

Rexroth PNC V7.3 Operating Instructions Diagnostics Tools

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Operating Instructions



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Operating Instructions
Diagnostics Tools

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1 Safety Instructions

Please read this manual before you start working with the PNC control unit. Store this manual in a place to which all users have access at any time.

1.1 Intended use

This manual contains all information required for the proper use of the control units. For reasons of clarity, however, it cannot contain each and every detail about each and all combinations of functions. Likewise, it is impossible to consider each and any aspect of integration or operation.

The PNC control is used to


- activate feed drives, spindles and auxiliary axes of a machine tool via SERCOS interface for the purpose of guiding a processing tool along a programmed path to process a workpiece (CNC). Furthermore, I/O components are required for the integrated PLC which – in communication with the actual CNC – controls the machine processing cycles holistically and acts as a technical safety monitor.
- program contours and the processing technology (path feedrate, spindle speed, tool change) of a workpiece.

Any other application is deemed improper use!

The products described

- have been developed, manufactured, tested and documented in compliance with the safety standards. These products normally pose no danger to persons or property if they are used in accordance with the handling stipulations and safety notes prescribed for their configuration, mounting, and proper operation.
- comply with the requirements of
 - the EMC Directives (89/336/EEC, 93/68/EEC and 93/44/EEC)
 - the Low-Voltage Directive (73/23/EEC)
 - the harmonized standards EN 50081-2 and EN 50082-2
- are designed for operation in industrial environments, i.e.
 - no direct connection to public low-voltage power supply,
 - connection to the medium- or high-voltage system via a transformer.

In residential environments, in trade and commerce as well as small enterprises class A equipment may only be used if the following warning is attached:

 **This is a Class A device. In a residential area, this device may cause radio interference. In such case, the user may be required to introduce suitable countermeasures, and to bear the cost of the same.**

The faultless, safe functioning of the product requires proper transport, storage, erection and installation as well as careful operation.

Safety Instructions

1.2 Qualified personnel

The requirements as to qualified personnel depend on the qualification profiles described by ZVEI (central association of the electrical industry) and VDMA (association of German machine and plant builders) in:

Weiterbildung in der Automatisierungstechnik

edited by: ZVEI and VDMA

MaschinenbauVerlag

Postfach 71 08 64

D-60498 Frankfurt.

The present manual is designed for **NC professionals** who need special knowledge and skills with regard to operating processing functions.

Programming, start and operation as well as the modification of programs or program parameters may only be performed by properly trained personnel! This personnel must be able to judge potential hazards arising from programming, program changes and in general from the mechanical, electrical, or electronic equipment.

Interventions in the hardware and software of our products, unless described otherwise in this manual, are reserved to our specialized personnel.

Tampering with the hardware or software, ignoring warning signs attached to the components, or non-compliance with the warning notes given in this manual may result in serious bodily injury or material damage.

Only electrotechnicians as recognized under IEV 826-09-01 (modified) who are familiar with the contents of this manual may install and service the products described.

Such personnel are

- those who, being well trained and experienced in their field and familiar with the relevant norms, are able to analyze the jobs being carried out and recognize any hazards which may have arisen.
- those who have acquired the same amount of expert knowledge through years of experience that would normally be acquired through formal technical training.

With regard to the foregoing, please note our comprehensive range of training courses. Please visit our website at

<http://www.boschrexroth.com>

for the latest information concerning training courses, teachware and training systems. Personal information is available from our Didactic Center Erbach,

Telephone: (+49) (0) 60 62 78-600.

Safety Instructions

1.3 Safety markings on products

Warning of dangerous electrical voltage!



Warning of danger caused by batteries!



Electrostatically sensitive components!



Warning of hazardous light emissions
(optical fiber cable emissions)!



Disconnect mains power before opening!



Lug for connecting PE conductor only!



Connection of shield conductor only

Safety Instructions

1.4 Safety instructions in this manual



DANGEROUS ELECTRICAL VOLTAGE

This symbol is used to warn of a **dangerous electrical voltage**. The failure to observe the instructions in this manual in whole or in part may result in **personal injury**.



DANGER

This symbol is used wherever insufficient or lacking compliance with instructions may result in **personal injury**.



CAUTION

This symbol is used wherever insufficient or lacking compliance with instructions may result in **damage to equipment or data files**.

☞ This symbol is used to draw the user's attention to special circumstances.

★ This symbol is used if user activities are required.

Safety Instructions

1.5 Safety instructions for the described product**DANGER**

Danger of life through inadequate EMERGENCY-STOP devices! EMERGENCY-STOP devices must be active and within reach in all system modes. Releasing an EMERGENCY-STOP device must not result in an uncontrolled restart of the system!

First check the EMERGENCY-STOP circuit, then switch the system on!

**DANGER**

Incorrect or undesired axis movement!

First, new programs should be tested carefully without axis movement! For this purpose, the control offers the possibility of inhibiting axis movements and/or auxiliary function outputs by appropriate softkeys in the 'Automatic' mode.

**DANGER**

Incorrect or undesired control unit response!

Rexroth accepts no liability for damage resulting from the execution of an NC program, an individual NC block or the manual movement of axes!

Furthermore, Rexroth accepts no liability for consequential damage which could have been avoided by programming the PLC appropriately!

**DANGER**

Retrofits or modifications may adversely affect the safety of the products described!

The consequences may include severe injury, damage to equipment, or environmental hazards. Possible retrofits or modifications to the system using third-party equipment therefore have to be approved by Rexroth.

**DANGEROUS ELECTRICAL VOLTAGE**

Unless described otherwise, maintenance works must be performed on inactive systems! The system must be protected against unauthorized or accidental reclosing.

Measuring or test activities on the live system are reserved to qualified electrical personnel!

Safety Instructions



DANGER

Tool or axis movements!

Feed and spindle motors generate very powerful mechanical forces and can accelerate very quickly due to their high dynamics.

- **Always stay outside the danger area of an active machine tool!**
 - **Never deactivate safety-relevant functions!**
 - **Report any malfunction of the unit to your servicing and repairs department immediately!**
-



CAUTION

Use only spare parts approved by Rexroth!



CAUTION

Danger to the module!

All ESD protection measures must be observed when using the module! Prevent electrostatic discharges!

The following protective measures must be observed for modules and components sensitive to electrostatic discharge (ESD)!

- Personnel responsible for storage, transport, and handling must have training in ESD protection.
- ESD-sensitive components must be stored and transported in the prescribed protective packaging.
- ESD-sensitive components may only be handled at special ESD-workplaces.
- Personnel, working surfaces, as well as all equipment and tools which may come into contact with ESD-sensitive components must have the same potential (e.g. by grounding).
- Wear an approved grounding bracelet. The grounding bracelet must be connected with the working surface through a cable with an integrated 1 M Ω resistor.
- ESD-sensitive components may by no means come into contact with chargeable objects, including most plastic materials.
- When ESD-sensitive components are installed in or removed from equipment, the equipment must be de-energized.

Safety Instructions

1.6 Documentation, software release and trademarks**Documentation**

The present manual provides information on the operation of the diagnostics tools in the PNC control unit.

Overview of available documentation	Part no.			
	German	English	French	Italian
PNC-R – Connectivity Manual for project engineering and maintenance	1070 073704	1070 073736	–	–
PNC-R – Software installation	1070 073796	1070 073797	–	–
PNC-P – Connectivity Manual	1070 073880	1070 073881	–	–
PNC-P – BF2xxT/BF3xxT Control Panel Connectivity Manual	1070 073814	1070 073824	–	–
PNC-P – Software installation	1070 073882	1070 073883	–	–
Description of functions	1070 073870	1070 073871	–	–
MACODA Operation and configuration of the machine parameters	1070 073705	1070 073742	–	–
Operating instructions – Standard operator interface	1070 073726	1070 073739	1070 073876	1070 073887
Operating instructions – Diagnostics Tools	1070 073779	1070 073780	–	–
Error Messages	1070 073798	1070 073799	–	–
PLC project planning manual (V8.x), Software interfaces of the integrated PLC	1070 073728	1070 073741	–	–
PLC project planning manual (V10.x, PNC-P only), Software interfaces of the integrated PLC	R911307968	R911307969	–	–
iPCL system description and programming manual	1070 073874	1070 073875	–	–
ICL700 system description (PNC-R only), Program structure of the integrated PLC ICL700	1070 073706	1070 073737	–	–
DIN programming manual for programming to DIN 66025	1070 073725	1070 073738	1070 073888	1070 073886
CPL programming manual	1070 073727	1070 073740	1070 073877	1070 073885
CPL Debugger Operating Instructions	1070 073872	–	–	–
Tool Management – Parameterization	1070 073782	1070 073793	–	–
Drive oscilloscope, Operation and programming	1070 073878	–	–	–
Software PLC Development environment for Windows NT	1070 073783	1070 073792	–	–
Measuring cycles for touch-trigger switching probes	1070 073788	1070 073789	–	–
Universal Milling Cycles	–	1070 073795	–	–

Safety Instructions

Release

 **This manual refers to the following version:**
Software release: V7.3

The current release number of the individual software modules can be viewed by selecting the 'Control-Diagnostics' softkey in the 'Diagnostics' operating mode.

The software version of Windows may be displayed as follows:

1. Click the right mouse button on the **My Computer** icon on your desktop.
2. Select **Properties**.

Trademarks

All trademarks of software installed on Rexroth products upon delivery are the property of the respective manufacturer.

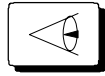
Upon delivery, all installed software is copyright-protected. The software may only be reproduced with the approval of Rexroth or in accordance with the license agreement of the respective manufacturer.

MS-DOS® and Windows™ are registered trademarks of Microsoft Corporation.

PROFIBUS® is a registered trademark of the PROFIBUS Nutzerorganisation e.V. (user organization).

SERCOS interface™ is a registered trademark of the SERCOS interface Joint VDW/ZVEI Working Committee.

2 Diagnostics Tools



These operating instructions “**Diagnostics Tools**” provide information on the functions offered by the **Diagnosis** main mode of the standard operator interface of the PNC.

 **The present manual supplements the “Diagnosis” section of the “Rexroth PNC Operating Instructions – Standard Operator Interface”.**

The “Diagnostics Tools” chapter describes the functionality of the PNC from the machine operator’s point of view. Questions such as “What do I have to do in order to...” or “How can I...” are answered here.

Functions specific to machines (such as coolant ON/OFF or the loading and unloading of tools) are not described here. These operating instructions, therefore, do not describe all functions on the machine.

You will require the user and development documentation if you want to configure the operator interface of the PNC control unit to suit your requirements. If you encounter any special problems in handling the control that are not described in this manual, or not in sufficient detail, please contact your nearest Rexroth Service Office or our Customer Service.

Overview

This section comprises the following Diagnostics Tools of the “Diagnosis” main mode:

- logic analyzer
- set diagnosis memory
- axis oscilloscope
- contour display
- drive oscilloscope
- SERCOS monitor
- PC logbook

The softkey operation sequence is displayed for this purpose. This sequence enables you to reach a specified function via the individual operating levels.

Diagnostics Tools

☞ **The following functions of the "Diagnosis" main mode are described in detail in the "Rexroth PNC Operating Instructions – Standard Operator Interface":**

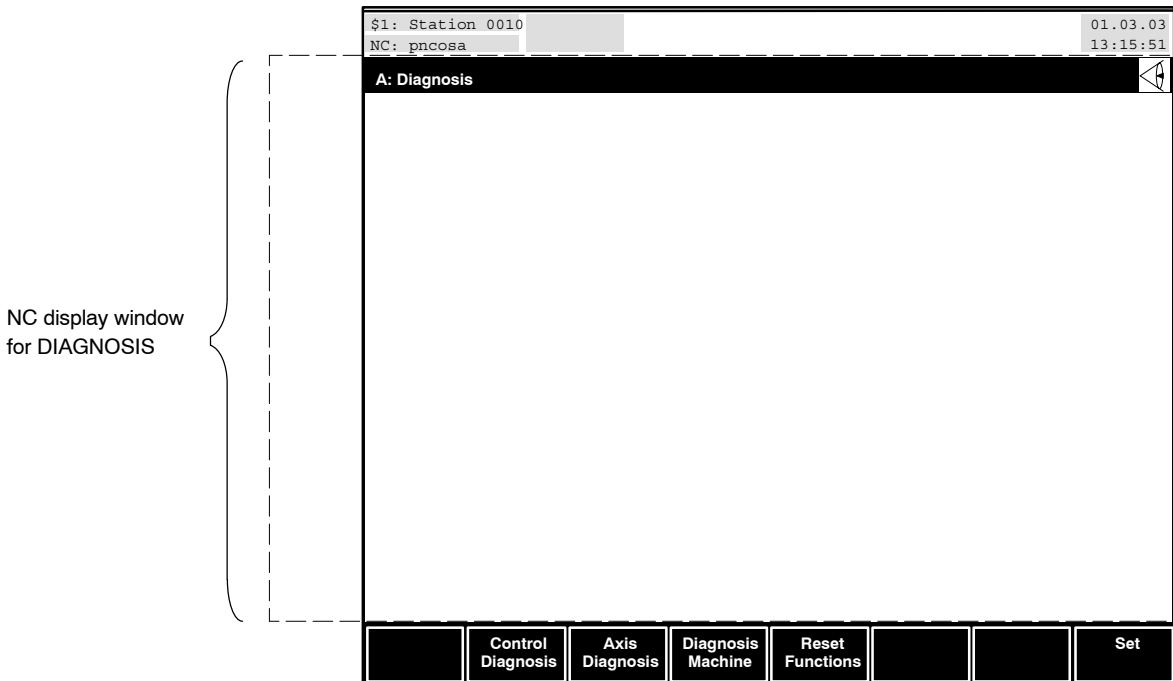
- display software version
- release control reset
- set time, screen colours, function key assignments, language
- adjustment of the CNC to the system environment (MACODA)
- machine status display (MSD)
- display I/O status of PLC and CNC signals
- PLC monitor (currently not available)

Please look in the index of the "Rexroth PNC Operating Instructions – Standard Operator Interface" under "Softkey" if you require information about one particular softkey only. The page on which the respective softkey is described can be found there.

☞ **Knowledge in respect of the structure of softkeys and dialog boxes is absolutely necessary in order to be able to operate the PNC.**

For basic information, please refer to section "Operator interface" in the manual "Rexroth PNC Operating Instructions – Standard Operator Interface".

Basic display of the "Diagnosis" main mode



Diagnostics is not channel-specific, i.e. all displays and operations in the NC display window of the "Diagnosis" main mode are independent of the currently active channel.

Diagnostics Tools

**DANGER**

If operation is carried out by insufficiently trained or inexperienced personnel, serious damage to the machine, drives, tools, workpieces or even to persons could occur!

First test the programs thoroughly without axis movement. The control unit provides the “General Inhibit” softkey in the “Automatic” main mode. If the function of the softkey is activated, no axis movement, directly initiated by a part program, takes place.

Rexroth accepts no liability for damage resulting from the execution of an NC or CPL program, an individual NC block or from manual traversing of axes!

Rexroth also accepts no liability for damage which could have been avoided by programming the PLC appropriately!

Logic analyzer

2.1 Logic analyzer

The logic analyzer is used for diagnostics or trouble shooting within the PLC.

Additional external measuring instruments and their wiring are not necessary. Approx. 20 kB free RAM memory should be available in the control unit before calling up the logic analyzer.

Data can be recorded at the following positions:

- Inputs I 0.0 to I 8191.7
- Outputs O 0.0 to O 8191.7
- Markers M 0.0 to M 8191.7
- Special markers SM 0.0 to SM 31.7
- Timers T 0 to T 255
- Data buffers DB 0.0 to DB 511.7
- Data fields DF 0.0 to DF 32767.7
- Data words from data modules

In these cases up to

- 16 individual bit signals and
 - 8 individual byte, word and double word signals
- can be recorded simultaneously.

Extremely flexible trigger options can be used to influence the beginning and end of recording.

The shortest possible sampling time corresponds to **one PLC cycle**.

The PLC saves all measured values in an internal memory during the course of a measuring process. This measured data memory operates as a ring memory: when the available memory area has been filled, the oldest measured value is overwritten by the newly added value.

The occurrence of the start trigger condition activates the actual measuring process. The measured data memory is refilled again completely (no more than once) by the time the end trigger condition occurs. The recording then stops automatically.

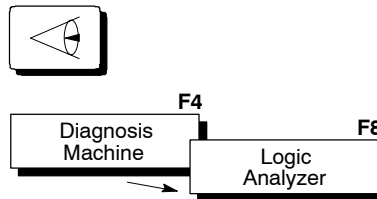
The PNC copies the contents of the PLC measured data memory into the "test.la" (size: approx. 15 kB) file upon conclusion of the measuring process and stores it in the root directory.

- ★ Execution of the measuring process:
1. Start logic analyzer (refer to section 2.1.1)
 2. Select measuring points (refer to section 2.1.2)
 3. Set sampling time (refer to section 2.1.3)
 4. Set trigger conditions (refer to section 2.1.4)
 5. Start recording (refer to section 2.1.1, "Start Recording" softkey)
 6. Graphically display the measured values (refer to section 2.1.5), or save them in a file for subsequent evaluation (refer to section 2.1.6).

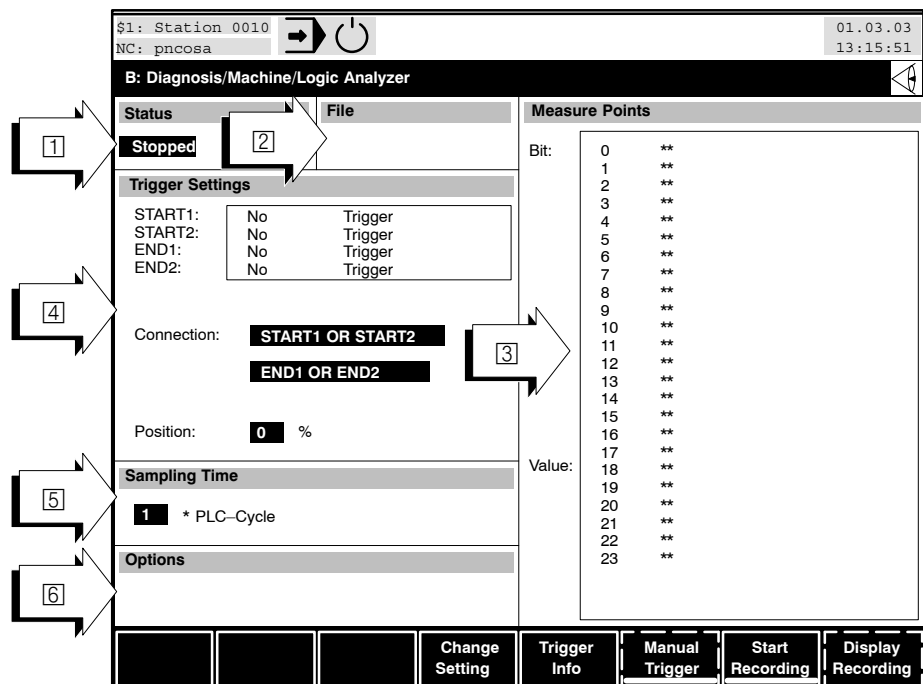
Logic analyzer

2.1.1 Starting logic analyzer

Selection:



The following monitor display appears:



1 The PNC displays the current status of the logic analyzer in the “Status” area:

- Stopped:** No measured data is being recorded. The logic analyzer is in wait status.
- Running:** Recording has been started. The PLC constantly saves measured data in the ring memory. A specific trigger event has not yet occurred.
- Recording:** The start trigger event has occurred. The measured data memory is filled completely once or is filled until the end trigger event occurs.
- Save:** The measuring process is terminated. All measured data is currently being downloaded from the PLC and saved in the “test.la” file in the root directory.

2 currently unavailable

Logic analyzer

- ③ The “Measure Points” area displays all measuring points which can be specified within a list select field. 16 individual bit signals (measuring point numbers 0 to 15) and 8 individual byte, word or double word signals (measuring point numbers 16 to 23) can be simultaneously assigned to measuring points 0 to 23. The sequence of the assignment is definable. Information on how to assign signals to individual measuring points can be found in section 2.1.2, “Setting measuring points”.
- ④ The area informs you of the currently active trigger and its logical operation. You can obtain exact specifications on the trigger parameters by pressing the “Trigger Info” softkey. Refer to section 2.1.4 for information on setting the triggers.
- ⑤ Indicates the set sampling time.
- ⑥ Currently unavailable

At this point you can



- **return to the previous operating level** with the level return key.
- **set signals, sampling times and triggers.** Refer to sections 2.1.2, 2.1.3 and 2.1.4.
- **display information on all trigger parameters.** The PNC displays which of the 4 triggers are active and how they are connected in the logic analyzer screen area ④.

The control unit opens the “Trigger Information” display box when the “Trigger Info” softkey is pressed. You can see,

- which signal type (e.g. bit, byte, word, dword)
- which address (e.g. “I0.1”) and
- which data value (the logical status of high or low in the case of bit signals) has been assigned to the individual triggers. If the character string “*****” is displayed under a trigger name, the trigger has not yet been assigned a signal.



- **release the “Manual Trigger” trigger event.** This softkey can only be selected if the trigger condition “Manual Trigger” has been set and the recording has already been started (refer to the “Start Recording” softkey).

The recording status changes to “Recording”. The PLC measured data memory is refilled again completely (no more than once) by the time the end trigger condition occurs.



- **start the measuring process.** The recording status changes to “Running” and the softkey text changes to “Cancel Recording”. The PLC constantly saves measured data in the ring memory and waits for the possible occurrence of the set start trigger event.

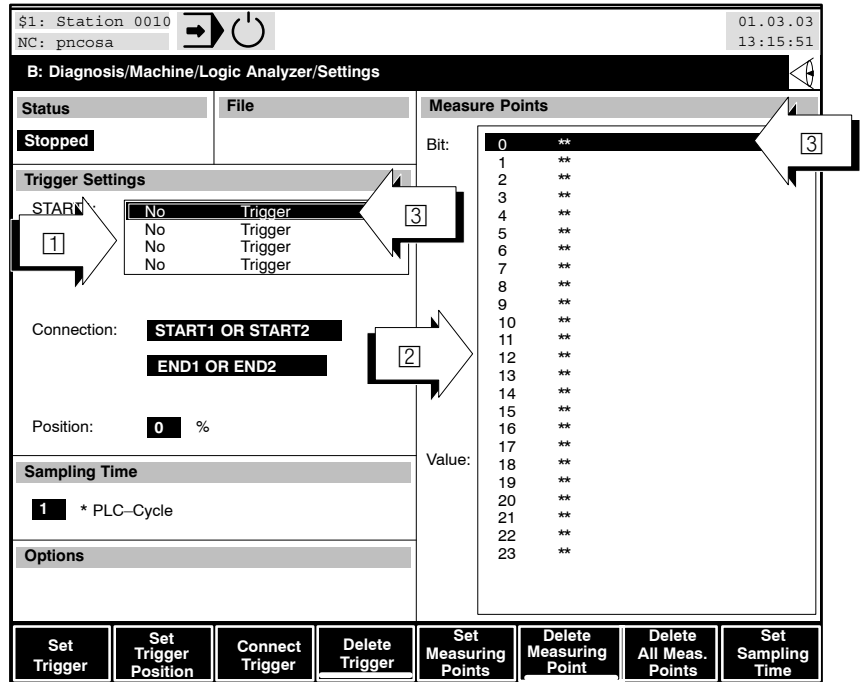
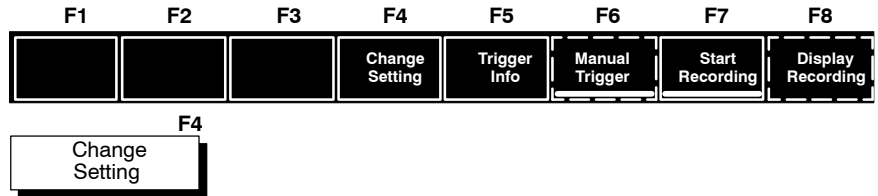


- **graphically display a measuring process which has already been correctly concluded.** Refer to section 2.1.5 for further information.

Logic analyzer

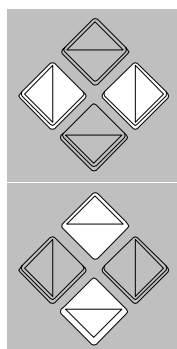
2.1.2 Setting measuring points

Selection:



The PNC activates the selection frames (3) of both the “Trigger Settings” (1) and the “Measure Points” (2) list select fields.

► Select the measuring point



1. You can toggle between both list select fields with the <tab> or <⬅> and <➡> keys.
You select the **list select field “Measure Points”** (2) in this way.

2. You can now select the measuring point to which a signal is to be assigned by pressing the <⬆> and <⬇> keys.

Please note that **measuring points 0 to 15 can only be assigned bit signals** and measuring points 16 to 23 only byte, word or double word signals. The sequence of the assignment is definable.

Logic analyzer



At this point you can **return to the previous operating level** with the level return key.



- delete the assignment of the currently selected measuring point

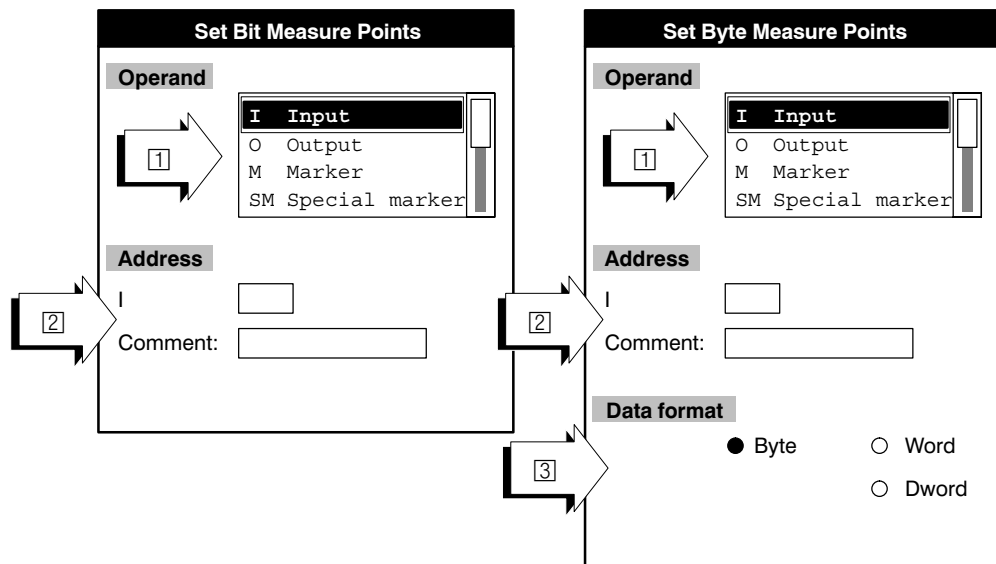


- delete the assignment of all measuring points



- set the assignment of the currently selected measuring point.

The PNC opens either the “Set Bit Measuring Points” or “Set Byte Measuring Points” dialog box, depending on the previously selected measuring point (for bit signals or for byte, word and double word signals):



1 In this select field, you should select whether the signal of a(n)

- input or output
- marker or special marker
- time operand or data buffer
- data field or data word

should be measured.

The corresponding operand abbreviations (I, O, M, SM etc.) appear under the “Address” text in accordance with the current selection.

2 Indicate the signal (operand) address. In the case of bit signals, the address must be entered in the following form: **byte number.bit number** (e.g. “2.0”). In the case of byte signals, the byte number (e.g. “2”) is sufficient.

You can enter a character string which describes the signal in the “Comment” input field.

Logic analyzer

If you have selected the “Data word” operand, the DM (data module) input field also appears right of the address input field. Enter the corresponding data module number:

iPCL: 0 ... 1023

KNS: 0 ... 246

(Number depends on size, refer to Software PLC manual)

ICL700: 0 ... 511

③ Select the data format.

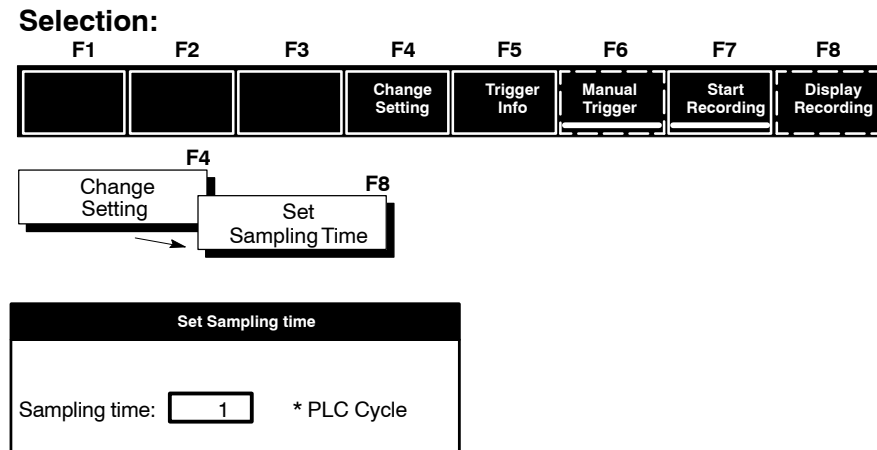
- Byte: 8 bit length
- Word: 16 bit length
- DWord: 32 bit length

When the “OK” softkey is pressed, the PNC activates the data and displays it in the “Measure Points” list select field, to the right of the measuring point number. Bit signals are marked with the letter “b” and byte signals with “B”, “W” or “D”, depending on the data format (refer to ③).

Cancel the “Set Measuring Points” function by pressing the level return key.

Logic analyzer


2.1.3 Setting sampling time



The shortest possible sampling time corresponds to one PLC cycle. This sampling time is pre-set as the default value. Other sampling times can be set as integer multiples of a PLC cycle.

 **The diagnosis memory has a fixed size that cannot be changed. Therefore, only the sample time can be increased to extend the recording time, which is associated with lower accuracy.**

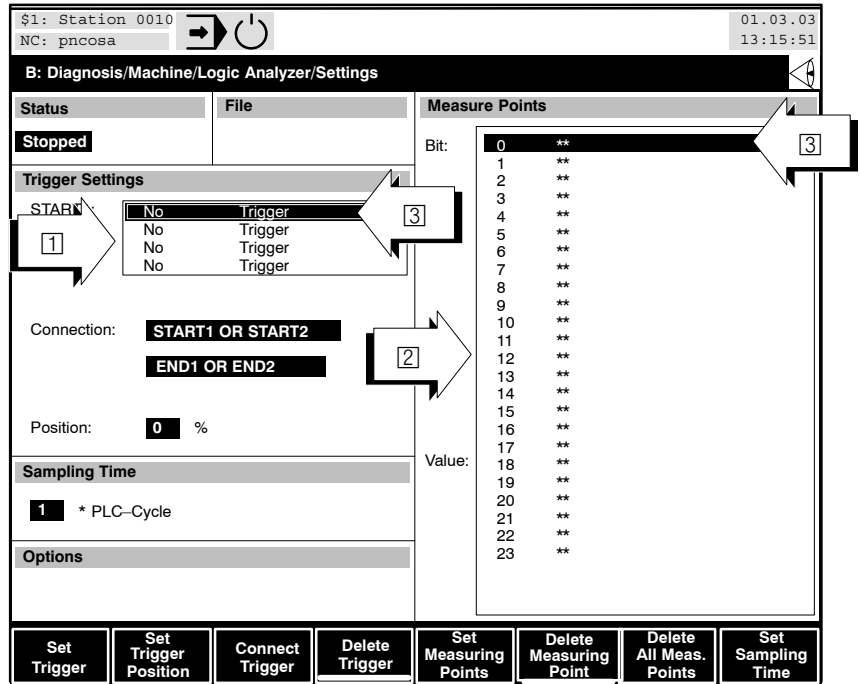
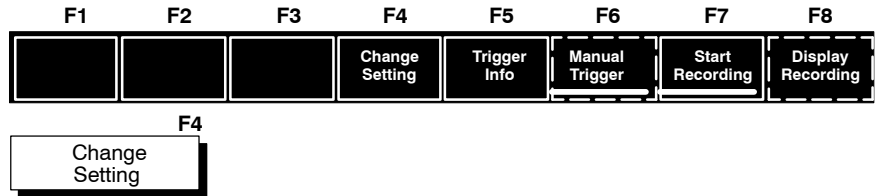
The amount of time necessary for a PLC cycle is not generally constant, due to the fact that varying program strings or modules could be run through, depending on the current signal status. At each sampling stage the PLC, therefore, saves its own system time in addition to the actual measured values. These times will be subsequently indicated as the current cursor positions when the measured values are displayed.

