

PS/R-CNC Version 5

Maskintyp:

Machine type:

Z-60

Maschine Typ:

Maskinnummer:

Machine number:

5043

Maschine Nummer:

	Minimivärde Minimum value Mindestwert	Kalibreringsvärde Calibration value Kalibrierwert	Maximivärde Maximum value Maximalwert
Sidovals A: Side roll A: Seite Rolle A:	10	300	500
Sidovals B: Side roll B: Seite Rolle B:	10	300	500
Axel D: Axis D: Achse D:	--	--	--
Axel E: Axis E: Achse E:	--	--	--

I

I N S T R U C T I O N M A N U A L K U M L A P S / R - C N C

<u>Table of contents</u>	<u>Page</u>
General description	1
Starting up the machine - Manual control	2 - 5
PS/PAS-machines	6
Description of Switches and Push buttons	7 - 9
Description of CNC Control panel	10 - 14
Teach-in mode	15 - 17
Interpolation function (optional equipment)	18
Programming example	19 - 24
Running a CNC-program	25 - 27
PS-machines with backstop unit (optional equipment)	28 - 29
Inserting a new position	30
Deleting a step	31
GOTO function	32 - 34
Printer function (optional equipment)	35 - 37
RAM-card function (optional equipment)	38 - 41
Computer front details	42 - 44
In case of Computer breakdown	45
Pulse encoders	46
Linear encoders	47
Troubleshooting the CNC	48 - 49

II

I N S T R U C T I O N M A N U A L K U M L A P S / R - C N C

<u>List of Figures</u>	<u>Page</u>
Figure 1 Initial page	4
2 Value page, uncalibrated	4
3 Value page, one reference point found	5
4 Value page, both reference points found	5
5 Control panel	9
6 CNC control panel (terminal)	13
7 Program pages	14
8 Teach-in page (Program No:)	17
9 Teach-in page (Step No:)	17
10 Program table (example)	20
11 Program example drawing	21
12 Complete program, step 1 - 4	22
13 Complete program, step 5 - 8	23
14 Complete program, step 9 - 11	24
15 CNC page	27
16 Backstop-unit	29
17 GOTO function in programming	33
18 GOTO function in a program run	34
19 Printer page	37
20 RAM-card details	40
21 RAM-card pages	41
22 Computer front details	43
23 IN- and OUT-signals from CNC	44

K U M L A P S / R - C N C S Y S T E M

GENERAL DESCRIPTION

The CNC-unit can, in CNC-mode, automatically position three axes, one axis at a time.

As an option, the CNC-unit can be equipped with interpolation for positioning two rolls at the same time (A+C or B+C). This is very helpful when bending e.g. ellipses.

During the running of a program, the values of the different axes can be read on the display.

Also present step is displayed.

It is possible to run the program in INTERMITTENT-mode (i.e. with interruptions for radius check etc.).

The program can also be run CONTINUOUSLY.

The Operator communicates with the Computer via the Keyboard at the Control unit.

The programming of the unit takes place by entering the absolute position of all three axes. This is done by entering the positions on the keyboard, or during a bending using the Teach-In-function.

The storage capacity in the battery backed up RAM-memory is 60 programs and each program can contain up to 50 different sets of positions.

With GOTO-function (standard) it is possible to link several programs together, in order to achieve more than 50 sets of positions, i.e. it is possible to make a total program holding 3000 sets of positions.

The different programs are saved under a Program number (1-60). It is very easy to make changes in a program (edit) as the memory (RAM) is directly accessed from the terminal via the computer.

KUMLA PS/R-system is equipped with "Teach-in" function, i.e. it is possible to bend one plate, enter the positions continuously and then you will have a complete program, ready to use.

Further there is the possibility, as an option, to connect an external Memory Back up. It is of RAM-card type, which is easy to handle and small in format. One card (size as a credit card) can store all the 60 programs in computer memory.

KUMLA PS/R-CNC can also be equipped with printer for easier program editing and "visual back up".

Note! The PS/R-CNC is equipped on a standard hydraulic system which means that it is quite normal that the reached position do not fully correspond to programmed value (within 1-2 digits).

STARTING UP THE MACHINE - MANUAL CONTROL

Every morning or each time the Control system has been switched off (not the Hydraulics) the machine/system must be initiated (calibrated) again.

Thus, the reference positions of the two rolls A and B must be found as the CNC has "forgotten" the position of these axes when the power was switched off.

The Starting procedure takes place as follows:

- Turn the Main switch for incoming power on. (Optional equipment, which is located on the cubicle of the machine).
It is recommended that when the machine is not in operation this switch shall be switched off, in order to protect the system from thunderstorms, voltage glitches etc.
- Turn the Key-switch for Hydraulic Start circuit on. (Optional equipment, which is located on the door of the electrical cubicle on the machine).
- Start the Hydraulic pump by pressing "I" on the Start/Stop push button on the control panel.
If nothing happens, any of the following things might have occurred:
 - * Any of the Emergency stops is activated (Reset).

NOTE! If the machine is equipped with Wire cable operated Emergency stop (Optional), the wire must be properly adjusted.
The switch has two sets of contacts, one for pulling the wire and one if the wire breaks.
Therefore, it is important that the wire has been properly adjusted.
After a release the switch must be reset with the yellow push button on the unit.

- * Thermal motor protection relay has released.
Check and reset.
- * Fuse is broken.
Check and replace.
- Let the pump run for a few minutes at first start in the morning when the oil is cold, before operating the machine.
- Turn the Key-switch for the CNC-unit to "ON".
(NOTE! This system is separated from the pump start circuit).
- Turn the Mode-switch "TEACH-MAN-CNC" in Manual position (if not already done).

- The Display will show the Initial Page of the system.
See Figure (1).
This page will stay for a few seconds before the Value Page appears. See Figure (2).
This page shows the position of all three CNC-regulated axes A, B and C (Top roll rotation).
Please note that the position values of the two Side rolls (A and B) are "-----".
This indicates that the reference values are not found.
(The machine is not initiated).

- To give these two axes their correct position values, the reference point for each axis has to be found.
(= Reference signal from the encoders).

The reference points of the Side rolls are somewhere between the upper and lower position. (Please see special data sheet for min., max. and reference values).
Depending on where the rolls were located when the machine was switched off last time, respective roll shall be moved up or down.

- Start by regulating Side roll B by moving the Joy-stick up or down.
When the reference point is found the display is showing the correct value for the roll position (B: XXX). See Figure (3).
- Do the same procedure with the other Side roll (A), collecting this reference value.
Now the Display is showing both values for the rolls.
See Figure (4).
- The machine is now ready to be operated Manually or Automatically (CNC-mode) via a program.
- Also regulate the last axis, the Rotation of Top roll (C) forward and reverse.
Forward is from A-roll towards B-roll.
Note that the length measuring operates on the display, "C:".

The digits count positively forward and negatively when operating reverse.
(A - sign is placed in front of the digits when 0 is passed when reversing).

The Rotation speed is proportionally adjustable by the Joy-stick between Minimum and Maximum.

The displayed value, "C:", is the circumference of the Top roll (C), i.e. the Inner length of a rolled plate. (Only PS- and PAS-machines).

This value can be cleared/reset ("C: 0") at any time manually in MAN- or TEACH-mode. This is done by pressing the "Reset/C=0" push button in the control panel.

FIGURE 01 : Initial page.

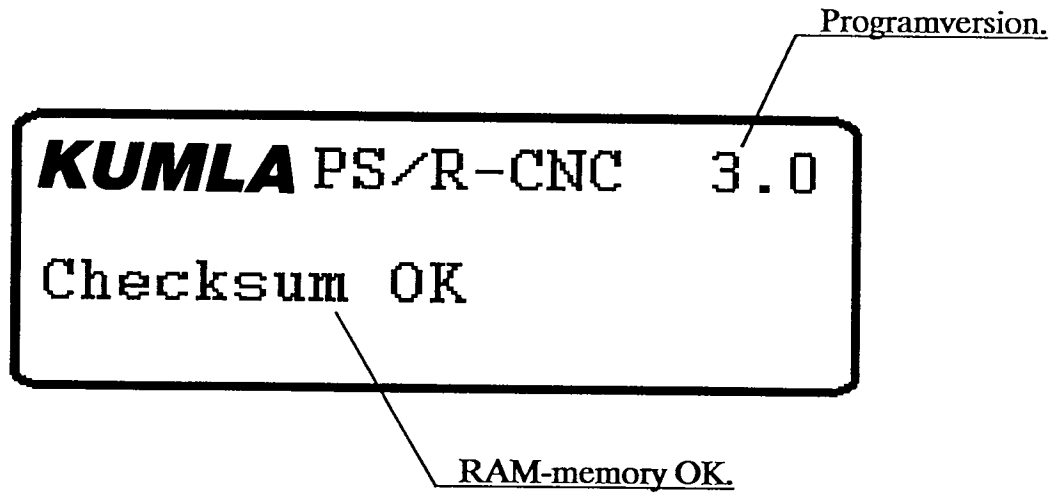


FIGURE 02 : Value page (Uncalibrated).

