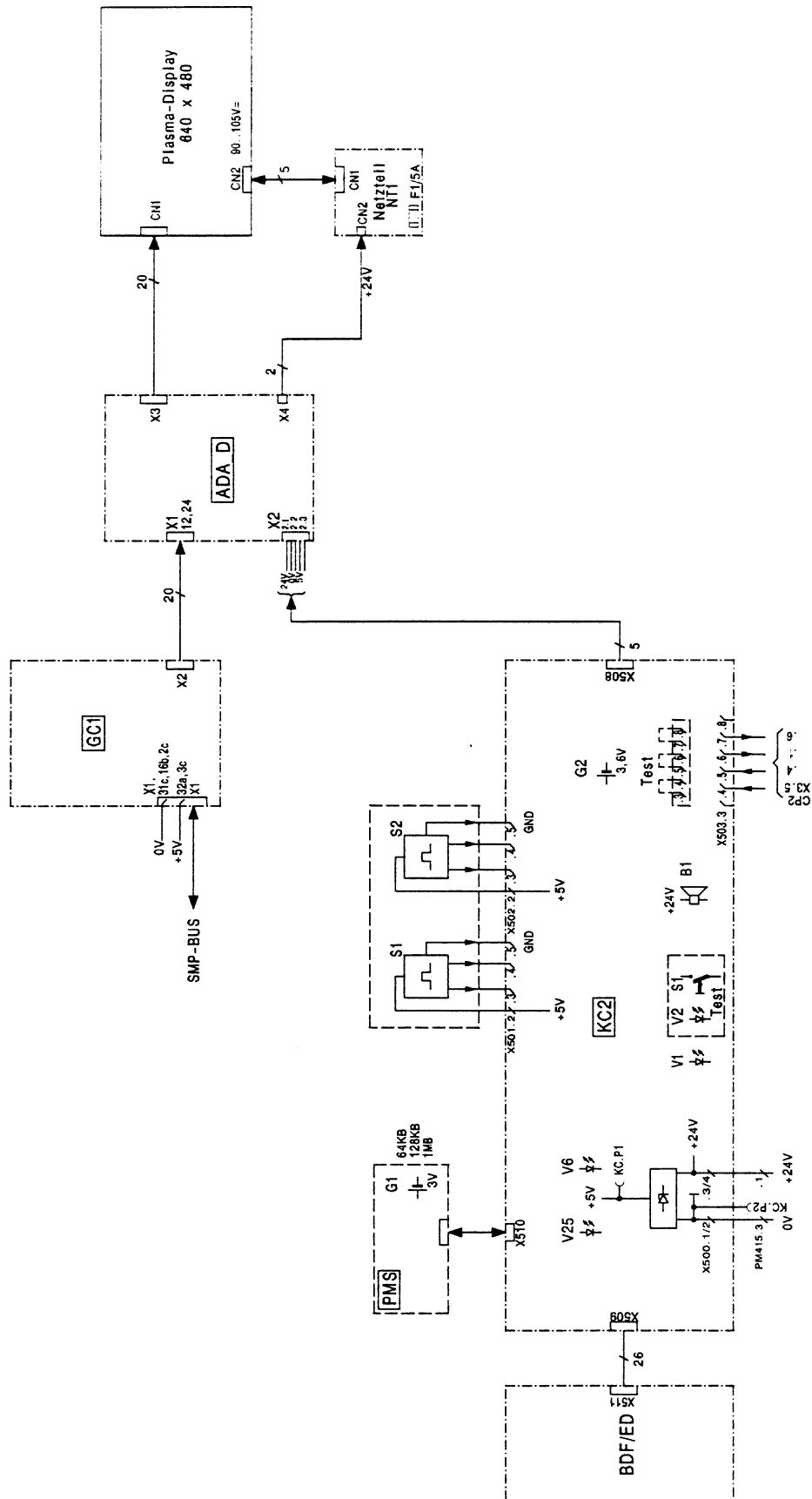


## Keyboard and Display 78 ES

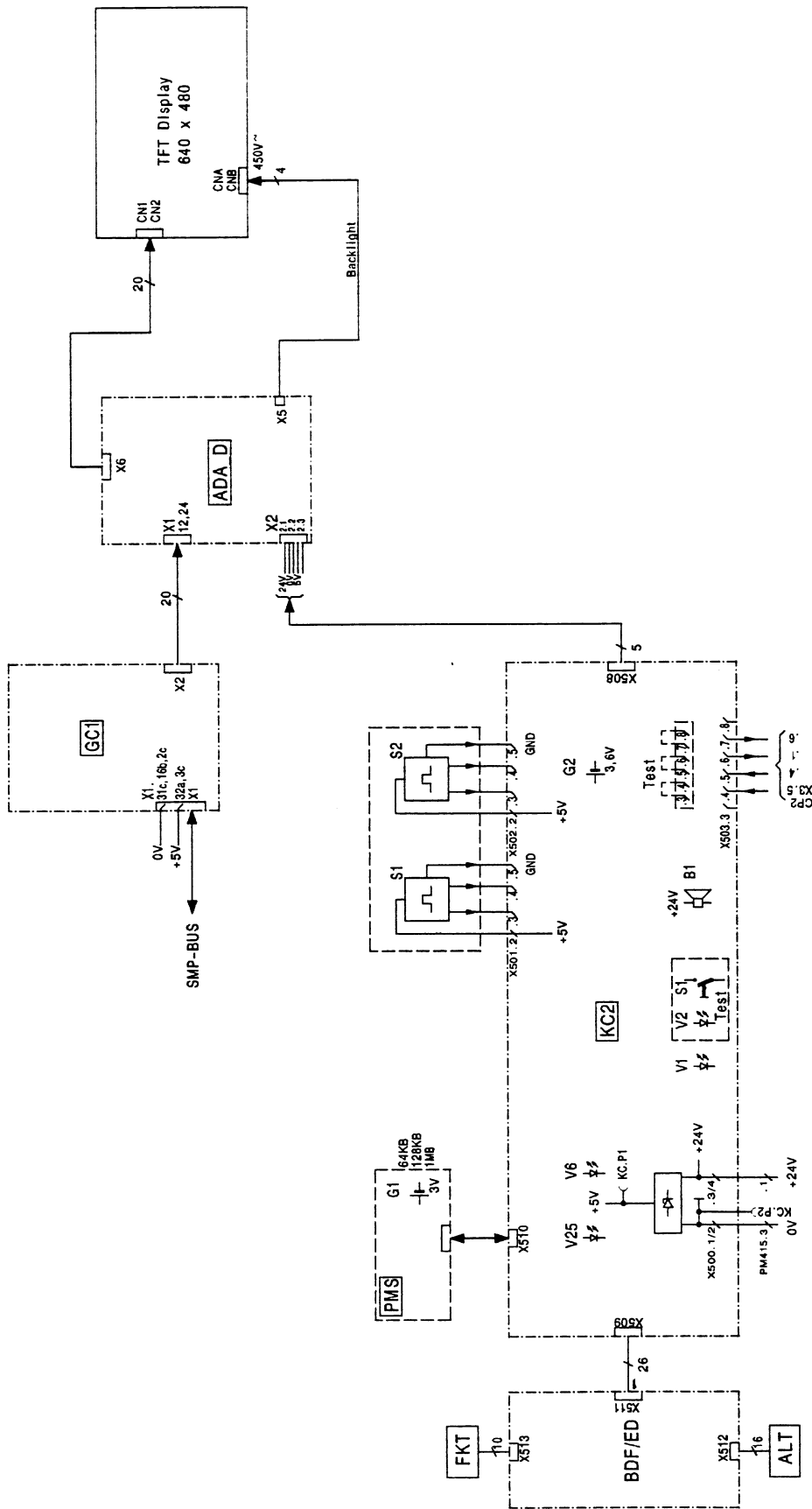
The keyboard and keyboard controller in 78 ES machines is one unit like in the