 **The resolution of the internal PLC system time is 2 ms. It is therefore possible that measured values which have been recorded at intervals of less than 2 ms may be displayed with identical times.**

Logic analyzer

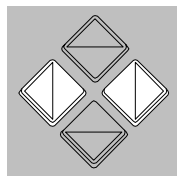
2.1.4 Setting triggers

Selection:

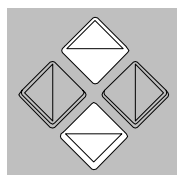


The PNC activates the selection frames (3) of both the “Trigger Settings” 1 and the “Measure Points” (2) list select fields.

► Selecting the trigger



1. You can toggle between both list select fields with the <tab> or <◀> and <▶> keys.
Select the “Trigger Settings” list select field (1) using this method.



2. You can now select the desired trigger by pressing the <▲> and <▼> keys.
2 start triggers and 2 end triggers are available to you. Both start triggers and both end triggers can be logically linked in various ways (refer to “Connect Trigger” softkey).
You may define any sequence of the trigger settings.

Logic analyzer



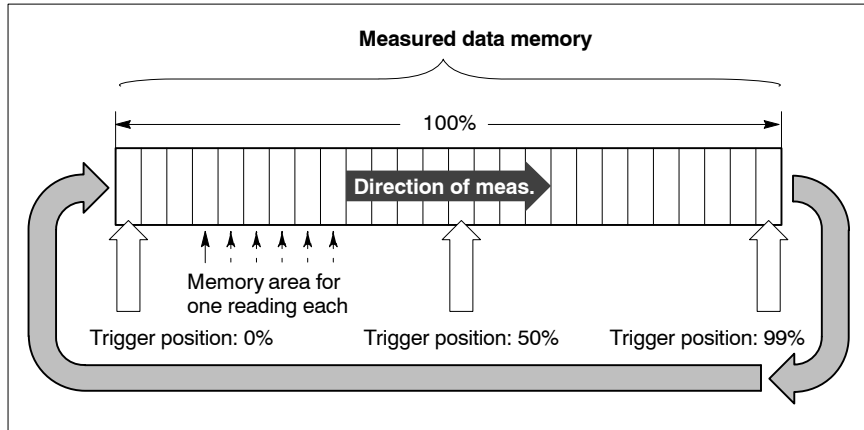
At this point you can:



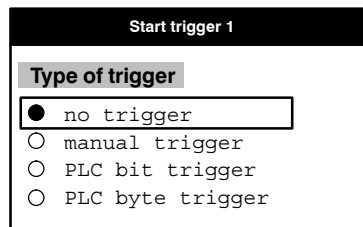
- return to the previous operating level with the level return key.
- delete the setting of the currently selected trigger



- set the trigger position. You can determine how many measured values already in the measured data memory should be maintained when the valid trigger occurs. Enter a value between 0 and 99 % in relation to this complete measured data memory.



- set currently selected trigger (START1, START2, END1 or END2). The PNC opens the “Start Trigger/End Trigger x” dialog box:



- no trigger: deactivate trigger
- manual trigger: release the trigger by pressing the “Manual Trigger ”softkey
- PLC bit trigger: release trigger with a bit signal
- PLC byte trigger: release trigger with a (decimal) value
- Select the desired type of trigger with the <▲> and <▼> keys and press the <sel> or <space> keys. Then acknowledge using the “OK” softkey or cancel with the level return key.
- If “No Trigger” or “Manual Trigger” has been set, the setting has been concluded and the PNC returns to the previous operating level.

Logic analyzer

- If the “PLC Bit Trigger” or the “PLC Byte Trigger” has been set, a further box opens in which additional information on the trigger is queried.
The “PLC Bit Trigger” and the “PLC Byte Trigger” dialog boxes differ in structure. Please refer to the following diagrams.

Dialog box for the PLC bit trigger:
Dialog box for the PLC byte trigger:

1 In this select field, you should select whether the signal of a(n)

- input or output
- marker or special marker
- time operand or data buffer
- data field or data word

should be measured.

The corresponding operand abbreviations (I, O, M, SM etc.) appear under the “Address” text in accordance with the current selection.

Logic analyzer

- ② Indicate the signal (operand) address. In the case of a PLC bit signals, the address has to be entered in the following form: **byte number.bit number** (e.g. "2.0"). In the case of PLC byte signals, the byte number (e.g. "2") is sufficient.

You can enter a character string which describes the trigger signals in the "Comment" input field. If you have selected the "Data word" operand, the DM (data module) input field also appears to the right of the address input field. Indicate the corresponding data module number:

iPCL: 0 ... 1023

KNS: 0 ... 246

(Number depends on size, refer to Software PLC manual)

ICL700: 0 ... 511

- ③ Specification of the trigger conditions. In the case of a PLC bit trigger, triggering can take place for the High or Low level of the operand. If you are using a PLC byte trigger, select one of the conditions

"=" (equal),

"<", ">" (less than, greater than)

"<=", ">=" (less-equal, greater-equal).

The condition relates to the value specified in ④.

- ④ Specify the decimal value to be triggered for the set signal (only in the case of the PLC byte trigger). The range of values depends on the defined data format (refer to ⑤):

- Byte: 8 bit length Input range: -128 to 127
- Word: 16 bit length Input range: -32768 to 32767
- Dword: 32 bit length Input range:

The radio buttons are only displayed in the case of byte measuring points.

- ⑤ Select the data format of the trigger word (only in the case of the PLC byte trigger):

- Byte: 8 bit length
- Word: 16 bit length
- Dword: 32 bit length

Pressing the "OK" softkey causes the PNC to activate the trigger settings, to close all dialog boxes and to return to the previous operating level.

Close the "PLC Bit Trigger" dialog box or the "PLC Byte Trigger" dialog box and return to the "Start Trigger/End Trigger x" dialog box by pressing the level return key.



- **Logically links** the available **triggers**.

The control unit opens the "Connect Trigger" dialog box in which you can connect:

- the START1 and START2 triggers with AND or OR and
- the END1 and END2 triggers with AND or OR.

Logic analyzer

- AND operation: Triggering occurs, if **both** triggers become logically true.
OR operation: Triggering occurs, if **one of the two** triggers becomes logically true.

☞ **Please take care to select logical trigger settings.**

The following trigger settings would be illogical or can never be fulfilled:

- (Start1==Manual) && (Start2==Manual)
- (End1==Manual) && (End2==Manual)
- (Start1==Manual) && (Start2==no trigger): Condition is never fulfilled

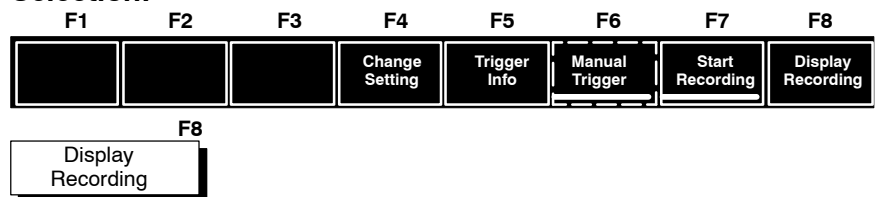
Example:

Trigger setting: (Start1==Manual) && (Start2==Manual)
(End1==Manual) && (End2==Manual)

This trigger setting would have the following effects:

- Pressing the softkey for the first time does not have any effect yet.
- The start condition would be satisfied only after the softkey is pressed the second time; the logic analyzer indicates "Recording".
- Pressing the softkey for the third time does not have any effect.
- With the softkey pressed the fourth time, measuring will be terminated.

2.1.5 Displaying recordings

Selection:

The display form depends on the recorded signals. 4 display forms are possible:

- 1 **max. of 8 bit signals** on measuring points 0 to 7; **no byte signals** on measuring point numbers 16 to 23
- 2 **max. of 16 bit signals** on measuring points 0 to 15; **no byte signals** on measuring point numbers 16 to 23
- 3 **max. of 8 bit signals** on measuring points 0 to 7; **at least one byte signal** on measuring point numbers 16 to 23

Logic analyzer

4 max. of 16 bit signals on measuring points 0 to 15; **at least one byte signal** on measuring point numbers 16 to 23

The display form **1** appears, if a maximum of 8 bit signals have been assigned to the measuring point numbers 0 to 7 and the measuring point numbers 16 to 23 have not been used.

The difference between this form and the display form **2** is merely the **number of displayed bit signals** (8 instead of 16 signal waves). This allows the signal level in the "Signal Wave" area to be more clearly displayed.

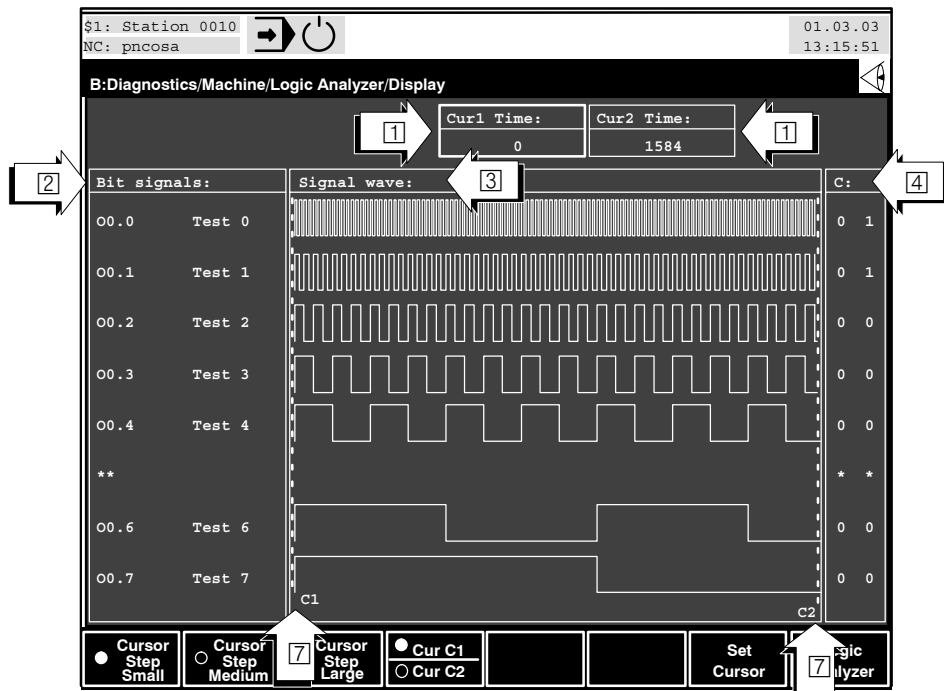
In the following description only the **1** display form is represented as the structure and functions of both forms are identical.

The display form **3** appears, if a maximum of 8 bit signals have been assigned to measuring point numbers 0 to 7 **and** at least **one** measuring point has been used in number area 16 to 23.

The difference between this form and the display form **4** is once again merely the number of displayed bit signals.

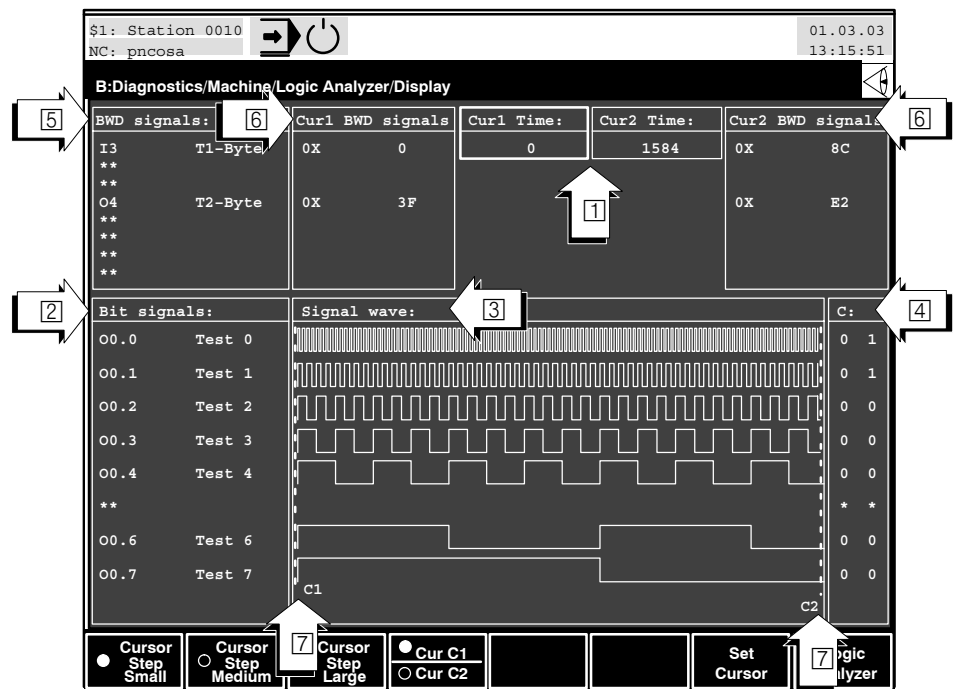
In the following description only the display form **3** is represented as the structure and functions of both forms are identical.

Display form 1:



Logic analyzer

Display form 3:



- 1 Time value of cursors C1 and C2 (for positions in signal curve, refer to 7). The currently active cursor is indicated by a thick border around the field 1 and the "Cur C1 / Cur C2" toggle softkey. The values relate to the start of the measuring process and have to be multiplied by 2 ms. The values correspond to the internal PLC system time. During the course of the reading, they are saved at each sampling stage together with the actual measured data. As the PLC's internal system time has a resolution of 2 ms, it is not possible to display measured values for shorter time intervals.
- 2 The PNC displays all bit signals with operand markings, addresses and comments in ascending measuring point order. Unused measuring points are marked with "***".
- 3 Temporal signal wave of all displayed bit signals in the area 2.
- 4 Indicates the logical status of all bit signals at both cursor positions. In the left column the level at C1 is displayed, in the the right column the level at C2.
- 5 The PNC shows you all byte, word and double word signals with operand markings, addresses and comments in ascending measuring point order. Unused measuring points are marked with "***".
- 6 Indicates the measured value of all byte, word and double word signals at both cursor positions C1 (Cur1) and C2 (Cur2). The values are displayed in hexadecimal form (marked by the leading string "0X").

Logic analyzer

Cursor markers C1 and C2 as broken, vertical lines within the “Signal Wave” area.

Optionally, it is possible to turn the background of the display window “black” or “white” using the key combinations <Control> + and <Control> + <w>, respectively.

You can now adapt the display and the cursor positions according to your requirements using the cursor function and the zooming function.

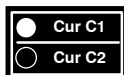
2.1.6 Cursor functions

2 cursor markers, in the form of broken, vertical lines which can be moved separately are available to you within the display. C1 is always located left of C2.

Accurate investigations within the PLC can be carried out using the cursor position numerical displays for time (area [1]), the logical status display for bit signals (area [4]) and the hexadecimal values for byte, word and double word signals (area [6]).

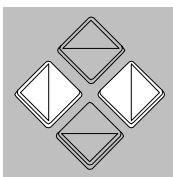
When the display is activated, the control unit sets C1 at the start trigger position and C2 at the end of the measurement (reading).

Cursor selection



You select the cursor to be moved using the “Cur C1 / Cur C2” toggle softkey. You can see which cursor is currently active from the checked point on the softkey and the thick border around the areas [1] and [6].

Moving the cursor



You can move the **active cursor** to the right or left with the <◀> and <▶> keys.

If the zoom is not switched on, (refer to the next page for zooming functions), C1 can only be moved as far as the left edge and C2 as far as the right edge of the “Signal Wave” window ([3]).

If a magnification is active, the following applies: if the active cursor leaves the magnified area in the course of a movement to the left or right, the control unit also moves the displayed section of the timing diagram to the left or to the right. Both cursor lines are therefore always visible in a magnified display.

Logic analyzer



The 3 radio softkeys control the step size of the active cursor.



The “Set Cursor” softkey sets cursor C1 to the start trigger.



Use the “Logic Analyzer” softkey to change to the basic display of the logic analyzer.



If you set the cursors on two readings (measurements) which follow each other at close intervals, the cursor lines may cover each other due to the finite resolution of the monitor display. In this case, they remain invisible until the distance increases between C1 and C2.

2.1.7 Zooming function

You can increase the area between the C1 and C2 cursors using the zooming functions. This allows signal changes which are of interest to be closely examined.



You activate the zooming functions by pressing the zoom key on the PNC keyboard. The assignment in the softkey line changes.



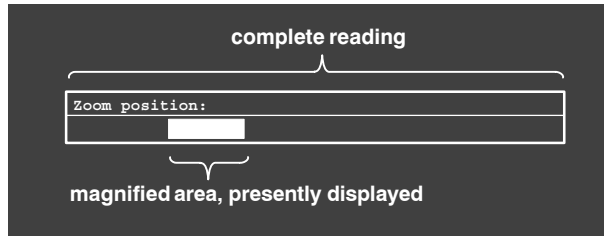
At this point you can

- **return to the previous operating level** with the level return key. A signal wave **display will remain magnified** until you explicitly disable the zoom or execute a new reading regardless of whether you have left the logic analyzer.
- **increase the area** between the C1 and C2 cursors over the complete width of the “Signal Wave” window (3). The C1 cursor is placed at the left edge, the C2 at the right edge of the “Signal Wave” window.
- The softkey is dimmed if further magnification is not possible.



Logic analyzer

- The control unit masks-on a bar graph with the title “Zoom position”. The currently magnified subsection of the entire reading is displayed in this graph.

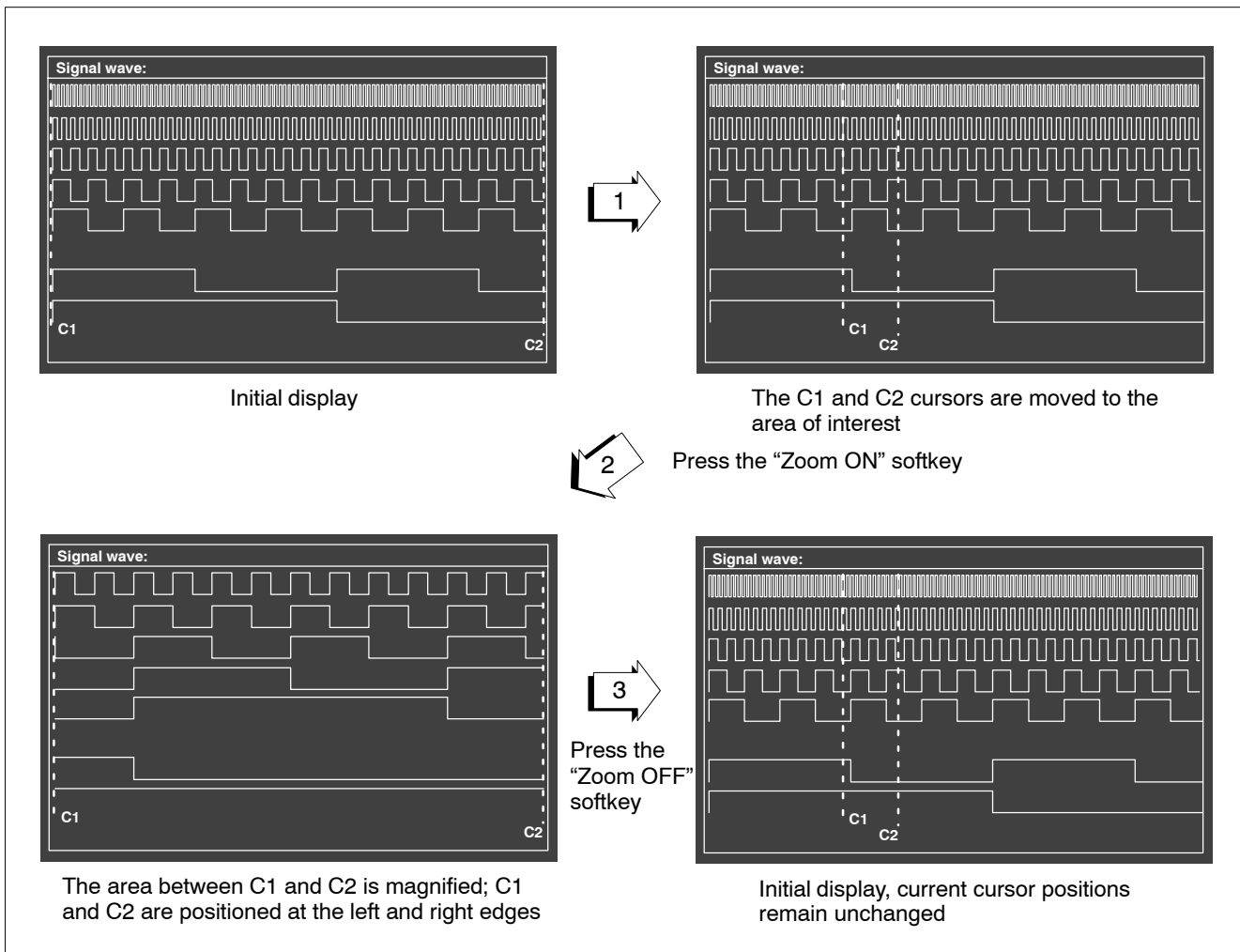


- **return to the magnification** which was active before the “Zoom up” softkey was pressed. The cursor position remains unchanged. The softkey is unavailable if magnification is inactive.



- **reset the signal wave display to non-magnified status.** The control unit displays the complete reading in the “Signal Wave” area. The cursor remains unchanged. The zoom function is terminated.

Example of the zooming function:



Logic analyzer

2.1.8 Saving recordings

The logic analyser settings and the measured data are currently still saved in the “test.la” file located in the root directory (size: approx. 15 kB). This file is overwritten with every new reading.

If you wish to keep the measured data, proceed as follows:

1. Change to the root directory in the “Manage” main mode.
2. Then copy the “test.la” file into a file of another name (e.g. “BACK1.LA”, “BACK2.LA” etc.).

You must copy the appropriate file back to “test.la”, should it be necessary to display the data in the logic analyser again. The “Display Recording” softkey can be used to display the measured data once again.

 **The logic analyser must have the “STOPPED” status during the copying process!**

Diagnosis memory

2.2 Diagnosis memory

All diagnosis programs store data in the **DIAGNOS1.TMP** file that is created whenever a diagnosis program is started. The maximum possible recording time depends on the size of this file which can be set for the “contour display” and the “axis oscilloscope”. Especially for the contour display, it is often necessary to adjust the diagnosis memory to the program runtime.

The maximum size of the diagnosis memory for the “drive oscilloscope” diagnosis program is defined by the memory of the drive and is limited to 16000 bytes, and the logic analyser also uses a fixed memory size.

For the “contour display” and the “axis oscilloscope”, the memory size should be verified subject to the following parameters:

- Runtime of the program or the program section
- Interpolation cycle in MP 9030 00001
- sampling time setting, identical to interpolation cycle (default) or higher
- Number of signals to be recorded (max. 4)
- Number of bytes per signal to be recorded.

The memory size is calculated as follows:


$$\text{Size of the memory} = \left(\frac{\text{Program runtime [sec]} * 1000}{\text{Max (IPO cycle [msec], sample time [msec])}} * \text{Number of signals} * 8 \text{ bytes} + 1000 \text{ bytes} \right)$$

Example:

Program runtime: 20 sec
 IPO cycle: 4 ms (= sample time)
 Number of signals: 1

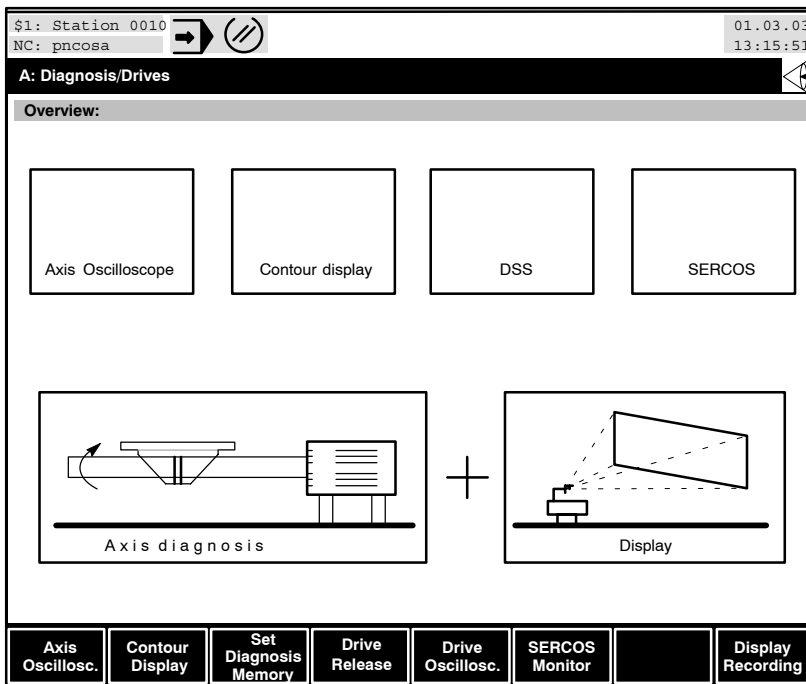
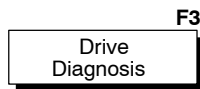
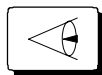
$$\text{Size of the memory} = (20 \times 1000 \div 4) \times 1 \times 8 + 1000 = 41000 \text{ bytes}$$

Diagnosis program	Diagnosis memory (bytes)	
	default	max.
Contour display	30000	depends on the memory configuration of the PNC
Axis oscilloscope	30000	depends on the memory configuration of the PNC
Drive oscilloscope	16000	16000
Logic analyzer	approx. 15000	approx. 15000

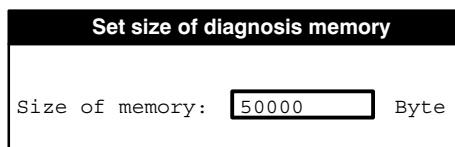
 **The value input is used by the control unit as “minimum memory size”. For internal reasons, the file is normally larger than specified.**

Diagnosis memory

Selection:



Enter the size of the diagnosis memory in bytes and confirm your input by hitting the softkey.



When the axis oscilloscope or the contour display are started, the control unit will respect the size value input when creating a new **DIAGNOS1.TMP** file.



CAUTION

Loss of data!

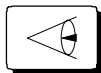
When a new file is created by a diagnosis program, the data of the previous measurement will be deleted.

If necessary, rename the existing **DIAGNOS1.TMP** file before creating a new one in order to avoid overwriting the old data.

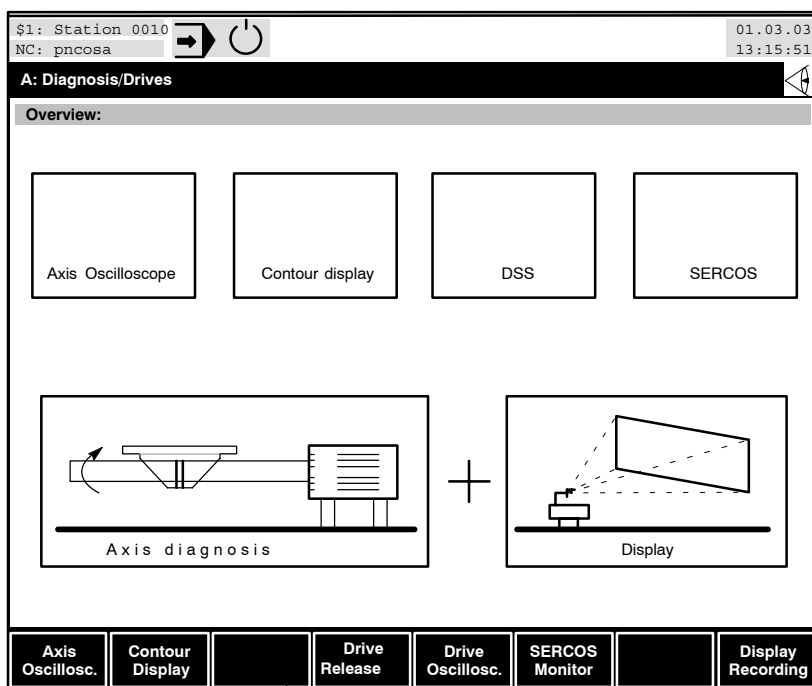
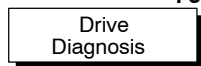
Diagnosis memory

2.2.1 Displaying the measured data

Selection:



F3



The "Display Recording" softkey is **always active at this level**, even if no measurements are made using the axis oscilloscope, contour display, or drive oscilloscope.

- When data measured by the axis oscilloscope, contour display or drive oscilloscope is available, this data is displayed (last measured values from DIAGNOS1.TMP).
- If the DIAGNOS1.TMP file does not contain any data (e.g. measurement was canceled prior to the data stream) or if the file does not exist, an error will be output that has to be reset, and then a stored file containing measured data can be displayed.

Diagnosis memory

File dialog: Selection of a measurement

\$1: Station 0010		01.03.03	
NC: pncosa		13:15:51	
A: Diagnosis/Drives/Display			
Group: User			
Name	Size	Date	Access
Axis.ACH	23010	28.02.03 12:10:00	rwX
Axis2.ACH	51191	01.02.03 12:42:20	rwX
Circle1.CON	11001	02.02.03 12:42:20	rwX
Circle2.CON	34321	03.02.03 12:42:20	rwX
Circle3.CON	44567	04.02.03 12:42:20	rwX
Circle4.ACH	72711	05.02.03 12:42:20	rwX
Filter: *.TMP *.ACH *.CON *.DSS		Directory: /usr/user/	
Number: 6 Size: 236801		Free memory: 596945	
OK		Switch Directory	

At this point you can

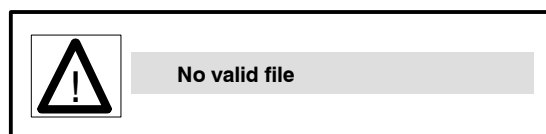


- return to the previous operating level with the level return key.



- use the “Switch Directory” softkey to select a directory that contains data of measurements made by the axis oscilloscope, the contour display, or the drive oscilloscope.

If a file was selected that does not contain any measured data for the display although it has the appropriate filename extension (.ACH, .CON, .TMP, .DSS), the following **error** will be displayed:



- select a file containing measured data using the “OK” softkey.

Axis oscilloscope

2.3 Axis oscilloscope

The following information can, for testing or optimisation purposes, be recorded **as a function of time** by means of the axis oscilloscope:

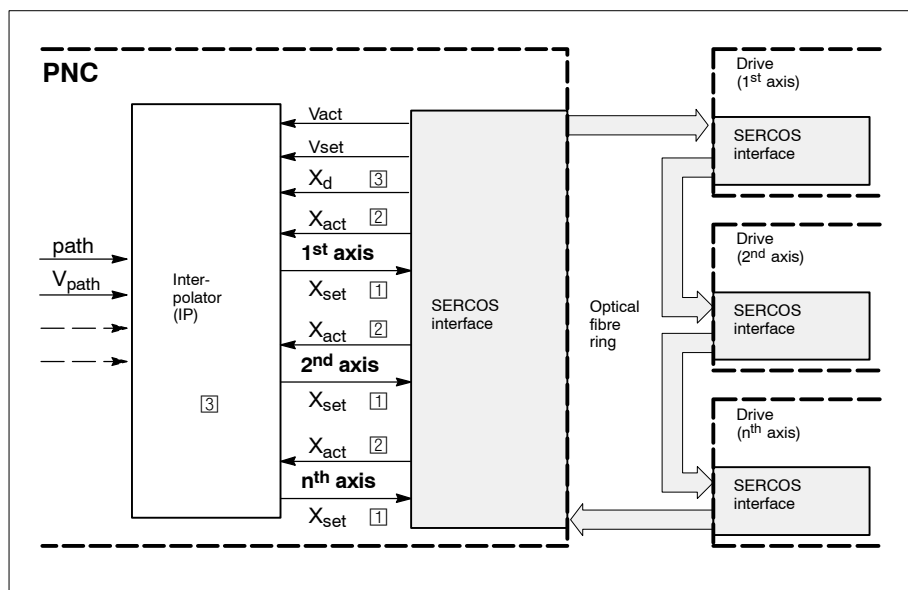
- **all data** which is transferred in the **cyclic operation** (cyclic SERCOS message) via the SERCOS interface (e.g. position data) and
- **interpolator internal data** (e.g. path speed, lag).