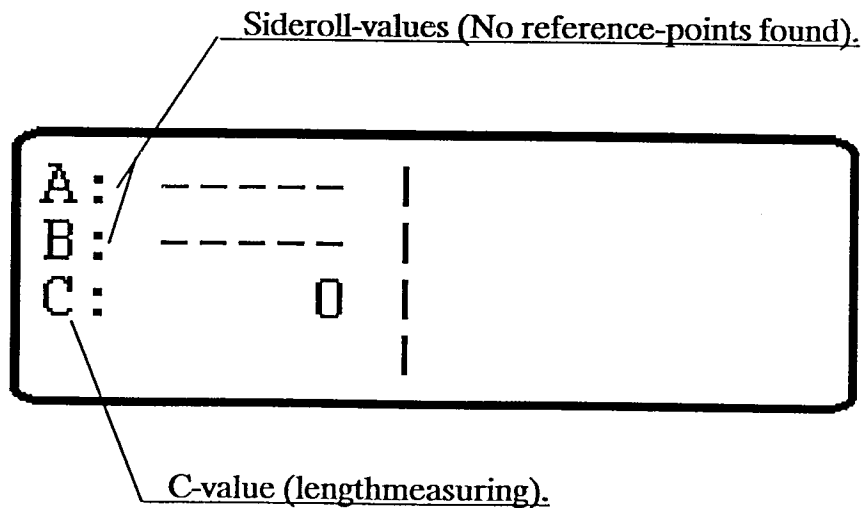


FIGURE 03 : Value page (B-roll calibrated).

A:	-----	
B:	277	
C:	0	

FIGURE 04 : Value page (Both rolls calibrated).

A:	277	
B:	277	
C:	0	

-6-

THIS SIDE IS VALID FOR PS-/PAS MACHINES ONLY!

- Further for Manual operation there are two push buttons for the Drop end. (Please see Figure 5).

When rolling cylinders or objects that are closing, the Drop end must be opened in order to remove the finished object from the machine.

Operation of the Drop end takes place as follows:

Make sure that the Side rolls are in their lower positions and not pressing against the Top roll.
If it is a PAS-machine the D-roll must also be lowered.
Press the push button with the symbol for "DROP END OUT" and keep it pressed all the time as the Yoke opens.

When pressing the other push button with the symbol for "DROP END IN", the Yoke will move up and close.
Keep the button pressed 1-2 seconds after the closing, in order to secure the Yoke by hydraulic pressure.
The Yoke shall be pressed inwards every morning at starting up plus regularly when operating the machine without using the Drop end.
The reason for this is to keep a hydraulic pressure in the Drop End cylinder and prevent the Yoke from opening when rolling.

On small PAS-machines Top roll C will automatically be raised when the Drop end has reached its lower position. When closing the Drop end, the Top roll C will automatically lower into position before the Drop end is coming up.

- Before the machine can be put in proper operation the two Side rolls must be set parallel against the Top roll. (See separate instruction). This is important and the parallelity must be checked at least every morning after Start up and "reference running".
If it is a PAS-machine, the Lower roll D must also be parallel. Please see special instruction for how to do this.
Also remember, that when running a CNC-program in a PAS-machine, you must pinch the plate manually before starting the program.

NOTE! The hydraulic pump can be stopped by the Stop push button (or any Emergency stop) without losing the reference values!

It is only when the CNC-unit has been switched off that a new "reference run" has to be performed again.

Please see Figure (5), showing the Control panel on this Machine.

-7-

DESCRIPTION OF SWITCHES AND PUSH BUTTONS

Please see Figure (5).

- "MODE"-switch: With this switch you choose desired function from your machine.
- Teach: You can now enter desired program and step, and then "teach" the machine a program step by step.
 - Man: "Normal position". You operate the machine as a normal PS-, PAS- or R-machine. Remember that the machine must be in this mode for calibrating when starting up.
 - CNC: The machine will perform your program (must be chosen by entering Program number in Program-mode) when [CNC-start] is pushed.
- Remember that -Teach and -CNC only can be entered when the machine is calibrated.
- "CYCLE"-switch: Here you choose -Cont. (continuously) or -INT (intermittent). This switch only works in CNC-mode.
- Cont: Program will only stop at your Pauses (PSE-command in a program run) and will only continue when you re-start it by pushing [CNC-start].
 - Int: Program will stop after each step in the program and must be re-started to continue.
- "CNC START"-push button: With this push button (which only is active in CNC-mode) you start and re-start (after a Pause /PSE-command/) or after each step (INT-mode) your program.
- "RESET C=0"-push button: Will reset length measuring any time when pushed in MAN- or TEACH-mode. Remember to push this button before starting to "teach" the machine. In CNC-mode C will automatically be zeroed when [CNC-START] is pressed.
- "SPEED CNC MODE"-potentiometer: With this potentiometer you can set maximum speed during a CNC-program. It can be changed while running, but it is not recommended. In Interpolation programs you should take down the speed a little, e.g. to 7-8 to give the computer a possibility to "speed up", if necessary.

-8-

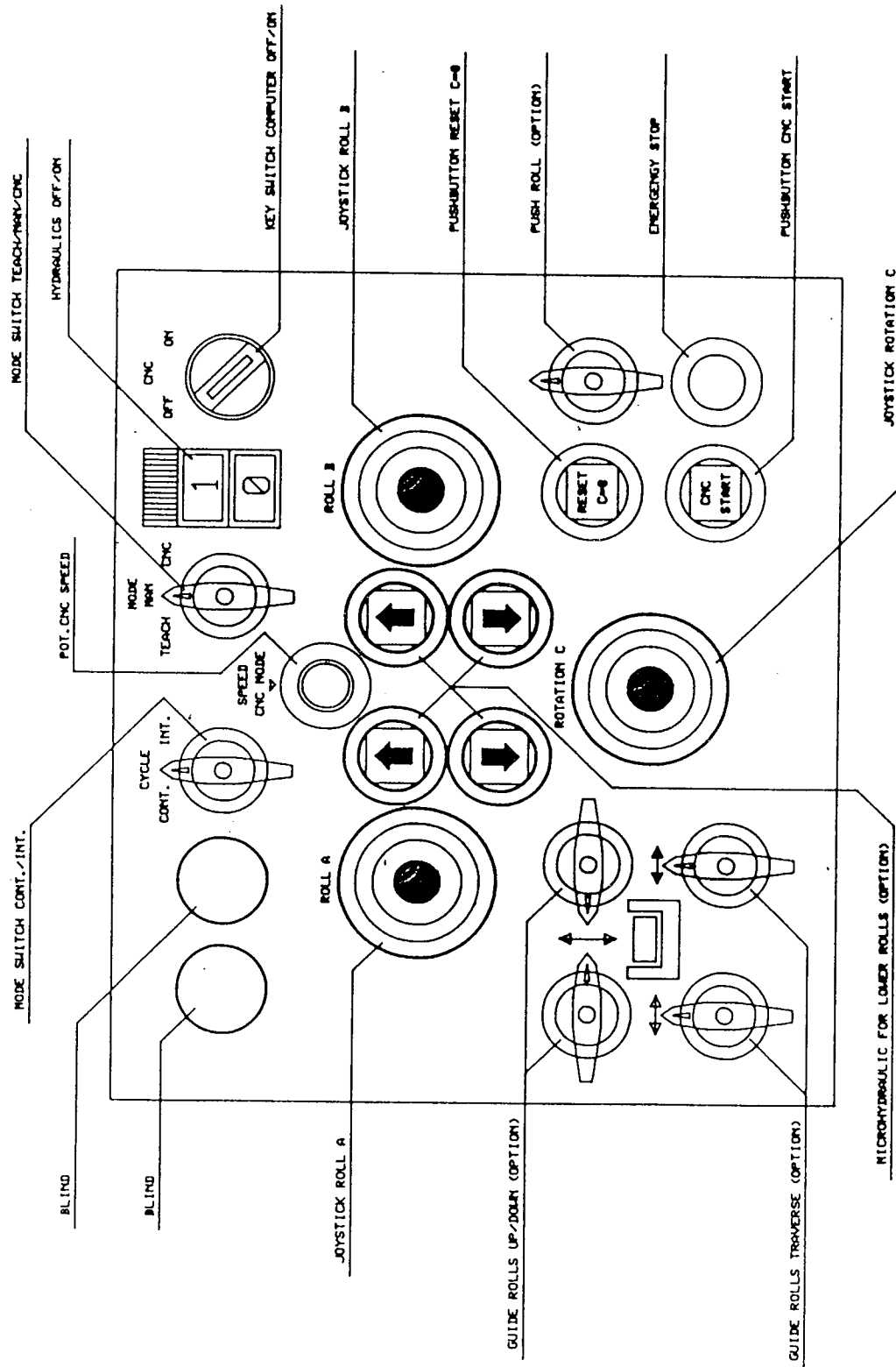
"SPEED MAN MODE"-
potentiometer:

This potentiometer only exists if the machine is equipped with push buttons instead of joysticks. Choose desired speed in Manual mode from 0-10 (min. - max.).

FIGURE 5

01/-90

Control panel layout.



-10-

DESCRIPTION OF CNC CONTROL PANEL

Please see Figure (6).

Studying Figure (6) you can see three different groups of push buttons as well as a display for visual information.

There is also a "logo" of the three axes to inform you which axis is which.

