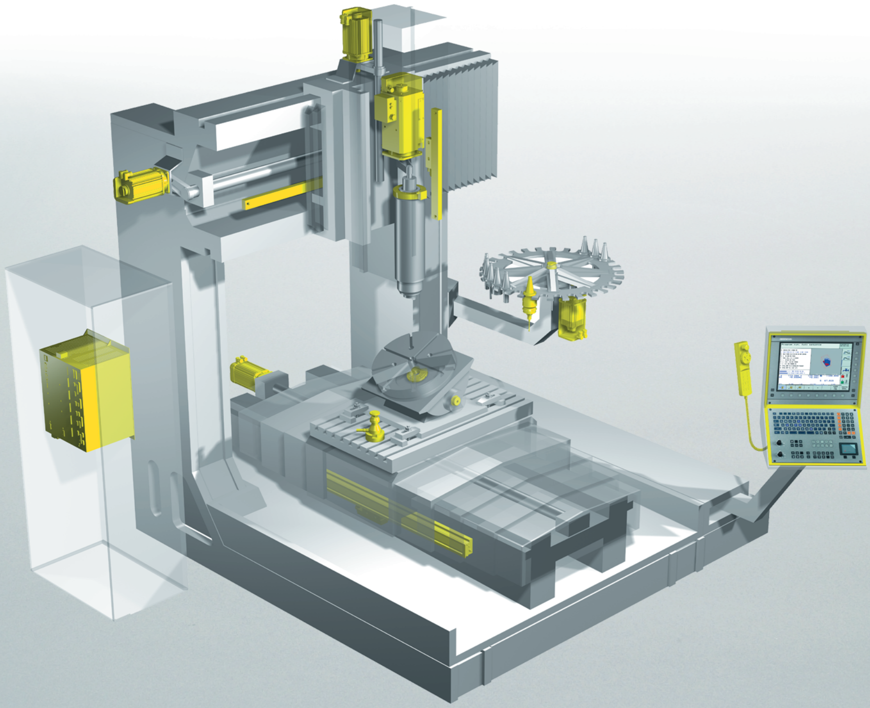
HEIDENHAIN



Service Manual

iTNC 530

May 2006

Contents

1 Safety Precautions

DANGER

Ensure that the equipment grounding conductor is continuous!
Interruptions in the equipment grounding conductor may cause damage to persons or property.

DANGER

Ensure that the main switch of the control and units are switched off when you engage or disengage connecting elements or connection clamps.

Caution

In order to be able to judge the behavior of an NC controlled machine, you need to have fundamental knowledge about controls, encoders, drives, electronics and mechanics.

Inappropriate use may cause considerable damage to persons or property.

DANGER

Incorrect or not optimized input values may lead to malfunction of the machine and may thus cause damage to persons or property.
Machine parameters may only be changed by the machine manufacturer or after consulting the machine manufacturer!

Caution

Note the safety precautions on the machine (e.g., stickers, signs) and the safety precautions in the documentation of the machine manufacturer (e.g., operating instruction).

Caution

HEIDENHAIN does not accept any responsibility for indirect or direct damage caused to persons or property through incorrect use or operation of the machine!

DANGER

Technicians who work on the electricity of the machine must have the corresponding technical knowledge and competence!

DANGER

Always secure vertical axes from falling down before you perform tests on these axes!

DANGER

The interfaces for the PLC inputs/outputs, machine operating panel and PL expansion cards comply with the basic insulation in accordance with **IEC 742 EN 50 178**.
Only units that comply with the requirements of **IEC 742 EN 50 178** for basic insulation may be connected, otherwise damage to persons or property may be caused.
The **maximum** dc voltage mean value of the PLC inputs is 31 V.

Meaning of the symbols used in this manual

DANGER

Failure to comply with this information could result in most serious up to fatal injuries or in substantial material damage.

Caution

Failure to comply with this information could result in injuries and interruptions of operation up to material damage.

Note

These boxes contain important and useful information for servicing.

2 Using the Service Manual

2.1 About this Manual

This service manual will assist service personnel in the diagnosis and correction of errors on TNC-controlled machine tools.

It includes:

- Theoretical explanation of functions and their correlations
- Details of possible error reasons
- Descriptions of error diagnosis
- Details of corrective action

The “Overview of Possible Errors” on page 26 often includes references to the descriptions of error diagnosis. You will find these descriptions in the chapters of the Service Manual structured according to topics.

The Service Manual does not provide commissioning support!

It comprises the service possibilities with the current hardware and software of the control at the editing date of this manual. The service possibilities of your units may differ from the manual. Hardware or software based differences in servicing are indicated in the corresponding descriptions.

This manual is valid for:

- iTNC 530 single-processor with NC software 340420 / 421
- iTNC 530 single-processor with NC software 340422 / 423
- iTNC 530 dual-processor with NC software 340480 / 481
- iTNC 530 single-processor with NC software 340490 / 491
- iTNC 530 dual-processor with NC software 340492 / 493

It must be provided that …

- The machine had been working perfectly before the error ocurred.
- Only genuine spare parts are used!

Note

Basic knowledge in Windows is required for some descriptions in this Service Manual concerning the handling of the dual-processor control iTNC 530 and the use of a service laptop or PC.

Udpate service

This Service Manual is updated only at irregular intervals.
You find the current printable version on our website.
(http://www.heidenhain.de/Services/...)
A zip file can be downloaded. This zip file can be unzipped with a password. Your receive this password during a HEIDENHAIN service training course or upon telephoned request!

Loose-leaf binders or ring binders are only provided in connection with a service training course.

2.2 Further Service Manuals

- Service Manual for Inverter Systems and Motors

2.3 Other Documentation

In the following documents your find further important information:

- Machine documentation of the machine manufacturer
  (circuit diagrams, wiring diagrams, machine operation manual, etc.)
- HEIDENHAIN User's Manual for iTNC 530
- TNCguide (DVD)
- Mounting instructions by HEIDENHAIN
- Brochures of the corresponding HEIDENHAIN units

Note

Current HEIDENHAIN documentation can be obtained fast from our website.
–> www.heidenhain.de

2.4 Support

Caution

The machine manufacturer must be contacted for error diagnosis on your machine tool!

However, support will also be provided by the Service Department of HEIDENHAIN Traunreut or by the nearest HEIDENHAIN agency.

You will find the necessary telephone and fax numbers, as well as relevant e-mail addresses, on the back cover of the Service Manual, or on the HEIDENHAIN website at http://www.heidenhain.de.

2.5 Service Training Seminars

HEIDENHAIN Traunreut offers service training seminars in German. We recommend the HEIDENHAIN Service Training Seminars for iTNC 530 for the technician who works with this Service Manual.
Please inquire at HEIDENHAIN Traunreut or go to our website at www.heidenhain.de/Services/Training.

Note

If required, please inquire at the HEIDENHAIN subsidiary in your country whether Service Training Seminars are offered in your language.

2.6 Safety

DANGER

It is extremely important to read also the general safety precautions in chapter 1!
See “Safety Precautions” on page 9.

3 Code Numbers

3.1 Introduction

With code numbers …

- Certain areas of the hard disk
- Certain file types
- Certain functions

... can be called.

DANGER

Code numbers may only be passed on and/or used by trained service technicians.
Inexpert handling may result in the loss of important data, in a faulty machine performance and thus lead to damage or injury to property or persons.

3.2 Overview

Code number	Brief Description
0	Delete the soft keys MP EDIT, PLC EDIT, OSCI, etc.
123	Edit subset of machine parameters for the machine operator
75368	Offset adjustment for analog axes, see page 1- 346
79513	Info menu (U[BATT], U[ACCU], U[VCC], TEMP, T[CPU1], see page 1- 220
95148	Call the active machine parameter list, see page 1- 468
531210	Reset non-volatile PLC markers and words in the RAM
688379	Integrated oscilloskop, see page 1- 49
807667	Call the PLC area, see page 1- 241
857282	Reset the operating times
LOGBOOK	Call and save the internal log of the TNC, see page 1- 35
NET123	Network settings for the single-processor control, see page 1- 247
SIK	Display of the number of the SIK system identification key and display of the enabled options, see page 1- 414
VERSION	Create the file TNC:\Version.a System data is saved in this file for diagnostic purposes. The file can be read out for diagnosis.

3.3 Notes on Entering the Code Numbers

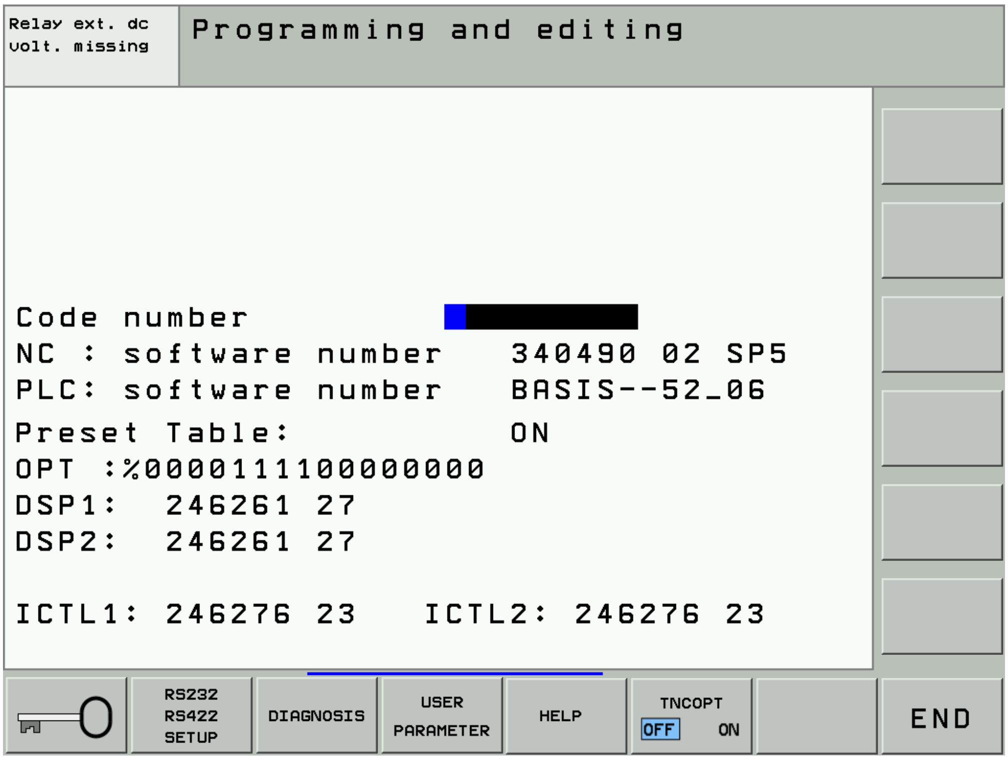
- Keep the code numbers **in confidence!**
- Code numbers can only be entered in the ***Programming and Editing mode***.
- The screen must be blank or the file editor is displayed.
  The program manager must not be open (pressing the MOD key would activate the interface settings screen).
- Press MOD and enter the code number. Finish with ENTER.

Example of calling the active machine parameter list

▶ Select the ***Programming and Editing*** operating mode.

MOD

▶ Call window for code number



9 5 1 4 8 ENT

▶ Enter and confirm code number

Note

The machine manufacturer can define own MP and PLC code numbers.
In this case the HEIDENHAIN code numbers do not function any longer.
–> Contact your machine manufacturer.

- As long as the machine parameter list is in the editor no further code number can be entered. I.e., first close the MP list when you want to enter a new code number
- When certain code numbers are entered, new soft keys are displayed, e.g., ***MP EDIT, PLC EDIT, OSCI***.
  With these soft keys you can also change to the corresponding areas without having to enter the code number again.
- After you have entered the code number for the machine parameters the PLC tree can be seen in the program manager. Only files with the ending ***.MP*** are displayed.

- After you have entered the PLC code number, all files of the PLC tree can be seen and loaded into the editor. However, to edit machine parameters, the soft key ***MP EDIT*** needs to be pressed.
- When you have finished your work do not forget to delete all code-number soft keys ***(MP EDIT, PLC EDIT, OSCI,*** etc.) --> Enter code number ***0,*** confirm with ***ENTER*** and exit the code-number page with ***END*** or reboot the control.

4 Error Messages

4.1 Introduction

iTNC 530 features a comprehensive integral monitoring system for the prevention of **input or operation errors**, as well as for identification and diagnosis of **technical errors** on the control and the connected units. The monitoring system is an integral component of the iTNC hardware and software and is active as long as the control is switched on. The presence of a technical fault or an operation error is made known through a plain-language message.

The machine manufacturer can also define specific PLC error messages.

Type of error message

PLC Error Messages

- Machine-specific error messages
- Are defined by the machine manufacturer (e.g., coolant pump defective, protective door open, etc.)
- The machine manufacturer defines how the control reacts to a PLC error message (NC stop, EMERGENCY STOP, etc.).
- The machine manufacturer defines whether the control can still be operated or has to be rebooted after a PLC error message.
- If you have any questions, please contact your machine manufacturer.

NC Error Messages

- Are part of the HEIDENHAIN NC software
- Can be subdivided in error messages that result from operation, programming and machine applications and those that indicate a technical defect (units, electronical and mechanical parts, etc.).
- DSP error messages are special NC error messages. Such error messages are preceded by a HEX code, e.g., "C300 track error". DSP errors may signalize defects in the CC 42x and/or connected units.
- HEIDENHAIN defines how the control reacts to an NC error message (NC stop, EMERGENCY STOP, etc.).
- HEIDENHAIN defines whether the control can still be operated or has to be rebooted after an NC error message.
- If you have any questions, please contact your machine manufacturer and/or HEIDENHAIN.

Note

Is the displayed error message an **NC or PLC error message?**
If you cannot see this from the error text, press *ERR* --> See the ***Group*** column of the error list in the newly displayed window. PLC errors are marked as such, NC errors are again subdivided into subsections; See “ERR Key” on page 20.
A further possibility is to call the **log.** --> See “Log” on page 35. The NC error messages are there distinguished by a ***N-***, PLC error messages by a ***P-***.
There are no error numbers assigned to NC error messages that begin with ***N-1*** .

Operating System Error Messages

- Often show the note *CHILD PROCESS ERROR*
- The control cannot be operated any more and has to be rebooted.
- If you have any questions, please contact your machine manufacturer and/or HEIDENHAIN.

Display of error message

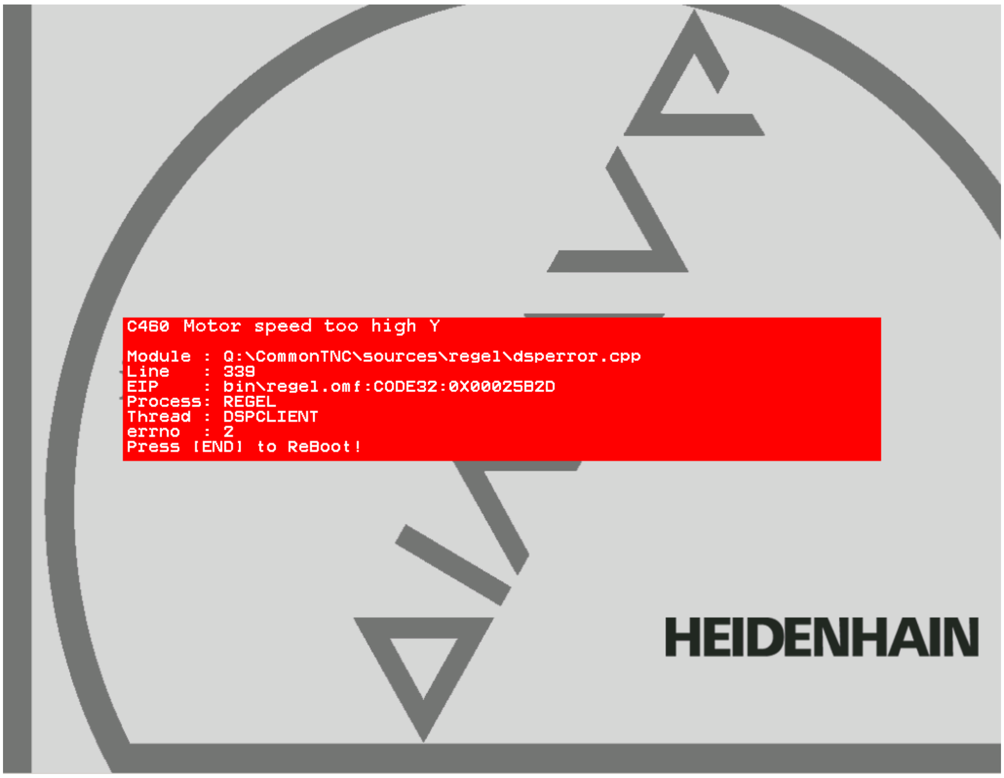
All error messages that can be acknowledged with the CE key are …

- Displayed **in the headline** (upper edge of display; normally in red color).
- Are made known through a plain-language message.
(before some error messages there is an additional HEX code. It is used for identification purposes as so-called DSP error. These are errors in the control loop or errors that are recognized by the control-loop software.)

The machine manufacturer can display additional information on PLC error messages in the small PLC window (atop the soft-key row).

Error messages that require a rebooting of the control ...

- Are displayed **in a red window** in the center of the screen.
- Are made known through a plain-language message.
(before some error messages there is an additional HEX code. It is used for identification purposes as so-called DSP error. These are errors in the control loop or errors that are recognized by the control-loop software.)



Reaction of the control

Display Only

- The machine does not react. Programs are not stopped.

NC Stop

- The axes decelerate at the nominal-value characteristics; normally the contour of the workpiece is not damaged.

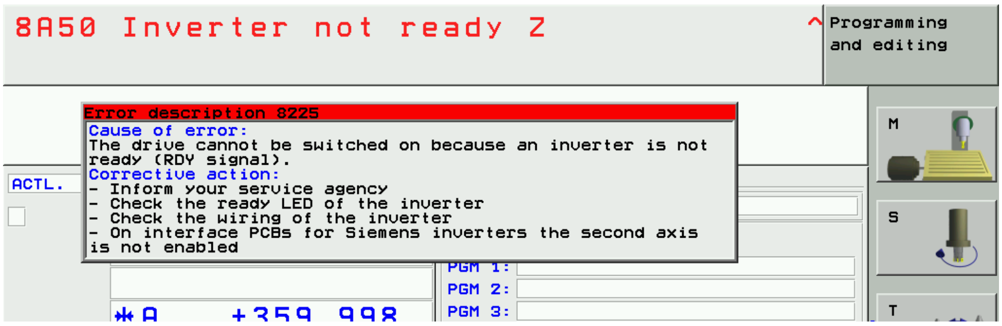
EMERGENCY STOP

- Axes and spindle decelerate at the current limit; the machine should be stopped as fast as possible. The contour of the workpiece is not regarded and may be damaged.

4.2 HELP Key

▶ Display help texts for error messages
(if this key is pressed again, the window will be closed)

If the service technician presses the HELP key a window is shown that describes **the cause of error and possibilities of corrective action** in addition to the displayed error message. This support can also be realized for PLC error messages by the machine manufacturer!



Note

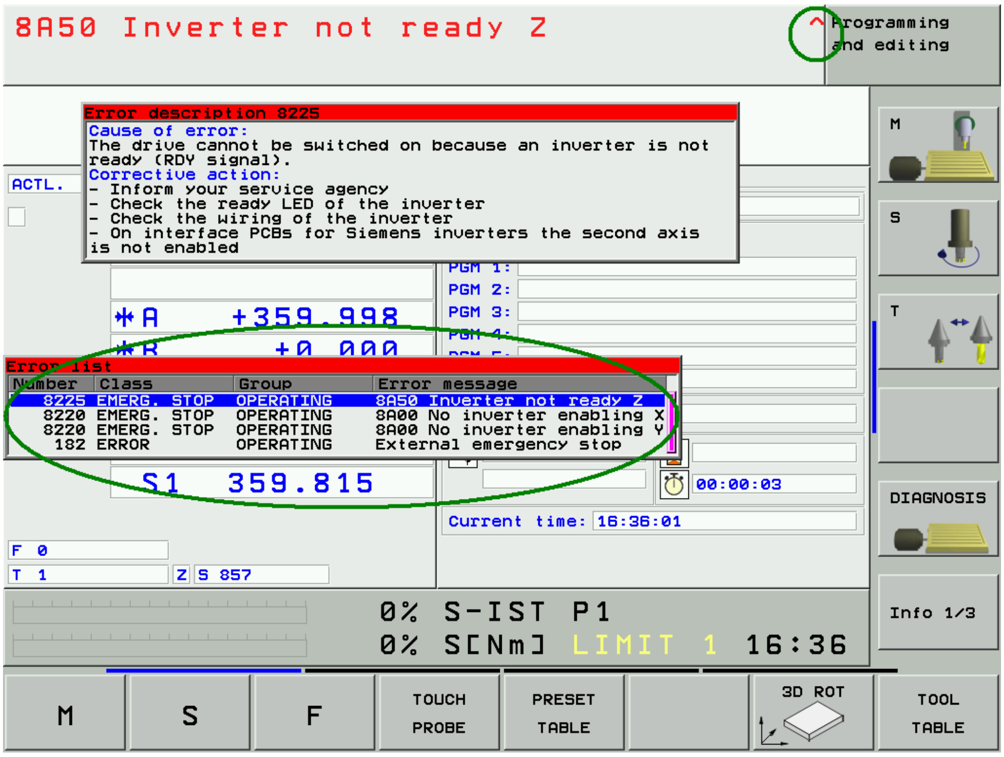
HELP texts cannot be displayed any more for error messages in red windows. The control is not in operating condition any more. It must be rebooted.
Information on these errors can be found in the list of NC error messages;
See “List of NC Error Messages” on page 22.

4.3 ERR Key

▶ Display all pending error messages
(if this key is pressed again, the window will be closed)

If there is an AND symbol (little red roof) in the header in addition to the error message, there is more than one pending error message.

The ERR key (ERROR) is located directly over the HELP key. If this key is pressed, an error list appears. All pending NC and PLC error messages of the control are displayed in an own window. In addition, the help window can be called with the HELP key.



Note

If there is no ERR key over the HELP key on your keyboard, press the corresponding space bar over the HELP key. --> If the NC software of the iTNC 530 supports the function of the ERR key, the ERR list can also be called!

The ERR window is described below:

Column	Description
`Number`	Error number that was defined by HEIDENHAIN or the machine manufacturer (-1: No error number defined)
`Class`	Error class. Defines the reaction of the control: ■ **ERROR** Program run is interrupted by the TNC (INTERNER STOP) ■ **FEED HOLD** The feed rate enable is deleted ■ **PGM HOLD** The program run is interrupted (control-in-operation symbol blinking) ■ **PGM ABORT** The program run is aborted (INTERNER STOP) ■ **EMERG. STOP** EMERGENCY STOP is generated ■ **RESET** TNC executes a warm start ■ **WARNING** Warning message, program run is continued ■ **INFO** Info message, program run is continued
`Group`	Error source. ■ **GENERAL** General error ■ **OPERATING** Error during machining and machine traverse ■ **PROGRAMMING** Error during programming ■ **PLC** PLC error message of the machine manufacturer
`Error message`	Displayed error text

The individual error messages can be selected with the cursor; the open help window shows the appertaining text.

4.4 CE Key

CE

▶ Delete the error message

Displayed error messages can be acknowledged with the CE key.
If the error cause is still existing, the corresponding error message is displayed again.
--> Eliminate the error!

Note

Messages regarding very fatal errors, cannot be confirmed with the CE key.
The control must be rebooted.--> Press the END key.
If this does not function ... --> Switch the power switch of the machine off and on again.

4.5 List of NC Error Messages

You can find the complete list of NC error messages (incl. operation errors) on the **DVD TNCguide** in several languages and sorted by error numbers. These TNCguide information can also be found on our website **http://www.heidenhain.de/Services/...**

☞ **Note**

Where it is possible and makes sense, you may switch the control off and on again to observe whether the error message is generated again afterwards.

Note:

In the next version of this Service Manual the list of NC error messages will be filtered for error messages that indicate a technical defect.
Information and links to suitable routines for error diagnosis will be included!

5 Errors

5.1 Introduction

Not all error conditions on the control or machine can be shown by error messages on the monitor.
Therefore, this chapter gives you an overview of errors with notes and tips how to proceed.

What is the cause of the error?

Ask the last operator or technician who has worked with or on the machine about the course of events.

Have there been any particular incidences, such as …

- Cleaning of the machine (humidity, etc.)
- Thunderstorms
- Modifications to the machine
- NC software update
- New machining program
- Tool breakage
- Collision
- Power failure
- Etc.

The error diagnosis will be easier for you by pointed questions and precise answers!

Static and nonstatic errors

Errors can also be defined in the categories of static errors (e.g., interruption in the electrical cabinet, defective unit) and nonstatic errors (e.g., loose connection, shielding problems, interferences).
Naturally, the error location of static errors is easier.

Sporadic and nonsporadic errors

Check whether you can reproduce a certain error on the machine at any time (nonsporadic error). This assists you in trouble shooting.
The integrated log or the PLC logic diagram are some possibilities to investigate sporadic errors.

5.2 Notes and Tips

Comparison with functioning machines

If a dimensionally identical or similar machine is available, the functionality of this machine can be compared with the defective machine.
This can be very helpful for trouble shooting!

Connectors and females

Observe the following during connecting and disconnecting:

D-Sub Connectors or Females

- Connect and disconnect straightly! Otherwise, the spring contact in the D-sub connectors could be widened. This may result in contact problems!

Ribbon Connectors or Females

- Connect carefully and straightly with constant pressure to prevent a deflection of the males.

Signal Socket at the Motor

- Slide the nib of the connector into the notch of the signal socket and screw the connector straightly. Do not use force! Otherwise the males could be bent or even pressed into the socket.

Low voltages

All **units connected to the control are also supplied by the control** (encoders with long cables are maybe provided with voltage amplifiers). It is thus possible that **defective connected units or also damaged cables** have an influence on the low voltages in the control and generate a variety of error messages.
Only the newer control hardware is equipped with the so-called polyfuses. These are electronic fuses that separate defective peripheral units from the low voltages in the control in case of an error. Polyfuses are equipped with a self-resetting function ("self-healing effect")

- Always disconnect suspicious units from the control for error diagnosis!
- If necessary, deactivate these units or the axis concerned in the machine parameter list.

Note

It is not sufficient to deactivate a suspicious axis with machine parameter MP10 (without disconnecting suspicious units).
The corresponding units (e.g., position encoder for this axis) are not monitored any more but are still supplied with power. The defective scale can thus influence the low voltages of the control, for example!

Note

If you are not in a position/allowed to activate the axes with MP10, MP subfiles might be active and/or this is not permitted by the PLC program. --> Ask the machine manufacturer!

- Switch on the control and check whether errors still occur.

Caution

- For trouble shooting do not connect obviously defective controls (e.g., position encoder with short circuit after entering of humidity) to other input connectors (z.B. X1-X6, X35-X38) of the control.
- Defective cables may result in interruptions but also in undefined conditions and direct error messages. Therefore, especially check possible worn and squeezed positions of the cables.

Shielding and grounding

Also **defective shieldings and groundings** can result in undefined errors or in a malfunction of the machine (e.g., vibration of axes, poor surface of the workpiece). The reason are compensating currents that are caused by potential differences.
Therefore, check the terminals, shielded cables (the shielding braid must not contact the 0 V conductor inside the cable), cover plates, grounding bars, contact plates, etc.

Caution

If HEIDENHAIN expansion boards for the SIMODRIVE system are used, please check the mandatory grounding.
--> See “Important Notes on the Use of HEIDENHAIN Interface Boards in SIMODRIVE System” on page 29.

Sources of interference

Also observe **likely sources of interference** that may have a negative effect on the connected units.

Noise is mainly produced by capacitive and inductive coupling from electrical conductors or from device inputs/outputs, such as ...

- Strong magnetic fields from transformers or electric motors
- Relays, contactors and solenoid valves
- High-frequency equipment, pulse equipment and stray magnetic fields from switch-mode power supplies
- Power lines and leads to the above equipment

Make sure that …

- There is a minimum distance of 20 cm from the MC 42x(B), CC 42x and its leads to interfering equipment.
- There is a minimum distance of 10 cm from the MC 42x(B), CC 42x and its leads to cables that carry interference signals. For cables in metallic ducting, adequate decoupling can be achieved by using a grounded separation shield.
- The cross section of potential compensating lines is min. 6 mm2.

Contact the machine manufacturer if these conditions are not fulfilled!

Caution

Only use original HEIDENHAIN cables, connectors and couplings as replacement!

Contamination

Pay special attention to **contaminated units** (oil, grease, dust, etc.)!

What could be the reason for the contamination?
Some examples:

- Machining of graphite
- Coolant or coolant vapor
- Defective filter system in the electrical cabinet (filter pads)
- Oil or oil vapor
- Oil in the compressed-air system

Humidity

Check whether **humidity** has entered the units!

What could be the reason?
Some examples:

- Defective climate control unit in the electrical cabinet
- Coolant or coolant vapor
- Condensation of boards due to differences in temperature
- Defective tubes, sealings, etc.

Shipping brace of the hard disk

Check whether the shipping brace of the hard disk of the mounted control has been removed.

5.3 Overview of Possible Errors

This table shows an overview of specific errors on the machine or control, possible causes of the errors as well as measures for correcting these errors.
The potential measures for correcting the errors are described in more detail in the corresponding chapters.

> **Note**
>
> Where it is possible and makes sense, you may switch the control off and on again to observe whether the error is generated again afterwards.

Error	Possible Cause of Error	Measures for Error Diagnosis and/ or Corrective action
The iTNC monitor remains dark after the machine has been switched on.	■ iTNC monitor defective ■ Power supply to monitor defective ■ Power supply of the MC defective ■ Defective unit connected to the control (short circuit, etc.)	■ Check the visual display unit; See “Visual Display Unit” on page 353 ■ Check power supply of the MC; See “Power Supply” on page 205 ■ Disconnect defective or suspicious units or cables, See “Low voltages” on page 24
The control does not boot completely (error messages regarding the boot process are sometimes displayed).	■ Hard disk defective	■ Exchange MC or HDR or drive assembly; See “Exchange of HEIDENHAIN Components” on page 411
The message "RELAY EXTERNAL DC VOLTAGE MISSING" does not disappear although the key "Control voltage ON" is pressed.	■ EMERGENCY STOP chain interrupted ■ 24 V power supply (connector) X34 missing ■ MC defective	■ Check output "Control is ready" and acknowledgement I3; See “Checking the Enables on the iTNC” on page 311
When the machine is switched on, the error message "EMERGENCY STOP defective"	■ Wiring defective, contactors defective or too slow ■ MC defective	■ Check the related components; See “Error message EMERGENCY STOP DEFECTIVE” on page 317
During switch-on or operation DSP errors are generated. A mechanical reason or a defective unit can be ruled out.	■ Data loss on the hard disk in the range of the SYS partition.	■ Check the hard disk; See “Hard Disk Test” on page 233 ■ Activate the NC software again; See “Activating the NC Software Used on the Machine” on page 453
The "Power interrupted" message cannot be confirmed or the login password cannot be entered in a dual-processor control.	■ The key gets caught	■ See “Keyboard Unit” on page 357
The machine cannot be referenced after switch-on or the axes cannot be moved during operation or the spindle cannot be switched on during operation.	■ Interruption between the NC-stop key and control (the NC-stop signal is lowactive)	■ Eliminate the interruption, repair the key, etc. See “Machine Operating Panel” on page 385
The machine is in the mode "Cross over reference points" which is neither possible with the NC-START key nor with the axis direction keys.	■ Inverter system is not ready for operation	■ See “Checking the Readiness of the Inverter System” on page 322
During reference run, the machine moves to the limit switch.	■ The trip dogs for the reversal of direction during reference run are defective	■ See “Referencing” on page 301
During reference run, the machine moves to the mechanical stop (for machines without limit stop). An error message is sometimes displayed, e.g. "8640 I2T value of motor is too high ..."	■ The machine was switched off at the wrong position	■ Referencing with axis-direction keys (no automatic reference mark traverse)!

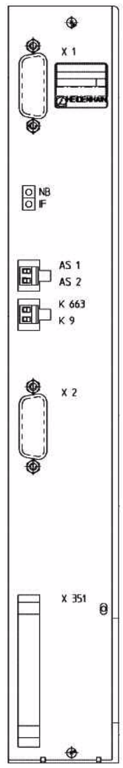
Error	Possible Cause of Error	Measures for Error Diagnosis and/ or Corrective action
iTNC monitor is frozen. The control has locked up. The main switch has to be switched off and on again. After reset of the control **"Power fail Interrupt!"** is entered in the log of new software versions.	■ Power failure ■ Failure of one or several phases in the supply line ■ The power supply voltage has fallen below the minimum value ■ Interruption in the electrical cabinet ■ Inverter (power supply module) defective ■ Short circuit of drives (drive modules, motors)	■ Check the primary supply (cables, fuses, terminals); See "Power Supply" on page 205 ■ Check the wiring of the inverter system, see circuit diagrams of the machine manufacturer ■ Check the functioning of the inverter system or the motor (see Service Manual for Inverter Systems and Motors)
STIB ("Control-in-operation = "*" in status display) remains in place even though positioning appears to be completed. The next NC block is not executed in the automatic operating modes , the NC program gets caught.	■ Axis did not reach the positioning window ■ Excessive drift of analog axes ■ Approach behavior of axis not optimized	■ Carry out drift adjustment; See "Interface to the Drives" on page 327 ■ Re-optimization or new optimization of the axis by the machine manufacturer
"Vibrating" axes, sometimes connected with loud noises.	■ Poor shielding or grounding ■ Connectors on grounding terminal X131 of infeed/regenerative module (Simodrive 611D) not properly wired ■ Grounding terminal X131 of power supply module (Simodrive 611D) or grounding connection damaged	■ Check the grounding of your machine, refer to the machine manufacturer ■ Ensure the grounding clamps are secure ■ Check the shielding or the covers
Servo lag is too high at standstill	■ Electrical offset of analog axes	■ Carry out offset adjustment; See "Adjusting the Electrical Offset (Drift Adjustment)" on page 346
Error messages regarding encoders or other connected units are generated although you find out that these do not cause the errors!	■ Probe or handwheel that were exposed to humidity (coolant, etc.) or have been damaged. --> Supply voltages (5 V, 12 V, 15 V) are impaired. A variety of error messages are possible.	■ Disconnect the probe and handwheel including the cables. Screw the dummy plug (ID 271958-03) instead of the handwheel or bridge the handwheel in the EMERGENCY STOP chain. Deactivate the handwheel in MP7640. Check whether the error messages are still generated.
Various error messages are generated but are not substantiated.	■ Connection (short circuit) of shielding potential (chassis, cable shielding) with 0 V voltage potential of the NC power supply	■ Check the cables for damage. Check the machine for correct shielding (ask the machine manufacturer).
NC functions do not function any more (There might be an information by the control that the corresponding files have been deleted).	■ Data loss on the hard disk in the range of the SYS partition	■ Check the hard disk; See "Hard Disk Test" on page 233 ■ Activate the NC software again; See "Activating the NC Software Used on the Machine" on page 453
Bucking of the analog axis	■ Carbon brushes for power supply or tachometer measuring that have been abrided on one side or used up	■ Exchange the carbon brushes
The axes cannot be traversed and the red LEDs SH2 of all HEIDENHAIN drive modules light up (or the red LEDs SH2 or RESET of the HEIDENHAIN interface cards for the SIMODRIVE system)	■ Drive release missing	■ See "Checking the Enables on the iTNC" on page 311
There are repeated hard disk errors	■ Defects on the hard disk ■ Defective unit connected to the control (short circuit, etc.)	■ Check the hard disk; See "Hard Disk Test" on page 233 ■ Disconnect suspicious units; See "Notes and Tips" on page 23

Error	Possible Cause of Error	Measures for Error Diagnosis and/ or Corrective action
During processing the motors run (axes, spindle) down out of loop.	■ Defective braking resistor (conversion of electrical energy to heat energy not possible) ■ Defective infeed/regenerative feedback module (energy recovery not possible) ■ Interruption in the primary supply (fuses, wires, etc.; energy recovery not possible)	■ Check the primary supply (cables, fuses, terminals); See “Power Supply” on page 205 ■ Check the functioning of the inverter system or the braking resistor; See Service Manual for Inverter Systems and Motors ■ Check the wiring of the inverter system, see circuit diagrams of the machine manufacturer
An axis is to be traversed and an error message is displayed, e.g. "8640 I2T value of motor is too high ..." (or a similar error message that indicates an excessive load of the drive)	■ Brake not released	■ Check whether the brake is released ■ Check the wiring of the motor system; See circuit diagrams of the machine manufacturer ■ Some HEIDENHAIN inverters can control the motor brakes; See Service Manual for Inverter Systems and Motors

5.4 Important Notes on the Use of HEIDENHAIN Interface Boards in SIMODRIVE System

Version with D-Sub connector

HEIDENHAIN interface boards for the SIMODRIVE system in the version with D-Sub connector are available **with or without metallic insulation** of HEIDENHAIN PWM signals to the Siemens interface.

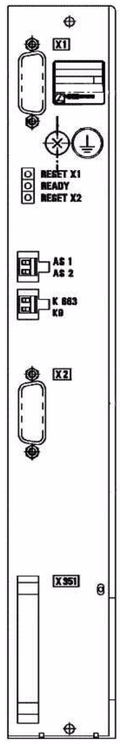
Interface boards **without metallic insulation** are recognized as follows: ■ On the front panel there are the LEDs ***NB*** (not ready) and ***IF*** (pulse release). ■ There is no grounding screw on the front panel. ■ There is no transformer on the front panel. ■ These board have the Id.Nr. 291070-01, 324952-01, 02, 03 and 10 without index A.	

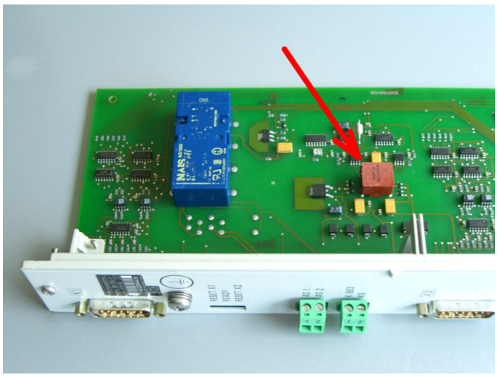
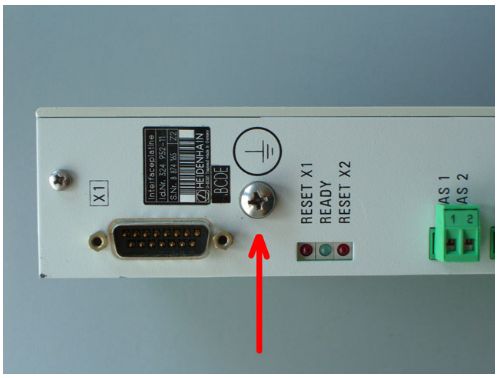
Caution

The terminal X131 of the Siemens E/R module of boards without metallic insulation may not be connected to the central signal ground of the machine!

Note

The HEIDENHAIN interface boards of the first generation were built without metallic insulation.

Interface boards **with metallic insulation** are distinguished as follows: ■ On the front panel there are the LEDs *RESET X1, READY* and *RESET X2.* ■ There is a grounding screw on the front panel. ■ There is no transformer on the front panel. ■ These boards have the ID 324952-10 with index A, 11, 12, ...	

Transformer component on the board	
Grounding screw on the front panel	

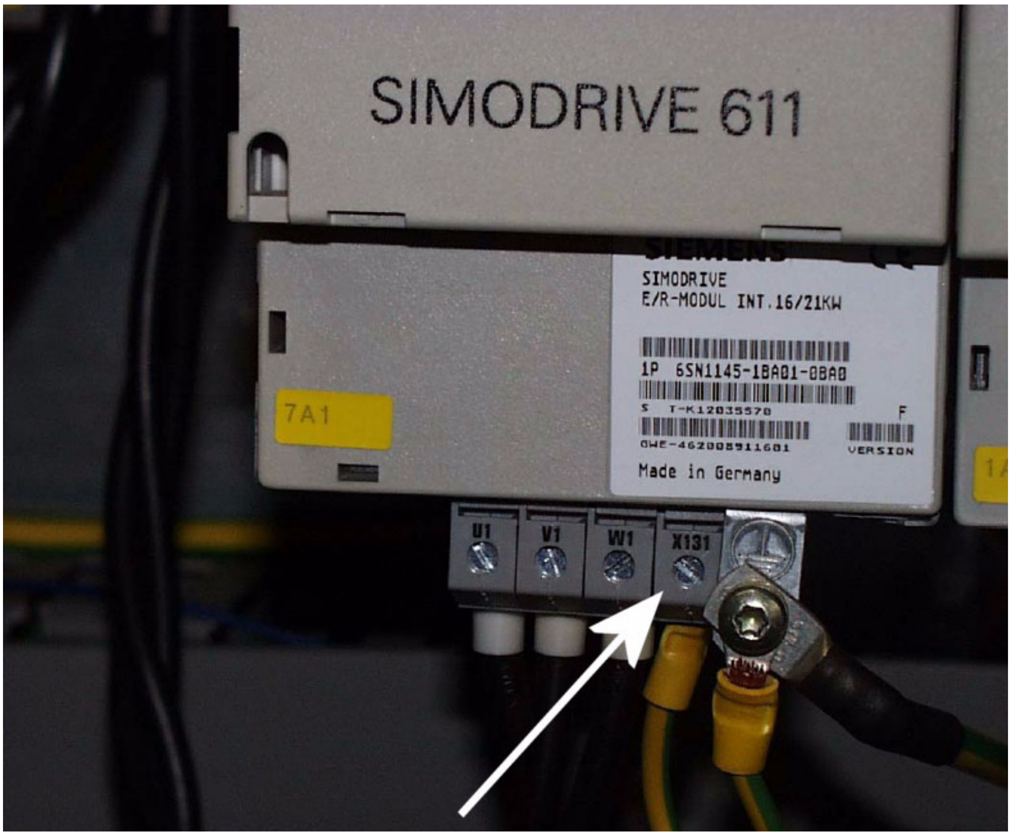
Caution

The terminal X131 of the Siemens E/R module of boards with metallic insulation has to be connected to the central signal ground of the machine!

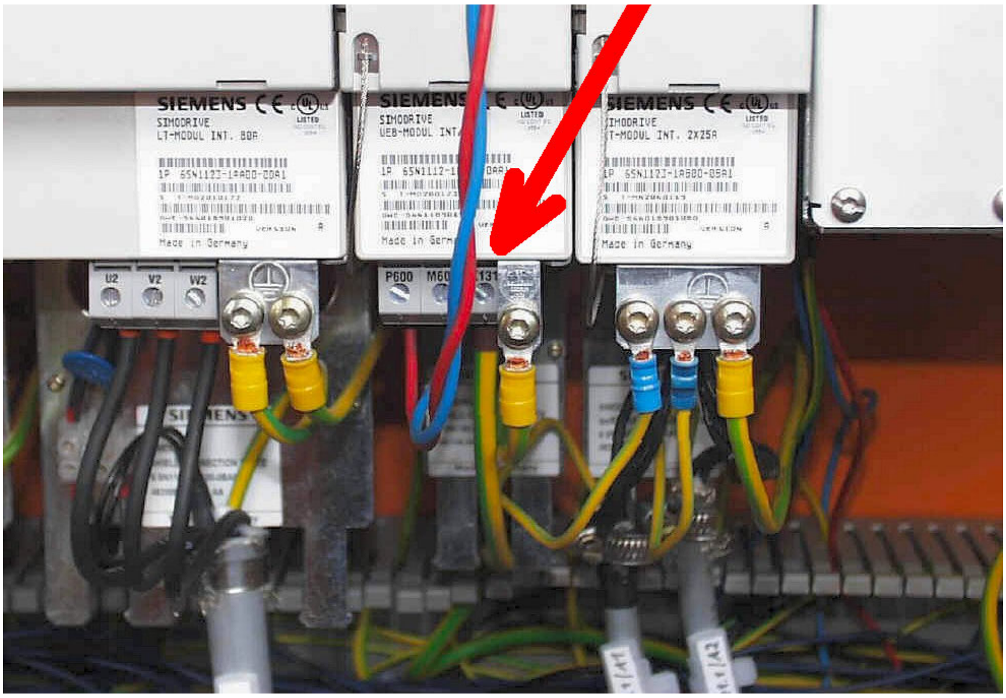
Caution

Interface boards **with and without metallic insulation** must **not be used together**! Either all boards have a metallic insulation and X131 is wired or all cards do not have a metallic insulation and X131 is not wired!

Siemens E/R module with X131



Siemens UEB module with X131



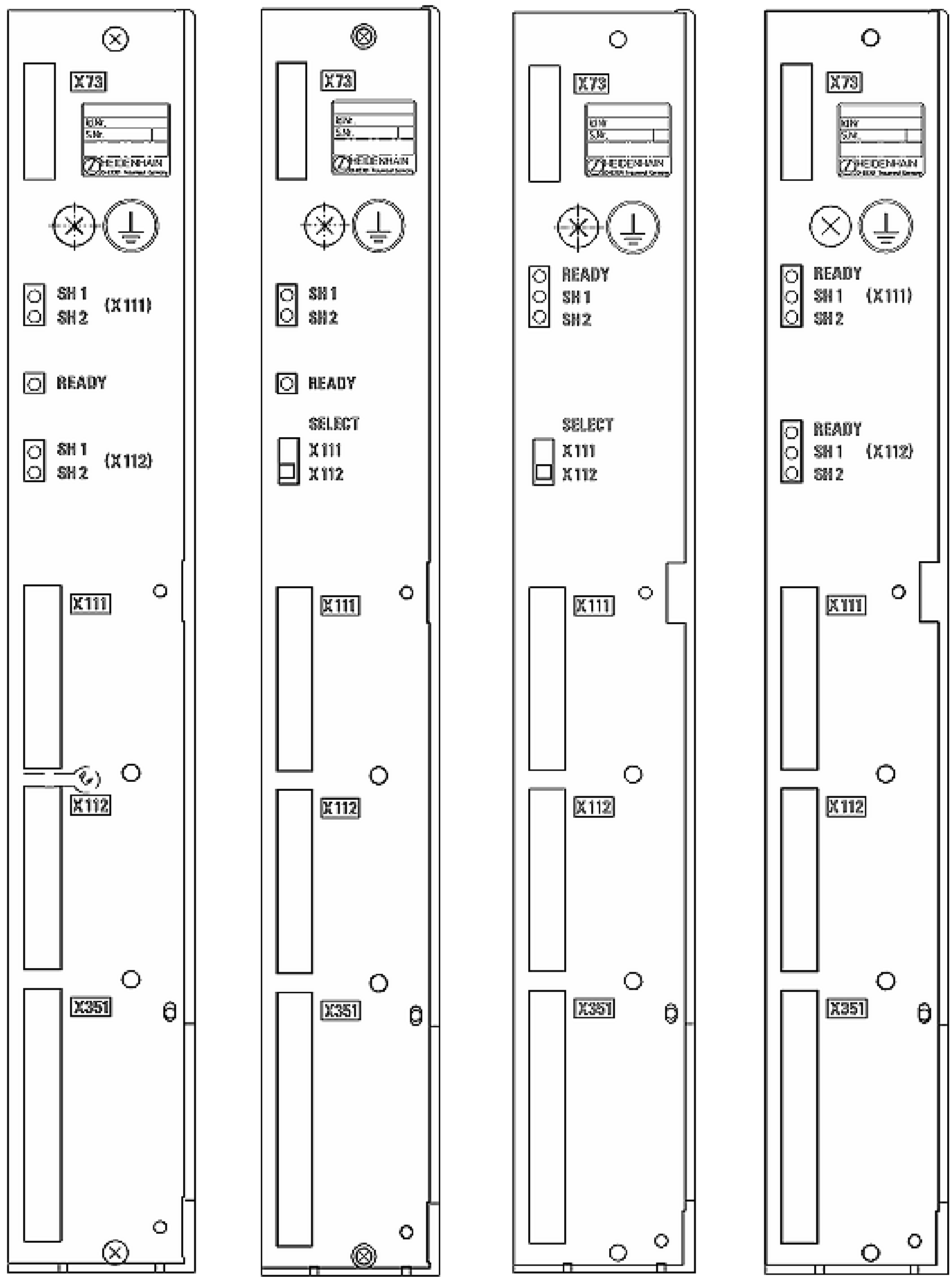
Caution

If a Siemens E/R module is used together with the so-called monitoring module (UEB module) , the terminal X131 on this module has to be wired as on the E/R module!

Version with ribbon cable connector

HEIDENHAIN interface boards for the SIMODRIVE system in the version with ribbon cable have a metallic insulation of the HEIDENHAIN PWM signals to the Siemens interface.

Thus X131 of the Siemens drive system must be wired!



6 Log

6.1 General

- The log serves as a troubleshooting aid.
- For this purpose 4 MB memories are reserved in the control.
- Error messages and keystrokes are recorded in a process memory. If you intend to perform tests and to see the entries in the log, you have to call it each time again.
- Error messages and key strokes are stored in the log.
- The sources of the keystrokes are entered in ***INFO: MAIN KEYSOURCE: <source>***.
  <source> may include following entries:
  - KEYBOARD
  - PLC
  - PLCNCSTART
  - HANDWHEEL
  - LSV2

Note

The first soft key (down left on the screen) is recorded in the log as soft key 0, the second soft key as soft key 1, etc.
The arrow keys for the switching of the soft-key rows are recorded.
Any newly called soft-key row starts again with soft key 0.

- All entries show the date and the local time.
- The machine manufacturer can use up to 8 additional OEM logs. --> If necessary, ask your machine manufacturer if these OEM logs are used and which information is available for the service technician.

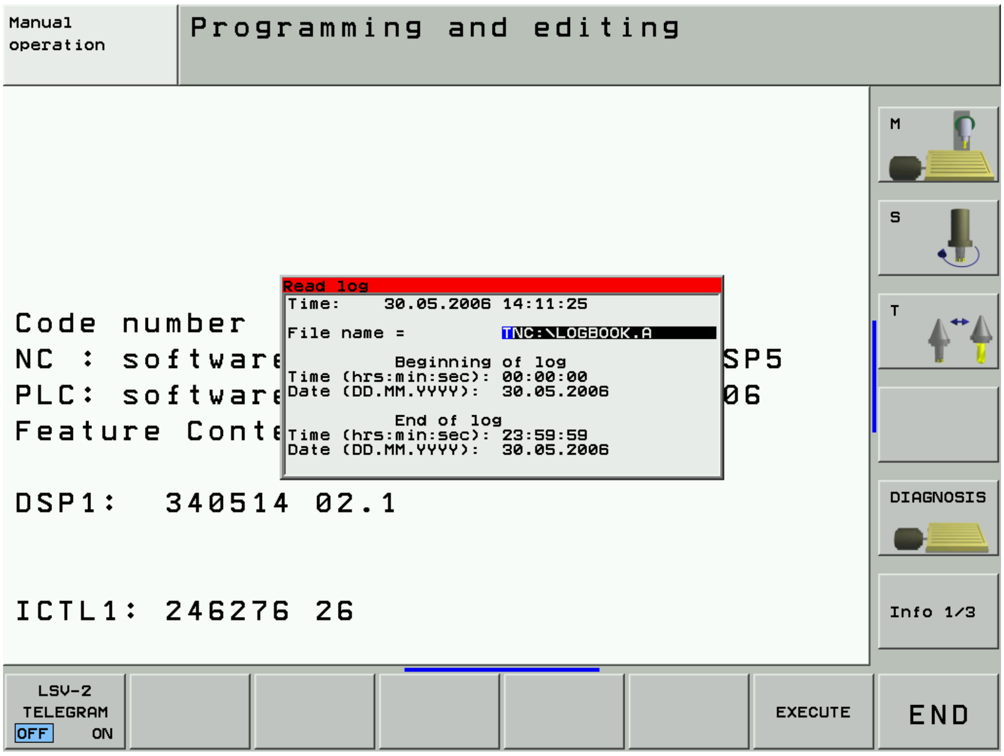
Note

Following messages are not shown in the log:
File system error x
Reason: In case of a write or read error all write activities on the hard disk are always interrupted as data cannot be written reliably any more.
Relay external DC voltage missing
Reason: This message is always displayed on the monitor after confirming the message *Power interrupted*. This is an information, not an error message. An entry in the log is not made.

6.2 Calling the Log

Enter the code number ***LOGBOOK.*** --> See “Code Numbers” on page 13.

The following screen is displayed:



If you wish, you may change the path and the file name in this selection window.
Default setting: ***TNC:\LOGBOOK.A***.

Here you can also define the starting point and the end point for reading out the log.

Note

Ensure correct spelling when making any changes in the log window!

Then start reading out the log by pressing the ***EXECUTE*** soft key.

An ASCII file with the log entries is generated and displayed on the screen!

Note

The log can be read out directly from the PC/laptop with the HEIDENHAIN software tool TNCremoNT. The code number *LOGBOOK* has not to be entered on the control.
The local time on the control and the PC/laptop should be identical!

6.3 Overview of Log Entries

Entry		Description
RESET		Restart of the control
ERR		Error Messages - **P -->** PLC error message with line number in the PLC error text file - **N -->** NC error message with number - **Power fail interrupt ! -->** Control is switched off by a POWERFAIL - Result of the file system test: If the control is not properly shut down, the file system is checked during the next startup and the result is entered in the log. --> Search in the log for **"dosfsck -a"**
INFO	MAIN ERRCLEARED	Confirmation of an error message
INFO	MAIN ERR_RECURED	Error message entered several times
KEY		Key strokes
INFO	MAIN SOFTKEY	Path with appropriate image file of a pressed soft key
STIB[a]	ON	"Control-in-operation" on
	OFF	"Control-in-operation" off
	BLINK	"Control-in-operation" blinking
INFO	MAIN START	Control model and NC software
INFO	MAIN FILE DEL	Faulty files on the hard disk, to be erased during booting
INFO	MAIN CYCLES	Test results for fixed cycles and touch probe cycles
INFO	MAIN KEYSOURCE	Source of the keystrokes - KEYBOARD - PLC - PLCNCSTART - HANDWHEEL - LSV2

a. Control-in-operation symbol = "* " in the screen display

Entry			Description
INFO	MAIN PGM		Started NC program or NC macro
INFO	MAIN LINE		Line number of the started NC program or NC macro
INFO	MAIN PGMEND		Information about the program end in program run Byte 0/1 00 01 Emergency stop 00 02 Positioning error 00 03 Programmed stop 00 04 Block end for single block 00 05 Geometry error 00 06 END PGM, M02 00 07 Internal stop key 00 08 Data transfer error (V.24/V.11) In addition, when an NC program is stopped by an error message, the following information is entered: NC program, line number, actual position, datum, datum shifts, tool number
INFO	MAIN MACEND		Information about the end of an NC macro Byte 0/1 00 01 Emergency stop 00 02 Positioning error 00 03 Programmed stop 00 04 Block end for single block 00 05 Geometry error 00 06 END PGM, M02 00 07 Internal stop key 00 08 Data transfer error (V.24/V.11)
INFO	MAIN PATH	PLCEDIT	File for PLC Editor
		NCEDIT	File for NC Editor
		RUNPGM	Main program for program run
		RUNPALET	Pallet table for program run
		RUNDATUM	Datum table for program run
		RUNTOOL	Tool table for program run
		RUNTCH	Pocket table for program run
		SIMPGM	Main program for program test
		SIMDATUM	Datum table for program test
		SIMTOOL	Tool table for program test
		RUNBRKPGM	Stopping point for block scan
		SIMBRKPGM	Stopping point for program test
		RUNPRINT	Path for FN15: PRINT for program run
		SIMPRINT	Path for FN15: PRINT for program test
		MDIPGM	File for positioning with manual data input
		NCFMASK	Mask for file management in the NC area
		PLCFMASK	Mask for file management in the PLC area
		EASYDIR	Paths for standard file management
		TCHPATH	Datum table for manual measurement
		SIMTAB	Freely definable table in program test
		RUNTAB	Freely definable table in program run
		KINTAB	Active kinematic table

Entry			Description
INFO	MAIN NCEVENT		Entries through **FN38: SEND** of the operating mode **Program Run, Full Sequence** or **Program Run, Single Block**
	MAIN NCTEVENT		Entries through **FN38: SEND** of the operating mode **Test Run**
INFO WARNING ERROR	PLC <log identifier>		Entries through PLC Modules 9275 and 9276
INFO	SYS	SHUTDOWN	Shut down the control
		REBOOT-TNC	Reboot the control
INFO[a]	REMO A_LG		Log in with LSV2 protocol
	REMO A_LO		Log out with LSV2 protocol
	REMO C_LK		LSV2 protocol: Locking and releasing the keyboard; the key codes between locking and releasing are sent via LSV2 protocol

a. For testing all LSV-2 telegrams can be entered in the log. This function has to be released after entering the code number LOGBOOK via soft key **LSV-2 TELEGRAM ON OFF** .

Entry of operating-system error messages

Operating-system error messages require a rebooting of the control. During rebooting the operating-system error message is entered in the log. The time when the operating-system error message is entered in the log is indicated, i.e., the reboot time. In the headline of the operating-system error message the Greenwich Mean Time (Universal Time) is shown.

Entry of NC programs

Not each single block of an NC program is recorded in the log (this would exceed the size of the log file). You receive **information on the start and end of an NC program**. Information about the program end is shown in …

- Byte 0 and 1
- Conversational language in the line *Stop reason: ...*

You receive further information on …

- Line number of the NC program at program end
- ACTUAL position at program end
- Active preset values, if available
- Set datum shift, if available
- Tool number
- Tool length, tool radius, etc.

6.4 Example of a Log Entry

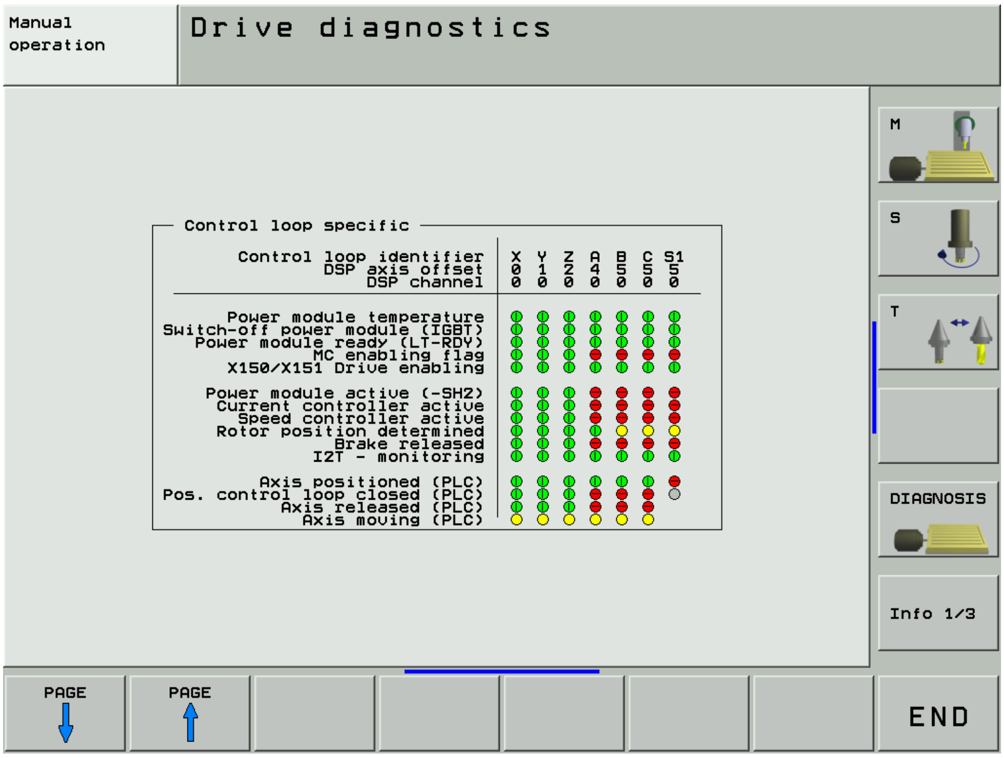
```
STIB:      ON                              20.01.2001 14:01:42
INFO:      MAIN PGM                        20.01.2001 14:01:42
           TNC:\mercedes\Mbprog5a.I
INFO:      MAIN LINE                       20.01.2001 14:01:42
           0
STIB:      OFF                             20.01.2001 14:01:44
INFO:      MAIN PGMEND                     20.01.2001 14:01:44
           00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F
           00 02 00 02 00 00 00 33 00 00 00 11
            |  |
         Byte 0  Byte 1

INFO:      MAIN PGMEND                     20.01.2001 14:01:44
           Stop reason: Positioning error
           Error      : 51
           Error class: "Positioning"
           NC program : TNC:\mercedes\Mbprog5a.I line 17
INFO:      MAIN PGMEND                     20.01.2001 14:01:44
           Actual pos.:
            X = 1.8251
            Y = -9.2372
            Z = 45.0030
            A = 0.0000
            B = 359.9999
            C = 0.0000
            W = 65.9894
           Preset     : (Range = 0)
            X = -8.6201
            Y = 7.5515
            Z = -1835.3142
            A = 0.0000
            B = 0.0000
            C = 0.0000
            W = -178.8965
           Datum shift:
            X = 0.0000
            Y = 0.0000
```

7 Integrated Diagnosis Functions

7.1 Introduction

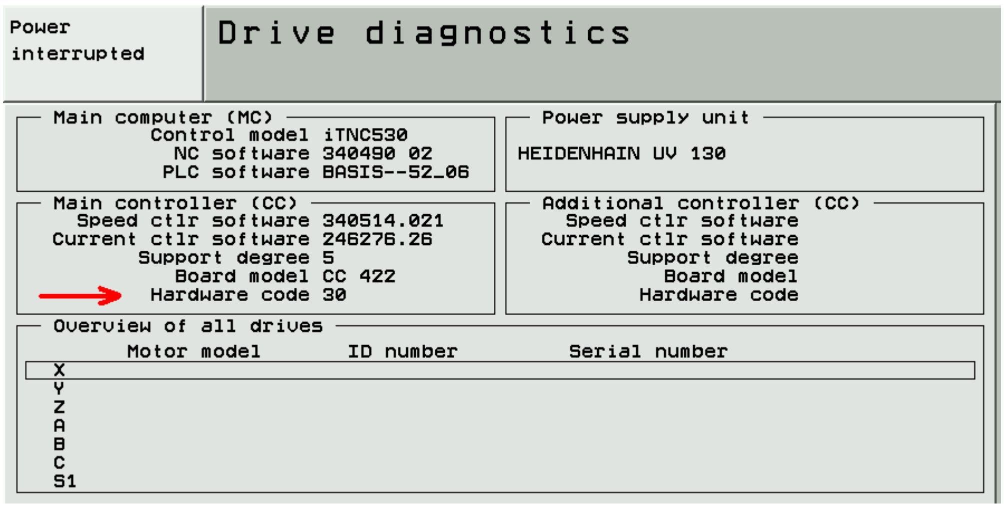
Example: Display of the DSP Diagnosis



The iTNC 530 features various diagnosis functions for trouble shooting.

The following tests function for **CC 422 as of hardware code 30**.

The hardware code is shown after pressing the drive information softkey.
--> See description on the following pages.

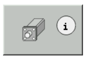


The drive tests for the CC 424 are not yet supported!

To call the diagnostic functions:

- Press the MOD key in the **Programming and Editing** mode of operation.
- Press the **DIAGNOSIS** soft key.

The following diagnostic functions are available:

Soft key	Soft key	Soft key	Function
ANTRIEBS-DIAGNOSE			Various drive diagnosis functions can be selected after pressing this soft key. Before selecting the diagnostic function, under **Supply unit** you must select the power supply unit being used, so that the signals present are not interpreted as errors.
	OSCI		The integrated oscilloscope is started. (See “Integrated Oscilloscope” on page 49)
	DSP	SEITE ↓ SEITE ↑	Presents a graphically supported, dynamic display of various release, inverter and PLC signals. Use the soft keys for scrolling to switch between controller and control-loop specific signals, See “Meanings of the Signals under “DSP”” on page 43
	AMP		Presents a display of the analog signals available to the drive controller (**n. p.** = signal not present).
			A display with all available analog values appears.
		↓ ↑	In **Overview of all drives** you use these soft keys to select a drive. The following soft keys display more detailed information.
		EnDAT DREHZAHL	If an absolute speed encoder with EnDat interface is connected, a detailed display of the encoder information appears.
		EnDAT LAGE	If an absolute position encoder with EnDat interface is connected, a detailed display of the encoder information appears.
		MOTOR-DATEN	The motor data for the selected motor is displayed from the motor table.
		M TYPEN-SCHILD	If a HEIDENHAIN motor with electronic ID label is connected, the information stored in the ID label is displayed.
		TYPEN-SCHILD	If a HEIDENHAIN power module with an electronic ID label is connected, the information stored in the ID label is displayed.
HEROS DIAGNOSE			The file TNC:\herosdiagnose.txt is created after pressing this soft key. HEIDENHAIN uses this file for diagnosis of the operating system.

7.2 Meanings of the Signals under “DSP”

Controller specific

Signal	Meaning	Colors
External enabling signals		
Control-is-ready acknowledgment (–NE1)	The signal NE1 (emergency stop input 1, MC) is active if a 0-level is present (low active). For the iTNC 530 the corresponding input is located at connector X42/I3 (PLC input), and is looped to the MC as a hardware line.	■ Gray: No information about the signal available ■ Green: Signal is not active, enable ■ Red: Signal is not active, no enabling
Drive enabling (–NE2)	The signal NE2 (emergency stop input 2, CC) is active if a 0-level is present (Low active). For the iTNC 530 the corresponding input is located at connector X42/I32 (PLC input), and is looped to the CC as a hardware line.	■ Gray: No information about the signal available ■ Green: Signal is not active, enable ■ Red: Signal is not active, no enabling
Powerfail	The PF signal shows the status of the "effective" powerfail signal for the drive controller. The signal results from gating the PF.PS.ZK (powerfail dc-link) and PF.PS.AC (AC fail). The gating can be set via machine parameter and via PLC.	■ Gray: No information available ■ Green: Enable PF not active (1-level) ■ Red: PF is active (0-level), the dc-link voltage has decreased below a permissible (inverter-specific) level or the phase monitoring responded; no enabling
MC ready (–WD)	This signal shows that the MC is ready for control. This signal is a possible reason that the power module was switched off via SH1.	■ Gray: No information available ■ Green: Enable ME not active (1-level) ■ Red: Do not enable: WD1 is active (0-level), the MC’s watchdog is not retriggered. This signal is transmitted as SH1 to the inverter (SH1 can also be generated by other signal sources).
Powerfail (ZK)	The signal is generated at the inverter, and is led via the supply bus to the drive controller. The input at the drive controller is displayed. Depending on the wiring, either this signal or **Powerfail (AC)** is relayed on the controller PCB to the powerfail signal.	■ Gray: No information available ■ Green: Enable Powerfail (ZK) is inactive (1-level) ■ Red: Do not enable: Powerfail (ZK) is active (0-level), the dc-link voltage has decreased below a permissible level (inverter-specific).
Powerfail (AC)	The signal is generated at the inverter, and is led via the supply bus to the drive controller. The input at the drive controller is displayed. Depending on the wiring, either this signal or **Powerfail (ZK)** is relayed on the controller PCB to the powerfail signal. **Powerfail (AC)** does not exist for all supply units (e.g., not UV 130).	■ Gray: No information available ■ Green: Enable Powerfail (ZK) is inactive (1-level) ■ Red: Do not enable: Powerfail (AC) is active (0-level), phase monitoring responded, at least one power supply phase failed.
Internal enabling signals		
CC controller ready	If no error is present in the drive controller and the CC was started, “ready for control” is reported.	■ Gray: No information about the signal available ■ Green: Enable, CC is ready for control ■ Red: Do not enable

Signal	Meaning	Colors
Clearable DSP error	Clearable DSP errors are 2nd class errors (such as motor temperature). The CC can only resume control after the error has been cleared (by pressing the CE key).	■ Gray: No information about the signal available ■ Green: Enable: There is no (clearable) 2nd class error ■ Red: Do not enable: There is no (clearable) 2nd class error
Current controller's watchdog	This signal is activated by the current controller’s watchdog. It influences SH2 at the power module via the PWM interface.	■ Gray: No information about the signal available ■ Green: Enable, current controller's watchdog is OK ■ Red: Do not enable: Current controller's watchdog is active (0-level). No pulse release from the current controller via the PWM interface
Signals of power supply unit		
DC-link voltage >>	The signal reports the status of the dc-link voltage: Either it is OK or too high. This signal also switches off all power modules (via the device bus). Possible cause of error: ■ Missing or faulty braking resistor ■ Excessive braking power	■ Gray: No information about the signal available ■ Green: DC-link voltage OK ■ Red: DC-link voltage too high
Temperature	The signal reports the status of the heat sink temperature in the inverter: Either it is OK or too high.	■ Gray: No information about the signal available ■ Green: Temperature OK ■ Red: Temperature too high
DC-link current >>	The signal reports the status of the dc-link current: Either it is OK or too high. Both positive and negative dc-link currents are evaluated.	■ Gray: No information about the signal available ■ Green: DC-link current OK ■ Red: DC-link current too high
Power supply unit ready	The signal reports the ready status of the supply unit: Supply unit OK, Main contactor on, or supply unit not ready.	■ Gray: No information about the signal available ■ Green: Power supply unit OK, main contactor switched on ■ Red: Power supply unit not ready for operation
Short circuit to ground	The signal reports the status of the leakage current monitoring: Either it is OK or too high or short circuit to ground	■ Gray: No information about the signal available ■ Green: Leakage current OK ■ Red: Leakage current too high or short circuit to ground

Control-loop specific

Signal	Meaning	Colors
Temperature of power module	The signal reports the status of the heat sink temperature in the power module: Either it is OK or too high.	■ Gray: No information about the signal available ■ Green: Temperature of power module OK ■ Red: Temperature of power module too high
Power module switch-off (IGBT)	The signal shows that the IGBT in the power module has been switched off.	■ Gray: No information about the signal available ■ Green: No power module switch-off (IGBT) ■ Red: Power module switch-off (IGBT)

Signal	Meaning	Colors
Power module unit ready (LT-RDY)	The power module is ready: ■ Safety relay has picked up ■ Main contactor is switched on ■ SH1 (MC) is "High" ■ No error from the power module	■ Gray: No information about the signal available ■ Green: Power module is ready ■ Red: Power supply unit not ready for operation
MC enabling marker	The MC can accelerate the switch-off via this marker.	■ Gray: No information about the signal available ■ Green: Enabling ■ Red: Do not enable
X150/X151 drive enabling	The signal shows the enabling status for the "X150/X151" switch-off. The signal is formed from the status of the inputs X150/X151 and the setting in MP2040.x.	■ Gray: No information about the signal available ■ Green: Enable: There is currently no switch-off via X150/X151 ■ Red: Do not enable: The drive is currently switched off or locked via X150/X151
Power module active (–SH2)	The signal shows the status of the SH2 line to the power module. The CC activates/deactivates the line for switching off the power module.	■ Gray: No information about the signal available ■ Green: Enabling: The signal SH2 is not active ■ Red: No enabling: The signal SH2 is active
Current controller active	This signal shows the status of the current controller. The current controller is either switched on (in control) or switched off.	■ Gray: No information about the signal available ■ Green: Enable: Current controller is switched on (in control) ■ Red: No enabling: Current controller is off
Speed controller active	This signal shows the status of the speed controller. The speed controller is either switched on (in control) or switched off.	■ Gray: No information about the signal available ■ Green: Enable: Current controller is switched on (in control) ■ Red: No enabling: Speed controller is off

Signal	Meaning	Colors
Rotor position captured	This signal gives information about determining the field angle: **Drive is not oriented:** ■ Motor with rotary encoder without Z1 track (incl. linear motors) after the first “Drive on” status ■ Non-aligned rotary encoder with EnDat interface (incl. linear motors), if the field angle has not yet been determined. **Drive is roughly oriented:** ■ Motor with rotary encoder without Z1 track (incl. linear motors) after the first “Drive on” status ■ Motor with rotary encoder with Z1 track after it has been read **Drive is oriented:** ■ Motor with rotary encoder with Z1 track after traversing the reference mark ■ Aligned rotary encoder with EnDat interface immediately after switch-on ■ Non-aligned rotary encoder with EnDat interface immediately if the field angle has already been determined. ■ Motor with rotary encoder without Z1 track after traversing the reference mark if the field angle has already been determined.	■ Gray: No information about the signal available ■ Green: Field angle has been determined ■ Yellow: Field angle has been determined roughly ■ Dark gray: Field angle has not been determined
Brake released	This signal shows the status of the motor brake signal on the PWM bus. The signal is led on the power module via a relay to the motor.	■ Gray: No information about the signal available ■ Green: Brake released ■ Red: Brake active
I2t monitoring	This signal indicates the current and the stored status of the I2t-monitoring.	■ Gray: No information about the signal available ■ Green: No I2t warning so far ■ Yellow: There was already (since switch-on) an I2t warning, but there is no current warning. ■ Orange: I2t warning is now active
Axis in position (PLC)	If the axes have reached the positioning window after a movement, the status is shown in W1026.	■ Green: Axis in position ■ Yellow: Axis not in position
Position controller closed (PLC)	Position controller closed (W1040 inverted) By setting W1040 in the PLC, the position control loop is opened by the PLC program.	■ Green: Position control loop closed ■ Yellow: Position control loop open
Axis enabled (PLC)	W1024 shows if the position control loop is open or closed, and if the axis has been enabled.	■ Green: Axis not enabled ■ Yellow: Axis enabled
Axis in motion (PLC)	During axis movement, the NC sets the bits in W1026.	■ Green: Axis in motion ■ Yellow: Axis is stationary

7.3 Electronic ID Label

HEIDENHAIN inverter components of type D, as well as HEIDENHAIN synchronous motors with absolute encoders with EnDat interface, are equipped with an electronic ID label.
The product name, the ID number and the serial number are saved in this ID label. These devices are automatically detected when the control is started.

▶ Load the displayed component to the corresponding machine parameter automatically with the **SELECT** sof key.

During every further control restart, the control checks whether the connected units with electronic ID label match the entries in MP2100.x or MP2200.x. If necessary, a message window appears and the connected device must be entered into the corresponding machine parameters via soft key.

In exceptional cases, the evaluation of the electronic ID label can be deactivated with MP7690.

MP7690 **Evaluation of the electronic ID labels**

Input: %xx

Bit0 – HEIDENHAIN power modules
0: Active
1: Inactive
Bit1 – HEIDENHAIN synchronous motors
0: Active
1: Inactive

8 Integrated Oscilloscope

8.1 General

The iTNC features an integrated oscilloscope.

Note

The integrated oscilloscope is a useful appliance to investigate errors connected to axis movements.
For example, the comparison of actual-to-nominal values such as distance, velocity, acceleration may give information about possible error locations and reasons.

The oscilloscope has six channels; of those, no more than four can display data from the current and speed controller. If more than four channels are to be displayed from the current and speed controller, the error message
Channel <number> cannot be displayed.

The following signals can be recorded:

Note

All current signals in the integrated oscilloscpe of the **CC 422** are displayed as **peak values**.

All current signals in the integrated oscilloscpe of the **CC 424** are displayed as **effective values**.

Signal	Meaning
Saved	The last traced signal is shown.
s actual	Actual position [mm]
s nominal	Nominal position [mm]
s diff	Following error of the position controller [mm]
Volt.analog	Analog axis/spindle: Analog voltage = nominal velocity value [mV]
Actl. speed	Actual value of the axis feed rate [mm/min]. Calculated from position encoder
Noml. pos	Nominal value of the axis feed rate [mm/min]. Axis feed rate calculated from the difference from the nominal position values. The following error is not included.
Feed rate	Contouring feed rate [mm/min]
Position: A	Signal A of the position encoder
Position: B	Signal B of the position encoder
V (ACT RPM)	Shaft speed actual value [mm/min]; Calculated from rotary speed encoder and standardized with MP1054
V (NOML RPM)	Nominal velocity value [mm/min]: Output quantity of the position controller
I (INT RPM)	Integral-action component of the nominal current value [A]; CC 422: peak value, CC 424: effective value
I nominal	Nominal current value [A] that determines torque; CC 422: peak value, CC 424: effective value
PLC	The PLC operands (B, W, D, I, O, T, C) are recorded. Enter the operand in the text box next to PLC.
a nominal	Nominal acceleration value (m/s2)
r nominal	Nominal jerk value (m/s3)
Pos. diff.	Difference between position and speed encoder (mm)
a actual	Actual acceleration value (m/s2). Calculated from position encoder.
r actual	Actual jerk value [m/s3]; calculated from position encoder.
I2-t (mot.)	Current value of I2-t monitoring of the motor (%)

Signal	Meaning
I2-t (p.m.)	Current value of I2-t monitoring of the power module (%)
Utilization	Actual utilization of the drive (%)
Block number	Block numbers of the NC program
Gantry Diff	Difference between synchronized axes (mm)
U nominal	Nominal voltage (V)
P mech.	Mechanical power (W)
P elec.	Electrical power (W)
M actual	Actual torque value (Nm)
S noml (f.)	Nominal position after nominal position value filters (mm)
DSP debug	Diagnosis function for internal purposes
Contour dev.	Circular interpolation test, contour deviation (mm)
F TCPM	Feed rate for the tool point with TCPM
Int. diagn.	Reserved for internal purposes

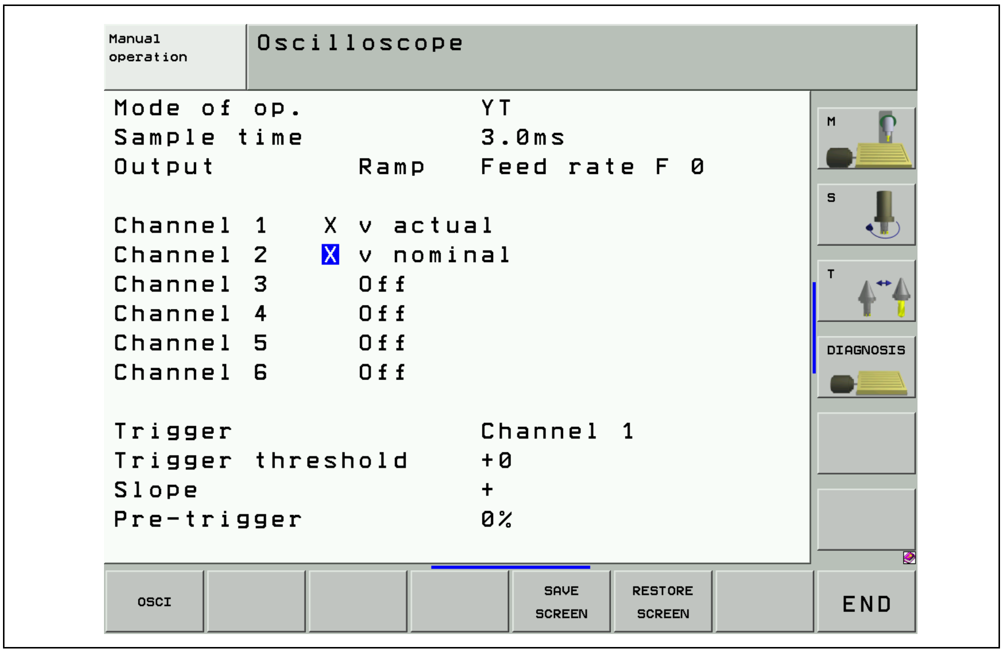
The recorded data remain stored until you start recording again or activate another graphic function.

8.2 Setup

- Activate the oscilloscope as follows:
  Programming and Editing --> *MOD* key
  --> soft keys *DIAGNOSIS* --> *DRIVE DIAGNOSIS* --> *OSCI*
  or with the code number 688379

The setup menu appears:

- Choose the parameters to be entered with the cursor keys.
- Open the selection window with the GOTO key.
- Use the cursor to select a value and confirm it with the ENT key.



Operating mode:

▶ Select the desired setting or choose the circular interpolation test
- YT:Chronological depiction of the channels
- XY:X/Y graph of two channels
- CIRC:Circular form test

Sample time:

▶ Set the time interval for recording the signals.
Entry: 0.6 ms; 1.8 ms and 3.6 ms
4096 samples are stored. The signals are therefore stored for the following duration:
- 0.6 ms · 4096 = 2.4576 s
- 1.8 ms · 4096 = 7.3728 s
- 3.6 ms · 4096 = 14.7456 s

Output:

▶ Select whether the nominal speed value is to be output as a jump or a ramp.
- If you select ramp output, then the programmed feed rate, kV factors and acceleration values that you have specified on the machine go into effect.
- If you select step output, a step will be output as nominal velocity value when you press the axis-direction buttons in the **Manual operating mode.** During output, the position control loop is open. A step can be output only if the code numbers 688379 or 807667 have been entered.

DANGER

With the step function the machine can be accelerated with maximum force.
- When the step function is used improperly, machine damage or even **personal injury** can be caused!
- Recordings made with the step function in the integrated oscilloscope are mainly used for the optimization of control loops on the machine. The optimazation may only be performed by trained specialists of machine tool builders.
- The indicated feed rate corresponds to the height of the step --> As a precaution set the feed rate to zero!
When the internal oscilloscope is activated again, "Ramp" output is automatically selected.

Feed rate:

▶ Define the height of the jump for the nominal speed value (mm/min). If you have defined a ramp as output, this field has no meaning.

Channel 1 to channel 6:

▶ Assign the channels of the recorded signals to the respective axes.

Trigger:

▶ Define the type of recording.
You have the following possibilities:
- **Free run**: The recording is started and ended by soft key. When you press the STOP soft key, the last 4096 events are saved.
- **Single shot**: When you press the START softkey, the next 4096 events are saved.
- **Channel 1** to **channel 6**: Recording begins as soon as the trigger threshold for the set channel is crossed.

Trigger threshold:

▶ Enter the trigger threshold
(the height of the threshold is determined by the signal size to be expected; the appropriate units result from the signal type; enter a threshold of 1 or 0 for PLC signals).

Slope:

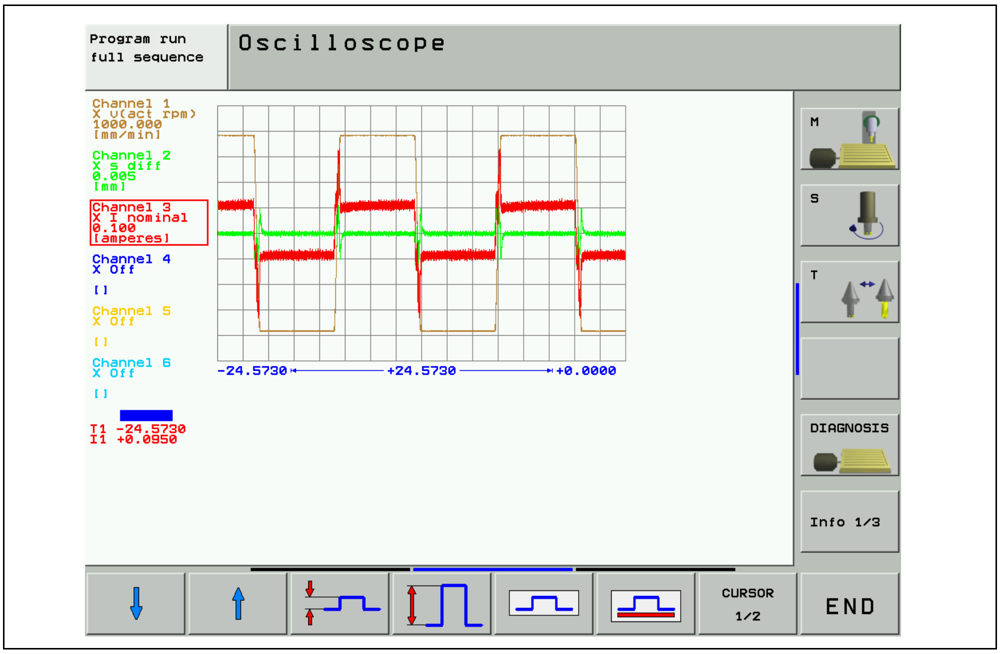
▶ Define whether recording will be triggered with the rising (positive) or falling (negative) edge.

Pre-trigger:
Recording begins at a time preceding the trigger time point by the value entered here

▶ Enter a value.

Oscilloscope display:

▶ Press the Osci soft key



During recording, the trains of selected signals are constantly depicted. After recording ends, the memory contents are displayed. For every channel, the manner of the signal and the resolution are also shown. The length of the recorded range referenced to the entire memory contents is displayed as a bar in the status field.

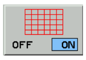
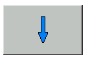
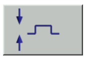
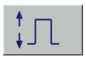
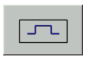
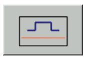
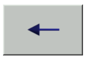
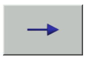
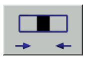
▶ Move the cursor with the arrow keys to select the channel. The amplitude of the selected channel as well as the time (with reference to start of recording) are shown in the status field.

▶ With the soft key **CURSOR 1/2**, you can activate a second soft key. For this cursor the current amplitude and time are also displayed. The time (s) displayed for the second cursor depends on the status of the first cursor. This function allows you to measure the acceleration time of an axis.

Note

The cursor is only placed at the trigger point, if it was not moved by pressing the cursor keys. If the cursor has been moved, it will remain at the point of the time axis to which it has been moved. The cursor does not return to the trigger point until a trigger parameter has been changed.

Explanation of the soft keys:

Explanation of the soft keys:	
	Hide/show gridlines.
Line OFF ON	Hide/show lines between measured points.
START	Start recording. Recording is finished either by a trigger condition or by pressing the soft key STOP.
	Move the signal down.
	Move the signal up.
	Decrease vertical resolution.
	Increase vertical resolution.
	Optimum vertical resolution. The signal is centered in the middle of the screen.
	Optimum vertical resolution. The signal is referenced to the datum line.
CURSOR 1/2	Switch to second cursor.
	Move the signal to the left.
	Move the signal to the right.
	Decrease horizontal resolution.
	Increase the horizontal resolution.
INVERT	The signal is inverted.
END	Terminate the oscilloscope function.

8.3 Saving and Loading Recordings

You can display the signal last recorded for a channel again by selecting the **Saved** signal.

With the **SAVE SCREEN** soft key in the Setup menu you can save the recorded signals with all settings in a file on the hard disk. The file must have the extension *.DTA.
This file can

- be recalled with the PLC development software PLCdesign
- be read in again into the control

To read in a *.DTA file in the control again:

- Press the **RESTORE SCREEN** softkey in the setup menu
- Enter the complete file name and path of the *.DTA file.
- Press the ENT key.
- Press the **OSCI**, softkey to display the signals of the *.DTA file.

8.4 Circular Interpolation Test

A circular interpolation test can be run in the oscilloscope.

- Choose the **CIRC** operating mode in the oscilloscope
- Select the **Contour dev.** setting for the appropriate axes in the two channels
- Begin recording
- Start an NC program in which a circle is programmed; the circle center point must be at the origin of both axes.

Note

Ask the machine operator how to create and execute the NC program!

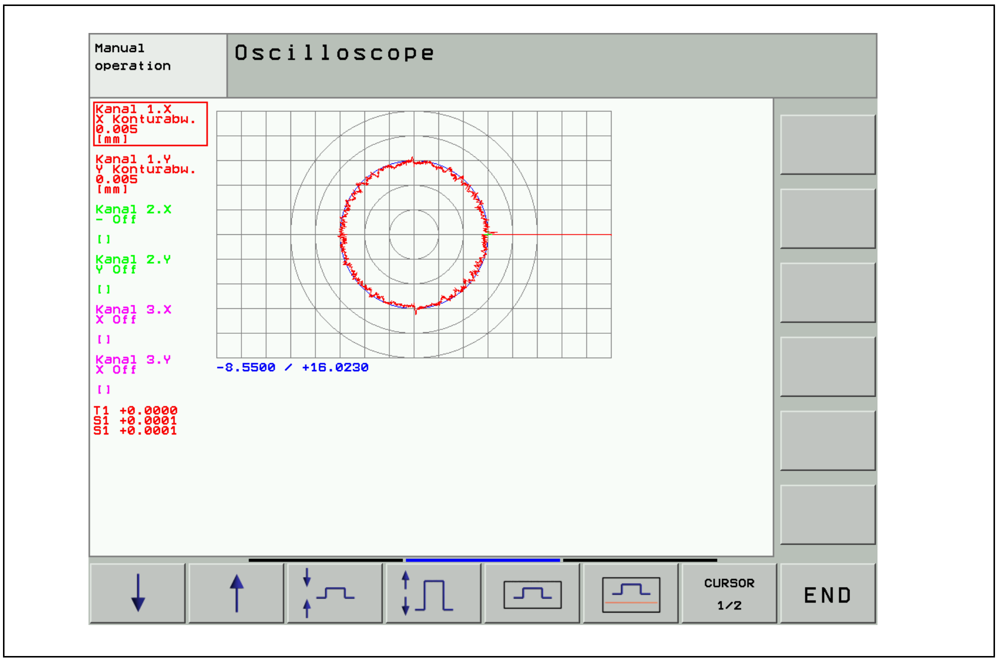
- Stop recording

Below the grid, the recording time relative to the trigger time point is displayed.

Example of a circular interpolation test with the integrated oscilloscope:

Actual position:
X +30
Y +0

NC program:
0 BEGIN PGM Circular interpolation test MM
1 CC X+0 Y+0
2 CP IPA+360 DR+ F1000
3 M30
4 END PGM Circular interpolation test MM



9 Monitoring Functions

9.1 Introduction

The iTNC 530 features comprehensive monitoring functions.

Values are defined for axis positions and dynamic response of the machine.
If the specified values are exceeded, it displays an error message and stops the machine.

DANGER

Active monitoring functions are essential for a safe machine operation!
Safe machine operation is not possible if the monitoring functions are switched off.
Uncontrolled axis movements are not detected.

- Deactivated monitoring functions or changed tolerance values may result in damage to persons or property.
- You must not switch off the monitoring functions!

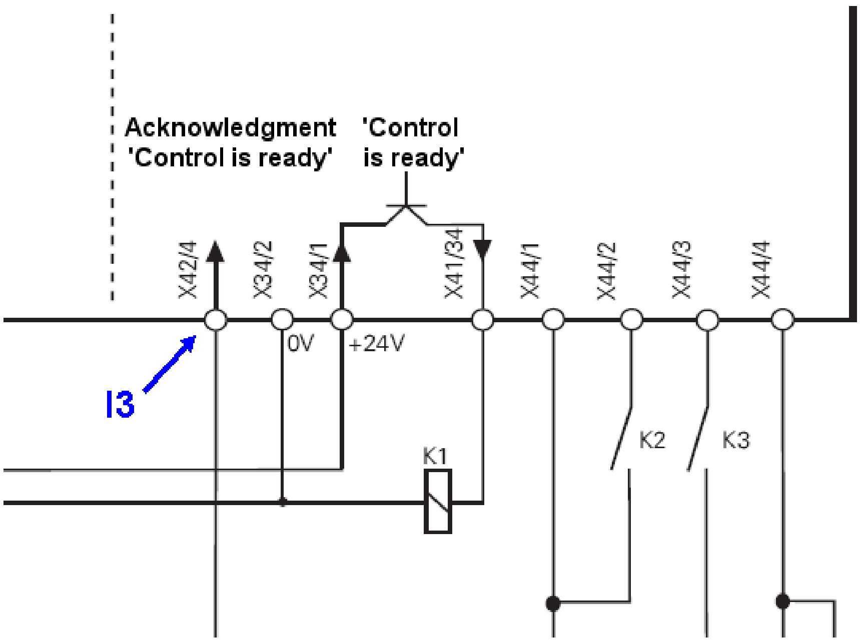
Refer to this chapter which monitoring functions exist and how they are defined.

9.2 During Booting

Booting or EMERGENCY STOP routine

In the event of hazardous errors the control switches off the *Control-is-ready* output.
An EMERGENCY STOP must be generated. --> The EMERGENCY STOP chain must be interrupted.

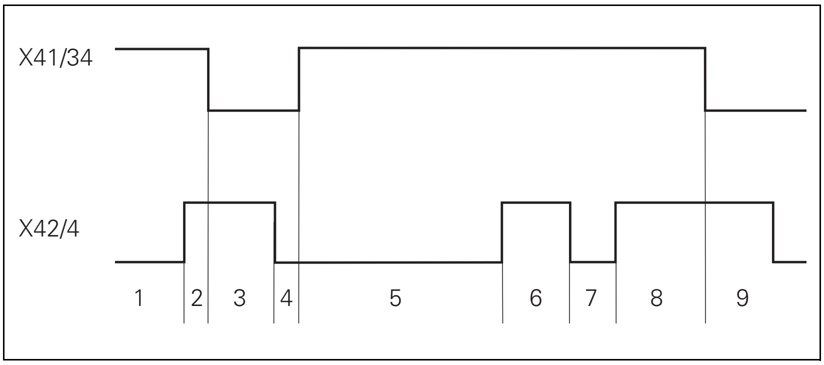
Since this is a function important for the safety on the machine, it is tested via the so-called Switch-on or EMERGENCY-STOP routine each time the line power is switched on.



Note

Refer to the circuit diagram
--> See "Basic Circuit Diagrams" on page 11 – 116 for the wiring recommended by HEIDENHAIN.
The ***Control-is-ready signal acknowledgment*** has to occur within 1 s.

Flowchart



Step	Function	Screen display
1	Waiting for machine control voltage	**RELAY EXTERNAL DC VOLTAGE MISSING**
2	Recognition of the machine control voltage on X42/4 and switch-off of the control-is-ready signal on X41/34 by host computer (t < 66 ms).	
3	Max. time in which the control-is-ready acknowledgement on X42/4 must go to 0 (t < 1 s)	If exceeded, **EMERGENCY STOP defective**
4	Recognition of the acknowledgment and setting of X41/34 (t < 20 ms)	
5	Waiting for machine control voltage	**RELAY EXTERNAL DC VOLTAGE MISSING**
6	Normal control operation. Control-is-ready output and acknowledgment are high.	
7	Control voltage is switched off externally.	**EMERGENCY STOP**
8	After switching on again, the machine control voltage can be switched off, and then the control operates normally.	
9	After detecting a fault, the control switches off the control-is-ready output (X41/34).	Error message

Possible errors

- The message *Relay external DC voltage missing* does not disappear although the key *Control voltage ON* is pressed.
- When the key *Control voltage ON* is pressed, the error message *EMERGENCY STOP defective* is displayed.

Possible causes of error

- EMERGENCY STOP chain interrupted
- 24 V power supply from connector X 349 is missing
- MC defective
- Wiring defective, contactors defective or too slow

Service diagnosis

See “Examination of the Output Control-is-ready (X41/pin34) and Input Control-is-ready signal acknowledgement I3 (X42/pin 4)” on page 19 – 314.

9.3 During Operation

During operation, the iTNC 530 monitors the following positions:

- Amplitude of encoder signals
- Edge separation of encoder signals
- Absolute position for encoders with distance-coded reference marks
- Current position (position or servo lag monitoring)
- Actual path traversed (movement monitoring)
- Position deviation at standstill (standstill monitoring)
- Nominal speed value
- Checksum of safety-related functions
- Power supply
- Buffer battery voltage
- Operating temperature of MC and CPU
- Run time of PLC program

With digital axes, the TNC also monitors:

- Motor current
- Motor temperature
- Temperature of power module
- DC-link voltage
- I^2t of power module and motor

Depending on the PLC program, the following can be evaluated:

- Current utilization of the drive motors
- Status of HEIDENHAIN inverters

If the "Control is ready" signal output and the "Control is ready" signal acknowledgment input are correctly connected to the emergency-stop loop, the control interrupts the loop via the "Control is ready" signal output as soon as a dangerous error occurs.

9.3.1 Position or Servo Lag Monitoring

The axis positions are monitored by the iTNC as long as the control loop is closed.

The input values for position monitoring depend on the maximum possible following error (servo lag). Therefore the input ranges for operation with following error and velocity feedforward are separate.

For both modes of operation there are two range limits for position monitoring.

If the first limit is exceeded, the following error message is generated:
EXCESSIVE SERVO LAG IN <AXIS>. The machine stops.
You can clear this message with the CE key. An actual-to-nominal value transfer is then executed for the respective axes.

If the second limit is exceeded, the follwing error message is generated:
EXCESSIVE SERVO LAG IN <AXIS>. The control-is-ready signal is reset.
You cannot clear this message. You must restart the control to correct the error.

MP1410.x **Position monitoring for operation with velocity feedforward (erasable)**

MP1420.x **Position monitoring for operation with velocity feedforward (EMERGENCY STOP)**

MP1710.x **Position monitoring for operation with following error (erasable)**

MP1720.x **Position monitoring for operation with following error (EMERGENCY STOP)**

Possible causes of error

No claim for completeness; contact your machine manufacturer!
If possible, write your own experience!

- Edgeless tool
- Excessive machining feed rate
- Spindle speed too low
- Insufficient lubrication
- General mechanical stiffness
- Machine vibration
- With analog axes: excessive offset (drift), faulty tachometer or carbon brushes
- Hardware error in the control loop

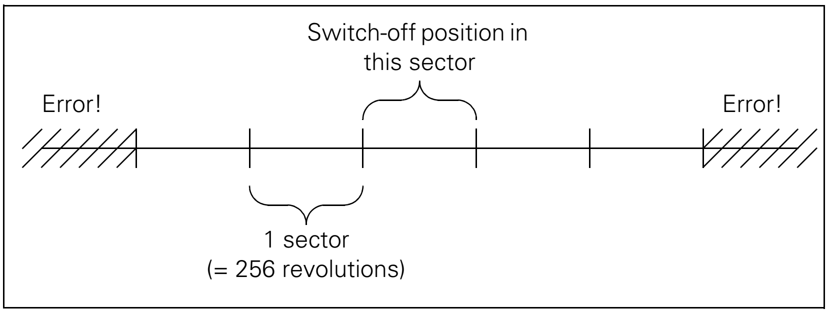
Difference between position at switch-on and shutdown

When the control is switched off, the actual position of the axes is saved with an absolute encoder. During switch-on it is compared with the position values read by the encoder.

If the positions differ by more than the difference defined in MP1146.x, a pop-up window appears with both positions. The new position must be confirmed with a soft key. If it is not confirmed, the error message `Check the position encoder <axis>` appears.

Special case: Absolute multiturn rotary encoder

The control saves an overflow (more than 4096 revolutions of the encoder) internally. Additionally, the number of traversed sectors (1 sector = 256 revolutions) is saved. After the drives are switched on, the current sector is compared to the saved sector.



When the motor is switched on and to the switch-off position two complete sectors are in between (further than the sector "after next"), the error message Switch-off pos. <axis> unequal ENDAT is immediately displayed after the drives are switched on.

Caution

The error has to be eliminated!

It is assumed that after restarting the control the number of revolutions is correct again.

It is possible that a pop-up window appears with the information that there is a difference between switch-on and switch-off position by more than the value in MP1146.x. If the motor is at the correct position, the message can be confirmed with the YES soft key.

MP1146.x **Difference between switch-off position and position read in via the EnDat interface**

Input: 0.0000 to 300.0000 (mm) or (°)

0: No difference permitted

9.3.2 Nominal Speed Value

For the axes, the nominal speed value monitoring is effective only in operation with velocity feedforward.

For the spindle, it is effective in operation with following error as long as the position control loop is closed (orientation).

If the nominal speed value calculated by the position controller is greater than the maximum possible nominal value, the error message NOMINAL SPEED VALUE TOO HIGH <AXIS> appears and the control-is-ready output is reset.

Analog axes: Maximum nominal speed value = 10 V

Analog spindle: Maximum nominal speed value = 20 V

Digital axes and spindle: Maximum nominal value = maximum motor speed from motor table

Caution

Entries in the motor table must not be changed!

Problem or error

The machine does not reach the set acceleration and braking ramps.
It has lost its dynamic!

Possible remedies

No claim for completeness; contact your machine manufacturer!
If possible, write your own experience!

- For analag axes: Check the tachometer and carbon brushes, adjust the servo amplifier again
- For digital axes: New adjustment of the control loops by the machine manufacturer
- Overhaul the mechanics
- Eliminate the hardware error in the control loop

9.3.3 Movement Monitoring

Movement monitoring is possible during operation both with velocity feedforward and with following error.

During movement monitoring, the actual path traveled is compared at short intervals (several servo cycles) with the nominal path calculated by the NC. If during this period the actual path traveled differs from the calculated path, the blinking error message MOVEMENT MONITORING <AXIS> A is displayed.

Analog axes:
An existing offset during a standstill may cause a potential at the analog output without any resulting positioning movement:

- In MP1140.x, enter a threshold from which the movement monitoring should go into effect.

Digital axes:
There is no offset.

- In MP1140.x, enter a speed from which the movement monitoring should go into effect.

For digital axes, in addition to the comparison of actual and nominal values, the calculated position from the pulses of the position encoder are compared with the pulses of the speed encoder:

- Enter in MP332.x the number of signal periods and in MP331.x the path for the number of signal periods.
- MP1054.x contains the displacement per motor revolution. A formula can also be entered.
- MP1144.x contains the value for this position difference. If no position encoder is used, the value 0 must be entered as position difference.

If the difference is greater than the input value of MP1144.x, the error message MOVEMENT MONITORING <AXIS> B is displayed.

DANGER

If you enter the maximum value in MP1140.x or MP1144.x, no movement monitoring is active. Safe machine operation is not possible without movement monitoring!

MP1140.x	**Threshold above which the movement monitoring functions**
Input:	Analog axes: 0.030 to 10.000 [V]
	Digital axes: 0.030 to 10.000 [1000 min^{-1}]

MP1054.x	**Distance of a motor revolution (mm or °)**
Input:	Analog axes: without function
	Digital axes: A formula can be entered.

MP1144.x	**Movement monitoring for position and speed**
Input:	Analog axes: without function
	Digital axes: 0 to 99 999.999 (mm) 0: No monitoring

Possible causes of error

No claim for completeness; contact your machine manufacturer!
If possible, write your own experience!

- Large backlash (ball screw, gear, belt, coupling, etc.)
- Edgeless tool
- Excessive machining feed rate
- Spindle speed too low
- Insufficient lubrication
- General mechanical stiffness
- Machine vibration
- With analog axes: excessive offset (drift), faulty tachometer or carbon brushes

Possible causes of error for movement monitoring … B

No claim for completeness; contact your machine manufacturer!
If possible, write your own experience!

- Large backlash (ball screw, gear, belt, coupling, etc.)
- Belt torn
- Coupling defective
- Gear defective

9.3.4 Standstill Monitoring

The standstill monitoring is possible during operation both with velocity feedforward and with following error.

If the position deviation is greater than the value defined in MP1110.x, the error message STANDSTILL MONITORING <AXIS> is displayed. The message also appears if, while moving to a position, an overshoot occurs that is larger than the input value in MP1110.x, or if the axis moves in the opposite direction when beginning a positioning movement:

- In MP1140.x, enter a threshold from which the standstill monitoring should go into effect.

MP1110.x **Standstill Monitoring**

Input: 0.0010 to 30.0000 (mm)

Possible causes of error

No claim for completeness; contact your machine manufacturer!
If possible, write your own experience!

- Analog axes: Excessive offset (drift)
- Vertical axes: Poor brake or defective weight balance
- Clamped axes: Great mechanical effects during machining

9.3.5 Positioning Window

The positioning window defines the limits within which the control considers a position to have been reached. After the position has been reached, the control begins running the next block. The position controller can correct a disturbance inside this window without activating the "Return to the Contour" function.

- The size of the positioning window is defined in MP1030.x.

MP1030.x **Positioning Window**

Input: 0.0001 to 2.0000 (mm)

Possible error

The NC program gets caught up in an NC block.

Possible causes of error

No claim for completeness; contact your machine manufacturer!
If possible, write your own experience!

- Excessive static and sliding friction ("slip & stick")
- Chip in the thread during tapping, thread milling or forming (The spindle "vibrates" to the left and right without leaving the hole.)
- Analog axes: Excessive drift
- Digital axes: Insufficient controller adjustment (The axis "oscillates" and "vibrates" around the positioning window.)
- Missing acknowledgment of M, S, T, G, Q strobe signals (strobe acknowledgments, PLC)

Axes in position

If the axes have reached the positioning window after a movement, the corresponding bits are set in W1026. This also applies to the status after the machine control voltage is switched on. Axes that are not used are considered to be in position.

The NC resets the bits as soon as you start a positioning movement or traverse the reference marks.

In the ELECTRONIC HANDWHEEL mode of operation, the bit for the current handwheel axis is reset.

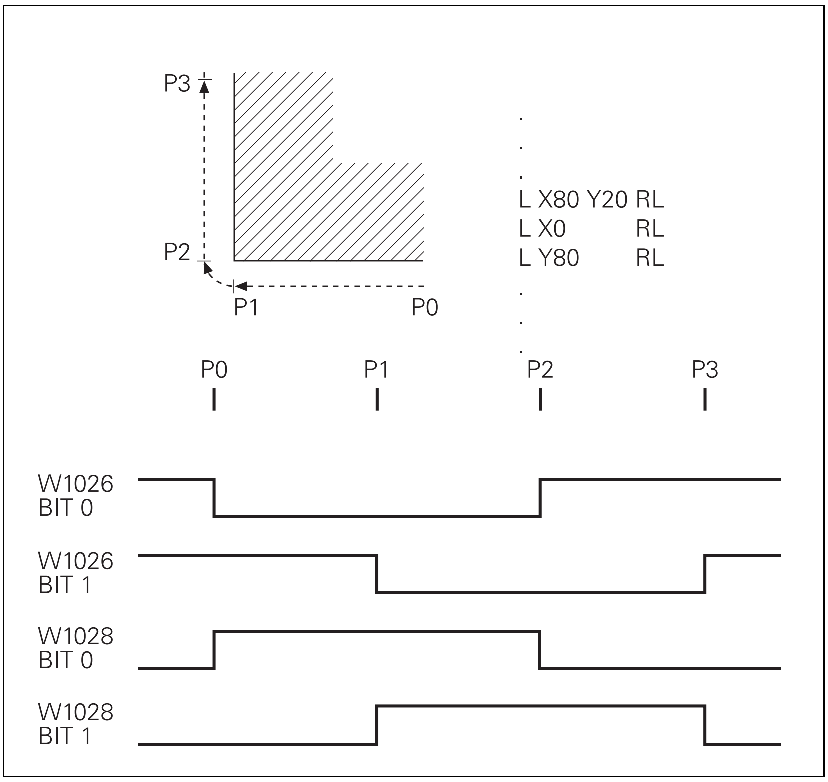
On contours that can be machined with constant contour speed, NN_AxInPosition is not set.

		Set	Reset
W1026	**Axes in position** Bit 0 to 8 corresponds to axis 1 to 9 0: Axis not in positioning window 1: Axis in positioning window	NC	NC

Axis in motion

During axis movement, the NC sets the corresponding bits in W1028.

		Set	Reset
W1028	**Axis in motion** Bit 0 to 8 corresponds to axis 1 to 9 0: Axis not in motion 1: Axis in motion	NC	NC



9.3.6 Monitoring of the Power Supply Unit

The rectified supply voltage of the power supply unit is monitored. The supply voltage must lie within a defined range
(400 V ± 10%). If this is not the case the power supply unit reports an AC fail ($\overline{\text{PF.PS.AC}}$).

At the same time, the dc-link voltage is monitored:

Motors run out non-controlled

If approx. 760 V- (UV 120, UV 140, UV 150, UR 2xx: approx. 800 V) is exceeded, the NC revokes the pulse release (reset) for the IGBT (end stage) of the power stage. The motors run out non-controlled. No energy is returned to the dc link.

Possible causes of error

No claim for completeness; contact your machine manufacturer!
If possible, write your own experience!

- Defective braking resistor (conversion of electrical energy to heat energy not possible)
- Defective infeed/regenerative feedback module (energy recovery not possible)
- Interruption in the primary supply (fuses, wires, etc.; energy recovery not possible)

Power fail

- Below approx.. 385 V– (UV 120, UV 140, UV 150. UR 2xx: approx. 410 V), the power supply unit reports a powerfail (signal $\overline{\text{PF.PS.ZK}}$).
- Below approx. 155 V– (UV 120, UV 140, UV 150, UR 2xx, UV 105: approx. 200 V), there is a reset of the control (signal $\overline{\text{RES.PS}}$).
- Below approx. 135 V– (UV 120, UV 140, UV 150, UR 2xx, UV 105: approx. 180 V), the power supply unit switches off.

The UV 105 power supply unit reports a powerfail if the dc-link voltage
is < approx. 385 V and the supply voltage is < approx. 330 V.

▶ With MP2150, you can define which inverter signal is to trigger powerfail on the control.

Inverter Signal	Meaning
AC-fail ($\overline{\text{PF.PS.AC}}$)	Failure of supply voltage for inverter
Powerfail ($\overline{\text{PF.PS.ZK}}$)	Dc-link voltage failure

Since the AC fail is reported to the control before the power fail, the control has more time to react to the subsequent dc-link voltage failure.

Note

Only regenerative HEIDENHAIN power supply units provide the AC-fail signal.

If a power fail is triggered on the control, all drives are brought to a controlled stop. The PLC-outputs are switched off and the control freezes to ensure that the hard disk can no longer be accessed.

The control has to be switched off and on again.

MP2150 **Powerfail signal on the control**

Input: 0: AC-fail
1: Power fail and AC-fail
2: reserved
3: Powerfail

Possible causes of error

No claim for completeness; contact your machine manufacturer!
If possible, write your own experience!

- Power failure
- Failure of one or several phases in the supply line.
- The power supply voltage has fallen below the minimum value.
- Interruption in the electrical cabinet.
- Inverter (power supply module) defective
- Short circuit of drives (drive modules, motors)

9.3.7 Temperature Monitoring

Temperature of the MC 42x(B)

The internal temperature of the MC 42x(B) is continuously monitored. At approx. 55° C the temperature warning TNC temperature warning appears. If the temperature does not fall below 55° C any more, the warning is reactivated after two minutes. Beginning at about 60° C the error message TNC temperature too high <Temperature> °C is displayed and an emergency stop generated. If the temperature does not fall below 60 °C when the machine is switched on again, the error message reappears after 10 to 20 seconds.

Motor temperature

To measure the motor temperature, a KTY 84 must be connected at pins 13 and 25 of X15 to X20, X80 to X83. The temperature value is ascertained at least once per second. The maximum permissible motor temperature is taken from the motor table.

As soon as the given temperature is exceeded, the blinking error message: MOTOR TEMPERATURE <AXIS>TOO HIGH appears and the drives are automatically switched off.

Caution

Entries in the motor table must not be changed!

Heat sink temperature of the power module

At X51 to X60 the temperature warning signal is available at pin 10.

If the permissible temperature of the heat sink on the power module is exceeded, this signal is reset.

The TEMPERATURE WARNING signal is not evaluated in the NC. This information is made available via the modules 9610 or 9066.

- When a temperature warning is generated, the PLC program of the machine tool builder immediately must bring the drives to a standstill; otherwise the power modules would be destroyed.

Possible Causes of Error

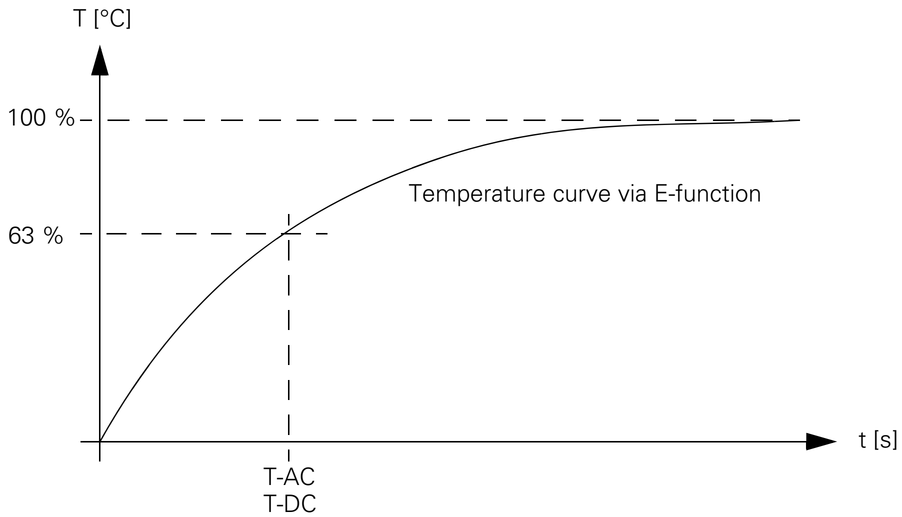
No claim for completeness; contact your machine manufacturer!
If possible, write your own experience!

- Contaminated filter pads
- Defective climate control unit in the electrical cabinet
- Defective fan
- Unfavorable mounting of components
- Defective temperature sensor

9.3.8 I^2t Monitoring

The actual motor current is limited to either the maximum current of the power module, or the maximum motor current, whichever is lower. The values result from the type of power module and type of motor, and are saved in the motor or power module table.

In addition the I^2t monitoring for the power module and for the motor is executed:
The temperature rise of motor and power module is proportional to the square of the current consumed. Since heat removal may be non-uniform during standstill or slow movement of the motor, the monitoring distinguishes two different ranges: This is the purpose of the F-AC (Cutoff frequency for T-AC [Hz]) in the motor-and-power-module table. Above this frequency the T-AC (Thermal time constant AC [s]) applies; below this frequency the T-DC (Thermal time constant DC [s]) takes effect. The T-AC and T-DC input values mark that point of the temperature curve at which 63 % of the maximum temperature are reached. This defines a temperature model of the motor or power stage.



With the aid of this temperature model, a mean current value is permanently calculated. If this calculated mean current value exceeds the rated current (for motors, plus MP2302.x and additionally for power modules MP2304.x), the I^2t monitoring (module 9160) responds. In this case, you should reduce the machining feed rate in the PLC program. If the calculated mean current value is more than 1.1-fold of the rated current, (for motors, plus MP2302.x) an error message appears; the drives are not switched off.

- MP2302.x contains a reference value for I^2t monitoring of the motor. The input value is a factor of the rated current of the motor (1 = rated current of the motor). If you enter zero, the I^2t monitoring for the motor (not for the power module) is switched off.
- MP2304.x contains a reference value for I^2t monitoring of the power module. The input value is a factor of the rated current of the power module (1 = rated current of the power module). If you enter zero, the I^2t monitoring for the power module (not for the motor) is switched off.

Note

In the integrated oscilloscope you can display the current values of the I^2t monitoring of the motor and power module, as well as the current load of the drive.

The I^2t monitoring according to the temperature model above can only be used if entries not equal to 0 are in the F-DC, T-DC, F-AC and T-AC columns of the motor or power module tables.

If the value 0 is entered in these columns, the following default values are valid:

- Axis drives:
  - F-DC = 0
  - T-DC = 10
  - F-AC = 0
  - T-AC = 10
- Spindle drives:
  - F-DC = 0
  - T-DC = 150
  - F-AC = 0
  - T-AC = 150

In the power module table, all HEIDENHAIN inverters whose names do **not** end in "...-QAN" or "...-QSY" have entries in these columns.

MP2302.x **Reference value for I^2t monitoring of the motor**

Input: 0 to 1 000.000 [· rated current of motor]

0: I^2t monitoring of the motor switched off
1: Rated current of motor as reference value

MP2304.x **Reference value for I^2t monitoring of the power module**

Input: 0 to 1 000.000 [rated current of power module]

0: I^2t monitoring of power module switched off
1: Rated current of power module as reference value

Possible causes of error

No claim for completeness; contact your machine manufacturer!
If possible, write your own experience!

- Overload of drives (power module, motor)
- Axis traverses as far as it will go
- Mechanical stiffness

9.3.9 Current Utilization of the Drive Motors

Module 9166 provides the momentary utilization of the given drive motor as a percentage value.

Ask your machine tool builder whether this PLC module is evaluated and how the information is displayed.