Recorded position data can be converted to feedrate or acceleration data at a later stage in order to be displayed as a function curve. Furthermore, the **circle deviation** can be calculated and displayed from the actual positions of two axes (refer to section 2.3.5, "Display recording"). The circle under review is traversed and recorded by the controller with the help of a suitable test program.

Additional external measuring instruments and their wiring are not required. Commissioning of a machine or axis is therefore greatly simplified.

The following values can be individually recorded (also refer to figure below):

- Position command, which is specified for an axis by the interpolator (IP) ("measuring point" ①),
- Actual position value, which is signalled to the IP ("measuring point" ②).
- Speed setpoint (V_{set})
- Actual speed (V_{act})
- Lag (X_d); Internal IP value ("measuring point" ③), if defined in the cyclic telegram.
- 4 analog outputs
- Permanent variables @91 ... @100
- Path velocity.



Axis oscilloscope

Values can be simultaneously extracted from a maximum of 4 measuring points during recording.

The shortest possible sampling time is determined by the SERCOS clock applied. Other sampling times which must be integer multiples of the SERCOS clock can be set.

All recorded values can be stored and displayed as a graph at any time.

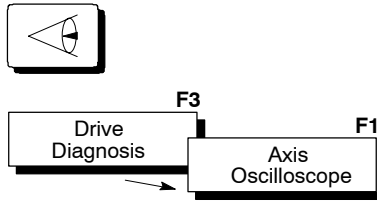
► Execution of a measurement:

1. Start the axis oscilloscope (refer to section 2.3.1)
2. Select signals (measuring points) (refer to section 2.3.2)
3. Set sampling time (refer to section 2.3.3)
4. Set trigger conditions (refer to section 2.3.4)
5. Start recording (refer to “Start Recording” softkey, section 2.3.1).
The PNC saves all selected signals initially in a measured data memory (refer to Diagnosis Memory on page 2–22). This measured data memory is designed as a ring memory: when the available memory area is full, the oldest measured value is overwritten by the new value.
The actual measurement is activated by the occurrence of the trigger event and the measured data memory is once again completely filled with measured values (no more than once). The recording then stops.
6. Display the measured values graphically or save them in a diagnostic file to enable subsequent evaluation (refer to section 2.3.5, “Saving and loading measurements”, “Save Recording” softkey).

Axis oscilloscope

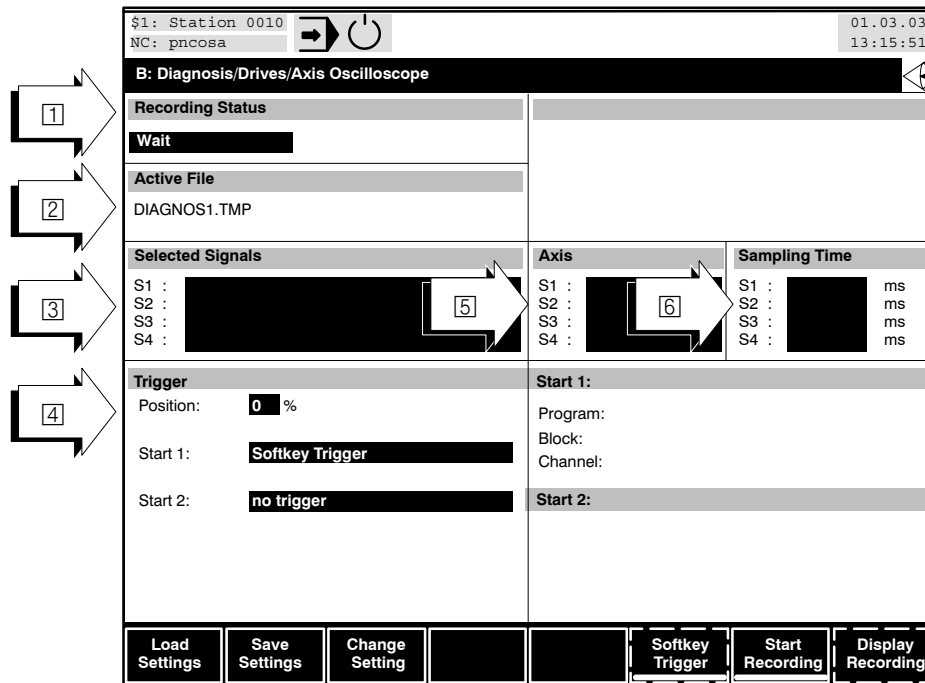
2.3.1 Starting the axis oscilloscope

Selection:



☞ Switch to the NC display window “B” (if available) and repeat the selection if the “Axis Oscilloscope” softkey is dimmed.

The following monitor display appears:



1 The PNC displays the current status of the axis oscilloscope in the “Recording Status” area:

- Wait: No measured data being recorded. The axis oscilloscope is in wait mode.
- Running: Recording has been started. The axis oscilloscope continuously saves measured data in the ring memory. The defined trigger events have not yet occurred.
- Recording: The trigger events have taken place. The measured data memory is refilled again completely (no more than once).
- Save: The measuring process is terminated, all measured data is currently being saved.

Axis oscilloscope

② Indicates the currently active measuring file (standard: DIAG-NOS1.TMP).

③ to ⑥: These areas give you information on the current setting of the axis oscilloscope. These settings can be changed by means of the “Change Setting” softkey.

At this point you can



- **return to the previous operating level** with the level return key.



- **load a measurement setting which has already been saved.** The PNC displays all saved measuring settings (*.ACH) on the screen. Measuring settings are saved in the control unit root directory (Path: \). Select the desired file using the cursor keys and press the “OK” softkey.



- **save the currently active measurement settings** (signals, sampling time, trigger). The PNC opens a dialog window in which you can enter the file name for the settings to be saved. An “.ACH” file ending is automatically assigned.
- The generated file (size: approx. 1 kB) is saved in the control unit root directory.



- **set signals, sampling times and trigger conditions.** Refer to sections 2.3.2, 2.3.3 and 2.3.4 for explanations.



- **release the “Softkey Trigger” trigger event.** This softkey can only be selected if the trigger condition “Softkey Trigger” has been set and the recording has already been started (refer to “Start Recording” softkey). The recording status changes to “Recording”. The measured data memory is refilled again completely (no more than once).



- **start the measuring process.** The recording status changes to “Running”, the softkey text changes to “Cancel Recording”. The PNC continuously saves measured data in the ring memory and waits for the possible occurrence of the set trigger events.

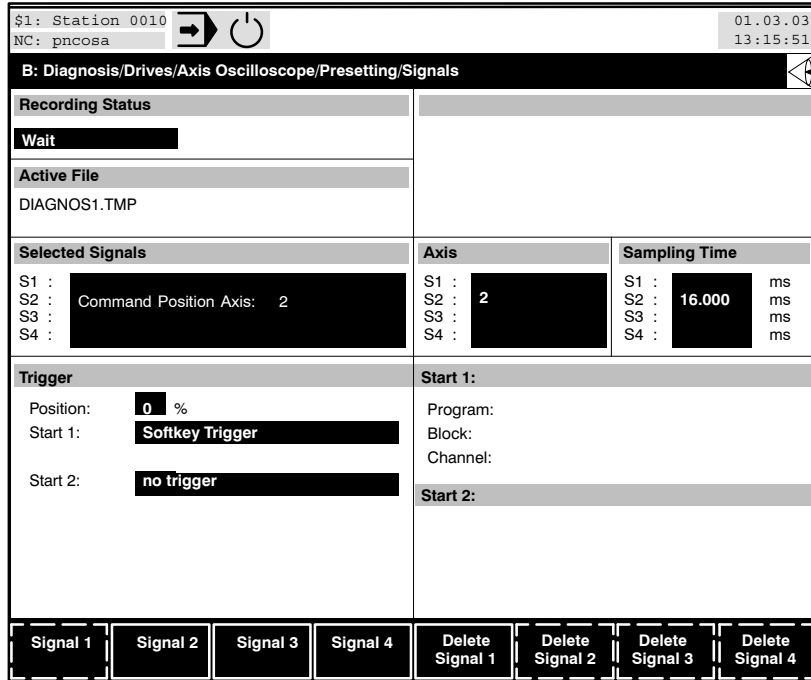
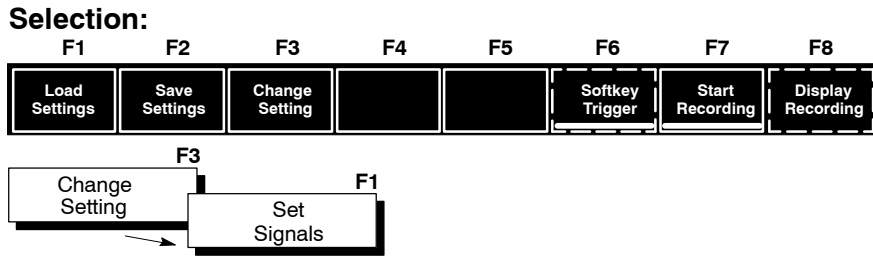
☞ **If no signal was defined, or if the sample time is invalid, an error message will be displayed.**



- **graphically display a measuring process which has already been correctly concluded.** Refer to section 2.3.5 for further information.

Axis oscilloscope

2.3.2 Setting signals (measuring points)



The values of maximum 4 signals (S1 to S4) can be simultaneously recorded. The measuring point for each signal for which the values are to be recorded is determined using the “Signal 1” to “Signal 4” softkeys. Signals which have already been assigned can be deleted with the “Delete Signal 1” to “Delete Signal 4” softkeys. The possible “measuring point” positions are illustrated in the block circuit diagram in section 2.3.

Assign the S1 to S4 signals in ascending order only!

At this point you can



- return to the previous operating level with the level return key.

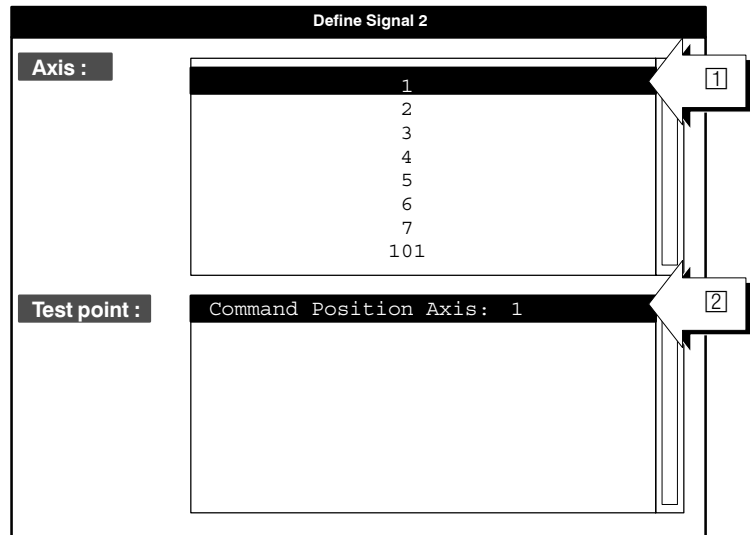


- delete already assigned signals

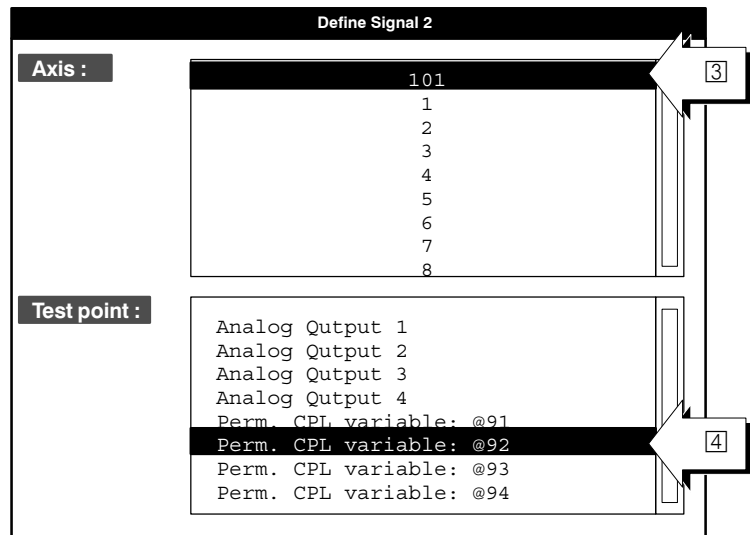
Axis oscilloscope



- **set the relevant signals** with the “Signal 1” to “Signal 4” softkeys. The “Define Signal x” dialog box opens when this softkey is pressed: By moving the focus (1) with the cursor keys \blacktriangledown \blacktriangle , you can select the desired axis x in the upper list field. In the lower list field (2) you may select one of the related measuring points. The possible measuring point positions are illustrated in the block circuit diagram on page 2-26. Use only position data for the measuring point.



Axis 101 provides **axis-independent measure points**, such as permanent CPL variables:



 **In test mode, only the position setpoints of axes (Command Position Axis x) can be activated.**

Axis oscilloscope

If drives are connected, more measuring points can be selected:

- Actual Position: actual position value
- Lag: lag
- Command Speed: speed command value
- Actual Speed: actual speed value
- Path Velocity (Shape Output): interpolator path speed

☞ However, these points must have been defined in the cyclic SERCOS telegram (cf. "SERCOS initialization" section in the MACODA manual).

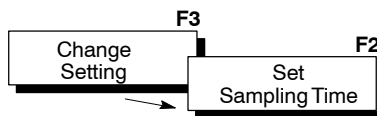
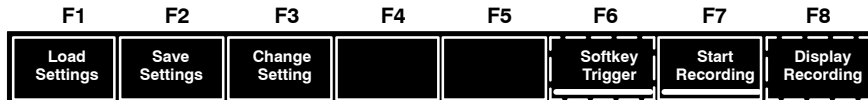
Close the "Define signal x" dialog box:



- with the level return key (or the "Cancel" softkey), in order to return to the **previous operating level**. Changes which were not confirmed are discarded.
- with the "OK" softkey, in order to **activate the currently selected measuring point** and return to the previous operating level.

2.3.3 Setting sampling times

Selection:



Set Sampling time

Sampling time: ms

The shortest possible sampling time is determined by the employed SERCOS clock. Other sampling times can be set, but must be integer multiples of the SERCOS clock.

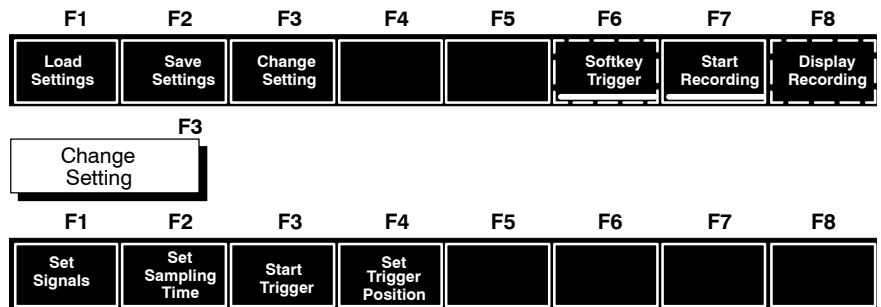
The smallest grid width of the time axis (abscissa) in the graph which is subsequently displayed corresponds to the defined time.

☞ In order to obtain a longer recording time, the diagnosis memory can be extended (refer to page 2-22). A longer sample time also leads to a longer recording time.

Axis oscilloscope

2.3.4 Setting triggers

Selection:



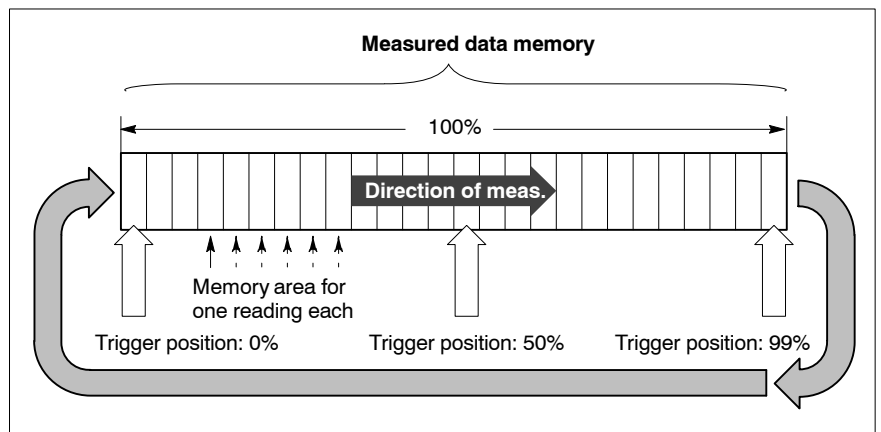
At this point you can



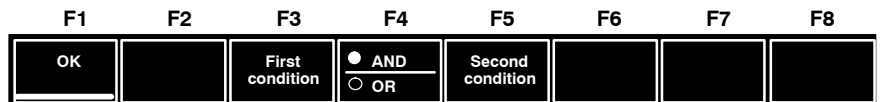
- return to the previous operating level with the level return key.



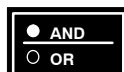
- determine how many of the measured values already in the measured data memory should be maintained when the valid trigger occurs. Enter a value between 0 and 99 % in relation to the complete measured data memory.



- set the required trigger condition. The PNC displays another softkey level when you press this softkey.



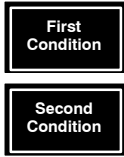
There are 3 different trigger events that can be selected with the “First condition” and “Second condition” softkeys. Furthermore, the selected trigger conditions can be linked as follows:



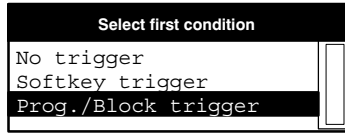
AND operation: Trigger occurs when **both** conditions are logically true.

OR operation: Trigger occurs when **one of the two** conditions are logically true.

Axis oscilloscope



- The required trigger event can be selected separately for each condition from a list selection field using the “First Condition” or “Second Condition” softkeys.



No trigger:

The trigger has been switched off.

Softkey Trigger

No data is recorded for as long as the “Softkey Trigger” softkey is depressed. For example, the operator may determine when the recording is to start during the machining process.

Prog./Block Trigger

You should proceed as follows (cf. figure below):

- Select part program (1) from a directory of your choice (“Switch Directory” softkey).
- Set the block number (2) in the selected part program. The diagnosis program searches for N<number input> (e.g.: N10)
- Enter the channel in which the program is to be executed.

**A fault message is output if the program name including path exceeds the length of 31 characters!
If the desired block is not found, or if the channel number is invalid, the error “Invalid address” will be output.**



Axis oscilloscope

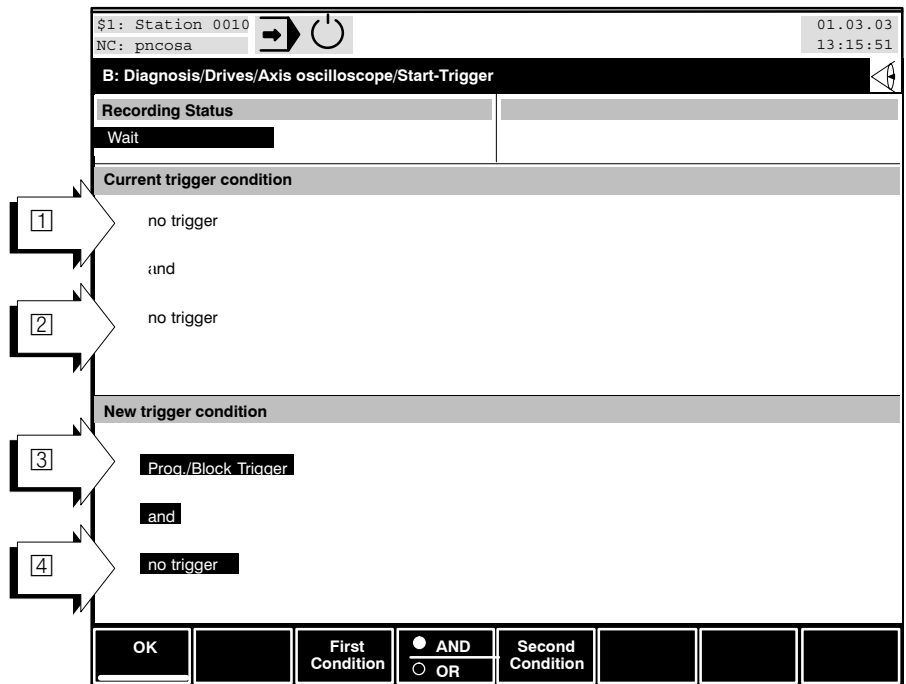
Only the first 25 characters of the program name are included in the comparison.

The program does not verify whether or not the program was changed after the program trigger had been set. If changes were made, the operator must verify the trigger settings or set new trigger conditions.

When the settings of the axis oscilloscope are saved/retrieved, the program does not check whether or not the program exists.

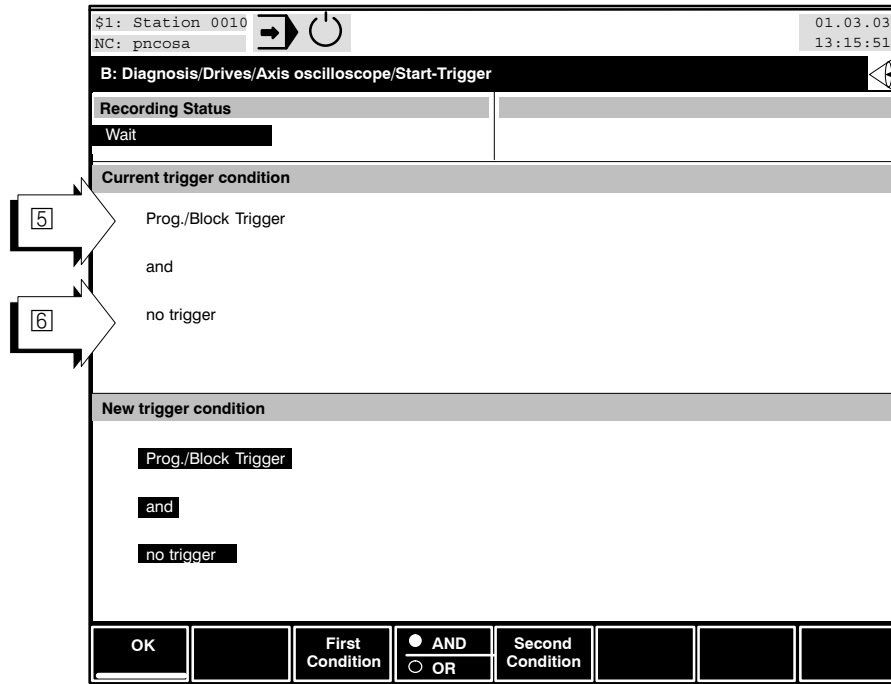


Hit the "OK" softkey to obtain the trigger status of the **current** trigger conditions (first: (1)) and second: (2)) as well as the **new settings** of the trigger conditions (first: (3)) and second: (4)).

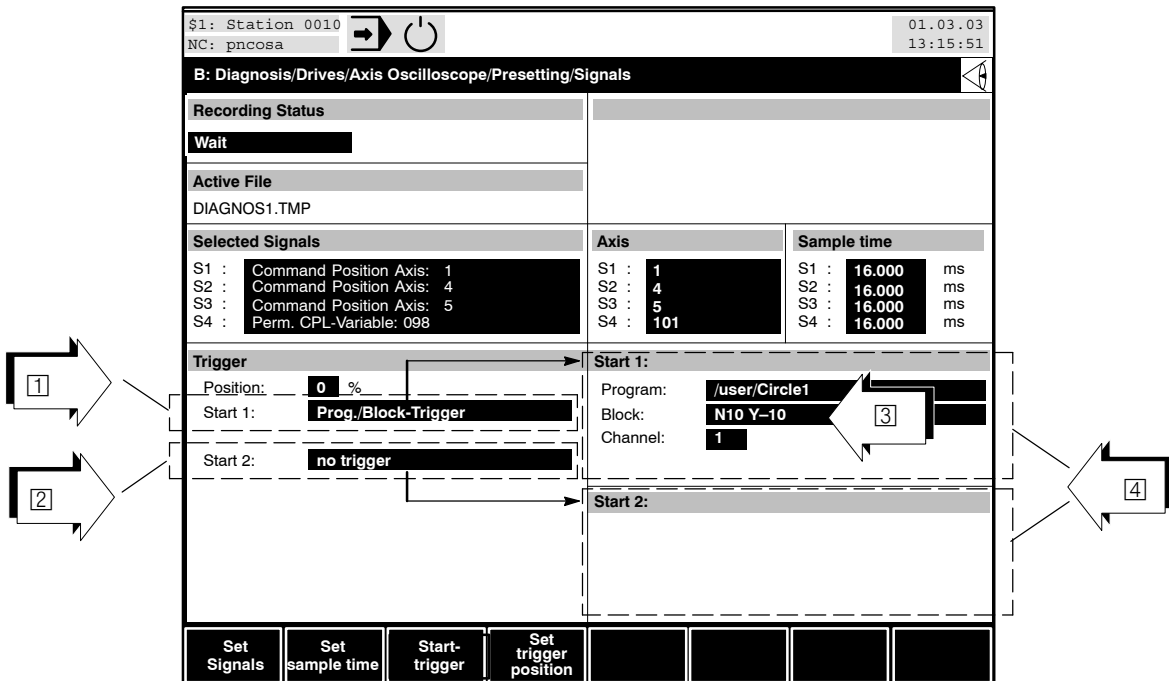


Axis oscilloscope

The new trigger conditions are not accepted as current trigger conditions (5) and (6) unless you hit "OK" again.



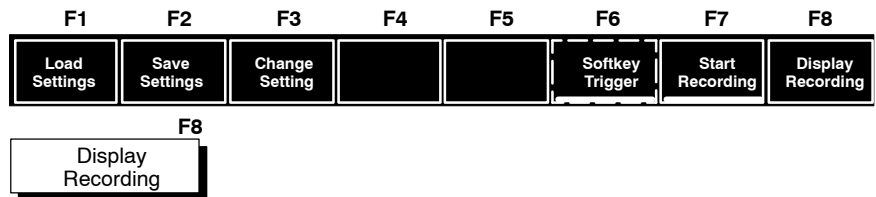
Afterwards, the new trigger conditions ("Prog./Block trigger" and "no trigger") will also appear in the basic display (1, 2 and 4). The block display will include the whole line of the part program (3).



Axis oscilloscope

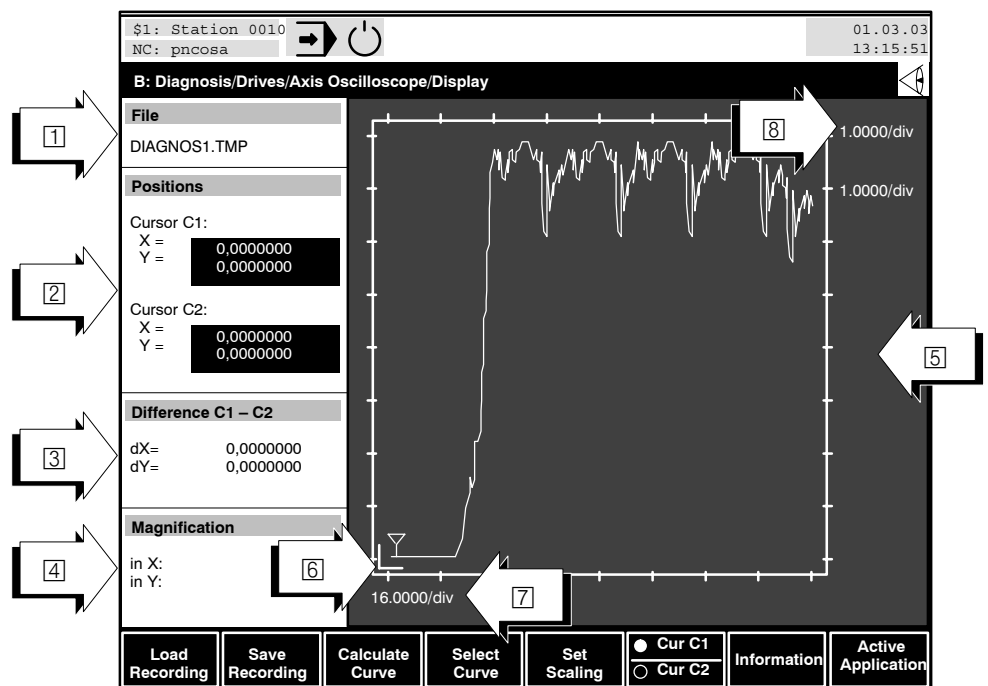
2.3.5 Displaying recordings

Selection:



The "Display Recording" softkey is active if the "DIAGNOS1.TMP" file contains measured values from the axis oscilloscope or contour display functions.

☞ "Display recording" also visualizes the measured values of the contour display. In this case, you can switch back to the axis oscilloscope using the "Active application" softkey.



Up to 4 curves can be simultaneously displayed in area [5]. The distinguishing feature is the color presentation:

Curve 1: red, Curve 2: green, Curve 3: blue, Curve 4: yellow

The **standard** curves displayed reproduce the course of all signals S1 to S4 (refer to section 2.3.2) that were previously set at the measuring points, in relation to time. If, for example, only 2 signals have been recorded, they will be assigned to curves 1 and 2. In this case, curves 3 and 4 will not be displayed.

Axis oscilloscope

- ☞ **The terms “Curve” and “Signal” denote two different things!**
- A “Signal” is the sequence of measured values that was registered at a measuring point during recording.
 - A “Curve” is the graphic object which can display a signal on the screen.

Each of the 4 curves that can be displayed can be assigned to a definable measured value sequence or to a converted measured value sequence (position, feedrate, acceleration). You can find out why and how this functions in the “Displaying or suppressing curves” section.

The smallest grid width of the abscissa corresponds to the set sampling time. The display in area 5 is scaled in such a way as to facilitate the complete display of all recorded measured data in the available display area. Of course, the scaling can also be changed manually (refer to “Scaling” section). The control unit sets the C1 and C2 cursors at the start of the first active curve.

- 1 Indicates the file from which the currently displayed measured values originate. The measured values have not yet been saved in a *.ACH file if the entry “DIAGNOS1.TMP” appears. All measured data would, in this case, be overwritten during the next recording.
- 2 Actual **values** at the current positions of both cursors (∇). Since both cursors can be independently assigned to different curves, the numerical values and the cursor markers maintain the same colour as the corresponding curve.
- 3 Display of the **difference between the current values** at C1 and C2 cursor positions.
- 4 Currently set **display magnification factor** in area 5, split according to the abscissa (X axis) and the ordinate (Y axis). The current display will have a scale of 1:1 if no value is entered here. The scale can be changed by using the zoom function.
- 6 Zero point of the display axes. If negative values have also been measured, the control unit moves the zero point according to the display axes. The axis lines then appear as horizontal and vertical **white** lines within the complete display area.
- 7 Value of a scale division of the abscissa. For example, if the value “60.0000/div” is displayed, one scale division on the axis corresponds to a value of 60 (unit of measure here: ms).
- 8 Value of a scale division of the ordinate. For example, if the value “1.0000/div” is displayed, one scale division on the axis corresponds to a value of 1.0000.

You can now adapt the display and the cursor positions according to your requirements by means of a series of functions:

Axis oscilloscope

2.3.6 Display system

Key combinations for adjusting the display window.

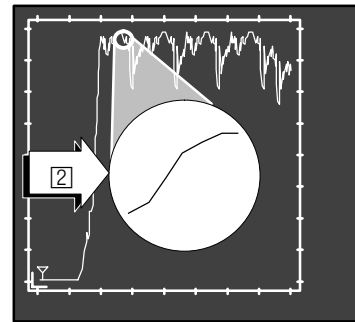
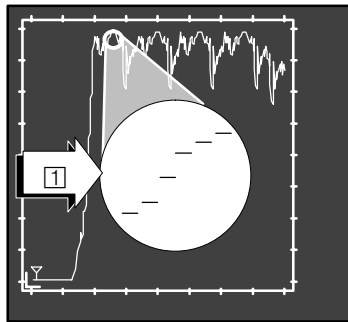
- <Ctrl> + : black background
- <Ctrl> + <w> : white background
- <g> : Activate grid lines
- <shift> + <g> : Deactivate grid lines.