- For PS-machines you shall see this as seen from the End yoke side
- For PAS-machines as from Drop end side. D-roll will be between A- and B-rolls.
- For R-machines seen in front of or above the machine.
(For bigger R-machines with pendant control, there might be a reversed function).

CONTROL:

These push buttons are for "Main functions", i.e. here you choose program, you can delete steps or insert steps in a program. You can also, when these options are included, start your printer and save/load from the memory card unit.

- PRG: When pushing [PRG] you will enter a new page. Please see Figure (7).
In this case your default program is 1. If you want to have another program, for example 12, then push [1] [2] [ENTER].
Now choose which step you want to enter (default is step 1), then push [ENTER].
When leaving a program just push [PRG].
Remember to exit Program-mode before entering CNC-mode.
Please also see special Programming instruction.
- INS: If you want to put another step inbetween two already existing steps, just jump to that step you want to put a new step in front of, and then push [INS].
Now a new step is created with a "NOP" function (No operation). This means that if you do not give any command on this step, the computer will ignore it and continue in the program.
Also, when inserting a step, all steps after the inserted one, will have a new number (+1); 17 will become 18 etc.
This new step can now be edited as any other step.
Please also see special Insert-instruction.

-11-

- DEL: With this push button you delete the step you are on. The computer will automatically re-number all steps after the deleted one; 18 will become 17 etc.
You can only delete one step at a time, and never an entire program. This means, that when you want to erase an entire program, you must delete every single step.
Enter step 1 and then push [DEL] repeatedly until no more steps are coming up (i.e. all steps are "END").
Please also see special Delete-instruction.

OPTIONAL

- SAVE: For RAM-card, please see separate instruction.
- LOAD: For RAM-card, please see separate instruction.
- PRN: For Printer, please see separate instruction.

FUNCTION

- A, B, C: Your three axes.
Please see program instruction, teach-in instruction and optional interpolation instruction for how to use them.
- PSE: Pause-command.
When the Computer comes to a step that contains this command during a CNC-run, it will stop and not continue until [CNC-START] is pushed. Pause-commands are used for inserting plate, check radius etc..
It is also possible to rotate the rolls manually on a PSE-command without C-value is changing. This is helpful for example when putting material into an R-machine. Use rotation for moving the object to start position, then push [CNC-START].
- GOTO: This command will force the computer to jump to a desired program (GOTO XX), perform that program and, when reaching the "END" return to the primary program.

Please also see separate instruction.
- END: Normally end of CNC-run, but can also, together with GOTO, force the program-run to jump back to the program from where the GOTO-routine was started.

PARAMETER

- ↑↓ : Used for jumping up and down in a program. Works both in "PRG"-mode and Teach-mode, where you can step up and see the last input step.
- CLR: Clear the last input character on the screen. (Not when having pushed [ENTER]).
- ENTER: Will enter your input data from screen to memory.
- /: "Together with". Our interpolation sign. When having this sign at the end of an A- or B-step, the computer will automatically take next coming C-value as your interpolation value.
Please also see separate instruction.
- and 0-9: For input of value, program numbers, steps etc.

FIGURE 6

01/-90

CNC CONTROL PANEL (Terminal)

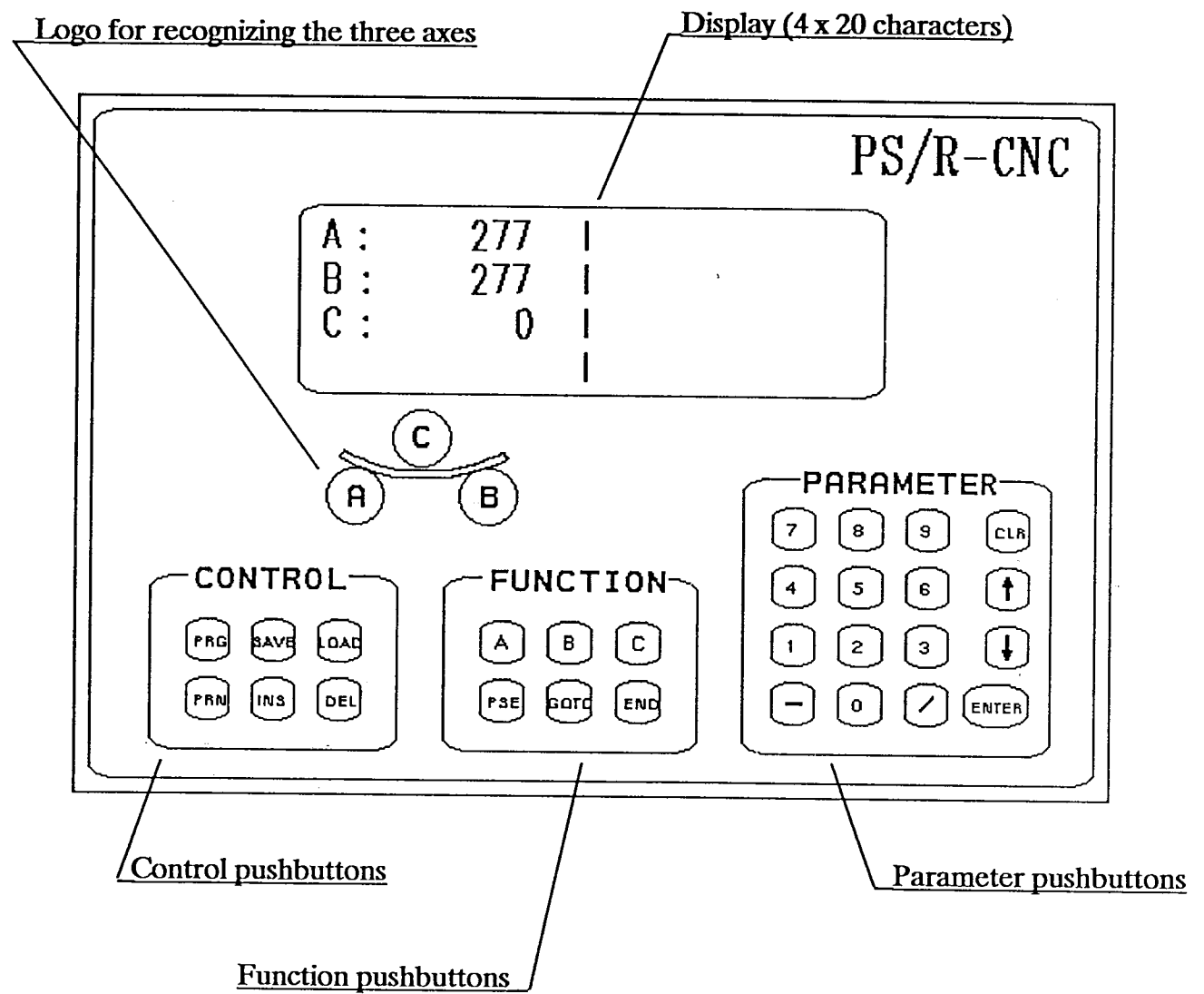


FIGURE 7A : Program page;Number.

Current program in memory.

A:	277		PGM:	01
B:	277			
C:	0			
**	PGM	**		PGM: ☐

Input program-number (if not current)

FIGURE 7B : Program page;Step.

Current step (Always 1 when entering)

A:	277		PGM:	01
B:	277		STP:	01
C:	0			
**	PGM	**		STP: ☐

Input step-number (if not current)

-15-

TEACH-IN - MODE

To enter TEACH-IN-mode, you must first calibrate the machine.
(Please see the Starting up machine-instruction).
Switch mode switch marked "TEACH/MAN/CNC" to position "TEACH".

A new page will appear on the display. Figure (8).

When the PS/R-CNC Computer is initially started up, program number 1 will be default (current) program.
This means that program number 1 will be in Memory, ready to use for a CNC-run or for editing.

However, if you want another program, for example 17, enter
[1] [7] [ENTER].

On the display (Figure 9) the computer now asks for step number. Here is step number 1 always default, due to that mostly you want to enter the first step in a program. If you want to change/edit a step or start Teach-in from another step than 1, key in that number and then press [ENTER].
You are now on desired step in the program you want to "teach-in".

NOTE! It is of highest importance that C-roll value is zeroed whenever a new program is to be taught into the computer.
Therefore, always have as a rule to push [RESET C=0] whenever you enter TEACH-mode.

Since your first steps in a completed program are starting position for plate insert, move your rolls to the positions for this.

Now push [A] and [B] respectively for storing these two positions.

NOTE! The order in which the axis are stored will be the order in which they will move in a CNC-run.

You will see that whenever [A], [B] or [C] is pressed, CNC will automatically store the chosen axis as a step. Value for this axis will be the value that is on the display the moment that the key was pressed.

When a step is stored, the CNC will also automatically jump to next step. This means that [ENTER] is not used in TEACH-mode.

Now, make your program (bending the material) step by step and store the positions continuously when a position is "good".
Whenever you want, you can put in a pause by just pushing [PSE].

-16-

To check already stored steps, use the arrow keys for moving up and down in your program. They also give you the possibility of editing in Teach-mode.

If you want to change a step, or if a step was incorrectly stored, move with arrow key up to actual step and then re-store correct axis and value.

If the machine is equipped with optional interpolation, there is a slight difference in storing an interpolation from storing a "normal" step.

Since an interpolation step is a combination of two axes (A-C or B-C) there are two axes that must be stored.