POLAR 66. A slot for a PMS card is not included. The keyboard controller is supplied with +5 V d.c.



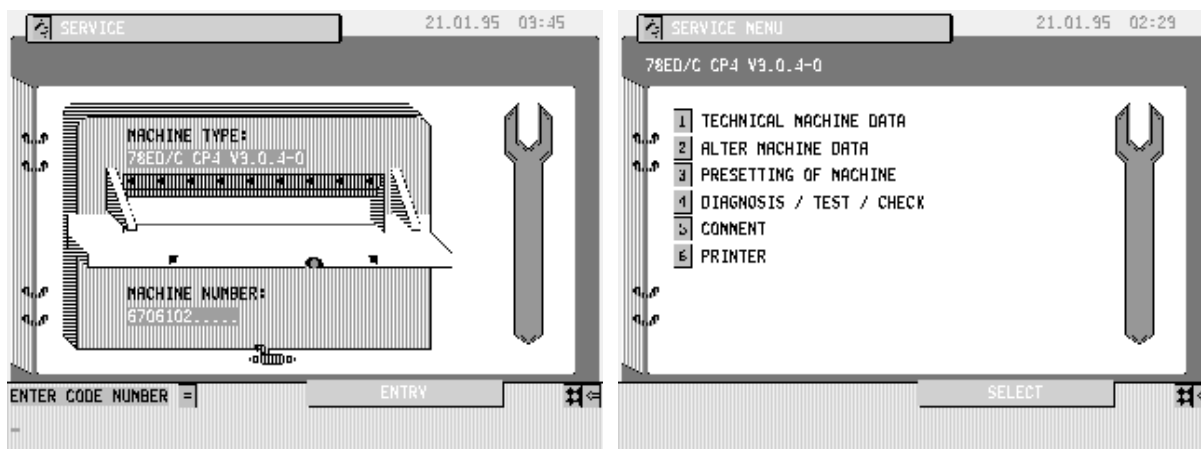
Keyboard and Display "E" 92 - 176 (monochrome)