Curve display

Curves in area ⑤ can be displayed as a sampling display (sample and hold principle) or as a continuous display. Two successive measured values are simply connected by a line in the case of a continuous display. The curve shape is therefore clearer. The continuous display is normally set as standard display. Use the key



with the < - > (hyphen) character to switch to sampling display (①), with the < _ > (underline) character to switch to continuous display (②).



Changing over between oscilloscope and contour display



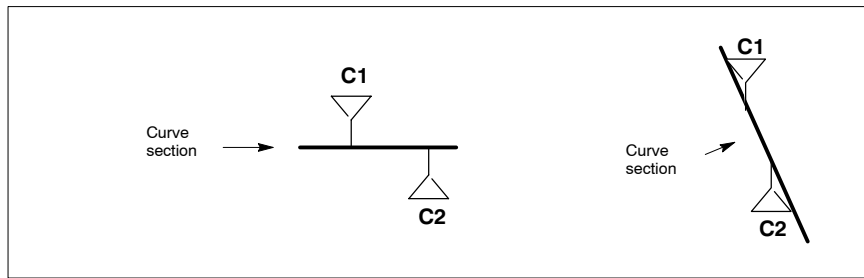
Press < h > to select the contour display, or < H > to select the axis oscilloscope display.

Axis oscilloscope

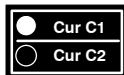
2.3.7 Cursor functions

2 cursor markers, which you can move independently of one another or assign to certain active curves, are available within the display. **Exact differential measurements on one curve and between differing curves** are relatively easy in conjunction with the curve coordinate numerical display (in the left section of the display screen).

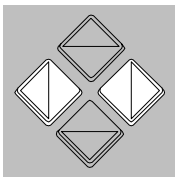
The PNC presents both cursors as the symbol ∇ on the screen. The cursor C1 is always located above, and the cursor C2 below, the course of an assigned curve:



Selecting the cursor

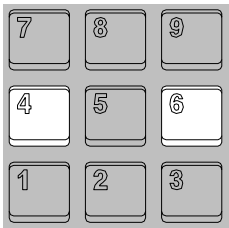


You select the cursor to be moved or assigned to a curve with the “Cur C1/Cur C2” toggle softkey. The currently active cursor is indicated by the checked point on the softkey.



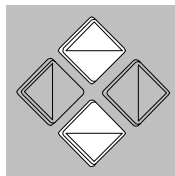
Moving the cursor

You can move the **active cursor** back and forth on the curve **in small steps** with the keys \leftarrow and \rightarrow (grid width: sampling time).



You can move the **active cursor** back and forth on the curve **in large steps** with keys 4 and 6.

Assign a cursor to an active curve



Assign the **active cursor to the next curve** with the \blacktriangle key. If, for example, the cursor is currently assigned to curve 1, the cursor will now be assigned to curve 2.

Assign the **active cursor to the previous curve** with the \blacktriangledown key. If, for example, the cursor is currently assigned to curve 2, the cursor will now be assigned to curve 1.

The assignment is indicated by the cursor colour; it always corresponds to the respective curve colour. The colour of the curve coordinate numerical display changes accordingly.

Axis oscilloscope

2.3.8 Scaling

The display in area [5] is normally scaled in such a way as to facilitate the complete display of all recorded measured data in the display area.

The shape of a curve with a low range of values – where the value ranges for individual signals are very different – may, however, appear to be practically constant if several signals were simultaneously recorded or various display types are active (e.g. if position data as well as feedrate and acceleration data is displayed). The display area available for this curve is not being optimally used.

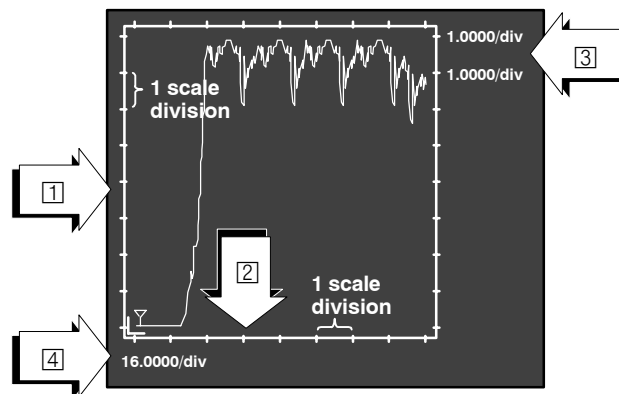
The scaling of each active curve can be changed for this reason.



The “Set Scaling” dialog box can be opened with the “Set Scaling” softkey. The control unit now offers a softkey level at which you can select an active curve. You then enter the required scaling of the horizontal or vertical axis in the dialog box.

The input values each refer to one scale division of the ordinate ([1]) and abscissa ([2]) and will also be displayed within the display range (ordinate scaling: [3]; abscissa scaling [4]).

The ordinate scaling will be displayed in the corresponding curve colour for every active curve.



If the scaling of a horizontal time axis in the [ms] unit involves, for example, an input value of “16”: 1 scale division = 16 ms.

- ☞ **If the curve scaling is changed, the corresponding cursor position remains unchanged. The cursor is, therefore, sometimes located outside the displayed area. You should use the zooming function, not scaling, to examine details in the display area.**

Axis oscilloscope

You set standard scaling by pressing the “Automatic Scaling” softkey. All active curves are once again completely displayed inside the display frame.

Scaling examples:

<p>1 scale division of the horizontal axis = 2000 ms</p>		<p>1 scale division of the horizontal axis = 4000 ms</p>
	<p>CAUTION! The display no longer shows all measured values of the original curve!</p>	
<p>1 scale division of the horizontal axis = 2000 ms</p>		<p>1 scale division of the horizontal axis = 1000 ms</p>
<p>1 scale division of the vertical axis = 1 m/min</p>		<p>1 scale division of the vertical axis = 10 m/min</p>
	<p>CAUTION! The display no longer shows all measured values of the original curve!</p>	
<p>1 scale division of the vertical axis = 1 m/min</p>		<p>1 scale division of the vertical axis = 0.5 m/min</p>

Axis oscilloscope

2.3.9 Zooming function

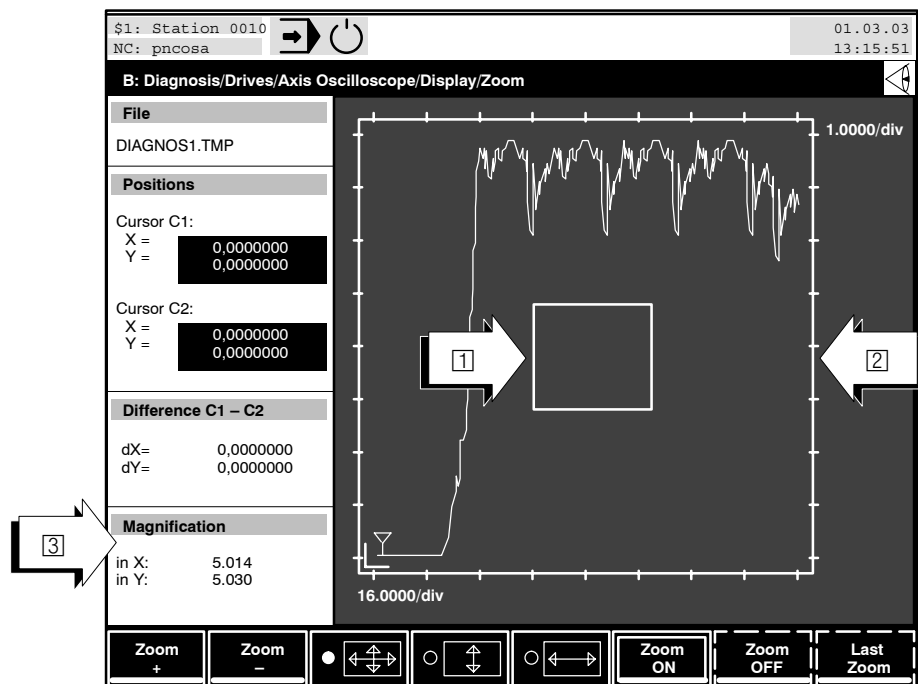
You can magnify an area in the display window using the zooming function. This allows curve areas which are of interest to be closely examined.



You activate the zooming functions by pressing the zoom key on the PNC keyboard. A rectangular box (1) appears in the display area.

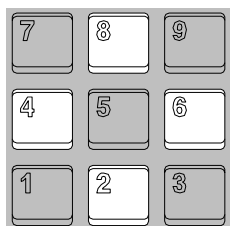
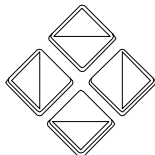
This rectangular box marks the area which will be magnified on the total available display area (2), when the zoom is activated.

The magnification factor is displayed in screen area 3.



At this point you can

- return to the previous operating level with the level return key.
- move the box in small steps with the cursor keys
- move the box in large steps with the keys 2, 4, 8 and 6



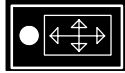
Axis oscilloscope



- **magnify the box** (1)

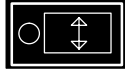


- **reduce the size of the box** (1)

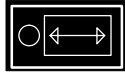


- determine, using the 3 radio softkeys, whether:

- the proportional reduction of the box remains constant,
- the box is only reduced vertically or
- the box is only reduced horizontally



on pressing the “Zoom +” or “Zoom –” softkeys;



- **magnify the marked area** over the complete display area (2). Although you then exit the zoom function, the actual magnification remains constant.

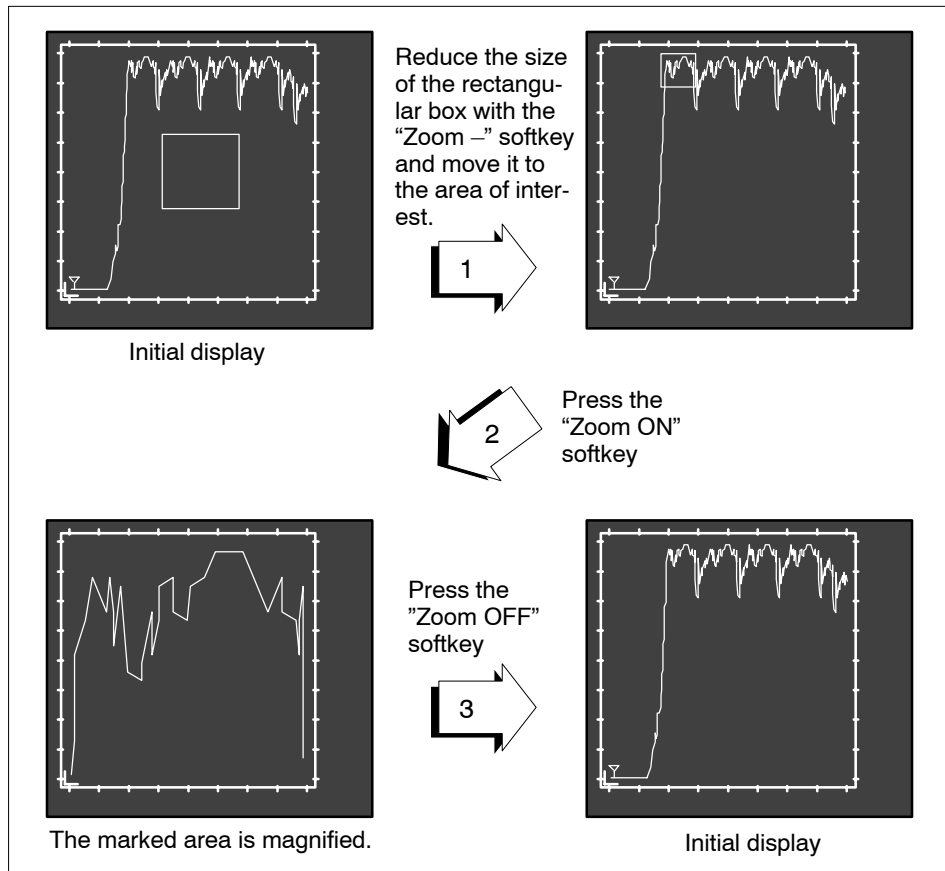


- **reset** the currently active **magnification** (switch zoom off). This softkey has a function only if a magnified display is active (i.e. the “Zoom ON” softkey has already been pressed).



- **reset to the zoom status** which was active before the “Zoom ON” softkey was last pressed. This softkey has a function only if a magnified display is active (i.e. the “Zoom ON” softkey has already been pressed).

Example of the zooming function:



Axis oscilloscope

2.3.10 Displaying or suppressing curves



You have a total of 4 curves at your disposal each of which can be assigned a separate measured value sequence (signal) or converted measured value sequence (position, feedrate, acceleration).

The PNC **normally** assigns the appropriate curve numbers (curve 1 to 4) to the signals 1 to 4. A curve which has been assigned a real measured signal is automatically activated (= is displayed as a curve shape).

All curves which are not required (if e.g. only 2 signals have been measured) are inactive. These curves are not displayed.

There are two cases in which you may wish to switch the curve status (active / inactive):

- You have measured several signals but only wish to display a subset of the signals.

You select the curves which should be suppressed using the “Curve 1” to “Curve 4” softkeys. You then set the “Active / Inactive” toggle softkey to “Inactive” and acknowledge with the “OK” softkey. If you wish to display these suppressed curves at a later stage, simply reset the toggle softkey to “Active”.

- You wish to have the real measured values and the converted values at one measuring point displayed simultaneously. If, for example, position data has been measured, it can be converted to a **curve display** of feedrate and acceleration values (refer also to the “Calculate Curve” softkey).

In this case, you select a curve which has not yet been used with the “Curve 1” to “Curve 4” softkeys. The control unit opens the “Signal Selection” dialog box.

The screenshot shows a dialog box titled "Signal Selection:". At the top, it says "Curve 1: Active". Below this, there are two sections: "Horizontal:" and "Vertical:". The "Horizontal:" section has a dropdown menu currently showing "Time (ms)" and a text field below it containing "Command Position Axis: 1 (mm)". The "Vertical:" section has a dropdown menu currently showing "Command Position Axis: 1 (mm)" and an empty text field below it. Both dropdown menus have a vertical scrollbar on the right side.

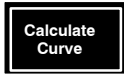
Set the measuring point whose values are to be assigned to the selected curve in the “Vertical” list select field. You then switch the “Active / Inactive” toggle softkey to “Active”, acknowledge with the “OK” softkey and press the level return key once.

You then continue with the previously activated curve as described in the following section.

Axis oscilloscope

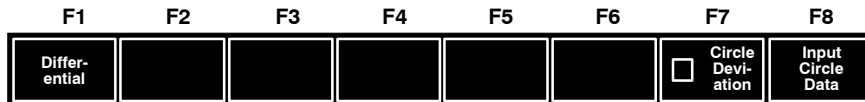
2.3.11 Calculations

All recorded signals are initially displayed in their **measured** unit.



If position data were recorded, the following additional calculations can be made by pressing the "Calculate curve" softkey:

- Calculation of the velocity and acceleration characteristic
- Calculation and display of a circle deviation.

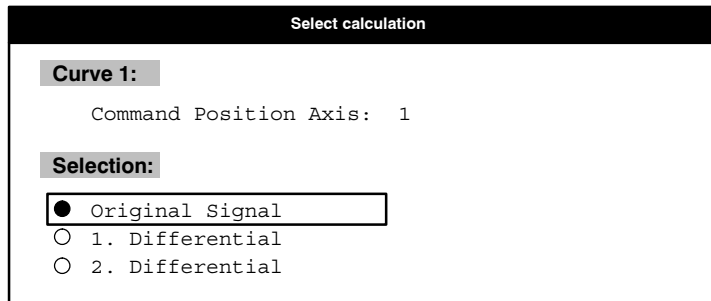


The conversion of the recorded measured values does not influence the original measured values. The conversion only has an effect on the display form of a curve.

Calculation of the velocity and acceleration characteristic:



First, select the required curve with the "Curve 1" to "Curve 4" softkeys and then open the "Select calculation" dialog box with the "Differential" function. Activate the desired type of calculation (Original Signal, 1st Differential or 2nd Differential).



Instead of "Position" data, "Feedrate" data may have been recorded (Original Signal). With position signals, the 1st differential represents the "Feedrate", with feedrate signals, the 1st differential represents "Acceleration".

Axis oscilloscope

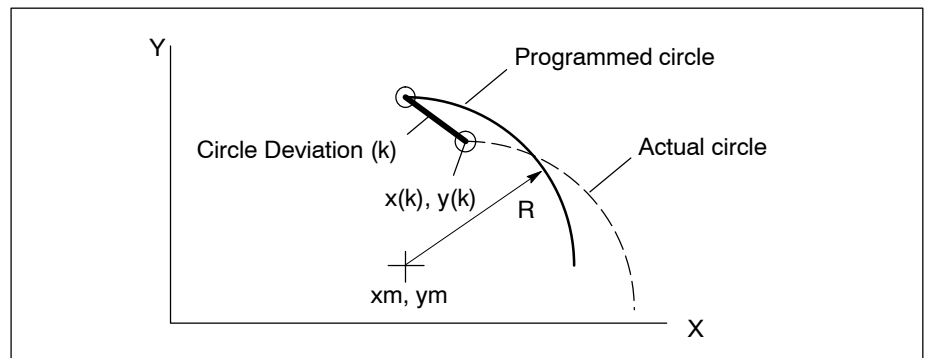
Calculation and display of a circle deviation

A circle deviation is a deviation between an **ideal circle** (programmed circle) and the **actual circle** traversed by the axes involved.


$$\text{Circle deviation } (k) = \sqrt{(y(k) - y_m)^2 + (x(k) - x_m)^2} - R$$

where:

- R: Programmed radius
 y_m : Programmed center in y
 x_m : Programmed center in x
 $y(k), x(k)$: Actual position of the axes (with respect to the circle) measured at a specific sample time k.



In order to display the circle deviation in the axis oscilloscope, the programmed data of the circle must be input when the actual positions of the axes involved have been measured.

 **The measured actual positions must comprise data belonging to the circle traversed, because the display does not perform a plausibility check of the measured values.**



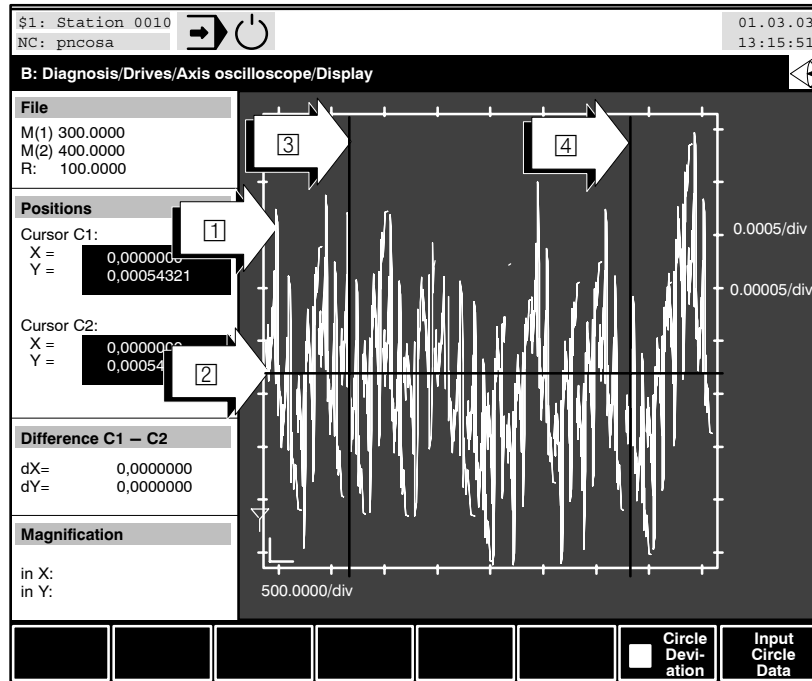
Enter the required programmed data for the circle in the following dialog box which is called up by the "Input Circle Data" softkey:

Input Circle Data	
Circle Center 1:	<input type="text" value="300.0000"/> mm
Circle Center 2:	<input type="text" value="400.0000"/> mm
Radius:	<input type="text" value="100.0000"/> mm

Axis oscilloscope



When the data programmed for the circle have been input, the calculated circle deviation can be displayed as a function of time. The display changes from the representation of the actual positions (curve 1 and 2) to the following screen:



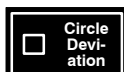
- ① shows the characteristic of a calculated **circle deviation**.
- ② shows the average circle deviation.

For a better overview, the **quadrant transitions** are also calculated from the actual data and transferred to the display of the circle deviations (③ and ④). They are shown in the respective color of the two actual position curves.

All known display functions (zooming, scaling ...) are still available.

Restrictions are limited to the signal selection because the circle deviation display uses a fixed curve assignment.

- Curve 1: actual positions axis 1
- Curve 2: actual positions axis 2
- Curve 3: calculated circle deviation
- Curve 4: calculated average circle deviation.



When the "Circle Deviation" softkey is operated again, the display returns to Curve 1 and Curve 2.

However, these characteristics will be shown in the "Velocity" mode.

Axis oscilloscope

2.3.12 Saving and loading measurements

In order to save a measuring sequence, you may save the current measurement settings including the measured values in an internal format or as an ASCII file. Current settings relevant to the display (curve active / inactive, scaling or magnified displays) are not taken into consideration in either case.



- **A measurement which has already been saved can be loaded.** The PNC displays all saved measuring files (*.ACH) on the screen. Measuring files are saved in the control unit root directory (Path: \). Select the required file with the cursor keys and press the "OK" softkey.



If another measurement had previously been displayed by the user by calling up "Load recording", this display will be discarded and the currently measured data will be displayed. If no new measurement is performed, the last selected file will always remain active.



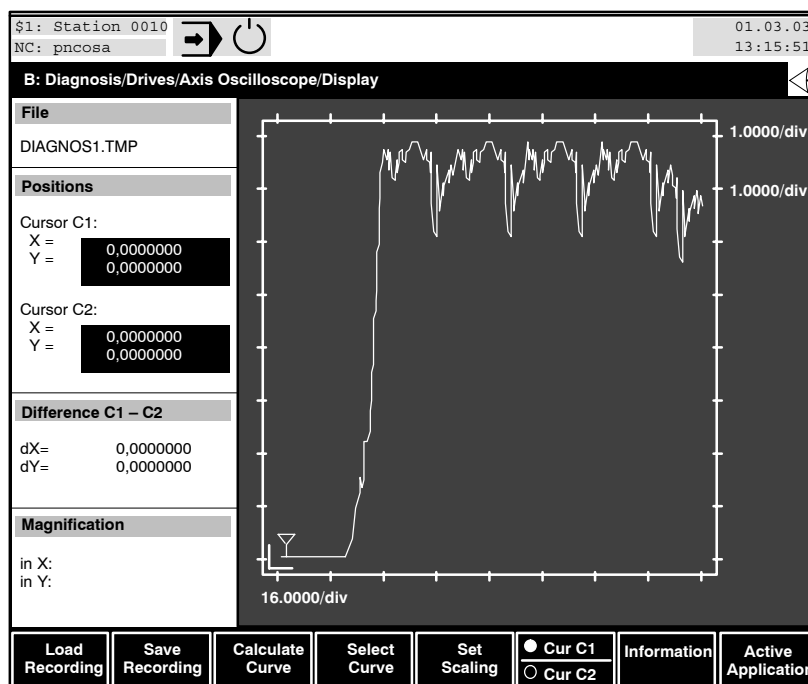
- **A measurement can be saved.** The PNC opens a dialog window in which you can enter the file name. You must also specify whether the measuring sequence should be stored
 - in the internal format of the control unit, or
 - as an ASCII file.
- **Internal format of the control unit:** Only this type of file can be displayed at any time by pressing the "Load recording" softkey. Use this format if you wish to display a measurement curve again later on the screen of PNC. The file is assigned the specified file name including the extension ".ACH" is saved in the root directory of the control unit.
- **ASCII format:** Use ASCII files if you wish to export the measured values for evaluation or display, e.g. to a spreadsheet or database on an external PC. The ASCII file is assigned the specified file name including the extension ".DAT" and is saved in the control unit root directory. The directory can be switched by pressing the appropriate softkey. The structure of the ASCII files corresponds to a table containing all relevant data and measurement settings. All columns are separated by one tab; therefore, most commercially available spreadsheets and databases can easily import the structure of the file. During import, you only have to specify that the ASCII character <tab> shall be used as separator. The second and following lines contain the measured values of a recorded signal in the individual columns.

Axis oscilloscope

The first line of the ASCII file contains the following additional information in separate columns:

Column 1:	Name of signal 1 (e.g. "Command Position Axis: 0")
Column 2:	Name of signal 2
Column 3:	Name of signal 3
Column 4:	Name of signal 4
Column 5:	Unit of measure of signal 1 (e.g. "mm")
Column 6:	Unit of measure of signal 2
Column 7:	Unit of measure of signal 3
Column 8:	Unit of measure of signal 4
Column 9:	Axis number of signal 1 (e.g. "0")
Column 10:	Axis number of signal 2
Column 11:	Axis number of signal 3
Column 12:	Axis number of signal 4
Column 13:	Number of sampling processes recorded
Column 14:	Index for the trigger position
Column 15:	Sampling time

2.3.13 Displaying curve information



Axis oscilloscope



Provides a clear overview of the assignments of all 4 available curves. The control box opens the “Information” dialog box.

Information:

Curve 1:
Signal name: Command Position Axis: 1
Unit: mm

Curve 2:
Signal name: Command Position Axis: 1 (d/dt)
Unit: mm

Curve 3:
Signal name: Command Position Axis: 1 (d/dtdt)
Unit: m/(s*s)

Curve 4:
Inactive

Curve x: Curve number. The text background is the same colour as the curve.

Signal name: Name of the measuring point assigned to the curve.

Unit: Unit in which the measured values are available.

- ☞ **If a curve is switched to inactive, the control box merely prints the text “Inactive” under the curve designation.**
If the curve is displayed with calculated values, – “(d/dt)” appears for feedrate displays and – “(d/dtdt)” for acceleration displays after the axis input.
The unit is changed accordingly to m/min or m/s².

Contour display

2.4 Contour display

The comparison of the command contour and the actual contour of a workpiece is often required. The position values of both axes of the contour, which are specified by the CNC interpolator, and their check-back position data are necessary for this comparison.

The first machine axis can then be assigned to one coordinate axis and the second machine axis to the other in a two-dimensional coordinate system. This provides you with an exact representation of the command and actual tool paths on one plane following the recording.

This allows

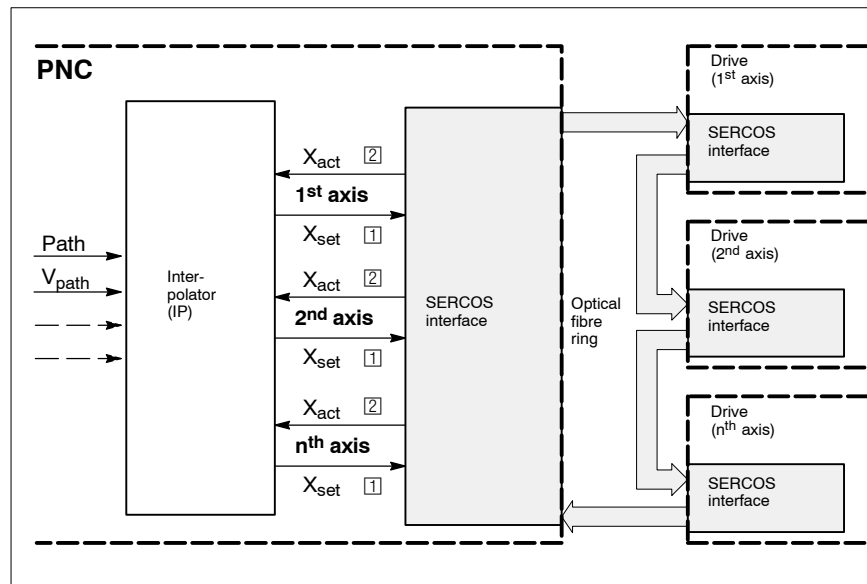
- **position data** which is transmitted over the SERCOS interface for **cyclical operation** (cyclical SERCOS message), to be recorded, for testing purposes, using the contour display.

Additional external measuring instruments and their wiring are not necessary.

The following values can be individually displayed:

- Position command value specified for one axis by the interpolator (IP) ("measuring point" [1]),
- Actual position value which is signalled to the IP ("measuring point" [2]).

All "measuring points" from which data can be extracted are displayed in the following block diagram:



The values at a maximum of 4 measuring points can be simultaneously extracted during a recording.

Contour display

The shortest possible sampling time is determined by the employed SERCOS clock. Other sampling times can be set, but these must be integer multiples of the SERCOS clock.

All recorded values can be saved and graphically displayed at any time.

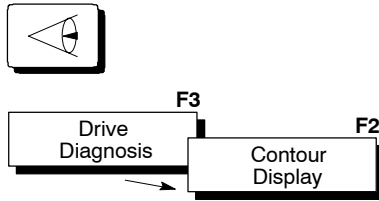
► Execution of the measuring process

1. Start contour display (see section 2.4.1)
2. Select signals (measuring points) (refer to section 2.4.2)
3. Set sampling time (refer to section 2.4.3)
4. Set trigger conditions (refer to section 2.4.4)
5. Start recording (refer to “Start Recording” softkey, section 2.4.1).
The PNC constantly saves all selected signals in a measured data memory (refer to “Diagnosis memory” on page 2-22). This measured data memory operates as a ring memory: when the available memory area has been filled, the oldest measured value is overwritten by the newly added value.
The occurrence of the trigger event activates the actual measuring process. The measured data memory is refilled again completely (no more than once). Recording then stops automatically.
6. Graphically display the measured values or save them in a diagnostic file for subsequent evaluation (refer to section 2.4.5, “Saving and loading measurements” and “Save Recording” softkey).

Contour display

2.4.1 Starting contour display

Selection:



If the “Contour Display” softkey is dimmed, switch to the NC display window “B” (if available) and repeat the selection.

The following display appears:

The PNC displays the current status of the contour display in the “Recording Status” area:

Wait: No measured data is being recorded. The contour display is in wait status.

Running: Recording has been started. The contour display constantly saves measured data in the ring memory. The defined trigger events have not yet occurred.

Contour display

- Recording: The trigger events have taken place. The measured data memory is refilled again completely (no more than once).
- Save: The measuring process is terminated, all measured data is currently being saved.

② Indicates the currently active measuring file (standard: DIAGNOS1.TMP).

③ to ⑥: These areas contain information on the current setting of the contour display. These settings can be changed with the “Change Setting” softkey.

At this point you can



- **return to the previous operating level** with the level return key.



- **load a measurement setting which has already been saved.** The PNC displays all saved measuring settings (*.CON) on the screen. Measuring settings are saved in the control unit root directory (Path: \). Select the desired file using the cursor keys and press the “OK” softkey.



- **save the currently active measurement settings** (signals, sampling time, trigger). The PNC opens a dialog window in which you can enter the file name for the settings to be saved. A “.CON” file ending is automatically assigned and does not have to be entered.
- The generated file (size: approx. 1 kB) is saved in the control unit root directory.



- **set signals, sampling times and trigger conditions.** Refer to sections 2.4.2, 2.4.3 and 2.4.4 for further information.



- **release the “Softkey Trigger” trigger event.** This softkey can only be selected if the trigger condition “Softkey Trigger” has been set and the recording has already been started (refer to “Start Recording” softkey).

The recording status changes to “Recording”. The measured data memory is refilled again completely (no more than once).



- **start the measuring process.** The recording status changes to “Running” and the softkey text changes to “Cancel Recording”. The PNC constantly saves measured data in the ring memory and waits for the possible occurrence of the set trigger.