When you have both axes in position (you have made an interpolation by hand), first press [/] and after that [A] or [B], depending on which roll the interpolation was performed with.

When [A] or [B] was pressed, the CNC stored the chosen axis plus C-axis value.

When your bending is made, lower the Side rolls, store their positions and finally press [END].

You now have a completed CNC-program, ready to use.

If you want to change/edit a certain step, it is easy to make that in Program-mode.

To get out of Teach-mode, switch the Mode-switch back to "MAN".

FIGURE 08 : Teach-In Mode;Program.

Current program

A: 277 | PGM: 01

B: 277 |

C: 0 |

* TEACH * | PGM: ☐

Input program-number (if not current)

FIGURE 09 : Teach-In Mode;Step.

Current step (Always 1 when entering)

A: 277 | PGM: 01

B: 277 | STP: 01

C: 0 |

* TEACH * | STP: ☐

Input step-number (if not current)

-18-

INTERPOLATION FUNCTION

As an option, KUMLA PS/R-CNC machines can also be equipped with one additional pump and proportional valve to make it possible to interpolation-run, i.e. move one axis and rotate at the same time. This is extremely useful when bending e.g. ellipses or when pre-bending in PS-machines.

To operate the machine there will be no changes from a standard machine, except for the possibility to run one side roll + rotation at the same time.

In CNC-mode (running a program) the computer will perform your interpolation steps in order to reach both positions at the same time (within 0,5 s).

Please be aware of the system's capability. You cannot run e.g. side roll 400 units and rotations 3 units and expect them to reach position at the same time. Of course, there are limits, which have to be experienced from machine to machine.

Programming of an interpolation step is easily performed both in Program-mode and TEACH-mode.

Program-mode

If you want to do an interpolation between A-roll moving to 450 and C-roll rotating to 500 (beginning positions is of no importance) then input as follows:

[A] [4] [5] [0] [/]

Normally you would have pushed [ENTER] after your A-roll value, but when making an interpolation step you must tell the Computer to make an interpolation between this step and the nextcoming C-step.

Therefore we have made "/" to our interpolation sign.

"/" means divided by, or, in our case, together with (interpolated with).

When ["/"] is pushed, A-value will be stored and a "C:" will be displayed. This is for reminding you that "C" is only axis allowed after "/"-sign. Now enter C-value:

[5] [0] [0] [ENTER]

To edit an interpolation step you must re-write both A- or B-value and C-value if you edit your A- or B-value. If only C-value is to be edited, it is done as a normal edit, i.e. go to actual step and enter your new C-value.

Please see separate Teach-In Instruction for how to enter an interpolation step in Teach-mode.

PROGRAMMING EXAMPLE

Before the positions are being entered to the computer from the keyboard, it is recommended to run the plate manually and write down the positions in a table (see Figure 10).

By this method it will be easier to avoid programming errors as the program can be checked more conveniently. Another advantage by doing records will be that all programs are documented on paper, not only in the computer memory.

If, by chance, any of the programs will be erased unintentionally from memory, it will be possible to re-install again more easily.

After bending a plate, written the positions down, we can store the positions in the CNC-program.

The following example is a cylinder made in a PS-machine:
See Figure (11) for drawing of this cylinder.

- Turn the mode switch to manual operation. (Position "MAN").
- Push [PRG]. Now the computer wants to know which program number we want (1-60).
In our example we use program No. 1, so push [1] and [ENTER].
- Now we have to select step. Normally this should be "1", but is possible to jump further into the program.
We will enter [1] and [ENTER] (see Figure (7)).
(It is also possible to push [ENTER] without having given [1] before.)
- Now enter the program as follows:

1)	[B]	[4]	[5]	[0]	[ENTER]
2)	[A]	[2]	[5]	[0]	[ENTER]
3)	[PSE]				[ENTER]
4)	[B]	[4]	[8]	[0]	[ENTER]
5)	[C]	[1]	[0]	[0]	[0] [ENTER]
6)	[A]	[3]	[5]	[0]	[ENTER]
7)	[C]	[2]	[2]	[0]	[0] [ENTER]
8)	[PSE]				[ENTER]
9)	[B]	[1]	[0]	[0]	[ENTER]
10)	[A]	[1]	[0]	[0]	[ENTER]
11)	[END]				[ENTER]

If you have entered the program you can go back with the cursor, using the arrow keys [↑] [↓] to control or edit (e.g. if you have incorrectly entered B:110 at step 9, just go to step 9 using the arrow keys and press [B] [1] [0] [0] [ENTER]. Otherwise the program should be as in Figures (12), (13) and (14).

FIGURE 10

01/-90

PROGRAM EXAMPLE

Program no: 1

Drawing no: 123456

Date: 1987-07-08

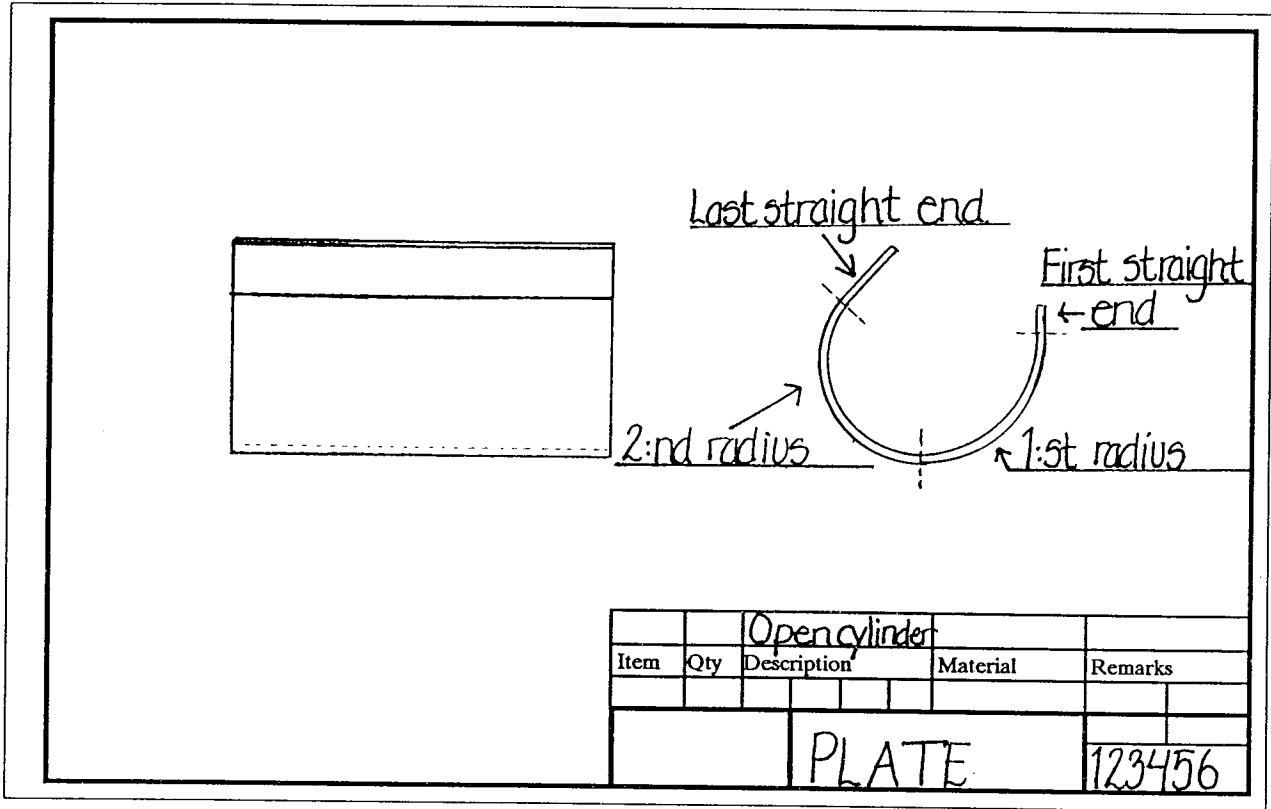
Object: Plate

STEP	A	B	C	Spec. command	Remarks
1		450	0		When starting C will be set to zero
2	250				} Start position: feeding the plate
3				PSE	Waiting for "CNC-Start" push button
4		480			
5			1000		} First radius
6	350				
7			2200		} Second radius
8				PSE	Waiting for "CNC-Start" push button
9		100			
10	100				} Bring rolls to a low position
11				END	End of program
12					Take out plate
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					

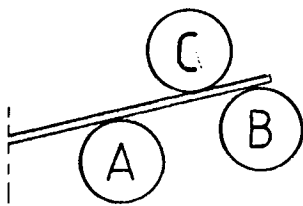
FIGURE 11

01/-90

CYLINDER DRAWING / ROLLING EXAMPLE

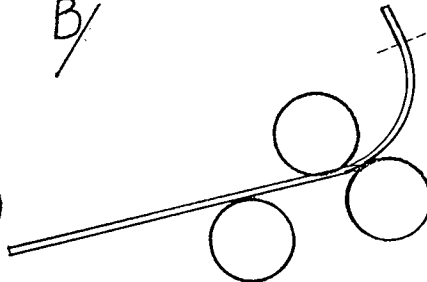


A/



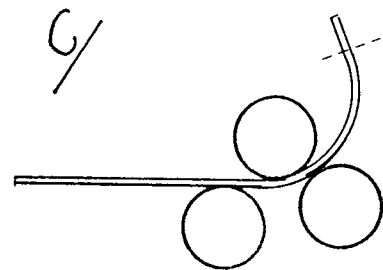
A= 250, B= 450, C= 0

B/



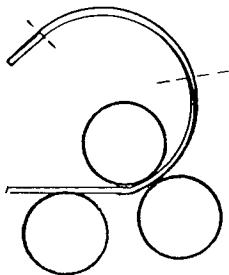
A= 250, B= 480, C= 1000

C/



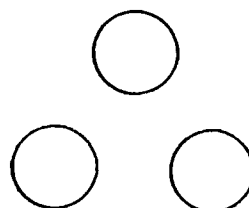
A= 350, B= 480, C= 1000

D/



A= 350, B= 480, C= 2200

E/



A= 100, B= 100, C= 2200

FIGURE 12

01/-90

COMPLETE PROGRAM : Step 1-4 .