Keyboard and Display "ED" - 92 - 176 (color)



## Service Information POLAR S, E, ED



**SW2.4 OFF**

**SW2.4 ON**

If the window service in the main menu is selected, you can enter via code no or with the preselection of SW2.4 in CCard into the service mode. There you will find the following overlook.

### 1. Technical Machine Data

Indication of machine dependent data

### 2. Alter Machine Data

Adjustment of variable machine parameters.

### 3. Presetting of Machine

Indication of software version and preset of DIP switches on board CP-2

### 4. Diagnoses / Test / Check

For the machine check necessary information and support are collected under this menu point.

### 5. Comment

Menu for storing machine and/or service information

### 6. Printing

Selection of sub-menus: Print service report, print texts, print text errors (wrong/missing texts)

## Technical Machine Data

TECHNICAL MACHINE DATA		21.01.95 02:36
78ED/C CP4 V9.0.4-0		
BRAKE AFTERRUN	+0.011 CM	
SLOW DOWN DISTANCE	0.352 CM	
BACKGAUGE END POSITION	79.601 CM (78)	
REFERENCE POSITION	37.633 / 37.920 / 38.451 CM	
MAXIMUM SPEED	19.958 CM/SEC	
CREEP RATE	+1.007 CM/SEC	
CUTTING TIME UDC>BDC/BDC>UDC	1.16 / 0.72 SECONDS	
KNIFE REACTION TIME	0.34 SECONDS	
KNIFE POSITIONS AT UDC & BDC	357 / 192 DEGR.	
KNIFE AFTERRUN TOLERANCE	0.12 SECONDS / 25 DEGR.	
KNIFE AFTERRUN	0.04 SECONDS / 7 DEGR.	

### Brake afterrun

determines the distance which is covered after the backgauge motor brake has been switched off and until the backgauge actually stops.

### Slow down distance

describes the last portion of the positioning distance, which is covered at minimum positioning speed. The creepage distance is calculated on the basis of the creep speed measured and a creepage time of 350 ms. (Those machines fitted with parameter step „Smooth stop at position“ when activated allow a creepage time of 700 ms; this means positioning with twice the creepage distance.)

### Backgauge end position

is determined by the position of the rear table limit switch. This measured value which is automatically determined by the machine in a reference run serves to determine the type of machine for the computer. The calculated value is the basis of a correct positioning of the backgauge as well as an adequate selection of the menu guided knife change by the computer.

### Reference position

The three measurements are composed of the electrical and mechanical reference points, (pulse generator and switch B 341). The first and the last value is generated by switch B 341 with the corresponding operating flag. (signal sequence „0-1-0“).

The middle value which is designated as reference point of the pulse generator,, is output upon every rotation of the spindle (= 10 mm backgauge forward feed). To detect the reference point which is important for backgauge positioning the machine requires the following condition to be met:

- Switch 341 is supplied to Psignal by the operating flag.
- the pulse generator must also generate a reference point during this phase. The value should be as close as possible to the centre of the High phase of switch B 34 1. The value can be corrected by moving the operating flag. Once the conditions have been complied with correctly LED -V2 - of CP2 will indicate the AND logic of the signals by lighting up briefly.

### Max. speed

The maximum advance speed of the backgauge drive unit obtainable in automatic operation. The basic adjustment is made at the frequency converter for the backgauge motor. The setting of the frequency converter requires a keyboard unit lid. no. 229709). This service tool can be purchased from the Polar Spare Parts Department. The adjusting values for types 79 and 92 are approx. 45 Hz, which corresponds to a forward feed of approx. 20 cm/s. On machines as of type 115 the frequency is set to approx. 65 Hz or approx. 30 cm/s.

### Creep rate

The creep speed is the minimum positioning speed for the backgauge drive unit to be adjusted at the frequency converter. It is approx. 2 Hz. It must be observed, however, that the motor being adjusted in this way should be left sufficient torque to position a particular measure. Attention must be drawn to possible mechanical stiffness in the area of the backgauge drive unit. The optimum value of  $V_{min}$  is approx. 3.0% of  $V_{max}$ .

\* after any modifications of the frequency converter a new reference run must be performed prior to a new function test.