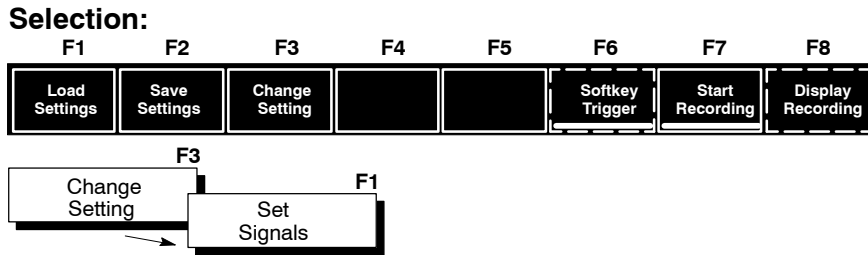
☞ **If no signal was defined, or if the sample time is invalid, an error message will be displayed.**



- **graphically display a measuring process which has already been correctly concluded.** Refer to section 2.4.5 for further information.

Contour display

2.4.2 Setting signals (measuring points)



\$1: Station 0010 01.03.03
 NC: pncosa 13:15:51

B: Diagnosis/Drives/Contour Display/Presetting/Signals

Recording Status

Wait

Active File

DIAGNOS1.TMP

Selected Signals	Axis	Sampling Time
S1 : Command Position Axis: 1	S1 : 1	S1 : 16.000 ms
S2 : Command Position Axis: 2	S2 : 2	S2 : 16.000 ms
S3 :	S3 :	S3 : ms
S4 :	S4 :	S4 : ms

Trigger

Position: 0 %

Start 1: Softkey Trigger

and

Start 2: no trigger

Signal 1
Signal 2
Signal 3
Signal 4
Delete Signal 1
Delete Signal 2
Delete Signal 3
Delete Signal 4

The values of max. 4 signals (S1 to S4) can be simultaneously recorded. Define the measuring points whose values are to be recorded for every signal using the “Signal 1” to “Signal 4” softkeys. Signals which have already been assigned can be deleted with the “Delete Signal 1” to “Delete Signal 4” softkeys.

The possible measuring points are displayed in the block diagram in section 2.4.

- ☞ **Assign the S1 to S4 signals in ascending order only!**
- Assign the S1 to S4 signals in pairs (both axes of the contour plane to be measured) only!**

At this point you can



- return to the previous operating level with the level return key.



- delete already assigned signals

Contour display



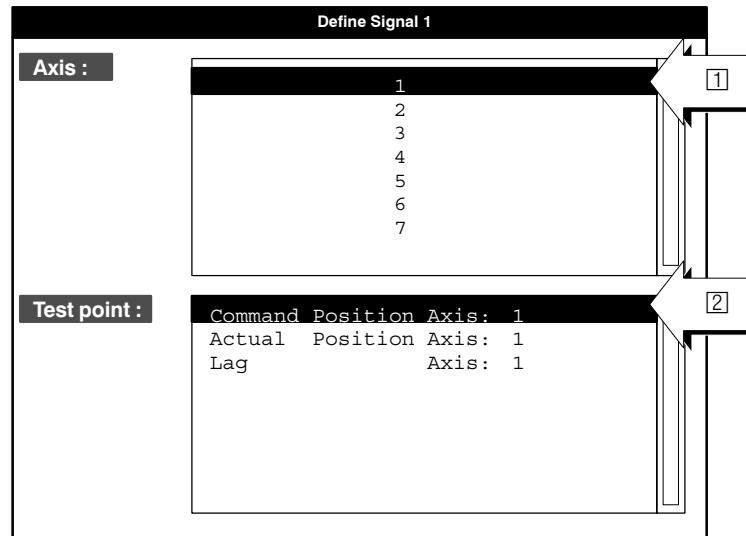
- **set the corresponding signals** with the “Signal 1” to “Signal 4” softkeys.

After this softkey has been pressed, the PNC opens the “Define Signal x” dialog box:

By moving the focus (1) with the cursor keys \blacktriangledown \blacktriangleup , you can select the desired x axis in the upper list field.

In the lower list field (2) you may select one of the related measuring points.

The possible measuring points are displayed in the block diagram on page 2-52. Use only position data for the measuring point.



- ☞ **In test mode, only the position setpoints of axes (Command Position Axis x) can be activated.**

If drives are connected, more measuring points can be selected:

- Command Position: command position value
- Actual Position: actual position value
- Lag

- ☞ **However, these points must have been defined in the cyclic SERCOS telegram (cf. “SERCOS initialization” section in the MACODA manual).**

Close the “Define Signal x” dialog box



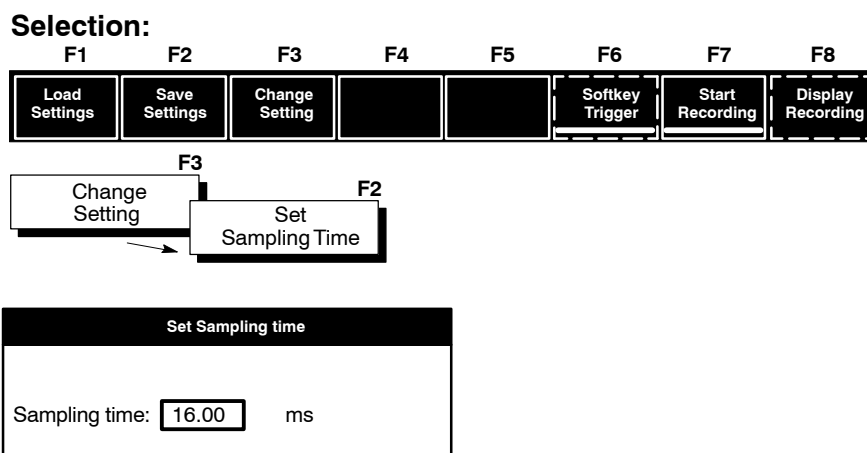
- with the level return key in order to return to the **previous operating level**. Changes that have not been confirmed will not be saved.




- Hit “OK” in order to **activate the currently selected measuring point, to close the dialog box and to return to the previous operating level**.

Contour display

2.4.3 Setting sampling times



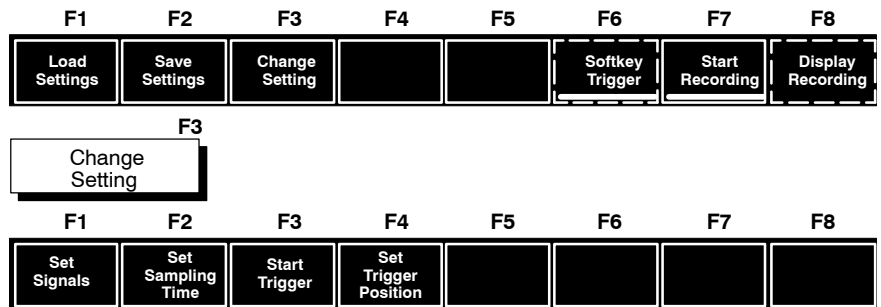
The shortest possible sampling time is determined by the employed SERCOS clock. Other sampling times can be set, but these must be integer multiples of the SERCOS clock.

 **In order to obtain a longer recording time, the diagnosis memory can be extended (refer to page 2-22). A longer sample time also leads to a longer recording time.**

Contour display

2.4.4 Setting triggers

Selection:



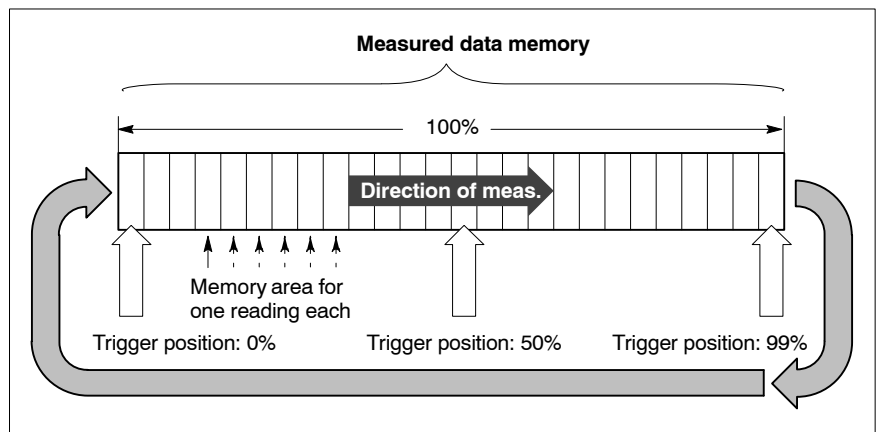
At this point you can



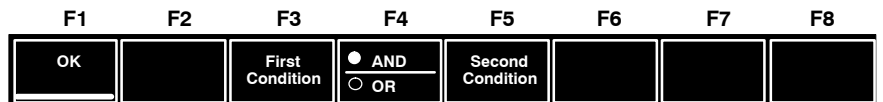
- return to the previous operating level with the level return key.



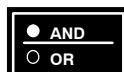
- determine how many of the measured values already in the measured data memory should be maintained when the valid trigger occurs. Enter a value between 0 and 99 % in relation to the complete measured data memory.



- set the required trigger condition. The PNC displays another softkey level when you press this softkey:



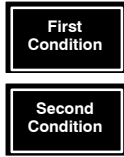
There are 3 different trigger events that can be selected with the “First condition” and “Second condition” softkeys. Furthermore, the selected trigger conditions can be linked as follows:



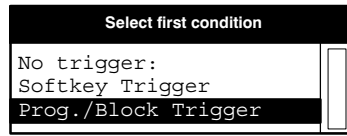
AND operation: Trigger occurs when **both** conditions are logically true.

OR operation: Trigger occurs when **one of the two** conditions are logically true.

Contour display



- The required trigger event can be selected separately for each condition from a list selection field using the “First Condition” or “Second Condition” softkeys.



No trigger:

The trigger has been switched off.

Softkey Trigger

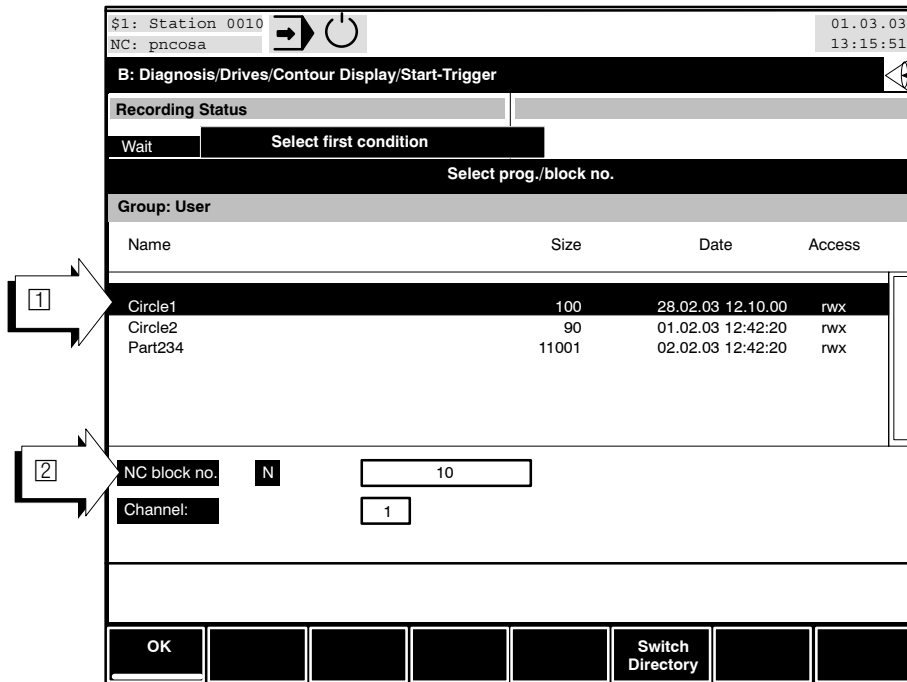
No data is recorded for as long as the “Softkey Trigger” softkey is depressed. For example, the operator may determine when the recording is to start during the machining process.

Prog./Block Trigger

You should proceed as follows (cf. figure below):

- Select part program (1) from a directory of your choice (“Switch Directory” softkey).
- Set the block number (2) in the selected part program. The diagnosis program searches for N<number input> (e.g.: N10)
- Enter the channel in which the program is to be executed.

A fault message is output if the program name including path exceeds the length of 31 characters!
If the desired block is not found, or if the channel number is invalid, the error “Invalid address” will be output.



Contour display

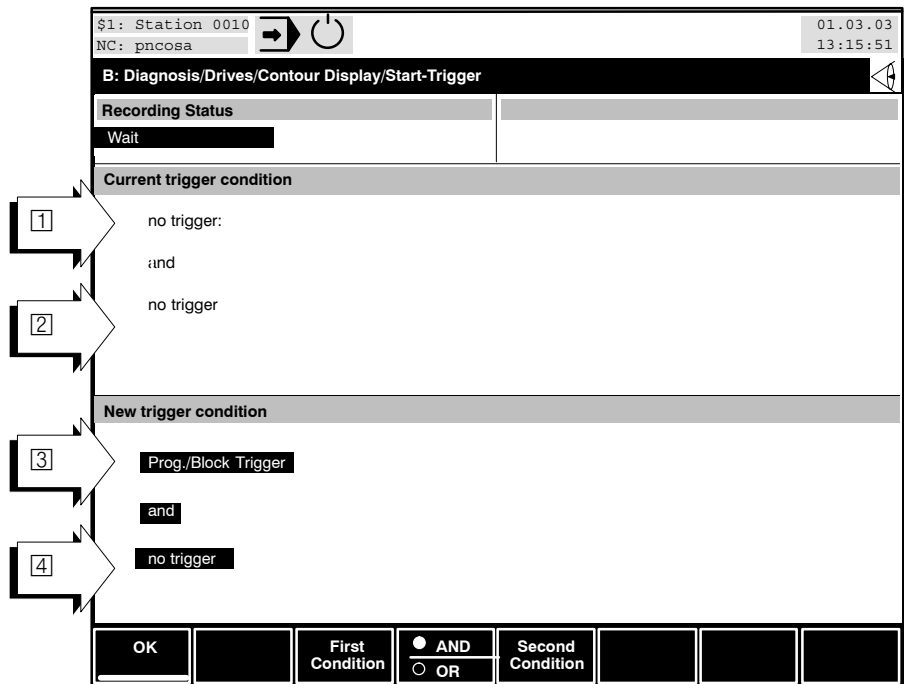
Only the first 25 characters of the program name are included in the comparison.

The program does not verify whether or not the program was changed after the program trigger had been set. If changes were made, the operator must verify the trigger settings or set new trigger conditions.

When the settings of the axis oscilloscope are saved/retrieved, the program does not check whether or not the program exists.

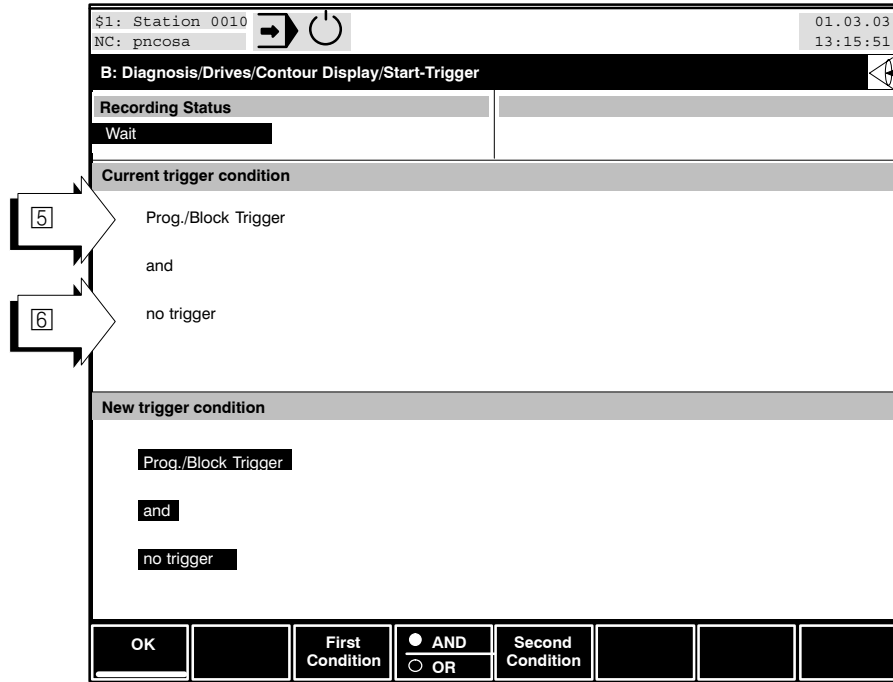


Hit the "OK" softkey to obtain the trigger status of the **current** trigger conditions (first: (1)) and second: (2)) as well as the **new settings** of the trigger conditions (first: (3)) and second:(4)).

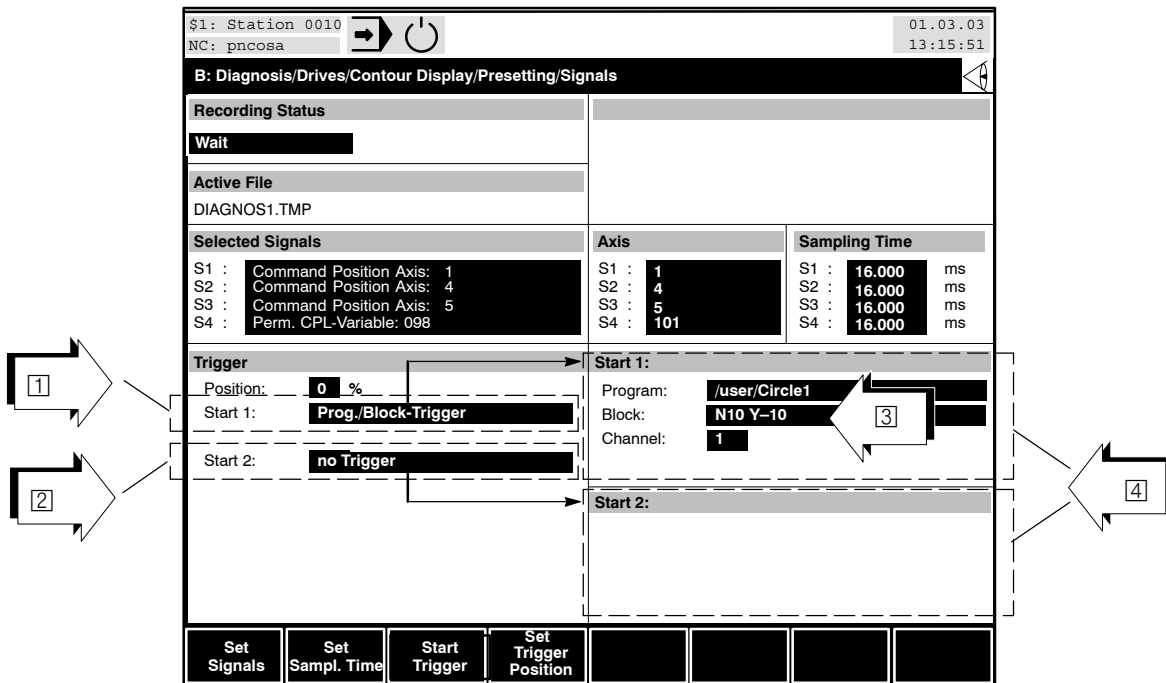


Contour display

The new trigger conditions are not accepted as current trigger conditions (5) and (6) unless you hit "OK" again.



Afterwards, the new trigger conditions ("Prog./Block trigger" and "no trigger") will also appear in the basic display below (1, 2 and 4). The block display will include the whole line of the part program (3).



Contour display

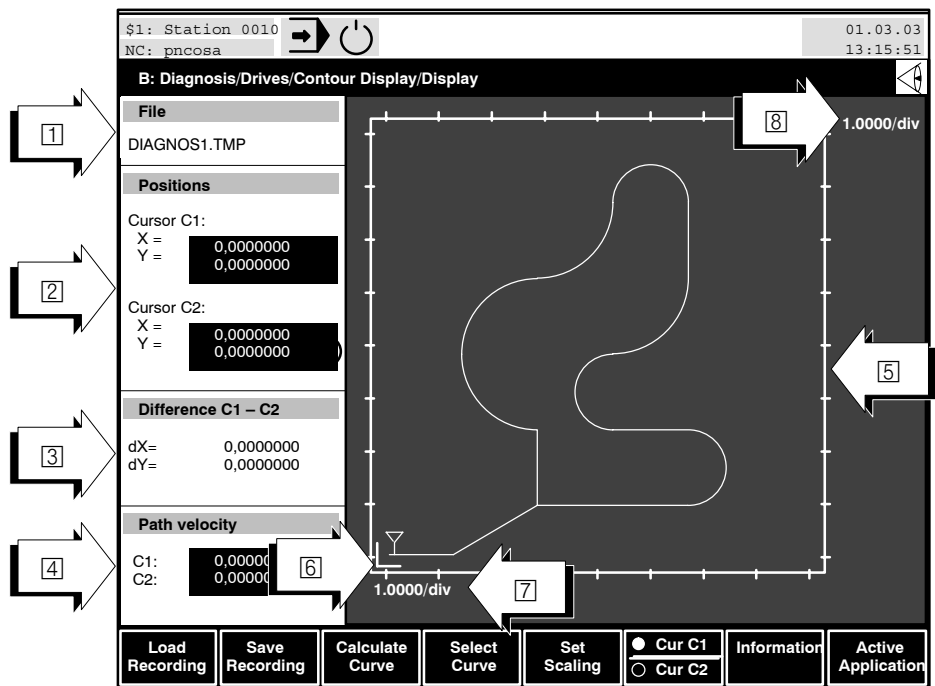
2.4.5 Displaying recording

Selection:



The "Display Recording" softkey is active if the "DIAGNOS1.TMP" file contains measured values from the axis oscilloscope or contour display functions.

☞ "Display recording" also visualizes the measured values of the axis oscilloscope. In this case, you switch back to the contour display using the "Active application" softkey.



Up to 4 curves (curve 1 to 4) can be simultaneously displayed in area [5]. The distinguishing feature is the colour presentation: Curve 1: red, Curve 2: green, Curve 3: blue, Curve 4: yellow

The displayed **standard** curves are created from the signals S1 to S4 displayed at the measuring points (refer to section 2.4.2). If, for example, only 2 signals have been recorded, they will be assigned to Curve 1. Curves 2, 3 and 4 remain inactive (= will not be displayed).

Contour display

- ☞ **The terms “Curve” and “Signal” denote two different things!**
- A “Signal” is the sequence of measured values that was registered at a measuring point during recording.
 - A “Curve” is created when all measured values (represented by 2 signals respectively) are displayed as coordinates on the horizontal and vertical curve axes.

Each of the 4 displayed curves can be assigned any 2 measured value sequences. Information on the functioning of this process can be found in the section “Displaying or suppressing curves”.

The grid width of both display axes corresponds to the set sampling time and the traversing speed.

The display in area ⑤ is scaled in such a way as to facilitate the complete display of all recorded measured data in the available display area. Of course, the scaling can also be changed manually (refer to “Scaling” section). The control unit sets the C1 and C2 cursors at the start of the first active curve.

- ① Indicates the file from which the currently displayed measured values originate. The measured values have not yet been saved in a *.CON file, if the entry “DIAGNOS1.TMP” appears. All the measured data would, in this case, be overwritten during the next recording.
- ② Actual **position data** at the current positions of both cursors (∇). Since both cursors can be independently assigned to different curves, the numerical values and the cursor markers maintain the same colour as the corresponding curve.
- ③ Display of the **difference between the actual values** at the C1 and C2 cursor positions. The contour differences between the command and actual contours can be easily read, if C1 is assigned to the command contour and C2 to the actual contour.
- ④ **Path velocity** at the current positions of the two cursor markers.
- ⑥ Zero point of the display axes. If negative values have also been measured, the control unit moves the zero point according to the display axes. The axis lines then appear as horizontal and vertical **white** lines within the complete display area.
- ⑦ Value of a scale division of the abscissa. For example, if the value “1.0000/div” is displayed, one scale division on the axis corresponds to a value of 1.0000.
- ⑧ Value of a scale division of the ordinate. For example, if the value “1.0000/div” is displayed, one scale division on the axis corresponds to a value of 1.0000.

You can now adapt the displays and the cursor positions according to your requirements by means of a series of functions.

Contour display

2.4.6 Display system

Key combinations for varying the display window.

- <Ctrl> + : black background
- <Ctrl> + <w> : white background
- <g> : Activate grid lines
- <shift> + <g> : Deactivate grid lines.

Change over between oscilloscope and contour display

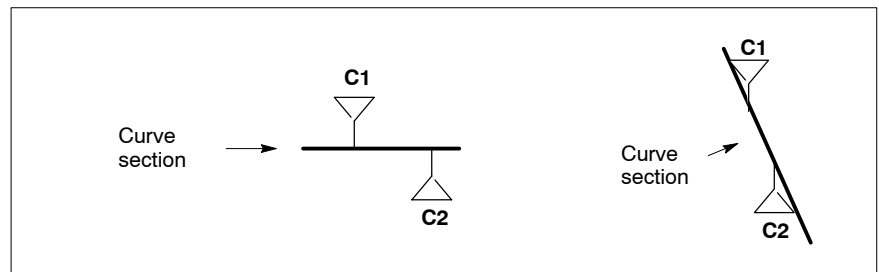


Press < h > to select the contour display,
or < H > to select the axis oscilloscope display.

2.4.7 Cursor functions

2 cursor markers, which you can move independently of one another or assign to certain active curves, are available within the display. **Exact differential measurements on one curve, and between differing curves** (e.g. between the command and actual contours), are relatively easy in conjunction with the curve coordinate numerical display (in the left section of the display screen).

The PNC presents both cursors as the symbol ∇ on the screen. The cursor C1 is always located above, and the cursor C2 below, the course of an assigned curve:



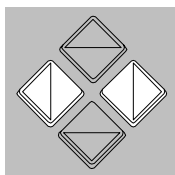
Selecting the cursor



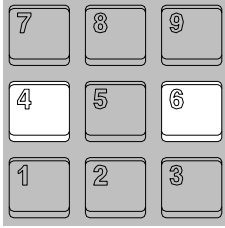
You select the cursor to be moved or assigned to a curve with the “Cur C1 / Cur C2” toggle softkey. The currently active cursor is indicated by the checked point on the softkey.

Moving the cursor

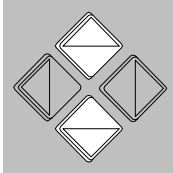
You can move the **active cursor** back and forth on the curve in **small steps** with the keys <⬅> and <➡> (grid width: sampling time).



Contour display



You can move the **active cursor** back and forth **on the curve in large steps** with keys 4 and 6.

**Assign a cursor to an active curve**

Assign the **active cursor to the next curve** with the <▲> key. If, for example, the cursor is currently assigned to curve 1, the cursor will now be assigned to curve 2.

Assign the **active cursor to the previous curve** with the <▼> key. If, for example, the cursor is currently assigned to curve 2, the cursor will now be assigned to curve 1.

The assignment is indicated by the cursor colour; it always corresponds to the respective curve colour. The colour of the curve coordinate numerical display changes accordingly.

2.4.8 Scaling

The display in area [5] is scaled in such a way as to facilitate the complete display of all recorded measured data in the display area.

If 2 contours have, however, been simultaneously recorded (e.g. signals 1 and 2 for the X and Y machine axes path course and signals 3 and 4 for the X and Z machine axes path course), the course of a contour with a low range of values may, in the case of differing ranges of values, practically appear as one line. The display area available for this contour is not being optimally used.

The scaling of each active curve can, as a result, be changed.

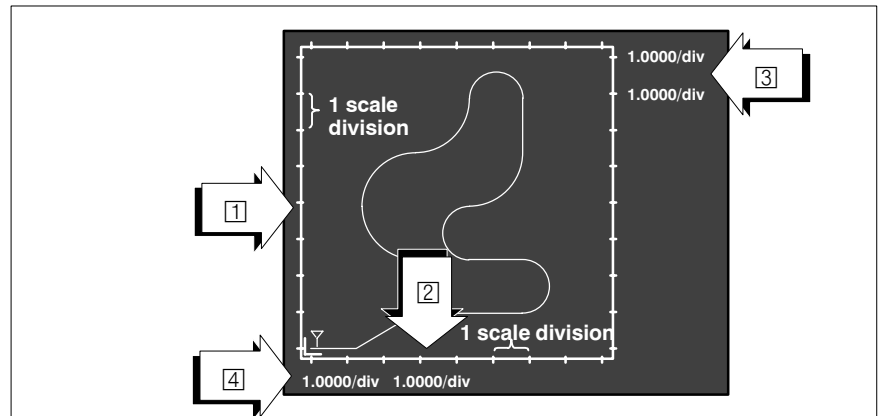


The "Set Scaling" dialog box can be opened with the "Set Scaling" softkey. The control unit now offers a softkey level, at which you can select an active curve. You then enter the required scaling of the horizontal or vertical axis in the dialog box.

The input values each refer to one scale division of the ordinate ([1]) and abscissa ([2]) and will also be displayed within the display range (ordinate scaling: [3]; abscissa scaling [4]).

Contour display

The ordinate scaling will be displayed in the corresponding curve colour for every active curve.



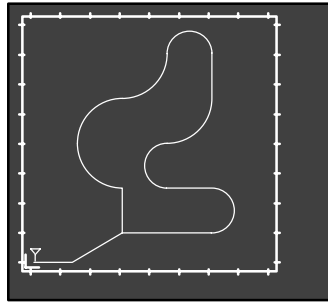
If the scaling of the horizontal axis in the [mm] unit involves an input value of “1” for example: 1 scale division = 1 mm.

- ☞ **If the curve scaling is changed, the corresponding cursor position remains unchanged. The cursor is, therefore, sometimes located outside the displayed area. You should use the zooming function, not scaling, to examine details in the display area.**

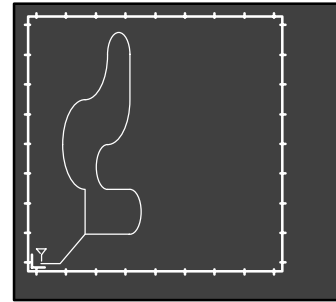
You set standard scaling by pressing the “Automatic Scaling” softkey. All active curves are once again completely displayed inside the display frame.

Contour display

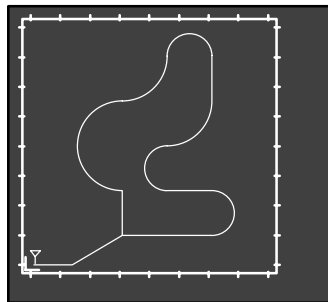
Scaling examples:



1 scale division of the horizontal axis = 14 mm

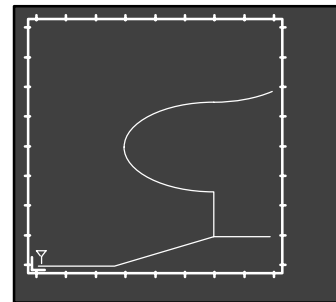
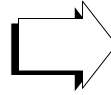


1 scale division of the horizontal axis = 28 mm

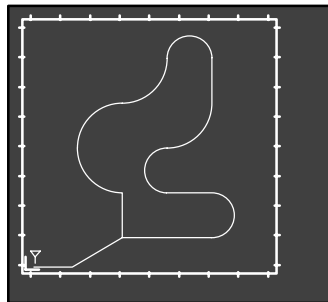


1 scale division of the horizontal axis = 14 mm

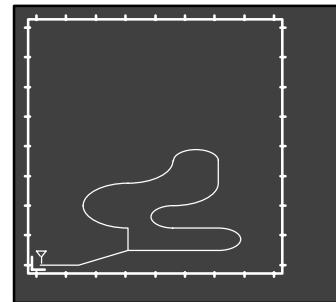
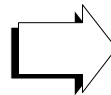
CAUTION! The display no longer shows all measured values of the original curve!



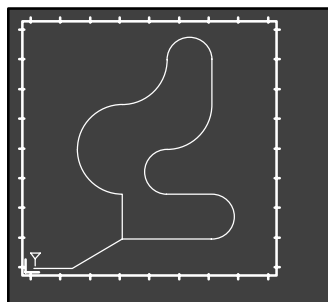
1 scale division of the horizontal axis = 7 mm



1 scale division of the vertical axis = 14 mm

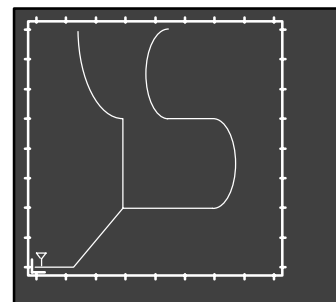
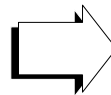


1 scale division of the vertical axis = 28 mm



1 scale division of the vertical axis = 14 mm

CAUTION! The display no longer shows all measured values of the original curve!



