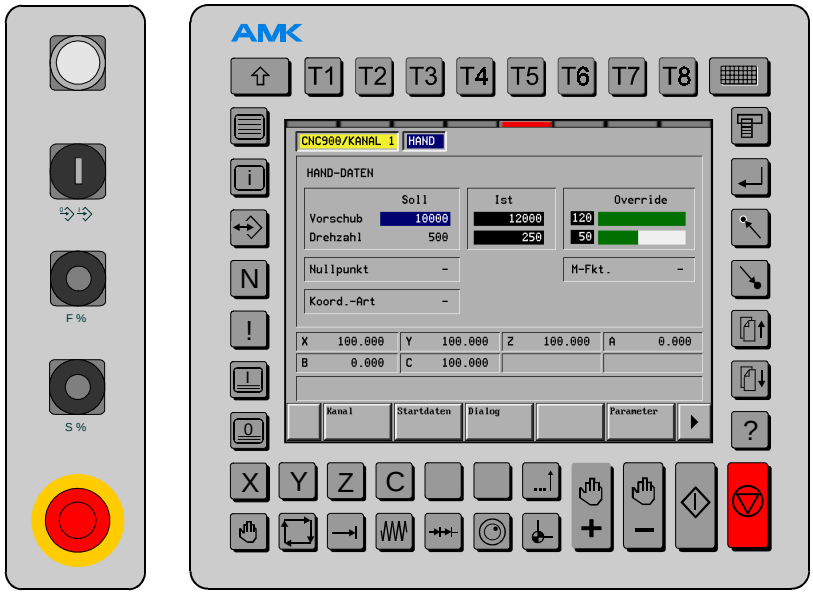
2. Operating

2. Operating

2.1 Compact controls CNC 903 / CNC 905

The compact controls CNC 903 / CNC 905 are conceived for the application with CAN Bus. Communicate to they over the CAN Bus with the drives and the I/O bus.
The CNC Control actual in the operating panel integrates. The operating panels have fully graphicable color LC displays and foil keyses with mechanical pressure point.



Compact controls CNC 903 / CNC 905 with additional machine operating panel

Dimensions (B x H in mm)	328 x 310
Machine operating panel (option)	80 x 310

2.1.1 Machine operating panels

Separate machine operating panel CNC 903 / CNC 905

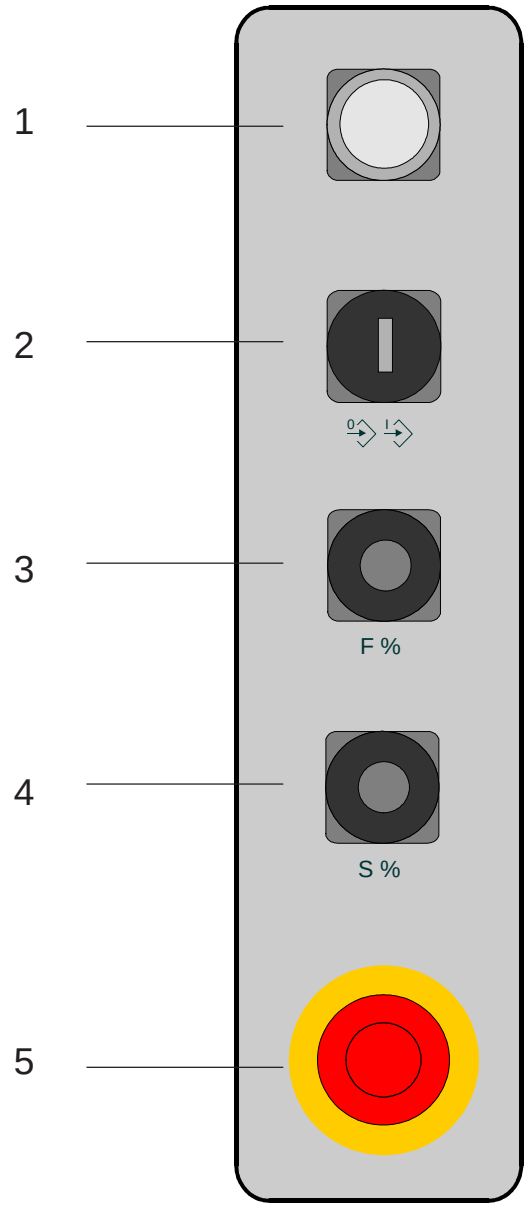
1 Illuminated push button

2 Code switch
Program block-free

3 Feed override

4 Spindle override

5 Emergency-stop key

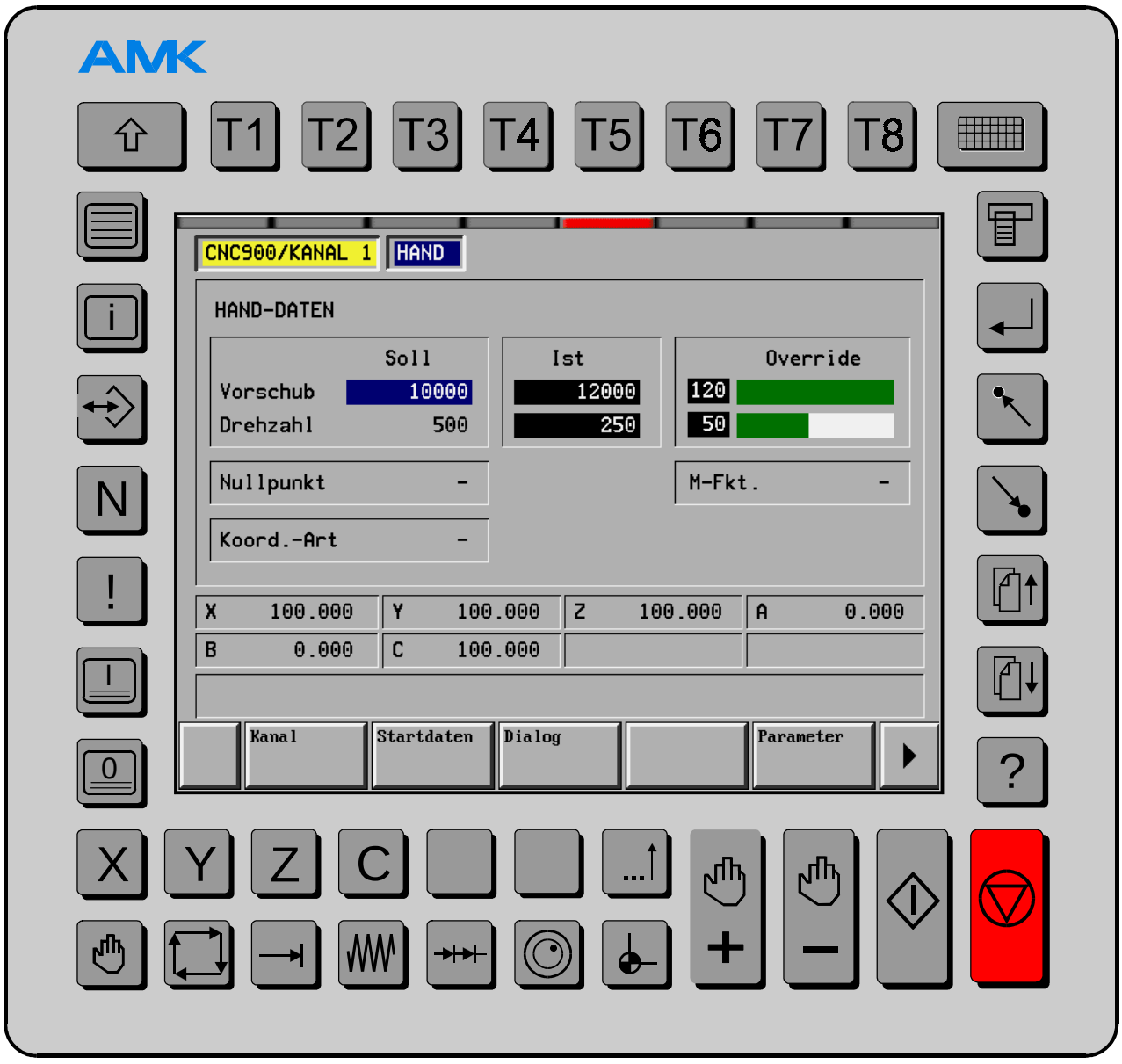


Note:

Code switch 1 opener (21/22) freely

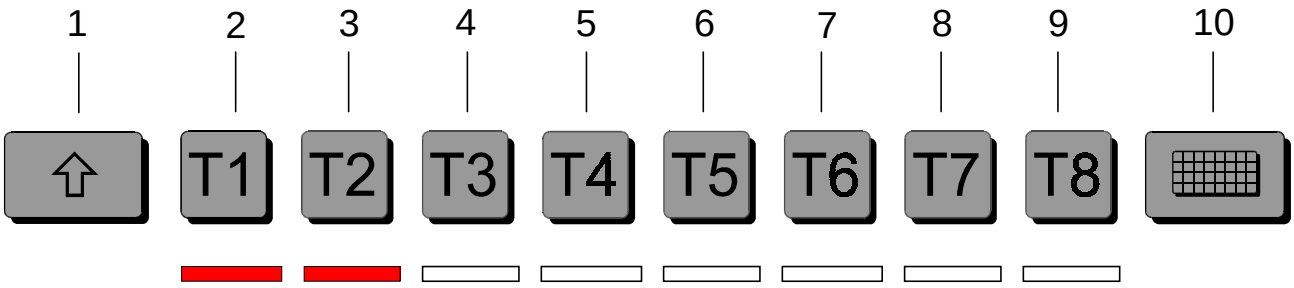
Emergency stop 2 openers (11/12 and 21/22) freely

2.1.2 Control keys



2.1.2 Control keys

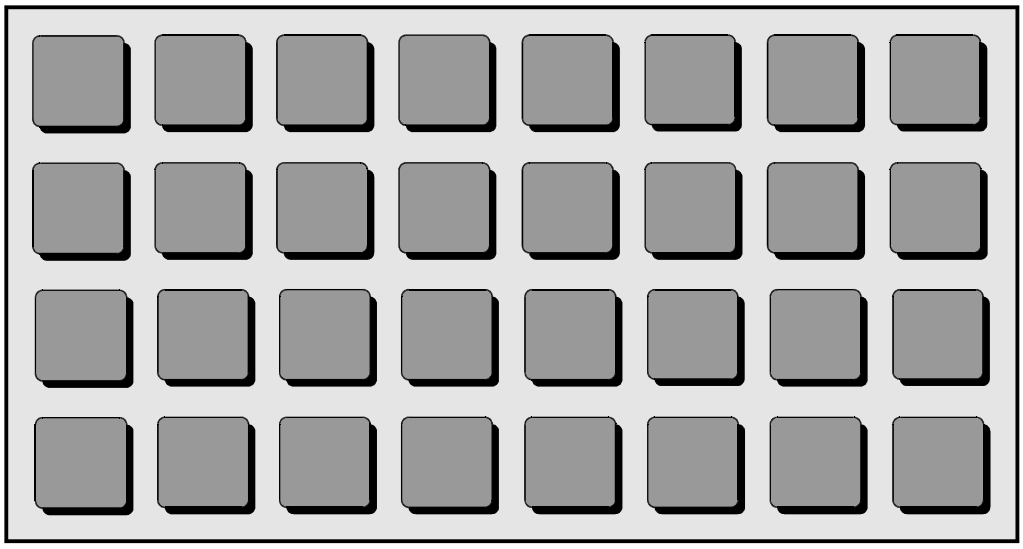
Control keys for PLC functions



1 Shift
In connection with further keys special functions can be released,
e.g. can with editor  on /  off the touch screen activated or deactivated become (to the cleaning of the screen).

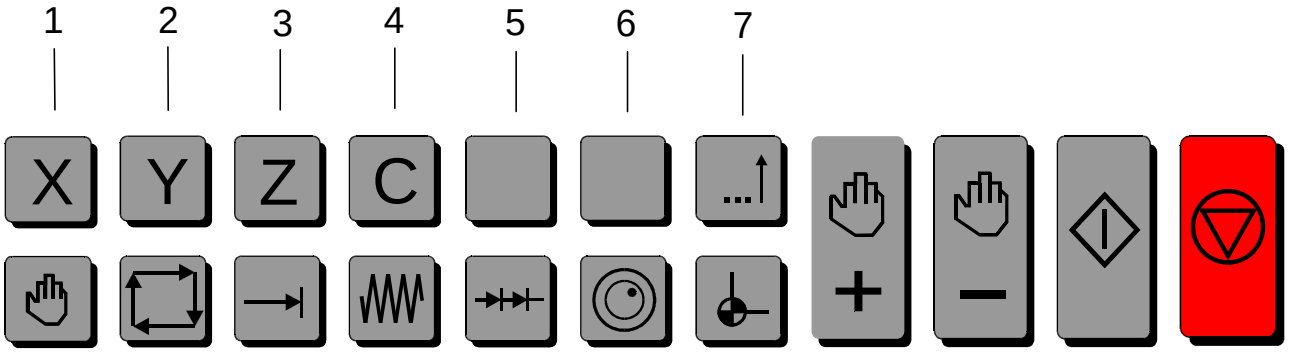
2 to 9 8 PLC keys with LED on the display
can by the user as desired be marked
(with label strip e.g. T1 to T8).

10 additional 32 PLC keys with LED on the Touch screen
The PLC additive keys can be designated by the user as desired,
e.g.:



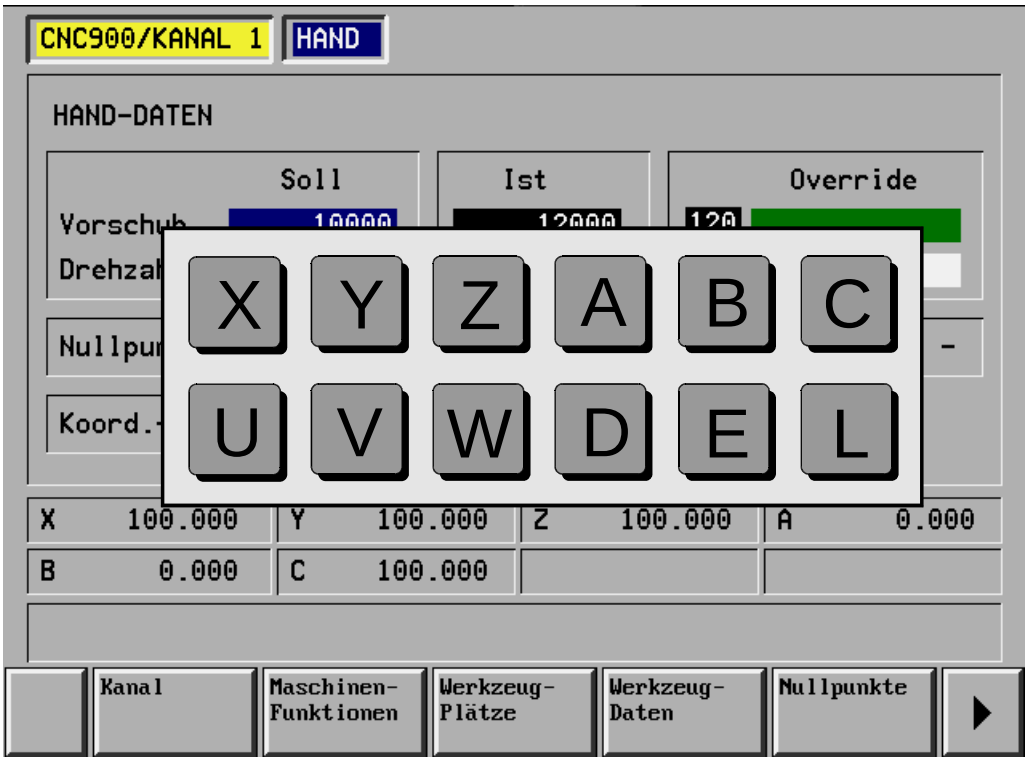
2.1.2 Control keys

Control keys for axis selection



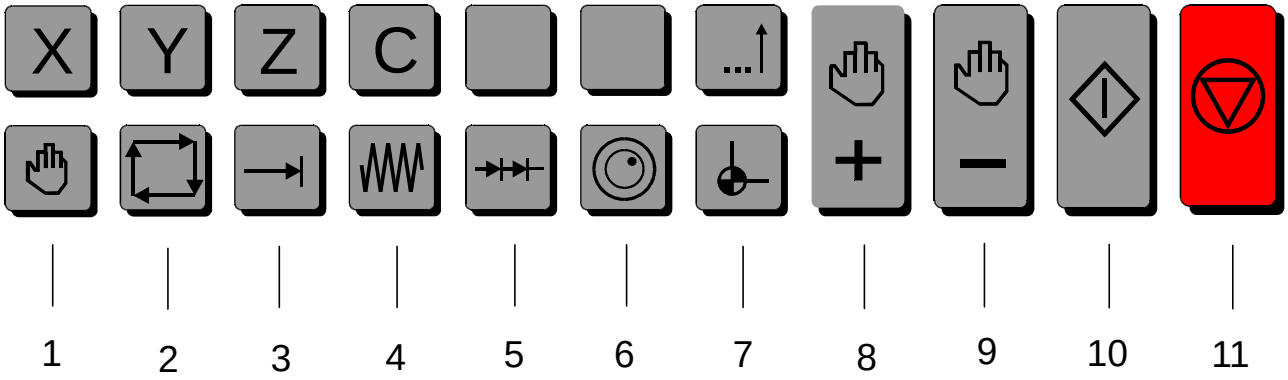
1 bis 6 6 axis keys
Can by the user as desired be marked (with label strip e.g. X, Y, Z, A, B, C).

7 12 axis keys on the Touch screen, can by the user as desired be marked
e.g.:



2.1.2 Control keys

Control keys for modes of operation

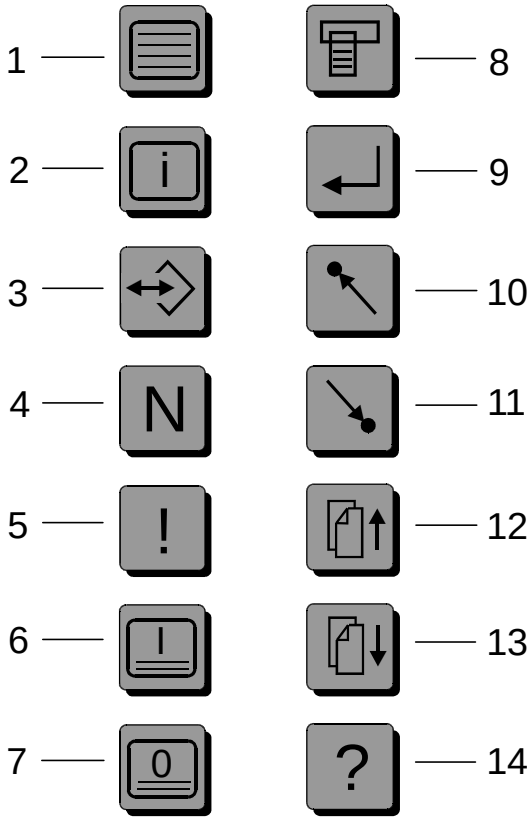


1	Manual mode	
2	Switching in automatic mode:	With the 1. Pressures becomes the sequential block adjusted. Afterwards becomes when each pressing key between sequential block and single block back and forth switched.
3	Switching in positioning mode	
4	Continuous traversed in the manual mode	
5	Step by step traversed in the manual mode, incrementations freely definably	
6	With handwheel traversed	
7	Automatic home position and travel of point of reference	
8 und 9	Push buttons for traversing the selected axis with manual mode	
10 und 11	start and stop The automatic program sequence is started or stopped - in the positioning mode: The NC block in the indication area is processed. - in the automatic mode: The selected NC program is worked on.	

2.1.2 Control keys

Control keys for program input and data communication

1	Key function freely shapable, e.g. graphic simulator.
2	Key function freely shapable, e.g. cycle or info. pictures.
3	I/O circulation Selection of the I/O menu to the data communication
4	Block editor
5	Diagnosis Information about conditions, interfaces, parameters.
6	Editor on
7	Editor off
8	Menu selection
9	Enter
10 und 11	Beginning / end
12 und 13	Picture up / down
14	Additional information Information about lining up NC program.

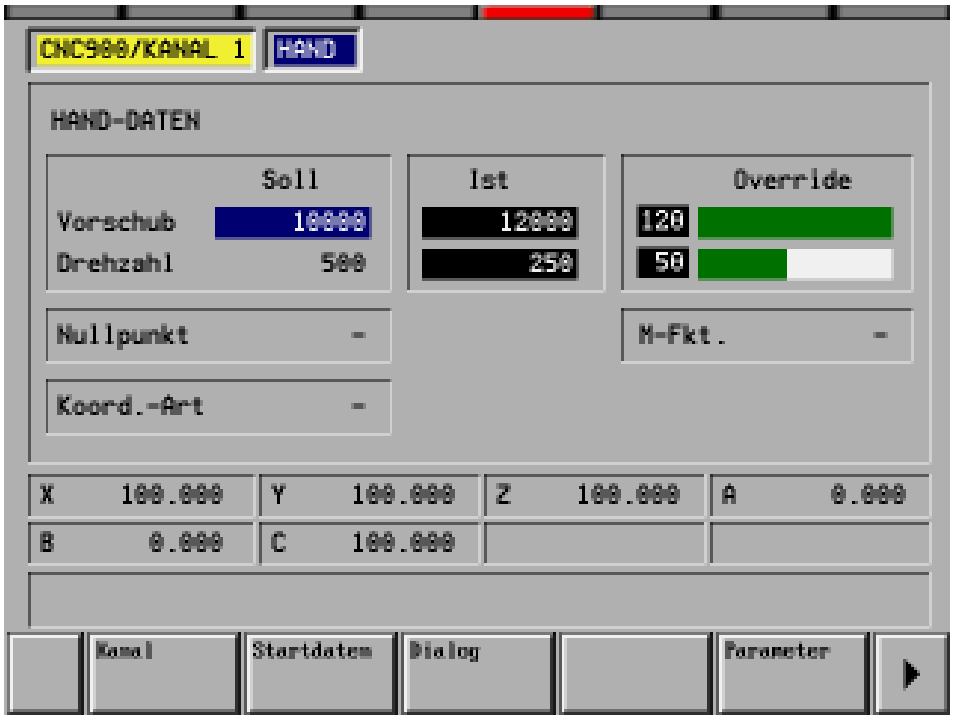


2.1.3 Touch screen keys

Touch screen keys for manual mode and program input

Opening display
Selection menu

Menu screen 1



Selection keys on the touch screen

Menu screen 2

Switching between the menu screens with key ▸ (roll function)

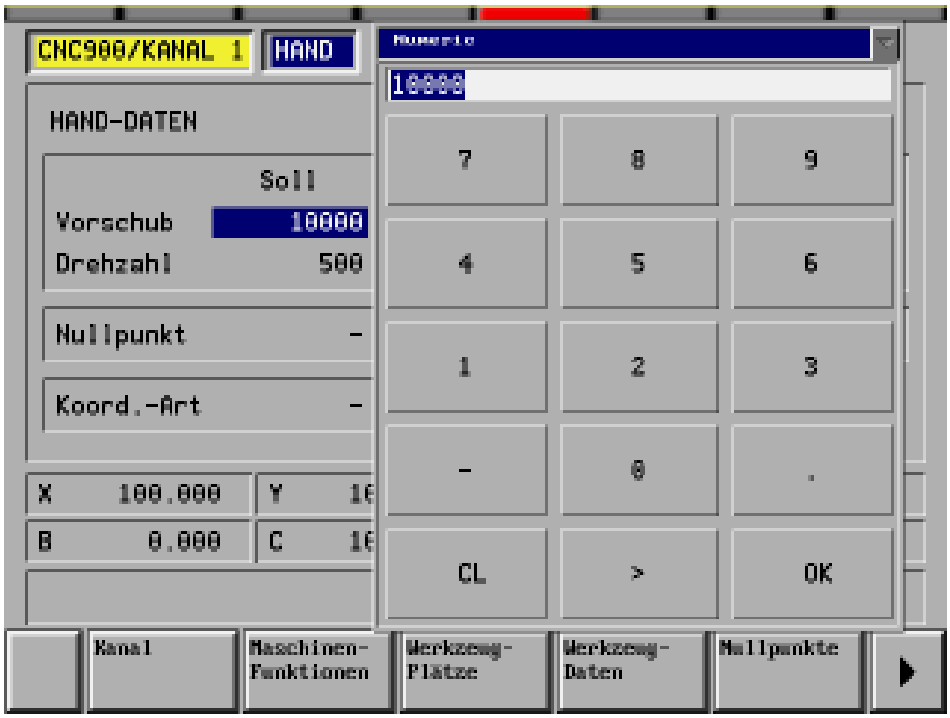
2.1.3 Touch screen keys

Touch screen keys for input with numeric keyboard

The cursor press and shift on a wished input field .

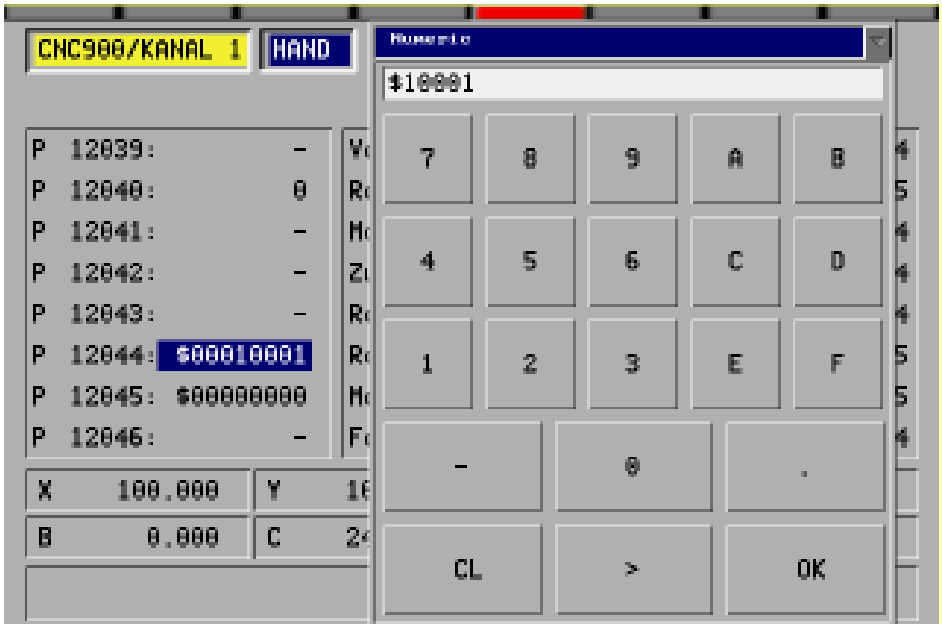
The numeric keyboard will during contact an input field faded in.

Input break off:
With the finger press on not with input fields occupied place on that display.



Requires the input field hexadecimal input, will the hexa-decimal keyboard faded in.

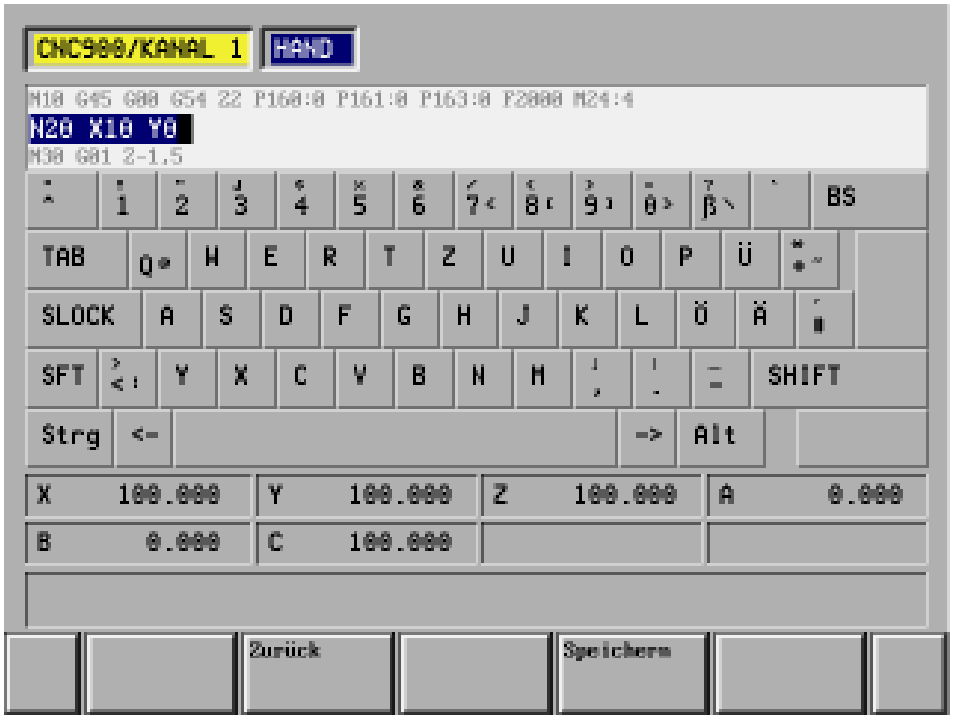
With 2 x pressures on ‘ - ‘ indication becomes between decimally and hexadecimal keyboard around switched.



2.1.3 Touch screen keys

Touch screen keys for input with ASCII keyboard

With the program input will a ASCII keyboard faded in.



Special functions with WINTERM

The ASCII keyboard can be switched by hand: on / off

The contrast of the announcement of the ASCII keyboard can be adjusted.
It can be struggled so far that the keyboard appears only as background picture.

The key functions remain.
However one can read now also the text, which is under the keyboard.

Contrast of the announcement: more brightly more darkly

2.2 Power on tests

The display field is activated after swichting on the control. The control starts a self-test. The position of the key-operated switch 1 (P11000) determines the course.

2.2.1 Automatic power on tests

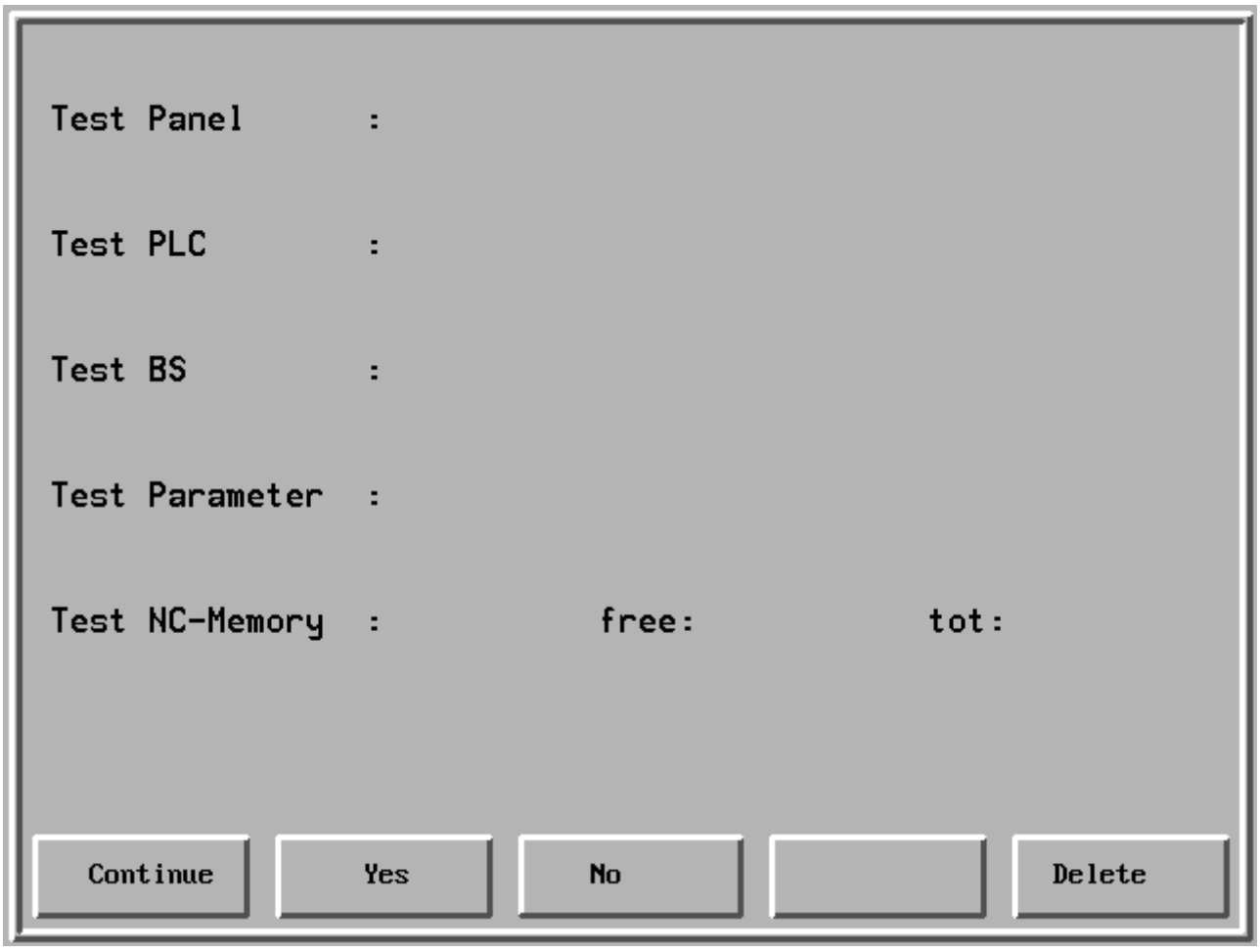
If the key-operated switch is closed (position 1), the power on tests are running automatically, if no errors appear (e.g. def. parameter or def. NC memory).

Closed switch	Position 1	Automatic power on test
Open switch	Position 0	Power on test has to be activated with pressing a key.

2.2.2 Power on test with confirmation

Test operating panel

First, the operating panel is tested (takes some seconds).

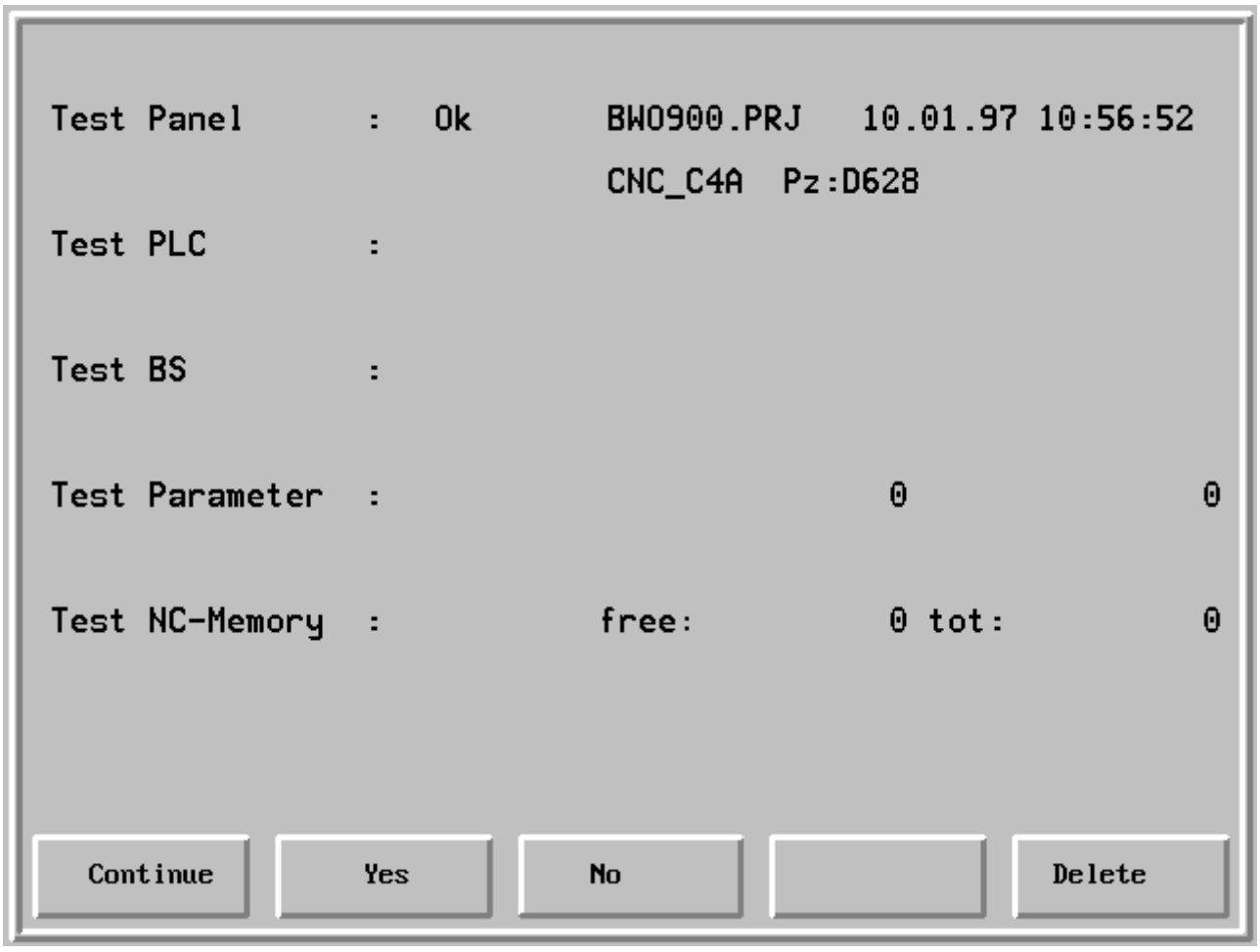


Here the function keys “Continue” and “Yes” and “No” are used combined with the key  (Delete).

2.2.2 Power on test with confirmation (continued)

Test operating panel

After a successful test, the following display appears:



Meaning:

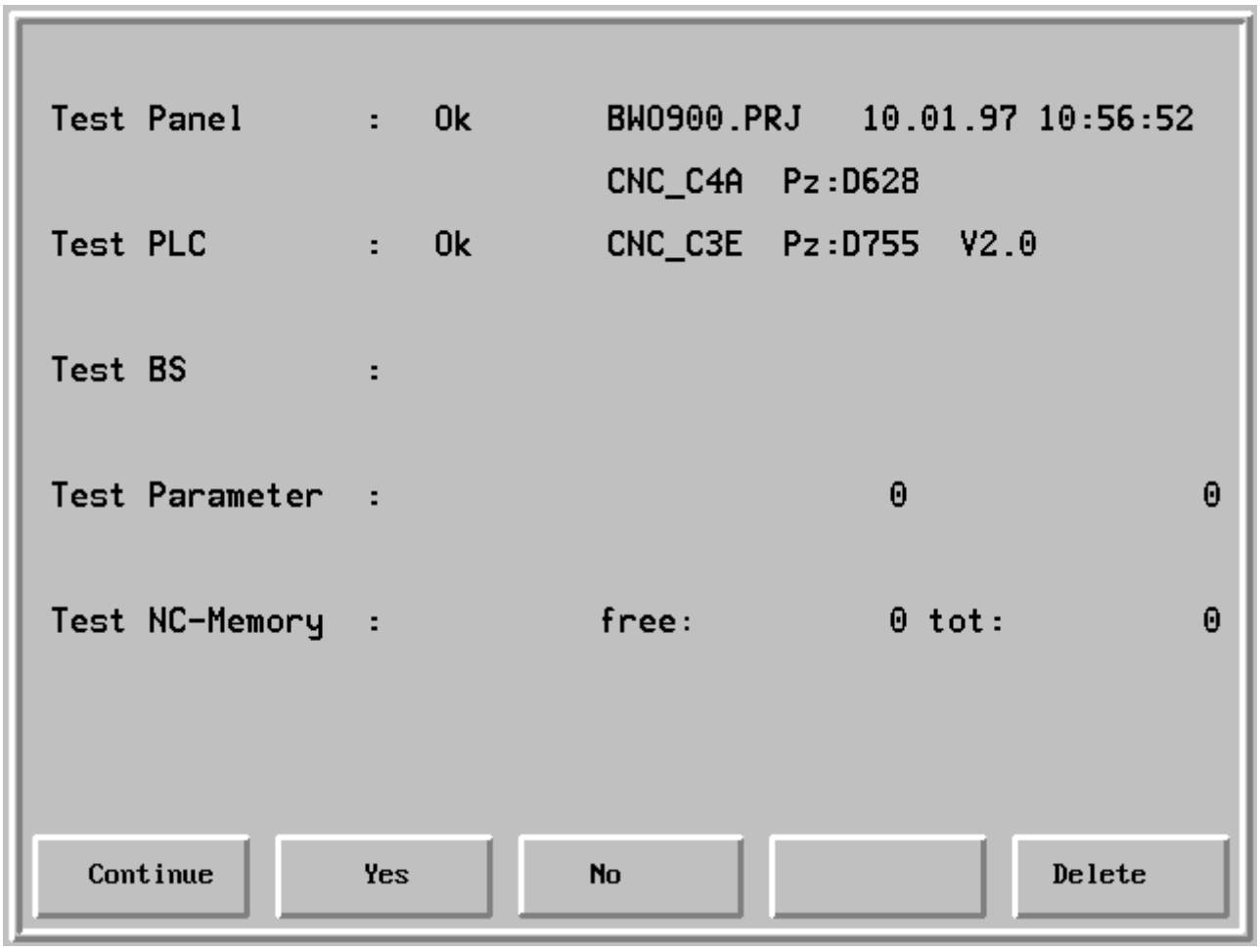
Line 1 Project name of the PROMA surface
with date and time of making the surface (SHOW_E).

Line 2 PLC program, from which the symbols are taken, with check sum.

2.2.2 Power on test with confirmation (continued)

Test PLC program

After a successful test, the following display appears:



Meaning:

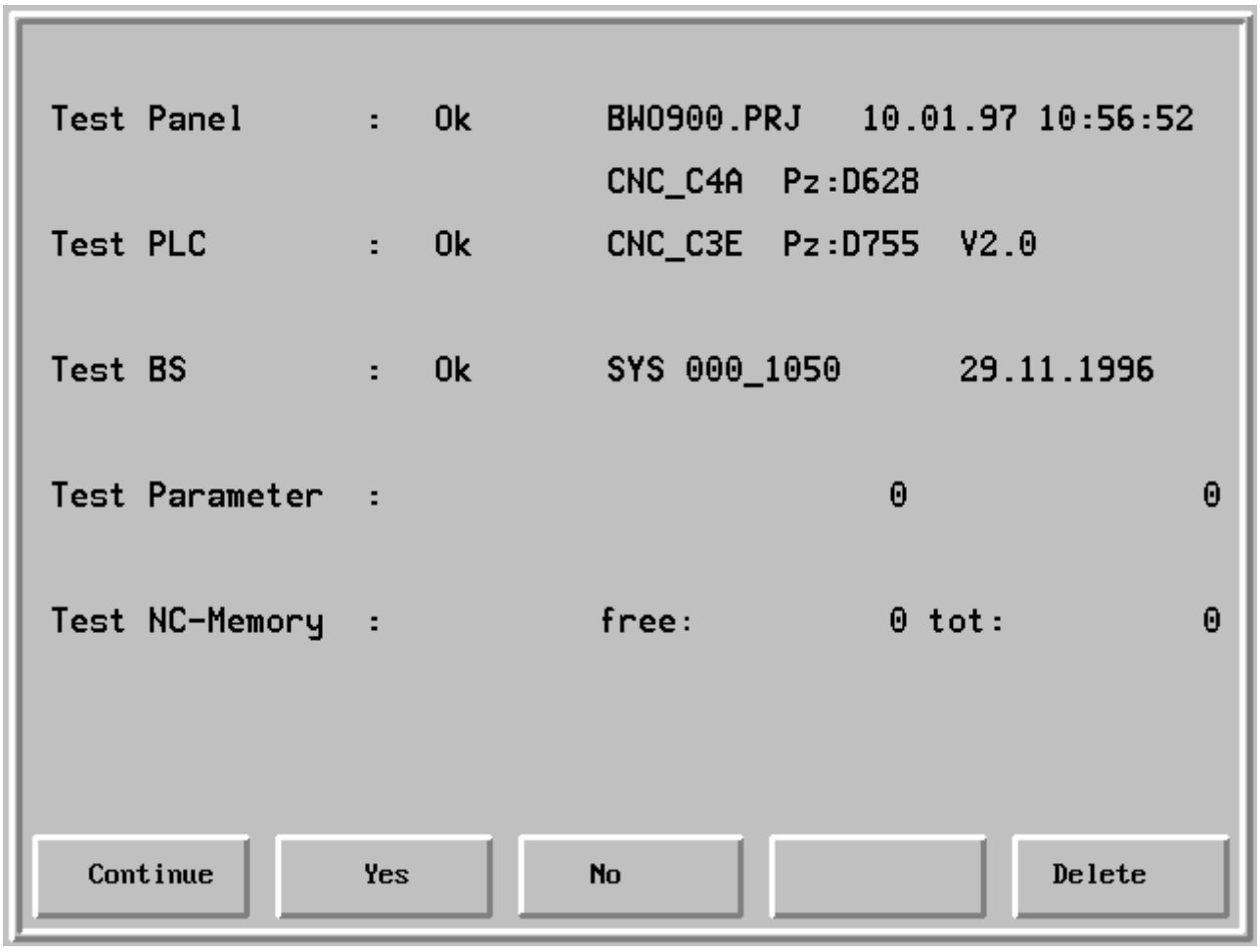
Line 3 Actual PLC program with check sum and number of version

Note: Program name and check sum of the PLC program (operating panel) from which the symbols are taken, and of the actual PLC program should be the same (line 2 and 3).
If the names or check sums are different, it has to be checked if the symbols used in the surface have the same position as they do in the actual NC program.

2.2.2 Power on test with confirmation (continued)

Test operating system

After a successful test, the following display appears:



Meaning:

Line 4 CNC standard operating system with version and date

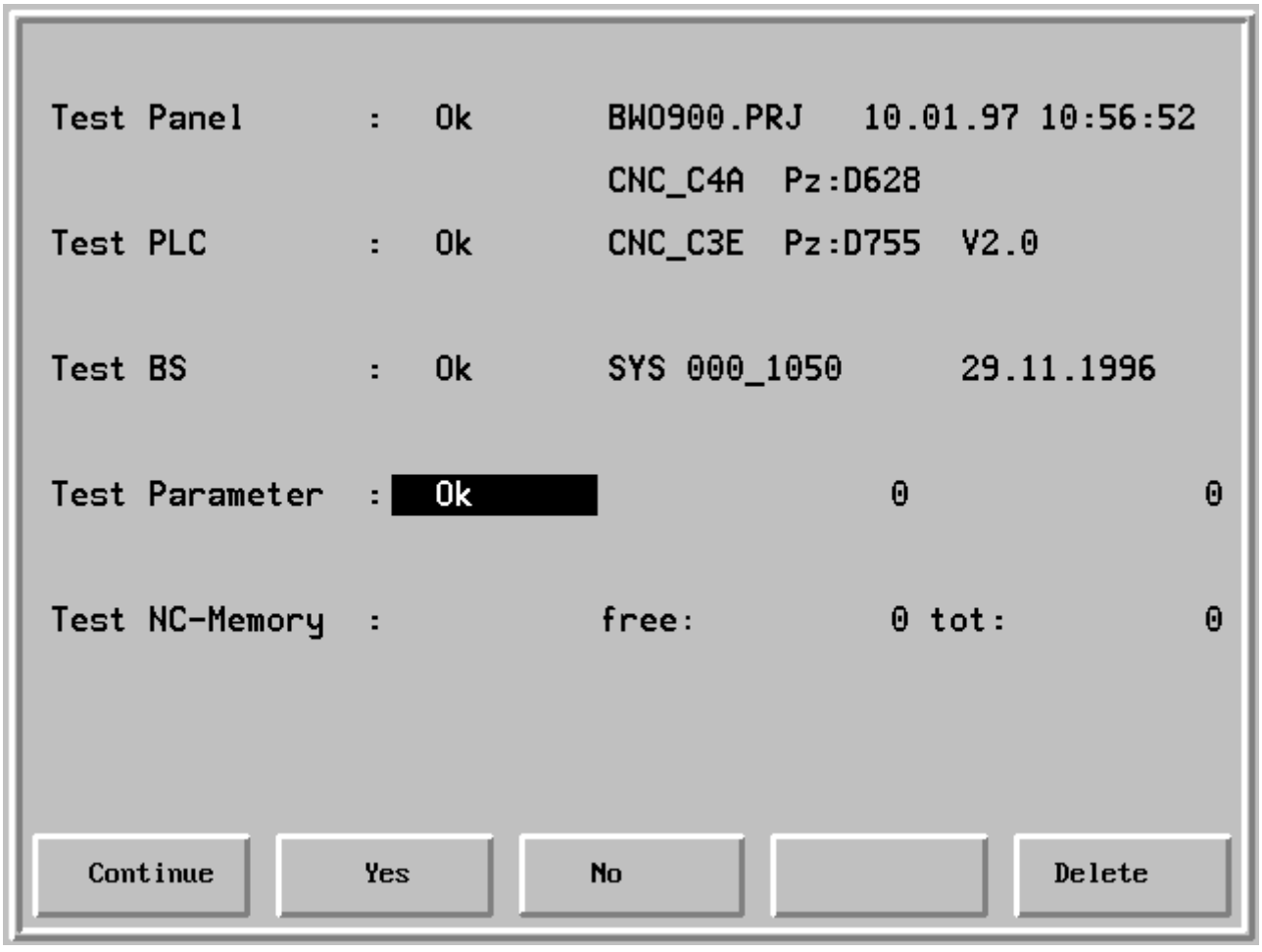
Line 5 Option: DLL-software for customer-specific operating system enlargements with name and date

2.2.2 Power on test with confirmation (continued)

Test parameter

After pressing the function key “Continue”, the parameter memory is checked.

The following display appears after a successful test:



Meaning:

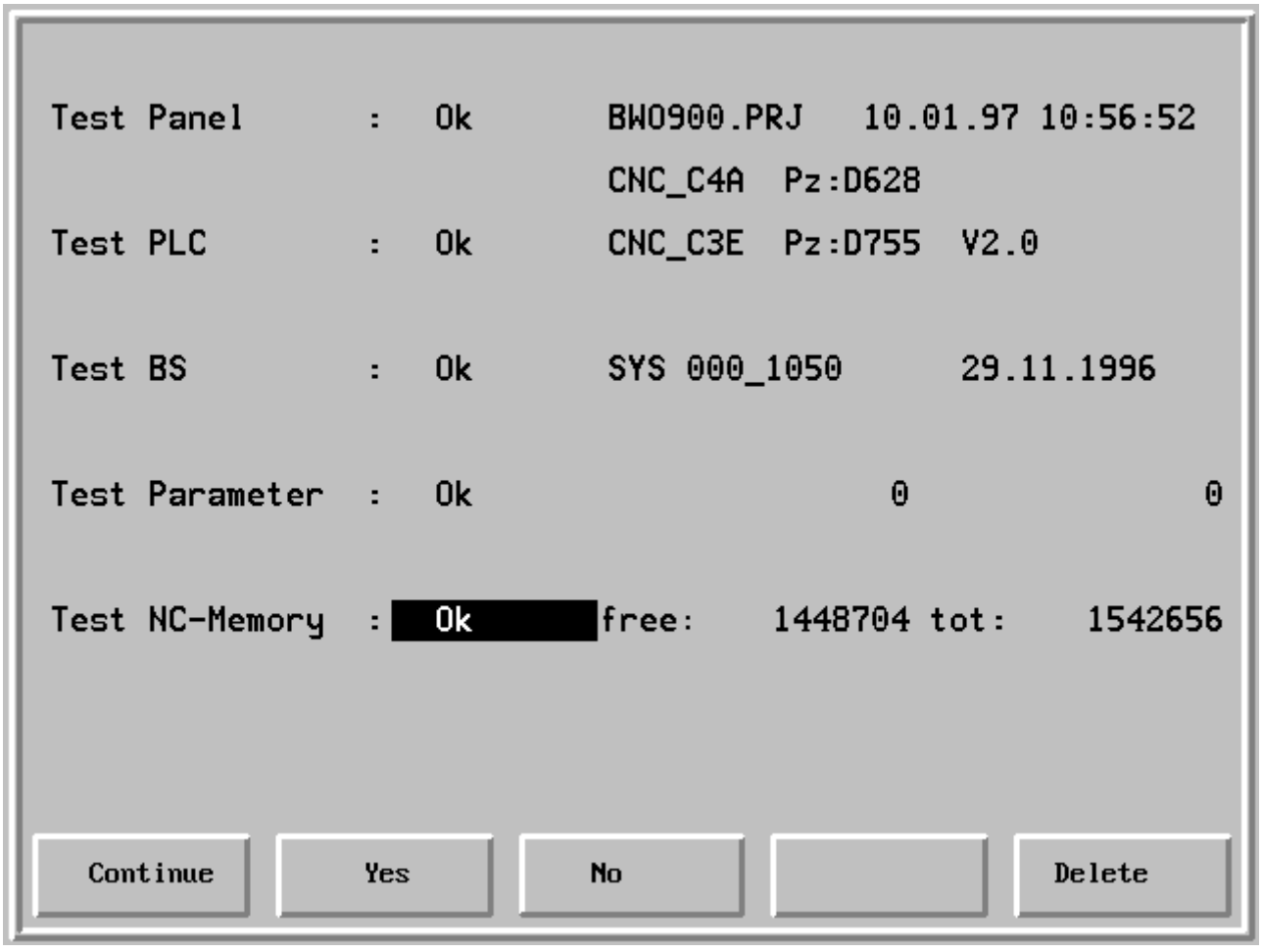
Line 6 The parameter memory is all right.