9.3.10 Status of HEIDENHAIN Inverters

The HEIDENHAIN power supply units have several status signals which lead to error messages on the control:

Status Signal	Associated Error Message	Possible Causes of Error
Excessive DC-link voltage (ERR.UZ.GR)	8080 Uz UV 1xx too high	■ Defective braking resistor (conversion of electrical energy to heat energy not possible) ■ Defective infeed/regenerative feedback module (energy recovery not possible) ■ Interruption in the primary supply (fuses, wires, etc.) energy recovery not possible)
Heat sink temperature too high (ERR.TEMP)	8040 Heat sink temperature UV 1xx	■ Excessive load of the power module ■ Temperature in the electical cabinet too high ■ Fan defective ■ Temperature sensor defective ■ Unfavorable mounting of components
Excessive DC-link voltage (ERR.IZ.GR)	8041 Iz UV 1xx too high	■ Overload of the machine while machining a work-piece ■ Edgeless tool
Power supply unit not ready for operation (RDY.PS)	8061 Ready of inverter missing	■ Inverter defective ■ Control of inverter defective (load and main con-tactor)
Excessive leakage current (ERR.ILEAK)	8060 Excessive UV 1xx leakage current	■ Insulating problems (motor, cable, etc.) ■ Humidity has entered the motor

MP2195 is used to suppress the error message for each status signal.

HEIDENHAIN does not recommend suppressing the error messages from the power supply units!

If you are using an UE 2xx, the signals must be suppressed because the UE 2xx compact inverter does not provide these signals.

Note

Status information of the HEIDENHAIN inverters can also be read with PLC module 9066.
--> Ask your machine tool builder whether this PLC module is evaluated and how the information is displayed.

Status signals that are already low-active or not available during control start-up

Warning and danger signals are low-active; i.e., line-break proof!

The handling of status signals of the HEIDENHAIN power supply unit that are already low-active or not available during control start-up, varies depending on MP2195 bit 0.

MP2195 bit 0 = 0: Missing signals cannot be detected with module 9066 and do not result in an error message when the drive is switched on.

MP2195 bit 0 = 1: Missing signals can be detected with module 9066 and result in an error message when the drive is switched on. Signals that are not provided by the power supply unit (e.g. non-HEIDENHAIN inverter system, "older" HEIDENHAIN inverters) must be suppressed with MP2195 (bit 1 to bit 6), because non-existent signals are always identified as errors.

Note

Signals that change their status during operation are always identified as errors.

MP2195 **Handling of status signals from HEIDENHAIN power supply units**

Input: Bit0 - Status signals that are already active during control start-up

0: Missing signals are ignored
1: Missing signals are evaluated
Bit1 - $\overline{\text{ERR.UZ.GR}}$ signal
0: Error message is not suppressed
1: Error message is suppressed
Bit2 - $\overline{\text{ERR.TMP}}$ signal
0: Error message is not suppressed
1: Error message is suppressed
Bit3 - reserved
Bit4 - $\overline{\text{ERR.IZ.GR}}$ signal
0: Error message is not suppressed
1: Error message is suppressed
Bit5 - RDY.PS signal
0: Error message is not suppressed
1: Error message is suppressed
Bit6 - $\overline{\text{ERR.ILEAK}}$ signal
0: Error message is not suppressed
1: Error message is suppressed
Bit7 - reserved

9.3.11 Control of Motor Brakes

The motor brakes are controlled with the $\overline{\text{BRK}}$ braking signal, which is transmitted to the **HEIDENHAIN inverters** via the PWM interface (X51 to X62). The corresponding outputs are activated there. See the basic circuit diagrams.
Control of the motor brakes via the PWM interface must be deactivated for non-HEIDENHAIN inverters that do not support this function:

- MP2234.x bit 0 = 1

The motor brakes are opened no later than 50 ms after the speed controller is switched on. For safety reasons, the controller is not switched off until the braking signal has been output:

- Enter in MP2308.x the time (overlap time) after which the controller is to be switched off (after the braking signal has been output).

If the inverter sends the $\overline{\text{RES.PS}}$ reset signal, then the $\overline{\text{BRK}}$ braking signals are output immediately upon switch-off of the controllers, i.e. without any overlap time.

Activated brakes cause a change in the controlled system. The motor with the changed controlled system is controlled during the overlap time. This can lead to oscillations when the controller is switched off. These oscillations are suppressed by the NC software. MP2220 bit 3 can be used to not suppress the vibrations. HEIDENHAIN does not recommend switching off the suppression of the oscillations.

MP2220	**Monitoring Functions**
Input:	Bit3 - Switching off the controller when the motor brakes are activated
	0: Oscillations are suppressed 1: Oscillations are allowed

MP2234.x	**Internal triggering of the motor brakes via the PWM interface**
Format:	%xx
Input:	Bit0 -
	0: Signal is output 1: Signal is not output Bit1 - reserved

MP2308.x	**Time between output of the $\overline{\text{BRK}}$ braking signal and the switching off of the controller (overlap time)**
Input:	0.001 to 0.500 [s]
	0: 0.200 s

Automatic test of the motor brakes at switch-on

After switching on the drive, but before traversing the reference mark, you can carry out an automated functional test of the motor brake. For the period of one second, a current is output while the brake is applied. The path that the axis has moved is then measured. If the permissible path is exceeded, the error message **8130 Motor brake defective <axis>** appears, and the axis remains controlled. The test is carried out simultaneously for all affected axes.

DANGER

If the machine were switched off in case of an error, vertical axes could fall down!
This could lead to damage to property or persons!
In case of an error, the axis must be moved to a safe position, and physically supported, if necessary. Only then may the machine be switched off so that the defect can be corrected!

If no motor current flows while testing the motor brakes, the error message **8140 No current for brake test <axis>**.

▶ MP2230.x contains a factor for the motor current with which the test of the motor brake should be performed. MP2230.x = 0 if the test is not to be performed or for motors without brakes.

The **I0** standstill current is used as motor current entered in the motor table. If **I0** = 0 in the motor table, the rated current **I-N** from the motor table is used.

Recommended input value for MP2230.x:

$$\text{MP2230.x} \geq 1.3 \cdot \frac{M_L}{M_0}$$

M_L: Maximum torque of the axis
M_0: Standstill torque of the motor

Always keep in mind:

- Torque for motor test ≥ 1.3 · Maximum torque of the axis
- Standstill torque of the motor ≥ Maximum torque of the axis
- Holding torque of the motor brake ≥ Torque for motor test

▶ MP2232.x contains the permissible path that the motor is allowed to move against the brake. MP2232.x = 0 if the test is not to be performed or for motors without brakes.

Enter MP2232.x < MP1110.x so that the standstill monitoring does not respond!

Recommended input value for MP2232.x:

$$\text{MP2232.x} = 2 \cdot \alpha \cdot \frac{\text{MP1054.x}}{360°}$$

a: Permissible brake angle: Backlash of motor brake according to instructions by the manufacturer (for HEIDENHAIN motors a ≤ 1°)

Example:
QSY 155B-EcoDyn: M_0 = 13 Nm, M_{Br} = 40 Nm
M_L = 11 Nm

$$MP2230.x \geq 1.3 \cdot \frac{11\ \mathrm{Nm}}{13\ \mathrm{Nm}} = 1.1$$

MP1054.x = 20 mm
a = 1°

$$MP2232.x = 2 \cdot 1° \cdot \frac{20\ \mathrm{mm}}{360°} = 0.111\ \mathrm{mm}$$

MP2230.x **Factor for motor current during test of motor brake**

Input: 0.1 to 30.0 [· motor current]

0: No test of motor brakes, or motor without brake
1.3: Recommended input value

MP2232.x **Maximum permissible path during test of motor brakes**

Input: 0 to 10.0000 [mm] or [°]

9.3.12 EMERGENCY STOP Monitoring During Operation

A PLC input (X42/4) and a PLC output (X41/34) with the designation "control-is-ready" are available on the control for the EMERGENCY STOP routine.

If a functional error is detected, the iTNC switches the control-is-ready output off. An error messages appears and the PLC program is stopped. Some error messages **cannot** be cleared with the CE key:

▶ Correct the error and restart the switch-on routine --> See “During Booting” on page 9 – 55!

If the “control-is-ready signal acknowledgment” input is switched off by a process external to the control, the error message **EXTERNAL EMERGENCY STOP** appears. The NC sets M4177 and M4178. The nominal speed value 0 is output and the drives are switched off. You can clear this error message with CE after switching the machine control voltage back on.

The “control-is-ready signal acknowledgment” input is passed on directly to the NC; it **cannot** be manipulated by the PLC (I3).

Resetting the “control-is-ready signal acknowledgment” inputs leads to position monitoring being shut off for the time defined in MP1150.1, and to an actual-to-nominal value transfer. After the time defined in MP1150.1 has expired, position monitoring is again active, for at least the time defined in MP1150.2.

If marker M4580 is set, then instead of the external emergency stop (“control-is-ready signal acknowledgment” input), the control loops of all axes and of the spindle are opened, and an NC stop is performed.

		Set	Reset
M4177	**Cancellable error message displayed**	NC	NC
M4178	**EXTERNAL EMERGENCY STOP error message is displayed**	NC	NC
M4580	**Suppress EMERGENCY STOP, open all position control loops, NC stop**	PLC	PLC

10 PLC Diagnosis

10.1 General

Definition of PLC

PLC is a general term of the control technology and is the abbreviation for:
Programmable **L**ogic **C**ontrol.

The PLC is included in the HEIDENHAIN control units and is thus designated as Integral PLC:

Tasks of the PLC

- Adaptation of different machine types to HEIDENHAIN controls
- Control tasks

Note

The machine manufacturer creates the PLC program for the machine or adapts an existing PLC project to a machine.

DANGER

Changes in the PLC program or the PLC wiring may influence not only the function but also the safety of the machine! This could lead to damage to property or persons!
Changes in the PLC may only be performed by the machine manufacturer!

PLC error messages

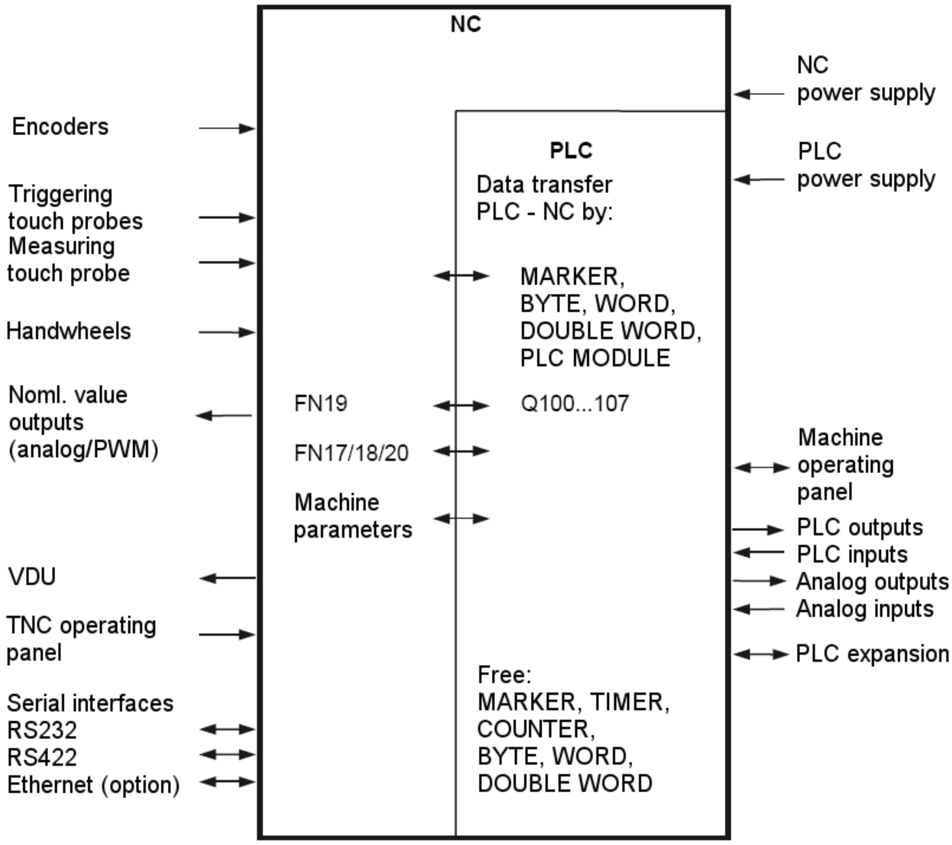
See "Error Messages" on page 4 – 17

PLC error messages (text, reaction of the control, etc.) are defined by the machine manufacturer.

Data exchange with the PLC

The PLC has to exchange data with the machine but also with the operating system of the control to be in a position to undertake adaptation and control tasks.

TNC Control



Depending on the type of control, various inputs and outputs are available for the data exchange with the machine.

The data exchange between PLC and NC is performed via firmly assigned markers, bytes, words, doublewords, machine parameters and PLC modules.

Calling the PLC Mode

▶ Press the following key combination to call the PLC mode:

▶ Select the ***Programming and Editing*** operating mode

MOD ▶ Call window for code number

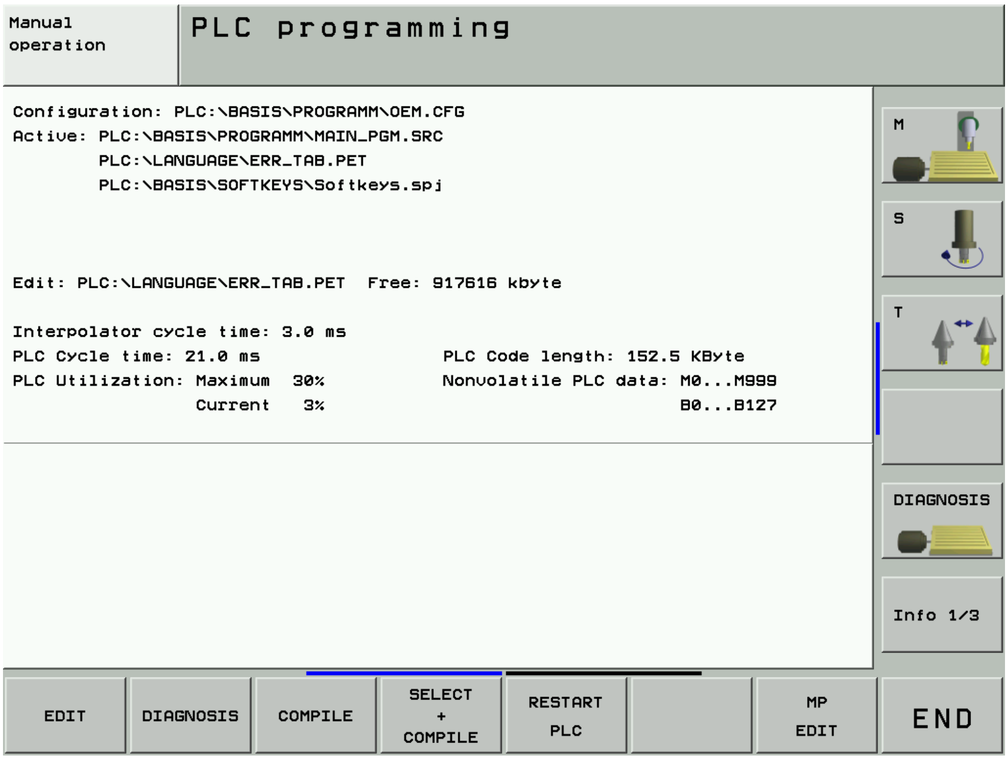
8 0 7 6 6 7 ENT ▶ Enter and confirm code number

▶ After the code number has been entered, the PLC main menu is displayed.

Note

If the dialog ***READONLY*** appears on the left side of the screen, the machine manufacturer has protected the PLC mode with his own code number.
The diagnosis possibilities with the standard PLC code number 807667 are limited.
--> Contact the machine manufacturer!

PLC Basic Menu



On this page you may see, e.g.:

- Which PLC main program is running
- Which PLC error table is used
- The range of remanent PLC markers and words (or bytes)
- The PLC utilization

Note

Depending on the currently running machine functions and the PLC program used, also values considerably higher than 100% may be displayed for the PLC utilization.
You do not have to take any measures!
Only when the permissible PLC utilization is superseded, the error message ***PLC: time out*** is displayed.
--> Contact your machine manufacturer!

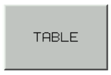
10.2 Service Diagnosis in PLC Mode

10.2.1 The TABLE Function

The TABLE function provides the possibility to display the logic states of of the inputs, outputs, markers, counters and timers in a table.

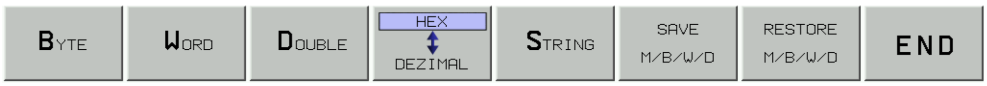
Call

▶ Shift the soft-key row



▶ Call TABLE function

▶ Shift the soft-key row



The table is called after the corresponding soft key has been pressed.

The display mode for byte, word and doubleword tables can be switched between ***HEX*** and ***DECIMAL***.
With the cursor keys or the ***GOTO*** key followed by an entry, the operands can be selected within the table.

The following describes the testing of PLC inputs and outputs for which the TABLE function can be very helpful.

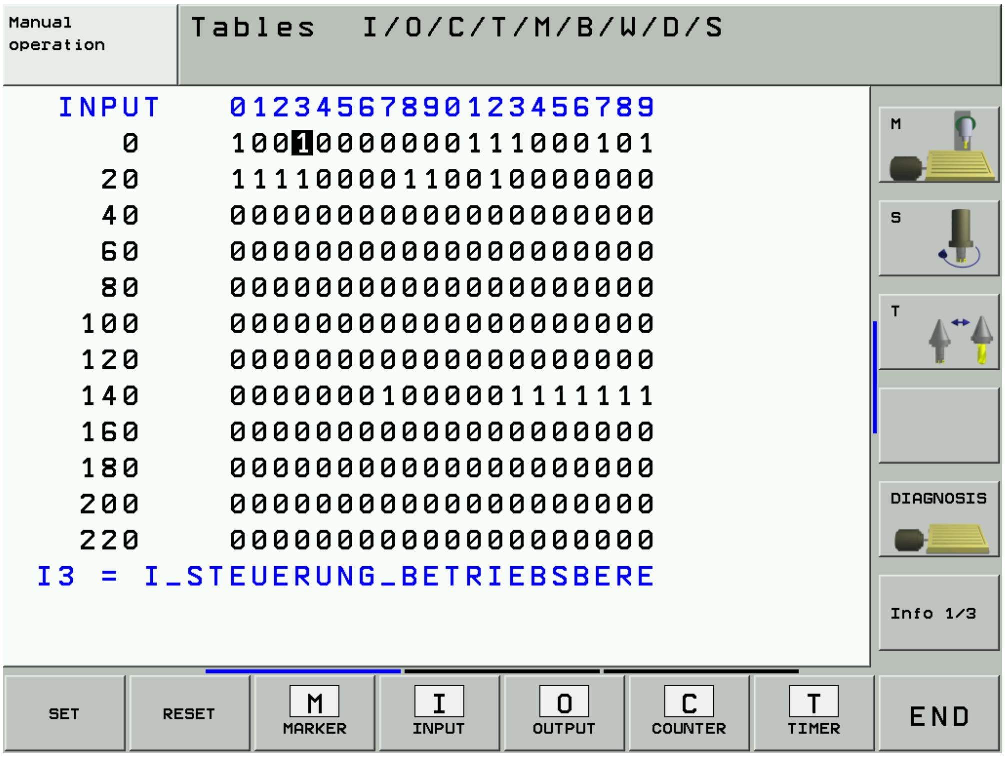
Checking the PLC inputs

TABLE

▶ Call TABLE function

INPUT

▶ Display of the inputs



▶ Regard the logic state of the input to be checked.

▶ Measure the voltage for the input to be checked, e.g.

- At the terminals in the electrical cabinet where X42 is connected
- Directly at the terminals of the machine operating panel
- Directly at the terminals of the PL 4xxB input/output unit
- Directly at the terminals of the EA module PLD 16-8

Assignment --> see “Connector Designation and Layout” on page 13 – 135

Note

An active input at the PLD 16-8 is indicated by a yellow LED!

The displayed logic states must be in agreement with the voltage levels for each input --> see “Specifications” on page 10 – 106!

Possible causes of error

If there is a difference (e.g., the voltage level is within the tolerance range but the logic state is 0), this could have the following causes:

- Defective input at the MC or the PLC expansion board
- Defective cable or connector
- Disturbance in the PLC bus

Note

It is not possible to measure PLC inputs directly at the handwheel or at the cable adapter for the handwheel!

Note

If the test adapter (or the "Universal Measuring Adapter") by HEIDENHAIN is available, they can be connected between the connectors X42 and X45 of the MC and the voltage level of the input to be checked can be measured. --> see “Inspection, Measuring and Test Equipment” on page 29 – 455

Checking the PLC outputs

TABLE

▶ Call TABLE function

OUTPUT

▶ Display of the outputs

▶ Regard the logic state of the output to be checked.

▶ Measure the voltage and, if required, the current for the output to be checked, e.g.

- At the terminals in the electrical cabinet where X41 is connected
- Directly at the terminals of the machine operating panel
- Directly at the terminals of the PL 4xxB input/output unit
- Directly at the terminals of the EA module PLD 16-8

Assignment --> see “Connector Designation and Layout” on page 13 – 135

Note

An active output at the PLD 16-8 is indicated by a yellow LED!

A red LED at X4/pin1 indicates a short circuit at the output side of a PLD 16-8.

Meaning of the LEDs on the PLD 16-8

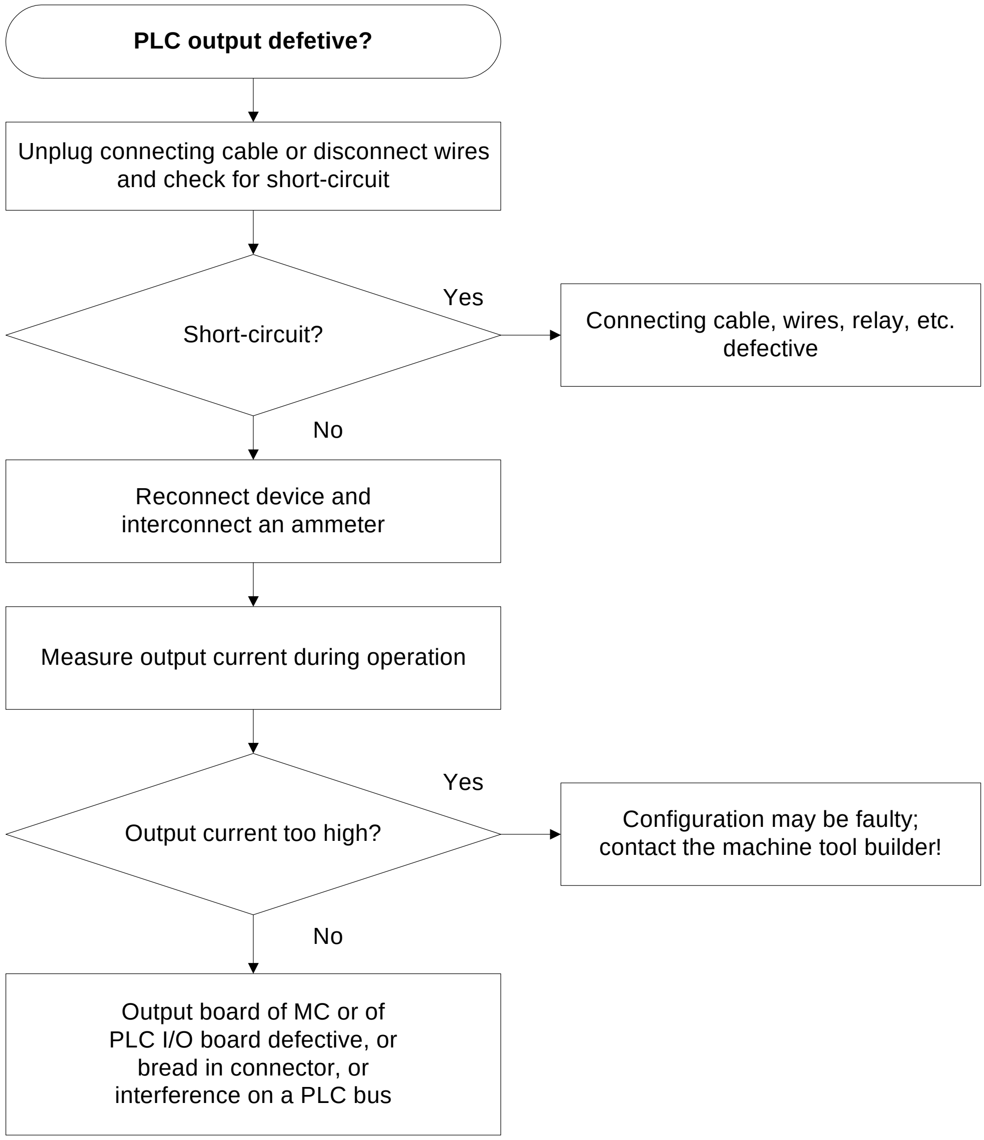
LED	Meaning
Red LED at X4, pin 1	Short circuit of the outputs [a]
Yellow LEDs at X4, X5 and X6	Status of the inputs and outputs
Green LEDs at X6, pin 9 and pin 10	24 V power supply of the outputs

a. In case of a short circuit of an output, the output voltage is reset.
The short-circuit monitoring remains in place. It can be reset with the manufacturer's PLC program or by switching the machine on and off. In order to recognize a short circuit, a current of 20 A must be able to flow for approximately 3 ms.
If this is not the case (e.g. the 24-V supply limits the current sooner), the short-circuit monitoring might not become effective.

The displayed logic states must be in agreement with the voltage levels for each output.
--> see “Specifications” on page 10 – 106!

Service diagnosis

If there is a difference (e.g., the logic state is 1, but the voltage level is below the tolerance range), proceed as follows:



Permissible output currents –> see “Nominal operating current per output” on page 14 – 222

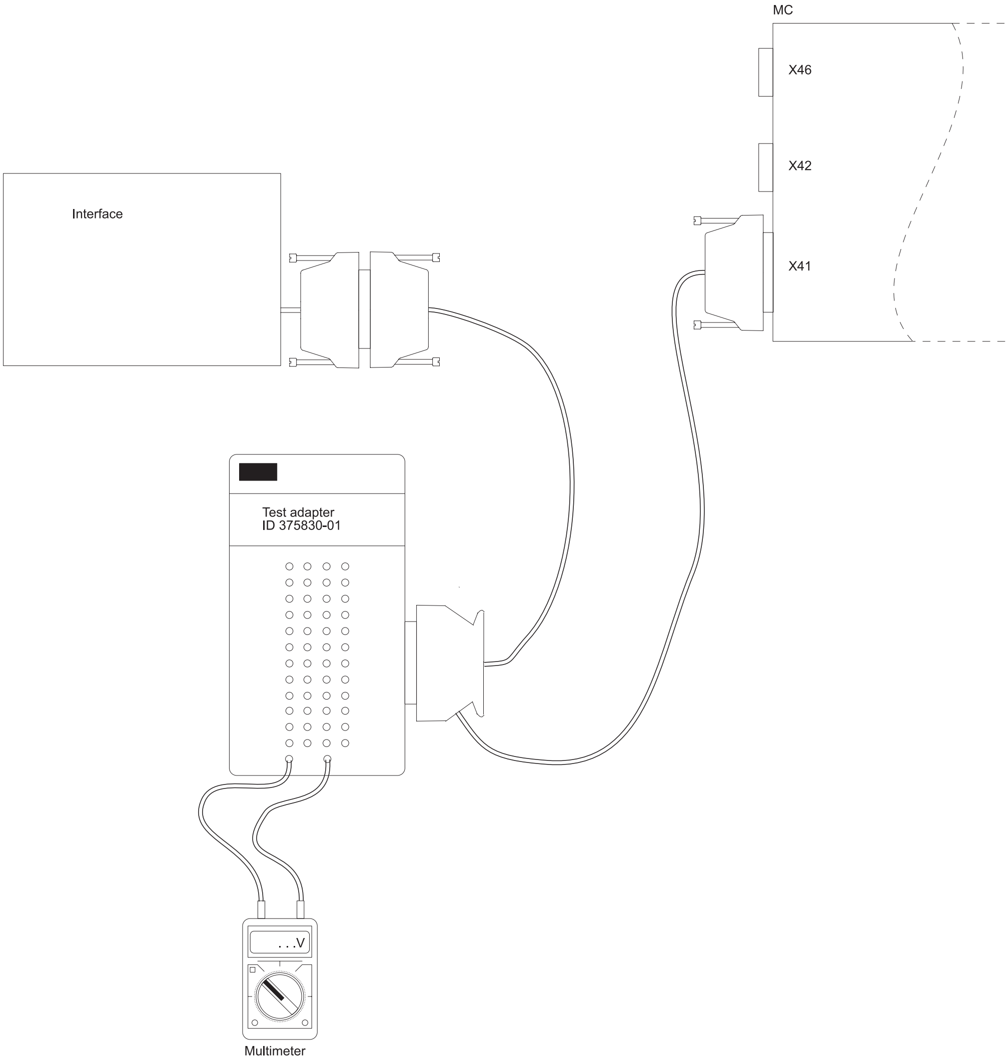
Note

It is not possible to measure PLC outputs directly at the handwheel or at the cable adapter!

Note

If the test adapter (or the "Universal Measuring Adapter") by HEIDENHAIN is available, they can be connected between the connectors X41 and X46of the MC and the voltage level of the output to be checked can be measured.
–> see “Inspection, Measuring and Test Equipment” on page 29 – 455

Measuring circuit with test adapter for PLC inputs and outputs on the MC



DANGER

Connect and disconnect any plugs and terminals only if the machine is not under power!

X41:	PLC output
X42:	PLC input
X46:	Machine operating panel

10.2.2 The LOGIC Diagram

With the LOGIC DIAGRAM function, the time course of the dynamic change of operands (M, I, O, T, C) can be displayed.

Call

LOGIC DIAGRAM

▶ Soft key to call the logic diagram function

Selection of the operands

▶ Press the following keys:

SELECT M/I/O/T/C

▶ Display selection table

A table appears in which the desired operands can be selected. The individual positions in the table are interrogated using dialog. Incorrect entries can be deleted with DEL key. A trigger condition can be set for each operand. 512 states are recorded each before and after a trigger event. The following trigger conditions are possible:

1	Record when operand is logical on (Triggering on positive edge)
0	Record when operand is logical zero (Triggering on negative edge)
NO ENT	No trigger: If no trigger condition is entered for any of the operands, the operand states are traced the operands are recorded continuously. The 1024 most recent states remain saved.

e.g.:	0	I5	1	Trigger on positive edge
	1	O6	0	Trigger on negative edge
	2	M2003		No trigger

Note

The WATCH LIST can also be called before and with the soft key ***ADD TO LOGIC DIAGRAM*** operands can be added to the logic diagram.

Start the recording

START LOGIC TRACE

▶ Start the LOGIC TRACE function

Note

A recording begins with START TRACE and ends with STOP TRACE and is terminated with the STOP LOGIC TRACE soft key with the arrival of a trigger event.
During the recording, ***tracing ...*** appears over the logic diagram.
If the screen displays a machine operating mode, the signal word ***PCTR*** is shown during the recording.

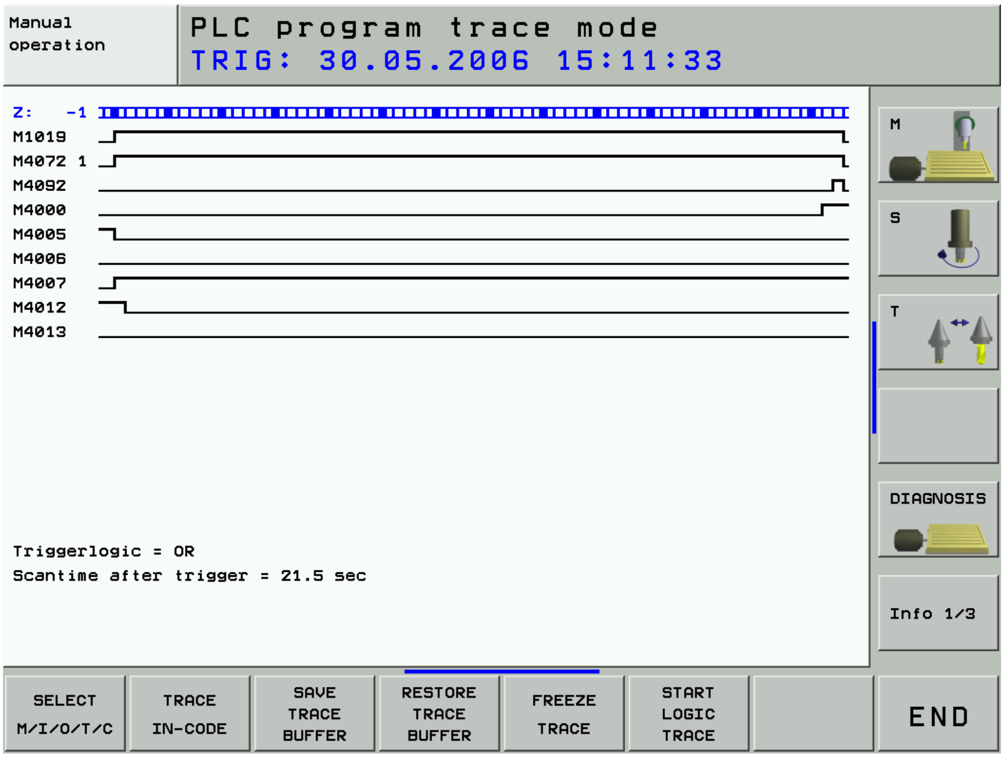
▶ Display the Machine mode on the iTNC monitor (key on visual display unit)

PCTR blinking: Trigger condition has not yet arrived

PCTR not blinking: Trigger condition has arrived, buffer is written

PCTR not lit: Buffer full, LOGIC DIAGRAM can be called

The logic states of up to 16 operands (M,I,O,T,C) can be displayed at the same time. Only a maximum of 1024 PLC scans are traced.



The trigger event is displayed on the left edge of the display with the PLC run 0. It is possible to scroll -512 PLC cycles to the left and +512 PLC cycles to the right.

Note

The distance of two bars in the upper line describes the duration of one PLC cycle. According to this, the distance of two thicker bars describes the duration of 5 PLC cycles.

- Soft key for storing a completed trace on the hard disk.

- Soft key for loading a saved trace into the logic diagram.

Note

Also the **integrated oscilloscope** offers the possibility to record inputs, outputs, markers and the control signals of timer and counter! It is also possible to record bytes, words and double words. For this, 6 channels are available:
See “Integrated Oscilloscope” on page 8 – 49!

10.2.3 The TRACE Function

The TRACE function allows the control of the logic states of PLC operands (M,I,O,T,C) within the corresponding PLC files (statement list).
Furthermore, the contents of byte, word and double word can be checked.

Call

TRACE IN-CODE

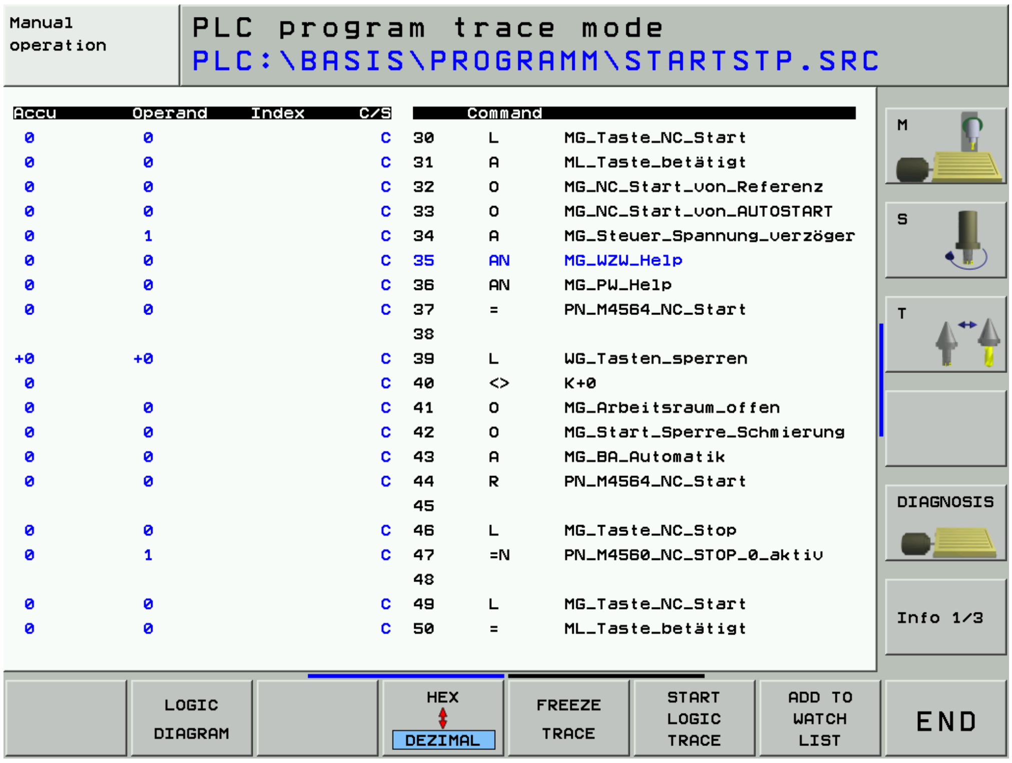
▶ Soft key to call the TRACE function.

PGM MGT

▶ Call the program management.

▶ Select the file to be checked.

▶ Set the display to the program part to be checked (e.g., with the GOTO key, the FIND soft key, with the cursor keys, etc.).



The statement list (STL) of the converted program is displayed. In addition, the contents of the operand and the accumulator is displayed in HEX or decimal code for every program line (can be selected via soft key). Each cyclically executed command is identified with a ***C***.

10.2.4 The WATCH LIST Function

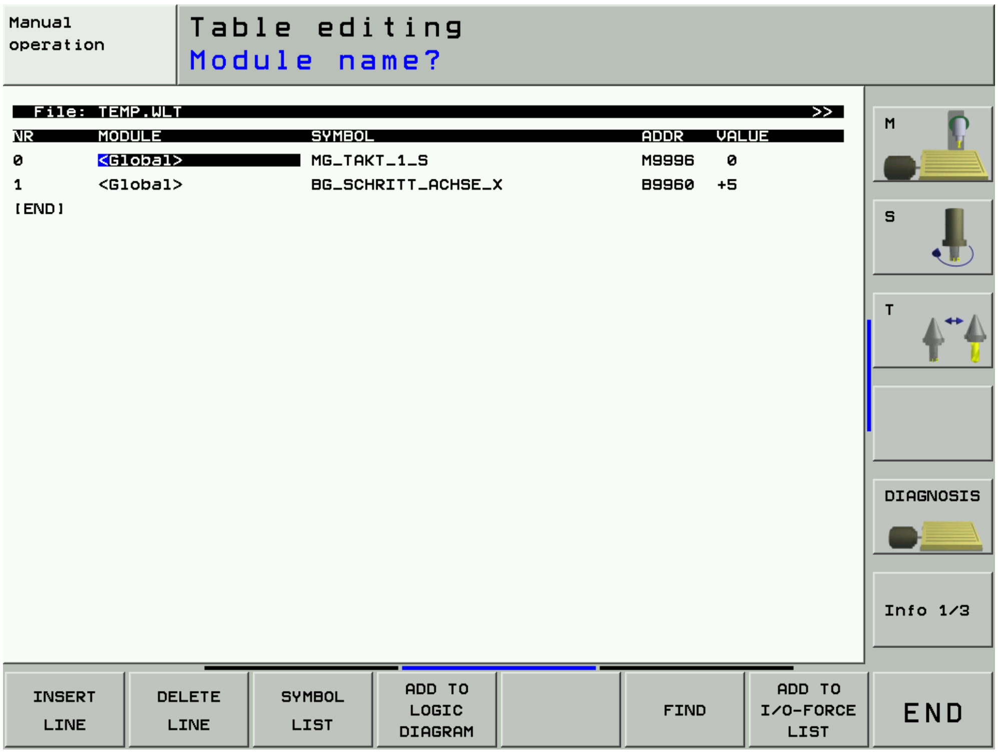
The WATCH LIST function enables you to create a table providing selected operands whose conditions are then displayed dynamically.

Call

▶ Soft key to call the WATCH LIST function

Meaning of the columns in WACTH LIST:

- **MODULE**: **<Global>** for global symbolic operands or path with the name of the *.SRC file in which the operand is defined
- **SYMBOL**: Symbolical address of the operand
- **ADDR**: Absolute address of the operand
- **VALUE**: Content of the operand
- **COMMENT**: Comment for the operand



Note

Create a WATCH LIST, if necessary, with the aid of the machine manufacturer!

Display of symbolic operands in the WATCH LIST

- Press the WATCH LIST soft key to call the menu of the WATCH LIST function.
- Press the SYMBOL LIST soft key to open a list box containing all global and local operands used in the PLC program.
- Use the arrow keys to select the desired operand and press the SELECT soft key or the ENT key to transfer it.
- Press the STOP soft key to close the selection window.

Note

Operands can only be selected with the SYMBOL LIST soft key if you are working with the *.SRC source files of the PLC program on the control.
Otherwise the error message **`Selection list is empty`** is displayed.

Display of operands in the WATCH LIST

- Press the WATCH LIST soft key to call the menu of the WATCH LIST function.
- Press the INSERT LINE soft key.
- Enter the address of the operand in the column **ADDR** e. g. W1022.
- Press the ENT key.

Note

The TABLE or TRACE IN CODE can also be called before and with the soft key ***ADD TO WATCH LIST*** operands can be added to the WATCH LIST.

10.2.5 The I/O-FORCE LIST

This diagnosis function is available as of NC software 340490-xx (with programming surface smarT.NC),

Independently of the currently running PLC program and the status of the hardware, the PLC inputs and outputs can be set or reset via the I/O-FORCE LIST.

DANGER

The I/O-FORCE LIST can overrule safety-relevant monitoring operations in the PLC program!
This could lead to damage to property or persons.
Make sure that hanging axes are supported!
Consult the machine manufacturer!

Call

- Soft key to call the I / O FORCE LIST function

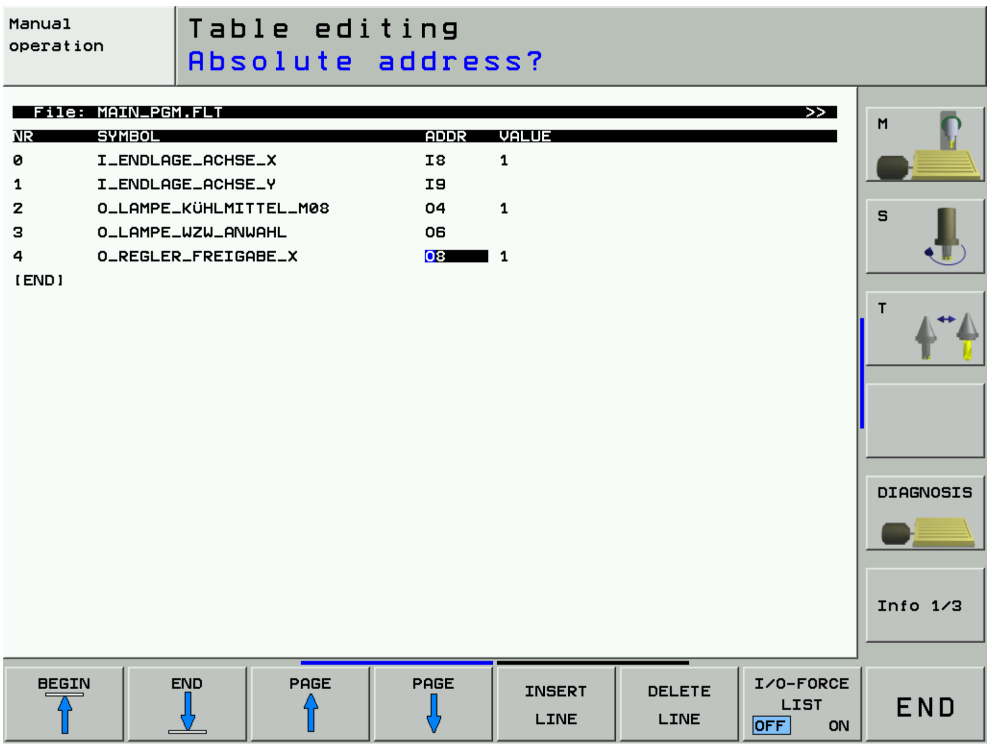
- Press this soft key.

- Select the inputs and outputs by entering the symbolic or absolute address.

Note

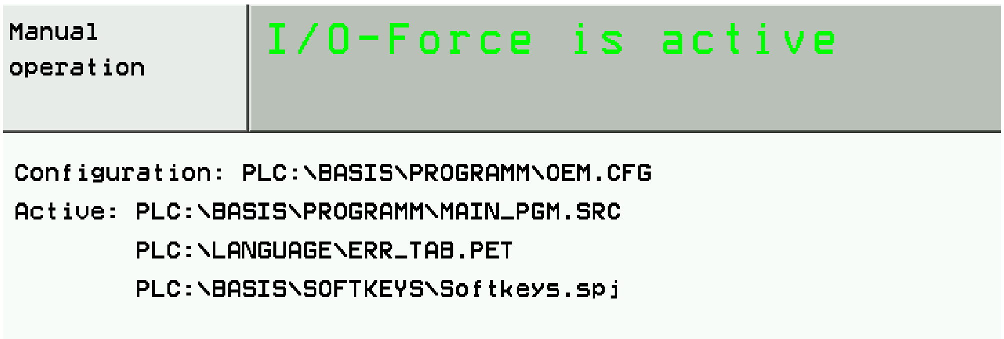
The TABLE, die WATCH LIST oder TRACE IN-CODE can be called before and with the soft key *ADD TO I/O-FORCE LIST* inputs and outputs can be added to the I/O-FORCE LIST.

- Enter the value 0 or 1 which is to be "forced".
- If required, enter a comment.



▶ Press this soft key.

▶ ON is highlighted; the I/O-FORCE LIST is active.
▶ If you now exit the I/O-FORCE LIST with END, the following display is shown:



DANGER

The text *I/O-Force is active* is now shown in the PLC mode. If a machine operating mode is displayed on the monitor (e.g., Program Run, Full Sequence), this informational text is not visible!

Note

If you call the TABLE with the INPUTS and OUTPUTS, the "forced" inputs and outputs are displayed in a different color (e.g., blue).

DANGER

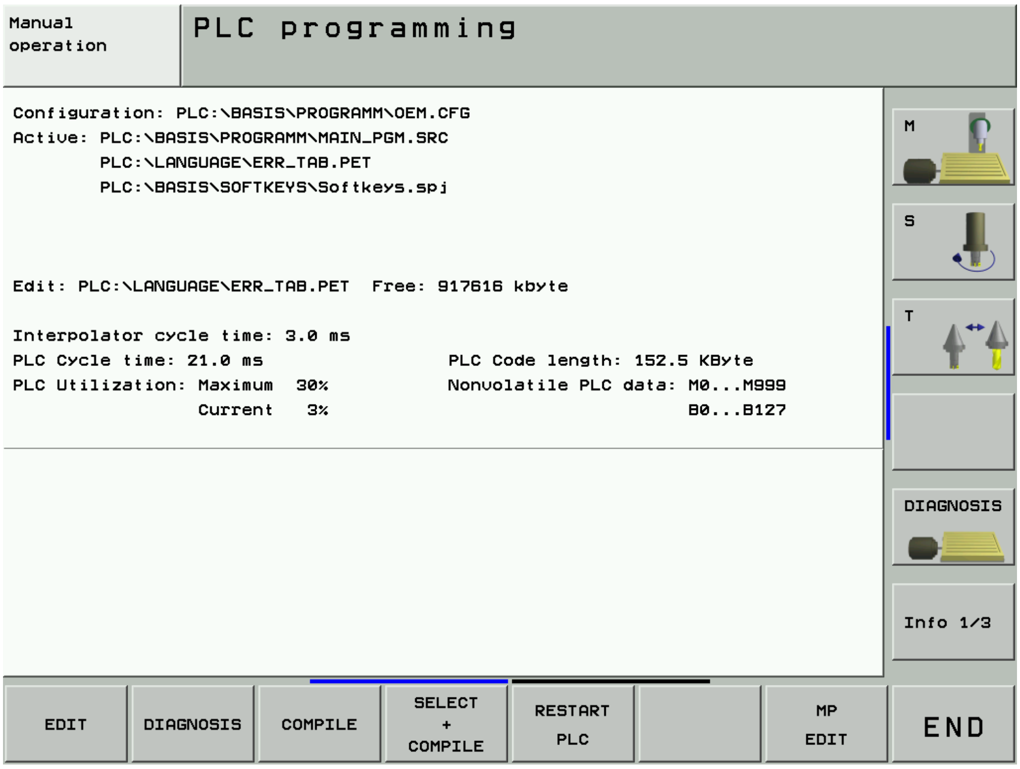
Do not forget to deactivate the I/O-Force List after the tests have been performed!
As a precaution also delete all lines in the I/O-FORCE LIST!

10.3 The COMPILE Function

Compiling a completed PLC program transfers it to the process memory where it can then become active. The name of the compiled program then appears in the PLC main menu.

The PLC program can also be recompiled for service purposes.

PLC basic menu



Call

COMPILE

▶ Soft key to call the COMPILE function

Soft keys within the COMPILE function:

Soft key	Function
COMPILE ALL	Compile current PLC program, current PLC error table and current soft-key project file (entries **PLCMAIN=**, **PLCERRTAB=**, **SOFTKEYPROJECT=** in the OEM.SYS)
COMPILE PLC-MAIN PROGRAM	Compile only the current PLC program (entry **PLCMAIN=** in the OEM.SYS)
COMPILE PLC-ERRORTAB.	Compile only the current PLC error table (entry **PLCERRTAB=** in the OEM.SYS)
COMPILE SOFTKEY-PROJECT	Compile only the current soft-key project file (entry **SOFTKEYPROJECT=** in the OEM.SYS)
END	Returns to the PLC main menu

Call

SELECT + COMPILE

▶ Soft key to call the SELECT + COMPILE function

Soft keys within the SELECT + COMPILE function:

Soft key	Function
SELECT COMPILER CONFIG.	Select and compile the configuration file for the compilation of source code
SELECT PLC-MAIN PROGRAM	Select and compile a PLC program
SELECT PLC-ERRORTAB.	Select and compile a PLC error table
SELECT SOFTKEY-PROJECT	Select and compile a soft-key project file
SELECT MAGAZINE RULES	Select and compile a magazine rule file
END	Returns to the PLC main menu

E.g. to compile any desired PLC program:

- ▶ Press the SELECT + COMPILE soft keys
- ▶ Press the SELECT PLC-MAIN PROGRAM soft key
- ▶ Use the arrow keys to select the PLC program to be compiled
- ▶ Press the ENT key

The name and path of the compiled PLC program **PLCMAIN=** are entered in the OEM.SYS. With the COMPILE PLC-MAIN PROGRAM soft key the PLC program is now compiled from this entry.

Caution

Only the main program may be converted.
If a subprogram was accidentally compiled instead of the PLC main program, the error message ***PLC program not translated*** is generated. In this case the compiler has detected global modules in this file.
In a main PLC program there are no modules defined as "global".
It is possible that the error message ***PLC: global in the main file*** is also displayed, which indicates that a subprogram was compiled instead of the main PLC program.

10.4 Calling the PLC Error Table for Diagnosis

Introduction

The machine manufacturer defines the PLC error messages in the **P**LC-**E**RROR-**T**ABLE.

This PLC error table has the **extension .PET.**
The name and path of the PLC error table is shown in the PLC main menu.

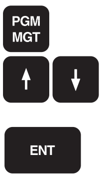
You may open the corresponding file to learn more about the PLC error messages!

DANGER

The PET table may only be opened for the purpose of fault diagnosis.
Under no circumstances may the settings be changed, as this will alter the performance of the machine!
This could lead to damage to property or persons!

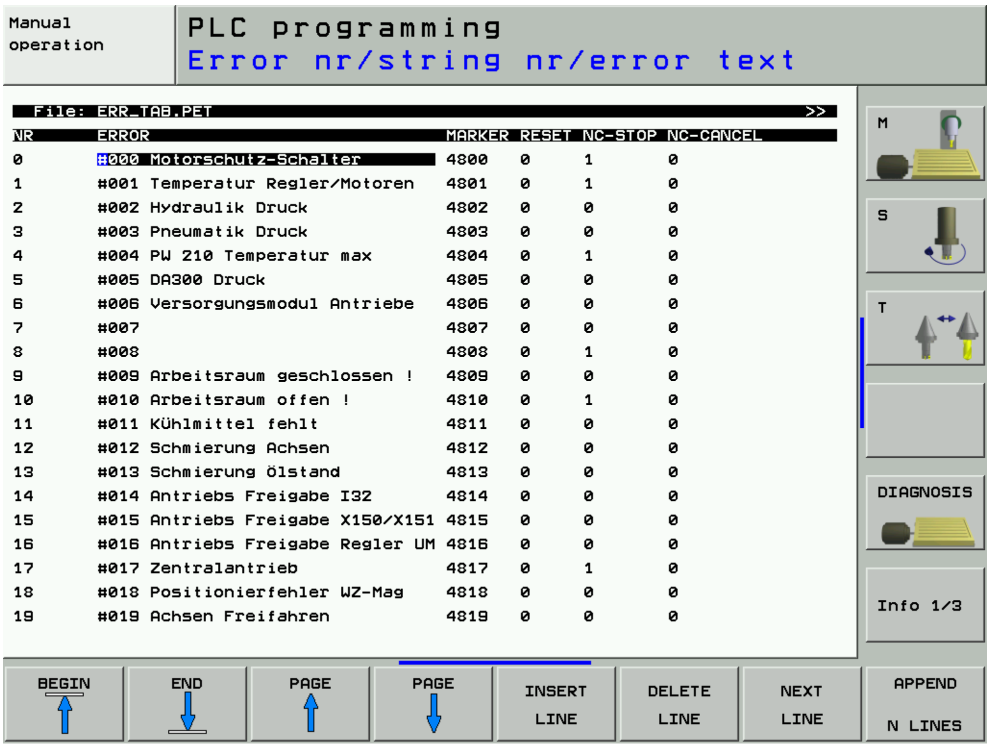
Calling the PET table

- Enter the PLC code number. --> see “Code Numbers” on page 3 – 13
- Read the name and path of the PLC error table on the PLC main menu now displayed.



- Call the program management
- Select the PLC error table (z.B. PLC:\LANGUAGE\ERR_TAB.PET) with the arrow keys.
- Confirm.

Example for a PET table



NR	ERROR	MARKER	RESET	NC-STOP	NC-CANCEL
0	#000 Motorschutz-Schalter	4800	0	1	0
1	#001 Temperatur Regler/Motoren	4801	0	1	0
2	#002 Hydraulik Druck	4802	0	0	0
3	#003 Pneumatik Druck	4803	0	0	0
4	#004 PW 210 Temperatur max	4804	0	1	0
5	#005 DA300 Druck	4805	0	0	0
6	#006 Versorgungsmodul Antriebe	4806	0	0	0
7	#007	4807	0	0	0
8	#008	4808	0	1	0
9	#009 Arbeitsraum geschlossen !	4809	0	0	0
10	#010 Arbeitsraum offen !	4810	0	1	0
11	#011 Kühlmittel fehlt	4811	0	0	0
12	#012 Schmierung Achsen	4812	0	0	0
13	#013 Schmierung Ölstand	4813	0	0	0
14	#014 Antriebs Freigabe I32	4814	0	0	0
15	#015 Antriebs Freigabe X150/X151	4815	0	0	0
16	#016 Antriebs Freigabe Regler UM	4816	0	0	0
17	#017 Zentralantrieb	4817	0	1	0
18	#018 Positionierfehler WZ-Mag	4818	0	0	0
19	#019 Achsen Freifahren	4819	0	0	0

Description of elements

Column	Description
NR	Line number in the table. The modules select the PLC error message by assigning the line number.
ERROR	Error text There are three ways to specify the error text: ■ Direct entry of the error text (max. 32 characters). ■ Line number of the PLC error text file. The PLC error text file is defined in the OEM.SYS by "PLCERROR = ..." (#< line no.>). ■ Number of the string memory, where the error text may be found (#S<string no.>).
MARKER	The PLC error message can be activated without a module call by setting the marker defined here. Only markers in the range M4800 to M4999 can be entered. The marker is also set if the error message was activated through Module 9085. 0 means no error marker.
RESET	0 = No NC reset when error message is activated. 1 = NC reset when error message is activated.
NC-STOP	0 = No NC stop when error message is activated. 1 = NC stop when error message is activated.
NC CANCEL	0 = No NC stop with INTERNAL STOP when the error message is activated. 1 = NC stop with INTERNAL STOP when the error message is activated.
F-STOP	0 = Feed rate enable is not affected. 1 = Feed rate enable is reset when error message is activated.
EMER.STOP	0 = No EMER. STOP stop when error message is activated. 1 = EMER. STOP when error message is activated.
CE	0 = error message can be deleted with CE key. 1 = error message cannot be deleted with CE key.
PRIOR	A priority from 0 to 2 can be entered for the error message. 0 is the highest priority. Pending PLC error messages are displayed according to their priority.
MType	Message type: E = Error, W = Warning, I = Info

END

▶ Exit PET table

Text of the PLC Error Message

The texts for the PLC error messages are either defined directly in the PET table (max. 32 characters; not language-sensitive) or in a text file.

These text files are language-sensitive:
Example for the path of the text file: PLC:\LANGUAGE\GERMAN\ERROR.A

The machine manufacturer defines the PLC error text file in the OEM.SYS with PLCERROR = ...

Note

If the # symbol is entered in the ERROR column of the PET table, there is a link to an error text file in the correspondingly defined national language.
Ideally the PLC programmer also writes the text of the error message (z.B. # 010 Machine guard is open!) next to the # symbol with the error number. But this is not mandatory.
--> The error texts can be found in the corresponding PLC error text file!

10.5 Nonvolatile PLC Markers and Words

Certain PLC markers and words are not deleted when the machine is switched off but remain battery-buffered in the RAM of the control.
The remanent PLC memory area is displayed on the PLC main menu.

This remanent PLC memory area can also stored on a file of the hard disk and loaded again for test purposes.

Saving on Hard Disk

- Enter the PLC code number --> see "Code Numbers" on page 3 – 13

▷

- Shift the soft-key row

TABLE

- Call the TABLE function

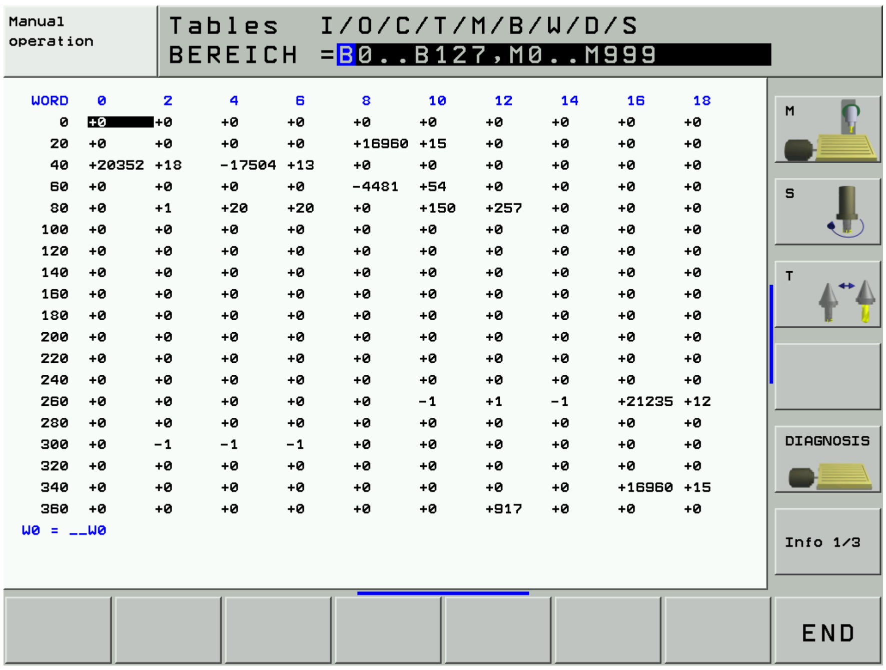
▷

- Shift the soft-key row

SAVE M/B/W/D

RANGE =

- The defined maximum range of the nonvolatile PLC markers and words (e.g. M0... M999, B0 ... B127) is automatically entered by iTNC.
  This range can be changed by the operator.
  Note: Here the unit B (bytes) instead of W (words) is not an error.
  --> A byte is the smallest subset of a word.



WORD	0	2	4	6	8	10	12	14	16	18
0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
20	+0	+0	+0	+0	+16960	+15	+0	+0	+0	+0
40	+20352	+18	-17504	+13	+0	+0	+0	+0	+0	+0
60	+0	+0	+0	+0	-4481	+54	+0	+0	+0	+0
80	+0	+1	+20	+20	+0	+150	+257	+0	+0	+0
100	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
120	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
140	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
160	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
180	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
200	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
220	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
240	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
260	+0	+0	+0	+0	+0	-1	+1	-1	+21235	+12
280	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
300	+0	-1	-1	-1	+0	+0	+0	+0	+0	+0
320	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
340	+0	+0	+0	+0	+0	+0	+0	+0	+16960	+15
360	+0	+0	+0	+0	+0	+0	+917	+0	+0	+0

W0 = __W0

ENT

- Confirm setting

- The default setting offered by the iTNC is PLC:\PLCMEM.A. If required, more than one file can be stored on the hard disk.

ENT

- The states or contents of the PLC markers / words are stored on the hard disk in the indicated file.

END END

- Exit PLC operating mode.

Writing back to RAM

▶ Enter the PLC code number --> see “Code Numbers” on page 3 – 13

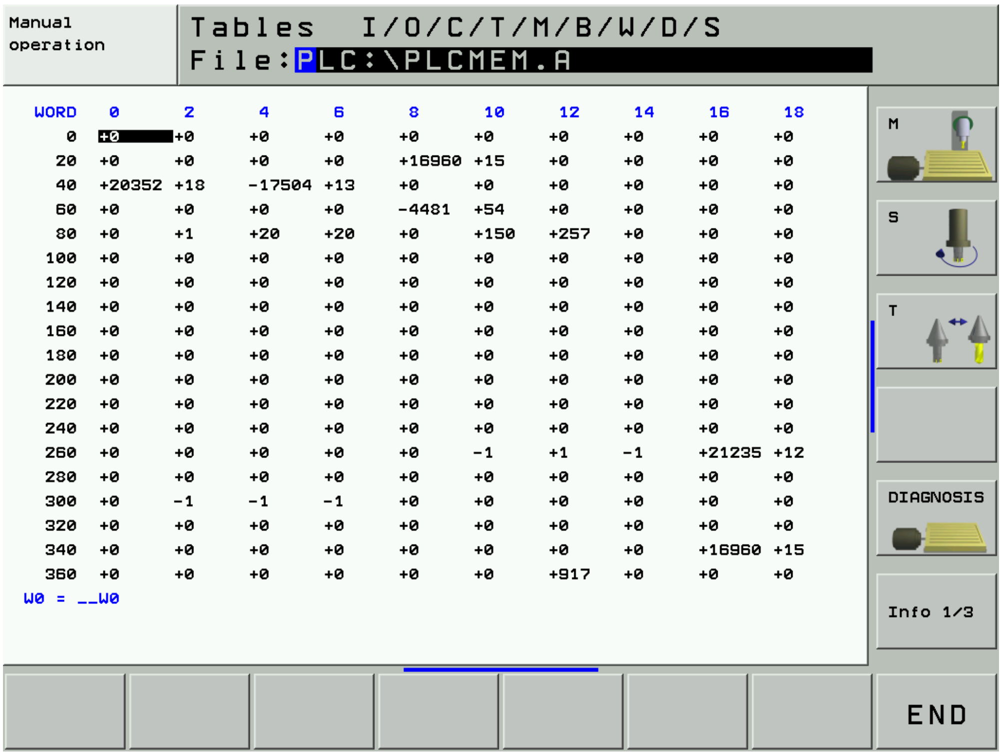
▶ Shift the soft-key row.

TABLE

▶ Call the TABLE function.

▶ Shift the soft-key row.

RESTORE M/B/W/D



WORD	0	2	4	6	8	10	12	14	16	18
0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
20	+0	+0	+0	+0	+16960	+15	+0	+0	+0	+0
40	+20352	+18	-17504	+13	+0	+0	+0	+0	+0	+0
60	+0	+0	+0	+0	-4481	+54	+0	+0	+0	+0
80	+0	+1	+20	+20	+0	+150	+257	+0	+0	+0
100	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
120	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
140	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
160	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
180	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
200	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
220	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
240	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
260	+0	+0	+0	+0	+0	-1	+1	-1	+21235	+12
280	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
300	+0	-1	-1	-1	+0	+0	+0	+0	+0	+0
320	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
340	+0	+0	+0	+0	+0	+0	+0	+0	+16960	+15
360	+0	+0	+0	+0	+0	+0	+917	+0	+0	+0

W0 = __W0

▶ Enter the target directory and the file name under which the states of the PLC markers and words are stored on the hard disk.
The default setting offered by the iTNC is PLC:\PLCMEM.A.

ENT

▶ The stored states of the PLC markers and words are restored in the RAM.

END END

▶ Exit PLC operating mode.

10.6 Overviews

The following tables are excerpts from the Technical Manual iTNC 530 of July 2004.

Commands overview

The following table provides an overview of all possible PLC commands:

Group of functions	Syntax	Function
Loading and saving commands		
	L	Load
	LN	Load NOT
	L–	Load two's complement
	LB	Load BYTE
	LW	Load WORD
	LD	Load DOUBLE WORD
	=	Assign
	B=	Assign BYTE
	W=	Assign WORD
	D=	Assign DOUBLE WORD
	=N	Assign NOT
	=–	Assign two's complement
Setting commands		
	S	Set
	R	Reset
	SN	Set NOT
	RN	Reset NOT
Logical operations		
	A	And
	AN	And NOT
	O	Or
	ON	Or NOT
	XO	Exclusive OR
	XON	Exclusive OR NOT
Arithmetical commands		
	+	Addition
	–	Subtraction
	x	Multiplication
	/	Division
	MOD	Remainder

Group of functions	Syntax	Function
Increment		
	INC	Increment operand
	INCW	Increment word accumulator
	INCX	Increment index register
Decrement		
	DEC	Decrement operand
	DECW	Decrement word accumulator
	DECX	Decrement index register
Comparisons		
	==	Equal
	<	Less than
	>	Greater than
	<=	Less than or equal
	>=	Greater than or equal
	<>	Not equal
Parenthetical expression in logical operations		
	A[ ]	And [ ]
	AN[ ]	And NOT [ ]
	O[ ]	Or [ ]
	ON[ ]	Or NOT [ ]
	XO[ ]	Exclusive OR [ ]
	XON[ ]	Exclusive OR NOT [ ]
Parenthetical expressions with arithmetical instructions		
	+[ ]	Addition [ ]
	–[ ]	Subtraction [ ]
	x[ ]	Multiplication [ ]
	/[ ]	Division [ ]
	MOD[ ]	Remainder [ ]
Parenthetical expressions in comparisons		
	==[ ]	Equal [ ]
	<[ ]	Less than [ ]
	>[ ]	Greater than [ ]
	<=[ ]	Less than or equal [ ]
	>=[ ]	Greater than or equal [ ]
	<>[ ]	Not equal [ ]
Shifting instructions		
	<<	Shift left
	>>	Shift right
Bit commands		
	BS	Set bit
	BC	Clear bit
	BT	Test bit

Group of functions	Syntax	Function
Stack operations		
	PS	Push data onto the data stack
	PL	Pull data from the data stack
	PSL	Push logic accumulator onto the data stack
	PSW	Push word accumulator onto the data stack
	PLL	Pull logic accumulator from the data stack
	PLW	Pull word accumulator from the data stack
Jump commands		
	JP	Unconditional jump
	JPT	Jump if logic accumulator = 1
	JPF	Jump if logic accumulator = 0
	CM	Call module
	CMT	Call module if logic accumulator = 1
	CMF	Call module if logic accumulator = 0
	EM	End of module, program end
	EMT	End of module if logic accumulator = 1
	EMF	End of module if logic accumulator = 0
	LBL	Label

Overview of markers and words

A list of PLC operands with brief description in English and German (GLB_NC_de.DEF, GLB_NC_en.DEF) is contained in the control under PLC:\JH\.

Operand		Description	Set	Reset	SW vers.
M	1900 - 1999	Decoded M function if M4571 is set	NC	NC	
M	4000	Spindle in position	NC	NC	
M	4001	Nominal speed command signal of the spindle not in the ramp	NC	NC	
M	4002	Nominal speed value = 0	NC	NC	
M	4003	Nominal speed value output analog or digital (MP3010 = 3 to 8)	NC	NC	
M	4004	Impermissible speed was programmed	NC	NC	
M	4005	Status display and nominal speed value output for M03	PLC	PLC	
M	4006	Status display and nominal speed value output for M04	PLC	PLC	
M	4007	Status display M05 and spindle stop	PLC	PLC	
M	4008	Disable speed output for spindle	PLC	PLC	
M	4009	Counterclockwise spindle rotation (for gear change)	PLC	PLC	
M	4010	Clockwise spindle rotation (for gear change)	PLC	PLC	
M	4011	Activate rotational speed MP3520.0 and direction of rotation from M4013	PLC	PLC	
M	4012	Opening the spindle control loop	PLC	PLC	
M	4013	Direction for spindle orientation from a standstill (M03 = 0; M04 = 1)	PLC	PLC	
M	4014	Reverse the direction of spindle rotation	PLC	PLC	
M	4015	Renewed evaluation of the spindle reference mark	PLC	NC	
M	4016	Cycle 13 is executed	NC	PLC	
M	4017	Spindle moving in feedback control	NC	NC	
M	4018	Reference mark for spindle not yet traversed	NC	NC	
M	4019	Reversing the counting direction of the position encoder on the spindle	PLC	PLC	
M	4030	Cycle 2 or Cycle 17 active	NC	NC	
M	4031	Cycle 17 or Cycle 18 active	NC	NC	

Operand		Description	Set	Reset	SW vers.
M	4040	Status display M07, M08, and M09 highlighted	PLC	PLC	
M	4041	Status display M07, M08, M09, MK	PLC	PLC	
M	4042	Status display M07, M08, M09, MK	PLC	PLC	
M	4050	Touch probe not ready, ready signal is missing	NC	NC	
M	4051	Stylus deflected before start of probing cycle	NC	NC	
M	4052	Stylus is deflected, probing process is completed	NC	PLC	
M	4053	Probing process has been completed or canceled	NC	NC	
M	4054	Battery voltage too low (battery warning at touch probe connection); evaluated only during the probing process	NC	NC	Not supported as of 340 422-03, 340 480-03
M	4055	Enable the probing process	NC	PLC	
M	4056	NC stop in all operating modes if stylus is deflected	PLC	PLC	
M	4057	Touch probe cycles active (FN17: ID990 NR2)	NC	NC	340 422-09, 340 480-09
M	4060	Cycle for tool measurement started	NC	NC	
M	4061	0: Measure the tool 1: Check the tool	NC	NC	
M	4062	0: Wear tolerance not exceeded 1: Wear tolerance exceeded	NC	NC/ PLC	
M	4063	0: Breakage tolerance not exceeded 1: Breakage tolerance exceeded	NC	NC/ PLC	
M	4065	Workpiece dimensions are OK	NC	PLC	
M	4066	Workpiece must be reworked	NC	PLC	
M	4067	Workpiece is scrap	NC	PLC	
M	4070	Strobe signal for gear code	NC	NC	
M	4071	Strobe signal for S code	NC	NC	
M	4072	Strobe signal for M functions	NC	NC	
M	4073	Strobe signal T code (P code) with TOOL CALL	NC	NC	
M	4074	Strobe signal T code (P code) with TOOL DEF	NC	NC	
M	4075	Transfer active with FN19	NC	NC	
M	4090	Acknowledgment of “gear change completed”	PLC	PLC	
M	4091	Acknowledgment of S code	PLC	PLC	
M	4092	Acknowledgment of M functions	PLC	PLC	
M	4093	Acknowledgment of T code (P code) with TOOL CALL	PLC	PLC	
M	4094	Acknowledgment of T code (P code) with TOOL DEF	PLC	PLC	
M	4095	Acknowledgment of transfer with FN19	PLC	PLC	

Operand		Description	Set	Reset	SW vers.
M	4120 - 4128	PLC positioning axis 1 to 9 active	NC/ PLC	NC/ PLC	
M	4130	Activation of spindle orientation, or spindle orientation has been started with Module 9171	NC/ PLC	NC	
M	4131	Activation of Q-parameter transfer to the NC; data from D258, Q number from W516	PLC	NC	
M	4132	Activate datum shift from D528 to D544, or call Module 9230	PLC	NC	
M	4133	Starting and stopping the free rotation function	PLC	NC	
M	4134	Activation of a gear range and speed through the PLC	PLC	NC	
M	4135	Strobe marker for selecting the traverse range	PLC	NC	
M	4150	Operating mode: Manual Operation	NC	NC	
M	4151	Operating mode: Electronic Handwheel	NC	NC	
M	4152	Operating mode: Positioning with Manual Data Input	NC	NC	
M	4153	Operating mode: Program Run, Single Block	NC	NC	
M	4154	Operating mode: Program Run, Full Sequence	NC	NC	
M	4155	Operating mode: Reference-Mark Traverse	NC	NC	
M	4156	MANUAL TRAVERSE soft key pressed	NC	NC	
M	4157	Returning to the contour (MOVE TO POSITION) is active	NC	NC	
M	4158	Block scan active	NC	NC	
M	4159	PLC editor: END key or soft key pressed	NC	NC/ PLC	
M	4160	Pallet table selected	NC	NC	
M	4161	M/S/T/Q transfer after block scan	NC	NC	
M	4170	END PGM, M02 or M30 was executed	NC	NC	
M	4172	1. PLC scan after power on	NC	NC	
M	4173	1. PLC scan after interruption of the PLC program	NC	NC	
M	4174	1. PLC scan after editing the MPs (MP edit was exited and the MPs were altered)	NC	NC	
M	4175	Program interruption, control-in-operation symbol is blinking	NC	NC	
M	4176	Control is in operation, control-in-operation symbol is on or is blinking	NC	NC	
M	4177	Cancellable error message displayed	NC	NC	
M	4178	Error message EMERGENCY STOP is displayed	NC	NC	
M	4179	Control is being shut down	NC	NC	
M	4180	Rapid traverse programmed (FMAX)	NC	NC	
M	4181	NC program selected	NC	PLC	
M	4182	AUTOSTART active	NC	NC	
M	4183	Time from AUTOSTART expired	NC	NC	
M	4185	Internal stop performed	NC	PLC	340 420-06
M	4200	Overflow during multiplication	NC	PLC	
M	4201	Division by 0	NC	PLC	
M	4202	Incorrectly executed modulo	NC	PLC	

Operand		Description	Set	Reset	SW vers.
M	4203	Error status for PLC module	NC	NC/ PLC	
M	4204	Reserved for errors that the PLC programmer would like to catch	NC	NC	
M	4220	Error from PET table with F stop active	NC	NC	
M	4221	Error from PET table with NC stop active	NC	NC	
M	4222	Error from PET table with EM. STOP active	NC	NC	
M	4223	Error from PET table with NC Cancel active	NC	NC	340 422-10, 340 480-10
M	4227	PLC error message with priority 0 (error)	NC	NC	340 422-10, 340 480-10
M	4228	PLC error message with priority 1 (warning)	NC	NC	340 422-10, 340 480-10
M	4229	PLC error message with priority 2 (info)	NC	NC	340 422-10, 340 480-10
M	4230	NC start via LSV2	NC	NC	
M	4231	NC stop via LSV2	NC	NC	
M	4300 - 4315	Value from MP4310.0	NC	NC	
M	4316 - 4331	Value from MP4310.1	NC	NC	
M	4332 - 4347	Value from MP4310.2	NC	NC	
M	4348 - 4363	Value from MP4310.3	NC	NC	
M	4364 - 4379	Value from MP4310.4	NC	NC	
M	4380 - 4395	Value from MP4310.5	NC	NC	
M	4396 - M4411	Value from MP4310.6	NC	NC	
M	4520	Additional T code (P code) follows with TOOL CALL	NC	NC	
M	4521	Tool number zero programmed	NC	NC	
M	4522	Tool with pocket number programmed is in effect with MP7480.0 = 3 or 4 and TOOL CALL	NC	NC	
M	4523	Tool without pocket number programmed is in effect with MP7480.0 = 3 or 4 and TOOL CALL	NC	NC	
M	4524	Special tool called, TOOL CALL	NC	NC	
M	4525	TOOL CALL after expiration of tool life	NC	NC	
M	4526 - 4534	Axis 1 to axis 9 is the tool axis	NC	NC	
M	4538	Geometry of the tool from W264	PLC	NC	
M	4539	Tool number highlighted in the status display	PLC	PLC	
M	4540	Sequence of tool number or pocket number transfer (M4520 = 1)	PLC	PLC	
M	4541	Special tool in original pocket in spite of variable pocket coding	PLC	PLC	
M	4542	Do not update pocket number in the pocket table	PLC	PLC	
M	4543	Tool life 1 expired (TIME1 in the tool table)	NC	NC/ PLC	

Operand		Description	Set	Reset	SW vers.
M	4546	Tool life 2 expired (TIME2 in the tool table)	NC	NC/ PLC	
M	4547	T and G strobes with TOOL CALL	NC	NC	
M	4560	NC stop (0: Stop)	PLC	PLC	
M	4561	Rapid traverse	PLC	PLC	
M	4562	Memory function for axis direction keys (MP7680 Bit 0 = 1)	PLC	PLC	
M	4563	Feed-rate enable for all axes	PLC	PLC	
M	4564	NC start	PLC	PLC	
M	4570	Unit of measure for transfer with FN19	NC	NC	
M	4571	Activation of decoded M-code transfer in M1900 to M1999	PLC	PLC	
M	4574	Select the traverse range (with M4575)	PLC	PLC	
M	4575	Select the traverse range (with M4574)	PLC	PLC	
M	4576	Locking the handwheel	PLC	PLC	
M	4577	Disabled key was pressed	NC	PLC	
M	4579	INCREMENT OFF/ON soft key	NC	NC	
M	4580	Suppress EMERGENCY STOP, open all position control loops, NC stop	PLC	PLC	
M	4581	Open all position control loops, NC stop, activate “Approach position”	PLC	PLC	
M	4586	Enable AUTOSTART	PLC	NC/ PLC	
M	4587	Rescind feed rate limit above F MAX	PLC	PLC	
M	4589	Activate datum management via preset table	NC	NC	
M	4590	Status fast PLC input from MP4130.2	NC	PLC	
M	4591	Status fast PLC input from MP4130.3	NC	PLC	
M	4592	Status fast PLC input from MP4130.4	NC	PLC	
M	4593	Status fast PLC input from MP4130.5	NC	PLC	
M	4600	Faulty internal communication between HeROS and Windows 2000	NC	NC	340 480-06
M	4620	Enable LIFTOFF function	PLC	NC/ PLC	340 422-06, 340 480-06
M	4622	Delay NC makro with **RESETINIT =** from NCMACRO.SYS	PLC	PLC	340 422-10, 340 480-10
M	4660	HR 420 assumes control	NC	NC	340 422-09, 340 480-09
M	4661	NC start on HR 420	NC	NC	340 422-09, 340 480-09
M	4662	NC stop on HR 420	NC	NC	340 422-09, 340 480-09
M	4663	Rapid traverse key on HR 420	NC	NC	340 422-09, 340 480-09
M	4664	Spindle start on HR 420	NC	NC	340 422-09, 340 480-09
M	4665	Spindle stop on HR 420	NC	NC	340 422-09, 340 480-09
M	4666	+Key on HR 420	NC	NC	340 422-09, 340 480-09
M	4667	–Key on HR 420	NC	NC	340 422-09, 340 480-09
M	4668	CTRL key on HR 420	NC	NC	340 422-09, 340 480-09

Operand		Description	Set	Reset	SW vers.
M	4753	Write errors from PLC modules in the PLC log	PLC	PLC	340 422-09, 340 480-09
M	4754	Write diagnostic information in MYDEBUG.LOG	PLC	PLC	340 422-10, 340 480-10

	Operand	Description	Set	Reset	SW vers.
W	256	Gear code	NC/ PLC	NC/ PLC	
W	258	S code	NC	NC	
W	260	Code for M functions	NC	NC	
W	262	Tool pocket number	NC	NC	
W	264	Tool number	NC	NC	
W	266	Index number of a programmed indexed tool	NC	NC	
W	268	Tool magazine number	NC	NC	
W	270	Line number in help file	NC	NC	
W	272	Operating mode	NC	NC	
W	274	Code of the depressed key	NC	NC	
D	276	Code of the code number last entered via MOD	NC	NC	
D	280	First numerical value from FN19	NC	NC	
D	284	Second numerical value from FN19	NC	NC	
W	302	Number of the horizontal PLC soft key that was pressed	NC	NC	
W	304	Number of the vertical PLC soft key that was pressed	NC	NC	
W	320	Nominal speed value [min–1]	NC	NC	
W	322	Actual speed value [min–1]	NC	NC	
D	356	Programmed speed [0.001 min–1]	NC	NC	
D	360	Programmed feed rate	NC	NC	
D	364	Nominal speed value [min–1]	NC	NC	
D	368	Actual speed value [min–1]	NC	NC	
D	388	Current contouring feed rate [mm/min]	NC	NC	
W	480-484	Analog input at X48 [0.1 V]	NC	NC	
W	486 - 490	Temperature input at X48 [0.5 °C]	NC	NC	
W	492	Percentage for spindle override (NC to PLC)	NC	NC	
W	494	Percentage for feed-rate override (NC to PLC)	NC	NC	
W	516	Q no. 0-7 for numerical data transfer PLC to NC	PLC	PLC	
B	518	Definition of the free rotation function	PLC	PLC	
B	519	Traverse direction for free rotation	PLC	PLC	
W	522	Enabling the high-speed PLC inputs	PLC	PLC	
W	524	Open the control loop if drive enabling via X150/X151 is missing	PLC	PLC	
D	528	Double word with multiple function, here data for transfer from PLC to NC	PLC	PLC	
D	528 - 544	Target position for PLC positioning	PLC	PLC	
D	528 - 544	Datum shift for axis 1 to 5	PLC	PLC	
W	560 - 568	Feed rate for PLC positioning	PLC	PLC	
W	576 - 584	Lag-tracking axis error compensation	PLC	PLC	

	Operand	Description	Set	Reset	SW vers.
D	592	Nominal position for spindle orientation	PLC	PLC	
D	596	Max. feed rate from PLC [mm/min]	NC/ PLC	PLC	
D	604	Maximum possible spindle speed	PLC	NC/ PLC	
W	754	% function for feed-rate override for free rotation	PLC	PLC	
D	756	Programmed rotational speed or rotational speed from the PLC [0.001 min–1]	NC/ PLC	NC/ PLC	
D	760	Offset in tilting axes touch probe center offset [1/10 000°]	PLC	PLC	
W	764	Percentage for spindle override (PLC to NC)	NC/ PLC	NC/ PLC	
W	766	Percentage for feed-rate override (PLC to NC)	NC/ PLC	NC/ PLC	
D	768 - 956	Value from MP4210.0 to MP4210.47	NC	NC	
W	960 - 968	Value from MP4220.0 to MP4220.4	NC	NC	
W	976 - 988	Value from MP4310.3 to MP4310.6	NC	NC	
W	1008	S code for minimum speed	NC	NC	
W	1016	PLC module that was last processed erroneously	NC	NC	
W	1018	Number of files opened by the PLC	NC	NC	
W	1020	Number of open files	NC	NC	
W	1022	Error status of the last called PLC module	NC	NC	
W	1024	Axis enabling	NC	NC	
W	1026	Axes in position	NC	NC	
W	1028	Axes in motion	NC	NC	
W	1030	Current direction of traverse	NC	NC	
W	1032	Reference marks not yet traversed	NC	NC	
W	1034	Positive software limit switch was traversed	NC	NC	
W	1036	Negative software limit switch was traversed	NC	NC	
W	1038	Prepare to open the position control loop	PLC	PLC	
W	1040	Axis-specific opening of the position control loop	PLC	PLC	
W	1042	Deactivation of monitoring functions	PLC	PLC	
W	1044	Actual-to-nominal value transfer	PLC	PLC	
W	1046	Manual traverse in positive direction	PLC	PLC	
W	1048	Manual traverse in negative direction	PLC	PLC	
W	1054	Reference end position	PLC	PLC	
W	1056	Lubrication pulse: Value in MP4050.x exceeded	NC	NC	
W	1058	Reset the accumulated distance	PLC	PLC	
W	1060	Axis-specific feed rate enable	PLC	PLC	
W	1062	Lock the handwheel for specific axes	PLC	PLC	

Operand overview

Operand	Short designation	Address range
Markers	M (marker)	**M0 to M9999** **M0 to M999** are free. They are deleted only after entering the code number 531210, not during a reset (nonvolatile area). The range can be reduced or increased in the *.CFG file of the PLC compiler. **M1000 through M3999** are free; they are deleted during a reset. **M4000 to M5999** reserved for NC/PLC interface (M4800 through M4999 are deleted before the first run of the PLC program, e.g. after compilation or restarting) **M6000 through M9999** are free; they are deleted during a reset.
Input	I (input)	**I0 to I31** (MC 42x(B)) **I128 to I152** (machine operating panel) **I160 to I175** (HR 410, HRA 110) **I64 to I127** (first PL) **I192 to I255** (second PL) **I256 to I319** (third PL) **I320 to I383** (fourth PL)
Output	O (output)	**O0 to O30** (MC 42x(B)) **O0 to O7** (via machine operating panel) **O96 to O111** (HR 410, HRA 110) **O32 to O62** (first PL) **O64 to O94** (second PL) **O128 to O158** (third PL) **O160 to O190** (fourth PL)
Counter	C (counter)	Set counter: **C0 to C47** Counter contents: **C48 to C95** Counter pulse release: **C96 to C143**
Timers	T (timer)	Timer start: **T0 to T47** Timer is running: **T48 to T95 and T96 to T999**
Bytes Words Double words	B (byte) W (word) D (double word)	**B0 to B9999** (8 bits) **B0 through B255** are free; depending on the definition in the *.CFG file of the PLC compiler, the defined range is only deleted when the code number 531210 is entered, but not during a reset (remanent range). If no range is defined in the *.CFG file, B0 through B127 is the remanent range. **B256 to B2047** reserved for NC/PLC interface **B2048 through B9999** are free; they are deleted during a reset.
Constant	K	**-2,147,483,647 to +2,147,483,647**
String	S	**S0 to S99**

10.7 Specifications

10.7.1 PLC Inputs

Input signals of the switching inputs on the MC 42x(B), PL 4xxB, and PLD 16-8:

Voltage range	MC 42x(B), PL 4xxB	PLD 16-8
“1” signal: Ui	13 V to 30.2 V	13 V to 28.8 V
“0” signal: Ui	-20 V to 3.2 V	-3 V to 2.5 V

Current ranges	MC 42x(B)	PL 4xx B	PLD 16-8
“1” signal: Ii	3.8 mA to 8.9 mA	2.5 mA to 6 mA	2.5 mA to 5.8 mA
“0” signal: Ii when Ui = 3.2 V	1.0 mA	0.65 mA	0.3 mA

Addresses of the switching inputs:

Address	Number	Device
I0 to I31	31 + Acknowledgment *Control is ready*	PLC inputs directly on the MC, connector X42
I64 to I127 I64 to I95	64 32	First PL 410B, PL 510 (PLD 16-8) First PL 405 B
I128 to I152	25	Machine operating panel (MC, X46)
I160 to I175	16	Handwheels HR 410, HR 332 and handwheel adapter HRA 110 (MC, X23)
I192 to I255 I192 to I223	64 32	Second PL 410B, PL 510 (PLD 16-8) Second PL 405 B
I256 to I319 I256 to I287	64 32	Third PL 410B, PL 510 (PLD 16-8) Third PL 405B
I320 to I383 I320 to I351	64 32	Fourth PL 410B, PL 510 (PLD 16-8) Fourth PL 405B

Which PLC input is located on which pin of the corresponding connector?
--> See “Connector Designation and Layout” on page 13 – 135!

Note

The transmission of input states of handwheels and PLC input/output units (expansion cards) is performed with HEIDENHAIN serial data transmission busses on the connectors X23 and X47. On the X42 and X46 connectors, each input has its own wire.

10.7.2 Analog Inputs

The MC 42x(B), the PL 410B PLC I/O unit, and the PLA 4-4 (for PL 510) have analog inputs.

The PL 410 B is available with and without analog inputs.

	Analog inputs (±10 V)
MC 42x(B), X48	3
PL 405 B	–
PL 410 B (263 371-02)	4
PLA 4-4 (PL 510)	4

Voltage range: –10 V to +10 V
Input resistance: > 250 kW
Resolution (W480, W482, W484):100 mV
Resolution (Module 9003, 9138): 10 mV (MC 42x(B))
100 mV (PL 410B)
4.9 mV (PLA 4-4)

Which analog input is located on which pin of the corresponding connector?
--> See "Connector Designation and Layout" on page 13 – 135!

10.7.3 Inputs for Thermistors

The MC 42x(B), the PL 410B PLC I/O unit, and the PLA 4-4 (for PL 510) have inputs for Pt 100 thermistors.

The PL 410 B is available with and without analog inputs.

	Inputs for Pt 100 thermistors
MC 42x(B), X48	3
PL 405 B	–
PL 410 B (263 371-02)	4
PLA 4-4 (PL 510)	4

Constant current: 5 mA
Temperature range: 0 °C to 100 °C
Resolution (W486, W488, W490):0.5 °C
Resolution (Module 9003, 9138): 0.1 °C (MC 42x(B))
0.5 °C (PL 410B)
0.03 °C (PLA 4-4)

Which thermistor input is located on which pin of the corresponding connector?
--> See "Connector Designation and Layout" on page 13 – 135!

10.7.4 PLC Outputs

Output signals and addresses

The switching outputs are transistor outputs with current limitation.

Please note:

- Permissible load: Resistive load (inductive load only with quenching diode parallel to inductivity)
- MC 42x(B), PL 4xxB: Short circuiting of **one** output is **permissible.** **No more than one** output may be short-circuited **at one time.**
- PLD 16-8: The outputs are short-circuit proof.

Output signals:

	MC 42x(B), PL 4xxB, PLD 16-8
Min. output voltage for “1” signal	3 V below supply voltage

Note

The switching outputs need a minimum load of 5 mA.
They conform to EN 61131-2.

DANGER

PLC outputs must neither be connected to a 24-V supply, nor to other PLC outputs with a difference in potential. Otherwise, the voltage present at the PLC outputs is transmitted to the power supply. As a result, the PLC outputs that can be switched off may nevertheless be supplied with this voltage.
This could lead to damage or injury to property or persons!

Addresses:

Address	Number	Device
O0 to O30	31	PLC outputs directly on the MC, connector X41
O0 to O7	8	Machine operating panel (MC, X46)
O32 to O62	31	First PLC input/output unit (MC, X47)
O64 to O94	31	Second PLC input/output unit
O96 to O111	16	Handwheels HR 410, HR 332 and handwheel adapter HRA 110 (MC, X23)
O128 to O158	31	Third PLC input/output unit
O160 to O190	31	Fourth PLC input/output unit

Note

The transmission of output states of handwheels and PLC input/output units (expansion cards) is performed with HEIDENHAIN serial data transmission busses on the connectors X23 und X47.
On the X41 and X46 connectors, each output has its own wire.

Which PLC output is located on which pin of the corresponding connector?
--> See “Connector Designation and Layout” on page 13 – 135!

Supply voltage for PLC outputs

See “Power Supply for PLC Outputs” on page 14 – 222

11 Principle of Operation of the iTNC 530 Control

11.1 Introduction

This chapter gives you short explanations on the principle of operation of the iTNC 530 control.

Of course fundamental knowledge about controls, encoders, drives, electronics and mechanics simplifies the error detection and is often indispensible for servicing.

Please ask your machine manufacturer for detailed or special explanations (e.g., machine functions, circuit diagram of the machine)!

11.2 Block Diagrams with Short Explanations

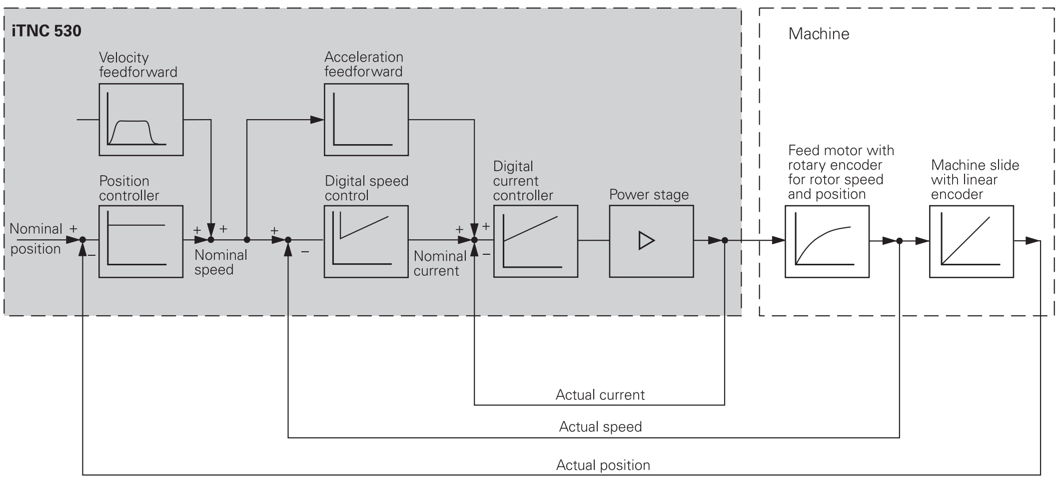
The control loop for digital axes/ spindles

Machine tools normally function on the principle of cascade control. Here the position control loop is prior to the speed and current control loops.

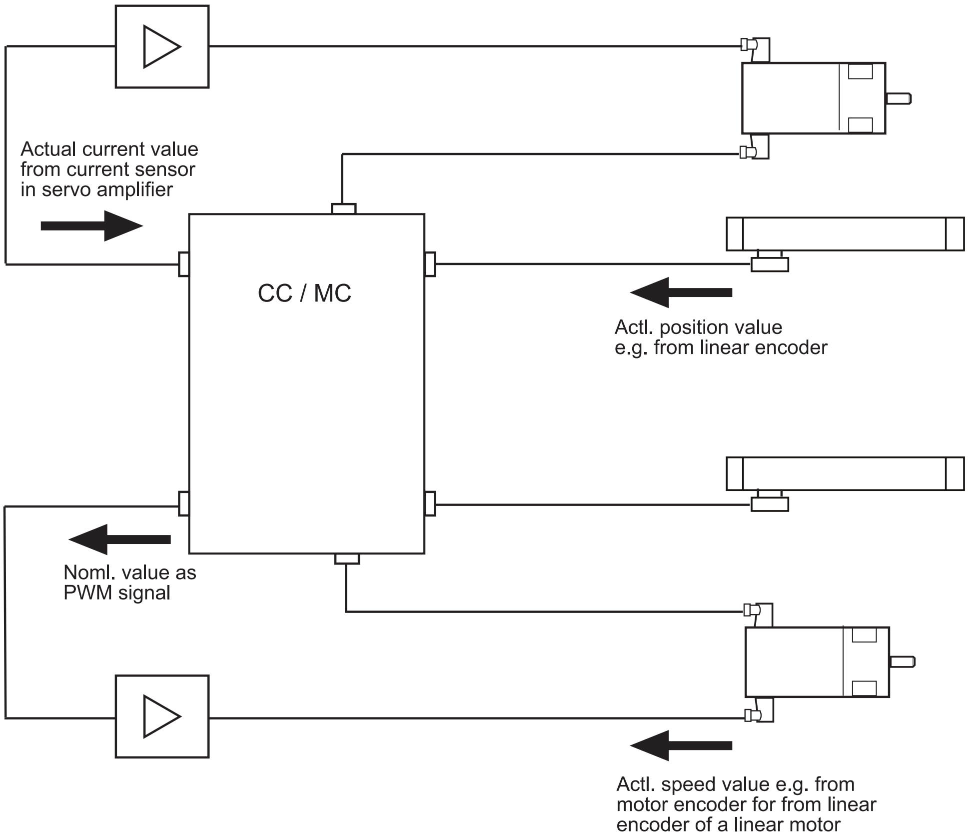
Benefits of cascade control:

- Transparent structure of the individual control loops.
- Disturbances can be compensated through the subsequent controllers. This relieves the prior controller.
- The respective outer control loop protects the inner control loop by limiting the command variable.

The position, speed and current controllers are located in the control.
The power module is driven by the CC 42x through PWM signals.
PWM is the abbreviation for pulse-width modulation. The information content in this signal depends on the relation of pulse duration to pulse-off duration.



Principle of operation of iTNC530



Nominal and actual values for the controllers

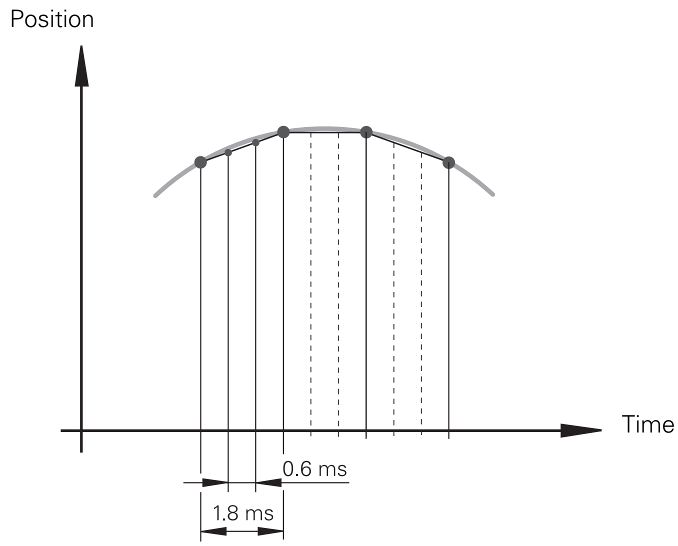
The **position controller** receives its nominal value, e.g., from the NC program; the actual value is normally provided by a linear encoder (scale). The actual position value can also be provided by a motor encoder instead of a scale. The position of the machine table depending on the number of counting pulses or revolutions of the motor encoder is set in the machine parameters (e.g., one revolution of the encoder changes the table position by 10 mm).

The **speed controller** receives its nominal value from the position encoder. Thus the output quantity of the position controller is the input quantity of the speed controller. This is why this interface is also designated as "nominal speed value interface". With analog axes, the control leads the nominal speed value interface (± 10V) "outside" to the analog servo amplifier. With digital axes, this interface is "inside" the control!
The actual value for the speed controller is supplied by the motor encoder.

The **current controller** receives its nominal value from the speed controller. The actual value is provided by current sensors in the power module.

Cycle times

The **position controller cycle time** is the time interval during which the interpolation points on the path are calculated. The **speed controller cycle time** is the time interval in which the actual speed value is compared to the calculated nominal speed value. The **current controller cycle time** is the time interval in which the actual current value is compared to the calculated nominal current value.



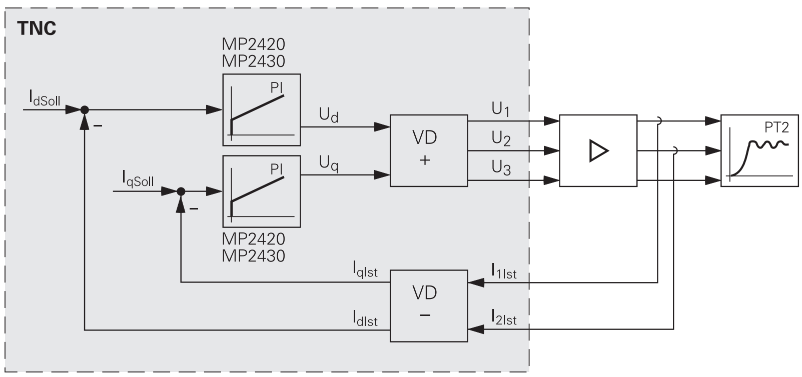
Detail current controller

6, 10 or 12 digital current controllers for the axes and spindle(s) are integrated in the iTNC 530:

The nominal values for magnetizing current Idnom and torque current Iqnom are divided into the PWM signals U1, U2 and U3 through a PI controller and vector rotator VD+, and are transferred to the power module through X51 to X60.

The actual current values I1act and I2act are determined by the power module and are transferred to vector rotator VD– through X51 to X60. The vector rotator determines the actual values of magnetizing current Idist and torque current Iqnom.

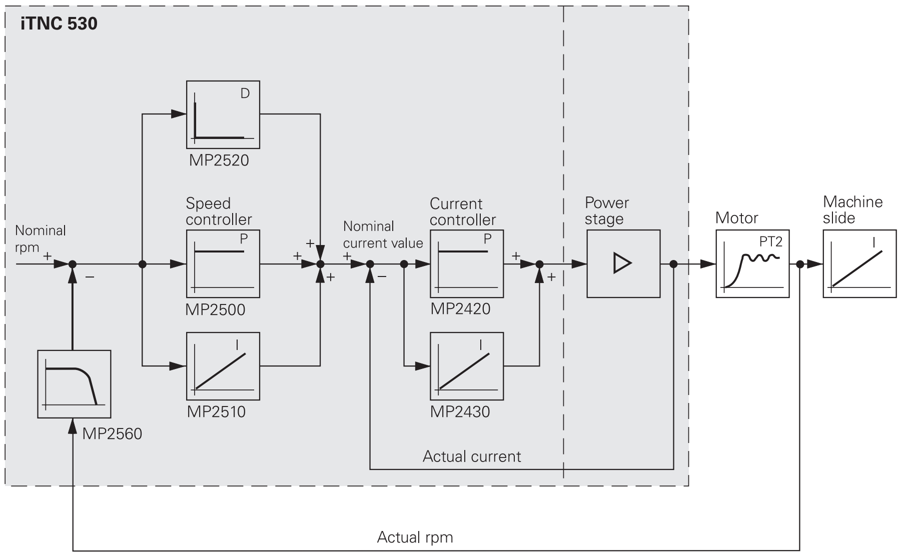
Circuit diagram:



Detail speed controller

6, 10 or 12 digital speed controllers for the axes and spindle(s) are integrated in the iTNC 530:

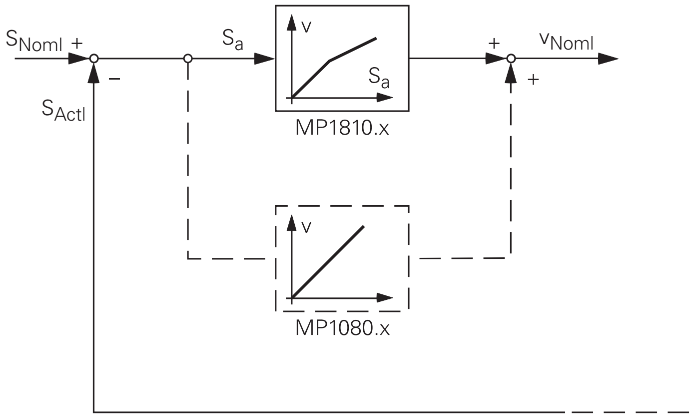
The actual speed values are measured directly at the motors with HEIDENHAIN rotary encoders. The position controller provides the nominal speed value. The speed controller is driven by the difference between nominal and actual speed values. It provides the nominal current value as output.



Position feedback control with servo lag

Following error (also known as servo lag) is a gap that remains between the nominal position commanded by the NC and the actual position.

Simplified representation:



The nominal position value snoml for a given axis is compared with the actual position value sactl and the resulting difference is the following error sa:

sa = snoml – sactl

sa = following error
snoml = nominal position value
sactl = actual position value

The following error is multiplied by the kv factor and passed on as nominal velocity value:

vnoml = kv · sa

vnoml = nominal velocity value

kv factor during control with following error

The control loop gain, known as the kv factor, defines the amplification of the position control loop.

The kV factor is set by the machine tool builder.

For axes that are interpolated with each other, the kv factors must be equal to prevent contour deviations.

DANGER

Control-loop parameter may only be changed by the machine manufacturer or after consultation with the machine manufacturer!
An increase of the kv factor could lead to damage or injury of property or persons!

Interrelation of kv factor feed and following error

The following formula shows the interrelation of kv factor, feed rate, and following error:

$$k_v = \frac{v_e}{s_a} \quad \text{Or} \quad s_a = \frac{v_e}{k_v}$$

kv = loop gain [(m/min)/mm]
ve = rapid traverse [m/min]
sa = following error [mm]

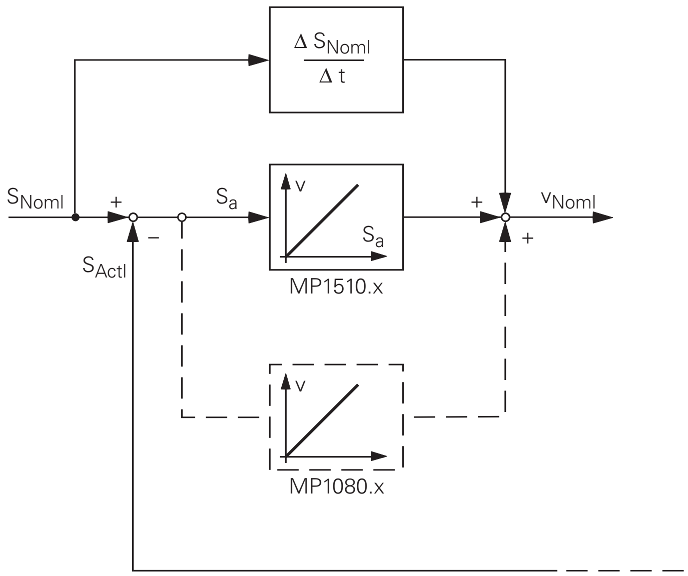
Position control with velocity feedforward control

The nominal velocity value consists of an open-loop and a closed-loop component.

With velocity feedforward control, the machine-adjusted nominal velocity value is the open-loop controlled component. The closed-loop velocity component is calculated through the following error. The following error is small.

On the basis of MP 1392 (for the operating modes **Positioning with manual data input**, **Program run / single block** and **Program run full sequence)** and MP 1391 (for the operating modes **Manual operation** and **El. handwheel**) you can find out whether the traverse is performed in the following error mode or feedforward mode. –> With velocity feedforward control, the bits are set to 1.

Block diagram:



Unlike operation with following error, the optimum kv factor for each axis when operating with interpolated axes is set by the machine manufacturer.

Position control with velocity semifeedforward control

MP1396.x allows the operator to switch to velocity semifeedforward control.
Normally, work will be carried out using velocity feedforward. Velocity semifeedforward is activated, for example, by an OEM cycle before roughing, in order to permit a higher following error and thereby a higher velocity, combined with a lowered accuracy, in order to traverse corners.
Before finishing, another OEM cycle can be used to switch back to velocity feedforward, in order to finish with the highest accuracy possible.

In order to use velocity semifeedforward, a factor must be entered for every axis in MP1396.x, where values toward 0 control the following error more, and values toward 1 control the velocity feedforward more.

As soon as a factor between 0.001 and 0.999 has been entered in MP1396.x, the kV factor from MP1516.x becomes effective.

Note

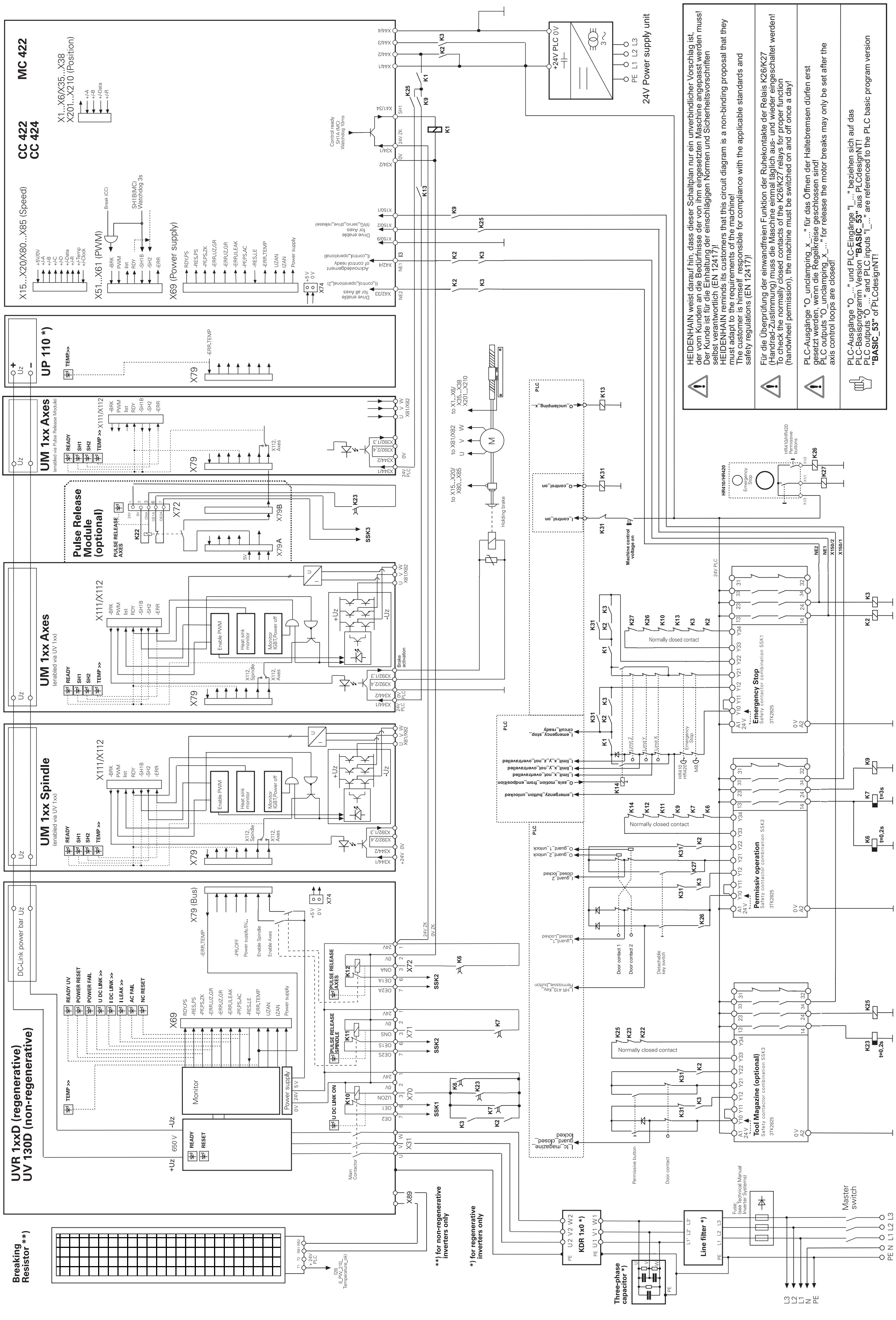
For axes that are interpolated with each other, the kv factors must be equal. In this case the smaller kV factor determines the input value for these axes.

The values for position monitoring are interpolated according to the factor in MP1396.x between the values for servo lag (MP1710.x, MP1720.x) and the values for velocity feedforward control (MP1410.x, MP1420.x).

Feedback control with following error (servo lag)	Feedback control with velocity semifeedforward	Feedback control with velocity feedforward
MP1391 bit x = 0 MP1392 bit x = 0 MP1396.x = nonfunctional	MP1391 bit x = 1 MP1392 bit x = 1 MP1396.x = 0.001 ◄──► MP1396.x = 0.999	MP1391 bit x = 1 MP1392 bit x = 1 MP1396.x = 1

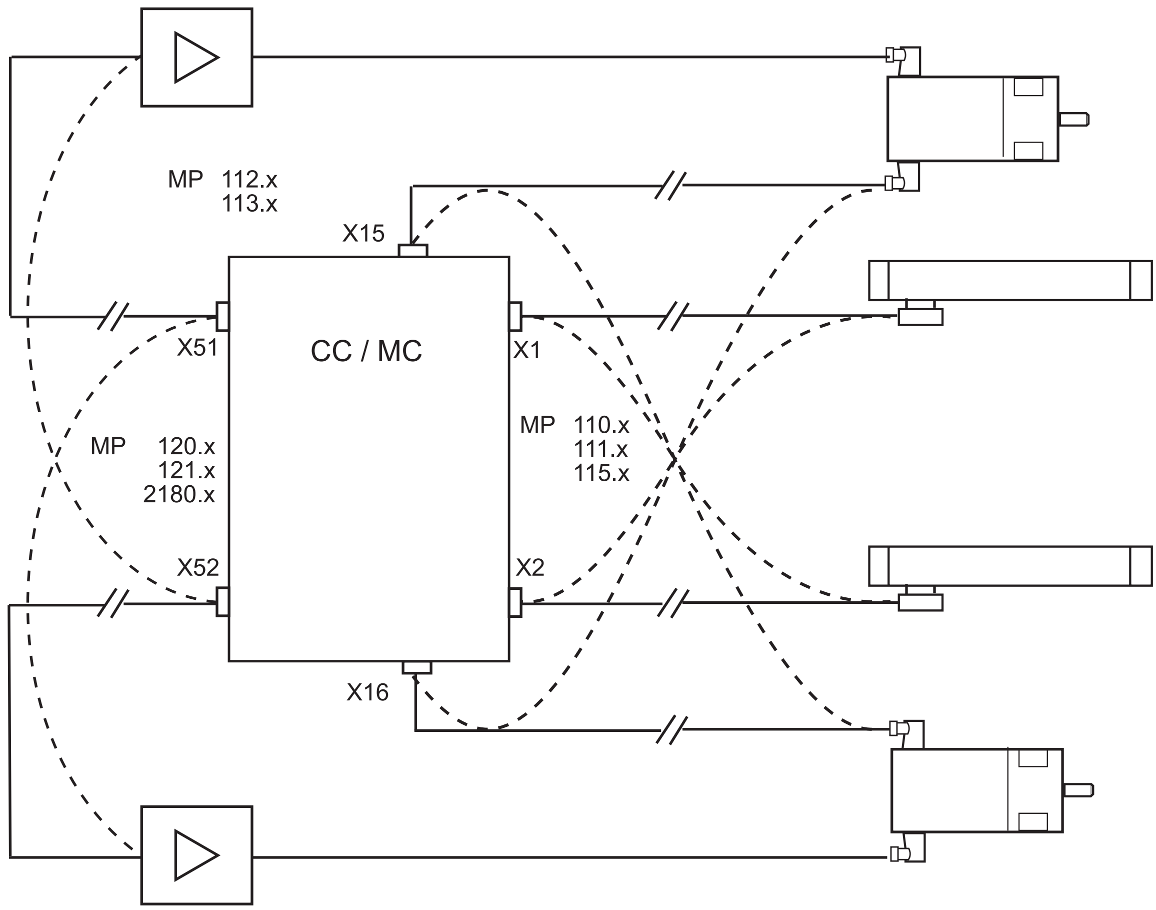
11.3 Basic Circuit Diagrams

iTNC 530 with Modular HEIDENHAIN Inverter System



Further basic circuit diagrams are in preparation!

11.4 Exchange Possibilities of the iTNC 530



Note

For details, constraints and specifics, see “Encoder Interface” on page 279 and “Interface to the Drives” on page 327.

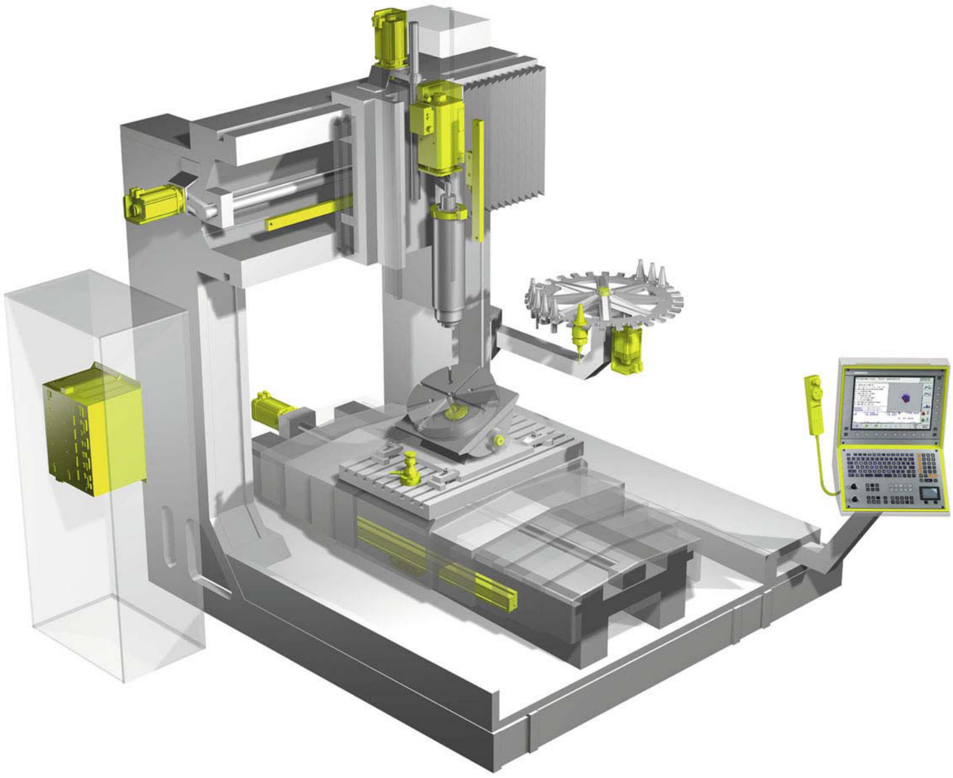
Note

Always exchange both, the cable and interface assignment by means of machine parameters!