1 scale division of the vertical axis = 7 mm

Contour display

2.4.9 Zooming function

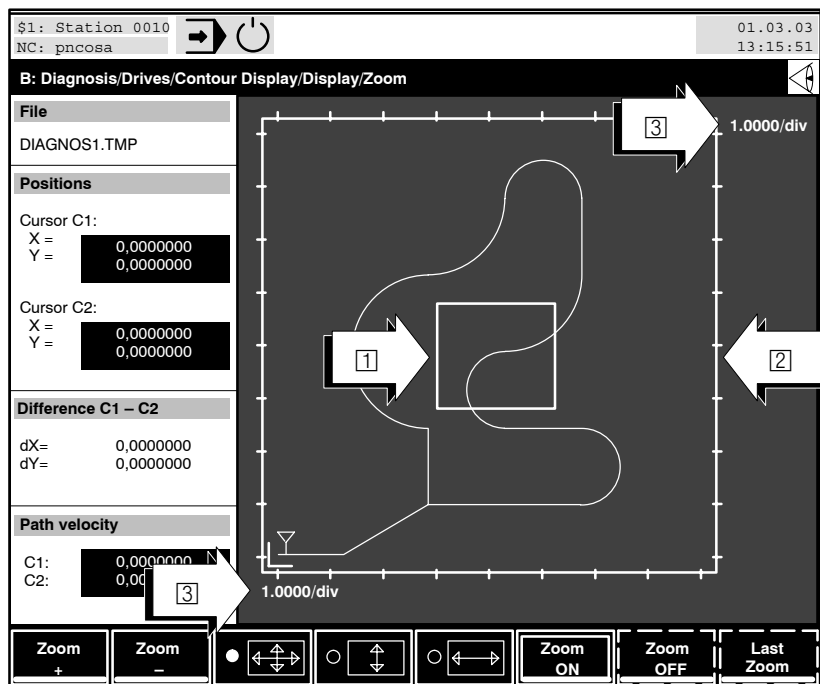
You can magnify an area in the display window with the help of the zooming function. This is very important for comparisons between command and actual contours, due to the fact that variations are (hopefully!) negligible in relation to the range of values of the complete contour. This allows curve areas of interest to be closely examined, especially those at irregular curve transitions.



You activate the zooming functions by pressing the zoom key on the PNC keyboard. A rectangular box (1) appears in the display area (2).

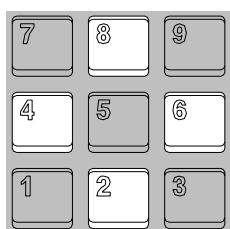
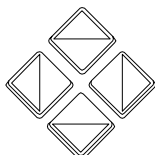
This rectangular box marks the area which will be magnified on the total available display area (2), when the zoom is activated.

The scale information (3) of the abscissa and ordinate is adapted accordingly when zooming is active.



At this point you can

- return to the previous operating level with the level return key.
- move the box in small steps with the cursor keys.
- move the box in large steps with the keys 2, 4, 8 and 6.



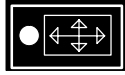
Contour display



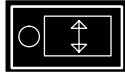
- magnify the box (1)



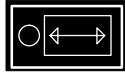
- reduce the size of the box (1)



- determine, using the 3 radio softkeys, whether:
 - the proportional reduction of the box remains constant,



- the box is only reduced vertically or



- the box is only reduced horizontally

on pressing the “Zoom +” or “Zoom –” softkeys;



- magnify the **marked area** over the complete display area (2). The scale information of the abscissa and ordinate is adapted accordingly. Although you then exit the zoom function, the actual magnification remains constant.

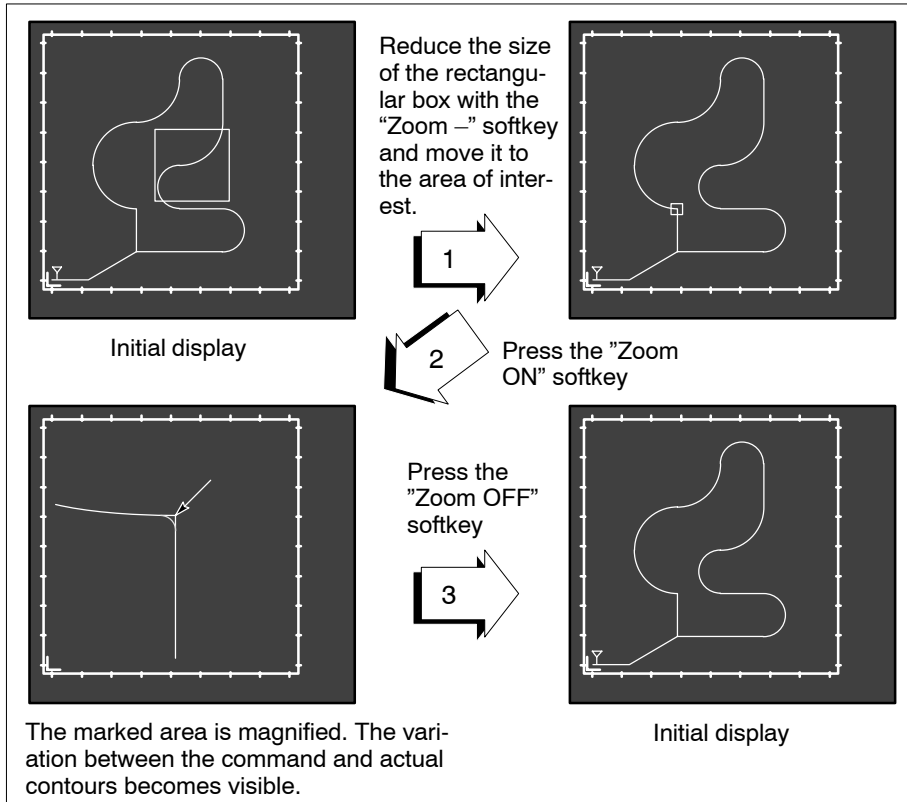


- reset the currently active magnification (switch zoom off). This softkey has a function only if a magnified display is active (i.e. the “Zoom ON” softkey has already been pressed).



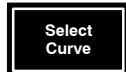
- reset to the zoom status which was active before the “Zoom ON” softkey was last pressed. This softkey has a function only if a magnified display is active (i.e. the “Zoom ON” softkey has already been pressed).

Example of the zooming function:



Contour display

2.4.10 Displaying or suppressing curves



You have a total of 4 curves at your disposal each of which can be assigned 2 different signals.

The PNC **normally** assigns the curve number 1 (curve 1) to signals 1 and 2. An assigned curve is automatically activated (= is displayed as curve shape or contour).

All curves which are not required (if e.g. only 2 signals have been measured, 3 curves remain unused) are inactive. These curves are not displayed.

There are two cases in which you may wish to switch the curve status (active / inactive):

1. You have recorded 2 contours, but wish to have only one contour displayed.

You select the curves which should be suppressed using the "Curve 1" to "Curve 4" softkeys. You then set the "Active / Inactive" toggle softkey to "Inactive" and acknowledge with the "OK" softkey. If you wish to display these suppressed curves at a later stage, simply reset the toggle softkey to "Active".

2. You have measured 3 signals (e.g. on the X, Y and Z machine axes) and now wish to display the contours on the X/Y and X/Z planes. We assume that the contour on the X/Y plane is usually displayed as curve 1 by the CNC.

In this case, select a curve, which has not yet been used with the "Curve 2" to "Curve 4" softkeys. The control box opens the "Signal Selection" dialog box.

You now set the measuring point of the X machine axis in the "Horizontal" list select field and that of the Z machine axis in the "Vertical" field.

You then switch the "Active / Inactive" toggle softkey to "Active", acknowledge with the "OK" softkey and press the level return key once.

Contour display

2.4.11 Saving and loading measurements

In order to save a measuring sequence, you may save the current measurement settings including the measured values in an internal format or as an ASCII file. Current settings relevant to the display (curve active / inactive, scaling or magnified displays) are not taken into consideration in either case.



- **A measurement which has already been saved can be loaded.** The PNC displays all saved measuring files (*.CON) on the screen. Measuring files are saved in the control unit root directory (Path: \). Select the required file with the cursor keys and press the "OK" softkey.



If another measurement had previously been displayed by the user by calling up "Load recording", this display will be discarded and the currently measured data will be displayed. If no new measurement is performed, the last selected file will always remain active.



- **A measurement can be saved.** The PNC opens a dialog window in which you can enter the file name. You must also specify whether the measuring sequence should be stored
 - in the internal format of the control unit, or
 - as an ASCII file.
- **Internal format of the control unit:** Only this type of file can be displayed at any time by pressing the "Load recording" softkey. Use this format if you wish to display a measurement curve again later on the screen of PNC. The ASCII file is assigned the specified file name including the extension ".CON" is saved in the root directory of the control unit.
- **ASCII format:** Use ASCII files if you wish to export the measured values for evaluation or display (e.g. to a spreadsheet or database on an external PC). The ASCII file is assigned the specified file name including the extension ".DAT" and is saved in the root directory of the control unit. The directory can be switched by pressing the appropriate softkey. The structure of the ASCII files corresponds to a table containing all relevant data and measurement settings. All columns are separated by one tab; therefore, most commercially available spreadsheets and databases can easily import the structure of the file. During import, you only have to specify that the ASCII character <tab> shall be used as separator. The second and following lines contain the measured values of a recorded signal in the individual columns.

Contour display

The first line of the ASCII file contains the following additional information in separate columns:

Column 1:	Name of signal 1 (e.g. "Command Position Axis: 0")
Column 2:	Name of signal 2
Column 3:	Name of signal 3
Column 4:	Name of signal 4
Column 5:	Unit of measure of signal 1 (e.g. "mm")
Column 6:	Unit of measure of signal 2
Column 7:	Unit of measure of signal 3
Column 8:	Unit of measure of signal 4
Column 9:	Axis number of signal 1 (e.g. "0")
Column 10:	Axis number of signal 2
Column 11:	Axis number of signal 3
Column 12:	Axis number of signal 4
Column 13:	Number of sampling processes recorded
Column 14:	Index for the trigger position
Column 15:	Sampling time

Contour display

2.4.12 Displaying curve information


 Information

Provides a clear overview of the assignments of all 4 available curves.


The control box opens the “Information” dialog box.

Information:		
	Abscissa	Ordinate
Curve 1:		
Signal name:	Command Position Axis: 1	Command Position Axis: 2
Unit:	mm	mm
Curve 2:		
Signal name:	Actual Position Axis: 1	Actual Position Axis: 2
Unit:	mm	mm
Curve 3:		
	Inactive	
Curve 4:		
	Inactive	

Curve x: Curve number. The text background is the same colour as the curve.

Signal name: Name of the measuring points which are assigned to the abscissa and ordinate of the corresponding curve.

Unit: Unit in which the measured values are available or calibration (scaling) data of the display.

 **If a curve is switched to inactive, the control box merely prints the text “Inactive” under the curve designation.**

Drive oscilloscope

2.5 Drive oscilloscope

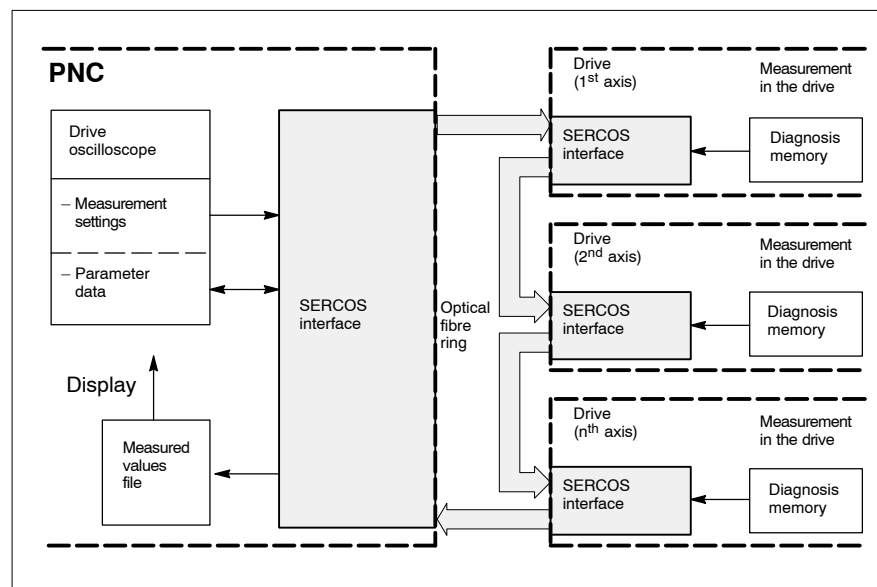
 **Only possible in connection with the Rexroth drives of the Servodyn-D series.**

The following processes can be carried out for the purposes of testing or optimization with the help of the drive oscilloscope:

- The recording of internal **drive data as a function of time**. Measured data from the drive end is saved in its own diagnosis memory and transferred to the PNC on termination of the reading within the SERCOS service channel.
- The **reading out** of up to 6 pre-defined **drive parameters** from a drive, **or their transfer** to a drive, is also possible. The SERCOS service channel is also used for this purpose.

Additional external measuring instruments and their wiring are not necessary. This greatly simplifies the commissioning of a machine or axis.


The following diagram outlines the principle:



CAUTION

Possibility of damage to drives, machines, tools, or workpieces! Drive parameters may only be set or changed by trained personnel! They must have advanced knowledge in the areas of automatic control engineering, drive engineering and in the functions of the SERCOS interface.

Drive oscilloscope

 You should generally use the SERCOS monitor (refer to section 2.6) for reading out or setting drive parameters via the SERCOS interface. The function (currently limited to 6 parameters) was integrated in the drive oscilloscope for the sole purpose of simplifying handling. You would otherwise have to constantly change from the controller parameters to the SERCOS monitor to make trial changes during the course of testing and optimization work.

On principle, the values of all

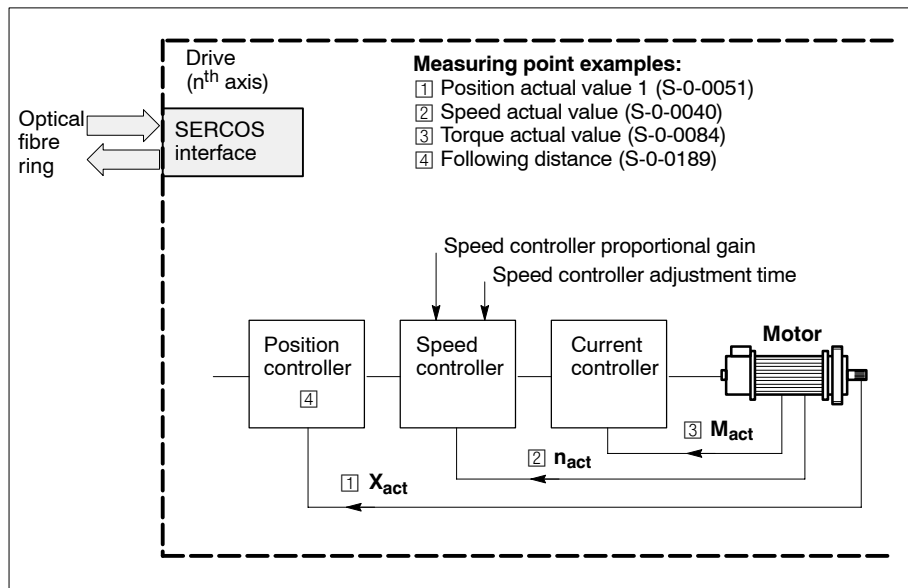
- SERCOS-ident. nos. (“S-x-xxxx”) and
- ident. nos. specific to the manufacturer (“P-x-xxxx”)

available in the drive can be recorded. However, you should record only values which can also be temporally changed. These include e.g. position, spindle speed, torque and messages about certain events (in position, $n_{actual}=0$, $n_{actual}=n_{set}$ etc.).

A maximum of 4 ident. nos. can be simultaneously recorded during a measurement.

The shortest possible sampling time is determined within the drive by the speed control clock (250 μ s). Other sampling times can be set, but have to be integer multiples of the **position** control clock (the cycle time of the position controller is defined in the P-0-0007 parameter). All recorded values can be saved and then graphically displayed when required.

In the following block diagram, some measuring points at which data can be extracted are displayed. Please refer to the documentation on your drive for information on further parameters. All ident. nos. used by the drive and their meaning are generally explained there.



Drive oscilloscope

► Execution of the measuring process

1. Start drive oscilloscope (refer to section 2.5.1)
2. Select axis (refer to section 2.5.2)
3. Select signals (measuring points) (refer to section 2.5.2)
4. Set sampling time (refer to section 2.5.3)
5. Set trigger conditions (refer to section 2.5.4)
6. Start recording (refer to section 2.5.1, “Start Recording” softkey). The PNC sends all relevant data, via the SERCOS service channel, to the drive. The measured value recording is activated in the drive. All selected signals are continuously saved in a diagnosis memory. This memory operates as a ring memory. When the available memory area has been filled, the oldest measured value is overwritten by the newly added value.

The occurrence of the triggers causes the actual measuring process to be activated. The diagnosis memory is completely filled (no more than once). Recording then stops automatically.

The contents of the diagnosis memory are transmitted via the SERCOS service channel to the PNC where the data is saved in a diagnostic file in the root directory.

7. Graphically display the measured values or save them in a diagnostic file for subsequent evaluation (refer to section 2.5.5, “Saving and loading measurements”, and “Save Recording” softkey).

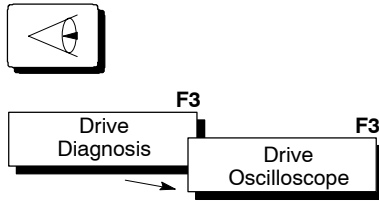
► Reading out drive parameters or their transfer to a drive

1. Start the drive oscilloscope (refer to section 2.5.1)
2. Select an axis (refer to section 2.5.6)
3. Transfer parameters (refer to section 2.5.6)

Drive oscilloscope

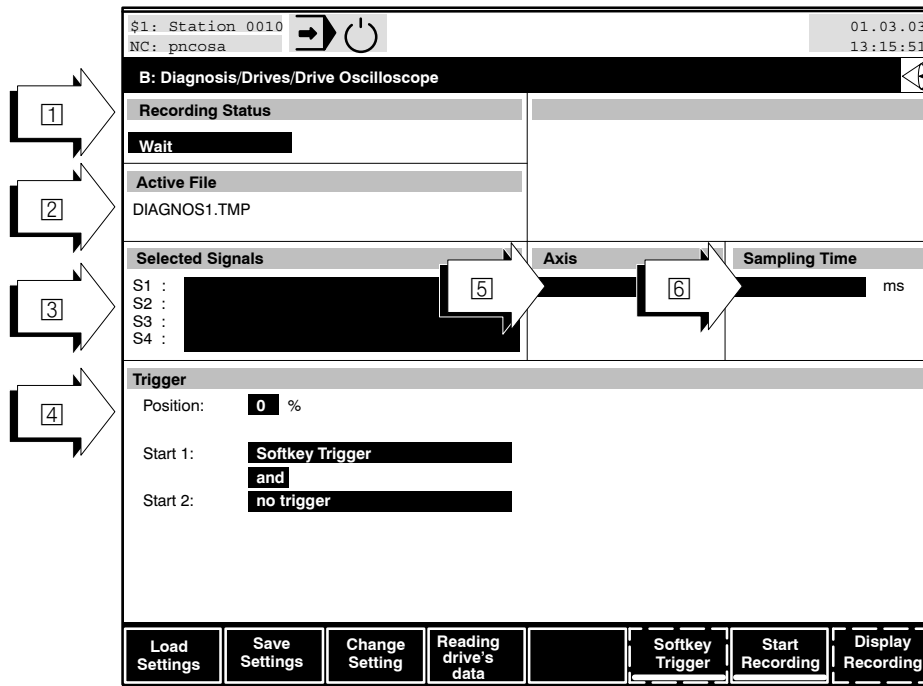
2.5.1 Starting drive oscilloscope

Selection:



If the “Drive Oscilloscope” softkey is dimmed, switch to the NC display window “B” (if available) and repeat the selection. If the softkey is still dimmed, no Rexroth Servodyn-D drives are connected.

The following monitor display appears:



1 The PNC displays the current status of the drive oscilloscope in the “Recording Status” area:

- Wait: No measured data is being recorded. The drive oscilloscope is in wait mode.
- Running: Recording has been started. The drive constantly saves measured data in the ring memory. Defined trigger events have not yet occurred.

Drive oscilloscope

- Recording: The trigger events have occurred. The measured data memory is completely filled (no more than once).
- Save: The measuring process is terminated. All measured data is currently being transmitted from the drive, via the SERCOS service channel, to the PNC, where it is saved in a measuring file.

② Displays the currently active measuring file (standard: DIAGNOS1.TMP).

③ to ⑥: These areas give you information on the current setting of the drive oscilloscope. These settings can be changed with the “Change Setting” softkey.

At this point you can



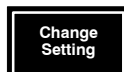
- **return to the previous operating level** with the level return key.



- **load a measurement setting which has already been saved.** The PNC displays all saved measuring settings (*.DSS) on the screen. Measuring settings are saved in the control unit root directory (Path: \). Select the desired file using the cursor keys and press the “OK” softkey.



- **save the currently active measurement settings** (signals, sampling time, trigger). The PNC opens a dialog window in which you can enter the file name for the settings to be saved. A “.DSS” file ending is automatically assigned and does not have to be entered. The generated file (size: approx. 1 kB) is saved in the control unit root directory.



- **set axes, signals, sampling times and trigger conditions.** Refer to sections 2.5.2, 2.5.3 and 2.5.4 for further information. This softkey also allows you to enter an operating level at which you can **read out drive parameters or transfer them to a drive** (refer to section 2.5.6).



- specifically read the oscilloscope data from the drive if communication through the service channel was overloaded. In this case, automatic reading of the drive data is aborted after several attempts and an error message is displayed. You should then stop the PNC and load the recorded data into the PNC with the “Reading drive’s data” softkey when the service channel is not busy.



- **release the “Softkey Trigger” trigger event.** This softkey can only be selected if the trigger condition “Softkey Trigger” has been set and the recording has already been started (refer to “Start Recording” softkey). The recording status changes to “Recording”. The measured data memory is completely filled (no more than once).

Drive oscilloscope



- **start the measuring process.** The recording status changes to “Running”, the softkey text changes to “Cancel Recording”. The PNC transmits all measurement settings to the drive. The PNC constantly saves measured data in the internal ring memory (diagnosis memory) and waits for the possible occurrence of the set trigger events.

☞ **If no signal was defined, or if the sample time is invalid, an error message will be displayed.**
If the error message “Service channel is busy” appears, the SERCOS service channel is being used. Wait for a moment before starting again.

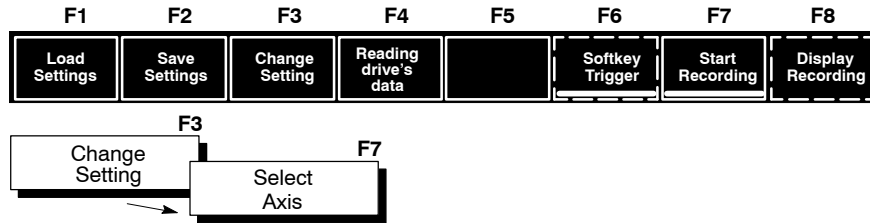


- **graphically display a measuring process which has already been correctly concluded.** Refer to section 2.5.5.

2.5.2 Setting signals (measuring points)

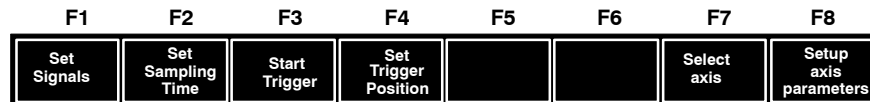
The control unit must know which drive should be used for communication before you can work with the drive oscilloscope:

Selection:



The PNC then opens the “Select Axis” dialog box. All of the connected axes are listed here together with their logical system axis numbers. Select the required axis and press the “OK” softkey.

Es erscheint folgende Softkeyebene:



☞ **If you have not yet selected an axis, all softkeys (with the exception of the “Select Axis” softkey) will be dimmed and are therefore unavailable.** If the softkeys remain dimmed although you have selected an axis, check the ”diampk.dat” file in the FEPRM, the user FEPRM or the root directory (refer to comment on ”Signal x” softkey on the next page).

Drive oscilloscope

Signals can now be set:

Selection:



\$1: Station 0010		01.03.03	
NC: pncosa		13:15:51	
B: Diagnosis/Drives/Drive Oscilloscope/Presetting/Signals			
Recording Status			
Wait			
Active File			
DIAGNOS1.TMP			
Selected Signals		Axis	Sampling Time
S1 :	Speed command value	0	0.25 ms
S2 :			
S3 :			
S4 :			
Trigger			
Position: 0 %			
Start 1: Softkey Trigger			
and			
Start 2: no trigger			
Signal 1	Signal 2	Signal 3	Signal 4
Delete Signal 1	Delete Signal 2	Delete Signal 3	Delete Signal 4

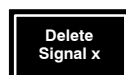
The values of maximum 4 signals (S1 to S4) can be simultaneously recorded. Define the measuring points whose values are to be recorded for every signal using the “Signal 1” to “Signal 4” softkeys. Signals which have already been assigned can be deleted with the “Delete Signal 1” to “Delete Signal 4” softkeys.

Some “measuring point” positions within the drive are displayed in the block diagram on page 2–76.

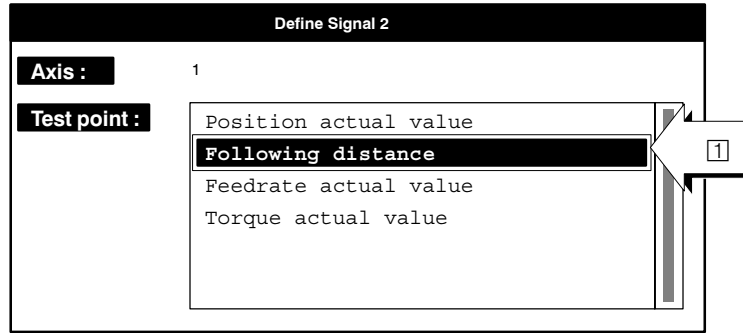
☞ **Signals S1 to S4 may be assigned in ascending order and deleted in descending order only.**

At this point you can

- return to the previous operating level with the level return key.
- delete already assigned signals
- set the corresponding signals with the “Signal 1” to “Signal 4” softkeys. The PNC opens the “Define Signal X” dialog box when this key is pressed:



Drive oscilloscope




All ident. nos. offered here come from the "diampk.dat" file. One ident. no. per line can be contained in the file as

- S-x-xxxx (x=group number; xxxx=parameter number) or
- P-x-xxxx (x=group number; xxxx=parameter number).

The "diampk.dat" file allows you to define various factors in the work environment. First save all of the necessary ident. nos. in a text file, which then only has to be given the name "diampk.dat" and copied to the root directory, the user FEPROM or the FEPROM.

 **Changes made in the "diampk.dat" file will not be displayed automatically in the dialog box unless the controller has been re-booted.**

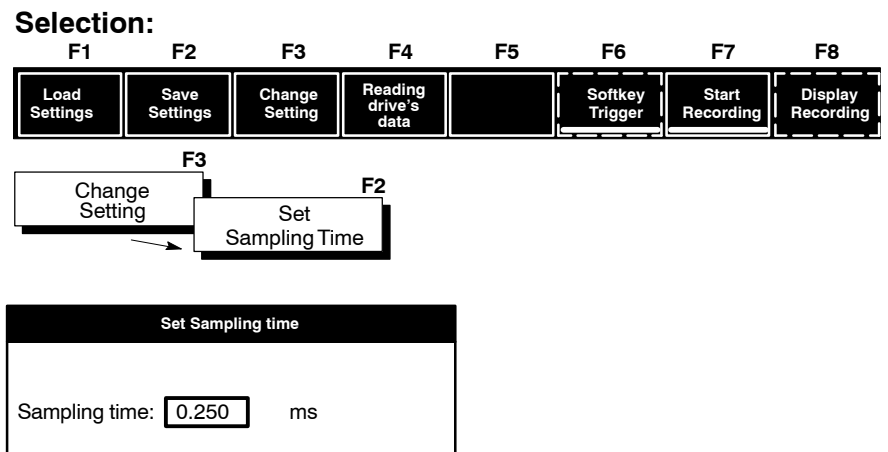
At this point you can

- **select** the desired **measuring point** within the **list select field** by moving the focus (1) with the  cursor keys. Some "measuring point" positions within the drive are illustrated in the block circuit diagram on page 2-76 together with their ident. nos.
- **close the dialog box** and **return to the previous operating level** with the level return key. Changes which have not yet been confirmed will not be saved.
- **activate the currently selected measuring point, close the dialog box** and **return to the previous operating level.**



Drive oscilloscope

2.5.3 Setting sampling times



- ☞ **If you have not selected an axis (refer to “Select Axis” softkey on section 2.5.2), the “Set Sampling Time” softkey is dimmed and therefore not available.**

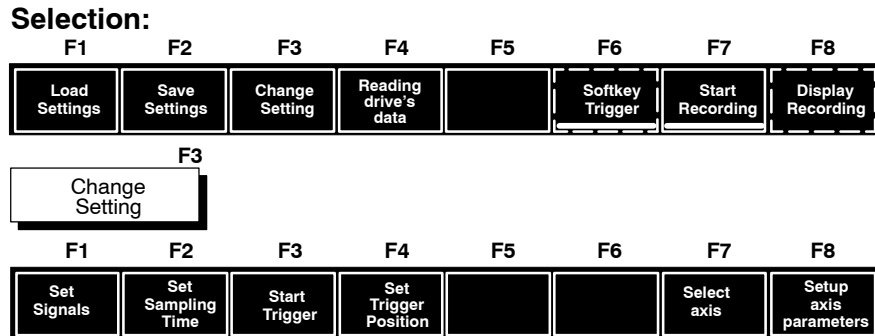
The shortest possible sampling time is determined by the speed control clock within the drive (250 μ s). Other sampling times can be set, but must be integer multiples of the **position** control clock (the cycle time of the position controller is defined in the P-0-0007 parameter).

The grid width of the time axis (abscissa) in the graph which is subsequently displayed corresponds to the defined sampling time.

- ☞ **The diagnosis memory has a fixed size that cannot be changed. Therefore, only the sample time can be increased to extend the recording time, which is associated with lower accuracy.**

Drive oscilloscope

2.5.4 Setting triggers



☞ If you have not selected an axis (refer to “Select Axis” softkey in section 2.5.2), all softkeys (with the exception of the “Select Axis” softkey) are dimmed and therefore not available.

At this point you can



- return to the previous operating level with the level return key.

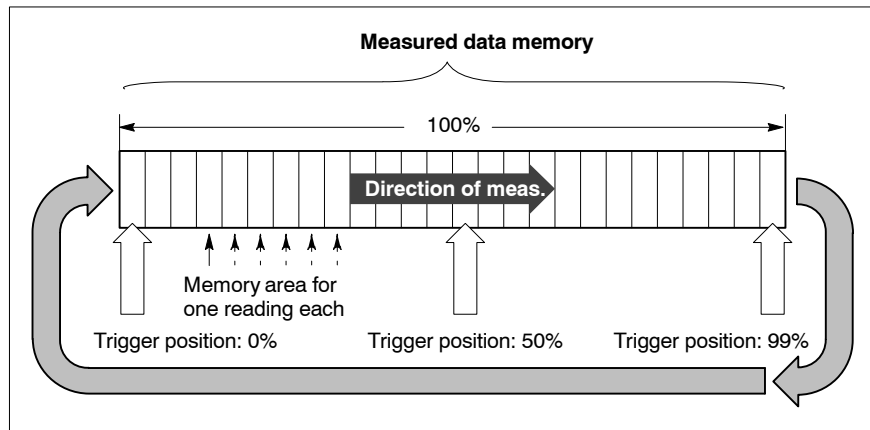


- set the desired trigger condition. The PNC displays a further softkey level when this softkey is pressed. The required trigger event is selected from a list select field using the “First Condition” softkey. If no trigger is required, select the value “No Trigger”.