A:	277		PGM:	01
B:	277		STP:	01
C:	0		B:	0450
**	PGM	**		■

A:	277		PGM:	01
B:	277		STP:	02
C:	0		A:	0250
**	PGM	**		■

A:	277		PGM:	01
B:	277		STP:	03
C:	0		PSE	
**	PGM	**		■

A:	277		PGM:	01
B:	277		STP:	04
C:	0		B:	0480
**	PGM	**		■

To be contined....

FIGURE 13

01/-90

COMPLETE PROGRAM : Step 5-8.

```
A:      277 | PGM: 01
B:      277 | STP: 05
C:        0 | C: 1000
** PGM ** | ■
```

```
A:      277 | PGM: 01
B:      277 | STP: 06
C:        0 | A: 0350
** PGM ** | ■
```

```
A:      277 | PGM: 01
B:      277 | STP: 07
C:        0 | C: 2200
** PGM ** | ■
```

```
A:      277 | PGM: 01
B:      277 | STP: 08
C:        0 | PSE
** PGM ** | ■
```

To be continued....

FIGURE 14

01/-90

COMPLETE PROGRAM : Step 9-11.

```
A:      277 | PGM: 01  
B:      277 | STP: 09  
C:        0 | B: 0100  
** PGM ** | ■
```

```
A:      277 | PGM: 01  
B:      277 | STP: 10  
C:        0 | A: 0100  
** PGM ** | ■
```

```
A:      277 | PGM: 01  
B:      277 | STP: 11  
C:        0 | END  
** PGM ** | ■
```

-25-

RUNNING A CNC-PROGRAM

Before running a CNC-program, there are a couple of things that must be considered.

- First of all, the machine must be calibrated.
This is necessary, otherwise the CNC could not perform the same job from one day to another.
Please see "Starting up machine" for calibration run.
- Choose a program number to run, by entering the Program mode.
Push [PRG] and then on request the desired program number.
When that is entered, push [PRG] again to get out of the Program-mode.
- Now switch over to CNC-mode, using the Mode-switch to position "CNC".
A new page will appear. Figure (15).
Textline says "START". This is the message that everything is OK and that the program is waiting at first program step for your start command.
- Now choose if the program shall run continuously or intermittent.
This is done with Cycle-switch "CONT/INT/AUTO".
Continuously means that the program will perform step by step, only stopping at pause-commands ("PSE").
Each time a pause is reached, [CNC-START] must be pressed again.
Intermittent means that the program halts after each step and must be re-started each time.
Automatically is an option on PAS-machines. It will extend the program cycle to contain both pinching and ejection of the plate.
The program will only halt for pause-commands ("PSE").
- Adjust the speed potentiometer to desired speed.
0-10 gives minimum to maximum speed.
It is possible to change the speed during a CNC-run, but is not recommended.
The computer regulation may be confused. (In Interpolation run it is impossible to change speed).
- Press the push button for Drop end in (closing) in order to secure pressure in the cylinder (only PS/PAS-machines).
- Push [CNC START] and run the program once without material in the machine to check that all movements are correct and that everything is functioning OK.

Please make the above checklist to a habit, performed each time a new program is to be run or each morning after start up.

Now the machine is ready for production.

If we use our program example and have Cycle-switch in "CONT" the program will be performed as follows:

-26-

- Push [CNC/START].
- C will be set to zero.
- B will be moved to 450 and A to 250.
- On step 3 there is a "PSE" function. The program will stop and wait until the [CNC/START] is pushed.
Now place the plate in the machine;
 - On PS-machines, put the plate against one of the rolls for alignment (for machines with backstop, use that instead).
 - On PAS-machines, put the plate against the roll that is on the opposite side from the infeeding side.
DO NOT forget to pinch the plate with Lower roll D before restarting the CNC-program.
- Now the program goes to the other positions from step 4 to 7.
- Another "PSE" is at step 8, this is for a radius check.
Push [CNC/START] and the program will continue.
- A and B will go to 100 and then the program stops.

During the run, it was possible to see present step on the textline. Now when the program is finished, the textline will say "START", showing that machine is ready for a new program-run. Before this new run, finished object must first be removed from the machine.
When that is done and if you want to run the program again, just push [CNC/START], otherwise switch over the MODE-switch to "MAN".

FIGURE 15

01/-90

CNC-MODE : Ready for CNC-run.

Current step (Program not started,therefore no step).

Current program

A:	277		PGM:	01
B:	277		STP:	
C:	0		START	
**	CNC	**		

Information-line : Ready to start

CNC-MODE : Running the first step. (Moment just after having pushed "CNC START")

Current step

A:	277		PGM:	01
B:	277		STP:	01
C:	0		B:	0450
**	CNC	**		

B-roll have not yet started

Information-line : B-roll going to 450

PS-MACHINES WITH BACKSTOP UNIT

(Please see Figure (16))

If your KUMLA PS/R-CNC-machine is equipped with a hydraulic Backstop unit, (option), there are certain things to remember.

You can, of course, use the hydraulic Backstop in a "normal" way, i.e. it can be operated with the push buttons for the up- and down-movement.

When using the machine in CNC-mode the Backstop unit must be in its lowest position, otherwise it may be damaged by the plate. This is, however, already taken care of.

When pushing "CNC START" a signal will be generated to a special printed circuit board that operates the Backstop. It will lower the Backstop to its lowest position, and thereafter give a start signal to the computer to run the program.

If the Backstop unit already is in its lowest position the signal from "CNC START" will go directly to the computer.

When your program reaches the pause where you want to insert the plate, you must move the Backstop to an upright position by pushing the button for this. See to that it comes all the way up and with pressure, to make sure that you have the same starting position for the plate each time.

When the plate is inserted (you can use the rotation for this purpose, without losing the C-value) push [CNC-START] and the Backstop will be lowered before the CNC-program continues.

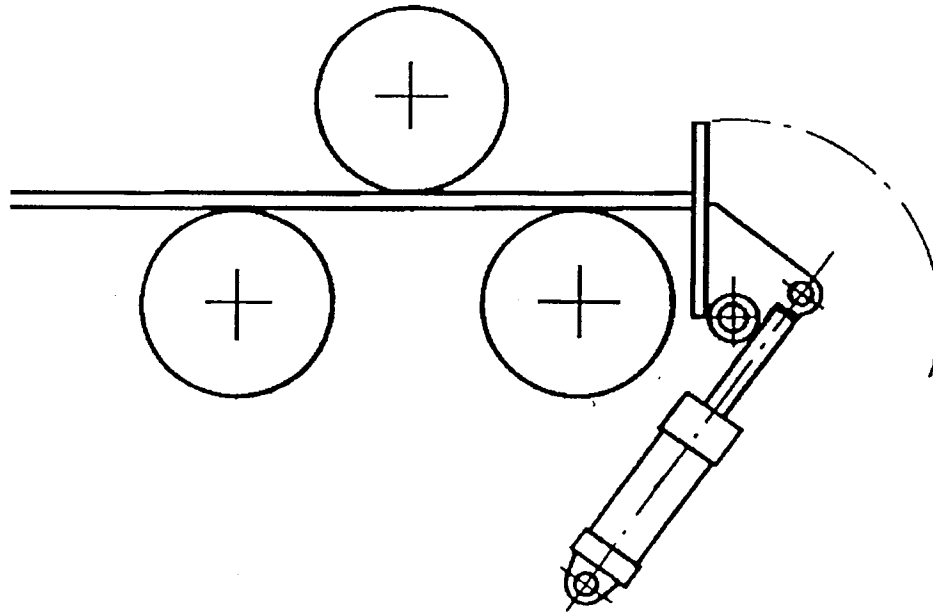
If the Backstop comes down, but the CNC-program will not start, please adjust the bolt for the limit switch on the Backstop.