12 Important Features of HEIDENHAIN Components

12.1 HEIDENHAIN Components in a Machine Tool

The picture shows possible HEIDENHAIN components on a machine tool.
The picture is only an example as, of course, there exists a large selection of different machine tools and machining centers.
Furhermore, it does not claim to be complete!



Note

On the cover page of this Service Manual and in the PDF file the highlighted HEIDENHAIN components are well visible.

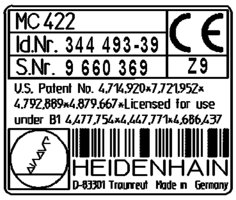
12.2 Hardware Identification

There is an ID label on each HEIDENHAIN unit which indicates, e.g.

- Unit designation
- Part number
- Serial number

Thus each unit can be identified clearly.

ID label (example)

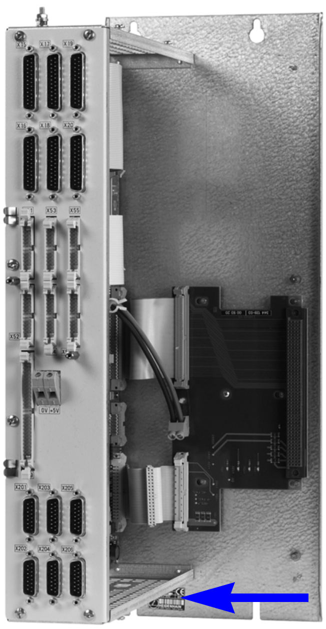
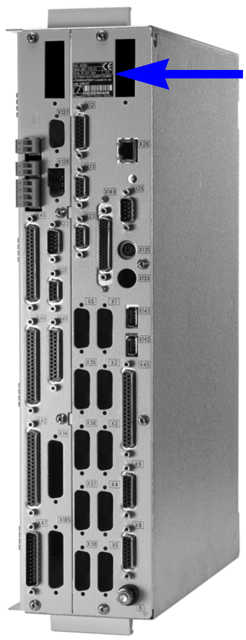


Note

The most important information for the service are the **unit designation** and the **Id.Nr.**!

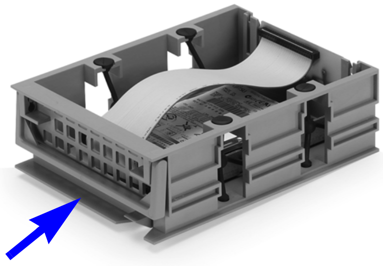
In the following pictures **the position of the ID label** on the HEIDENHAIN components is displayed **with arrows**.

Main computer, controller unit, power supply unit

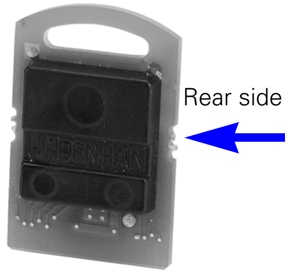
The iTNC 530 comprises 2 components: ■ MC 42x(B) Main Computer (MC = Main Computer) ■ CC 42x Controller Unit (CC = Controller Computer) The MC 42x(B) main computer is available in two versions: ■ Standard version MC 422B ■ Basic version MC 420 with 5 position encoder inputs and reduced performance range. However, these functions can be activated with two code numbers.	 CC 424 / 6 control loops  MC 422B

The main computer consists of three components:

- MC 42x(B) main computer
- HDR hard disk
- SIK system identification key



HDR



Rear side

SIK

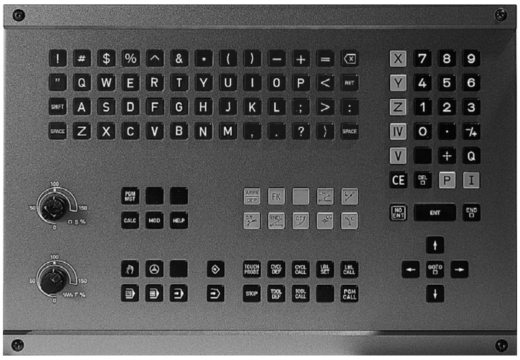
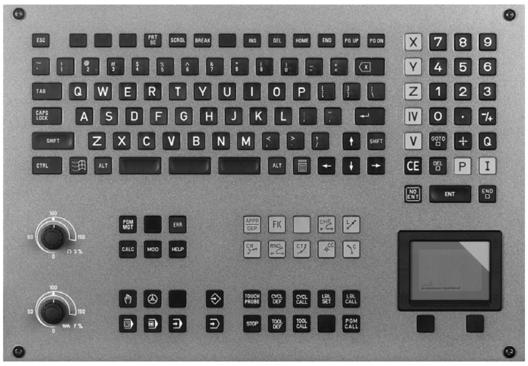
UV 105 Power Supply Unit

The UV 105 serves to supply the power to the CC42x if a non-HEIDENHAIN inverter is used, or, if required, to supply additional power if a HEIDENHAIN inverter is used.

If a non-HEIDENHAIN inverter system is used, the adapter connector is connected to X69 of the UV 105.

The cover for the UV 105 and the adapter connector for X69 are included in the items supplied.

Monitors and keyboard units

TE 420 Operating Panel Only used for iTNC 530 single-processor Rear side →	
TE 530, TE 530B Operating Panel with Touchpad Only used for iTNC 530 single-processor and dual-processor Rear side →	
BF 150 Visual Display Unit 15.1-inch color flat panel display (1024 x 768 pixels) with horizontal and vertical soft keys Rear side →	

BF 120 Visual Display Unit

10.4-inch color flat-panel display (640 x 480 pixels) with horizontal soft keys:

Rear side

BTS 1x0 Screen-Keyboard Switching Unit

With the BTS 1x0, it is possible to connect two monitors and two operating panels to an MC 42x(B).

Rear side

MB 420 Machine Operating Panel

Machine operating panel with snap-on (switchable) keys.

Rear side

Handwheels

HR 410 Handwheel

Portable electronic handwheel with snap-on (exchangeable) keys.

- Keys for selection of 5 axes
- Keys for traverse direction
- Keys for preset feeds
- Actual-position-capture key
- Three keys for machine functions (definable with PLC)
  - Spindle right/left/stop
  - NC start/stop, spindle start (for HEIDENHAIN basic PLC program)
- Two permissive buttons (24 V)
- Emergency-stop button (24 V)

Magnetic holding pads

HR 420 Handwheel

Portable electronic handwheel with

- Display for operating mode, actual positon value, programmed feed rate and spindle speed, error message
- Spindle speed and feed-rate override
- Axis selection via keys and soft keys
- Actual-to-nominal value transfer
- NC start/stop
- Spindle start/stop
- Keys for traverse direction
- Two permissive buttons (24 V)
- Emergency-stop button (24 V)
- Magnetic holding pads
- Mount for attaching the handwheel to the machine

HR 130 Handwheel

Panel-mounted handwheel

With ergonomic knob,
radial cable outlet

HRA 110 Handwheel adapter

For connecting up to three **HR 150** handwheels to the TNC.
The axes and the subdivision factor are selected via rotary switch.

HRA 110

HR 150 with radial cabl outlet

Handwheel selection switch

Touch Probe Systems

TT 130 Tool Touch Probe Touch-trigger probe for measuring tools. TT 130 Adapter cable for connection to the MC 42x(B)	

TS 220 Touch Probe Touch-trigger probe with cable connection for workpiece setup and measurement during machining.	

TS 640, TS 440 Touch Probe

Touch-trigger probe with infrared transmission, for workpiece setup and measurement during machining.

TS 640
TS 440

SE 640 transmitter-receiver unit
SE 540 transmitter-receiver unit

TS 640


TS 440


SE 640


SE 540

Other Accessories

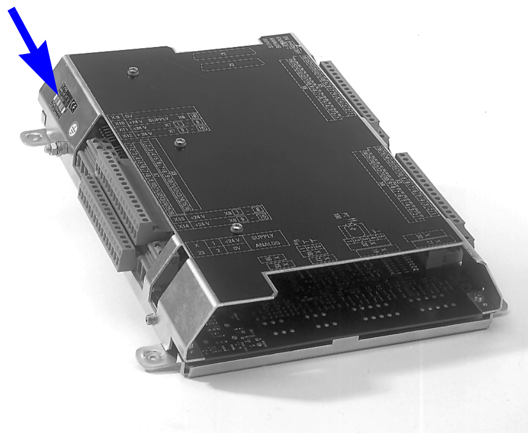
PL 410 B PLC Input/Output Unit
For the expansion of PLC inputs and outputs

64 inputs
31 outputs

64 inputs
31 outputs
4 analog inputs ± 10 V
4 inputs for PT 100 thermistors

PL 405 B PLC Input/Output Unit

32 inputs
15 outputs

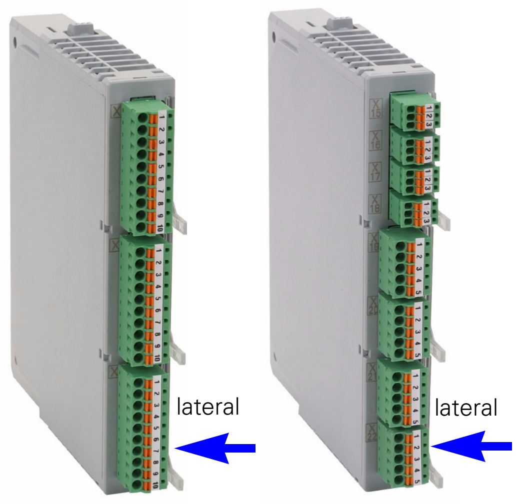


PL 510 PLC Input/Output Unit
This is a modular I/O system for the expansion of PLC inputs and outputs.
The PL 510 consists of the **PLB 510** basic module and the following components:

- **PLD 16-8** I/O module with 16 digital inputs and 8 digital outputs
- **PLA 4-4** analog module with 4 analog inputs for Pt 100 thermistors and 4 ±10 V analog inputs
- Empty housing for partial assembly

The PL 510 can be mounted on a top hat rail (NS 35 EN 50022).
The PL 510 equipped (completely or partially) with PLD 16-8 is compatible with PL 410 B/PL 405 B.

PLB 510 Basic Module

PLD 16-8 input/output module PLA 4-4 analog module Empty housing	

PLD 16-8 PLA 4-4

12.3 Display of System Information

General

When consulting your machine manufacturer or HEIDENHAIN in case of error or malfunction of your machine, it is important to know which software is installed on the iTNC.

Calling the display

▶ Press the following keys to display the currently active NC software on the iTNC screen:

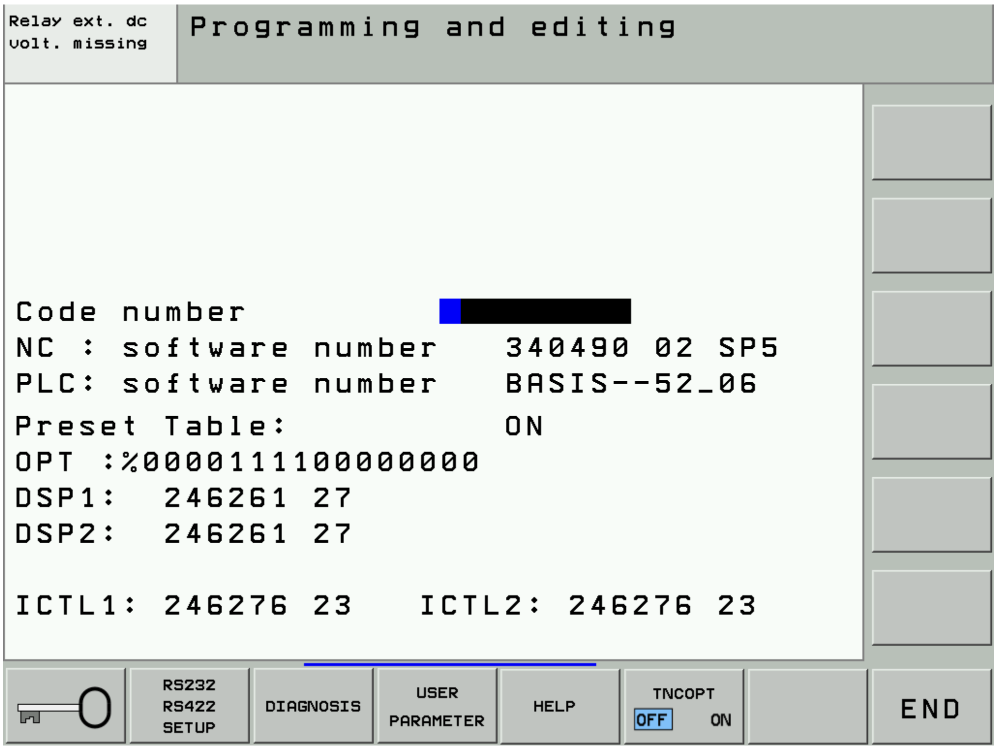
▶ Select the *Programming and Editing* operating mode

▶ Press MOD key

Note

Which information is now displayed depends on the NC software installed!

Display for NC software 340420-xx to 340480-xx



NC software

```
NC : software number   340490 02 SP5
```

340480 Program number of NC software
08 Version of NC software

The iTNC 530 is equipped with the following NC software versions:

Standard	Export	Remark
340 420-xx	340 421-xx	without preset tables
340 422-xx	340 423-xx	with preset tables
340 480-xx	340 481-xx	with preset tables and Windows 2000 (dual-processor control)
340 490-xx	340 491-xx	with preset tables and smarT.NC programming surface
340 492-xx	340 493-xx	with preset tables, smarT.NC programming surface and Windows 2000 (dual-processor control)

Due to restrictions on the export of the iTNC 530, HEIDENHAIN can also supply a special export version. This export version differs from the standard control through the installed NC software type. HEIDENHAIN releases a new NC software type whenever it introduces extensive new functions.

PLC software

```
PLC: software number   BASIS--52_06
```

BASIS--51 Random string which the machine manufacturer uses to identify his PLC software

Preset table

```
Preset Table:          ON
```

ON Preset table active
OFF Preset table not active

Options

```
OPT :%0000111100000000
```

% Identifier of binary format
0000111100000000 Options enabled in the SIK (e.g. auxiliary axes, tilting operation, HSC milling etc.)

DSP software

```
DSP1:  246261 27
```

246261	Program number of DSP software
27	Version of DSP software

> **Note**
>
> The DSP software designates the operating system for the **d**igital **s**ignal **p**rocessors (DSP) that are responsible for the speed control of digital axes/spindles.
> DSP1: software for the main controller board, DSP2: software for the additional controller board.

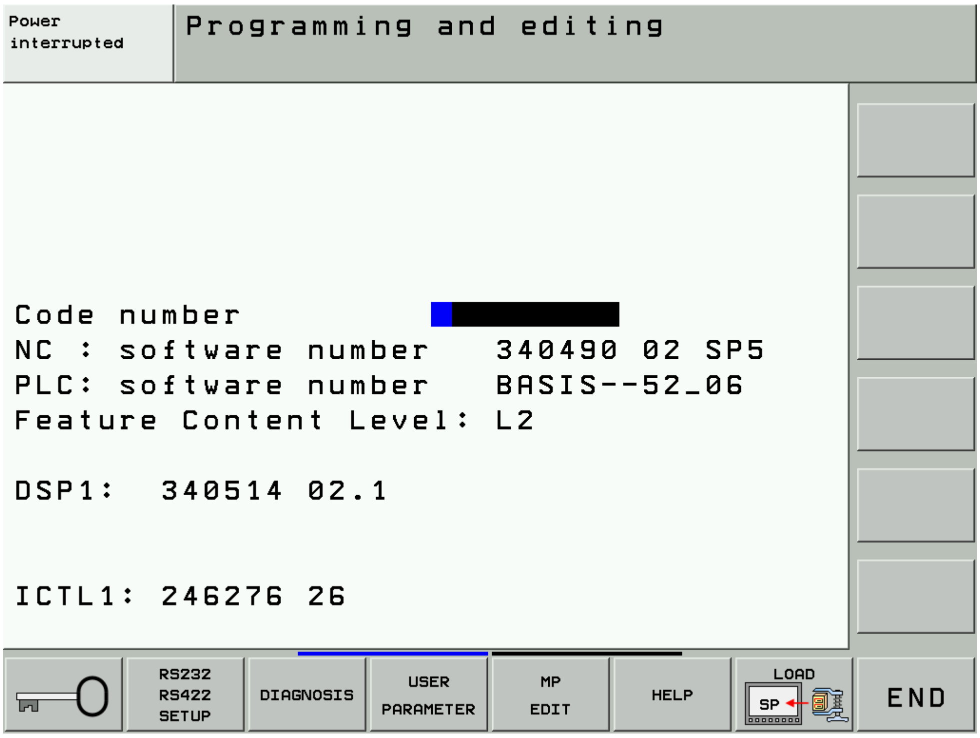
Current Controller Software

```
ICTL1: 246276 23
```

246276	Program number of current controller software
23	Version of current controller software

> **Note**
>
> The ICTL software designates the operating system for the **d**igital **s**ignal **p**rocessors (DSP) that are responsible for the speed control of digital axes/spindles.
> ICTL1: software for the main controller board, ICTL2: software for the additional controller board.

Display for NC software as of 340490-xx (with smarT.NC programming surface)



Note

As opposed to the display for the NC software types of 340420-xx to 340480-xx , the "feature content level" is here displayed. (The display for "preset table" and "OPT" is no longer required.)
Please see previous picture for explanations of "NC: software number" etc.!

Feature content level

L1 "L" is the abbreviation of "level"; "1" stands for the scope of functions.

When a new version is released as of NC software 340490-xx, the ranges for error fixes and expanded functions are managed separately.
When the NC software is updated to a new version, first only the included error fixes will be effective.

The ***Feature Content Level*** is defined by the machine manufacturer:

- The ***Feature Content Level*** is shown in the line "Feature Content Level".
- The displayed number cannot be higher than the NC software version (i.e., the highest possible ***Feature Content Level*** for NC software 340490-03 is 3).
- A higher ***Feature Content Level*** always includes the features of the previous versions.
- After entering the SIK code word you can see the ***Feature Content Level*** under option Nr. 53.

13 Connector Designation and Layout

13.1 Important Note

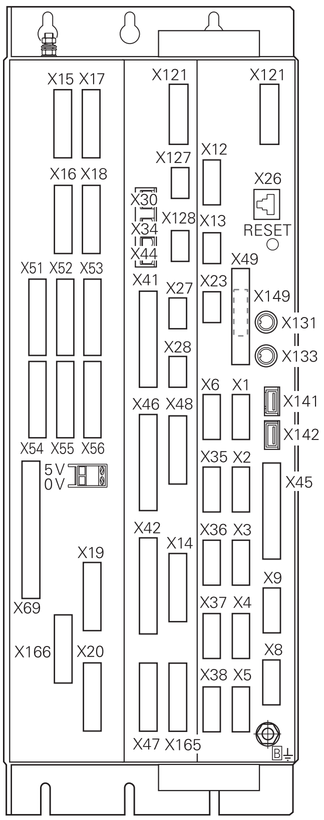
Caution

Do not engage or disengage any plug and clamped connections while the unit is under power!
148!

13.2 MC and CC

13.2.1 Designation and Position of Connectors

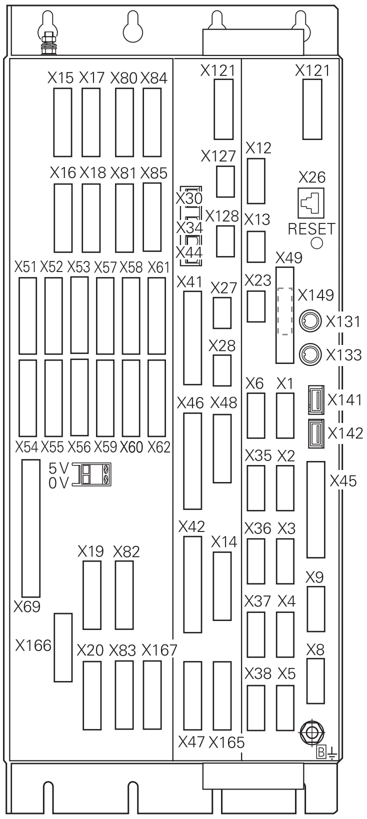
MC 422 with 5 position encoder inputs and CC 422 with 6 control loops



X150, X151 at bottom of housing

X1 to X5	Position encoder 1 Vpp
X35 to X38	Vacant
X15 to X20	Speed encoder 1 Vpp
X51 to X60	PWM output (power stage of motor)
X8, X9	Nominal value output, analog
X12	TS touch trigger probe
X13	TT 130 touch trigger probe
X23	Handwheel
X26	Ethernet data interface
X27	RS-232-C/V.24 data interface
X28	V.11/RS-422 data interface
X30	24 V reference signal for spindle
X34	24 V for control-is-ready signal output
X41	PLC output
X42	PLC input
X44	24 V PLC supply voltage
X45	Keyboard unit (TE 4xx)
X46	Machine operating panel
X47	PLC expansion (PL 4xxB)
X48	PLC analog input
X149 (X49)	BF 150 (BF 120) visual display unit
X69	Power supply
X121, X125	Reserved
X127, X128	Reserved
X131, X133	Reserved
X141, X142	Reserved
X165, X166	Reserved
5V/0V	Power supply for processor
X150	Axis-specific drive release 1 to 6
B	Signal ground
⏚	Equipment ground (YL/GN)

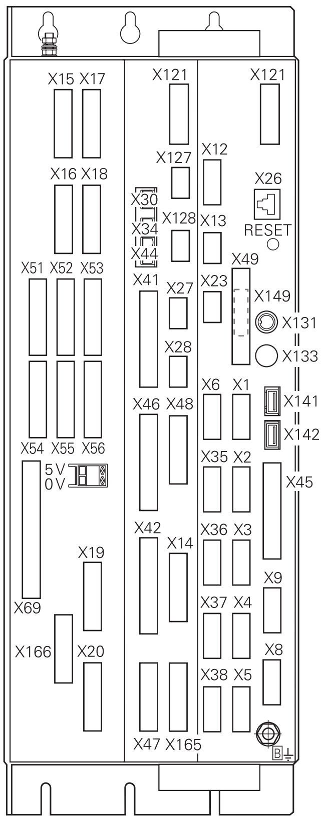
MC 422 M with 10 position encoder inputs and CC 422 with 10 control loops



X150, X151 at bottom of housing

X1 to X6	Position encoder 1 V_{PP}
X35 to X38	Position encoder 1 V_{PP}
X15 to X20	Speed encoder 1 V_{PP}
X80 to X83	Speed encoder 1 V_{PP}
X84, X85	Vacant
X51 to X60	PWM output (power stage of motor)
X61, X62	Vacant
X8, X9	Nominal value output, analog
X12	TS touch trigger probe
X13	TT 130 touch trigger probe
X23	Handwheel
X26	Ethernet data interface
X27	RS-232-C/V.24 data interface
X28	RS-422/V.11 data interface
X30	24 V reference signal for spindle
X34	24 V for control-is-ready signal output
X41	PLC output
X42	PLC input
X44	24 V PLC supply voltage
X45	Keyboard unit (TE 4xx)
X46	Machine operating panel
X47	PLC expansion (PL 4xxB)
X48	PLC analog input
X149 (X49)	BF 150 (BF 120) visual display unit
X69	Power supply
X121, X125	Reserved
X127, X128	Reserved
X131, X133	Reserved
X141, X142	Reserved
X165, X166, X167	Reserved
5V/0V	Power supply for processor
X150	Axis-specific drive release 1 to 6
X151	Axis-specific drive release 7 to 10
B	Signal ground
⏚	Ground lead (YL/GN)

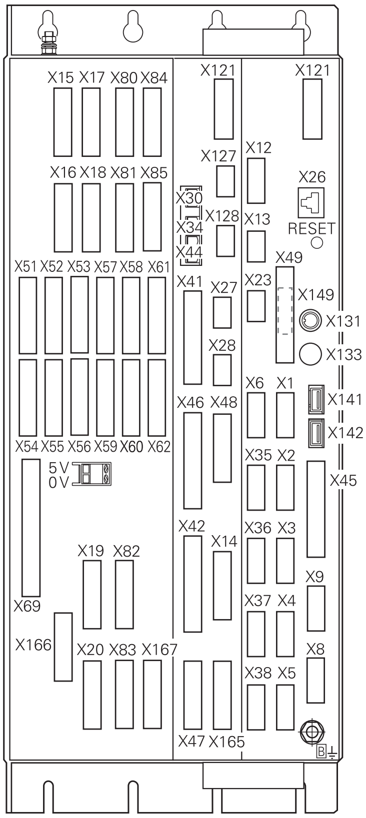
MC 422B with 5 position encoder inputs and CC 422 with 6 control loops



X150 at bottom of housing

X1 to X5	Encoder for position
X35 to X38	Vacant
X15 to X20	Encoder for speed
X51 to X60	PWM output
X8, X9	Nominal value output, analog
X12	TS touch trigger probe
X13	TT 130 touch trigger probe
X23	Handwheel
X26	Ethernet data interface
X27	RS-232-C/V.24 data interface
X28	RS-422/V.11 data interface
X127	RS-232-C/V.24 (only for Windows 2000)
X128	RS-422/V.11 (only for Windows 2000)
X141, X142	USB interface
X30	24 V reference signal for spindle
X34	24 V for “control-is-ready” output
X41	PLC output
X42	PLC input
X44	24 V PLC supply voltage
X45	Keyboard unit
X46	Machine operating panel
X47	PLC expansion
X48	PLC analog input
X149 (X49)	BF 150 (BF 120) visual display unit
X131	Reserved
X69	Power supply
X121, X125	Reserved
X165, X166	Reserved
X74	5-V power supply
X150	Axis-specific drive release
B	Signal ground
⏚	Equipment ground (YL/GN)

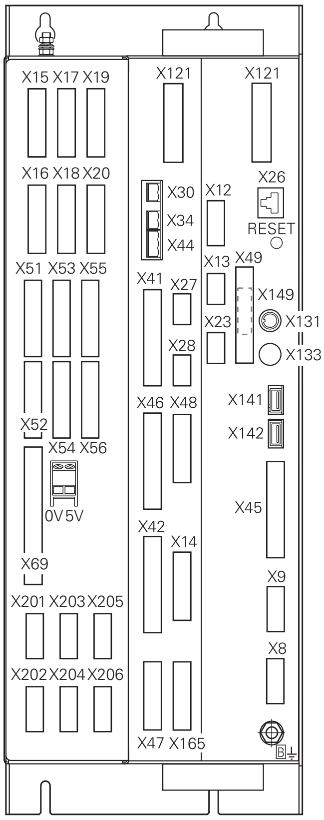
MC 422B with 10 position encoder inputs and CC 422 with 10 or 12 control loops



X150, X151 at bottom of housing

X1 to X6	Encoder for position
X35 to X38	Encoder for position
X15 to X20	Encoder for speed
X80 to X83	Encoder for speed
X84, X85	Encoder for speed (12 control loops)
X51 to X60	PWM output
X61, X62	PWM output (12 control loops)
X8, X9	Nominal value output, analog
X12	TS touch trigger probe
X13	TT 130 touch trigger probe
X23	Handwheel
X26	Ethernet data interface
X27	RS-232-C/V.24 data interface
X28	RS-422/V.11 data interface
X127	RS-232-C/V.24 (only for Windows 2000)
X128	RS-422/V.11 (only for Windows 2000)
X141, X142	USB interface
X30	24 V reference signal for spindle
X34	24 V for "control-is-ready" output
X41	PLC output
X42	PLC input
X44	24 V PLC supply voltage
X45	Keyboard unit
X46	Machine operating panel
X47	PLC expansion
X48	PLC analog input
X149 (X49)	BF 150 (BF 120) visual display unit
X131	Reserved
X69	Power supply
X121, X125	Reserved
X165, X166, X167	Reserved
X74	5-V power supply
X150/X151	Axis-specific drive release
B	Signal ground
⏚	Equipment ground (YL/GN)

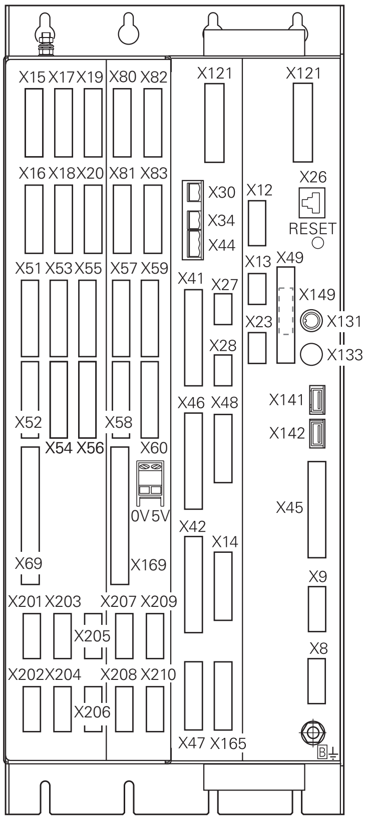
MC 422B and CC 424 with max. 6 control loops



X150 at bottom of housing

X201 to X206	Encoder for position
X15 to X20	Encoder for speed
X51 to X60	PWM output
X8, X9	Nominal value output, analog
X12	TS touch trigger probe
X13	TT 130 touch trigger probe
X23	Handwheel
X26	Ethernet data interface
X27	RS-232-C/V.24 data interface
X28	RS-422/V.11 data interface
X127	RS-232-C/V.24 (only for Windows 2000)
X128	RS-422/V.11 (only for Windows 2000)
X141, X142	USB interface
X30	24 V reference signal for spindle
X34	24 V for "control-is-ready" output
X41	PLC output
X42	PLC input
X44	24 V PLC supply voltage
X45	Keyboard unit
X46	Machine operating panel
X47	PLC expansion
X48	PLC analog input
X149 (X49)	BF 150 (BF 120) visual display unit
X131	Reserved
X69	Power supply
X121, X125, X165	Reserved
X74	5-V power supply
X150	Axis-specific drive release
B	Signal ground
⏚	Equipment ground (YL/GN)

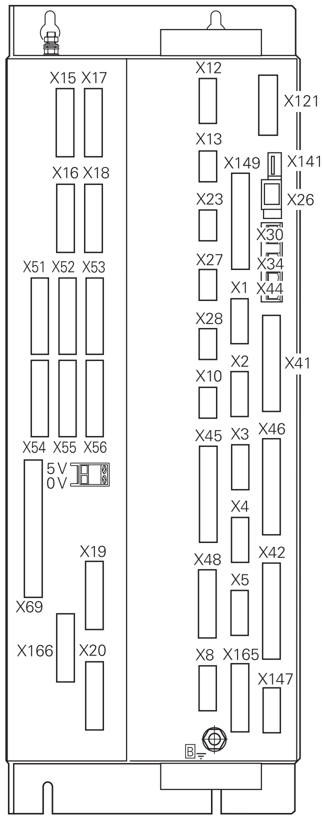
MC 422B and CC 424 with max. 10 control loops



X150, X151 at bottom of housing

X201 to X210	Encoder for position
X15 to X20	Encoder for speed
X80 to X83	Encoder for speed
X51 to X60	PWM output
X8, X9	Nominal value output, analog
X12	TS touch trigger probe
X13	TT 130 touch trigger probe
X23	Handwheel
X26	Ethernet data interface
X27	RS-232-C/V.24 data interface
X28	RS-422/V.11 data interface
X127	RS-232-C/V.24 (only for Windows 2000)
X128	RS-422/V.11 (only for Windows 2000)
X141, X142	USB interface
X30	24 V reference signal for spindle
X34	24 V for "control-is-ready" output
X41	PLC output
X42	PLC input
X44	24 V PLC supply voltage
X45	Keyboard unit
X46	Machine operating panel
X47	PLC expansion
X48	PLC analog input
X149 (X49)	BF 150 (BF 120) visual display unit
X131	Reserved
X69, X169	Power supply
X121, X125, X165	Reserved
X74	5-V power supply
X150/X151	Axis-specific drive release
B	Signal ground
⏚	Equipment ground (YL/GN)

MC 420 and CC 422 with 6 control loops



X150 at bottom of housing

X1 to X5	Encoder for position
X15 to X20	Encoder for speed
X51 to X56	PWM output
X8	Nominal value output, analog
X12	TS touch trigger probe
X13	TT 130 touch trigger probe
X23	Handwheel
X26	Ethernet data interface
X27	RS-232-C/V.24 data interface
X28	RS-422/V.11 data interface
X141	USB interface
X30	24 V reference signal for spindle
X34	24 V for “control-is-ready” output
X41	PLC output
X42	PLC input
X44	24 V PLC supply voltage
X45	Keyboard unit
X46	Machine operating panel
X147	PLC expansion
X48	PLC analog input
X149	BF 150 monitor
X69	Power supply
X10	Reserved
X121	Reserved
X165, X166	Reserved
X74	5-V power supply
X150	Axis-specific drive release
B	Signal ground
⏚	Equipment ground (YL/GN)

13.2.2 Pin Layouts on the MC and CC

X1 to X6,
X35 to X38,
X201 to X214:
position encoder
1 VPP

MC 42x(B), CC 424		AK 309 783-xx AK 310 197-xx			Measuring system	
Male	**Assignment**	**Female**	**Color**	**Female**	**Male**	**Color**
1	+5 V (UP)	1	Brown/Green	12	12	Brown/Green
2	0 V (UN)	2	White/Green	10	10	White/Green
3	A+	3	Brown	5	5	Brown
4	A–	4	Green	6	6	Green
5	Do not assign	5				
6	B+	6	Gray	8	8	Gray
7	B–	7	Pink	1	1	Pink
8	Do not assign	8				
9	+5 V (sensor)	9	Blue	2	2	Blue
10	R+	10	Red	3	3	Red
11	0 V (sensor)	11	White	11	11	White
12	R–	12	Black	4	4	Black
13	0 V	13				
14	Do not assign	14	Violet	7	7	Violet
15	Do not assign	15				
Hsg.	External shield	Hsg.	External shield	Hsg.	Hsg.	External shield

Note

The interface complies with the requirements of EN 50 178 for “low voltage electrical separation.”

X1 to X6, X35 to X38, X201 to X214: position encoder with EnDat interface

MC 42x(B), CC 424		AK 332 115-xx			VB 323 897-xx				AK 313 791-xx		
Male	**Assign-ment**	**Female**	**Color**	**Female**	**Male**	**Color**	**Fem.**		**Male**	**Color**	**Fem.**
1	+5 V (UP)	1	Brown/ Green	7	7	Brown/ Green	7	Line drop compensator 336 697-02, if required	7	Brown/ Green	5b
2	0 V (UN)	2	White/ Green	10	10	White/ Green	10		10	White/ Green	6a
3	A+	3	Green/ Black	15	15	Green/ Black	15		15	Green/ Black	2a
4	A–	4	Yellow/ Black	16	16	Yellow/ Black	16		16	Yellow/ Black	2b
5	data	5	Gray	14	14	Gray	14		14	Gray	3b
6	B+	6	Blue/ Black	12	12	Blue/ Black	12		12	Blue/ Black	1a
7	B–	7	Red/ Black	13	13	Red/ Black	13		13	Red/ Black	1b
8	data	8	Pink	17	17	Pink	17		17	Pink	3a
9	+5 V (sensor)	9	Blue	1	1	Blue	1		1	Blue	5a
10	Free	10		3	3	Red	3		3		
11	0 V (sensor)	11	White	4	4	White	4		4	White	6b
12	Free	12		2	2	Black	2		2		
13	Internal shield	13	Internal shield	11	11	Internal shield	11		11	Internal shield	
14	Clock	14	Violet	8	8	Violet	8		8	Violet	4a
15	Clock	15	Yellow	9	9	Yellow	9		9	Yellow	4b
Hsg.	Housing	Hsg.	External shield	Hsg.		External shield			Hsg.	External shield	

Note

The interface complies with the requirements of EN 50 178 for "low voltage electrical separation."

X8:
Analog output
1 to 6

MC 42x(B)		Connecting cable	
D-sub conntn. (female) 15-pin	**Assignment**	**D-sub conntr. (male) 15-pin**	**Color**
1	Analog output 1: ±10 V	1	Brown
2	Do not assign	2	Brown/Green
3	Analog output 2: ±10 V	3	Yellow
4	Analog output 5: ±10 V	4	Red/Blue
5	Analog output 3: ±10 V	5	Pink
6	Analog output 5: 0 V	6	Gray/Pink
7	Analog output 4: ±10 V	7	Red
8	Analog output 6: ±10 V	8	Violet
9	Analog output 1: 0 V	9	White
10	Do not assign	10	White/Gray
11	Analog output 2: 0 V	11	Green
12	Do not assign	12	
13	Analog output 3: 0 V	13	Gray
14	Analog output 4: 0 V	14	Blue
15	Analog output 6: 0 V	15	Black
Housing	External shield	Housing	External shield

X9:
Analog output
7 to 13

MC 42x(B)		Connecting cable	
D-sub conntn. (female) 15-pin	**Assignment**	**D-sub conntr. (male) 15-pin**	**Color**
1	Analog output 7: ±10 V	1	Brown
2	Analog output 13 [a]: ±10 V	2	Brown/Green
3	Analog output 8: ±10 V	3	Yellow
4	Analog output 11: ±10 V	4	Red/Blue
5	Analog output 9: ±10 V	5	Pink
6	Analog output 11: 0 V	6	Gray/Pink
7	Analog output 10: ±10 V	7	Red
8	Analog output 12: ±10 V	8	Violet
9	Analog output 7: 0 V	9	White
10	Analog output 13a: 0 V	10	White/Gray
11	Analog output 8: 0 V	11	Green
12	Do not assign	12	
13	Analog output 9: 0 V	13	Gray
14	Analog output 10: 0 V	14	Blue
15	Analog output 12: 0 V	15	Black
Housing	External shield	Housing	External shield

a. Only for MC 422B, but not for MC 422

X12: Connection of the touch probe for workpiece measurement

> **Note**
>
> The interface complies with the requirements of EN 50 178 for "low voltage electrical separation."

Pin layout for TS 220:

MC 42x(B)		AK 274 543-xx			TS 220	
Female	**Assignment**	**Male**	**Color**	**Pin**	**Pin**	**Color**
1	0 V (internal shield)	1				
2	Do not assign	2				
3	Ready	3	Pink	4	4	
4	Start	4				
5	+ 15 V ± 10% (UP), max. 100 mA	5	Gray	3	3	
6	+5 V ± 5% (UP), max. 100 mA	6	Brown/Green	2	2	Brown
7	Battery warning	7	Gray			
8	0 V (UN)	8	White/Green	1	1	White
9	Trigger signal	9	Green	5	5	Green
10	Trigger signal[a]	10	Yellow	6	6	Yellow
11 to 15	Do not assign	11 to 15				
Hsg.	External shield	Hsg.	External shield	Hsg.		

a. Stylus at rest means logic level HIGH.

Pin layout for TS 440, TS 640 with SE 640:

MC 42x(B)		AK 310 197-xx			SE 640		TS 440, TS 640
Female	**Assignment**	**Male**	**Color**	**Female**	**Male**	**Color**	
1	0 V (internal shield)	1	White/ Brown	7			
2	Do not assign						
3	Ready	3	Gray	5	5	Gray	
4	Start	4	Yellow	3	3		
5	+ 15 V ± 10% (UP), max. 100 mA	5	Brown	2	2	Brown	
6	+5 V ± 5% (UP), max. 100 mA						
7	Battery warning	7	Blue	6	6	Blue	
8	0 V (UN)	8	White	1	1	White	
9	Trigger signal						
10	Trigger signal[a]	10	Green	4	4	Green	
11 to 15	Do not assign						
Hsg.	External shield	Hsg.	External shield	Hsg.	Hsg.		

a. Stylus at rest means logic level HIGH.

Pin layout for TS 440, TS 640 with SE 540:

MC 42x(B)		AK 310 197-xx			AK 517 375-xx			SE 540
Female	**Assignment**	**Male**	**Color**	**Female**	**Male**	**Color**	**Female**	
1	0 V (internal shield)	1	White/ Brown	7	7	Internal shield	7	**TS 440, TS 640**
2	Do not assign							
3	Ready	3	Gray	5	5	Gray	5	
4	Start	4	Yellow	3	3	Yellow	3	
5	+ 15 V ± 10% (UP), max. 100 mA	5	Brown	2	2	Brown	2	
6	+5 V ± 5% (UP), max. 100 mA							
7	Battery warning	7	Blue	6	6	Blue	6	
8	0 V (UN)	8	White	1	1	White	1	
9	Trigger signal							
10	Trigger signal[a]	10	Green	4	4	Green	4	
11 to 15	Do not assign							
Hsg.	External shield	Hsg.	External shield	Hsg.	Hsg.	External shield	Hsg.	

a. Stylus at rest means logic level HIGH.

Pin layout for TS 632 with EA 632:

MC 422		AK 310 197-xx			EA 632 346 322-xx		TS 632
Female	**Assignment**	**Male**	**Color**	**Female**	**Male**	**Color**	
1	0 V (internal shield)	1	White/ Brown	7	7	White/ Brown	
2	Do not assign						
3	Ready	3	Gray	5	5	Gray	
4	Start	4	Yellow	3	3		
5	+ 15 V ± 10% (UP), max. 100 mA	5	Brown	2	2	Brown	
6	+5 V ± 5% (UP), max. 100 mA						
7	Battery warning	7	Blue	6	6	Blue	
8	0 V (UN)	8	White	1	1	White	
9	Trigger signal						
10	Trigger signal[a]	10	Green	4	4	Green	
11 to 15	Do not assign						
Hsg.	External shield	Hsg.	External shield	Hsg.	Hsg.		

a. Stylus at rest means logic level HIGH.

Two EA 652 can be connected to the MC 422 via the APE 652. This is necessary for example on large machines or on machines with swivel heads.

Pin layout for TS 632 with 2 EA 652 via the APE 652:

MC 422	Adapter cable 310 197-xx	APE 652 354 656-xx		VB 336 157-xx			EA 652 346 323-xx		TS 632
		Male	Female	Male	Color	Female	Male	Color	
Assignment see above!		7	7	7	White/ Brown	7	7	White/ Brown	
		5	5	5	Gray	5	5	Gray	
		3	3	3	Yellow	3	3		
		2	2	2	Brown	2	2	Brown	
		6	6	6	Blue	6	6	Blue	
		1	1	1	White	1	1	White	
		4	4	4	Green	4	4	Green	
		Hsg.	Hsg.	Hsg.	External shield	Hsg.	Hsg.		

X13: Connection of the touch probe for tool measurement

Pin layout on the MC 422(B):

Note

The interface complies with the requirements of EN 50 178 for "low voltage electrical separation."

Pin layout on adapter cable and touch probe:

MC 42x(B)		AK 335 332-xx			TT 130 296 537-xx	
Female	Assignment	Male	Color	Female	Male	Color
1	Ready	1	Pink	6	6	
2	0 V (UN)	2	White/Green	1	1	White
3	Do not assign	3				
4	+15 V ±5% (UP)	4	Brown/Green	2	2	Brown
5	Do not assign	5		5	5	
6	Do not assign	6				
7	+ 5 V ± 5% (UP)	7				
8	Trigger signal	8	Brown	3	3	Green
9	Trigger signal[a]	9	Green	4	4	Yellow
–	–	–	–	7	7	
Hsg.	External shield	Hsg.	External shield	Hsg.	Hsg.	

a. Stylus at rest means logic level HIGH.

X15 to X20,
X80 to X87:
speed encoder
1 Vpp

CC 42x		AK 289 440-xx				VB 336 847-xx		
Male	**Assignment**	**Female**	**Color**	**Female**		**Male**	**Color**	**Female**
1	+5 V (UP)	1	Brown/Green	10	Line drop compensator 370 226-01, if required	10	Brown/Green	10
2	0 V (UN)	2	White/Green	7		7	White/Green	7
3	A+	3	Green/Black	1		1	Green/Black	1
4	A–	4	Yellow/Black	2		2	Yellow/Black	2
5	0 V							
6	B+	6	Blue/Black	11		11	Blue/Black	11
7	B–	7	Red/Black	12		12	Red/Black	12
8	0 V	8	Internal shield	17		17	Internal shield	17
9	Do not assign							
10	Do not assign							
11	Do not assign							
12	Do not assign							
13	Temperature +	13	Yellow	8		8	Yellow	8
14	+5 V (sensor)	14	Blue	16		16	Blue	16
15	Do not assign							
16	0 V (sensor)	16	White	15		15	White	15
17	R+	17	Red	3		3	Red	3
18	R–	18	Black	13		13	Black	13
19	C+	19	Green	5		5	Green	5
20	C–	20	Brown	6		6	Brown	6
21	D+	21	Gray	14		14	Gray	14
22	D–	22	Pink	4		4	Pink	4
23	Do not assign							
24	0 V							
25	Temperature –	25	Violet	9		9	Violet	9
Hsg.	Housing	Hsg.	External shield	Hsg.		Hsg.	External shield	Hsg.

Note

The interface complies with the requirements of EN 50 178 for “low voltage electrical separation.”

X15 to X20,
X80 to X87:
Speed encoder with EnDat interface

CC 42x		**AK 336 376-xx**				**VB 340 302-xx**		
Male	**Assignment**	**Female**	**Color**	**Female**		**Male**	**Color**	**Female**
1	+5 V (UP)	1	Brown/Green	10	Line drop compensator 370 224-01, if required	10	Brown/Green	10
2	0 V (UN)	2	White/Green	7		7	White/Green	7
3	A+	3	Green/Black	1		1	Green/Black	1
4	A–	4	Yellow/Black	2		2	Yellow/Black	2
5	0 V							
6	B+	6	Blue/Black	11		11	Blue/Black	11
7	B–	7	Red/Black	12		12	Red/Black	12
8	0 V	8	Internal shield	17		17	Internal shield	17
9	Do not assign							
10	Clock	10	Green	5		5	Green	5
11	Do not assign							
12	Clock	12	Brown	14		14	Brown	14
13	Temperature +	13	Yellow	8		8	Yellow	8
14	+5 V (sensor)	14	Blue	16		16	Blue	16
15	data	15	Red	3		3	Red	3
16	0 V (sensor)	16	White	15		15	White	15
17	Do not assign							
18	Do not assign							
19	Do not assign							
20	Do not assign							
21	Do not assign							
22	Do not assign							
23	data	23	Black	13		13	Black	13
24	0 V							
25	Temperature –	25	Violet	9		9	Violet	9
Hsg.	Housing	Hsg.	External shield	Hsg.		Hsg.	External shield	Hsg.

Note

The interface complies with the requirements of EN 50 178 for “low voltage electrical separation.”

Pin layout (for the LC or RCN):

CC 42x		**AK 336 376-xx**				**AK 369 124-xx AK 369 129-xx**	
Male	**Assignment**	**Female**	**Color**	**Female**		**Male**	**Color**
1	+5 V (UP)	1	Brown/Green	10	Line drop compensator 368 210-02	7	Brown/Green
2	0 V (UN)	2	White/Green	7		10	White/Green
3	A+	3	Green/Black	1		15	Green/Black
4	A–	4	Yellow/Black	2		16	Yellow/Black
5	0 V						
6	B+	6	Blue/Black	11		12	Blue/Black
7	B–	7	Red/Black	12		13	Red/Black
8	0 V	8	Internal shield	17		11	Internal shield
9	Do not assign						
10	Clock	10	Green	5		8	Violet
11	Do not assign						
12	Clock	12	Brown	14		9	Yellow
13	Temperature +	13	Yellow	8			
14	+5 V (sensor)	14	Blue	16		1	Blue
15	data	15	Red	3		14	Gray
16	0 V (sensor)	16	White	15		4	White
17	Do not assign						
18	Do not assign						
19	Do not assign						
20	Do not assign						
21	Do not assign						
22	Do not assign						
23	data	23	Black	13		17	Pink
24	0 V						
25	Temperature –	25	Violet	9			
Hsg.	Housing	Hsg.	External shield	Hsg.		Hsg.	External shield
					1		
					2 temperature+		
					3 temperature+		
					4		

Note

The interface complies with the requirements of EN 50 178 for "low voltage electrical separation."

Pin layout (for the LC or RCN):

CC 42x		AK 336 376-xx			AK 369 502-xx			AK 369 124-xx AK 369 129-xx or RCN	
Male	**Assignment**	**Female**	**Color**	**Female**	**Male**	**Color**	**Female**	**Male**	**Color**
1	+5 V (UP)	1	Brown/ Green	10	10	Brown/ Green	7	7	Brown/ Green
2	0 V (UN)	2	White/ Green	7	7	White/ Green	10	10	White/ Green
3	A+	3	Green/ Black	1	1	Green/ Black	15	15	Green/ Black
4	A–	4	Yellow/ Black	2	2	Yellow/ Black	16	16	Yellow/ Black
5	0 V								
6	B+	6	Blue/ Black	11	11	Blue/ Black	12	12	Blue/Black
7	B–	7	Red/ Black	12	12	Red/ Black	13	13	Red/Black
8	0 V	8	Internal shield	17	17	Internal shield	11	11	Internal shield
9	Do not assign								
10	Clock	10	Green	5	5	Violet	8	8	Violet
11	Do not assign								
12	Clock	12	Brown	14	14	Yellow	9	9	Yellow
13	Temperature +	13	Yellow	8	8	Green	5		
14	+5 V (sensor)	14	Blue	16	16	Blue	1	1	Blue
15	data	15	Red	3	3	Gray	14	14	Gray
16	0 V (sensor)	16	White	15	15	White	4	4	White
17	Do not assign								
18	Do not assign								
19	Do not assign								
20	Do not assign								
21	Do not assign								
22	Do not assign								
23	data	23	Black	13	13	Pink	17	17	Pink
24	0 V								
25	Temperature –	25	Violet	9					
Hsg.	Housing	Hsg.	External shield	Hsg.	Hsg.	External shield	Hsg.	Hsg.	External shield

Note

The interface complies with the requirements of EN 50 178 for “low voltage electrical separation.”

X23:
Handwheel input

D-sub connection (female) 9-pin	Assignment
1	CTS
2	0 V
3	RTS
4	+12 V
5	Do not assign
6	DTR
7	TxD
8	RxD
9	DSR
Housing	External shield

Note

The interface complies with the requirements of EN 50 178 for "low voltage electrical separation."

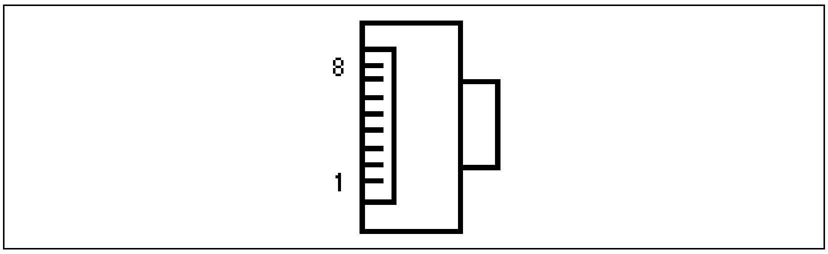
X26:
Ethernet interface
RJ45 port

Maximum data transfer rate:
Approx. 2 to 5 Mbps (depending on file type and network utilization)

Maximum cable length, shielded: 100 m

RJ45 connection (female) 8-pin	Assignment
1	TX+
2	TX–
3	REC+
4	Do not assign
5	Do not assign
6	REC –
7	Do not assign
8	Do not assign
Housing	External shield

Face of the connector:



Note

The interface complies with the requirements of EN 50 178 for "low voltage electrical separation."

Meanings of the LEDs on the Ethernet data interface X26:

LED	Condition	Meaning
Green	Blinking	Interface active
	Off	Interface inactive

LED	Condition	Meaning
Yellow	On	100 Mb net
	Off	10 Mb net

X27: RS-232-C/V.24 data interface to HEIDENHAIN HeROS operating system

> **Note**
>
> The interface complies with the requirements of EN 50 178 for "low voltage electrical separation."

25-pin adapter block:

MC 42x(B)		VB 365 725-xx			Adapter block 310 085-01		VB 274 545-xx		
Male	**Assignment**	**Female**	**Color**	**Female**	**Male**	**Female**	**Male**	**Color**	**Female**
1	Do not assign	1		1	1	1	1	WH/BN	1
2	RXD	2	Yellow	3	3	3	3	Yellow	2
3	TXD	3	Green	2	2	2	2	Green	3
4	DTR	4	Brown	20	20	20	20	Brown	8
5	Signal GND	5	Red	7	7	7	7	Red	7
6	DSR	6	Blue	6	6	6	6		6
7	RTS	7	Gray	4	4	4	4	Gray	5
8	CTS	8	Pink	5	5	5	5	Pink	4
9	Do not assign	9					8	Violet	20
Hsg.	External shield	Hsg.	Ext. shield	Hsg.	Hsg.	Hsg.	Hsg.	Ext. shield	Hsg.

9-pin adapter block:

MC 42x(B)		VB 355 484-xx			Adapter block 363 987-02		VB 366 964-xx		
Male	**Assignment**	**Female**	**Color**	**Male**	**Female**	**Male**	**Female**	**Color**	**Female**
1	Do not assign	1	Red	1	1	1	1	Red	1
2	RXD	2	Yellow	2	2	2	2	Yellow	3
3	TXD	3	WH	3	3	3	3	WH	2
4	DTR	4	Brown	4	4	4	4	Brown	6
5	Signal GND	5	Black	5	5	5	5	Black	5
6	DSR	6	Violet	6	6	6	6	Violet	4
7	RTS	7	Gray	7	7	7	7	Gray	8
8	CTS	8	WH/GN	8	8	8	8	WH/GN	7
9	Do not assign	9	Green	9	9	9	9	Green	9
Hsg.	External shield	Hsg.	External shield	Hsg.	Hsg.	Hsg.	Hsg.	External shield	Hsg.

X28: RS-422/V.11 data interface to HEIDENHAIN HeROS operating system

MC 42x(B)		VB 355 484-xx			Adapter block 363 987-01	
Female	Assignment	Male	Color	Female	Male	Female
1	RTS	1	Red	1	1	1
2	DTR	2	Yellow	2	2	2
3	RXD	3	WH	3	3	3
4	TxD	4	Brown	4	4	4
5	0 V	5	Black	5	5	5
6	CTS	6	Violet	6	6	6
7	DSR	7	Gray	7	7	7
8	RxD	8	WH/GN	8	8	8
9	TxD	9	Green	9	9	9
Hsg.	External shield	Hsg.	External shield	Hsg.	Hsg.	Hsg.

Note

The interface complies with the requirements of EN 50 178 for "low voltage electrical separation."

X30: Reference signal spindle

Connecting terminal	Assignment
1	+24 V
2	0 V

X34: Power supply for control is ready

The control-is-ready signal output is powered by 24 Vdc provided by the UE 2xx B inverter or the UV1xx power supply unit. The voltage is connected with terminal X34.

Connecting terminal X34	Assignment	Connection when using a HEIDENHAIN inverter
1	+24 V	X72/1
2	0 V	X72/2

X41:
PLC outputs
on the MC 42x(B)

MC 42x(B)		**VB Id. Nr. 244 005-xx** **Id. Nr. 263 954-xx**	
D-sub connctn. (female) 37-pin	**Assignment**	**D-sub connctr. (male) 37-pin**	
Supply via X44, pin 3; can be switched off with EMERGENCY STOP			
1	O0[a]	1	Gray/Red
2	O1a	2	Brown/Black
3	O2 a	3	White/Black
4	O3a	4	Green/Black
5	O4a	5	Brown/Red
6	O5a	6	White/Red
7	O6a	7	White/Green
8	O7a	8	Red/Blue
9	O8	9	Yellow/Red
10	O9	10	Gray/Pink
11	O10	11	Black
12	O11	12	Pink/Brown
13	O12	13	Yellow/Blue
14	O13	14	Green/Red
15	O14	15	Yellow
16	O15	16	Red
Supply via X44, pin 2; can be switched off with EMERGENCY STOP			
17	O16	17	Gray
18	O17	18	Blue
19	O18	19	Pink
20	O19	20	White/Gray
21	O20	21	Yellow/Gray
22	O21	22	Green/Red
23	O22	23	White/Pink
24	O23	24	Gray/Green
Supply via X44, pin 1; **cannot** be switched off with EMERGENCY STOP			
25	O24	25	Yellow/Brown
26	O25	26	Gray/Brown
27	O26	27	Yellow/Black
28	O27	28	White/Yellow
29	O28	29	Gray/Blue
30	O29	30	Pink/Blue
31	O30	31	Pink/Red
32, 33	Do not assign	32	BN/BL, PK/GN
34	Control is ready	34	Brown
35, 36, 37	Do not assign	35	YL/PK, VI, WH
Housing	External shield	Housing	External shield

a. Also via X46 (PLC inputs/outputs)

X42:
PLC inputs
on the MC 422x(B)

MC 42x(B)		Connecting cable Id. Nr. 244 005-xx, Id. Nr. 263 954-xx	
D-sub connctn. (female) 37-pin	**Assignment**	**D-sub connectn. (male) 37-pin**	
1	I0	1	Gray/Red
2	I1	2	Brown/Black
3	I2	3	White/Black
4	I3 Control-is-ready signal acknowledgement	4	Green/Black
5	I4	5	Brown/Red
6	I5	6	White/Red
7	I6	7	White/Green
8	I7	8	Red/Blue
9	I8	9	Yellow/Red
10	I9	10	Gray/Pink
11	I10	11	Black
12	I11	12	Pink/Brown
13	I12	13	Yellow/Blue
14	I13	14	Green/Blue
15	I14	15	Yellow
16	I15	16	Red
17	I16	17	Gray
18	I17	18	Blue
19	I18	19	Pink
20	I19	20	White/Gray
21	I20	21	Yellow/Gray
22	I21	22	Green/Red
23	I22	23	White/Pink
24	I23	24	Gray/Green
25	I24	25	Yellow/Brown
26	I25	26	Gray/Brown
27	I26	27	Yellow/Black
28	I27	28	White/Yellow
29	I28	29	Gray/Blue
30	I29	30	Pink/Blue
31	I30	31	Pink/Red
32	I31	32	Brown/Blue
33	I32 Drive enable	33	Pink/Green
34	Do not assign	34	Brown
35	0 V (PLC) test output; do not assign	35	Yellow/Pink
36	0 V (PLC) test output; do not assign	36	Violet
37	0 V (PLC) test output; do not assign	37	White
Housing	External shield	Housing	External shield

X44:
PLC supply voltage

Pin layout on the MC 422(B):

Connection terminal	Assignment	PLC outputs
1	+24 V cannot be switched off via EMERGENCY STOP	O24 to O30
2	+24 V can be switched off via EMERGENCY STOP	O16 to O23
3		O0 to O15
4	0 V	

☞ **Note**

If the +24-V power supply (which cannot be shut off via emergency stop) is missing at X44, the error message **Supply voltage missing at X44** appears.

X45:
iTNC keyboard unit

MC 42x(B)		VB Id. Nr. 263 954-xx			TE
D-sub connctn. (female) 37-pin	**Assignment**	**D-sub connctr. (male) 37-pin**		**D-sub cnnctr. (female) 37-pin**	**X2: D-sub connctn. (male) 37-pin**
1	RL0	1	Gray/Red	1	1
2	RL1	2	Brown/Black	2	2
3	RL2	3	White/Black	3	3
4	RL3	4	Green/Black	4	4
5	RL4	5	Brown/Red	5	5
6	RL5	6	White/Red	6	6
7	RL6	7	White/Green	7	7
8	RL7	8	Red/Blue	8	8
9	RL8	9	Yellow/Red	9	9
10	RL9	10	Gray/Pink	10	10
11	RL10	11	Black	11	11
12	RL11	12	Pink/Brown	12	12
13	RL12	13	Yellow/Blue	13	13
14	RL13	14	Green/Blue	14	14
15	RL14	15	Yellow	15	15
16	RL15	16	Red	16	16
17	RL16	17	Gray	17	17
18	RL17	18	Blue	18	18
19	RL18	19	Pink	19	19
20	SL0	20	White/Gray	20	20
21	SL1	21	Yellow/Gray	21	21
22	SL2	22	Green/Red	22	22
23	SL3	23	White/Pink	23	23
24	SL4	24	Gray/Green	24	24
25	SL5	25	Yellow/ Brown	25	25
26	SL6	26	Gray/Brown	26	26
27	SL7	26	Yellow/Black	27	27
28	RL19	28	White/Yellow	28	28
29	RL20	29	Gray/Blue	29	29
30	Do not assign	30	Pink/Blue	30	30
31	RL21	31	Pink/Red	31	31
32	RL22	32	Brown/Blue	32	32
33	RL23	33	Pink/Green	33	33
34	Spindle override (wiper)	34	Brown	34	34
35	Feed-rate override (wiper)	35	Yellow/Pink	35	35
36	+5 V override potentiometer	36	Violet	36	36
37	0 V override potentiometer	37	White	37	37
Housing	External shield	Housing	External shield	Housing	Housing

X46: Machine operating panel

PLC inputs I128 to I152 and PLC outputs O0 to O7 are on connection X46 of the machine operating panel. The reference potential (PLC) for outputs O0 to O7 is connected to pins 34 and 35.

Pin layout on the MC 42x(B), connecting cables and machine operating panel:

Caution

PLC inputs I128 to I152 must be switched only with the power supply from pins 36 and 37, since this power supply is internally protected for this purpose (PLC supply voltage from X44 connection 2).

MC 42x(B), X46		VB Id. Nr. 263 954-xx			MB 420, X1	
D-sub connctn. (female) 37-pin	Assignment	D-sub connctr. (male) 37-pin		D-sub connctr. (female) 37-pin	D-sub connctn. (male) 37-pin	Key
1	I128	1	Gray/Red	1	1	X –
2	I129	2	Brown/Black	2	2	Y –
3	I130	3	White/Black	3	3	Z–
4	I131	4	Green/Black	4	4	IV –
5	I132	5	Brown/Red	5	5	V –
6	I133	6	White/Red	6	6	X +
7	I134	7	White/Green	7	7	Y +
8	I135	8	Red/Blue	8	8	Z +
9	I136	9	Yellow/Red	9	9	IV +
10	I137	10	Gray/Pink	10	10	V +
11	I138	11	Black	11	11	Tool change
12	I139	12	Pink/Brown	12	12	Unlock tool
13	I140	13	Yellow/Blue	13	13	Menu selection
14	I141	14	Green/Blue	14	14	Unlock door
15	I142	15	Yellow	15	15	Chip removal
16	I143	16	Red	16	16	Spindle on
17	I144	17	Gray	17	17	Spindle off
18	I145	18	Blue	18	18	Coolant
19	I146	19	Pink	19	19	NC start
20	I147	20	White/Gray	20	20	NC stop
21	I148	21	Yellow/Gray	21	21	Rapid traverse
22	I149	22	Green/Red	22	22	Retract axis
23	I150	23	White/Pink	23	23	Rinse water jet
24	I151	24	Gray/Green	24	24	Via X3
25	I152	25	Yellow/Brown	25	25	Via X3
26	O0[a]	26	Gray/Brown	26	26	Via X4
27	O1a	26	Yellow/Black	27	27	Via X4
28	O2 a	28	White/Yellow	28	28	Via X4
29	O3a	29	Gray/Blue	29	29	Via X4
30	O4a	30	Pink/Blue	30	30	Via X4
31	O5a	31	Pink/Red	31	31	Via X4
32	O6a	32	Brown/Blue	32	32	Via X4
33	O7a	33	Pink/Green	33	33	Via X4
34, 35	0 V (PLC)	34, 35	BN, YL/PK	34, 35	34, 35	
36, 37	+24 V (PLC)	36	VI, WH	36, 37	36,37	

MC 42x(B), X46		VB Id. Nr. 263 954-xx			MB 420, X1	
D-sub connctn. (female) 37-pin	Assignment	D-sub connctr. (male) 37-pin		D-sub connctr. (female) 37-pin	D-sub connctn. (male) 37-pin	Key
Housing	Ext. shield	Housing	External shield	Housing	Housing	

a. Also via X41 (PLC outputs on the MC 42x(B))

X47: PLC expansion for PL 4xx B on the MC 422 (B)

MC 42x(B)		Conn. cable Id. Nr. 289 111-xx / Id. Nr. 317 788-xx			1st PL 410B/PL405B	
D-sub connctn. (male) 25-pin	Assignment	D-sub connctr. (female) 25-pin		D-sub connctr. (male) 25-pin	X1 D-sub connctn. (female) 25-pin	Assignment
1	0 V	1	Brown, Yellow, Pink, Red, Violet	1	1	0 V
2	0 V	2	Red/Blue, Brown/Green, Yellow/Brown, Gray/ Brown, Pink/Brown	2	2	0 V
3	0 V	3	BN/BL, BN/RD, BN/BK, YL/GY, YL/PK	3	3	0 V
4	Do not assign	4	Gray/Green	4	4	Serial IN 2
5	Address 6	5	White/Green	5	5	Address 6
6	INTERRUPT	6	Pink/Green	6	6	INTERRUPT
7	RESET	7	Green/Blue	7	7	RESET
8	WRITE EXTERN	8	White/Blue	8	8	WRITE EXTERN
9	WRITE EXTERN	9	White/Red	9	9	WRITE EXTERN
10	Address 5	10	Gray/Pink	10	10	Address 5
11	Address 3	11	Blue	11	11	Address 3
12	Address 1	12	Green	12	12	Address 1
13	Do not assign	13		13	13	Do not assign
14	PCB identifier 3	14	Yellow/Blue, Pink/Blue, Yellow/Black	14	14	+12 V
15	PCB identifier 4	15	Yellow/Red, Gray/Red, Pink/Red	15	15	+12 V
16	Do not assign	16	Gray/Blue	16	16	PCB identifier 2
17	Do not assign	17	Green/Black	17	17	PCB identifier 1
18	Address 7	18	White/Yellow	18	18	Address 7
19	Serial IN 1	19	White/Black	19	19	Serial IN 1
20	EM. STOP	20	Green/Red	20	20	EM. STOP
21	Serial OUT	21	White/Gray	21	21	Serial OUT
22	Serial OUT	22	White/Pink	22	22	Serial OUT
23	Address 4	23	Black	23	23	Address 4
24	Address 2	24	Gray	24	24	Address 2
25	Address 0	25	White	25	25	Address 0
Housing	External shield	Housing	External shield	Housing	Housing	External shield

X47:
PLC expansion for
PL 510 on the
MC 422(B)

MC 42x(B)		**VB Id. Nr. 371 045-xx**			**1st PL 510**	
D-sub connctn. (male) 25-pin	**Assignment**	**D-sub connctr. (female) 25-pin**		**D-sub connctr. (male) 26-pin**	**X1 D-sub connctn. (female) 26-pin**	**Assignment**
1	0 V	1	Black	1	1	0 V
2	0 V	2	Violet	2	2	0 V
3	0 V	3		3	3	0 V
4	Do not assign	4		4	4	Do not assign
5	Address 6	5	Yellow	5	5	Address 6
6	INTERRUPT	6	Blue	6	6	INTERRUPT
7	RESET	7	Red	7	7	RESET
8	WRITE EXTERN	8	Gray	8	8	WRITE EXTERN
9	WRITE EXTERN	9	Pink	9	9	WRITE EXTERN
10	Address 5	10	Green	10	10	Address 5
11	Address 3	11	White	11	11	Address 3
12	Address 1	12	Brown	12	12	Address 1
13	Do not assign	13		13	13	Do not assign
14	+5 V (output)	14	White/Blue	14	14	
15	+5 V (feedback)	15	Brown/Blue	15	15	
16	Do not assign	16	White/Pink	16	16	PCB identifier. 2
17	Do not assign	17	Pink/Brown	17	17	PCB identifier 1
18	Address 7	18	Brown/Green	18	18	Address 7
19	Serial IN 1	19	White/Gray	19	19	Serial IN 1
20	EM. STOP	20	Gray/Brown	20	20	EM. STOP
21	Serial OUT	21	White/Yellow	21	21	Serial OUT
22	Serial OUT	22	Yellow/Brown	22	22	Serial OUT
23	Address 4	23	White/Green	23	23	Address 4
24	Address 2	24	Gray/Pink	24	24	Address 2
25	Address 0	25	Red/Blue	25	25	Address 0
				26	26	
Housing	External shield	Housing	External shield	Housing	Housing	External shield

X48: Analog input (PLC) on the MC 42x(B)

Caution

Remember to connect the analog inputs with the correct polarity!

D-sub connection (female) 25-pin	Assignment
1	I1+ Constant current for Pt 100
2	I1– Constant current for Pt 100
3	U1+ Measuring input for Pt 100
4	U1– Measuring input for Pt 100
5	I2+ Constant current for Pt 100
6	I2– Constant current for Pt 100
7	U2+ Measuring input for Pt 100
8	U2– Measuring input for Pt 100
9	I3+ Constant current for Pt 100
10	I3– Constant current for Pt 100
11	U3+ Measuring input for Pt 100
12	U3– Measuring input for Pt 100
13	Do not assign
14	Analog input 1: –10 V to +10 V
15	Analog input 1: 0 V (reference potential)
16	Analog input 2 2: –10 V to +10 V
17	Analog input 2: 0 V (reference potential)
18	Analog input 3: –10 V to +10 V
19	Analog input 3: 0 V (reference potential)
20 to 25	Do not assign
Housing	External shield

Note

The interface complies with the requirements of EN 50 178 for “low voltage electrical separation.”

X49:
BF 120 flat-panel display

MC 42x(B), X49		VB Id. Nr. 340 300-xx			BF 120, X2
D-sub connectn. (female) 62-pin	**Assign-ment**	**D-sub connctr. (male) 62-pin**		**D-sub connector (female) 62-pin**	**D-sub connctn. (male) 62-pin**
1	0 V	1	Gray/Black	1	1
2	CLK.P	2	Brown/Black	2	2
3	HSYNC	3	Green/Black	3	3
4	BLANK	4	Orange/Black	4	4
5	VSYNC	5	Blue/Black	5	5
6	0 V	6	Green/White	6	6
7	R0	7	Orange/White	7	7
8	R1	8	Brown/White	8	8
9	R2	9	Gray/White	9	9
10	R3	10	Blue/White	10	10
11	0 V	11	Violet/White	11	11
12	G0	12	Violet/Brown	12	12
13	G1	13	Violet/Green	13	13
14	G2	14	Violet/Orange	14	14
15	G3	15	Violet/Blue	15	15
16	0 V	16	Red/Gray	16	16
17	B0	17	Red/Brown	17	17
18	B1	18	Yellow/Gray	18	18
19	B2	19	Yellow/Brown	19	19
20	B3	20	Yellow/Green	20	20
21	0 V	21	Free	21	21
22	0 V	22	Black/Gray	22	22
23	CLP.P	23	Black/Brown	23	23
24	HSYNC	24	Black/Green	24	24
25	BLANK	25	Black/Orange	25	25
26	VSYNC	26	Black/Blue	26	26
27	0 V	27	White/Green	27	27
28	R0	28	White/Orange	28	28
29	R1	29	White/Brown	29	29

MC 42x(B), X49		VB Id. Nr. 340 300-xx			BF 120, X2
D-sub connectn. (female) 62-pin	**Assign-ment**	**D-sub connctr. (male) 62-pin**		**D-sub connector (female) 62-pin**	**D-sub connctn. (male) 62-pin**
30	R2	30	White/Gray	30	30
31	R3	31	White/Blue	31	31
32	0 V	32	Gray/Violet	32	32
33	G0	33	Brown/Violet	33	33
34	G1	34	Green/Violet	34	34
35	G2	35	Orange/Violet	35	35
36	G3	36	Blue/Violet	36	36
37	0 V	37	Gray/Red	37	37
38	B0	38	Brown/Red	38	38
39	B1	39	Gray/Yellow	39	39
40	B2	40	Brown/Yellow	40	40
41	B3	41	Green/Yellow	41	41
42	0 V	42	Free	42	42
43	DISP. LOW	43	Red/Blue	43	43
44	DISP. LOW	44	Blue/Red	44	44
45	DISP.ON	45	Red/Orange	45	45
46	DISP.ON	46	Orange/Red	46	46
47	C0	47	Green/Red	47	47
48	C1	48	Red/Green	48	48
49	C2	49	Orange/Yellow	49	49
50	C3	50	Yellow/Orange	50	50
51	C4	51	Yellow/Blue	51	51
52	C5	52	Blue/Yellow	52	52
53 to 56	Do not assign	53 to 56	Free	53 to 56	53 to 56
57 to 62	0 V	57 to 62	Free	57 to 62	57 to 62
Housing		Housing		Housing	Housing

X51 to X64: PWM-output

Ribbon cable connector 20-pin	Assignment
1a	PWM U1
1b	0 V U1
2a	PWM U2
2b	0 V U2
3a	PWM U3
3b	0 V U3
4a	SH2
4b	0 V (SH2)
5a	SH1
5b	0 V (SH1)
6a	+Iactl !
6b	–Iactl 1
7a	0 V (analog)
7b	+IACT 2
8a	–Iactl 2
8b	0 V (analog)
9a	BRK
9b	Do not assign
10a	ERR
10b	RDY

☞ **Note**

The interface complies with the requirements of EN 50 178 for “low voltage electrical separation.”

X69:
NC power supply and control signals, see X169

Ribbon cnnctr., 50-pin	Assignment	Ribbon cnnctr., 50-pin	Assignment
1a to 5b	+ 5 V	16b	GND
6a to 7b	+12 V	17a	RDY.PS
8a	+5 V (low-voltage separation)	17b	GND
8b	0 V (low-voltage separation)	18a	ERR.ILEAK
9a	+15 V	18b	GND
9b	–15 V	19a	PF.PS.AC (only UV 120, UV 140, UV 150, UR 2xx)
10a	UZAN	19b	GND
10b	0 V	20a	Do not assign
11a	IZAN	20b	GND
11b	0 V	21a	Do not assign
12a	RES.PS	21b	GND
12b	0 V	22a	Do not assign
13a	PF.PS.ZK	22b	GND
13b	GND	23a	Reserved (SDA)
14a	ERR.UZ.GR	23b	GND
14b	GND	24a	Reserved (SLC)
15a	ERR.IZ.GR	24b	GND
15b	GND	25a	RES.LE
16a	ERR.TMP	25b	GND

X74:
5-V connection of UV 105

Wire color of 5-V connection	5-V terminal on CC 42x
Black	0V
Red	+ 5 V

X127:
RS-232-C/V.24
data interface
to Windows 2000
operating system

Note

The interface complies with the requirements of EN 50 178 for “low voltage electrical separation.”

25-pin adapter block:

MC 42x(B)		Connecting cable 365 725-xx			Adapter block 310 085-01		Connecting cable 274 545-xx		
Male	**Assignment**	**Female**	**Color**	**Female**	**Male**	**Female**	**Male**	**Color**	**Female**
1	Do not assign	1		1	1	1	1	WH/BN	1
2	RXD	2	Yellow	3	3	3	3	Yellow	2
3	TXD	3	Green	2	2	2	2	Green	3
4	DTR	4	Brown	20	20	20	20	Brown	8
5	Signal GND	5	Red	7	7	7	7	Red	7
6	DSR	6	Blue	6	6	6	6		6
7	RTS	7	Gray	4	4	4	4	Gray	5
8	CTS	8	Pink	5	5	5	5	Pink	4
9	Do not assign	9					8	Violet	20
Hsg.	External shield	Hsg.	External shield	Hsg.	Hsg.	Hsg.	Hsg.	External shield	Hsg.

9-pin adapter block:

MC 42x(B)		Conn. cable VB 355 484-xx			Adapter block 363 987-02		Connecting cable 366 964-xx		
Male	**Assignment**	**Female**	**Color**	**Male**	**Female**	**Male**	**Female**	**Color**	**Female**
1	Do not assign	1	Red	1	1	1	1	Red	1
2	RXD	2	Yellow	2	2	2	2	Yellow	3
3	TXD	3	WH	3	3	3	3	WH	2
4	DTR	4	Brown	4	4	4	4	Brown	6
5	Signal GND	5	Black	5	5	5	5	Black	5
6	DSR	6	Violet	6	6	6	6	Violet	4
7	RTS	7	Gray	7	7	7	7	Gray	8
8	CTS	8	WH/GN	8	8	8	8	WH/GN	7
9	Do not assign	9	Green	9	9	9	9	Green	9
Hsg.	External shield	Hsg.	External shield	Hsg.	Hsg.	Hsg.	Hsg.	External shield	Hsg.

X128: RS-422/V.11 data interface to Windows 2000 operating system

MC 42x(B)		Connecting cable 355 484-xx			Adapter block 363 987-01	
Female	Assignment	Male	Color	Female	Male	Female
1	RTS	1	Red	1	1	1
2	DTR	2	Yellow	2	2	2
3	RXD	3	WH	3	3	3
4	TxD	4	Brown	4	4	4
5	0 V	5	Black	5	5	5
6	CTS	6	Violet	6	6	6
7	DSR	7	Gray	7	7	7
8	RxD	8	WH/GN	8	8	8
9	TxD	9	Green	9	9	9
Hsg.	External shield	Hsg.	External shield	Hsg.	Hsg.	Hsg.

Note

The interface complies with the requirements of EN 50 178 for “low voltage electrical separation.”

X141, X142: USB connection

USB connection (female) 4-pin	Assignment
1	+ 5 V
2	USBP–
3	USBP+
4	GND

USB hub

The power supply for the USB hub must comply with EN 50 178, 5.88 requirements for “low voltage electrical separation.”

Connections on the USB hub (368 735-01):

Connection designation	Function
X1	24 V power supply
X32	5-V output
X140	USB input (to the MC 42x(B))
X141	USB output 1
X142	USB output 2
X143	USB output 3
X144	USB output 4

X147:
PLC expansion
for PL 510
on the MC 420

MC 420		**Connecting cable Id. Nr. 371 045-xx**			**First PL 510**	
D-sub connctn. (male) 26-pin	**Assignment**	**D-sub connctr. (female) 26-pin**		**D-sub connctr. (male) 26-pin**	**X1 D-sub connctn. (female) 26-pin**	**Assignment**
1	0 V	1	Black	1	1	0 V
2	0 V	2	Violet	2	2	0 V
3	0 V	3		3	3	0 V
4	Do not assign	4		4	4	Do not assign
5	Address 6	5	Yellow	5	5	Address 6
6	INTERRUPT	6	Blue	6	6	INTERRUPT
7	RESET	7	Red	7	7	RESET
8	WRITE EXTERN	8	Gray	8	8	WRITE EXTERN
9	WRITE EXTERN	9	Pink	9	9	WRITE EXTERN
10	Address 5	10	Green	10	10	Address 5
11	Address 3	11	White	11	11	Address 3
12	Address 1	12	Brown	12	12	Address 1
13	Do not assign	13		13	13	Do not assign
14	+5 V (output)	14	White/Blue	14	14	
15	+5 V (feedback)	15	Brown/Blue	15	15	
16	PCB identifier. 2	16	White/Pink	16	16	PCB identifier. 2
17	PCB identifier 1	17	Pink/Brown	17	17	PCB identifier 1
18	Address 7	18	Brown/Green	18	18	Address 7
19	Serial IN 1	19	White/Gray	19	19	Serial IN
20	EM. STOP	20	Gray/Brown	20	20	EM. STOP
21	Serial OUT	21	White/Yellow	21	21	Serial OUT
22	Serial OUT	22	Yellow/Brown	22	22	Serial OUT
23	Address 4	23	White/Green	23	23	Address 4
24	Address 2	24	Gray/Pink	24	24	Address 2
25	Address 0	25	Red/Blue	25	25	Address 0
26		26		26	26	
Housing	External shield	Housing	External shield	Housing	Housing	External shield

X149
BF 150
flat-panel display

MC 42x(B), X149		**Connecting cable Id. Nr. 353 545-xx**			**BF 150, X2**
D-sub connctn. (female) 44-pin	**Assignment**	**D-sub connctr. (male), 44-pin**		**D-sub connctr. (female), 44-pin**	**D-sub connctn. (male) 44-pin**
1	A7M	1		1	1
2	A6M	2	WH/BN	2	2
3	A5M	3	WH/GN	3	3
4	A4M	4	Red/Gray	4	4
5	A3M			5	5
6	CLKM	6	Red/Blue	6	6
7	A2M	7	WH/OR	7	7
8	A1M	8	Red/Brown	8	8
9	A0M	9	Red/Green	9	9
10	LVDSGND	10	Red/Orange	10	10
11	HWK_GND	11	Orange/Red	11	11
12	HWK0	12	WH/BL	12	12
13	HWK1	13	BL/WH	13	13
14	HWK2	14	WH/GY	14	14
15	HWK3	15	GY/WH	15	15
16	A7P	16		16	16
17	A6P	17	BN/WH	17	17
18	A5P	18	GN/WH	18	18
19	A4P	19	Gray/Red	19	19
20	A3P			20	20
21	CLKP	21	Blue/Red	21	21
22	A2P	22	OR/WH	22	22
23	A1P	23	Brown/Red	23	23
24	A0P	24	Green/Red	24	24
25 to 30	Not assigned			25 to 30	25 to 30
31 to 39	LVDSGND			31 to 39	31 to 39
40 to 44	Not assigned			40 to 44	40 to 44
Housing		Housing		Housing	Housing

X150, X151: Drive-controller enable for axes groups

The connecting terminals X150 and X151 are located on the bottom of the CC 42x.

- X150 controls drive enabling for the axis groups on the first controller board (PWM outputs X51 to X56).
- X151 controls drive enabling for the axis groups on the second controller board (PWM outputs X57 to X60 or X62).

Note

The pin of an axis group must always be wired to the connector on whose PCB the control loop is located.
If an axis group contains control loops located on both PCBs, then the pins of both connectors must be wired.

Terminal X150/X151	Assignment of X150	Assignment of X151
1	+24 V[a] drive controller -enabling for axis group 1	+24 Va; drive controller enabling for axis group 1
2	+24 Va; drive controller enabling for axis group 2	+24 Va; drive controller enabling for axis group 2
3	+24 Va; drive controller enabling for axis group 3	+24 Va; drive controller enabling for axis group 3
4	Only CC 424: +24 Va; drive controller enabling for axis group 4	Only CC 424: +24 Va; drive controller enabling for axis group 4
5	Only CC 424: +24 Va; drive controller enabling for axis group 5	Only CC 424: +24 Va; drive controller enabling for axis group 5
6	Only CC 424: +24 Va; drive controller enabling for axis group 6	Only CC 424: +24 Va; drive controller enabling for axis group 6
7	Reserved, do not assign	Reserved, do not assign
8	Reserved, do not assign	Reserved, do not assign
9	0 V	0 V

a. maximum current consumption 10 mA

X169:
NC supply voltage and control signals, see X69

Ribbon cnnctr., 50-pin	Assignment	Ribbon cnnctr., 50-pin	Assignment
1a to 5b	+ 5 V	16b	GND
6a to 7b	+12 V	17a	RDY.PS
8a	+5 V (low-voltage separation)	17b	GND
8b	0 V (low-voltage separation)	18a	ERR.ILEAK
9a	+15 V	18b	GND
9b	–15 V	19a	PF.PS.AC (only UV 120, UV 140, UV 150, UR 2xx)
10a	UZAN	19b	GND
10b	0 V	20a	Do not assign
11a	IZAN	20b	GND
11b	0 V	21a	Do not assign
12a	RES.PS	21b	GND
12b	0 V	22a	Do not assign
13a	PF.PS.ZK	22b	GND
13b	GND	23a	Reserved (SDA)
14a	ERR.UZ.GR	23b	GND
14b	GND	24a	Reserved (SLC)
15a	ERR.IZ.GR	24b	GND
15b	GND	25a	RES.LE
16a	ERR.TMP	25b	GND

13.3 Power Supply Units

The iTNC 530 is supplied via connector X69 (X169) on the CC;
see “X69: NC power supply and control signals, see X169” on page 13 – 166.

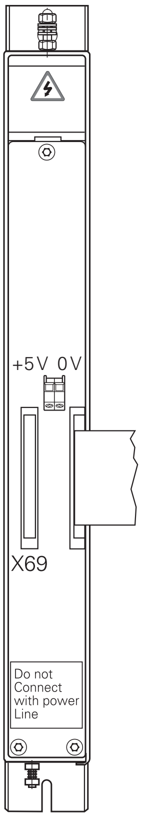
Exception: An MC can be connected directly to a UV 106 (B), the CC is not required. This constellation is intended for machines with analog axes and spindle(s).

The power supply units are, e.g., the UV 105, UV 105 B and UV 106, UV 106 B power supply units.
Further information --> see “Power Supply” on page 14 – 205.

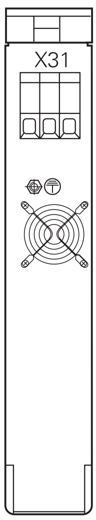
The UV, UVR power supply units and the UE, UR compact inverters also belong to the power supply units.
For detailed information, refer to the Service Manual "Inverter Systems and Motors".

13.3.1 UV 105 Power Supply Unit

Connection overview UV 105



Conductor bar	Power supply with U_Z
X74	5-V power supply for CC 42x
Free ribbon cable	Power supply for CC 42x (to X69 on CC 42x)
X69	Status signals from UV 1x0



X31	Power supply

Caution

Do not engage or disengage any connecting elements while the unit is under power!

Variant	Changes to UV 105
344980-01	First edition
344980-02	Version only for non-HEIDENHAIN inverters
344980-12	Version only for HEIDENHAIN inverters
344980-13	Version for HEIDENHAIN and non-HEIDENHAIN inverters
344980-14	Leads and ribbon cables elongated for double-row configuration

X31: Power supply unit for UV 105

Supply voltage: 400 V ± 10 %

Pin layout:

Connecting terminal	Assignment
U	U[a]
V	Va
⏚	Equipment ground (YL/GY), Š 10 mm2

a. Connecting cable: 1.5 mm^2

Note

The supply voltage at terminals U and V must:

- be supplied via an isolating transformer (300 VA, basic isolation in accordance with EN 50 178 or VDE 0550) for non-HEIDENHAIN inverters and regenerative HEIDENHAIN inverter systems.
- There is no need for an isolating transformer if non-regenerative HEIDENHAIN inverter systems are used.

DANGER

Do not ground this isolating transformer on the secondary side!

The isolating transformer decouples the dc-link voltage from ground. Grounding the isolating transformer on the secondary side leads to an addition of the dc-link voltage and the supply voltage. This would overload and thus destroy the UV 105.

Power supply of the UV 105 with UZ

The UV 105 is powered with dc-link voltage UZ through

- the conductor bars (for HEIDENHAIN inverter systems).
- a cable which is connected instead of the conductor bar (for non-HEIDENHAIN inverter systems).

X69: NC supply voltage and control signals

When connecting to connector X69/X169 of the CC, see “X69: NC power supply and control signals, see X169” on page 13 – 166

Operation with HEIDENHAIN inverters:
For the NC to be able to evaluate the status signals of the compact inverters or the power supply units, connector X69 must be connected by ribbon cable with X69 of the UV 105.
Operation with non-HEIDENHAIN inverters:
Since status signals from non-HEIDENHAIN inverters are not available or are not compatible to HEIDENHAIN systems, the adapter (Id. Nr. 349 211-01) must be connected to X69 on the UV 105.

**X74:
5V connection
of the UV 105**

Pin layout:

Wire color of 5-V connection	5-V terminal on CC 42x
Black	0V
Red	+ 5 V

DANGER

For mounting the UV 105, the additional 5V lines must be connected with the correct polarity!
Otherwise there will be a short circuit of these lines on the 5V ribbon wires of X69.

13.3.2 UV 105 B Power Supply Unit

Connection overview UV 105 B

Caution

Do not engage or disengage any connecting elements while the unit is under power!

Connector on the front panel

Supply voltage: 400 V ± 10 %

Pin layout:

Connecting terminal	Assignment
U	U[a]
V	Va
+UDC	DC-link voltage of the non-HEIDENHAIN inverster system
-UDC	DC-link voltage of the non-HEIDENHAIN inverster system

a. Connecting cable: 1.5 mm^2

Equipment ground (YL/GY) Š 10 mm2

Note

You must connect the supply voltage to the terminals U and V via an isolating transformer (300 VA, basic insulation as per EN 50 178 and VDE 0550).

Caution

Do not ground this isolating transformer on the secondary side!

The isolating transformer decouples the dc-link voltage from ground. Grounding the isolating transformer on the secondary side leads to an addition of the dc-link voltage and the supply voltage. This would overload and thus destroy the UV 105 B.

50-pin ribbon cable

When connecting to connector X69/X169 of the CC, see “X69: NC power supply and control signals, see X169” on page 13 – 166.

5V terminal on the front panel

Pin layout:

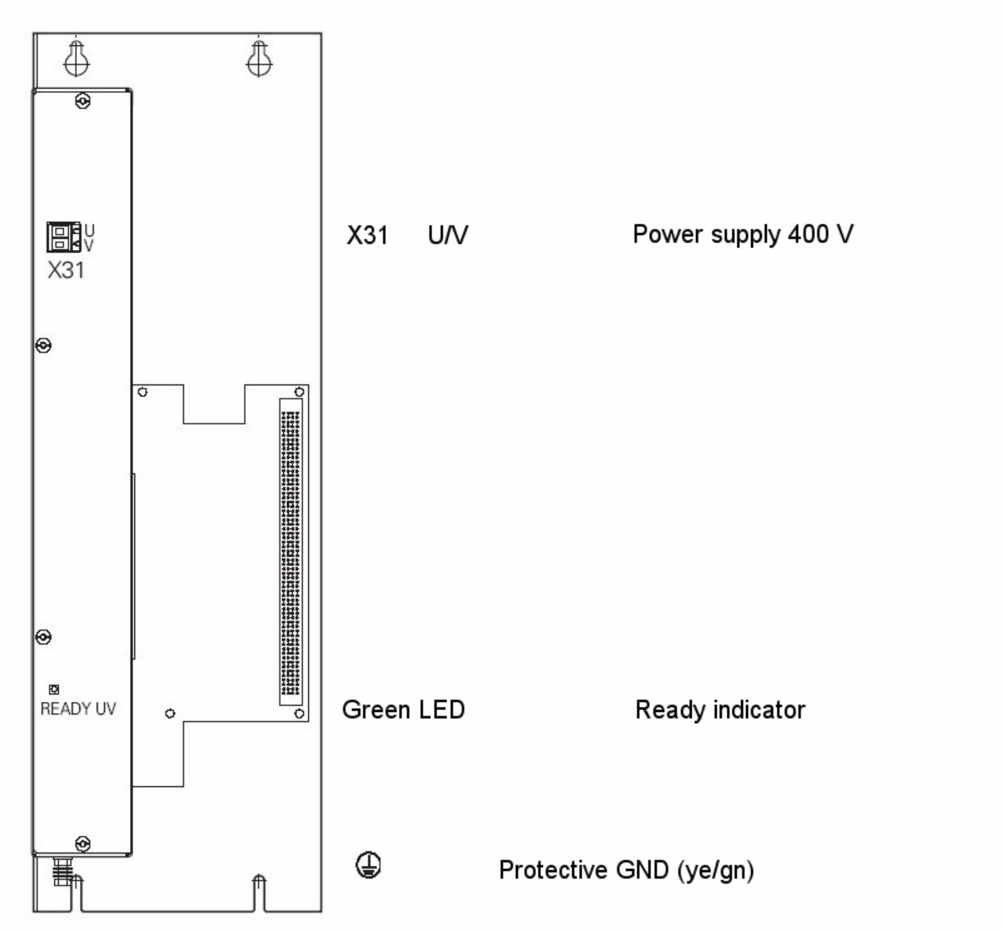
Wire color of 5-V connection	5-V terminal on CC 42x
Black	0V
Red	+ 5 V

Caution

For mounting the UV 105 B, the additional 5V lines must be connected with the correct polarity!
Otherwise there will be a short circuit of these lines on the 5V ribbon wires.

13.3.3 UV 106 (B) Power Supply Unit

Connection overview UV 106 (B)



Caution

Do not engage or disengage any connecting elements while the unit is under power!

X31: Supply voltage for UV 106 (B)

Supply voltage: 400 V ± 10 %

Pin layout:

Connecting terminal	Assignment
U	U[a]
V	Va

a. Connecting cable: 1.5 mm^2

Equipment ground (YL/GY) Š 10 mm2

13.4 Inverters and Motors

Power modules (UM, Simodrive via HEIDENHAIN expansion board, etc.) or power output stages in compact inverters (UE, UR) are driven via the PWM outputs of the control.
--> see “X51 to X64: PWM-output” on page 13 – 165.

The motor encoders are connected to the speed encoder interface of the control.
--> see “X15 to X20, X80 to X87: speed encoder 1 Vpp” on page 13 – 148.

For further information, refer to the Service Manual "Inverter Systems and Motors".

13.5 Interface Boards for the SIMODRIVE System 611D

The HEIDENHAIN expansion boards for the SIMODRIVE system receive PWM signals from the control and converts them. --> see “X51 to X64: PWM-output” on page 13 – 165.

For further information, refer to the Service Manual "Inverter Systems and Motors".

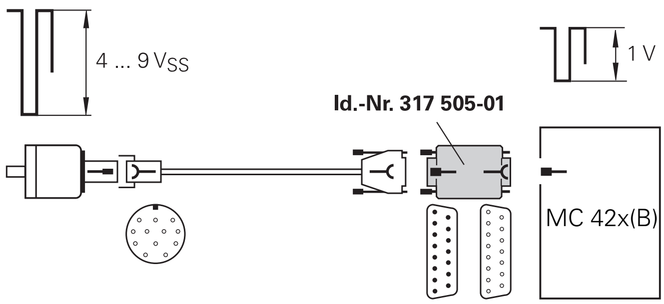
13.6 Encoders

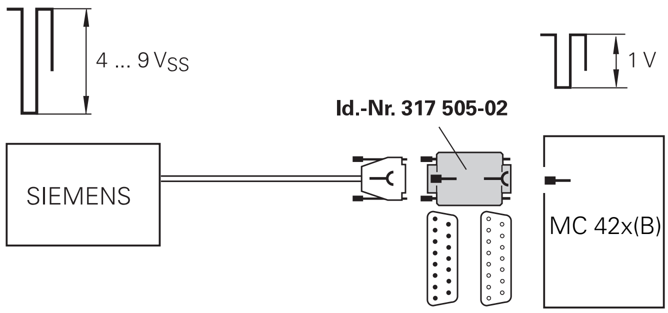
13.6.1 Position Encoders

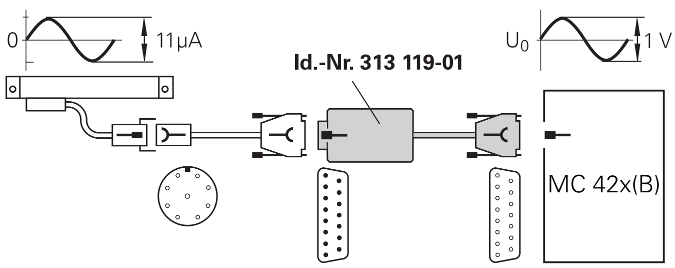
See “X1 to X6, X35 to X38, X201 to X214: position encoder 1 V_{PP}” on page 13 – 142.

Epecially for the retrofit of machines, the use of adapters for the encoder signal adjustment can be interesting.

Encoder signals with 11 µApp or TTL level can be adapted to the 1 Vpp interface with HEIDENHAIN adapter connectors.







Adapters for encoder signals	Id. No.
TTL (HEIDENHAIN layout)/1 Vpp	317 505-01
TTL (SIEMENS layout)/1 Vpp	317 505-02
11 µApp to MC 42x(B)	317 505-05
11 µApp /1 Vpp	313 119-01

Note

Please note:

- The adapters adjust only the levels, not the signal shape.
- The contamination signal of the square-wave encoder cannot be evaluated.
- A square-wave signal can be subdivided no more than 4-fold.

Adapter connector TTL (HEIDENHAIN)/ 1 Vpp

Pin layout of D-sub connector (female) and D-sub connector (male):

D-sub connctr. (female) 15-pin	Assignment	D-sub connectn. (male) 15-pin	Assignment
1	+5 V (UP)	1	+5 V (UP)
2	0 V (UN)	2	0 V (UN)
3	A+	3	Ua1
4	A–	4	–Ua1
5	0 V	5	0 V
6	B+	6	Ua2
7	B–	7	–Ua2
8	0 V	8	0 V
9	+ 5 V	9	+ 5 V
10	R+	10	Ua0
11	0 V	11	0 V
12	R–	12	–Ua0
13	0 V	13	0 V
14	–UaS	14	–UaS
15	Not assigned	15	Not assigned

Adapter connector TTL (SIEMENS)/ 1 Vpp

Pin layout of D-sub connector (female) and D-sub connector (male):

D-sub connctr. (female) 15-pin	Assignment	D-sub connectn. (male) 15-pin	Assignment
1	Not assigned	1	Not assigned
2	0 V	2	0 V
3	A+	3	Ua1
4	A–	4	–Ua1
5	Not assigned	5	Not assigned
6	B+	6	Ua2
7	B–	7	–Ua2
8	Not assigned	8	Not assigned
9	Not assigned	9	Not assigned
10	R+	10	Not assigned
11	Not assigned	11	Not assigned
12	R–	12	Ua0
13	Not assigned	13	–Ua0
14	Not assigned	14	Not assigned
15	Not assigned	15	Not assigned

Adapter connector 11 µApp / 1 Vpp

Pin layout of D-sub connector (female) and D-sub connector (male):

D-sub connctr. (female) 15-pin	Assignment	D-sub connection (male) 15-pin	Assignment
1	+5 V (UP)	1	+5 V (UP)
2	0 V (UN)	2	0 V (UN)
3	A+	3	0°+
4	A–	4	0°–
5	0 V	5	0 V
6	B+	6	90°+
7	B–	7	90°–
8	0 V	8	0 V
9	+ 5 V	9	+ 5 V
10	R+	10	R+
11	0 V	11	0 V
12	R–	12	R–
13	0 V	13	0 V
14	Not assigned	14	Not assigned
15	Not assigned	15	Not assigned

13.6.2 Speed Encoders

See “X15 to X20, X80 to X87: speed encoder 1 Vpp” on page 13 – 148.

13.7 Touch Probe Systems

Touch probe systems for workpiece measurement

See “X12: Connection of the touch probe for workpiece measurement” on page 13 – 145.

Touch probe systems for tool measurement

See “X13: Connection of the touch probe for tool measurement” on page 13 – 147.

13.8 Handwheels

X23: Handwheel input

See “X23: Handwheel input” on page 13 – 152.

13.8.1 HR 4xx Portable Handwheel

The HR 4xx is a portable electronic handwheel.

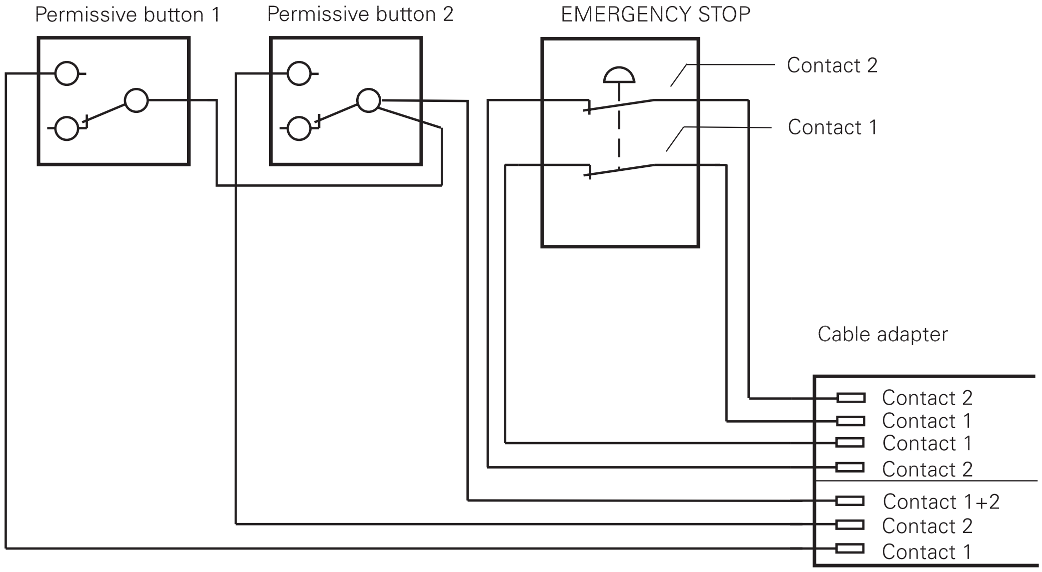
Assignment of the keys of the HR 410 to the PLC inputs and outputs.
–> see “HR 410 Portable Handwheel” on page 24 – 396.

Pin layout for the various extension cables, adapter cables, connecting cables, and the handwheel:

Extension cable ID 281 429-xx			**Adapter cable ID 296 466-xx**			**Connecting cable ID**			**HR 4xx**	
D-sub connector (male) 9-pin		**D-sub connctr. (female) 9-pin**	**D-sub connector (male) 9-pin**		**Cplg. on mntg. base (female) (5+7)-pin**	**Cnnctr. (male) (5+7)-pin**		**Cnnctr. (female) (5+7)-pin**	**Connector (male) (5+7)-pin**	
Housing	Shield	Housing	Housing	Shield	Housing	Housing	Shield	Housing	Housing	Shield
2	White	2	2	White	E	E	White	E	E	
4	Brow n	4	4	Brown	D	D	Brown	D	D	
6	Yello w	6	6	Yellow	B	B	Yellow	B	B	
7	Gray	7	7	Gray	A	A	Gray	A	A	
8	Green	8	8	Green	C	C	Green	C	C	
					6	6	BK	6	6	
					7	7	RD/BL	7	7	
					5	5	Red	5	5	
					4	4	Blue	4	4	
					2	2	WH/ GN	2	2	
					3	3	BN/ GN	3	3	
					1	1	GY/PK	1	1	
				WH/ BN	3	Contacts 1 + 2				
				WH/ YL	2	Contact 2 (left) permissive button				
				WH/ GN	1	Contact 1 (right)				
				WH/ BL	1	Contact 1				
				WH/ RD	2	Contact 1 EMERGENCY STOP				
				YL/BK	3	Contact 2				
				WH/ BK	4	Contact 2				

The cable adapter Id.Nr. 296466-xx includes plug-in terminal strips for the contacts of the EMERGENCY STOP button and permissive button (maximum load 24 V DC / 1.2 A).

Internal wiring of the contacts for the EMERGENCY STOP and permissive buttons:



Additional components		ID
Dummy plug for EMERGENCY STOP circuit		271 958-03
Connecting cable		
	Spiral cable	312 879-01
	Normal cable	296 467-xx
	Metal armor tubing	296 687-xx
Plug-in terminal strips		
	3-pin terminal block	266 364-06
	4-pin terminal block	266 364-12

13.8.2 HR 130 Panel-Mounted Handwheel

Standard cable length for the HR 130 is 1 meter.

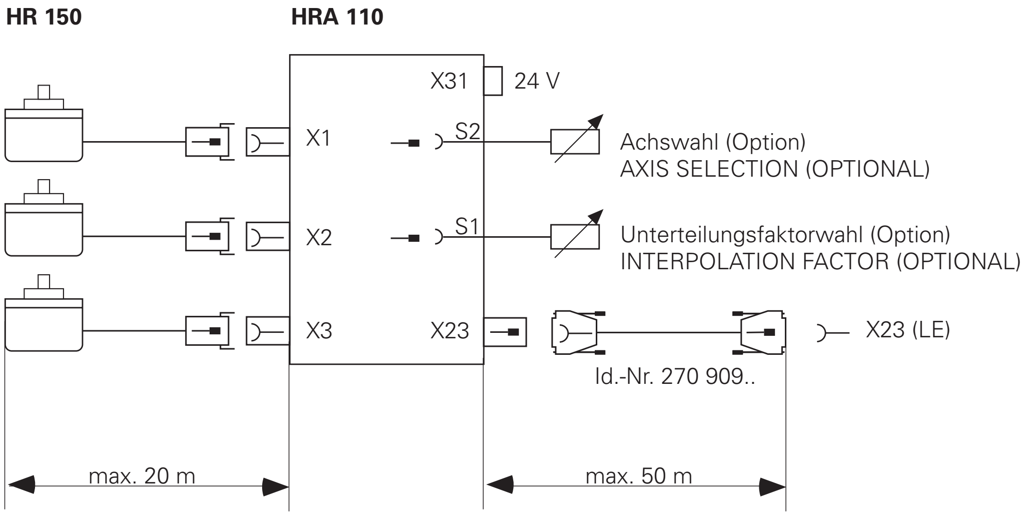
Pin layout for extension cable and handwheel:

Extension cable ID 281 429-xx			**HR 130 ID 254 040-xx**	
D-sub connctr. (male) 9-pin		**D-sub connctr. (female) 9-pin**	**D-sub connctr. (male) 9-pin**	
Housing	Shield	Housing	Housing	Shield
2	White	2	2	White
4	Brown	4	4	Brown
6	Yellow	6	6	Yellow
8	Green	8	8	Green
7	Gray	7		

13.8.3 HRA 110 Handwheel Adapter

With the handwheel adapter HRA 110 you can connect two or three HR 150 panel-mounted handwheels to the TNC.

The first and second handwheels are assigned to the X and Y axes. The third handwheel can be assigned either through a selection switch (option) or with MP7645.



An additional switch enables you to select, for example, the interpolation factor for the handwheel. The current position of the step switch is evaluated by the PLC.

X1 to X3: Inputs at the HRA 110 for the HR 150 handwheels

HRA 110	
Connection (female) 9-pin	**Assignment**
1	I1 +
2	I1 –
5	I2 +
6	I2 –
7	I0 –
8	I0 +
3	+ 5 V
4	0 V
9	Internal shield
Housing	External shield

X23: Connection to MC 422x(B)

Pin layout on the HRA 110:

HRA 110	
D-sub connection (female) 9-pin	**Assignment**
1	RTS
2	0 V
3	CTS
4	+12 V +0.6 V (UV)
5	Do not assign
6	DSR
7	RxD
8	TxD
9	DTR
Housing	External shield

X31: HRA 110 supply voltage

Pin layout on the HRA 110:

Caution

The power supply of the PLC must not be used simultaneously for the HRA110, otherwise the metallic isolation of the PLC inputs/outputs would be bridged.

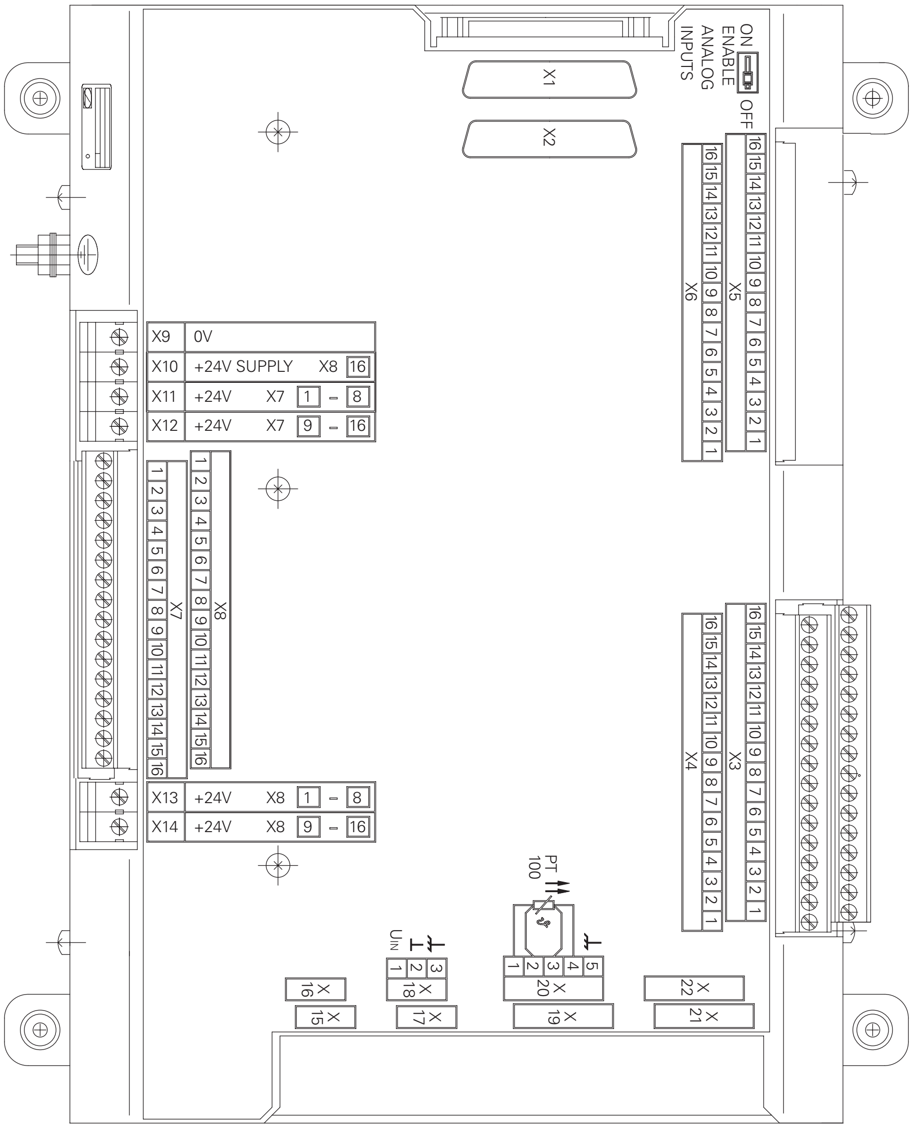
HRA 110	
Connecting terminal	**Assignment**
1	+ 24 Vdc as per IEC 742 (VDE 551)
2	0 V

Maximum current consumption 200 mA.

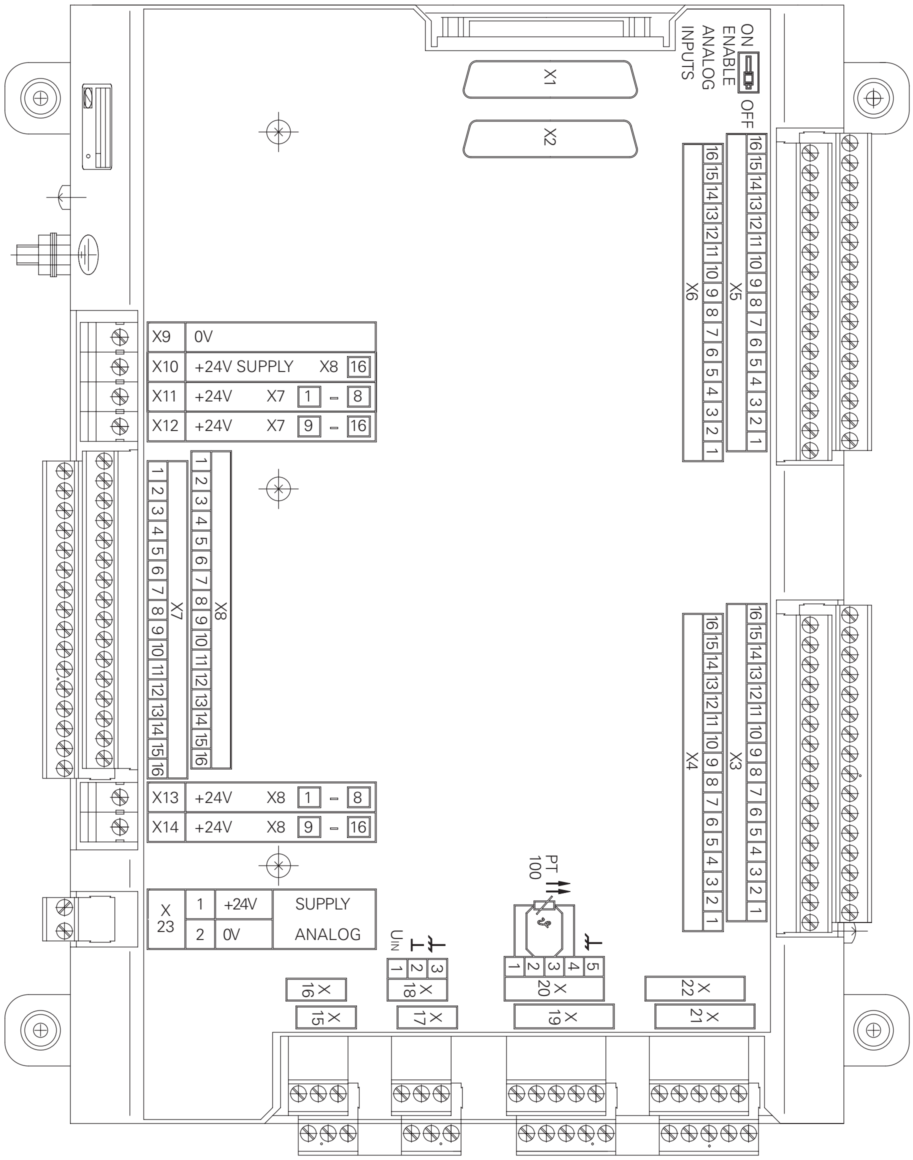
13.9 PLC Input/Output Units

13.9.1 Designation and Position of Connectors

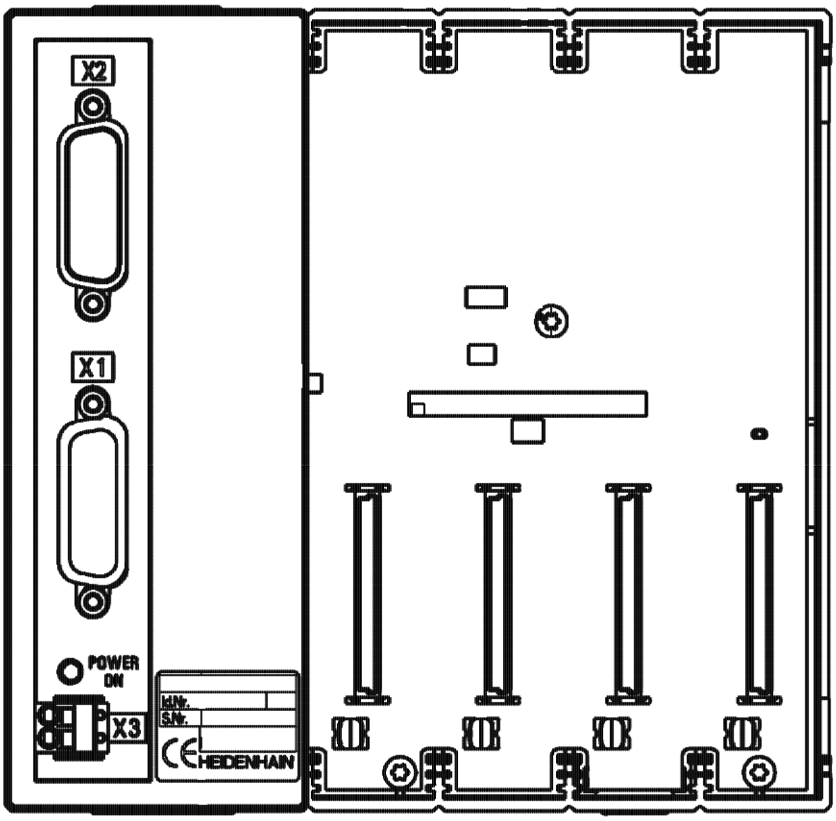
PL 405 B



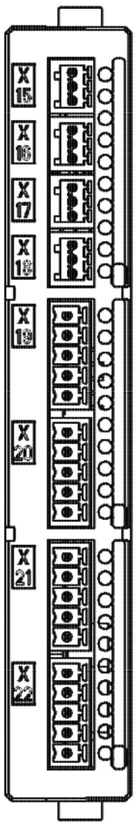
PL 410B

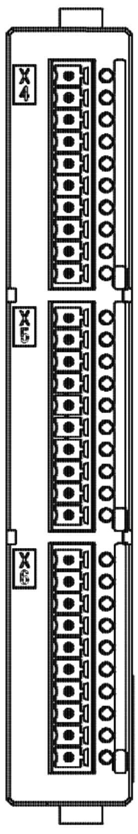

X1
X2
ON
ENABLE
ANALOG
INPUTS
OFF
X5
X6
X9 0V
X10 +24V SUPPLY X8 16
X11 +24V X7 1 – 8
X12 +24V X7 9 – 16
X7
X8
X3
X4
X13 +24V X8 1 – 8
X14 +24V X8 9 – 16
X 23
1 +24V SUPPLY
2 0V ANALOG
PT 100
X 16
X 15
X 18
X 17
X 20
X 19
X 22
X 21

PL 510 PLB 510 Basic Module



PLD 16-8 input/output modulePLA 4-4 analog module





13.9.2 PL 4xxB Pin Layouts

X1: PLC expansion on the MC

See “X47: PLC expansion for PL 4xx B on the MC 422 (B)” on page 13 – 160.