2.2.2 Power on test with confirmation (continued)

Test NC memory

After pressing the function key “Continue”, the NC memory is checked.

The following display appears after a successful test:



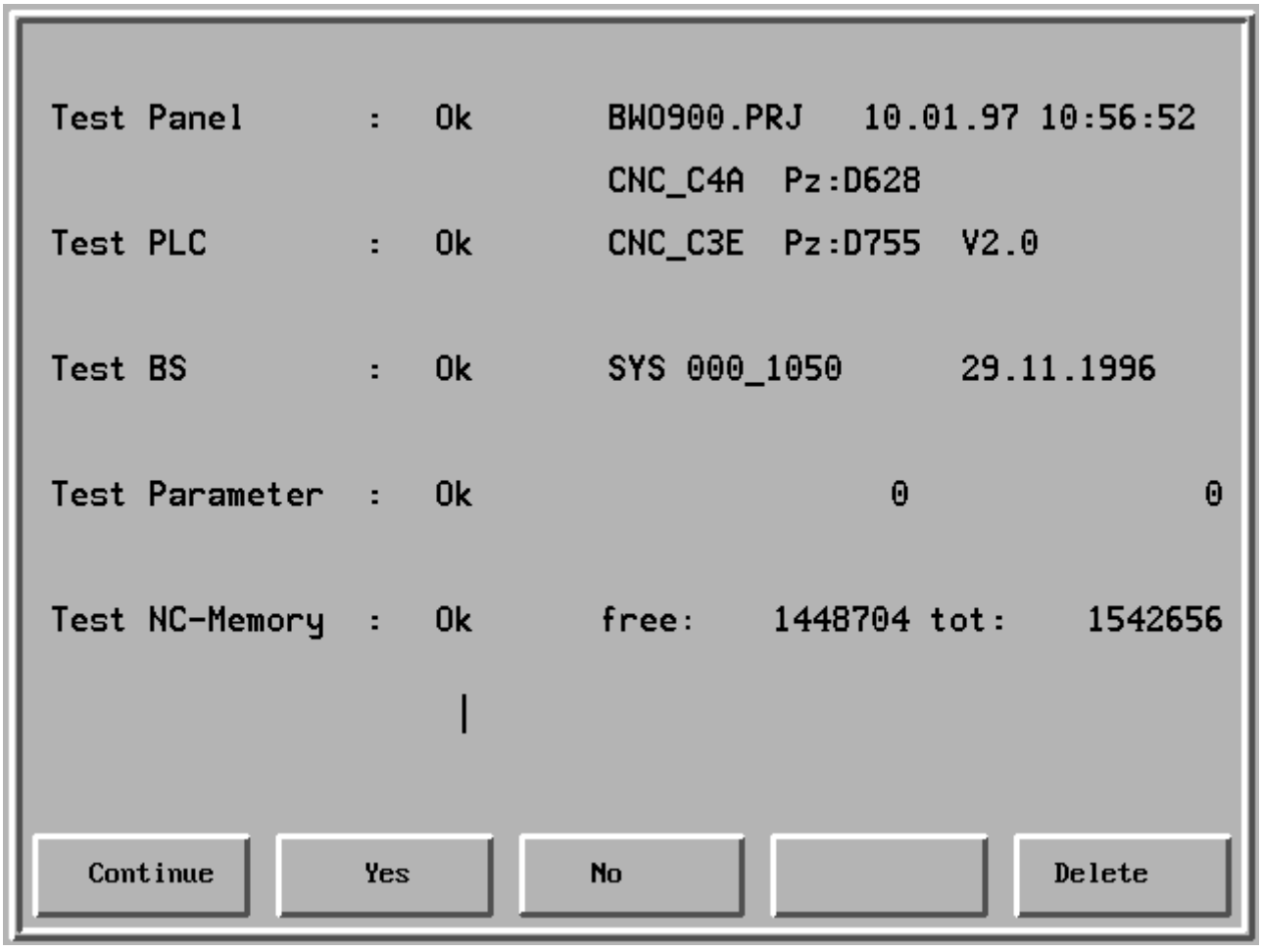
Meaning:

Line 7 NC memory is all right
Indicating free memory and complete memory

2.2.2 Power on test with confirmation (continued)

Finish power on test

After pressing the function key “Continue” the power on test is finished and the system is loaded (takes some seconds).
The following display appears after a successful test:

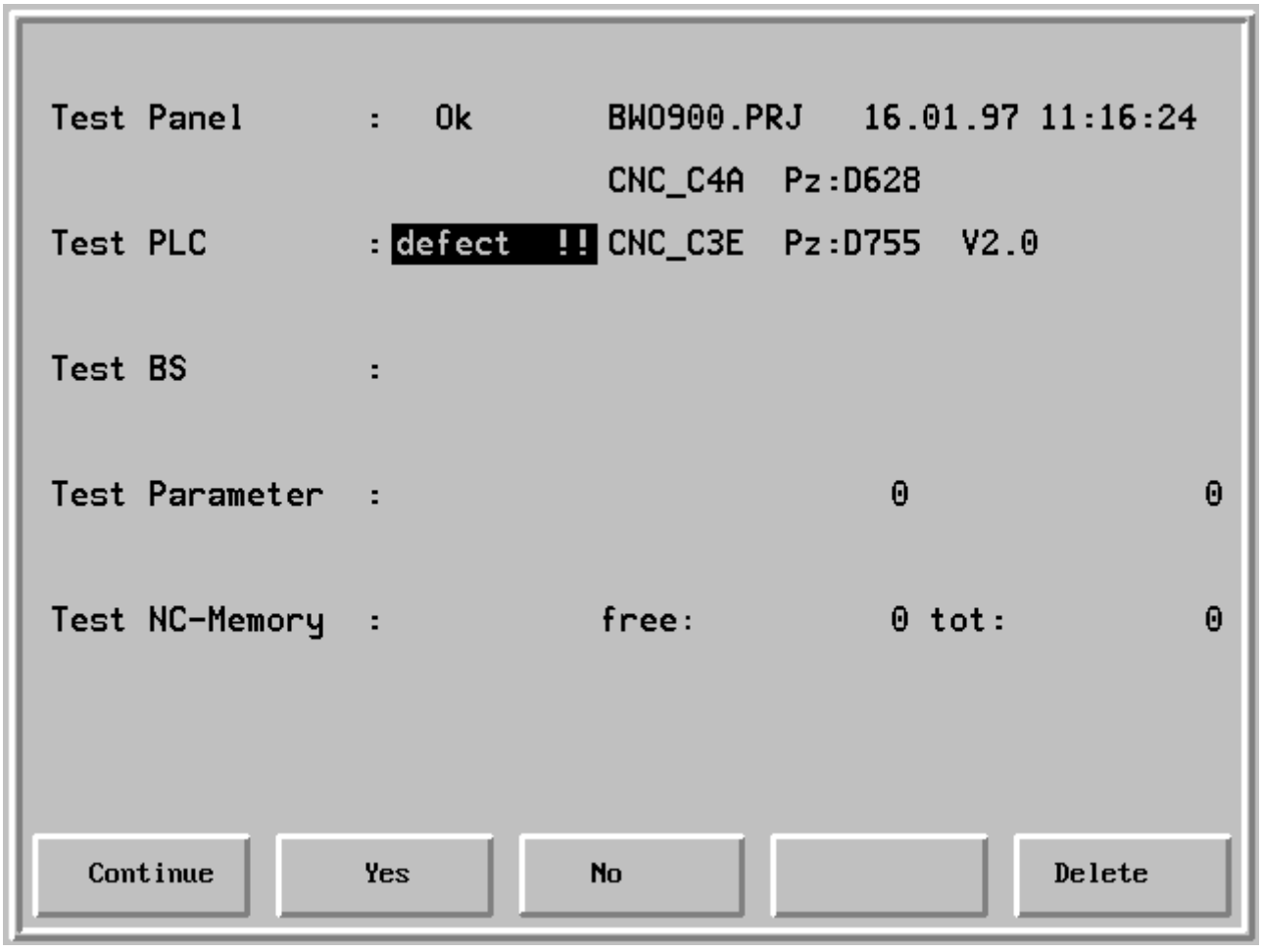


Then, the company sign appears.

2.2.3 Power on test with error

PLC test

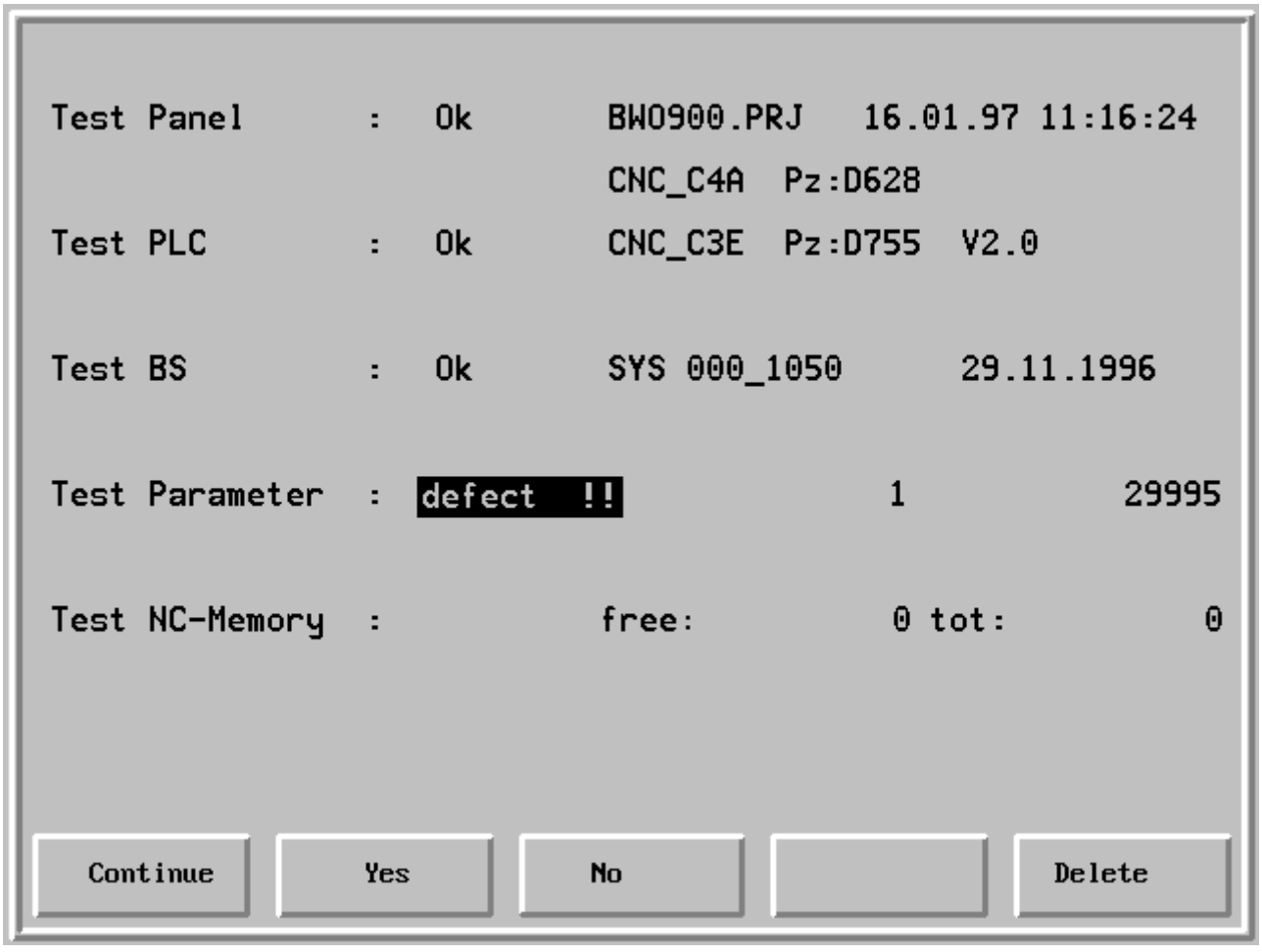
If the following display appears, the PLC program is defective. The power on test is stoped.
In this case, the PLC program has to be loaded again and has to be stored in the EEPROM.



2.2.3 Power on test with error (continued)

Parameter test

The following display appears if the parameter memory is defective. The power on test is stoped.



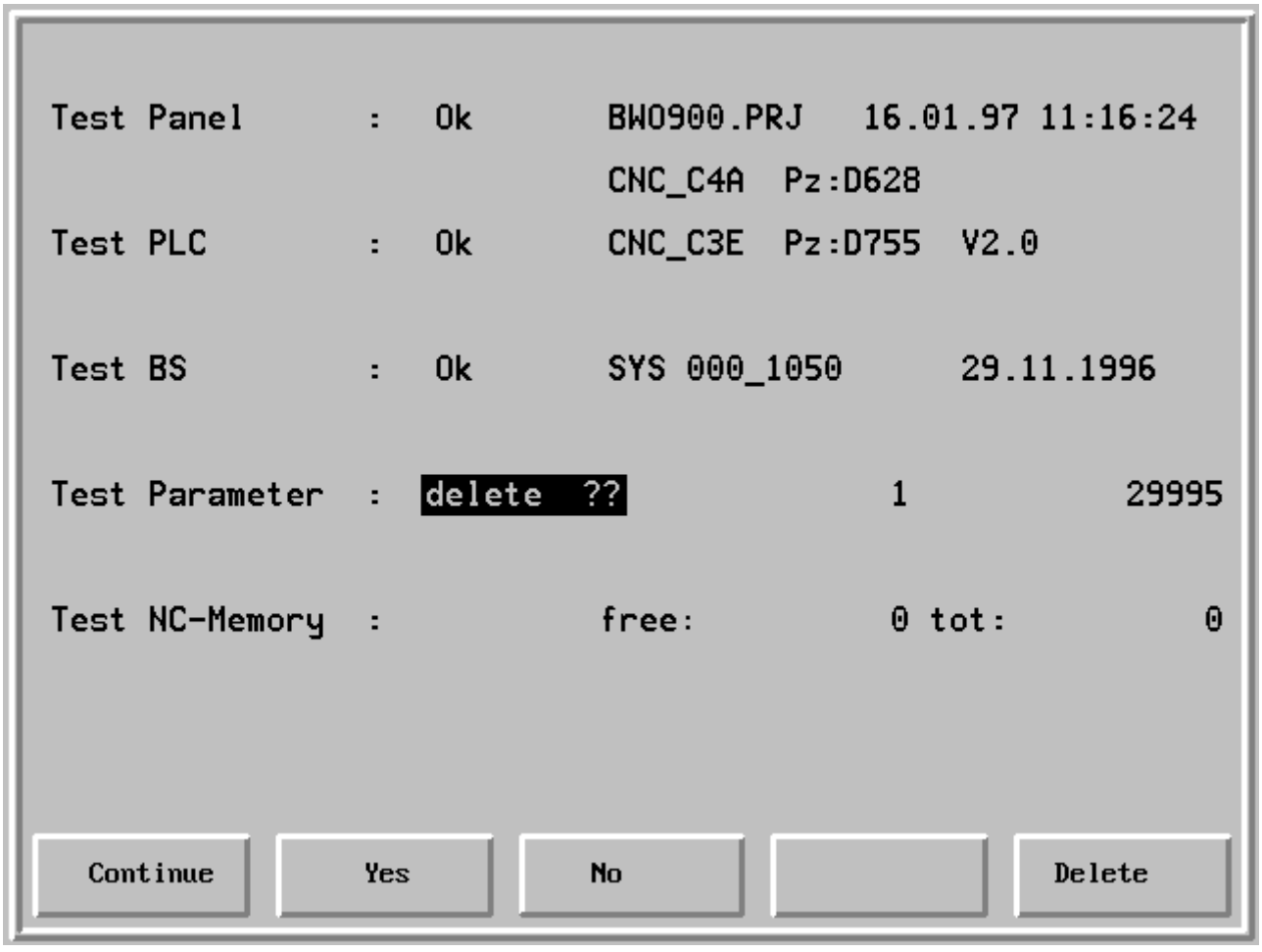
Meaning:

Line 6 Display of the first defective parameter (q) and the number of defective parameters.

2.2.3 Power on test with error (continued)

Parameter test

The power on test is only continued if the key (Delete) is pressed. The following display appears.



Delete ??

Key “Yes” Delete the complete parameter memory

Key “No” The parameter memory is not deleted.
Go on to test NC memory with pressing the key “Continue”

2.2.3 Power on test with error (continued)

Parameter test

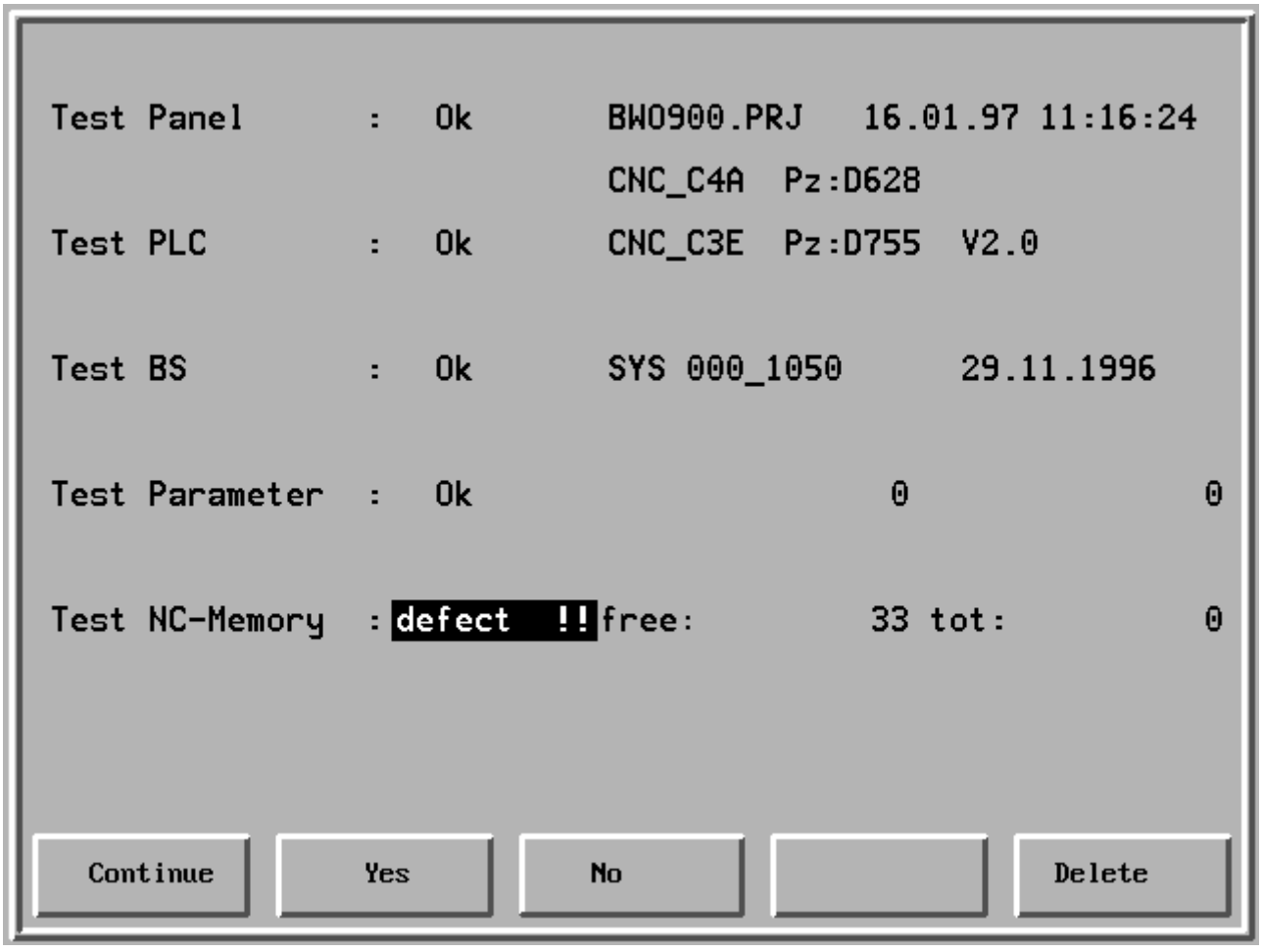
After Delete ? and pressing the key “Yes” the following functions are loaded
- BWO presettings
- customer-specific data from the EEPROM.

Go on to test NC memory with pressing the key “Continue”

2.2.3 Power on test with error (continued)

Test NC memory

The following display appears if the NC memory is defective. The power on test is stoped.



Meaning:

Line 7 Error code (33) and additional information (0)

2.2.3 Power on test with error (continued)

Test NC memory

Meaning of the error codes

Code	Meaning
02	Program not found
05	End of program or Write-/ Read indicator > program size
06	No free memory
07	Faulty check-sum
10	Error when reading from NC memory
11	Error when writing on NC memory
15	No program input , e.g. key-operated switch locking
16	Program should be opened for writing, but is already opened
25	Key-operated switch interlocking
30	Defective directory chain
31	Defective program chain
32	Defective list of free blocks
33	Defective check-sum of system data
35	Blocks in program system are double-chained

2.2.3 Power on test with error (continued)

Test NC memory

The power on test is only continued if the key (Delete) is pressed. The following display appears.

Delete ??

Key “Yes” Delete complete NC memory

Power on test is finished with pressing the key “Continue” and the company sign appears.

2.3 Reference points

Reference points are machine-specific mechanical fixed points.

After the power on tests, you have to approach with each axis the corresponding reference point, if the machine works in the incremental measuring system.
The reference point is stored and the actual value display is set with the correct value.
In the first line of the display field, the axes of which the reference point is not stored, are shown.

Because the traverse directions for taking reference points are depend on the machine, the following explanation can only be an example.

Note: The reference point must not be identical with the machine zero point.

2.3.1 Approaching reference points automatically

The reference points can be approached automatically, if a corresponding program is stored in the PLC. The key  is reserved for this program.

2.3.2 Manual approaching of reference points

Requirements

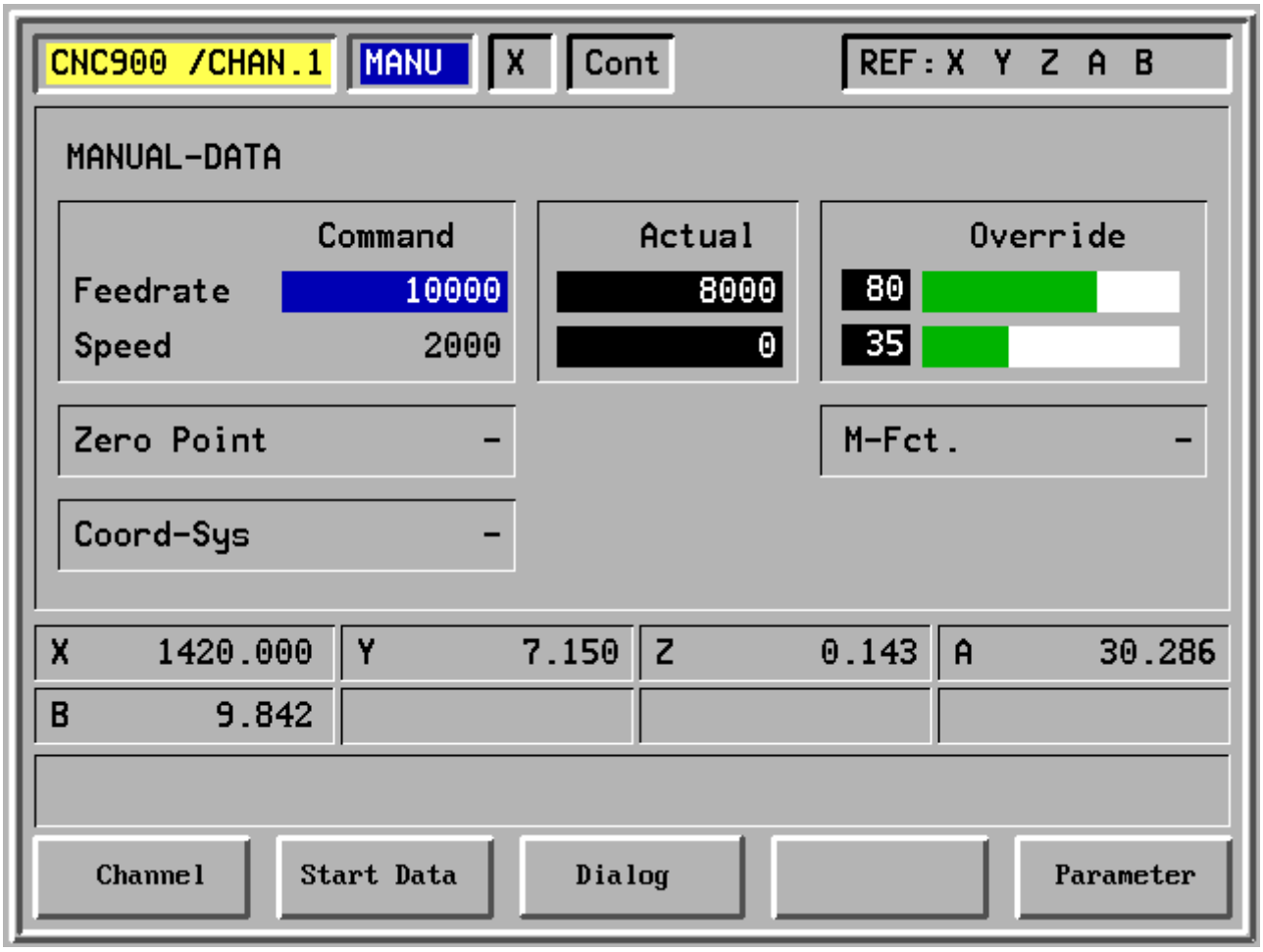
- Power on tests are ready.
- The control is switched on (key “Control on” is pressed)
- The operating mode “Manual” is set.
- The feed for manual mode is given, feed override > 0.
- The drive mode is set (e.g. “continually”).

Approach reference point of an axis, e.g. X-axis

Press key “X”

Display: MANUAL X Cont Ref: X Y Z A B

Press key “Manual” until max. end position of the X-axis is reached.



2.3.2 Manual approaching of reference points (continued)

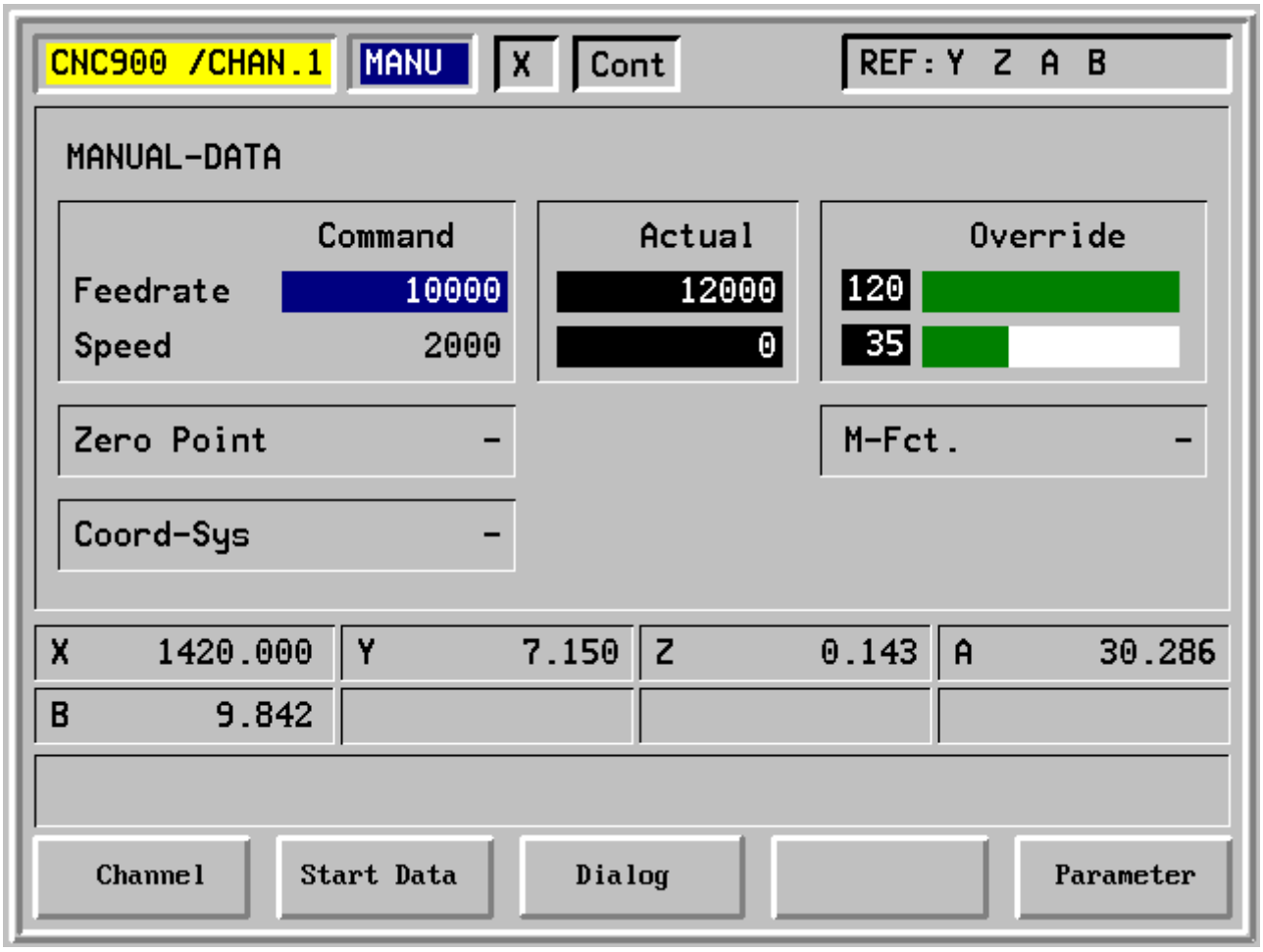
Approach reference point of an axis, e.g. X-axis

Then press “Manual” until the X disappears from the display.

Display: Manual X Cont REF: Y Z A B

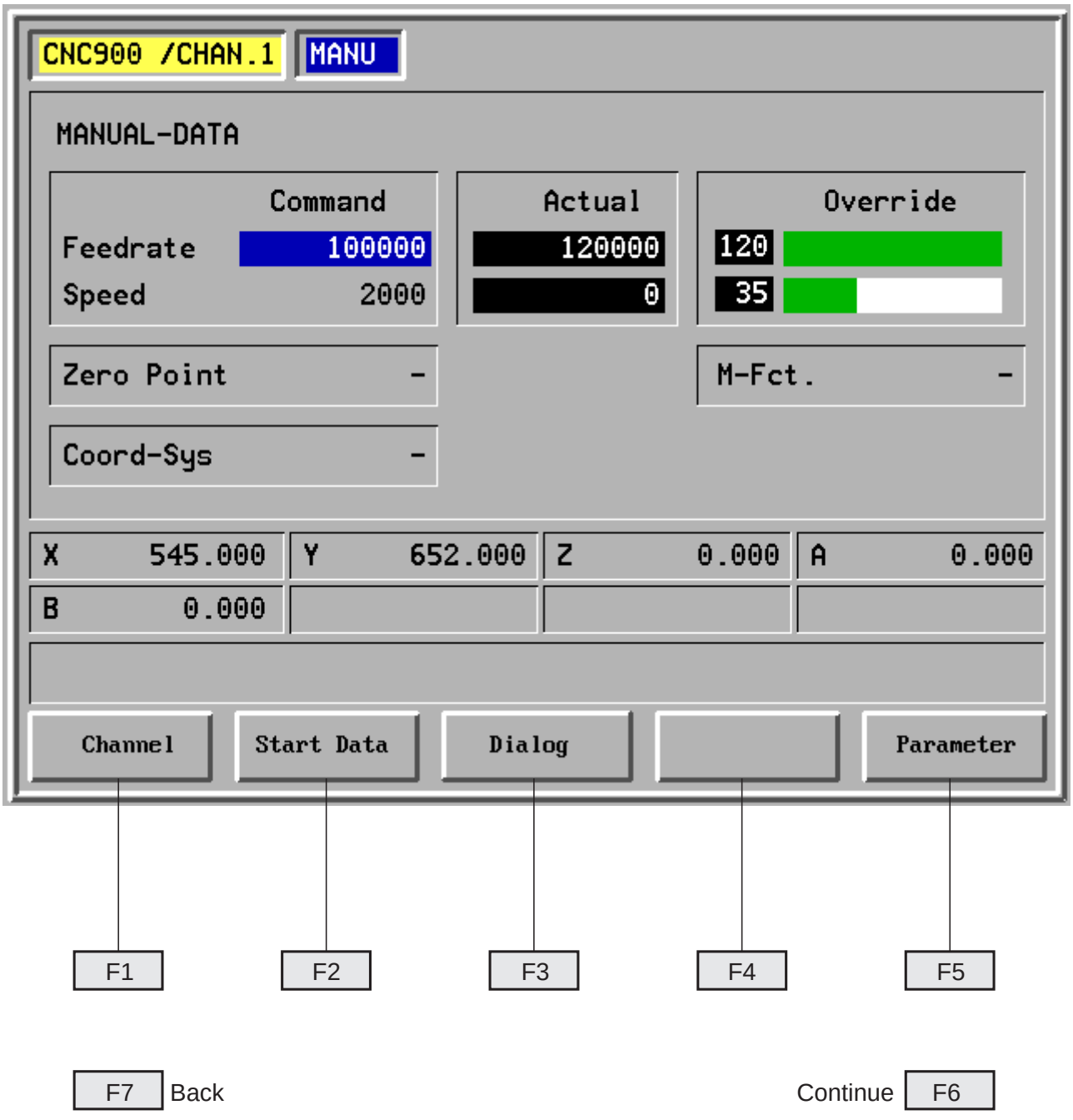
Now the reference point for the X-axis is stored.

The same procedure is valid for the other axes.



2.4 Screen keys and screen displays

2.4.1 Position of the function keys in the screen frame



2.4.2 Setting the screen brightness

The brightness of the screen can be set continuously.

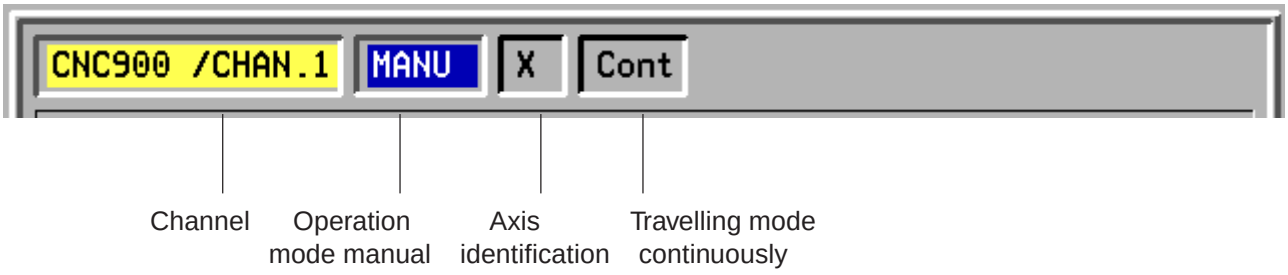
When pressing the function key “**F6**” and

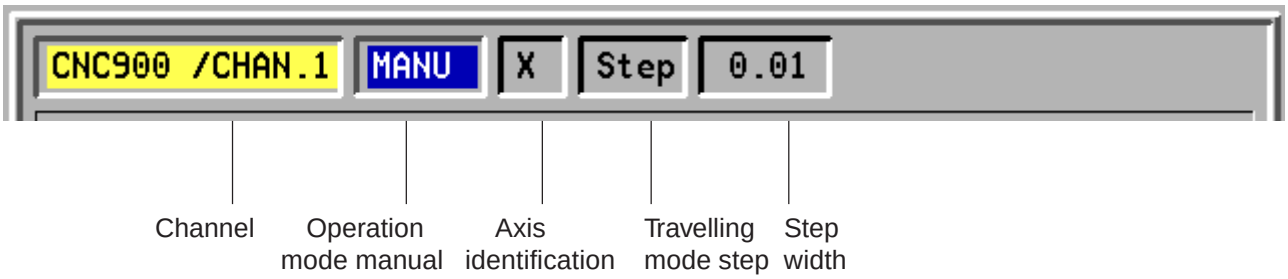
 (Page up) the creen becomes brighter,

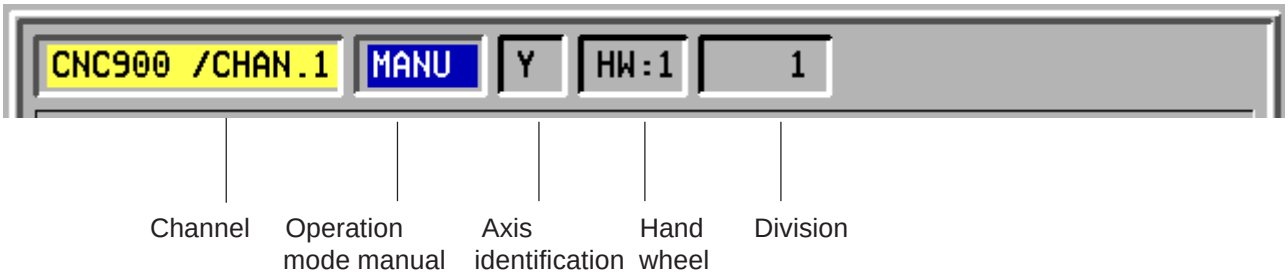
 (Page down) the screen becomes darker.

2.4.3 Screen display in the headline

Displays in manual mode

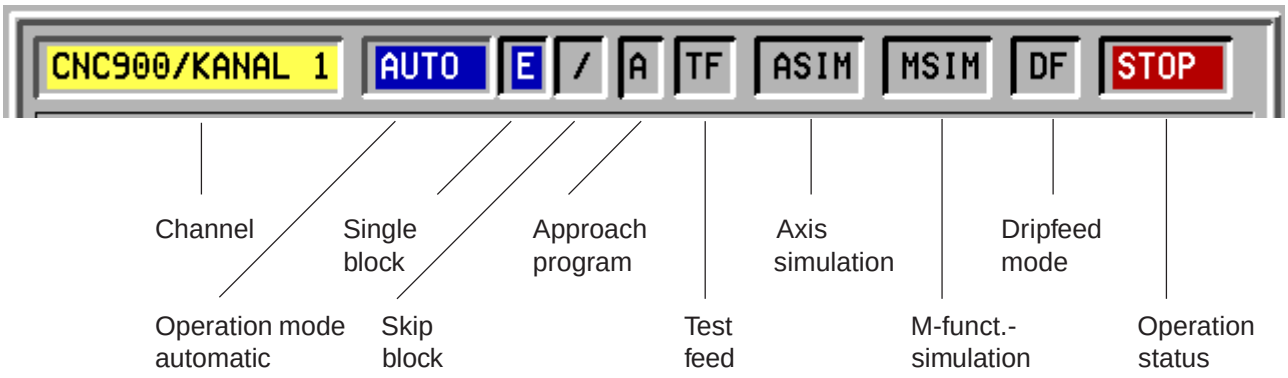






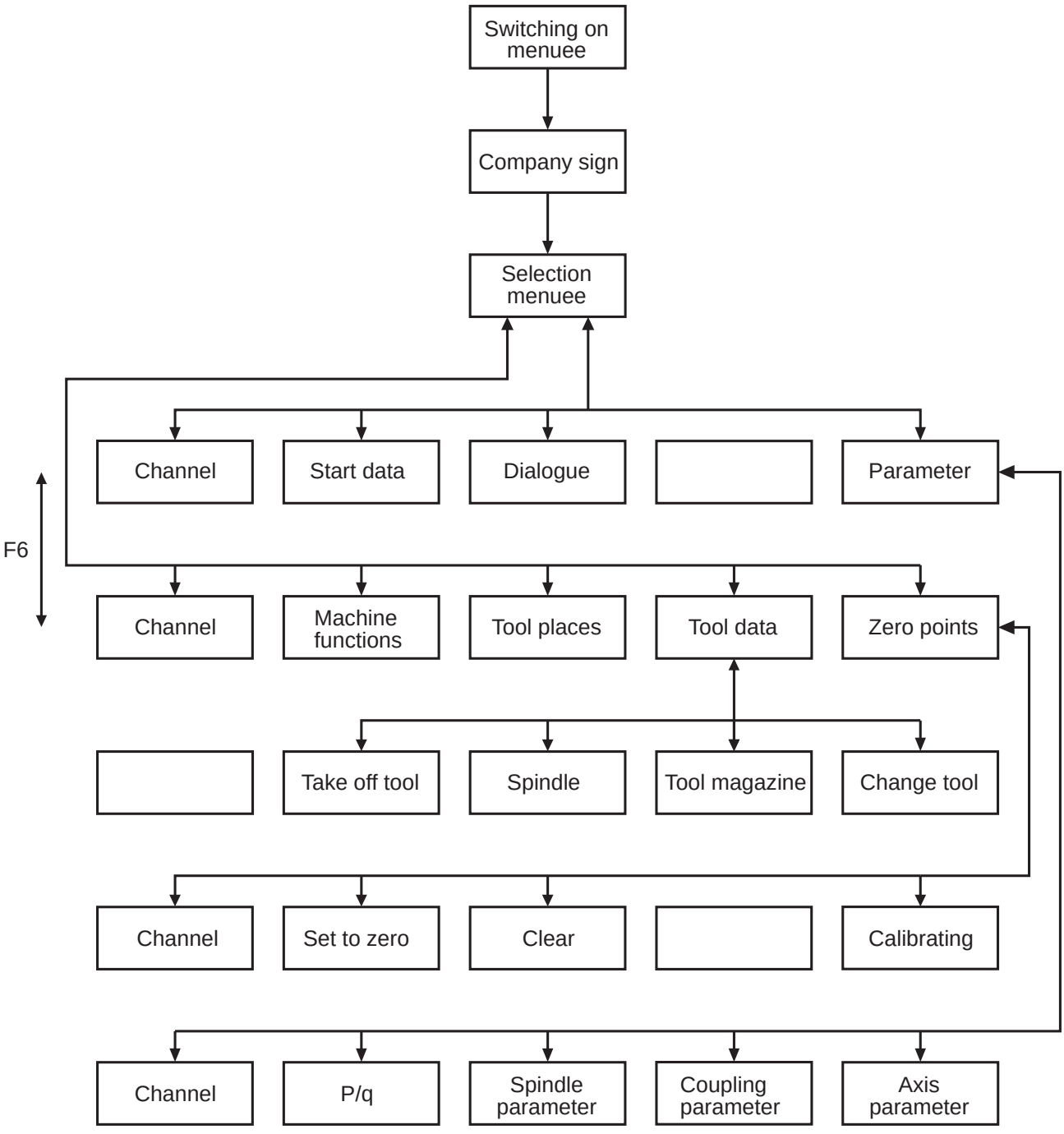
2.4.3 Screen display in the headline (continued)

Displays in automatic mode



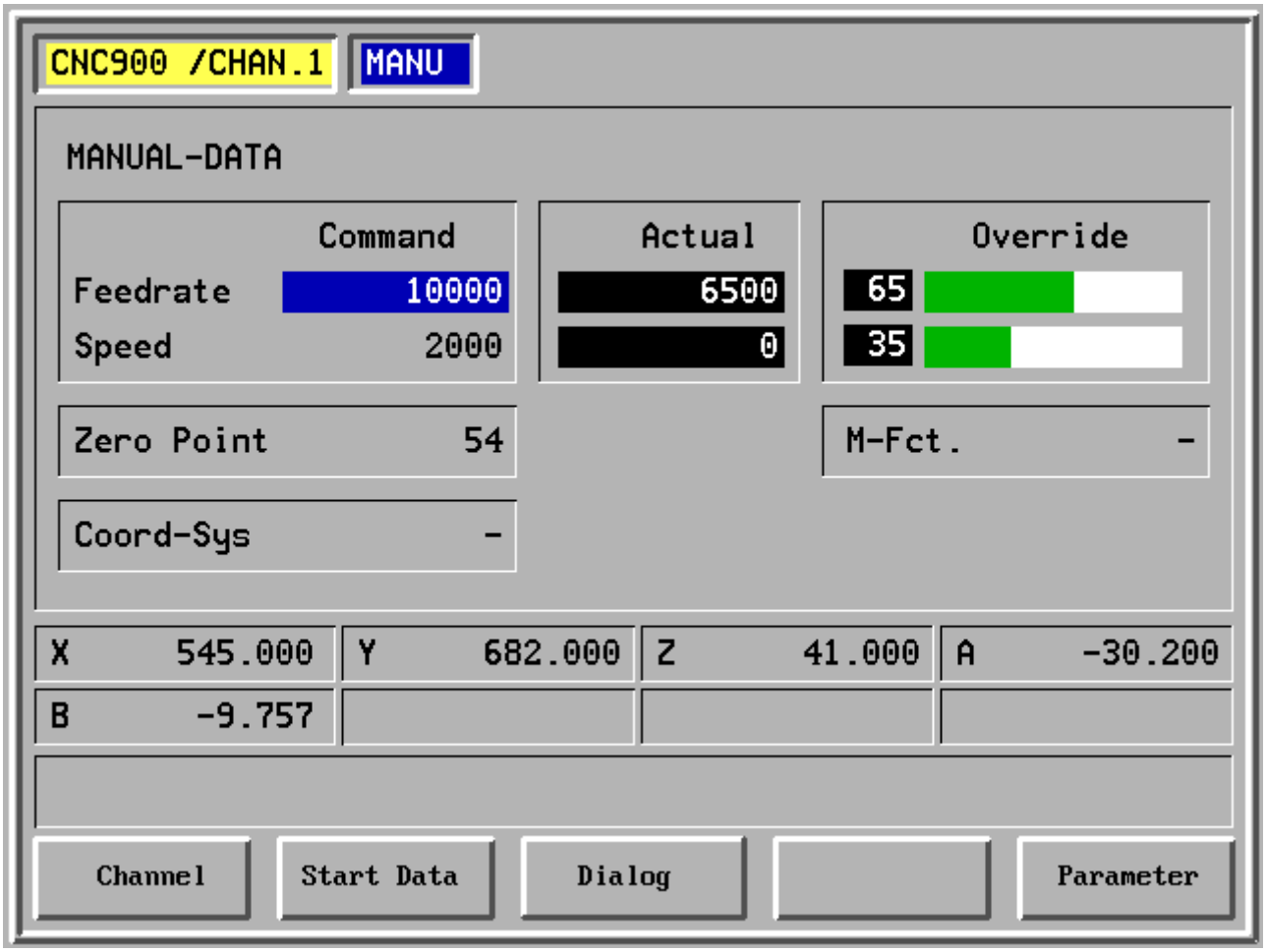
2.5 Selection menue

Menue tree



2.5 Selection menue (continued)

All functions can be selected with the selection menue with the function keys F 1 to F7.
The menue consists of two function pictures. **Selection picture 1:**



Selection of

F1 Channel

F2 Start data

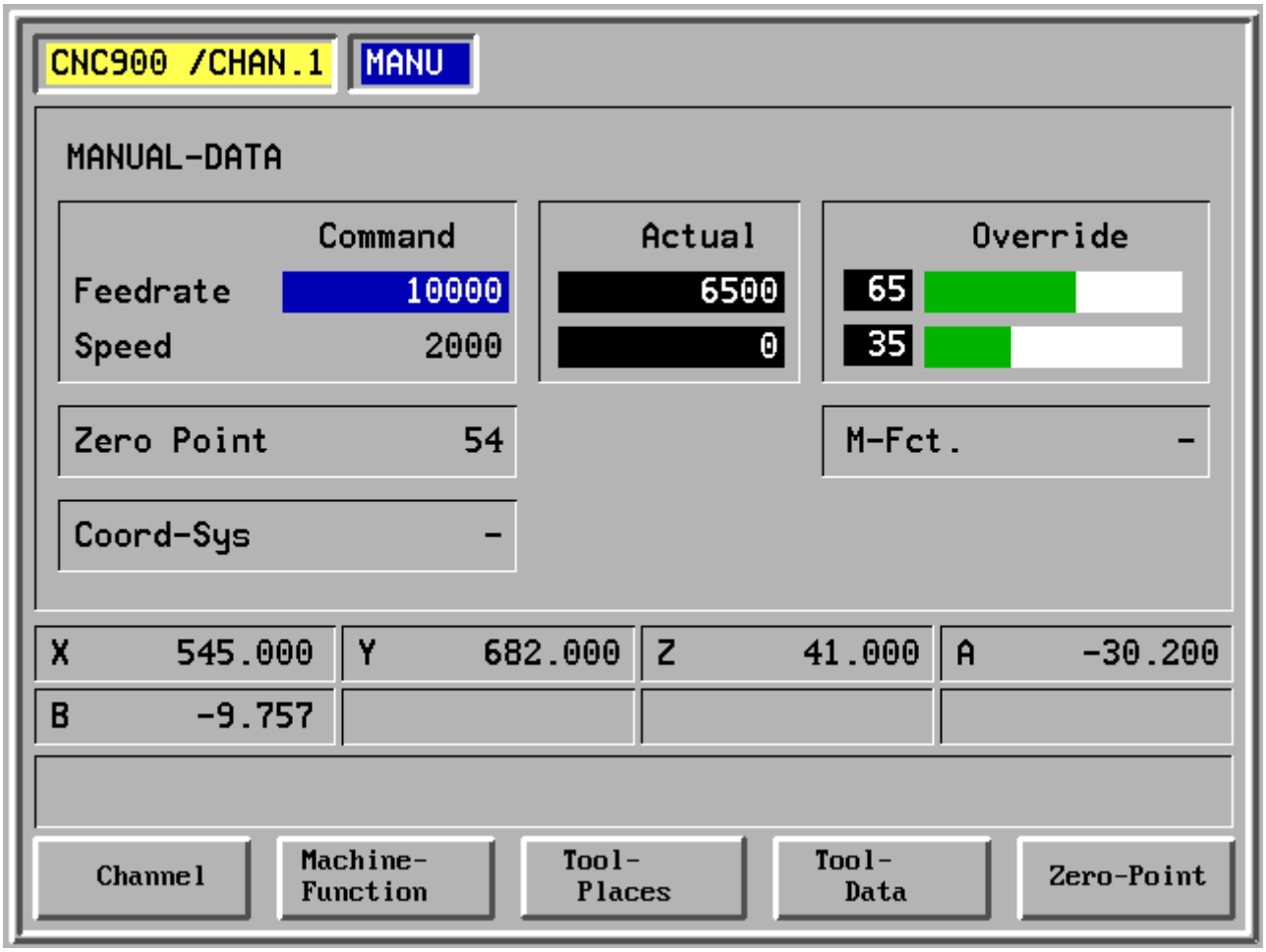
F3 Dialogue

F4 -

F5 Parameter

2.5 Selection menue (continued)

Selection picture 2:
Switching from selection picture 1 <—> selection picture 2 with function key F6 (roll function)



Selection of

F1 Channel

F2 Machine function

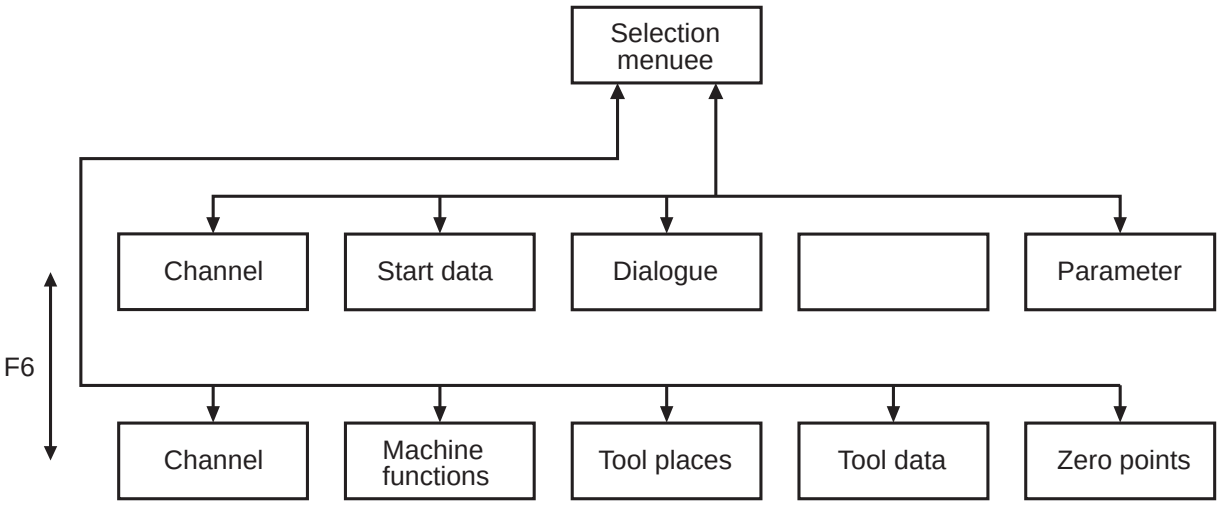
F3 Tool places

F4 Tool data

F5 Zero points

2.5 Selection menue (continued)

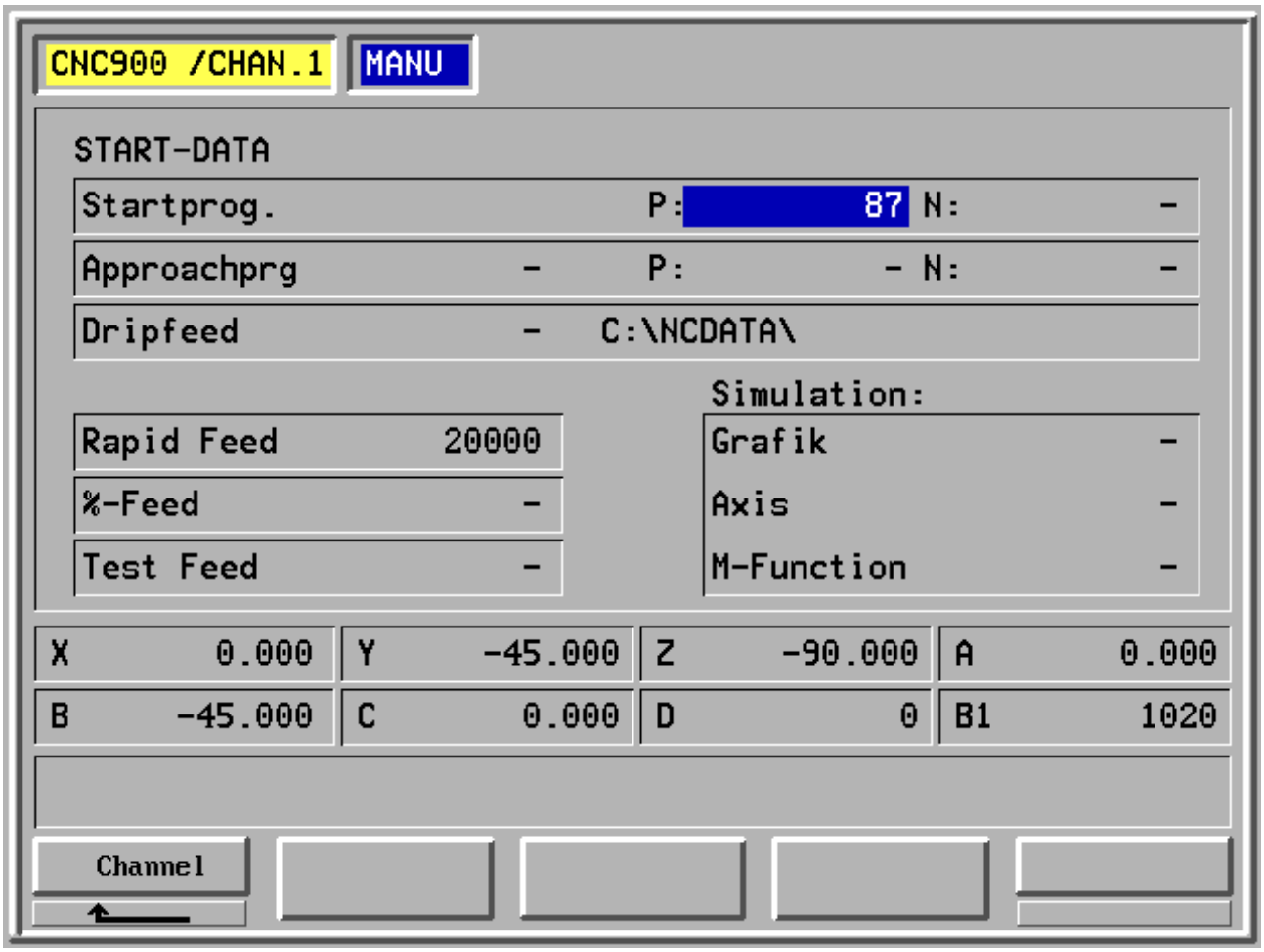
Menue tree



Functions	Section
Start data	2.8
Dialogue	2.9
Parameter	2.10
Machine functions	2.11
Tool data	2.12
Zero points	2.13

2.5.1 Start data

The following menue enables setting the start data.