FIGURE 16

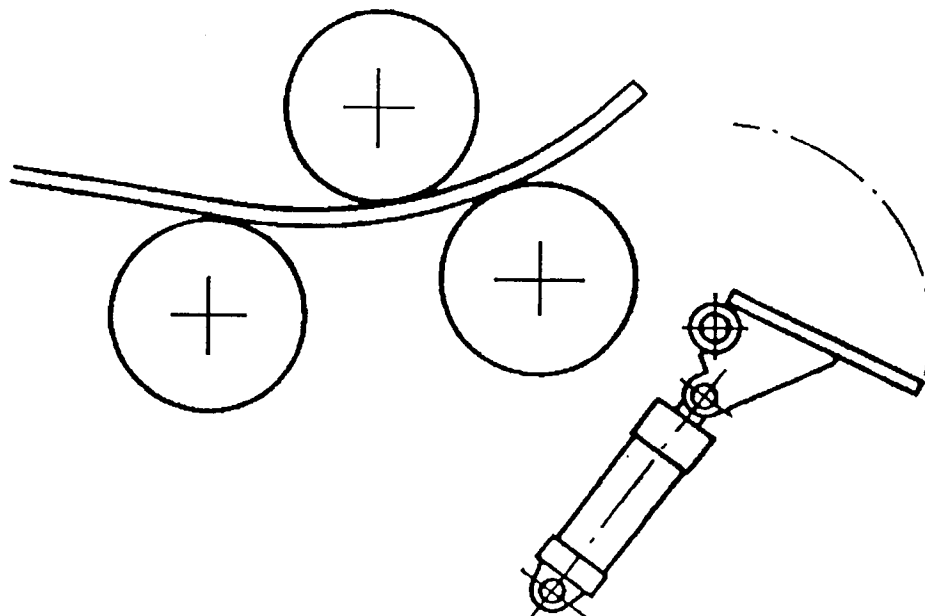
01/-90

BACKSTOP-UNIT (Optional equipment)

1. Insert plate against upright backstop.



2. Backstop will automatically be lowered when "CNC-START" is pressed, before the program continues to the next step.



-30-

INSERTING A NEW POSITION

It is possible to insert a position between two already existing positions in a program without deleting the positions.

This can be done by moving with the arrow keys [] [] to the position where we want to insert a step or two.

Example

```
Step 1  A : 100
Step 2  B : 100
Step 3  C : 500
Step 4  A : 150
Step 5  C : 300
```

We would like to have a "PSE" command between step 2 and 3.

- Move to step 3 and press [INS].
- Now there will be a No operation (NOP) displayed in step 3.
- Push the pause command [PSE] and [ENTER].
- Now there is a new line inserted and the program will be as follows:

```
Step 1  A : 100
Step 2  B : 100
Step 3  PSE
Step 4  C : 500
Step 5  A : 150
Step 6  C : 300
```

- Step 3 has become step 4
Step 4 has become step 5 etc.

-31-

DELETING A STEP

It is not possible to delete an entire program by pushing a key. A program delete must be done by deleting step by step until all steps have been erased.

To delete a single step, move with the arrow keys [] [] to the position where you want to delete a step.

Example

```
Step 1  A : 100
Step 2  B : 100
Step 3  PSE
Step 4  C : 500
Step 5  A : 150
Step 6  C : 300
```

We would like to delete step number 3 (PSE).

- Move to step 3 and then press [DEL].
- Now step number 4 has become number 3, 5 has become 4 etc.

If you instead want to delete an entire program, move to step number 1 and then press [DEL] repeatedly until all steps have been deleted.

(That is when only "END" commands comes up).

GOTO FUNCTION

KUMLA PS/R-CNC is equipped with a GOTO function, which allows more than 50 steps in a total program.

HOW TO USE THE GOTO FUNCTION

Please see Figures (17) and (18).

Figure (17) shows three different programs 10 to 12. The main program is number 10.

Program 11 is a sub-routine used in program 10.

Program 12 is a sub-routine used twice in program 11.

The "END" command in program 11 and 12 means sub-routine end, and the Computer jumps back to the program where the "GOTO" instruction was detected. The program will now continue at the next step after the "GOTO" instruction.

In this example there are two levels of Gotos. This means that in the first sub-routine there is a new GOTO instruction to another program. But in program 11 there are two "GOTO" instructions to the same program number 12. This will not cause a third level due to jumping from the same program.

When running program 10, there will be a "total program" called 10 + 11 + 12 as shown in Figure (18).

Now program 11 and 12 belong to program 10, but it is possible to run only program 12 as a single program.

Program 11 can also be started but then we will have a first level of "GOTO", due to the "GOTO" instructions step 3 and 4. Then the END instruction in program 11 will be as a normal END instruction (= total program END).

Make these three programs and run them, first program 10, 11 and then 12.

NOTE 1:

When making three programs into one big with total 150 steps, there will only be 58 programs totally. One with 150 steps and 57 with 50 steps

NOTE 2:

There can only be 9 levels of GOTO instructions.

FIGURE 17

01/-90

Program no: 10

Drawing no:

Date: 1989 - 02 - 16

Object: GOTO TEST a

STEP	A	B	C	Spec. command	Remarks
1	100				A moves to 100
2		100			B moves to 100
3				PSE	Press "CNC - START"
4			1455		C is rolling to 1455
5				GOTO 11	Here program jumps to a new sub-routine = Program 11
6				END	Program end (total).

Program no: 11

Drawing no:

Date: 1989 - 02 - 16

Object: GOTO TEST b

STEP	A	B	C	Spec. command	Remarks
1	200				A moves to 200
2		250			B moves to 250
3				GOTO 12	Jump to program 12
4				GOTO 12	Jump again to 12
5				END	Program end = Sub-routine end

Program no: 12

Drawing no:

Date: 1989 - 02 - 16

Object: GOTO TEST c

STEP	A	B	C	Spec. command	Remarks
1	150				A moves to 150
2		100			B moves to 100
3	350				A moves to 350
4		150			B moves to 150
5				END	Program end = Sub-routine end.

FIGURE 18

01/-90

Program no: 10 + 11 + 12

Drawing no:

Date: 1989 - 02 - 16

Object: GOTO TEST (total).

STEP	A	B	C	Spec. command	Remarks
1	100				Program 10:step 1(0)*
2		100			2
3				PSE	3
4			1455		4
5	200				Program 11:step 1(1)*
6		250			2
7	150				Program 12:step 1(2)*
8		100			2
9	350				3
10		150			4
11	150				Program 12:step 1(2)*
12		100			2
13	350				3
14		150			4
15				END	Program 10:step 6(0)* End of complete prog.

* Subroutine level (MAXIMUM 9 LEVELS).
More than 9 levels will be ignored
by the computer.

PRINTER MODE

As an option KUMLA PS/R-CNC can be equipped with printer for visual backup and easier editing of a program.

To print out a program, proceed as follows:

- Connect printer power plug to special connection on the Control panel frame. (220 VAC, 50 Hz).
(USA; connect printer power plug to external 110 VAC, 60 Hz).
- Use special KUMLA-cable for connection between printer and back plane on the control panel, connection marked with "PRINTER". The connections are of RS-232C type, i.e. DSUB connectors with 25 pins. The cable is reversable, i.e. it can be connected in any direction.
- Make sure that there is enough paper in the printer. If not, please see the printer manual for how to load paper into the printer.
- Turn on power on the printer. Green diode marked with either "LINE-ON" or "READY" shall be light.
If not, please see the printer manual for trouble shooting.
- Press the push button on the CNC-control panel marked with [PRN]. You will now see a new page on the display as on Figure (19).
- If you want to print out a single program, for example 7, then push [7] on request "Print from:", and [7] on request "Print to:". Then push [ENTER]. If everything was correctly connected, the printer starts printing your program No. 7.

After a few seconds the first display page (Figure 19) will appear again. Even if the printer still is printing, it is now possible to exit Printer-mode by pressing [PRN] and also to remove the data-cable from the panel.

Do not remove the power cable to the printer until the printer has stopped printing and the power has been switched off.

- If you instead want to print several programs in a row, enter the first program number on request "From program:" and last program number on request "To program:". Then push [ENTER].
It is possible to interrupt the printer output by pressing [ENTER].
If several programs are to be printed it will take a while, since the printer buffer is not big enough to contain more than one program at a time.
When printing is completed, just push [PRN] to return to normal mode again.

Maintenance

- When the printer is not used, it should be stored somewhere in the office environment.
This shall be done in order to protect the printer from dust, welding smoke etc.

- Also see the Printer Manual for normal maintenance and service of the printer.

FIGURE 19

01/-90

PRINTER MODE (Optional equipment)

**

PRINT MODE

**

Print from: ■

Print to :

Input line : Last program to print

Input line : First program to print.

Information line : Current program being printed

**

PRINT MODE

**

Printing prog : 01

Press ENTER to stop

Information line : How to stop output to printer

SAVE-/LOAD-MODE (RAM-CARD-function)

KUMLA PS/R-CNC also has the possibility of connecting an external memory of RAM-card type. (Optional).

This RAM-card unit (Fujisoku BA 232 A) is easily connected to the CNC via one data cable (RS 232).

This data cable also includes power supply (+ 12 VDC).

With this Memory card unit it is possible to save/copy all programs from the Computer's RAM onto a Memory card (RAM-card) as well as Load/Copy all programs back from the Memory card to the Computer's RAM.

Please see Figure (20), showing RAM-card, unit and cable.

One Memory card (data capacity 32kbytes) can store all 60 programs in Computer RAM.

It is highly recommended that Safety backups are made frequently from RAM (RAM copied onto a Memory card).

This is due to the fact that if any error occurs in the Battery backed up RAM, the entire content of programs may be lost.

If this happens, it is easy to re-install the programs again from the Memory card.