X2: PLC expansion PL 4xx B on the PL 410 B

PL 410 B		Conn. cable Id. Nr. 289 111-xx / Id. Nr. 317 788-xx			PL 410B PL 405B on the PL 410B	
D-sub connctn. (male) 25-pin	**Assignment**	**D-sub connctr. (female) 25-pin**		**D-sub connctr. (male) 25-pin**	**X1 D-sub connctn. (female) 25-pin**	**Assignment**
1	0 V	1	Brown, Yellow, Pink, Red, Violet	1	1	0 V
2	0 V	2	Red/Blue, Brown/ Green, Yellow/Brown, Gray/Brown, Pink/ Brown	2	2	0 V
3	0 V	3	BN/BL, BN/RD, BN/BK, YL/GY, YL/PK	3	3	0 V
4	Do not assign	4	Gray/Green	4	4	Serial IN 2
5	Address 6	5	White/Green	5	5	Address 6
6	INTERRUPT	6	Pink/Green	6	6	INTERRUPT
7	RESET	7	Green/Blue	7	7	RESET
8	WRITE EXTERN	8	White/Blue	8	8	WRITE EXTERN
9	WRITE EXTERN	9	White/Red	9	9	WRITE EXTERN
10	Address 5	10	Gray/Pink	10	10	Address 5
11	Address 3	11	Blue	11	11	Address 3
12	Address 1	12	Green	12	12	Address 1
13	Do not assign	13		13	13	Do not assign
14	PCB identifier 4	14	Yellow/Blue, Pink/Blue, Yellow/Black	14	14	+12 V
15	PCB identifier 3	15	Yellow/Red, Gray/Red, Pink/Red	15	15	+12 V
16	PCB identifier. 2	16	Gray/Blue	16	16	PCB identifier. 2
17	PCB identifier 1	17	Green/Black	17	17	PCB identifier 1
18	Address 7	18	White/Yellow	18	18	Address 7
19	Serial IN 1	19	White/Black	19	19	Serial IN 1
20	EM. STOP	20	Green/Red	20	20	EM. STOP
21	Serial OUT	21	White/Gray	21	21	Serial OUT
22	Serial OUT	22	White/Pink	22	22	Serial OUT
23	Address 4	23	Black	23	23	Address 4
24	Address 2	24	Gray	24	24	Address 2
25	Address 0	25	White	25	25	Address 0
Housing	External shield	Housing	External shield	Housing	Housing	External shield

X3:
PLC inputs
PL 410 B and
PL 405 B

Terminal	Assignment			
	1. PL	2. PL	3. PL	4. PL
1	I64	I192	I256	I320
2	I65	I193	I257	I321
3	I66	I194	I258	I322
4	I67	I195	I259	I323
5	I68	I196	I260	I324
6	I69	I197	I261	I325
7	I70	I198	I262	I326
8	I71	I199	I263	I327
9	I72	I200	I264	I328
10	I73	I201	I265	I329
11	I74	I202	I266	I330
12	I75	I203	I267	I331
13	I76	I204	I268	I332
14	I77	I205	I269	I333
15	I78	I206	I270	I334
16	I79	I207	I271	I335

X4:
PLC inputs
PL 410 B and
PL 405 B

Terminal	Assignment			
	1. PL	2. PL	3. PL	4. PL
1	I80	I208	I272	I336
2	I81	I209	I273	I337
3	I82	I210	I274	I338
4	I83	I211	I275	I339
5	I84	I212	I276	I340
6	I85	I213	I277	I341
7	I86	I214	I278	I342
8	I87	I215	I279	I343
9	I88	I216	I280	I344
10	I89	I217	I281	I345
11	I90	I218	I282	I346
12	I91	I219	I283	I347
13	I92	I220	I284	I348
14	I93	I221	I285	I349
15	I94	I222	I286	I350
16	I95	I223	I287	I351

X5:
PLC input
PL 410 B

Terminal	Assignment			
	1. PL	**2. PL**	**3. PL**	**4. PL**
1	I96	I224	I288	I352
2	I97	I225	I289	I353
3	I98	I226	I290	I354
4	I99	I227	I291	I355
5	I100	I228	I292	I356
6	I101	I229	I293	I357
7	I102	I230	I294	I358
8	I103	I231	I295	I359
9	I104	I232	I296	I360
10	I105	I233	I297	I361
11	I106	I234	I298	I362
12	I107	I235	I299	I363
13	I108	I236	I300	I364
14	I109	I237	I301	I365
15	I110	I238	I302	I366
16	I111	I239	I303	I367

X6:
PLC input
PL 410 B

Terminal	Assignment			
	1. PL	**2. PL**	**3. PL**	**4. PL**
1	I112	I240	I304	I368
2	I113	I241	I305	I369
3	I114	I242	I306	I370
4	I115	I243	I307	I371
5	I116	I244	I308	I372
6	I117	I245	I309	I373
7	I118	I246	I310	I374
8	I119	I247	I311	I375
9	I120	I248	I312	I376
10	I121	I249	I313	I377
11	I122	I250	I314	I378
12	I123	I251	I315	I379
13	I124	I252	I316	I380
14	I125	I253	I317	I381
15	I126	I254	I318	I382
16	I127	I255	I319	I383

X7:
PLC output
PL 410 B

Terminal	**Assignment**			
	1. PL	**2. PL**	**3. PL**	**4. PL**
1	O32	O64	O128	O160
2	O33	O65	O129	O161
3	O34	O66	O130	O162
4	O35	O67	O131	O163
5	O36	O68	O132	O164
6	O37	O69	O133	O165
7	O38	O70	O134	O166
8	O39	O71	O135	O167
9	O40	O72	O136	O168
10	O41	O73	O137	O169
11	O42	O74	O138	O170
12	O43	O75	O139	O171
13	O44	O76	O140	O172
14	O45	O77	O141	O173
15	O46	O78	O142	O174
16	O47	O79	O143	O175

X8:
PLC output
PL 410 B and
PL 405 B

Terminal	**Assignment**			
	1. PL	**2. PL**	**3. PL**	**4. PL**
1	O48	O80	O144	O176
2	O49	O81	O145	O177
3	O50	O82	O146	O178
4	O51	O83	O147	O179
5	O52	O84	O148	O180
6	O53	O85	O149	O181
7	O54	O86	O150	O182
8	O55	O87	O151	O183
9	O56	O88	O152	O184
10	O57	O89	O153	O185
11	O58	O90	O154	O186
12	O59	O91	O155	O187
13	O60	O92	O156	O188
14	O61	O93	O157	O189
15	O62	O94	O158	O190
16	Control is ready			

X9 to X14:
Power supply

Pin layout on the PL 4xx B:

Terminal	Assignment	1. PL	2. PL	3. PL	4. PL
X9	0 V				
X10	+24 Vdc logic power supply and supply for control-is-ready signal				
X11	+24 Vdc power supply for outputs	O32 – O39	O64 – O71	O128 – O135	O16O – O167
X12	+24 Vdc power supply for outputs	O40 – O47	O72 – O79	O136 – O143	O168 – O175
X13	+24 Vdc power supply for outputs	O48 – O55	O80 – O87	O144 – O151	O176 – O183
X14	+24 Vdc power supply for outputs	O56 – O62	O88 – O94	O152 – O158	O184 – O190

Note

The power supply must have a value of at least 20.4 V and maximum 28.8 V!
The terminals X11 and X12 of the PL 405 B are missing.

X15 to X18:
Analog input on the PL 410 B

Connecting terminals	Assignment
1	–10 V to +10 V
2	0 V (reference potential)
3	Shield

Note

The interfaces comply with the requirements of EN 50 178 for “low voltage electrical separation.”

X19 to X22:
Connection for Pt 100 on the PL 410B

Connecting terminals	Assignment
1	I + Constant current for Pt 100
2	U + Measuring input for Pt 100
3	U– Measuring input for Pt 100
4	I– Constant current for Pt 100
5	Shield

Note

The interfaces comply with the requirements of EN 50 178 for “low voltage electrical separation.”

X23:
Supply voltage for analog inputs on the PL 410 B

The PL 410B input/output unit is also available with additional analog inputs and inputs for Pt 100 thermistors. The power supply must comply with EN 50 178, 5.88 requirements for ”low voltage electrical separation.”

Terminal	Assignment
1	+24 Vdc as per EN 50 178, 5.88
2	+0 V

13.9.3 Pin Layout PL 510

X1: PLC expansion on the MC 422 (B)

See “X47: PLC expansion for PL 510 on the MC 422(B)” on page 13 – 161.

X1: PLC expansion on the MC 420

See “X147: PLC expansion for PL 510 on the MC 420” on page 13 – 169.

X2: PLC expansion PL 510 on the PL 510

Pin Layout on PLB 510 Basic Module

PL 510		**Connecting cable ID 371 045-xx**			**PL 510 on PL 510**	
D-sub connctn. (male) 26-pin	**Assignment**	**D-sub connctr. (female) 26-pin**		**D-sub connctr. (male) 26-pin**	**X1 D-sub connctn. (female) 26-pin**	**Assignment**
1	0 V	1	Black	1	1	0 V
2	0 V	2	Violet	2	2	0 V
3	0 V	3		3	3	0 V
4	Do not assign	4		4	4	Do not assign
5	Address 6	5	Yellow	5	5	Address 6
6	INTERRUPT	6	Blue	6	6	INTERRUPT
7	RESET	7	Red	7	7	RESET
8	WRITE EXTERN	8	Gray	8	8	WRITE EXTERN
9	WRITE EXTERN	9	Pink	9	9	WRITE EXTERN
10	Address 5	10	Green	10	10	Address 5
11	Address 3	11	White	11	11	Address 3
12	Address 1	12	Brown	12	12	Address 1
13	Do not assign	13		13	13	Do not assign
14	+5 V (output)	14	White/Blue	14	14	
15	+5 V (feedback)	15	Brown/Blue	15	15	
16	PCB identifier. 2	16	White/Pink	16	16	PCB identifier. 2
17	PCB identifier 1	17	Pink/Brown	17	17	PCB identifier 1
18	Address 7	18	Brown/Green	18	18	Address 7
19	Serial IN 1	19	White/Gray	19	19	Serial IN
20	EM. STOP	20	Gray/Brown	20	20	EM. STOP
21	Serial OUT	21	White/Yellow	21	21	Serial OUT
22	Serial OUT	22	Yellow/Brown	22	22	Serial OUT
23	Address 4	23	White/Green	23	23	Address 4
24	Address 2	24	Gray/Pink	24	24	Address 2
25	Address 0	25	Red/Blue	25	25	Address 0
26		26		26	26	
Housing	External shield	Housing	External shield	Housing	Housing	External shield

X3: Supply voltage for logic

Pin Layout on PLB 510 Basic Module

Terminal	Assignment
1	+24 Vdc (20.4 V to 28.8 V)
2	+0 V

X4 to X5: PLC inputs on the PL 510

Pin layout on the PLD 16-8 input/output module:

Note

The 0-V terminals of X4 and X5 of the PLD 16-8 are connected internally. These connections are used for connecting the potential of the electronics and for operating the LEDs. Since only a low current is required (max. 50 mA), it is sufficient to establish only one 0-V connection (preferably at X4).

X4											
Assignment		**Terminal**									
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
First PL 510	Slot 1	0 V	0 V	I64	I65	I66	I67	I68	I69	I70	I71
	Slot 2	0 V	0 V	I80	I81	I82	I83	I84	I85	I86	I87
	Slot 3	0 V	0 V	I96	I97	I98	I99	I100	I101	I102	I103
	Slot 4	0 V	0 V	I112	I113	I114	I115	I116	I117	I118	I119
Second PL 510	Slot 1	0 V	0 V	I192	I193	I194	I195	I196	I197	I198	I199
	Slot 2	0 V	0 V	I208	I209	I210	I211	I212	I213	I214	I215
	Slot 3	0 V	0 V	I224	I225	I226	I227	I228	I229	I230	I231
	Slot 4	0 V	0 V	I240	I241	I242	I243	I244	I245	I246	I247
Third PL 510	Slot 1	0 V	0 V	I256	I257	I258	I259	I260	I261	I262	I263
	Slot 2	0 V	0 V	I272	I273	I274	I275	I276	I277	I278	I279
	Slot 3	0 V	0 V	I288	I289	I290	I291	I292	I293	I294	I295
	Slot 4	0 V	0 V	I304	I305	I306	I307	I308	I309	I310	I311
Fourth PL 510	Slot 1	0 V	0 V	I320	I321	I322	I323	I324	I325	I326	I327
	Slot 2	0 V	0 V	I336	I337	I338	I339	I340	I341	I342	I343
	Slot 3	0 V	0 V	I352	I353	I354	I355	I356	I357	I358	I359
	Slot 4	0 V	0 V	I368	I369	I370	I371	I372	I373	I374	I375

X5											
Assignment		**Terminal**									
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
First PL 510	Slot 1	0 V	0 V	I72	I73	I74	I75	I76	I77	I78	I79
	Slot 2	0 V	0 V	I88	I89	I90	I91	I92	I93	I94	I95
	Slot 3	0 V	0 V	I104	I105	I106	I107	I108	I109	I110	I111
	Slot 4	0 V	0 V	I120	I121	I122	I123	I124	I125	I126	I127
Second PL 510	Slot 1	0 V	0 V	I200	I201	I202	I203	I204	I205	I206	I207
	Slot 2	0 V	0 V	I216	I217	I218	I219	I220	I221	I222	I223
	Slot 3	0 V	0 V	I232	I233	I234	I235	I236	I237	I238	I239
	Slot 4	0 V	0 V	I248	I249	I250	I251	I252	I253	I254	I255
Third PL 510	Slot 1	0 V	0 V	I264	I265	I266	I267	I268	I269	I270	I271
	Slot 2	0 V	0 V	I280	I281	I282	I283	I284	I285	I286	I287
	Slot 3	0 V	0 V	I296	I297	I298	I299	I300	I301	I302	I303
	Slot 4	0 V	0 V	I312	I313	I314	I315	I316	I317	I318	I319

X5											
Assignment		**Terminal**									
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Fourth PL 510	Slot 1	0 V	0 V	I328	I329	I330	I331	I332	I333	I334	I335
	Slot 2	0 V	0 V	I344	I345	I346	I347	I348	I349	I350	I351
	Slot 3	0 V	0 V	I360	I361	I362	I363	I364	I365	I366	I367
	Slot 4	0 V	0 V	I376	I377	I378	I379	I380	I381	I382	I383

X6: PLC outputs on the PL 510

Pin layout on the PLD 16-8 input/output module:

X6											
Assignment		**Terminal**									
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
First PL 510	Slot 1	O32	O33	O34	O35	O36	O37	O38	O39[a]	+24 V[b]	+24 V[c]
	Slot 2	O40	O41	O42	O43	O44	O45	O46	O47a	+24 Vb	+24 Vc
	Slot 3	O48	O49	O50	O51	O52	O53	O54	O55a	+24 Vb	+24 Vc
	Slot 4	O56	O57	O58	O59	O60	O61	O62	-	+24 Vb	+24 Vc
Second PL 510	Slot 1	O64	O65	O66	O67	O68	O69	O70	O71a	+24 Vb	+24 Vc
	Slot 2	O72	O73	O74	O75	O76	O77	O78	O79a	+24 Vb	+24 Vc
	Slot 3	O80	O81	O82	O83	O84	O85	O86	O87a	+24 Vb	+24 Vc
	Slot 4	O88	O89	O90	O91	O92	O93	O94	-	+24 Vb	+24 Vc
Third PL 510	Slot 1	O128	O129	O130	O131	O132	O133	O134	O135a	+24 Vb	+24 Vc
	Slot 2	O136	O137	O138	O139	O140	O141	O142	O143a	+24 Vb	+24 Vc
	Slot 3	O144	O145	O146	O147	O148	O149	O150	O151a	+24 Vb	+24 Vc
	Slot 4	O152	O153	O154	O155	O156	O157	O158	-	+24 Vb	+24 Vc
Fourth PL 510	Slot 1	O160	O161	O162	O163	O164	O165	O166	O167a	+24 Vb	+24 Vc
	Slot 2	O168	O169	O170	O171	O172	O173	O174	O175a	+24 Vb	+24 Vc
	Slot 3	O176	O177	O178	O179	O180	O181	O182	O183a	+24 Vb	+24 Vc
	Slot 4	O184	O185	O186	O187	O188	O189	O190	-	+24 Vb	+24 Vc

a. The function of this terminal can be set with a sliding switch on the rear side of the PLD 16-8 I/O modules:
Setting 1: Control-is-ready signal
Setting 2: PLC output

b. Group 1 (terminals 1 to 4)

c. Group 2 (terminals 5 to 8)

Note

If you use only the outputs at X6 for a PLD 16-8 I/O unit (and no inputs), the 0-V connection for supplying the electronics and for operating the LEDs must be established at X4 or X5.

The iTNC 530 cyclically monitors the PLC outputs of the PL510 for a short circuit.

X6: Power supply for the PLC outputs on PLD 16-8 input/ output module

Pin layout at X6 (power supply for PLC outputs):

Terminal	Assignment
9	+24 Vdc (20.4 V to 28.8 V) for group 1 (O1 … O4)
10	+24 Vdc (20.4 V to 28.8 V) for group 2 (O5 … O8)

X15 to X18: Analog input on PLA 4-4 analog module

Connecting terminals	Assignment
1	–10 V to +10 V
2	0 V (reference potential)
3	Shield

Note

The interfaces comply with the requirements of EN 50 178 for “low voltage electrical separation.”

X19 to X22: Connection for Pt 100 on the PLA 4-4 analog module

Connecting terminals	Assignment
1	I + Constant current for Pt 100
2	U + Measuring input for Pt 100
3	U– Measuring input for Pt 100
4	I– Constant current for Pt 100
5	Shield

Note

The interfaces comply with the requirements of EN 50 178 for “low voltage electrical separation.”

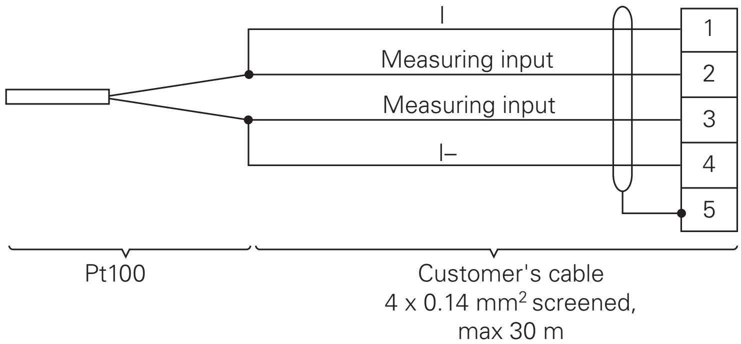
Connecting the analog voltage

Characteristics of the connecting cable:

- Shielding
- 2 conductors with 0.14 mm²
- Maximum length 50 meters

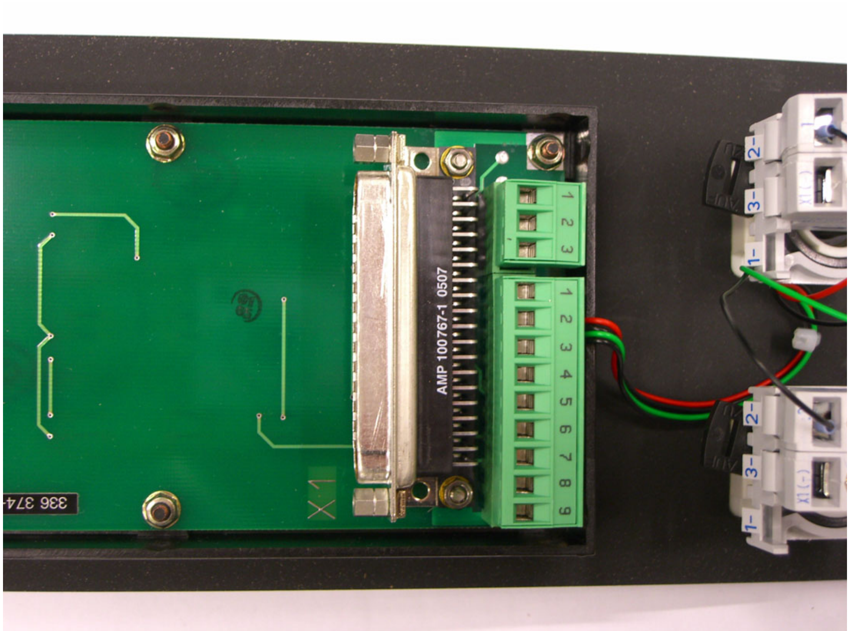
Connection of the Pt 100 thermistors

- Configure the thermistor connection as a "four-conductor circuit":



13.10 Machine Operating Panel

13.10.1 Designation and Position of Connectors on MB 420



13.10.2 Pin Layouts on MB 420

X1:
Connection to MC

See "X46: Machine operating panel" on page 13 – 159.

X2:
Connection of NC start and NC stop key

The NC start key and the NC stop key are connected with the MB 420 via X2.

X3:
PLC inputs

Terminal	Assignment
1	I151
2	I152
3	+24 V

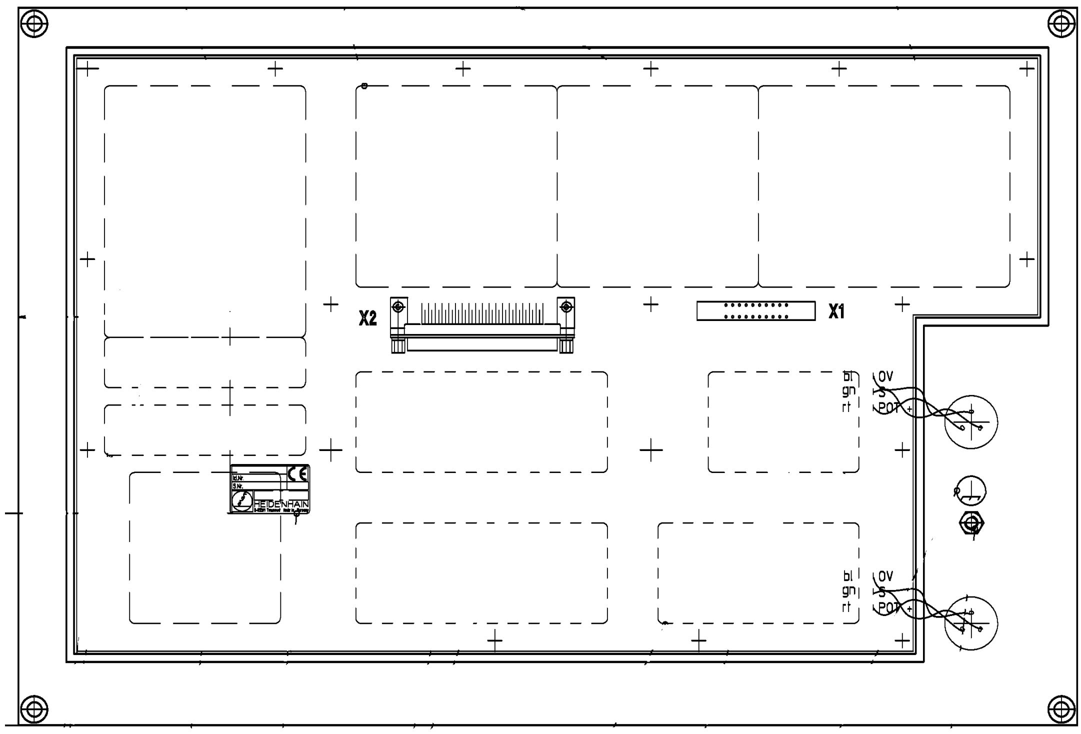
X4:
PLC outputs

Terminal	Assignment
1	O0
2	O1
3	O2
4	O3
5	O4
6	O5
7	O6
8	O7
9	0 V

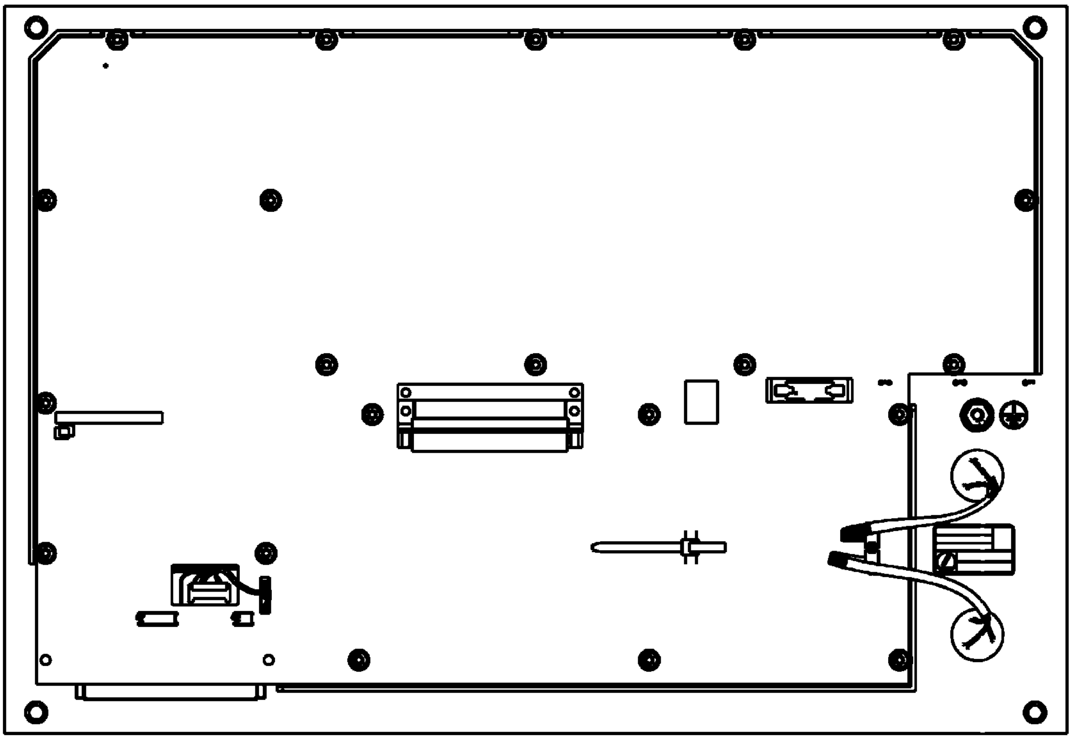
13.11 iTNC Keyboard

13.11.1 Designation and Position of Connectors

TE 420



TE 530 (B)



13.11.2 Pin Layouts

X1:
Connection of the softkeys of visual display unit to the iTNC keyboard

Pin layout of the iTNC keyboard:

Connecting element (male) 9-pin	Assignment
1	SL0
2	SL1
3	SL2
4	SL3
5	Do not assign
6	RL15
7	RL14
8	RL13
9	RL12

X2:
iTNC keyboard

See “X45: iTNC keyboard unit” on page 13 – 158.

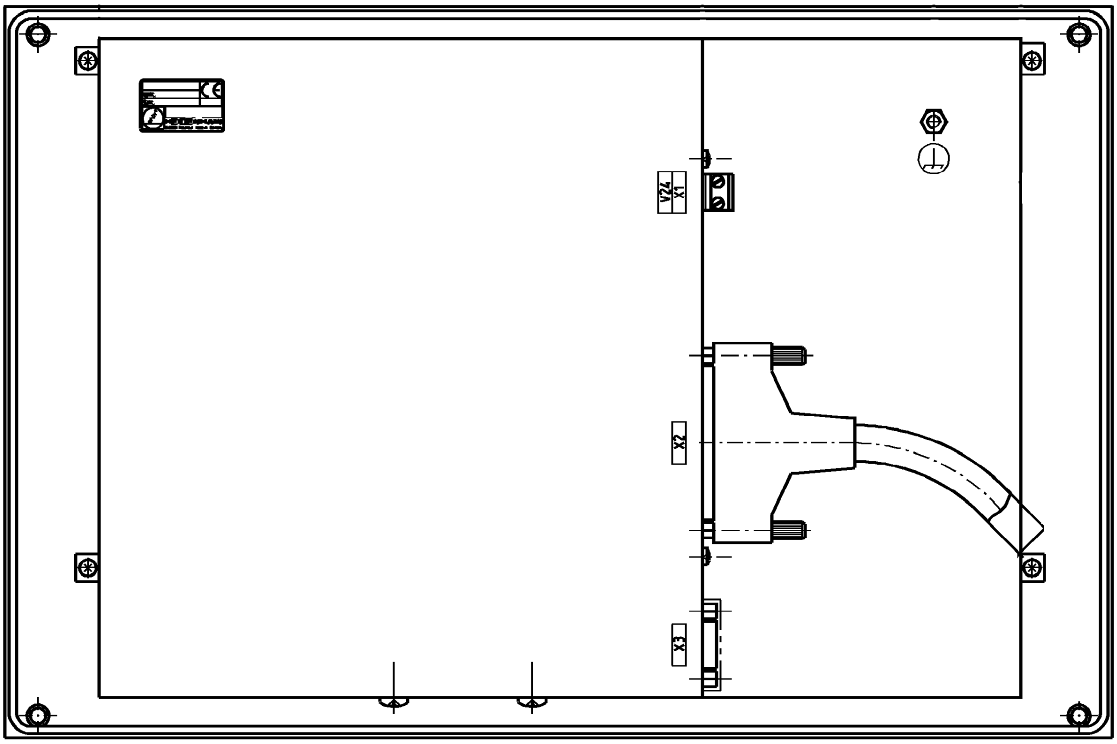
X9:
USB interface for the mousepad of the TE 530 (B)

See “X141, X142: USB connection” on page 13 – 168.

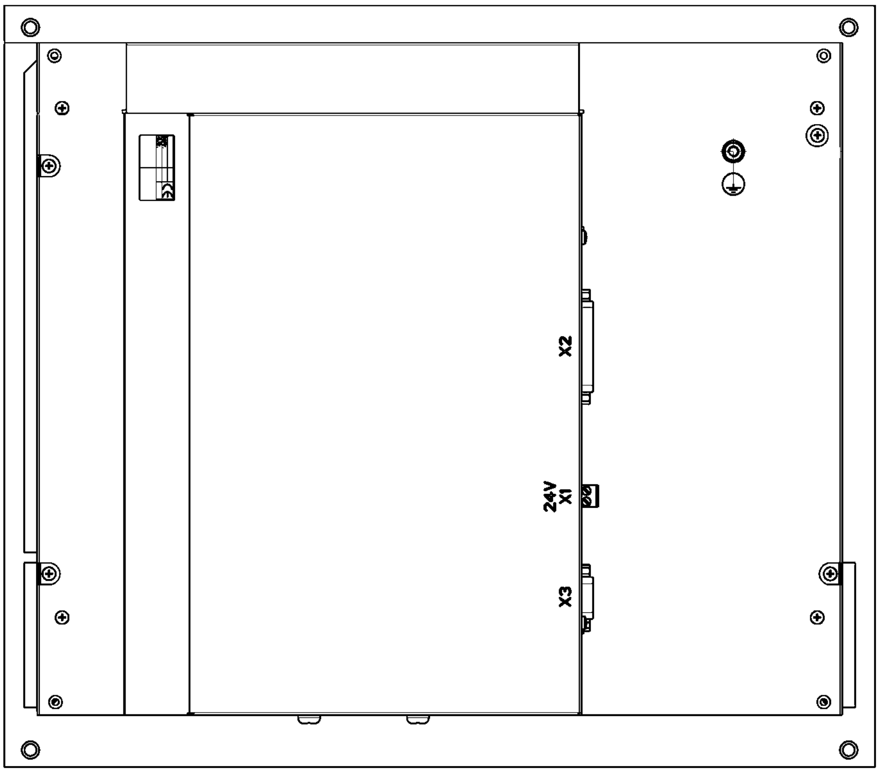
13.12 Visual Display Units

13.12.1 Designation and Position of Connectors

BF 120



BF 150



13.12.2 Pin Layouts

X1:
Power supply

Power supply with basic insulation in accordance with EN 50 178:

Connecting terminal X1	Assignment
1	+24 V
2	0 V

Power consumption: BF 120: 15 W
BF 150: 45 W

X2:
Connection of the BF 120 to the MC

See "X49: BF 120 flat-panel display" on page 13 – 163.

X2:
Connection of the BF 150 to the MC

See "X149 BF 150 flat-panel display" on page 13 – 170.

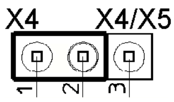
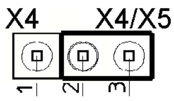
X3: Connection of the softkeys of the visual display unit to the iTNC operating panel

Connector (male) 9-pin	Assignment
1	SL0
2	SL1
3	SL2
4	SL3
5	Do not assign
6	RL15
7	RL14
8	RL13
9	RL12

13.13 BTS 1x0 Monitor/Keyboard Switch

Two monitors (BTS 110: 2 x BF 120, BTS 150: 2 x BF 150) and two TE keyboards can be connected to an MC 42x(B) with the BTS 1x0.

The two monitors are always active. Switchover between the two keyboard units is realized by a 24 V switching input on the BTS 1x0.
A jumper on the PCB is used to determine which potentiometer should be active. The jumper is on the upper PCB next to the ID plate.

Jumper setting	Active potentiometers
	Always keyboard 1 (at X4)
	Currently active keyboard

Note

You cannot switch between the two touchpads on the TE 530 with the BTS 1x0. You must connect both touchpads to the MC 42x(B) (possibly via the USB hub).

X1, X2, X4, X5 to X7: Monitor and keyboard connections

Assignment of the individual connections:
–> see “iTNC Keyboard” on page 13 – 200
–> see “Visual Display Units” on page 13 – 202

Connection designation	Monitor/Keyboard
X1	Input BF 120 or BF 150
X2	TE input
X4	First TE output
X5	Second TE output
X6	First BF 120 or BF 150 output
X7	Second BF 120 or BF 150 output

Note

The interfaces comply with the requirements of EN 50 178 for “low voltage electrical separation.”

X3: Switchover between the keyboards

Depending on the signal at X3, one of the keyboards at X4 or X5 is activated:

Signal at X3		Active keyboard
Terminal 1	Terminal 2	
0 V	0 V	At X4
+24 V	0 V	At X5

X8: Supply voltage for BTS 1x0

Power supply with double insulation in accordance with EN 50 178:

Connecting terminal	Assignment
1	+24 V
2	0 V

Current consumption: Max. 100 mA.

14 Power Supply

14.1 Power Supply for the iTNC 530

14.1.1 General

The iTNC 530 is powered by …

- HEIDENHAIN compact inverter (UE, UR) or
- HEIDENHAIN power supply units (UV, UVR) or
- HEIDENHAIN power supply units UV 105, UV 105 B, UV 106, UV 106 B

The CC 42x is powered via the 50-pin ribbon cable connection and additionally via a 5 V terminal, if required.

The CC 42x in turn powers the connected MC 42x (B) via a connecting board with connector.
When using the UV 106 (B), the CC is not required.
--> The MC is directly connected to the UV 106 (B).
This makes it possible to operate analog axes and spindles exclusively.

Note

The iTNC 530 (MC/CC) powers the connected units, such as scales, motor encoders, touch probes, handwheel, transmitter-receiver units.

Exceptions:

- The screen has its own connection for power supply.
- The PLC outputs are powered with 24 V machine voltage.
- Infra-red touch probes have a battery.

Damaged units that are powered by the iTNC may influence the supply voltages and thus the entire system.

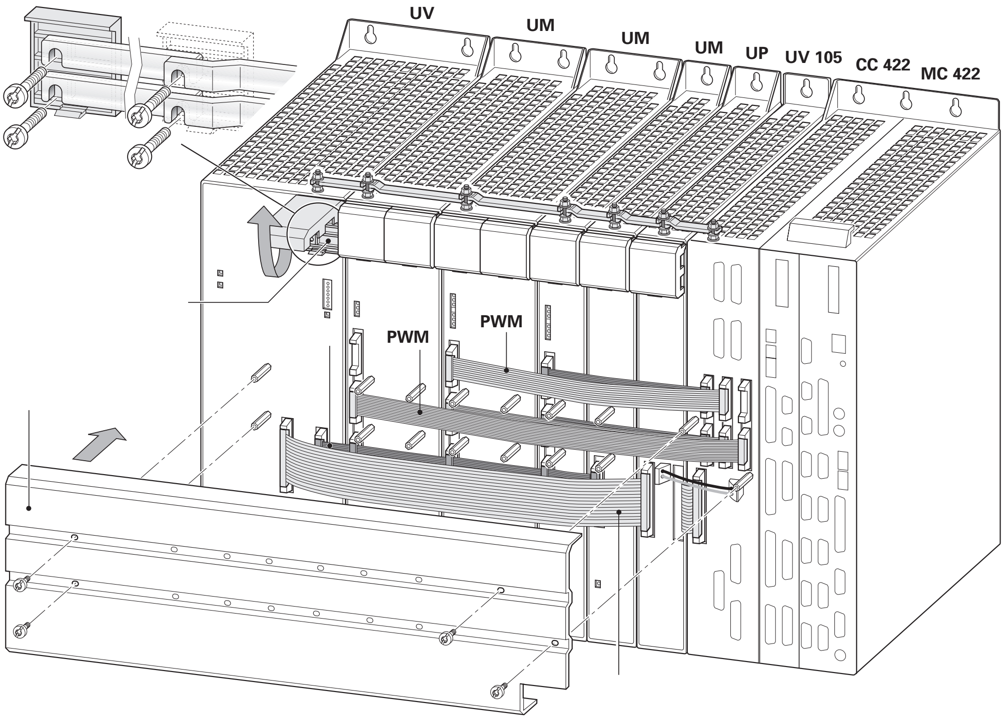
Note

The control monitors the 5-V supply voltage.
If it falls below 4.75 V, the error message **5 V power supply too weak** is displayed.
If it rises above 5.4, the error message **5 V power supply too large** is displayed.

Pin layout --> see "Power Supply Units" on page 13 – 173.

Power supply by UV 105

Power is supplied through the 50-line ribbon-cable connector X69 and in addition through a 5 V terminal on the UV 105.
The UV xxx does not have an additional 5 V terminal and thus cannot power the iTNC 530 sufficiently. The 50-line ribbon cable X69 of the UV xxx is connected to the UV 105 so that the status signals of the UV xxx can be transmitted to the iTNC.



Note

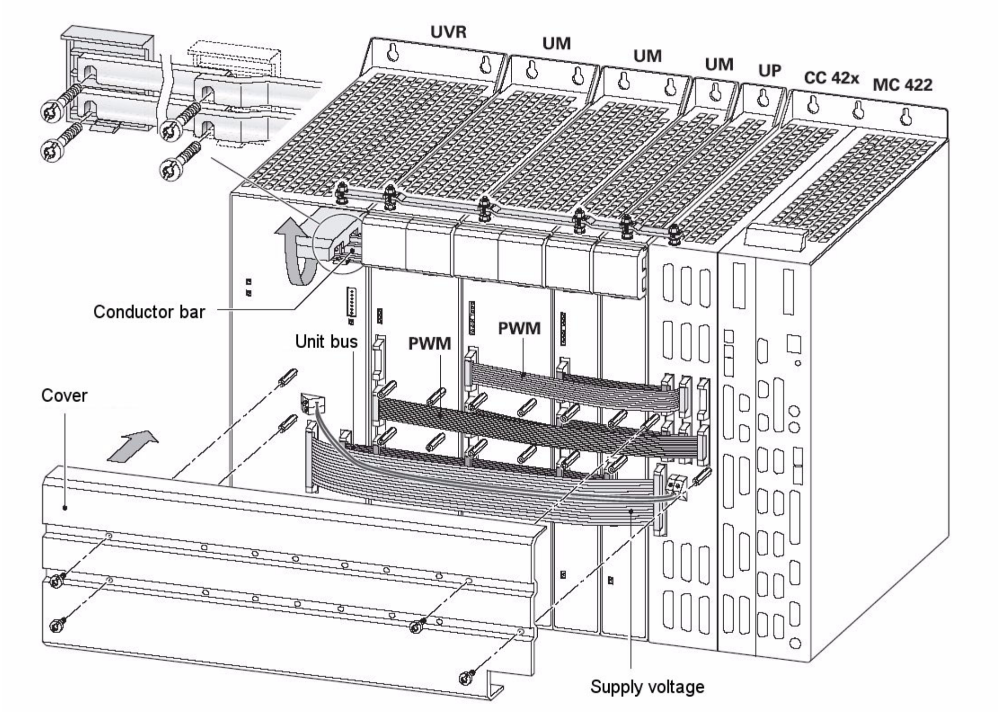
When using HEIDENHAIN inverters that are not provided with the additional 5 V terminal on the front panel (e.g. UE xxx, UE xxx B, UR xxx, UV xxx), normally the UV 105 is not required. In case of a low current consumption of the iTNC 530 (e.g., single processor with low clock frequency, only few peripheral units are connected) it is possible that the machine manufacturer has not used the UV 105.

The UV 105 can also be used if the iTNC 530 is combined with non-HEIDENHAIN inverters to power the HEIDENHAIN control.

Since status signals from non-HEIDENHAIN inverters are not available or are not compatible to HEIDENHAIN systems, the adapter (Id. Nr. 349 211-01) is then connected to X69 of the UV 105.

Power supply by UVR

Power is supplied through the 50-line ribbon-cable connector X69 and in addition through a 5 V terminal on the UVR.
A more powerful switching power supply and an additional 5 V terminal is built into the UVR.
--> The iTNC can be powered correspondingly.
The UV 105 is not required!



Note

When using HEIDENHAIN inverters that are not provided with the additional 5 V terminal on the front panel (e.g., UR xxx D, UV xxx D, UVR xxx, UVR xxx D), an accessory unit for the power supply of the iTNC 530 is not required.

Note

For information on the HEIDENHAIN compact inverters and power supply units, refer to **Service Manual "Inverter Systems and Motors".**

Power Supply by UV 105 B

The UV 105 B was designed solely for the use on HEIDENHAIN controls in connection with non-HEIDENHAIN inverter systems.
The phases U/V and the dc-link voltage ± UDC are connected via a connector on the front panel.
The LED ***READY UV*** on the front panel indicates the readiness of the unit.

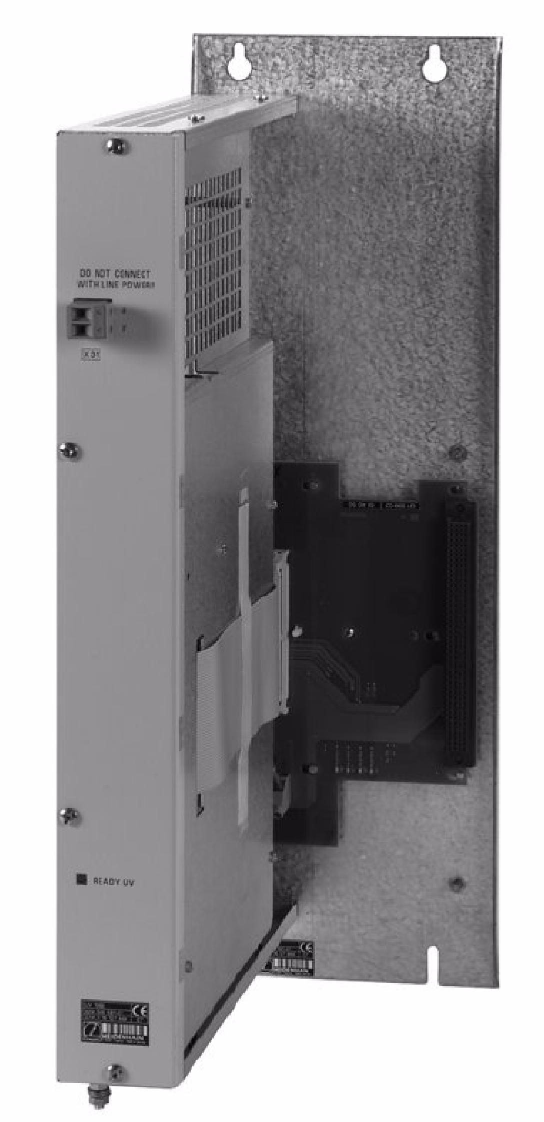
Power is supplied through the 50-line ribbon-cable connector and in addition through a 5 V terminal on the UV 105 B.

Power supply by UV 106 (B)

An MC 42x (B) can also be connected to a UV 106 (B) instead of a CC 42x controller unit. Thus the control loops for digital axes and spindles are not required. --> This combination is solely destined for analog axes and spindles.

The phases U and V are connected via a connector on the front panel.
The LED ***READY UV*** on the front panel indicates the readiness of the unit.

The MC is powered by means of a connecting board and connector on the rear side of the unit.



14.1.2 UV 105, UV 105 B

Possible causes of error

- Supply voltage to U and V missing
- Fan failed
- Fuse on board of the UV 105 (B) released
- UV 105 (B) defective
- DC-link voltage missing
- Fuses on protective PCB released (connected to conductor bar of a Simodrive system)

Service diagnosis UV 105 (B)

DANGER

Danger of electrical shock!

High voltages and currents

When checking the UV 105 (B) power supply unit, proceed as follows:

Control of the LED READY UV

The LED READY UV on the front panelof the UV 105 B indicates the readiness of the unit.

5 V on auxiliary terminal

▶ Measure whether the 5 V voltage on the auxiliary terminal of the UV 105 (B) is available.

Note

If you have the HEIDENHAIN test adapter with the corresponding ribbon cable, you can connect it parallel to the 50-line ribbon cable of the UV 105 (B) and measure the corresponding low voltages.
See “Test Adapter, ID 375830-01” on page 456.
See “X69: NC supply voltage and control signals” on page 175.

Function of the fan

▶ Check, whether the fan of the UV 105 (B) is running.

If it does not, this might indicate that ...

- No supply voltage for the UV 105 (B) is available.
- Fuses in the UV 105 (B) have released.
- The UV 105 (B) is defective.

However, this may also indicate that the fan is defective.

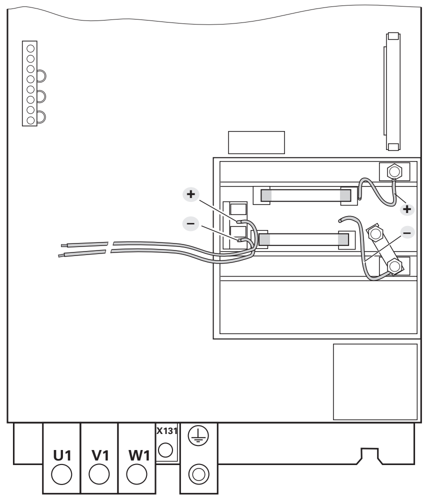
Control of the supply voltages

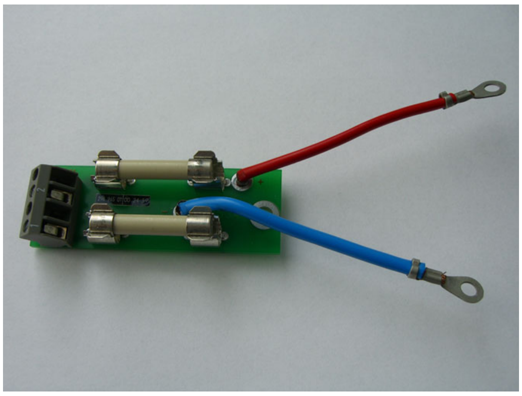
▶ Measure, whether 400 V ±10 % are available on U and V of connector X31 (on the bottom of the UV 105) or the connector on the front panel (UV 105 B).

▶ If connected:
Measure, whether a dc-link voltage on the conductor bars of the UV 105 or on the connector on the front panel of the UV 105 B is available (the voltage depends on the inverter system).

Uz of a non-HEIDENHAIN inverter system

When using a non-HEIDENHAIN inverter system (e.g., Simodrive 611), the power supply from the dc link is mostly lead via a protective PCB. This is secured to the conductor bar on the non-HEIDENHAIN inverter.





DANGER

Danger of electrical shock!

High voltages and currents

- Switch off the main switch of the machine.
- Check whether there is zero potential at the conductor bars.
- Take precautions against resetting.
- Check the fuses on the protective PCB and exchange them, if necessary.

Fuses in UV 105 (B)

- Switch off the main switch of the machine.
- Dismantle the UV 105 (B) power supply unit.
- Ensure that the unit is not under power.
- Remove the side plate.
  Caution: On the UV 105, one screw is located under the cover of the connector of the conductor bar.
- Check the fuses on the power supply board.

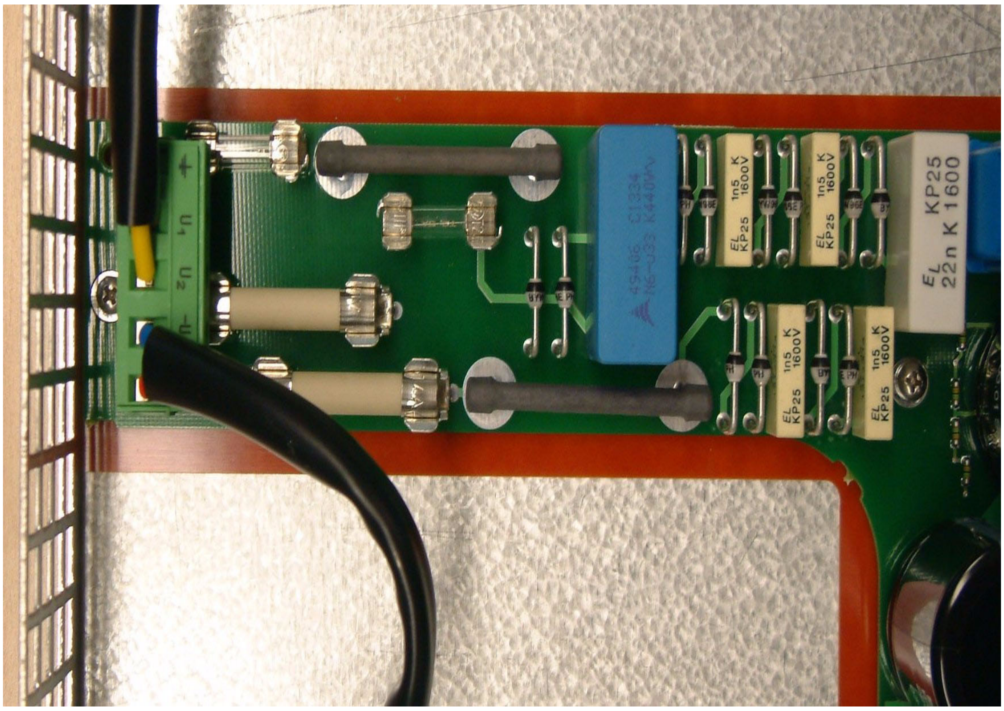
DANGER

Danger of electrical shock!
A switching power supply is located in the UV 105 (B). This switching power supply may still be under voltage although it is seperated from the power source (without current consuming unit, the voltage on the board is only reduced slowly).
Do not touch the board or the fuses with bare hands!
Use insulated pincers when removing the fuses!

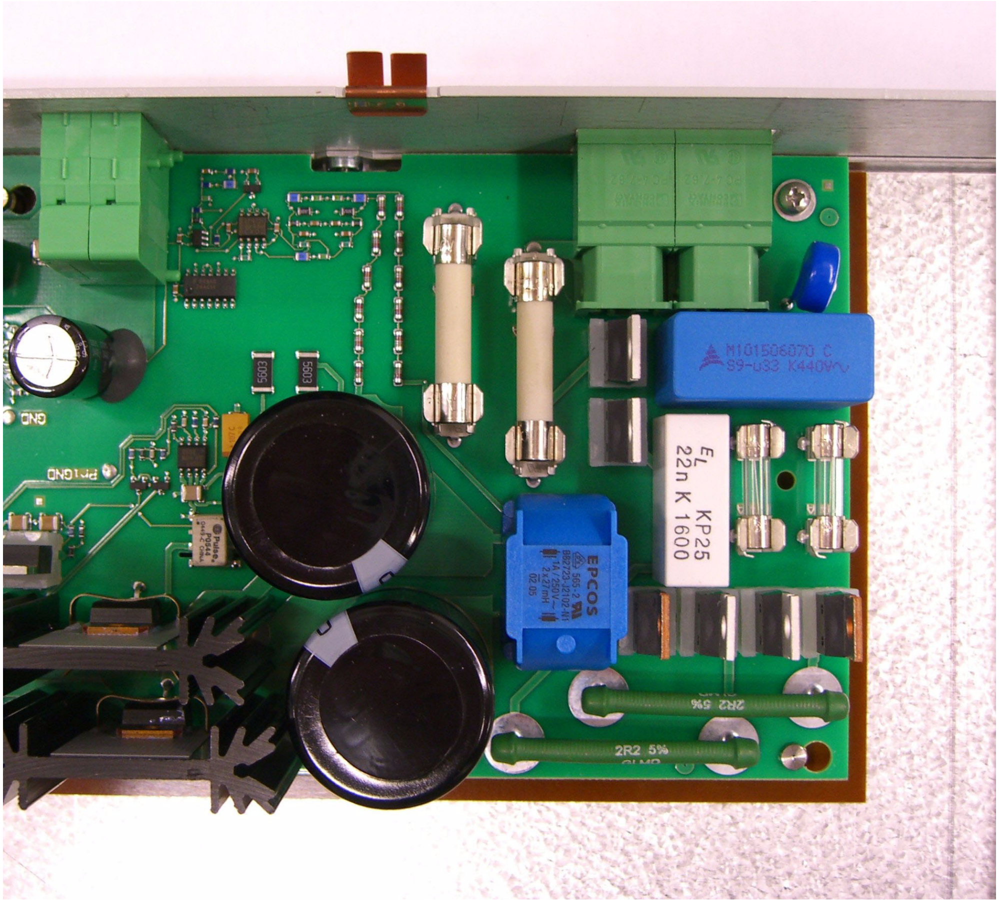
Caution

Be careful not to touch any components on the power supply board sensitive to electrostatic discharge and observe the ESD regulations!

Position of the fuses in the UV 105



Position of the fuses in the UV 105 B



Note

If any of the fuses is defective, the UV 105 (B) power supply unit must be replaced. Replacing the fuses is not advised.

Mounting the UV 105 (B)

DANGER

For mounting the UV 105 (B), the additional 5V lines must be connected with the correct polarity!
Otherwise there will be a short circuit of these lines on the 5V ribbon wires.

Restore the ground by means of lines and conductor bars!

14.1.3 UV 106, UV 106 B

Possible causes of error

- Supply voltage to U and V missing
- Fan failed
- Fuse on board of the UV 106 (B) released
- UV 106 (B) defective

Service diagnosis UV 106 (B)

DANGER

Danger of electrical shock!

High voltages and currents

When checking the UV 106 (B) power supply unit, proceed as follows:

Control of the LED READY UV

The LED READY UV on the front panelof the UV 106 (B) indicates the readiness of the unit.

Function of the fan

▶ Check, whether the fan of the UV 105 (B) is running.

If it does not, this might indicate that ...

- No supply voltage for the UV 105 (B) is available.
- Fuses in the UV 105 (B) have released.
- The UV 105 (B) is defective.

However, this may also indicate that the fan is defective.

Control of the supply voltages

▶ Measure, whether 400 V ±10 % are available on U and V of connector X31 on the front panel.

Note

It is not useful to measure the low voltages on the 50-line ribbon cable of the UV 106 (B) (e.g., with the HEIDENHAIN test adapter).
The MC could not be connected and the UV 106 (B) would operate without current consuming unit.

Fuses in UV 106 (B)

- Switch off the main switch of the machine.
- Dismantle the UV 106 (B) power supply unit.
- Ensure that the unit is not under power.
- Remove the side plate.
- Check the fuses on the power supply board.

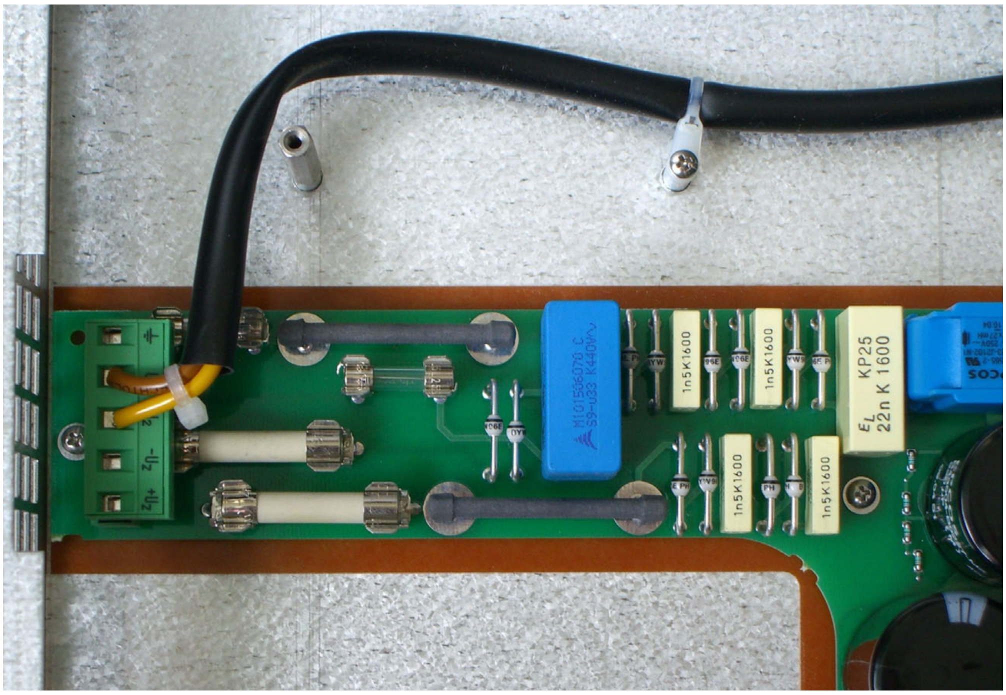
DANGER

Danger of electrical shock!
A switching power supply is located in the UV 106 (B). This switching power supply may still be under voltage although it is seperated from the power source (without current consumer, the voltage on the board is only reduced slowly).
Do not touch the board or the fuses with bare hands!
Use insulated pincers when removing the fuses!

Caution

Be careful not to touch any components on the power supply board sensitive to electrostatic discharge and observe the ESD regulations!

Position of the fuses in the UV 106



Note

If any of the fuses is defective, the UV 106 (B) power supply unit must be replaced. Replacing the fuses is not advised.

Mounting the UV 106 (B)

DANGER

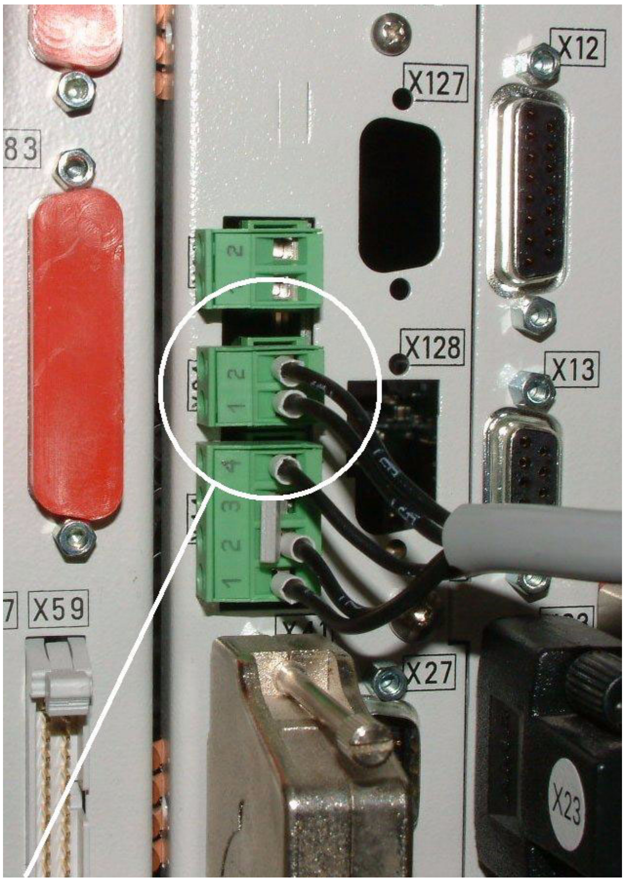
Restore the ground!

14.2 Power Supply for Control-Is-Ready Signal

X34:
Power supply for "Control-Is-Ready" signal output

The control-is-ready signal output is powered by 24 Vdc provided by the compact inverter or the power supply unit. The voltage is connected to terminal X34.

Pin layout:



Connecting terminal X34	Assignment	Connection when using a HEIDENHAIN inverter
1	+24 V	X72/1
2	0 V	X72/2

Error

If 24 Vdc at X34 are missing when the machine is switched on:

- The EMERGENCY STOP chain is interrupted and the machine cannot be switched on!

If 24 Vdc at X34 is reduced when the machine is switched on:

- The EMERGENCY STOP chain is interrupted.
  The control reports ***External EMERGENCY STOP***.

Note

It is a prerequisite that the "Control-is-ready" signal output is integrated correctly in the EMERGENCY STOP chain --> see “Basic Circuit Diagrams” on page 11 – 116, see “During Booting” on page 9 – 55!

14.3 Buffer Battery

General

If the machine is switched off, the power for the RAM is supplied by the buffer battery.
The rated voltage is 3 V.

The lifetime of the buffer battery is typically three to five years.

For safeguarding the RAM, an additional capacitor (Gold cap) was integrated onto the PCB of the iTNC. This capacitor stores the RAM content for approx. one day without batteries.

The following information is stored in the battery-buffered memory:

- Remanent PLC operands
- Most recent log entries
- Information about the trace function
- Information about program interruption
- Information from absolute encoders with EnDat interface
- Information about the boot process
- Information about errors

Message

> **Caution**
>
> If the voltage of the buffer battery falls below 2.6 V the error message **Exchange the Buffer Battery** is generated.
> The error message is activated every 30 minutes.
> **Exchange the buffer battery as soon as possible!**

Exchange of the buffer battery

To exchange the buffer battery, proceed as follows:

- Check the load status of the capicitor in the Info menu. -->
  Enter the code number 79513 and read U [ACCU].
  The voltage must be >= 3 V!

Note

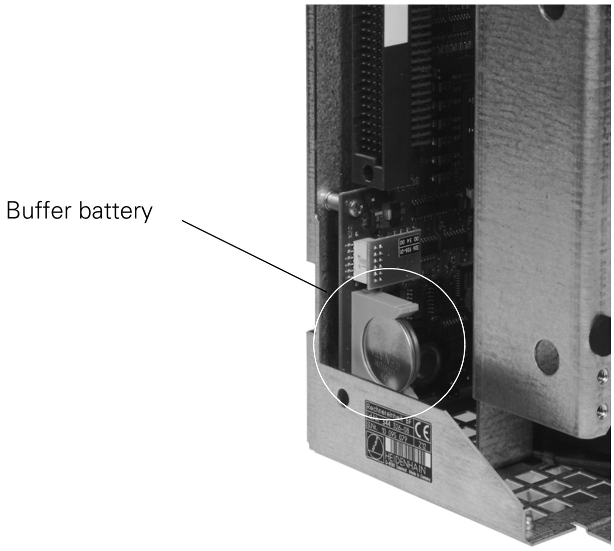
The capacitor (Gold cap) is only loaded when the iTNC is switched on. If the Gold cap is still not loaded sufficiently, please wait a few seconds and enter the code number 79513 again to read the updated voltage value.
If the voltage of the Gold cap does not reach 3 V or more, the MC must be replaced.

- Switch off the main switch of the machine.
- Dismount the MC.
- Exchange the battery.
  Due to the non-symmetric shape of the battery there is only one possibility of inserting.
  Battery type: 1 lithium battery, type CR 2450N (Renata), Id. Nr. 315878-01

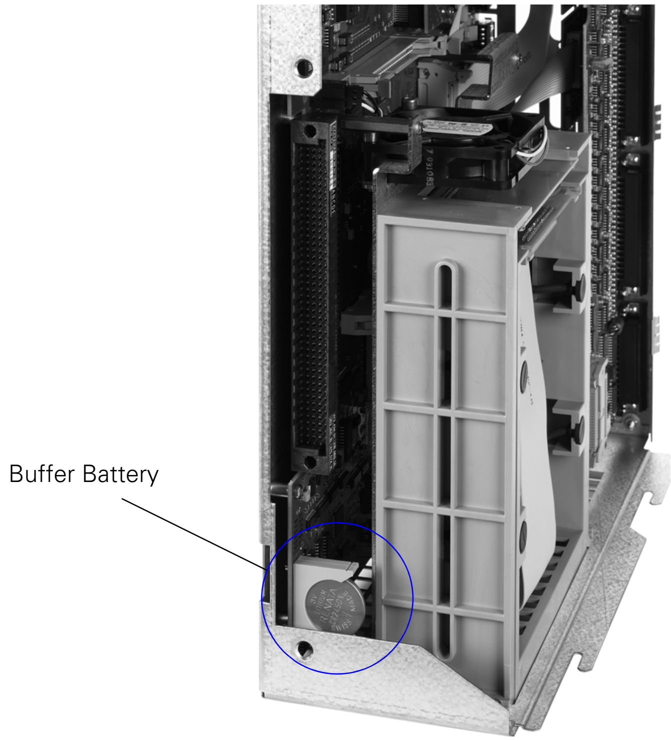
Caution

Be careful not to touch any components sensitive to electrostatic discharge
and observe the ESD regulations!

Position of the buffer battery of the MC 422



Position of the Buffer Battery of the MC 422 B



☞ **Note**

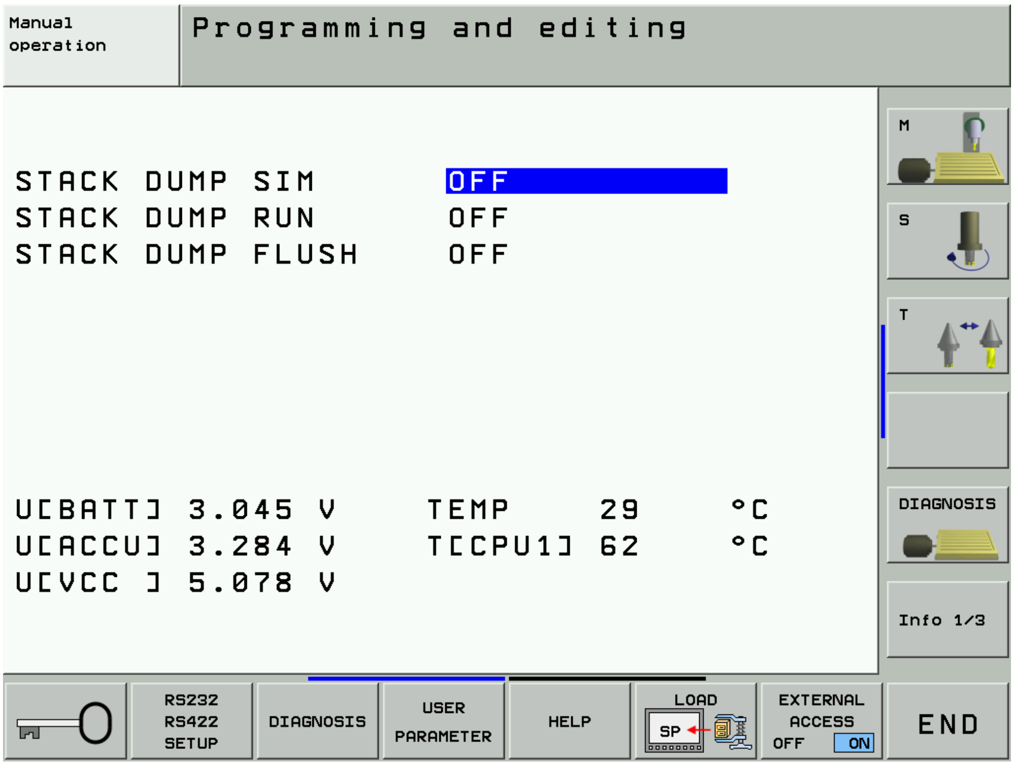
If the battery was exchanged although the Gold cap was not loaded sufficiently, the battery-buffered areas of the working memory are deleted. The non-volatile PLC markers and words belong to this area. This may mean that some components of the machine have to be set again (tool changer, swivel head, etc.) --> Ask the machine manufacturer!
The datum and the time of the BIOS setting were losts. Set these values again --> see “Setting the System Time” on page 15 – 237.

14.4 Info Menu

Call

Enter the code number ***79513*** –> see “Code Numbers” on page 3 – 13.

Confirm with ENTER and the following screen is displayed:



Description

The following information is displayed on the screen (the stack information is not important for the service technician):

U [BATT]	**3.037 V**	Voltage of buffer battery
U [ACCU]	**3.102 V**	Load status of capacitor (Gold cap)
U [VCC]	**5.03 V**	5 V supply voltage
TEMP	**35 °C**	Temperature in the housing of the MC/CC
T [CPU1]	**45 °C**	Temperature of CPU1

Note

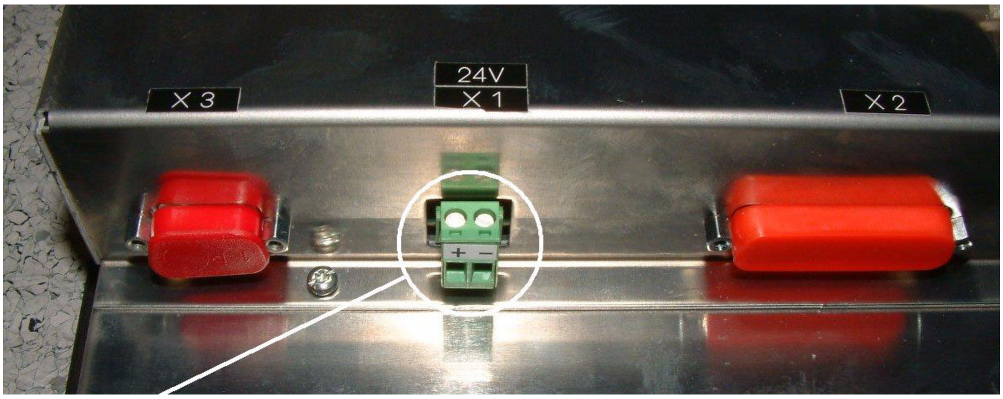
These values are updated internally in the minutes cycle.
The display is only updated with the new call of the Info menu. I.e., the code number 79513 must be entered again.

14.5 Power Supply for the Display Units

Power supply with basic insulation in accordance with EN 50 178:

Connecting terminal X1	Assignment
1	+24 V
2	0 V

Power consumption: BF 120: 15 W
BF 150: 45 W



14.6 Power Supply for PLC Outputs

14.6.1 General

The PLC of the iTNC 530 as well as the PL 410B/PL 405B/PL 510 are powered by the 24 Vdc control voltage of the machine (in accordance with VDE 0551).

The control voltage must be smoothed with a minimum 1000 µF at a rated current capacity of 150 µF/A. At a current load of 15 A, for example, this corresponds to a capacity of 2250 µF.

EN 61 131-2:1994 permits:

- 5% alternating voltage component is permissible
- Minimum absolute value: 20.4 Vdc
- Maximum absolute value: 28.8 Vdc

Power consumption

If half of the outputs are switched at the same time, the following are the values for power consumption:

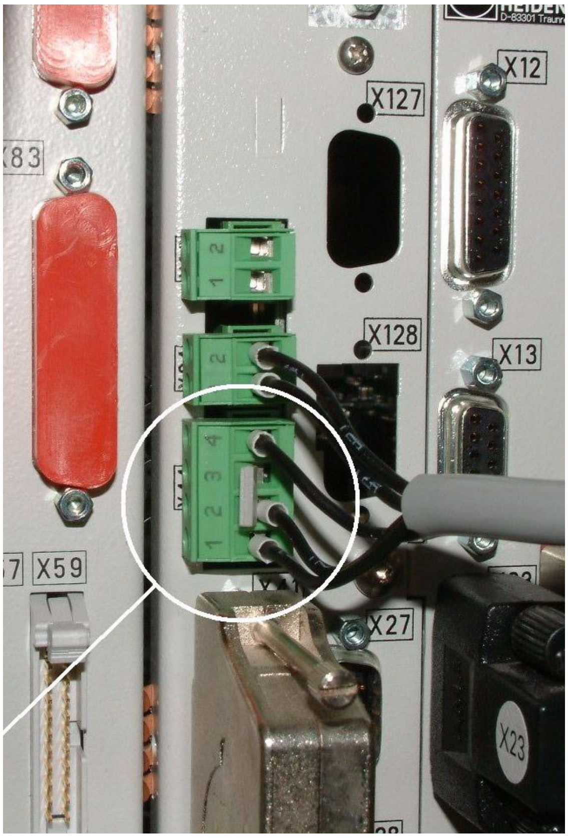
MC 42x(B):	48 W
PL 410B:	Approx. 460 W
PL 405B:	Approx. 235 W
PL 510:	Approx. 485 W

Nominal operating current per output

MC 422(B):	0.150 A
PL 410B:	2 A (with max. current consumption of 20 A)
PL 405B:	2 A (with max. current consumption of 20 A)
PLD 16-8:	2 A Simultaneity 2 outputs with 2 A each 4 outputs with 1 A each 8 outputs with 0.5 A each Total current: Out0 to Out7: £ 4 A Out0 to Out3: £ 2 A Out4 to Out7: £ 2 A

14.6.2 Supply Voltage for PLC Outputs on the MC

X44:
PLC supply voltage



Pin layout on the MC 422(B):

<table>
<tr><th>Connection terminal</th><th>Assignment</th><th>PLC outputs</th></tr>
<tr><td>1</td><td>+24 V cannot be switched off via EMERGENCY STOP</td><td>O24 to O30</td></tr>
<tr><td>2</td><td rowspan="2">+24 V can be switched off via EMERGENCY STOP</td><td>O16 to O23</td></tr>
<tr><td>3</td><td>O0 to O15</td></tr>
<tr><td>4</td><td>0 V</td><td></td></tr>
</table>

Error

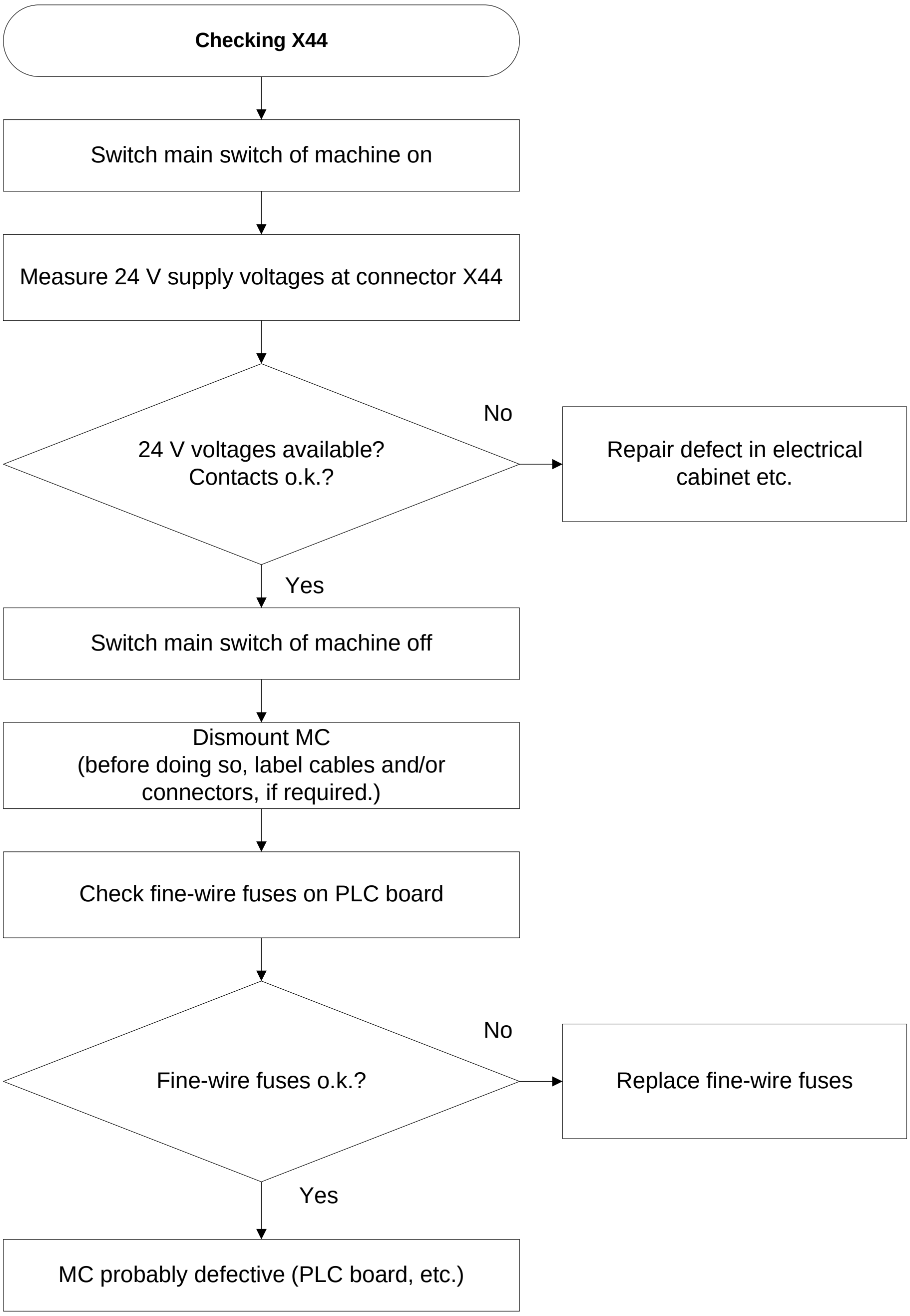
If the 24 V power supply (which cannot be shut off via emergency stop) is missing at X44, the error message **Supply voltage missing at X44** appears.

The corresponding PLC outputs do not function. Depending on the PLC program of the machine manufacturer, corresponding PLC error messages are displayed.

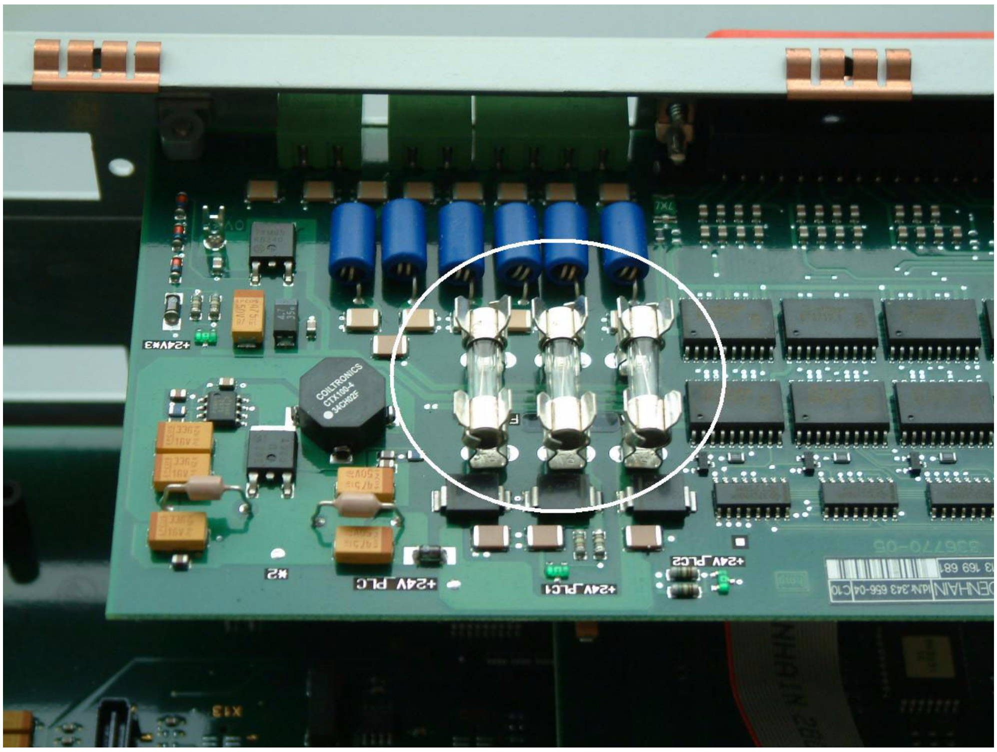
Note

Monitoring the PLC outputs –> see “The TABLE Function” on page 10 – 76.

Service diagnosis X44



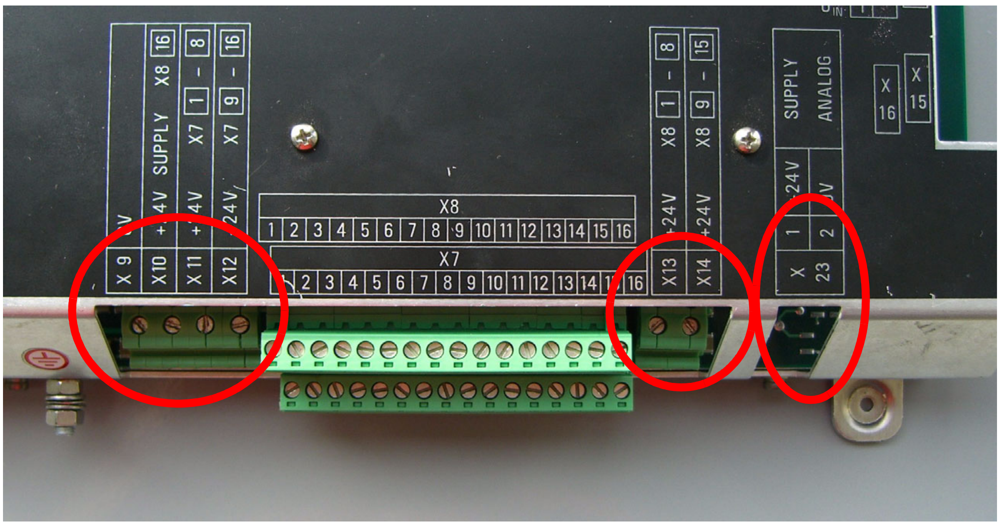
Fine wire fuses



> **Caution**
>
> Use only original replacement fuses.
> Be careful not to touch any components sensitive to electrostatic discharge and observe the ESD regulations!

14.6.3 Supply Voltage for PLC Outputs on the PL 4xx B

Connection



X9 to X14: Power supply

Pin layout on the PL 410 B:

Terminal	Assignment	PL 1	PL 2	PL 3	PL 4
X9	0 V				
X10	+24 Vdc logic power supply and for control-is-ready signal[a]				
X11	+24 Vdc power supply for outputsa	O32 – O39	O64 – O71	O128 – O135	O16O – O167
X12	+24 Vdc power supply for outputsa	O40 – O47	O72 – O79	O136 – O143	O168 – O175
X13	+24 Vdc power supply for outputsa	O48 – O55	O80 – O87	O144 – O151	O176 – O183
X14	+24 Vdc power supply for outputsa	O56 – O62	O88 – O94	O152 – O158	O184 – O190

a. 20.4 V to 28.8 V

Pin layout on the PL 405 B:

Terminal	Assignment	PL 1	PL 2	PL 3	PL 4
X9	0 V				
X10	+24 Vdc logic power supply and for control-is-ready signal[a]				
X13	+24 Vdc power supply for outputsa	O48 – O55	O80 – O87	O144 – O151	O176 – O183
X14	+24 Vdc power supply for outputsa	O56 – O62	O88 – O94	O152 – O158	O184 – O190

a. 20.4 V to 28.8 V

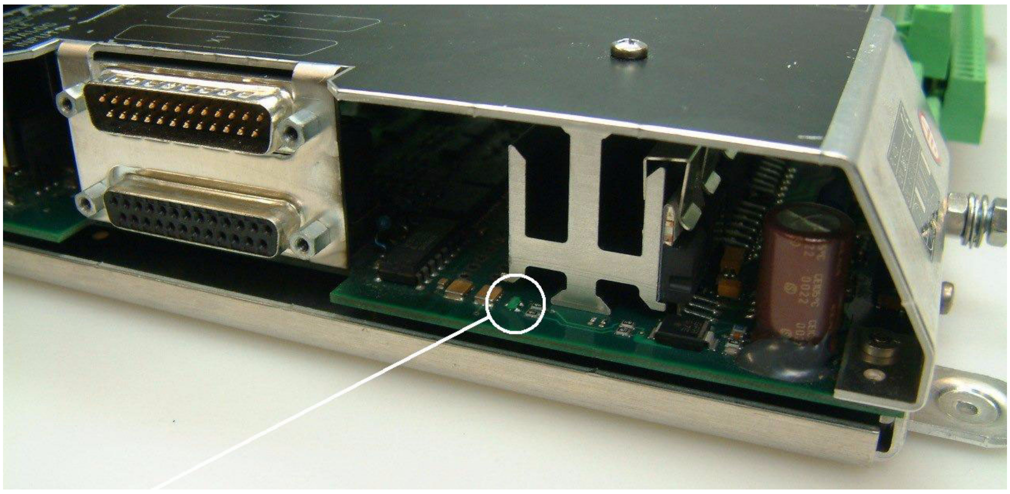
X23: Supply voltage for analog inputs on the PL 410 B

The PL 410B input/output unit is also available with additional analog inputs and inputs for Pt 100 thermistors. The power supply must comply with EN 50 178, 5.88 requirements for ”low voltage electrical separation.”

Terminal	Assignment
1	+24 Vdc as per EN 50 178, 5.88
2	+0 V

Functional control Ensure that:

- The green LED in the area of bus connector X1/X2 is on.



If this is not the case.

- Measure whether the 24 V supply voltage on X9/X10 is available.

Note

If LED is not lit up, despite available power supply, the PL board is probably defective.

- Measure all other power supply connections.

Note

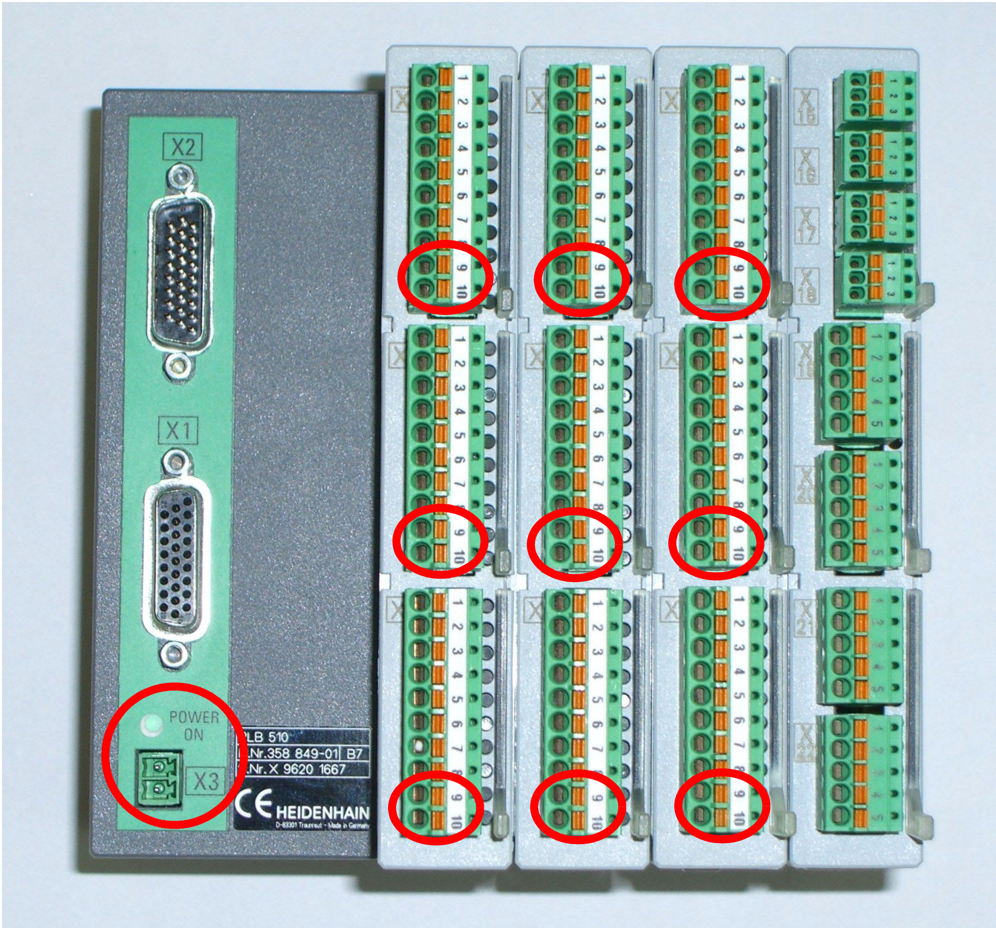
On older PLC expansion boards PL 4xx B, you may still find fine-wire fuses (glass fuses) on the board. These may be replaced, if necessary:
On newer PL 4xx B, the glass fuse has been replaced by an SMD fuse.
The SMD fuse has been soldered onto the board. Contact your HEIDENHAIN service agency.

14.6.4 Supply Voltage for PLC Outputs on the PL 510

Note

The iTNC 530 cyclically monitors the supply voltage and short circuits of the PLC outputs of a PL 510.

Connection



PLB 510 basic module

Pin layout for X3 (power supply for logic circuit):

Terminal	Assignment
1	+24 Vdc (20.4 V to 28.8 V)
2	+0 V

PLD 16-8 input/ output module

Pin layout at X6 (power supply for PLC outputs):

Terminal	Assignment
9	+24 Vdc (20.4 V to 28.8 V) for group 1 (O1 … O4)
10	+24 Vdc (20.4 V to 28.8 V) for group 2 (O5 … O8)

Error

The corresponding PLC outputs do not function. Depending on the PLC program of the machine manufacturer, corresponding PLC error messages are displayed.

> **Note**
>
> Monitoring the PLC outputs. –> see “The TABLE Function” on page 10 – 76.

Functional control

Ensure that:

- The green LEDs on X6 pin9 and pin10 of the I/O modules PLD16-8 are lit.
- The green LED POWER ON on the basic module PLB 510 is lit.

If this is not the case.

- Measure whether the 24 V supply voltages are available as indicated above.

> **Note**
>
> If the LEDs are not lit up, despite available power supply, the basic module PLB 510 or the corresponding I/O module PLD 16-8 is probably defective.

15 Hard Disk and File Manager of the iTNC 530

15.1 Introduction

- The TNC data and the PLC data are located on the hard disk of the iTNC 530 **as well as the complete NC software, including the setup files.**
  Note:
  With dual-processor controls, the Windows system is located on the hard disk.

Caution

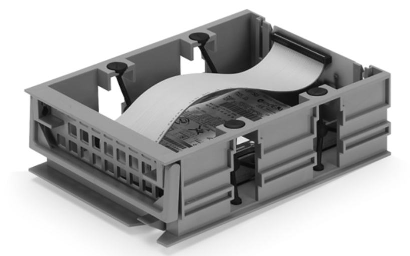
If there are defects on the hard disk, it may be possible that no functions at all can be called.

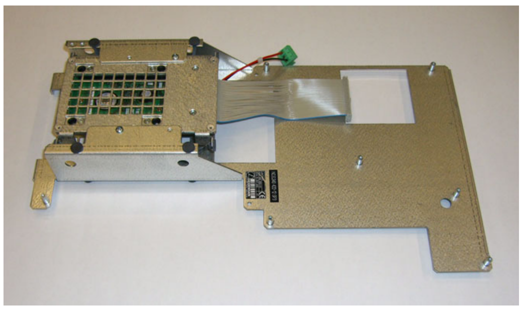
- The MC 422 includes the so-called drive assembly. It is permanently installed.
  The MC 422 B and the MC 420 have an expansion case for the HDR (Hard Disk Removeable).
- Depending on the operating conditions (e.g., vibration load, dirt), the hard disk is exposed to higher or lower loads. HEIDENHAIN thus recommends to have the hard disk checked after 3 to 5 years.

Caution

As the complete NC software is located on the hard disk **it is object of the export limitations.**

HDR and drive assembly





Removal and insertion of the HDR, shipping brace
--> See "Exchanging the HDR" on page 26 – 433.

Removal and insertion of drive assembly, shipping brace
--> See "Removing the Drive Assembly" on page 26 – 425.

15.2 Structure of the Hard Disk

Single-processor control

The hard disk is divided into three partitions:

TNC:	User-specific data: NC programs, tool tables, datum tables, pallet tables, etc. are stored here.
PLC:	OEM-specific data System files, PLC programs, machine parameters, help files, PLC dialogs, PLC error tables, compensation value tables and OEM cycles are stored here. The PLC partition only becomes visible when you enter the code number 807667.
SYS:	System-specific data The complete NC software including setup files is located here (NC dialogs, HEIDENHAIN cycles, etc.) and the HeROS operating system (HEIDENHAIN Real Time Operating System). A daily password is required to open the SYS partition.

Caution

Changes to the SYS partition can result in a malfunction of your TNC.

Dual-processor control

The hard disk is divided into four partitions:

Windows 2000	Drive letter under Windows –> **C:**
TNC:	User-specific data Drive letter under Windows –> **D:**
PLC:	OEM-specific data Drive letter under Windows –> **E:**
SYS:	System-specific data Drive letter under Windows –> **F:**

15.3 Hard Disk Test

General

When the control is started and there is no communication with the hard disk, normally the following error message is displayed:

Boot: Giving up
Reason is: Load processes failed
or
No bootable device available

At present no tests in the field are possible!

If data are still transferred to the hard disk, some tests could be carried out in the field.
–> See following instructions.
Additional and more comprehensive tests can only be performed at HEIDENHAIN agencies!

Caution

Do not use your own hard-disk test or repair programs!
This could complicate or make it impossible for HEIDENHAIN or specialized companies to rescue data.

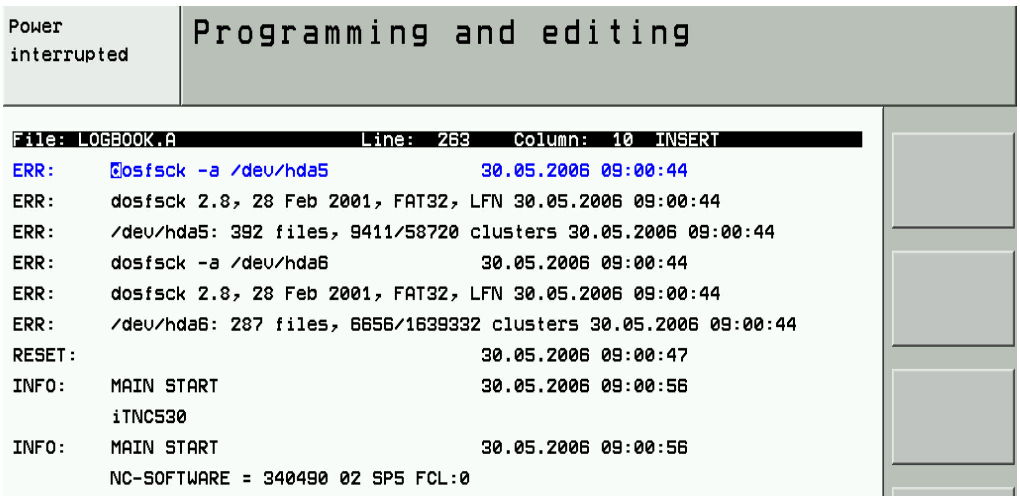
With the single-processor control (without Windows 2000)

Each time the control is booted, the SYS partition is tested (file-system check).
If the control is not properly shut down but is just switched off, the file-system of all partitions is tested when the control is restarted.

If a hard-disk error is suspected:

- Press the EMERGENCY STOP button of your machine.
- Switch the power switch off without properly shut down of the control.
- Switch on the control again.
- Call the log.
- Search in the log for the word ***dosfsck.***
- Read whether defective clusters or files have been found.

Excerpt from the log:



The file-system check has been assigned to the partitions as follows:

TNC:	dosfsck -a /dev/hda6
PLC:	dosfsck -a /dev/hda5
SYS:	dosfsck -a /dev/hda1 (is displayed in the log only in case of an error!)

Note

If the NC software cannot be started with the defective hard disk and thus the log cannot be called, contact your HEIDENHAIN service agency for further possibilities to investigate the hard disk!

With the dual-processor control (with Windows 2000)

Principally, all functions of Windows 2000 can be used with the dual-processor control. Windows 2000 also includes hard-disk test programs.

Note

To perform the hard-disk tests, you require certain local administrator rights in Windows 2000. --> Ask the machine manufacturer!

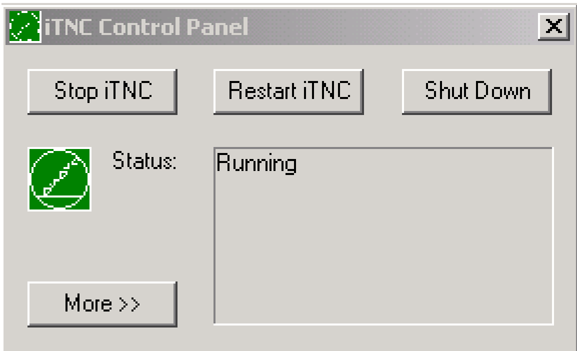
Caution

- First close all programs in Windows before you activate the test programs. This also applies to the iTNC application!
- Changes in Windows may influence the function of the control!
- HEIDENHAIN cannot guarantee the function of Windows applications!

You can use the following test routine:

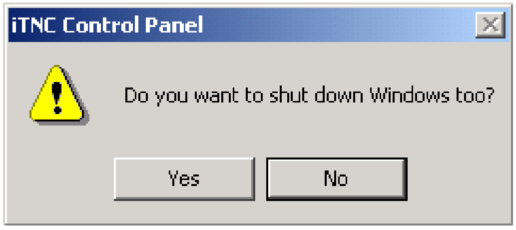
- Press the WINDOWS key.
- Close all programs in Windows, also the iTNC application.

- Double-click the HEIDENHAIN symbol in the status display of the task bar.
- The ***iTNC Control Panel*** opens:



- Now click ***Shut Down***
- The following message is displayed:

- Press EMERGENCY STOP and click ***Yes***
- The following message is displayed:



- Click ***No*** --> Windows is not supposed to be shut down!
- You can now see the Windows user interface.
- Click on ***My Computer/Control Panel/Administrative Tools/Computer Management/ Storage/Disk Management.***
- Here the condition of the data medium (hard disk) is shown, e.g. ***Healthy***
- Click with the right mouse button on the drive to be tested.
- Click on ***Properties*** in the open window.
- Click now on ***Tools*** and for ***Error-checking*** on ***Check Now*** (in window ***Check disk*** no additional information has to be selected).
- Click on ***Start***
- If no error has been detected, the error message ***Disk Check Complete*** is displayed.
- If you find an error, please contact HEIDENHAIN!

Note

The same test can also be performed with the *Command Prompt* and the command *chkdsk* , e.g., *chkdsk C:*

15.4 Setting the System Time

Single-processor control

- The setting of the system time of single-processor controls is only explained in the HEIDENHAIN service courses.
  If necessary, contact the HEIDENHAIN hotline!
- In machine parameter MP 7235, the difference between local time and system time can be entered.
  The Greenwich Mean Time (GMT) is used as system time.

Note

The wintertime and summertime are not changed automatically.

For this, MP 7235 must/can be adapted.

Dual-processor control

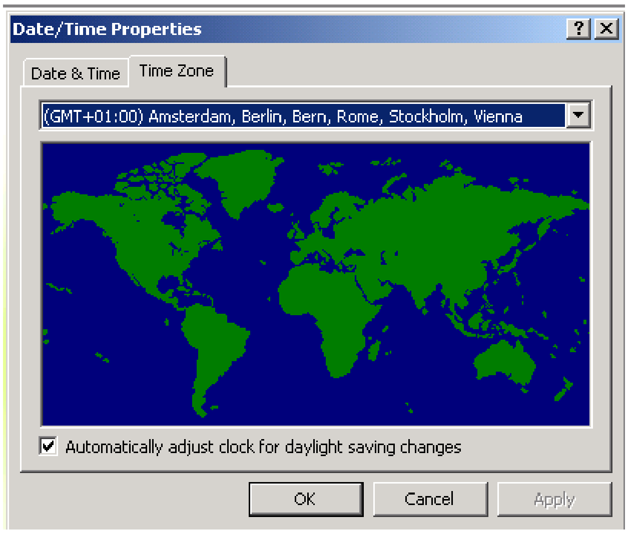
The system time of dual-processor controls is set by means of the Windows clock.

Note

To set the Windows clock, you require certain local administrator rights in Windows 2000. Contact your machine tool builder.

▶ Click on the time display in the Windows task bar (usually at the buttom right corner).

▶ Firt select the correct time zone.

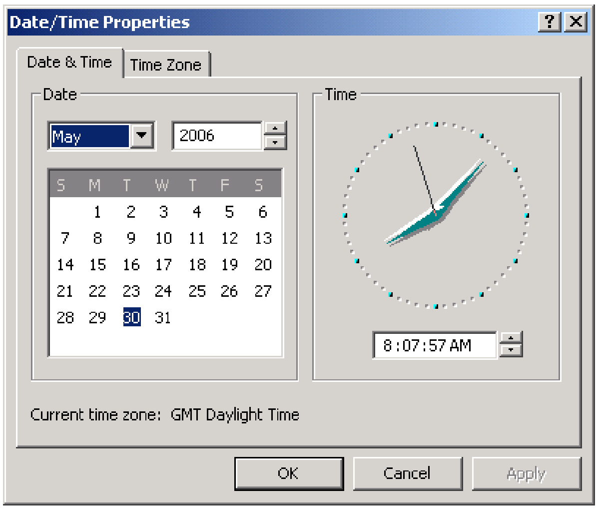


Note

The automatic conversion from summertime to wintertime can be activated.

The difference between local time to Greenwich Mean Time (GMT) is defined with the selected time zone. In dual-processor controls with Windows 2000, MP 7235 does not have any function.

▶ Subsequently, set the current datum and **the local time.**



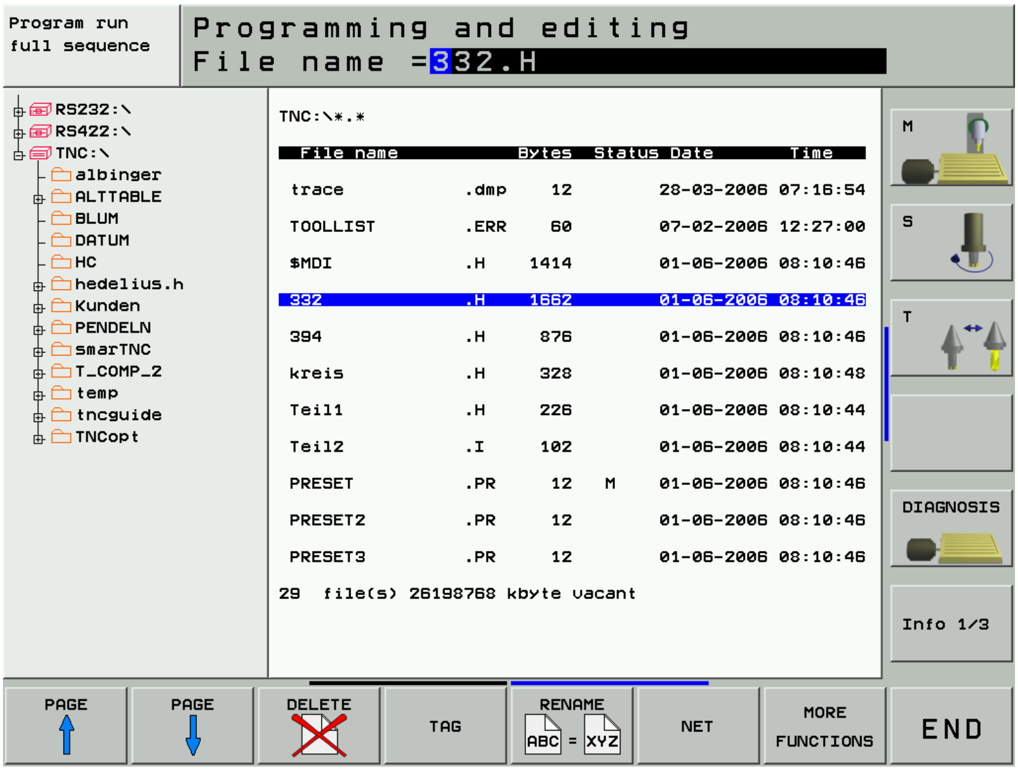
15.5 File Management of TNC Partition (TNC:\)

Calling the TNC partition

- Press the following key combination to call the TNC partition:

- Select the ***Programming and Editing*** operating mode

- Call ***Program Management***



The directory structure is displayed on the left.
The associated files are listed on the right.

With the UP and DOWN keys, the corresponding subdirectories or files can be selected. The selected directory or the selected file are indicated in the header. With the +/- key you can open and close subdirectories.

Use the LEFT and RIGHT arrow keys to move between the directory and file side of the screen.

Note

Under *RS232 RS422 Setup* the user can switch between ***standard*** display mode (without subdirectories, similar to TNC 415) and the ***enhanced*** display mode (with subdirectories) via the selection field *PGM MGT:* with the ENTER key.
Press the *MOD* key in the open *Program Management* to obtain the soft key *RS232 RS422 Setup*.

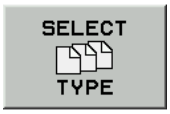
Overview of Important TNC file types

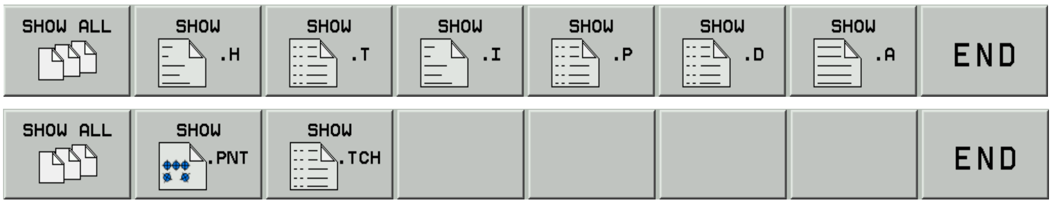
File type	File extension
NC program HEIDENHAIN language	.H
Tool table	.T
NC program in ISO format	.I
Pallet table	.P
Datum table	.D
ASCII file (text file)	.A
Point table	.PNT
Pocket table (tool changer)	.TCH
Preset table	.PR
Cutting-data table	.CDT
Freely definable tables (e.g., tables of tool material and workpiece material)	.TAB
Dependent data (such as structure items)	.DEP

Note

If you cannot find certain files although they are in the correct directory, it is possible that a filter for file types has been set. This filter can be removed by pressing the soft keys *SELECT TYPE --> SHOW ALL*.

Which file type is to be listed?





Use this key to switch between soft-key rows

File information

File name	Name consists of up to 16 characters plus file extension
Bytes	File size in bytes
Status	File properties:
	E The file is selected in Programming and Editing
	S The file is selected in Test Run
	M The file is selected in a Program Run mode
	P Protected file, i.e. cannot be deleted or edited
	+ This file has dependent files (see User's Manual)
Date	Date on which file was last changed
Time	Time at which file was last changed

Note

Refer to the iTNC 530 User's Manual for detailed information about file management!

15.6 File Management PLC Partition (PLC:\)

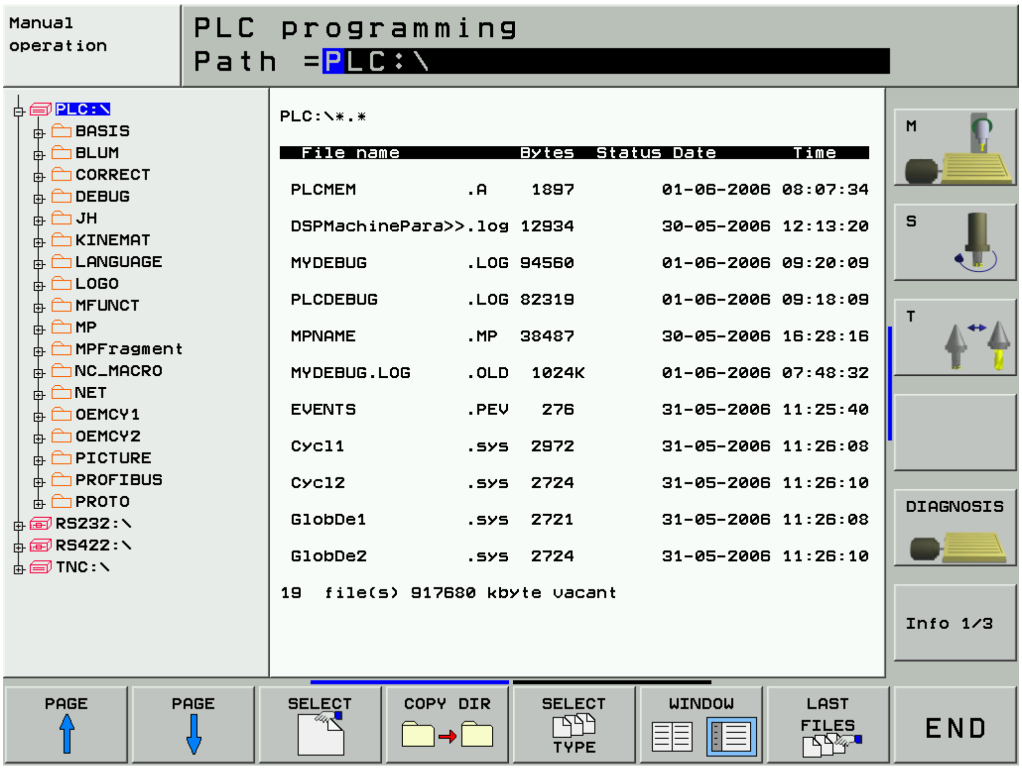
Calling the PLC partition

- Press the following key combination to call the PLC partition:
  - Select the ***Programming and Editing*** operating mode
  - MOD — Call window for code number
  - 8 0 7 6 6 7 ENT — Enter and confirm code number
- After the code number has been entered, the PLC main menu is displayed.

Note

If the dialog *READONLY* appears on the left side of the screen, the machine manufacturer has protected the PLC partition with his own code number. As a result, the *OEM.SYS* system file cannot be called again. All other PLC files can still be read but cannot be edited any more.

PGM MGT — Call ***Program Management***



The directory structure is displayed on the left.
The associated files are listed on the right.

With the UP and DOWN keys, the corresponding subdirectories or files can be selected. The selected directory or the selected file are indicated in the header. With the +/- key you can open and close subdirectories.

Use the LEFT and RIGHT arrow keys to move between the directory and file side of the screen.

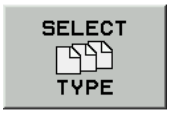
Overview of important PLC file types

File type	File extension
Converted PLC programs	.PLC
ASCII files (text files, e.g., PLC dialogs and error messages)	.A
Help files	.HLP
Important system file	OEM.SYS
System files	.SYS
Compensation tables	.COM
Compensation assignments	.CMA
Standard PLC error messages	.PET
Source files	.SRC
Soft-key project files	.SPJ
Machine parameter lists	.MP
OEM cycles	.CYC .DES .PIC .ELE
Oscilloscope recordings	.DTA
Network settings	.N00 .M00 .P00

Note

If you cannot find certain files although they are in the correct directory, it is possible that a filter for file types has been set. This filter can be removed by pressing the soft keys *SELECT TYPE --> SHOW ALL* .

Which File Type is to be Listed?



Use this key to switch between soft-key rows.

File information

File name	Name consists of up to 16 characters plus file extension	
Bytes	File size in bytes	
Status	File properties:	
	E	The file is selected in Programming and Editing
	S	The file is selected in Test Run
	M	The file is selected in a Program Run mode
	P	Protected file, i.e. cannot be deleted or edited
	+	This file has dependent files (see User's Manual)
Date	Date on which file was last changed	
Time	Time at which file was last changed	

Note

Refer to the iTNC 530 User’s Manual for detailed information about file management!

16 Data Backup

16.1 Introduction

Data backup recommended

It is often necessary or recommended for service visits to save certain data on the hard disk of the control!

The PLC data, i.e., the machine specific data of the machine, are mostly interesting for the service technician.

Note

If required, the machine data (PLC partition) for the machine tool can be obtained from the machine manufacturer or is supplied with the machine.

Caution

If changes were made to the machine (e.g., NC software update, modifications, etc.) resulting also in changes or adaptations of the machine data (machine parameter, PLC program, etc.), a new backup for this machine must be created!

Available data interfaces

For the data backup of the iTNC 530 the following data interfaces are available (standard):

- An Ethernet interface
  Connector X26
- An RS 232 interface (V.24)
  Connector X27
  Connector X127, additionally for the dual-processor control for Windows 2000
- An RS 422 interface (V.11)
  Connector X28
  Connector X128, additionally for the dual-processor control for Windows 2000

Note

The Ethernet interface X26 of the single-processor control is managed by the HEIDENHAIN operating system (HeROS), of the dual-processor control by Windows 2000.
The serial interfaces X27 and X28 are managed by the HEIDENHAIN operating system (HeROS), X127 and X128 by Windows 2000.

Note

For the service visit the use of the Ethernet interface is advisable. It is always integrated in the iTNC and represents the fastest mode of data transfer.

Depending on the Windows system of your laptop/PC, there are different proceedings regarding the interrogation and setting of the Ethernet configuration.
The following description shows an example with Windows 2000.
Windows knowledge is required! If necessary, ask your system administrator!

For the **access to the network settings** on your laptop/PC and also on the control, you require the **corresponding access rights** (passwords, code numbers, etc.).
If required, contact your system operator or the machine manufacturer!

Data transfer software TNCremoNT

For the data transfer and data backup the HEIDENHAIN data transfer software ***TNCremoNT*** as of version 2.3 is used in this description.

The **current *TNCremoNT*** version can be downloaded from the **HEIDENHAIN website** (www.heidenhain.de/Services/...) and installed on your service laptop or your stationary PC.

Note

The ***TNCremoNT*** program includes detailed operating descriptions including table of contents in ***Menu/Help***.

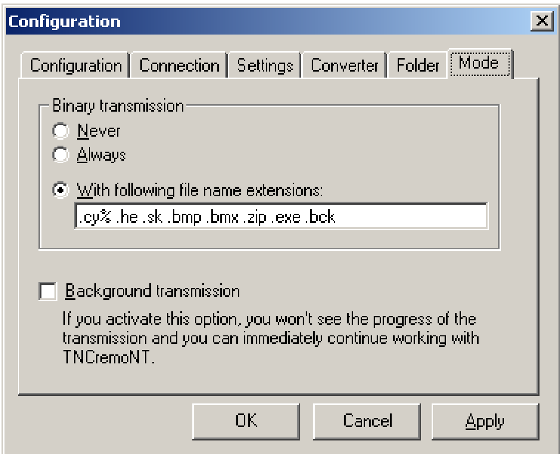
BINARY-ASCII conversion

Some files (e.g., NC programs) on the hard disk of the control are available in BINARY format.

Important advantages of this data format are the relatively fast access and the relatively low memory requirements.

If the default setting of the HEIDENHAIN data transfer software TNCremoNT is correct, the downloading of data from the control's hard disk to an external data medium (e.g., laptop/PC) is performed with an automatic conversion from BINARY format to ASCII format.
During transfer of data from an external data medium to the control's hard disk, the data are converted from ASCII format to BINARY format.

The picture shows the correct default setting in the TNCremoNT configuration.



Note

The data of a iTNC 530 are archived externally in the defined ASCII format as the BINARY format on the control can be changed, e.g., after an NC software update.

Protection from data tampering

It is possible that the machine manufacturer has activated the below soft key on the iTNC 530. Before data are read from or written to the control's hard disk, such and action must be approved.