### Cutting time „OT - UT / UT - OT“ (OT = TDC) (UT = BDC)

Both measuring values taken together result in the actual knife operating time for the complete cut. The first measuring value „OT - UT“ designates the time passing between the activation of magnetic valves Y33/Y33a and frictional connection of main clutch until knife upstroke control recognizes the „electrical UT“ and sends a signal to the computer.

The second time value „UT- OT“ is calculated from the detection of the electrical UT until signal change UT (>not UT <) is recognized by the computer. Once the signal has been recognized the knife movement is switched off and the knife will come to a standstill at the mechanical upper dead centre with the respective afterrun.

### Knife reacting time

The time delay between energizing of the magnet valves (or clutch in machine 78) and the moment of the first received counting pulses from the MHS95 is displayed. The maximum tolerance is different depending the software versions. In case of machine faults see the remedy in the list error explanations (Fehler 608).

### Knife positions at UDC & BDC

The position of the electrical switch points UDC (OT) as well as BDC (UT) on the circle of the crankarm.

### Knife Afterrun Tolerance (only visible if SW2.4 is in position ON)

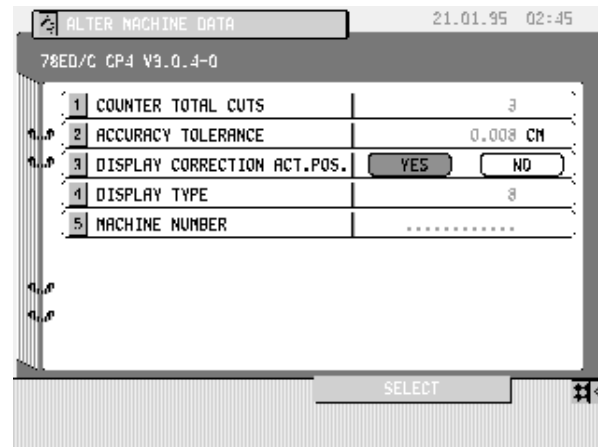
The indicated values, i.e. times and angles, are the max. admissible limit values, before the computer will output an error message on the display locking clamping and cutting. Prior to a permanent lock-up of the cut there is a so-called „warning threshold“ -

Machine	Warning Threshold	Max. Value
78 and 92	100 msec. / 20 degrees	120 msec. / 25 degrees
>= 115	120 msec. / 20 degrees	140 msec. / 25 degrees

### Knife Afterrun (only visible if SW2.4 is in position ON)

The knife afterrun determined by the computer for the respective machine. The two measured values calculated must be within the tolerance ranges specified in item 9. Any measured value (time/angle) which is not within the tolerance range will be regarded as an error causing clamping and cut to be locked.

## Alter Machine Data



Item	Value
1 COUNTER TOTAL CUTS	3
2 ACCURACY TOLERANCE	0.008 CM
3 DISPLAY CORRECTION ACT.POS.	YES NO
4 DISPLAY TYPE	3
5 MACHINE NUMBER	.....*

### 1. Counter total cuts

Counting of all cuts executed on the machine. This counter is independent from the cutting or preselection counters available to the operator. When the CP2 board or the battery is replaced the counter of total cuts shows an indefinite value which should be reset.

### 2. Accuracy tolerance

Admissible deviation in a positioning process. If the backgauge position selected is within a preset tolerance range the measuring display is adjusted to the nominal position stored. As soon as the tolerance is exceeded error message „position not reached“ is issued and the actual backgauge position is displayed. Values between 0.008 cm and 0.1 cm can be stored as tolerances. In the test mode the minimum value can be set to 0.000 cm\* The accuracy allowance adjusted in the factory is 0.008 cm.  
(\*applies only to a switching-on phase of the machine)

### 3. Display correction actual position

In standard operation this correction is switched on. This ensures that odd numbers are eliminated for those cut sizes approached which are within a preset tolerance. As a consequence, the operator will always read identical nominal and actual positions on the display. If the correction has been switched off for testing purposes it will be reactivated automatically after the machine has been restarted.

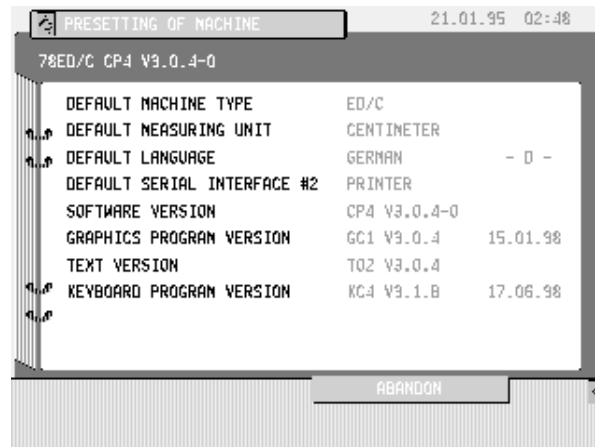
### 4. Display type

This setting option is only provided for internal testing. This issue of the menu will not be available any longer in the succeeding version of V 1.3.0. The factory setting in program versions up to V 1.3.-d, i.e. „1“, or „2“ for different types of TFT-displays.