A back up copy should be made every time a new program has been developed, or at least once a week, if new programs have been added or if earlier programs have been changed/edited.

Save/Load time in each direction is less than a minute for all 60 programs.

To save all programs, please do as follows:

- Connect the Memory card unit to the Control panel back plane, using the RS 232 cable from KUMLA.
The cable can be connected in any direction (= reversible).
- Turn on the power on the Memory Card unit. It is performed with the red push button on the unit's back side.
Now there should be a red light diode shining on the unit's front, indicating that the power is on (+ 12 VDC is OK).
- Insert a Memory card to the slot. The card can only be inserted one way and that is with the Memory card text and the arrow up. Push the card into the slot until it is in proper contact with the connector.
On the Memory card there is a small switch on the edge. This switch is for write protection of the card.
When the switch is in left position, the card is write protected and therefore not possible to save information on. However, it is possible to read (load) information from the card.
When you want to save programs on the card you must see to that the switch is in right position. If it is not, you will have an Error-message on the display, (if you try to save programs), telling you the reason for Error. Clear the message by pushing [CLR] and correct error.

- Now push [SAVE] on the CNC-control panel.
A new page will show. Figure (21).
Push [ENTER] and on the display you will see the saved program numbers counting.
When the saving is completed, the first page will appear again.
To get out of SAVE-mode, push [SAVE].

To load program from the Memory Card into the Computer's RAM, please do as follows:

NOTE! When you load programs from the Memory Card into the Computer's RAM, you will automatically DESTROY, (overwrite) all programs in the Computer's RAM.
Therefore it is of most importance, that before loading programs into the Computer you first save the Computer's RAM into another Memory card.

- Push [LOAD] on the CNC-control panel.
A new page will show. Figure (21).
- Push [ENTER] and you will see the loaded program numbers counting on the display.
- When the loading is completed, push [LOAD] to get out of the Load-mode.

Maintenance

- When the unit is not used it should be stored somewhere in the office environment. This is made in order to protect the unit from dust, welding smoke etc.
- The Memory cards shall be kept in their cases when not used and be stored together with the unit at the office.
Do not expose them to direct heat!
- Always use Certified RAM-cards!
Type: FUJISOKU SRAM 32 kByte (No. BS32E1-B).
- Inside the Memory Card there is a battery to keep program information in the RAM-circuits.
This battery should be changed every third year to protect the data information.

Type: One Litium battery 3V (BR2016).

The battery is exchanged by moving the LOCK-switch placed on the right front side marked "LOCK".
Please see Figure (20) showing this switch.
When pulling out the battery, there is a small capacitor in the card to keep the information for about 20 seconds while exchanging the battery.
Remember always to lock this switch, otherwise the battery could fall out and the data would be lost.

FIGURE 20

01/-90

RAM-CARD DETAILS (optional equipment)

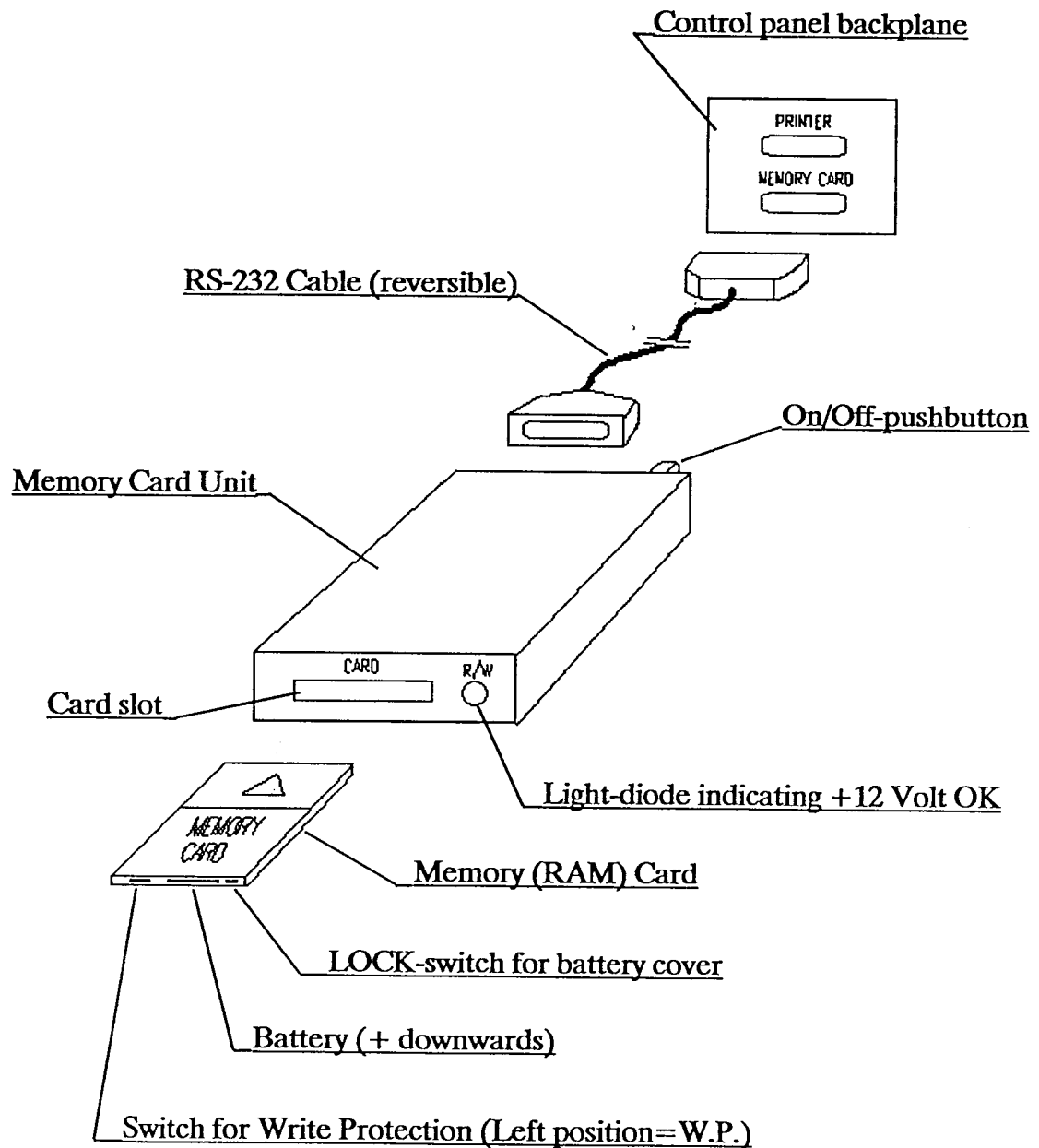


FIGURE 21

01/-90

RAM-CARD PAGES (Optional equipment)

**** SAVE PROGRAMS ****

Press ENTER to save
all programs

Command line : Start saving programs

**** SAVE PROGRAMS ****

Saving prog : 01

Information line : Current program being saved

**** LOAD PROGRAMS ****

Press ENTER to load
all programs

Command line : Start loading programs

**** LOAD PROGRAMS ****

Loading prog : 01

Information line : Current program being loaded

KUMLA PS/R-CNC

1. Key switch. The same function as CNC ON/OFF Key switch in the front panel, i.e. turns the computer power supply ON/OFF.
2. Fuses + light diodes. Shining diodes indicate OK voltage on +5, +12 and -12 VDC.
3. PWR-unit. Computer Voltage supply.
4. INT-unit. Interface-unit, i.e. In- and out signals are operated through this unit.
5. CPU-unit. Central Processing Unit. This is the computer itself. The EPROM that contains the program is placed on this board.
6. Cable-connector. Databus between INT- and CPU-units.
7. WD-diodes. Working data. If they are flashing with approx. 1 Hz the program is running and working.
8. Light-diodes for IN- and OUT-signals respectively.
(Please see separate list Figure 23).
9. PS/R-CNC Interface board. Makes it possible to use the machine even if the computer breaks down.
(Please see special instruction).
10. Gain-adjustment. Controls the top speed when using the machine without computer. (I.e. 100% Man.).
11. 100% Man. Light diode for indicating that "Man. ON/OFF"-button (13) is activated.
12. Power. Lights whenever the power is on.
13. Man. ON/OFF. Unpressed -> CNC
 Pressed -> 100% Manually
14. Computer ON/OFF. Unpressed -> 100% Manually
 Pressed -> CNC.