F1 Channel

F2 -

F3 -

F4 -

F5 -

2.5.1 Start data (continued)

Block

Input block number of the starting block. If the value is 0 or deleted, the NC program is started with the 1st block.

Rapid traverse

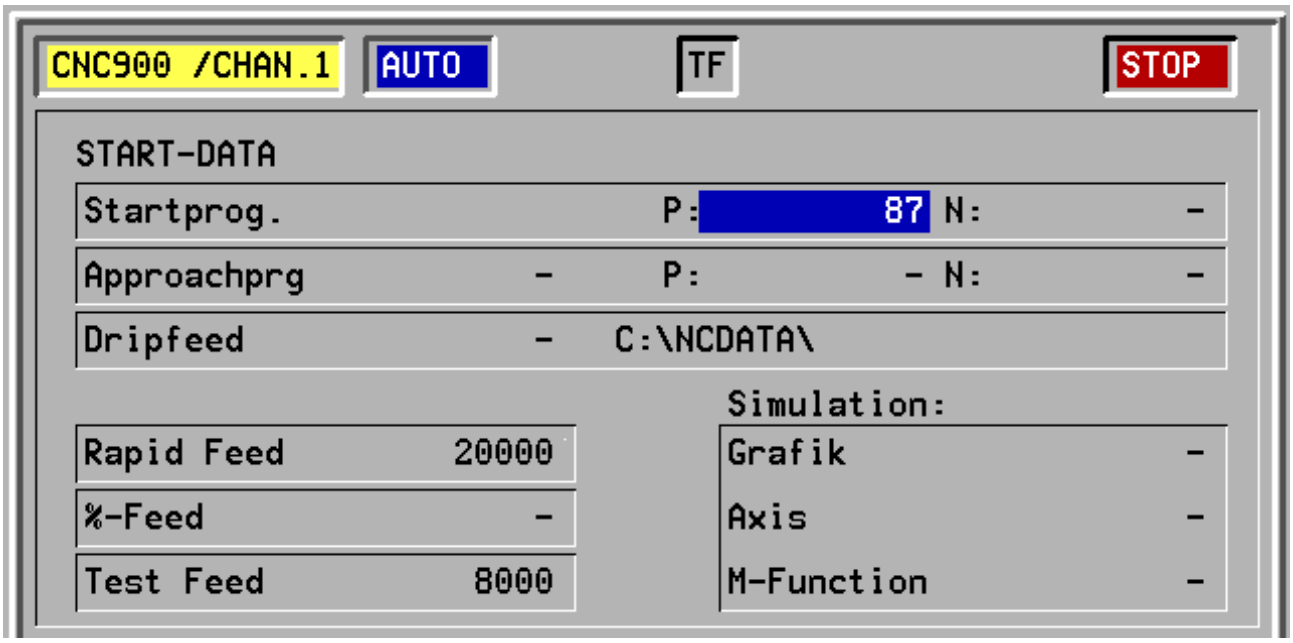
The desired rapid traverse can be input. If the value is 0 or deleted, the manual feed is active.

% Feed

The programmed feeds in the NC program are modified with the indicated percentage.

Test feed

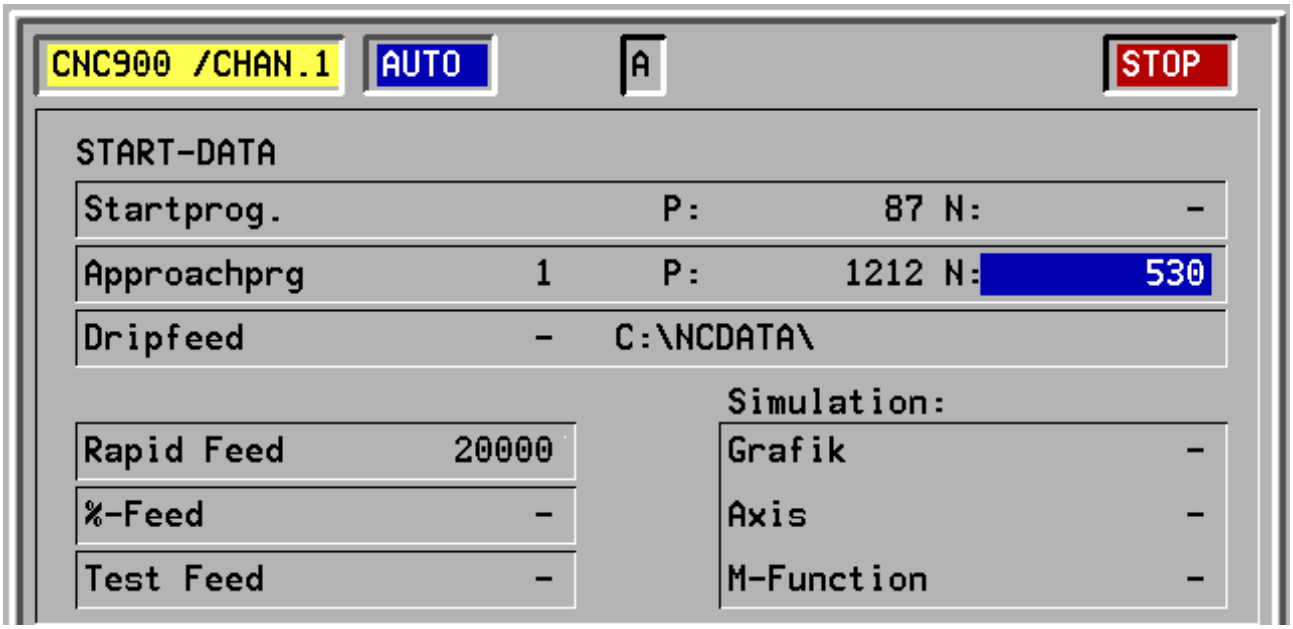
If a test feed is input the programmed feeds in the NC program are ineffective.
The test feed is active. If the value for the test feed is 0 or deleted, the test feed is not active.



2.5.1 Start data (continued)

Reapproach program

In the case of the abort of a current NC program (HAND abort, message) by the system the actual NC program position in the parameters P8802, P8803 and P8807 is stored. The NC program position is displayed in the start data menu. On properly terminated NC program resets this information.



After an NC abort if the restarting mode is switched on (P8804=1)und the NC program started, then the NC program up to the restarting point is simulated, i.e.. no axis movements result.

In the restarting block the simulation is switched off. The restarting position is started on direct path. With achieving the restarting position P8804=0 is settinged.

One re+starts on the initial position of the aborted block.

If the NC program in a process cycle is aborted, then becomes to cycle start started.
When restarting m-functions and m-cycles are treated according to m-Funktionsdefinition (P11050..., P8250...).

2.5.1 Start data (continued)

Dripfeed mode

The NC programs that should be processed are not in the NC memory of the control but in external data carriers.

The operating panel **CNC 900 C** has the NC programs on the hard disk or on a data server.

With the operating panel **CNC 900**, the NC programs have to be read in via I/O (BWO-I/O-socket, NCARC.EXE).

NC programs for dripfeed have to be linear, i.e. block skips and sub-program call-ups are not allowed.

Activating in the start-data menue:

Dripfeed	1	Dripfeed on
Dripfeed	0	Dripfeed off

Dripfeed mode with operating panel CNC 900 C

- In the start-data menue:
  switch on dripfeed mode,
  input program number,
  check DOS-path-name,
  path-name is indicated in the start-data menue (see also CNC900X.CFG).

- Change of operating mode after AUTOMATIC.
  Now the data transmission to the dripfeed-buffer is started.
- NC start.

Dripfeed mode with operating panel CNC 900

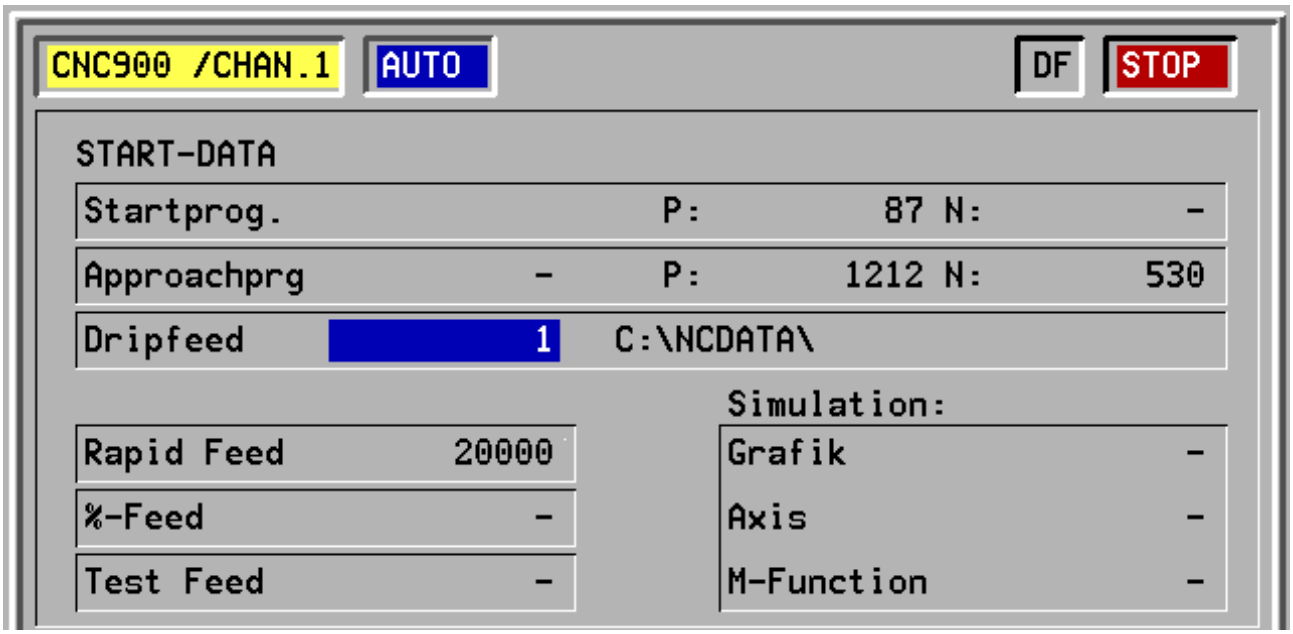
- In the start data menue:
  switch on dripfeed mode

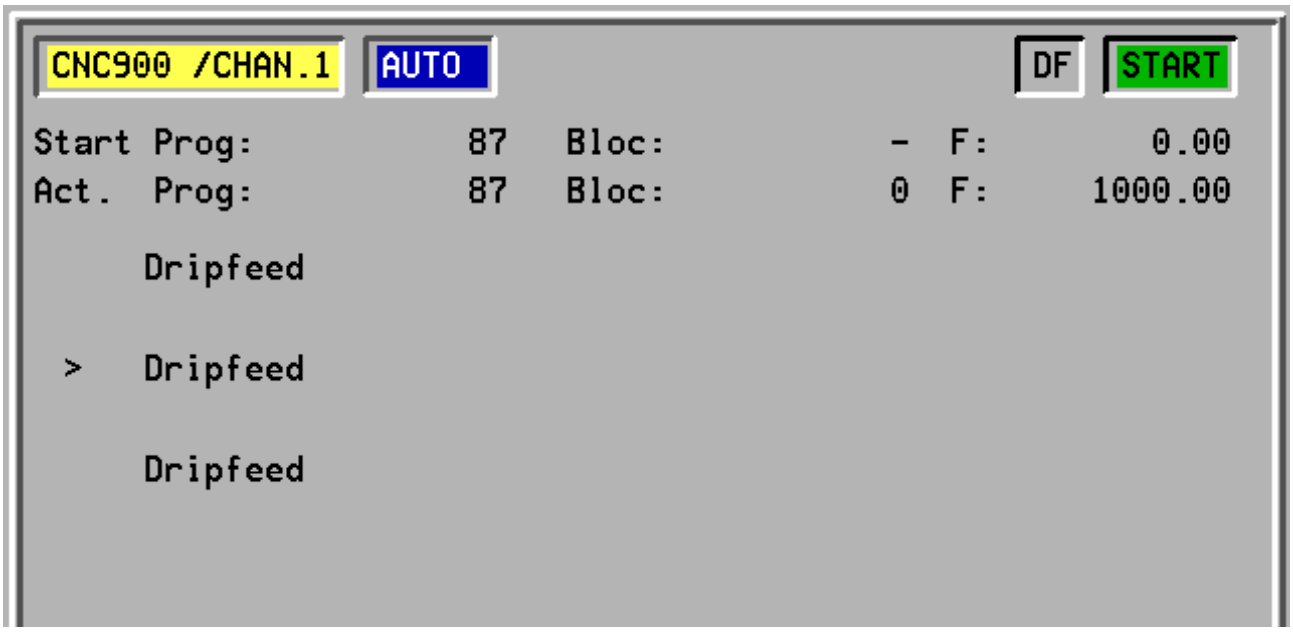
- Check I/O parameters
- Connect external data carrier
- Change of operating mode after AUTOMATIC,
  due to this an I/O-input-start is made automatically.
  The CNC is now waiting on a data transfer.
- Start data transfer at the external data carrier,
- NC start

2.5.1 Start data (continued)

Dripfeed mode

with operating panel CNC 900 C





2.5.1 Start data (continued)

Simulation

Graphic

The graphic simulation can be used for controlling optically the program run. Thereby e.g. the axes and the transmission of the M-functions can be switched off for a test run. The The graphic simulation is started in the start menue with ‘1’ and switched off with ‘0’ or ‘deleted’.

With the key  you can switch from graphic to normal picture. If the graphic simulation is not switched on in the start menue, the message M4402: ‘Graphic simulation not active’ appears if you press the key  .

Axes

If the simulation of the axes is activated (1), the axes do not move during program run. But the axes movements can be seen on the screen. ‘ASIM’ is written in the headline. The function can be switched off with ‘0’ or ‘deleted’.

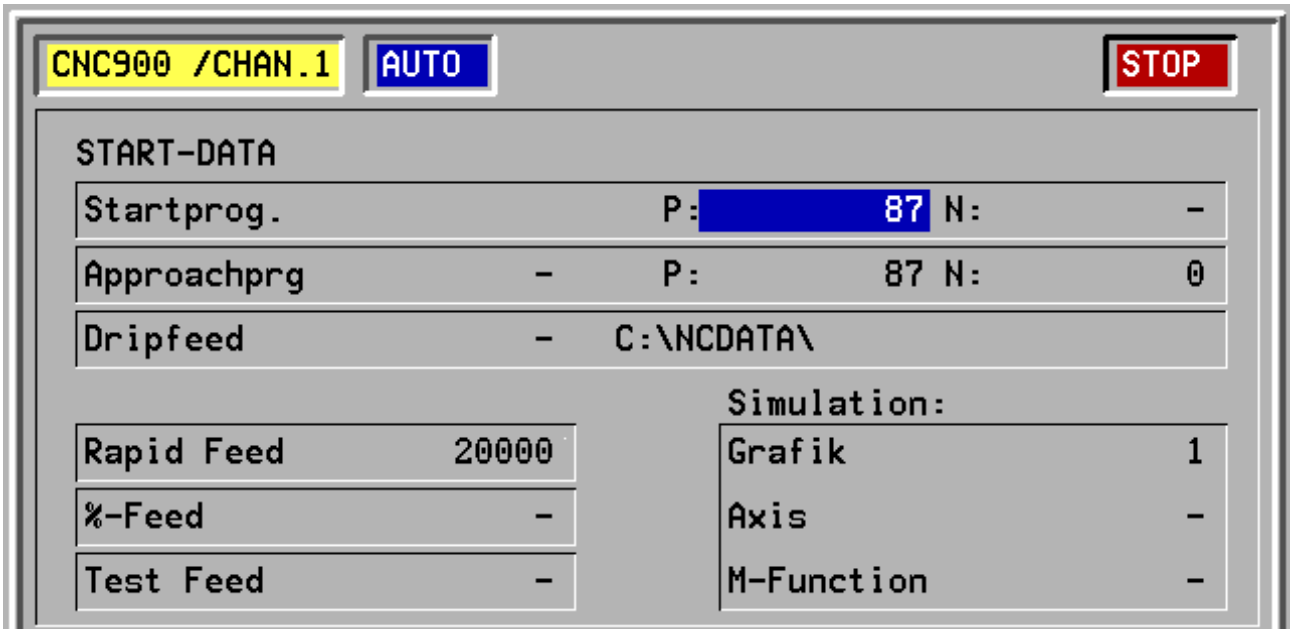
M-functions

If the simulation of the M-functions is activated (1), the M-functions are not transmitted to the PLC. ‘MSIM’ is written in the headline. The function can be switched off with ‘0’ or ‘deleted’.

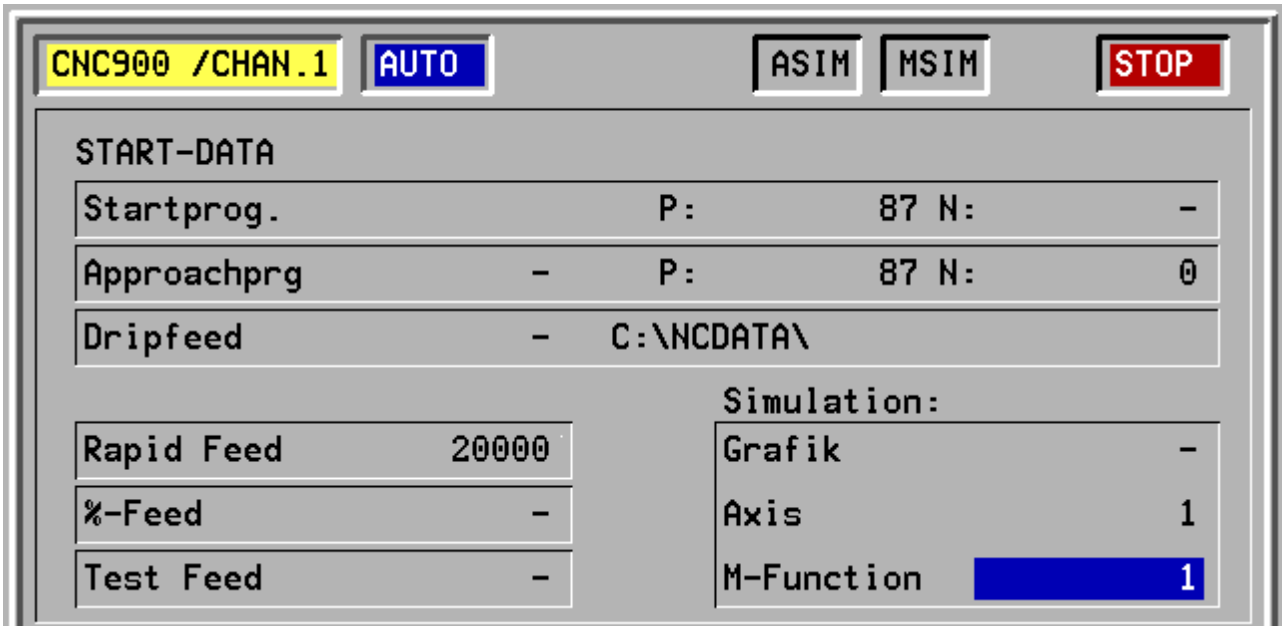
2.5.1 Start data (continued)

Simulation

Graphic on



Axes and M-functions on



2.5.1 Start data (continued)

Graphic simulation

Data input (F2)		Input with numerical keys
X, Y and Z		X, Y, and Z origin
Size		Zoom
View	0	XY-coordinates (G17)
	1	XZ-coordinates (G18)
	2	YZ-coordinates (G19)
	3	3D
A-angle		turning around X-axis
B-angle		turning around Z-axis

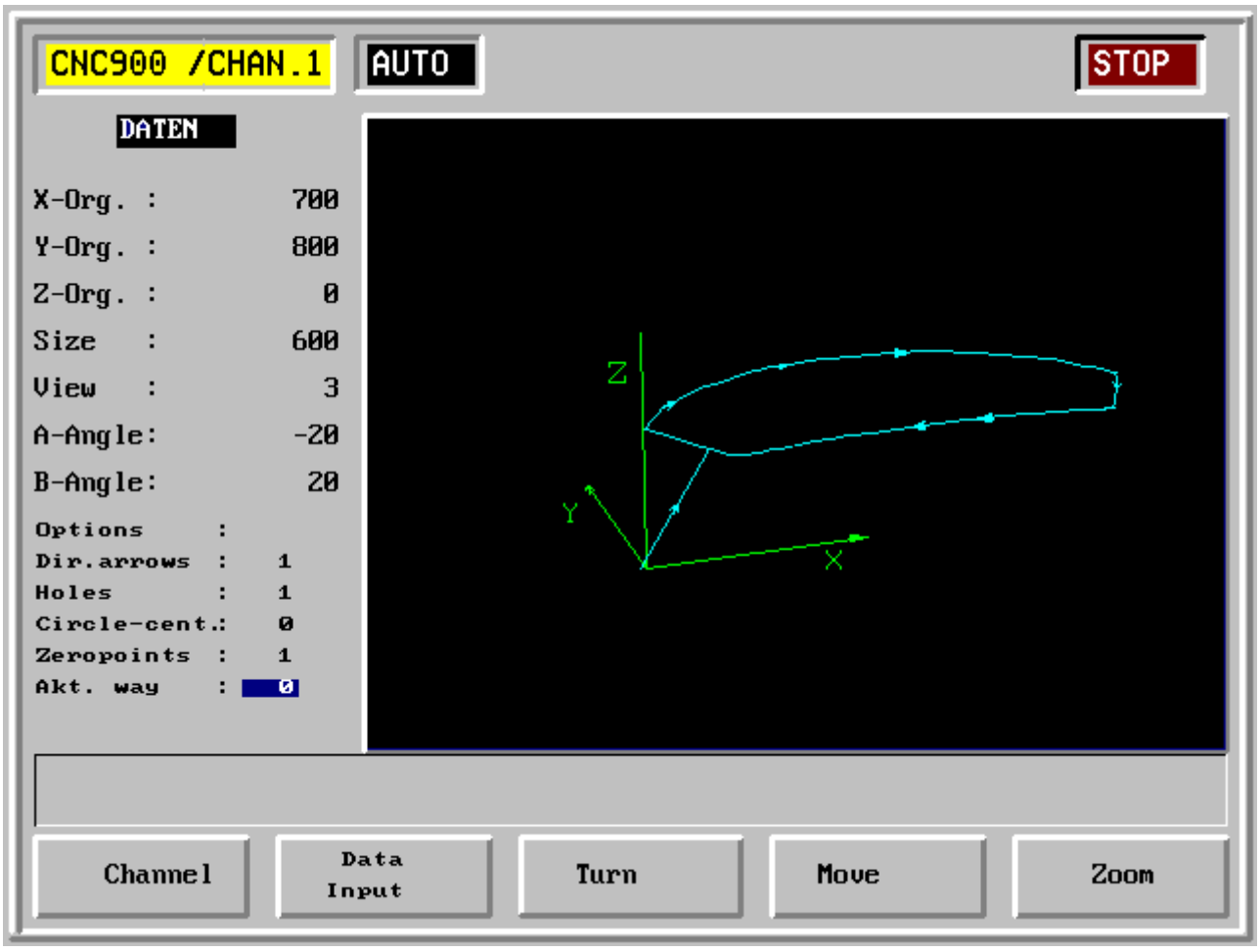
Options

Direcion arrows	1 on, 0 off
Holes	1 on, 0 off
Circle centres	1 on, 0 off
Zero points	1 on, 0 off
Actual ways	1 on, 0 off

2.5.1 Start data (continued)

Graphic simulation

Display of the target way (turned around X and Z axis)



F1 Channel

F2 Data input Input with numerical keys

F3 Turning Turning around the X-, Z-axis, input with cursor

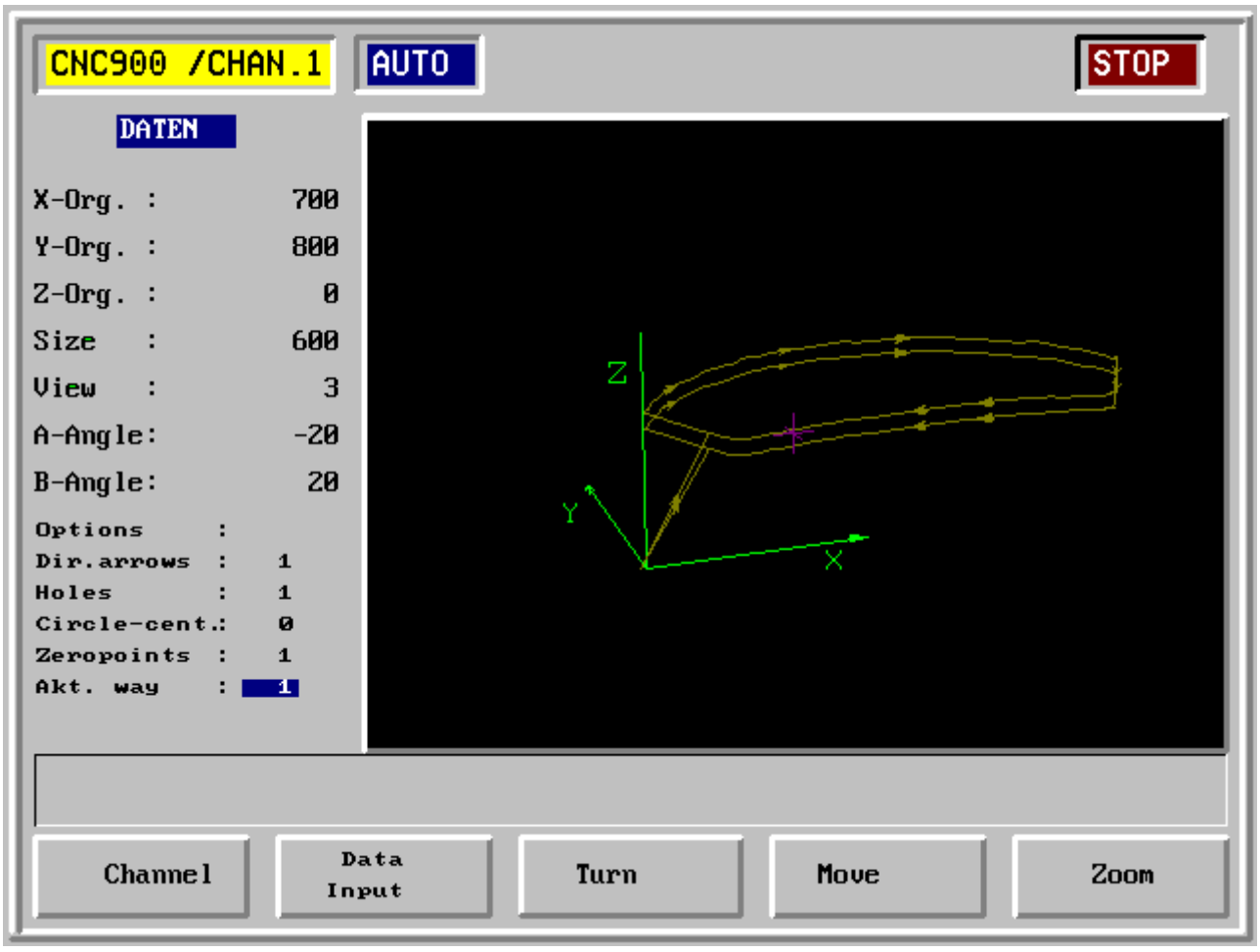
F4 Move X, Y and Z origin, input with cursor

F5 Zoom Size, input with cursor

2.5.1 Start data (continued)

Graphic simulation

Display of the target and actual way (turned around X and Z axis)



F1 Channel

F2 Data input Input with numerical keys

F3 Turning Turning around the X-, Z-axis, input with cursor

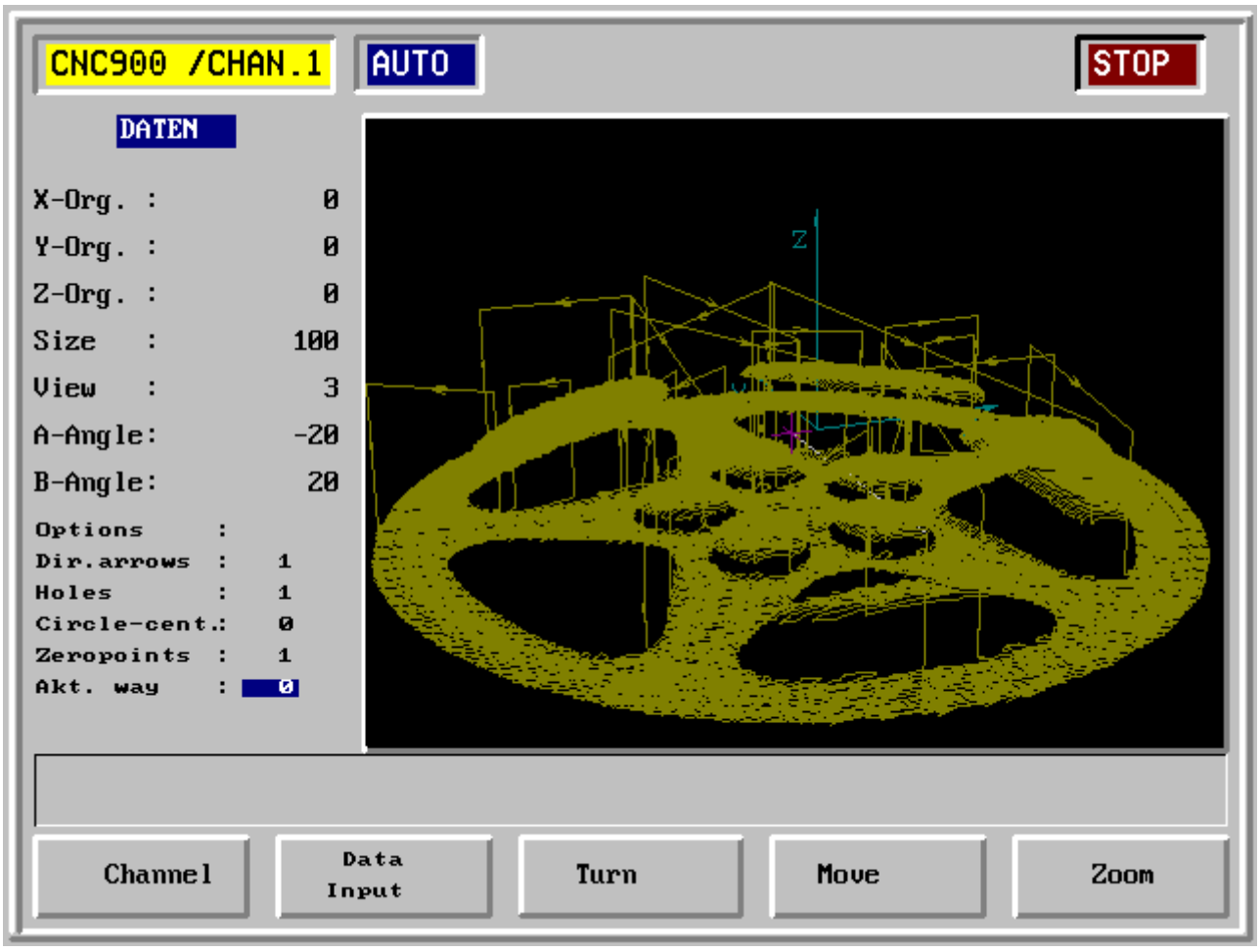
F4 Move X, Y and Z origin, input with cursor

F5 Zoom Size, input with cursor

2.5.1 Start data (continued)

Graphic simulation

Example of a complex workpiece



F1 Channel

F2 Data input Input with numerical keys

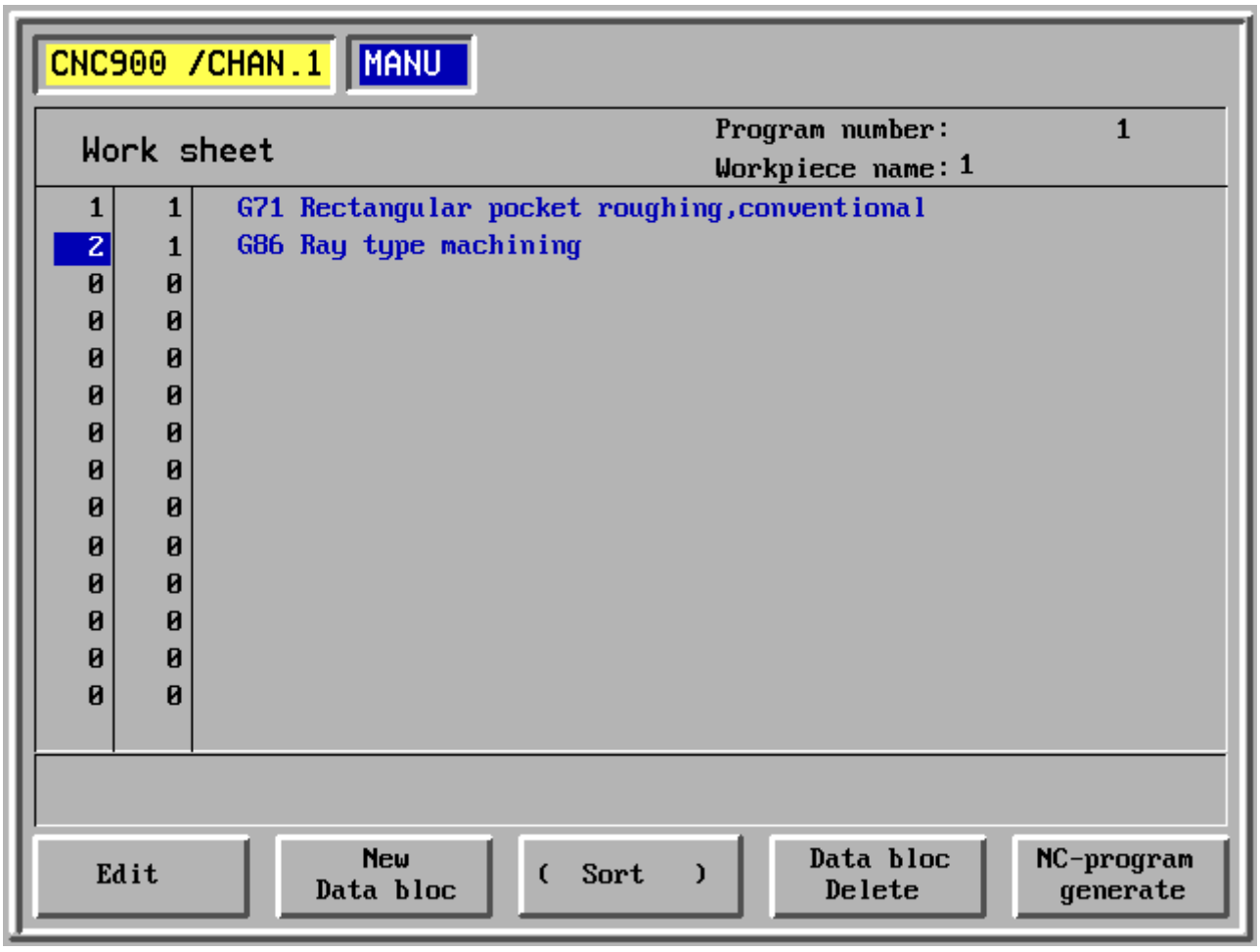
F3 Turning Turning around the X-, Z-axis, input with cursor

F4 Move X, Y and Z origin, input with cursor

F5 Zoom Size, input with cursor

2.5.2 Dialogue

Here you get the possibility to switch on a customer-specific dialogue,
e.g. **programming with work sheet**.



F1 Edit

F2 New data block

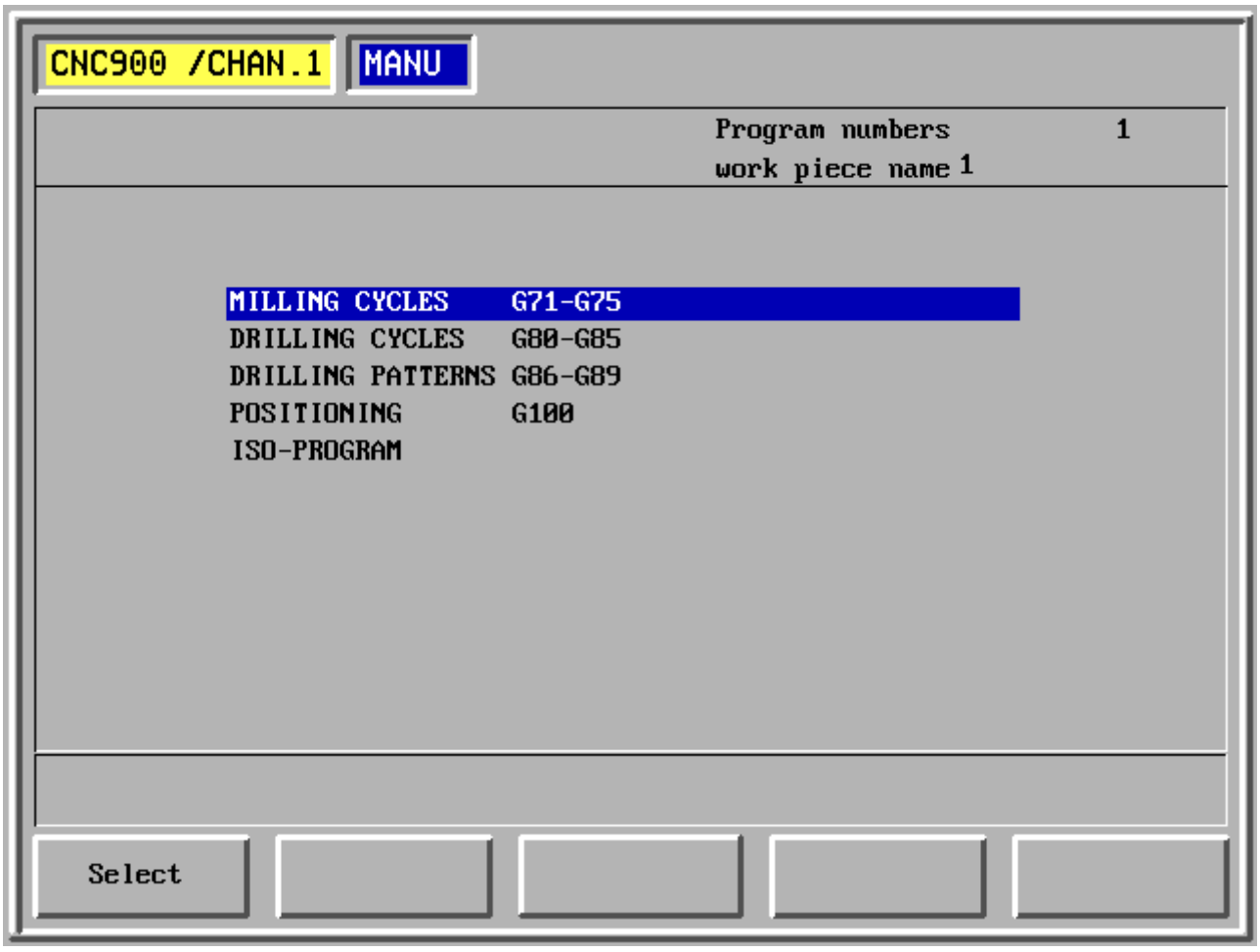
F3 Sort

F4 Delete data block

F5 Generate NC program

2.5.2 Dialogue (continued)

Programming with work-sheet - Selecting the cycle mode



F1 Selecting cycle mode

F2 -

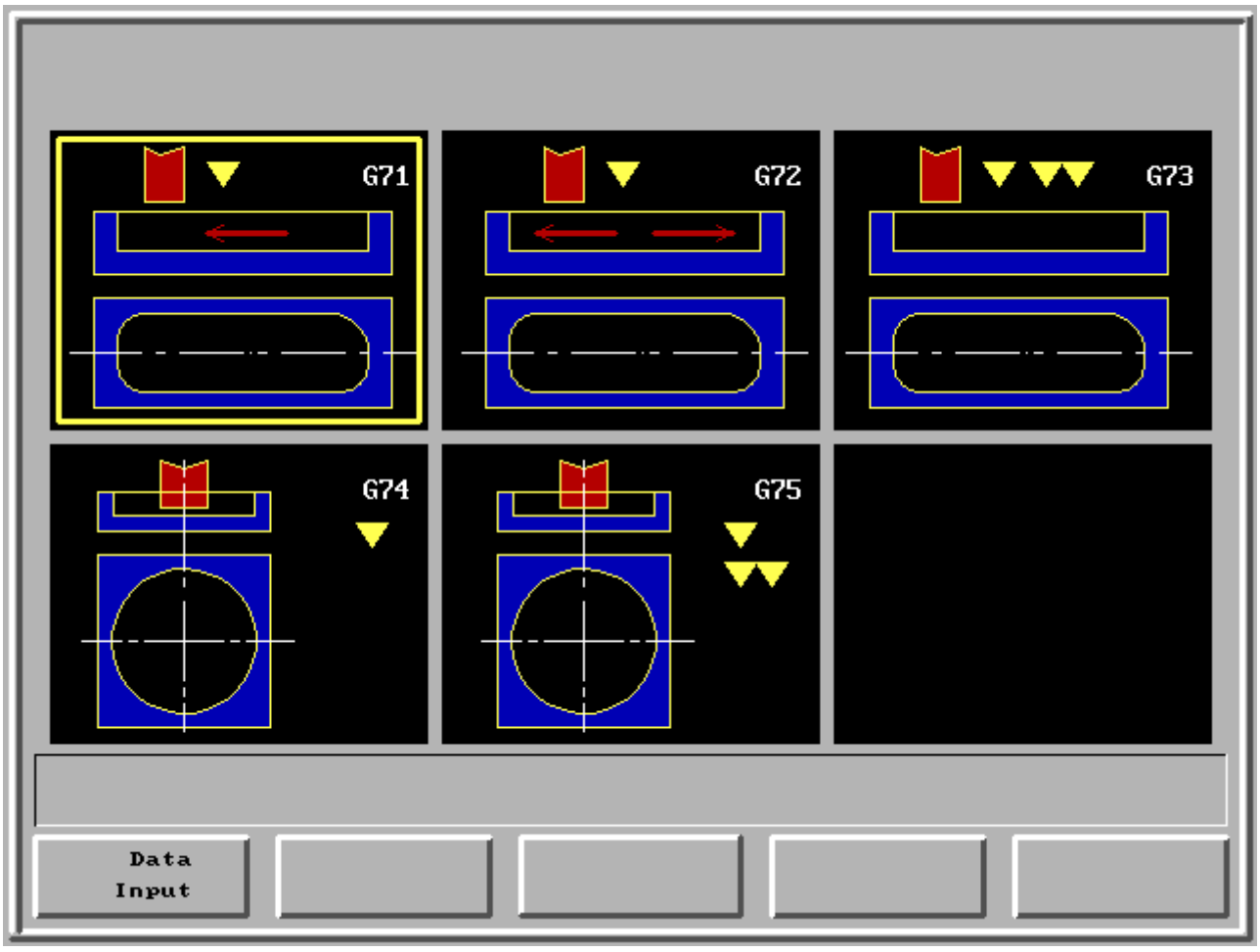
F3 -

F4 -

F5 -

2.5.2 Dialogue (continued)

Programming with work sheet - Selecting the cycle



F1 Data input

F2 -

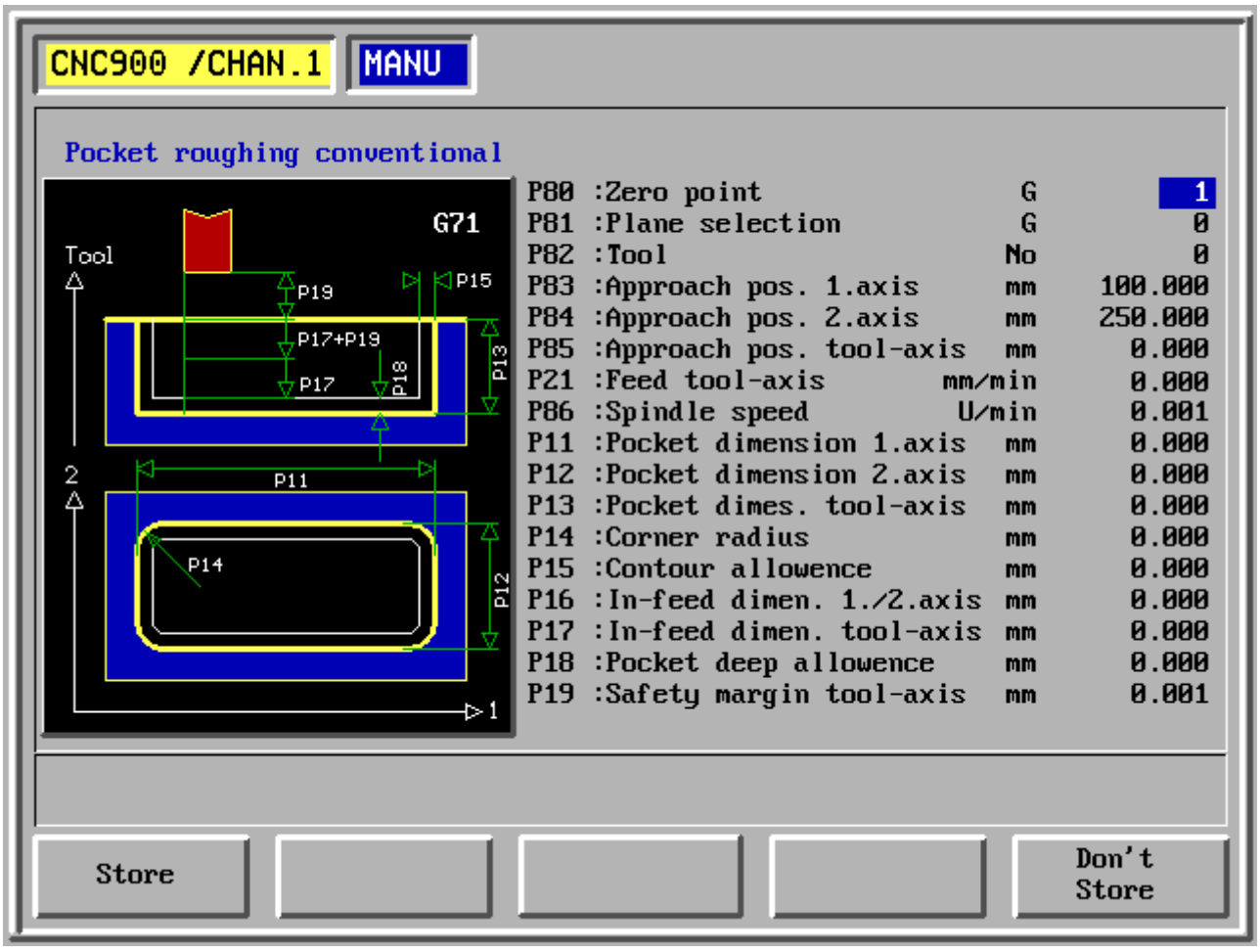
F3 -

F4 -

F5 -

2.5.2 Dialogue (continued)

Programming with work sheet - Selecting the cycle



F1 Store

F2 -

F3 -

F4 -

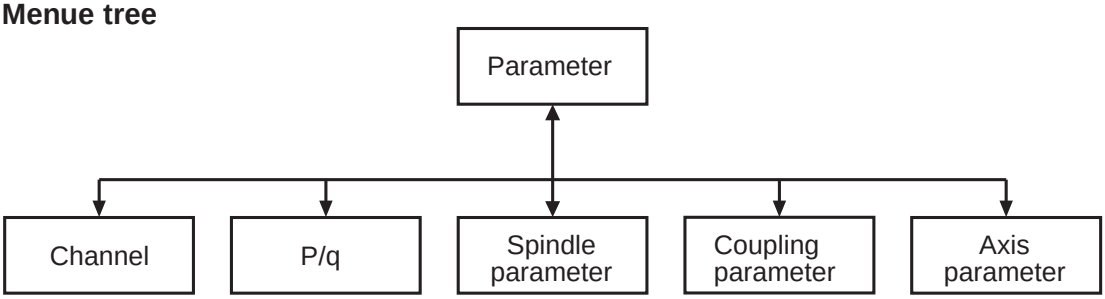
F5 Do not store

2.5.3 Parameter

The parameter menue consists of:

- Channel changeover
- Parameter changeover P/q (Channel - / System parameter)
- Spindle parameter
- Coupling parameter
- Axis parameter

Menue tree



System parameter q

0... 99	General system configuration
100... 999	Definition channel descriptor#
1000... 1999	System settings, system overlapping data
2000... 9999	Axis data
10000...	Channel parameter

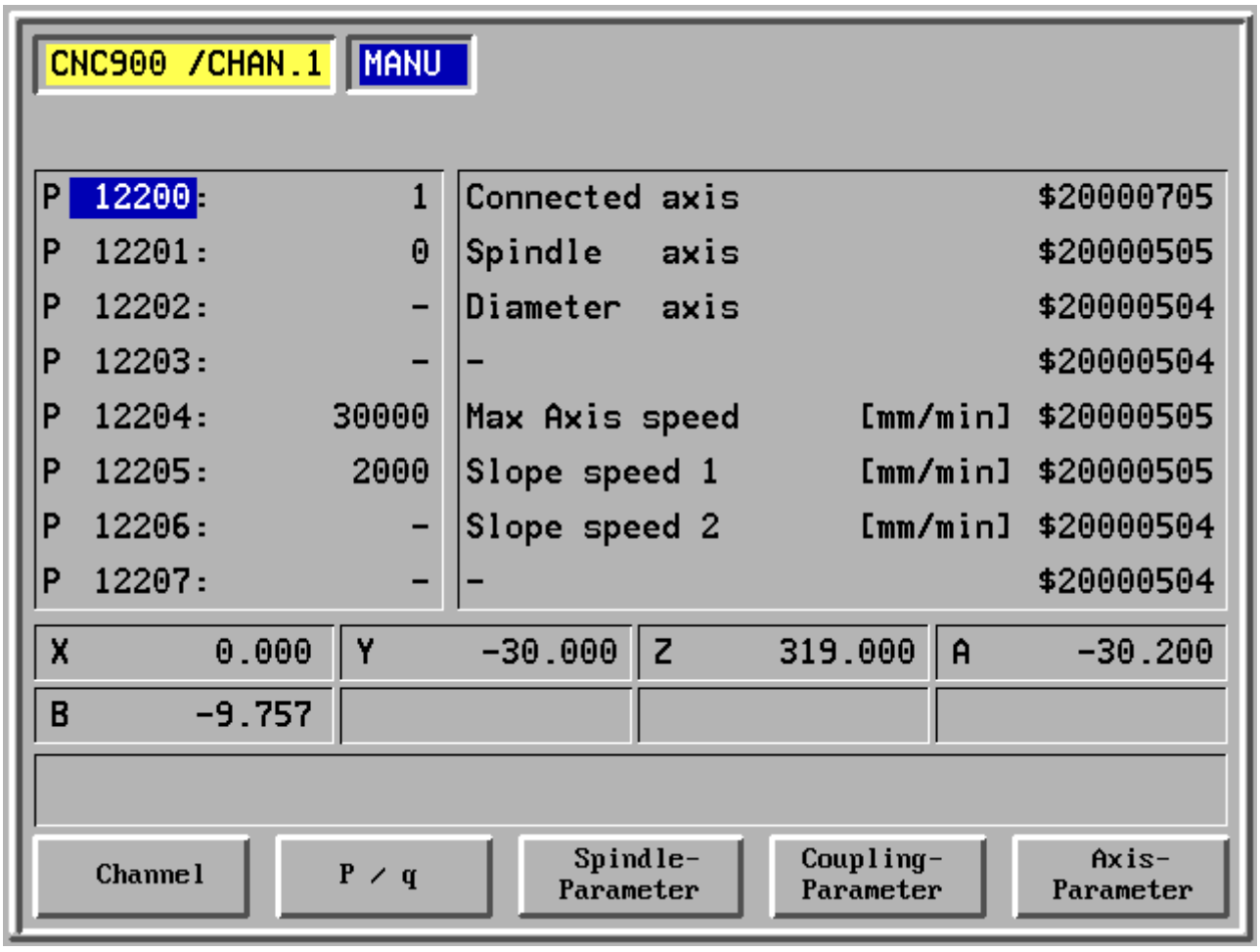
Channel parameter P

0... 6999	User block 1
0... 499	Reserved for BWO standard cycles
0... 299	Cycle-area for cycle interfaces
300... 399	Area reserved for cycles, area for static, modal data
400... 499	Area reserved for cycles, area for temporary data
500... 6999	Area free for the user
7000... 9999	Fix defined channel parameters
11000...11999	System overlapping data, common area of all channels
12000...18399	Axis data
20000...29999	User block 2
30000...39999	User block 3

2.5.3 Parameter

Channel parameter P:

Input addresses, displaying parameters, input values and store.



F1 Channel

F2 P/q Switching between channel (P) and system parameters (q)

F3 Spindle parameter

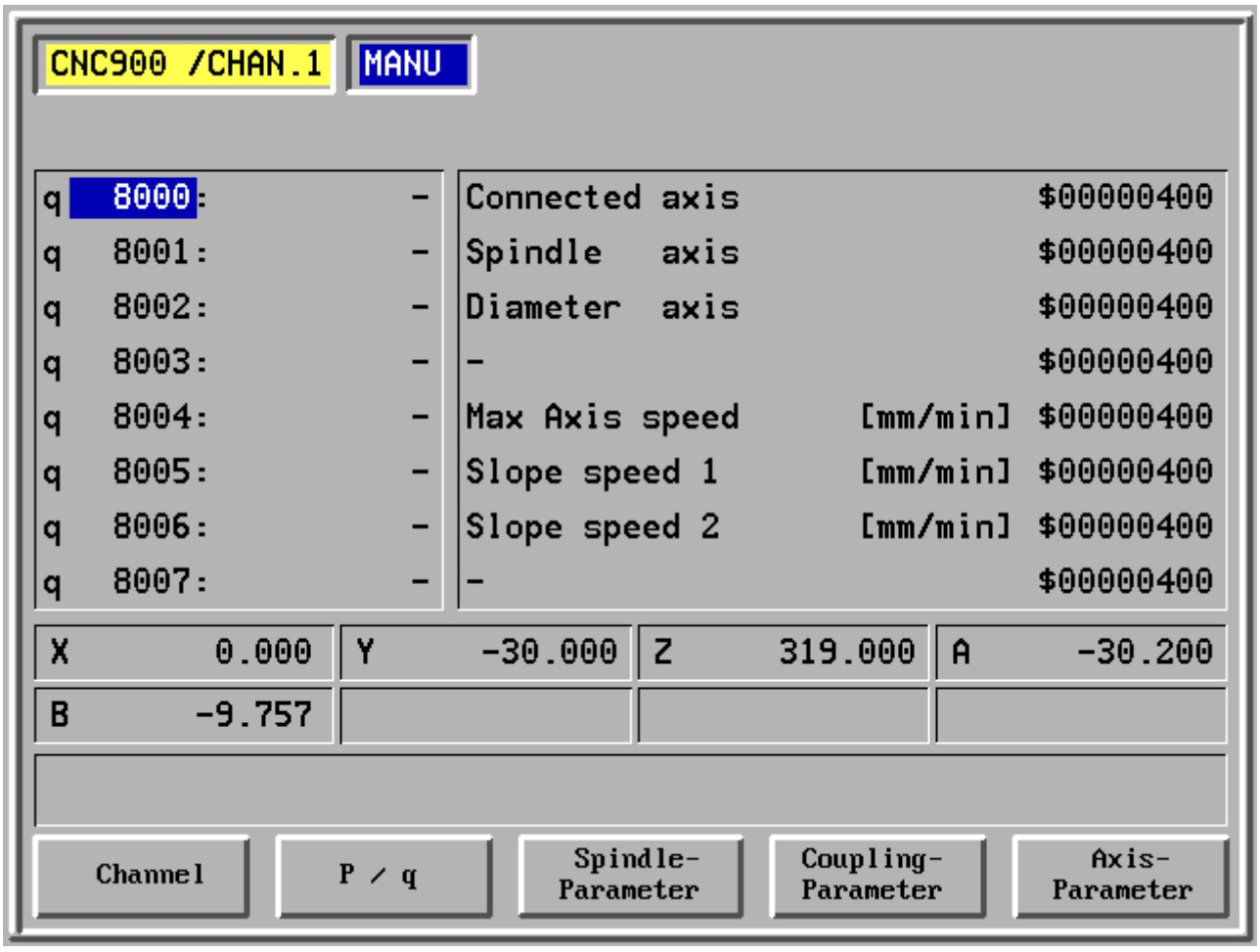
F4 Coupling parameter

F5 Axis parameter

2.5.3 Parameter (continued)

System parameter q:

Input addresses, displaying parameters, input values and store.



F1 Channel

F2 P/q Switching between channel (P) and system parameters (q)

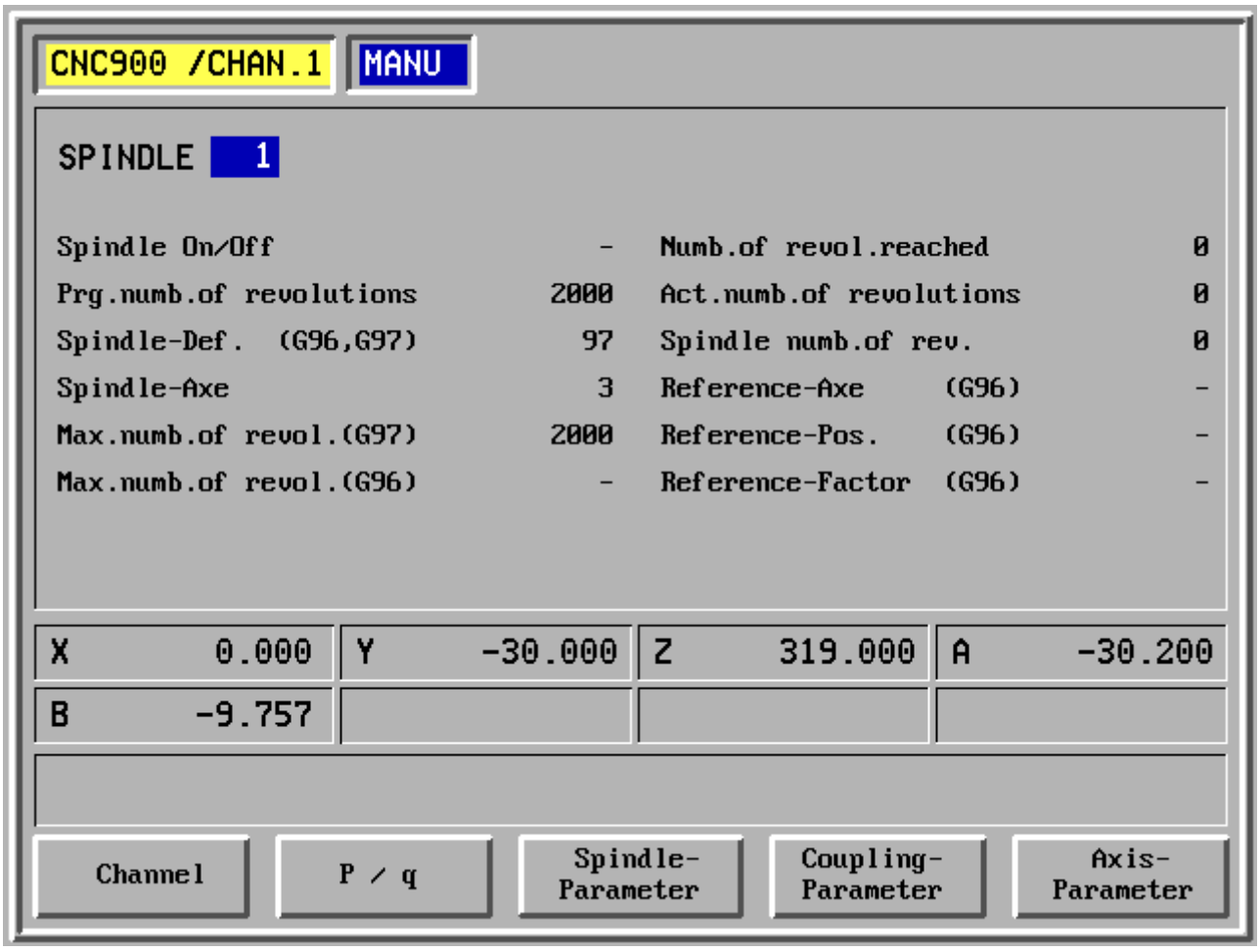
F3 Spindle parameter

F4 Coupling parameter

F5 Axis parameter

2.5.3 Parameter (continued)

Inputing spindle data is possible in this menue.



F1 Channel

F2 P/q Switching between channel (P) and system parameters (q)

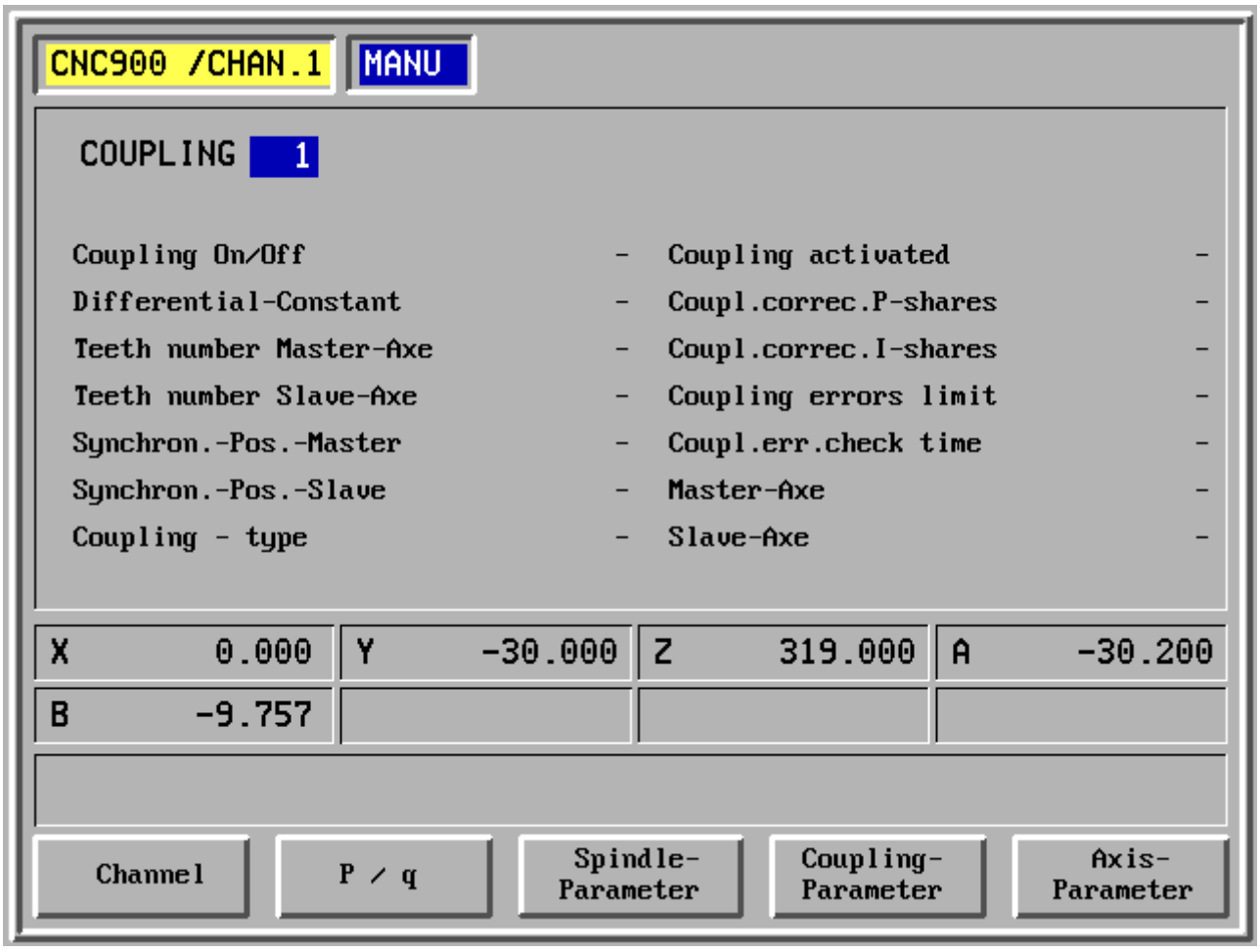
F3 Spindle parameter

F4 Coupling parameter

F5 Axis parameter

2.5.3 Parameter (continued)

Inputing coupling data is possible in this menue.



F1 Channel

F2 P/q Switching between channel (P) and system parameters (q)

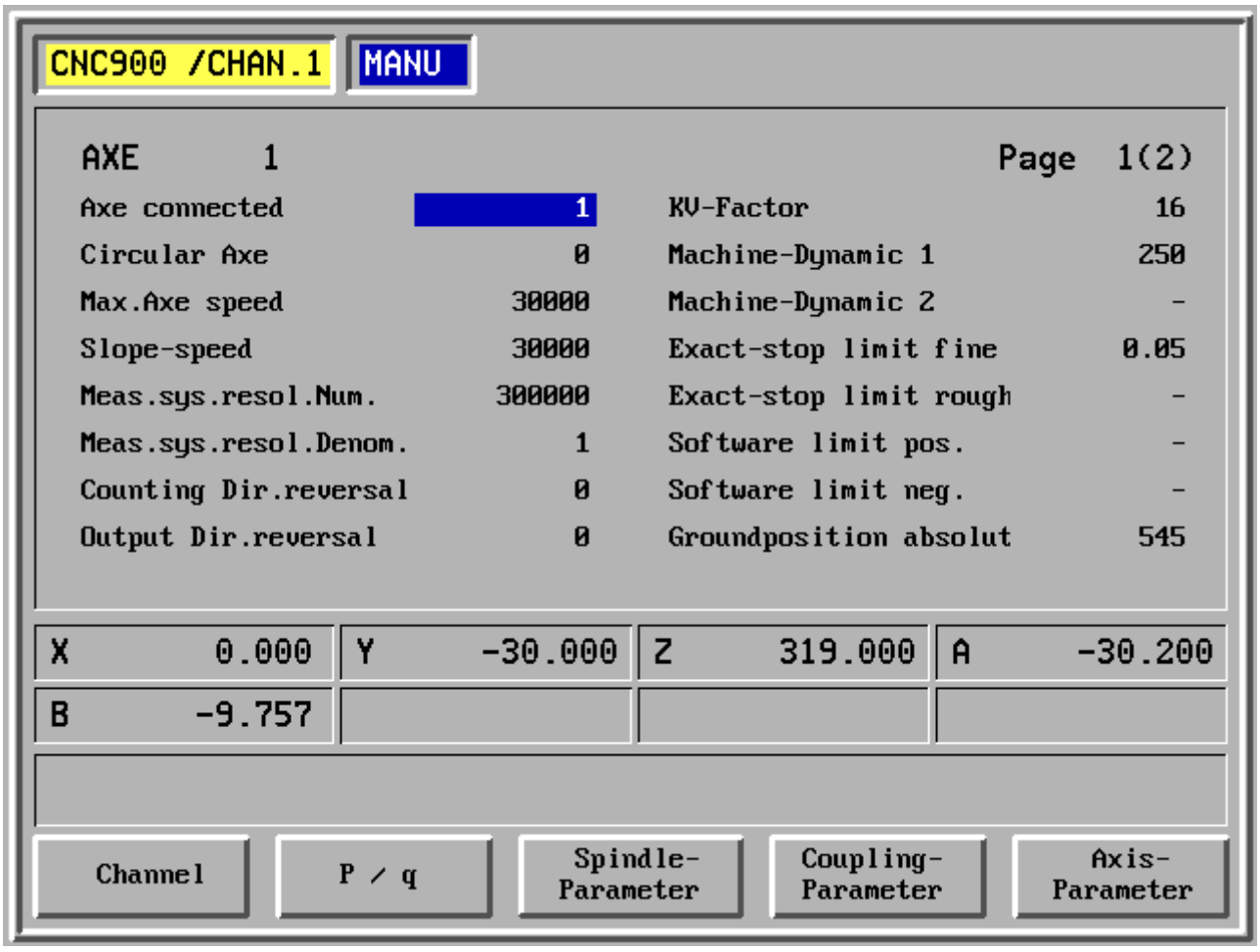
F3 Spindle parameter

F4 Coupling parameter

F5 Axis parameter

2.5.3 Parameter (continued)

Inputing axis data is possible in this menue. Page 1



F1 Channel

F2 P/q Switching between channel (P) and system parameters (q)

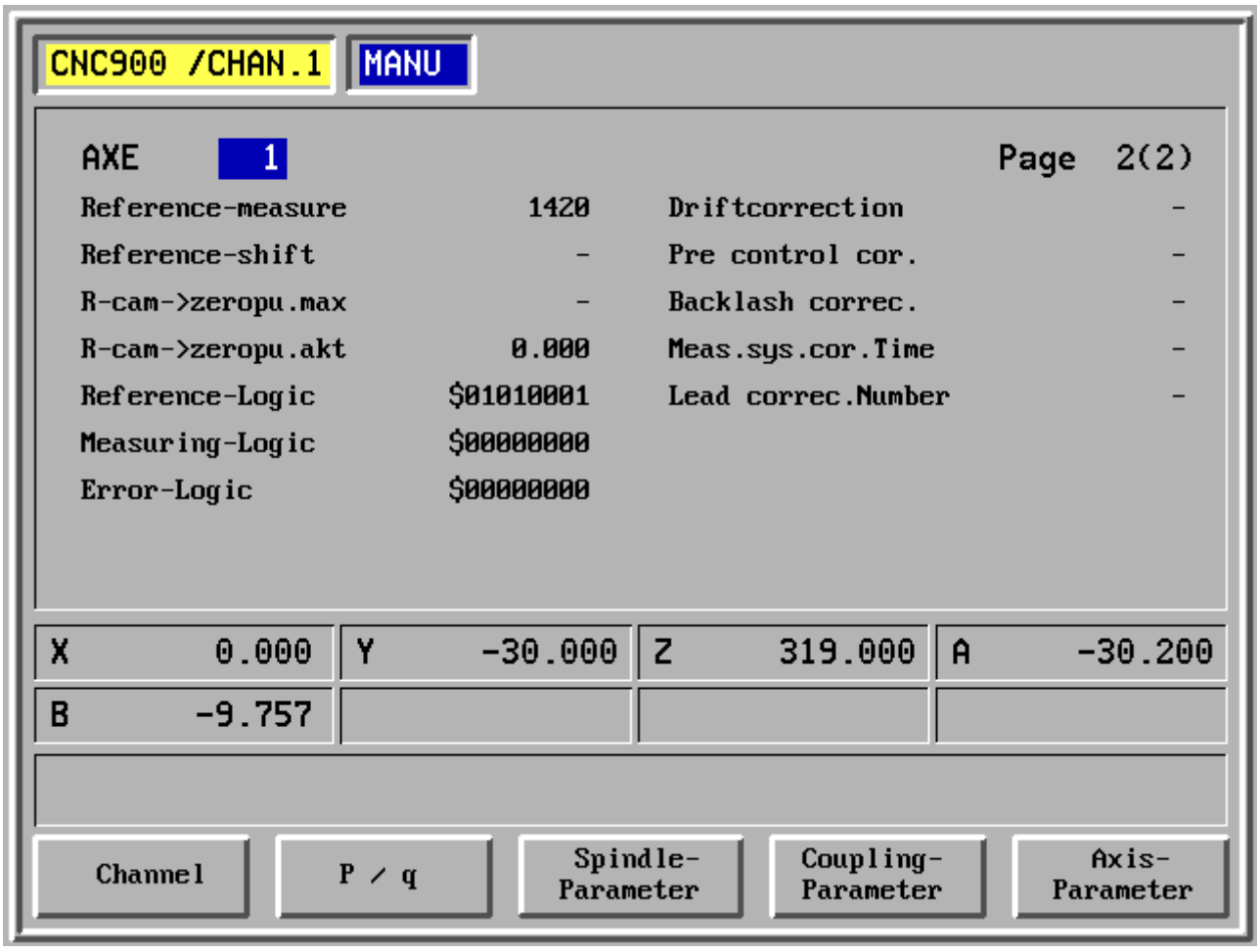
F3 Spindle parameter

F4 Coupling parameter

F5 Axis parameter

2.5.3 Parameter (continued)

Inputing axis data is possible in this menue. Page 2



F1 Channel

F2 P/q Switching between channel (P) and system parameters (q)

F3 Spindle parameter

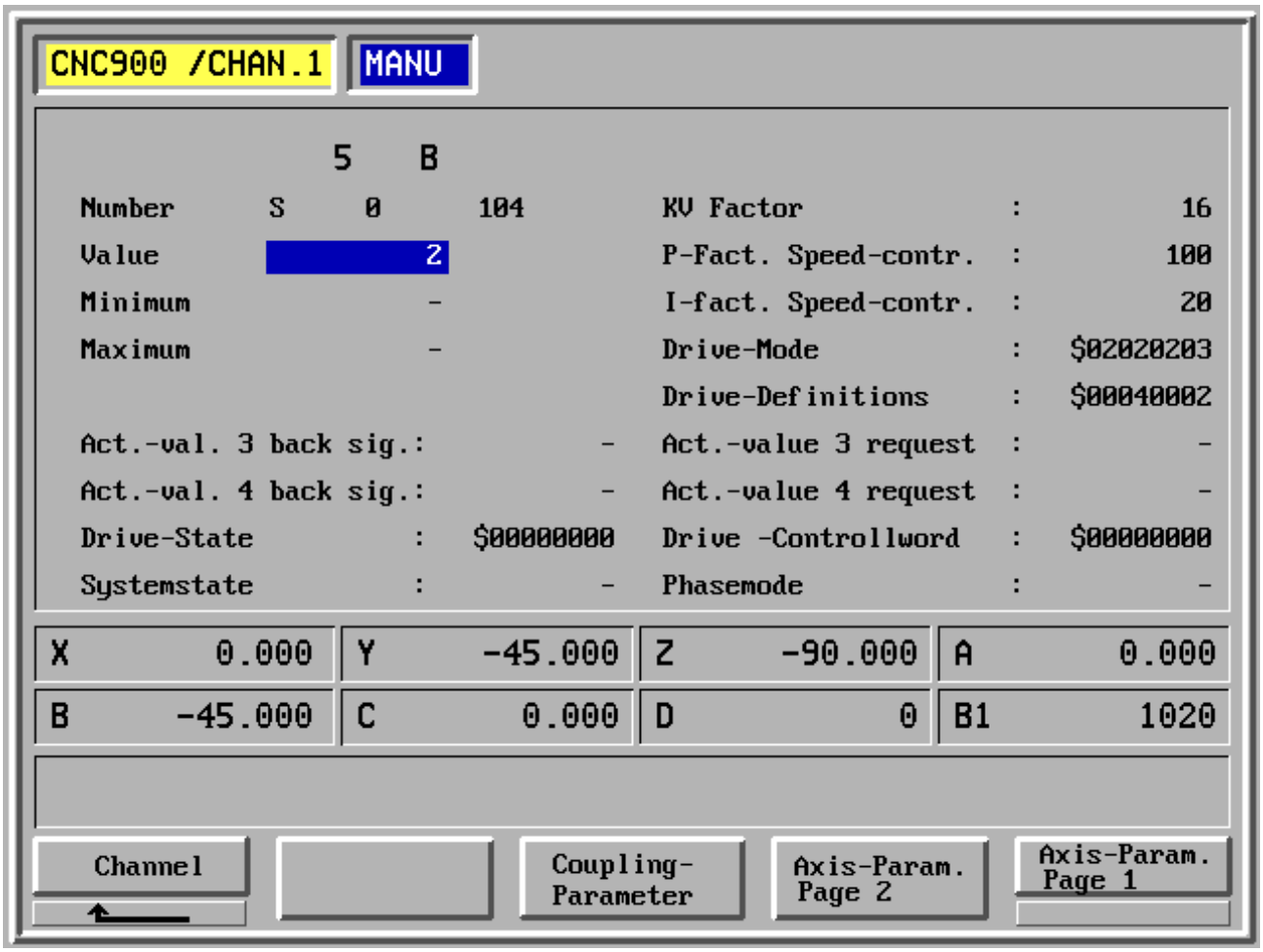
F4 Coupling parameter

F5 Axis parameter

2.5.3 Parameter (continued)

Drive parameter

This menu permits the Input of the drive data.



F1 Channel

F2 -

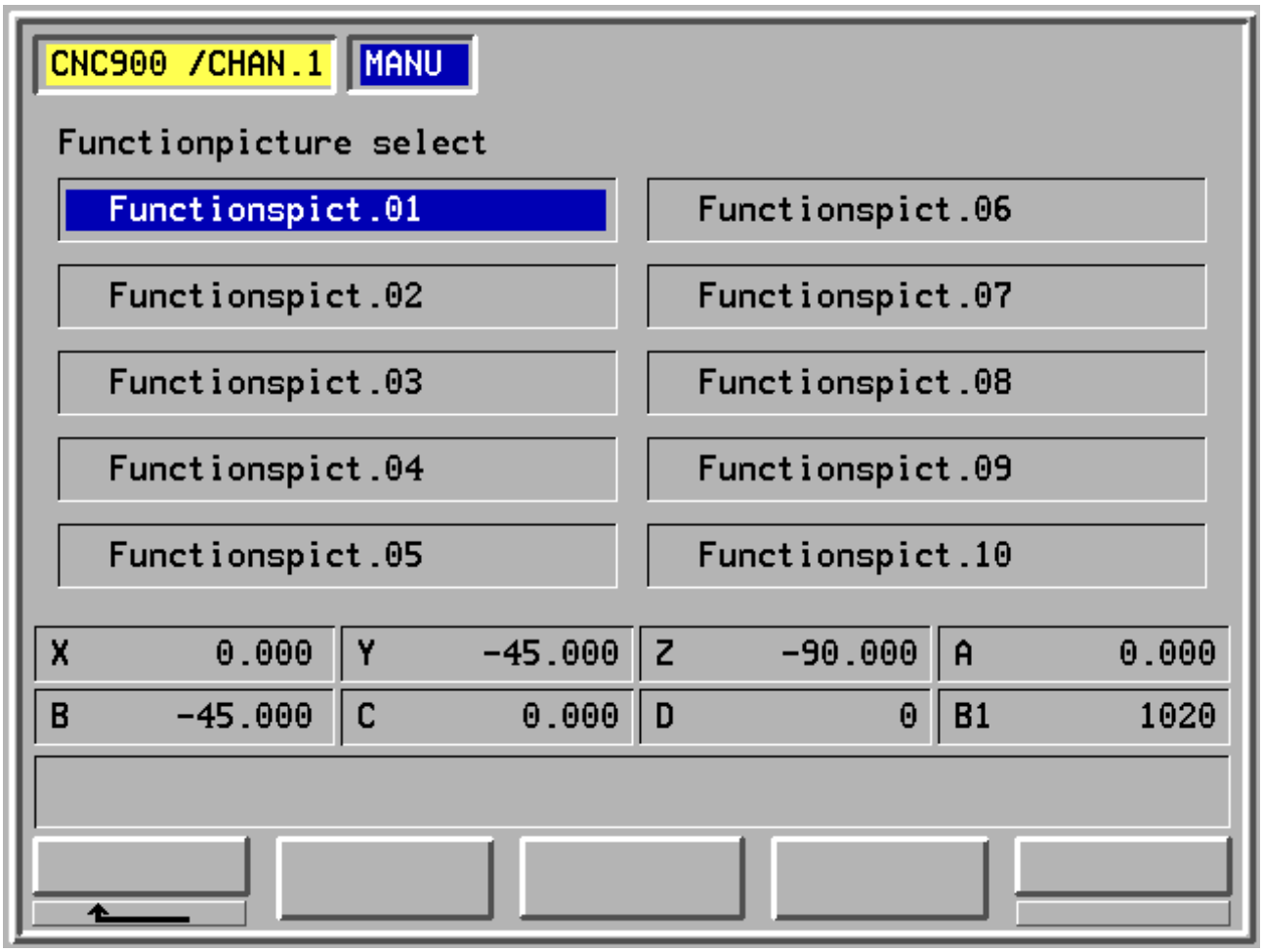
F3 Drive parameter

F4 Axis parameter page 2

F5 Axis parameter page 1

2.5.4 Machine functions

The actual function picture appears.



F1 -

F2 -

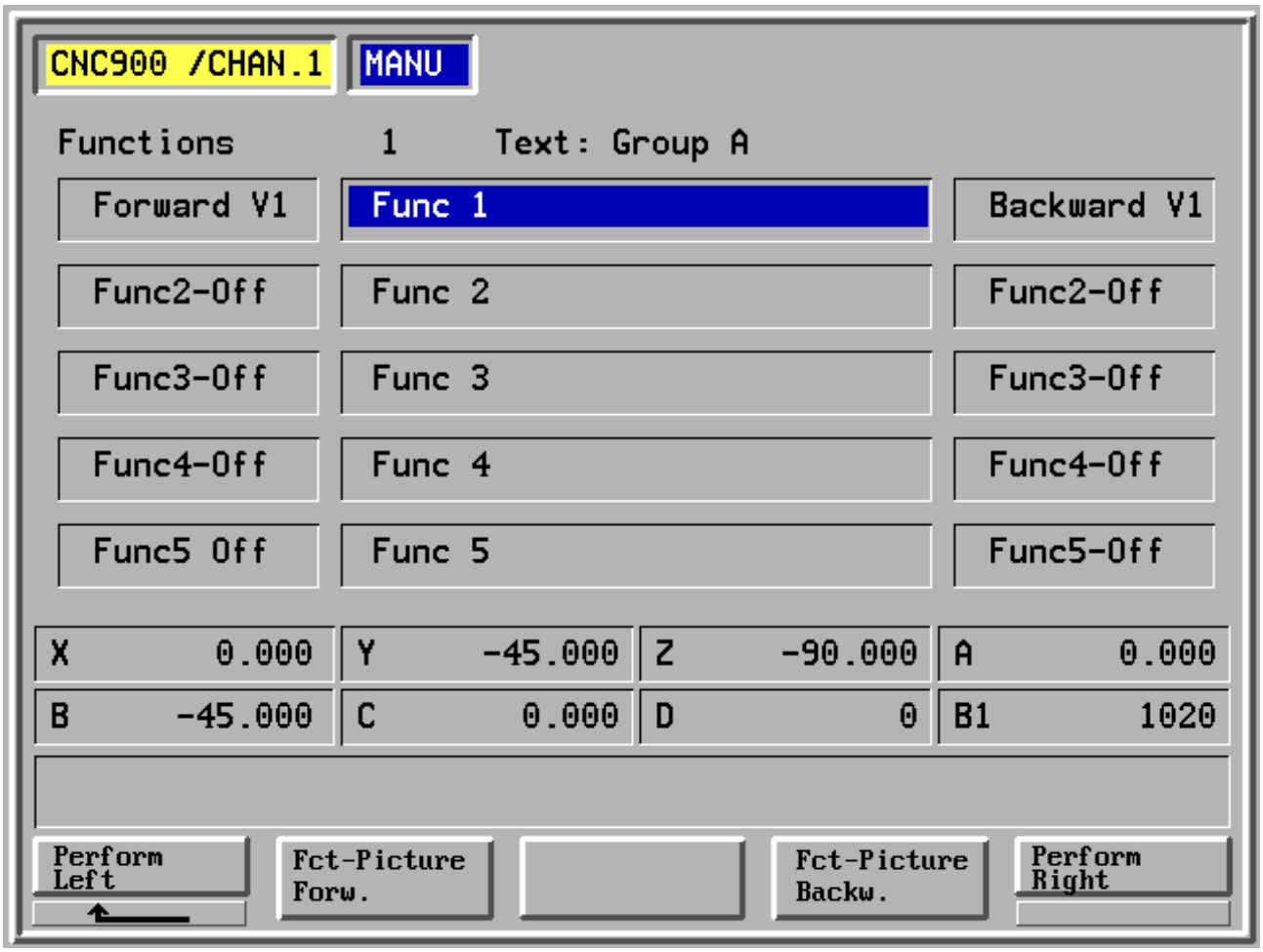
F3 -

F4 -

F5 -

2.5.4 Machine functions (continued)

The actual function picture appears.



F1 Performance left

F2 Function picture forward

F3 -

F4 Function picture backward

F5 Performance right

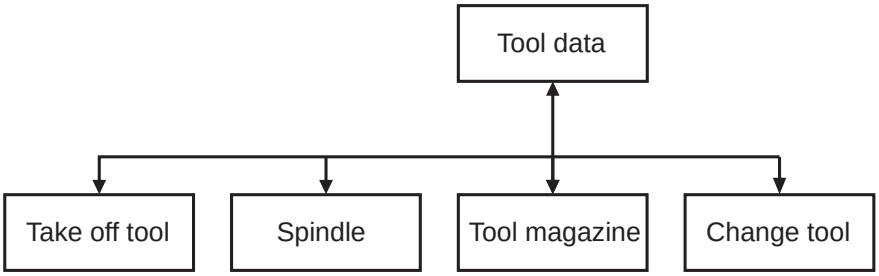
2.5.5 Tool data

The actual tool data can be input here.

The tool data menue consists of

- Lay down tool
- Spindle
- Magazine
- Tool change

Menue tree

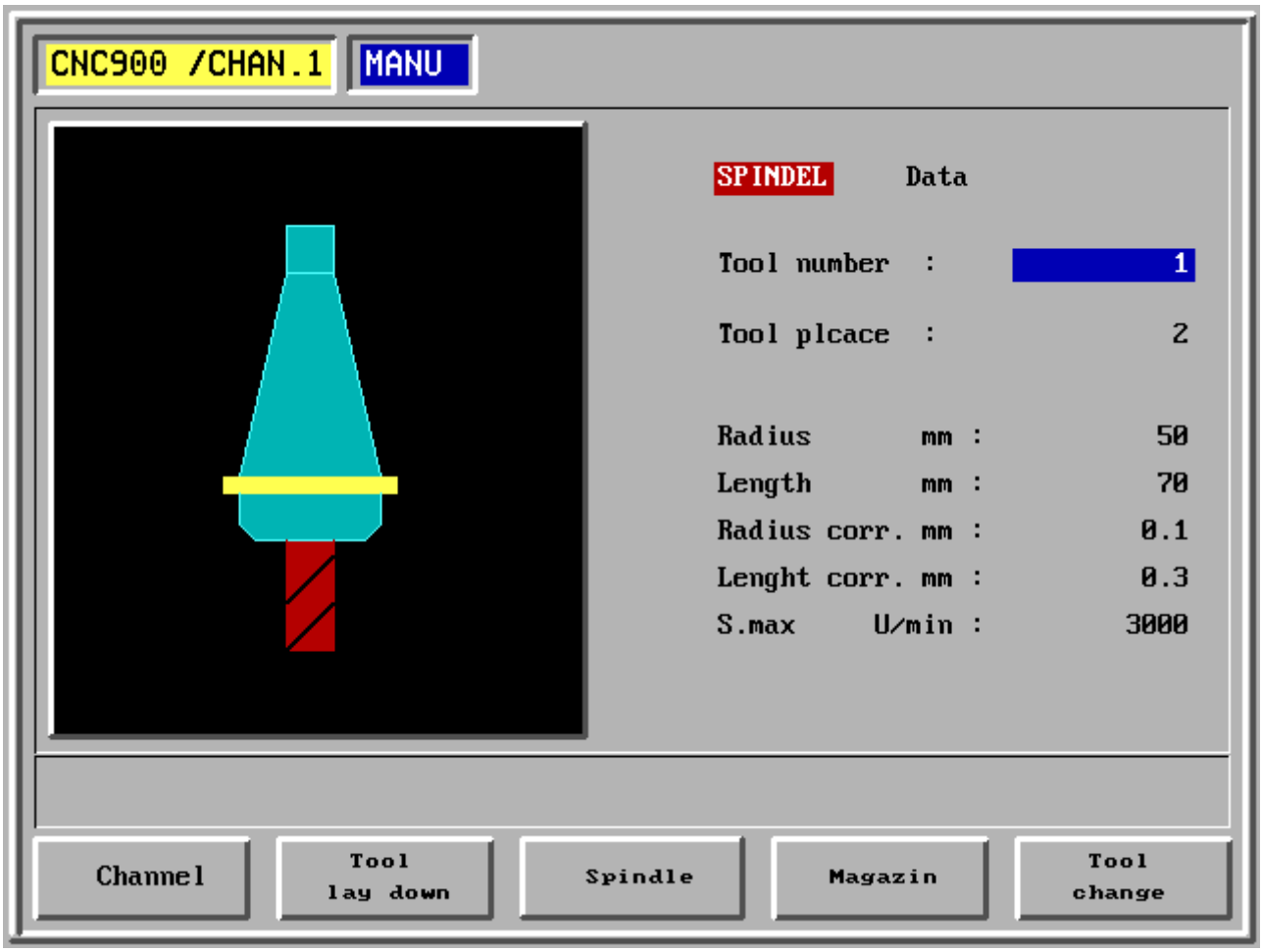


The tool dates (length, radius...) can be called up with 10-digit tool numbers in the program run.

Inputs are possible in manual mode via the operating panel or external data carriers without indicating a block number. If ‘delete store’ is input, the tool data are deleted during power on test.

2.5.5 Tool data

Tool in the spindle.



F1 Channel

F2 Lay down tool

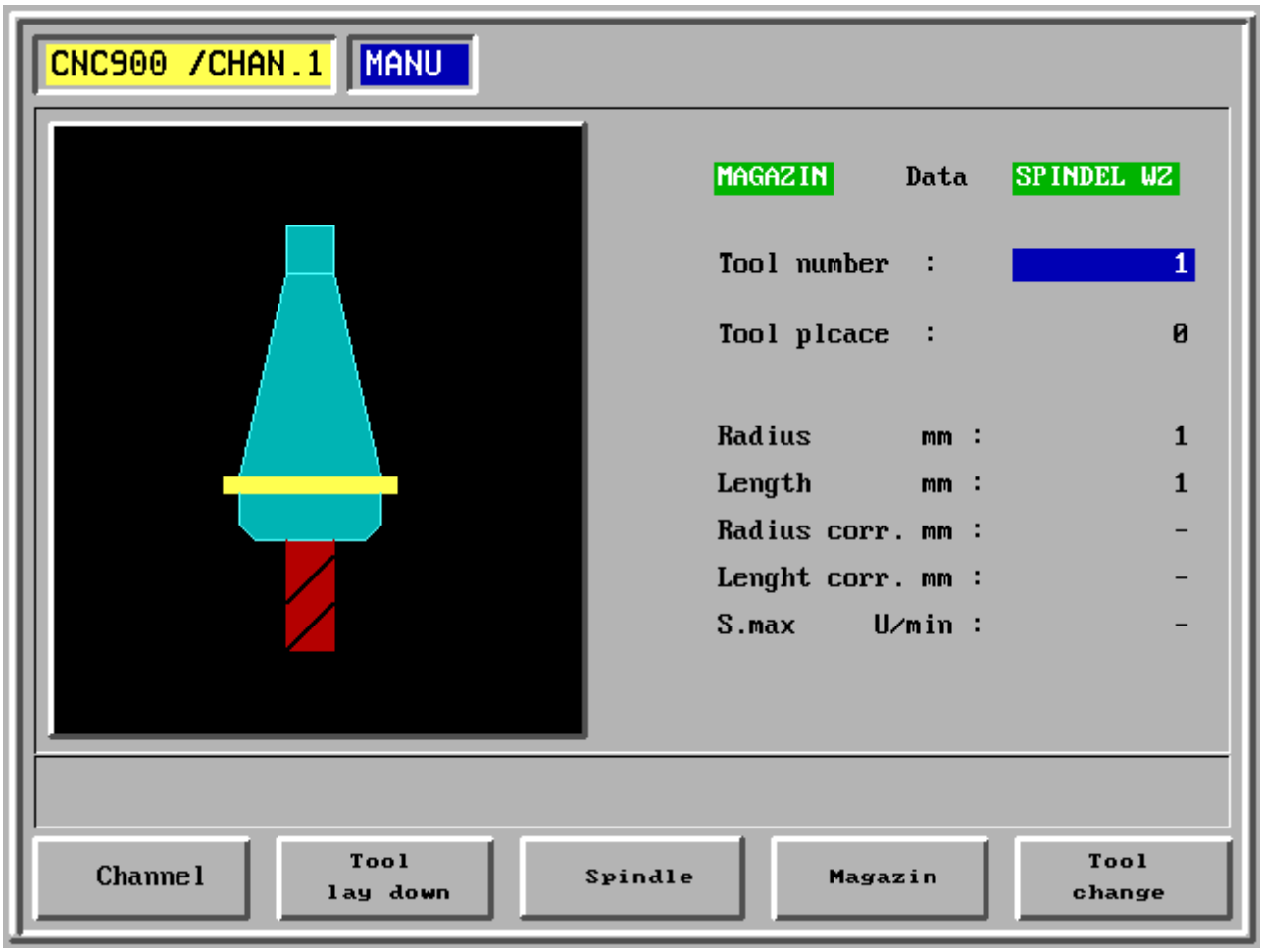
F3 Spindle

F4 Magazine

F5 Tool change

2.5.5 Tool data

Tool in the magazine.



F1 Channel

F2 Lay down tool

F3 Spindle

F4 Magazine

F5 Tool change

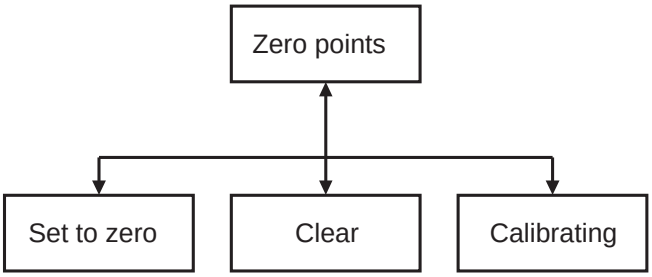
2.5.6 Zero points

The actual zero point data can be input here.

The zero point data menue consists of

- Set to zero
- Delete
- Calibrate

Menue tree



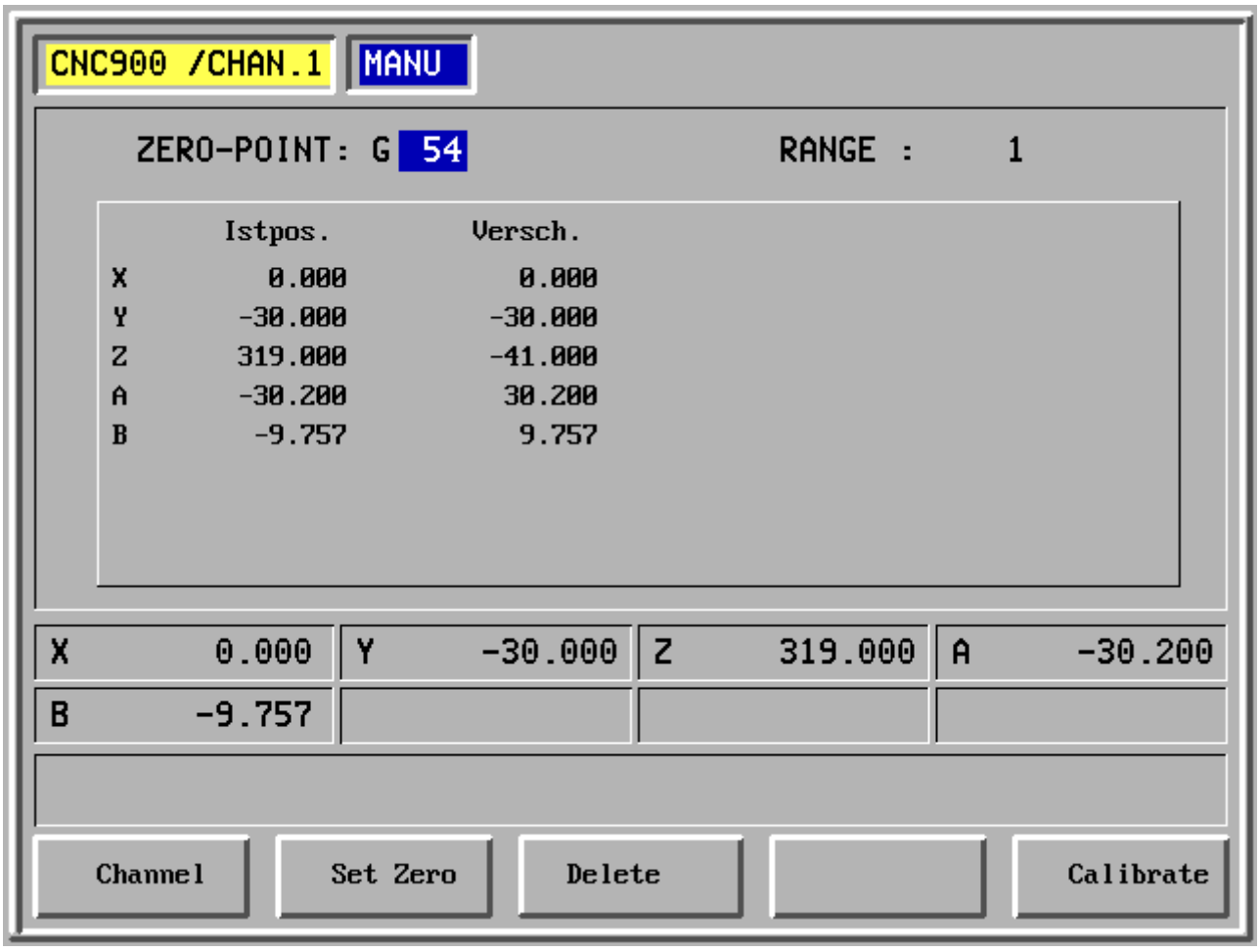
For each axis, a maximum of 6 zero points can be set with G54 to G59 and can be called up during program run.