- Press the **MOD** key and subsequently the soft key **EXTERNAL ACCESS ON/OFF.**
  --> The access must be approved!

Note

The **external access** (via laptop/PC) to partitions on the control's hard disk (e.g., PLC partition) **can be locked with passwords** by the machine manufacturer, like the internal access (on the control).
Contact the machine manufacturer!

16.2 Connection Setup

16.2.1 Via Ethernet

You need:

- A laptopt/PC with **Ethernet card**
- Either a **Ethernet crossover cable** for the direct connection between laptop and control **(peer-to-peer connection)** or a non-crossed Ethernet cable (patch cable) for connection via your local network (intranet).

> **Note**
>
> Mark your cable as "crossed" or "non-crossed"!

Connection via your local network

Ask your system administrator, if necessary!

Connection Establishment at the customer's (field service)

It is advisable to set up a direct connection between your service laptop and the control (peer-to-peer).

- Ask your customer whether you may disconnect the control from his in-house network for the duration of your work.
- Connect your laptop directly to the control by means of a crossed Ethernet cable.

> **Note**
>
> You can read the IP address and the subnet mask of the control after entering the code number ***NET123*** and pressing the ***DEFINE NET*** soft key.
>
> With the dual-processor control, the IP settings of Windows are managed.
> The HEIDENHAIN code number *NET123* has no effect. You can enter the command ***ipconfig*** in the prompt. Subsequently read the settings in the line ***Ethernet adapter Local Area Connection***.
> Or click on My Computer\Control Panel\Network ...
> Contact your system administrator.

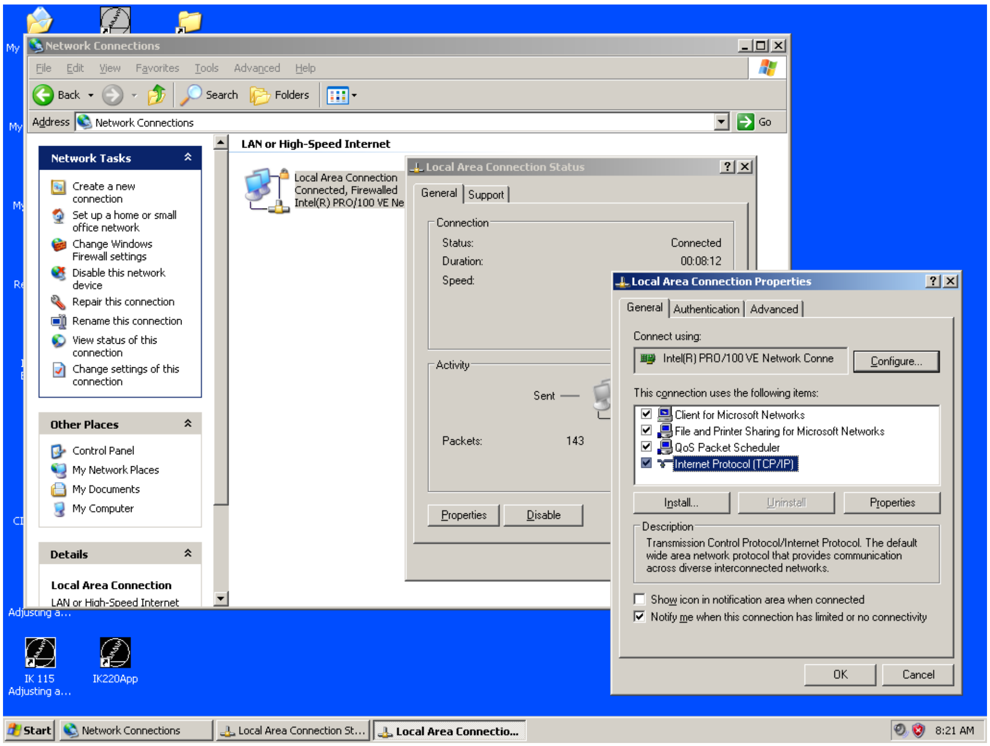
- Now either adapt the **IP address** and the **subnet mask** of your laptop to the IP address and the subnet mask of the iTNC, or vice versa.

Adapting the IP address of the laptop

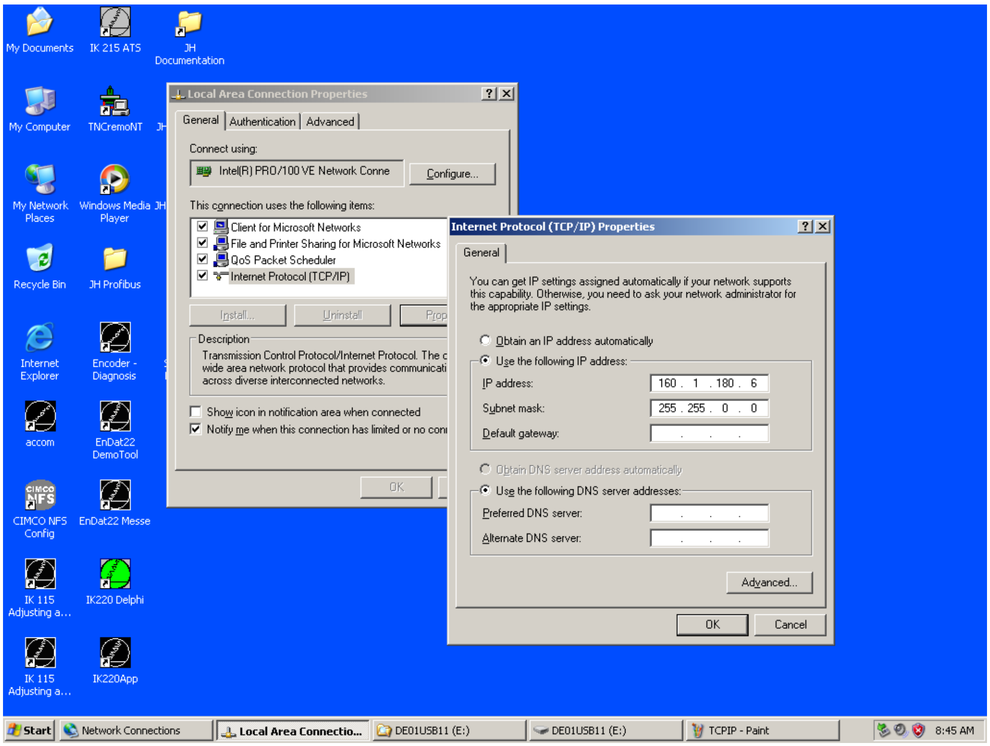
If you want to adapt the settings of your laptop to those of the iTNC:

- Click on your laptop on My computer --> Control Panel --> Network (or Network and Communication, or similar).
- Now search the place where you can call and edit the characteristics of the TCP/IP Protocol.

In the following example (Windows 2000) the characteristics of the TCP/IP protocol are stored in LAN connection --> Properties --> Internet protocol (TCP/IP) --> Properties.



Click on *Properties* to display the following window:



Caution

Note down the original settings which you will have to restore later!

For the following changes to the setting of you Ethernet card, you require the corresponding permissions. Contact your system administrator.

- The IP address must not be generated automatically
  (DHCP = Dynamic Host Configuration Protocol)!
  You require a fixed IP address! Specify this accordingly.
- Enter an IP address.

Note

We recommend to use the IP address of the iTNC and to increase or decrease the last place by one.

Example:
Adress of the iTNC160.1.180.5
Adress of the laptop160.1.180.6 or 160.1.180.4

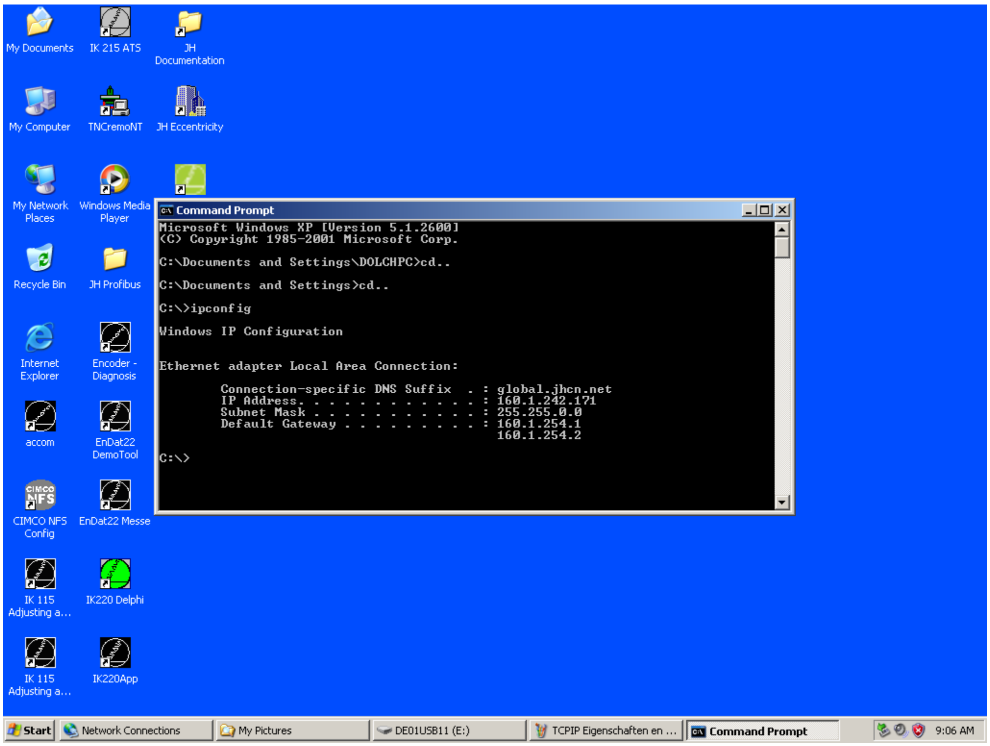
- The subnet mask of your laptop must be identical with that of the iTNC. Enter this accordingly (the standard gateway is of no significance here)!
- Confirm the settings (your laptop may reboot).

Adapting the IP address of the control

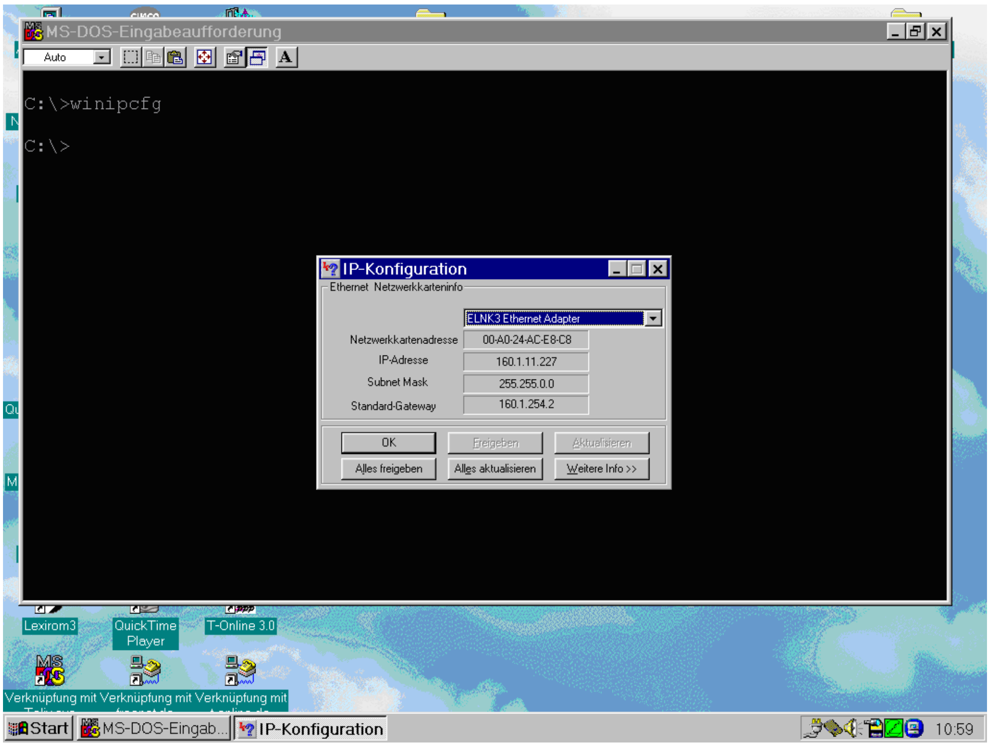
If you want to adapt the settings of your iTNC to those of the laptop:

- Determine IP address and subnet mask of our laptop.

At the prompt enter, e.g., the command ***ipconfig*** ...



or your enter the command ***winipcfg*** (depending on the Windows version).



You can also find this information in My Computer\Control Panel\Network ...

Now back up the original network settings of the iTNC 530:
With the **dual-processor control,** write down the original network settings.
With the **single-processor control,** these ***DEFINE NET*** settings are filed in a certain file ...

- Call the PLC partition (PLC code number) and subsequently the program manager.
- Enter the folder ***NET***.
- ***For this purpose copy the file* ip4-n00 *(in PLC:*WET*) as* ip4-n00.txt** (or similar) or write down the information in this file.

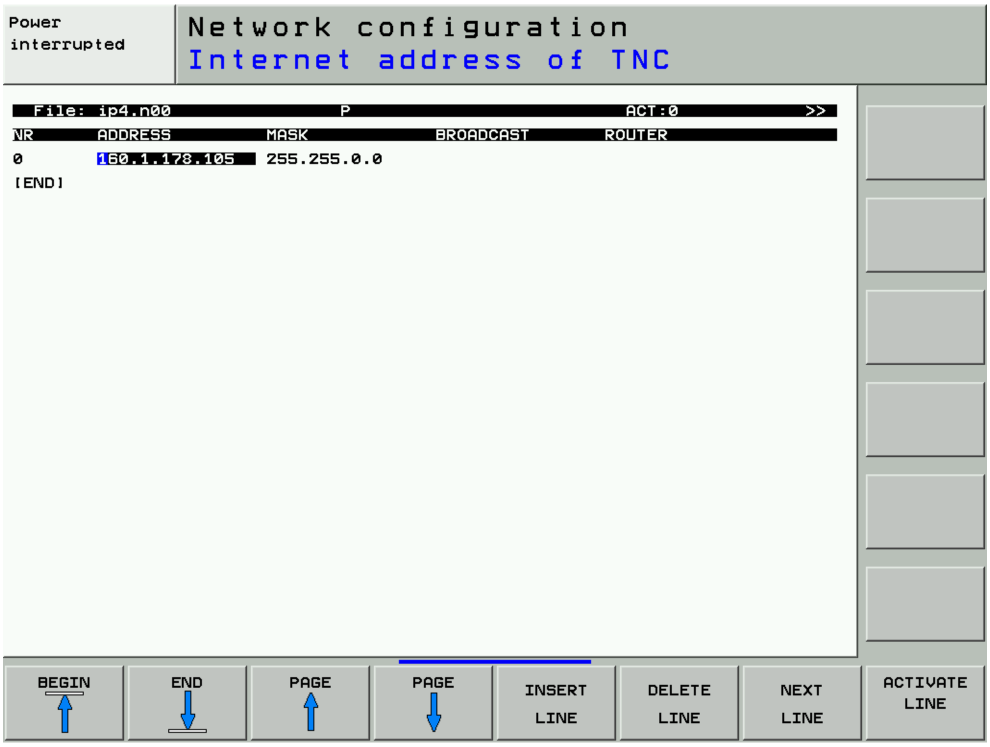
Note

If there is a *P* in the status column of the file *ip4.n00*, it is protected against editing. This protection can be cancelled: Press the soft keys *AUX. FUNCTIONS --> UNPROTECT.* The *P* in the status column disappears and the network settings can be changed.

Now adapt the original network settings of the iTNC 530:
With the **dual-processor control,** adapt the original network settings under Windows.
With the **single-processor control** ...

- Enter the code number ***NET123*** on the control and press the soft key ***DEFINE NET***.

The following display appears ...



- Press the soft key ***INSERT LINE*** (if available, depending on the NC software version).(You can then enter new settings without overwriting existing settings.)
- Adapt the IP address of the control to the IP address of your laptop.

Note

We recommend to use the IP address of the laptop and to increase or decrease the last place by one.

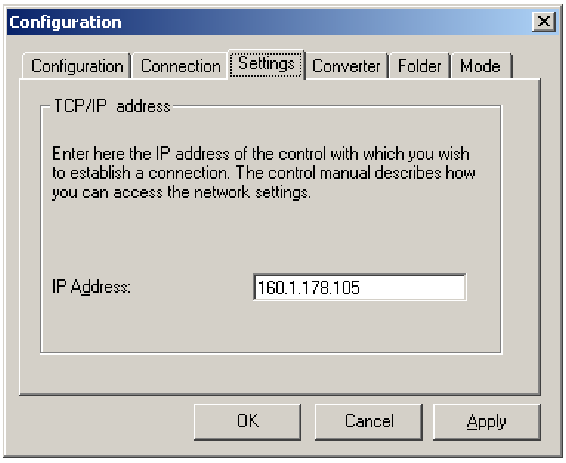
Example:
Address of the laptops160.1.11.227
Address of the iTNC160.1.11.228 or 160.1.11.226

- Enter the same subnet mask as that of your laptop.
- Press the soft key ***ACTIVATE LINE*** (if available, depending on the NC software version).
- Press END twice.
- The control now reboots.

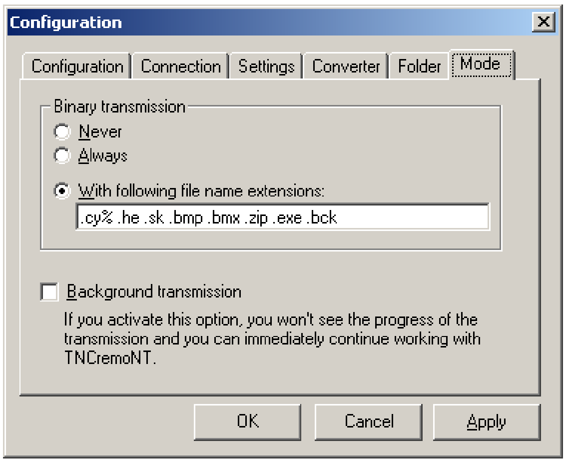
TNCremoNT

- Start the HEIDENHAIN data transfer program TNCremoNT.

- Click this icon to open the configuration window (can also be opened via ***Extras/Configuration ...***).
- Now click on ***Connection*** and select ***TCP/IP (Ethernet connection)***.
- Subsequently, click on ***Settings*** and enter the IP address of the control.



Check the transmission mode (binary-ASCII conversion). It should be set as follows:



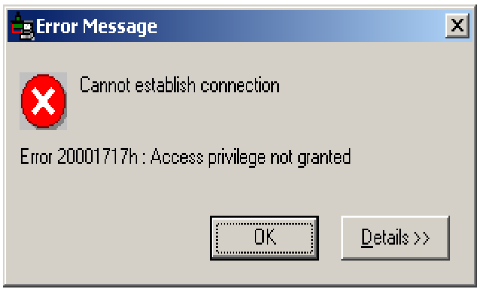
- Confirm with ***Apply*** and ***OK***.

- Click this icon. –> The connection is established.

- The TNCremo screen is divided and the control's hard disk is shown in the lower half of the screen. If this does not work, please check the connecting cable and the settings!

Note

If the following error message is displayed during connection establishment, …



... the external access to the control is not permitted!

In this case press the **MOD** key on the control and subsequently the soft key **EXTERNAL ACCESS ON/OFF** must be pressed. --> The access must be permitted!

"Pinging"

If the connection with TNCremoNT is not established, you can "ping" to check the functioning of the Ethernet cards in the laptop and in the control and to check the correct connection via Ethernet.

"Ping-loopback-test" on the laptop (test of the Ethernet card of the laptop):

- At the prompt enter the **ping** command followed by the IP address of the Ethernet card of the laptop (e.g., ping 160.1.11.227).
- Confirm with *ENTER*. --> If the Ethernet card functions you will receive an answer! If the Ethernet card does not function, a time-out message is generated.

"Ping-loopback-test" on the control (test of the Ethernet card of the control):

- Enter the code number ***NET123*** and press the soft key ***PING***
- Enter the IP address of the iTNC.
- Confirm with *ENTER* --> If the Ethernet card functions, you will receive the answer ***HOST RESPOND.*** If the Ethernet card does not function, the ***TIMEOUT*** message is displayed.

Pinging from the laptop to the control (test of the connection):

- At the prompt enter the **ping** command followed by the IP address of the Ethernet card of the control.
- Confirm with *ENTER*. --> If the connection functions you will receive an answer from the control! If the connection does not function, a time-out message is generated.

Example: Pinging from the laptop to the control ...

```
Command Prompt

C:\>ping 160.1.236.220

Pinging 160.1.236.220 with 32 bytes of data:

Reply from 160.1.236.220: bytes=32 time<1ms TTL=128
Reply from 160.1.236.220: bytes=32 time<1ms TTL=128
Reply from 160.1.236.220: bytes=32 time<1ms TTL=128
Reply from 160.1.236.220: bytes=32 time<1ms TTL=128

Ping statistics for 160.1.236.220:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>
```

Pinging from the control to the laptop (test of the connection):

- Enter the code number ***NET123*** and press the soft key ***PING.***
- Enter the IP address of the laptop.
- Confirm with *ENTER.* --> If the connection functions, you will receive the answer ***HOST RESPOND.*** If the connection does not function, the messageTIMEOUT ***is generated.***

Note

If the "pinging" does not function, you have to check again all settings and the hardware (Ethernet cables, Ethernet cards).

Meaning of the LEDs on the ethernet data interface X26

LED	Condition	Meaning
Green	Blinking	Interface active
	Off	Interface inactive
Yellow	On	100 Mb net
	Off	10 Mb net

Restoring the original settings

After having finished data back-up and separated the connection, do not forget to restore the original network settings of your laptop or of the iTNC.

- Enter the original settings and confirm with *ENTER*.
- Delete the newly inserted line in the network settings of the control. --> The line with the original settings moves again to the top-most position.
- If you have overwritten the original settings on the control, you have to enter them again or copy the back-up file (e.g., ip4n00.a) to file ip4.n00.

Note

The control has to be rebooted to activate the settings!

Note

You can protect the file ***ip4.n00*** with the original network settings.
Call the PLC partition (PLC code number) and subsequently the program manager. Enter the folder ***NET.*** Move the cursor to the file and press the soft keys ***AUX. FUNCTIONS.***
--> PROTECT. A ***P*** is shown in the status column for "protected".

16.2.2 Via Serial Interface RS 232/V.24 or RS 422/V.11

You need:

- A laptop/PC with a RS 232 (or RS 422) interface or a adapter RS 232 on USB.
- A **crossed serial connecting cable** (standard cable) for the connection between laptop and **D-sub connector on the electrical cabinet** (adapter block by HEIDENHAIN).
  Possible configurations, also for direct connection of the laptop to the iTNC. -->
  see “Cable Overview” on page 16 – 272.

Note

Do not use self-made cables (shielding problems, contact problems, short circuits, etc.).
Mark your cable as "crossed" or "non-crossed".

Caution

Use the **“Opto Bridge“**!
The serial interfaces RS 232 and RS 422 are not metallically isolated from the control electronics with every iTNC control hardware.
In the worst case this may result in spark formation if you connect the serial data transfer cable to your laptop and the control. As a consequence the control or the laptap/PC could be damaged. The reason can be the different potential of the power supply of both units. HEIDENHAIN therefore recommends to use the so called **"opto bridge"**. This serial adapter connector ensures a metallic isolation via opto coupler and can thus protect the serial interface against overvoltage, different load potentials and interference voltages on the ground lines. "Opto bridges" can be bought in the specialized computer trade.

Configuration of the serial interface on the iTNC

- Call --> see “Interface Configuration and Assignment of Mode” on page 16 – 270
- Select the baud rate for the LSV/2 protocol.
  You can select the highest possible baud rate. If there are transmission problems, you can back on lower baud rates.

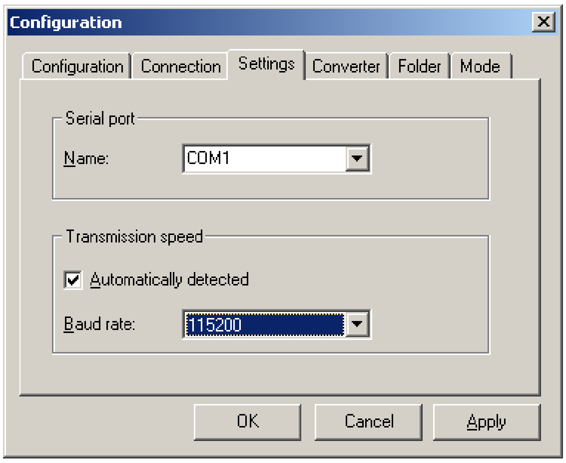
Note

The iTNC 530 recognizes automatically when the LSV-2 protocol is used (e.g., data transfer with TNCremoNT). It is not necessary to set the line *Operating mode*!

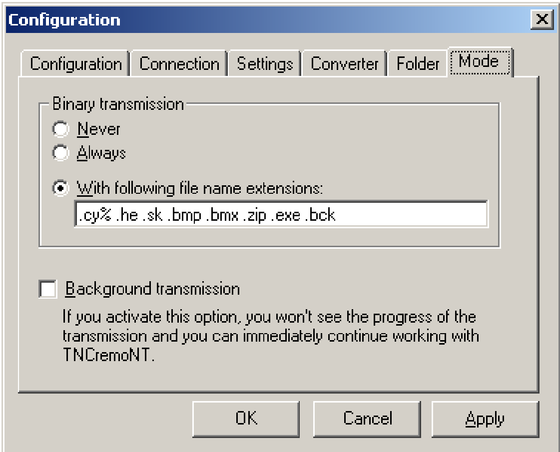
TNCremoNT

- Start the HEIDENHAIN data transfer program TNCremoNT.

- Click this icon to open the configuration window (can also be opened via ***Extras/Configuration ...***).
- Click now on ***Connection*** and select ***LSV-2 (serial connection)***.
- Subsequently, click on ***Settings*** and select the serial interface (e.g., COM1).
- Click the automatic detection of the transmission speed of the connection setup.
  --> The baud rate set on the iTNC is transferred.



Check the transmission mode (binary-ASCII conversion). It should be set as follows:



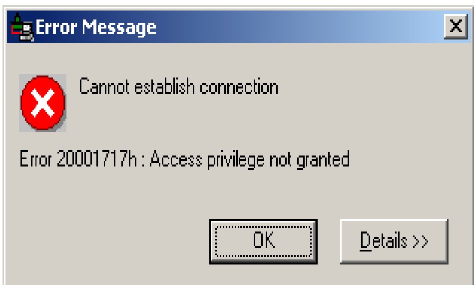
- Confirm with ***Apply*** and ***OK***.

- Click this icon. --> The connection is established.

- The TNCremo screen is divided and the control's hard disk is shown in the lower half of the screen. If this does not work, please check the connecting cable and the settings!

Note

If the following error message is displayed during connection establishment, ...



... the external access to the control is not permitted!

In this case press the **MOD** key on the control and subsequently the soft key **EXTERNAL ACCESS ON/OFF** must be pressed. --> The access must be permitted!

16.3 Reading In and Out of Individual Files or Directories

Introduction

> **Note**
>
> Information on setting data interfaces and reading in and out of data (e.g., ***TNCserver*** operation) can be found in the User's Manual for the iTNC 530.

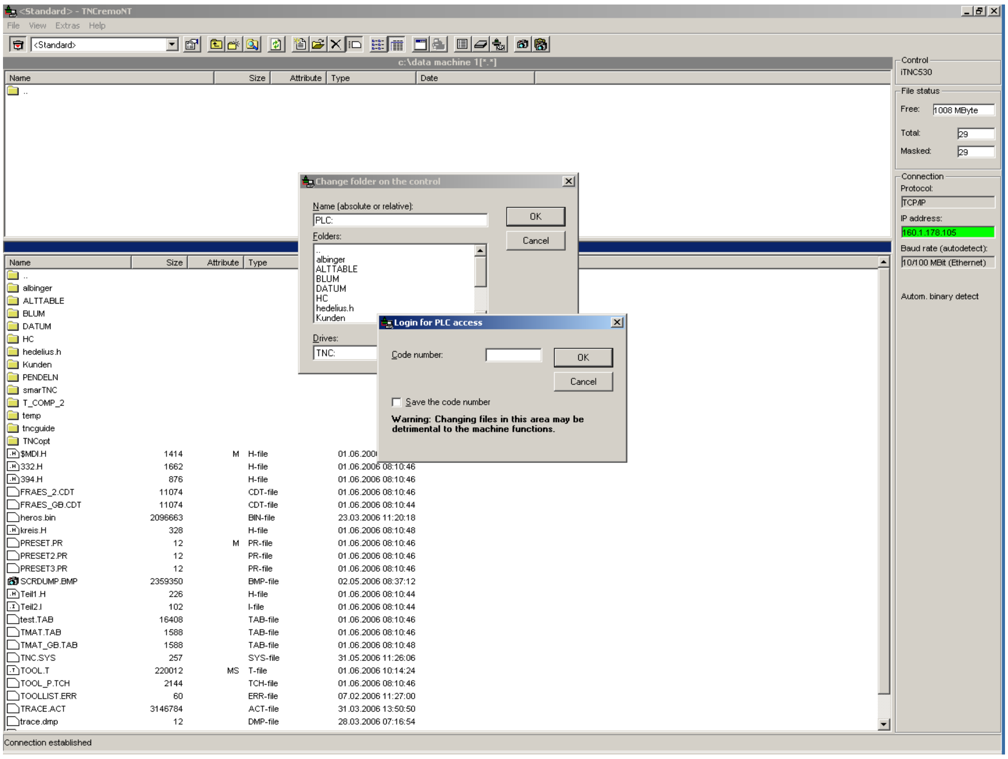
Connection setup

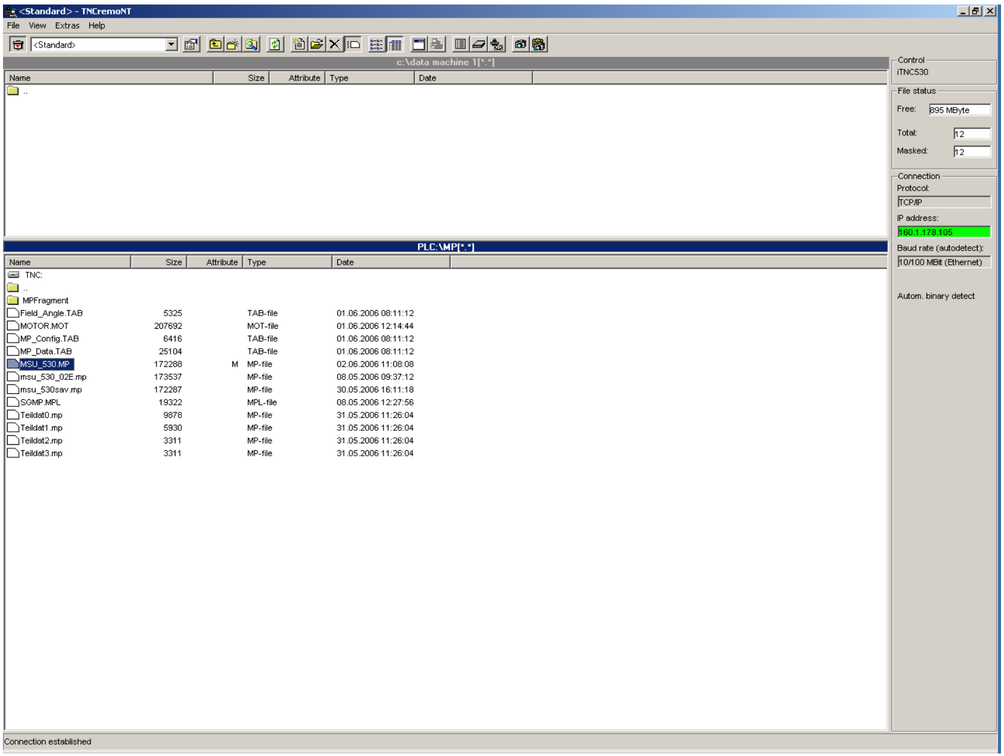
- Establish conntection to the iTNC 530 by means of TNCremoNT
  --> see "Connection Setup" on page 16 – 247.
  If this does not work, please check the connecting cable and the settings!

Read files from the iTNC

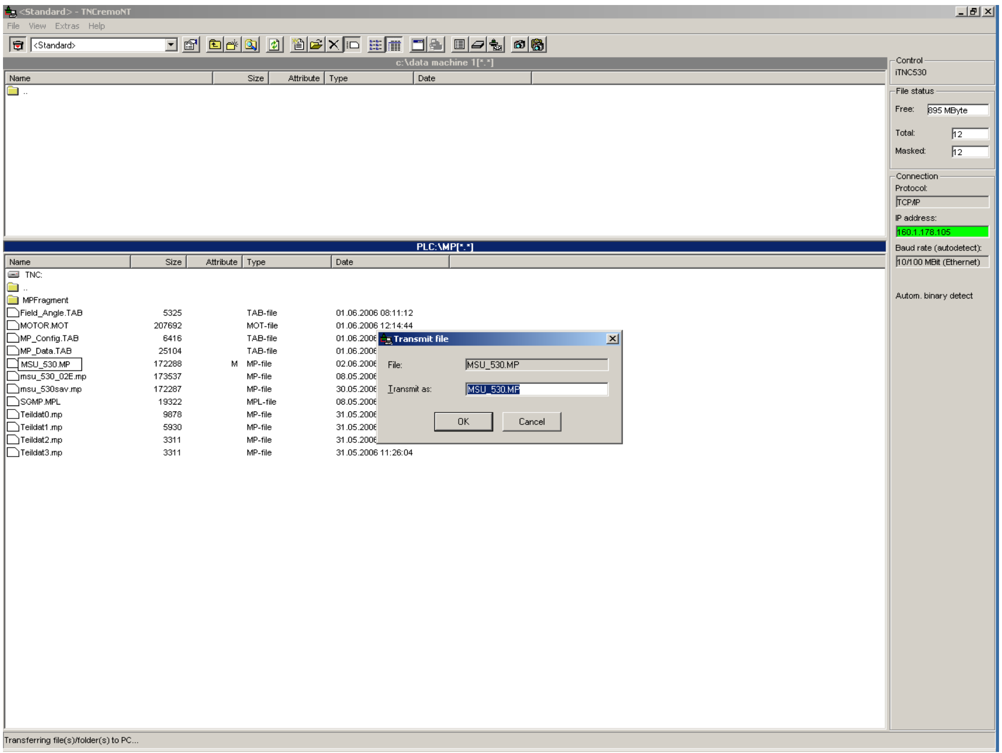
- Select the upper screen (laptop/PC contents) the target directory. --> Double click the requested directory. --> The path information appears in the blue bar atop.
- In the lower screen window (TNC contents), select the directory containing the file you wish to download. In example PLC:\MP --> Double click the requested directory. --> The path information appears in the blue bar atop.

> **Note**
>
> To change the partiction click the blue bar with the path information.
> To change to the PLC partition, enter ***PLC:*** and subsequently the PLC code number.





- Using the mouse, click the file you wish to download.
- Press the left mouse button and move the file to its destination (upper window).
- Release the mouse button. --> The file is transferred.



Note

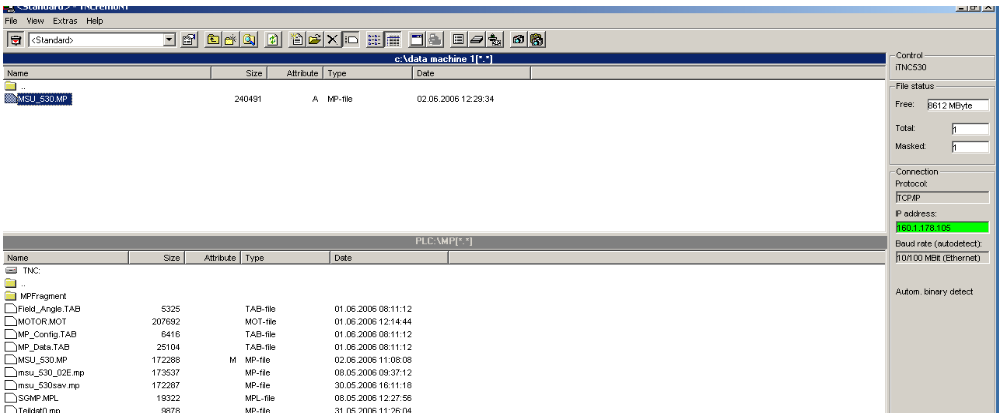
During downloading the data format is automatically converted from BINARY (control) to ASCII (laptop/PC) via TNCremoNT.

Uploading files onto iTNC

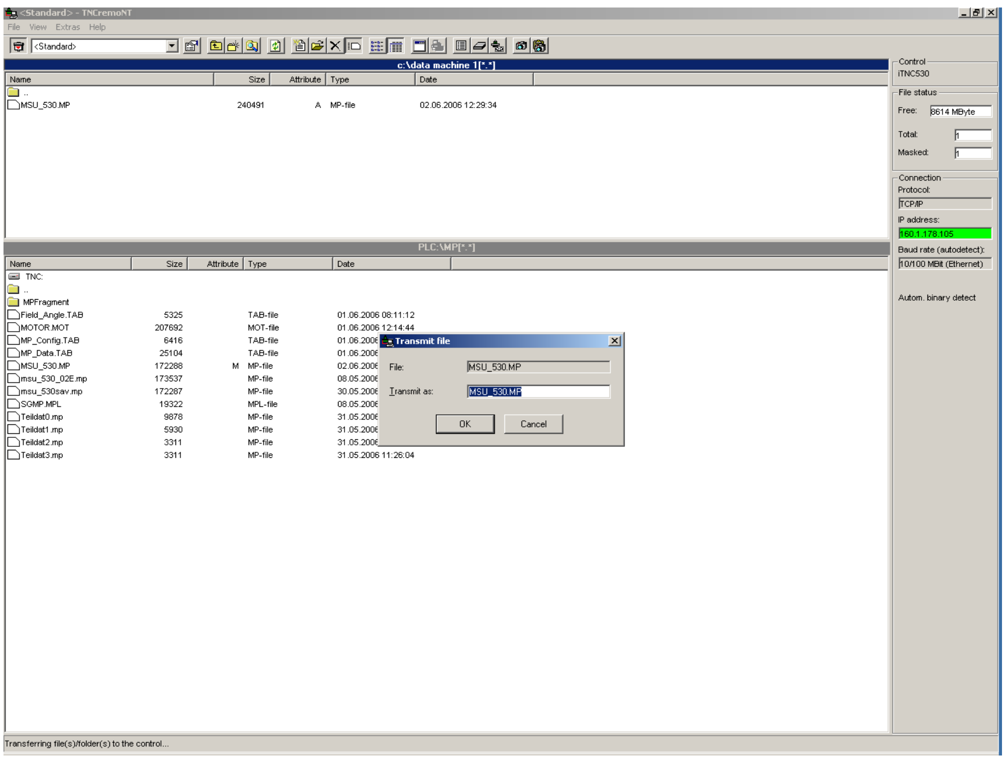
- Select the lower screen (contents iTNC) the target directory. --> Double click the requested directory. --> The path information appears in the blue bar atop.

> **Note**
>
> To change the partiction, click the blue bar with the path information.
> To change to the PLC partition, enter ***PLC:*** and then the PLC code number.

- In the upper screen window (laptop/PC contents), select the directory containing the file you wish to upload onto the iTNC. In example C:\Backup. --> Double click the requested directory. --> The path information appears in the blue bar atop.



- Using the mouse, click the file you wish to upload.
- Press the left mouse button and move the file to its destination (lower window).
- Release the mouse button. --> The file is transferred.



> **Note**
>
> During uploading the data format is automatically converted from ASCII (laptop/PC) to BINARY (control) via TNCremoNT.

16.4 Backup

During backup the data of the control's hard disk are stored on an external data medium (e.g. service laptop).

Note

It would be ideal that during backup the control is in the *Power interrupted* state.

Connection setup

▶ Set up a connection to the iTNC 530 by means of the TNCremoNT.
--> see “Connection Setup” on page 16 – 247.
If this does not work, please check the connecting cable and the settings!

Select partition

▶ In the upper screen half (laptop contents), select the directory where you folder where you want to store the backup files. --> Double click the requested directory.
--> The path information appears in the blue bar atop.
You can also create a new folder using TNCRemoNT. Click ***File / Create folder ...*** or the corresponding icon.

Note

The folder where the backup is filed should have an identifying name (e.g., machine number) so that it can clearly be assigned to the correct machine!

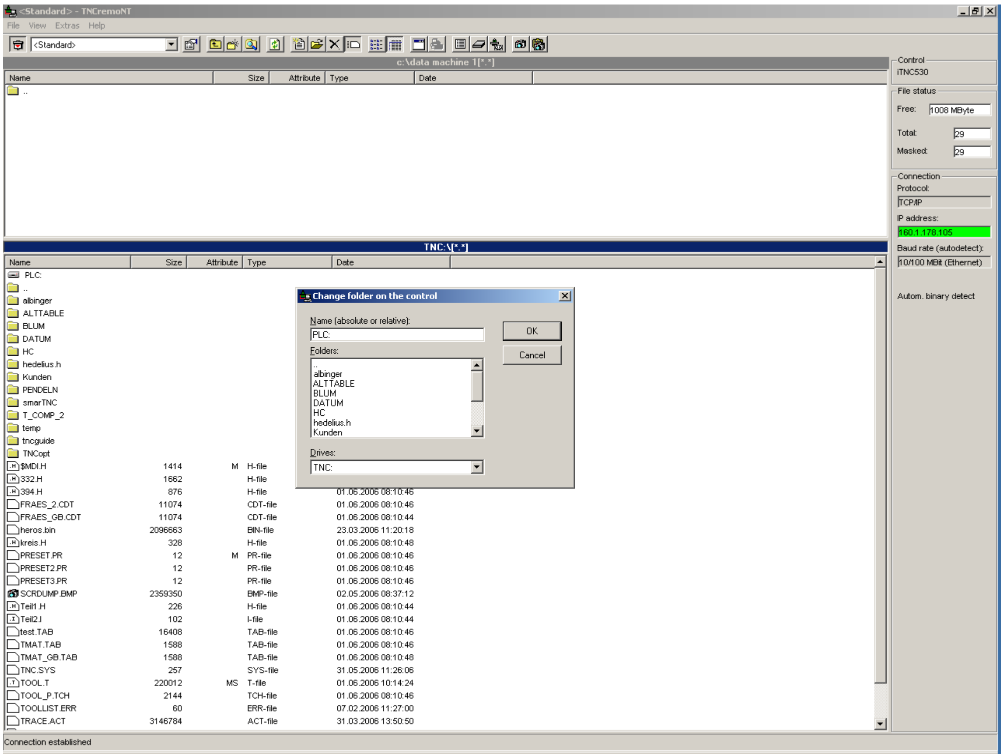
Avoid long path and file names (do not use more than 80 characters).

▶ In the lower screen half (iTNC contents), select the partition whose data you want to save.

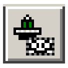
Note

To change the partiction click the blue bar with the path information.
To change to the PLC partition, enter ***PLC:*** and subsequently the PLC code number.

▶ Click the main directory of the selected partition (in the example PLC:).
It must be shown in the blue bar!

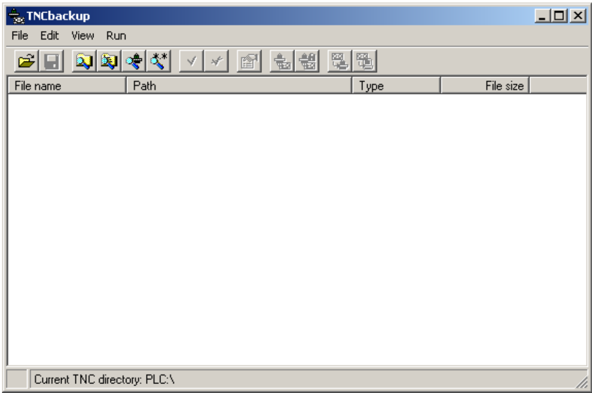


Miscellaneous backup types



▶ Activate the backup menu with this icon (or via ***Extras/Backup/Restore ...***)!

The following window appears:



The backup type can be selected via the following icons …

- ***Scan directory***
  The files in the selected directory are scanned.
  Files in subdirectories are ignored!

- ***Scan directory tree***
  The files in the selected directory and in all subdirectories are scanned.

- ***Scan system and machine files***
  All files of the PLC partition and the three files in the SYS partition (NCPATH.SYS, NCDATA.SYS, TIMES.SYS) are scanned.

- ***Scan everything***
  All files of the TNC and PLC partition and the three files in the SYS partition (NCPATH.SYS, NCDATA.SYS, TIMES.SYS) are scanned.

Note

Scanning in this context means creating a reference list for the directory tree.
A file with the extension *.LST is generated. This file serves to restore the original directory tree on the new hard disk.

Select the backup type according to the following criteria:

Backup for a data archive

If you want to create a **backup archive** for your TNC and PLC data:

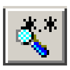
- Select ***Scan directory tree***

- The backup should have an identifying name (for example the machine number, etc.).

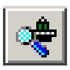
Archives can/should be created for the TNC partition and for the PLC partition.

Backup for the control exchange

If you want to exchange the **control** (MC with or without CC) :



- Select ***Scan everything*** ("full backup") or ...



- ***Scan system and machine files*** (Ask the customer if the TNC data have already been backed up or the source files are stored on an external data medium)

The machine time (TIMES.SYS), the calibration data of the touch probe, possible overflows of multiturn EnDat encoders, traverse range settings, etc. (NCDATA.SYS) are included in this backup and transferred to the new control or hard disk.
These backup types are not intended for an archive, since machine time, calibration data, overflows of multiturn EnDat encoders etc. continue to change.

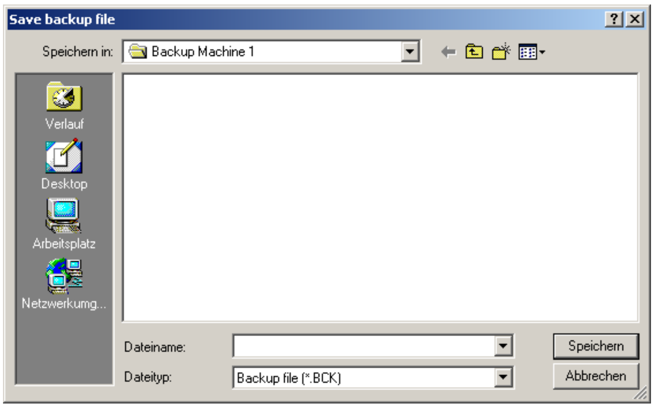
Note

For these backup types the settings of date and time on control and laptop must match.
Otherwise the error message ***Wrong password!*** is displayed.

Starting backup

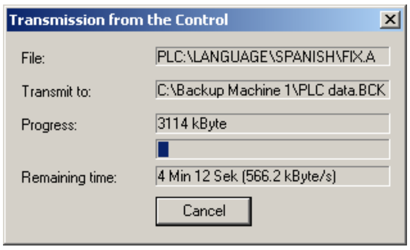
- Click ***Run/Backup*** (or the corresponding icon).

The following window appears:



- Enter the name of the backup file (extension BCK), e.g., Machine 1 PLC data (expansion BCK).
- Start the data transfer with Save.

The following window appears:



- When the backup is complete, the corresponding window is closed.

Note

If the data transfer has been completed successfully, there are two files on the laptop:
*.BCK backup file with the original files in compressed format
*.LST reference list containing the directories and the files

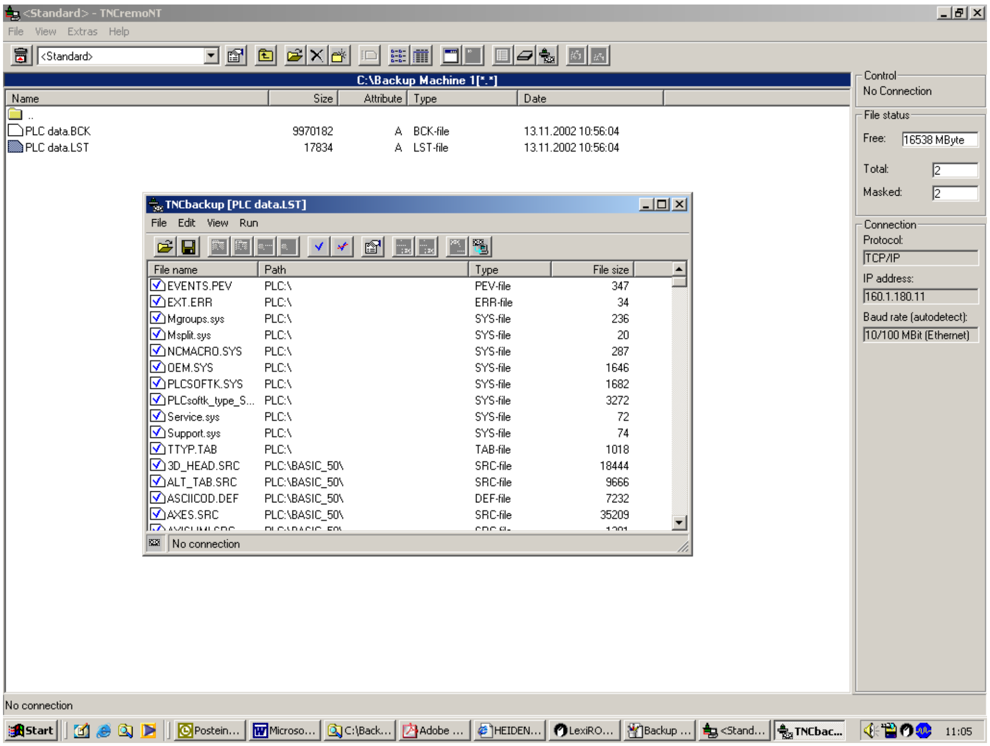
16.5 Extracting Files from the Backup File

General

If you want to create a backup (e.g. of the PLC partition), all related files are stored in one *.bck file using a compression algorithm.
To view individual files (e.g., MP list OEM.SYS, etc.) you can extract them from the *.bck file by means of TNCremoNT!

Extracting a file

- Start TNCremoNT.
- Go to the folder where the backup of the machine is filed.
- Double click the LST file (*.LST) and open the window TNCbackup.
- Sort the files listed there, e.g., by clicking the bar ***path.***
  (You can sort by file name, path, type and file size. Just click the corresponding bar.)



- Click ***Edit/Transmit all***.
- Remove the blue tick by clicking the corresponding icon (blue check mark crossed out).
- Double-click to mark the files you want to extract. --> The blue check mark appears before the file name.
- Click ***Run/Extract.***
- You can extract the selected files either directly or together with the corresponding directory structure into your backup directory.
- Now the extracted files can be read, transferred individually etc.

Caution

After the extraction restore all marks in your *.LST file.
(Otherwise only the marked files of this backup will be restored.)

16.6 Restore

When restoring, the backup of a machine (e.g., PLC data, TNC data, "full backup") are restored from an external data medium (e.g., service laptop) to the control's hard disk.

Caution

- When restoring the hard-disk data, the machine must not operate!
- The control should be in ***Power interrupted*** state.
- Never press any key on your control while data transfer is running!

Note

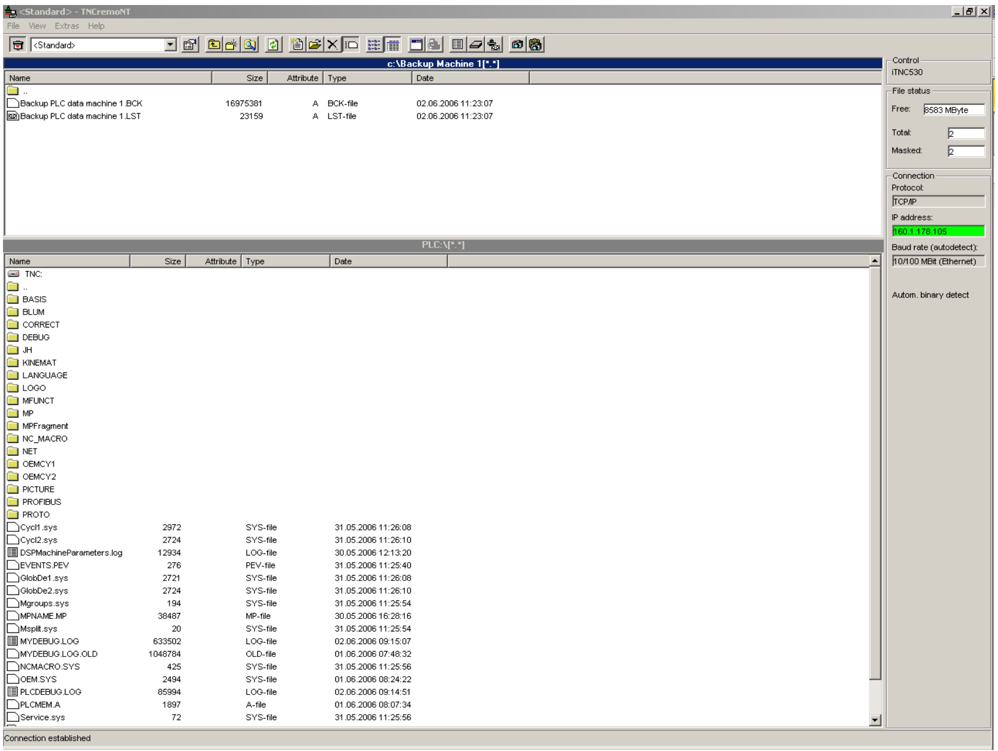
If you work with Ethernet connection, please check the necessary settings or reset them. --> see “Connection Setup” on page 16 – 247.
Tip: For the original settings for DEFINE NET, refer to file IP4.N00 that can be extracted, e.g., from the backup file of the corresponding machine. --> see “Extracting Files from the Backup File” on page 16 – 265.

Connection setup

- Set up a connection to the iTNC 530 by means of the TNCremoNT --> see “Connection Setup” on page 16 – 247.
  If this does not work, please check the connecting cable and the settings!

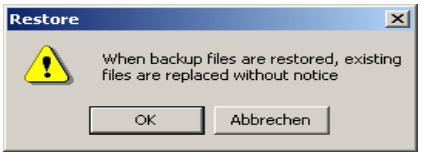
Select backup file

- In the upper screen half (laptop/PC contents), select the directory where you have stored the backup file.
  In example C:\Backup machine. --> Double click the requested directory.
  --> The path information appears in the blue bar atop.

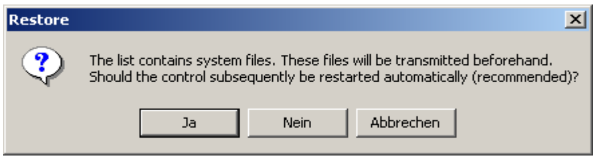


Restore starting

- Doubleclick on the LST file to open it.
- Start the data transfer with menu item Run/Restore or the corresponding icon.
- Confirm the following warning with OK.



- Confirm the message regarding automatic reset of control with Yes and continue data transfer.



- **Start the control after successful restoring the machine backup (reboot)**.
  Now the machine should operate as usual.

Note

We recommend to back up the network settings.
They can be found under PLC:\NET\ ...
Move the cursor to the corresponding filed, press the soft keys *AUX. FUNCTIONS* and *PROTECT*. A *P* is shown in the status column for "protected".

Note

When restoring with TNCremoNT and the error message ***Wrong password*** is displayed, probably the date and time of control and laptop do not correspond.
Background:
The backup for the control exchange also includes three SYS files. To bring it to the correct control partition, the TNCremoNT automatically transfers the SYS password. This SYS password is created with the date of the laptop.
If necessary, the system time must be set again on the control --> see "Setting the System Time" on page 15 – 237.

Note

After restoring the machine backup and subsequent booting of the control, **the following problem** may arise:
In the original MP list the control requires additional parameters (e.g. as of index xxx.5).

Background:
In the OEM.SYS there is the entry AXISNUMBER.
This serves to specify the number of axes for which indices are to be created in the MP file (e.g. indices xxx.0 to xxx.8 for 9 axes).
If a control boots without PLC data, the MP list is added to the hardware configuration (i.e. on controls with 5 axes only up to parameter xxx.4).
The same is true if the PLC data of a control were lost and for new or exchange controls.
The number of axis indices exceeds the hardware configuration for example if the spindle drives more than one axis (C-axis mode, etc.).
I.e., when booting the first time during data restoration the original MP list is truncated and therefore no longer useful.

Solution:

1. Load MPNAME.MP into the editor
   (as long as the original MP list is open for editing, it cannot be restored).
2. Load the entire backup to the control again.
3. Reboot the control.

16.7 Data Interface Operating Modes

16.7.1 Overview of Operating Modes

The iTNC can be set for data transfer according to the following interface operating modes:

FE1

For connection of the HEIDENHAIN floppy-disk unit FE 401B or other peripheral units.
This operating mode is supported by TNCremo/TNCremoNT.

Protocol:	Blockwise transfer
Data format:	7 data bits, 1 stop bit, even parity
Baud rate:	110 - 115 200 baud
Interface parameters:	Firmly adapted
Transfer stop:	Software handshake with DC3

Data format and protocol adjusted to suit FE 401/B!

EXT 1, EXT 2

For adjusting data transfer to external peripheral units.

Protocol:	Standard data format or blockwise transfer Adjusting via machine parameters from MP5000
Data format:	Adjusting via machine parameters from MP5000
Baud rate:	110 - 115 200 baud
Interface parameters:	Adjusting via machine parameters from MP5000
Transfer stop:	Software handshake with DC3 or hardware handshake with RTS, set via machine parameter from MP 5000

LSV-2:

The LSV2 protocol allows various functions such as file management and diagnosis of the iTNC to be executed from the PC.
This operating mode is supported by TNCremo/TNCremoNT.

Protocol:	Bidirectional data transfer in accordance with DIN 66019
Data format:	8 data bits, 1 stop bit, none parity
Baud rate:	110 - 115 200 baud
Interface parameters:	Firmly adapted
Transfer stop:	Software handshake via protocol

16.7.2 Interface Configuration and Assignment of Mode

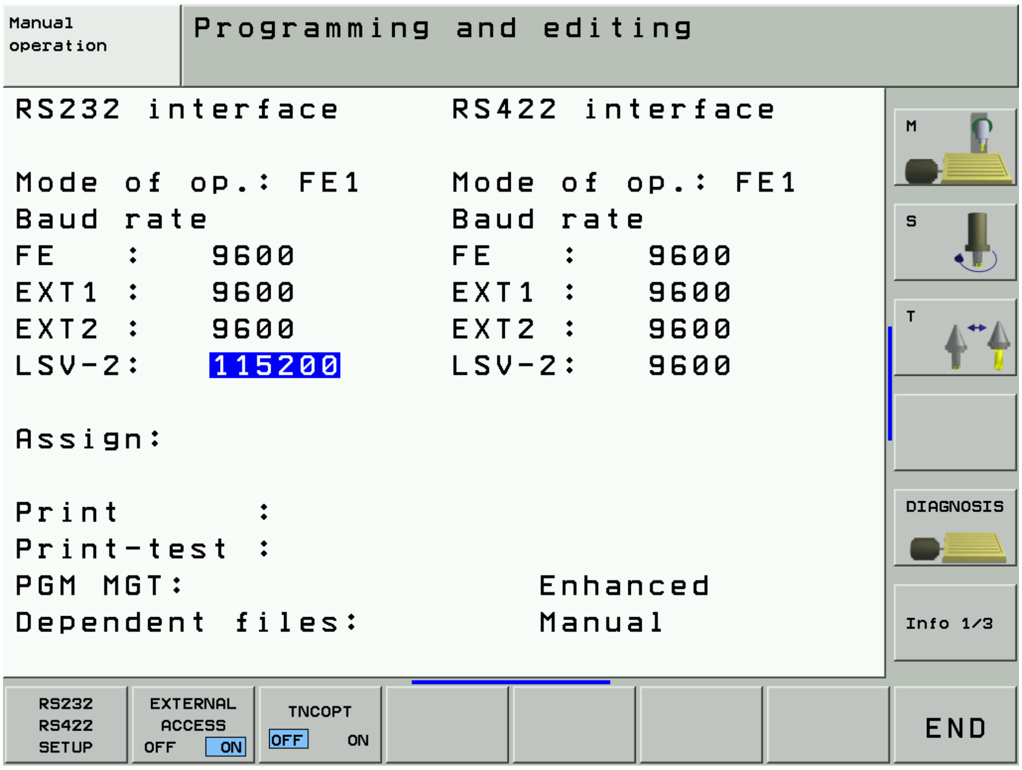
Calling the interface setup

Press the following key combination to call the main screen for interface configuration:

▶ Select the ***Programming and Editing*** operating mode

▶ Press the ***MOD*** key.

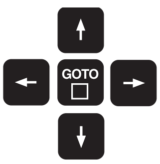
▶ Call the setup menu for the serial data interfaces.



Operating mode / baud rate

The data interface RS-232-C (V.24) is configured on the left side of the screen, and the data interface RS-422-C (V.11) on the right. The operating mode and the baud rate can be selected.

To edit the operating mode, baud rate and assignment of interfaces:



▶ Move the cursor to the entry you wish to edit.

▶ Press the ***GOTO*** key to display a popup window. Place the cursor at the desired value.

▶ Confirm with ***ENTER***.

▶ To leave the interface settings press the ***END*** soft key.

Note

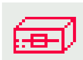
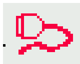
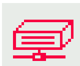
The iTNC 530 recognizes automatically, when the LSV-2 protocol is used (e.g., data transfer with TNCremoNT). It is not necessary to set the line *Operating mode*!

16.8 Drive Symbols

When you call program management in the ***Programming and editing operating mode***, the different drives are displayed.

RS 232:\	V.24 data interface (X27)
RS 422:\	V.11 data interface (X28)
TNC:\	TNC partition (user data)
PLC:\	PLC partition (machine data via code number)

Depending on the type of operating mode set, a symbol appears beside the external drive.

Operating mode	Drive symbol with PGM MGT
FE1	
EXT1, EXT2	
Ethernet	

16.9 Cable Overview

Please note:

- Maximum cable length with Ethernet 400 m (shielded), 100 m (unshielded)
- Maximum cable length with RS-232-C/V.24 is 20 meters
- Maximum cable length with RS-422/V11 is 1000 meters

Note

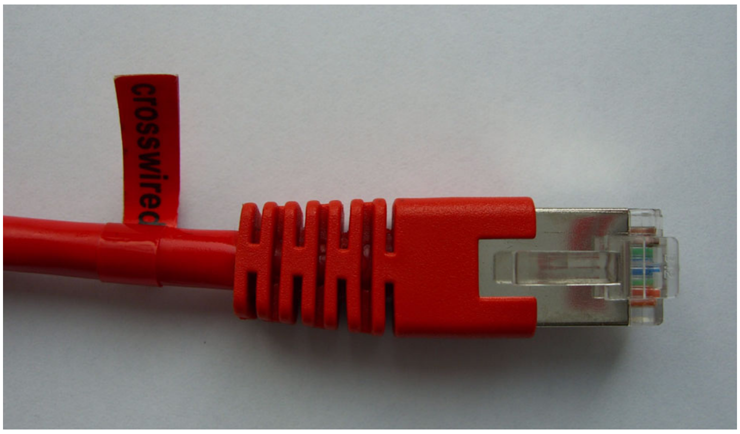
Do not use self-made cables (shielding problems, contact problems, short circuits, etc.). Mark your cable as "crossed" or "non-crossed".

Caution

The Ethernet interface is metallically isolated from the control electronics.
The serial interfaces RS 232 and RS 422 are not metallically isolated with every iTNC control hardware.
In the worst case this may result in spark formation if you connect the serial data transfer cable to your laptop and the control. The reason can be the different potential of the power supply of both units. HEIDENHAIN therefore recommends to use the so called **"opto bridge"**. This serial adapter connector ensures a metallic isolation via opto coupler and can thus protect the serial interface against overvoltage, different load potentials and interference voltages on the ground lines. "Opto bridges" can be bought in the specialized computer trade.

16.9.1 Ethernet Interface RJ45 Connection

For the direct connection between laptop and control **("peer-to-peer")** you require a **crossed Ethernet cable ("crossover cable")!**



Note

We recommend to mark the crossed Ethernet cable accordingly in order to avoid confusion.

If you establish the connection via your local network (intranet), normally use a non-crossed Ethernet cable (patch cable).

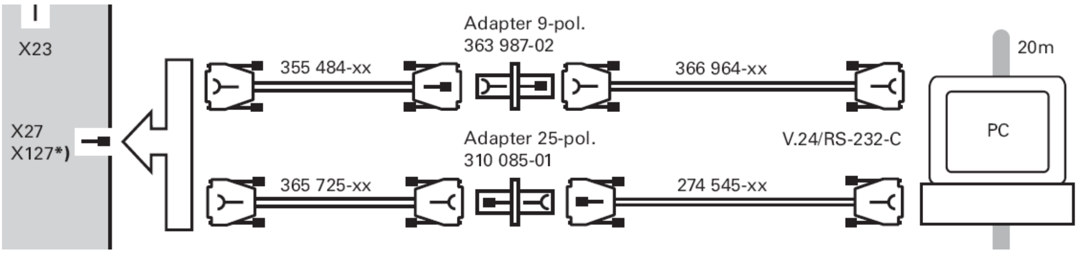
16.9.2 RS-232-C/V.24

Note

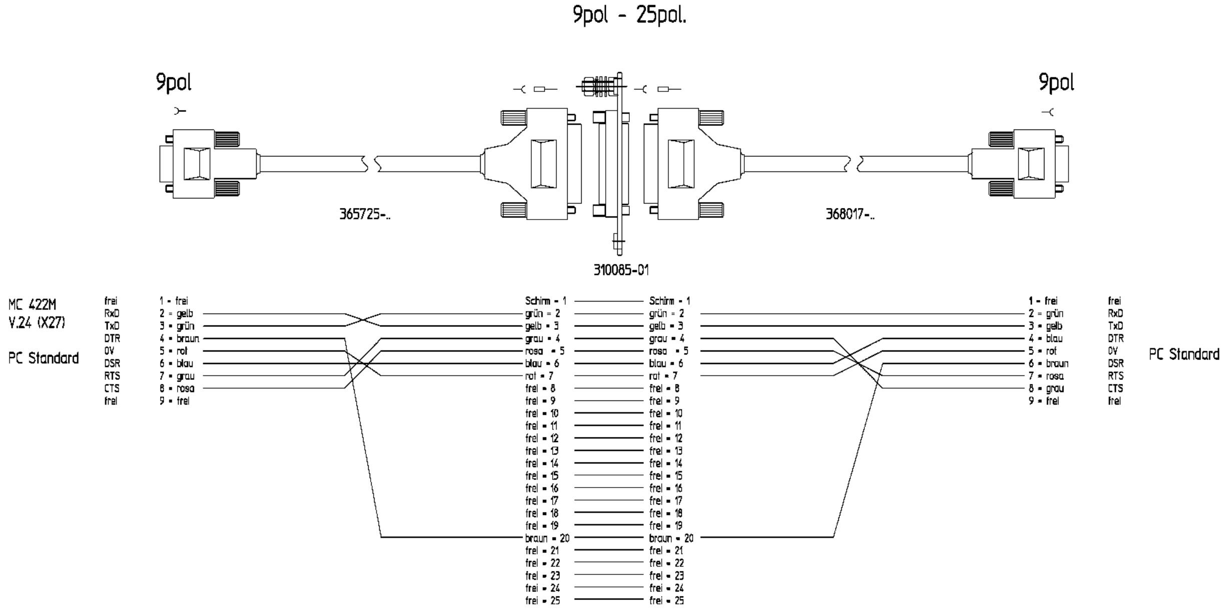
The V.24 / RS-232-C has different pin layouts at the iTNC (connector X27) and at the V.24 adapter block (D-sub connector on electrical cabinet).
Exception: The cable with the Id.No. 366964-xx may be connected to the 9-pin adapter block or directly to the control.

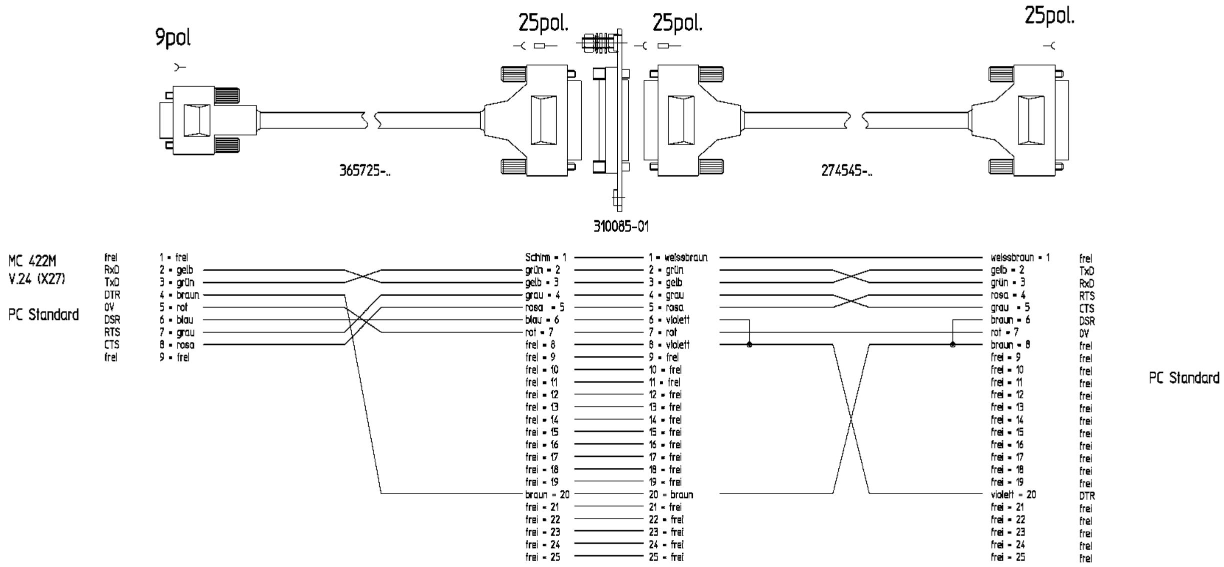
The serial data interfaces are described in detail in the ***Data Interfaces Service Manual of HEIDENHAIN Devices***. Download under www.heidenhain.de/Services/...

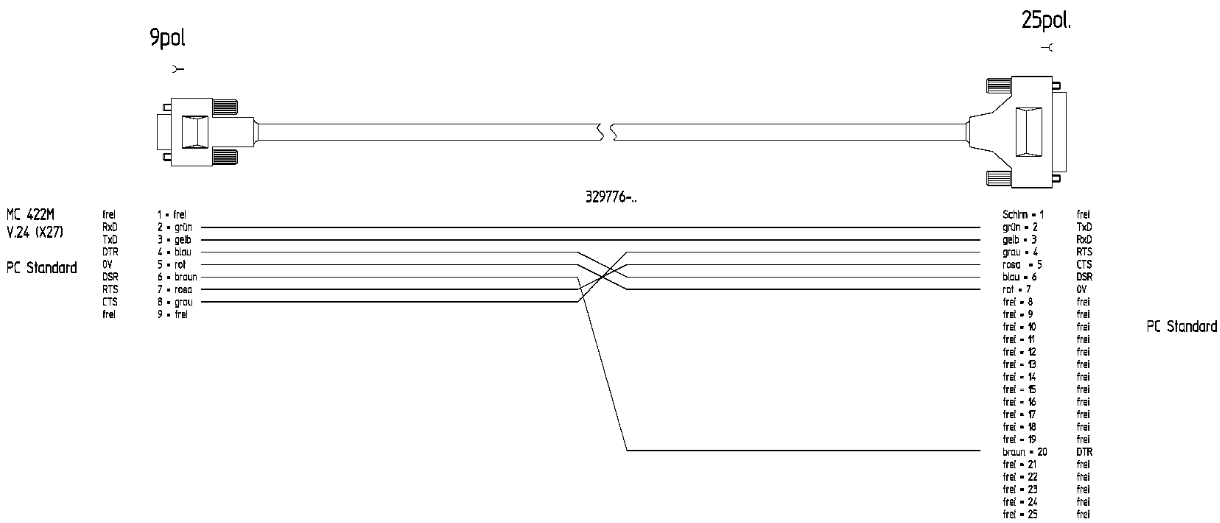
Overview:

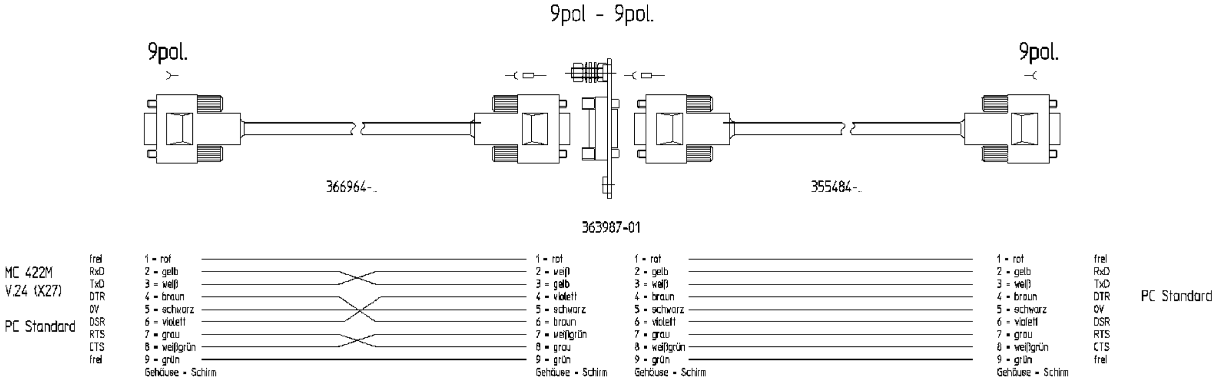


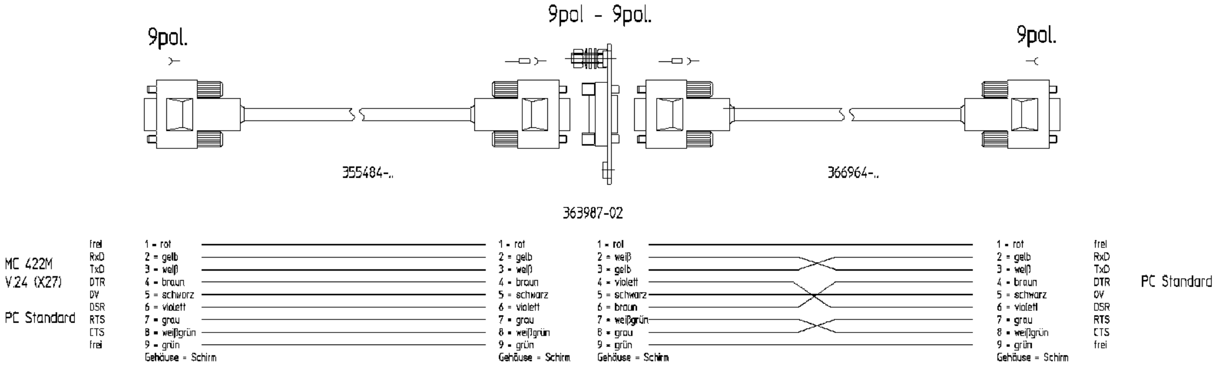
Cable assignment:



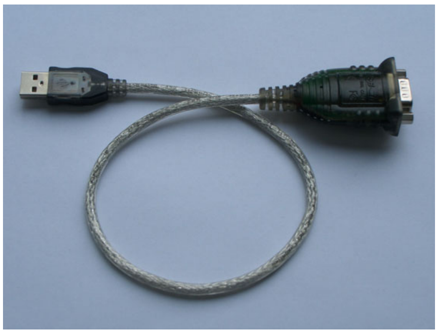


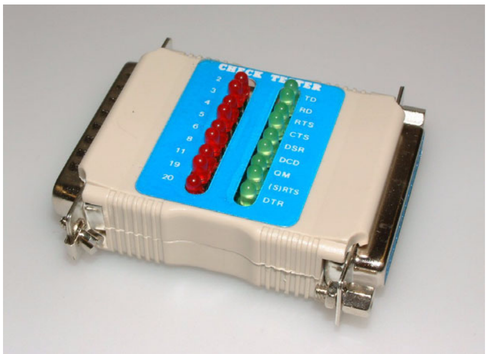
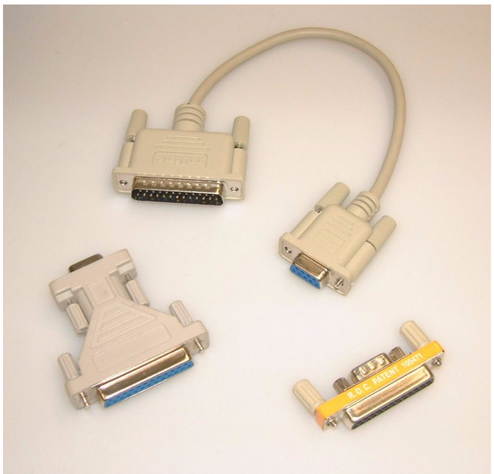



9pol - 9pol.
9pol.
9pol.
366964-..
355484-..
363987-01
MC 422M
V.24 (X27)
PC Standard
frei
RxD
TxD
DTR
0V
DSR
RTS
CTS
frei
1 = rot
2 = gelb
3 = weiß
4 = braun
5 = schwarz
6 = violett
7 = grau
8 = weißgrün
9 = grün
Gehäuse = Schirm
1 = rot
2 = weiß
3 = gelb
4 = violett
5 = schwarz
6 = braun
7 = weißgrün
8 = grau
9 = grün
Gehäuse = Schirm
1 = rot
2 = gelb
3 = weiß
4 = braun
5 = schwarz
6 = violett
7 = grau
8 = weißgrün
9 = grün
Gehäuse = Schirm
1 = rot
2 = gelb
3 = weiß
4 = braun
5 = schwarz
6 = violett
7 = grau
8 = weißgrün
9 = grün
Gehäuse = Schirm
frei
RxD
TxD
DTR
0V
DSR
RTS
CTS
frei
PC Standard


9pol - 9pol.
9pol.
9pol.
355484-..
366964-..
363987-02
MC 422M
V.24 (X27)
PC Standard
frei
RxD
TxD
DTR
0V
DSR
RTS
CTS
frei
1 = rot
2 = gelb
3 = weiß
4 = braun
5 = schwarz
6 = violett
7 = grau
8 = weißgrün
9 = grün
Gehäuse = Schirm
1 = rot
2 = gelb
3 = weiß
4 = braun
5 = schwarz
6 = violett
7 = grau
8 = weißgrün
9 = grün
Gehäuse = Schirm
1 = rot
2 = weiß
3 = gelb
4 = violett
5 = schwarz
6 = braun
7 = weißgrün
8 = grau
9 = grün
Gehäuse = Schirm
1 = rot
2 = gelb
3 = weiß
4 = braun
5 = schwarz
6 = violett
7 = grau
8 = weißgrün
9 = grün
Gehäuse = Schirm
frei
RxD
TxD
DTR
0V
DSR
RTS
CTS
frei
PC Standard

Accessories Following accessories can be very helpful and are available from computer vendors:

	D-sub adapter connector 25-pin Adapts from female to male
	D-sub adapter connector 9-in Adapts from female to male
	Adapter RS 232 to USB For laptops or PCs without RS 232 interface, but with USB interface
	D-sub adapter connector 25-pin "opto bridge" Metallically isolates the serial interface by means of integrated opto couplers and thus protects from: - Overvoltages - Different load potentials by different main current circuits - Interference voltlages on ground lines

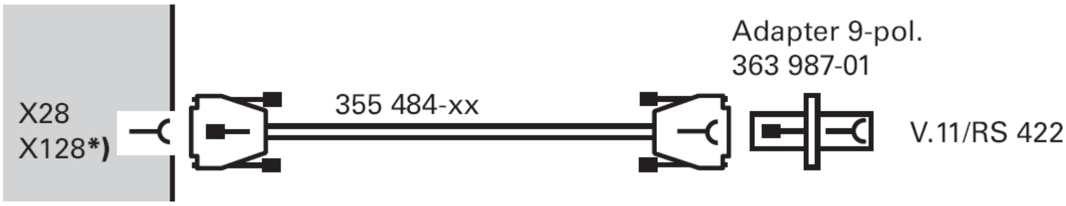
	D-sub adapter connector 25-pin To test the data transfer lines display by LEDs
	D-sub adapter connector 25-pin To cross the data transfer lines
	D-sub adapter connector Adaptation of 25-pin connector to 9-pin connector Background: The adapter block RS 232 on the switch cabinet mostly has a 25-pin connector, the COM interface on the laptop mostly has a 9-pin connector.

16.9.3 RS-422/V.11

Note

The RS-422-/V.11 data interface has the same pin layout at the iTNC (connector X28) and at the V.11 adapter block (D-sub connector on the switch cabinet).

The serial data interface are described in detail in the ***Data Interfaces Service Manual of HEIDENHAIN Devices***.
Download under www.heidenhain.de/Services/...



17 Encoder Interface

17.1 Position Encoders

17.1.1 Introduction

Position encoders report positions and movements of the machine to the control. The iTNC 530 operates with incremental and absolute encoders with EnDat interface.

Linear position encoders include **scales** and **scale tapes**.

Position encoders can also be angular encoders.

Following position encoder inputs are located on the MC 42x (B):

- **X1 to X6**
- **X35 to X38** (depending on the expansion stage)

On the CC 424 there are the following position encoder inputs:

- **X201 to X206**
- **X207 to X214** (depending on the expansion stage)

Scales for linear axes or **angular encoders for rotary axes/spindles** can be connected here.

The monitoring functions for the position encoders are activated in **MP 20.x**.
The following criteria are checked:

Criterion	Error message
Absolute position with distance-coded reference marks	**Encoder <AXIS> DEFECTIVE**
Amplitude of encoder signals	**Encoder AMPLITUDE TOO LOW <AXIS>**
Edge separation of encoder signals	**Encoder <AXIS>: FREQUENCY TOO HIGH**

DANGER

The monitoring functions for the position encoders (MP 20.x) must always be active!
Safe machine operation is not ensured without these movement monitoring functions.
Exception: MP 20.0 is only active for position encoders with distance-coded reference marks.

MP 100 contains the axis sequence (first, second, third axis, etc.)

Caution

MP 100 must not be edited!

The allocation of position encoder inputs to the axes can be found in the machine parameters **MP 110.x**

The allocation of position encoder inputs to the spindle can be found in the machine parameters **MP 111.x**

All position encoder inputs are **EnDat-compatible.**

The signal types 1 Vpp or 11µ App are set in **MP 115.0** for position encoders that are connected to the connectors X1 ... X6, X35 ...X38 on the MC.
For position encoders that are connected to the connectors X201 ... X214 on the CC 424, **MP 116.0** is applicable.
For other signal types (TTL, etc, adapters may be used.
–> See "Position Encoders" on page 13 – 180

The input frequency for position encoders that are connected to the MC on the connectors X1 ... X6, X35 ...X38, are set in **MP 115.2**.
For position encoders that are connected to the connectors X201 ... X214 on the CC 424, **MP 116.2** is applicable.

17.1.2 Possible Causes of Error

- Contamination of the position encoder
- Damage of the position encoder
- Scanning head (parallelism, distance, etc.)
- Cable damaged
- Signal may be disturbed by high frequency, strong magnetic fields, etc.
- Penetration of humidity
- Light unit defective (LED, light bulb)
- Strong vibrations on the machine
- Defective interface on the control

Caution

The amplitude of the reference marks is not monitored!
For example, if a reference mark is contaminated and thus cannot be evaluated, with distance-coded encoders a corresponding error message (e.g., *Reference marks: Incorrect spacing*) is generated. With encoders with a reference mark, an error message is not generated immediately. The refernce run does not function properly and the axis moves, e.g., to the limit switch.

17.1.3 Service Diagnosis

To find out whether the connected encoder or the control interface is defective, you can operate the encoder with another interface of the control. Use the interface of a functioning axis.

Caution

If the scanning head is wet and thus a short circuit is caused, it must not be connected again! Encoder interfaces are not always short-circuit proof.

Example: Error in X-axis

For fault diagnosis, proceed as follows:

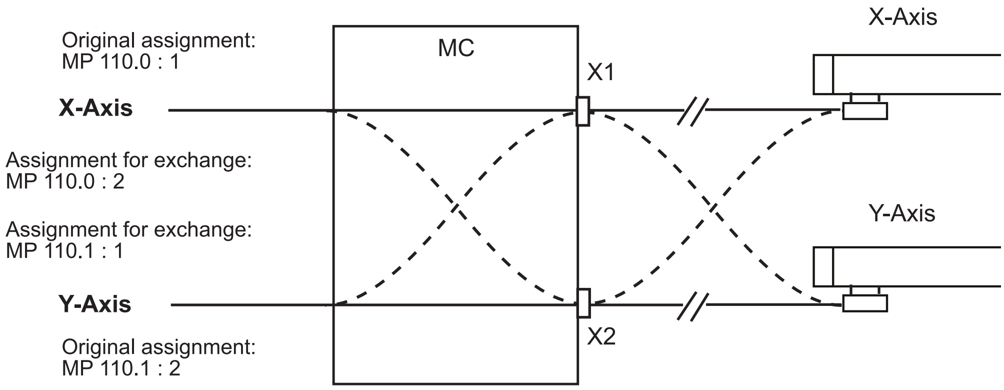
Example machine parameters

MP 100.x = CZYX (X = 1st axis, Y = 2nd axis, Z = 3rd axis, C = 4th axis)
MP 110.0 = 1 (X-axis at X1 input)
MP 110.1 = 2 (Y-axis at X2 input)
MP 110.2 = 3 (Z-axis at X3 input)
MP 110.3 = 4 (C-axis at X4 input)
MP 115.0 = %0000000000 (all inputs 1 Vpp)
MP 115.1 = %0000000000
MP 115.2 = %0000000000 (all inputs 50 kHz)

Notes and preliminary actions

- On position encoders connected to the CC 424, an exchange is only possible between the groups X201 to X206 (main drive-control board) and X207 to X214 (auxiliary drive-control board)!

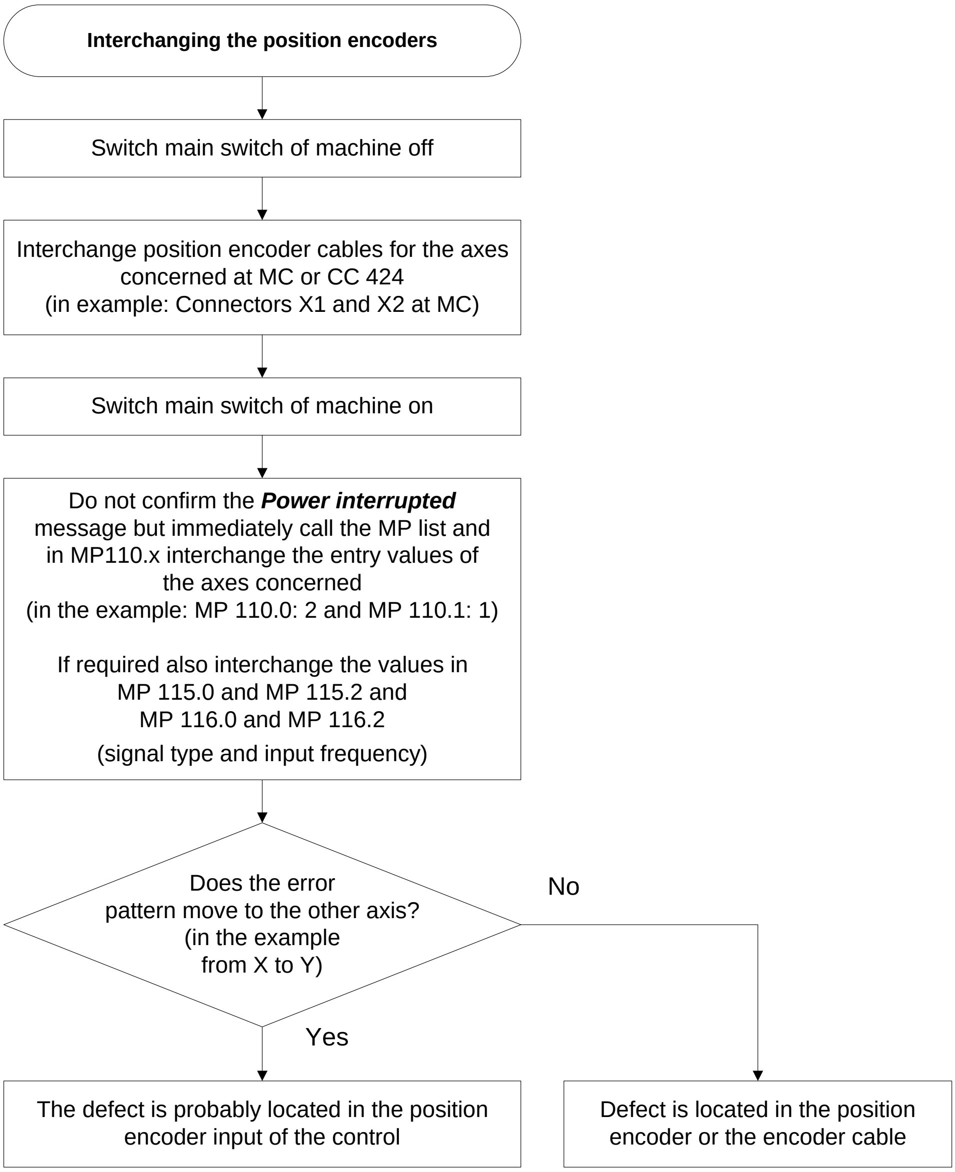
Block diagram



Note

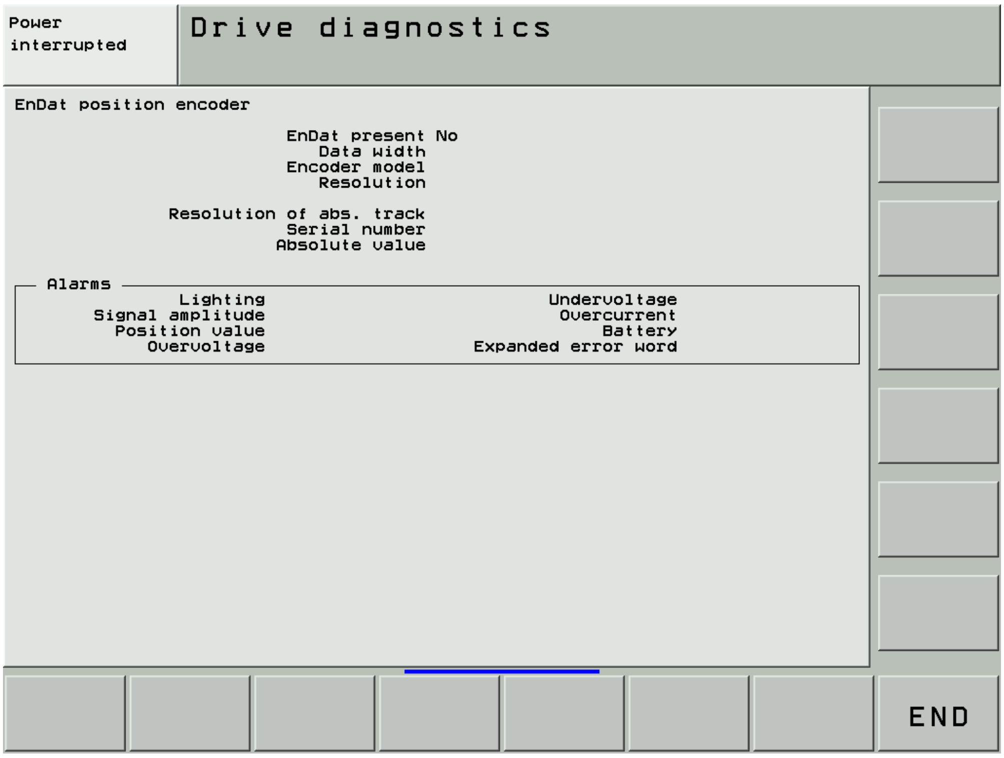
Always exchange both, the cable and interface assignment by means of machine parameters!

Flowchart Flowchart for diagnosing an error in the position encoders circuit



17.1.4 Additional Diagnosis Possibility on Encoders with EnDat Interface

On the information page "EnDat position Encoder" you can see whether so-called alarm bits are set:



Calling the page. --> See “Integrated Diagnosis Functions” on page 7 – 41.

17.1.5 Corrective Action

If you have found out that the interface on the control is defective:

- Exchanging the control --> See “Exchange of HEIDENHAIN Components” on page 26 – 411.

If you have found out the the scanning head/scale/cable is defective:

- Exchange the encoder or the encoder component or corrective action (e.g., cleaning of scale).

Note

To exchange the encoder components, use the mounting aids (distance plates, mounting brackets, etc.) as well as the mounting and replacing instructions.

For adjustment and signal assessment, special HEIDENHAIN units, such as PWM 9, PWT, PWM 8 (if available) may be used.

In a special encoder seminar you can learn about corrective action and how these units are used (e.g., cleaning of scales).

Following tolerances apply as a default …

- For 1 Vpp encoders: 0.6 ... 1.2 Vpp
- For 11 µApp encoders: 7 ... 16 µApp

The exact tolerances of the corresponding encoders can be found in the HEIDENHAIN brochures that can also downloaded from the HEIDENHAIN website (www.heidenhain.de).

17.1.6 Re-Setting the Machine Datum

As the machine datum (machine reference) refers to the scale reference point, a resetting might be necessary after removing and mounting of scales, scale tapes or angular encoders.

Note

With simple 3-axis machines, it is often not necessary to set the machine datum again. It is sufficient to the check the software limit-switches and to set them again, if necessary. If you have any questions, please contact your machine tool builder for more information!
It is indispensible to set the machine datum, but mostly machine tools with tool changers, tilting axes, etc. are concerned.

Individual axis

- Always tro to mount the scale as exactly as possible to its original position!
- Set the display to **REF**. --> You can now see **the current axis position referring to the machine datum.**
- Set the position display step (MP 7290.x) to the highest resolution.
- Reference the axis concerned.
- Position the machine datum or a machine's reference point defined by the machine manufacturer (e.g., reference hole, reference stud). --> **Ask the machine manufacturer!**

Note

If necessary, the traverse range (software limit switch) has to be expanded!
(The software limit switches are defined as of MP 910.x. It is also possible that the operator has limited the traverse range even further.)

- Write down the displayed REF value (if necessary, abstract the value defined by the machine manufacturer) and invert the result.
- Add the value to the value entered in MP 960.x for the axis concerned.
- Enter the sum in MP960.x.
- **Check whether the reset machine datum is correct (e.g., with M91)!**
- If required, reset the traverse range to the original value.

Gantry axes

- Always tro to mount the scale as exactly as possible to its original position!
- Set MP860.x to 0 for the slave axis.
  (After the reference marks have been traversed, no compensating motion is made.)
- Set the display to **REF**. --> You can now see **the current axis position referring to the machine datum.**.
  The slave axis must be displayed (MP 7291.x).
- Set the position display step (MP 7290.x) to the highest resolution.
- Reference the gantry axes.
- Position the machine datum or a machine's reference point defined by the machine manufacturer (e.g., reference hole, reference stud). --> **Ask the machine manufacturer!**

Note

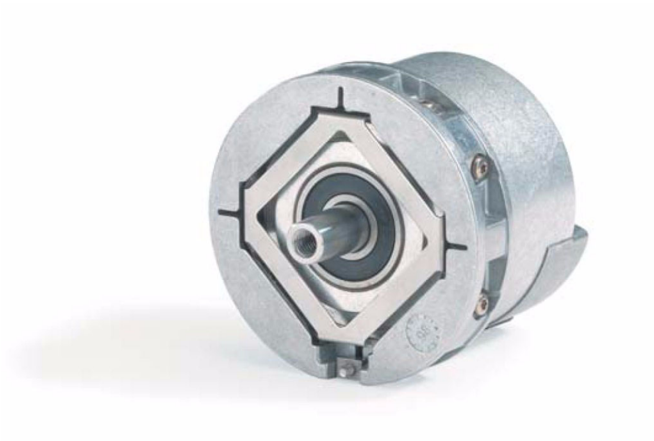
If necessary, the traverse range (software limit switch) has to be expanded!
(The software limit switches are defined as of MP 910.x. It is also possible that the operator has limited the traverse range even further.)

- Write down the displayed REF value (if necessary, abstract the value defined by the machine manufacturer) and invert the result.
- Add the value to the value entered in MP 960.x for the gantry axes.
- Enter the sum in MP 960.x ein.
- Check whether the displayed master and slave position values are identical.
- **Check whether the reset machine datum and the geometry of the gantry axes are correct (e.g., with M91)!**
- If required, reset the traverse range to the original value.
- Reset MP 860.x to the original value.

Further information --> See “Referencing” on page 18 – 301

17.2 Speed Encoders

17.2.1 Introduction



Speed encoders in motors are also referred to as **motor encoders**.

On the CC 422 or CC 424 there are the following speed encoder inputs:

- **X15 to X20**
- **X80 to X87** (depending on the expansion stage)

MP 100 contains the information which axis is the first, the second, the third axis etc.

Caution

MP 100 must not be edited!

The allocation of speed encoder inputs to the axes for CC 422 can be found in the machine parameters **MP 112.x**.

Note

As of MP 112.6 (7th axis) the connectors as of X80 can be allocated but not MP 112.0 to MP 112.5.

The allocation of speed encoder inputs to the axes for the CC 422 can be found in the machine parameters **MP 113.x**.

MP 112.x is not active for the **CC 424**. There is a **fixed assignment** of speed encoder inputs to the PWM outputs as in the following table:

Drive control board	PWM output (MP120.x/MP121.x)	Speed encoder input
1	X51	X15
1	X52	X16
1	X53	X17
1	X54	X18
1	X55	X19
1	X56	X20
2	X57	X80
2	X58	X81
2	X59	X82

Drive control board	PWM output (MP120.x/MP121.x)	Speed encoder input
2	X60	X83

The the encoder inputs and PWM outputs are only be selected via MP120.x/MP121.x.

All speed encoder inputs operate with **1 Vpp** and are**EnDat-compatible**.

For digital axes the speed encoders are always monitored!

Motor encoders with EnDat interface can be provided with a so-called **electronic ID label**. It contains the **motor data**, such as device name, ID number, serial number, etc.

Caution

The service on the CC 424 and CC 422 is different.
Ensure to use the correct instructions!

17.2.2 Possible Causes of Error

- Contamination by condensed oil, grease, water
- Signal socket damaged
- Cable damaged
- Signal may be disturbed by high frequency, strong magnetic fields, etc.
- Penetration of humidity
- Encoder electronics (e.g., light unit) defective
- Motor encoder is loose (e.g., loose or defective coupling between motor encoder housing and motor housing)
- Strong vibrations on the machine
- Defective interface on the control

17.2.3 Trouble Shooting on the CC 422

To find out whether the connected encoder or the control interface is defective, you can operate the encoder with another interface of the control. Use the interface of a functioning axis.

Caution

If the motor is wet and possibly also the motor encoder, what may result in a short circuit, it must not be connected any more!

Example for CC 422: Error in X-axis

For fault diagnosis, proceed as follows:

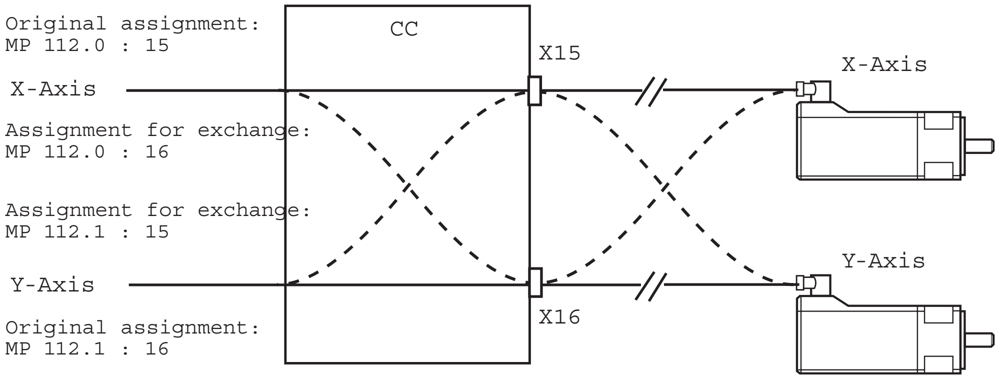
Example machine parameters

MP 100.x = CZYX (X = 1st axis, Y = 2nd axis, Z = 3rd axis, C = 4th axis)
MP 112.0 = 15 (X-axis at X15 input)
MP 112.1 = 16 (Y-axis at X16 input)
MP 112.2 = 17 (Z-axis at X17 input)
MP 112.3 = 18 (C-axis at X18 input)

Notes and preliminary actions

- Only encoders within the groups X15 to X20 (main controller board) and X80 to X83 (aux. controller board) may be exchanged.
- Master and slave axes must always be connected to the same speed controller PCB.
- **Before exchanging the** speed encoder inputs, **deactivate the evaluation of the electronic ID labels** im MP 7690!
  Enter value 1 for each bit.

Block diagram

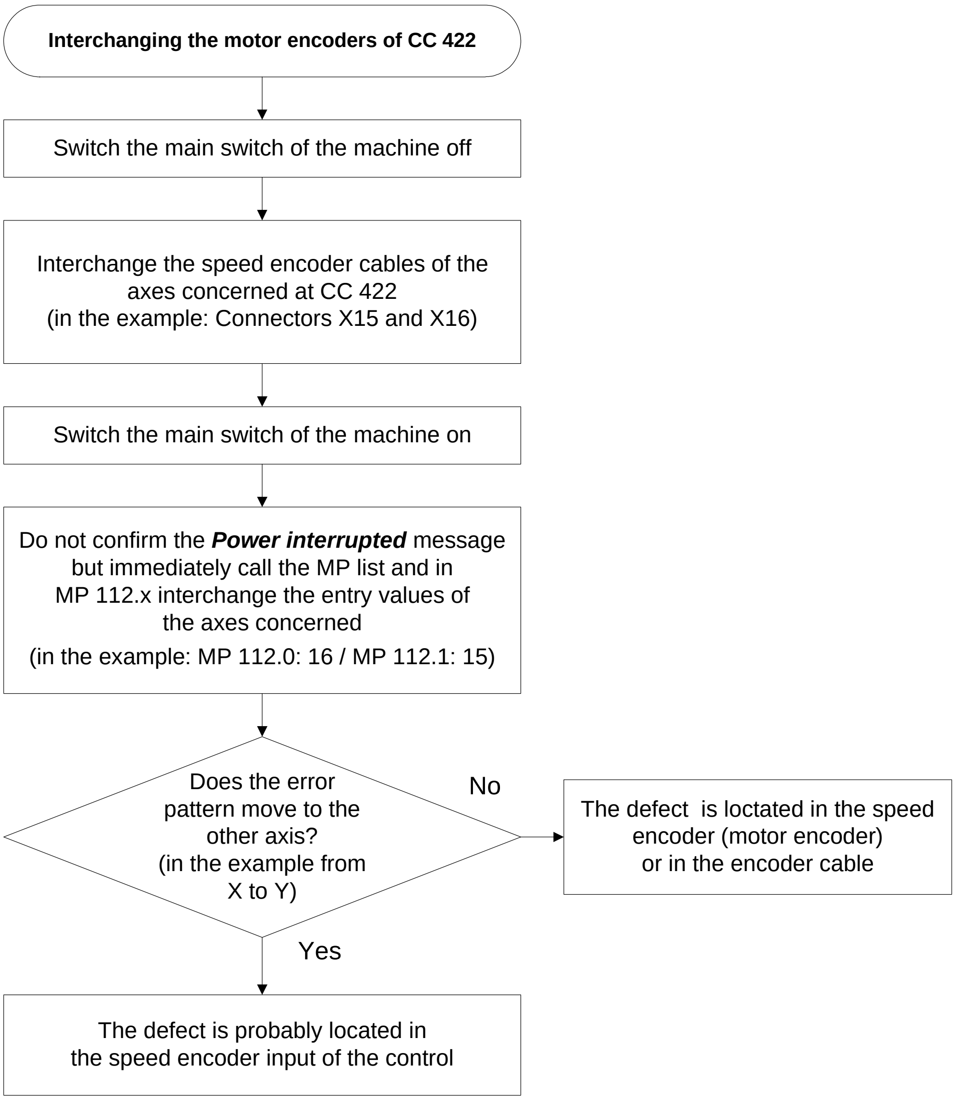


Note

Always exchange both, the cable and interface assignment by means of machine parameters!

Flowchart

Flowchart for diagnosing an error in the speed encoders circuit



Note

Set MP 7690 (evaluation of the electronic ID label) to its original state after the test!

17.2.4 Trouble Shooting on CC the 422

To find out whether the connected encoder or the control interface is defective, you can operate the encoder with another interface of the control.
Use the interface of a funtioning axis!

Caution

If the motor is wet and possibly also the motor encoder, what may result in a short circuit, it must not be connected any more!

Example for CC 424: Error in the X-axis

For fault diagnosis, proceed as follows:

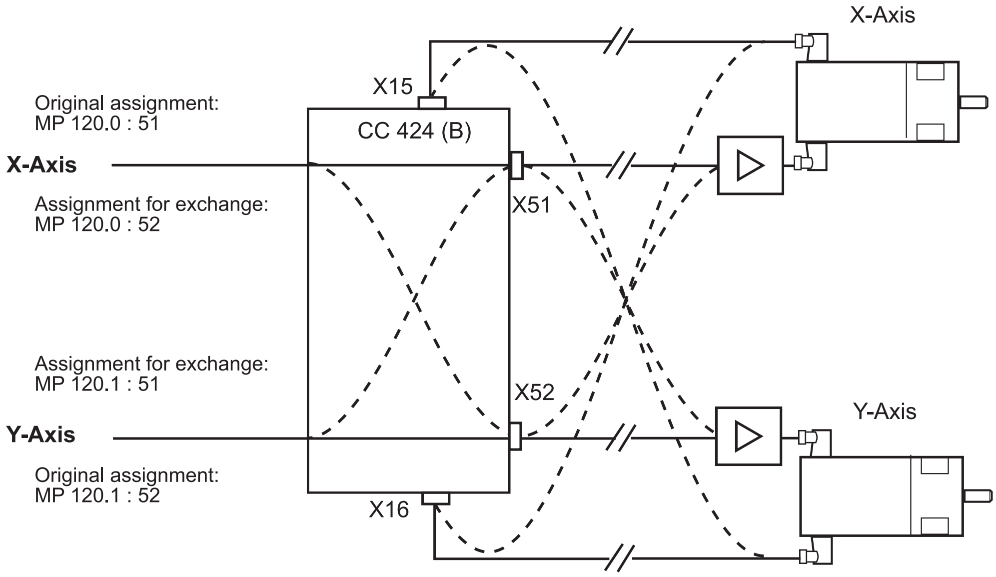
Example machine parameters

MP 100.x = CZYX (X = 1st axis, Y = 2nd axis, Z = 3rd axis, C = 4th axis)
MP 120.0 = 51 (X-axis on PWM output X51 and speed input X15)
MP 120.1 = 52 (Y-axis on PWM output X52 and speed input X16)
MP 120.2 = 53 (Z-axis on PWM output X53 and speed input X17)
MP 120.3 = 54 (C-axis on PWM output X54 and speed input X18)

Notes and preliminary actions

- Use the motor encoder input of a functioning axis.
  (The firmly assigned PWM output must be connected as unassigned PWM outputs might not be active, depending on so-called single-speed and double-speed outputs.)
- Only encoders of group X15 to X20 (main DCB) and X80 to X87 (auxiliary drive-control boared) can be exchanged!
- **The firmly assigned PWM output must also be exchanged!**
- Axes in master-slave torque control are only permitted at X15/X17 or X16/X18.
- The **same PWM frequency** should be set for axes to be exchanged!
  If different PWM frequencies are entered in parameter group MP 2180.x, ask the machine manufacturer or HEIDENHAIN for further service measures (the assignment of the machine parameter blocks for the current or speed controller by means of MP 130.x must also be regarded).
- **Before exchanging the** speed encoder inputs, **deactivate the evaluation of the electronic ID labels** im MP 7690!
  Enter value 1 for each bit.

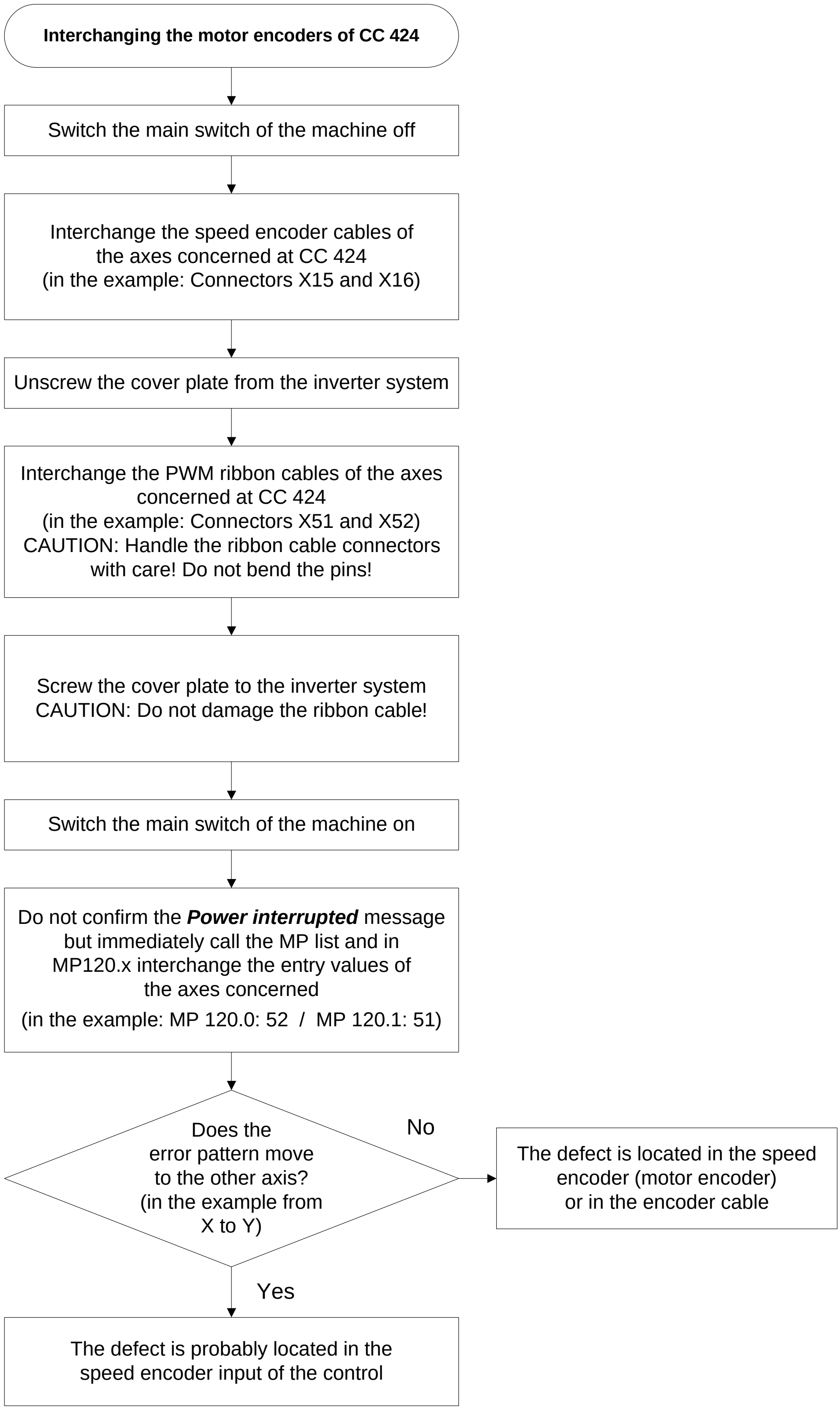
Block diagram



> **Note**
>
> Always exchange both, the cable and interface assignment by means of machine parameters!

Flowchart

Flowchart for diagnosing an error in the speed encoders circuit

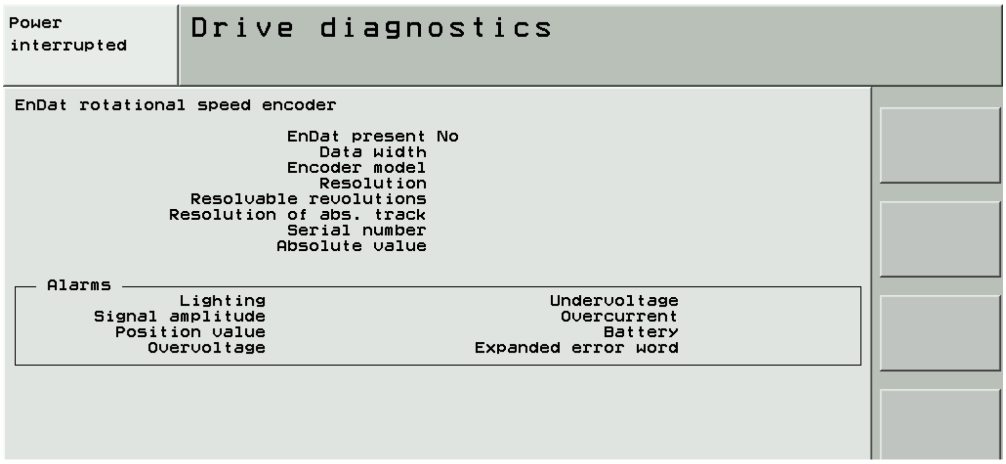


Note

Set MP 7690 (evaluation of the electronic ID label) to its original state after the test!

17.2.5 Additional Diagnosis Possibility on Encoders with EnDat Interface

On the information page "EnDat Speed Encoder" you can see whether so-called alarm bits are set:



Calling the page --> See “Integrated Diagnosis Functions” on page 7 – 41.

17.2.6 Corrective action

If you have found out that the interface on the control is defective …

- Exchange the control. --> See “Exchange of HEIDENHAIN Components” on page 26 – 411.

If you have found out that the **motor encoder in a synchronous motor** is defective (the HEIDENHAIN axis motors are normally synchronous motors with the designation QSY xxx):

- Exchange the synchronous motor completely!

Caution

Motor encoders in synchronous motors must be adjusted to a certain position.
This adjustment is performed by HEIDENHAIN.
Therefore, you must not exchange the motor encoder yourself!

In additon, new motors have so-called electronic ID labels. This electronic ID label for the motor is stored in the motor encoder with EnDat interface. When exchanging the motor encoder, the electronic ID label must be written again. This is made at HEIDENHAIN.

If you have found out that the motor encoder in an asynchronous motor is defective (the HEIDENHAIN axis motors are normally asynchronours motors with the designation QAN xxx) ...

- Exchange either the complete asynchronours motor or the motor encoder.

Note

In certain asynchronous motors, replacing the motor encoder may be very complicated due to their construction (in this case, nearly all add-on parts of the motor need to be removed and/or the cables in the terminal box disconnected and/or the signal socket removed with special tools).

Such a motor should be sent to HEIDENHAIN for repair.

If you want to exchange the motor encoder of the asynchronous motor:

- Read the instruction in the service manual "Inverter Systems and Motors".
- Use the enclosed mounting instructions (all motor encoders are supplied with mounting instructions).

17.2.7 Resetting the Spindle Orientation

DANGER

Ask the machine operator and regard the machine manufacturers's safety instructions (setup mode, etc.)!

If the motor encoder is used for the spindle orientation (e.g., for the tool change):

- Set MP 3430 to zero.
- Start the spindle orientation with rotating spindle.
- Regard the position now taken.
- Stop the spindle orientation (M5); the spindle must be free to rotate.

DANGER

Press EMERGENCY STOP!
It must be ensured that the spindle cannot be switched on!

- Set the display to **REF**. --> You can now see the **deviation of the reference mark from the desired position!**
- Set the spindle to the correct position (e.g., by means of measuring dial, touch probe, reference point, etc.) --> **Ask the machine manufacturer!**
- Subtract the displayed value from 360° and enter the result in MP 3430 (spindle preset).
- **Check the correct spindle orientation.**

Further information. --> See “Referencing” on page 18 – 301

17.3 Error Code for Encoders with EnDat Interface

In the event of a disturbance, the error message **EnDat defective <error code> <axis>** will appear.

The error code is shown in hexadecimal notation. Error codes may also appear combined, in which case they add themselves together.

There are two possible types of errors:

- The encoder reports an error.
- Access to the encoder via the EnDat interface is faulty.