☞ Only one trigger condition can currently be set for the drive oscilloscope. The “Second Condition” softkey and the “AND/OR” toggle softkey are therefore dimmed.



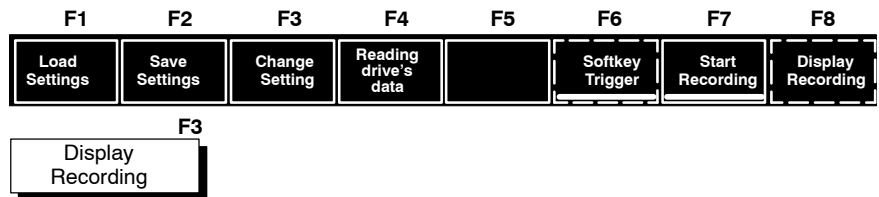
- Using the “Set Trigger Position” softkey, you can determine how many measured values already contained in the drive measured data memory, should be maintained when the valid trigger occurs. Enter a value between 0 and 99 % in relation to the complete measured data memory.



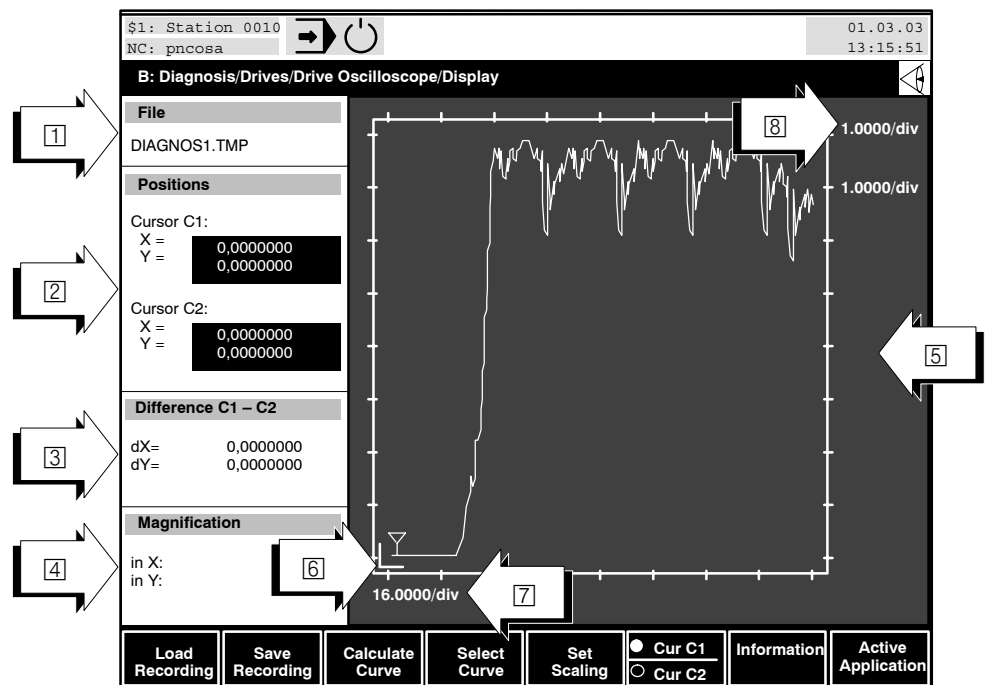
Drive oscilloscope

2.5.5 Displaying recordings

Selection:



☞ The "Display recording" softkey will not be active unless a measurement as been successfully completed. Afterwards, the measured data can be displayed.



Up to 4 curves (curve 1 to 4) can be simultaneously displayed in the area 5. The distinguishing feature is the colour presentation:

Curve 1: red, Curve 2: green, Curve 3: blue, Curve 4: yellow

The displayed **standard** curves represent the course of all signals S1 to S4 at the measuring points in relation to time (refer to section 2.5.2). If, for example, only 2 signals have been recorded, they will be assigned to curves 1 and 2. Curves 3 and 4 remain inactive (= will not be displayed)

☞ The terms "Curve" and "Signal" denote two different things!

- A "Signal" is the sequence of measured values that was registered during recording at a measuring point.
- A "Curve" is a graphic, which can display a signal on the screen.

Drive oscilloscope

Each of the 4 displayed curves can be assigned to any measured value sequence or to a converted measured value sequence (position, feed-rate, acceleration). Information on how this process functions can be found in the section "Displaying or suppressing curves".

The smallest grid width of the abscissa corresponds to the set sampling time. The display in area 5 is scaled in such a way as to facilitate the complete display of all recorded measured data in the available display area. Of course, the scaling can also be changed manually (refer to "Scaling" section). The control unit sets the C1 and C2 cursors at the start of the first active curve.

- 1 Indicates the file from which the currently displayed measured values originate. The measured values have not yet been saved in a *.DSS file if the entry "DIAGNOS1.TMP" appears. All measured data would then be overwritten during the next recording.
- 2 Actual **values** at the current positions of both cursors. Both cursors can be independently assigned to different curves. The numerical values and the cursor markers are the same colour as the corresponding curve.
- 3 Display of the **difference between the actual values** at the C1 and C2 cursor positions.
- 4 Currently set **display magnification factor** in area 5 split according to the abscissa (X axis) and ordinate (Y axis). If no value is displayed here, the current display is to the scale of 1:1. The scale can be changed by means of the zooming function.
- 6 Zero point of the display axes. If negative values have also been measured, the control unit moves the zero point according to the display axes. The axis lines then appear as horizontal and vertical **white** lines within the complete display area.
- 7 Value of a scale division of the abscissa. For example, if the value "16.0000/div" is displayed, one scale division on the axis corresponds to a value of 16.0000.
- 8 Value of a scale division of the ordinate. For example, if the value "1.0000/div" is displayed, one scale division on the axis corresponds to a value of 1.0000.

You can now adapt the display and the cursor positions to the requirements by means of a series of functions.

Drive oscilloscope

2.5.6 Display system

Key combinations for adjusting the display window:

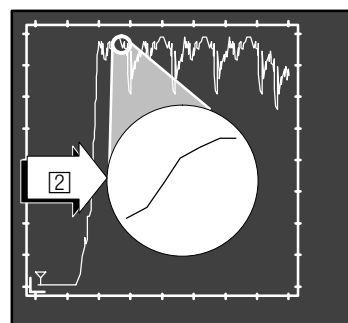
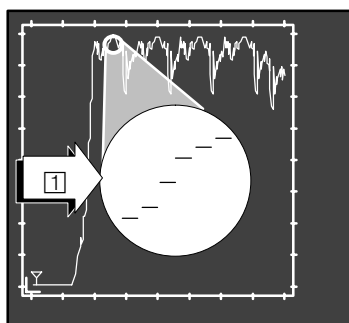
- <Ctrl> + : black background
- <Ctrl> + <w> : white background
- <g> : activate grid lines
- <shift> + <g> : deactivate grid lines.

Curve display

Curves in area **5** can be displayed as a sampling display (sample and hold principle) or as a continuous display. 2 successive measured values are connected by a line in the case of a continuous display. The course of the curve is thus clearer. The continuous display is normally set as the standard display. Use the key



with the < - > (hyphen) character to switch to sampling display (**1**),
with the < _ > (underline) character to switch to continuous display (**2**).

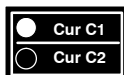
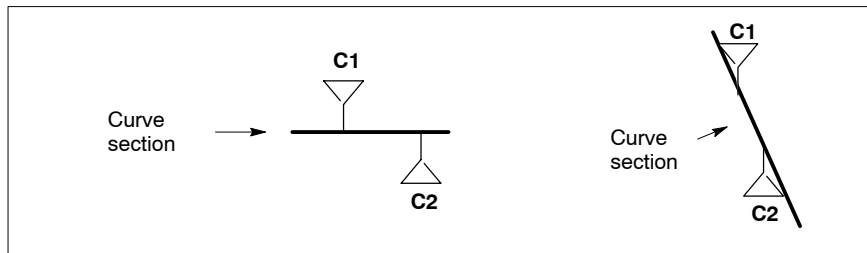


Drive oscilloscope

2.5.7 Cursor functions

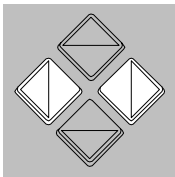
2 cursor markers, which you can move independently of one another or assign to certain active curves, are available within the display. **Exact differential measurements on one curve, and also between differing curves**, are relatively easy in conjunction with the curve coordinate numerical display (in the left section of the display screen).

The PNC displays both cursors as the symbol ∇ on the screen. The cursor C1 is always located above, and the cursor C2 below the course of an assigned curve:



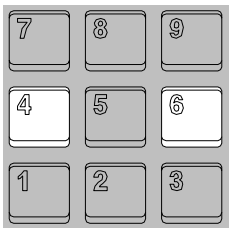
Cursor anwählen

You select the cursor to be moved or assigned to a curve with the “Cur C1 / Cur C2” toggle softkey. The currently active cursor is indicated by the checked point on the softkey.



Moving the cursor

You can move the **active cursor, in small steps**, back and forth on the curve with the keys \blacktriangleleft and \blacktriangleright (grid width: sampling time).

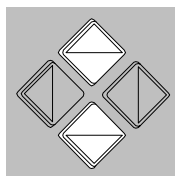


You can move the **active cursor, in large steps**, back and forth on the curve with keys 4 and 6.

Assign a cursor to an active curve

Assign the **active cursor to the next curve** with the \blacktriangleup key. If, for example, the cursor is currently assigned to curve 1, the cursor will now be assigned to curve 2.

Assign the **active cursor to the previous curve** with the \blacktriangledown key. If, for example, the cursor is currently assigned to curve 2, the cursor will now be assigned to curve 1.



The assignment is indicated by the cursor colour; this always corresponds to the respective curve colour. The colour of the curve coordinate numerical display changes accordingly.

Drive oscilloscope

2.5.8 Scaling

The display in area [5] is scaled in such a way as to facilitate the complete display of all recorded measured data in the display area.

If, however, several signals have been recorded simultaneously or various display types are active (e.g. if position, feedrate and acceleration data is displayed), the course of a curve with a low range of values may appear to be practically constant i.e. if individual signals have varying ranges of values. The display area available for this curve is not being optimally used.

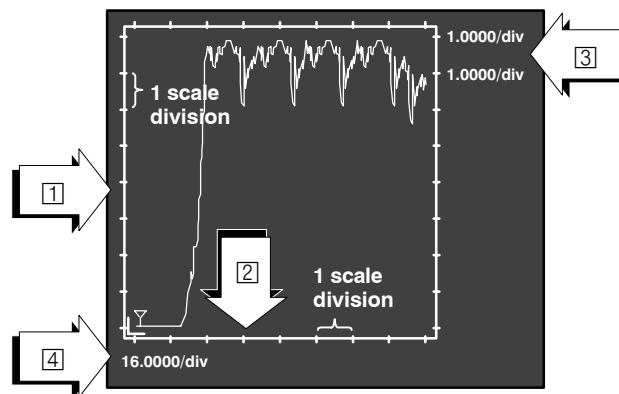
As a result, the scaling of each active curve can be changed.



The “Set Scaling” dialog box can be opened with the “Set Scaling” softkey. The control unit now offers a softkey level, in which you can select an active curve. Enter the required scaling of the horizontal or vertical axis.

The input values each refer to one scale division of the ordinate ([1]) and abscissa ([2]) and will also be displayed within the display range (ordinate scaling: [3]; abscissa scaling [4]).

The ordinate scaling will be displayed in the corresponding curve colour for every active curve.



The scaling of a horizontal time axis in the [ms] unit involves an input value of “16” for example: 1 scale division = 16 ms.

- ☞ **If the curve scaling is changed, the corresponding cursor position remains unchanged. The cursor is, therefore, sometimes located outside the displayed area. You should use the zooming function, not scaling, to examine details in the display area.**

Drive oscilloscope

You set standard scaling by pressing the “Automatic Scaling” softkey. All active curves are once again completely displayed inside the display frame.

Scaling examples:

<p>1 scale division of the horizontal axis = 2000 ms</p>		<p>1 scale division of the horizontal axis = 4000 ms</p>
	<p>CAUTION! The display no longer shows all measured values of the original curve!</p>	
<p>1 scale division of the horizontal axis = 2000 ms</p>		<p>1 scale division of the horizontal axis = 1000 ms</p>
<p>1 scale division of the vertical axis = 1 m/min</p>		<p>1 scale division of the vertical axis = 10 m/min</p>
	<p>CAUTION! The display no longer shows all measured values of the original curve!</p>	
<p>1 scale division of the vertical axis = 1 m/min</p>		<p>1 scale division of the vertical axis = 0.5 m/min</p>

Drive oscilloscope

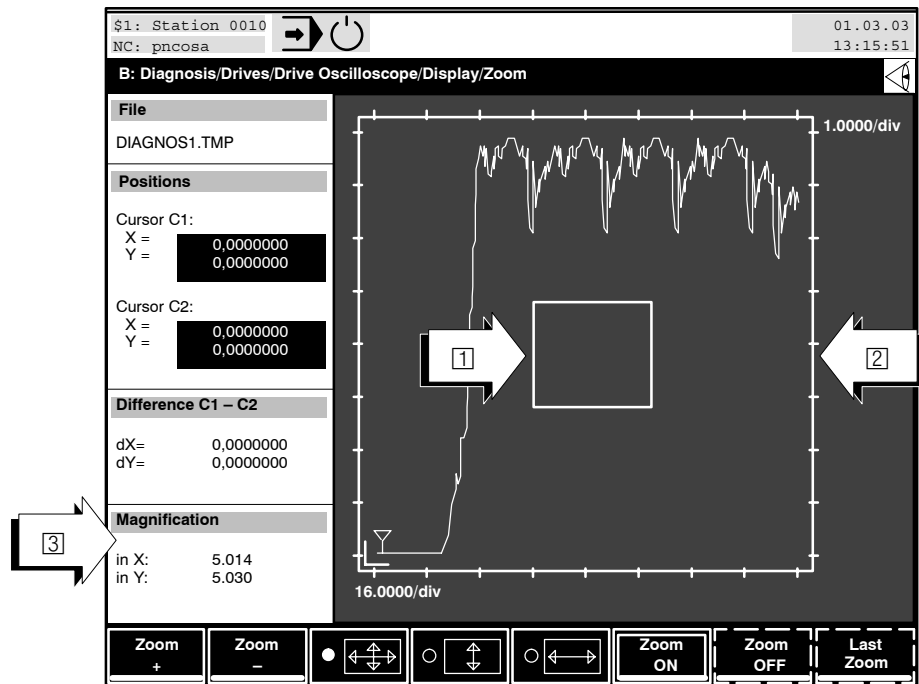
2.5.9 Zooming functions

You can magnify an area in the display window using the zooming function. This allows curve areas which are of interest to be closely examined.



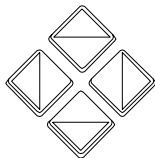
You activate the zooming functions by pressing the zoom key on the PNC keyboard. A rectangular box (1) appears in the display area. This rectangular box marks the area which will be magnified on the total available display area (2), when the zoom is activated.

The magnification factor is displayed in screen area 3.

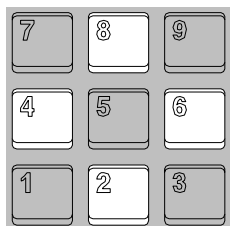


At this point you can

- return to the previous operating level with the level return key.
- move the box in small steps with the cursor keys



- move the box in large steps with the keys 2, 4, 8 and 6



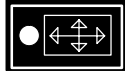
Drive oscilloscope



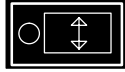
- magnify the box (1)



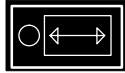
- reduce the size of the box (1)



- determine, using the 3 radio softkeys, whether:



- the proportional reduction of the box remains constant,



- the box is only reduced vertically or

- the box is only reduced horizontally

on pressing the "Zoom +" or "Zoom -" softkeys.



- magnify the marked area over the complete display area (2). Although you then exit the zoom function, the actual magnification remains constant.

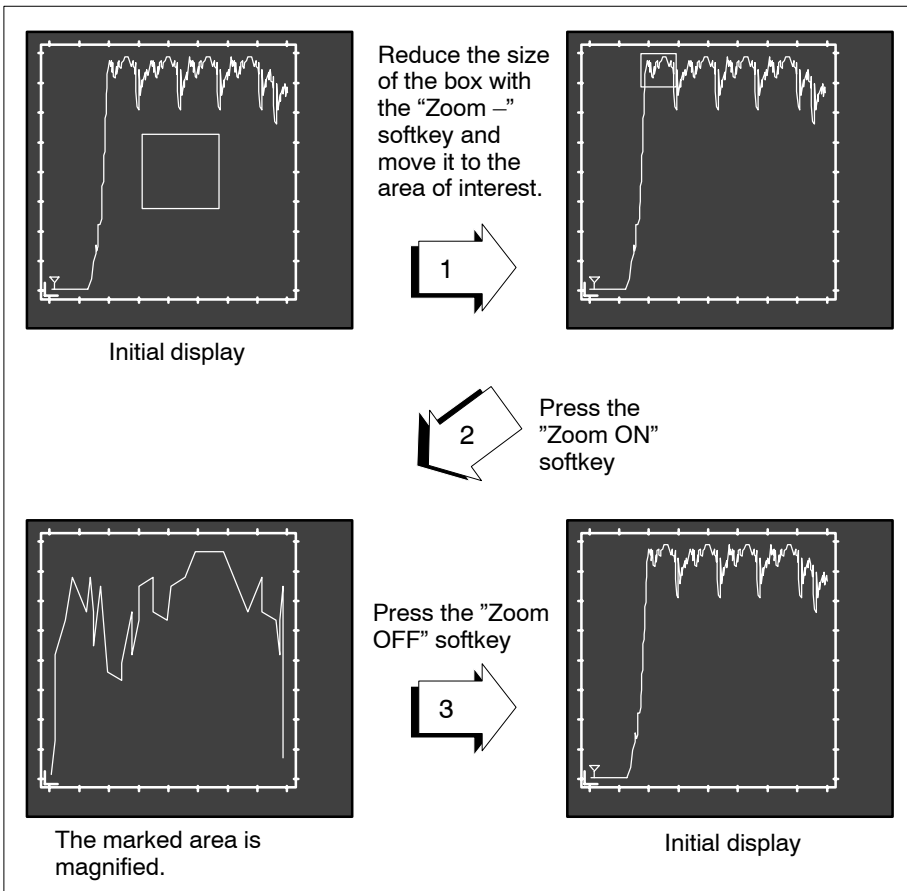


- reset the currently active magnification (switch zoom off). This softkey has a function only if a magnified display is active (i.e. the "Zoom ON" softkey has already been pressed).



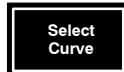
- reset to the zoom status which was active before the "Zoom ON" softkey was last pressed. This softkey has a function only if a magnified display is active (i.e. the "Zoom ON" softkey has already been pressed).

Example of the zooming function:



Drive oscilloscope

2.5.10 Displaying or suppressing curves



You have a total of 4 curves at your disposal each of which can be assigned a separate measured value sequence (signal) or converted measured value sequence (position, feedrate, acceleration).

The PNC **normally** assigns the appropriate curve numbers (curve 1 to 4) to the signals 1 to 4. A curve which has been assigned a real measured signal is automatically activated (= is displayed as a curve shape).

All curves which are not required (if e.g. only 2 signals have been measured) are inactive. These curves are not displayed.

There are two cases in which you may wish to switch the curve status (active / inactive):

1. You have measured several signals but only wish to display a subset of the signals.

You select the curves which should be suppressed using the “Curve 1” to “Curve 4” softkeys. You then set the “Active / Inactive” toggle softkey to “Inactive” and acknowledge with the “OK” softkey. If you wish to display these suppressed curves at a later stage, simply reset the toggle softkey to “Active”.

2. You wish to have not only the values measured at one measuring point displayed, but also the converted values.

For example, the measured position data **for curve representation** can be converted to velocity or acceleration values (refer also to the “Calculate Curve” softkey in the next section).

In this case, you select a curve which has not yet been used with the “Curve 1” to “Curve 4” softkeys. The control unit opens the “Signal Selection” dialog box.

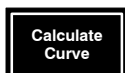
The screenshot shows a dialog box titled "Signal selection". At the top, it says "Curve 1: Active". Below this, there are two sections: "Horizontal:" and "Vertical:". Each section has a list of options with a scroll bar on the right. In the "Horizontal:" section, "Time (ms)" is selected. In the "Vertical:" section, "Command Position" is selected.

Set the measuring point whose values are to be assigned to the selected curve in the “Vertical” list select field. You then switch the “Active / Inactive” toggle softkey to “Active”, acknowledge with the “OK” softkey and press the level return key once.

You then continue with the previously activated curve as described in the following section.

Drive oscilloscope

2.5.11 Displaying curves as position, feedrate or acceleration data



All recorded signals are initially displayed in their **measured** unit. Recorded position data **can be converted** to feedrate data (1st Differential) and acceleration data (2nd Differential) **at a later stage** using the "Calculate Curve" softkey. Select the required curve with the "Curve 1" to "Curve 4" softkeys and enter the relevant calculation (selection: Original Signal, 1st Differential or 2nd Differential) within the "Select Calculation" dialog box.



If the original signal is a feedrate (velocity) signal, the 1st differential represents the "acceleration".

A screenshot of a dialog box titled "Select calculation". It has a black header bar with the title in white. Below the header, there is a section labeled "Curve 1:" with a grey background, containing the text "Command Position". Below that is a section labeled "Selection:" with a grey background, containing three radio button options: "Original Signal" (which is selected), "1. Differential", and "2. Differential".

Select calculation	
Curve 1:	Command Position
Selection:	<input checked="" type="radio"/> Original Signal
	<input type="radio"/> 1. Differential
	<input type="radio"/> 2. Differential



The conversion of the recorded measured values does not influence the original measured values. The conversion only has an effect on the display form of a curve.

Drive oscilloscope

2.5.12 Saving and loading measurements

In order to save a measuring sequence, you may save the current measurement settings including the measured values in an internal format or as an ASCII file. Current settings relevant to the display (curve active / inactive, scaling or magnified displays) are not taken into consideration in either case.



- **A measurement which has already been saved can be loaded.** The PNC displays all saved measuring files (*.ACH) on the screen. Measuring files are saved in the control unit root directory (Path: \). Select the required file with the cursor keys and press the "OK" softkey.



Another measurement that had previously been displayed by the user by calling up "Load recording" will be discarded and the currently measured data will be displayed. If no new measurement is performed, the last selected file will always remain active.



- **A measurement can be saved.** The PNC opens a dialog window in which you can enter the file name. You must also specify whether the measuring sequence should be stored
 - in the internal format of the control unit, or
 - as an ASCII file.
- **Internal format of the control unit:** Only this type of file can be displayed at any time by pressing the "Load recording" softkey. Use this format if you wish to display a measurement curve again later on the screen of PNC. The file is assigned the specified file name including the extension ".ACH" and is saved in the root directory of the control unit. Another directory can be selected with the "Switch directory" softkey.
- **ASCII format:** Use ASCII files if you wish to export the measured values for evaluation or display (e.g. to a spreadsheet or database on an external PC). The ASCII file is assigned the specified file name including the extension ".DAT" and is saved in the root directory of the control unit. The directory can be switched by pressing the appropriate softkey. The structure of the ASCII files corresponds to a table containing all relevant data and measurement settings. All columns are separated by one tab; therefore, most commercially available spreadsheets and databases can easily import the structure of the file. During import, you only have to specify that the ASCII character <tab> shall be used as separator. The second and following lines contain the measured values of a recorded signal in the individual columns.

Drive oscilloscope

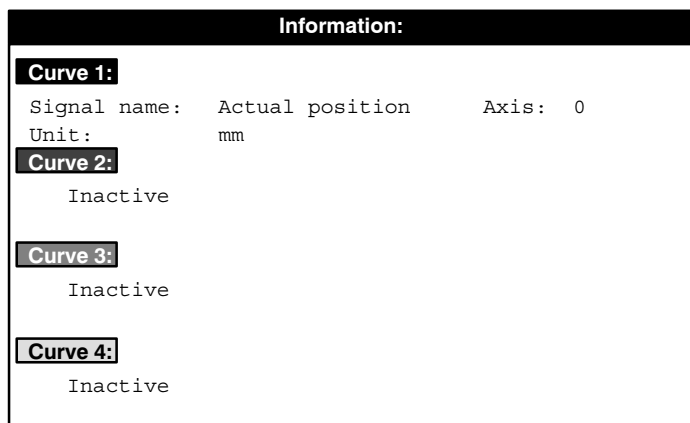
The first line of the ASCII file contains the following additional information in separate columns:

Column 1:	Name of signal 1
Column 2:	Name of signal 2
Column 3:	Name of signal 3
Column 4:	Name of signal 4
Column 5:	Unit of measure of signal 1
Column 6:	Unit of measure of signal 2
Column 7:	Unit of measure of signal 3
Column 8:	Unit of measure of signal 4
Column 9:	Axis number of signal 1
Column 10:	Axis number of signal 2
Column 11:	Axis number of signal 3
Column 12:	Axis number of signal 4
Column 13:	Number of sampling processes recorded
Column 14:	Index for the trigger position
Column 15:	Sampling time

2.5.13 Displaying curve information

Information


Provides a clear overview of the assignments of all 4 available curves. The control box opens the “Information” dialog box:



Curve x: Curve number, background is the same colour as the curve.

Signal name: Name of the measuring point.

Unit: Unit in which the measured values are available.

-  **If a curve is switched to inactive, the control box merely prints the text “inactive” under the curve designation.**
- If the curve is displayed with calculated values,**
- “(d/dt)” appears for feedrate displays and
 - “(d/dt²)” for acceleration displays after the axis input.

Drive oscilloscope

2.5.14 Reading out drive parameters or their transfer to the drive

It is sometimes necessary to change various drive parameters (e.g. controller parameter), if you are located within the drive oscilloscope during setting or diagnostic work.

As the drive parameters are normally changed via the SERCOS monitor, you must switch to the SERCOS monitor each time. The functions of the SERCOS monitor are therefore available to a somewhat limited extent in the drive oscilloscope by pressing the "Setup Axis Parameters" softkey.

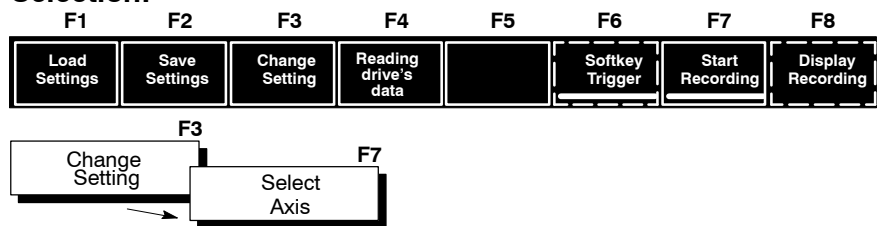


CAUTION

Possibility of damage to drives, machines, tools, or workpieces! Drive parameters may only be set or changed by qualified personnel! They must have extensive knowledge in the areas of automatic control engineering, drive engineering and in the functions of the SERCOS interface.

The control unit must know which drive should be used for communication before you can work with the drive parameters:

Selection:



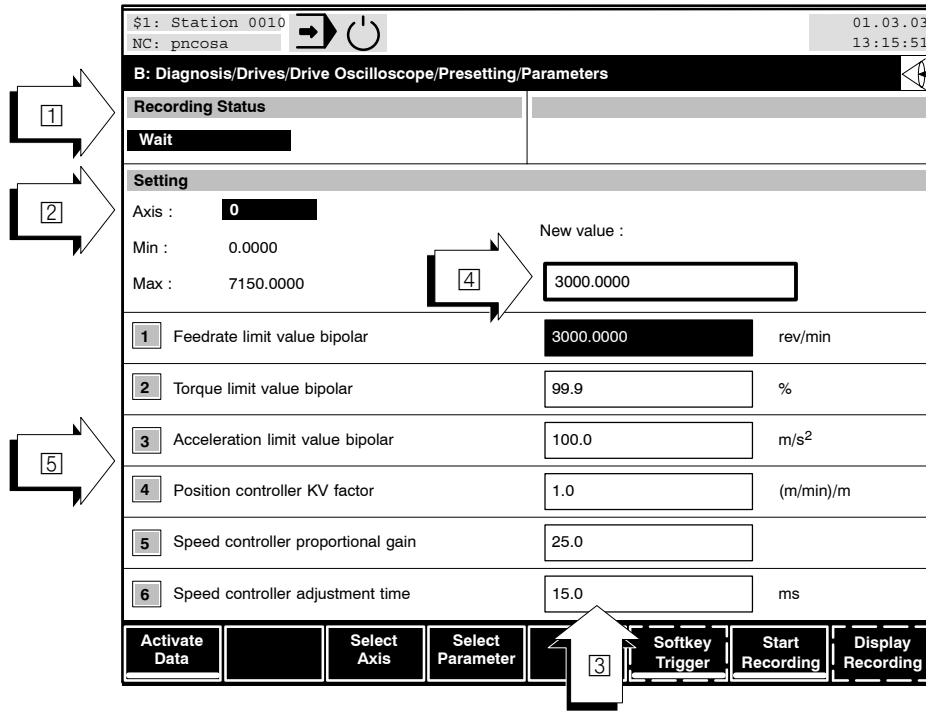
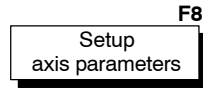
The PNC then opens the "Select Axis" dialog box. All of the connected axes are listed here together with their logical system axis numbers. Select the required axis and press the "OK" softkey.

If you have not yet selected an axis, all softkeys (with the exception of the "Select Axis" softkey) are dimmed and, therefore, not available. If the softkeys remain dimmed although you have selected an axis, check the "/diampk.dat" file (refer to "Select Parameter" softkey on page 2-100).

Drive oscilloscope

When an axis has been selected, the drive parameters can be modified.

Selection:



The values of parameters 1 to 6 displayed in area 5 are read from the drive when this operating level is selected.

1 The PNC displays the current status of the drive oscilloscope in the "Recording Status" area:

- Wait: No measured data is being recorded. The drive oscilloscope is in wait mode.
- Running: Recording has been started. The drive constantly saves measured data in the ring memory. Defined trigger events have not yet occurred.
- Recording: The trigger events have occurred. The measured data memory is completely filled (no more than once).
- Save: The measuring process is terminated all measured data is currently being transmitted from the drive, via the SERCOS service channel, to the PNC, where it is saved in a measuring file. During this process, the "Select axis", "Select parameter", and "Activate data" softkeys are dimmed. Furthermore, the cursor keys are not active.

Drive oscilloscope

- ② Indicates the axis selected for communication by its physical system axis number. You can change the displayed axis with the “Select Axis” softkey.
- ③ Display fields showing the values of the individual parameters. You may select a display field with the ▲ and ▼ cursor keys. The selected field is displayed in reverse video, and its contents are automatically copied to the “New value” dialog field (④).
- ④ In this field, you may enter a new value for the currently selected parameter (refer to ③). To the right of the “New value” input field, the control unit displays the maximum value range of the parameter next to “Min:” and “Max:”.
- ⑤ The “Active Parameters” area can be assigned 6 different SERCOS parameters. The assignment can be changed with the “Select Parameter” softkey. The current drive value and the unit is displayed for every parameter.

At this point you can

- select one of the display fields with the ▲ and ▼ cursor keys in area ③. The selected field is displayed in reverse video, and its contents are automatically copied to the “New value” dialog field (④).
- **return to the previous operating level** with the level return key.



- **release the “Softkey Trigger” trigger event.** This softkey can only be selected if the trigger condition “Softkey Trigger” has been set and the recording has already been started (refer to the “Start Recording” softkey).
The recording status changes to “Recording”. The drive diagnostic memory is refilled completely (at the most once).



- **start the measuring process.** The recording status changes to “Running”, the softkey text changes to “Cancel Recording”. The PNC transfers all measurement settings to the drive. The drive constantly saves measured data in the internal ring memory (diagnosis memory) and waits for the possible occurrence of the set trigger events.