Zero point shift is made ineffective with G53. The program then refers to the machine zero point.

Inputs are possible in manual mode via the operating panel or external data carriers without indicating a block number. When deleting the memory during power on test, the zero point data are alos deleted.
Zero point data can be loacated mathematically or they can be approached (edge scanner, clock gauge).

2.5.6 Zero points (continued)

The actual zero point is displayed. The values can be input and stored.



F1 Channel

F2 Set to zero

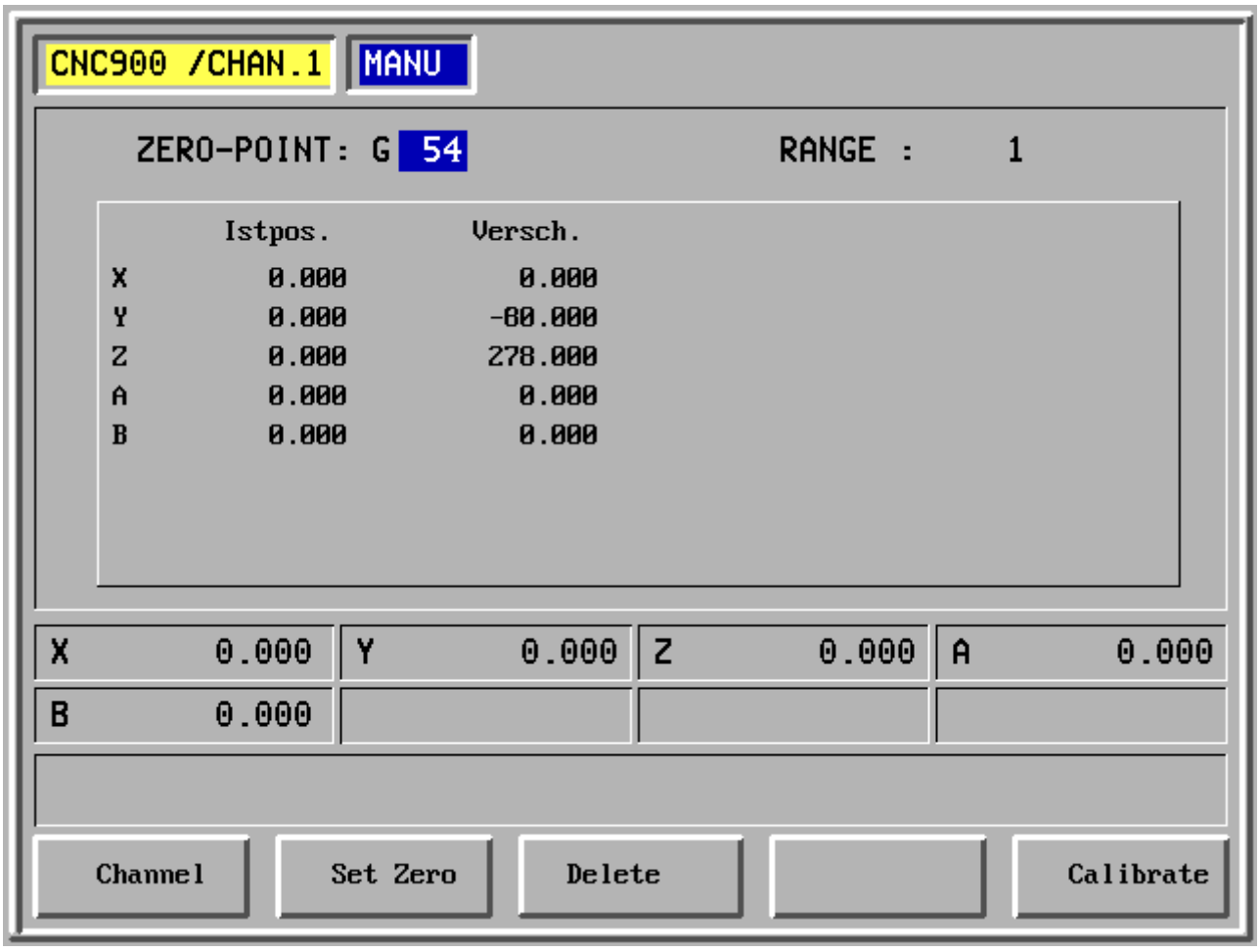
F3 Delete

F4 -

F5 Calibrate

2.5.6 Zero points (continued)

The actual values can be set to zero.



F1 Channel

F2 Set to zero

F3 Delete

F4 -

F5 Calibrate

2.6 Operating modes

The following operating modes can be set:
- MANUAL
- AUTOMATIC Sequential block
  Single block
  Positioning

2.6.1 Manual mode

Manual mode is switched on with key  .

For traversing the axes, the axis name (X, Y, Z, ...) and travelling mode (continuously or step by step) and the feed rate have to be input first.

By pressing the keys  (Manual+) or  (Manual-) the selected axis is traversed in positive or negative direction.

The length of the actual tool is calculated when traversing the tool axis.

Travelling mode

During  (continuously) travelling mode, the axis is moving as long until the manual key is pressed.
When traversing with fix length, the complete length is traversed by pressing a manual key once (the step width can be selected by pressing the key  (step) again and again).
During this time, the keys for Manual+/-, axis name and travelling mode remain ineffective.

When pressing the key  (Stop), the process can be interrupted. If a manual key is pressed again, the axis moves from the new position on with the selected length.

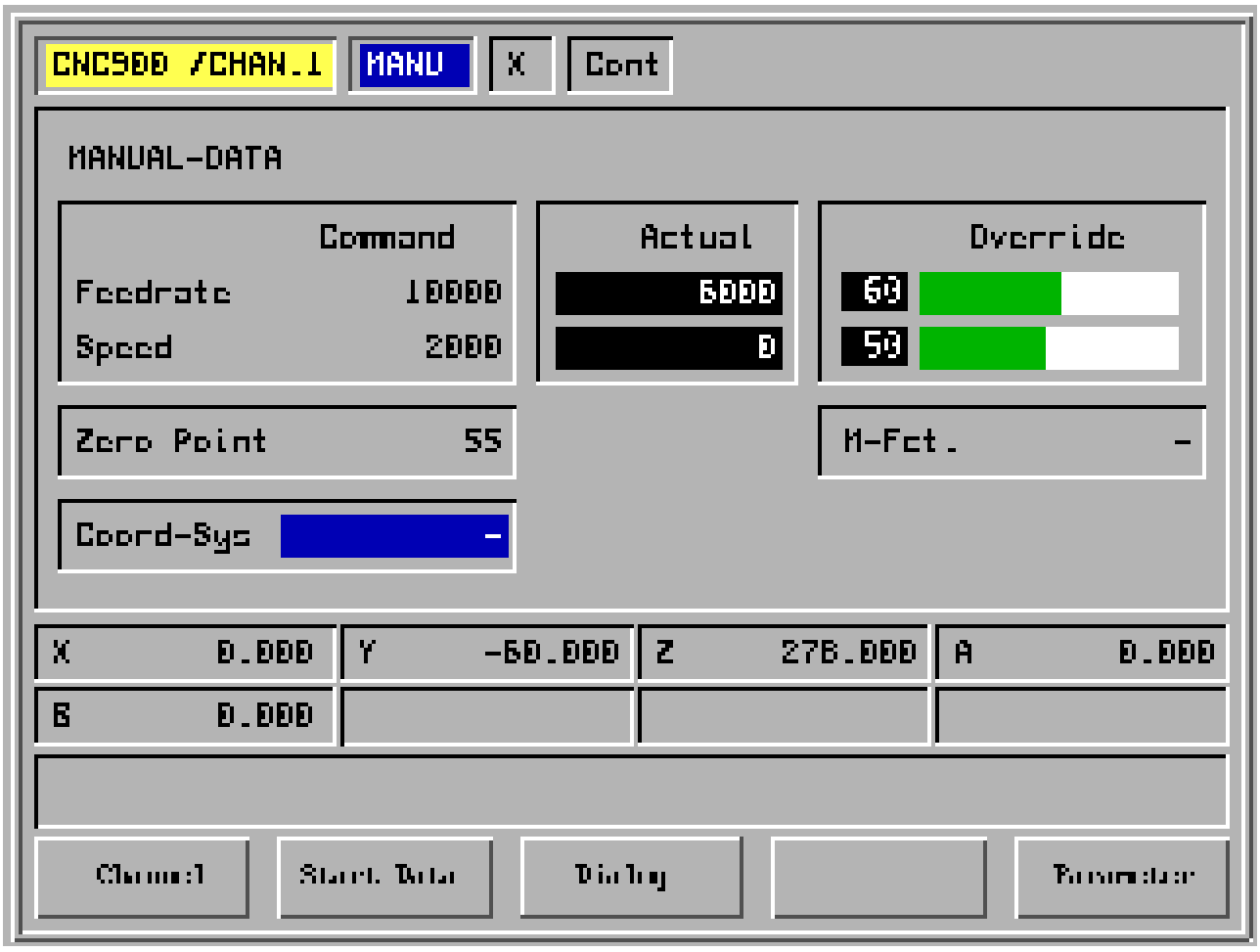
Command = Actual

Desired positions can be approached in the program and they can be overtaken into the command value display with key  (Command=Actual) and can be written into the memory with  (Input).

2.6.1 Manual mode (continued)

Traverse **continuously in manual mode**.

Switch on manual mode with key  . Select continuously with key  .



F1 Channel

F2 Start data

F3 Dialogue

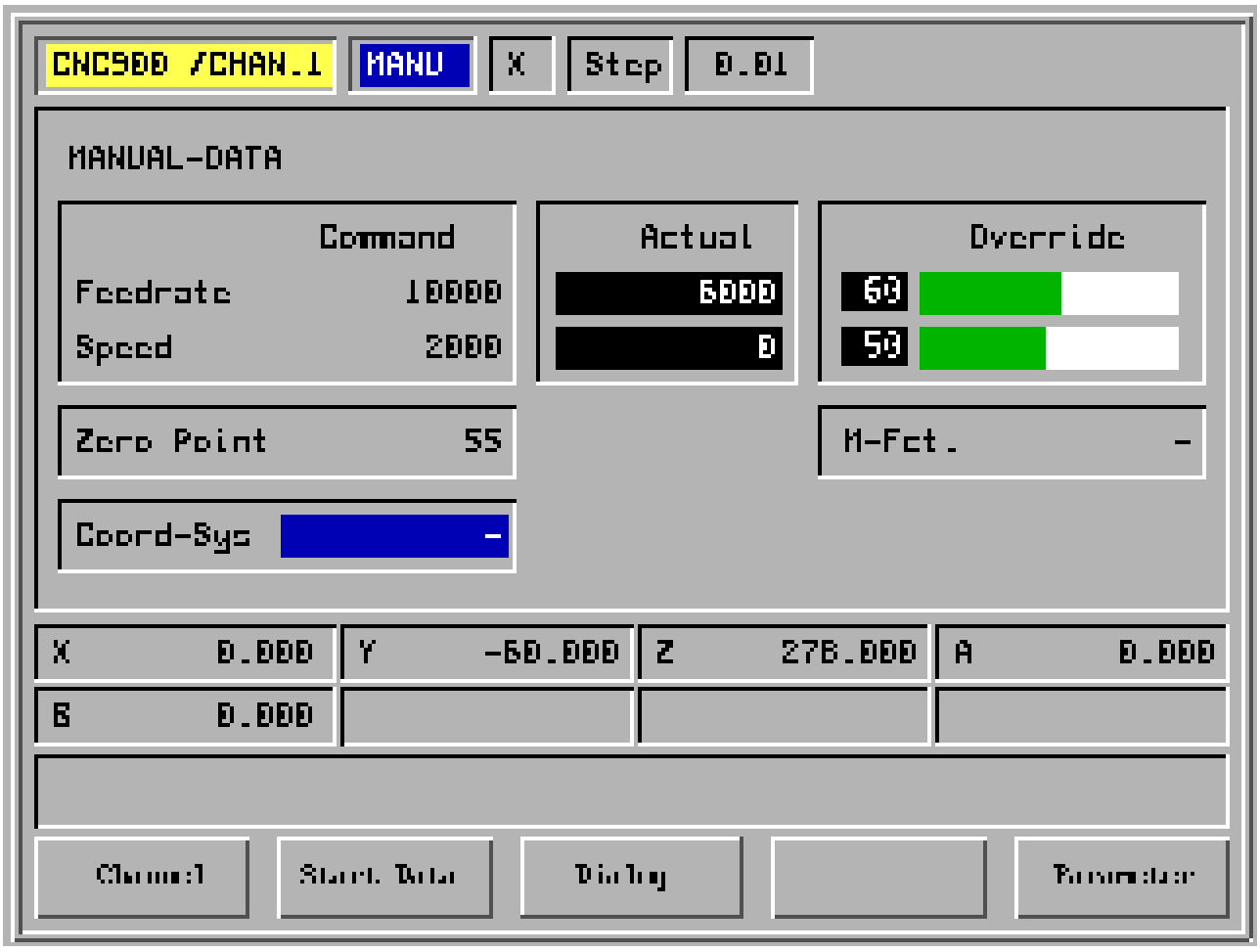
F4 -

F5 Parameter

2.6.1 Manual mode (continued)

Traverse **step by step in manual mode**.

Switch on manual mode with key . Select step-by-step with key .



F1 Channel

F2 Start data

F3 Dialogue

F4 -

F5 Parameter

2.6.2 Automatic mode

Automatic mode is switched on with the keys:

 Automatic sequential block

 Automatic single block

 Positioning

Start/Stop

The selected program is started with key  (Start). It can be interrupted with key  (Stop)

and continued with key  (Start) at any time.

The keys for machine functions are dependant of the PLC. The speed can be controlled with the override.

Skip block

When making a program, the blocks which do have a slash placed in front of them, are skiped in automatic mode if the key / (skip block) is switched on.

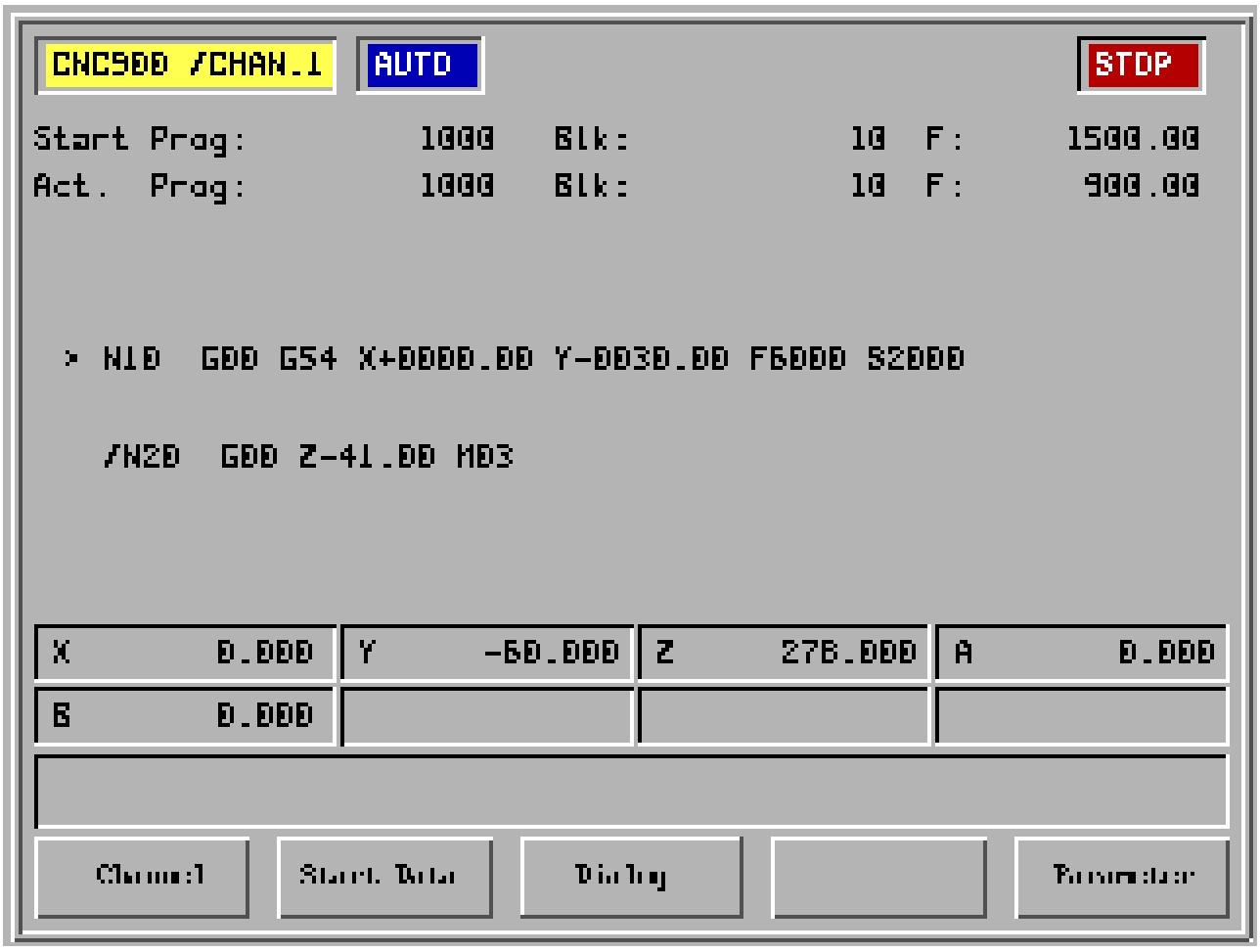
Switch on: Press key /
The key is only effective before program start.
The display of the operating mode is completed by the symbol '/'.

Switch off: Press key / again.

2.6.2 Automatic mode (continued)

In **automatic sequential block**, all blocks of a program are worked one after the other.

Switch on sequential block with key .



F1 Channel

F2 Start data

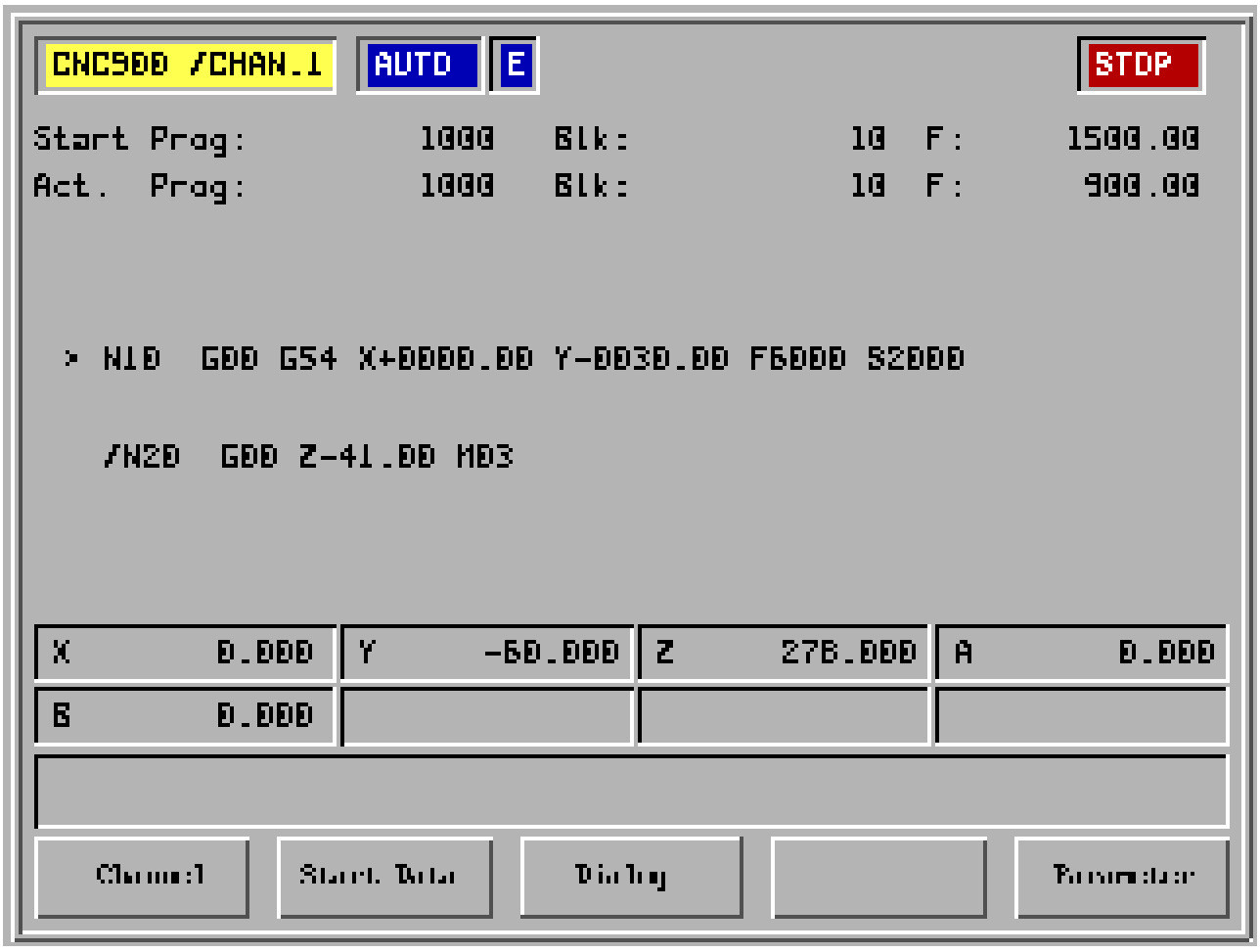
F3 Dialogue

F4 -

F5 Parameter

2.6.2 Automatic mode (continued)

In automatic single block, only one block is worked after the start. Start the next block with key  . Switch on automatic single block with key  .



F1 Channel

F2 Start data

F3 Dialogue

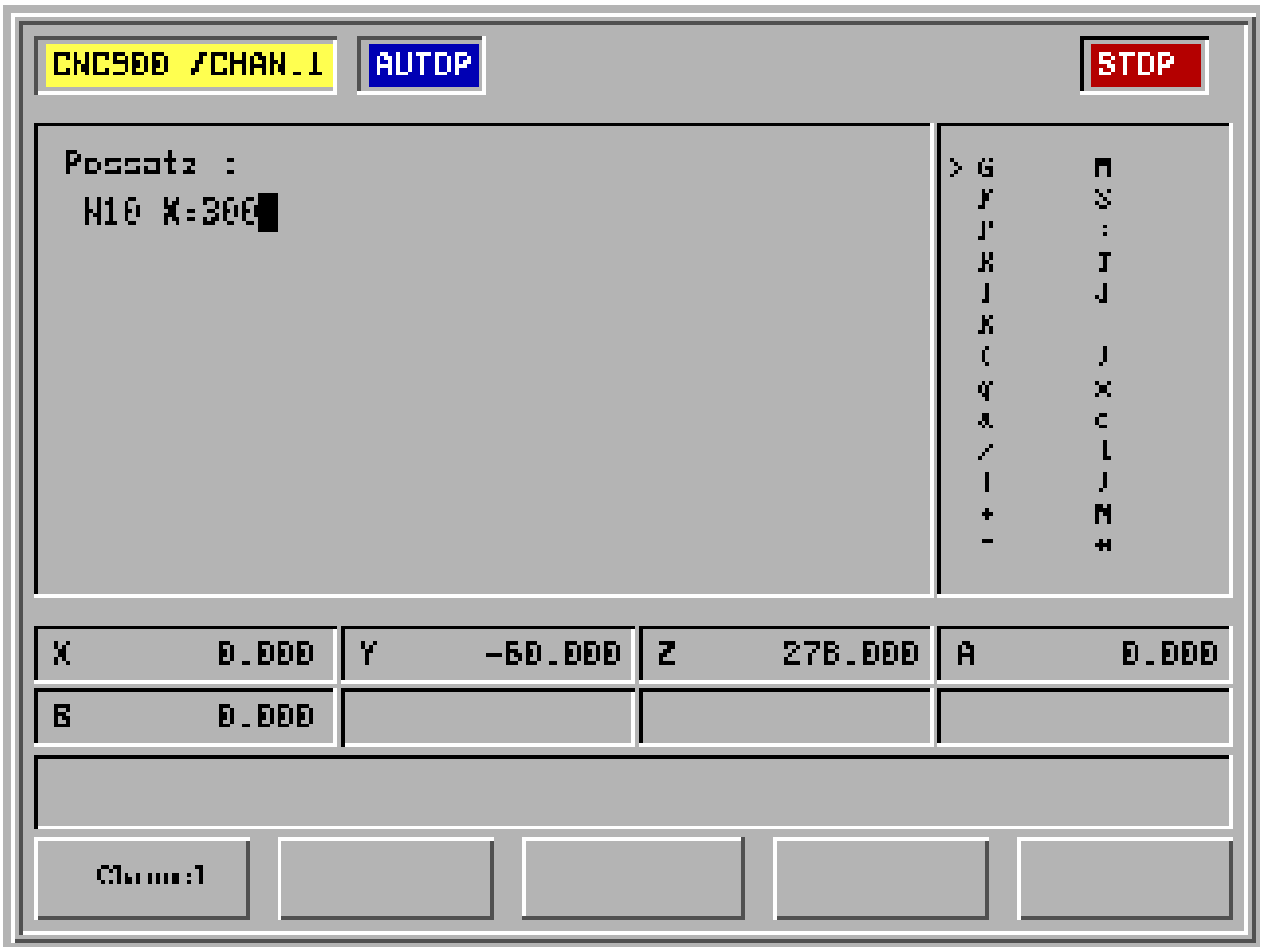
F4 -

F5 Parameter

2.6.2 Automatic mode (continued)

With positioning, a complete NC block or parts of it can be input via the numerical keys and worked without storing.

Switch on positioning with key ⇥.



F1 Channel

F2 -

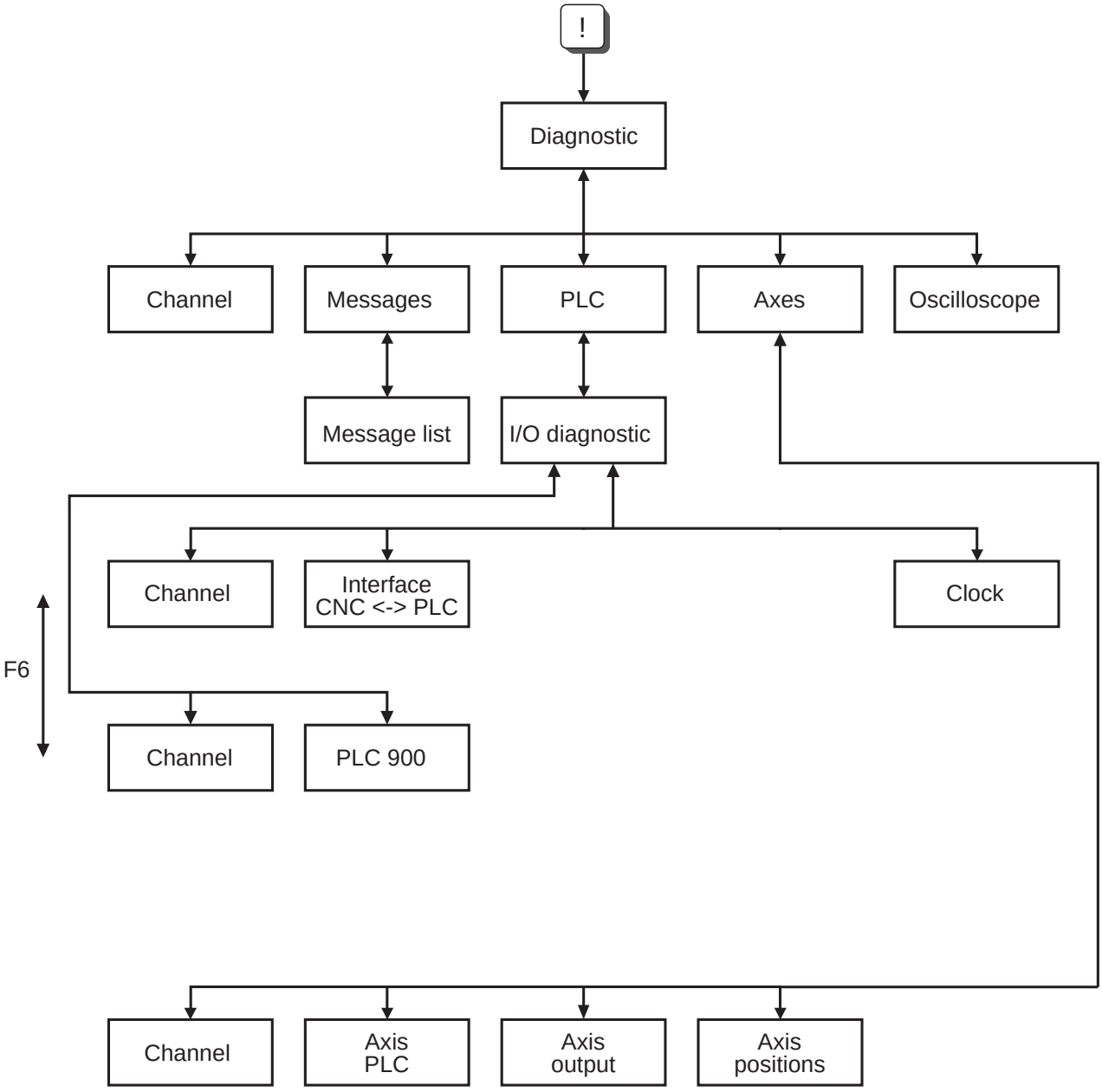
F3 -

F4 -

F5 -

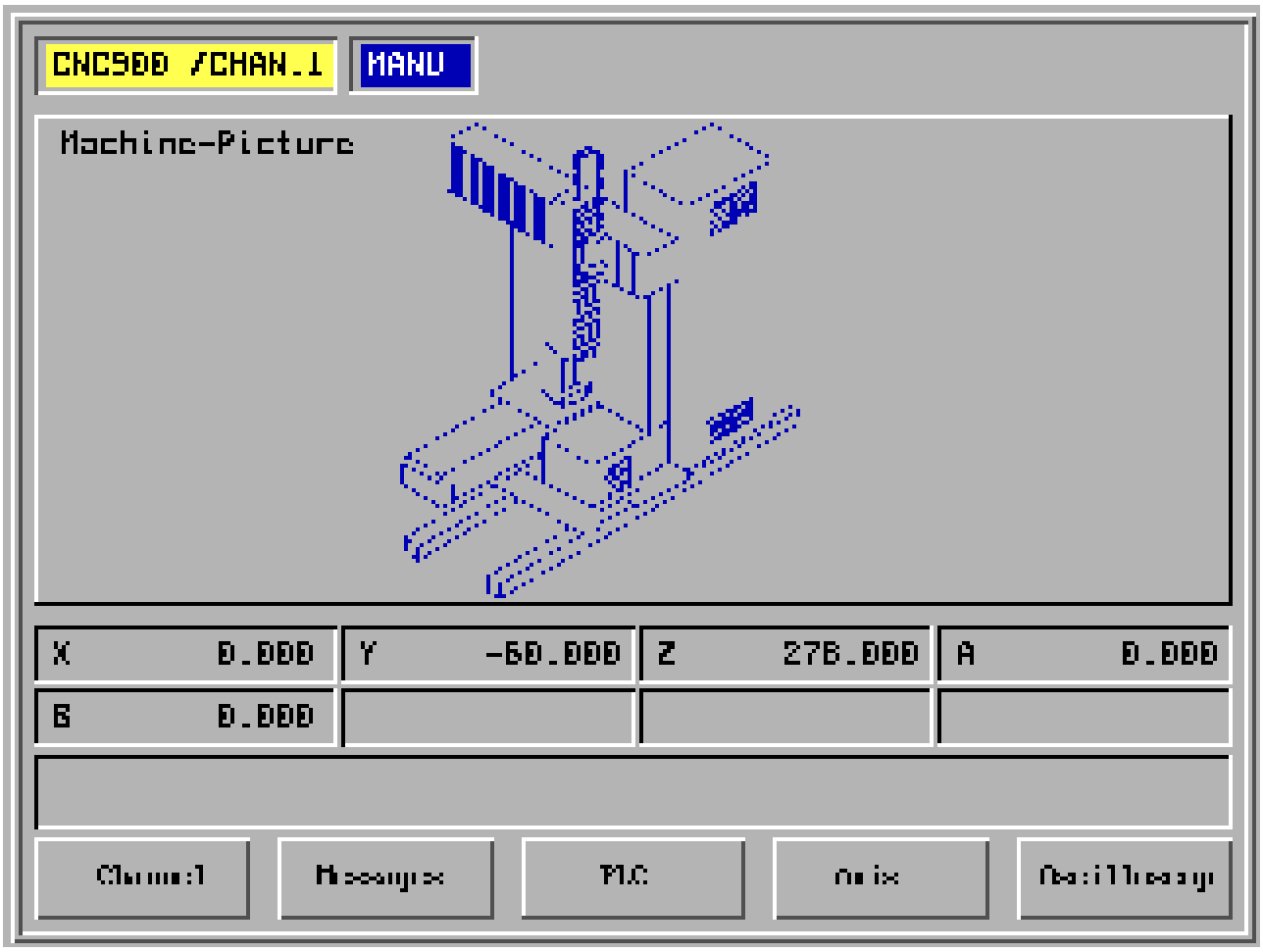
2.7 Diagnostic

Menue tree



2.7 Diagnostic

Diagnostic is switched on with the key [!]. The machine picture appears, e.g.



F1 Channel

F2 Messages Display messages

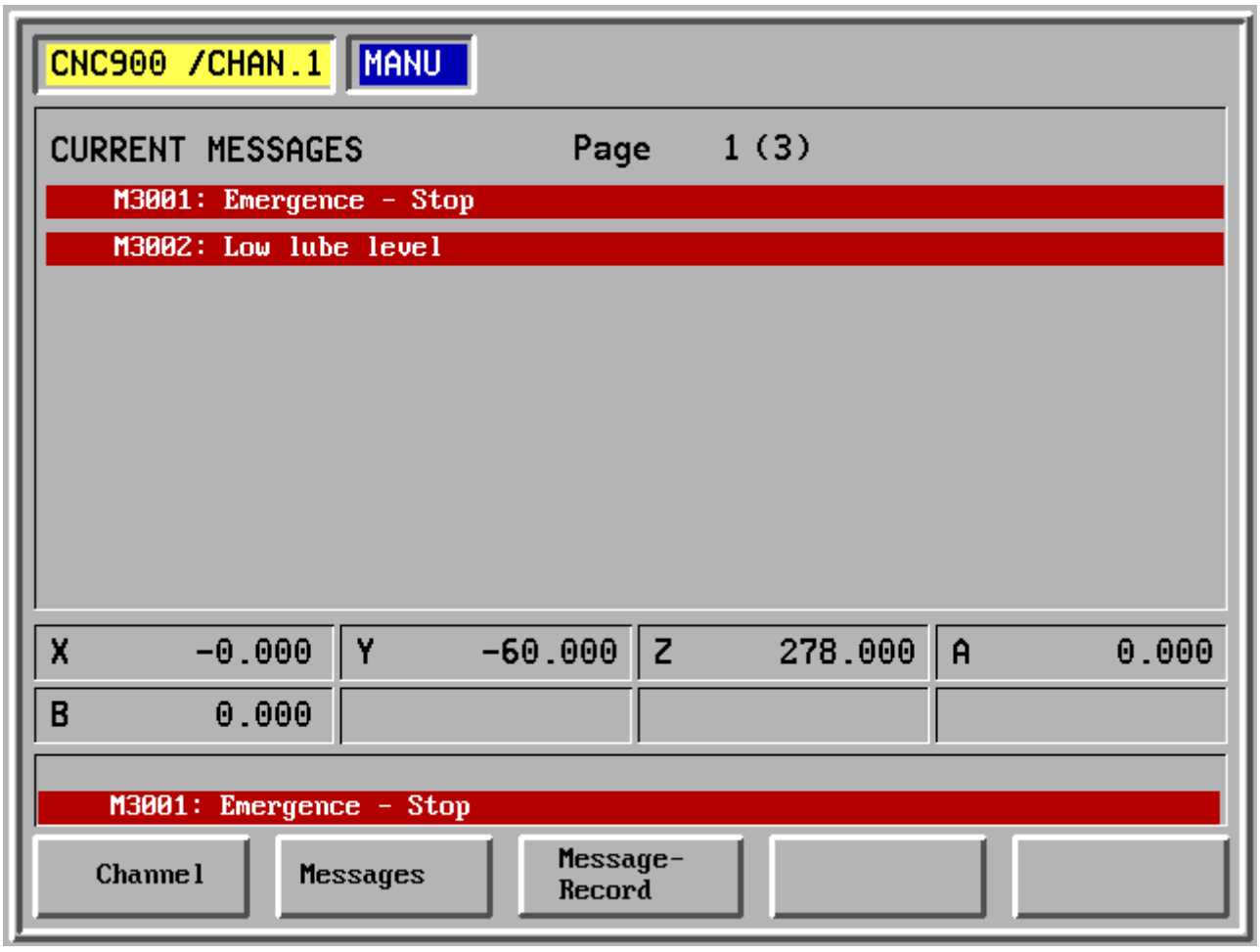
F3 PLC PLC diagnostic

F4 Axes Axis drive diagnostic

F5 Oscilloscope

2.7.1 Messages

Current messages



F1 Channel

F2 Messages

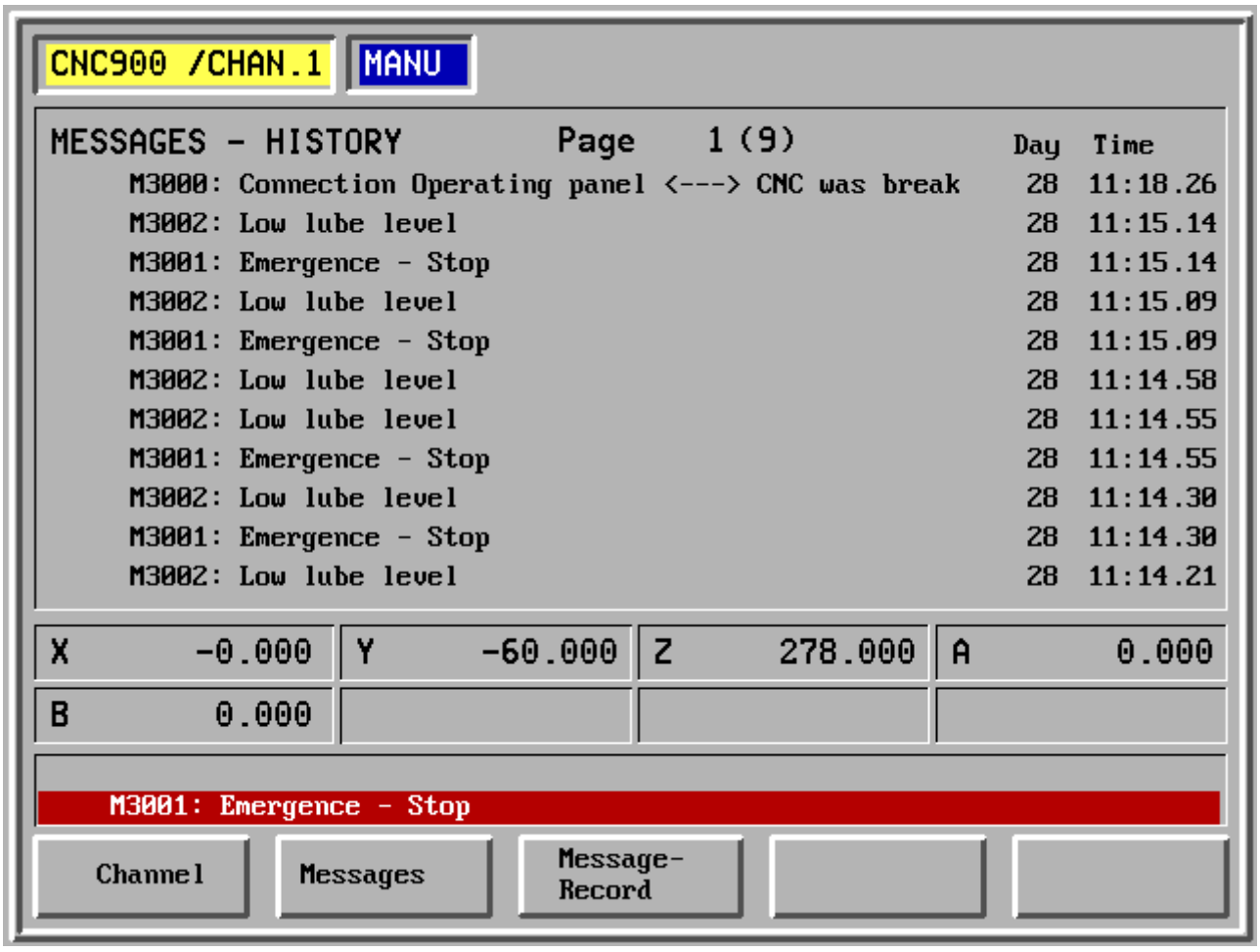
F3 Message record Display of previous messages

F4 -

F5 -

2.7.1 Messages

Current messages



F1 Channel

F2 Messages

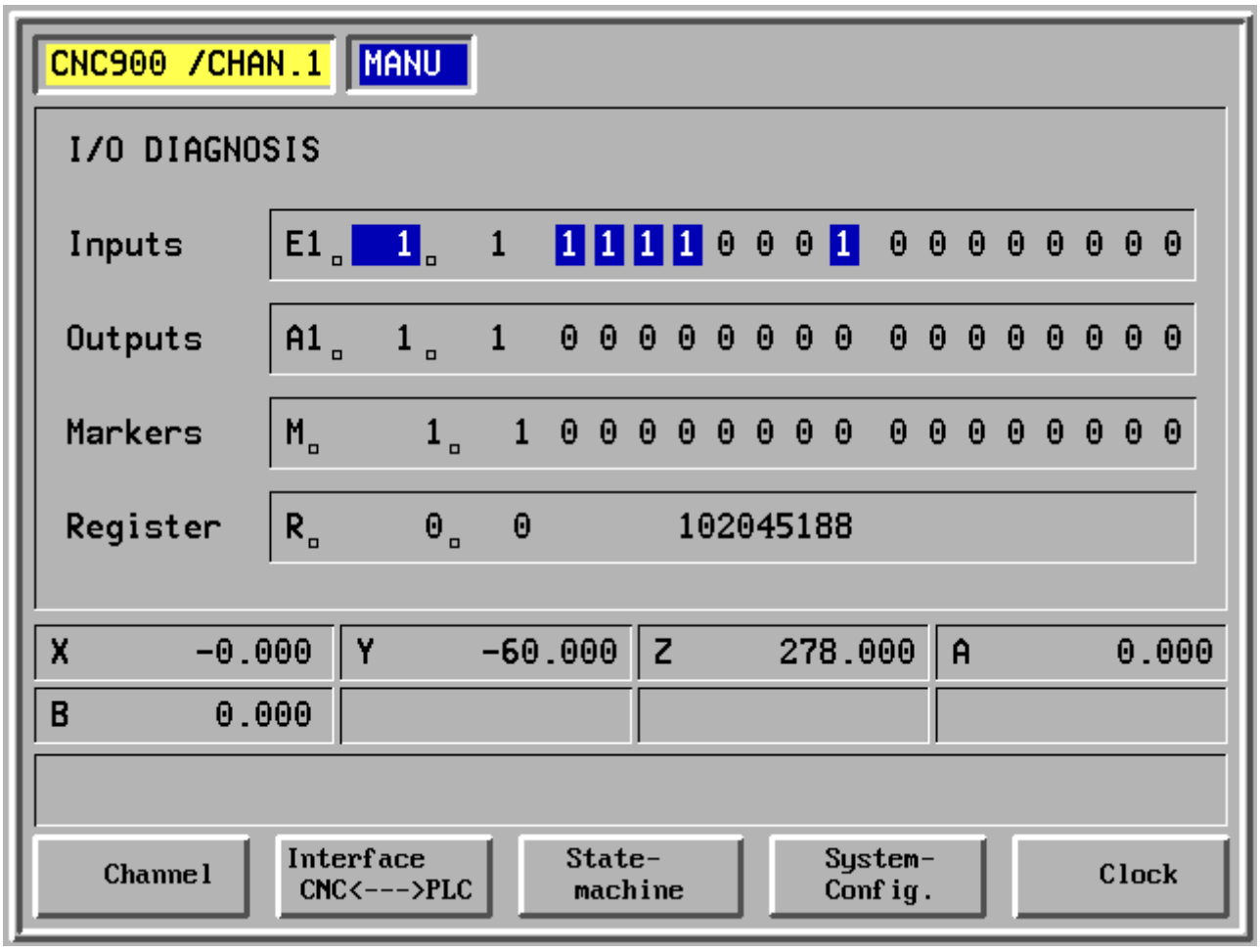
F3 Message record Display of previous messages