./43

FIGURE 22

01/-90

COMPUTER FRONT DETAILS

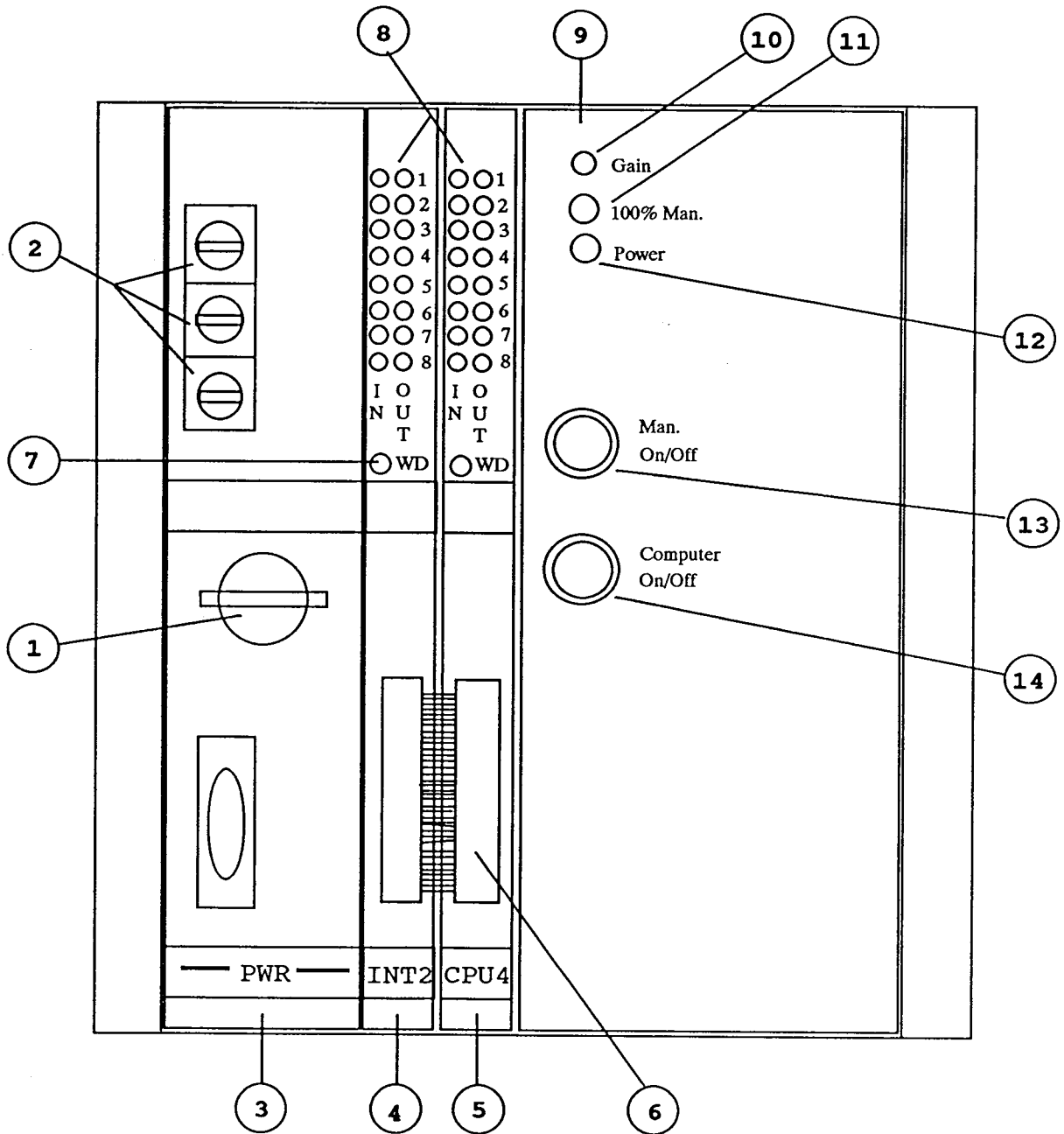


FIGURE 23

01/-90

COMPUTER IN- AND OUTSIGNALS

<u>INT. 2</u>	IN	1	A-roll up	Joystick/pushbutton signal
		2	A-roll down	"-
		3	B-roll up	"-
		4	B-roll down	"-
		5	C-roll forward	"-
		6	C-roll reverse	"-
		7	Not used	
		8	Not used	

	OUT	1	A-roll up	Computer signal
		2	A-roll down	"-
		3	B-roll up	"-
		4	B-roll down	"-
		5	C-roll forward	"-
		6	C-roll reverse	"-
		7	Not used	
		8	Not used	

<u>CPU. 3 (4)</u>	IN	1	Emergency stop	(+24VDC)
		2	CNC-mode	
		3	CNC-start	
		4	INT-mode	
		5	RESET C=0	
		6	TEACH IN-mode	
		7	Joystick/pushbutton	(0/1)
		8	Not used	

	OUT	1	Not used
		2	"-
		3	"-
		4	"-
		5	"-
		6	"-
		7	"-
		8	"-

-45-

KUMLA PS/R-CNC

IN CASE OF COMPUTER BREAKDOWN!

If the CNC-unit breaks down completely, it is still possible to use the machine until the CNC-unit has been repaired.

If the plate that covers the backplane of the Control panel is removed, you will see the computer rack as shown on Figure (22).

(Be careful with the cables for RS-232 connectors: printer + Memory card).

Now, turn off the power, then unpress the button marked "Computer ON/OFF" (14). Then press the button marked "Man. ON/OFF" (13).

Turn on the power. Make sure that the two light diodes "100% Man." (11) and "Power" (12) are shining. +12 and -12 VDC on Power supply (PWR1) must also be OK.

Now it is possible to use the machine as in normal case, but you will not have any kind of positioning for the rolls.

To shift back to normal function (i.e. with the computer on) you have to turn off the power and then unpress "Man. ON/OFF" (13) and finally press "Computer ON/OFF" (14).

You are now back where you started.

NOTE! Never have both push buttons (13 and 14) pressed at the same time with the power on!

PULSE ENCODERS (PV- AND Z-MACHINES)

Your KUMLA PS/R-CNC machine is equipped with three pulse encoders, one for each Side roll and one for the Top roll (= rotation).

For the Side roll encoders there are cogbelt + springs to keep firm position within the adjustment of the Side roll.

Depending on actual magnitude of adjustment (varying from machine to machine type), there are different sizes of cogwheels.

The encoder must not rotate more than about 1,5 revolutions, otherwise it may give a false reference point (please see Starting up machine).

If you have to replace for example the cogbelt + spring, you must also recalibrate the pulse encoder. This is a very easy operation to perform:

1. Remove cover for pulse encoders.
2. Replace broken part. Do not tighten the coupling between the encoder and the cogwheel.
3. Turn on power and find your reference value by turning the encoder's shaft slowly.
4. In your instruction manual you have original settings for max/min shown on Display.
5. Be sure that the roll is parallel. (Only PV-machines).
6. Move the roll to top position. (Against Top roll but with no pressure).
7. Rotate the encoder's shaft carefully till the correct value is shown on the display.
8. Tighten the coupling.
9. To be absolutely sure that it is correct, turn off power and recalibrate again.
10. Perhaps you must do it 2-3 times, because it is very sensitive.

Both Side rolls are adjusted in the same way.

If, however, you must replace cogbelt or encoder for rotation, you do not have to calibrate in any way.
Reference value is not used on rotation.

LINEAR ENCODERS (PAS-MACHINES)

On KUMLA PAS-machines with CNC-control Linear encoders are used on the Side rolls. They have fixed positions, but their scanning heads are possible to adjust by the encoder rod.

Reference point is in the middle of the encoder, and cannot be moved.

This encoder rod can be adjusted carefully in order to get exact positioning from the encoders.

If an encoder is changed or, if the mechanical arrangements for some reason have been taken apart, there might be reason for readjusting this rod.

However, if CNC does not find the reference point it is not due to mechanical adjustment.

-48-

PS/R-CNC TROUBLESHOOTING

<u>Problem</u>	<u>Check</u>
1. Nothing happens when the key for CNC ON is activated.	a. Main voltage is OK? b. Voltage after stabilizer?(220V) (Please see electrical diagram for connector numbers) c. Relay is activated when the key is switched on/off? Check wiring (See electrical diagram) d. Fuses are OK? e. Open backplane on control panel. Does power supply indicate +5 VDC, +12 VDC and -12 VDC OK. Check fuses, check 220 VAC into computer rack's backplane. f. Are WD-diodes on INT.2 and CPU. 4 flashing? If not, program does not work, contact KUMLA. g. Check connections between computer and terminal RT-420 Databus and 24 VDC OK!
2. Cursor is blinking on display, but no text will appear	a. Check connections between computer and terminal! b. Is computer working? (WD is flashing) c. Are push buttons for CNC/100% MAN in correct positions? (Please see "In case of computer breakdown")
3. Initial page appears, but machine does not operate when joysticks are activated	a. MODE-switch in "MAN" position? b. Check push buttons for CNC/100% MAN. c. Do you have IN- respectively OUT-signals on INT. 2? d. Is relayboard in main electrical cubicle functioning? e. Check hydraulic valves.

-49-

- f. Is there 0-10 VDC out from computer to proportional valve control card when joysticks are operated?
 - g. Check proportional valve card.
 - h. Check proportional valve.
- 4. Everything is working, but reference value on one roll will not appear
 - a. Check visually that encoders are OK and no cables are damaged
 - b. Check springs + cogbelt for damages
 - c. Check all wirings to the pulse encoder that does not work.
 - d. Open control panel and take carefully out computer rack. Exchange connectors 5 and 6 (A-roll and B-roll encoders). Do you now get reference value on troubling Side roll? If not, encoders wrecked. If so, computers not working.
- 5. Everything is working, but values on either Side roll is not correct
 - a. Has a "false" reference signal come? Check by moving the roll up/down a couple of times.
 - b. If permanent false value, check spring + cogbelt on encoder. Also check coupling between encoder and cogwheel. Readjust according to separate instruction.
 - c. Does cogbelt tend to jump over teeth on wheel? Tighten spring a little.