☞ **If the recording status does not change to “Running”, check whether a value not equal to “0” has been entered as sampling time and whether at least one signal has been defined. If the error message “Service channel is busy” appears, the SERCOS service channel is being used. Wait for a moment before starting again.**

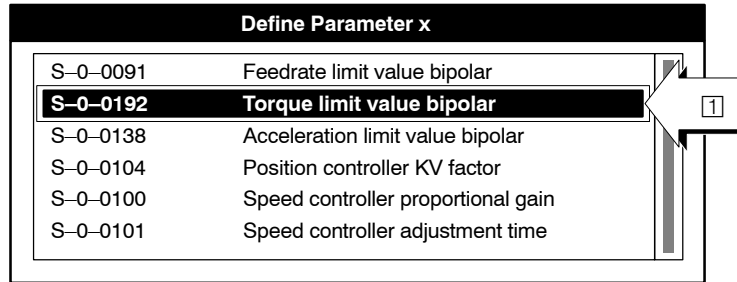


- **graphically display a measuring process which has already been correctly concluded.** Refer to section 2.5.5.

Drive oscilloscope



- **select an axis to which the parameter is to be transferred.** The values of all parameters displayed in area [5] are also read from the drive during axis selection.
- transfer all displayed parameter values to the drive.
- change the **parameter assignment of the area [5]**. The control unit offers you the “Parameter 1” to “Parameter 6” softkeys. The PNC opens the “Define Parameter x” dialog box when the respective softkey is pressed:



All ident. nos. offered here come from the "diapar.dat" file. One ident. no. per line can be contained in the file as

S-x-xxxx (x=group number; xxxx=parameter number) or
 P-x-xxxx (x=group number; xxxx=parameter number).

Therefore, different working environments can be preset in the "diapar.dat" file. For this purpose, you must first store all the necessary ident. numbers in a text file which must then be renamed to "diapar.dat" and copied to the root directory, the user FEPROM or the FEPROM.

Pressing the "Select Axis" softkey always updates the contents of the "Define Parameter x" dialog box with the contents of the "diapar.dat" file.

At this point you can

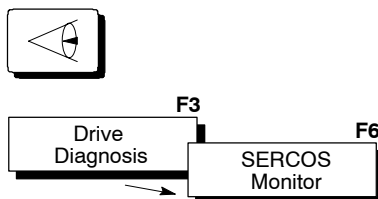
- **select** the required **parameters** within the **list select field** by moving the focus ([1]) with the \downarrow \uparrow cursor key.
- **close the dialog box and return to the previous operating level** with the level return key. Changes which have not yet been confirmed will not be saved.
- **activate the currently selected parameter in area [5], close the dialog box and return to the previous operating level.**



SERCOS monitor

2.6 SERCOS monitor

Selection:



You use the SERCOS monitor

- to manually set the individual SERCOS phases
- to read out drive parameters from a drive or transfer them to a drive.

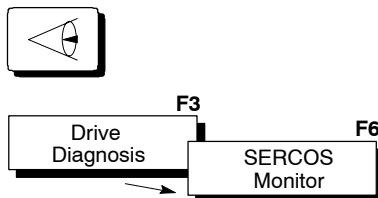


CAUTION

Possibility of damage to drives, machines, tools, or workpieces! Drive parameters may only be set or changed by qualified personnel! This is also valid for the setting of a SERCOS phase. This personnel must have extensive knowledge in the areas of automatic control engineering, drive engineering and the functions of the SERCOS interface.

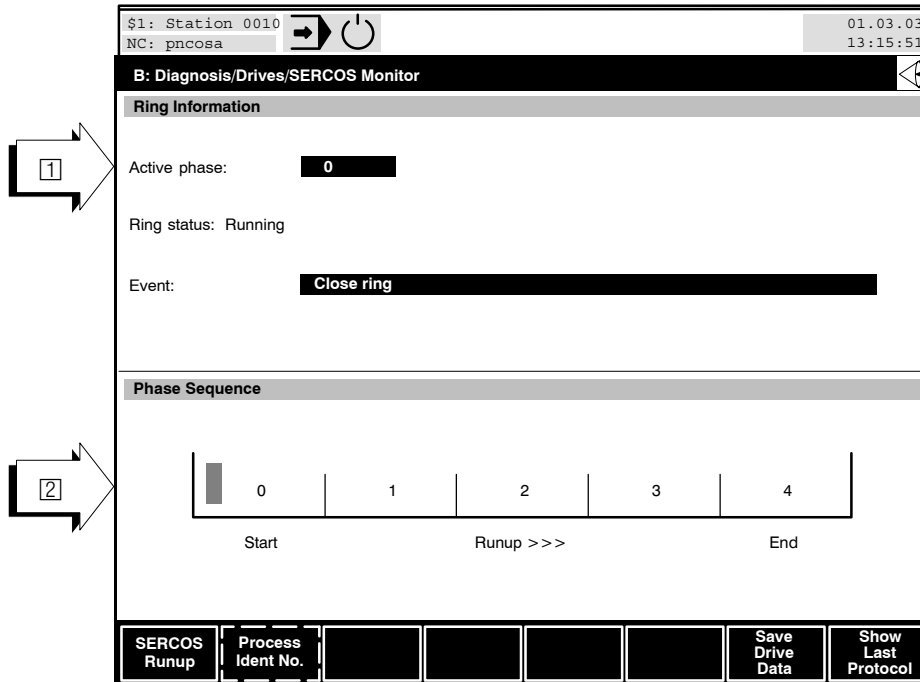
2.6.1 Starting the SERCOS monitor

Selection:



SERCOS monitor

The following monitor display appears:



- ① The PNC displays the current status of the SERCOS ring in the “Ring Information” area.
- ② displays the current SERCOS phase as a bar chart.

The phase display is updated automatically.

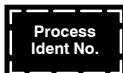
At this point you can



- **return to the previous operating level** with the level return key. The SERCOS monitor is subsequently terminated.



- **set a desired SERCOS phase** (refer to section 2.6.2)



- **read out drive parameters from a drive or transfer them to a drive** (refer to section 2.6.3). This parameter is dimmed if no drives are connected.



- For **all** connected drives, the “Save main memory” command must be executed. In this process, all data necessary for operation (= List S-0-0192) are taken over into the drive’s FEPR0M.

This command overwrites all data in the drive’s FEPR0M. If necessary, you should previously save this data using the DSS-D Commissioning and Diagnostics System.



- Checks whether the “Save main memory” command has been executed in all drives. Execution is logged for each drive in a list.

SERCOS monitor

2.6.2 Setting SERCOS phase

It may become necessary to manually specify a certain SERCOS phase for testing purposes.

The settings of the internal SERCOS initialisation files for phases 2 and 3, for example, can be adapted and reactivated without having to switch off the system.

 **Ident. nos. can only be transferred to and from a drive, if the SERCOS ring is in a phase ≥ 2 .**

Selection:

F1	F2	F3	F4	F5	F6	F7	F8
SERCOS Runup	Process Ident No.					Save Drive Data	Show Last Protocol

F1

SERCOS Runup

The PNC opens the “Set Phase” dialog box.

Set Phase

Active Phase:

Target Phase: (0 ... 4)

Standard Selection:

Clear D.Cl.1 error

Download phase 2

Download phase 3

Enter the required target phase.

You can also set the following:

- Clear D.Cl.1 error:** The control unit sends the command “Clear D.Cl.1 error” to all drives before entering phase 2. This is particularly important when switching back directly from phase 4 to phase 0 or when a D.Cl.1 error was active before the phase change-over (e.g. servo error).
- Download phase 2:** The contents of the SERCOS file “sysgrph2.scs” are loaded in the drives in phase 2.
- Download phase 3:** The contents of the SERCOS file “sysgrph3.scs” are loaded in the drives in phase 3.

SERCOS monitor

The PNC always executes the functions of the selected check boxes during a phase change-over.

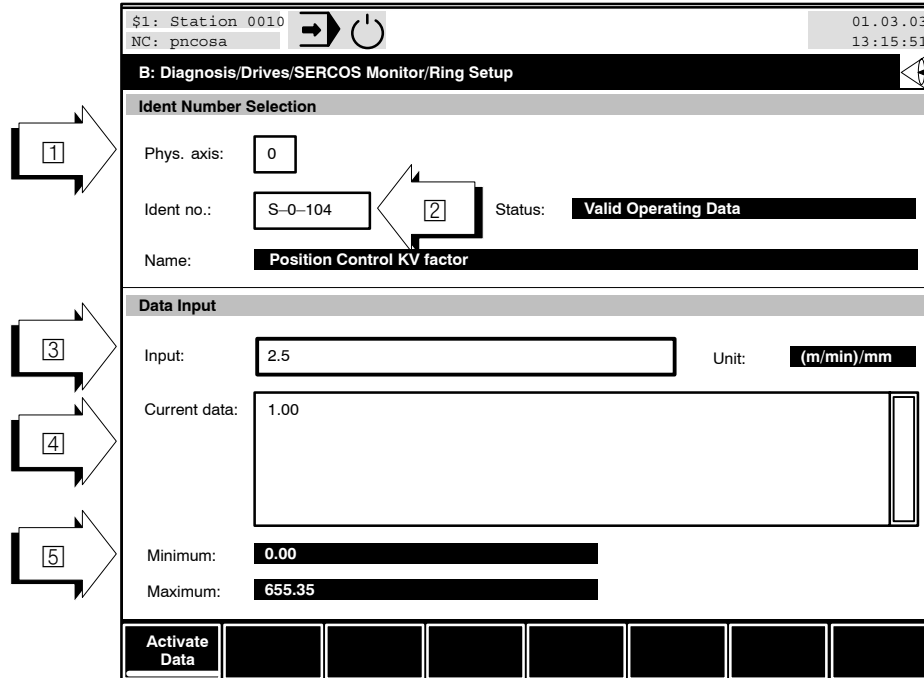
Acknowledge the settings and initiate the change-over to the selected phase with the “OK” softkey.
 Cancel the phase change-over with the “Abort” softkey. Changes in the dialog box are not saved.

2.6.3 Transmitting drive parameters for processing

 **Ident. nos. can only be transferred to and from a drive, if the SERCOS ring is in a phase ≥ 2 .**



The following monitor display appears:



1 Input of the physical axis number. You determine from which drive data is to be read, or to which drive data is to be transmitted. The choice of drive depends on MACODA parameter 1050 00004, “Assignment of physical axes to SERCOS addresses”.

SERCOS monitor

② Input of the desired ident. nos. as

S-x-xxxx or

P-x-xxxx

in which case, the following applies:

S	SERCOS-ident. no.
P	Manufacturer specific ident. no.
x	Group nos. 0 to 7
xxxx	Parameter no.

The SERCOS monitor displays all elements of this parameter after the no. is entered:

- Name
- Data status
- Unit (refer to ③)
- Current value (refer to ④)
- Minimum input value (refer to ⑤)
- Maximum input value (refer to ⑤)

③ New input value for the ident. no. entered in ②. The permissible range of values can be found in area ⑤.

Send the new value to the currently selected drive with the “Activate Data” softkey after input.

Decimal values do not have to be specially marked.

Hexadecimal values must be preceded by the character string “0x” or “0X” and binary values by the character string “0b” or “0B”.

④ The current values of the ident. nos. entered in ② are displayed here. The following data formats are specially marked:

hexadecimal: the value is preceded by the string “0x” or “0X”
(Examples: “0xE2”, “0x1234”, “0XFF”).

binary: the value is preceded by the string “0b” or “0B”
(Examples: ”0b1010101000001111”)

An ident. no. can also comprise of one or more ident. nos. For example, S-0-0017 is a list of all ident. nos. that contain operating data.

⑤ Display of the permissible range of values (“minimum:”, “maximum:”).

At this point you can

- **select the individual input fields** with the ▼▲ cursor keys or with the <tab> key. The selected active input field has a thick border.
- **return to the previous operating level** with the level return key.



SERCOS monitor



- **read the data** of the currently displayed ident. no. from the drive, **or send** the currently displayed ident. no., together with the new values, **to the drive**.

The function of the softkeys depends on the **currently selected input field**:

input field ② selected: **read data from the drive**

input field ③ selected: **transfer data to the drive.**

Logbook

2.7 Logbook

Logging events

The logbook is an application that is automatically started as a service on the PC control panel when the operating system is booted. This application logs and memorizes events occurring in the PNC, including errors, warnings, and messages.

 **In order to use the logbook (option), this feature must have been installed together with the PNC software.**

The events to be logged can be restricted by a filter. By selecting the type of event (error, warning, info, monitoring) and event class, a separate filter profile can be defined for each PNC. Furthermore, the software version of the PNC is scanned and saved.

The logbook is connected to the PNC through a network link and synchronized to the error management function of the PNC which may have detected errors in the run-up phase, for example. As it is possible to monitor several PNCs at a time, each PNC must be introduced by its "host name".

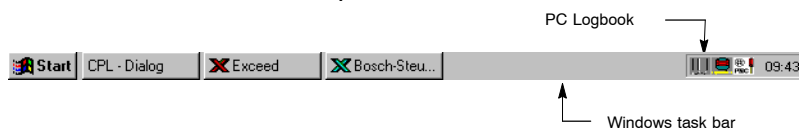
Displaying events

The data provided is stored and visualized in the "Application" log of the **event viewer of the operating system** (refer to page 2-115). The error texts will be stored in English. The current language can be selected with the help of the input filter.

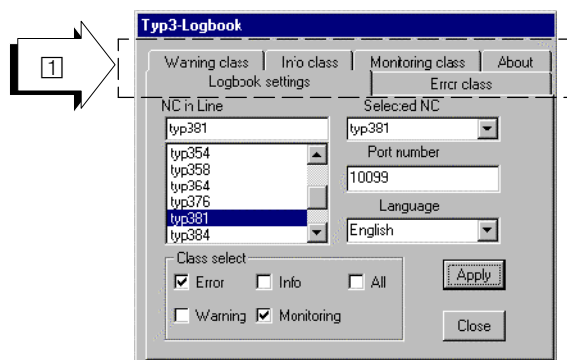
Logbook

2.7.1 Start and operation of the logbook

- ★ The logbook dialog is started by double-clicking on the icon in the task bar and then selecting "Parameter ON".
"Parameter OFF" will stop the service.



- ★ Alternatively, you may start the logbook dialog by selecting Start ► Programs ► Bosch PNC PC-Panel ► PC-Logbook.

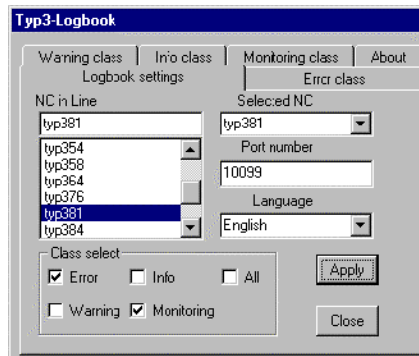


The logbook dialog contains several **tabs** (1), where settings can be made:

- Logbook settings
- Error class
- Warning class
- Info class
- Monitoring class
- About (list of links)

Logbook

2.7.2 Logbook settings



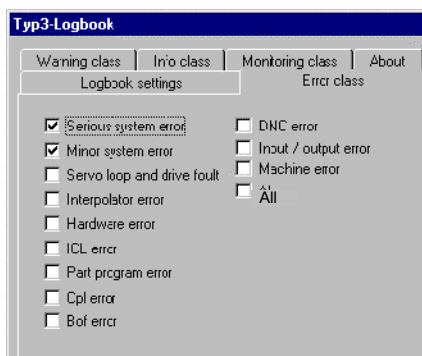
The following settings can be made:

NC in Line	Displays all PNC controllers that can be addressed via the network by their symbolic names. Press the <Enter> key to accept the desired controller to Selected NC .
Controller selection: Selected NC	Displays the controllers whose events will be logged in the logbook. To remove controllers: first select controller in the field Selected NC , then delete with key.
Portnumber	The logbook is linked to the controller in the field Selected NC through this port number. Default: 10099 .
Language	Changes over the error texts in the event viewer (default assignment: English).
Class select	Preselection of types of events to be logged: <ul style="list-style-type: none"> ● Error ● Warning ● Info (message) ● Monitoring It is also possible to set all four types of events at the same time (All) . To activate a class, click a checkmark with the mouse or position cursor with <Tab> and set checkmark with <space bar>.
Accepting the input: Apply	By selecting Apply , the controller that is currently shown in the field Selected NC is linked to the logbook.

☞ **You should log the changes you can make at any time to the logbook settings in order to draw conclusions from subsequent error messages.**

Logbook


2.7.3 Setting the "Error" class of events



Various **Error classes** may be selected from the errors occurring.

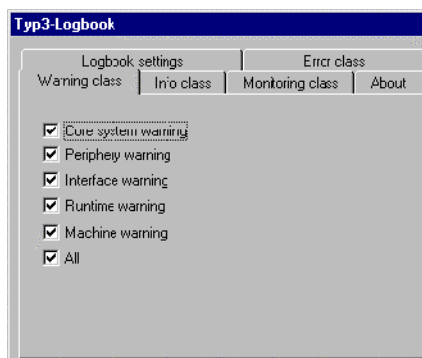
- All the classes activated with a checkmark will be listed in the logbook. To activate a class, click a checkmark with the mouse or position cursor with <Tab> and set checkmark with <space bar>.
- By selecting "All", all classes of this type of event can be activated.

Class:	Name	Description
1	Serious system error	
2	Minor system error	
3	Servo loop and drive error	
4	Interpolator error	
5	Hardware error	
6	ICL error	PLC Error (if a software PLC is active, the customer's error number and the text assigned to it are displayed)
7	Part program error	
8	CPL error	
9	BOF error	
10	DNC error	
11	Input/Output error	Interface error
12	Machine error	
All	(selects all classes)	

 For a detailed description of the event classes, please refer to the "PNC error messages" manual.

Logbook

2.7.4 Setting the "Warning" class of events



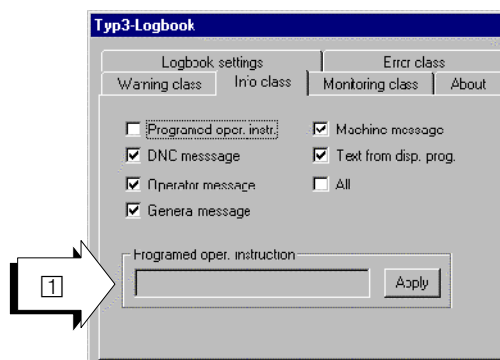
Various **Warning classes** may be selected from the warnings occurring:

- All the classes activated with a checkmark will be listed in the logbook. To activate a class, click a checkmark with the mouse or position cursor with <Tab> and set checkmark with <space bar>.
- By selecting "All", all classes of this type of event can be activated.

Class:	Name
20	Core system warning
21	Periphery warning
22	Interface warning
23	Runtime warning
24	Machine warning
All	(selects all classes)

Logbook


2.7.5 Setting the "Info" class of events



Various **Info classes** may be selected from the messages occurring.

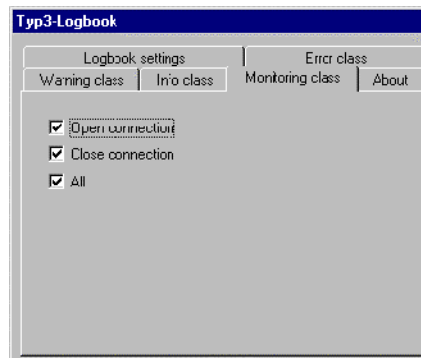
- All the classes activated with a checkmark will be listed in the logbook. To activate a class, click a checkmark with the mouse or position cursor with <Tab> and set checkmark with <space bar>.
- A **Search string** (1) may furthermore be entered for the "Programmed oper. instr." class. Afterwards, only the programmed messages containing the search string will be logged. Press "Apply" to accept your entry as the search string.
- By selecting "All", all classes of this type of event can be activated.

Classes	Name	Description
30	Programmed oper. instr.	Programmed message
31	DNC message	
32	Operator message	
33	General message	
34	Machine message	Texts stored in the diagnosis program
35	Text from disp. prog	Machine info
All	(selects all classes)	

 For a detailed description of the event classes, please refer to the "PNC error messages" manual.

Logbook

2.7.6 Setting the "Monitoring" class of events



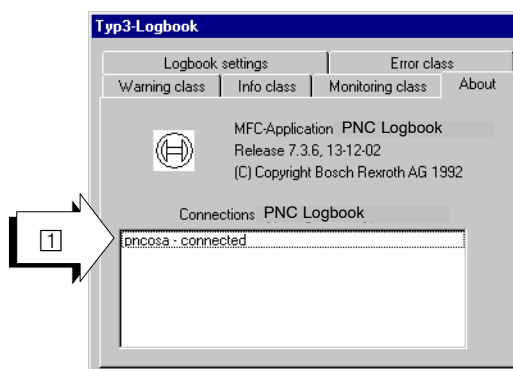
The link between the logbook and the controller can be monitored using various **Event classes**.

- All the classes activated with a checkmark will be listed in the logbook. To activate a class, click a checkmark with the mouse or position cursor with <Tab> and set checkmark with <space bar>.
- By selecting "All", all classes of this type of event can be activated.

Class:	Name	Description
40	Open connection	The link to the controller has been established
45	Reconnect	Reset at the PNC (This monitoring is active if class 40 has been selected)
50	Close connection	The logbook was stopped
All	(selects all classes)	

Logbook

2.7.7 Display active connection



The **About** tab shows the link statuses (1) of the controllers selected in the **Logbook settings** (refer to section 2.7.2):

connecting:	Connection is established
connected:	Connection is active
disconnected:	Connection has been interrupted

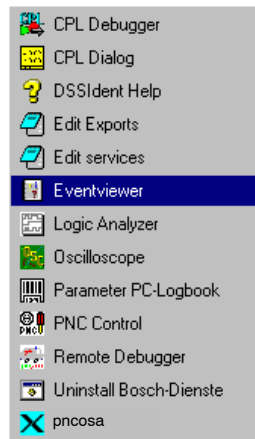
Logbook

2.8 Visualization of the logbook (event viewer)

The entries in the log book are visualized in the event viewer offered by the operating system.

- ★ You can start it right through the PNC program group. Select:

START ► PROGRAMS ► BOSCH PNC PC-PANEL ► EVENT VIEWER



The **Event viewer** application is opened showing the "System" log. However, the events stored in the logbook are only displayed in the "**Application**" log.

- ★ For this purpose, you must select the LOG ► APPLICATION menu sequence.

The logged events are shown in **chronological** order in a table that is built up according to the following pattern:

Date	Time	Source	Category	Event	User	Computer
6/29/04	10:01:56 AM	pncosa_7.3.15	(40)	0	N/A	IPC
6/29/04	10:00:35 AM	BoschNFSServer	None	0	N/A	IPC
6/29/04	10:00:27 AM	UPSNTService	None	2	N/A	IPC
6/29/04	9:58:26 AM	UPSNTService	None	10	N/A	IPC
6/29/04	9:46:55 AM	pncosa_7.3.15	(40)	0	N/A	IPC
6/29/04	9:45:29 AM	BoschNFSServer	None	0	N/A	IPC
6/29/04	9:45:21 AM	UPSNTService	None	2	N/A	IPC
6/29/04	3:25:47 PM	UPSNTService	None	10	N/A	IPC
6/20/04	2:04:52 PM	pncosa_7.3.15	(40)	0	N/A	IPC
6/28/04	2:03:28 PM	BoschNFSServer	None	0	N/A	IPC
6/28/04	2:03:20 PM	UPSNTService	None	2	N/A	IPC

Date: The first column contains a symbol of the event type and the date on which the event occurred:

! Warning, info (yellow)

i Monitoring (blue)

Stop Error (red)

Time: Time at which the event occurred.

Logbook

Source: Indicates where the event was signaled:
Controller name (e.g. pncosa), plus the current software version of the PNC (e.g. 7.3.6)

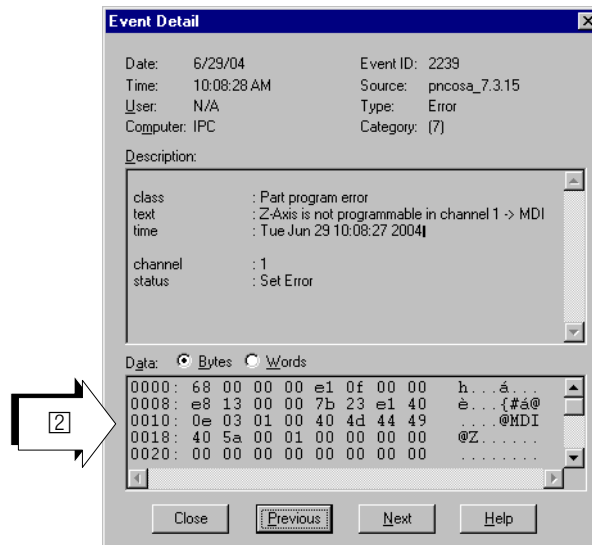
Category: Indicates the event class (refer to page 2-110 and following), e.g. 21 -> Periphery Warning

Event Contains the error number,
(refer to "PNC error messages" manual)

User: Indicates the user name

Computer: Name of the PC running the PNC software
(e.g. IPC)

By double-clicking on an event that has been marked by the cursor bar (1), information is displayed in a new "Event Detail" window.



The "Description" field contains additional information:

class:	Event class in plain text (default: English texts)
text:	Error text corresponding to the error number (English texts)
time:	Date and time of occurrence of the error
channel:	Channel information
status:	Error status: Set error: The error was entered in the logbook when it occurred. Delete error: The error was deleted.

Logbook

status:	Error from NC-Logbook:	The error was retrieved from the NC's internal error management. There, serious and minor system errors will be saved and retrieved whenever the logbook is synchronized with the NC (connection build-up, HW reset).
Binary data: ([2])	Number of data, software version, text number, auxiliary text number, variable data for the error text (parameter)	

☞ **If certain information or events are missing, you may have to change the log settings in the results display (refer to page 2-119) and/or the logbook settings (refer to pages 2-109 to 2-113).**

The entries in the event viewer are deleted after a specified period of time (default: 7 days) or if a maximum number of entries is reached. Nevertheless, old system errors remain stored in the NC error management. When synchronized with the logbook, they are entered in the event viewer again.

In order to protect entries, the individual "System", "Security", and "Application" logs may be saved in logfiles.

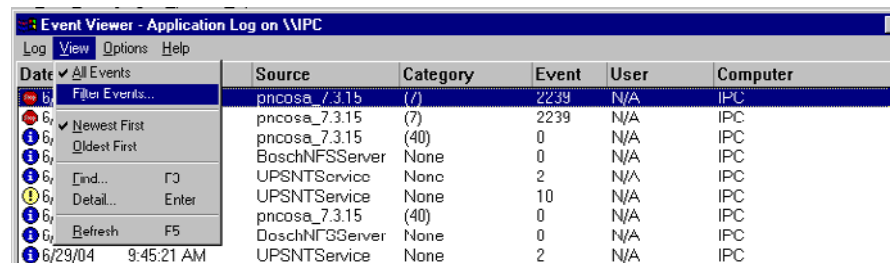
★ For this purpose, you must select the LOG ► SAVE AS menu sequence.

This function will generate logfiles (*.evt) or text files (*.txt) which can be retrieved into the event viewer (*.evt) or a text editor (*.txt) as necessary.

2.8.1 Setting filters for the visualization of the logbook

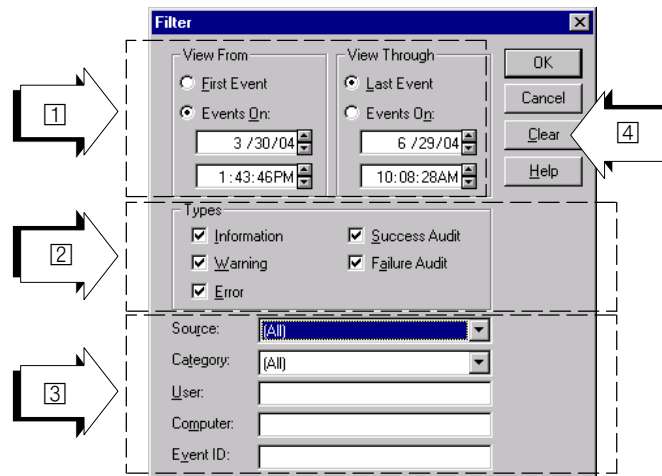
In the event viewer, the visualization can be limited to certain events by defining **filters**.

★ For this purpose, you must select the VIEW ► FILTER EVENTS menu sequence.



Logbook

You may make the settings in the "Filter" window that is then displayed:



There are various filter options available:

- **Limiting the data according to (1):**
 - Time period (Events On ...)
 - Order of occurrence (First/Last Event)
- **Searching for data (2):**
Highlighting certain classes such as
 - Information
 - Warning
 - Error
 - Success audit
 - Failure audit
- **Filtering the data according to (3):**
 - Source
 - Category
 - User
 - Computer
 - Event ID (number)

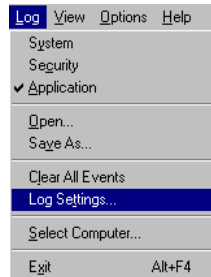
All changes made can be reset to their default status (4).

Logbook

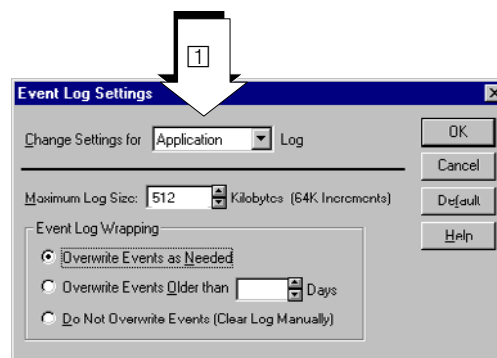
2.8.2 Log properties in the event viewer

The log properties for events in the logbook can be set in the "Event viewer" application.

- ★ For this purpose, you must select the LOG ► **Log settings...** menu sequence.



The following figure shows the **default setting** for making logbook entries:



The following settings can be made:

- Set the log to "Application" (1).
- The maximum log size of the logbook file may be higher or lower than the default value (512 KB), if necessary. This depends on the number of events and the time period, i.e. for how long the events should be logged.
- "Overwrite events" as soon as the maximum logbook size is reached.
- "Overwrite events" older than x days.
- "Do not overwrite events" (requires manual deletion of the log).

**CAUTION**

Overwriting events may result in the loss of important information concerning the analysis of the controller behavior.

However, old system errors are preserved in the NC logbook and will be re-entered in the course of a synchronization of the PC logbook and the pncosa. The correct time stamp of the error is shown in the "Time" line in the "Description" field of the "Event detail" window within the "Event viewer".

You should select a greater log size and/or activate "Clear log manually" in the "Event Log Settings" window.

2.8.3 Saving/Retrieving/Deleting logs

Various file operations are available for the event log:

- The individual "System", "Security", and "Application" logs may be saved in logfiles.
One logfile will always contain the selected log only.
The log (e.g. Log ► Application) can be saved as a logfile (*.evt) or text file (*.txt) using the LOG ► **Save as...** menu sequence.
- Logfiles (*.evt) may be retrieved and displayed in the event viewer using the LOG ► **Open** menu.
Text files (*.txt) can be viewed in any text editor.
- All events may be deleted by the LOG ► **Clear all events** menu sequence.

For further details, please refer to the **Help** functions of the event viewer.

Annex

A Annex

A.1 Abbreviations

Abbreviation	Description
BOF	Bosch Standard Operator Interface
C:	Drive name, in this case drive C (hard disk drive)
ESD	Electrostatic Discharge Abbreviation for all terms relating to electrostatic discharge, e.g. ESD protection, ESD hazards, etc.
Fx	Function key with number x
HP	Main Program ('Hauptprogramm')
LSEC	Lead Screw Error Compensation
MDI	"Manual Data Input" mode
MMI	Man-Machine-Interface (see 'BOF')
MP	Machine parameter
MSD	Machine-Status Display
MTB	Machine-Tool Builder
NC, CNC	Control Unit
OM	Operating Mode
PE	Protective Earth
PLC	Programmable Logic Controller
SK	Softkey
SP	Subprogram

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