F4 -

F5 -

2.7.2 PLC

I/O diagnostic



F1 Channel

F2 Interface CNC <—> PLC

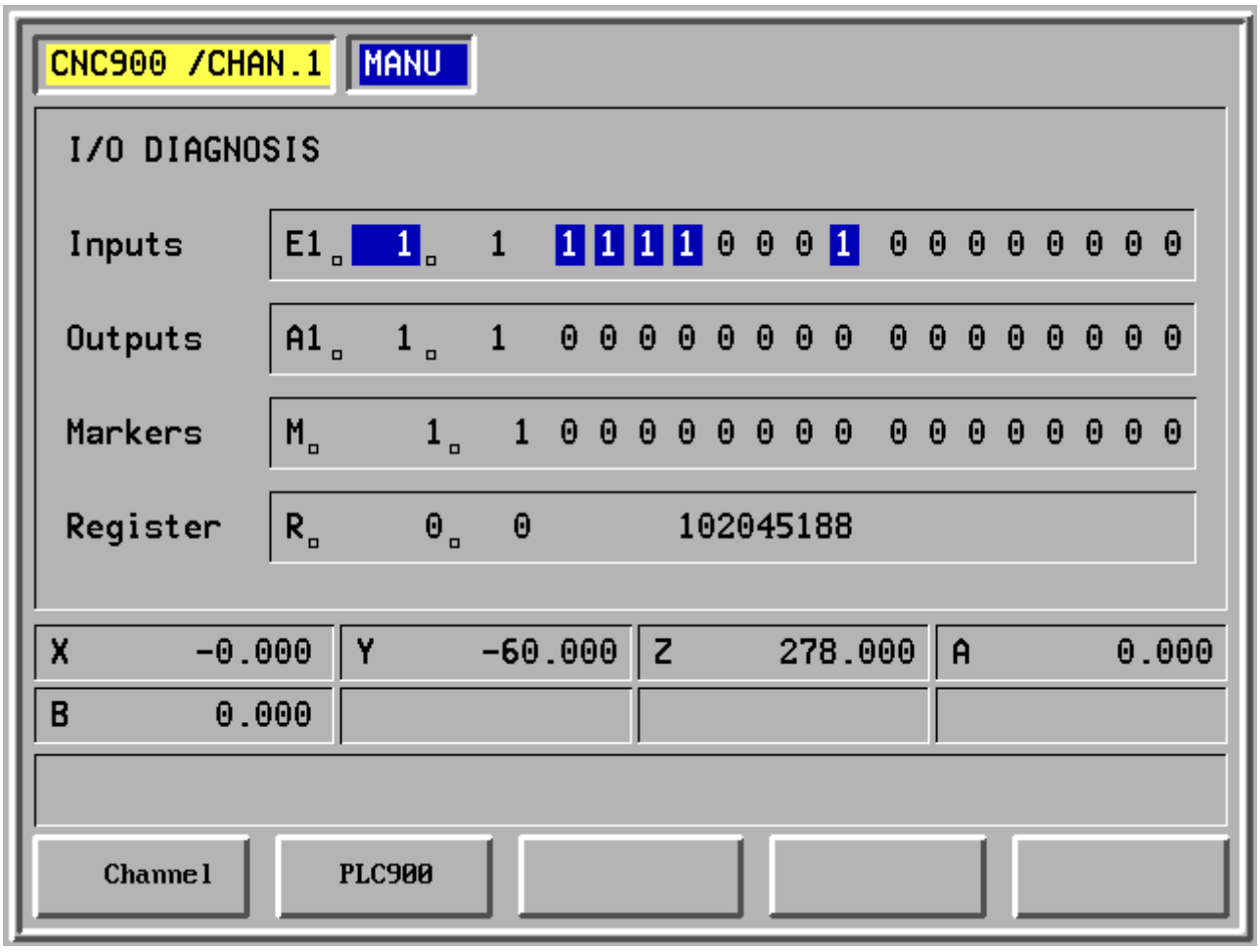
F3 State machine

F4 System configuration

F5 Clock

2.7.2 PLC (continued)

I/O diagnostic



F1 Channel

F2 PLC 900

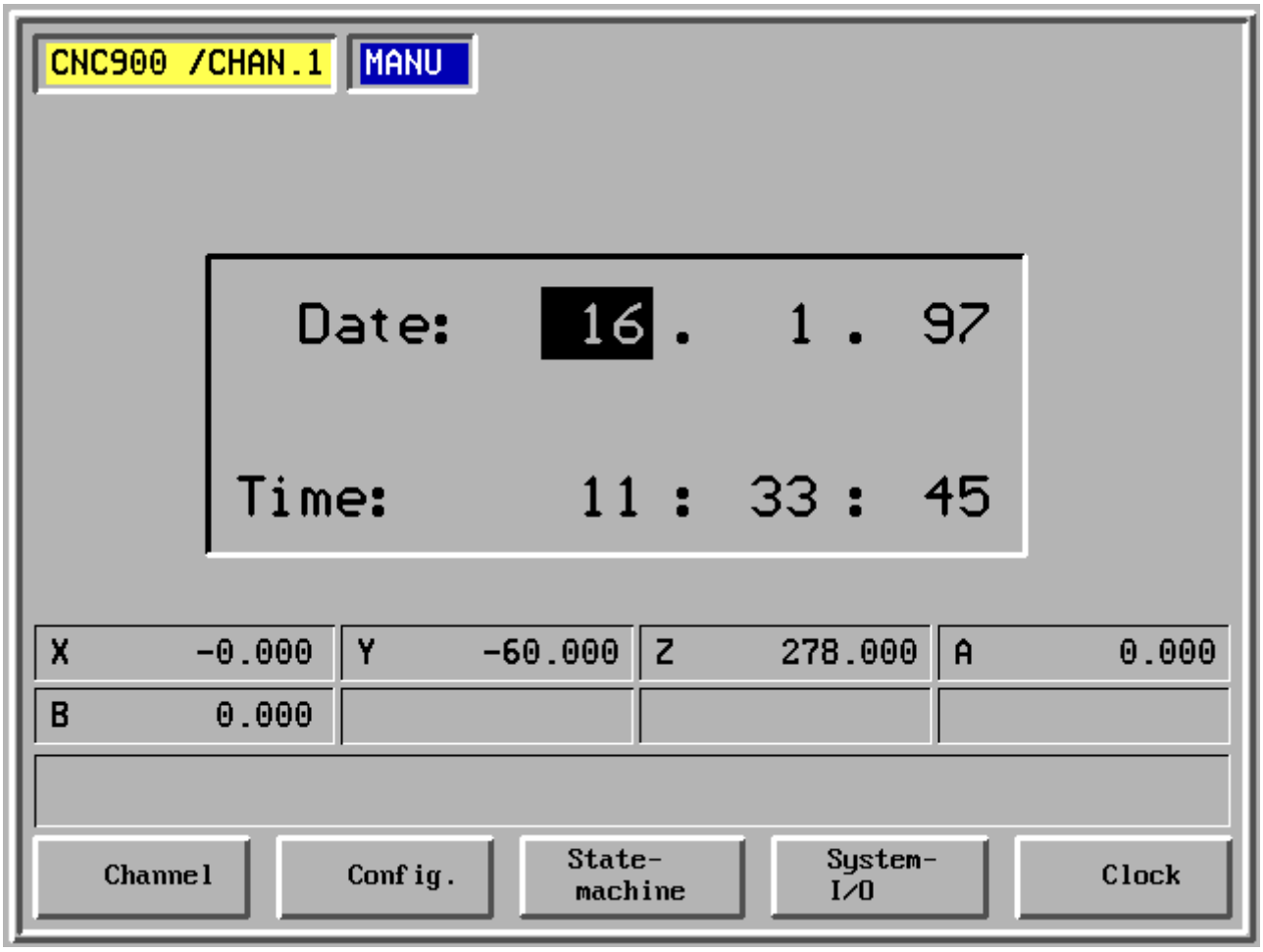
F3 -

F4 -

F5 -

2.7.2 PLC (continued)

Clock



F1 Channel

F2 I/O

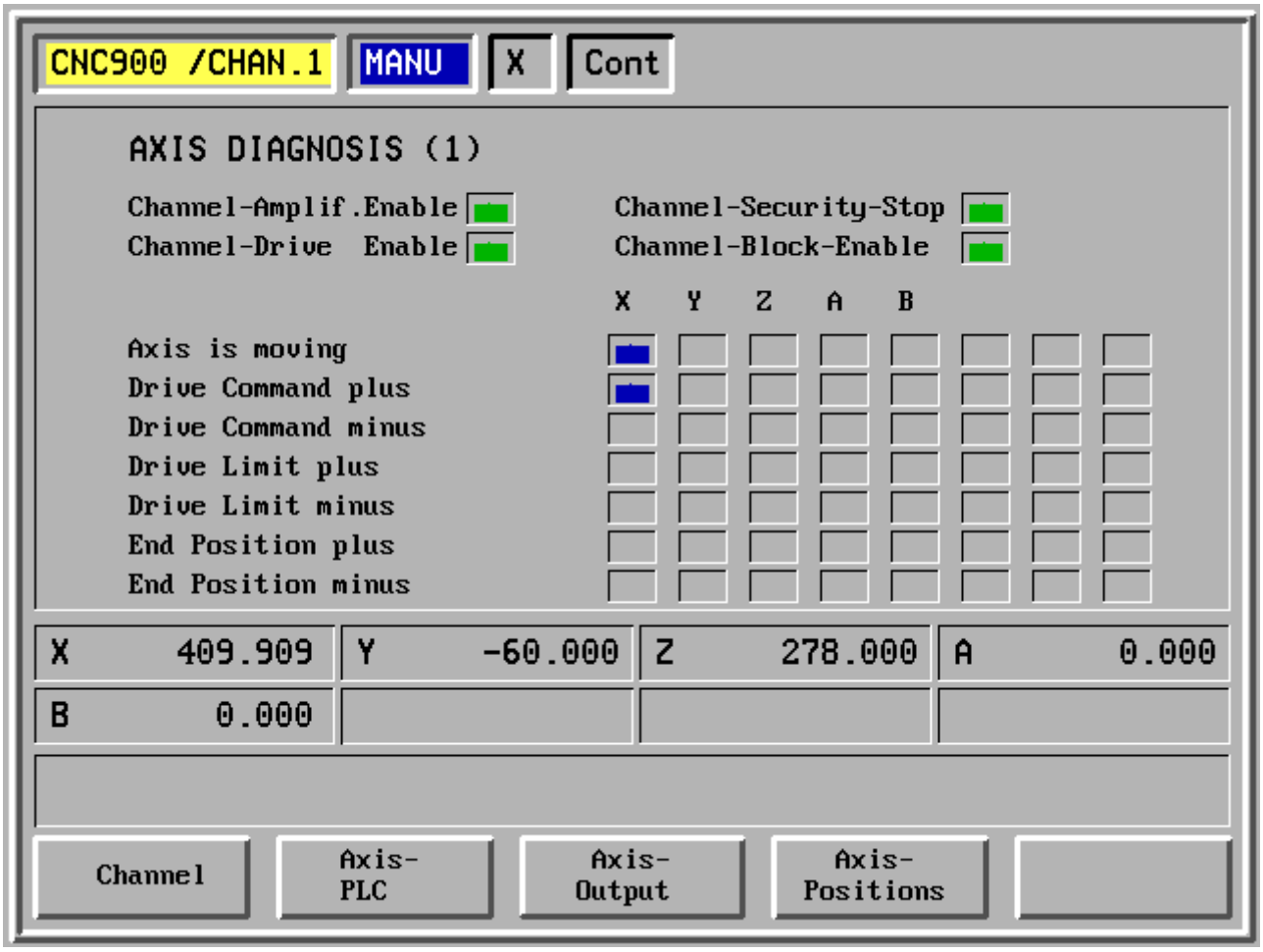
F3 State machine

F4 System configuration

F5 Clock

2.7.3 Axes

Axis diagnostic 1



F1 Channel

F2 Axis PLC

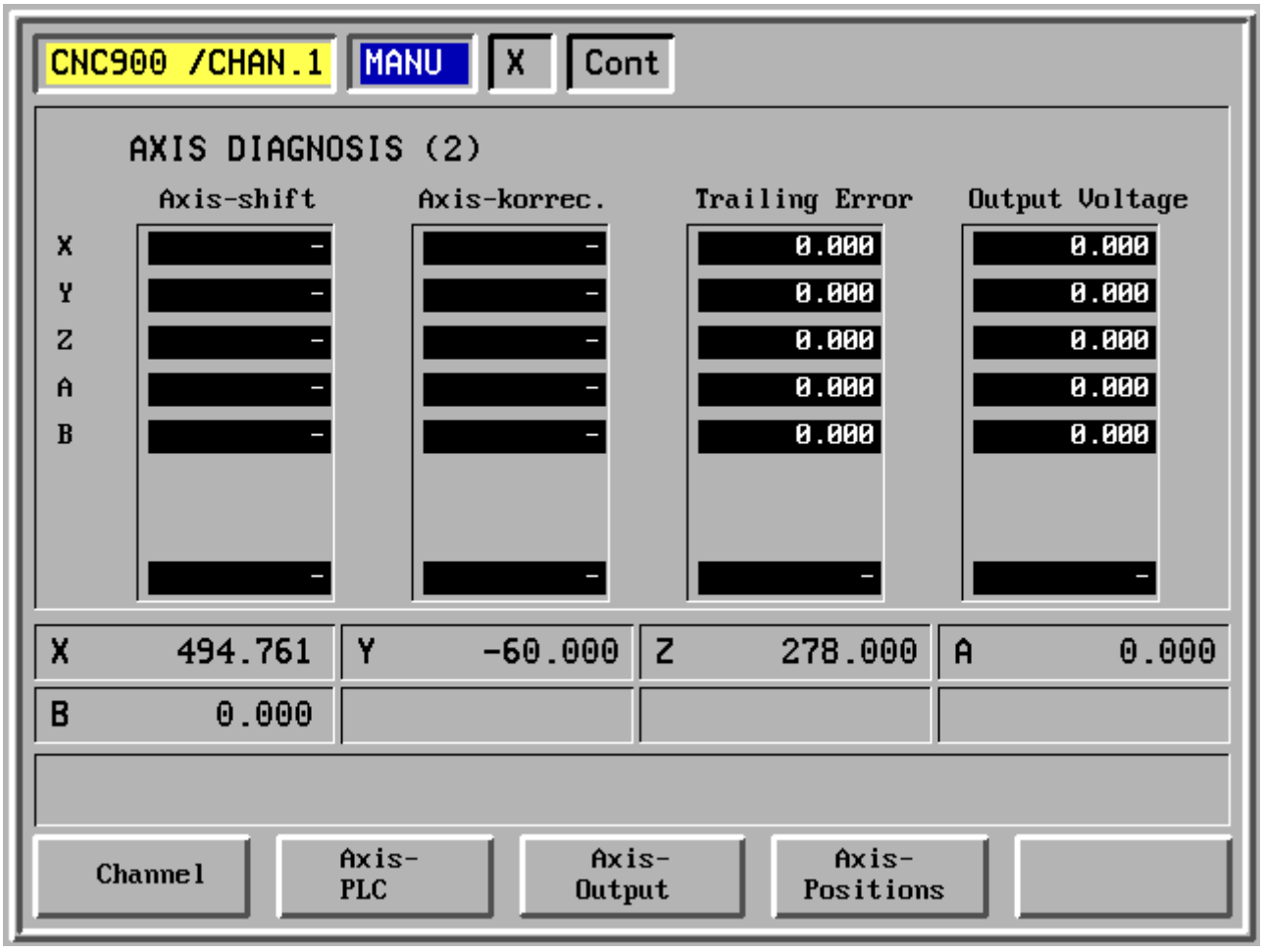
F3 Axis output

F4 Axis positions

F5 -

2.7.3 Axes (continued)

Axis diagnostic 2



F1 Channel

F2 Axis PLC

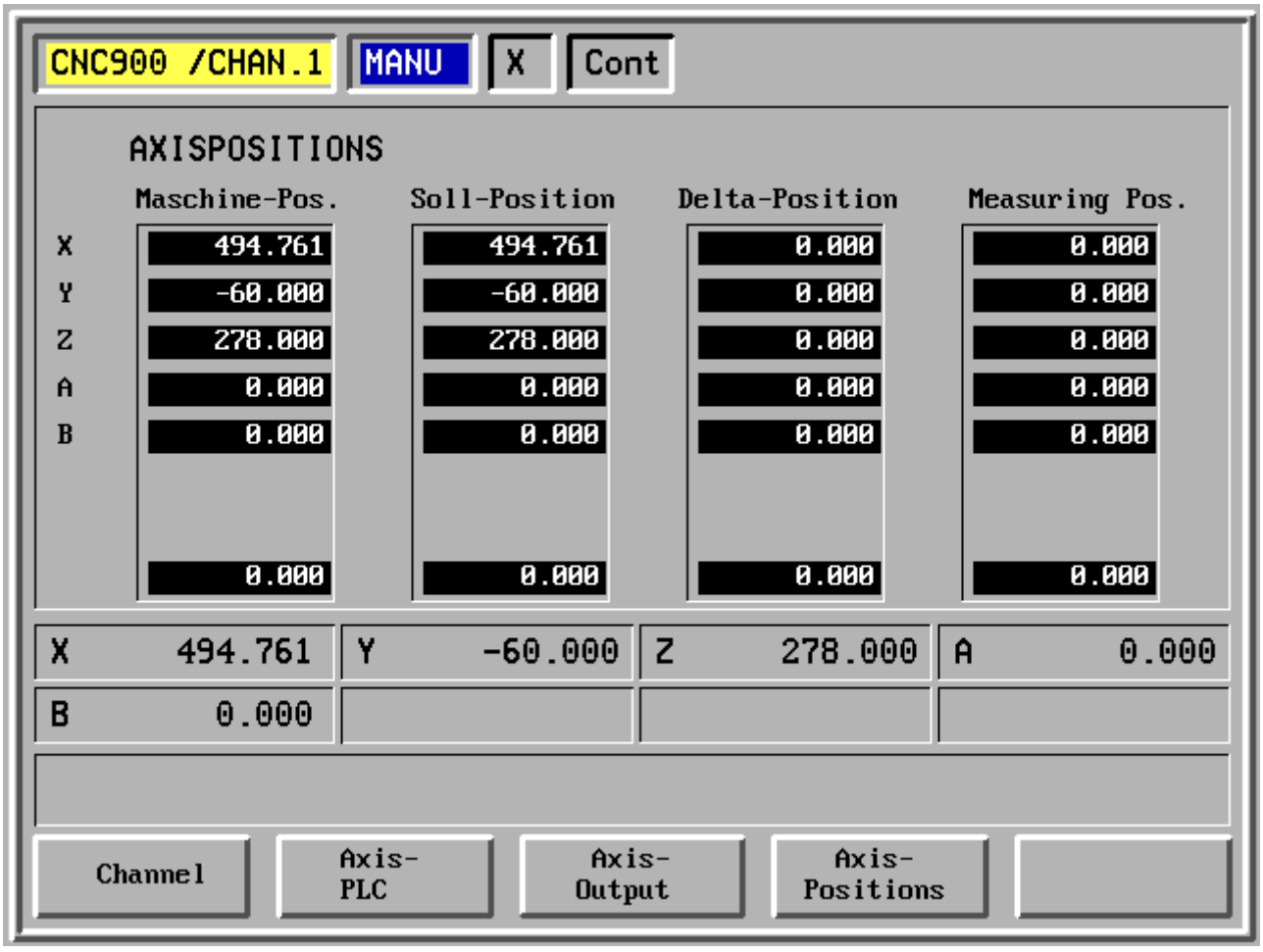
F3 Axis output

F4 Axis positions

F5 -

2.7.3 Axes (continued)

Axis positions



F1 Channel

F2 Axis PLC

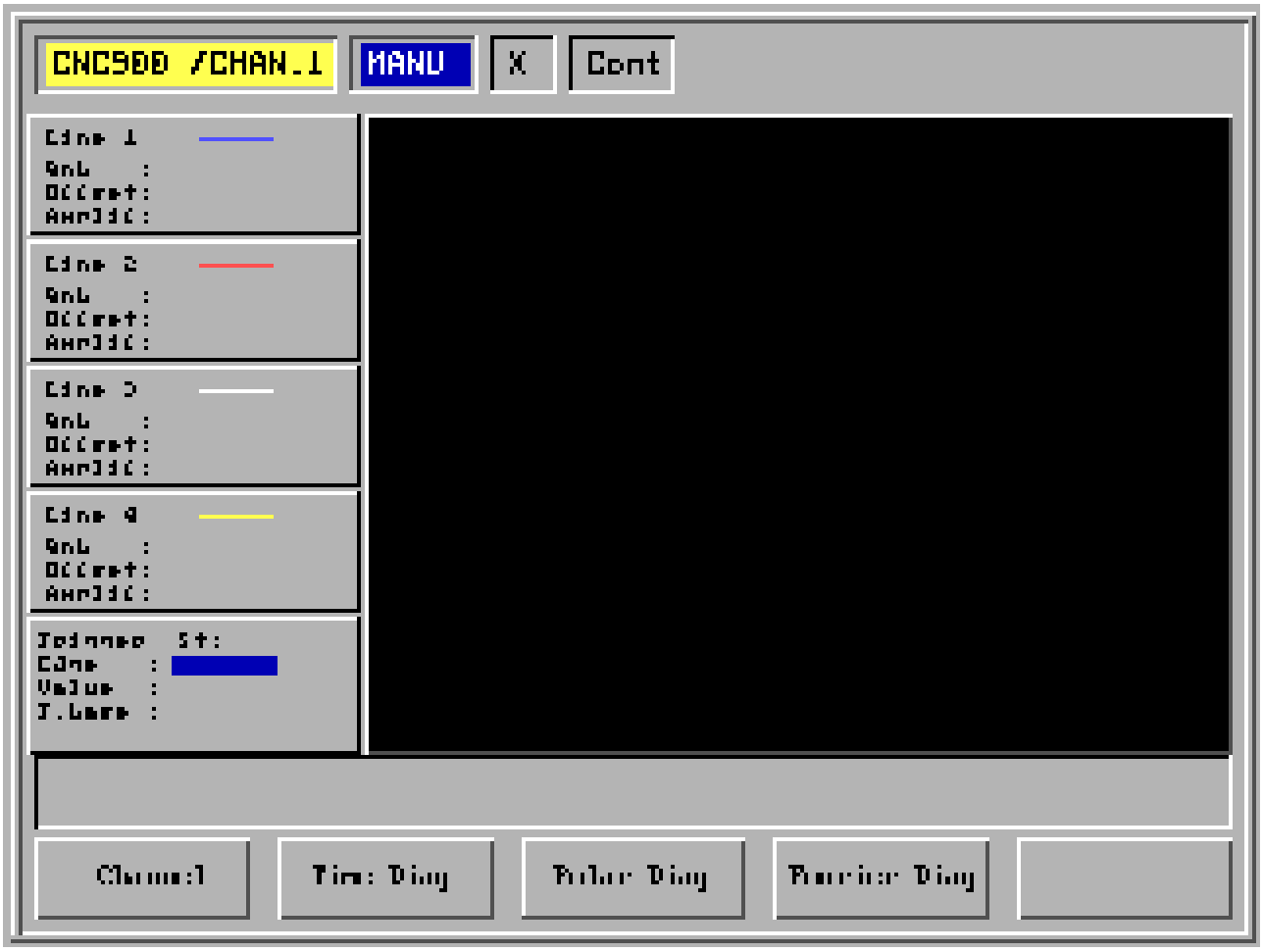
F3 Axis output

F4 Axis positions

F5 -

2.7.4 Oscilloscope

Four-channel oscilloscope with time-, polar- and Fourier diagnostic for evaluating the mechanical settings and for recognising defective mechanical parts.



F1 Channel

F2 Start time diagnostic

F3 Start polar diagnostic

F4 Start Fourier diagnostic

F5 -

2.7.4 Oscilloscope (continued)

Qnr Parameter number (connection)

Number	Meaning	
q2150	Command position	[mm, degree]
q2152	Actual position	[mm, degree]
q2160	Lag distance	[mm, degree]
q2161	Coupling correction	[mm, degree]
q2168	Actual difference (corresponds to speed)	[mm, degree]
q2169	Output voltage of positioning control	[V]

Offset Vertical offset

Amplif Amplification, vertical resolution, units per division

Trigger St Trigger line number

Edge

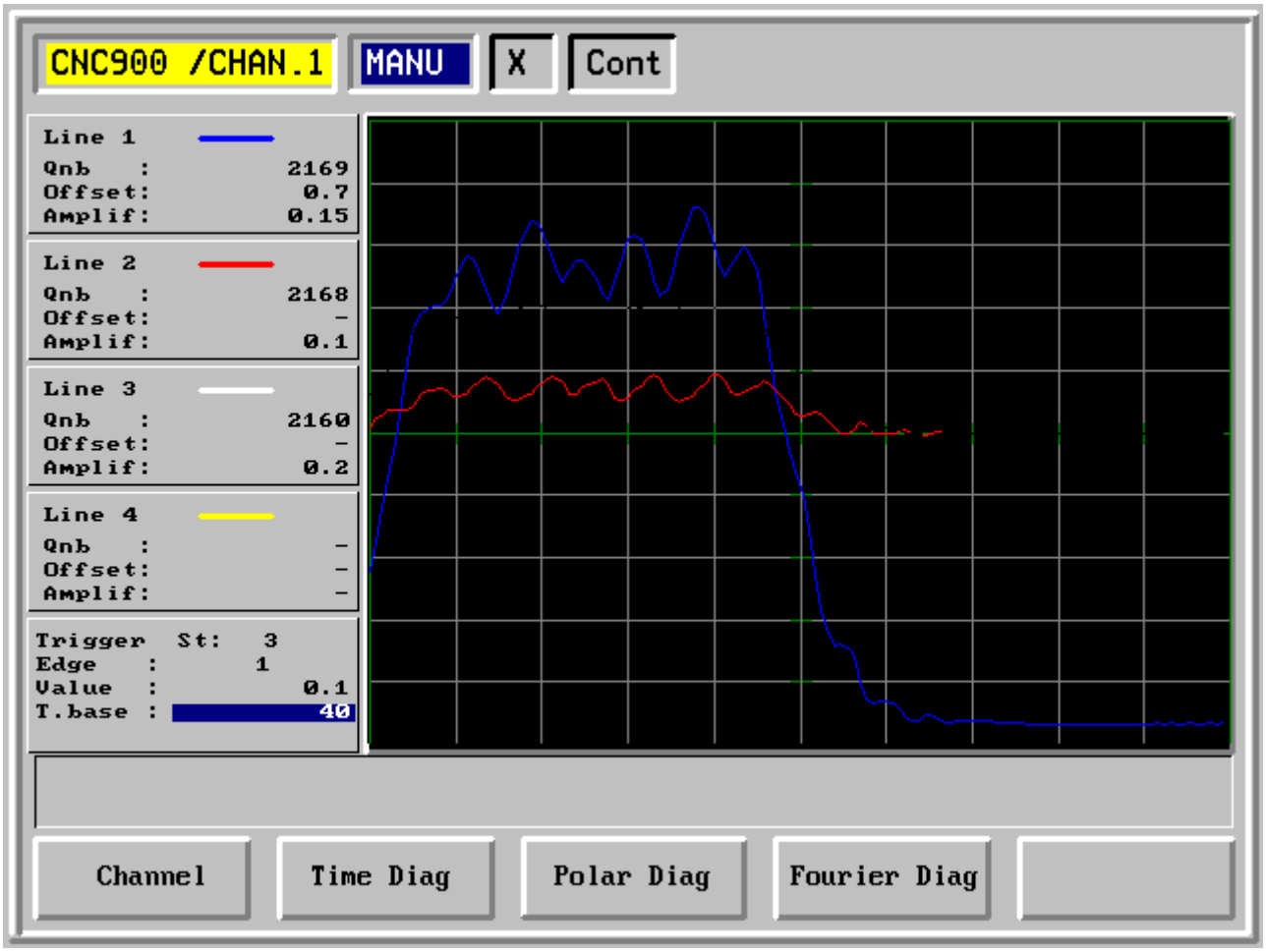
1	trigger at rising edge
-1	trigger at declining edge
0	trigger immediately

Value Value at which it is triggered.

TB/Freq Time basis / frequency, horizontal resolution, units per division [ms, Hz]

2.7.4 Oscilloscope (continued)

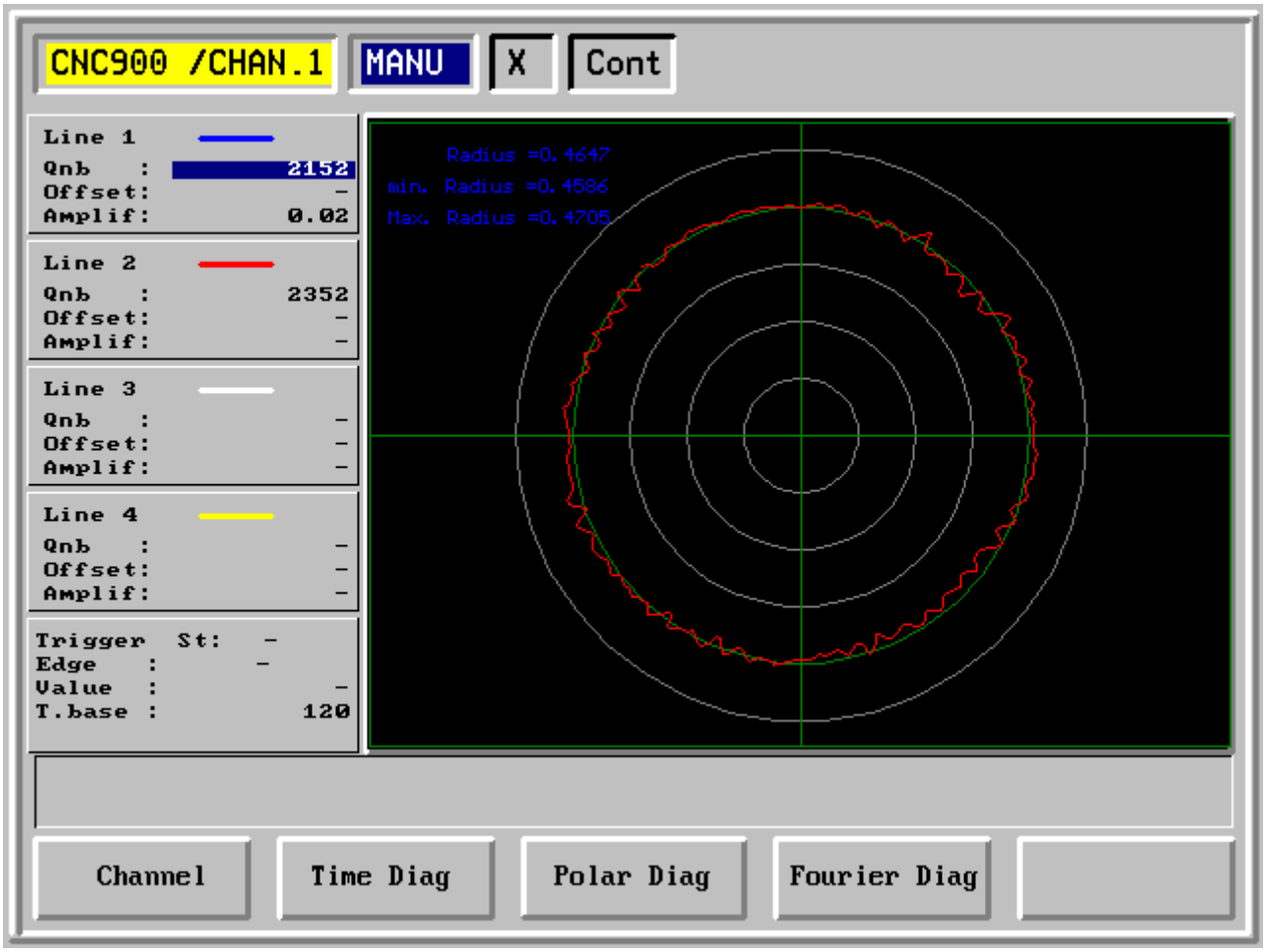
Example: Three-channel time diagnostic



Line 1	Qnr	2169	output voltage of positioning control in V
	Offset	0,7	vertical offset
	Amplif.	0,15	units per division
Line 2	Qnr		actual difference in mm/degree
	Amplif.	0,1	units per division
Line 3	Qnr	2160	lag distance in mm/degree
	Amplif.	0,2	units per division
Trigger	Line number	3	
Edge		1	trigger at rising edge
Value		0,1	trigger at this value
Time basis / Frequency		40	units per division

2.7.4 Oscilloscope (continued)

Example: polar diagnostic, circle test

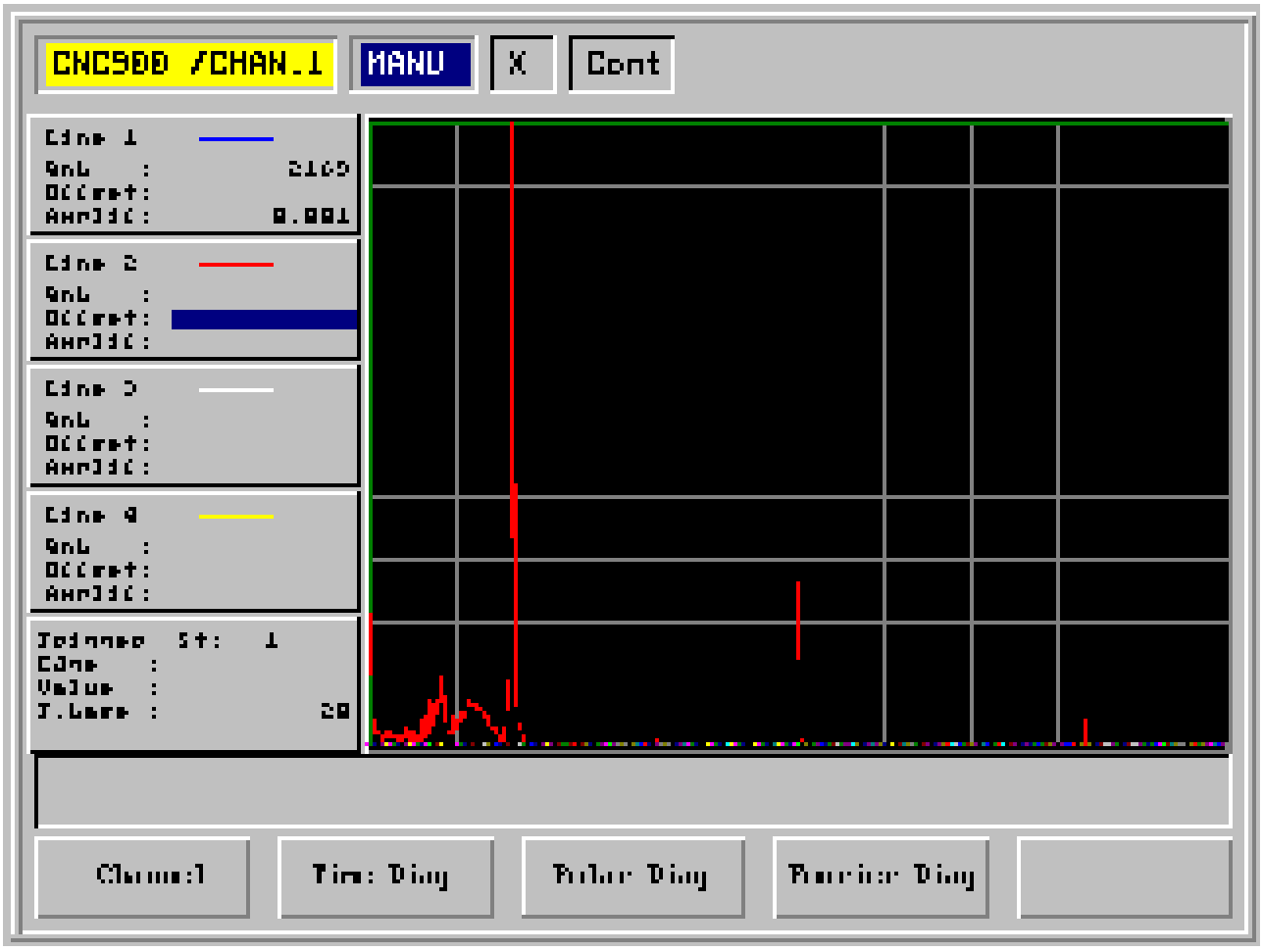


Line 1	Qnr	2152	actual position 1st axis in mm/degree
	Amplification	0,02	units per division
Line 2	Qnr	2352	actual position 2nd axis in mm/degree
Time basis / Frequency		120	units per division chose time/frequency basis so that at least one full circle is run.

2.7.4 Oscilloscope (continued)

Example: Fourier diagnostic, frequency spectrum

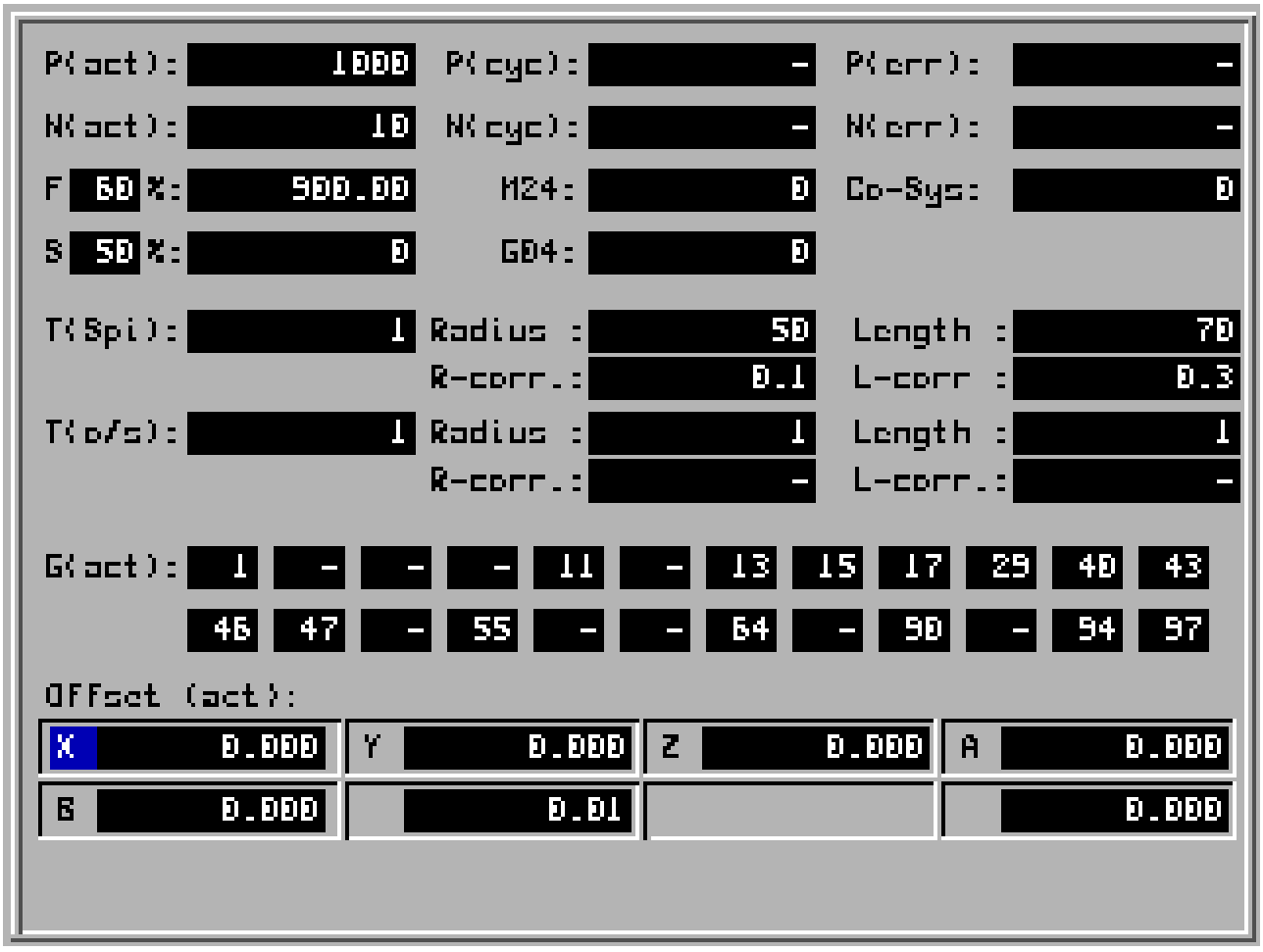
Frequency spectrum with oscillations at 33Hz and harmonics at 99Hz and 165HZ



Line 1	Qnr	2169	output voltage of positioning control in V
	Amplification	0,01	units per division vertically
Trigger	Line number	1	
Time basis / frequency		20	units per division horizontally in Hz

2.7.5 Additional informations

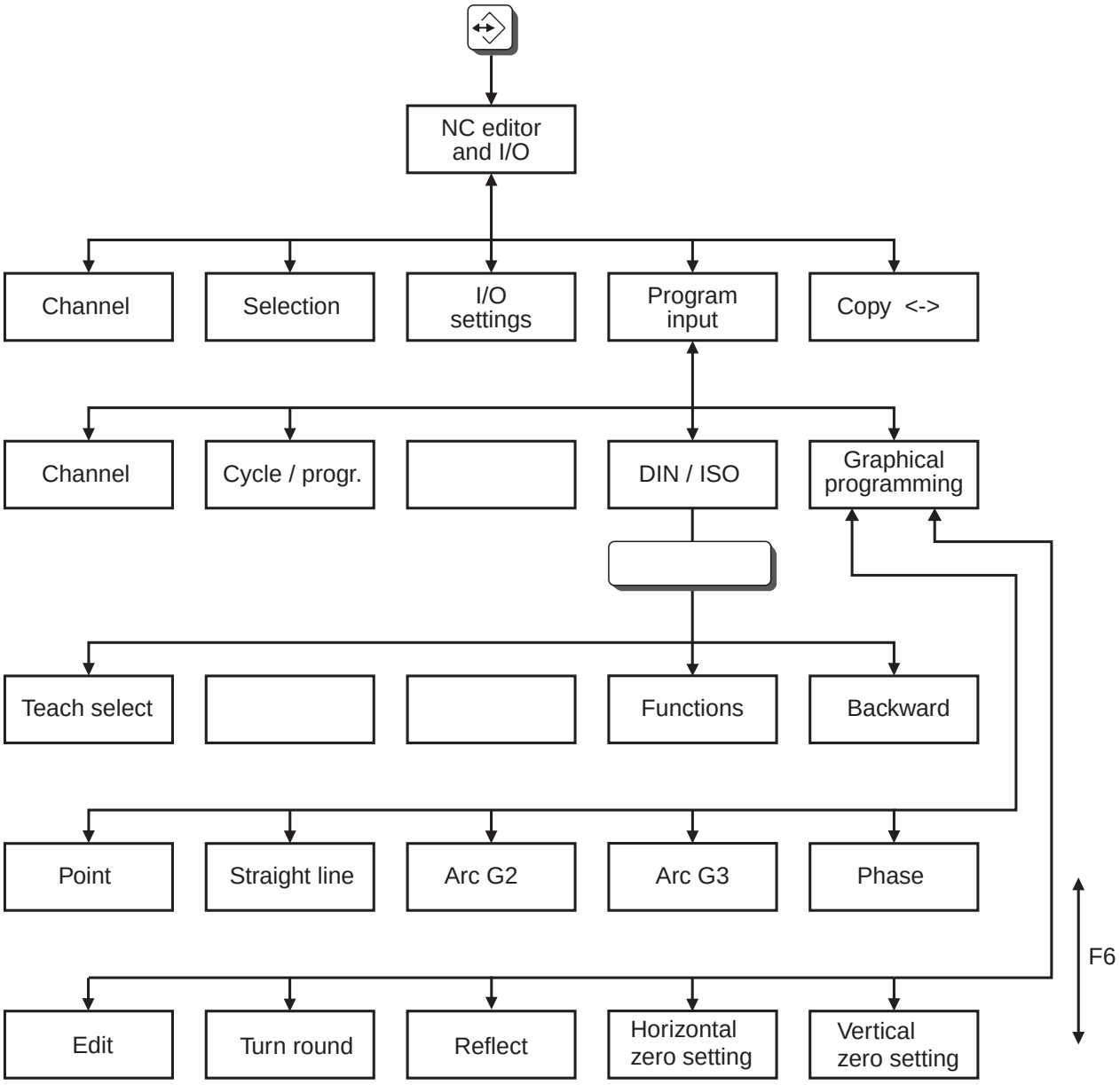
Additional online informations can be called up during operating with the key ?.



2.8 NC editor and I/O

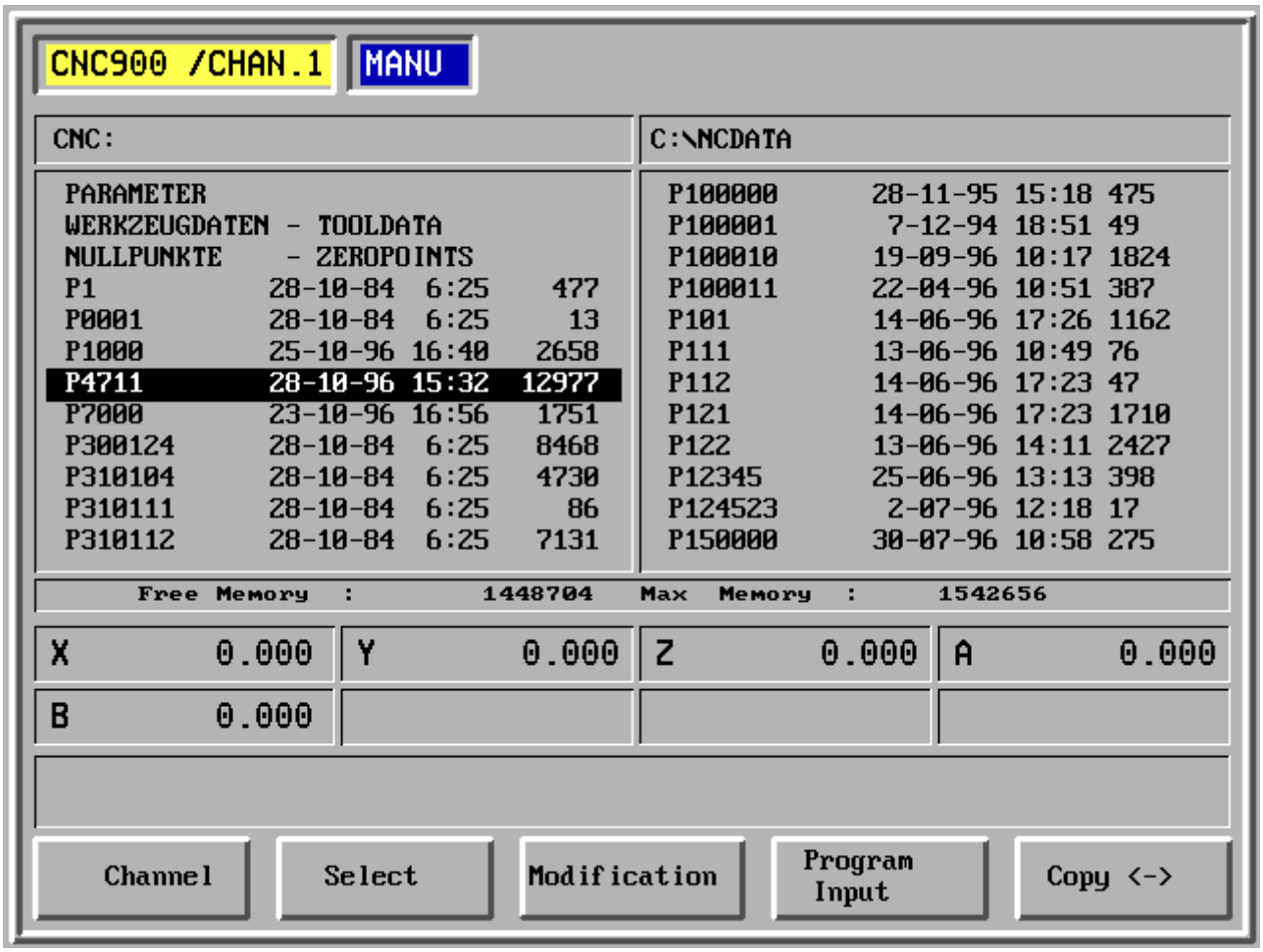
Writing, changing and storing NC programs;
Storing parameter, tool data and zero points.

Menue tree



2.8 NC editor and I/O (continued)

When pressing the key  the menue for NC programming and I/O appears.



F1 Channel

F2 Selection

F3 I/O settings

F4 Program input

F5 Copy <->

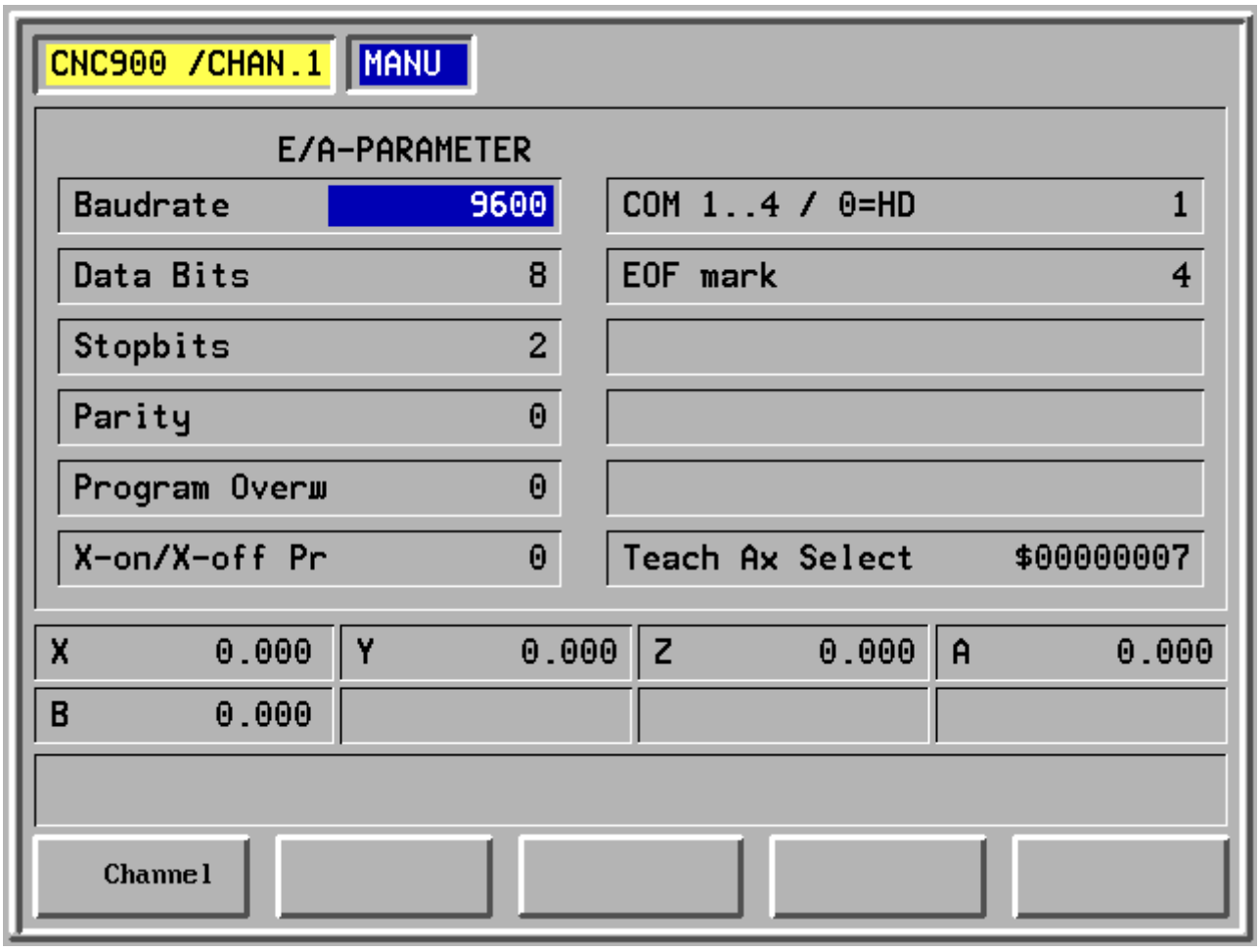
2.8.1 Selection

Selection of storing modes

on the left side	on the right side
CNC:	CNC:
C:\NCDATA	C:\NCDATA
	A:\
	Serial I/O

2.8.2 I/O parameters

This menue can be used for inputing I/O parameters.



F1 Channel

F2-

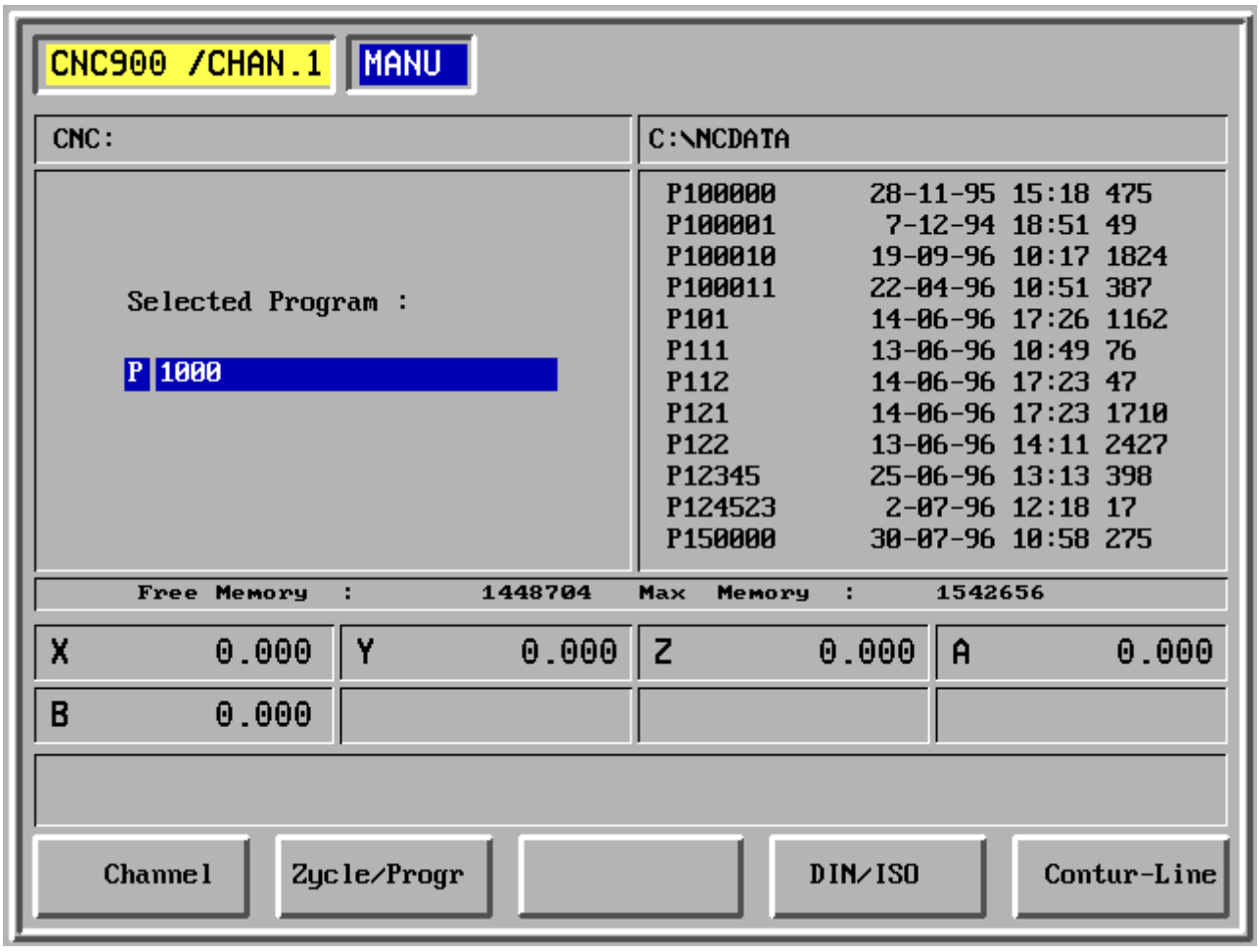
F3-

F4-

F5-

2.8.3 Program input

Program selection appears with pressing key F4 (in screen frame). With the cursor keys an existing program can be chosen or the number of a new program can be input with the numerical keyboard.