Codes for errors reported by the encoder:

Error code	Meaning
0x00000001	Light source defective
0x00000002	Signal amplitude too low
0x00000004	Erroneous position value
0x00000008	Overvoltage
0x00000010	Undervoltage
0x00000020	Overcurrent
0x00000040	Replace battery
0x00000080	reserved
0x00000100	reserved
0x00000200	reserved
0x00000400	reserved
0x00000800	reserved
0x00001000	reserved
0x00002000	reserved
0x00004000	reserved
0x00008000	reserved

Error codes if the access to the encoder via the EnDat interface is faulty:

Error code	Meaning
0x80010000	Delete the alarm bit
0x80020000	Read the alarm status
0x80040000	Read the number of pulses
0x80080000	Read the number of signal periods
0x80100000	Read the number of differentiable revolutions
0x80200000	Read the measuring steps
0x80400000	Read the series number
0x80800000	Read the type of encoder
0x81000000	Read the position value
0x82000000	reserved
0x84000000	reserved
0x88000000	Read the checksum
0x90000000	Alarm bit remains set
0xA0000000	Timeout while waiting for data - signal “high”
0xC0000000	Timeout while waiting for data - signal “low”
0x80000000	Error during access to EnDat interface

17.4 Checking Position and Speed Encoders

PWM 9

The electric functioning of an encoder is measured using a **phase angle measuring unit** (PWM), an oscilloscope and an impedance tester (see Operating Instructions, Encoder Diagnostics Kit PWM 9).

Adapter

Various adapters have been developed to permit PWM8 measurement of the different encoder signals (11 µApp, 1 Vpp, TTL) at iTNC 530. You will find a **connection diagram** of the adapters and ID numbers in the PWM 9 operating manual.

Internal oscilloscope

In the **internal oscilloscope** (See “Integrated Oscilloscope” on page 8 – 49) of the iTNC 530 the analog encoder signals of the **position encoder** are recorded:
Position: A (0° signal) and position: B (90° signal)

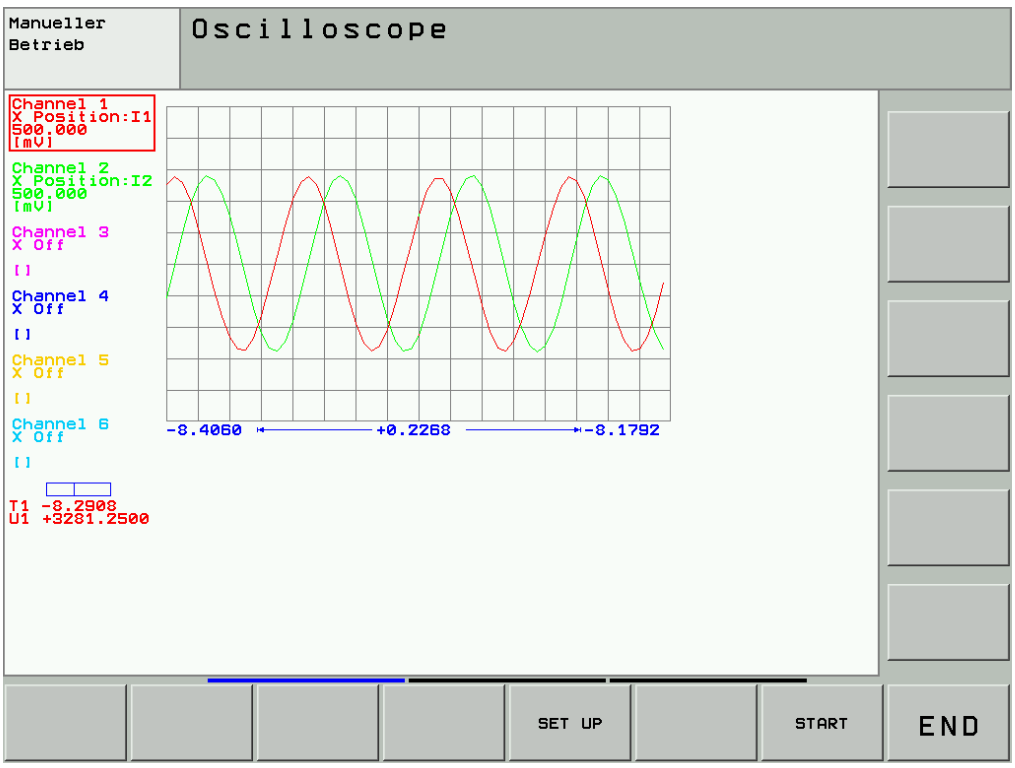
Note

Solely the incremental signals (A, B or I1, I2) of position encoders can be recorded and this only if they are not connected to an MC (not CC).
Reference signals and EnDat signals cannot be displayed!
A phase angle measuring unit is required for an accurate tracing of the signals.

The signals in the integrated oscilloscope are always displayed in the unit mV, independent of the type of encoder connected (1 Vpp or 11 µApp).

These displayed signals are the image of the input on the counter IC inside the control. Therefore certain amplification factors and an offset voltage of 2500 mV must be regarded. --> The **signal amplitude in mV oscillates symmetrically about 2500 mV** and must therefore be divided by the corresponding amplification factor:

Current signal 11 µApp:	Oscilloscope display [mV] / 284 = encoder signal at input [µA] e.g.: 3124 [mV] / 284 = 11 [µA]
Voltage signal 1Vpp:	Oscilloscope display [mV] / 3480 = encoder signal at input [V] e.g.: 3480 [mV] / 3480 = 1 [V]



17.5 Position Measurement with the Motor Encoder (Indirect Position Measurement)

Example for servicing

The axis (single or gantry axis) of a machine is on a position where you cannot remove the defective scale.

DANGER

The traverse with indirect distance measurement is only described for servicing!

You cannot/must not continue to work with the machine!

Reasons:

- No reference point for the axis concerned is evaluated; thus you could traverse to the limit switches or the machine stop.
- The manufacturer has not set the machine for the traverse with motor encoders as position information system.

General

With **analog axes** you can use the so-called **battery box** that ± supplies 10 V for the nominal speed value interface to the servo amplifier.

With **digital axes** you can use the **motor encoder**. The position control loop then receives the information from the motor encoder and not from the scale any more!

With an axis with **master-slave torque control**, two motors (master and slave) are mechanically coupled. Because of the coupling, only one position encoder is required. The motor to which the position encoder is assigned is the master.
If the scale is defective, in principle the proceeding is the same as with a single axis. --> See "Description for axis with master-slave torque control" on page 17 – 298

The proceeding for a **gantry axis (synchronized axis)** is different. --> See "Description for gantry axis" on page 17 – 300

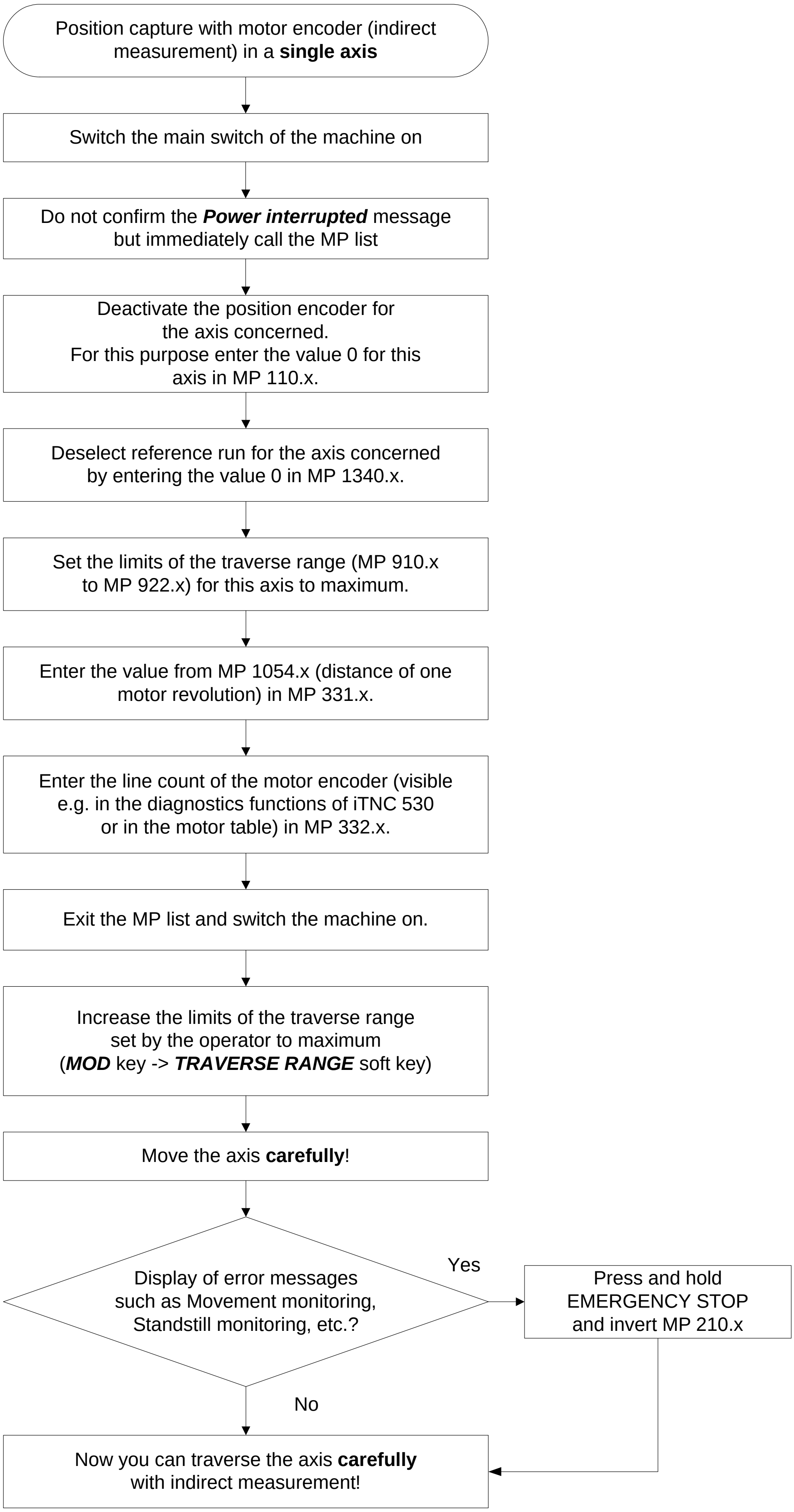
Note

Please clarify with the machine manufacturer whether the axis concerned is operated as individual axis, master-slave torque control, gantry axis or gantry axis with master-slave torque control!

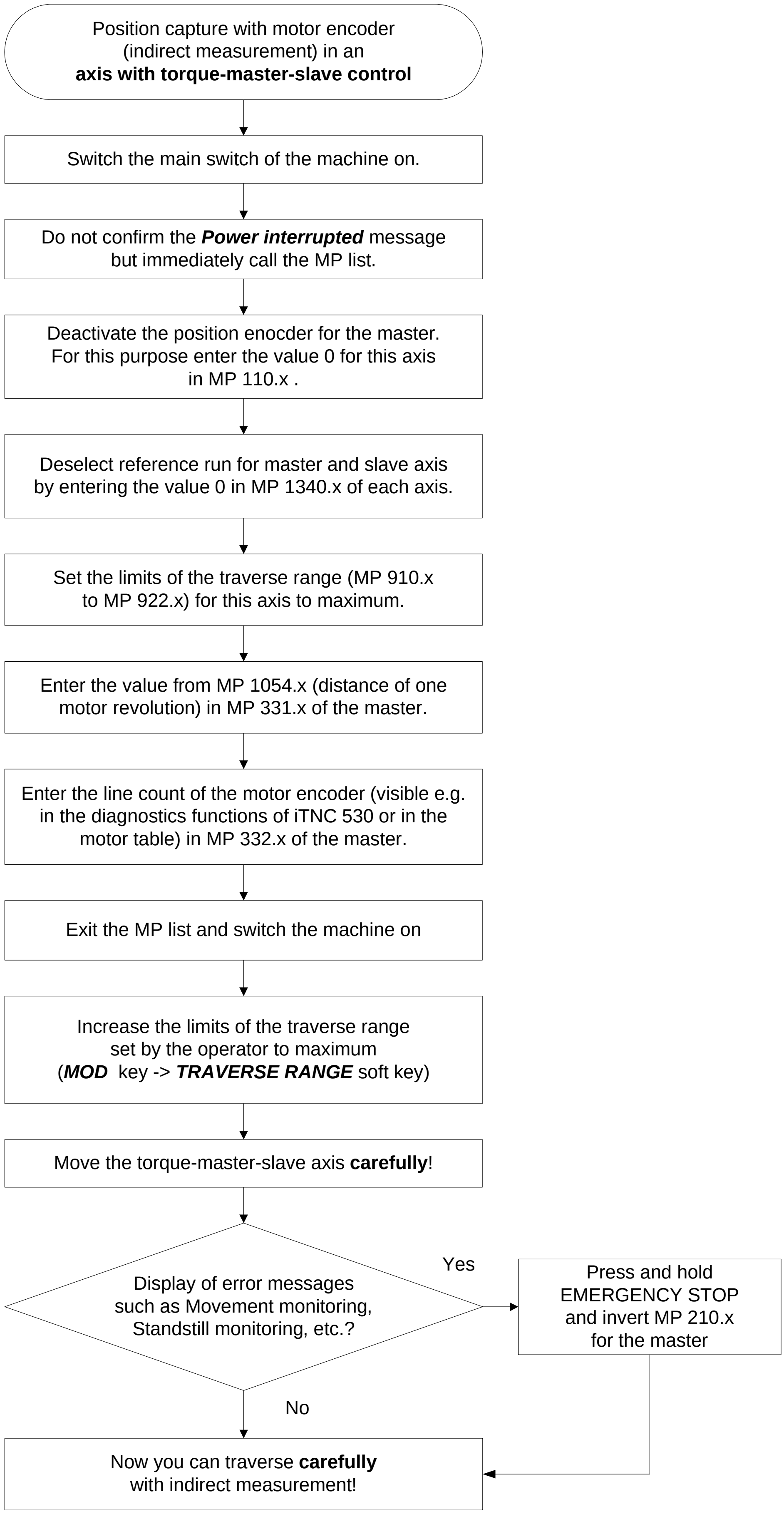
Preliminary actions

A defective scale or scanning head or a defective encoder cable could influence the low voltages of the control. This could have an effect on the overall function!
Switch off the machine and separate the position encoder from the control!

Description for individual axis



Description for axis with master-slave torque control



Additional information on gantry axes

The following flow chart shows the interrogation whether the currents (I nominal) of the gantry axes deviate considerably. A maximum tolerable current value cannot be given as different drives, motors and mechanical designs are used.

A misalignment of the gantry axes may be the result, for example, of the emergency stop of the machine when the scale failed.

If this is the case, contact the machine manufacturer!

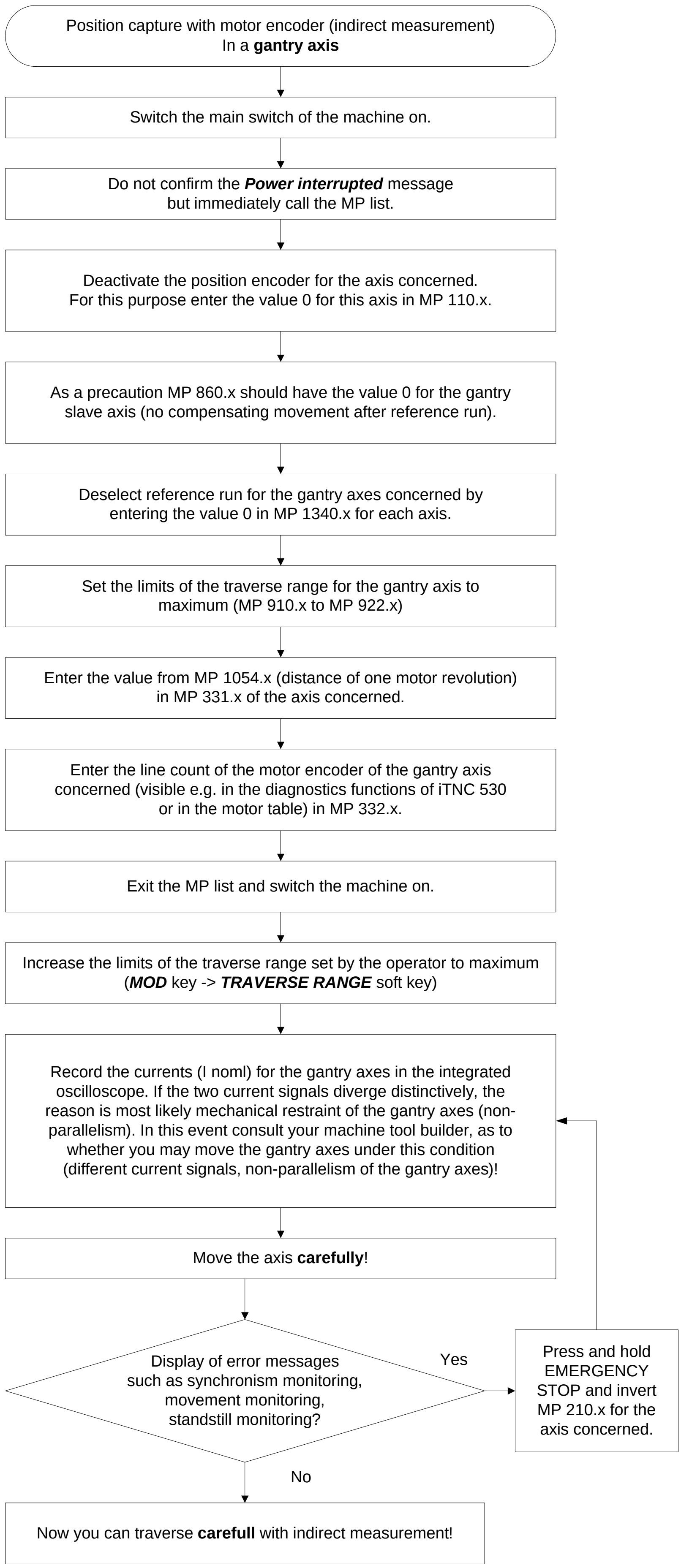
The following proceeding would be possible:

- Separate the master-slave relation in MP 850.x.
- Switch on the jog increment function.
- Enter a very low jog increment (0.001 … 0.01 mm).
- Call the integrated oscilloscope and record the current values (I nominal) of the ganty axes.
  --> See "Integrated Oscilloscope" on page 8 – 49
- Move master axis with this jog increment to a position with a minimum difference of current of both gantry axes. --> The mechanical strain has been eliminated!
- Restore master-slave relation in MP 850.x.
- Further procedure as described in the flow chart.

Note

In case the monitoring tolerances for speed stability and standstill have been set reasonably, it can be prevented that the gantry axes traverse mutually too long if the counting direction of the position encoder signals (MP 210) is wrong.
Contact the machine manufacturer!

Description for gantry axis



18 Referencing

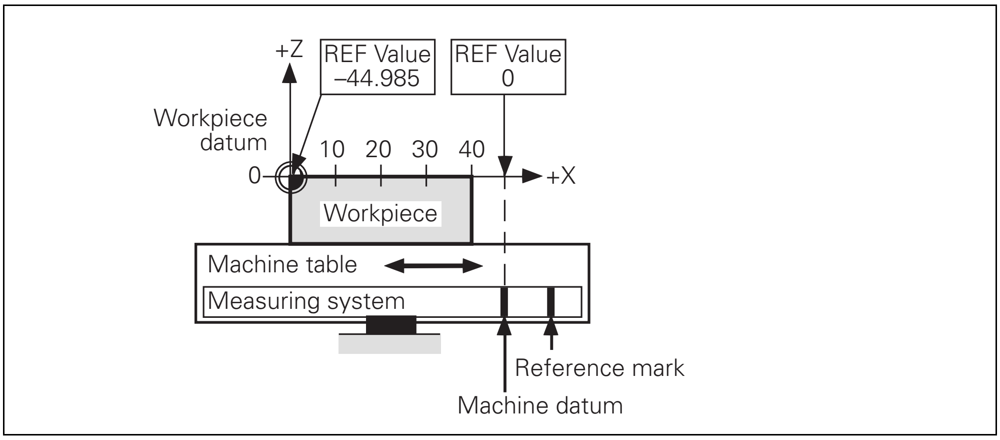
18.1 Definition

The position value (the coordinates) of an axis position is defined with respect to a freely selectable datum. When the axes are moved, the ACTUAL position is calculated incrementally. If there is an interruption in power, the reference between the axis position and the position value is lost.

Reference marks

HEIDENHAIN linear encoders are designed with one or more reference marks. The reference marks identify an axis position at a known distance from the machine datum. The position of the freely selectable datum is defined with respect to the machine datum.

The datum and the actual position can be reproduced as soon as the reference marks are traversed.



Machine datum

The machine datum is determined by the machine manufacturer.
It is required for:

- Defining the limits of traverse (software limit switches)
- Moving to machine-referenced positions (such as tool change positions)
- Setting the workpiece datum

Distance between the scale reference point and the machine datum

For distance-coded reference marks, the machine datum is defined with respect to the scale reference point, which is at the first reference mark after the beginning of the measuring length.

▶ MP 960.x contains the distance between scale reference point and machine datum
.

Note

After removing and remounting a measuring system MP 960.x may have to be altered.
See “Re-Setting the Machine Datum” on page 17 – 284.

Spindle preset

A corresponding angle encoder or also the motor encoder in the spindle motor may be used for spindle orientation.

▶ **MP 3430.x** contains the deviation of the reference mark from the desired position.

Note

After exchanging the angle encoder or the motor encoder in the spindle motor, it might be necessary to set MP 3430 again.
See “Resetting the Spindle Orientation” on page 17 – 293.

18.2 Traversing the Reference Marks

The reference marks must be traversed after any interruption in power: This can be done in two different ways:

- Press the NC-START key. –> The reference marks are traversed automatically.
  (the sequence of axes and how often the NC-START key must be pressed was determined by the machine manufacturer).

or:

- Press the machine axis-direction button. –> The user determines the sequence for the referencing of the axes.

DANGER

When servicing, the machine may be in a position where the sequence for the automatic referencing of axes could result in a collision and thus a damage or injury to the machine or persons (e.g., error message with reboot).
Determine the sequence for the reference run yourself!
Please ensure that the last set ***Tilt working plane*** function ***active*** or***inactive*** has been called correctly.
Enter a low feed rate and press the corresponding axis direction keys in succession!
If necessary, ask the machine operator!

Soft key PASS OVER REFERENCE MARK

If after power on of the machine no or not all reference marks were traversed (e.g., due to a previous change to another operating mode) with ***PASS OVER REFERENCE MARK*** the reference mark traverse must be activated. Select the manual operating mode and press the soft key.
–> ***Traverse reference points*** appears on the screen.

After the reference marks have been traversed:

- The software limit switches are activated.
- The most recently saved datum and machine datum are reproduced.
- PLC positioning and positioning with M91 and M92 become possible.
- The counter is set to zero for axes in an open loop.

External reference pulse

If the reference mark of the encoder cannot be used, e.g. owing to an unfavorable transmission of motor and rotary axis, an external reference pulse may be evaluated.

- In MP 4130.x a fast PLC input is defined for an external reference pulse.
- In MP 1360.x the number of the fast PLC input is entered for the axis concerned.
- MP 1350.x = 6 for the axis concerned.

Reference end position

To prevent the axes from violating their traverse limits when traversing the reference marks, each axis requires a trip dog (at the reference end position). The trip dogs must be installed by the machine tool builder at the ends of the traverse range. The switch signals from the trip dogs are sent to free PLC inputs. The PLC program must gate these PLC inputs with W1054 for "reference end position."

The axis will automatically be positioned to the software limit switch if …

- It is beyond the positive software limit switch and is moving in the positive direction to the positive trip dog.
- It is beyond the negative software limit switch and is moving in the negative direction to the negative trip dog.

Encoders with EnDat interface

Encoders with EnDat interface can be connected to the position and speed inputs of the MC 422 (B) and CC 42x. With these encoders there is no need to traverse the reference marks. The position value is only read when the control is switched on. It cannot be read again.
When connecting a position encoder with an EnDat interface:

- MP1350.x = 5 for the axis concerned

When connecting a speed encoder with an EnDat interface:

- The iTNC automatically attempts to communicate with the encoder.

When connecting a speed encoder with an EnDat interface as a position encoder:

- MP1350.x = 5 for the axis concerned
- MP110.x = 0 for the axis concerned

Note

If use of multiturn encoders with EnDat interfaces results in overruns, the corresponding information is entered in the system file NCDATA.SYS. For a control exchange, this file must be transferred or MP960.x must be readjusted (see "Exchange of HEIDENHAIN Components" on page 26 – 411)!

Double reference run

During the double reference run, the absolute position is first output via the EnDat interface of the speed encoder. If at a later time the reference mark of the position encoder is traversed, the control continues to work with this reference.

- Set the corresponding bits in MP1355 to 1 for the axes for which the double reference run is to be used.

The distance between the speed encoder and the position encoder is entered in MP1356.x.

If the reference mark of the position encoder is **first** traversed, the message **Set MP1356.<axis number> to <value>** appears.

- Enter this value in MP1356.x.

Possible causes of error

The causes of error of encoders also apply here
--> see "Possible Causes of Error" on page 17 – 280 and
see "Possible Causes of Error" on page 17 – 287.

Especially for the referencing, the following causes of error are possible:

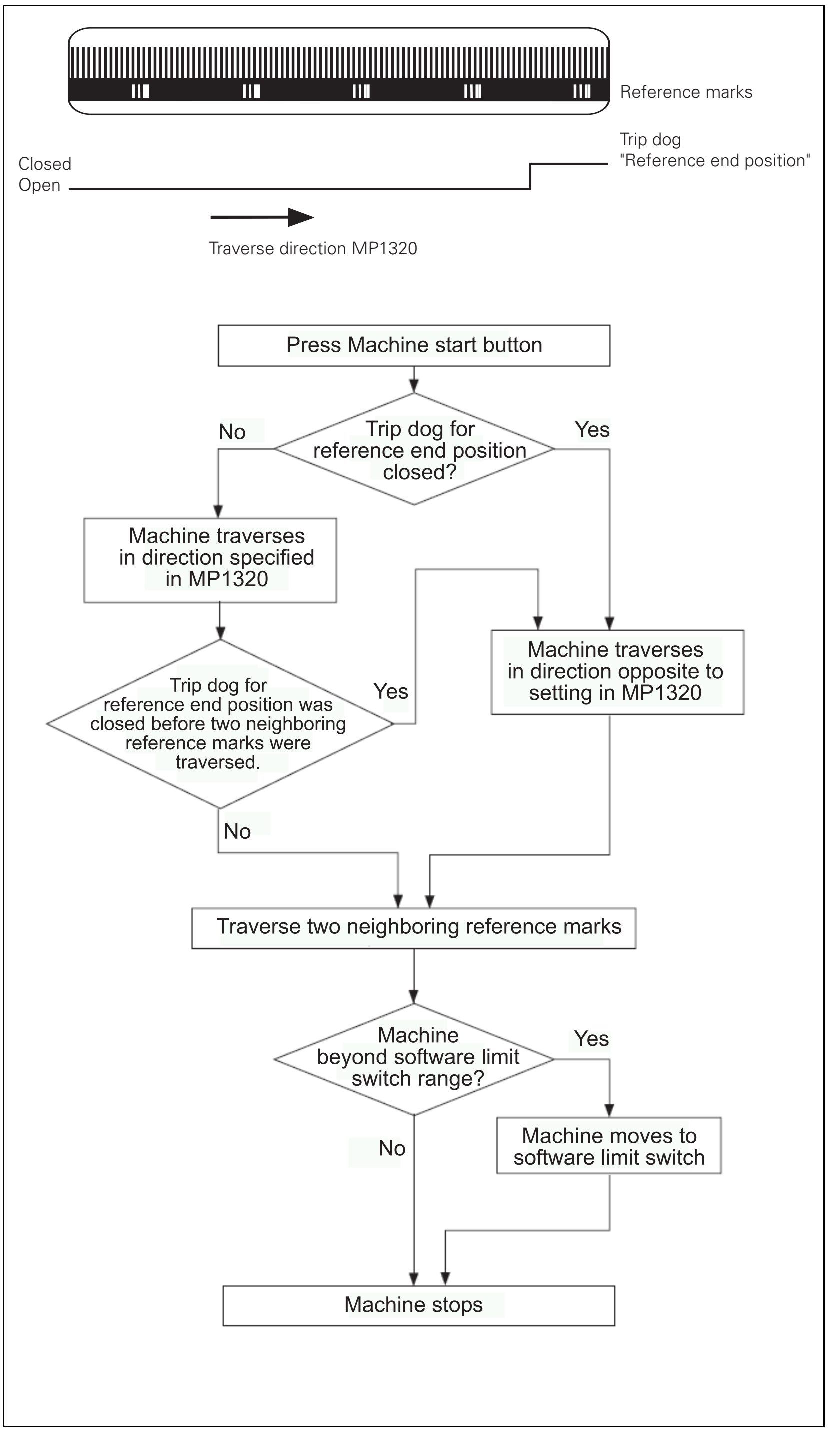
- Defective trip dog (reference end position)
- Shifted magnetic sheet (wrong or no reference mark is evaluated)
- Trip dogs are too close to the reference mark signal (during reference run via the motor encoder, a wrong reference position is evaluated)

Machine parameters

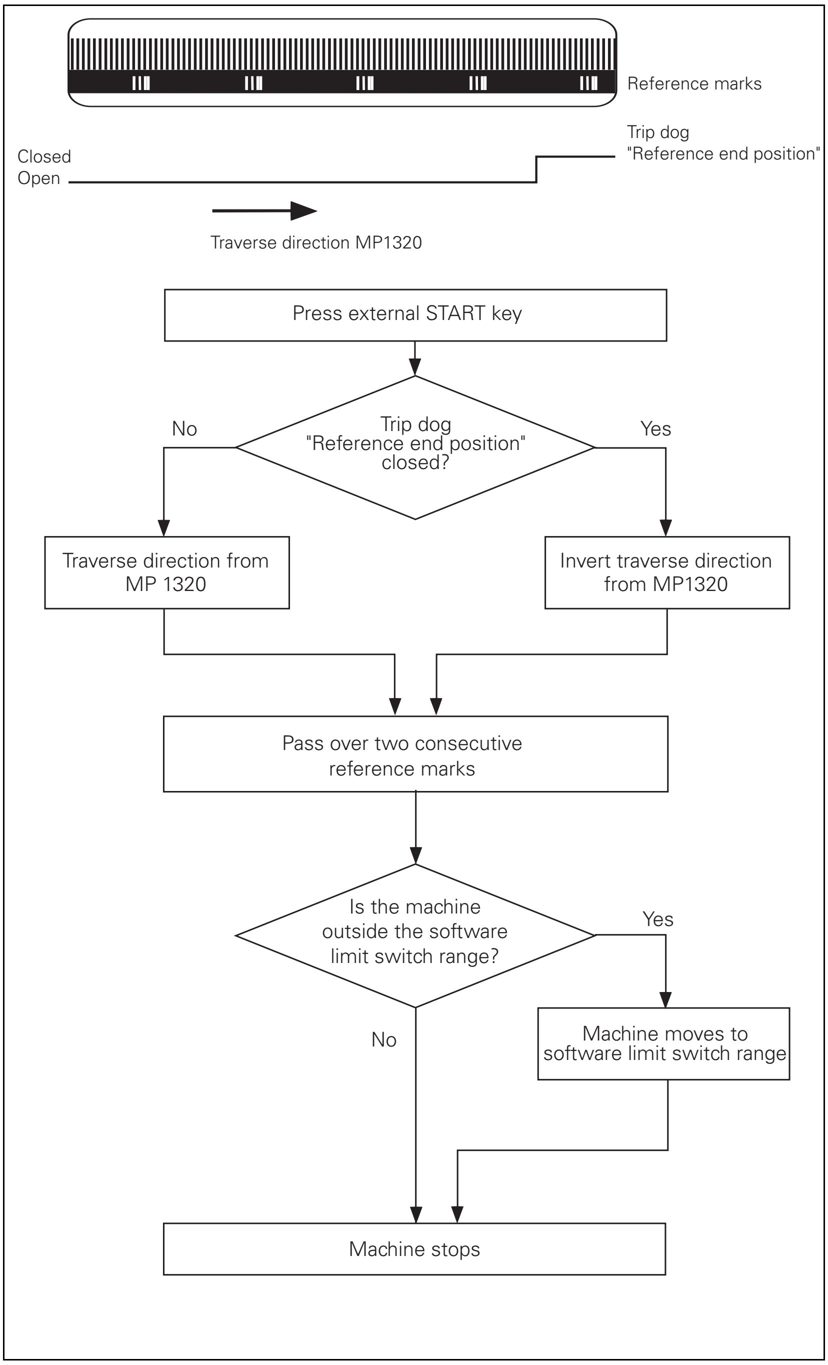
MP960.x	**Machine datum**
Input:	–1.79769313486E+308 to +1.79769313486E+308 [mm] or [°]
	Values with respect to the scale reference point
MP1320	**Direction for traversing the reference marks**
Format:	%xxxxxxxxxxxxxx
Input:	Bits 0 to 13 represent axes 1 to 14
	0: Positive 1: Negative
MP1330.x	**Velocity for traversing the reference marks**
Input:	80 to 300 000 [mm/min]
MP1331.x	**Velocity for leaving the reference mark end position for axes 1 to 9 (only for rotary encoders MP1350 = 2)**
Input:	10 to 300 000 [mm/min]
MP1340.x	**Sequence for traversing the reference marks**
Input:	0: No evaluation of reference marks
	1 to 14: Axes 1 to 14
MP1350.x	**Sequence for finding the reference mark**
Input:	0: Linear encoder with distance-coded reference marks (old routine)
	1: Position encoder with one reference mark 2: Special type (length measurement with ROD) 3: Linear encoder with distance-coded reference marks (new routine) 4: Same as 3 except that two reference marks are evaluated 5: Encoder with EnDat interface 6: Reference pulse via fast PLC input
MP1355	**Double reference run**
Format:	%xxxxxxxxxxxxxx
Input:	Bits 0 to 13 represent axes 1 to 14
	0: Reference run as defined in MP1350.x 1: Double reference run
MP1356.x	**Distance between speed and position encoder for double reference run**
Input:	–99 999.999 to +99 999.999 [mm] or [°]
MP1357.x	**W1032 for double reference run**
Input:	0: Reset W1032 if the reference run has been over the EnDat interface of the speed encoder
	1: Reset W1032 if the reference mark was traversed with the position encoder
MP1360.x	**Fast PLC input for reference pulse**
Input:	0: No fast PLC input for reference pulse
	1 to 5: Fast PLC input for reference pulse (MP4130.x)
MP1360.x	**Fast PLC input for reference pulse**
Input:	0: No fast PLC input for reference pulse
	1 to 5: Fast PLC input for reference pulse (MP4130.x)

Position encoder with distance-coded reference marks

Function when MP1350.x = 3



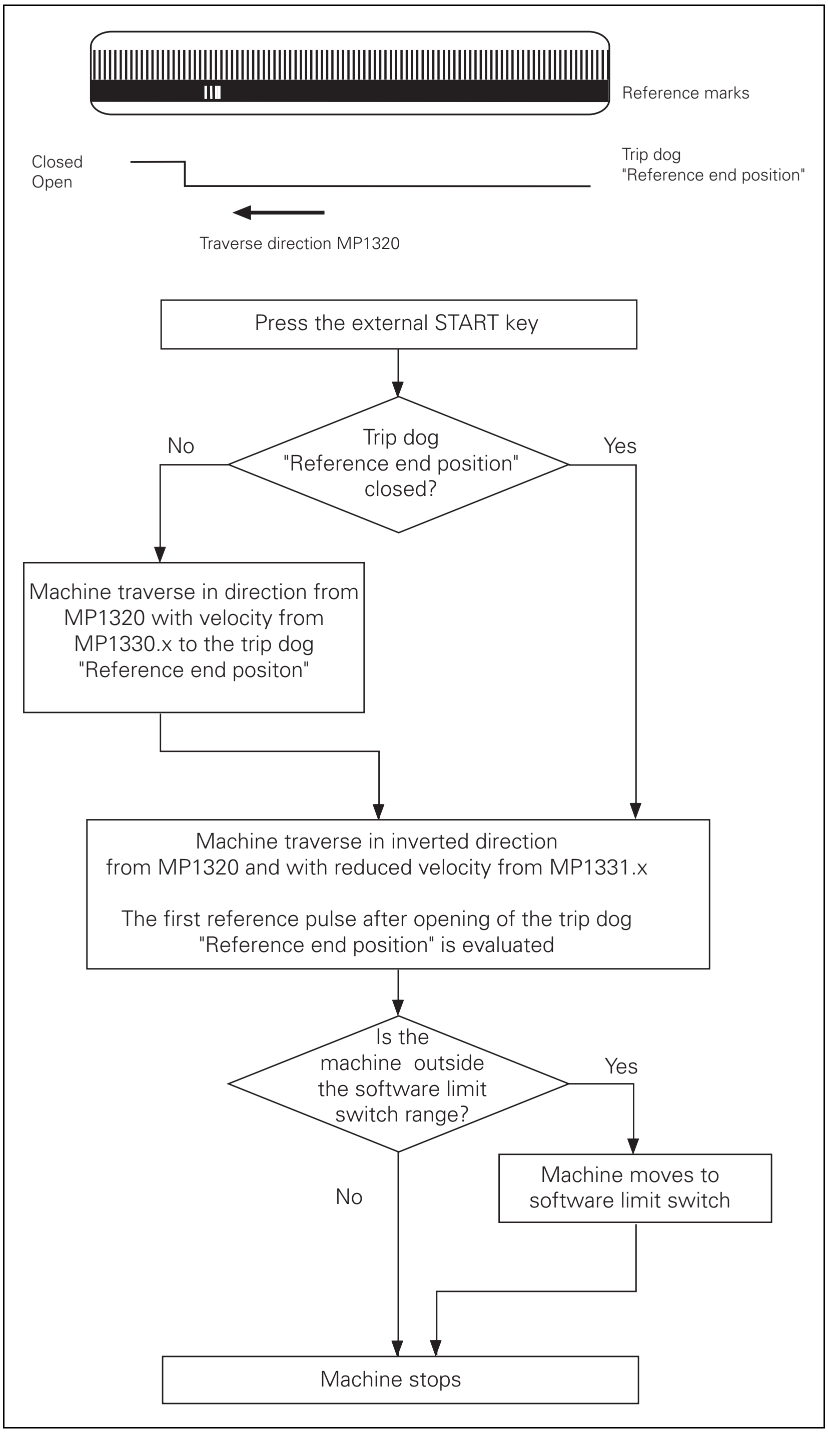
Function when MP1350.x = 0. This setting is used only to ensure compatibility. Do not use for new installations.



If during automatic referencing the trip dog is not closed until it is in the reference end position range, the contouring control will ignore this signal. It is therefore necessary that there are at least two reference marks in the range of the reference end position.

Position encoder with one reference mark

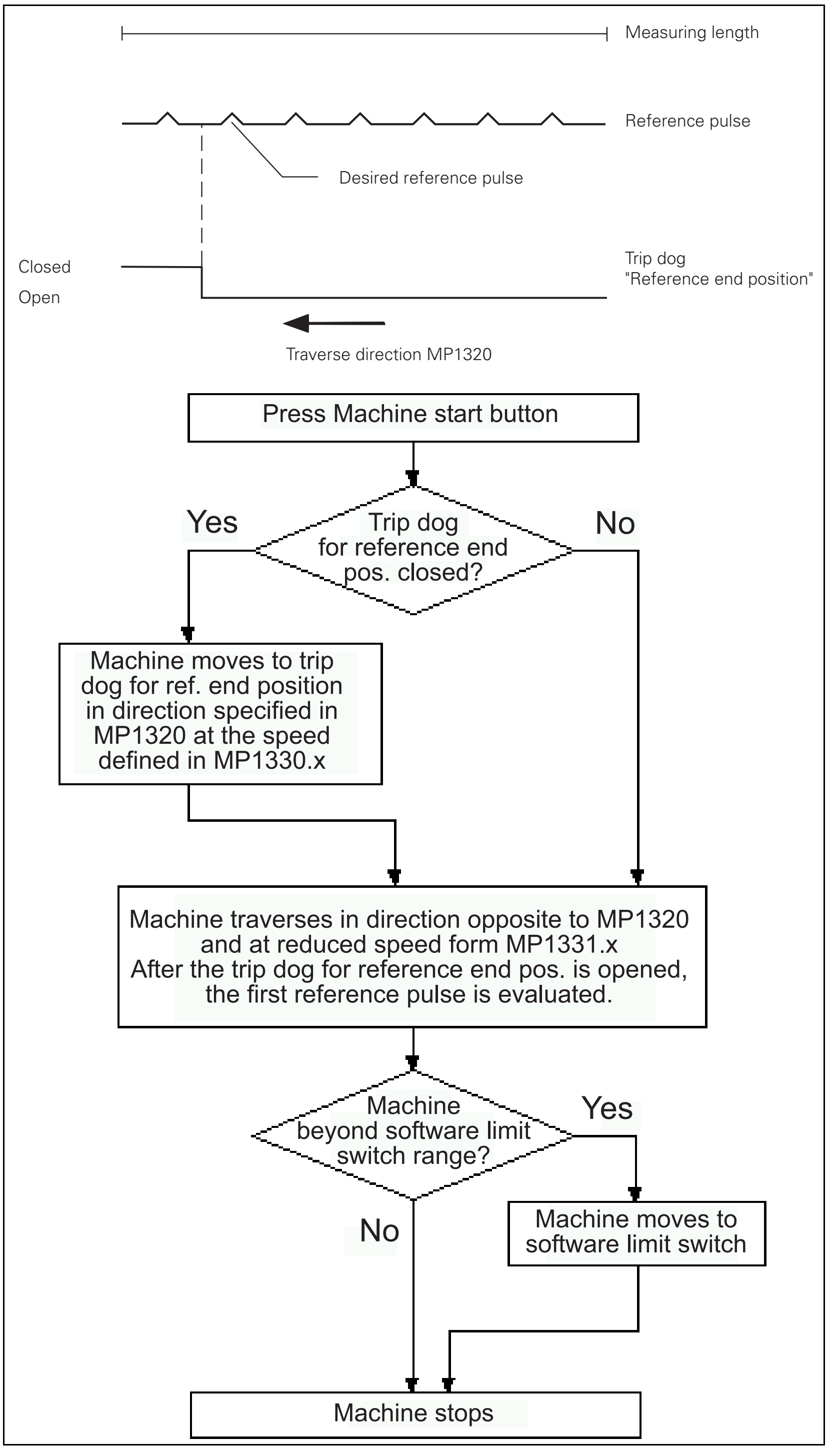
Function when MP1350.x = 1



Linear measurement through rotary encoder

Function when MP1350.x = 2

For linear measurement using a rotary encoder, a reference pulse is produced at each revolution of the encoder. Ensure that during referencing the same reference pulse is always evaluated. This can be realized with the trip dog for reference end position.



18.3 Deselect Referencing for Axes

For axis examinations it is possible to deselect the referencing **MP 1340.x**.

▶ Enter value 0 (= no evaluation of the reference mark) for the corresponding axis.

☞ **Note**

In MP1340.x the sequence for the reference mark run is listed.

With following entries, i.e.:

- MP1340.0 : 3
- MP1340.1 : 2
- MP1340.2 : 1

... first the 3rd axis is referenced (e.g., Z axis), then the 2nd axis (e.g., Y axis) and subsequently the 1st axis (e.g., X axis).

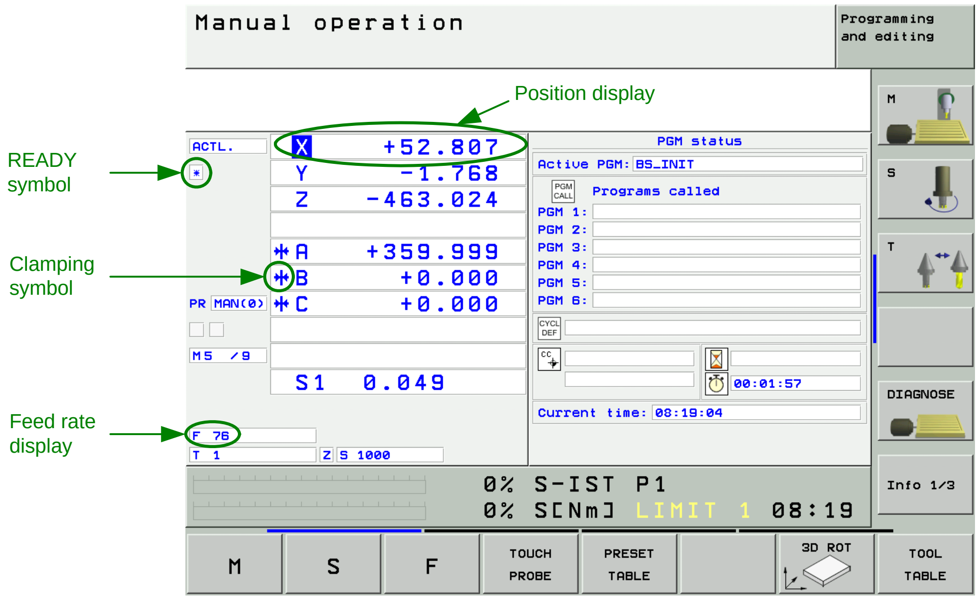
If you now want to deselect the X axis, you must enter MP1340.2 = 0!

19 Checking the Enables on the iTNC

19.1 General

With an operating axis (axis in control) ...

- No terminal symbol is shown
- The "STIB" star (control in operation) is shown.
- The feed rate enable must not be highlighted.
- The position display changes in case of a movement.



To operate with axes or spindles the appropriate enables are required.

If one or several enables are missing, an error message is output or the axes and/or the spindles cannot be operated.

The following **conditions** must be fulfilled to drive **digital axes and spindles**:

- **I3** set
  (X42/4, ***Control-is-ready signal acknowledgement***)

- **I32** set
  (X42/33, ***global drive enabling***; the functionality of the I 32 global drive enabling is defined in **MP 2050**.

- **24V** at **X150 / 151** for the corresponding axis group is available.
  (X150/151 are not wired on every machine,
  but if they are, you can see in **MP 2040,** how the axis groups are assigned)

■ **Drives ready for operation**
(on the HEIDENHAIN inverter system the green **LEDs *READY*** at the drive modules UM xxx or at the output stages of a compact inverter) must be lit.

Note

If a drive is taken in control, there must be a READY signal from the drive module after a defined time. For this purpose the corresponding relays must trigger.
The iTNC monitors the time between power on of the control and the READY signal of the drive modules via the PWM cables.
If the READY signal is missing after the waiting time has passed, the error message **8B40 No drive release <axis>***appears*.
E.g., a connection may be interrupted, or the relays trigger too slowly or the drive is defective, etc.
The permissible waiting time is entered in **MP2170**.

It is possible that this error message is not generated as the PLC program does not hook up the current and speed controllers as long as the ready signal of the drives is missing. --> Observe the green READY-LEDs of the drives. --> See "Checking the Readiness of the Inverter System" on page 19 – 322

■ **PLC module 9161** called
(This module serves to activate the current and speed controllers individually for each axis. If necessary ask the machine manufacturer, in which program part this module is called.)

Note

The word W1024 contains the axes enabled by the NC.

The word W1060 contains the axes for which the feed rate was individually enabled by the PLC.

If the marker M4563 is set, the PLC enables the feed rate in all axes.
(Use either W1060 or M4563.)

The word W1040 contains the axes in which the control loop is opened by the PLC (e.g., with. clamping axes).

The PLC module 9169 serves to call those axes for which I32 does not switch off the drives.

MP2040	**Axis groups for drive enabling through X150 / X151**
Format:	%xxxxxxxxxxxxxx
Input:	0: Axis not assigned 1: Axis assigned
MP2040.0-5:	Groups 1 to 6
MP2040.6-7:	Reserved, enter %00000000000000
MP2050	**Functionality of drive enabling I32 (X42/33)**
Input:	0: Emergency stop for all axes, Module 9169 not effective 1: Emergency stop for all axes that are not excepted with Module 9169 2: I32 and Module 9169 are without functionality
MP2170	**Waiting time between the switch-on of the drive and the drive's standby signal**
Input:	0.001 to 4.999 [s] 0: 2 [s]

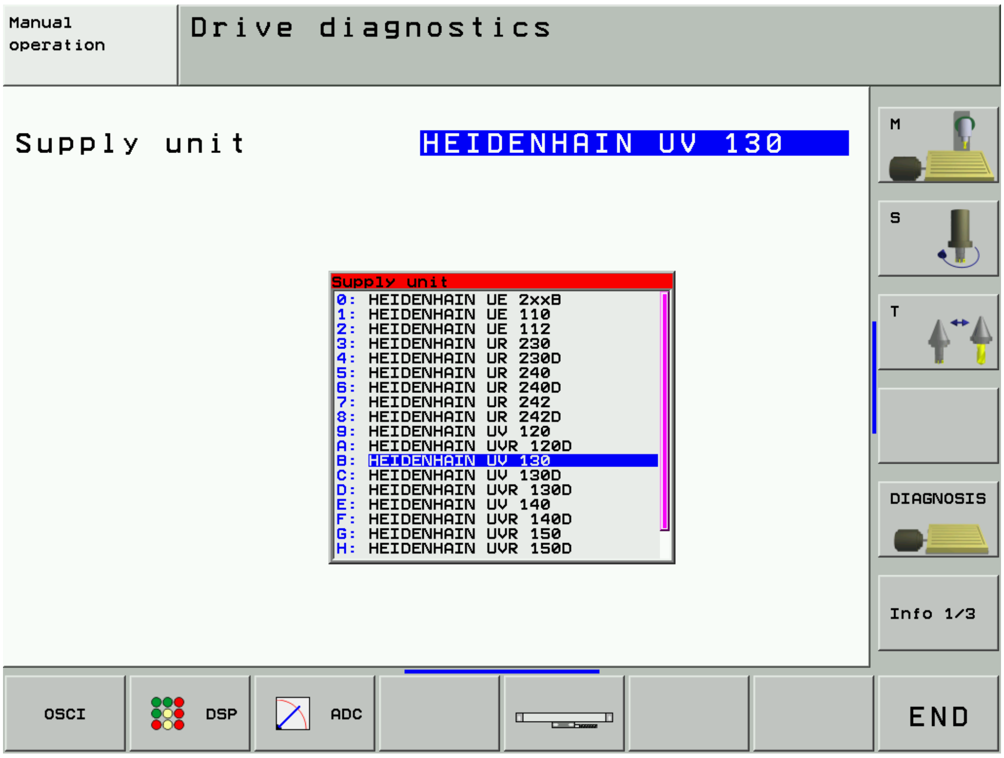
19.2 Examination

The iTNC 530 features comprehensive diagnosis possibilities.
--> See “Integrated Diagnosis Functions” on page 7 – 41.

These **diagnosis functions** can be used for the following examinations!

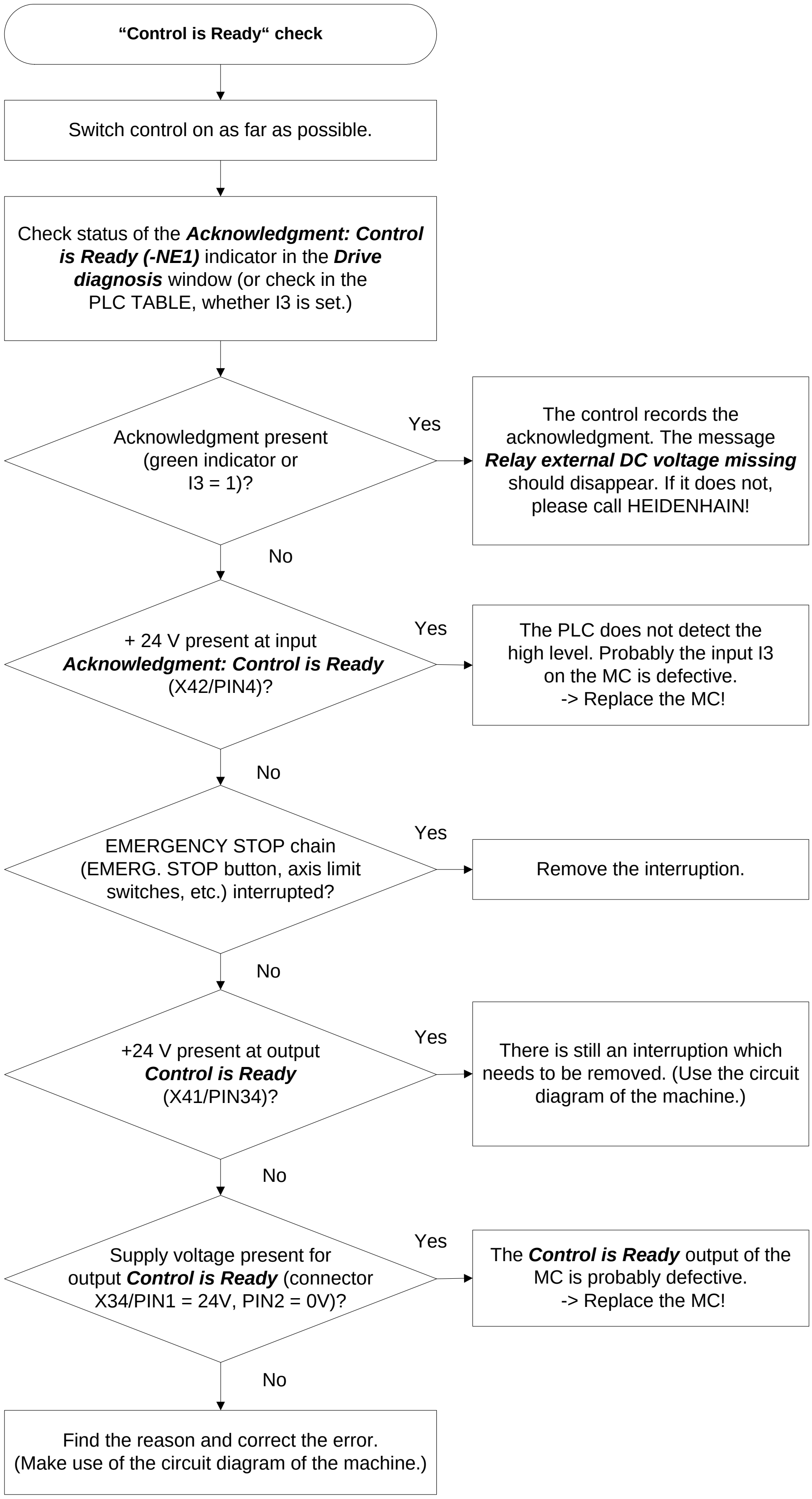
Selection of the supply device

- Select the power supply unit used
  (not all status information of non-HEIDENHAIN inverters can mostly be used):



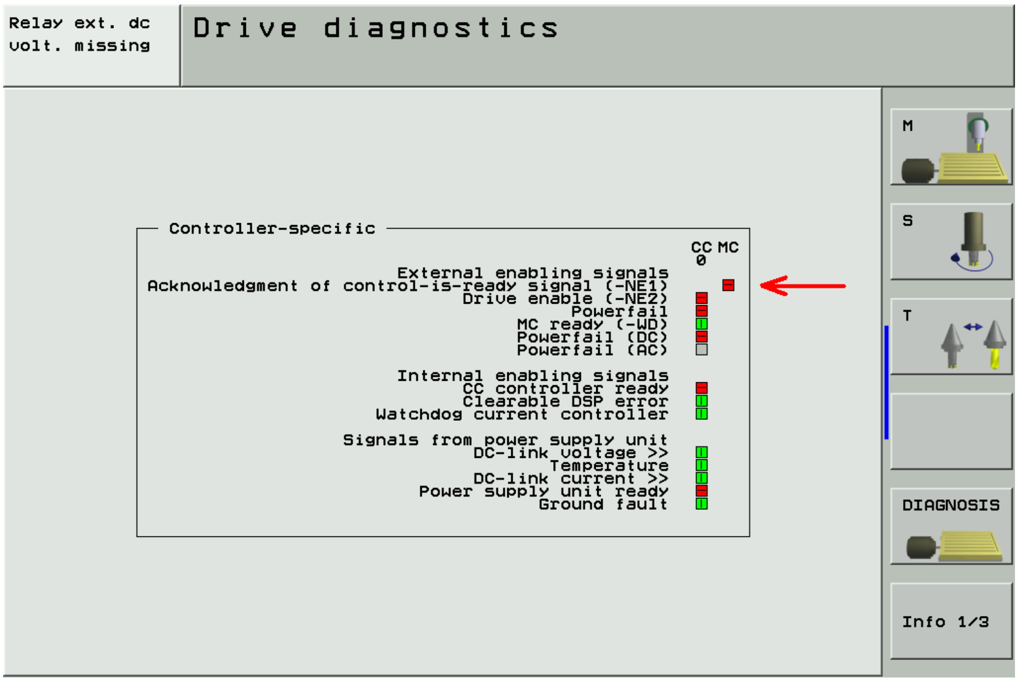
19.2.1 Examination of the Output *Control-is-ready* (X41/pin34) and Input *Control-is-ready signal acknowledgement* I3 (X42/pin 4)

If the message ***Relay external DC voltage missing*** does not disappear after pressing the key ***Control ON***, carry out the folllowing fault diagnosis:



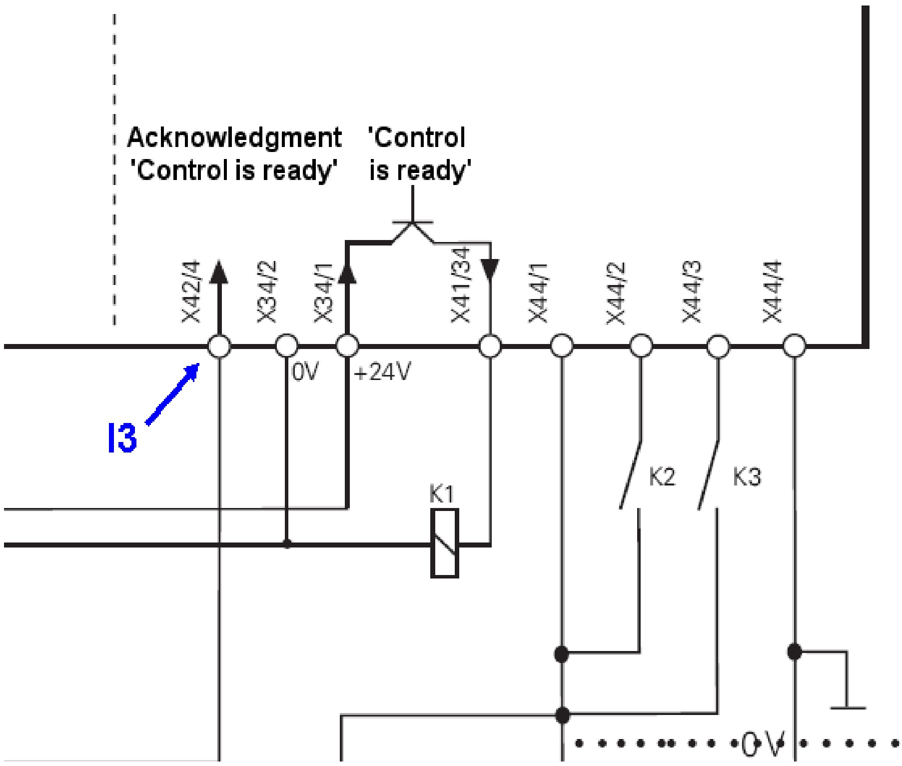
Page from the DSP diagnosis of drives

Call via the soft keys *DIAGNOSIS --> DRIVE DIAGNOSIS --> DSP*
See "Integrated Diagnosis Functions" on page 7 – 41.



Excerpt from the basic circuit diagram

Here you can see the terminals that can be measured
(the PLC inputs and outputs are mostly connected to a strip in the electrical cabinet).



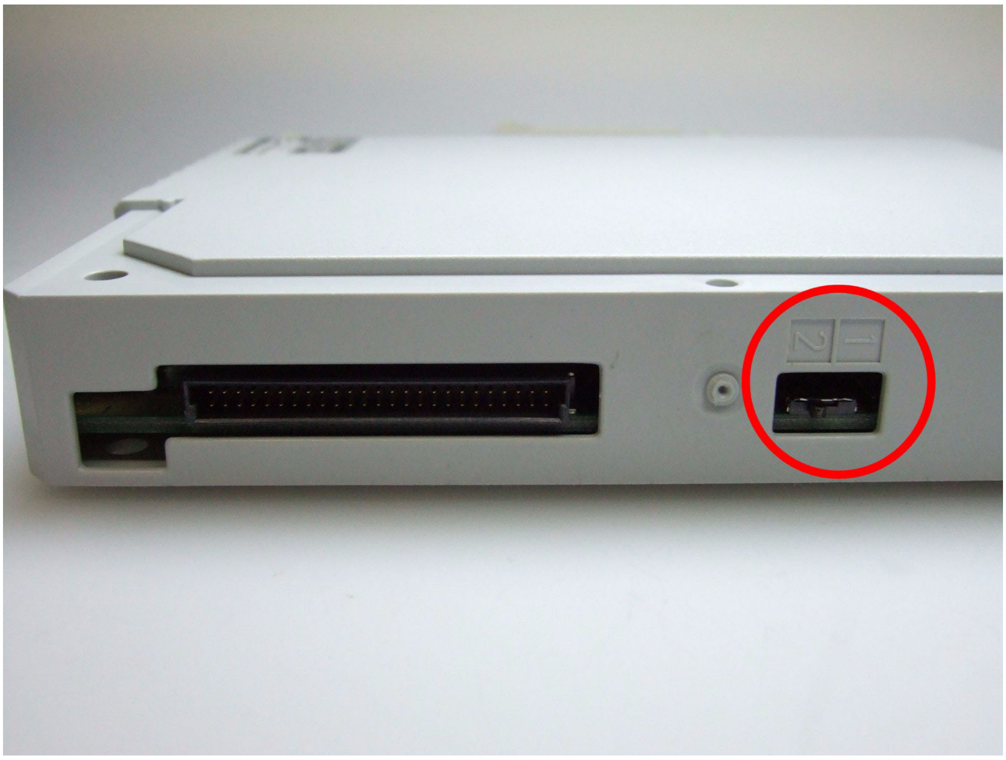
Note

If the ***Control-is-ready output*** on the MC is defective, you can use the ***Control-is-ready output*** of a PLC expansion board as makeshift:

- PL 405 B or PL 410 B: X8 / pin16
- PL 510, input/output module PLD 16-8: X6 / terminal 8

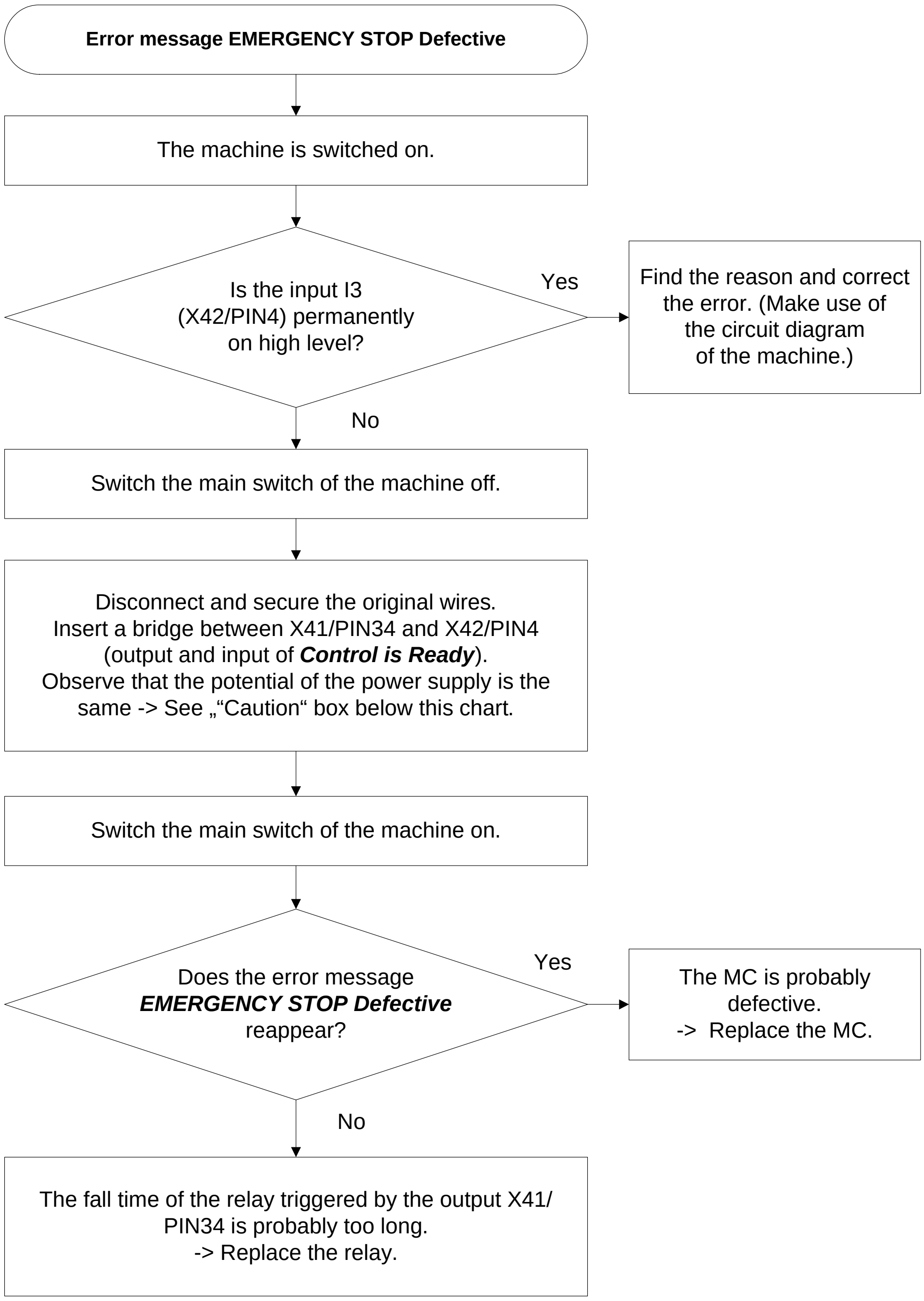
(The function of this terminal can be set with a sliding switch on the rear side of the corresponding I/O modules, setting 1 = "Control is ready", See "X6: PLC outputs on the PL 510" on page 13 – 197)

Sliding switch on I/O module



Error message
EMERGENCY STOP DEFECTIVE

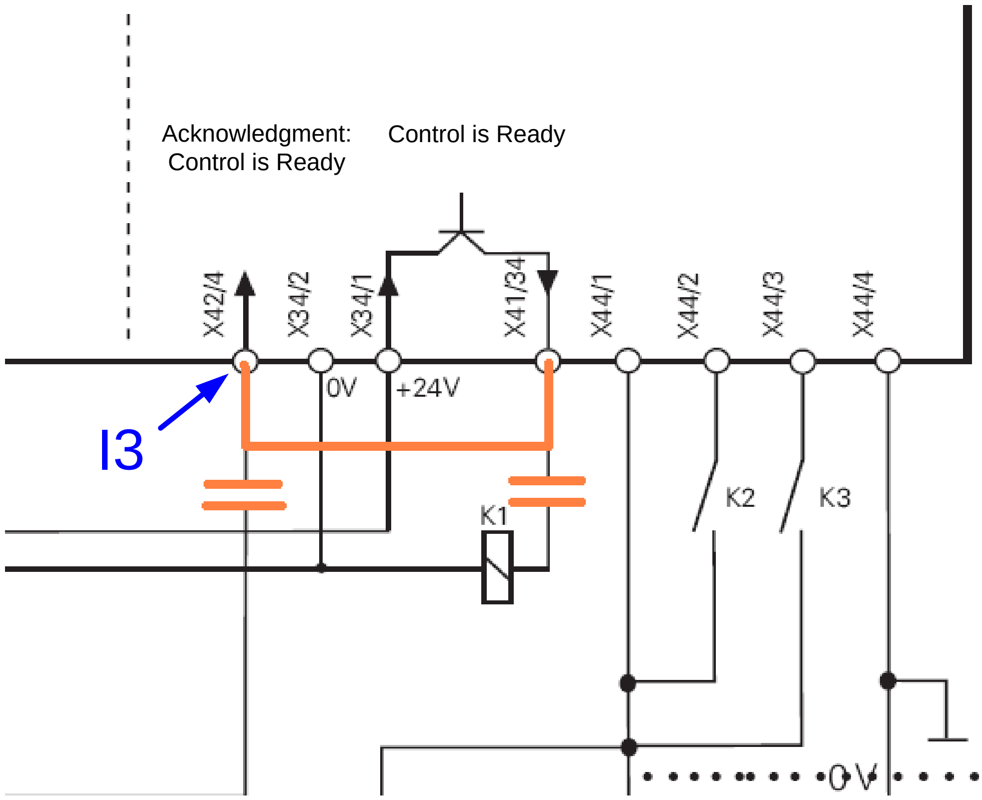
If the error message ***"Emergency Stop Defective"*** appears when the machine is switched on, carry out the error diagnosis as follows:



Caution

If 24 V is supplied to the control-is-ready output from the HEIDENHAIN inverter system via connector X34, potential differences between the 24 V machine voltage and the 24 V from the inverter can result in compensating currents.
Therefore it is perferable to supply X34 with machine voltage before you insert a bridge between the "Control-is-ready" input and output during the following investigation!

Bridge inserted

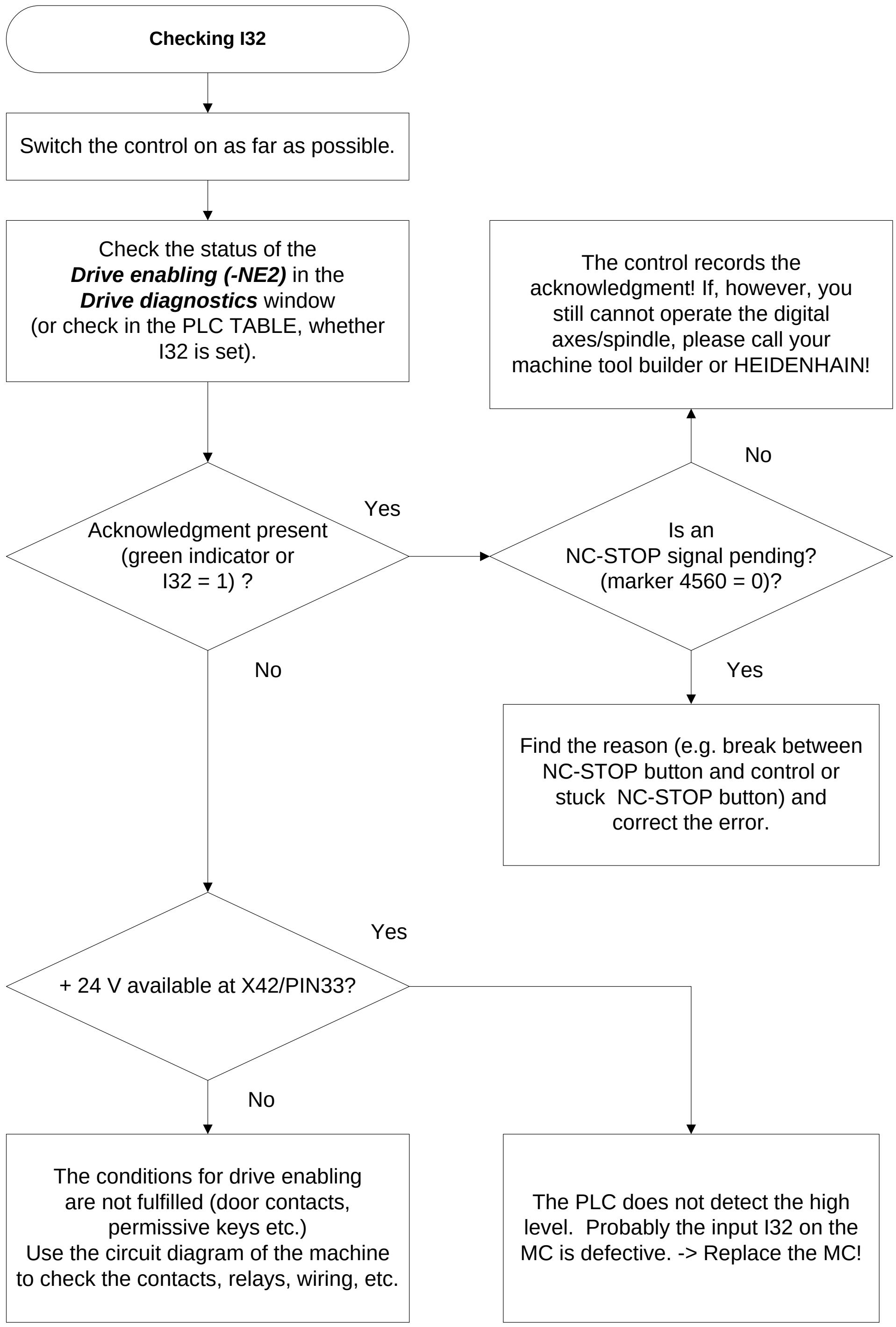


> **Note**
>
> The function of the ***Control-is-ready*** output of an I/O module PLD 16-8 can also be tested with this method.

> **Note**
>
> Course of the emergeny stop (or booting) routine.
> --> See “Monitoring Functions” on page 9 – 55!

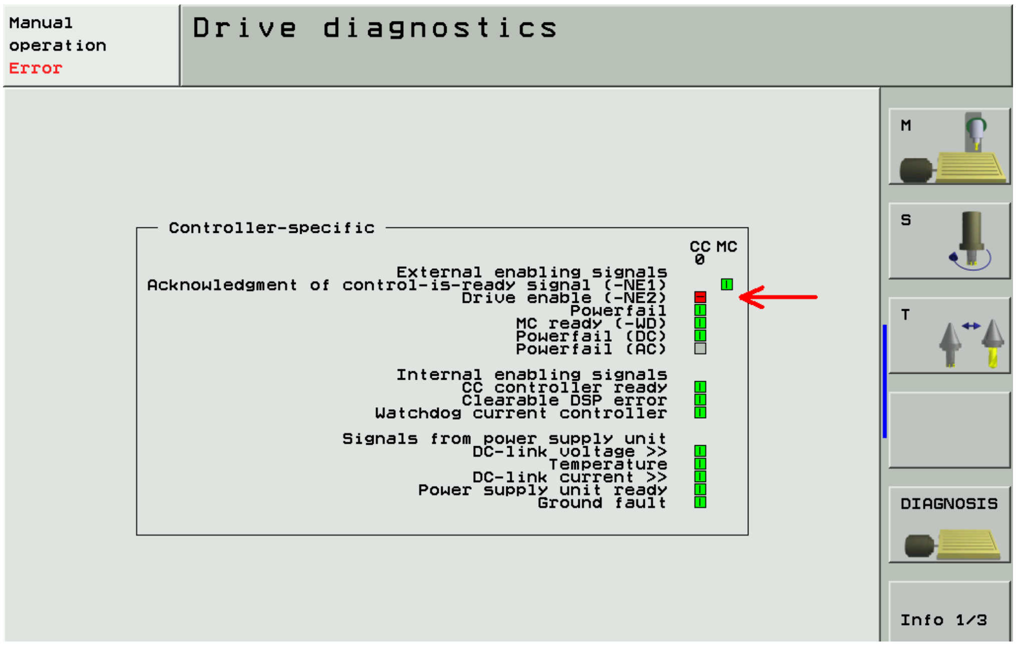
19.2.2 Checking the Global Drive Enable I32, Connector X42 / pin 33

If you can switch on the machine but cannot move with a digital axis/spindle, check the following:



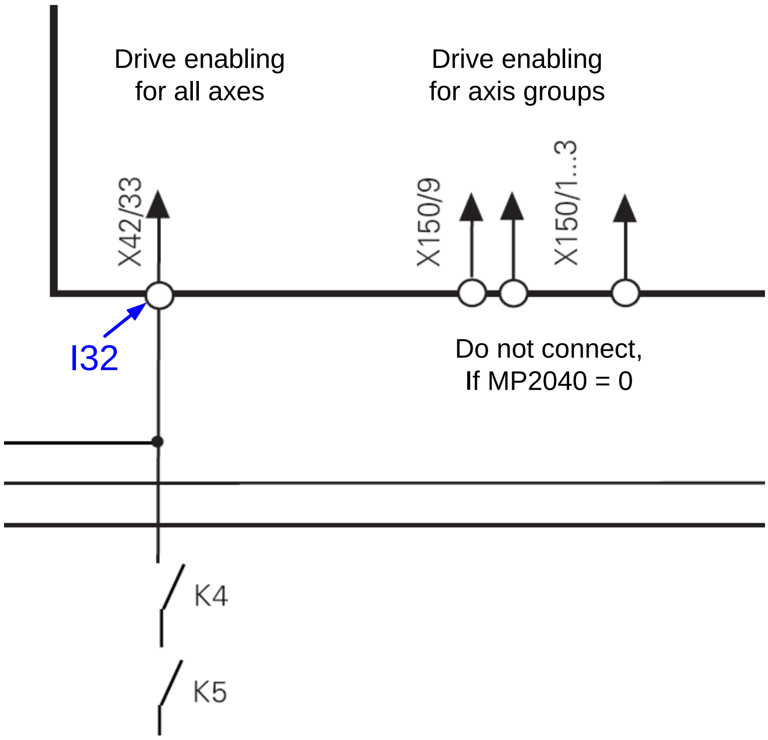
Page from the DSP diagnosis of drives

Call via the soft keys *DIAGNOSIS --> DRIVE DIAGNOSIS --> DSP*
See “Integrated Diagnosis Functions” on page 7 – 41.



Excerpt from the basic circuit diagram

Here you can see the terminals that can be measured
(the PLC inputs and outputs are mostly connected to a strip in the electrical cabinet).

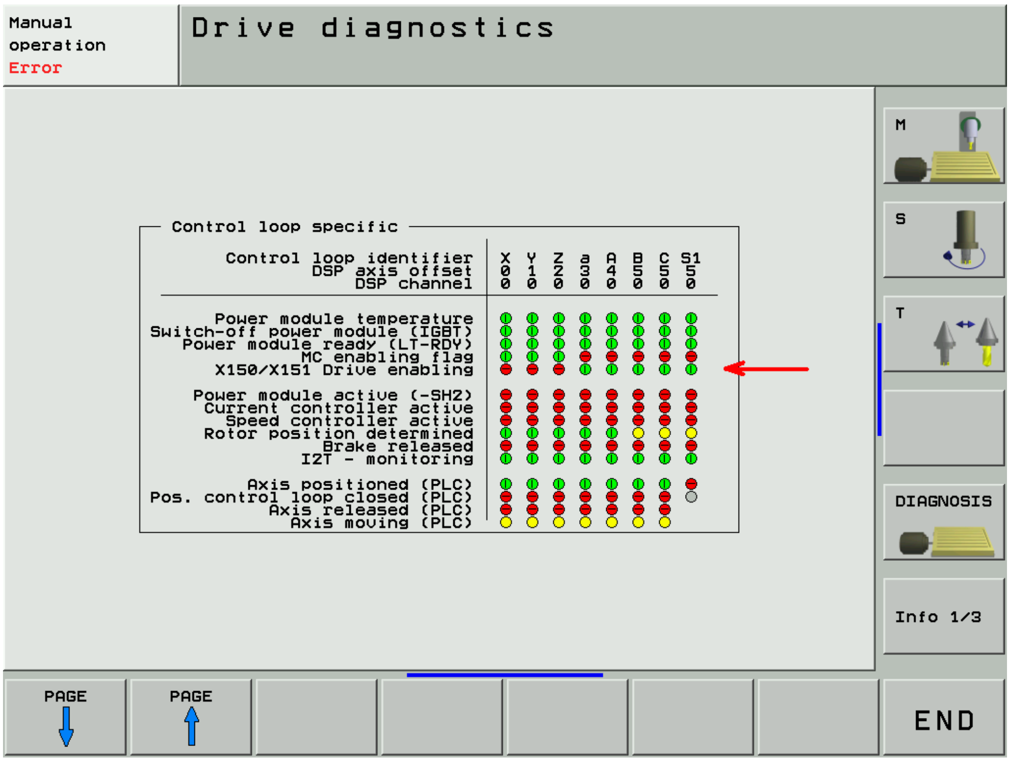


19.2.3 Checking the Drive Enabling for the Axis Groups via Connector X150 and X151 (if Wired)

- Check whether 24V are available for the axis group to be traversed.

  The axis groups for the drive enabling via X150 (main DCB) and X151 (auxiliary DCB) are defined in MP2040.

- Check according to the integrated drive diagnosis whether the corresponding axis groups are released:



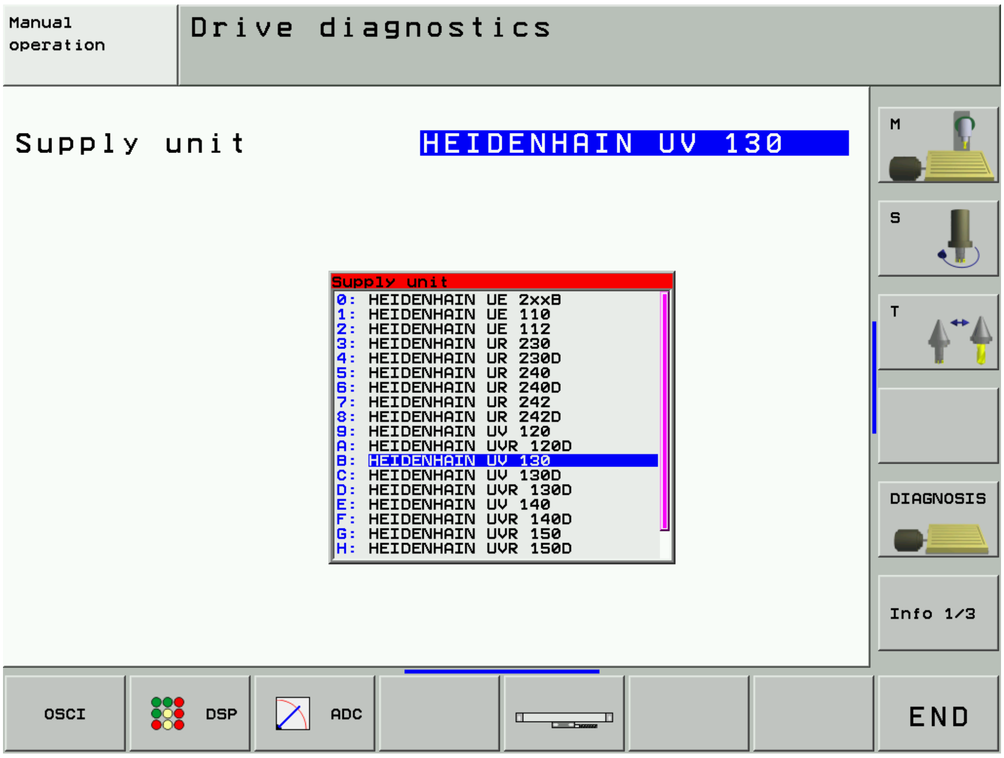
Note

If no axis groups are defined in MP 2040, the default setting of the drive release is active (via X150 / X151).

19.2.4 Checking the Readiness of the Inverter System

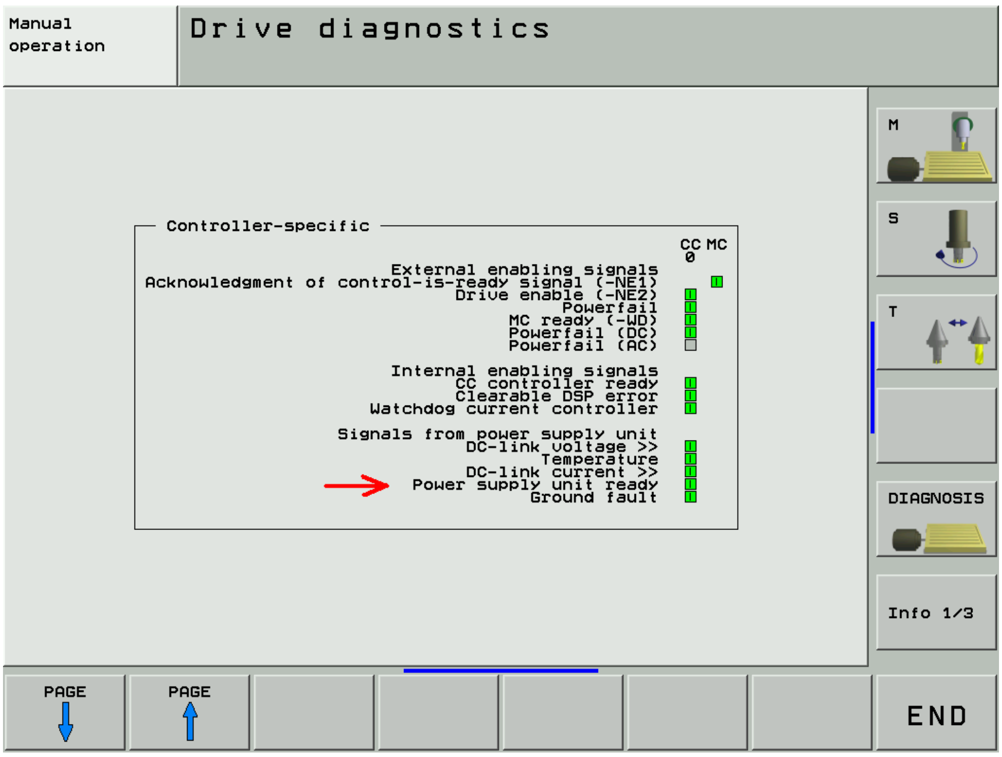
Selection of the power supply unit

- Select the power supply unit used for the integral diagnosis functions (mostly not all status information of non-HEIDENHAIN inverters can be used):

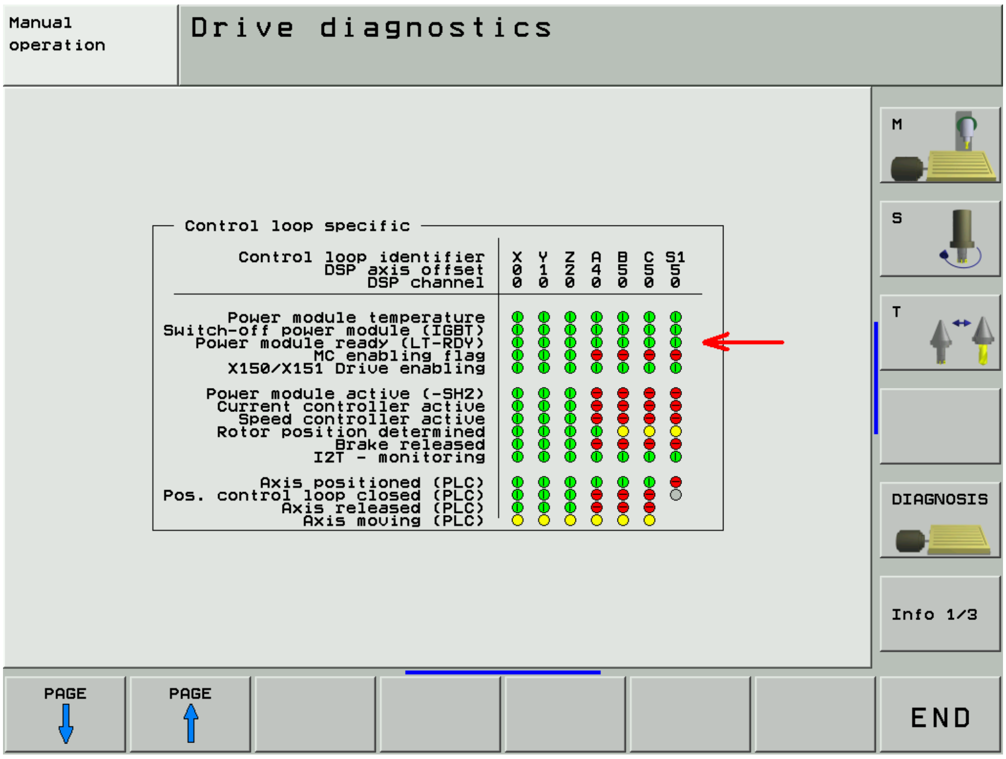


Green "READY" LED on

- Check according to the integrated drive diagnosis whether the corresponding axis groups are released:



▶ Check according to the integrated drive diagnosis whether the power modules are ready:



▶ Open the electrical cabinet and also check whether the green READY-LEDs on the compact inverter or the power supply unit light up (a non-HEIDENHAIN inverter is probably also equipped with a corresponding LED or display).

Inverters	**LED**
UE 1xx, UE 2xx B compact inverter	READY
UE 2xx compact inverter	AXIS/SPINDLE READY
UR 2xx, UR 2xxD compact inverter	READY UV
UV 120, UV 140, UV 150, UV 1xx D, UVR 1xx, UVR 1xx D power supply unit	READY UV and POWER MODULE READY
UV 130D power supply unit	READY
UV 130 D power supply unit	READY UV

▶ Check if the green READY-LED lights up on, e.g.

- on the compact inverter
- on the UM axis module
- on the HEIDENHAIN interface board for the SIMODRIVE system

for the axis to be traversed.
(A non-HEIDENHAIN inverter is probably also equipped with a corresponding LED or display.)

If the READY LEDs are not lit, proceed as follows:

- Check the supply of the inverter system.
- Check the electrical cabinet (relays, wiring, etc.).
- Check the ribbon cables and the plug-type connectors at the inverter system.

Note

Use the circuit diagram of the machine tool for this purpose.
Further inspection routines –> see service manual for Inverter Systems and Motors!

Red LED SH1

The ***SH1*** signal (safe stop 1) indicated by a red LED at the inverter, is generated by the computer of the iTNC. The signal is low-active, i.e. line-break proof.
If the computer is not ready for operation or if an error is pending, SH1 is output. The red SH1 LED and the green READY LED at the inverter can never be lit a the same time. They are mutually locked.

Red LED SH2

The ***SH2*** signal (safe stop 2) indicated by a red LED at the inverter, is generated by the controller of the iTNC. The signal is low-active, i.e. line-break proof.
If an axis or spindle is not controlled, SH2 is pending and the red LED is on.
This is for example the case with clamped axes or if a spindle is not controlled.
SH2 and READY are on simultaneously.

Note

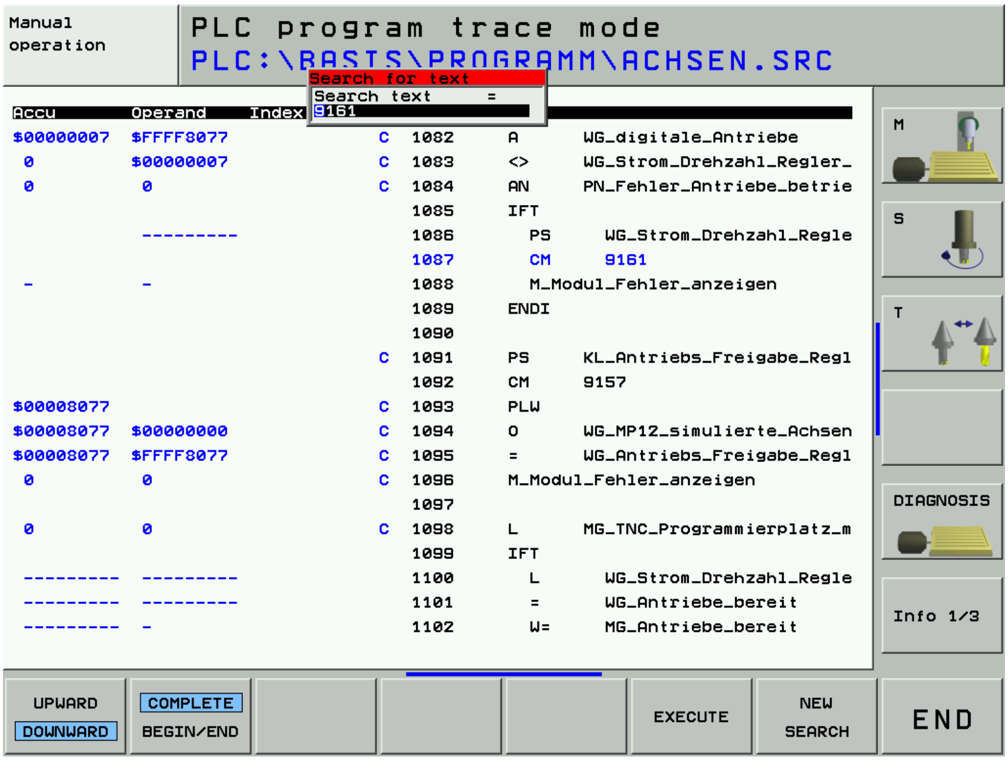
HEIDENHAIN interface cards for the SIMODRIVE system:
The cards for the plug-type connectors (ribbon cables) are equipped with the green *READY* LED and the red LEDs *SH1* and *SH2*.
The cards with D-Sub connectors are equipped with the green *READY* LED and the red LEDs ***RESET X1*** und ***RESET X2*** for the respective axis.
RESET X1, RESET X2 correspond to the SH2 signal.
The first generation of the cards with D-Sub connectors feature a green ***IF*** LED and a red ***NB*** LED.
IF stands for "pulse enable" (German: Impulsfreigabe) and means that the axis module is ready.
NB means that the axis module is "not ready" (nicht bereit).
For further information on the drives please refer to the service manual "Inverter Systems and Motors".

19.2.5 Checking PLC Modules, Markers and Words

For the following investigations, the PLC diagnosis functions are used.
–> See “PLC Diagnosis” on page 10 – 73.

For these PLC analyses it might be helpful or often even necessary to contact the machine manufacturer for support.

- Check whether the PLC module 9161 is called in the corresponding PLC program.
  (ask the machine manufacturer in which program block this PLC module is called).
  For this purpose enter the PLC TRACE mode.
  This module serves to activate the current and speed controllers individually for each axis.



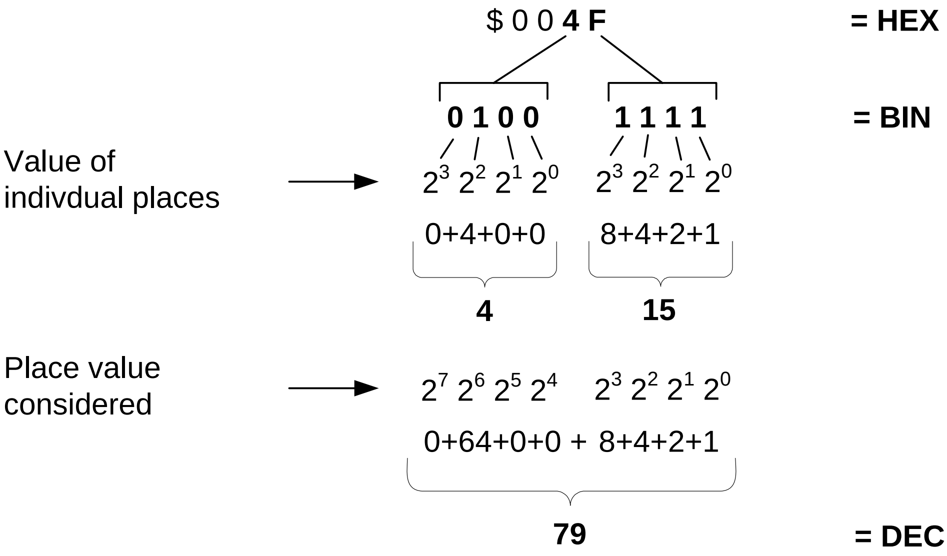
- Check the value in the word W1024.
  For this purpose enter the PLC TABLE.
  The word W1024 contains the axes enabled by the NC.

- Check the value in the word W1060 or whether the marker 4563 is set.
  For this purpose enter the PLC TABLE.
  The word W1060 contains the axes for which the feed rate was individually enabled by the PLC.
  If the marker M4563 is set, the PLC enables the feed rate in all axes.
  (Either W1060 or M4563 is used.)

- Check the value in the word W1040.
  For this purpose enter the PLC TABLE.
  The word W1040 contains the axes in which the control loop is opened by the PLC (e.g., clamping axes).

Note

The value of the words is displayed in hexadecimal or decimal format.The hexadecimal format is distinguished by a leading $. A hexadecimal digit comprises 4 bits. I.e. you can, for example, calculate for which axes the feed rate is enabled.
Example: W1024 = $004F
The first HEX digit has the value F, that is the first 4 axes are enabled
($2^0+2^1+2^2+2^3$ = 1+2+4+8 = F).
The second HEX digit has the value 4, i.e. the 7th axis is enabled (2^2 = 4).
In the binary format this is 0100 1111 and in the decimal format this is the value 79.



20 Interface to the Drives

20.1 Digital Drives

20.1.1 Introduction

Digital drive systems are also referred to as **inverter systems**.

For digital drives **three-phase ac motors** are used.

The most important motors are:

- Synchronous motors (e.g., HEIDENHAIN axis motors)
- Asynchronous motors (e.g., HEIDENHAIN spindle motors)
- Linear motors
- Torque motors

The digital servo amplifiers are controlled via so-called **PWM interfaces** (PWM = Pulse Width Modulation).
The position, speed and current controllers are located in the HEIDENHAIN control.

Following **PWM interfaces** are located **on the CC 422 / 424 controller unit**
(every digital axis/spindle has its own PWM ribbon-cable connector):

- **X51 to X56**
- **X57 to X64** (depending on the expansion stage)

Note

On the CC 424 (not CC 422), the speed encoder inputs are firmly assigned to the PWM outputs. --> See following table!
MP 112.x for the variable assignment of the speed encoders is not available for the CC 424!

Drive control board of CC 424	PWM output (MP120.x/MP121.x)	Speed encoder input
1	X51	X15
1	X52	X16
1	X53	X17
1	X54	X18
1	X55	X19
1	X56	X20
2	X57	X80
2	X58	X81
2	X59	X82
2	X60	X83

Caution

The service on the CC 424 and CC 422 is different.
Ensure to use the correct instructions!

MP 100 contains the axis sequence (first, second, third axis etc.).

Caution

MP 100 must not be edited!

The allocation of PWM outputs to the axes can be found in the machine parameters MP 120.x

Note

The connectors as of X57 can be assigned as of MP 120.6 (7th axis), but not those before!

The allocation of PWM outputs to the spindles can be found in the machine parameters **MP 121.x.**

20.1.2 Possible Causes of Errors

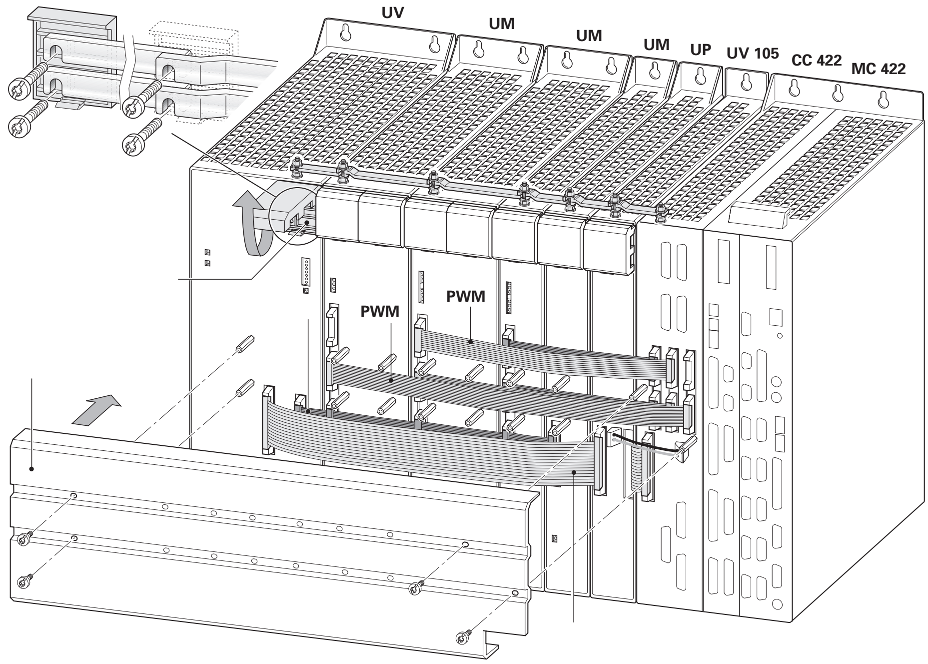
- Defective PWM interface or defective CC
- Defective cable
- Defective power module
- Defective motor
- Poor shielding and grounding
- Mechanical defects
- Error in the NC or PLC software
- Wear and tear of mechanical parts
- Deterioration of the machine
- Defective HEIDENHAIN interface board for the SIMODRIVE 611 drive system
- Wrong grounding in connection with the so-called HEIDENHAIN interface boards

There is wide variety of possible error causes.
Profound knowledge of the machine and the interaction of the components is very helpful for this type of error.
If error messages are generated, press the HELP key. To obtain information on possible error causes and tips for error elimination.

20.1.3 Trouble Shooting: Exchanging PWM Outputs on the CC 422

To find out whether the PWM interface on the control or the connected drive system is defective, you can try another PWM interface on the control.
Use the interface of a funtioning axis!

Modular setup with CC 422



Example: Error in X-axis

For fault diagnosis, proceed as follows:

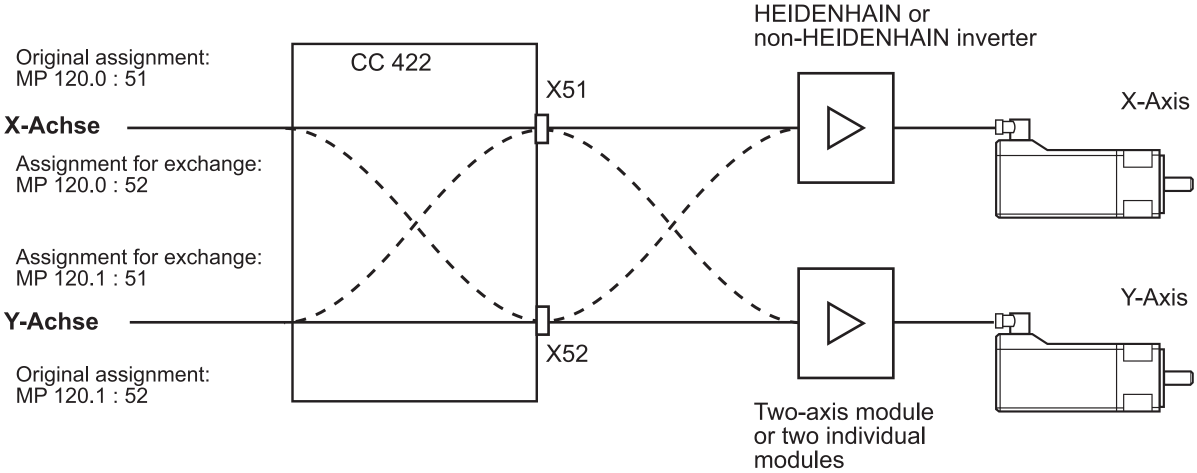
Assumed machine parameters

MP 100.x	= - - - - -CZYX (X = 1st axis, Y = 2nd axis, Z = 3rd axis, C = 4th axis)
MP 2180.x	= 0 (PWM frequency = 5 kHz for all axes)
MP 120.0	= 51 (X axis on PWM output **X51**)
MP 120.1	= 52 (Y axis on PWM output **X52**)
MP 120.2	= 53 (Z axis on PWM output **X53**)
MP 120.3	= 54 (C axis on PWM output **X54**)
MP 121.0	= 56 (1. Spindle on PWM output **X56**)
MP 121.1	= 0 (2. spindle not active)

Notes and preliminary actions

- Exchange the PWM output a functioning axis
  (depending on the configuration of the PWM frequencies, unassigned PWM outputs may not be active)
- Please observe that only within the groups X51 to X56 (main drive-control board) and X57 to X64 (drive-control board) an exchange is possible!
- The **same PWM frequency** should be set for axes to be exchanged!
  If different PWM frequencies are entered in parameter group MP 2180.x, ask the machine manufacturer or HEIDENHAIN for further service measures (the assignment of the machine parameter blocks for the current or speed controller by means of MP 130.x must also be regarded).
- **Before exchanging the** speed encoder inputs, **deactivate the evaluation of the electronic ID labels** in MP 7690!
  Enter value 1 for each bit.

Block dDiagram



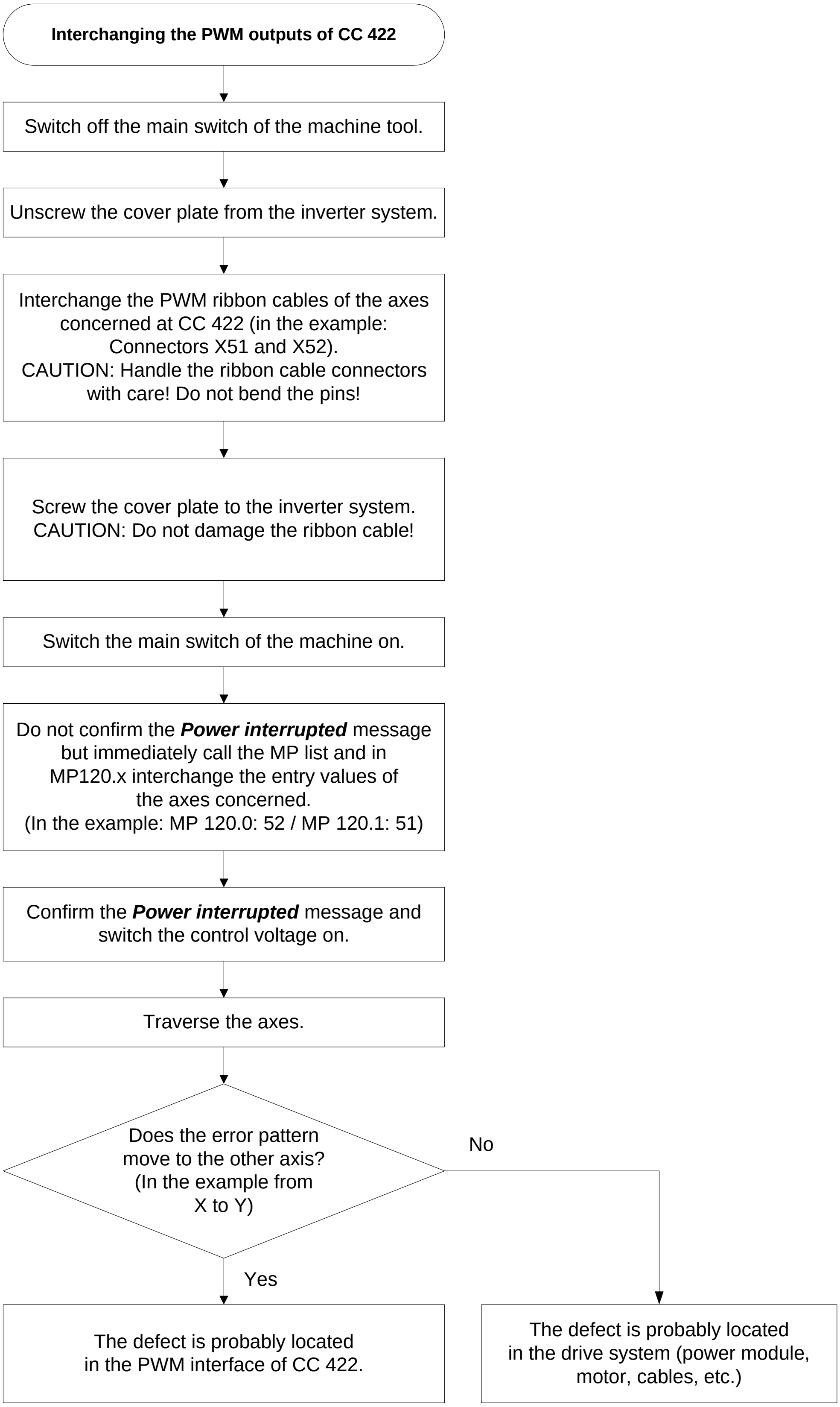
Note

Always exchange both, the cable and interface assignment by means of machine parameters!

Note

It is not relevant for this test routine which drive modules are connected!

Flowchart
CC 422



Note

Set MP 7690 (evaluation of the electronic ID label) to its original state after the test!

Corrective action

If you have found out that the interface on the CC 422 is defective …

- Exchanging the CC. --> See “Exchange of HEIDENHAIN Components” on page 26 – 411.

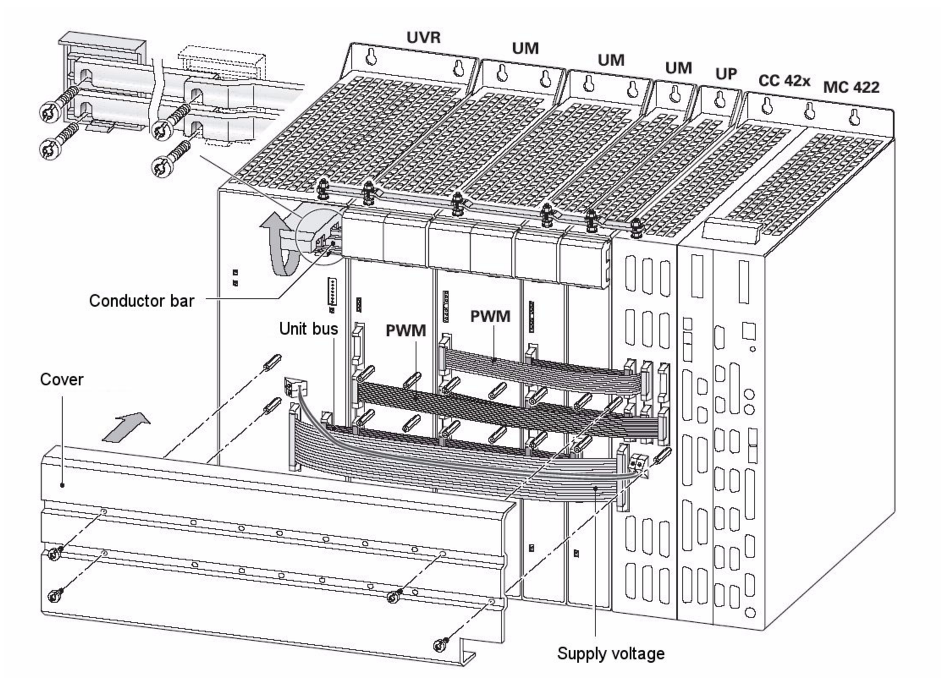
If you have detected that the error is outside the control (servo amplifier, motor, cable, etc.):

- Start the following routine. --> See “Trouble Shooting: Exchanging Power Modules or Output Stages of the Same Type” on page 20 – 337

20.1.4 Trouble Shooting: Exchanging PWM Outputs on the CC 424

To find out whether the PWM interface on the control or the connected drive system is defective, you can try another PWM interface on the control.
Use the interface of a funtioning axis!

Modular setup with CC 424



Example: Error in X-axis

For fault diagnosis, proceed as follows:

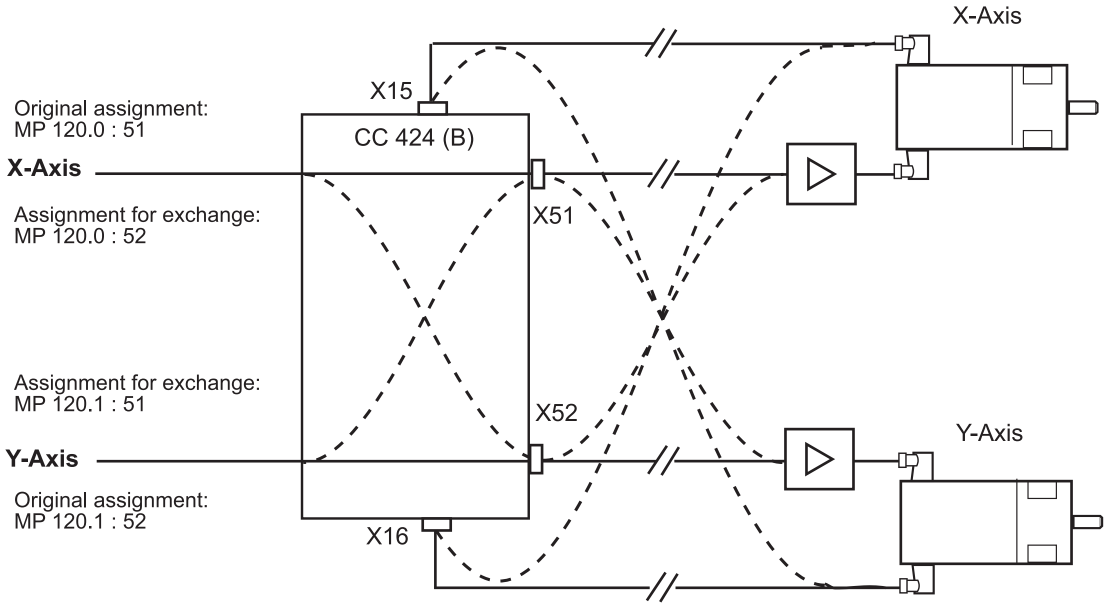
Assumed machine parameters

MP 100.x	= - - - - -CZYX (X = 1st axis, Y = 2nd axis, Z = 3rd axis, C = 4th axis)
MP 2180.x	= 0 (PWM frequency = 5 kHz for all axes)
MP 120.0	= 51 (X-axis at motor power stage connection **X51**)
MP 120.1	= 52 (Y-axis at motor power stage connection **X52**)
MP 120.2	= 53 (Z-axis at motor power stage connection **X53**)
MP 120.3	= 54 (C-axis at motor power stage connection **X54**)
MP 121.0	= 56 (1. spindle at motor power stage connection **X56**)
MP 121.1	= 0 (2. spindle not active)

Notes and preliminary actions

- Exchange the PWM output a functioning axis
  (depending on the configuration of so-called single-speed and double-speed outputs, unassigned PWM outputs may not be active)
- So-called single-speed and double-speed PWM outputs with equal PWM frequency can be exchanged for test purposes.
- Please observe that only within the groups X51 to X56 (main drive-control board) and X57 to X64 (drive-control board) an exchange is possible!
- **The firmly assigned motor encoder output must also be exchanged!**
- The **same PWM frequency** should be set for axes to be exchanged!
  If different PWM frequencies are entered in parameter group MP 2180.x, ask the machine manufacturer or HEIDENHAIN for further service measures (the assignment of the machine parameter blocks for the current or speed controller by means of MP 130.x must also be regarded).
- Master-slave axes function only on the outputs X51 to X53 and X52 to X54.
- **Before exchanging the** speed encoder inputs, **deactivate the evaluation of the electronic ID labels** im MP 7690!
  Enter value 1 for each bit.