### 5. Machine number

Here you can enter (store) the machine no.

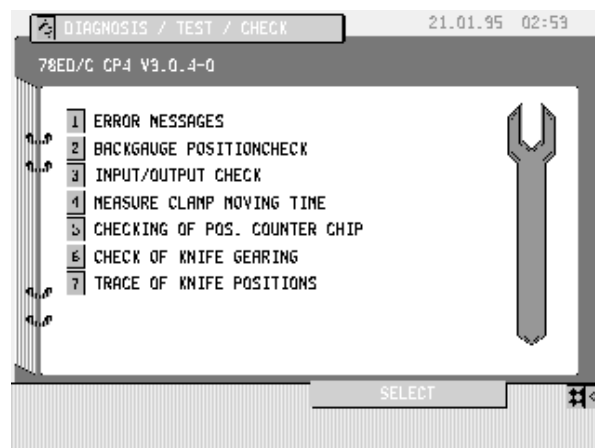
## Presetting of Machine



The preselection on the CP-board as well as the software versions of the components are displayed in the presetting of machine. The variation of presettings are described under DIP-switches SW2 and SW3 on CP-Board.

Also the software versions of CP-Board, graphic controller and keyboard controller are displayed.

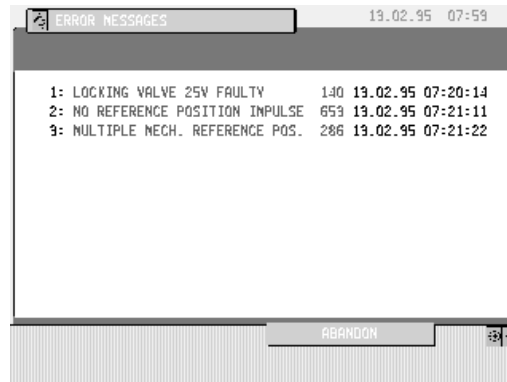
## Diagnosis / Test / Check



For the diagnosis helpful functions are selected in seven groups

1. Error messages
2. Backgauge position check
3. Input / Output check
4. Measure clamp moving time
5. Checking of position counter chip
6. Check of knife gearing
7. Trace of knife position

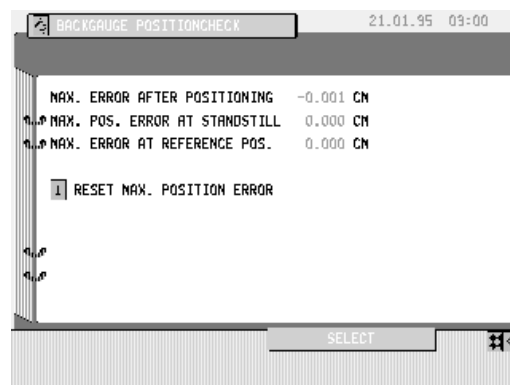
## Error messages



Any faults during operation of the machine are displayed in the screen and stored with time and date. Only the last eleven messages are shown. Earlier messages are deleted but the numbering continues. There is the following rule. If the same message comes up again, time and date are replaced only. An other error shows a new message.

## Backgauge position check

The machine control observes always the backgauge position. Deviations between nominal position and actual position are displayed in three different messages.



### Max. error after positioning

A comparison of nominal and actual position is done during each backgauge positioning. The result is always used as a correction of the backgauge afterrun and is also an information for the service technician. The display shows the maximal correction value ever need after the last zero resetting.

### Max. position error at standstill

The position is checked during the standstill of the backgauge too. If the control observes a change (i.e. during a hard knock up of material) the operator will be informed to position the backgauge again. Also here the maximal deviation after zero resetting is stored and shown.

### Max. error at reference position

The value of the reference point stored in the memory is compared to the value of the position counter every time the reference point is passed over. Any deviations are written into the error memory before the measuring indication is updated. The value stored will always be replaced by a higher one.

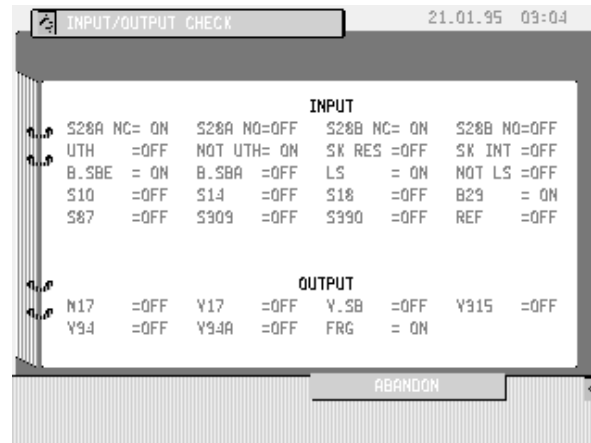
Should there be any deviations below the value stored such values are not indicated.