F1 Channel

F2 Cycle /program

F3 -

F4 Input a program according to DIN / ISO

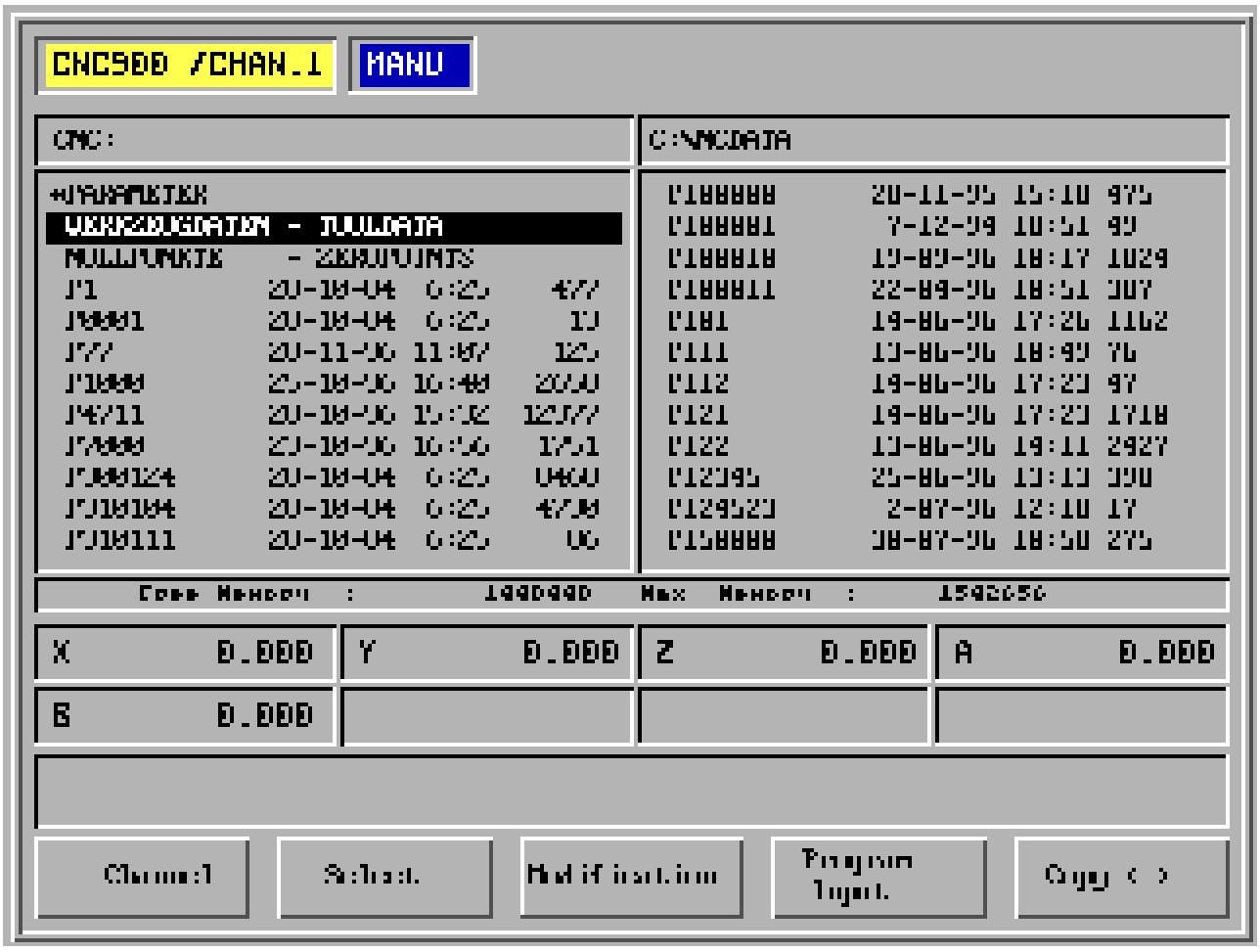
F5 Input a program with outline

2.8.3 Program input (continued)

Program input	paragraph
according to DIN / ISO	2.9
also Teach in	2.10
with graphic support (outline path)	2.11

2.8.4 Copying

Parameters, tool data, zero points and NC programs can be selected with the cursor keys for copying. The selected data are activated with the key and marked with an *.



F1 Channel

F2 Selection

F3 I/O settings

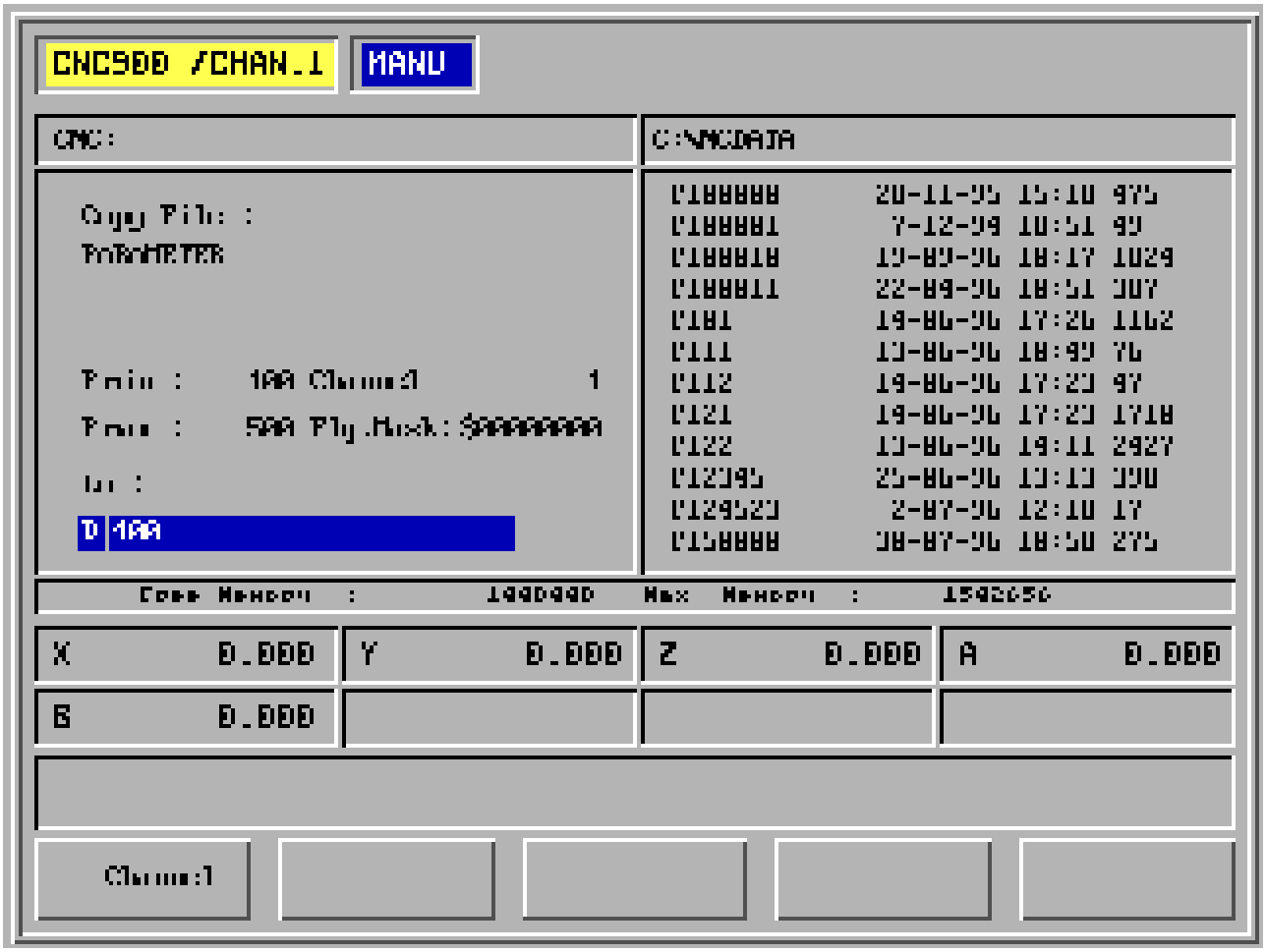
F4 Program input

F5 Copy <->

2.8.4 Copying (continued)

Parameter

After selecting with the cursor keys and after activating with  parameters can be copied with F5 from CNC: to C:\NCDATA or A:\ . Input Pmin and Pmax, identification letter D.



F1 Channel

F2 -

F3 -

F4 -

F5 -

2.8.4 Copying (continued)

Parameter

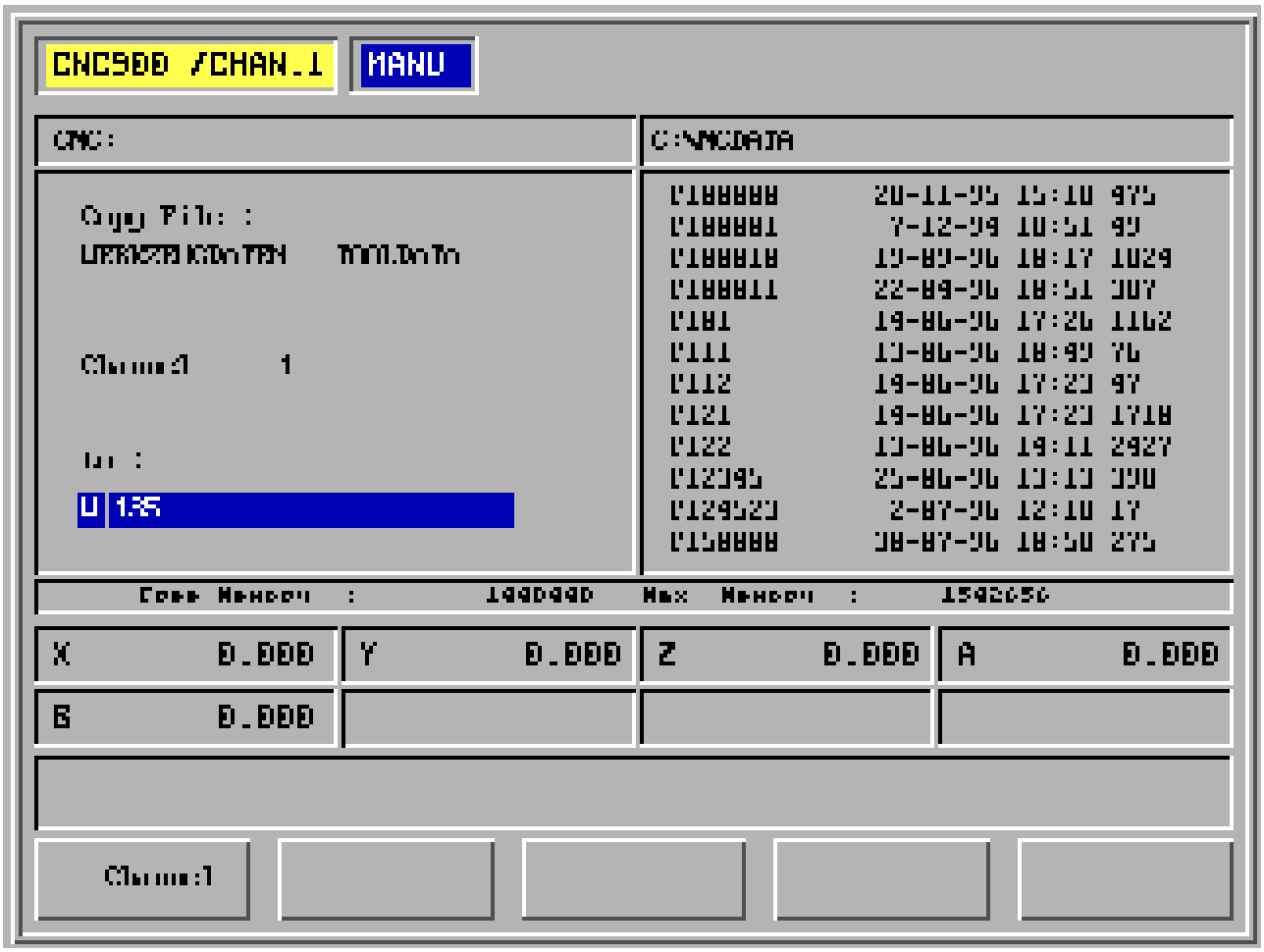
Meaning of the input fields

Pmin:	first parameter of output	
Pmax:	last parameter of output	
Channel	0	Output of q-parameters
	1 to 8	Output of P-parameters of the corresponding channel
Flag mask	Status flag mask	
	0	Output of all parameters according to Pmin - Pmax
	<>0	Output of parameters in the range of Pmin - Pmax, at which the bits are set in the parameter status according to the flag mask. Herewith an output of all parameters in which the EEPROM bit is set, is possible.
to:	DOS file name	

2.8.4 Copying (continued)

Tool data

After selecting with the cursor keys and after activating with  tool data can be copied with F5 from CNC: to C:\NCDATA or A:\ . Identification letter W.



F1 Channel

F2 -

F3 -

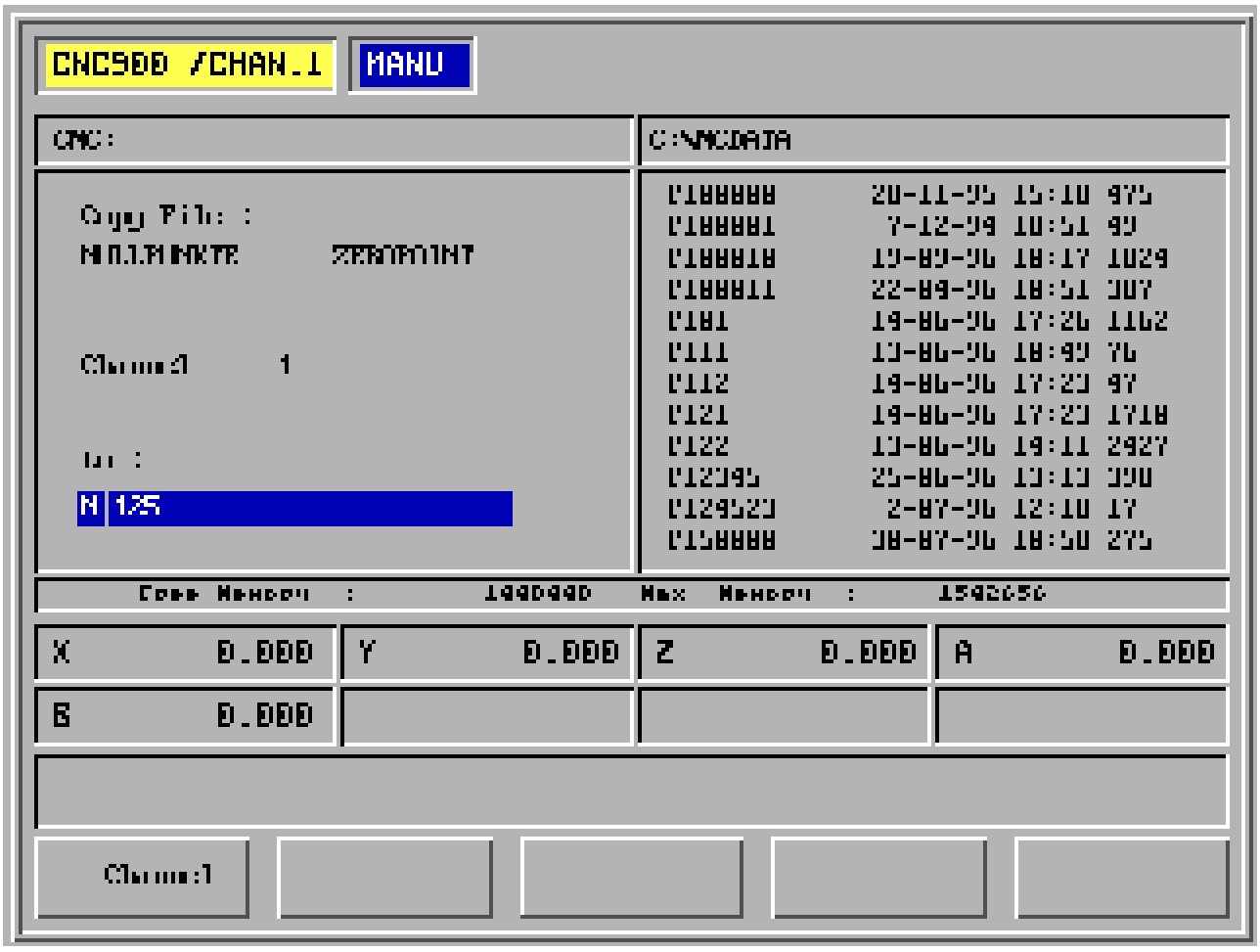
F4 -

F5 -

2.8.4 Copying (continued)

Zero points

After selecting with the cursor keys and after activating with  zero points can be copied with F5 from CNC: to C:\NCDATA or A:\ . Identification letter N.



F1 Channel

F2 -

F3 -

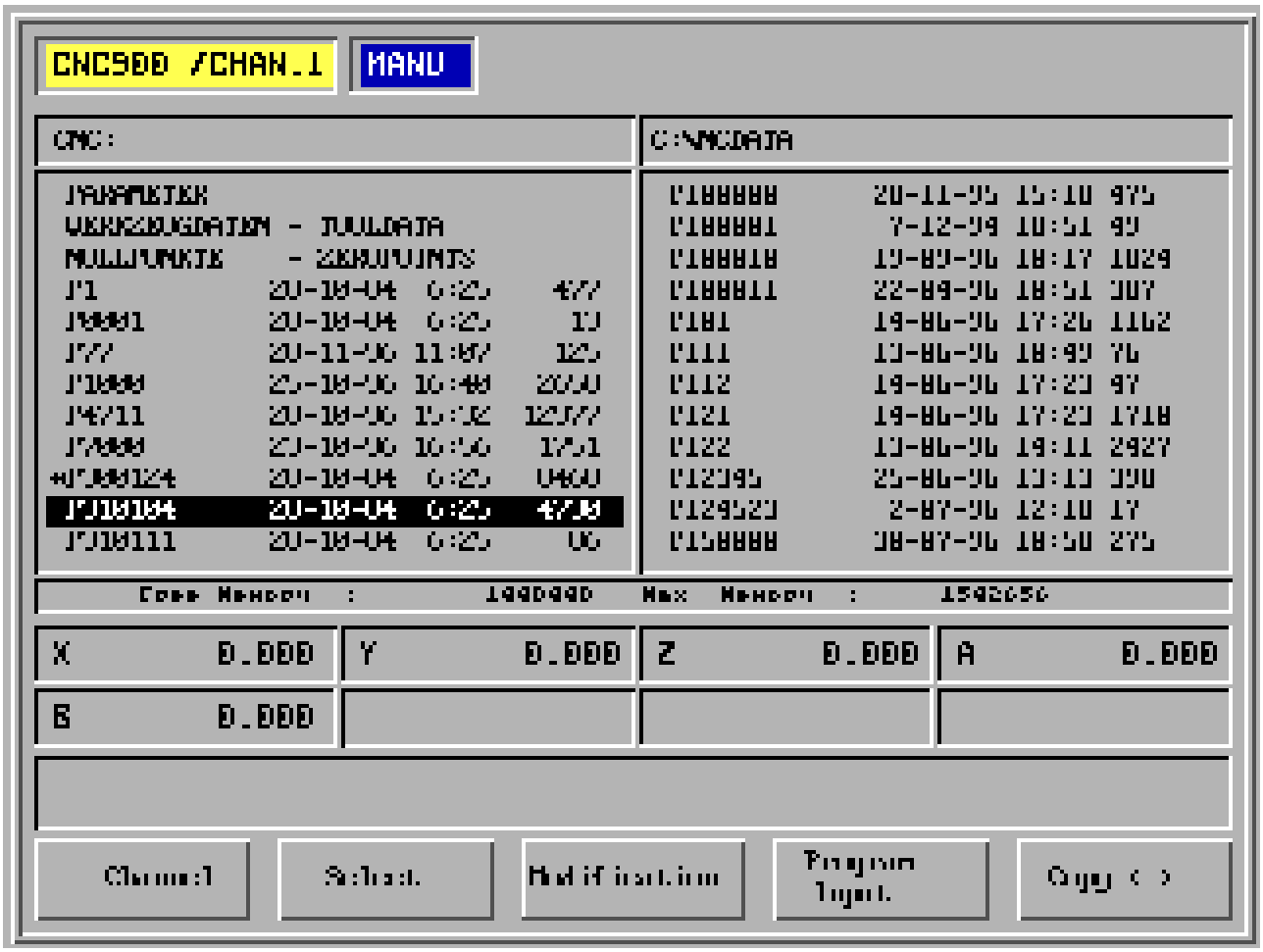
F4 -

F5 -

2.8.4 Copying (continued)

NC programs

After selecting with the cursor keys and after activating with  , the selected NC program is marked with *.



F1 Channel

F2 Selection

F3 I/O settings

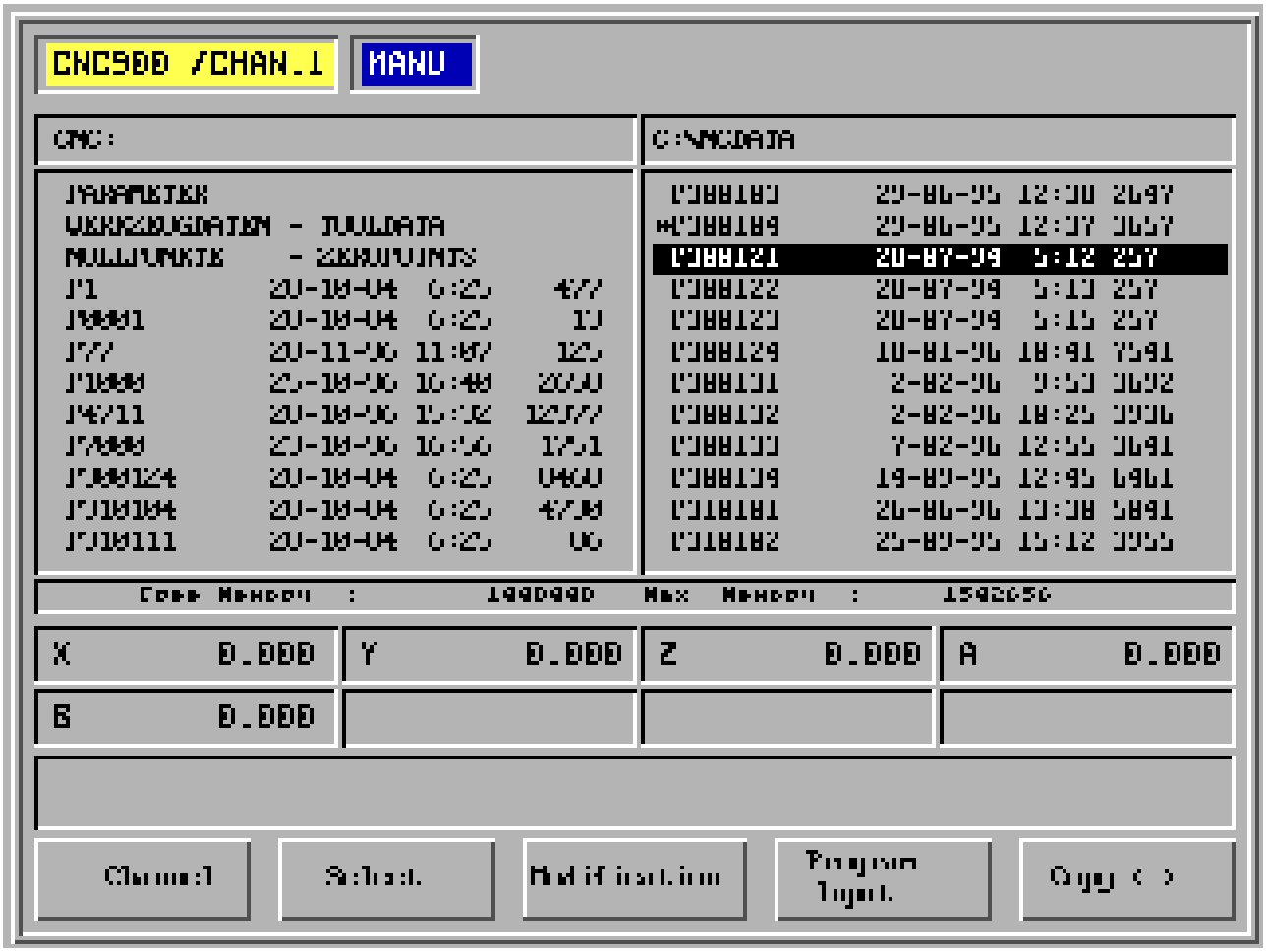
F4 Program input

F5 Copy <->

2.8.4 Copying (continued)

NC programs

After selecting with the cursor keys and after activating with tool daNC programs can be copied with F5 from CNC: to C:\NCDATA or A:\ . Identification letter P.



F1 Channel

F2 Selection

F3 I/O settings

F4 Program input

F5 Copy <->

2.8.4 Copying (continued)

NC programs

All programs mark

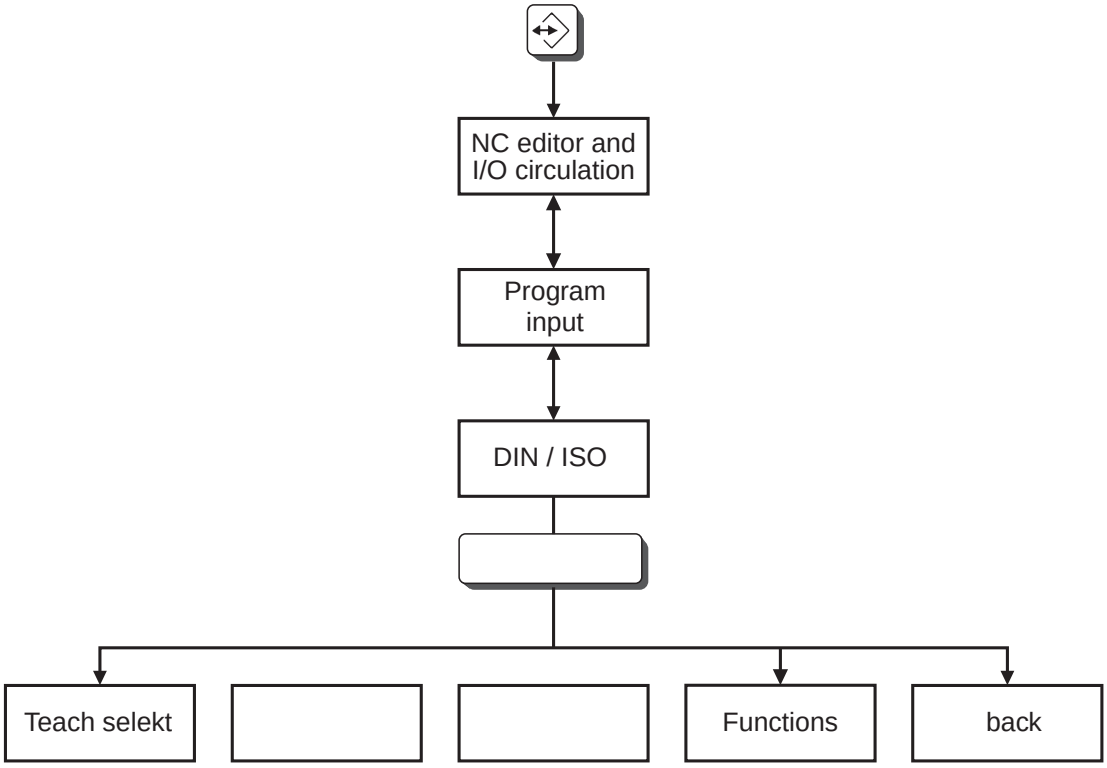
F6 and inserting branch press.

All programs off NC memory copy
(store total NC memory in a file)

Programs mark and Funktionstate F5 (copy) press.

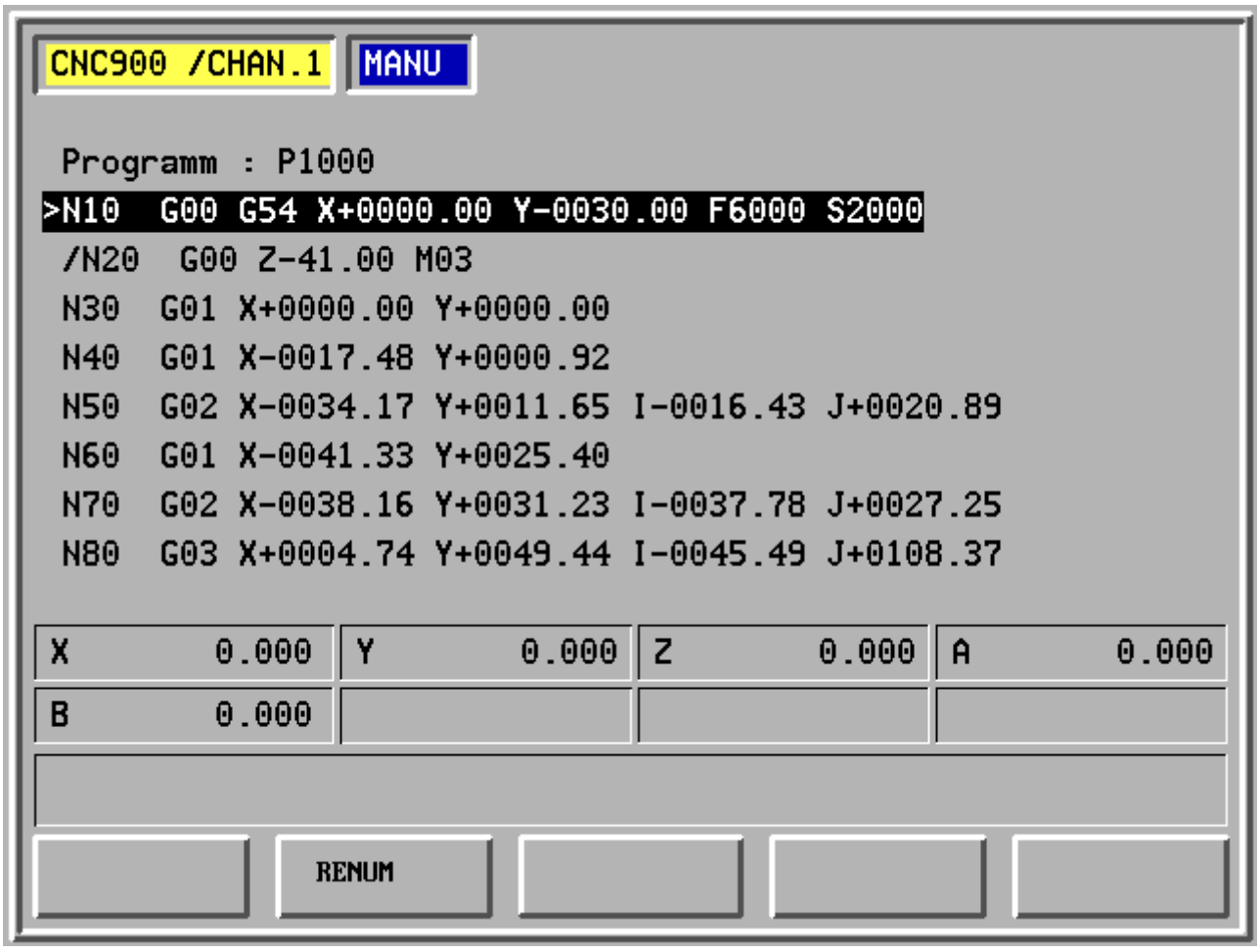
2.9 Input a program according to DIN / ISO

Menue tree



2.9 Input a program according to DIN / ISO (continued)

After inputing the program number and after pressing the key DIN / ISO the program appears with the first blocks in the display, if a program is existing with the indicated number. If not, only the program number and >N10 appears.



F1 -

F2 -

F3 -

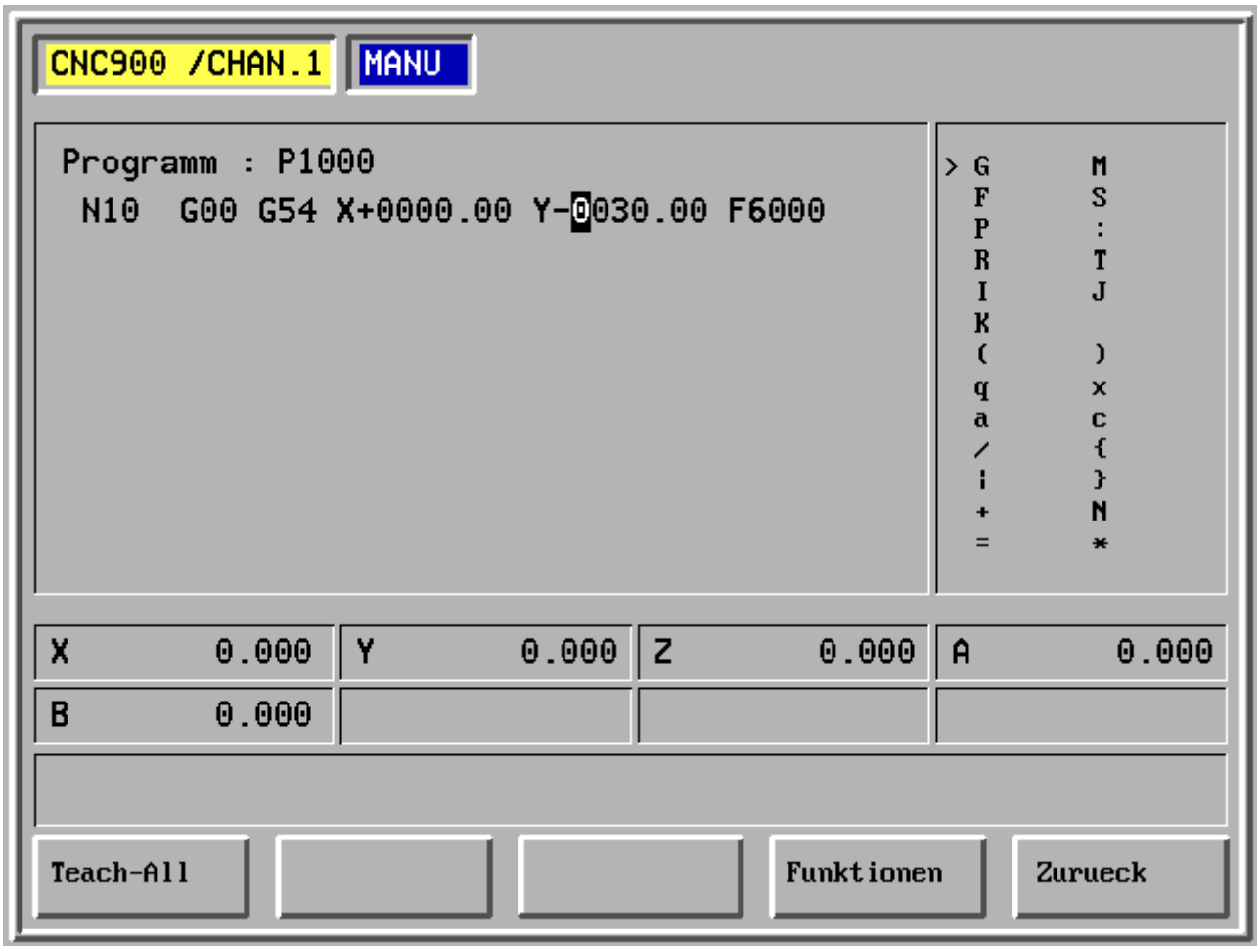
f4 -

F5 -

2.9 Input a program according to DIN / ISO (continued)

Changing or inputing blocks

When pressing ↵ the selected block and the function appear.



F1 Teach-Select

F2 -

F3 -

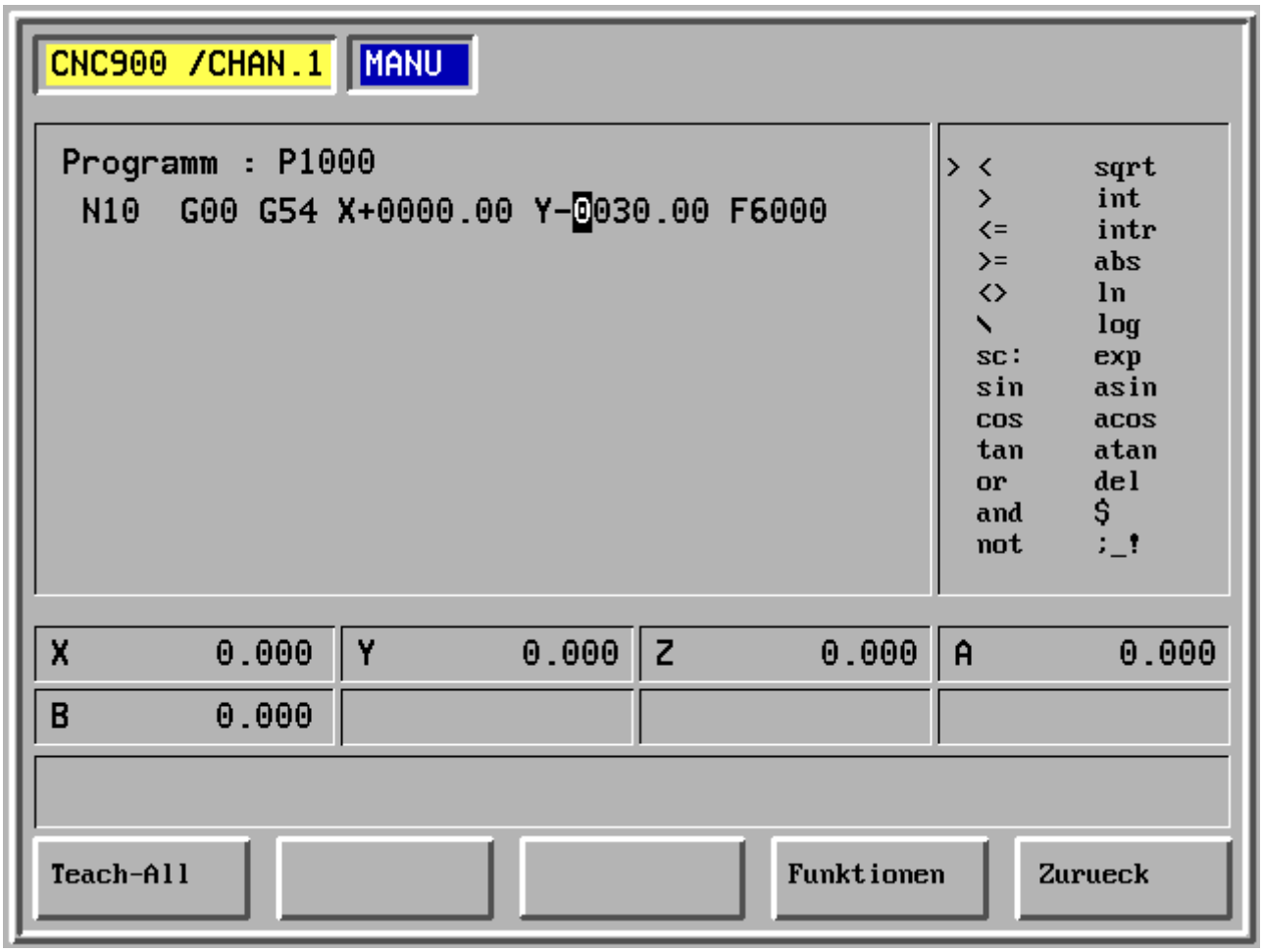
F4 Functions Switching on further programming functions

F5 Back

2.9 Input a program according to DIN / ISO (continued)

Functions

When pressing  the functions are activated. Selection with cursor keys.



F1 Teach-Select

F2 -

F3 -

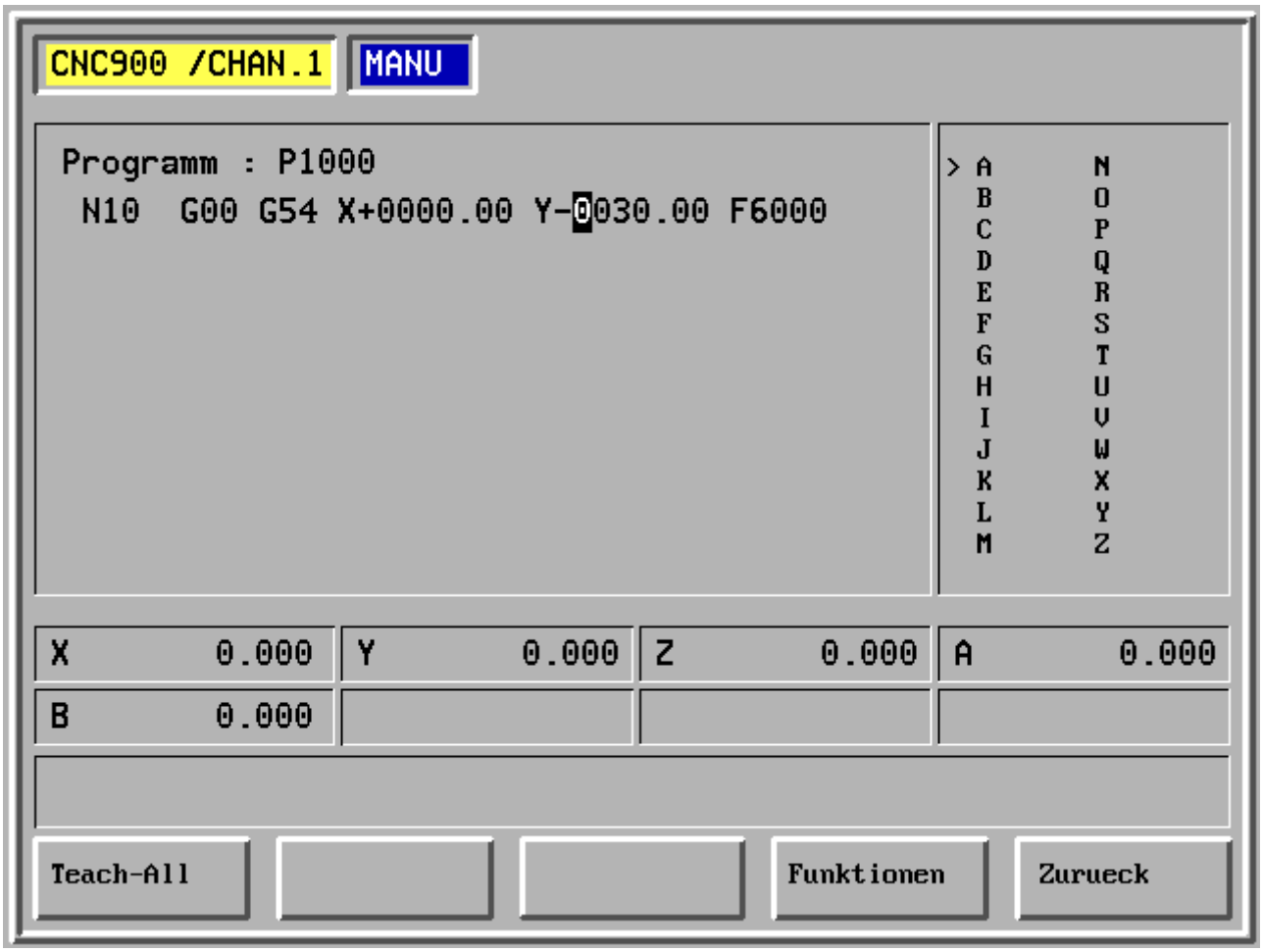
F4 Functions Switching on further programming functions

F5 Back

2.9 Input a program according to DIN / ISO (continued)

Functions

When pressing XXX another function siede appears.



F1 Teach-Select

F2 -

F3 -

F4 Functions Switching on further programming functions

F5 Back

2.10 Preparing a NC program in Teach mode

2.10.1 Setting zero points

The parameter P11804 (tool carrier - length) must be loaded with the right values and the tool dimension must be active.

Drive axes in the desired zero point position.

Call up function „**Command=Actual**“ and store with **‘Enter’**.
Herewith the current actual values of the axes are transmitted to the zero point memory.

In this way different zero pointes can be set.

If these zero point shifts should be active in manual operation mode, the parameter P8758 has to be loaded with the desired value (G54 to G59).

In automatic mode, the call up is made with the functions G54...G59.

Remark:
The zero point shifts are only effective in the tool coordinate system (G48) or in the workpiece coordinate system (G49).

2.10.2 Enter a program with “Teaching”

It is advisable, to mark the workpiece with all known or determining „Teach-points“.
This facilitates later a fast discovering of the individual NC blocks, to insert in the program certain data and/or functions.

A further help would be, if the stored „Teach-points” would be written in a list with the corresponding block number, e.g. Point 5 = block no. 80.

The stored zero point shift, on which the NC program refers, can be activated with parameter P382.

Select mode of operation „Positioning“.
Approach zero point position with a positioning block,
e..g. N10 G0 G55 X0 Y0 Z0 A0 B15

The mode of coordinate, in which the command / actual data were stored (P8751), must be inserted in the block over the corresponding G - function (G48, G49).

Select manual operation mode:
Enter and store program number and the corresponding functions and technological data in the designated NC blocks,
e.g. N10 T1 M16
N20 G55 G49 FOR. .. S .... X ... . Y.. ... .. Z.. ... ..

With „continuous drive“ or „step drive“ the desired position is approached with all axes.
If all axes are in their anticipated position, the position is stored with the function ‘Command=Actual’ and ‘Enter and transmitted to the indicated block.
e.g. N30 X ... . Y.. ... .. Z.. ... .. A.. ... .. C.. ... ..

The next Teach - points are started and stored likewise.

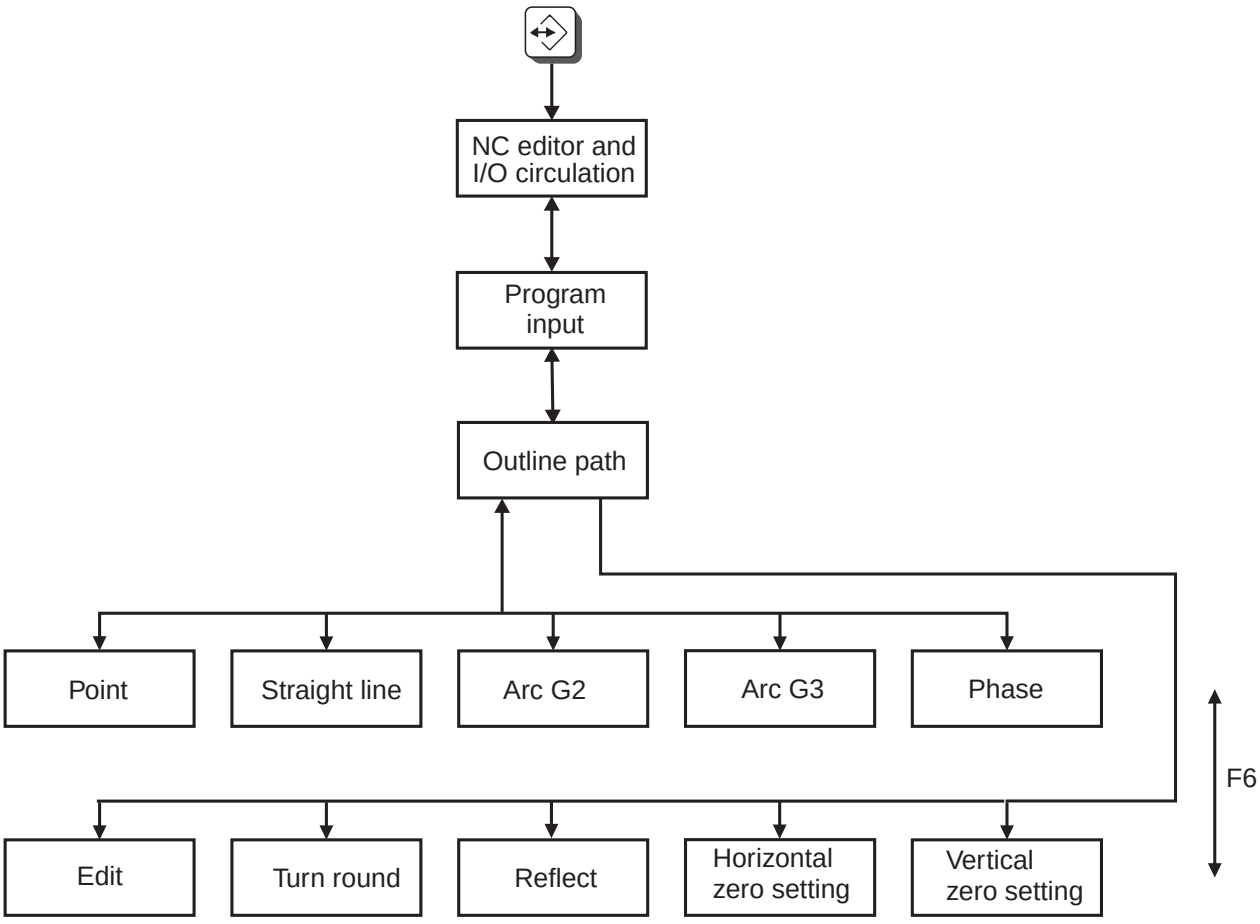
Subsequently the program is optimizeed by inserting feedrate, number of revolutions etc.

After reviewing the program and after a test run, the program is finished.

2.11 Program input with graphic support (outline path)

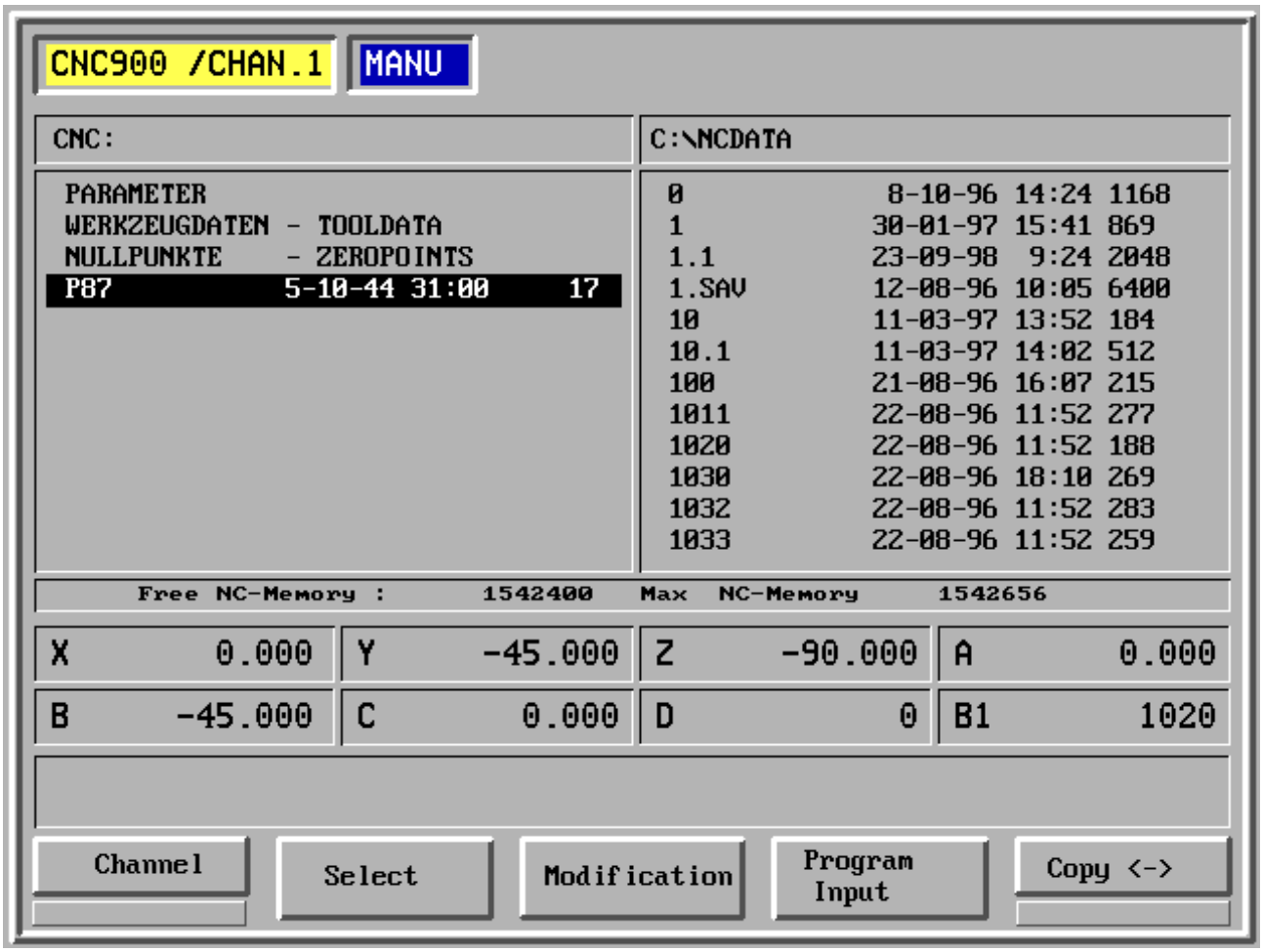
2.11.1 General

Menue tree



2.11.1 General (continued)

With pushing from key  the menu for NC programming seems.