Block Diagram



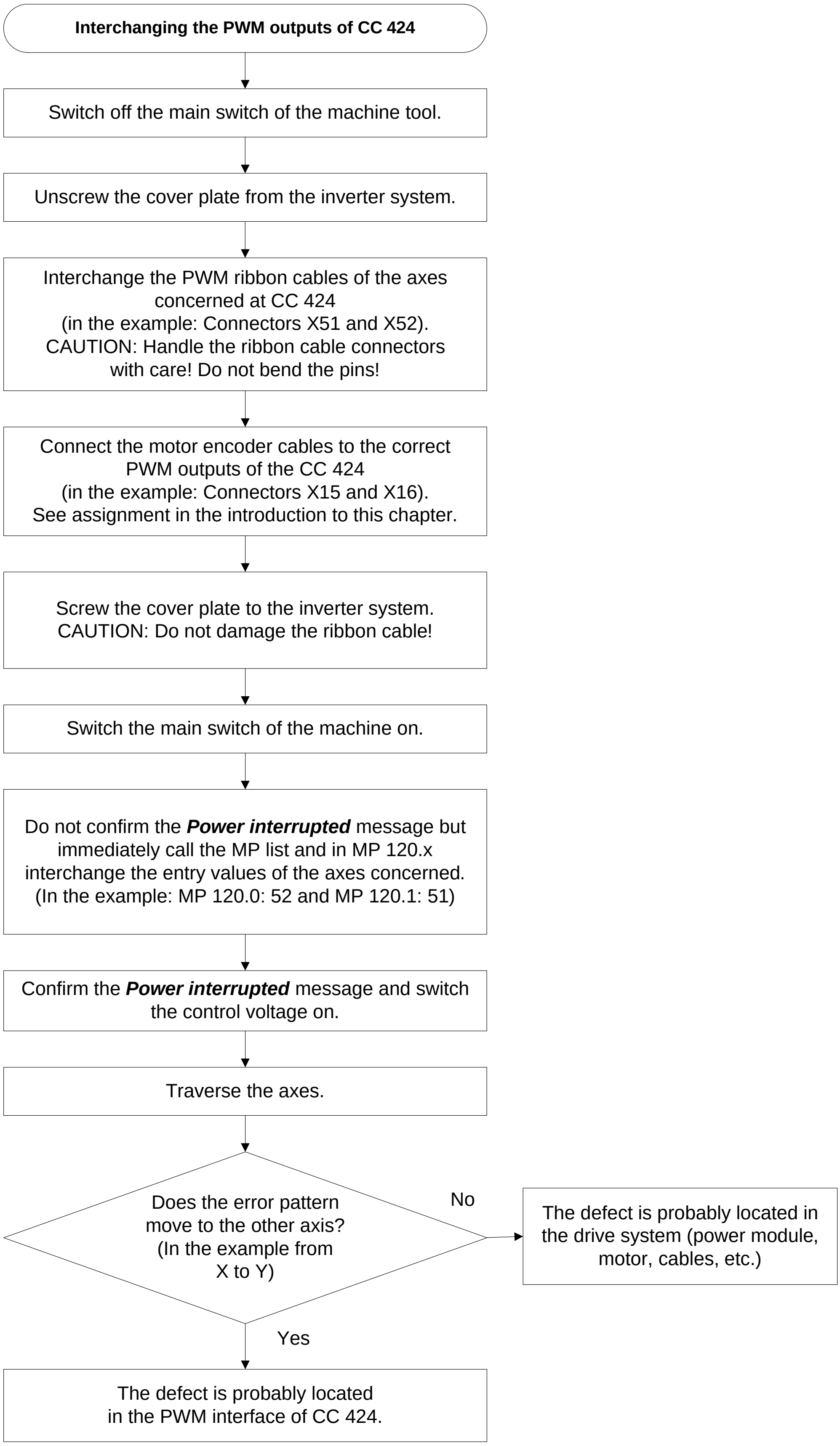
Note

Always exchange both, the cable and interface assignment by means of machine parameters!

Note

It is not relevant for this test routine which drive modules are connected!

Flowchart CC 424



Note

Set MP 7690 (evaluation of the electronic ID label) to its original state after the test!

Corrective action

If you have found out that the interface on the CC 424 is defective …

- Exchanging the CC --> See "Exchange of HEIDENHAIN Components" on page 26 – 411.

If you have detected that the error is outside the control (servo amplifier, motor, cable, etc.):

- Start the following routine. --> See "Trouble Shooting: Exchanging Power Modules or Output Stages of the Same Type" on page 20 – 337

20.1.5 Trouble Shooting: Exchanging Power Modules or Output Stages of the Same Type

General

If you have found out that the PWM interface on the CC is in order, you can test if a traverse of the faulty axis with …

- a dimensionally identical power module (modular inverter system) or
- an output stage with equal power (2-axis-module, compact inverter)

is possible.

DANGER

If you want to use other types of power stages or output stages, we strongly recommend contacting your machine manufacturer or HEIDENHAIN. Otherwise you could cause damage or injury to machine or persons!

Use one of the following units:

- Either a replacement unit
- Or a power stage or output stage already located in the electrical cabinet but is not used (with compact inverters, e.g., a output stage with equal power could be available)
- Or the power stage or output stage of a functioning axis

Note

It is not necessary to exchange a machine parameter for this test routine!
It does not matter whether the power stages are from HEIDENHAIN or other manufacturers.

Caution

If you strongly suspect that the motor of the axis to be examined causes a short circuit (penetration of humidity, etc.), you must not connect it to another power stage as it could be destroyed!

DANGER

Always secure vertical axes from falling down before you perform this test!

DANGER

Danger of electrical shock!
Make sure that the main switch of the machine is switched off and that any connectors and terminals are free of potential before you engage or disengage them.

Assumed configuration for two 1-axis modules

UM 12x: **X111** (PWM connection of channel 1) connected with **X51** (iTNC, X axis)
X81 (motor connection of channeel 1) connected with motor **X axis**

UM 11x: **X111** (PWM connection of channel 1) connected with **X52** (iTNC, Y axis)
X81 (motor connection of channel 1) connected with motor **Y axis**

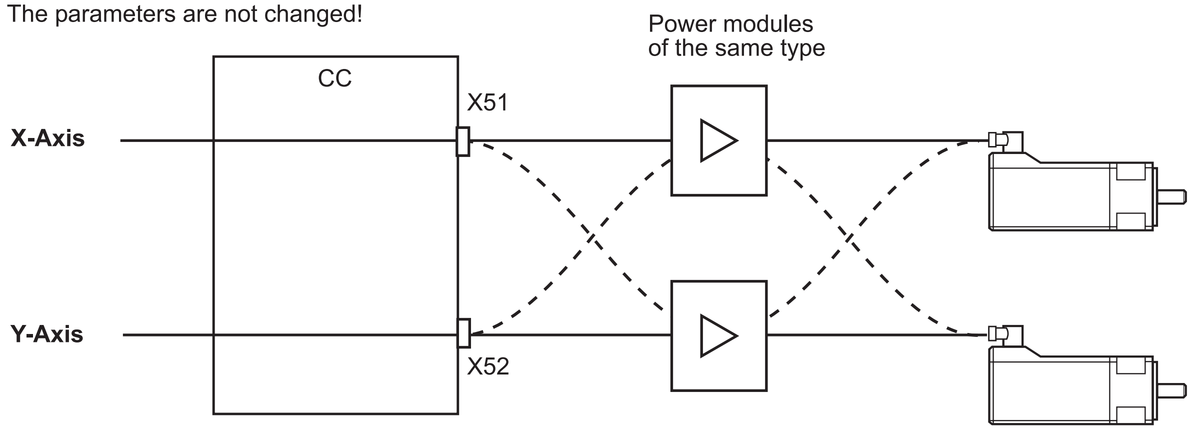
Assumed configuration for one 2-axis module

UM 12x: **X111** (PWM connection of channel 1) connected with **X51** (iTNC, X axis)
X112 (PWM connection of channel 1) connected with **X52** (iTNC, Y axis)
X81 (motor connection of channel 1) connected with motor **X axis**
X82 (motor connection of channel 2) connected with **Y-axis**

Example: Error in X axis

For fault diagnosis, proceed as follows:

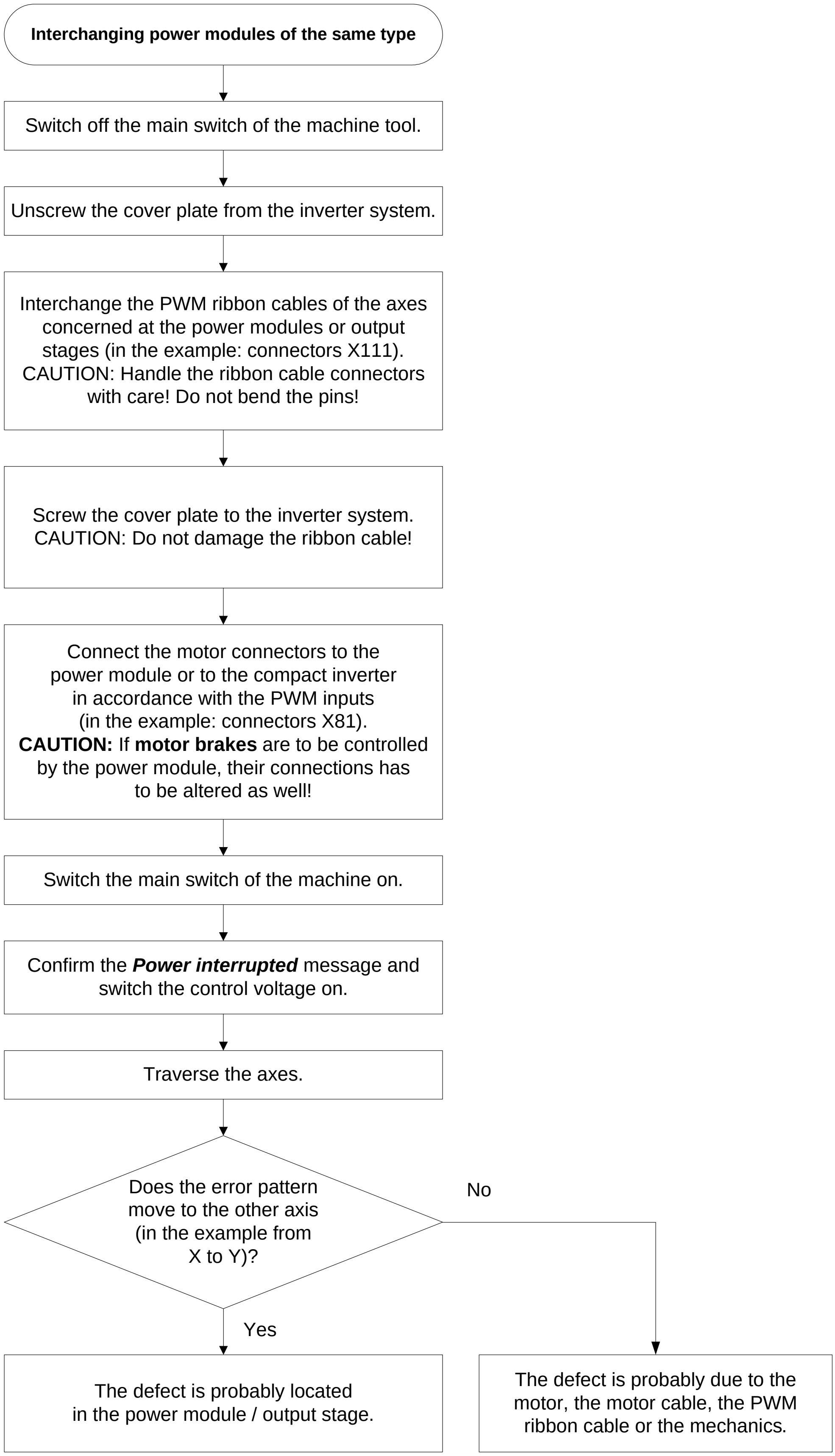
Block diagram for two 1-axis modules



Caution

If motor brakes are connected to the power stages, they have also to be exchanged (X344, X392, X393, X394, depending on the model. --> see Service Manual for Inverter Systems and Motors)!
Motor brakes can be connected to current HEIDENHAIN inverter modules and compact inverters. The motor brake is also powered via a connector on the inverter. The trigger signals for the motor brakes are transmitted via the PWM bus.

Flowchart for two 1-axis modules



20.1.6 Trouble Shooting: Exchanging the HEIDENHAIN Interface Boards for the SIMODRIVE 611 System

If a SIMODRIVE 611 system is used in connection with the HEIDENHAIN control, there are HEIDENHAIN interface boards in the Siemens drive modules to adapt the PWM signals.

Boards of the same type

Before using other drive modules for examination of faulty axes, you may exchange **dimensionally identical expansion boards**.
Observe the following:

- The machine is not under power when you exchange the boards
- Boards of the same type are exchanged (1-axis module or 2-axis module, metallically isolated or not metallically isolated --> See "Important Notes on the Use of HEIDENHAIN Interface Boards in SIMODRIVE System" on page 5 – 29)
- The grounding is correct --> See "Important Notes on the Use of HEIDENHAIN Interface Boards in SIMODRIVE System" on page 5 – 29

Boards of different types

If you do not have boards of the same type, under certain circumstances you may exchange boards for 1-axis modules for boards for 2-axis modules and vice versa.
Difficulties can be:

- Some 2-axis module boards (ID number smaller than 359002-xx) require the corresponding enabling signals of the control on every PWM interface. If such a board is inserted in a 1-axis module and one PWM interface is not assigned, the complete board is not released.
- If a 1-axis module board is inserted in a 2-axis module for test purposed, the corresponding axis can be inspected (if the other axis is to be inspected, to motor output on the power stage must be reconnected).
- For these tests it might be necessary to deselect axes that cannot be contolled by MP 10. With some machines this might be difficult.

  --> If necessary, ask the HEIDENHAIN service agency!

Caution

Boards with metallic isolation of HEIDENHAIN PWM signals to the Siemens interface must not be replaced by boards without metallic isolation and vice versa!
--> See "Important Notes on the Use of HEIDENHAIN Interface Boards in SIMODRIVE System" on page 5 – 29

20.2 Analog Drives

20.2.1 Introduction

Analog servo amplifiers ars also referred to as **analog servos**.

For analog drives often **DC motors** are used.

The analog servo amplifiers are controlled via **±10V interfaces**.
The position controller is located in the MC, speed and current controller in the servo amplifier. The HEIDENHAIN control also supplies the nominal speed value. This is why the ± 10V interface is also designated as nominal speed value interface.

On the MC 42x (B) there are the following analog nominal speed value outputs:
X8 and X9
On each of these D-Sub connectors there are several analog channels.

MP 100 contains the axis sequence (first, second, third axis etc.).

Caution

MP 100 must not be edited!

The allocation of nominal speed value outputs to the axes can be found in the machine parameters.
MP 120.x

The allocation of nominal speed value outputs to the spindles can be found in the machine parameters.
MP 121.x

20.2.2 Possible Causes of Errors

- Defective nominal speed value interface of the MC (X8, X9)
- Defective cable
- Defective servo amplifier
- Defective motor (carbon brushes, tachometer brushes, winding, etc.)
- Poor shielding and grounding
- Mechanical defects
- Errors in the NC or PLC software
- Wear and tear of mechanical parts
- Deterioration of the machine

There is wide variety of possible error causes.
Profound knowledge of the machine and the interaction of the components is very helpful for this type of error.
If error messages are generated, press the HELP key. To obtain information on possible error causes and tips for error elimination.

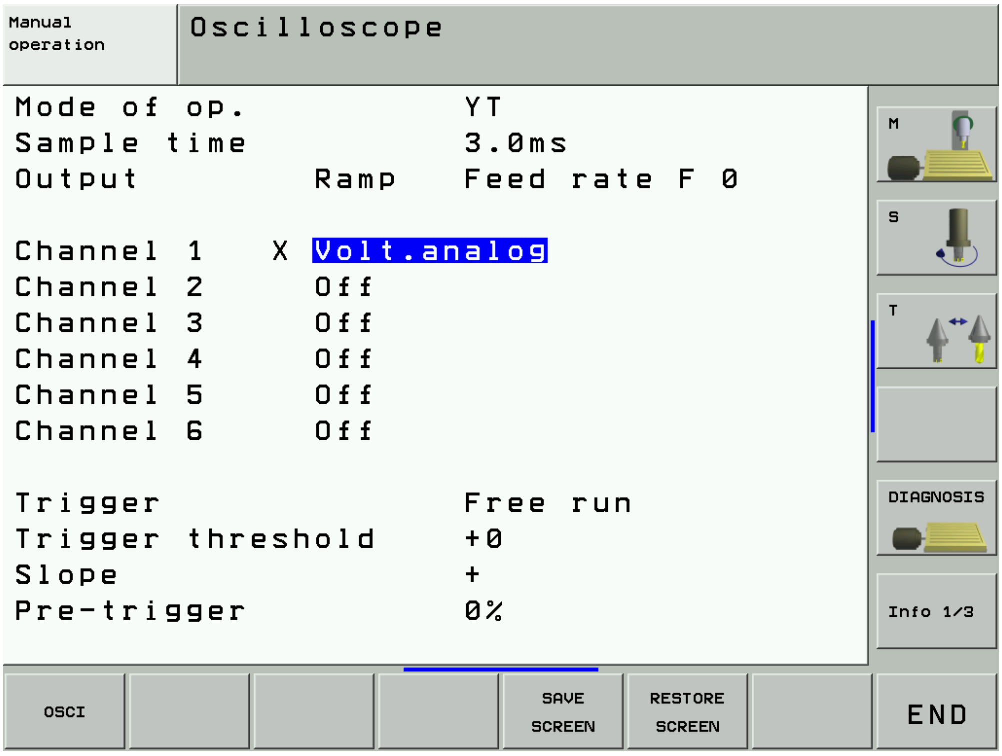
20.2.3 Testing the Analog Nominal Speed Value Interface

The control outputs an analog voltage of 0 V to maximum ± 10 V (the analog voltage is entered in MP 1050.x).

This voltage can be measured at the connecting terminals of the servo amplifier or directly at the MC with the HEIDENHAIN test adapter.

Investigation with the integrated oscilloscope

With the integrated oscilloscope the ***Volt. analog*** voltage can observed:



See “Integrated Oscilloscope” on page 8 – 49.

Error: No axis traverse!

It is a prerequisite that the release conditions (e.g., door contacts, permissive buttons, etc.) for the axis movements are given.

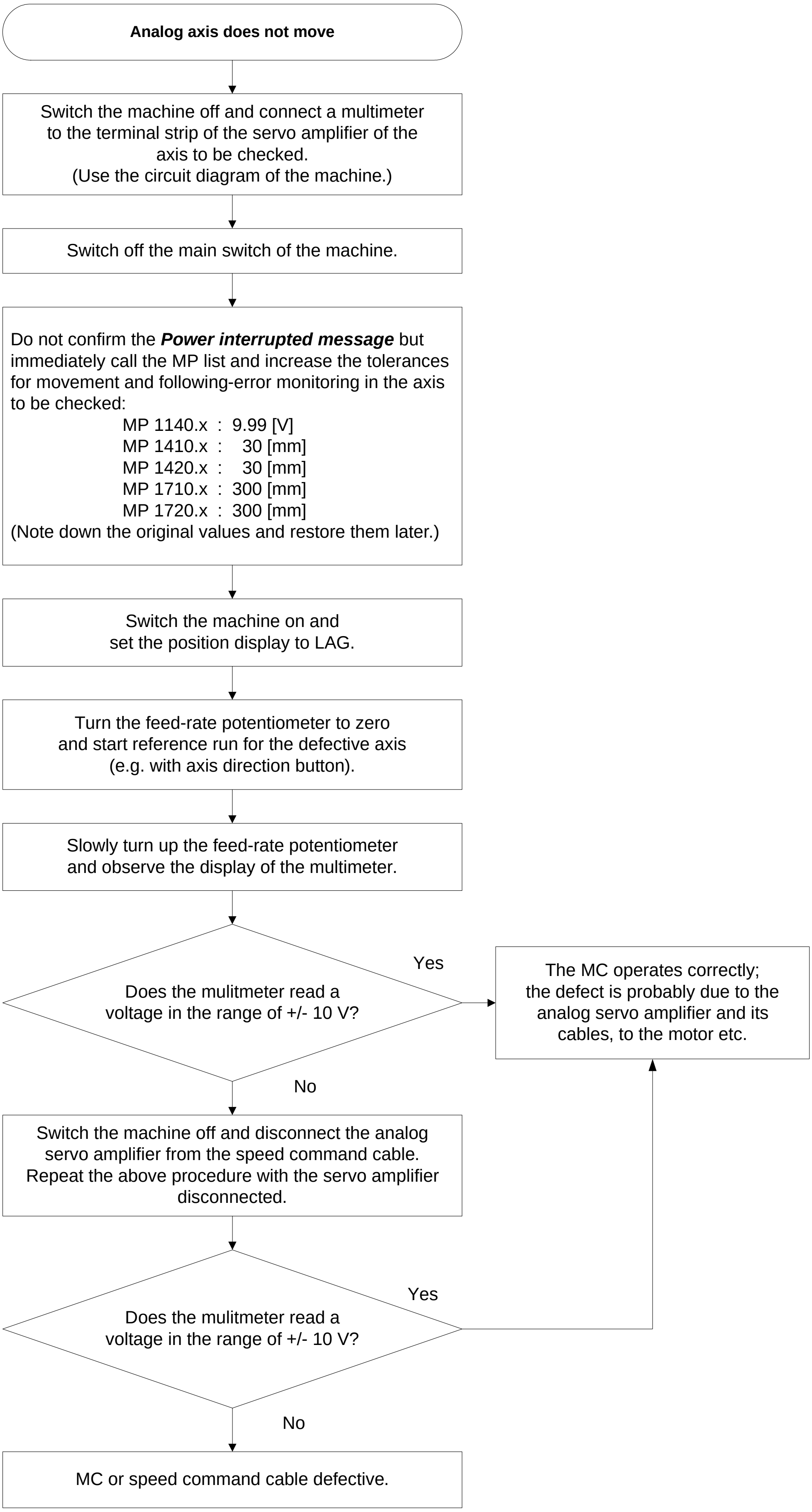
For the axes to be traversed ...

- No terminal symbol before the axis concerned must be shown.
- The feed rate display (F …) must not be highlighted.
- The "STIB" star (control in operation) must be shown.

If necessary, ask the machine operator!

Flowchart

If nevertheless one or several analog axes do not function, you may investigate the following:



Note

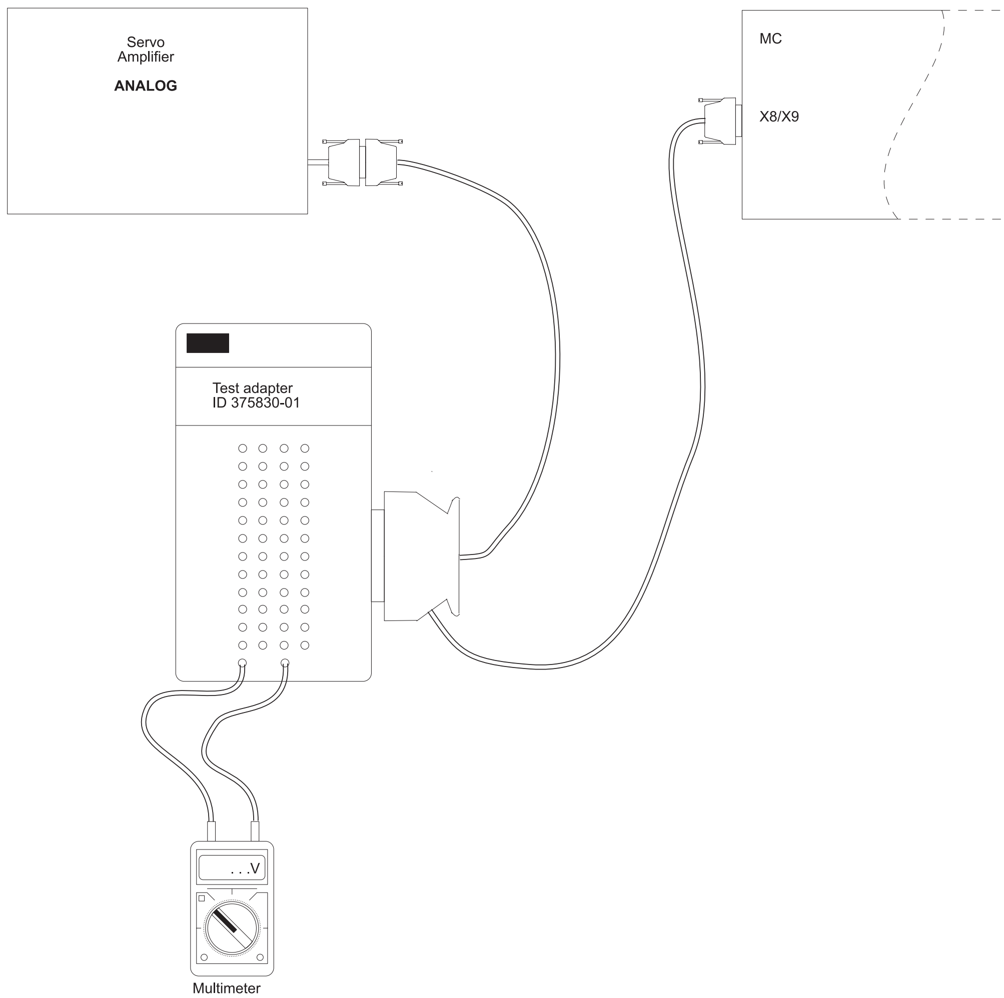
If the control functions properly, a nominal speed value interface can be read in the above routine until the monitoring value (movement, servo lag, etc.) is reached. The nominal speed value voltage 0 V is output together with the corresponding error messages.

Battery box

If available, you can investigate whether the analog servo amplifier can be operated with a **"Battery box"** (not a HEIDENHAIN unit).
This battery box replaces the control and provides the analog servo amplifier with a nominal speed value of ± 10 V.
(The servo amplifier must be released. --> If necessary, ask the machine manufacturer!)

Measuring setup with test adapter

If available, you can connect the test adapter between connection X8 or X9 of the MC and the nominal speed value cable. Connect a multimeter to the corresponding pin sockets of the test adapter.
Assignment for the analog channels. --> See “X8: Analog output 1 to 6” on page 13 – 144; See “X9: Analog output 7 to 13” on page 13 – 144



Specifications of the analog outputs

Load capacity:	RL Š 5 kW, I £2 mA CL £ 2 nF
Short-circuit stability:	one output short-circuit proof at a time
Voltage range:	Uamax = +10 V ± 100 mV Uamin = -10 V ± 100 mV
Resolution:	14 bit = 16 384 steps
Smallest step:	$\frac{10\text{V}}{16384} = 0.610\text{ mV}$

20.2.4 Adjusting the Electrical Offset (Drift Adjustment)

General

An offset adjustment is required or recommendable, in case of the following:

- The axis drifts.
- Servo lag of the axis at standstill is impermissibly high.
- You have exchanged the MC.
- You have exchanged the servo amplifier.
- You have exchanged the motor.
- You have replaced the motor brushes.
- You have replaced cables or electrical lines at the machine.
- If you receive the error message EXCESSIVE OFFSET <AXIS>.

> **Note**
>
> The drift adjustment only needs to be carried out with analog axes.

Offset Adjustment at servo amplifier

Analog servo amplifiers are no HEIDENHAIN products.
Follow the instructions of the servo manufacturer (operating instructions, etc.)!

Here are two proposals.

Proposal 1:

- Check or set following machine parameters (if you change the machine parameter, please take a note of the original values).
  - MP 1080.x (integral factor for offset) **:** **0** (switched off)
  - MP 1391.x, 1392.x (velocity feedforward control) **:** **1** (switched on)
  - MP 7290.x (display step) **:** **6** (0.1 µm)
- Switch on the machine completely.

- Select the ***Manual operating mode***
- Select the ***Programming and Editing*** operating mode

MOD
- Call window for code number

7 5 3 6 8
- Enter the code number

ENT
- Confirm

ABORT
- End compensation

- Axes to be adjusted must be in control (if necessary, ask the machine manufacturer).
- Switch position display to ***LAG***.
- Adjust the offset at the servo amplifier until the individual axes either display the value 0 or oscillate around 0 (approximate value ± 3-5 µm).

Note

Use also the integrated oscilloscope with the settings s actual, s nominal, s diff.
--> See “Integrated Oscilloscope” on page 8 – 49.

- Reset the machine parameters and the position display to the original values.
- Carry out offset fine adjustment with the code number 75368.
-->See “Offset fine adjustment by code number” on page 20 – 348

Proposal 2:

- Switch off main switch of machine.
- Disconnect the nominal speed value cable from the control.
- Bring the **nominal value** of the axis to be adjusted **to zero potential** (short-circuit the ± 10 V line with 0 V line of the corresponding axis).

Note

You can also produce a D-Sub connector for every analog nominal value interface X8 and X9. There is a bridge between ± 10 V and 0 V (See “X8: Analog output 1 to 6” on page 13 – 144; See “X9: Analog output 7 to 13” on page 13 – 144) for every channel in these connectors. Connect the corresponding connector to the nominal speed value cable that you have disconnected from the control (X8, X9).
Advantage of this method: The nominal value cable is included in the offset adjustment of the servo amplifier.

- Switch on main switch of machine.
- Do not acknowledge the ***Power interrupt*** message. Call machine parameter list.
- Set parameter 120.x to zero. --> No nominal value output, only display of axes.
(If necessary, deselect the reference point traverse in MP 1340.x).
- Switch on the machine completely.
- Establish the controller enabling on the servo amplifier or check whether it is on.
(if necessary, ask the machine manufacturer)!
- Select ***Manual operation***, set the display to the actual value and set the axis to zero.
- Adjust the servo amplifier ideally to standstill. The axis movement can be seen on the actual value display and possibly on a pulley.
- Restore original condition (cabeling, parameters).
- Carry out offset fine adjustment with the code number 75368. -->See “Offset fine adjustment by code number” on page 20 – 348

Offset fine adjustment by code number

Note

Before you carry out an offset fine adjustment via code number, you must first adjust the offset at the servo amplifier!
The control can compensate only ± 100 mV with the offset fine adjustment by code number!
This corresponds to 1 % of the ± 10 V interface!!
An insufficient offset adjustment on the servo amplifier can thus not be compensated any more with the code number adjustment.

The axes to be compensated must be in the position control loop. –> If necessary, ask the machine manufacturer!

- Select the ***Programming and Editing*** operating mode
- MOD: Call window for code number
- 7 5 3 6 8: Enter the code number
- ENT: Confirm

The iTNC displays the offset values of the analog axes in the dialog line.
The values show the setting of the voltage in 0.15-mV steps.
Display value 10 means: 10 · 0.15 mV = 1.5 mV. The displayed offset value consists of the offset values that are generated in the motor controller and in the control.

- Press the corresponding soft key in order to …

CONTINUE: **Carry out an offset compensation.** Offset adjusting via code number compensates the current offset values. By the offset adjustment with the code number, the current offset of the entire control loop is compensated. Later changes in offset are not compensated.

ABORT: Do not carry out an offset compensation, or end a previous compensation.

END: Exit the menu without making any changes.

20.2.5 Speed Adjustment at Servo Amplifier (Tachometer Adjustment)

General

Speed adjustment at servo amplifier needs to be carried out in case of the following:

- You have updated the mechanical design of the axis (e.g., guideway, bearing, belt, coupling, ball screw, etc.)
- You have exchanged the servo amplifier or the motor
- You have replaced the motor brushes.
- Servo lag at constant traverse is impermissibly high

The aim of speed adjustment is to achieve that the output nominal speed value is equal to the really measured actual speed value (Vnom = Vact).

Note

Adjusting only needs to be carried out with analog axes.

Execution

Analog servo amplifiers are no HEIDENHAIN products.
Follow the instructions of the servo manufacturer (operating instructions, etc.)!

Here is a proposal:

- Check or set the following machine parameter (if you change the machine parameter, please take note of the original input values).
  - MP 7290.x (display step) **: 6** (0.1 µm)
- Switch position display to ***LAG***.
- Enter the following test program (e.g. for X axis,select a larger traverse range than indicated in example X + 100)

DANGER

Enter this test program with the machine operator. Please be careful to prevent a collision (retract Z axis first, etc.)!

```
0   BEGIN PGM tacho_adjustment X MM
1   LBL 1
2   L    X+ 0   F MAX
3   L    X + 100   F MAX
4   CALL  LBL 1  REP 100
5   END PGM tacho_adjustment X MM
```

- Set the feed rate potentiometer to zero.
- Run the program in the ***Program Run, Full Sequence*** operating mode and turn the feed rate potentiometer slowly to 100 %.
- Adjust tachometer generator at the servo amplifier using the servo lag display as follows:

- For operation with velocity feedforward control, adjust the servo lag display to 0 (ideally).
- For operation with servo lag, adjust the servo lag display as follows:

$$\text{LAG [mm]} = \frac{\text{Traversing speed}\left[\frac{\text{m}}{\text{min}}\right]}{\text{kv-Faktor}}$$

Note

Read the traverse speed from the display:

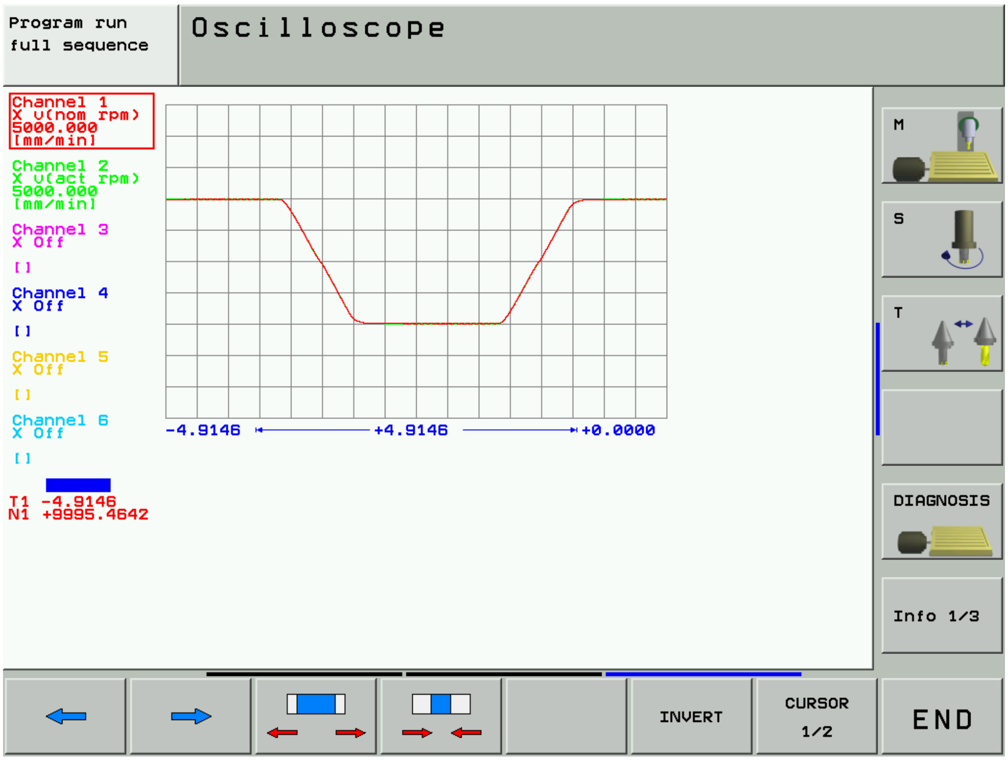
The kv factor for the lag mode is defined in MP 1810.x.
It is possible that a multiplication factor for the kv factor is active for the displayed traverse speed (MP 1820.x). A characteristic curve kink point must be entered in MP 1830.x. Contact the machine manufacturer!

- Repeat the adjustment procedure for all axes.
- Reset the original values in machine parameter MP 7290.x.

Note

It might be helpful to use the integrated oscilloscope. The signals **Vnoml and Vactl can be recorded and compared**. The quality of the speed adjustment can thus be controlled and improved, if required.

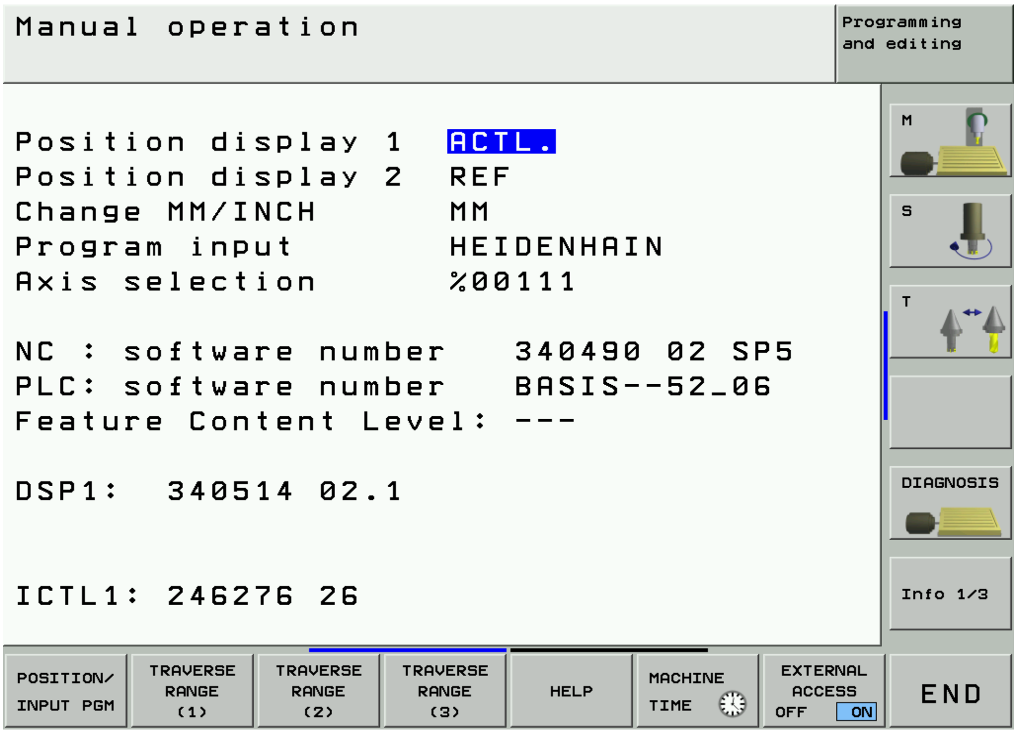
Comparison of noml. and actl. speed in the integrated oscilloscope



20.3 Switching the Position Display for Service Purposes

Call

- Press the following key combination to switch the position display:
  - Select a machine operating mode (manual, Program Run, Full Sequence, etc.).
  - Activate MOD function.



- Press GOTO to open a list box.

Description of settings

Possible position displays:

ACTL.	Actual position
REF	Distance to machine datum
LAG	Current following error
NOML	Nominal position
DIST.	Distance to go

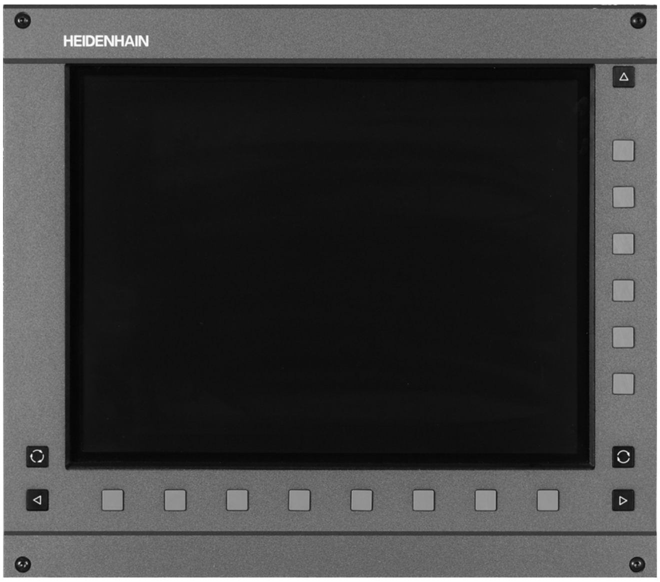
- Using the arrow keys, select the desired position display.
- Press ENT to activate the position display.

END

- Exit subordinate mode.

21 Visual Display Unit

21.1 General



One of the two flat-panel displays are connected to the iTNC 530:

- BF 150 with horizontal and vertical soft keys
- BF 120 with horizontal soft keys

The BF is …

- supplied with 24 V dc voltage from the electrical cabinet power supply unit.
- is driven with display signals from the control.

The screen interface ...

- connector X49 on the MC for the BF 120
- connector X149 on the MC for the BF 150

... is HEIDENHAIN-specific. A conventional flat-panel screen cannot be connected.

21.2 Possible Causes of Errors

- Defective screen
- Erroneous power supply 24 V-
- Defective monitor cable
- No display signals from the control
- Defective unit that is connected to the control and impairs it strongly
- Defective screen soft keys

21.3 Fault Diagnosis

Visual display unit soft keys

The soft keys of the BF screens are connected by flat cable with the keypad board of the TE.

Service diagnosis --> see “Checking the Keys” on page 22 – 360.

Monitor

If the screen remains black, check …

- if the fan is running.
- if the 24 V supply on the 2-pin connection of the visual display unit.
- if the screen cable is in good order.

If this is not the reason you can test whether the screen information can be read out, e.g., with the HEIDENHAIN PC software TNCremoNT.

- Connect the control to the laptop/PC.
  --> see “Connection Setup” on page 16 – 247.

- Click on one of the "camera" symbols.

If the display information is now available on the laptop/PC, the graphics board of the control is probably in order.
If this does not function, probably the MC (graphics board, etc.) is defective!?

Note

If you can see the display information with TNCremoNT, it is not completely sure that all areas of the graphics board are in good order!

You can also perform the following test:

- Switch off the machine.
- Make sure that all connectors and cables are labeled.
- Disconnect all connectors (exept the screen connector, the supply connector X69 and the 5 V supply terminal) from the MC and the CC.
- Press EMERGENCY STOP.
- Switch on the machine.
- If the screen is now functioning, the control is impaired by a defective unit such that the screen cannot be operated properly.

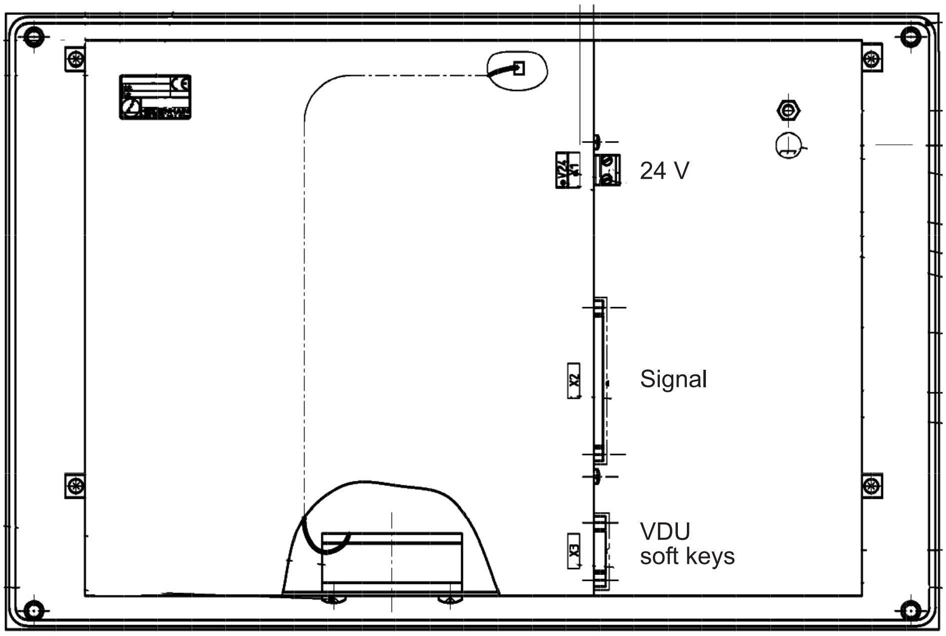
Note

Now you can connect all connectors to the MC and CC one after the other (the machine must always be switched off) and observe when the error occurs again (in this case the black screen). Subsequently, search the error of the connected unit including cable.

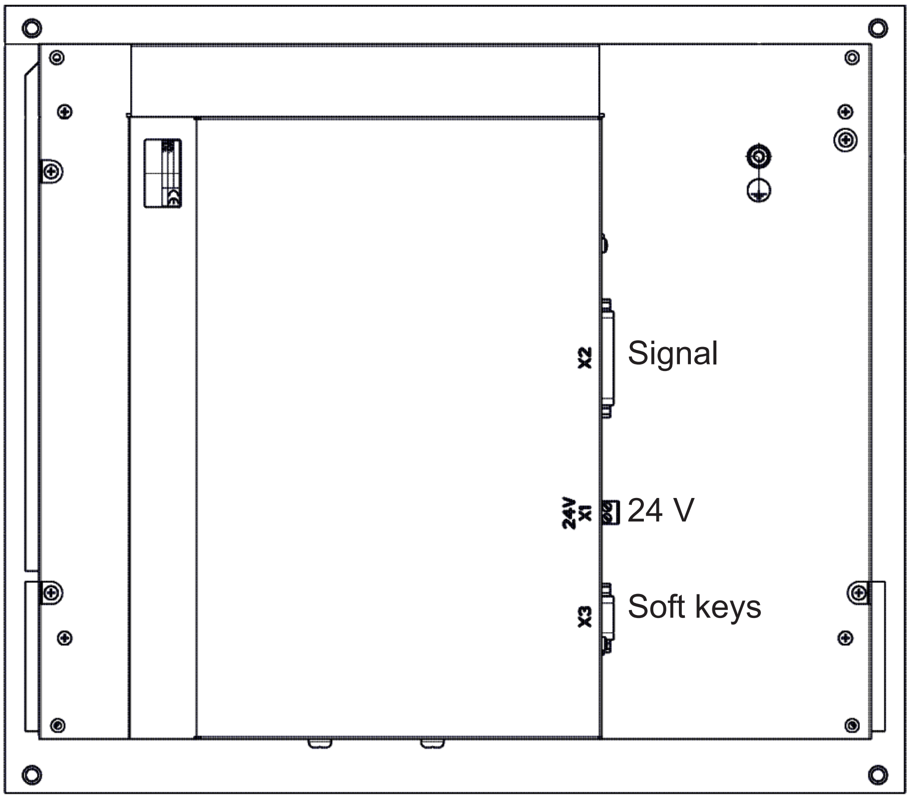
Note

If you have found out that the screen itself is defective, then a further inspection of the flat-panel display is not possible without special test equipment.

Rear view BF 120



Rear view BF 150



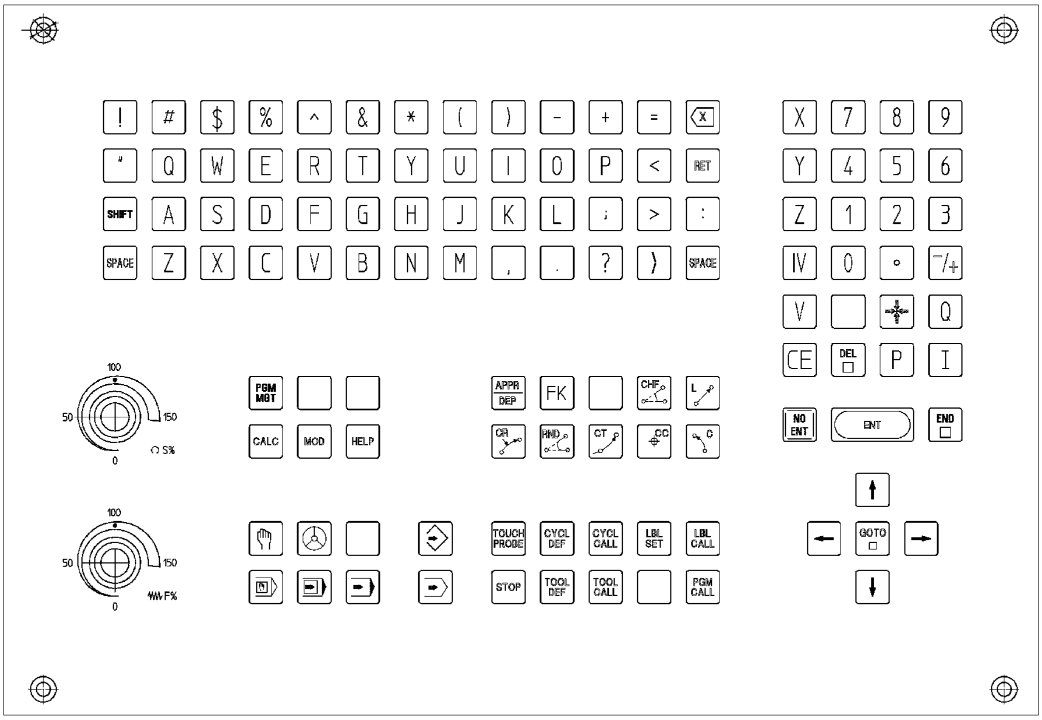
22 Keyboard Unit

22.1 General

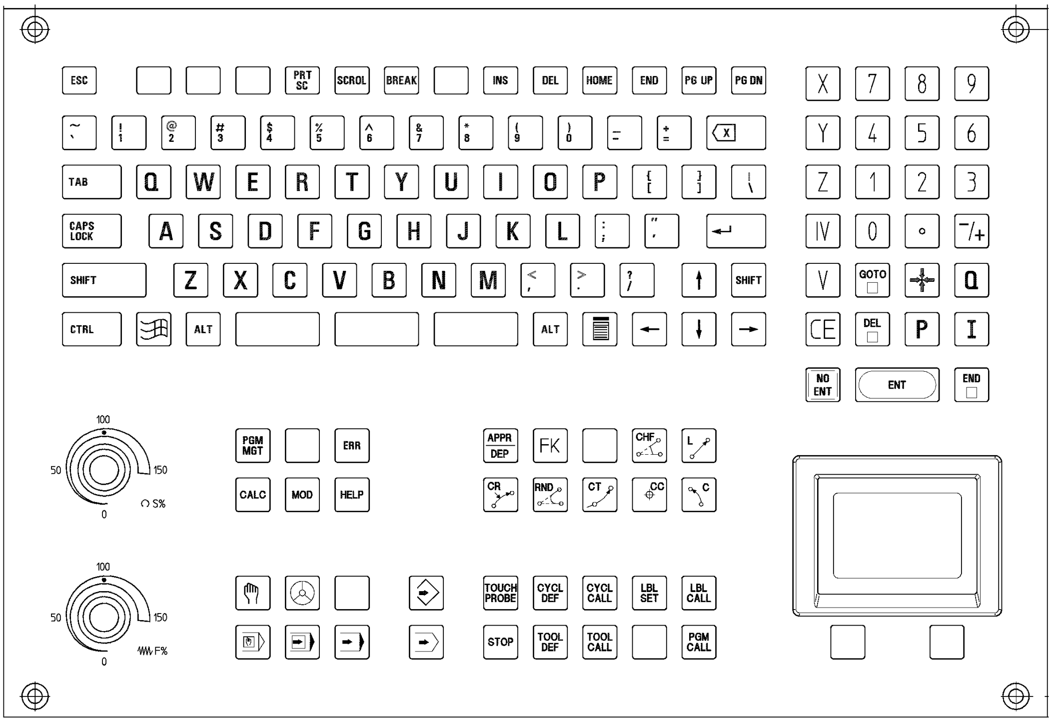
- The keyboard units are available with individual keys and as membrane keyboard.
- The screen soft keys are connected to the keypad board.
- The key signals on the control are transferred by a matrix. Every crosspoint of a SL (ScanLine) with a RL (ReturnLine) is assigned to a certain key.
- If HR 420 electronic handwheel is active, the operation of the machine via keypad is locked.
- For iTNC 530 single-processor controls a TE 420 can be used; for dual-processor controls, however, a mouse pad and additional Windows keys are required (Te 530, 530 B).
- For the HEIDENHAIN programming surface smarT.NC additional keys are necessary. (TE 530 B, TE 520 B).

22.2 Front View of the Keyboard Units

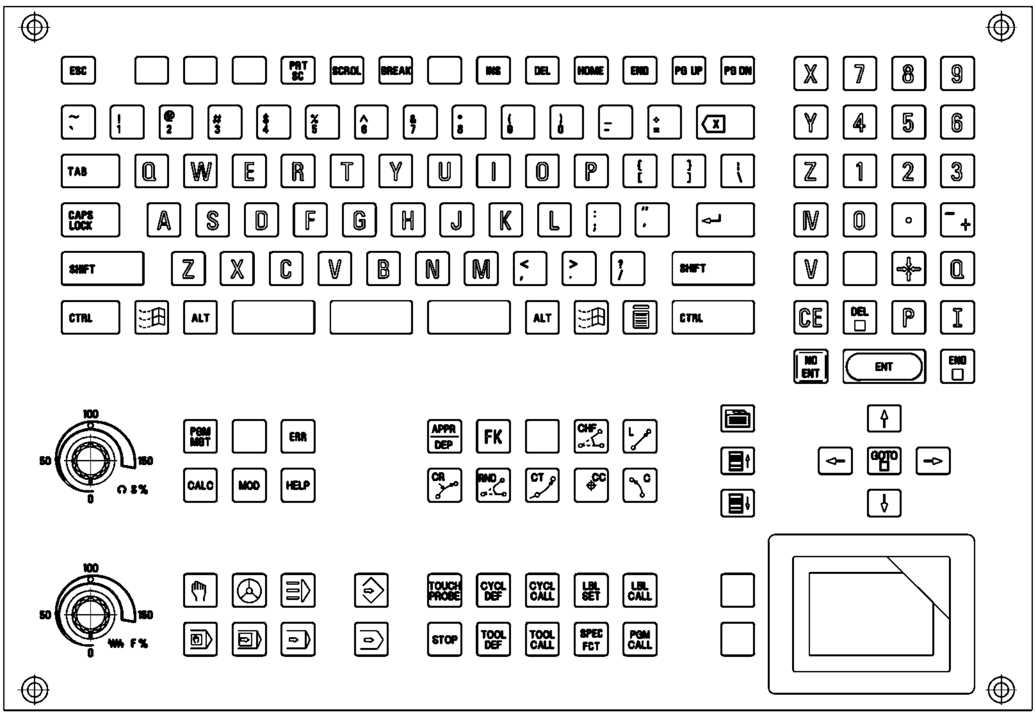
TE 420



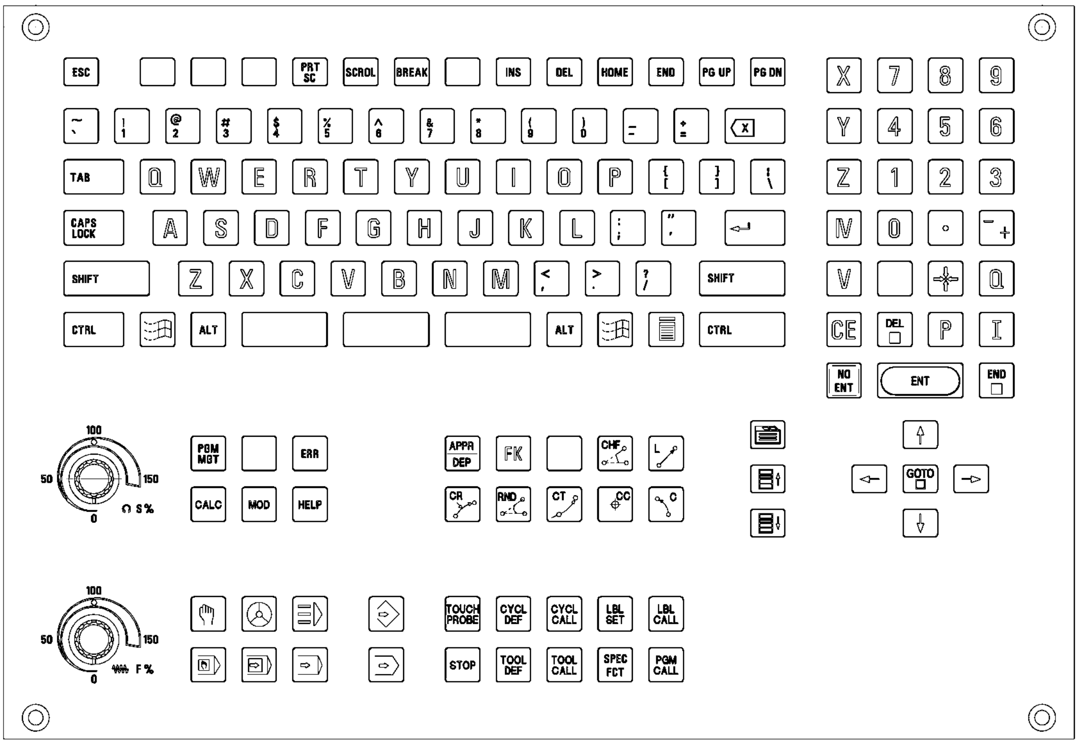
TE 530 (with mouse pad and additonal Windows keys)



TE 530 B (with additonal smarT.NC keys)



TE 520 B (with additional smarT.NC keys, without mouse pad)



22.3 Possible Causes of Error

Note

Defective keys cannot contact any more or are in continuous contact.

- Strong contramination --> Key gets caught
- Jammed chips --> Key gets caught
- Defective contact --> Key does not report to the control any more
- Penetrated liquid
- Defective keypad board
- Defective cable between screen and keypad (screen softkeys)
- Defective cable between keypad and control
- Defective interface on the control
- Worn potentiometer wiper
- Defective mouse pad

22.4 Checking the Keys

This includes the **keys on the TE keypad unit** and the **keys (soft keys) on the BF flat-panel display**. The soft keys of the screen are connected by ribbon cable with the keypad board.

Correct operation?

- Make sure that the key in the selected operating mode really functions.
  --> Ask the machine operator or look it up in the User's Manual!

Visual inspection

- First check the keypad visually!
- Is the **key strongly contaminated (grease, dust, oil, etc.)?**
- Are there **jammed chips?**

The key may thus get caught.
In such a case, the keypad must be cleaned carefully.

DANGER

When liquid cleaning agents have be used, the electrical units must dry completely before they are operated again.

Does the control receive the key signal?

To be sure you can observe the **key code in PLC word W274** when the keys are pressed:

- Press EMERGENCY STOP.
- Reboot the control.
- Do not acknowledge the *"Power interrupted"* message.
- Call the PLC table for the words (see “The TABLE Function” on page 10 – 76).
- Press the key to be examined and check if the display changes to the valid key code and/or the key reacts correspondingly. --> See note.

Note

When examining these keys, please check if the following reactions are generated:

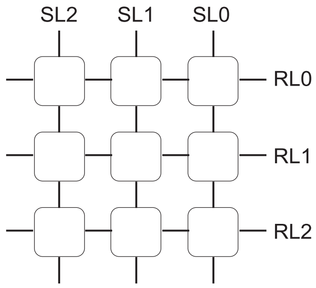
- END --> To leave the PLC table.
- PG UP --> The cursor jumps one page up.
- PG DN --> The cursor jumps one page down.
- GOTO --> A target must be entered at the top of the screen
  (press NO ENT to exit!).
- END BLOCK --> To leave the PLC table.
- MACHINE OPERATING MODES --> The corresponding machine operating mode is called.

Text file KEYTEST.A

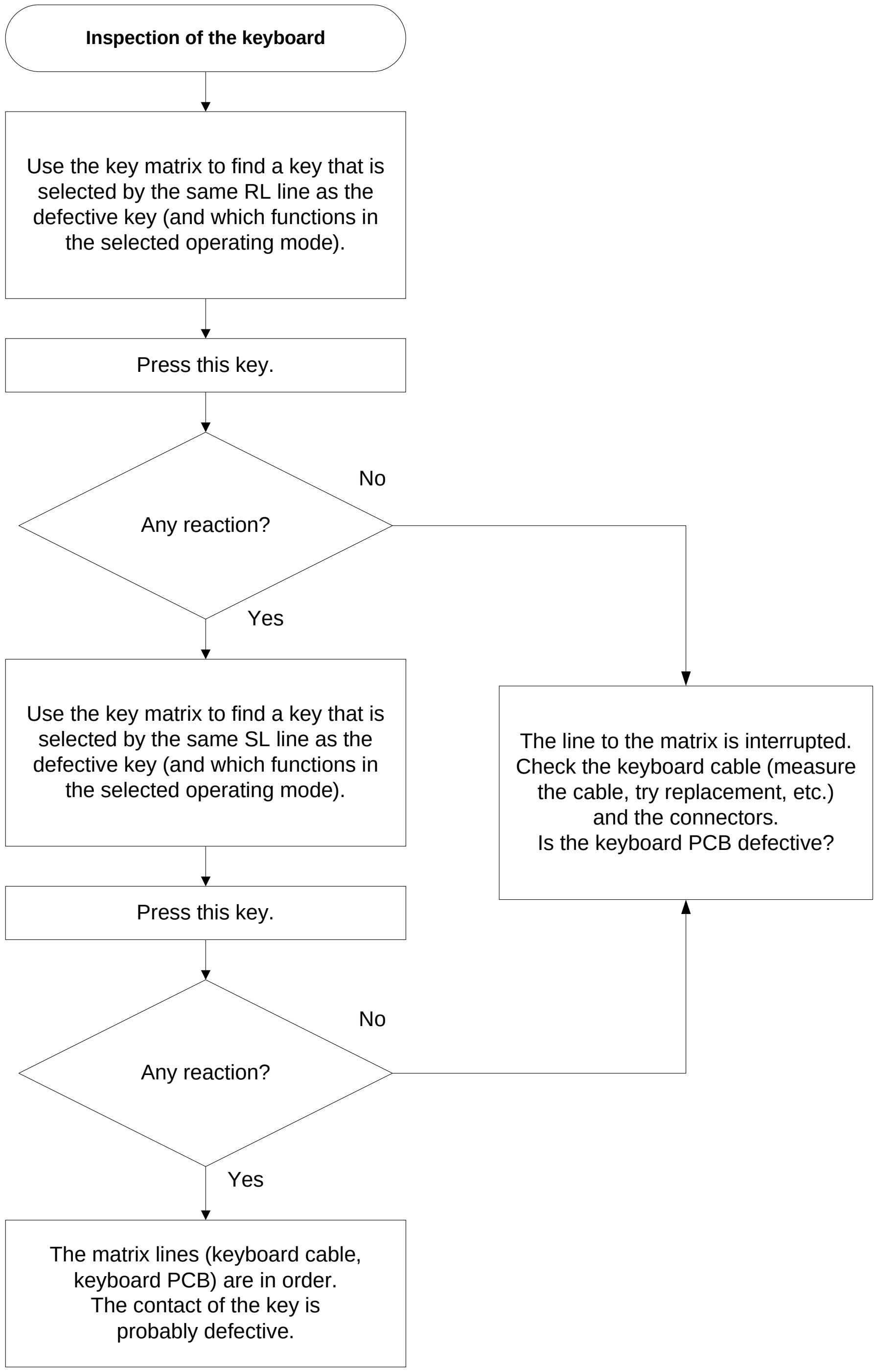
As an alternative to test whether the control receives the key signals, you can create a text file, e.g. KEYTEST.A.
The keys pressed on the ASCII field (blue keys) are displayed directly. Other keys mostly generate the message "Key non-functional" or a corresponding reaction, e.g., change to a machine operating mode.

Principle of the key matrix

The keys are evaluated via a matrix. Every key is located above a crosspoint of SL (= scan line) and RL (= return line). --> see “Key Matrix of the Keyboard Units” on page 22 – 367 or see “Key Matrix of the Keyboard Units” on page 22 – 382.



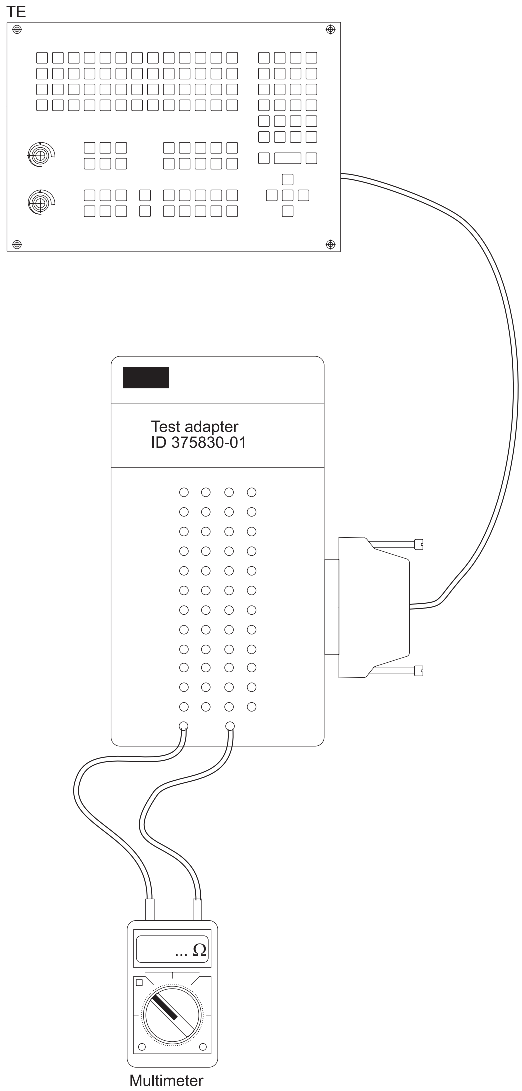
Is a line (cable, board) or the key defectibe?



Measuring setup with test adapter

The functioning of the keypad connected is tested with the following setup.
The following special appliance is required.
–> see “Test Adapter, ID 375830-01” on page 29 – 456:

- Switch off the machine.
- Disconnect the keypad cable on connector X45 of the MC.
- Connect the keypad cable to the test adapter.
- Connect the measuring lines of a multimeter to the pin sockets of the test adapter. Use the correspondig key matrix with the pin layout. –> see “Key Matrix of the Keyboard Units” on page 22 – 367.
- Set the multimeter to ohm measurement or continuity test.
- Press the key to be examined. If it functions, the resistance value from SL to RL approaches zero (regard the resistance of the measuring lines).



Note

Limitations for keypads as of TE 5xx:
A continuity test of the cross points of scan lines (SL) and the return line 0 (RL 0) is not possible. There are logical gates between RL 0 and the corresponding keys. These gates serve as keypad identifier as of TE 5 xx.
A direct ohmic measuring is thus not possible.

The **functioning of the keypad interface** on the MC can also be tested with the test adapter:

- Disconnect the keypad from the MC.
- Connect the test adapter instead to connector X45 of the MC.
- You can now simulate the pressing of keys by bridging the corresponding pin sockets on the test adapter.
  (Please refer again to the key matrix which sockets must be connected.)

Caution

Do not generate a short circuit of the potentiometer voltage (PIN 36 and 37)!

Note

As the keypad interface X45 on the MC is designed as female, you can also connect the pins with a wire bridge and thus conduct a simulation by pressing the keys.

22.5 Checking the Potentiometers

Potentiometer values in the PLC-TABLE

You can use the PLC table to determine whether the control receives the potentiometer signal.

The potentiometer setting is shown in the following **PLC words**:

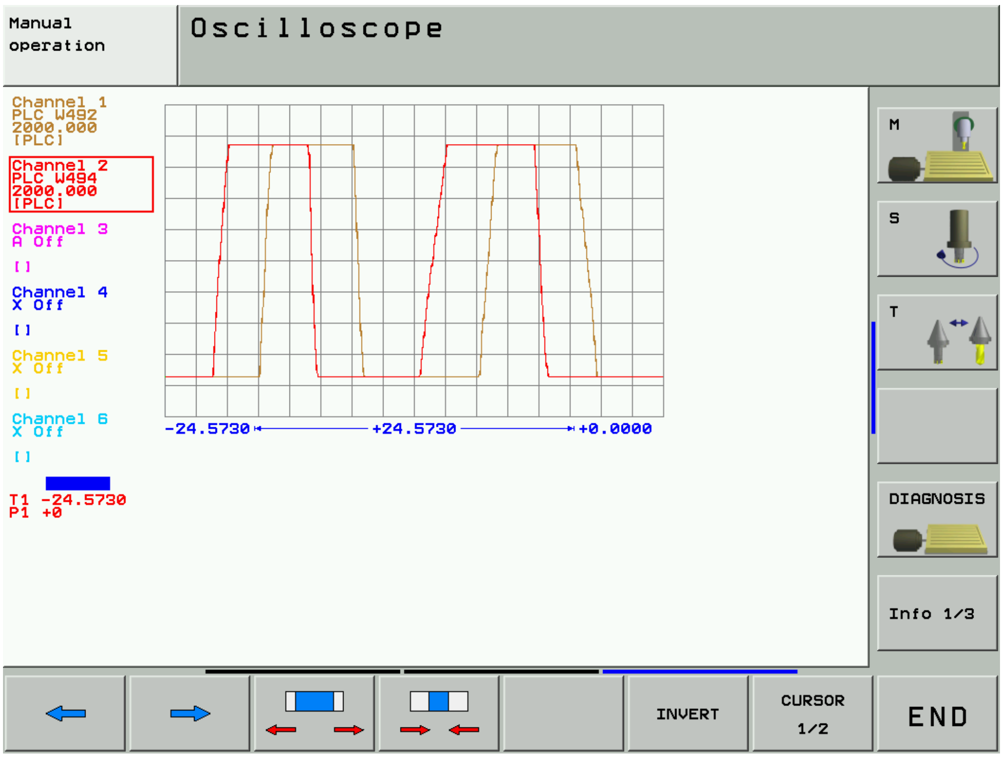
- **W492** (=S override)
- **W494** (= F override)

Proceed as follows:

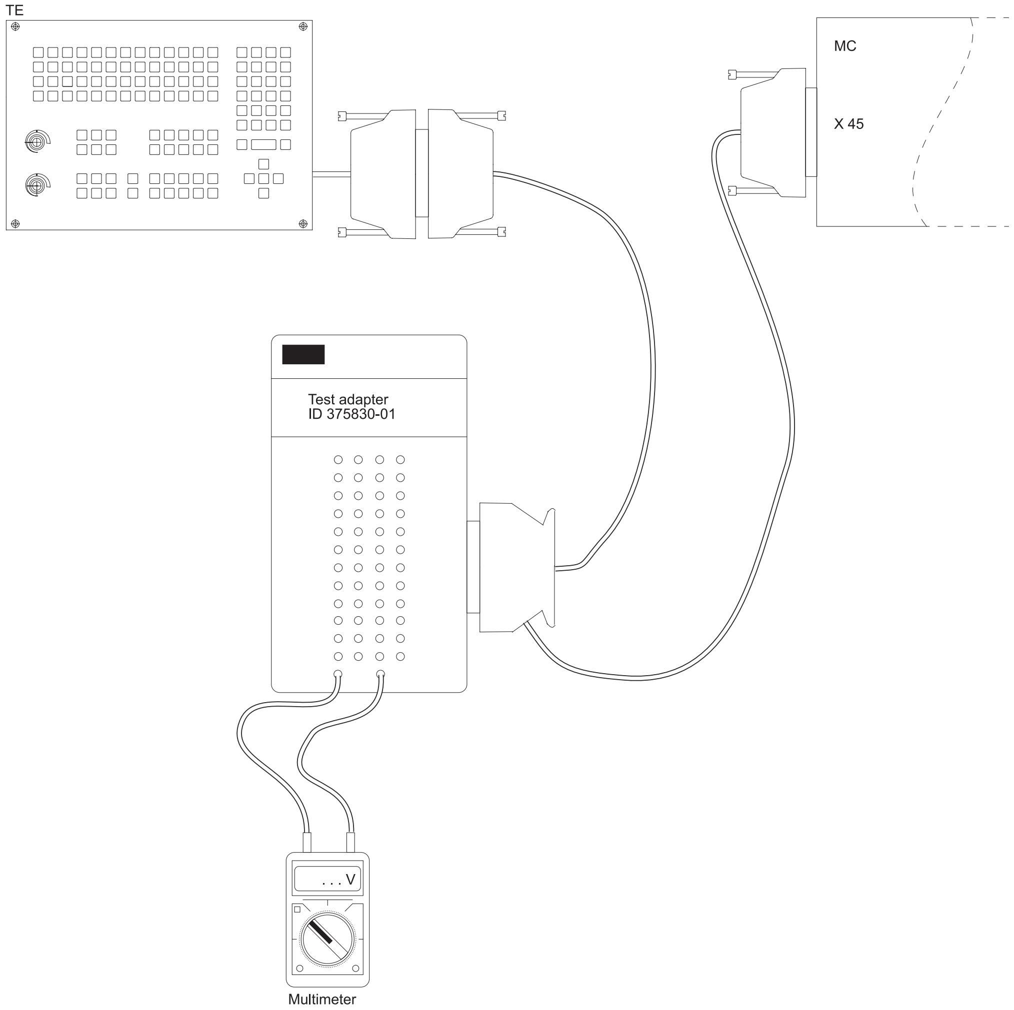
- Press EMERGENCY STOP.
- Call the PLC table for the words (see “The TABLE Function” on page 10 – 76).
- Place the cursor at W492 or W494.
- Select the decimal display.
- Turn the potentiometer to be examined.
- Check if the display can be changed from 0 to 15000 (with nonlinear characteristic curve) or 0 to 150 (with linear characteristic curve).
  The characteristic curve is defined in MP 7620 bit 3.

Potentiometer values in the oscilloscope

With the integrated oscilloscope you can also record the condition of PLC words.
-> see “Integrated Oscilloscope” on page 8 – 49.
The advantage of this method is that possible wiper interruptions of the potentiometers can be recognized better than in the PLC TABLE.
For this investigation the machine must be switched on completely!



Measuring setup with test adapter



Procedure:

- Switch off the machine.
- Insert the measuring adapter at the MC connector X45 between MC and TE cable.
- Switch the machine on again.
- Using a multimeter, check the wiper voltages of the potentiometers.

Potentiometers	PIN	Voltage range
Feed rate override F%	37 = 0V / 35 = Wiper pot	0 ... approx. + 5 V
Spindle override S%	37 = 0V / 34 = Wiper pot	0 ... approx. + 5 V

22.6 Checking the Touch Pad

The touch pad on the TE 530 and 530B keypads functions also for the single-processor control in connection with the Windows operating system of a dual-processor control and as of software version smarT.NC!

This touch pad is not connected to the MC via keypad connector X45 but with a USB cable to MC connector X141.

If the touch pad does not function, carry out the following test to find out if the touch pad itself or the interface on the control is defective:

- Try the second USB connector X142 on the control.

Note

If a new mouse or touch pad is connected, it functions only after the control has been switched off and on again.

- Try a commercially available mouse on the USB connectors of the control (the mouse should function on a Windows 2000 PC).
- If necessary, you can also extend the USB cable of the touch pad, connect it to a laptop and test the functioning (the laptop must be equipped with a Windows operating system with the corresponding mouse driver).

Note

As the touch pad is managed by Windows, there are also the corresponding Windows settings. --> "My computer/Control Panel/Mouse…"

22.7 Key Matrix of the Keyboard Units

TE 420

X2 pin key	1	2	3	4	5	6	7	8	9	17	18	19	28	29	31	32	20	21	22	23	24	25	26	27
	RL0	1	2	3	4	5	6	7	8	16	17	18	19	20	21	22	SL0	1	2	3	4	5	6	7
!										X							X							
#										X								X						
$											X						X							
%											X							X						
^												X					X							
&												X						X						
*													X				X							
(													X					X						
)														X			X							
−														X				X						
+															X		X							
=															X			X						
⌫																X	X							
"										X									X					
Q										X										X				
W											X								X					
E											X									X				
R												X							X					
T												X								X				
Y													X						X					
U													X							X				
I														X					X					
O														X						X				
P															X				X					
<															X					X				
RET																X			X					

X2 pin key	1	2	3	4	5	6	7	8	9	17	18	19	28	29	31	32	20	21	22	23	24	25	26	27
	RL0	1	2	3	4	5	6	7	8	16	17	18	19	20	21	22	SL0	1	2	3	4	5	6	7
SHIFT										X											X			
A										X												X		
S											X										X			
D											X											X		
F												X									X			
G												X										X		
H													X								X			
J													X									X		
K														X							X			
L														X								X		
;															X						X			
>															X							X		
:																X					X			
SPACE										X													X	
Z										X														X
X											X												X	
C											X													X
V												X											X	
B												X												X
N													X										X	
M													X											X
,														X									X	
.														X										X
?															X								X	
⟩															X									X
SPACE																X							X	
PGM MGT								X													X			

X2 pin key	1	2	3	4	5	6	7	8	9	17	18	19	28	29	31	32	20	21	22	23	24	25	26	27
	RL0	1	2	3	4	5	6	7	8	16	17	18	19	20	21	22	SL0	1	2	3	4	5	6	7
							X														X			
						X															X			
CALC					X																X			
MOD						X													X					
HELP			X																					X
	X																						X	
		X															X							
			X																					X
					X																		X	
	X																							X
		X																					X	
			X																				X	
				X																			X	
APPR DEP									X								X							
									X									X						
									X										X					
CHF									X											X				
L								X												X				
CR							X													X				
RND							X												X					
CT								X											X					
CC						X														X				
C					X															X				
TOUCH PROBE				X													X							
CYCL DEF								X										X						
CYCL CALL							X											X						
LBL SET						X												X						

X2 pin key	1	2	3	4	5	6	7	8	9	17	18	19	28	29	31	32	20	21	22	23	24	25	26	27
	RL0	1	2	3	4	5	6	7	8	16	17	18	19	20	21	22	SL0	1	2	3	4	5	6	7
LBL CALL					X													X						
STOP					X														X					
TOOL DEF								X									X							
TOOL CALL							X										X							
						X											X							
PGM CALL					X												X							
X				X																	X			
7			X																		X			
8		X																			X			
9	X																				X			
Y				X																X				
4			X																	X				
5		X																		X				
6	X																			X				
Z				X															X					
1			X																X					
2		X																	X					
3	X																		X					
IV				X														X						
0		X																X						
.			X															X						
-/+	X																	X						
V									X												X			
									X													X		
			X																			X		
Q			X														X							
CE					X																	X		

X2 pin / key	1	2	3	4	5	6	7	8	9	17	18	19	28	29	31	32	20	21	22	23	24	25	26	27
	RL0	1	2	3	4	5	6	7	8	16	17	18	19	20	21	22	SL0	1	2	3	4	5	6	7
DEL				X																		X		
P				X																				X
I					X																			X
NO ENT		X																				X		
ENT	X																					X		
END	X																X							
↑								X														X		
←						X																X		
GOTO							X															X		
→								X															X	
↓						X																	X	

TE 530, TE 530 B, TE 520 B

X2 Pin Key		ESC				PRT SC	SCROL	BREAK		INS	DEL	HOME	END	PG UP	PG DN	X
1	RL0															
2	1															
3	2															
4	3															X
5	4															
6	5															
7	6															
8	7															
9	8															
12	11		X	X												
13	12						X	X								
14	13					X										
15	14								X							
16	15															
17	16				X											
18	17															
19	18															
28	19															
29	20											X		X		
31	21															
32	22	X								X					X	
33	23										X		X			
20	SL0															
21	1															
22	2		X													
23	3	X		X									X			
24	4				X											X
25	5									X	X					
26	6							X	X			X				
27	7					X	X							X	X	

X2 Pin	Key	7	8	9	~ `	! 1	@ 2	# 3	$ 4	% 5	^ 6	& 7	* 8	(9	) 0	_ -
1	RL0			X												
2	1		X													
3	2	X														
4	3															
5	4															
6	5															
7	6															
8	7															
9	8															
12	11															
13	12															
14	13															
15	14															
16	15															
17	16					X		X								
18	17								X	X						
19	18										X	X				
28	19												X	X		
29	20														X	X
31	21						X									
32	22				X											
33	23															
20	SL0					X			X		X		X		X	
21	1				X		X	X		X		X		X		X
22	2															
23	3															
24	4	X	X	X												
25	5															
26	6															
27	7															

X2 Pin Key		+ =	⌫	Y	4	5	6	TAB	Q	W	E	R	T	Y	U	I
1	RL0						X									
2	1					X										
3	2				X											
4	3			X												
5	4															
6	5															
7	6															
8	7															
9	8															
12	11															
13	12															
14	13															
15	14															
16	15															
17	16								X							
18	17									X	X					
19	18											X	X			
28	19													X	X	
29	20															X
31	21	X														
32	22		X					X								
33	23															
20	SL0	X	X													
21	1															
22	2									X		X		X		X
23	3			X	X	X	X		X		X		X		X	
24	4															
25	5															
26	6							X								
27	7															

X2 Pin	Key	O	P	{ [	}]	| \	Z	1	2	3	CAPS LOCK	A	S	D	F	G
1	RL0									X						
2	1								X							
3	2							X								
4	3						X									
5	4															
6	5															
7	6															
8	7															
9	8															
12	11															
13	12															
14	13										X					
15	14															
16	15															
17	16											X				
18	17												X	X		
19	18														X	X
28	19															
29	20	X														
31	21		X			X										
32	22			X												
33	23				X											
20	SL0															
21	1															
22	2		X				X	X	X	X						
23	3	X														
24	4			X	X								X		X	
25	5											X		X		X
26	6										X					
27	7					X										

X2 Pin	Key	H	J	K	L	: ;	" '	↵	IV	0	°	7/+	SHIFT links	Z	X	C
1	RL0											X				
2	1									X						
3	2										X					
4	3								X							
5	4															
6	5															
7	6															
8	7															
9	8															
12	11															
13	12															
14	13															
15	14															
16	15															
17	16						X							X		
18	17														X	X
19	18															
28	19	X	X													
29	20			X	X											
31	21					X										
32	22							X								
33	23												X			
20	SL0												X			
21	1								X	X	X	X				
22	2						X	X								
23	3															
24	4	X		X		X										
25	5		X		X											
26	6														X	
27	7													X		X

X2 Pin Key		V	B	N	M	< ,	> .	? /	SHIFT rechts	V			Q	CTRL links	WIN links
1	RL0														
2	1														
3	2											X	X		
4	3														
5	4														
6	5														
7	6										X				
8	7														
9	8									X					
12	11														
13	12														
14	13														
15	14														X
16	15													X	
17	16														
18	17														
19	18	X	X												
28	19			X	X										
29	20														
31	21					X	X	X							
32	22														
33	23								X						
20	SL0												X		
21	1								X						
22	2														
23	3					X									
24	4									X					
25	5						X					X			
26	6	X		X				X			X			X	
27	7		X		X										X

X2 Pin	Key	ALT links	SPACE	ALT rechts	WIN rechts	WIN Kont	Ctrl rechts	CE	DEL	P	I	NO ENT	ENT	END
1	RL0												X	X
2	1											X		
3	2													
4	3								X	X				
5	4							X			X			
6	5													
7	6													
8	7													
9	8													
12	11	X		X										
13	12													
14	13				X									
15	14													
16	15						X							
17	16		X											
18	17													
19	18													
28	19													
29	20													
31	21													
32	22													
33	23					X								
20	SL0	X												X
21	1			X										
22	2					X								
23	3													
24	4													
25	5				X		X	X	X			X	X	
26	6													
27	7		X							X	X			

X2 Pin Key		PGM MGT		ERR	APPR DEP	FK		CHF	L	CALC	MOD	HELP	CR	RND	CT	CC
1	RL0															
2	1											X				
3	2															
4	3															
5	4									X						
6	5			X							X					X
7	6		X										X	X		
8	7	X							X						X	
9	8				X	X	X	X								
12	11															
13	12															
14	13															
15	14															
16	15															
17	16															
18	17															
19	18															
28	19															
29	20															
31	21															
32	22															
33	23															
20	SL0				X											
21	1					X										
22	2						X				X			X	X	
23	3							X	X				X			X
24	4	X	X	X						X						
25	5															
26	6															
27	7											X				

X2 Pin	Key						TOUCH PROBE	CYCL DEF	CYCL CALL	LBL SET	LBL CALL					STOP
1	RL0		X	X												
2	1				X							X				
3	2												X		X	
4	3						X							X		
5	4	X				X					X					X
6	5									X						
7	6								X							
8	7							X								
9	8															
12	11															
13	12															
14	13															
15	14															
16	15															
17	16															
18	17															
19	18															
28	19															
29	20															
31	21															
32	22															
33	23															
20	SL0				X		X									
21	1							X	X	X	X					
22	2															X
23	3	X														
24	4															
25	5															
26	6		X			X						X	X	X		
27	7			X											X	

X2 Pin Key		TOOL DEF	TOOL CALL		PGM CALL	↑	←	↓	→	GOTO □					
1	RL0														
2	1														
3	2														
4	3														
5	4				X										
6	5			X			X	X							
7	6		X							X					
8	7	X				X			X						
9	8														
10	9										X	X	X		
12	11														
13	12														
14	13														
15	14														
16	15														
17	16														
18	17														
19	18														
28	19														
29	20														
31	21														
32	22														
33	23														
20	SL0	X	X	X	X						X				
21	1											X			
22	2												X		
23	3														
24	4														
25	5					X	X			X					
26	6							X	X						
27	7														

Note

The two keys left of the touch pad do not belong to the key matrix!
If these keys are pressed, the signal is transmitted to the control via USB interface.

22.8 Key Matrix of the Keyboard Units

> **Note**
>
> The keys pressed are also recorded in the log. The SK1 key is entered as soft key 0, the SK2 key as soft key 1 and so on.
>
> The soft keys are numbered serially from left to right.

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X1 pin[a]	**9**	**8**	**7**	**6**	**1**	**2**	**3**	**4**
X2 pin[a]	**13**	**14**	**15**	**16**	**20**	**21**	**22**	**23**
[b] **key**	**RL12**	**RL13**	**RL14**	**RL15**	**SL0**	**SL1**	**SL2**	**SL3**
		X			X			
	X				X			
◁				X		X		
SK1			X			X		
SK2		X				X		
SK3	X					X		
SK4				X			X	
SK5			X				X	
SK6		X					X	
SK7	X						X	
SK8				X				X
▷			X					X

a. Connector on the keyboard unit
b. Key on visual display unit

X1: Connection for ribbon cable display unit => keyboard unit (plug-type connector)
X2: Connection for cable keyboard unit => MC (D-Sub 37-pin)
SK = Soft key (SK1..SK8 from left to right)

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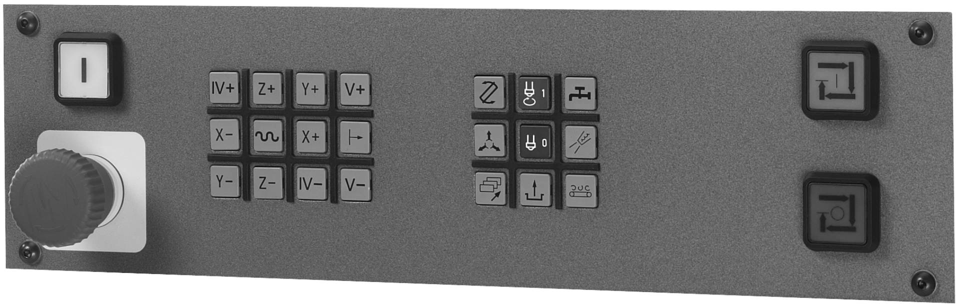
X1 pin[a]	9	8	7	6	1	2	3	4	5
X2 pin[a]	13	14	15	16	20	21	22	23	24
[b] key	RL12	RL13	RL14	RL15	SL0	SL1	SL2	SL3	SL4
△			X		X				
		X			X				
	X				X				
◁				X		X			
SK1			X			X			
SK2		X				X			
SK3	X					X			
SK4				X			X		
SK5			X				X		
SK6		X					X		
SK7	X						X		
SK8				X				X	
▷			X					X	
MF1		X						X	
MF2	X							X	
MF3				X					X
MF4			X						X
MF5		X							X
MF6	X								X

a. Connector on the keyboard unit
b. Key on visual display unit

X1: Connection for ribbon cable display unit => keyboard unit (plug-type connector)
X2: Connection for cable keyboard unit => MC (D-Sub 37-pin)
SK = Horizontal soft keys (SK1..SK8 from left to right)
MF = Vertical soft keys (MF1..MF6 from top to bottom)

23 Machine Operating Panel

23.1 General



For machines with up to four axes, HEIDENHAIN offers the MB 420 machine operating panel. It is normally mounted below the TNC keyboard.

The machine operating panel is connected to connector X46 of the MC.

The keys and buttons of the MB 420 are transmitted as PLC inputs to the control.

The MB 420 is provided with 8 PLC outputs (e.g., the lamps of the buttons can be controlled).

If a machine operating panel (tableau) from the machine tool buildler is used, please see the corresponding circuit diagram. It shows the wiring of the keys.

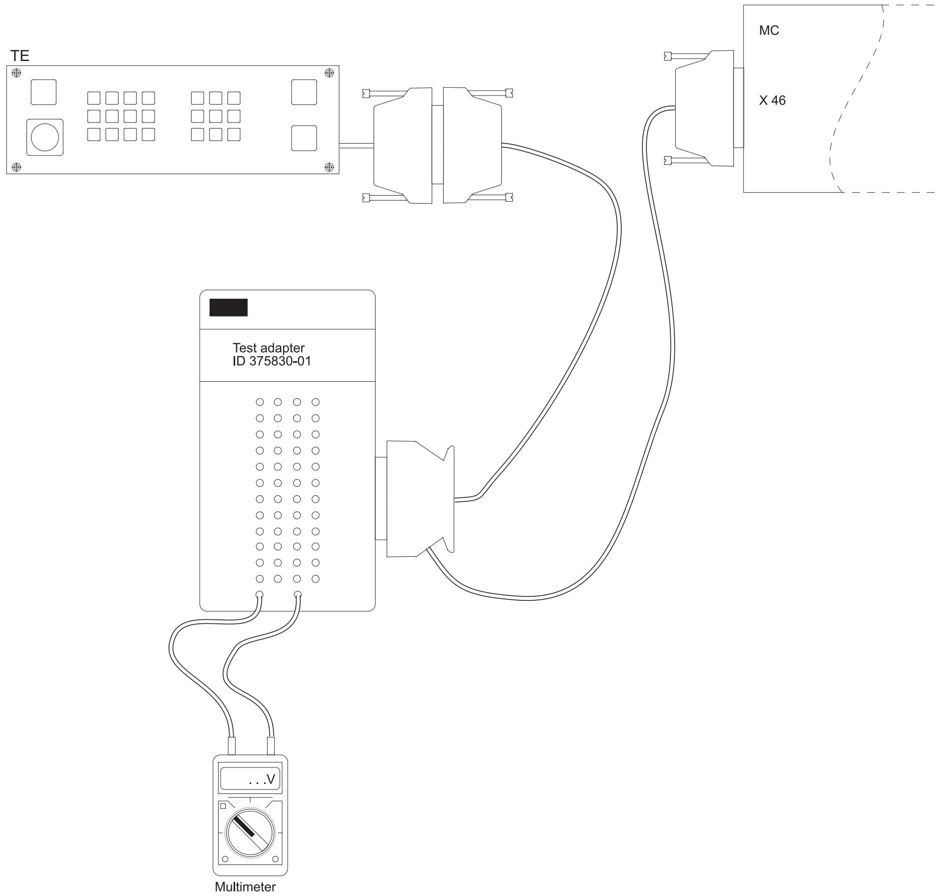
Caution

HEIDENHAIN recommends to check the function of the EMERGENCY STOP switch on the machine operating panel or operating tableau regularly!

23.2 Checking the Power Supply

The MB 420 is supplied with 24 V PLC voltage on X1/PIN 34, 35 with 0 V and on X1/PIN 36, 37. Measure if the power supply is in order!

Measuring setup with test adapter



Procedure:

- Switch off the machine.
- Insert the test adapter at the MC connector X1 between MC 420 and connecting cable.
- Switch the machine on again.
- Using a multimeter, check the supply voltage on the corresponding PINs.

23.3 Checking the Keys

Possible causes of error

- Strong contramination --> Key gets caught
- Jammed chips --> Key gets caught
- Defective contact --> Key does not report to the control any more
- Defective keypad board
- Defective cable MB control
- Defective interface on the control

Note

Due to an interruption of the NC stop signal (lowactive) between MB and control, the machine cannot be traversed any more. The same problem is caused if the NC-stop key gets caught.

Visual inspection

First check the keypad visually!

- Is the **key strongly contaminated (grease, dust, oil, etc.)?**
- Are there **jammed chips?**

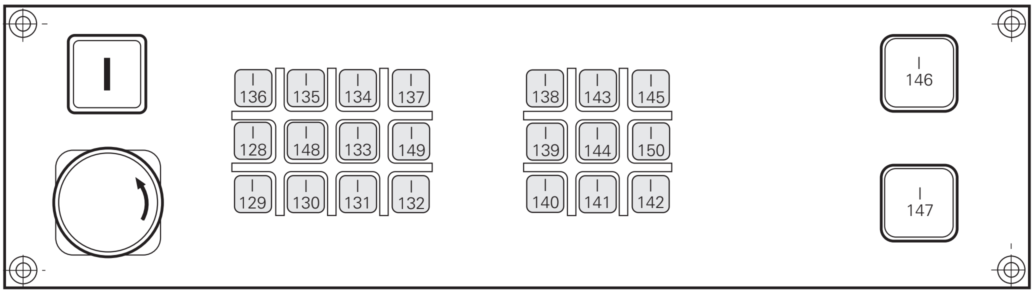
The key may thus get caught.
In such a case, the MB must be cleaned carefully.

DANGER

When liquid cleaning agents have be used, the electrical units must dry completely before they are operated again.

Does the control receive the key signal?

The keys and buttons of the MB 420 are assigned to PLC inputs:



Two other inputs (I151 and I152) can be wired via terminal row X3:

Terminal X3	Assignment
1	I151
2	I152
3	+24 V

The inputs are connected to the control (MC, connector X46) via connecting lines X1.
Connectors and pin layouts on MB 420 --> see "Machine Operating Panel" on page 13 – 199.

The function of the MB keys can be checked via the table for the PLC inputs:

- Press EMERGENCY STOP.
- Call the table with the PLC inputs. -->see "The TABLE Function" on page 10 – 76.
- Press the keys.
- The corresponding inputs must change to 1!
  Exception: I147 = NC stop, changes to 0 (line-break proof!) if activated.

Note

You can measure the input voltages, e.g. on terminal X3 of the MB 420 or via test adapter on connector X1. --> see "Test Adapter, ID 375830-01" on page 29 – 456.

23.4 Checking the Outputs

The MB 420 is provided with 8 PLC outputs (e.g., the lamps of the buttons can be controlled). These outputs are located on the connecting leads X1 and also on terminal block X4:

Terminal X4	Assignment
1	O0
2	O1
3	O2
4	O3
5	O4
6	O5
7	O6
8	O7
9	0 V

The function can be checked via the table for the PLC outputs:

- Call the table with the PLC outputs. --> see “The TABLE Function” on page 10 – 76.
- Establish the conditions for setting the corresponding output (keystroke, function call, etc.). If necessary, use the User's Manual or the circuit diagram of the machine or ask the machine manufacturer.
- The corresponding outputs must change the condition!

You can now find out, e.g., whether a lamp is defective or is not controlled correctly.

Note

You can measure the output voltages, e.g. on terminal X4 of the MB 420 or via test adapter on connector X1. --> see “Test Adapter, ID 375830-01” on page 29 – 456.

24 Handwheel

24.1 General Information

The following handwheels can be connected to the iTNC 530 controls:

- One panel-mounted HR 130 handwheel
- Three HR 150 panel-mounted handwheels via the HRA 110 handwheel adapter
- One HR 410 portable handwheel
- One HR 420 portable handwheel with display

Shock or vibrations can cause a slight motion at the handwheel and produce an unintentional axis movement. The threshold sensitivity is entered in MP 7660!

Portable handwheels with EMERGENCY stop button are connected to the control via a cable adapter. The EMERGENCY STOP wiring and the wiring for the permissive keys are located in cable adapter Id.Nr. 296466-xx.

Pin layouts and wiring (e.g., EMERGENCY STOP key and permissive key on cable adapter)
--> see “Handwheels” on page 13 – 183.

For information on the operation of the electronic handwheels. --> See User's Manual iTNC 530.

Caution

HEIDENHAIN recommends to check the function of the EMERGENCY STOP switch on the handwheel regularly!

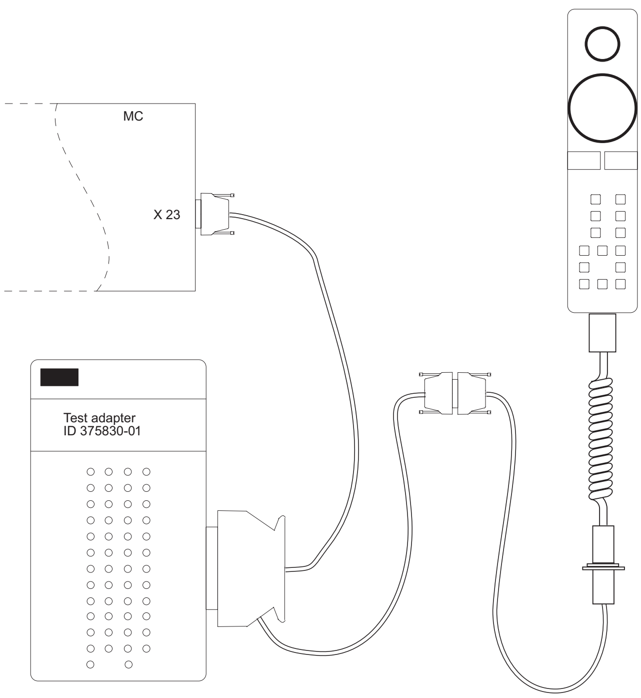
> **Note**
>
> The power of the handwheel is not monitored!
>
> A defective handwheel or a handwheel with penetrated humidity may influence the 12 V supply voltage of the control. This can lead to various disturbances of the control. It is possible that error messages are displayed that do not immediately refer to a defective handwheel.
>
> In such a case, unscrew the handwheel inclusive cable from the adapter block on the operating panel. Connect the dummy plug Id.Nr. 271958-03 instead or bridge the handwheel in the EMERGENCY STOP chain. Set MP 7640 to "No handwheel" (or a handwheel error message will be generated).
> You can now observe if the mentioned disturbances or error messages on the control are still generated.

Possible causes of error

- The portable handwheel fell down and was damaged
- Strong contramination --> Key functions are possibly damaged.
- Jammed chips --> Key gets caught
- Defective contact --> Key does not report to the control any more
- Defective potentiometers
- Defective board
- Defective handwheel encoder
- Humidity
- Defective handwheel cable
- Error in cable adapter --> Continuous EMERGENCY STOP or permissive keys nonfunctional
- Shock or vibrations --> Undesired traverse motions
- Handwheel interface on MC defective

Tips for trouble-shooting

- Switch the control display to "Nominal value" and observe if the display changes while turning the HR.
- Check the HR, cable, contacts, etc. visually
- If required, check the PLC inputs and markers --> See following pages
- If required, check the potentiometers and switches --> See following pages
- Connect the test adapter between connector X23 of the MC and handwheel and measure the +12 V voltage (see "Test Adapter, ID 375830-01" on page 29 – 456)
- **If available, connect a dimensionally identical handwheel and test the functioning.**



24.2 HR 420 Portable Handwheel with Display

24.2.1 Checking the Keys

The keys cannot contact any more (defective contact, line, etc.) or are in continuous contact (adhesion of the key by strong contamination, jammed chips, etc.).
With the PLC diagnostic functions TABLE or LOGIC DIAGRAM you can check the function of many handwheel keys my means of the corresponding PLC markers:

- Press EMERGENCY STOP.
- Activate the HR 420 (press the handwheel symbol on the HR 420)
- Call the table with the PLC markers and start the logic diagram. --> see “PLC Diagnosis” on page 10 – 73.
- Press the handwheel keys.
- Check whether the corresponding markers are set.

MP7641 defines if a HR 420 with or without detent is used or if the keys on the handwheel are evaluated by the NC or the PLC.

All keys are evaluated by the NC. Certain keys are mapped on markers.

F1	F2	F3	F4	F5
X	Y	Z	IV	V
	¦	Hand-wheel active/ inactive	Ø	
	– (M4667)	Rapid traverse (M4663)	+ (M4666)	
	Spindle start (M4664)	Actual-to-nominal value transfer	NC start (M4661)	
	Spindle stop (M4665)	CTRL (M4668)	NC stop (M4662)	

Note

Only if M4660 is set (HR 420 active), other markers can be set or reset.

Keys that are not mapped in markers can be checked easily by controlling if a function is called by pressing the corresponding key or if there is a reaction on the screen.

24.2.2 Checking the Potentiometers

The override potentiometers of the HR 420 are active up to NC software version as soon as the handwheel operation was selected!
The potentiometers of the keyboard are then inactive.

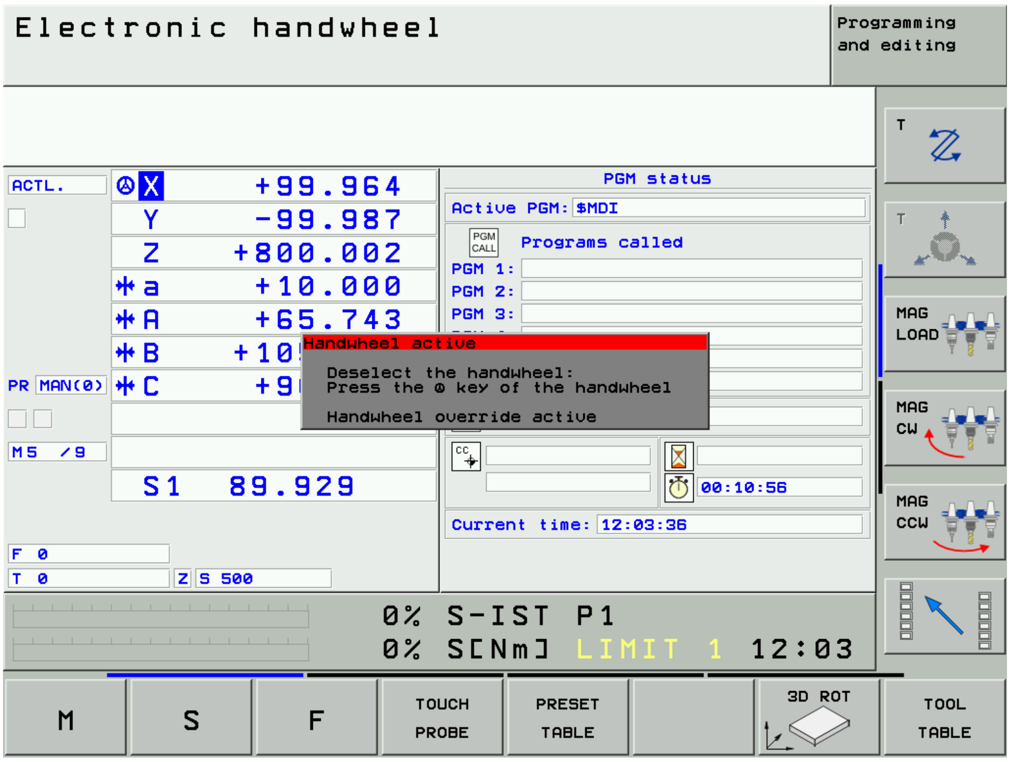
DANGER

By switching from the keyboard to the HR 420 and vice versa, the feed rate or the spindle speed can change depending on the corresponding potentiometer setting.

As of NC software version 34049x-xx (with smarT.NC programming surface), the potentiometers of the keyboard are still active after selecting the handweel operating mode.
To test the handwheel potentiometers, you must switch over correspondingly:

- Press the CTRL and Handwheel keys in the HR 420. --> The TNC shows the soft-key menu for selecting the potentiometers on the handwheel display.
- Press the HW soft key to activate the handwheel potentiometer.

Potentiometers on HR 420 active



If you have activated the potentiometers on the handwheel, you must reactivate the potentiometers of the machine operating panel before deselecting the handwheel. Proceed as follows:

- Press the CTRL and Handwheel keys in the HR 420. --> The TNC shows the soft-key menu for selecting the potentiometers on the handwheel display.
- Press the KBD soft key to activate the potentiometers of the machine operating panel.

By means of **W494** the function of the **feed-rate override potentiometer,** and by means of **W492** the function of the **spindle override potentiometer** can be controlled:

- Press EMERGENCY STOP.
- Activate the HR 420 (press the handwheel symbol on the HR 420).
- Activate the handwheel potentiometers (as of NC software version 34049x-xx).
- Call the PLC table with the words. --> see "The TABLE Function" on page 10 – 76.
- Select the decimal display.
- Turn the potentiometer to be investigated.
- The value of W492 or W494 changes between 0 and 10000 with nonlinear or between 0 and 100 with linear curve of the potentiometer (the curve is defined in MP 7620 bit 3).

Note

These PLC words can also be shown in the integrated oscilloscope.
--> see "Checking the Potentiometers" on page 22 – 364.

24.3 HR 410 Portable Handwheel

24.3.1 Checking the Keys

The keys cannot contact any more (defective contact, line, etc.) or are in continuous contact (adhesion of the key by strong contamination, jammed chips, etc.).
With the PLC diagnostic functions TABLE or LOGIC DIAGRAM you can check the function of the handwheel keys my means of the corresponding PLC inputs:

- Press EMERGENCY STOP.
- Call the table with the PLC inputs or start the logic diagram.
  --> see “PLC Diagnosis” on page 10 – 73.
- Press the handwheel keys.
- Check whether the corresponding inputs change to 1.

MP7645 determines whether the handwheel keys are evaluated by the NC or the PLC.

Evaluation of the keys via the NC. --> MP7645.0 = 0

X		IV
Y		V
Z		
Low feed rate	Medium feed rate	High feed rate
–		+
O109 I173	O110 I174	O111 I175

All keys are evaluated by the NC except the keys A, B and C!

Evaluation of the keys via the NC. --> MP7645.0 = 1

Note

Ask the machine manufacturer if MP 7645.0 can be changed for test purposes. It is possible that this is not permitted by the PLC program.

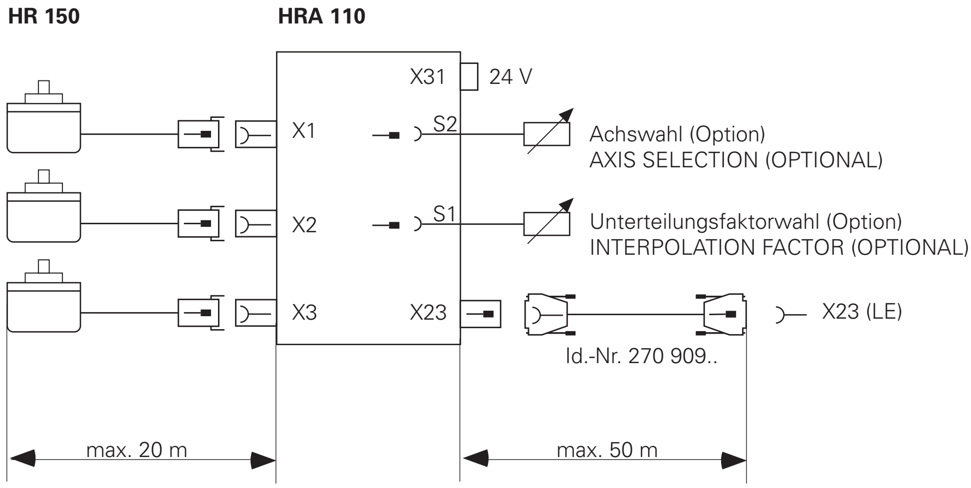
O96 I160		O97 I161
O98 I162		O99 I163
O100 I164		O103 I167
O104 I168	O105 I169	O106 I170
I171		I172
O109 I173	O110 I174	O111 I175

All keys are evaluated by the PLC!

24.4 HR 150 Panel-Mounted Handwheels with HRA 110 Handwheel Adapter

With the handwheel adapter HRA 110 you can connect two or three HR 150 panel-mounted handwheels to the TNC.

The first and second handwheels are assigned to the X and Y axes. The third handwheel can be assigned either through a selection switch (option) or with MP7645.



An additional switch enables you to select, for example, the interpolation factor for the handwheel. The current position of the step switch is evaluated by the PLC.

24.4.1 Checking the Switch

The function of the selective switches can be checked via the PLC table for the inputs:

- Press EMERGENCY STOP.
- Call the table with the PLC inputs. --> see “The TABLE Function” on page 10 – 76.
- Turn the selective switches.
- Using the following tables, check whether the corresponding inputs change to 0.

Assignment of the switch positions to the PLC inputs

The tables below list the assignments of switch positions of S1 and S2 to the PLC inputs I160 to I175.

The two switches work with a 0 V logic circuit.

Example:
If switch S1 is in position 3, input I162 is logically 0, and all other inputs are logically 1.

Step switch 1: Step switch for choosing the interpolation factor

Switch position	PLC input
1 (at the left stop)	I160
2	I161
3	I162
4	I163
5	I164
6	I165
7	I166
8 (at the right stop)	I167

Step switch 2: Axis selection switch

Switch position	PLC input
1 (at the left stop)	I168
2	I169
3	I170
4	I171
5	I172
6	I173
7	I174
8 (at the right stop)	I175

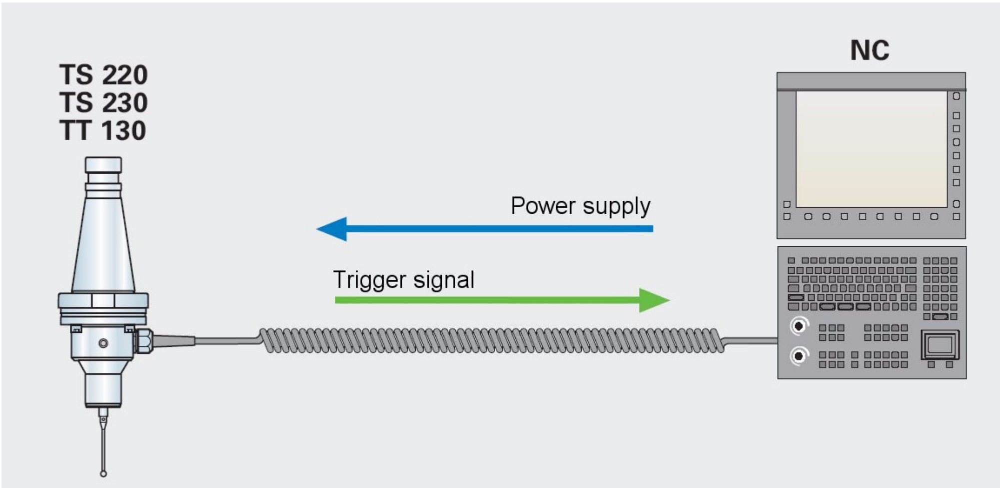
25 Touch Probe

25.1 General Information

An iTNC 530 can be equipped with different touch probes.

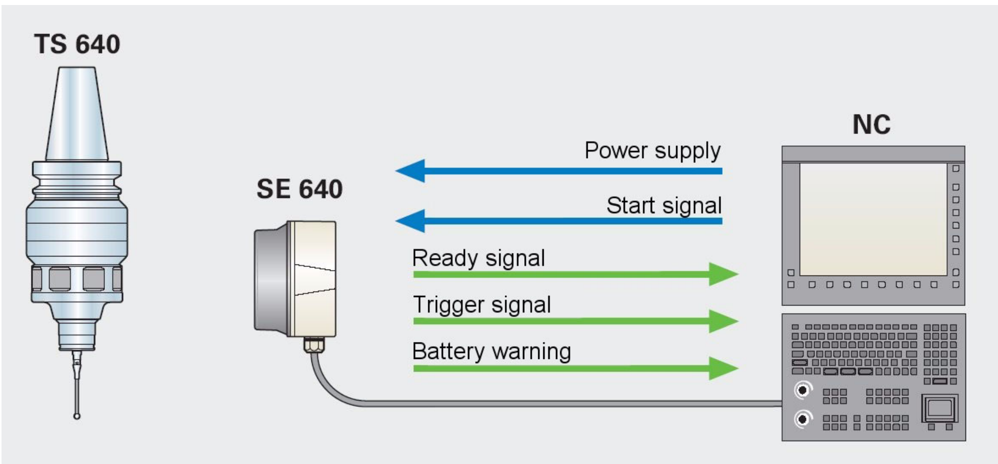
Touch probe with signal transmission via cable (e.g. TS 220)

- These touch probes are inserted manually into the spindle by the machine operator.
- They serve the purpose of aligning work pieces, setting datums and calibrating workpieces.



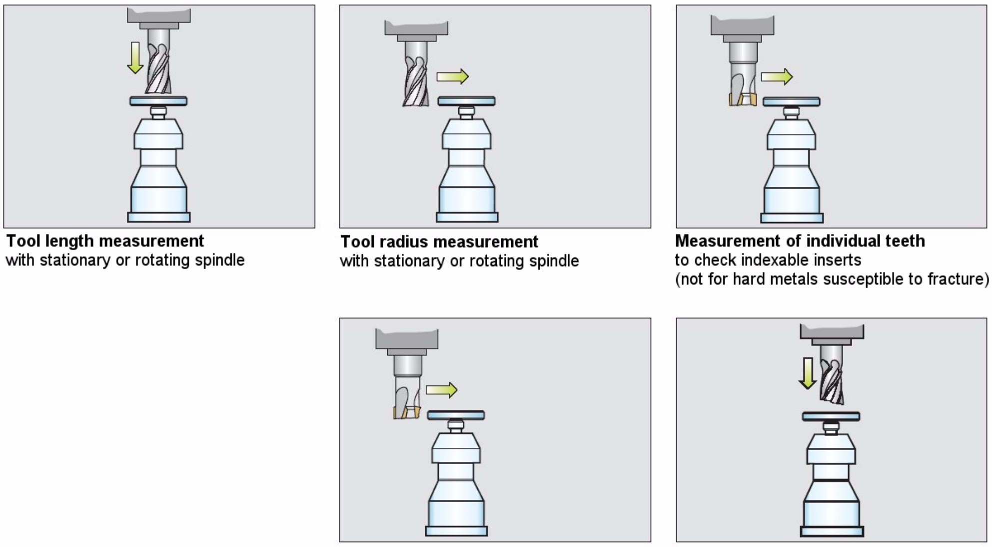
Touch probe with infrared transmission of the trigger signal (e.g., TS 640, TS 440)

- These touch probes are suited for machines with automatic tool changer.
- They serve the purpose of aligning work pieces, setting datums and calibrating workpieces.
- The infrared transmission is established between the touch probe and the transmitter/receiver unit.
- It is immune to disturbance and also operated via reflection.
- The probes are operated by batteries.
- The TS 640 is equipped with an integrated air blowing unit.



Touch probe for tool calibration (e.g., TT 130)

- This touch probe is used for tool calibration (e.g., length, radius, individual teeth).
- Tools can be investigated for tool breakage.
- The wear of tools can be determined.



Tool length measurement with stationary or rotating spindle

Tool radius measurement with stationary or rotating spindle

Measurement of individual teeth to check indexable inserts (not for hard metals susceptible to fracture)

Tool wear measurement

Tool breakage monitoring

By means of **touch probe cycles** ...

- Manual and automatic datum setting
- Compensation of manual or automatic workpiece misalignment
- Automatic workpiece measurement
- Automatic tool measurement
- Calibration of touch probe systems

... is possible.

Pin layout –> see “Touch Probe Systems” on page 13 – 182.

Further information on touch probes can be found in:

- The User's Manual iTNC 530
- The corresponding mounting instructions
- The brochure 3-D Touch Probes for Machine Tools

These documents can be downloaded from the HEIDENHAIN website (www.heidenhain.de). If you cannot find the requested document, ask the machine manufacturer or your HEIDENHAIN service agency!

Note

The power supply of the touch probes is not monitored.

A defective probe or a probe with penetrated humidity may influence the 5 Vdc and 15 Vdc supply voltages of the control. This also applies for a defective or wet transmitter/receiver unit.
This can lead to various disturbances of the control. It is possible that encoder error messages are displayed, as for example, the encoder signals cannot be evaluated properly if these voltages are impaired.

In such a case, disconnect the touch probe from the control (X12 or X13) and observe, whether the mentioned error messages are still generated.

25.2 Touch Trigger Probe with Cable Connection for Workpiece Setup and Measurement

Possible causes of error

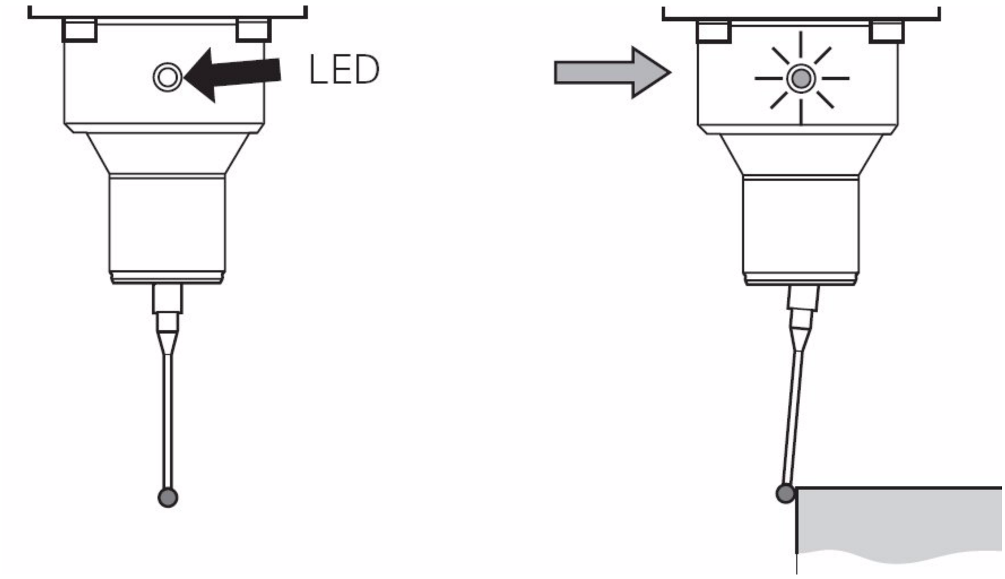
- Collision (probe damaged, etc.)
- Humidity
- Defective cable of probe
- Defective interface of probe on MC

Note

After a collision, check the accuracy of the touch probe. Ask the machine manufacturer or your HEIDENHAIN service agency!