### 1. Reset max. position error

By means of this function the „max. error of pos. counter“ value displayed in the „machine data“ image is reset to >0<.

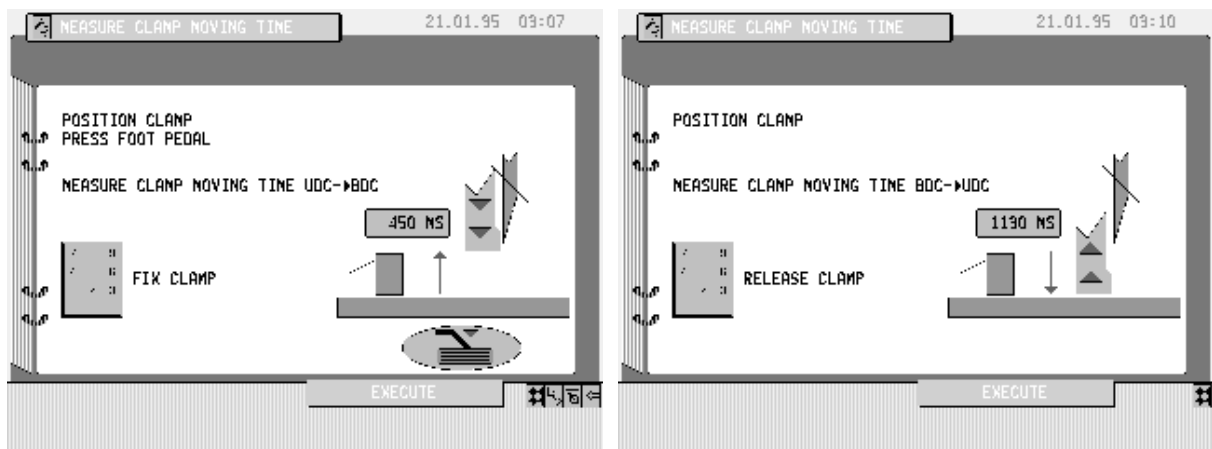
## Input Output check

Indication of inputs and outputs in the cutting cycle and backgauge drive unit for limit switches, magnetic valves and light barrier.



## Measure clamp moving time

For a better adjustment of the dynamic force of the clamp during use of the pedal the clamp speed can be measured.



Press pedal during the display "measuring clamp moving time" and in the moment when the clamp touches the table surface press any number key. Magnetic valve Y315 locks the clamp down and the display shows the lowering time in milliseconds.

Another pressing of any number key let energize magnetvalve Y315 again and proximity switch B29 observes the upper position and displays the lifting time in milliseconds.

## Check of knife gearing

MESSERGETRIEBE-KONTROLLE		21.01.95 03:33
MESSERWEG OT-UT	187 GRAD IN 0.82 SEK	
MESSERWEG UT-UT	172 GRAD IN 0.76 SEK	
EL. SCHALTPUNKTE UT-NICHT	192 GRAD UT / 957 GRAD OT	
MECHANISCHER UT GENESSEN	--- GRAD	
MESSERNACHLAUF	7 GRAD IN 0.04 SEK	
SCHNITTGESCHWINDIGKEIT LEER	--- GRAD/SEK LEERWEG --- GRAD	
SCHNITTGESCHWINDIGKEIT LAST	--- GRAD/SEK EINLAGE --- GRAD	
HOCHLAUF-GESCHWINDIGKEIT	229 GRAD/SEK	
TV MESSERBALKEN-SPERRE	0.10 SEK POSITION GESICHERT	
TV MAGNETVENTIL / KUPPLUNG	0.34 SEK	
AKTUELLE MESSERPOSITION	9 GRAD / 0 IMPULSE 240 OT	

(in german language only)

### Knife Path OT - UT

is the distance/time covered from the initial point (knife in mechanical upper dead centre) to the electrical lower dead centre. Time measurement is started with the first pulse of the knife upstroke control registered by the computer.

### Knife Path UT - OT

once the electrical lower dead centre has been recognized the distance and time needed to reach the electrical upper dead centre is determined.

### Electrical switching point "Not - UT"

Switching point of NOT - UT signal to computer

### Mech. lower dead center measured (not used)

### Knife Afterrun

is the distance covered at the electrical UDC after knife drive unit (Y33 + Y33a) is switched off, until the knife has come to a complete standstill. If the knife afterrun exceeds the admissible tolerances the operator will be informed by an error message (refer also to page 3).

### CUTTING SPEED EMPTY (i.e. without material)

### CUTTING SPEED LOADED (i.e. with material)

at present these data is only determined in connection with cutting optimization option.