F1 Channel

F2 Selection

F3 Adjustments

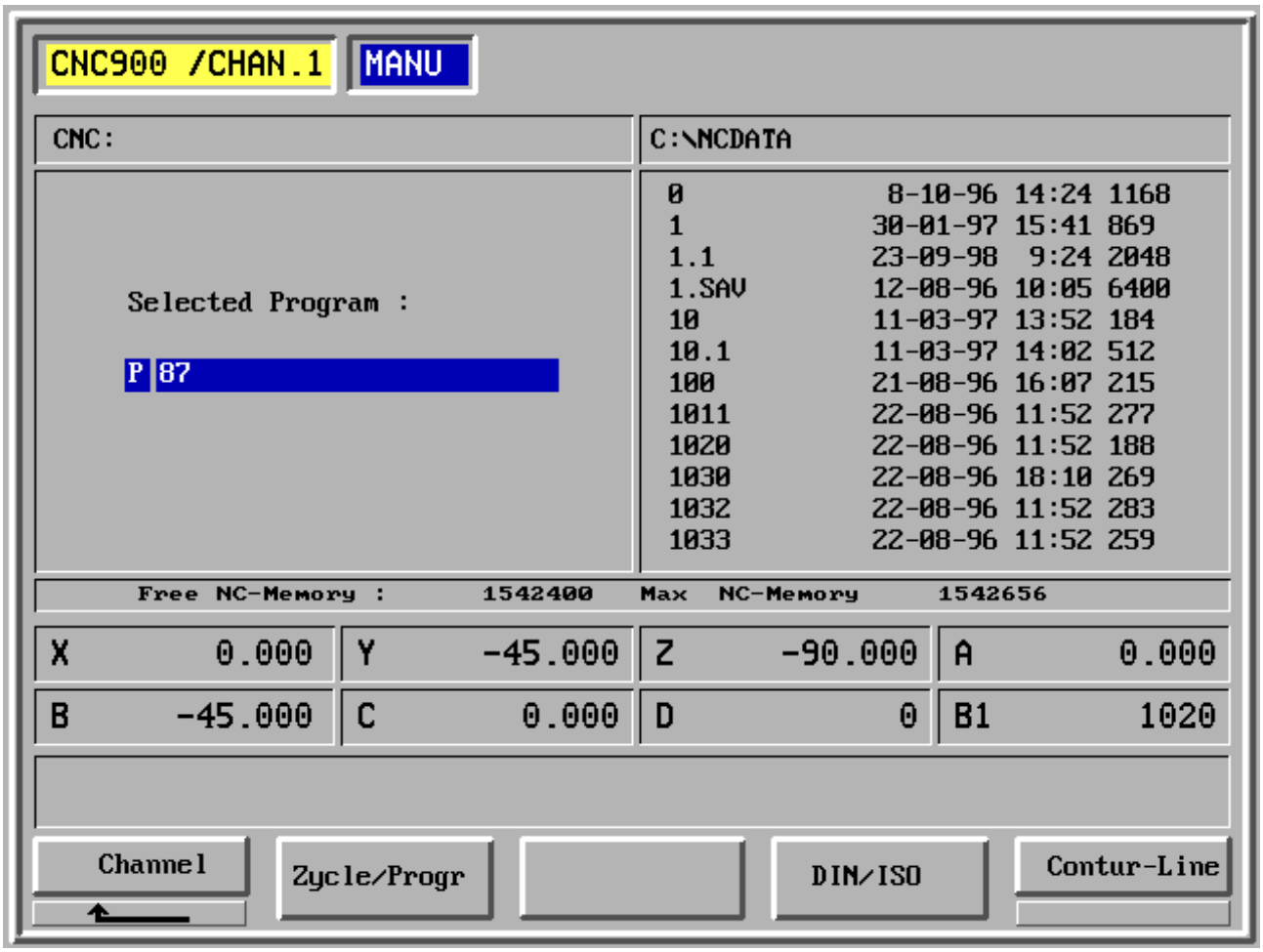
F4 Program input

F5 Copy <->

2.11.1 General (continued)

Program input

With pushing of key F4 (within the display frame) seems the program selection. The paragraph of a new program can be input with the numerical keyboard.



F1 Channel

F2 Cycle/program

F3 -

F4 Program input according to DIN / ISO

F5 Program input with outline path

2.11.1 General (continued)

With the cursor keys an existing program can be chosen or the number of a new program can be input with the numerical keyboard. After pressing the key F5, the picture with the coordinates appears.

With the keys (page up) and (page down), the picture can be enlarged or reduced (zoom function) for a better view.

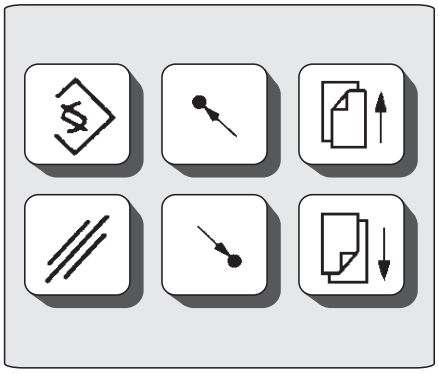
New outlines can be inserted continuously whereby a blue point is indicating the inserting place.

With the keys (Pos1) and (End) NC blocks can be moved forward and backward, they do then appear in red. Those moved NC blocks can be inserted or deleted with the keys (Change) or (Delete).

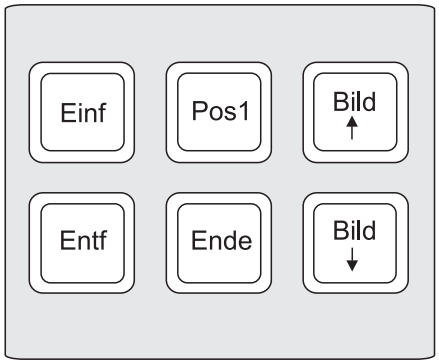
The block numbers are automatically numbered continuously (increased).

Max. 100 blocks can be programmed in a program with GPE.

Programming is finished and the program is stored with F7.



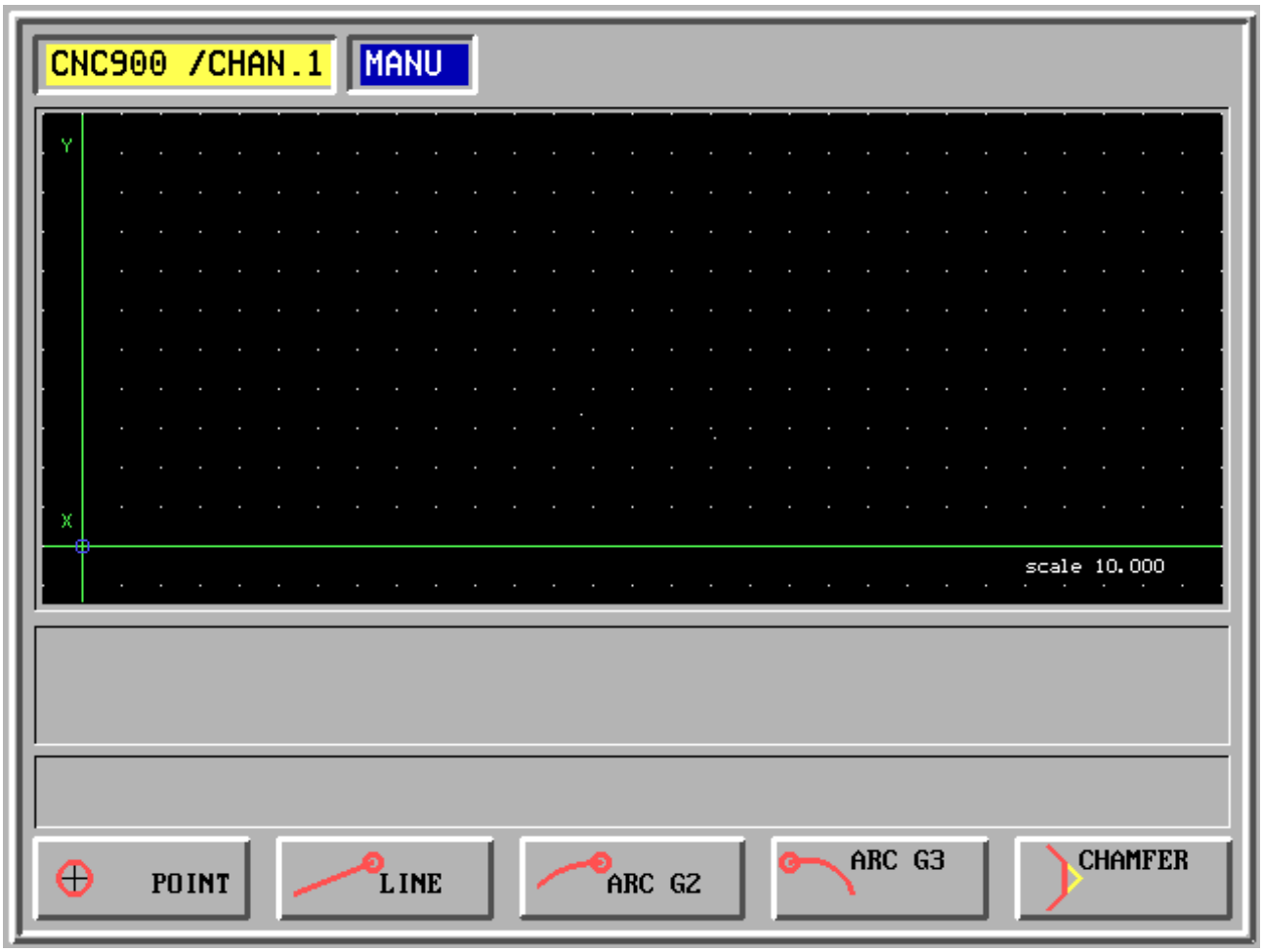
Key field operating panel



and suitable keys on the PC

2.11.1 General (continued)

Basic menu 1 (switch with F6)



F1 Insert point

F2 Insert straight line

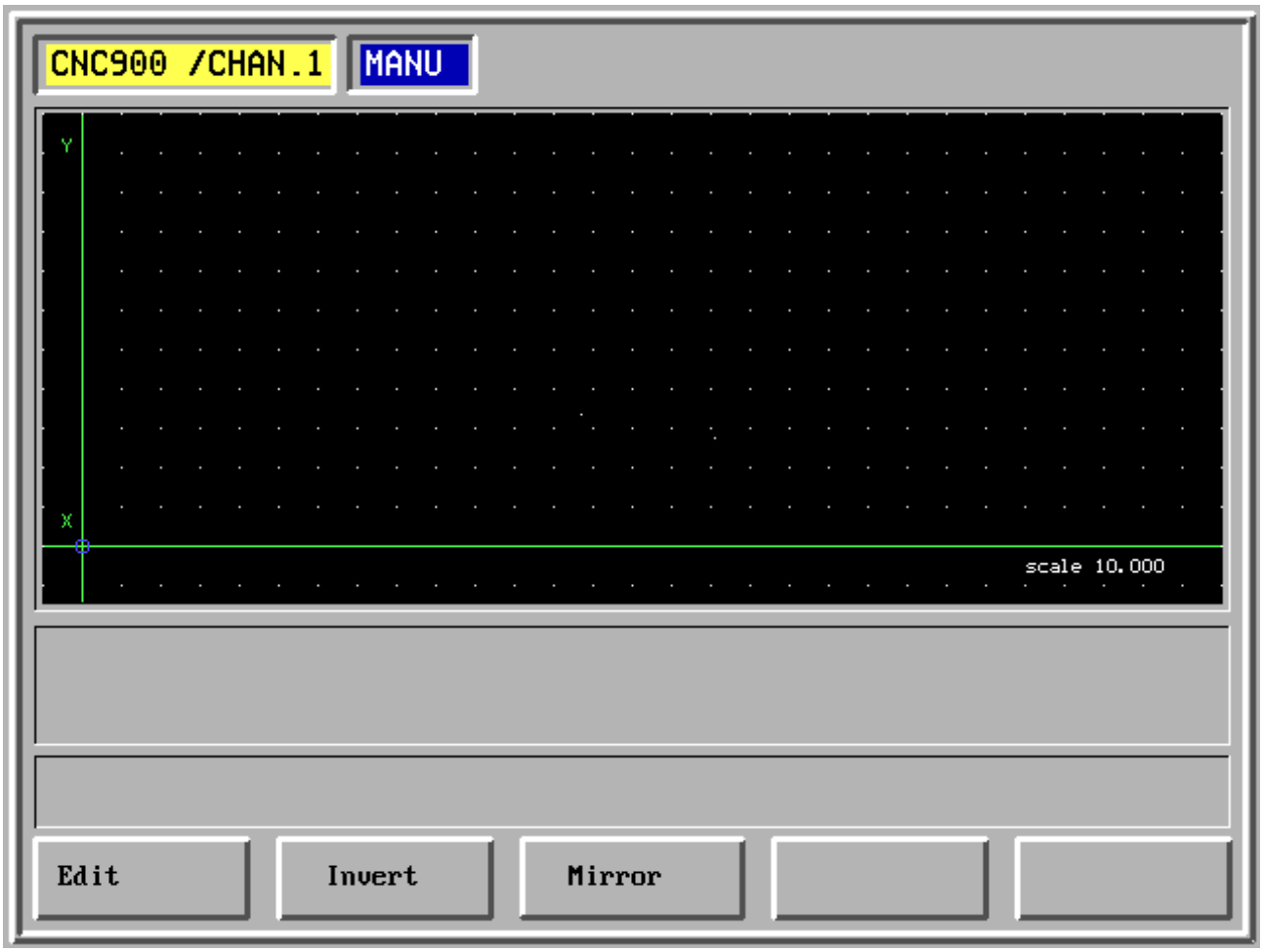
F3 Arc G2 (clockwise)

F4 Arc G3 (counter-clockwise)

F5 Insert phase and rounding

2.11.1 General (continued)

Basic menu 2 (switch with F6)



F1 Program edit with full function range (F, G, M etc.),
if a ASCII keyboard available actual

F2 Processing direction turn around

F5 Outline reflect

F4 Horizontal zero setting
F5 Vertically zero setting

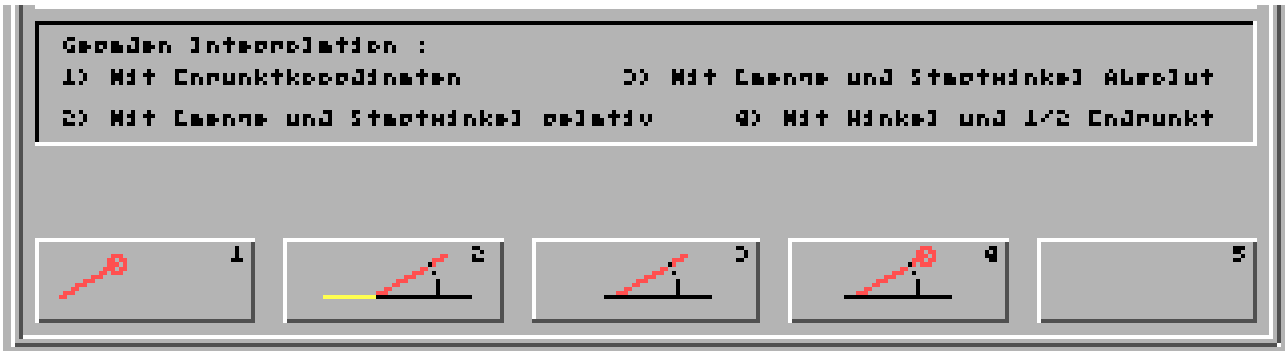
2.11.2 Inserting a point

With the numerical keyboard the coordinates of one point can be input and inserted with key  .

The input point is started with rapid traverse (G00).

2.11.3 Insert a straight line

With the numerical keyboard the coordinates of a straight line can be input and inserted with key  . One sets always at the blue point.



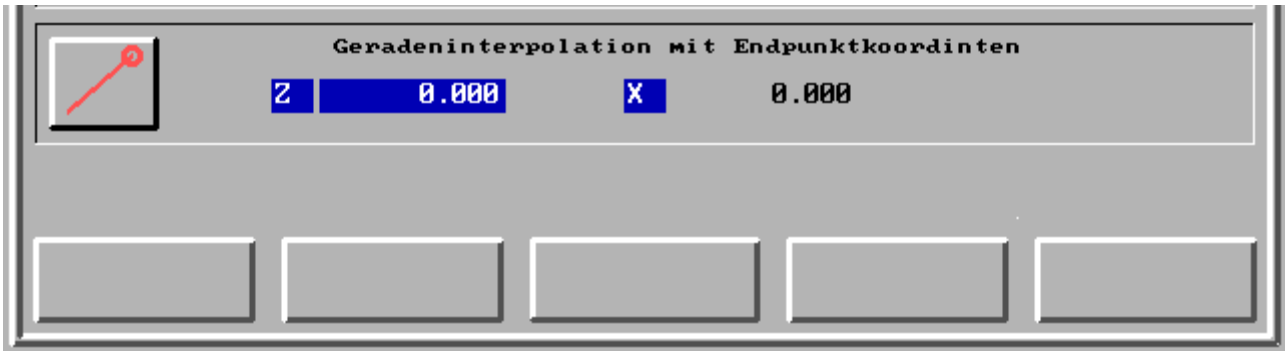
Selection of the different types of the straight line generation:

F1	Linear interpolation with Input of the terminator point coordinates
F2	Linear interpolation with Input of length and start angle relative
F3	Linear interpolation with Input of length and start angle absolutely
F4	Linear interpolation with Input of angle and 1/2 terminator point, i.e. that only one of the coordinates must be input. The coordinate input last is taken over.

2.11.3 Insert a straight line (continued)

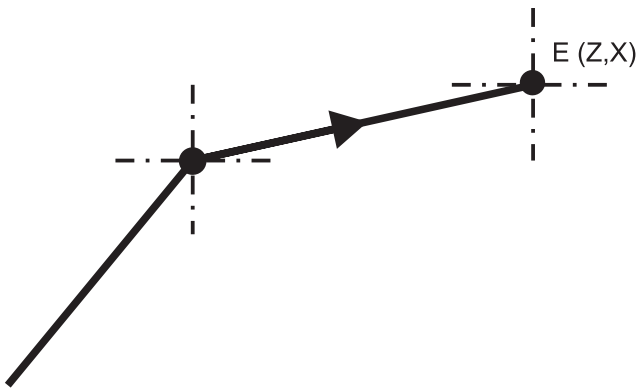
linear interpolation with Input of the terminator point coordinates

The terminator point coordinates input from the start point to a linear (G1) is inserted.



Linear interpolation with the terminator point coordinates (E) Z and X

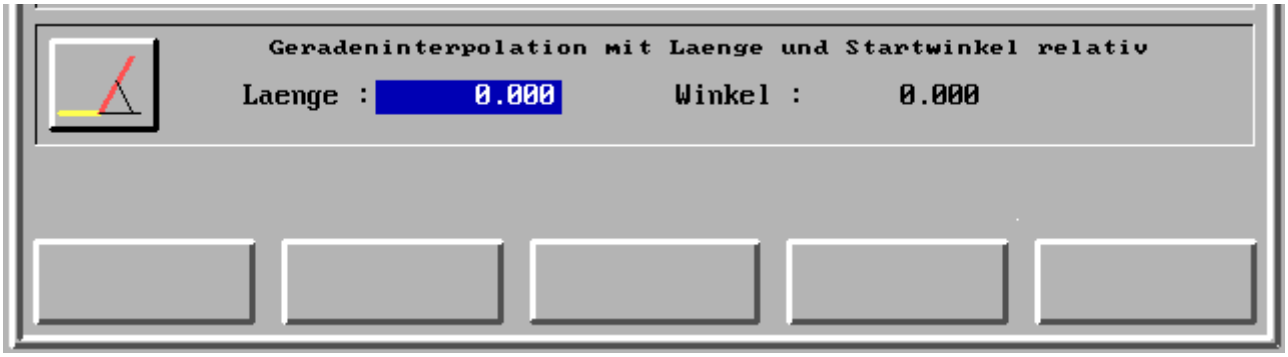
Example



2.11.3 Insert a straight line (continued)

linear interpolation with Input of length and start angle relative

A linear with length and start angle is relatively inserted by the start point.



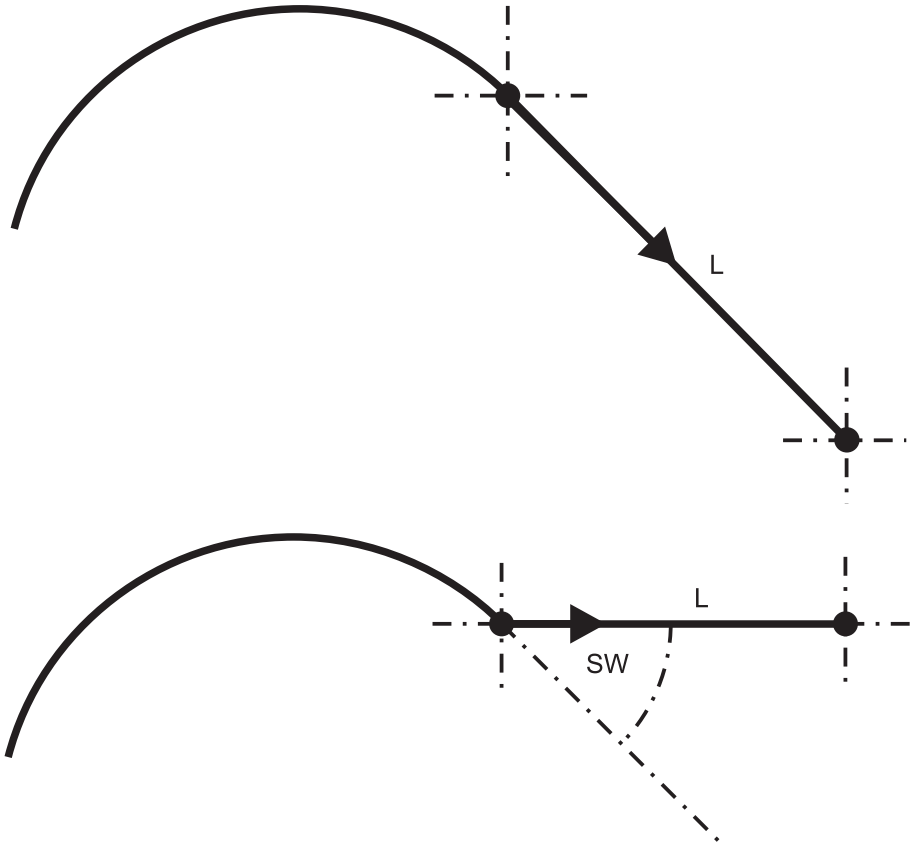
Linear interpolation
with length (l) and
Start angle (SW) relative
to the preceding block

Examples:

Angle relative 0°

i.e. tangential
to the preceding block

Angle relative 45°
to the preceding block



2.11.3 Insert a straight line (continued)

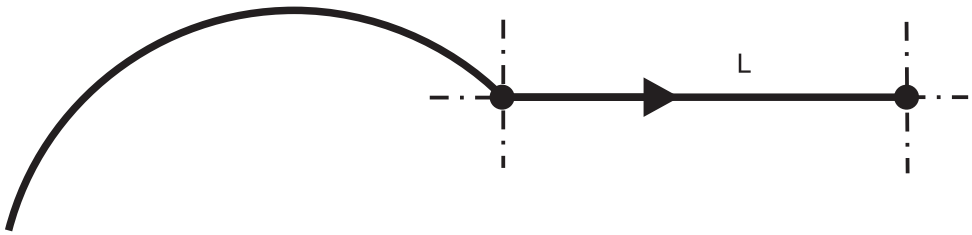
linear interpolation with Input of length and start angle absolutely

A linear with length and start angle is absolutely inserted by the start point.

Linear interpolation
with length (l) and final angle (EW) absolutely

Example:

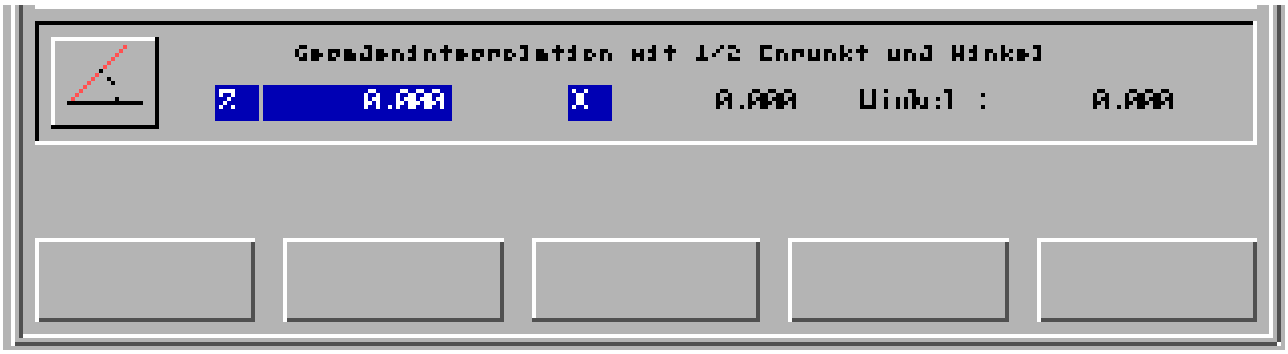
Angle absolutely 0°



2.11.3 Insert a straight line (continued)

linear interpolation with Input of final angle absolutely and 1/2 terminator point

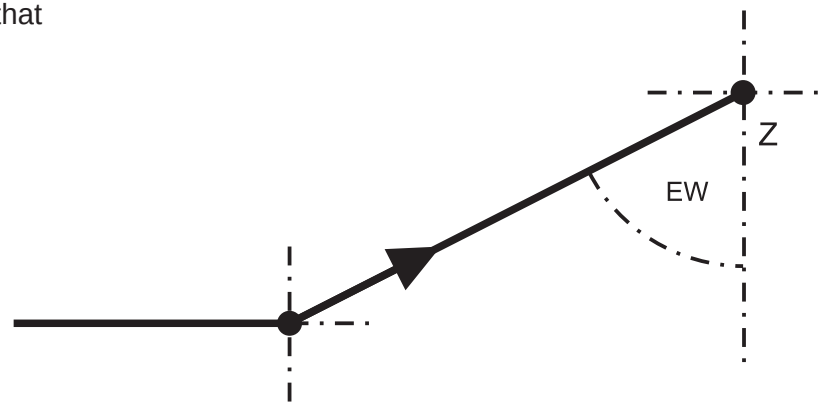
The terminator point coordinates with 1/2 terminator point and final angle, input from the start point to, absolutely a linear is inserted.



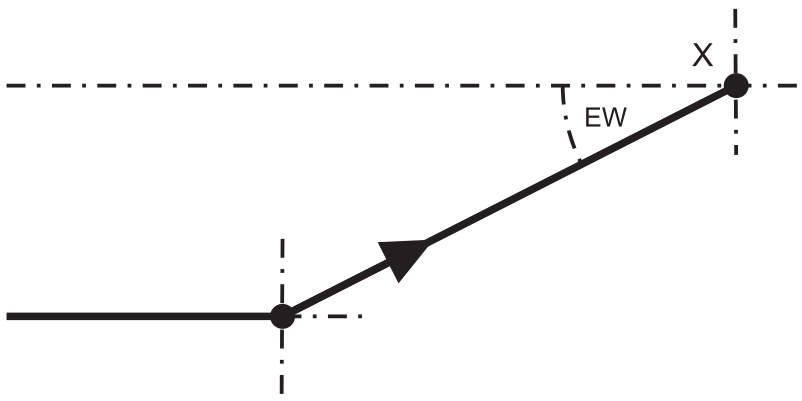
Linear interpolation
with 1/2 terminator point and final angle (EW) absolutely
The indicated angle actual of the final angles
the programmed straight lines with that
indicated direction in Z or X.

Examples:

Final angle absolutely 60° to Z



Final angle absolutely 30° to X



2.11.4 Inserting an arc

With the numerical keyboard the coordinates of an arc can be input and inserted with key  .
One sets always at the blue point.

F1 Circular interpolation with terminator point coordinates and radius

F2 Circular interpolation with terminator point and centre point

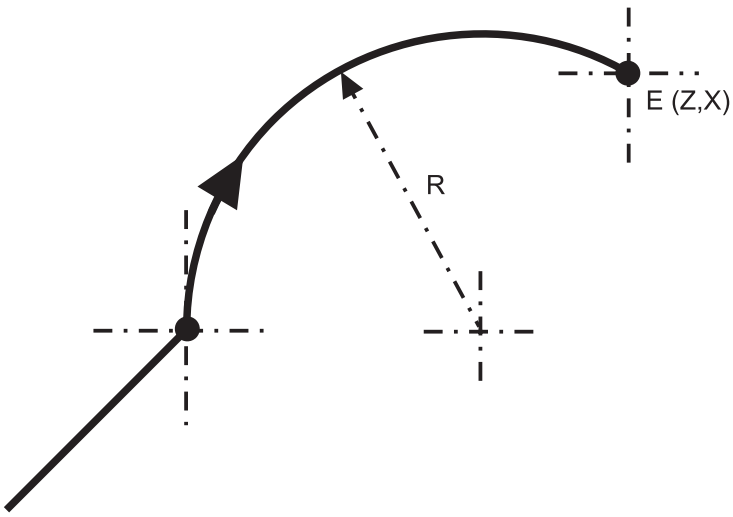
F3 Circular interpolation with radius and final angle

F4 Circular interpolation with radius and 1/2 terminator point
i.e. that only one of the coordinates must be input.
The coordinate input last is taken over.

2.11.4 Inserting an arc (continued)

Circular interpolation with terminator point coordinates and radius

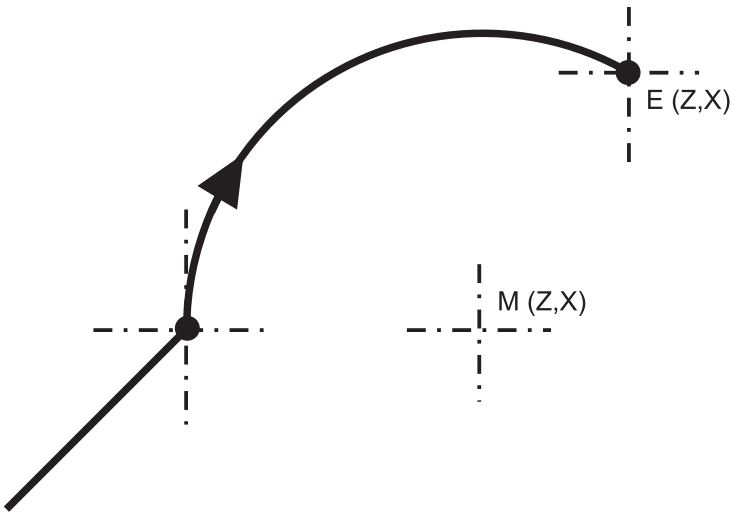
Circular interpolation in the clockwise direction
with terminator point coordinates (E) Z and X and radius (r)



2.11.4 Inserting an arc (continued)

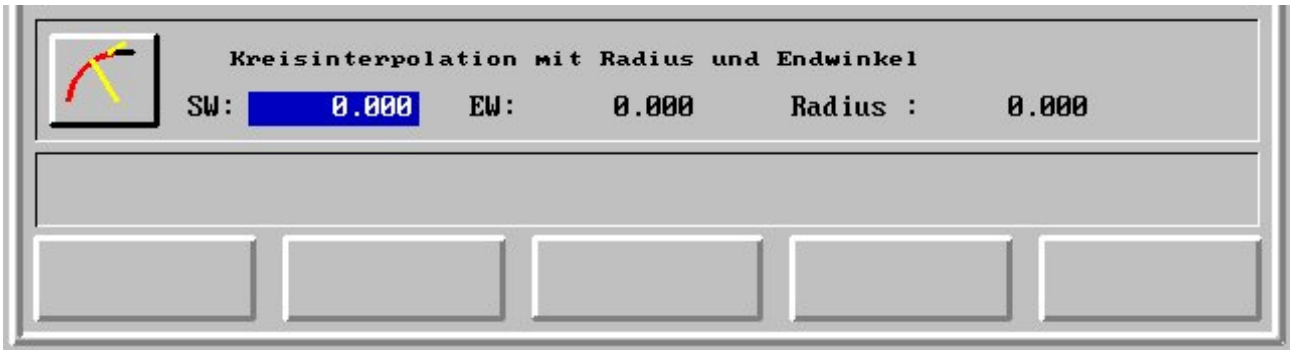
Circular interpolation with terminator point and centre point

Circular interpolation in the clockwise direction
with terminator point coordinates (E) Z and X
and Mittelpunkkoordinaten (m) Z and X

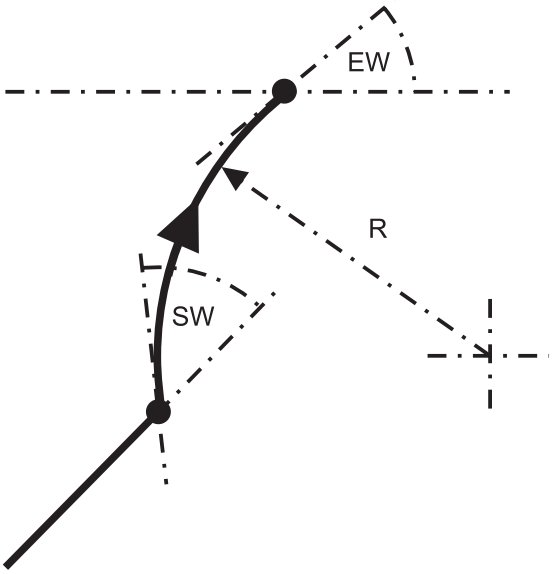


2.11.4 Inserting an arc (continued)

Circular interpolation with radius and final angle

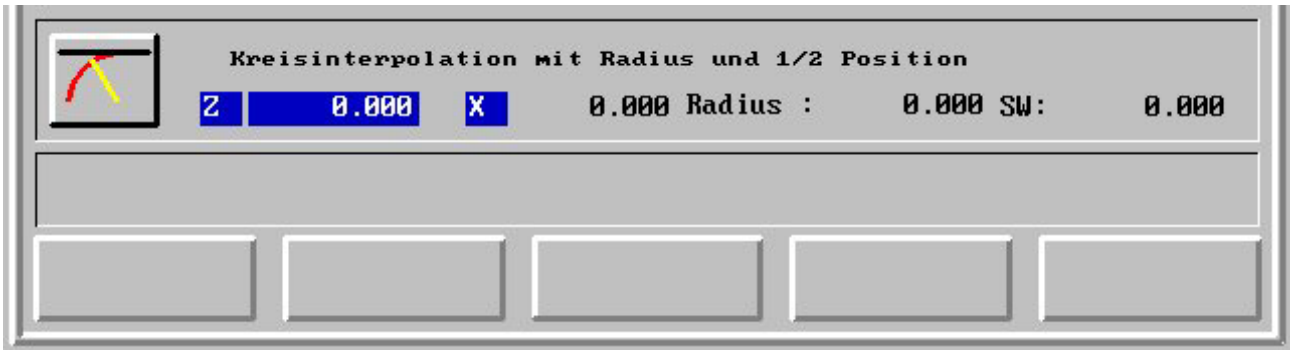


Circular interpolation in the clockwise direction
with radius (r) and start angle (SW) and final angle (EW)

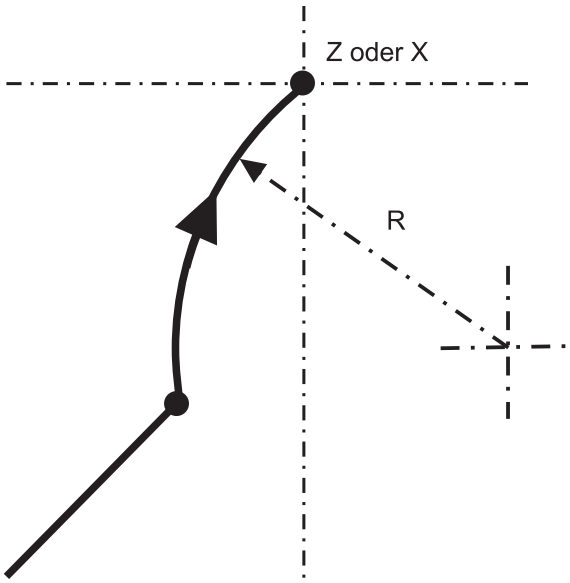


2.11.4 Inserting an arc (continued)

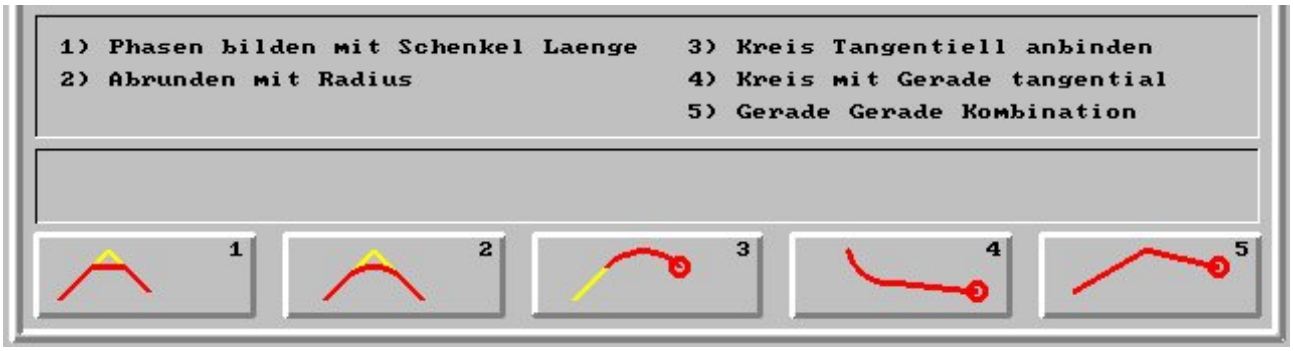
Circular interpolation with radius and 1/2 terminator point



Circular interpolation in the clockwise direction
with radius (r) and 1/2 final position (Z or X)



2.11.5 Inserting a chamfers or roundness



F1	Chamfers form with leg length
F2	Round off with radius
F3	Circle tangential tie up
F4	Circle with linear tangential
F5	Combination linear with linear

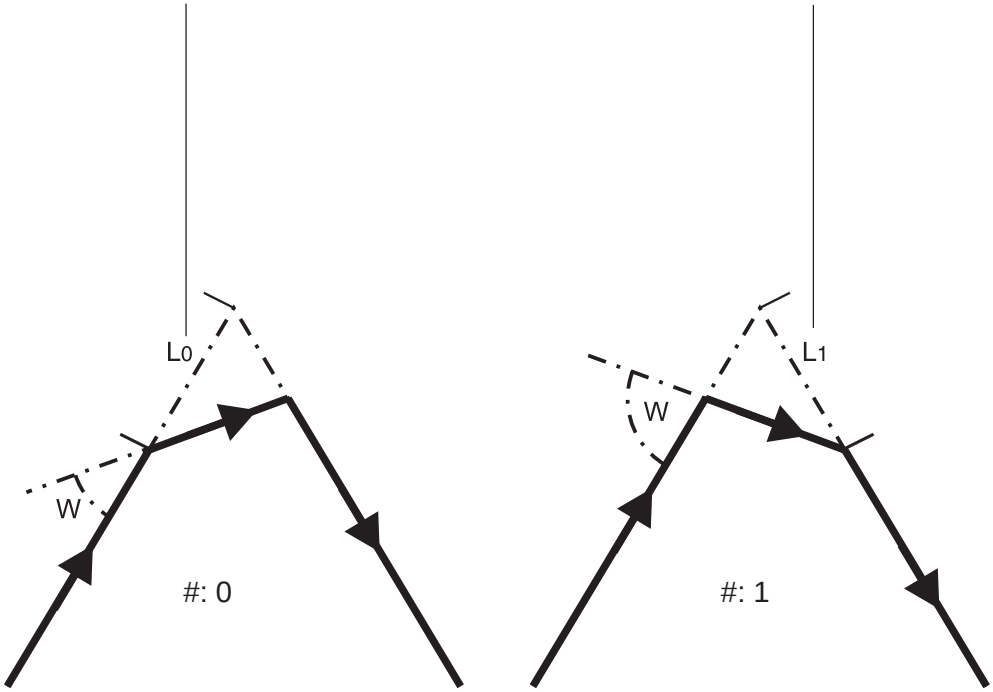
2.11.5 Inserting a chamfers or roundness (continued)

chamfers form with leg length

Chamfers at an edge with leg length and angle (w)

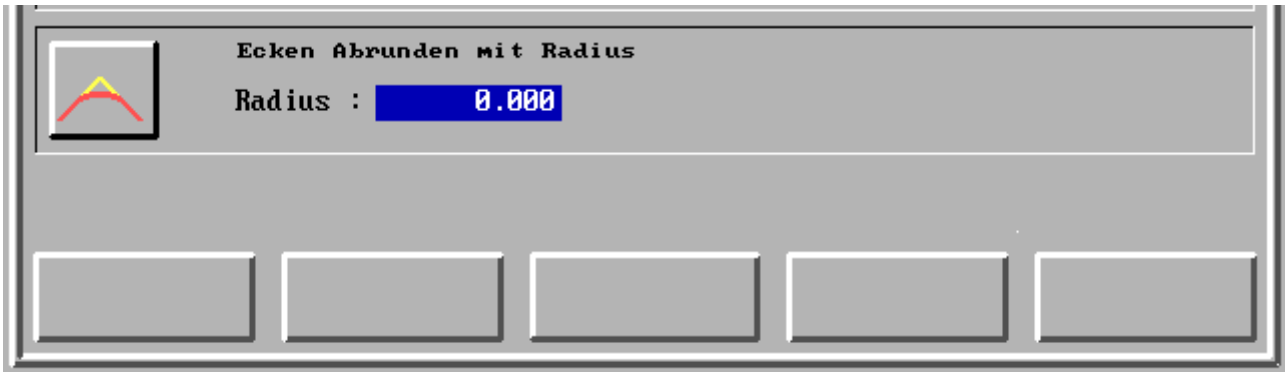
Selection of the length #: 0 1. Length #: 1 2. Length

Examples:



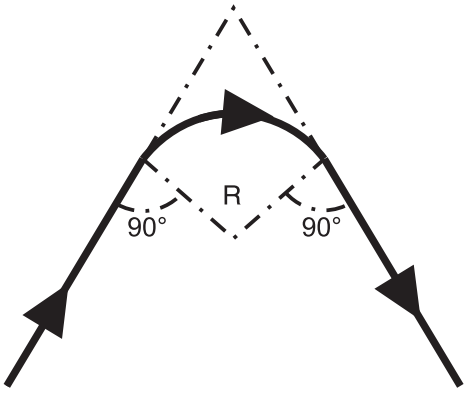
2.11.5 Inserting a chamfers or roundness (continued)

Rounding off with radius



Corner-round off with radius (r)

Example:



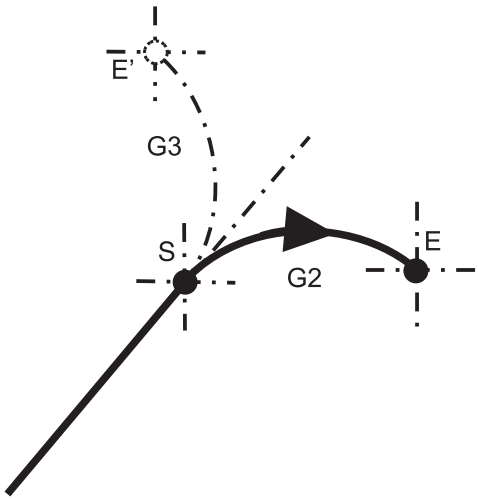
2.11.5 Inserting a chamfers or roundness (continued)

Circle tangential tie up

Circular interpolation with corner point and tagentieller binding

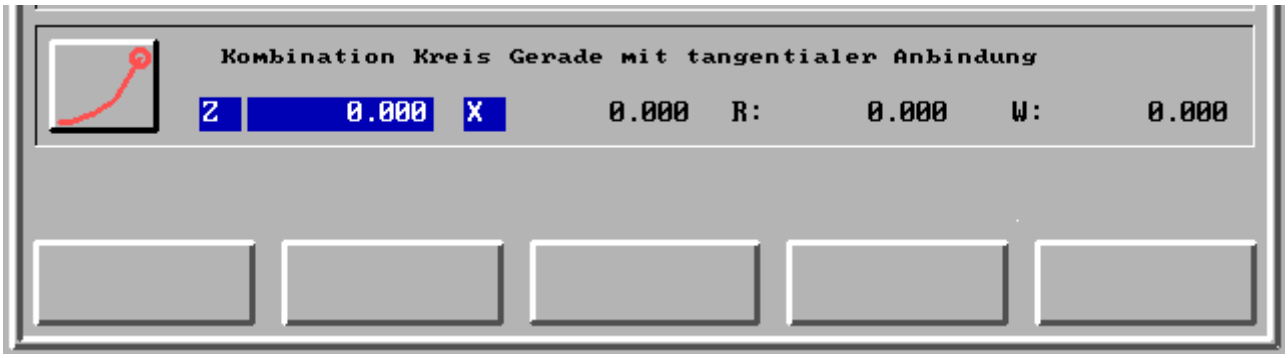
G2 or G3 become automatically
according to the position of the terminator point (E, E ‘) selected

Example:



2.11.5 Inserting a chamfers or roundness (continued)

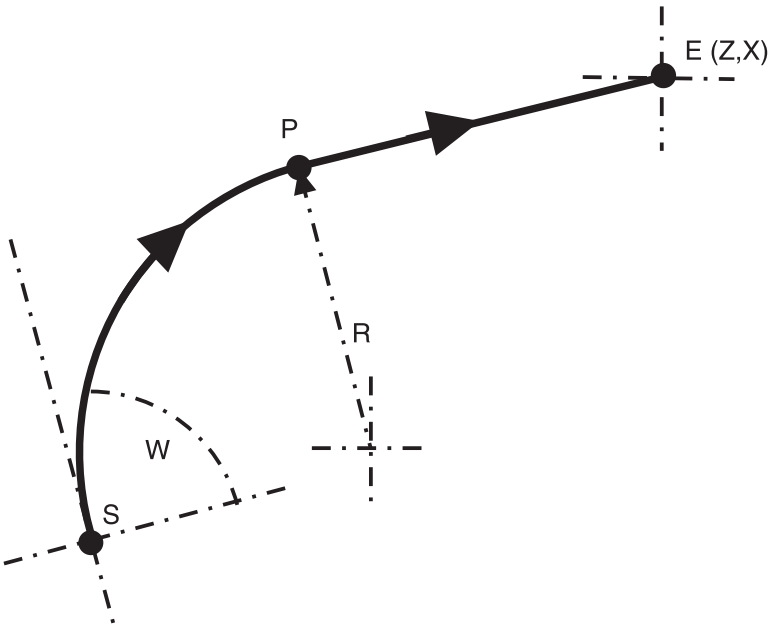
Circle with linear tangential



Combination circle - linear with tangential binding

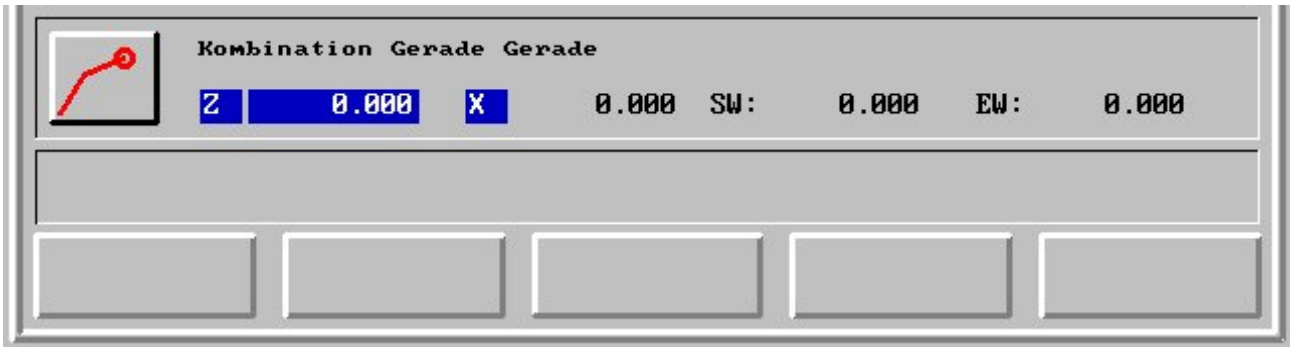
The position of the transition point (p) actual unknown.

Example:



2.11.5 Inserting a chamfers or roundness (continued)

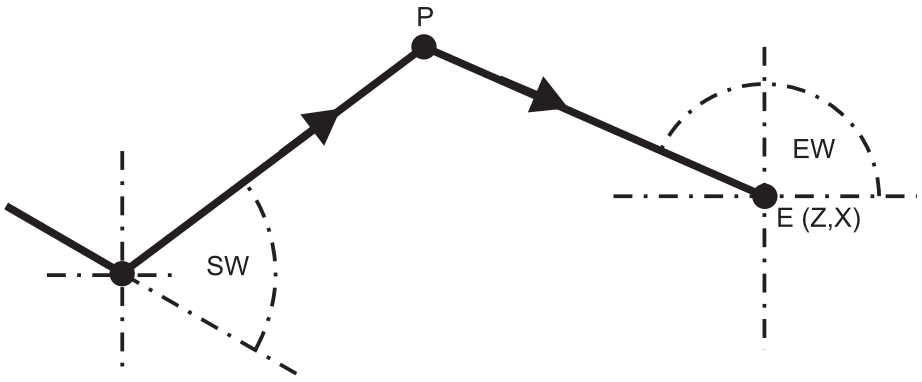
Combination linear - linear



Combination linear - linear
with start angle, final angle and
Terminator point with the coordinates Z and X
The start angle actual relative
to the preceding block.

The position of the transition point (p)
actual unknown.

Example:



2.11.6 Editing

If the processing direction determined, still the functions (F, T, G, M) know actual are inserted into the program.

F1 Program edit with full function range (F, T, G, M, P etc.), if a ASCII keyboard available actual

F2 Processing direction turn around

F3 Mirrors (in both axes)

F4 Horizontal zeros (settings the white point on zero)

F5 Vertically zeros (settings the white point on zero)

2.11.6 Editing (continued)

Program edit with full function range

The program can with full function range (F, T, G, M, P etc..) are edited,
if a ASCII keyboard available actual