### Upstroke Speed

Indication of knife return speed in degrees per second

### TV Knife Bar Lock-up

the time necessary after activation of SB magnet to lift the safety lever from lock-up position to unlocked position. Both conditions are scanned by a sensor, each. If the maximum admissible time has been exceeded (e.g. due to stiffness of machine) the cut will be locked and an error message output.

### TV Magnetic Valve/Clutch

is the time period between activation of magnetic valves Y33 and 33a and start of knife movement. Consequently, this time frame includes also the setup of the clutch pressure and the reaction time of the main clutch.

### Actual Knife Position

The actual knife position reached after the end of the cut. The second indication of counting pulses includes nominal and actual counter. The presetting of 240 pulses corresponds to a complete movement of the knife. The actual counter is cleared after every cut.



## Overlook of adjustments and check values

### 1. Mechanical

	78	92	115	137	155	176
Gap for knife carrier	0,05	0,05	0,05	0,05	0,05	0,05
Gap between clamp and knife	0,25-0,3	0,25-0,3	0,3-0,35	0,3-0,35	0,3-0,35	
Clutch gap	0,2-0,4	0,4-0,8	0,4-0,8	0,4-0,8	0,4-0,8	0,4-0,8
air gap (iron / iron gap)= min. size for brake and clutch shoes	clutch gap +0,1 mm					
	1 mm	1 mm	1 mm	1 mm	1 mm	1 mm
Basic assembling of turn buckle nut (old knife change)		2 top	4 bottom	4 bottom	1,5 bottom	
Gap for backgauge motor brake	0,2	0,2	0,2	0,2	0,2	0,2
Pos. of limitswitches in mm						
Front limit screw	16	19,5	19,5	20	29,5	29,5
Front limit screw by swivel backgauge.			21,5	22	29,5	29,5
S7						
S8	68	88	88	88	118	118
S9	18	24	24	24	34	34
S13a						
S13		935	1165	1465	1565	2015
Rear limit screw		945	1175	1475	1575	2025
Smallest cut in cm	2,5	2,5	2,5	2,5	3,5	3,5
with false clamp in cm	7	9	9	9	12	12
Max. ream height in cm	12	16,5	16,5	16,5	16,5	16,5
Weights						
Machine in KG	1300	1890	3200	4120	4950	5850
Frame						
Table						
Gearbox						
Knife thickness in mm	11,7	11,7	13,75	13,75	13,75	13,75

### 2. Hydraulic

	78	92	115	137	155	176
Safetypressure 1	12	17	17	16	20	20
Safetypressure 2	17	22	22	21	25	25
Safetypressure 3	<30	<30	<30	<30	<30	<50
Min. clamp pressure	38	30	34	33	34	34
Max. clamp pressure	155	115	102	125	135	135
	2200	3500	4500	4500	6000	7000
Clamp lowering time by using foot pedal		1,2	1,8	1,8	2	2
Clutch pressure		60	70	75	90	
Hydraulic system						
Oil quantity in l	6	17	33	33	33	33
Gearbox						
Oil quantity in l		0,7	1,2	1,6	2,5	2,5

**3. Electrical**

	78	92	115	137	155	176
<b>Fuses</b>						
F 1 AC-IN	6A	6A	6A	6A	6A	6A
F 1 AC-IN	6A	6A	6A	6A	6A	6A
F 3 AC	1,5A	1,5A	1,5A	1,5A	1,5A	1,5A
F 4 AC	10A	10A	10A (16A)	10A (16A)	10A (16A)	10A (16A)
F 5 AC	2A	2A	2A	2A	2A	2A
F 6 AC	2A	2A	2A	2A	2A	2A
F 7 DC	4A	4A	4A	4A	4A	4A
F 8 DC	5A	5A	5A	6A	6A	6A
F 9 DC						
F10 DC	6A	6A	6A	6A	6A	6A
F11 AC-IN	1AT	1AT	1AT	1AT	1AT	1AT
F12 ST-I	1AT	1AT	1AT	1AT	1AT	1AT
<b>Jumper FU</b>						
C001	0	0	0	0	0	0
C007	0	0	0	0	0	0
C008	9	9	9	9	9	9
C010	2 Hz	2 Hz	2 Hz	2 Hz	2 Hz	2 Hz
C011	45 Hz	45 Hz	60 Hz	60 Hz	60 Hz	60 Hz
C012	0,05	0,05	0,05	0,05	0,05	0,05
C013	0,05	0,05	0,05	0,05	0,05	0,05
C014	0	0	0	0	0	0
C015	50Hz	50Hz	50 Hz	50Hz	80Hz	80Hz
C016	8-15%	10-20%	10-20%	10-20%	10-20%	10-20%
Brake afterrun	0 - 0,10	0 - 0,10	0 - 0,20	0 - 0,20	0 - 0,20	0 - 0,20
Slow down travel						
Backgauge speed. max:	20 cm/sec	20 cm/sec	27 cm/sec	27 cm/sec	27 cm/sec	27 cm/sec
Offset Board SAP	0,0V (+/- 0,1V)					
Signal from SAP to FU	forward		backward			
	Volt	Hz	Volt	Hz		
slow by keyboard	2,6	18	2,6	18		
S10, S14	5,3	35	5,3	35		
Positioning	10	65	10	65		
Reference run						
in front of ref.-point 2,9	19,5	1,2	8,5			
behind of ref.-point	2,9	19,5	1,2	8,5		
+24 V	23,7 - 24,3 V					
+12 V	11,4 - 12,6 V					
+ 5 V	5,08 - 5,12 V					

## List of LED's

LED	Colour	Meaning	Basic condition
<b>Kimodul</b>			
ME	green	Motor start-up (flashing during start-up)	OFF
MH	red	Upstroke terminated	ON
<b>K1T</b>			
	yellow	Motor start-up (flashing during start-up)	OFF
<b>KAP</b>			
V8	green	+24V d.c. power supply KC	ON
V9	green	+45V d.c. power supply PS 95	ON
V10	green	+24V d.c. power supply for MHS (2 channels)	ON
V11	green	+8V d.c. power supply for MHS (SAP)	ON
V12	green	+25V d.c. power supply for valves	ON
<b>PS95</b>			
V1	green	+24V d.c.	ON
V2	green	+12V d.c.	ON
V3	red	Reset	OFF
V4	green	+5V	ON
<b>CP2</b>			
V1	red	Computer is activ	ON
V2	yellow	Reference point (flashes during scanning of reference point)	OFF
V11	green	Down-load	OFF
V12	green	Down-load	OFF
V13	green	Down-load	OFF
V14	green	Down-load	OFF
<b>SKÜ</b>			
PR	red	Clamping active	OFF
MS	red	Cutting active	OFF
<b>LS</b>			
D1	red	State	ON
D2	red	State	ON
D3	red	State	ON
D4	red	State	ON
D5	red	State	OFF
D6	red	State	OFF
<b>KC</b>			
V1	red	Computer active	flashing
V2	red	keyboard test active	OFF
V6	green	power supply	ON
V25	red	lights up during data exchange between PMS card and KC	OFF

LED	Colour	Meaning	Basic condition
<b>SAP</b>			
V29	yellow	UT1(lower dead centre) of MHS 95	OFF
V28	"	OT1(upper dead centre) of MHS 95	OFF
V27	"	UT (lower dead centre) of MHS 95	OFF
V26	"	OT (upper dead centre) of MHS 95	ON
V6	red	Backgauge motor brake Y17 on (free)	OFF
V5	yellow	End posit. at front, with false clamp plate and Fixomat	OFF
V4	red	not used	OFF
V3	"	Control signal backgauge return for frequency converter	OFF
V2	"	Control signal backgauge advance for frequency converter	OFF
V1	"	Enabling signal for FU*	OFF
V25	yellow	0° signal from MHS 95	ON/OFF
V24	"	90° signal from MHS	ON/OFF
V23	"	Limit switch front (S9)	ON
V22	"	Fixomat active	OFF
V21	"	Limit switch rear (S 13)	ON
V20	"	Handwheel precision adjustment (S 18)	OFF
V19	"	" (S 14)	OFF
V18	"	" (S 10)	OFF
V17	"	Pedal switch (S390)	OFF
V16	"	False clamp detection 3 (S 218b)	OFF
V15	"	False clamp detection 2 (S 218)	OFF
V14	"	False clamp detection 1 (S 6)	OFF
V13	"	Limit switch front slowly (S 7)	ON
V12	"	Limit switch rear slowly (S 13a)	ON
<b>Frequency Converter</b>			
V1	red	Error	OFF
V2	green	stand by (active during backgauge movement)	flashing
<b>SK</b>			
V83	red	Safety lever (YSB)	OFF
V84	"	Output for cutting circuit transformer (XFMR - press.- on SKÜ) 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 (nomin. condit.)	OFF
V88	"	Logic error in cutting circuit (reset)	OFF
V89	"	Output for cutting circuit transformer (XFMR -cutting- on SKÜ) (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 centre 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

### Last changes of this file

<b>Version</b>	<b>Date</b>	<b>Changes</b>	
ED_99e1_	14.01.1999	general revision	KMei
ED_99e2_	05.03.1999	text corrections	
		Layout for international paper sizes	KMei
ED_99gb3_	18.04.1999	New drawings and changings about V4.0 included	KMei
ED_99gb3_	18.02.2000	Software-versions "-13" added	KMei