Control of the LEDs

Red LEDs on the TS 220 signalize, that the stylus is deflected:



Short functional test

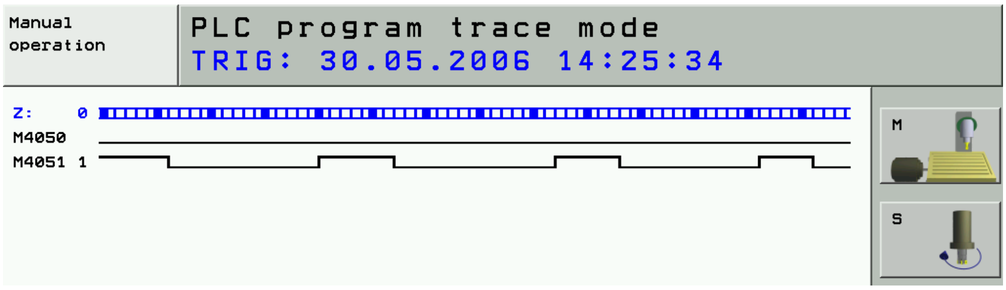
DANGER

Ask the machine operator and regard the machine manufacturers's safety instructions (setup mode, etc.)!

The probe to be investigated must be located inside the spindle.

- Call the logic diagram and enter the operands M4050 and M4051.
  Set the trigger to M4051. --> see "The LOGIC Diagram" on page 10 – 82.
- Begin recording.
- Check marker 4050. If the probe is ready, this marker has the status zero!
- Deflect the stylus manually.
- Check marker 4051. If the stylus is deflected, this marker changes to one!

Logic diagram



Note

You can also connect the test adapter between MC (X12) and probe cable and measure the corresponding voltages and signals.
--> see "Test Adapter, ID 375830-01" on page 29 – 456!

Ready signal	(X12/pin3)	+15 V --> Probe ready
Trigger signal negates	(X12/pin10)	+5 V --> Probe ready, stylus at rest
Trigger signal negates	(X12/pin10)	0 V --> Probe ready, stylus at rest

0 V (UN) are on pin 8 --> see "X12: Connection of the touch probe for workpiece measurement" on page 13 – 145

TS 220

Note

If available, you can also test a dimensionally identical probe and test the functions!

25.3 Touch Trigger Probe with Infrared Transmission for Workpiece Setup and Measuring

Possible causes of error

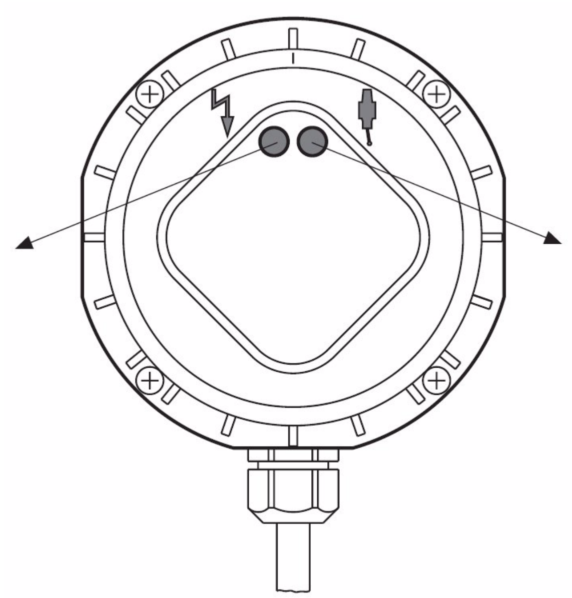
- Collision (probe or transmitter/receiver unit damaged, etc.)
- Battery or storage battery empty. --> A corresponding error message is generated when a touch probe is started.
- Contamination of the probe and/or the transmitter/receiver unit. --> No infrared connection.
- Obstacle in the infrared connection or strong shading of transmitter or receiver.
- Contact on infrared touch probe not closed or defective.
- It is possible, that several touch probes are within the receiving range of a SE; the infrared signals cannot be allocated any more; faulty operation.
- Humidity
- The cable to the transmitter/receiver unit is defective.
- Interface to transmitter/receiver unit on the MC is defective.

Note

After a collision, check the accuracy of the touch probe. Ask the machine manufacturer or your HEIDENHAIN service agency!

Control of the LEDs

By means of two multi-color LEDs, an optical status control of the SE 440, SE 640 and EA 632 transmitting/receiving units is possible:



LED with the "flash" or "transmit" symbol		LED with the "probe" symbol	
Color	**Meaning**	**Color**	**Meaning**
Green	Infrared connection in order	Green	Touch probe system ready, stylus at rest
Orange	Infrared connection still acceptable	Orange	Touch probe system ready, stylus deflected
Red	Infrared connection interrupted	Red	Battery capacity on probe approx. 10%, exchange of battery on probe
		Off	Touch probe not ready

On the SE 540, there is a LED with the following meaning:

Color	Meaning
Red (blinking)	Touch probe ready, but no infrared connection available
Green	Infrared connection available
Orange	Stylus already in contact
Off	Touch probe not ready

Note

A detailed description for optical status control, for direction of beam, for battery change, for stylus change, for centering, technical data, etc. can be found in the corresponding mounting instructions of the touch probe!

Short functional test

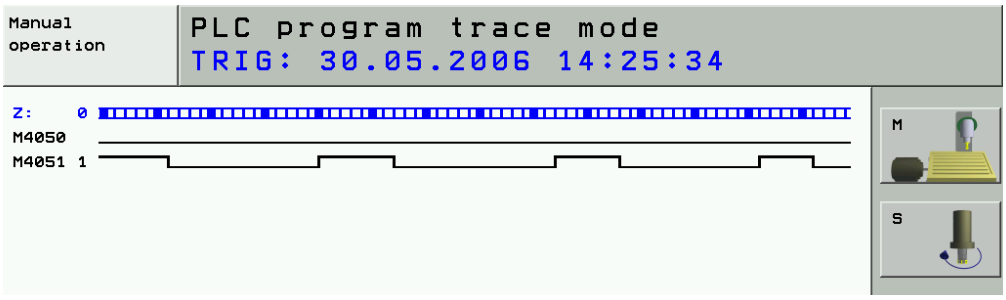
DANGER

Ask the machine operator and regard the machine manufacturers's safety instructions (setup mode, etc.)!

The probe to be investigated must be located inside the spindle.

- Call the logic diagram and enter the operands M4050 and M4051. Set the trigger to M4051. --> see “The LOGIC Diagram” on page 10 – 82.
- Begin recording.
- Check marker 4050. If the probe is ready, this marker has the status zero!
- Deflect the stylus manually.
- Check marker 4051. If the stylus is deflected, this marker changes to one!

Logic diagram



Note

You can also connect the test adapter between MC (X12) and probe cable and measure the corresponding voltages and signals.
--> see “Test Adapter, ID 375830-01” on page 29 – 456!

Ready signal	(X12/pin3)	+15 V --> Probe ready
Trigger signal negates	(X12/pin10)	+5 V --> Probe ready, stylus at rest
Trigger signal negates	(X12/pin10)	0 V --> Probe ready, stylus at rest

0 V (UN) are on pin 8 --> see “X12: Connection of the touch probe for workpiece measurement” on page 13 – 145

TS 640 with SE 640

> **Note**
>
> If available, you can also test a dimensionally identical probe and test the functions!

TS 440 with SE 540

25.4 Triggering Touch Probe for Tool Measurement

Possible causes of error

- Collision (probe damaged, etc.)
- Contamination
- Humidity
- Defective cable of probe
- Defective interface of probe on MC

Note

After a collission, check the accuracy of the touch probe. Ask the machine manufacturer or your HEIDENHAIN service agency!

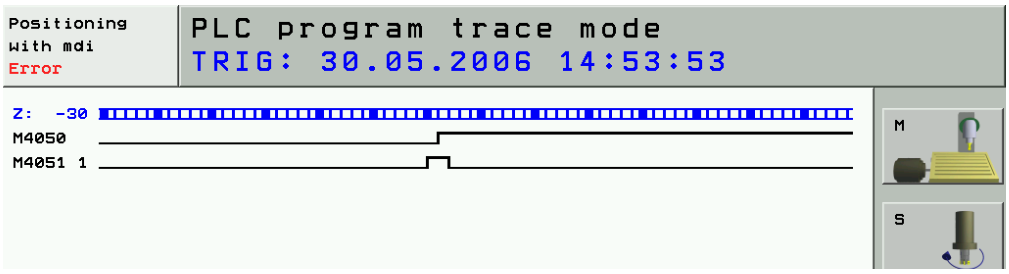
Functional test

DANGER

Ask the machine operator and regard the machine manufacturers's safety instructions (setup mode, etc.)!

- Call the logic diagram and enter the operands M4050 and M4051. Set the trigger to M4051.
  --> see “The LOGIC Diagram” on page 10 – 82.
- Begin recording.
- Set the feed-rate potentiometer to zero.
- Start the probing cycle with the TT (table touch probe).
- Check marker 4050. If the table touch probe is ready, this marker has the status zero!
- Deflect the table touch probe manually.
- Check marker 4051. If the table touch probe is deflected, this marker changes to one!
  The message ***Stylus deflected*** appears on the screen.

Logic diagram



Note

You can also connect the test adapter between MC (X13) and probe cable and measure the corresponding voltages and signals.
--> see “Test Adapter, ID 375830-01” on page 29 – 456!

Ready signal	(X13/pin1)	+15 V	--> Probe ready
Trigger signal negates	(X13/pin9)	+15 V	--> Probe ready, stylus at rest
Trigger signal negates	(X12/pin10)	0 V	--> Probe ready, stylus at rest

0 V (UN) are on pin2. --> see “X13: Connection of the touch probe for tool measurement” on page 13 – 147, X13

TT 130

☞ **Note**

If available, you can also test a dimensionally identical probe and test the functions!

26 Exchange of HEIDENHAIN Components

26.1 Important Information

DANGER

Observe the safety precautions to avoid damage to persons or machines.
--> See "Safety Precautions" on page 1 – 9.

Caution

Exchange only original HEIDENHAIN components!

Which items can be exchanged?

- **MC**
  (Main Computer = housing part with computer)
- **CC**
  (Controller Computer = housing part with controller)
- **Drive assembly**
  (Hard disk with adapter board and holding plate in the MC 422)
- **HDR**
  (Hard Disk Removable for the MC 422 B)
- **SIK**
  (System Identification Key)
- **Connected HEIDENHAIN units**
  (e.g., encoders, inverters, motors, handwheels, probes, etc.)
- **Cables and accessories**
- **Fan**
- **Buffer battery**

NC software update

An NC software update can only be performed by the **machine manufacturer** or after consultation with the machine manufacturer, as ...

- An export license is required for the NC software!
- The NC software must be released by the machine manufacturer!
- It might be necessary to adapt manufacturer cycles.
- It might be necessary to rename tables for cutting data, M function macros, tilting-axis geometry, etc.
- It might be necessary to install service packs for the NC software.
- Corresponding local user rights are required for dual-processor controls with Windows 2000.
- It might be necessary that new functions are activated.
- It might be necessary that new machine parameters have to be defined.
- The NC software update is different for single-processor and dual-processor controls and has become relatively complicated (partly due to the above reasons).

Note

The NC software update for the single-processor and dual-processor control is described in the Technical Manual iTNC 530 which is available to the machine manufacturer!

Goods subject to export permit

NC software for machine tools and machining centers, etc. is subject to **export permit!**

The NC software is located on the corresponding hard disk.

The following goods are automatically **subject to export permit:**

- **Drive assembly** (as spare part)
- **MC 422** (the drive assembly is a fixed component of the MC 422)
- **HDR** (Hard Disk Removable)

The **SIK** is subject to **export permit** as the software version of the control (standard of export version) is stored in the SIK.

Also **high-accuracy and high-resolution encoders** can be concerned.
Therefore, always exchange original units!

If there are conflicts, ask the machine manufacturer!

Caution

Also NC software that is available on your service laptop is subject to export permit!

Windows license

The corresponding Windows license is required for the dual-processor controls iTNC 530 with Windows 2000.

The Window license sticker is applied to:

- The housing of the MC 422
- The HDR for the MC 422B

Replacement units and spare parts

For replacement units and spare parts, ask your **machine manufacturer**!
This also applies for the NC software!

Please observe the following:

- **Exchange only original HEIDENHAIN components!**
- MC, HDR and drive assembly are normally equipped with the current NC software.
  If you want that the NC software of your defective control also runs on the replacement unit (e.g., loan and exchange unit, new control), please contact your machine manufacturer.
- Please send the dismounted defective unit in its **original packaging** to your machine manufacturer or your HEIDENHAIN agency.

Information on possible errors

If possible, write the assumed error or circumstances that caused the failure of the unit on a slip of paper and apply it on the outside of the unit.

Note

Replacement controls are delivered with a form that is to be filled in with information on the error of the defective control.

Repair

Many HEIDENHAIN units are not repaired at site but are exchanged or replaced.
These units are exclusively repaired by HEIDENHAIN specialists. The units are also tested and updated to the latest state-of-the-art.

ID numbers

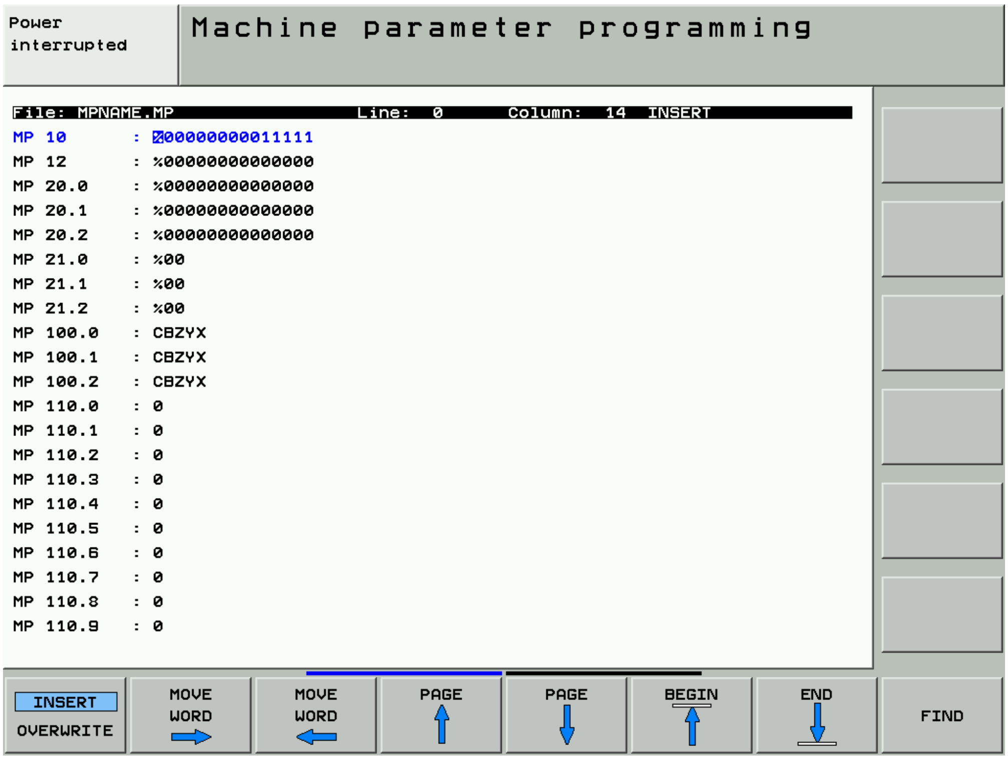
For a service order, always indicate the ID number of the corresponding HEIDENHAIN unit.

Note	Since the iTNC consists of two components (MC and CC) you can exchange each component individually or both together. When sending us both components, do not forget to state both ID numbers! The ID number of the MC can be found on the front panel or on the right side of the housing. The ID number of the CC can be found on the underside of the base plate of the housing.

MPNAME.MP

If the machine data are missing (data loss, replacement control, new control) the control opens the file MPNAME.MP:

- The file MPNAME.MP is generated by the HEIDENHAIN operating system.
- The axes cannot be traversed, and the control is set to programming station.
- There are no comments in MPNAME.MP.
- Each parameter of the MPNAME.MP could now be set by the machine manufacturer.
- In this case, the service engineer restores the backup of the machine data.
  --> See “Backup” on page 16 – 261.

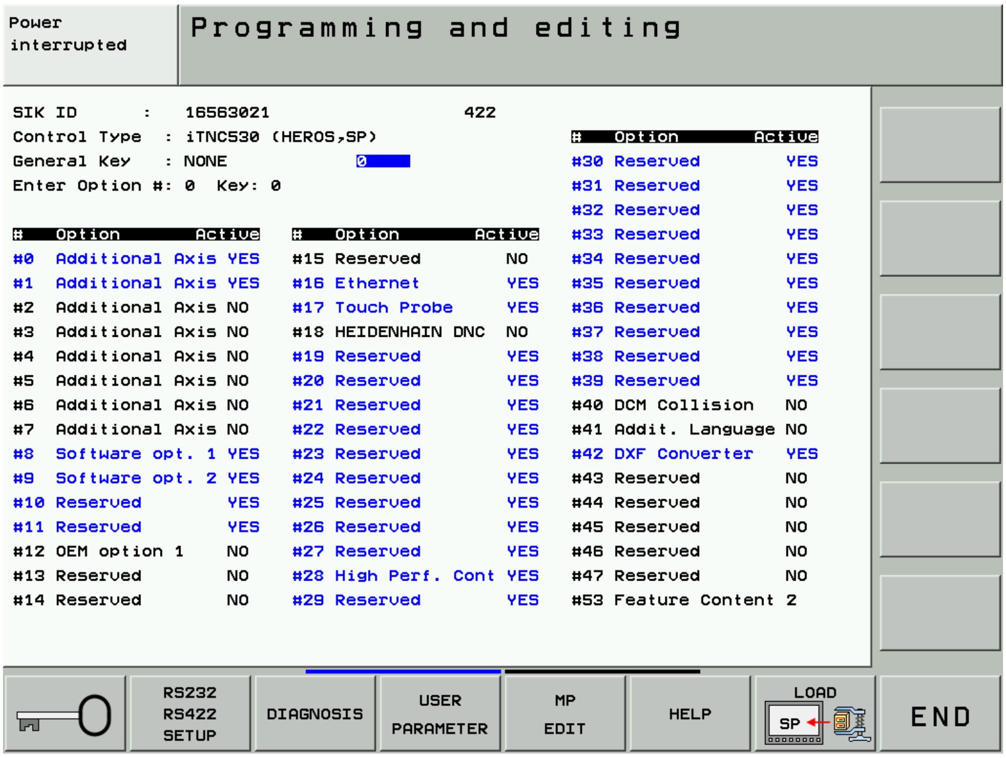


SIK

The SIK (= System Identification Key) ...

- Is located in a cap on the processor board of MC 422 (left figure)
- Is located in a slot on the HDR for the MC 422 B (right figure)
- Stores enabled control loops and software options (e.g, tilting operation, HSC milling, TCPM, cylindrical surface interpolation, etc.)
- Includes the Feature Content Level (NC software version)
- Includes the NC software license (standard or export version, with or without Windows 2000, with a various number of enabled control loops, etc.)
- Should service become necessary, it is inserted in the replacement control.
  --> All enabled options are still available!

The number is displayed on the screen after entering the ***SIK*** code. It can also be found on the SIK housing or on a sticker below the ID label of the MC.



Feature content level

When a new version is released as of NC software 340490-xx (with smarT.NC programming surface), the ranges for error fixes and expanded functions are managed separately.
When the NC software is updated to a new version, first only the included error fixes will be effective.
If the new features of this NC software version are also required, they can be enabled by a code number. –> Ask the machine manufacturer!

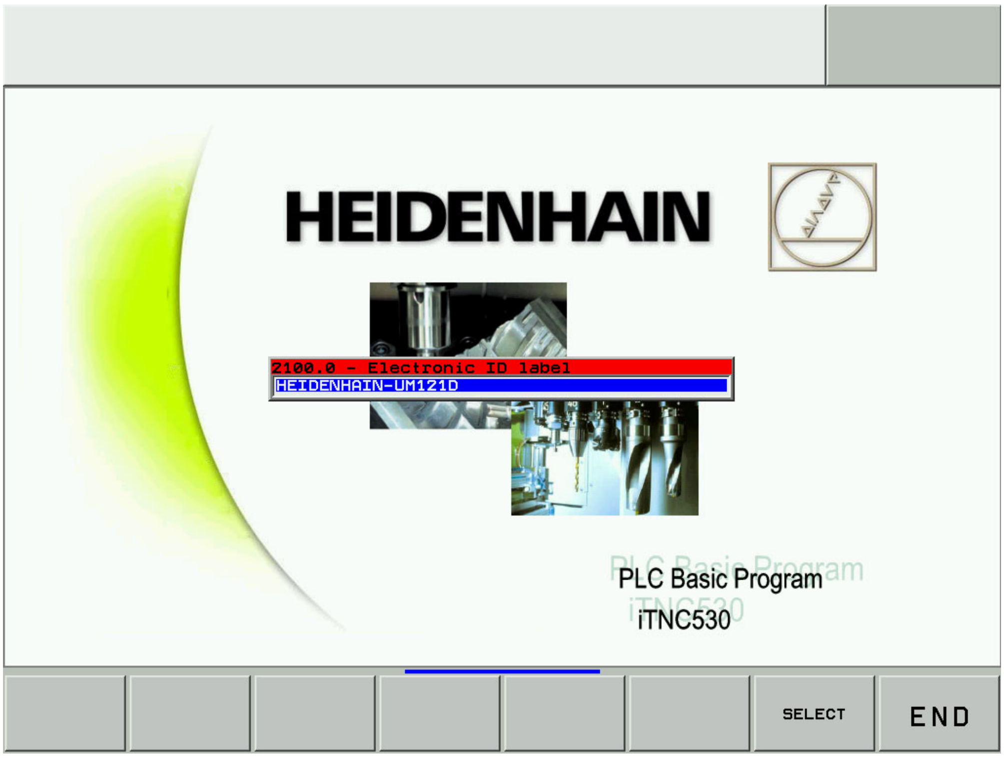
The ***Feature Content Level*** is defined by the machine manufacturer:

- The ***Feature Content Level*** is displayed in the window for entering the code number in the line "Feature Content Level". –> See “Display of System Information” on page 12 – 130.
- The displayed number cannot be higher than the NC software version (i.e., the highest possible ***Feature Content Level*** for NC software 340490-03 is 3).
- A higher ***Feature Content Level*** always includes the features of the previous versions.
- After entering the ***SIK*** code number you can see the ***Feature Content Level*** under option #53.

Electronic ID label

HEIDENHAIN inverter components of type D, as well as HEIDENHAIN synchronous motors with absolute encoders with EnDat interface, are equipped with an electronic ID label.
The product name, the ID number and the serial number are saved in this ID label. These devices are automatically detected when the control is started.

During every control restart, the control checks whether the connected units with electronic ID label match the entries in MP2100.x or MP2200.x.



Caution

If a unit with electronic ID label responds with the corresponding message window when the control is restarted …

- The active MP list does not correspond to the connected unit
  (e.g., if a backup was restored before that does not fit exactly to the machine).
- The connected unit does not correspond to the active MP list
  (e.g., the mounted replacement unit is not exactly the same).
- You have exchanged the rotary encoder inputs or PWM outputs for troubleshooting, without deactivating the evaluation of the electronic ID lables before.

The evaluation of the electronic ID labels should be deactivated via MP7690 before exchanging the rotary encoder inputs (motor encoder) of PWM outputs (interface to the power modules).

MP7690	**Evaluation of the electronic ID labels**
Input:	%xx
	Bit 0 – HEIDENHAIN power modules 0: Active 1: Inactive Bit 1 – HEIDENHAIN synchronous motors 0: Active 1: Inactive

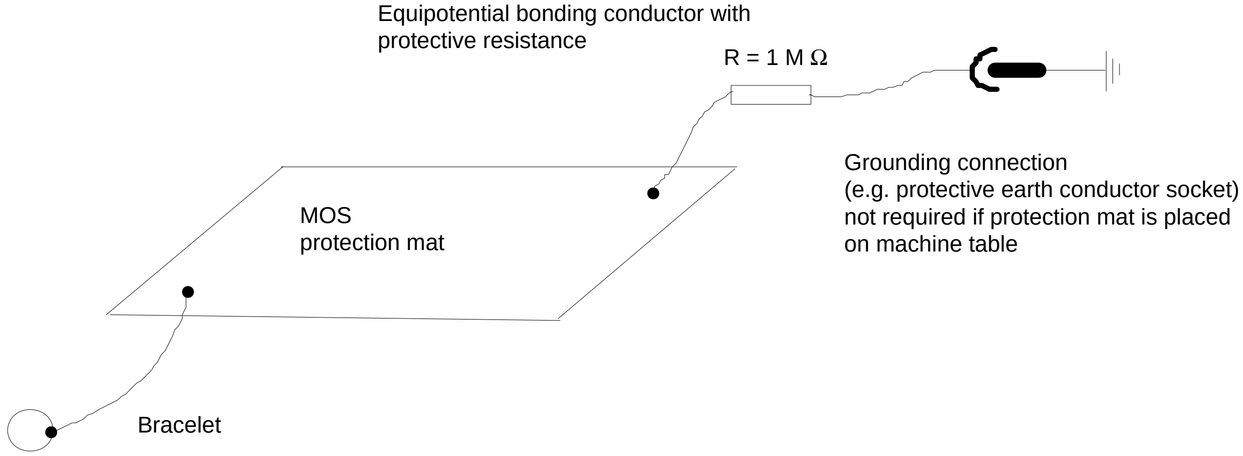
ESD protection

Caution

When exchanging HEIDENHAIN components, you might come into contact with electronic components.

These ESD-sensitive components could also come into contact with a statically loaded object (tool, tool table, packaging, etc.).

Therefore, when exchanging MC, CC, HDR, drive assembly and all units with openly accessible electronic components, observe the ESD precautions!



26.2 Exchanging the MC 422

Caution

The MC 422 may only be exchanged in consultation with the machine manufacturer or by the machine manufacturer!

MCs received for exchange and new MCs are normally equipped with the most recent NC software.
This latest NC software must be released by the machine manufacturer!
Moreover, you need to know from the machine manufacturer whether there may be conflicts related to fixed cycles, cutting data tables, etc. !

If the latest NC software has not been released by the machine manufacturer or if the NC software version of your defective control should also run on the replacement control, it must be loaded. Normally, you need support by the machine manufacturer.

Note: Dual-processor MCs have already loaded Windows 2000.

Preparing the machine

If still possible …

- Move machine to home position (axed, tool changer, tilting head, etc.). Ask the machine operator!
- Press EMERGENCY-STOP.

Backup of non-volatile PLC markers and words

- Back up the condition of non-volatile PLC markers and words from RAM to the hard disk. --> See "Nonvolatile PLC Markers and Words" on page 10 – 93.

Data backup

- Back up all control data on hard disk. Select the icon ***Scan everything.*** --> See "Backup" on page 16 – 261.

Note

If an external archive for the TNC data is already available, you need not to back up the TNC partition. Thus you save time!
Contact the customer!
In this case, select the icon *Scan system and machine files*.

Note

If you cannot back up data on the defective MC 422 anymore, you must go back to available archives (PLC data, TNC data) to back up the data on the new control.
If required, you may obtain the machine data also from the machine manufacturer.

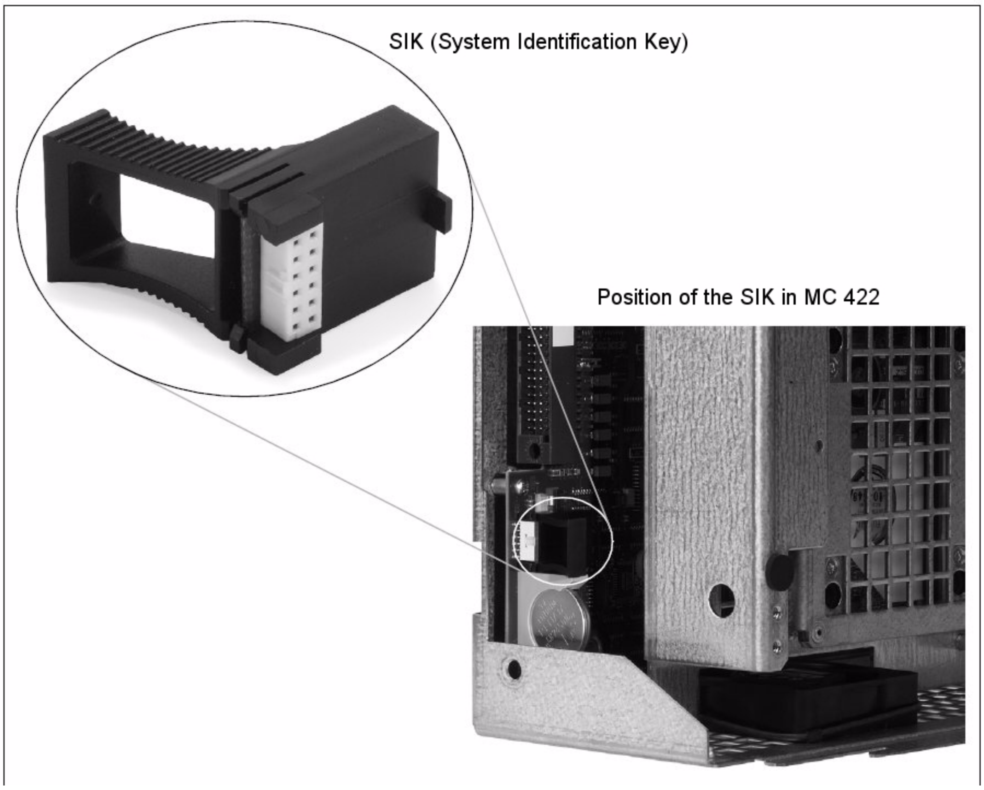
Removing the defective MC 422

- Switch off main switch of the machine and take precautions against resetting.
  --> See “Safety Precautions” on page 1 – 9!
- Label and remove all of the connections on the MC.
- Loosen two torx screws at the top and two at the bottom of the housing (do not screw off completely).
- Remove the defective MC by drawing it towards you by the handles until the MC disengages from the CC.
  Now you can pull out the MC at a slight angle to the right.

> **Caution**
>
> Observe the ESD precautions. --> See “Important Information” on page 26 – 411!

SIK

- Remove the SIK from the defective MC 422 and insert it into the new MC 422.

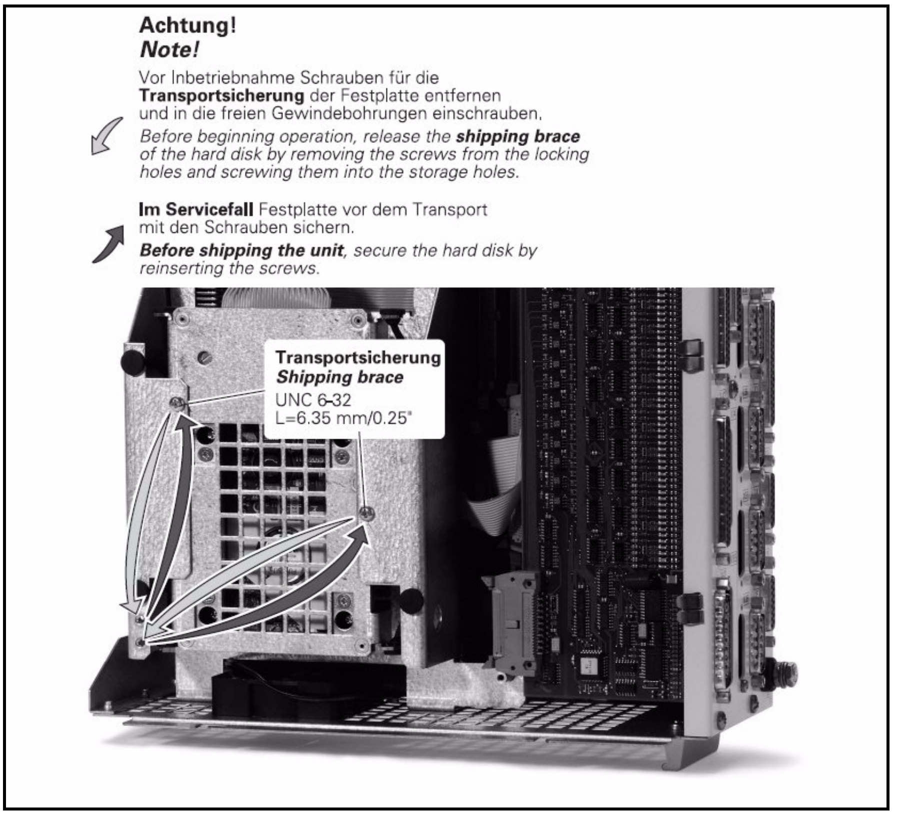


> **Caution**
>
> - The SIK (System Identification Key) will remain with the machine.
>   It must be inserted into the new or replacement MC; i.e. all enabled options are still available.
> - Only defective SIKs are exchanged.
>   If options were enabled on the defective SIK, you will receive the code numbers to enable these on your new SIK after giving us the number of your defective SIK.
>   The number is displayed on the screen after entering the ***SIK*** code. It can also be found on the SIK housing or on a sticker below the ID label of the MC.
>   The defective SIK has to be returned.

- Remove the label with the SIK number (over the ID plate) from the MC and apply it on the new MC 422 (over the ID plate).

- **Secure the hard disk for the transport!**
  (See sticker on the housing of the MC 422)

Sticker on the housing of the MC 422, transit support of the hard disk



> **Caution**
>
> Observe the ESD precautions. --> See "Important Information" on page 26 – 411!

Integrating the new MC 422

- The original SIK must be inserted in the new MC 422 and the SIK sticker must be applied over the ID label
- **Before mounting the new MC 422, remove the transit support of the hard disk**.
  --> See sticker on the housing of the MC 422. The hard disk must oscillate freely!
- Insert the new MC 422 and screw it into place.
- If required, remove the protective caps from the MC connectors.
- Re-establish and screw into place all the connections.

> **Caution**
>
> Do not forget the grounding screw!
> Do not confuse any of the connectors!

- Switch on main switch of machine.

Adapting the MPNAME.MP

Only necessary if you want to transmit backup files via Ethernet interface and the NC software version of the control is smaller than 340420-08!

If the file MPNAME.MP is now displayed on the screen:

- Press END to start the control again (with machine parameter list MPNAME.MP created by the operating system, the control is set to programming station).

Note

If entries for additional control-loop indexes are now required in the machine parameter list (error message ***MP: not defined)*** or there seem to be too many control-loop indexes (error message ***MP: incorrect number),*** then ...

- Delete MPNAME.MP --> An adapted MPNAME.MP will be generated automatically.
- Press END. --> The control boots and generates the *Power interrupt* message.

Background:
The MP list of the MC 422 is created corresponding to the hardware configuration. If the MC 422 is connected to a CC with 6 control loops, the number of indexes of the control-loop parameters is set correspondingly. If the MC 422 is connected to a CC with 6 control loops, the number of indexes of the control-loop parameters is set correspondingly. As all MC 422 are tested on a CC before they are delivered, the MPNAME.MP is configured correspondingly. It is not predictable, to which CC the MC 422 is connected by the customer. It may thus happen that the MPNAME.MP of your CC has too many or insufficient control-loop indexes. But this is not a problem! By deleting the MPNAME.MP, the iTNC 530 generates an MPNAME.MP that correlates to your CC.

Note

As of NC software version 340420-08, the code number NET 123 for setting up the Ethernet configuration is also accepted with open MP list.

Setting up the data interface

- Either make the settings for the Ethernet transmission on the control.
  --> See “Via Ethernet” on page 16 – 247.
  Subsequently, protect the IP4.N00 file to make sure it is not overwritten!
- Or define the settings for the RS 232 interface.
  --> See “Via Serial Interface RS 232/V.24 or RS 422/V.11” on page 16 – 256

Defining the NC software version

- Control the active NC software version.
  If you need another software version, it must be loaded now.
  --> Please contact your machine manufacturer!

Restoring the data

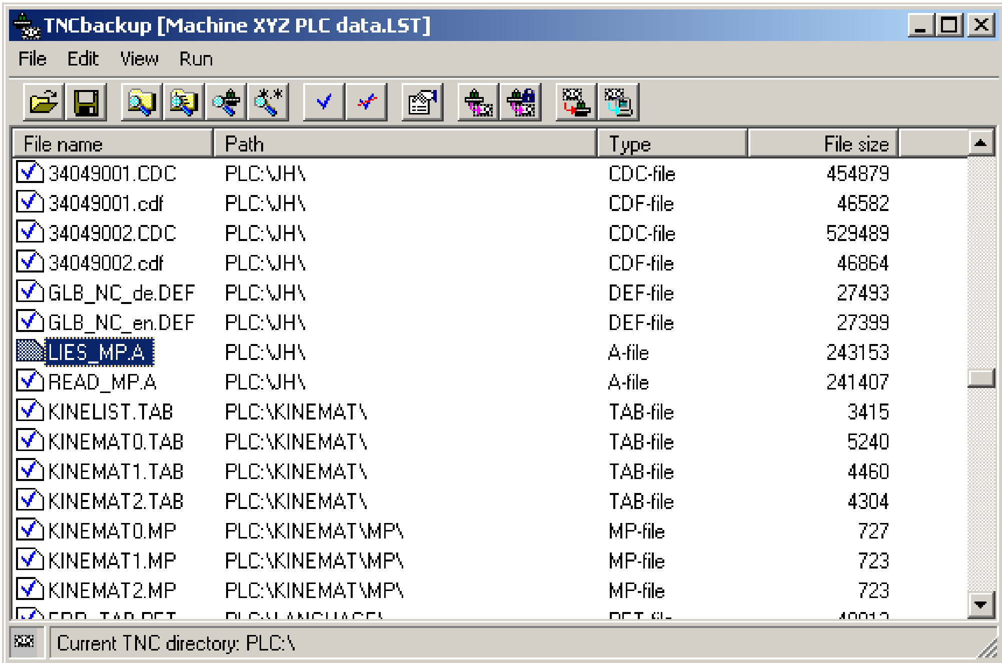
- Load the backup on the new MC 422. --> See “Restore” on page 16 – 266.

Note

Delete the blue check mark for LIES_MP.A in the LST file.

Background:
To each NC software version belongs a LIES_MP.A file which includes the comments on the current machine parameters (to be found under PLC:\JH\LIES_MP.A). As the replacement control is normally supplied with the latest NC software version, the LIES_MP.A in your backup file possibly belongs to an older NC software version. If you have deleted the check mark in your LST file, the current LIES_MP.A is not overwritten by the old LIES_MP.A.

It is not recommended to protect the LIES_MP.A file on the control as otherwise the file cannot be updated during an NC software update!



Updating the machine parameter list

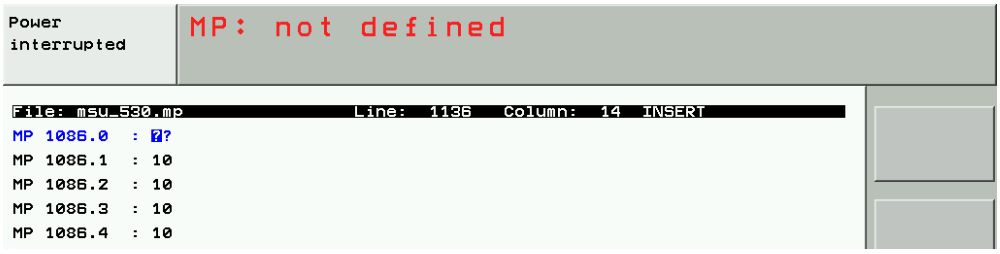
If the control opens the machine parameter list after you have restored the back up, new machine parameters are added with the current NC software of the replacement control or older MPs are removed.

Note

In this case the following tip for an NC software update might be interesting:
Copy the original MP file (e.g., MachineXYZ.MP). As a name for the copy select the corresponding NC software version (e.g., 340422-11).
Then make the changes in the original MP file. Enter the NC software version in the first line of the machine parameter list(e.g., 340422-12) as well as the date of the last change.
After the changes, the original MP file matches the current NC software version.
The backed up MP file matches the older NC software version.
Advantage:
If you want to install another (older) NC software version for servicing, there also exists the appropriate MP list.

- Press the END key.
  The following messages may be generated:

Error message MP: Not defined

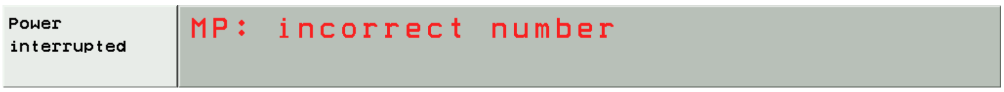


▶ Enter a value for the new machine parameter.

Note

Comments on the new MPs can be found in the text file *LIES_MP.A* or *READ_MP.A* in path PLC:\JH\ ...
Contact the machine manufacturer for more information!
If required you can add comments on the function of the new parameters in the MP list.

Error Message MP: Incorrect number



▶ The parameter is not required. --> Delete this MP or mark the parameter as comment so it remains in the machine parameter list.

END

▶ After each change, try to activate the machine parameter list with END.
If the MP list is complete, the iTNC 530 makes a restart.

Reset non-volatile PLC markers and words

▶ Write the non-volatile PLC markers and words from the hard disk into the RAM before confirming the power interrupt message.
--> See “Nonvolatile PLC Markers and Words” on page 10 – 93.

Restoring the default settings on the machine

On machines with analog axes, an offset fine adjustment should be performed with the HEIDENHAIN code number after the exchange of the control.
--> See “Adjusting the Electrical Offset (Drift Adjustment)” on page 20 – 346.

Check the machine functions.
If necessary, you may ...

- Recalibrate the touch probes
- Initialize the swivel head again
- Initialize the swivel head again

Information can be provided by your machine tool builder!

Check the date and time and set these settings again, if necessary.
--> See “Setting the System Time” on page 15 – 237.

Creating machine backup

If changes were made to the machine or control (e.g., new machine parameters have been added), you should create a current machine backup.
--> See “Backup” on page 16 – 261!

Returning the defective MC 422

> **Caution**
>
> **Before shipping the MC 422, the hard disk must be secured for the transport,!**

- Replacement controls are delivered with a form that is to be filled in with information on the error of the defective control.
  Please fill in this form and attach it to the housing of the MC 422.
- Pack the defective MC 422 in the original packaging of the new MC 422.
- Return the defective MC 422 to the machine manufacturer or to your HEIDENHAIN service agency.

26.3 Removing the Drive Assembly

Caution

The drive assembly may only be exchanged in consultation with the machine manufacturer or by the machine manufacturer!

Drives that you receive in exchange and new drives are already partitioned and formatted. The HeROS operating system and the NC software are installed (the hard disks are normally equipped with the current NC software).
This latest NC software must be released by the machine manufacturer!
Moreover, you need to know from the machine manufacturer whether there may be conflicts related to fixed cycles, cutting data tables, etc. !

If the latest NC software has not been released by the machine manufacturer or if the NC software version of your defective control should also run on the replacement control, it must be loaded. Normally, you need support by the machine manufacturer.

Note: Dual-processor drives have loaded Windows 2000.

Preparing the machine

If still possible:

- Move machine to home position (axed, tool changer, tilting head, etc.). Ask the machine operator!
- Press EMERGENCY-STOP.

If possible ...

Backup the non-volatile PLC markers and words.

It may be assumed that you cannot write data to the defective hard disk any more.
If this is still possible:

- Back up the condition of non-volatile PLC markers and words from RAM to the hard disk. --> See “Nonvolatile PLC Markers and Words” on page 10 – 93.

Data Backup

It may be assumed that you cannot write data to the defective hard disk any more. To restore data on the new hard disk later, you must go back to available archives (PLC data, TNC data; if required, the machine manufacturer can also provide you with PLC or machine data.
If this is still possible:

- Back up all control data on hard disk. Select the icon ***Scan everything*** --> See “Backup” on page 16 – 261.

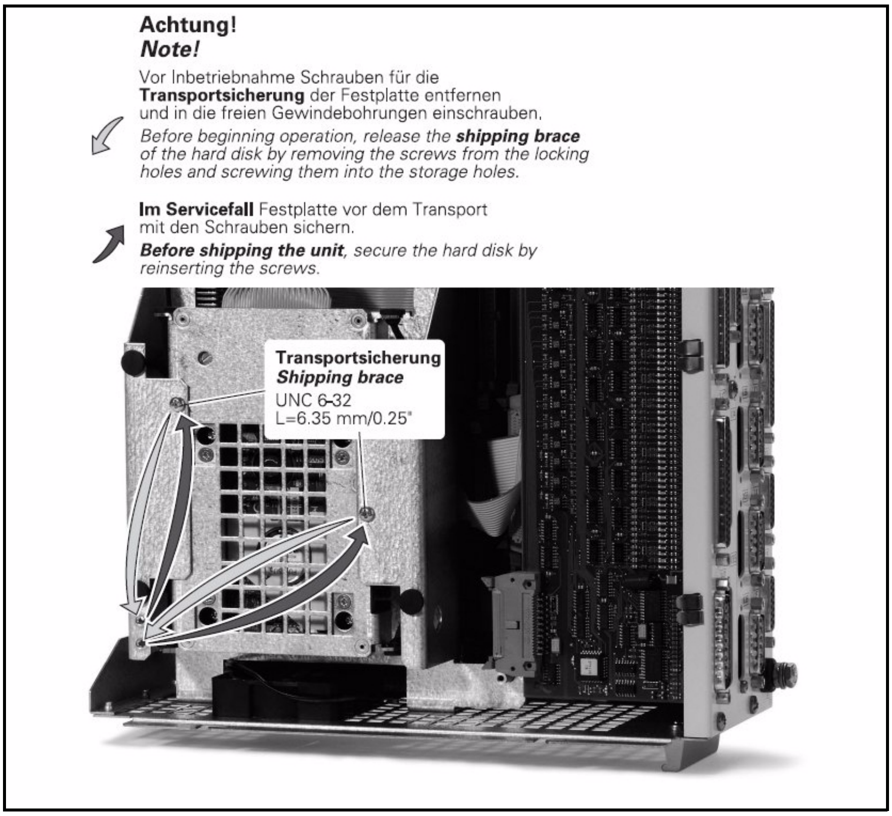
Note

If an external archive for the TNC data is already available, you need not to back up the TNC partition. Thus you save time!
Contact the customer!
In this case, select the icon *Scan system and machine files*.

Removing the defective drive assembly

- Switch off main switch of the machine and take precautions against resetting. --> See “Safety Precautions” on page 1 – 9!
- Dismount the MC. --> See “Exchanging the MC 422” on page 26 – 418.
- Dismount the hard disk together with the holding plate (drive assembly)
- **Secure the hard disk for the transport!**
(See sticker on the housing of the MC 422)

Sticker on the housing of the MC 422, transit support of the hard disk



Caution

Observe the ESD precautions. --> See “Important Information” on page 26 – 411!

Integrating the new drive assembly

- **Before mounting the new hard disk, remove the transit support.** --> See sticker on the housing of the MC 422. The hard disk must oscillate freely!
- Insert the new drive assembly in the MC 422.

Note

The new iTNC hard disk is partioned and formatted.
The HeROS operating system and the current NC software are installed (for dual-processor controls also Windows 2000 is available on hard disk).
The control boots with this software.
If you need another software version, please contact your machine manufacturer!

- Connect MC 422 to the CC and screw into place.
- Re-establish and screw into place all the connections.

Caution

Do not forget the grounding screw!
Do not confuse any of the connectors!

- Switch on main switch of machine.

Adapting the MPNAME.MP

Only necessary if you want to transmit backup files via Ethernet interface and the NC software version of the control is smaller than 340420-08!

If the file MPNAME.MP is now displayed on the screen:

- Press END to start the control again (with machine parameter list MPNAME.MP created by the operating system, the control is set to programming station).

Note

If entries for additional control-loop indexes are now required in the machine parameter list (error message ***MP: not defined)*** or there seem to be too many control-loop indexes (error message ***MP: incorrect number),*** then ...

- Delete MPNAME.MP. --> An adapted MPNAME.MP will be generated automatically.
- Press END. --> The control boots and generates the *Power interrupt* message.

Background:
The MP list on the new hard disk has a basic configuration of the control-loop indexes. The number of control loops of the CC used by the customer may deviate from this basic configuration. It may thus happen that the MPNAME.MP of your CC has too many or insufficient control-loop indexes. But this is not a problem! By deleting the MPNAME.MP, the iTNC 530 generates an MPNAME.MP correlates to your CC.

Note

As of NC software version 340420-08, the code number NET 123 for setting up the Ethernet configuration is also accepted with open MP list.

Setting up the data interface

- Either make the settings for the Ethernet transmission on the control.
--> See “Via Ethernet” on page 16 – 247.
Subsequently, protect the IP4.N00 file to make sure it is not overwritten!
- Or define the settings for the RS 232 interface.
--> See “Via Serial Interface RS 232/V.24 or RS 422/V.11” on page 16 – 256

Defining the NC software version

- Control the active NC software version.
If you need another software version, it must be loaded now. --> Please contact your machine manufacturer!

Restoring the data As you could probably not store data from the defective hard disk, you must now go back to available archives (PLC-data, TNC-data) to restore data on the new hard disk; if required, the machine manufacturer can also provide you with PLC or machine data.

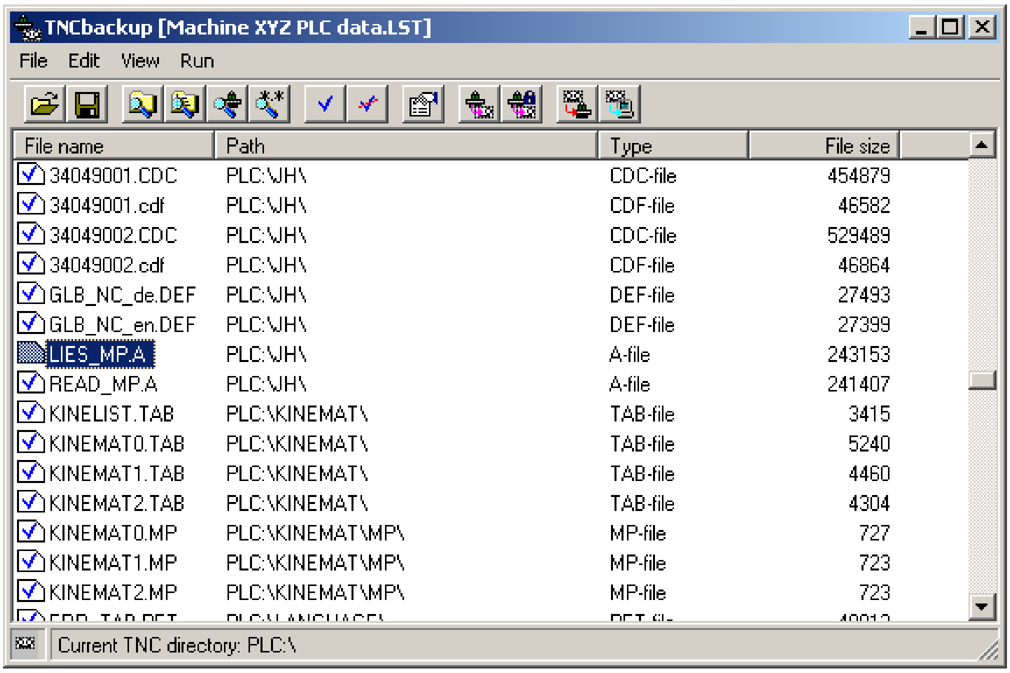
- Load the backup on the new hard disk of the MC 422. --> See “Restore” on page 16 – 266.

Note

Delete the blue check mark for LIES_MP.A in the LST file.

Background:
To each NC software version belongs a LIES_MP.A file which includes the comments on the current machine parameters (to be found under PLC:\JH\LIES_MP.A). As the replacement control is normally supplied with the latest NC software version, the LIES_MP.A in your backup file possibly belongs to an older NC software version. If you have deleted the check mark in your LST file, the new LIES_MP.A is not overwritten by the old LIES_MP.A.

It is not recommended to protect the LIES_MP.A file on the control as otherwise the file cannot be updated during an NC software update!



Updating the machine parameter list

If the control opens the machine parameter list after you have restored the back up, new machine parameters are added with the current NC software of the replacement hard disk or older MPs are removed.

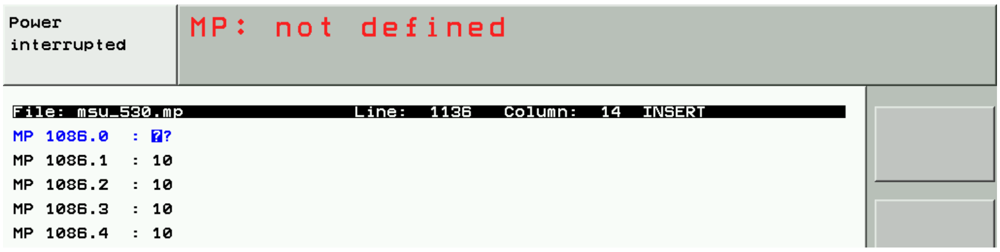
Note

In this case the following tip for an NC software update might be interesting:
Copy the original MP file (e.g., MachineXYZ.MP). As a name for the copy select the corresponding NC software version (e.g., 340422-11).
Then make the changes in the original MP file. Enter the NC software version in the first line of the machine parameter list(e.g., 340422-12) as well as the date of the last change.
After the changes, the original MP file matches the current NC software version.
The backed up MP file matches the older NC software version.
Advantage:
If you want to install another (older) NC software version for servicing, there also exists the appropriate MP list.

END

- Press the END key.
  The following messages may be generated:

Error message MP: Not defined

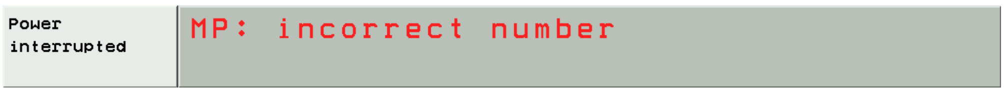


- Enter a value for the new machine parameter.

Note

Comments on the new MPs can be found in the text file *LIES_MP.A* or *READ_MP.A* in path PLC:\JH\ ...
Contact the machine manufacturer for more information!
If required you can add comments on the function of the new parameters in the MP list.

Error message MP: Incorrect number



If possible ...

If you could still store the non-volatile PLC markers and words from RAM to the defective hard disk and subsequently create a backup :

- Write the non-volatile PLC markers and words from the hard disk into the RAM before confirming the power interrupt message.
  --> See “Nonvolatile PLC Markers and Words” on page 10 – 93.

Restoring the default settings on the machine

On machines with analog axes, an offset fine adjustment should be performed with the HEIDENHAIN code number after the exchange of the control.
--> See “Adjusting the Electrical Offset (Drift Adjustment)” on page 20 – 346.

Check the machine functions.
Depending on the machine features you have to ...

- Recalibrate the touch probes
- Initialize the swivel head again
- Initialize the swivel head again

Information can be provided by your machine tool builder!

Check the date and time and set these settings again, if necessary. --> See “Setting the System Time” on page 15 – 237.

Creating machine backup

If changes were made to the machine or control (e.g., new machine parameters have been added), you should create a current machine backup.
--> See “Backup” on page 16 – 261!

Returning the drive assembly MC 422

> **Caution**
>
> **The hard disk must be secured for the transport!**

- Apply a note with the error description on the sheet metal of the drive assembly.
- Pack the defective drive assembly in the original packaging of the new drive assembly.
- Return the defective drive assembly to the machine manufacturer or to your HEIDENHAIN service agency.

26.4 Exchanging the MC 422 B or the MC 420

Preparing the machine

If still possible …

- Move machine to home position (axed, tool changer, tilting head, etc.). Ask the machine operator!
- Press EMERGENCY-STOP.

Backup of non-volatile PLC markers and words

- Back up the condition of non-volatile PLC markers and words from RAM to the HDR. --> See “Nonvolatile PLC Markers and Words” on page 10 – 93.

Removing the defective MC 422 B

- Switch off main switch of the machine and take precautions against resetting. --> See “Safety Precautions” on page 1 – 9!
- Label and remove all of the connections on the MC.
- Loosen two torx screws at the top and two at the bottom of the housing (do not screw off completely).
- Remove the defective MC by drawing it towards you by the handles until the MC disengages from the CC.
  Now you can pull out the MC at a slight angle to the right.

> **Caution**
>
> Observe the ESD precautions. --> See “Important Information” on page 26 – 411!

- Remove the HDR (hard disk removable). -->See “Exchanging the HDR” on page 26 – 433.
  The SIK to the machine is located in a plug-in slot in the HDR housing.

> **Caution**
>
> If you want to send us the HDR for investigation or repair, it must be secured for the transport and packed separately. --> See “Exchanging the HDR” on page 26 – 433!
> Remove the SIK before (it remains "with the machine")!
> If possible, use the original packaging for the HDR.
> **Do not transport the HDR with the MC 42x (B) after you have installed the HDR!**

Integrating the new MC 422 B

- Insert the SIK into the new MC 422 B and lock it.
  --> See “Exchanging the HDR” on page 26 – 433.
- Insert the new MC 422 B and screw it into place.
- If required, remove the protective caps from the MC connectors.
- Re-establish and screw into place all the connections.

> **Caution**
>
> Do not forget the grounding screw!
> Do not confuse any of the connectors!

- Switch on main switch of machine.

Reset non-volatile PLC markers and words

- Write the non-volatile PLC markers and words from the hard disk into the RAM before confirming the power interrupt message.
  --> See “Nonvolatile PLC Markers and Words” on page 10 – 93.

Restoring the default settings on the machine

On machines with analog axes, an offset fine adjustment should be performed with the HEIDENHAIN code number after the exchange of the control.
--> See "Adjusting the Electrical Offset (Drift Adjustment)" on page 20 – 346.

Check the machine functions.
If necessary, you may ...

- Recalibrate the touch probes
- Initialize the swivel head again
- Initialize the swivel head again

Information can be provided by your machine tool builder!

Check the date and time and set these settings again, if necessary. --> See "Setting the System Time" on page 15 – 237.

Returning the defective MC 422 B

- Replacement controls are delivered with a form that is to be filled in with information on the error of the defective control.
  Please fill in this form and attach it to the housing of the MC 422 B.
- Pack the defective MC 422 B in the original packaging of the new MC 422 B.
- Return the defective MC 422 B to the machine manufacturer or to your HEIDENHAIN service agency.

26.5 Exchanging the HDR

Caution

The drive assembly may only be exchanged in consultation with the machine manufacturer or by the machine manufacturer!

Drives that you receive in exchange and new HDRs are already partitioned and formatted. The HeROS operating system and the NC software are installed (the HDRs are normally equipped with the current NC software).
This latest NC software must be released by the machine manufacturer!
Moreover, you need to know from the machine manufacturer whether there may be conflicts related to fixed cycles, cutting data tables, etc. !

If the latest NC software has not been released by the machine manufacturer or if the NC software version of your defective HDR should also run on the replacement HDR, it must be loaded. Normally, you need support by the machine manufacturer.

Note.: Dual-processor HDR have loaded Windows 2000.

Preparing the machine

If still possible:

- Move machine to home position (axed, tool changer, tilting head, etc.).
  Ask the machine operator!
- Press EMERGENCY-STOP.

If possible ...

Backup the non-volatile PLC markers and words.

It may be assumed that you cannot write data to the defective HDR any more.
If this is still possible:

- Back up the condition of non-volatile PLC markers and words from RAM to the HDR.
  --> See “Nonvolatile PLC Markers and Words” on page 10 – 93.

Data Backup

It may be assumed that you cannot write data to the defective HDR any more. To restore data on the new HDR later, you must go back to available archives (PLC data, TNC data; if required, the machine manufacturer can also provide you with PLC or machine data).
If this is still possible:

- Back up all control data on the HDR. Select the icon ***Scan everything.***
  --> See “Backup” on page 16 – 261.

Note

If an external archive for the TNC data is already available, you need not to back up the TNC partition. Thus you save time!
Contact the customer!
In this case, select the icon *Scan system and machine files*.

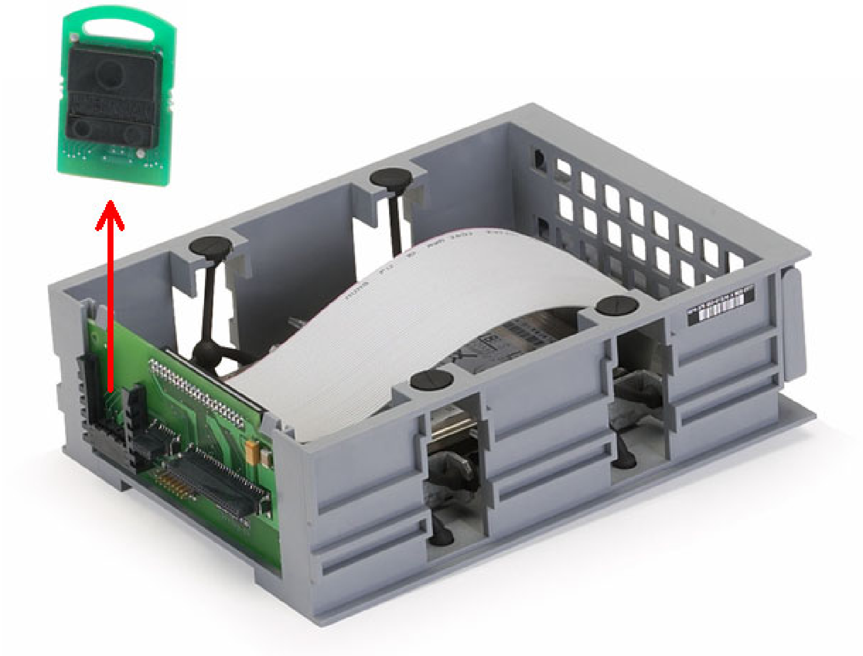
Removing the defective HDR

- Switch off the main switch of the machine and take precautions against resetting.
  --> See "Safety Precautions" on page 1 – 9!
- Press the handle of the HDR upwards to loosen the locking.

- Press the locking hook upwards and remove the HDR.

SIK

▶ Remove the SIK from the defective HDR and insert it into the new HDR.



Caution

- The SIK (System Identification Key) will remain with the machine.
  It must be inserted into the new or replacement HDR; i.e. all enabled options are still available.
- Only defective SIKs are exchanged.
  If options were enabled on the defective SIK, you will receive the code numbers to enable these on your new SIK after giving us the number of your defective SIK.
  The number is displayed on the screen after entering the ***SIK*** code. It can also be found on the SIK housing or on a sticker below the ID label of the MC.
  The defective SIK has to be returned.

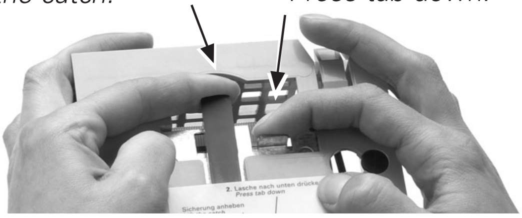
▶ **Secure the hard disk for the transport!**
(The hard disk is mounted to a steel plate that is inserted into a plastics holder.
--> See sticker on the HDR.)

Sticker on the HDR, shipping brace

Festplatte entriegeln · ***Unlocking the hard disk***

1. Sicherung anheben.
Lift the catch.

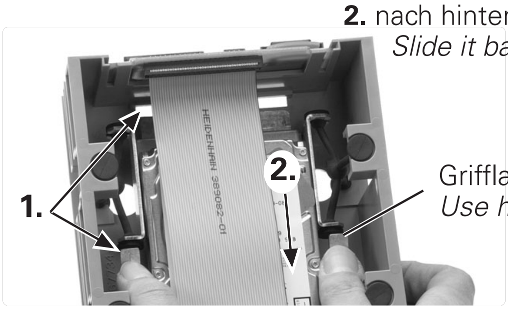
2. Lasche nach hinten drücken.
Press tab down.



Festplatte verriegeln · ***Locking the hard disk***

1. hineindrücken, nach vorne schieben. (Click)
Press hard disk down, slide it forwards. (click)

2. nach hinten schieben. (Click)
Slide it backwards. (click)



Grifflaschen benützen.
Use holding tabs.

Caution

Observe the ESD precautions. --> See "Important Information" on page 26 – 411!

Installing the new HDR

- The original SIK must be inserted into the new HDR.
- Loosen the shipping brace. --> See sticker on the HDR.
- Insert lock new HDR (please also press the handle down).

Note

The new HDR for the iTNC hard disk is partioned and formatted.
The HeROS operating system and the current NC software are installed (for dual-processor controls also Windows 2000 is available on hard disk).
The control boots with this software.
If you need another version, please contact your machine manufacturer!

- Switch on the machine.

Adapting the MPNAME.MP

Only necessary if you want to transmit backup files via Ethernet interface and the NC software version of the control is smaller than 340420-08!

If the file MPNAME.MP is now displayed on the screen:

- Press END to start the control again (with machine parameter list MPNAME.MP created by the operating system, the control is set to programming station).

Note

If entries for additional control-loop indexes are now required in the machine parameter list (error message ***MP: not defined)*** or there seem to be too many control-loop indexes (error message ***MP: incorrect number),*** then ...

- Delete MPNAME.MP. --> An adapted MPNAME.MP will be generated automatically.
- Press END. --> The control boots and generates the *Power interrupt* message.

Background:
The MP list on the new HDR has a basic configuration of the control-loop indexes. The number of control loops of the CC used by the customer may deviate from this basic configuration. It may thus happen that the MPNAME.MP of your CC has too many or insufficient control-loop indexes. But this is not a problem! By deleting the MPNAME.MP, the iTNC 530 generates an MPNAME.MP correlates to your CC.

Note

As of NC software version 340420-08, the code number NET 123 for setting up the Ethernet configuration is also accepted with open MP list.

Setting up the data interface

- Either make the settings for the Ethernet transmission on the control.
--> See "Via Ethernet" on page 16 – 247.
Subsequently, protect the IP4.N00 file to make sure it is not overwritten!
- Or define the settings for the RS 232 interface.
--> See "Via Serial Interface RS 232/V.24 or RS 422/V.11" on page 16 – 256

Defining the NC software version

- Control the active NC software version.
If you need another software version, it must be loaded now. --> Please contact your machine manufacturer!

Restoring the data

As you could probably not store data from the defective HDR, you must now go back to available archives (PLC-data, TNC-data) to restore data on the new HDR; if required, the machine manufacturer can also provide you with PLC or machine data.

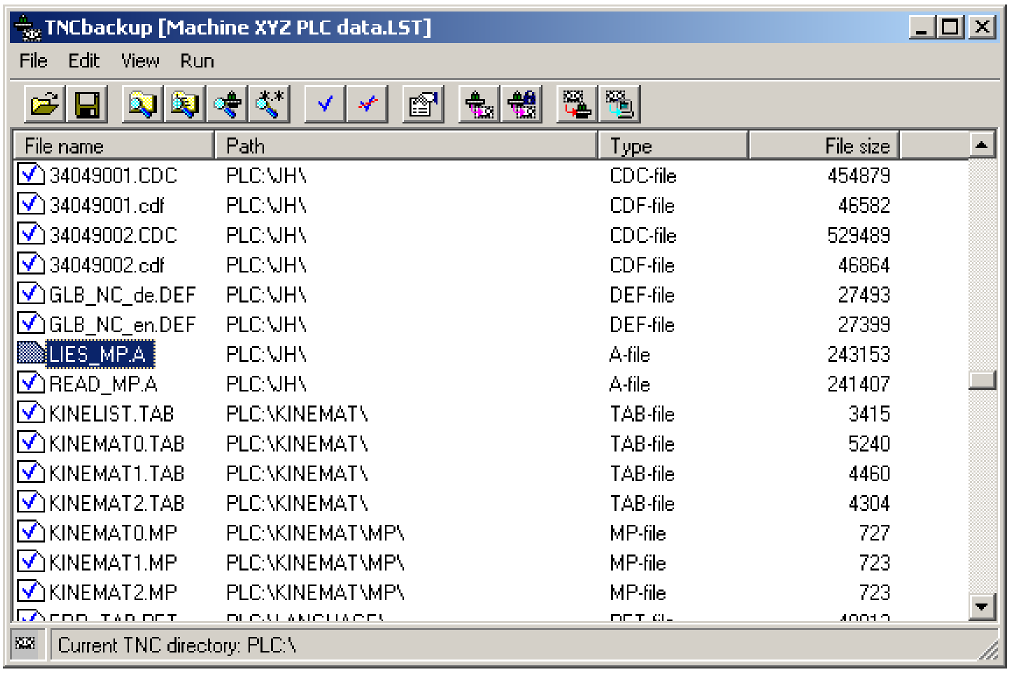
- Load the backup on the new HDR. --> See "Restore" on page 16 – 266.

Note

Delete the blue check mark for LIES_MP.A in the LST file.

Background:
To each NC software version belongs a LIES_MP.A file which includes the comments on the current machine parameters (to be found under PLC:\JH\LIES_MP.A). As the replacement control is normally supplied with the latest NC software version, the LIES_MP.A in your backup file possibly belongs to an older NC software version. If you have deleted the check mark in your LST file, the new LIES_MP.A is not overwritten by the old LIES_MP.A.

It is not recommended to protect the LIES_MP.A file on the control as otherwise the file cannot be updated during an NC software update!



Updating the machine parameter list

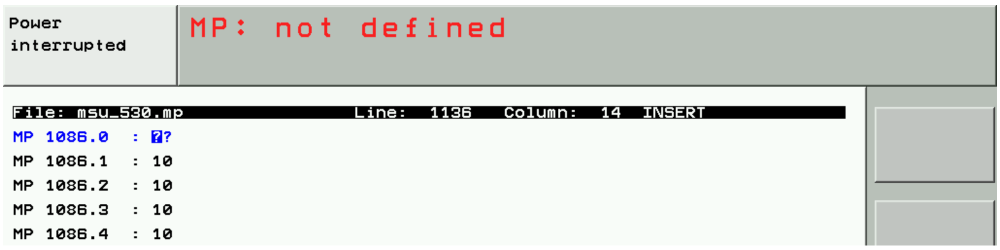
If the control opens the machine parameter list after you have restored the back up, new machine parameters are added with the current NC software of the replacement HDR or older MPs are removed.

Note

In this case the following tip for an NC software update might be interesting:
Copy the original MP file (e.g., MachineXYZ.MP). As a name for the copy select the corresponding NC software version (e.g., 340422-11).
Then make the changes in the original MP file. Enter the NC software version in the first line of the machine parameter list(e.g., 340422-12) as well as the date of the last change.
After the changes, the original MP file matches the current NC software version.
The backed up MP file matches the older NC software version.
Advantage:
If you want to install another (older) NC software version for servicing, there also exists the appropriate MP list.

- Press the END key.
  The following messages may be generated:

Error Message MP: Not defined

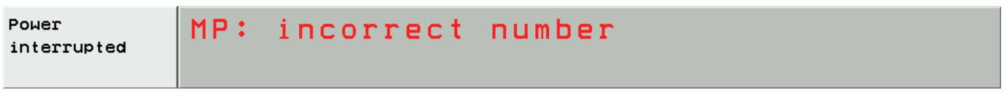


- Enter a value for the new machine parameter.

Note

Comments on the new MPs can be found in the text file *LIES_MP.A* or *READ_MP.A* in path PLC:\JH\ ...
Contact the machine manufacturer for more information!
If required you can add comments on the function of the new parameters in the MP list.

Error message MP: Incorrect number



If possible ...

If you could still store the non-volatile PLC markers and words from RAM to the defective HDR and create a backup subsequently:

- Write the non-volatile PLC markers and words from the HDR into the RAM before confirming the power interrupt message. --> See “Nonvolatile PLC Markers and Words” on page 10 – 93.

Restoring the default settings on the machine

On machines with analog axes, an offset fine adjustment should be performed with the HEIDENHAIN code number after the exchange of the control. -> See “Adjusting the Electrical Offset (Drift Adjustment)” on page 20 – 346.

Check the machine functions.
Depending on the machine features you have to ...

- Recalibrate the touch probes
- Initialize the swivel head again
- Initialize the swivel head again

Information can be provided by your machine tool builder!

Check the date and time and set these settings again, if necessary. --> See “Setting the System Time” on page 15 – 237.

Creating machine backup

If changes were made to the machine or control (e.g., new machine parameters have been added), you should create a current machine backup.
--> See “Backup” on page 16 – 261!

Returning the MC 422

> **Caution**
>
> **The HDR must be secured for the transport!**

- Apply a note with the error description on the HDR.
- Pack the defective HDR in the original packaging of the new HDR.
- Return the defective HDR to the machine manufacturer or to your HEIDENHAIN service agency.

26.6 Exchanging the CC

Preparing the machine

If still possible …

- Move machine to home position (axes, tool changer, tilting head, etc.). Ask the machine operator!
- Press EMERGENCY-STOP.

Removing the defective CC

- Switch off main switch of the machine and take precautions against resetting. --> See "Safety Precautions" on page 1 – 9!
- Screw off the shielding plate.
- Label and remove all of the connections on the CC and the MC.
- Dismount the CC component together with the MC from the electrical cabinet.
- Separate the MC from the defective CC.
  Loosen two torx screws at the top and two at the bottom of the housing (do not unscrew completely). Remove the MC by drawing it towards you by the handles until the MC disengages from the CC.
  Now you can pull out the MC at a slight angle to the right.

Caution

Observe the ESD precautions. --> See "Important Information" on page 26 – 411!

Mounting the new CC

- Connect the MC with the new CC.
- Mount the new CC together with the MC in the electrical cabinet.
- Re-establish all of the connections on the CC and the MC.

Caution

Do not confuse any of the connectors!

DANGER

Do not forget to connect the grounding screw at bottom right of the MC and the grounding bar above the CC housing!

- Screw off the shielding plate.
- Check the machine functions.

Returning the defective CC

- Replacement controls are delivered with a form that is to be filled in with information on the error of the defective control.
  Please fill in this form and attach it to the housing of the CC.
- Pack the defective CC in the original packaging of the new CC.
- Return the defective CC to the machine manufacturer or to your HEIDENHAIN service agency.

26.7 Exchange of Further HEIDENHAIN Components

- Many HEIDENHAIN units (encoders, scanning heads, etc.) are delivered with **mounting instructions** in the packaging.
- The HEIDENHAIN testing equipment PWM 9 or PWT is helpful for the adjustment of scanning heads.
- When exchanging **electrical original components** (inverters, motors, etc.) a **new adjustment of control loops** of axes and spindle **is normally not necessary.**
  Exception: When exchanging an MC that also (or exclusively) controls analog axes, an offset adjustment with the code number for the fine compensation should be performed.
  --> See "Adjusting the Electrical Offset (Drift Adjustment)" on page 20 – 346.
- When exchanging **mechanical components, a new adjustment of the control loops** of axes and spindle **may be necessary.** --> Contact the machine manufacturer!
- For information on the exchange of drive components, refer to the Service Manual "Inverter Systems and Motors".
- Exchange cables only for **original cables**! Do not exceed any maximum lengths!
- If required, ensure a **clean shielding and grounding** of cables and components.
- If possible, use **original packagings** from HEIDENHAIN.

Note

If you have any questions, contact the **machine manufacturer** or a **HEIDENHAIN service agency.**

27 Loading of Service Packs

27.1 Introduction

- Errors in the current HEIDENHAIN NC software are eliminated by so-called service packs.
- Service packs are loaded in addition to the NC software.
- The service pack must match the released NC software version.
- The last service pack version includes all changes of the predecessor versions, i.e., only the service pack with the highest version number must be loaded.
- It is not necessary to convert data (binary to ASCII) and to backup the non-volatile PLC operands.

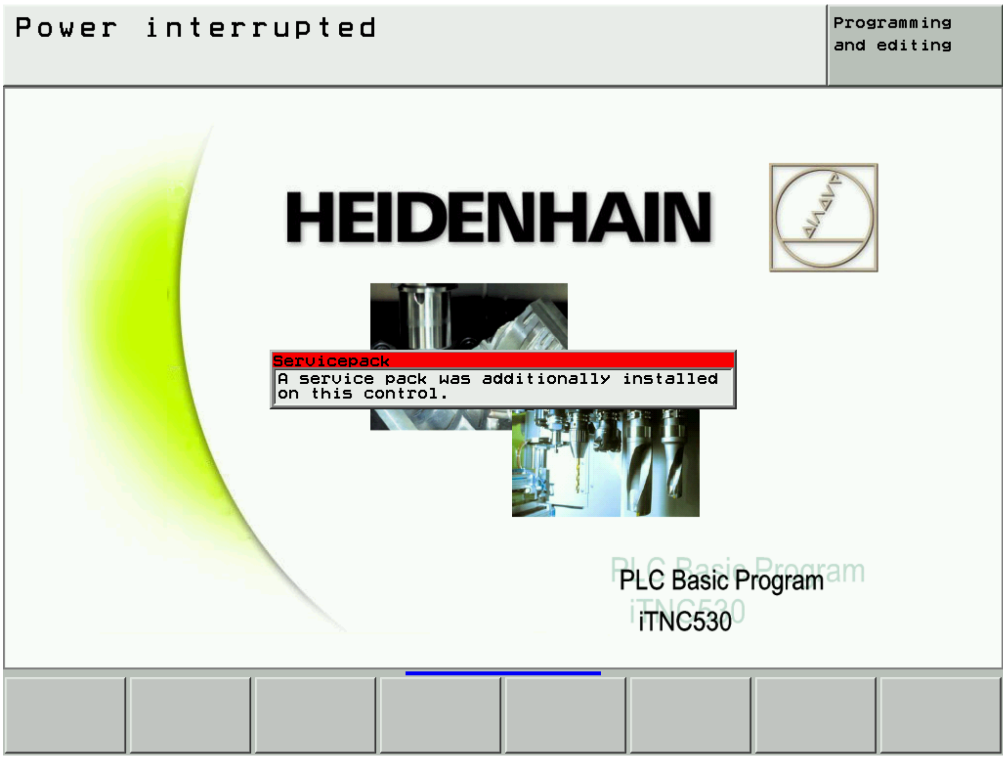
Caution

The service pack is normally loaded by the machine manufacturer. This should be initiated by the machine manufacturer and performed after prior consultation.

- End users receive the service pack via the machine manufacturer.
- Machine manufacturers who have access rights to the protected range of the HEIDENHAIN website (member area), can download the service pack from the HEIDENHAIN website via user name and password.

Display on the screen

If a service pack is installed on the iTNC 530, a corresponding message is shown after the control is booted (before confirming the the Power interrupted message).



The machine manufacturer, however, may overlap this message window.

If you press the MOD key while the machine is switched on, you can see whether a service pack is active. Behind the ID number of the NC software, you may then find the designation ***SP*** with the version number (e.g., 340490 01 SP2)!

There are different proceedings for the loading of service packs, depending on the NC software version. In the following, find the corresponding description:

27.2 Preparations and Execution up to NC Software 34049x-01 (Single and Dual-Processor Version)

Downloading the new service pack

If you have access rights to the protected range of the HEIDENHAIN website (member area), you can download the current service packs.

For this purpose proceed as follows:

- In the internet, go to ***www.heidenhain.de***.
- Click on ***Services/Member-Area/FileBase.***
- Enter your user name and your password.
- Click on ***NC Milling iTNC530.***
- Click on ***Software*** or ***Software export***
- Select the corresponding service pack with the highest version for the NC software on your machine (e.g., 34049001 - iTNC530 service pack 2).
- Download the service pack onto your laptop/PC.
  For this purpose select a folder and start the procedure.
- **Decompress the ZIP file** (e.g., 34049001sp2.zip) in this folder.
  A folder with the number of the NC software (e.g., 34049001) is created. It includes the service pack in compressed format (e.g., 340490_001_SP2.zip).

End users may receive the service packs via the machine manufacturer.

Access to the service pack files

If your control is connected to the company network and the service pack files were filed on a released folder of the network, you have access to these data. –> If necessary, ask the system administrator.

Otherwise, you may also transfer the service pack from your service laptop to the control.

Transferring the service packs to the control

Note

It would be ideal that the control is in the *Power interrupted* state.

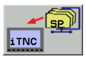
- Connect the data transfer cable to the laptop and control, set the required configurations in the program TNCremoNT and establish the connection (see “Connection Setup” on page 16 – 247).
- Select the PLC partition of the iTNC 530 and create a new folder.
  (e.g., PLC:\Service-Packs).
- Open the folder.
- Transfer the folder with the service pack from your laptop to the iTNC 530.
- Separate the connection to TNCremoNT.

Preparing the machine

- Move machine to home position (axed, tool changer, tilting head, etc.).
  Ask the machine operator!
- Restart the control, do not acknowledge the "Power interrupted" message.
- Press EMERGENCY STOP.

Loading the service pack

- In the ***Programming and Editing*** mode, press the ***MOD*** key



- Press the softkey ***SP-->iTNC***
  A pop-up window is opened.

- In the upper part of the window, set the cursor to the folder that contains the zip file (e.g., 340490_001_SP1.zip) of the service pack.

Note

With the +/- key you may open and close the directory trees.

- Press ***ENT***. --> All ZIP files of available service packs are shown in the lower part of the window.
- Press the softkey ***FILES***. --> The cursor changes to the lower part of the window.
- Select the latest service pack and press the softkey ***SELECT.*** --> The installation of the service pack starts (the control also reboots).
- Finally, check the machine functions!

27.3 Preparations and Execution as of NC Software 34049x-02 (Single-Processor Version)

Downloading the new service pack

If you have access rights to the protected range of the HEIDENHAIN website (member area), you can download the current service packs.

For this purpose proceed as follows:

- In the internet, go to ***www.heidenhain.de***.
- Click on ***Services/Member-Area/FileBase.***
- Enter your user name and your password.
- Click on ***NC Milling iTNC530.***
- Click on ***Software*** or ***Software export***
- Select the corresponding service pack with the highest version for the NC software on your machine (e.g., 34049002 - iTNC530 service pack 2).
- Download the service pack onto your laptop/PC or a USB stick.
- **Decompress the ZIP file** (e.g. 34049002sp2.zip) onto the USB stick into a folder on the laptop. A folder with the number of the NC software (e.g., 34049002) is created. It is located in a subfolder (e.g., 340490_002_SP2), that contains the files **setup.omf** and **setup.zip**.

End users may receive the service packs via the machine manufacturer.

Preparing the machine

- Move machine to home position (axes, tool changer, tilting head, etc.). Ask the machine operator!
- Restart the control, do not acknowledge the "Power interrupted" message
- Press EMERGENCY STOP.

Access to the service pack files

If your control is connected to the company network and the service pack files were filed on a released folder of the network, you have access to these data. –> If necessary, ask the system administrator.

You may also use a USB stick as data medium, as described in the following.

Loading the service pack

- Connect the USB stick to X141 or X142 (USB interfaces of the iTNC 530).

Note

When connecting, USB memory devices that use the file system VFAT or ISO 9660 (no NTFS, etc.) are recognized and included automatically.

Note

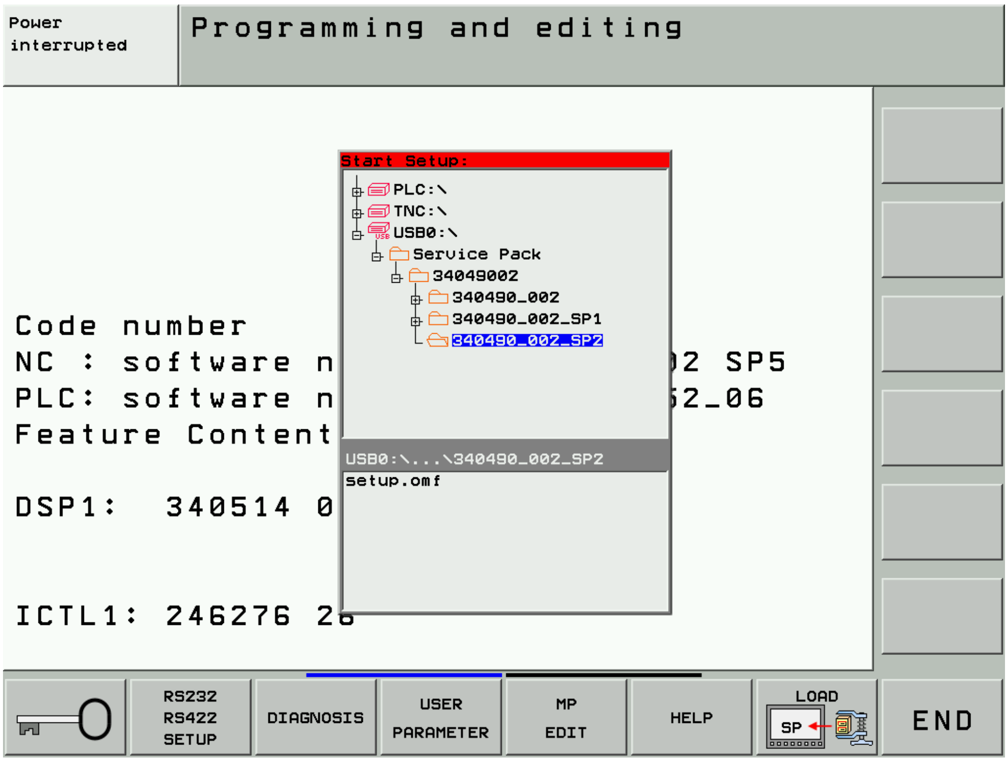
Alternatively, you may also transfer the service pack to the control's hard disk with TNCremoNT. Under *Extras/Configuration/Mode* click on *Transmission in binary mode (always)*. When data transfer has been finished, restore the mode to its original setting.

- In the ***Programming and Editing*** mode, press the **MOD** key.
- Enter the code number ***SETUP***. –> A pop-up window appears.
- In the upper part of the window, set the cursor to the USB data medium (or to the partition of the control's hard disk where you have transferred the setup data with TNCremoNT).

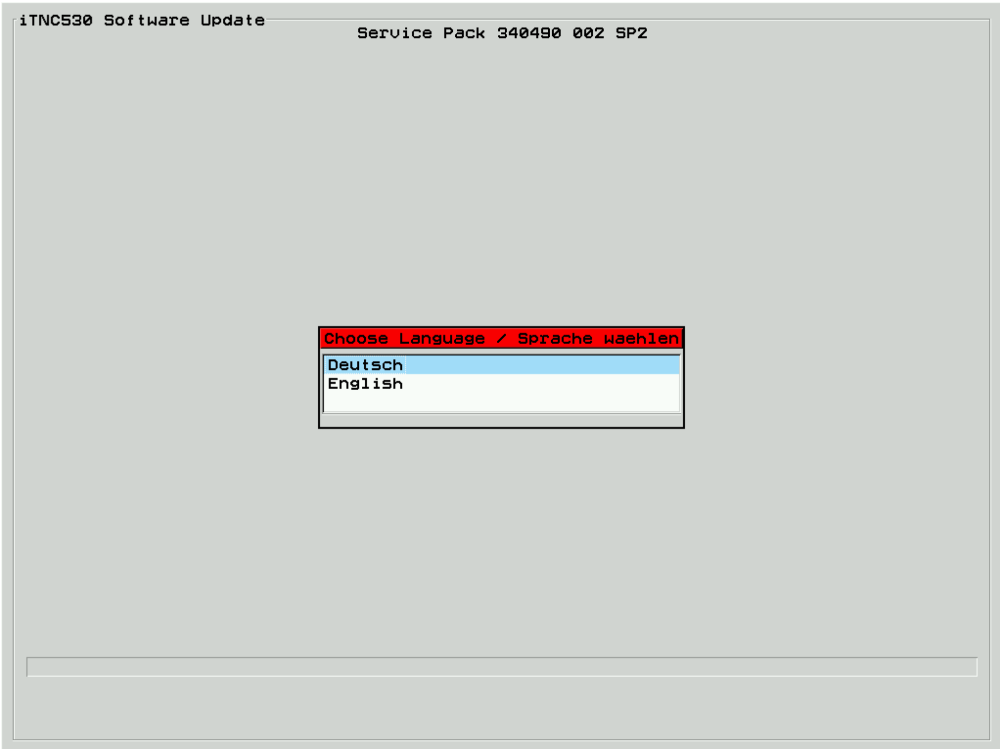
Note

With the +/- key you may open and close the directory trees.

- Now set the cursor to the folder with the designation of the NC software + service pack (e.g., 340490_002_SP2).
- Press ***ENT***. --> The file **setup.omf** is shown in the lower part of the window.



- Press the ***FILES*** softkey. --> The cursor changes to the lower part of the window.
- Press the ***SELECT*** softkey.
--> An installation menu guides you now through the installation of the service pack.



▶ Select the language and confirm the following enquiries with mouse click or the ENT key. The menu page shows which actions are currently being performed. The progress is shown by a progress bar.

▶ When installation of the service pack was successful, the following message is displayed:

▶ Disconnect the USB stick and click OK or press the ENT key. --> The control reboots!

▶ Finally, check the machine functions!

27.4 Preparations and Execution as of NC Software 34049x-02 (Dual-Processor Version)

Downloading the new service pack

If you have access rights to the protected range of the HEIDENHAIN website (member area), you can download the current service packs.

For this purpose proceed as follows:

- In the internet, go to ***www.heidenhain.de***.
- Click on ***Services/Member-Area/FileBase.***
- Enter your user name and your password.
- Click on ***NC Milling iTNC530.***
- Click on ***Software*** or ***Software export.***
- Select the corresponding service pack with the highest version for the NC software on your machine (e.g., 34049002 - iTNC530 (DP) service pack 2).
- Download the service pack onto your laptop/PC or a USB stick.
- **Decompress the ZIP file** (e.g., 34049202sp2.zip) onto the USB stick or into a folder on the laptop.
  A folder with the number of the NC software (e.g., 34049202) is created. It is located in a subfolder (e.g., 340492_002_SP2) that contains the files **setup.exe** and **setup.zip**.

End users may receive the service packs via the machine manufacturer.

Preparing the machine

- Move machine to home position (axed, tool changer, tilting head, etc.).
  Ask the machine operator!
- Restart the control, do not acknowledge the "Power interrupted" message
- Press EMERGENCY STOP.

Access to the service pack files

If your control is connected to the company network and the service pack files were filed on a released folder of the network, you have access to these data. --> If necessary, ask the system administrator.

You may also use a USB stick as data medium, as described in the following ...

Loading the service pack

Caution

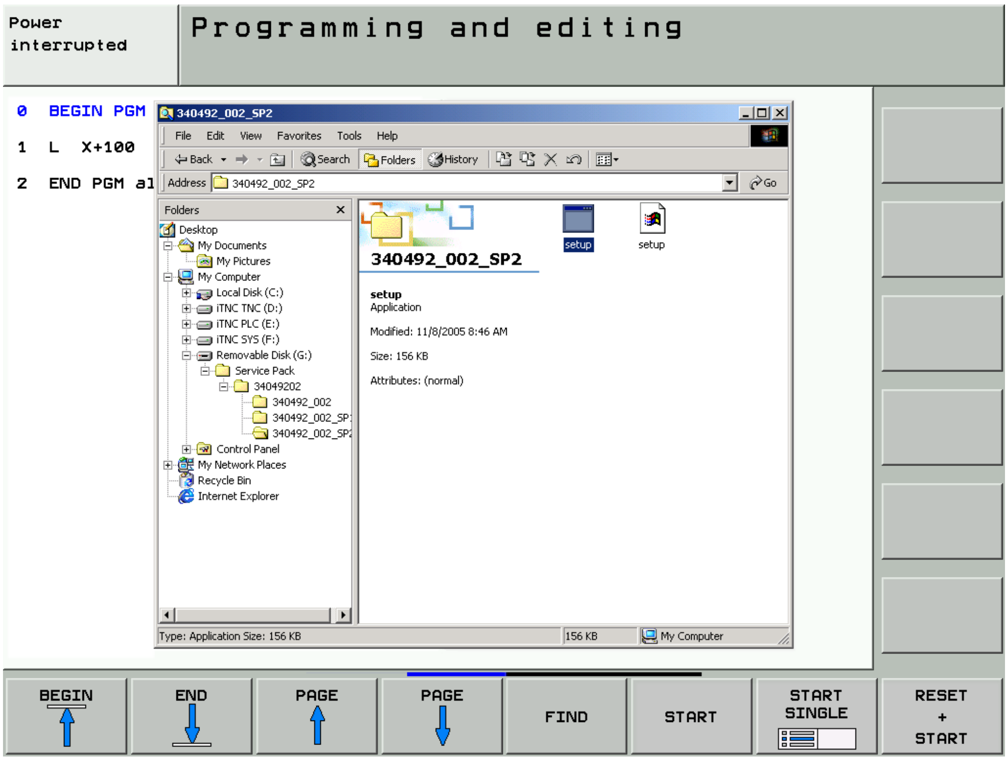
With the dual-processor version of the iTNC 530 as of NC software 34049x-02, service packs are installed with Windows. You need the corresponding Windows authorizations to install the software. If necessary, ask the machine manufacturer!

- Connect the USB stick to X141 or X142 (USB interfaces of the iTNC 530).

Note

When attached, USB devices that use the VFAT or ISO 9660 file systems (not NTFS or other systems), are detected and connected automatically.

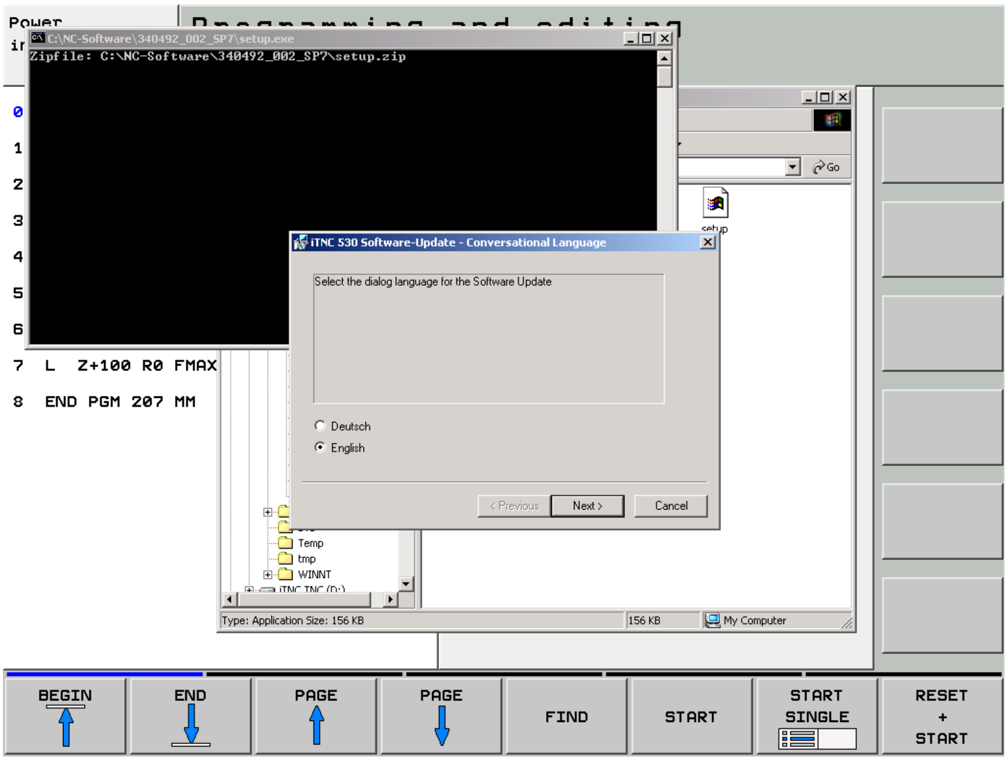
- Now work with Windows.
- With the Windows explorer, e.g., open the folder on the USB stick, that contains the setup files.



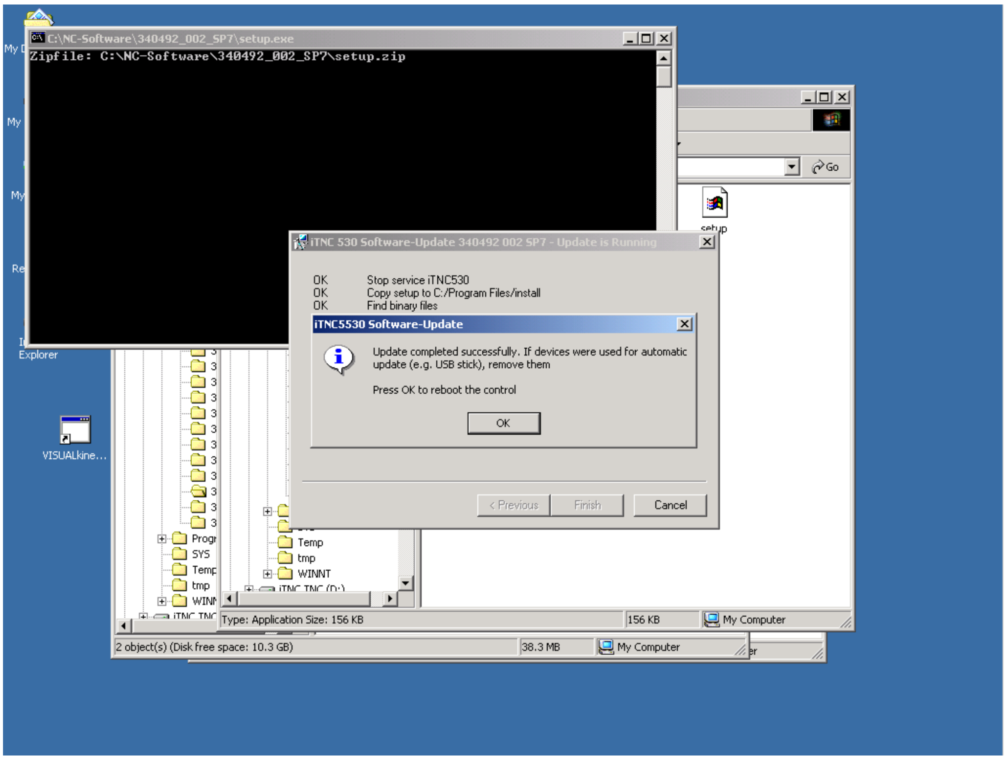
- Double click on setup. --> An installation menu guides you now through the installation of the service pack.

Note

Before a new installation under Windows, please always close all other applications. This also applies for the HEIDENHAIN NC software! In this case you do not have to stop the NC software via the control panel manually as this is made automatically by the update procedure.



- Select the language and confirm the following enquiries with mouse click.
  The menu page shows which actions are currently being performed. The progress is shown with a progress bar.
- When installation of the service pack was successful, the following message is displayed:



- Disconnect the USB stick and start the control by mouse click on OK. --> The control reboots!
- Finally, check the machine functions!

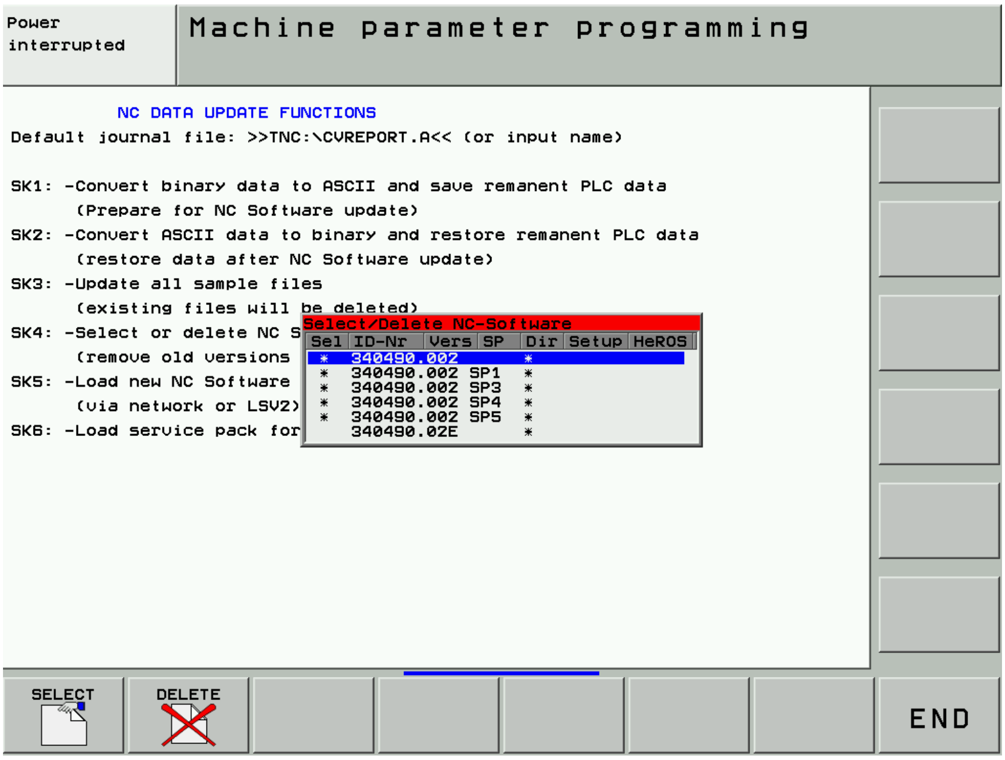
27.5 Service Packs on the Control's Hard Disk

Service packs are automatically archived on the SYS partition of the control's hard disk.

As of NC software 34049x-02, a selection window can be called in which all available service packs are shown.

- Call the MP list.
- Press the ***MOD*** key.
- Press the ***UPDATE DATA*** soft key.
- Press the ***SELECT*** Soft key.

--> A selection window appears in which all available NC software versions and service packs are listed.
The active NC software version and the active service packs in the table are marked with a star.



DANGER

Other NC software versions or service packs may only be activated by the machine manufacturer or in consultation with the machine manufacturer.
See “NC software update” on page 26 – 411

28 Activating the NC Software Used on the Machine

28.1 Introduction

It can be helpful for servicing to activate the NC software used on the machine on the iTNC 530 if **data of the SYS partition were lost**.
For example:

- HEIDENHAIN cycles were lost.
- DSP errors are generated frequently that were obviously caused by a loss of data.
- Messages are generated that refer to a loss of data.

By activating the NC software again, the data belonging to the software are extracted again. It might thus be possible to restore destroyed files on the hard disk.

Caution

Before activating the NC software, check if a service pack is installed. Press the ***MOD*** key.
--> If the NC software number is followed by ***SP*** (e.g., 340490 01 SP2), a service pack is active.
After activating the NC software again, the service pack used so far must be installed again --> see “Loading of Service Packs” on page 27 – 443!

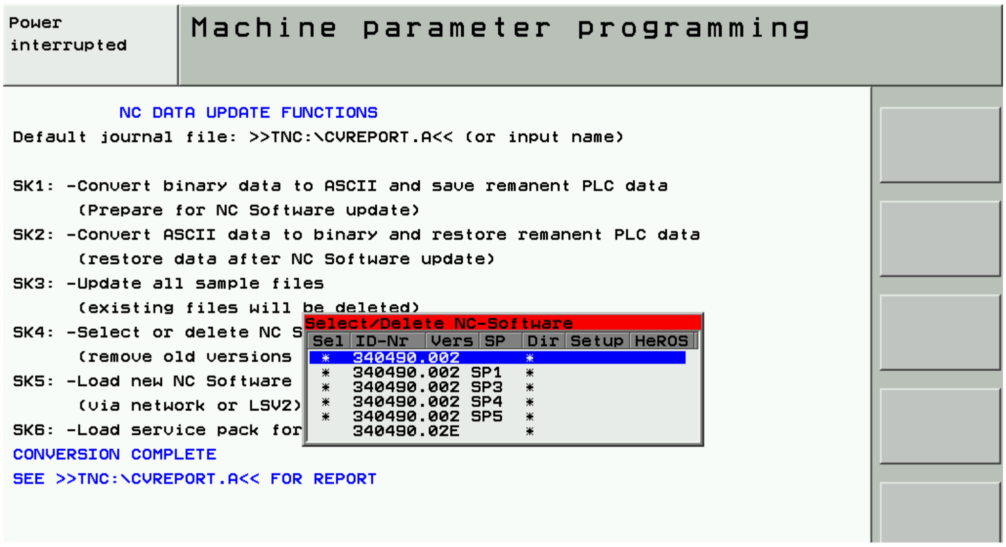
If a hard disk defect is suspected, carry out the corresponding tests (see “Hard Disk Test” on page 15 – 233) or contact the machine manufacturer or a HEIDENHAIN service agency!

28.2 Execution

- Call the machine parameter list with the corresponding code number.
- Now press the ***MOD*** key.
- Press the ***UPDATE DATA*** soft key.
- Press ***the BIN --> ASCsoft key*** to convert the files on the hard disk from binary to ASCII format.

Equivalent file name extensions in binary and ASCII format					
.H	.H%	.I	.I%	.T	.T%
.TCH	.TC%	.D	.D%	.P	.P%
.PNT	.PN%	.COM	.CO%	.CMA	.CM%

- Press the ***NCVer*** or ***SELECT*** soft key.
  All NC software versions that exist in the control are shown in the selection window that appears.



- The currently used software version is distinguished by a asterisk. Place the cursor to the marked NC software version!

Caution

You may only activate the NC software currently used by the machine!

It is marked with an "*."

If further NC software versions are shown in the selection window shown, they could be selected. This is only possible after prior consultation with the machine manufacturer as ...

- The NC software must be released by the machine manufacturer.
- Manufacturer cycles are no longer displayed.
- Cutting-data, workpiece-material tables, etc. could be overwritten.
- Machine parameters may be added or are not active any more.

- Press the ***SELECT*** soft key .
- Confirm your selection with the ***YES*** soft key.

Note

If now the error message *Not enough space on SYS:* is generated, one or several packed NC software versions must be deleted from the SYS partition. --> Ask the machine manufacturer!

- The control activates the selected NC software again and performs a reset.
- Call the machine parameter list with the corresponding code number.
- Now press the **MOD** key.
- Press the ***UPDATE DATA*** soft key.
- Press the ***ASC-->BIN*** soft key to convert the files on the hard disk from binary to ASCII format.
- The activation of the NC software is completed.

Caution

The service pack used so far must now be installed again.
--> see "Loading of Service Packs" on page 27 – 443!

- Finally, check the machine functions!

29 Inspection, Measuring and Test Equipment

29.1 Important Notes

Caution

The following inspection, measuring and test equipment is **only** intended for a **test run** on machines!

DANGER

Observe the safety precautions in chapter 1 of this manual. --> see “Safety Precautions” on page 1 – 9

Caution

When using the test adapter or the universal measuring adapter, e.g., encoder cables are not shielded universally any more.

When using measuring equipment that is not ungrounded (e.g., oscilloscope with power connection), always the socket of the machine's switch cabinet should be used. Compensating currents due to different earth potentials can thus be avoided!

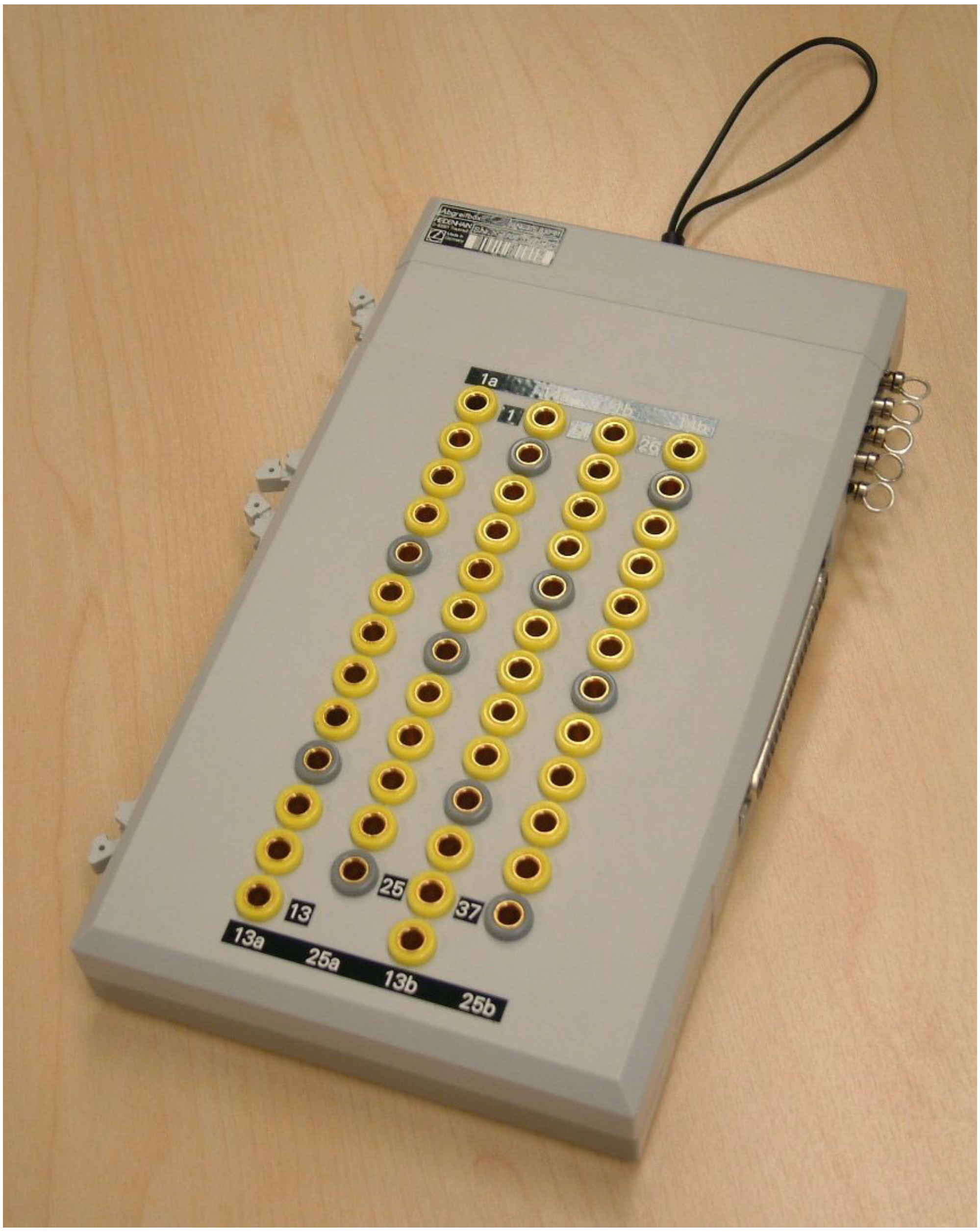
For measuring voltages, the contact should first be established with 0 V and only then the contact with the voltage to be measured!

Always observe the **operating instructions** of the corresponding units PWM 9, PWT 10/17/18 and IK 215!

29.2 Test Adapter, ID 375830-01

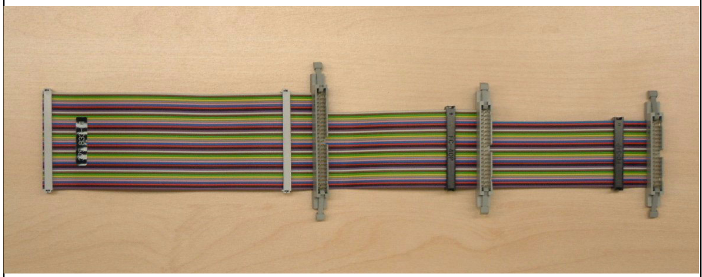
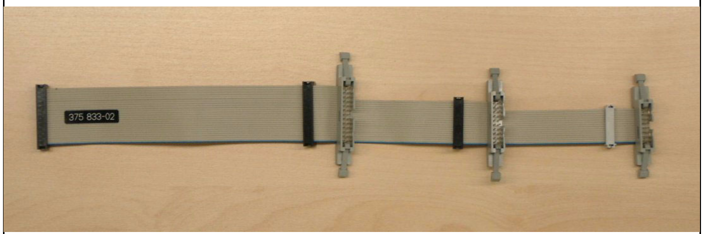
The test adapter ...

- Is the successor of the "Universal measuring adapter" (see “Universal Measuring Adapter, ID 255480-01” on page 29 – 460) and is completely compatible.
- Can be connected to all D-Sub and ribbon-cable connectors of HEIDENHAIN units or is connected in-between.
- Requires adapter cables.
- Has numbered pin sockets to which, e.g., a multimeter can be connected.
- Permits the measuring of signals and voltages during operation of HEIDENHAIN units.
- Has 5 prepared pin sockets with eyes to be clipped on the measuring lines. These pin sockets are located at upper right; if required, they can be connected into the numbered pin sockets.



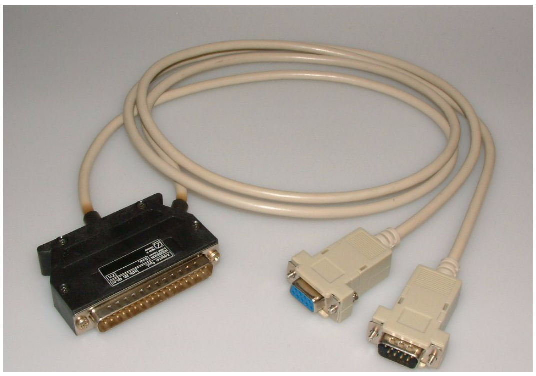
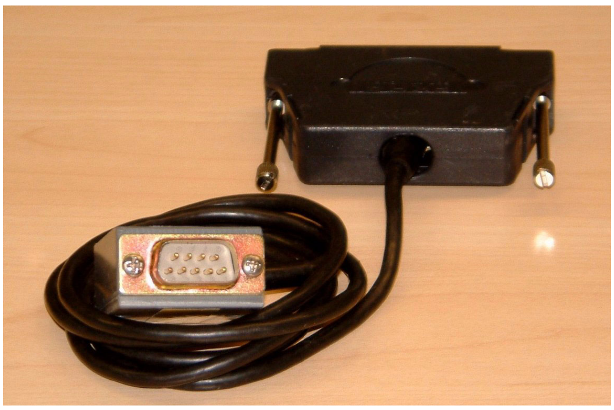
Adapter cable to the test adapter

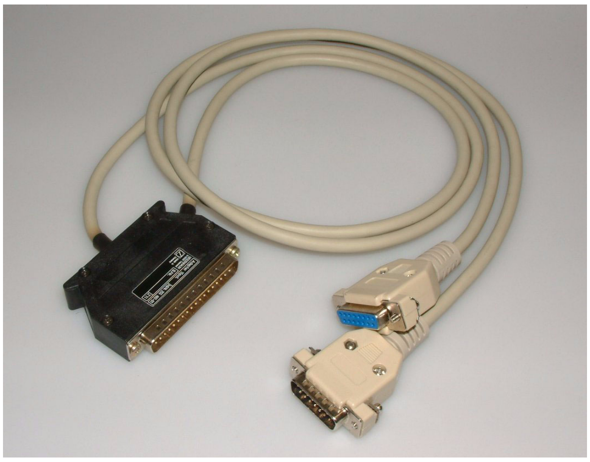
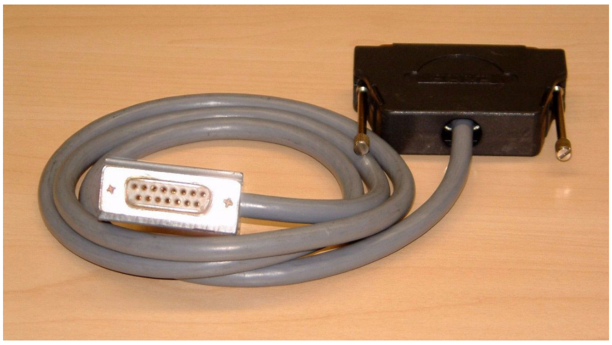
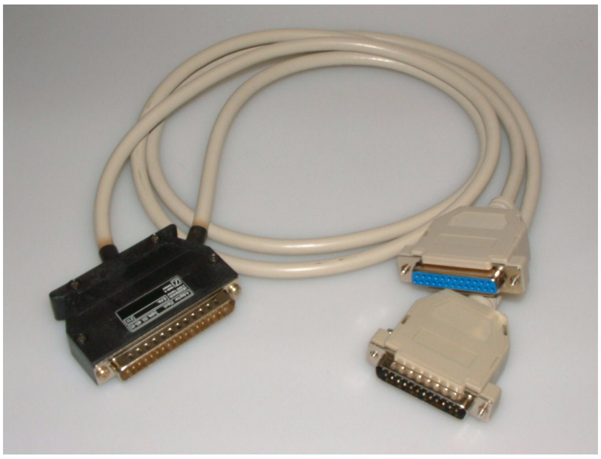
Each ribbon-cable and D-Sub connector requires an own adapter cable.

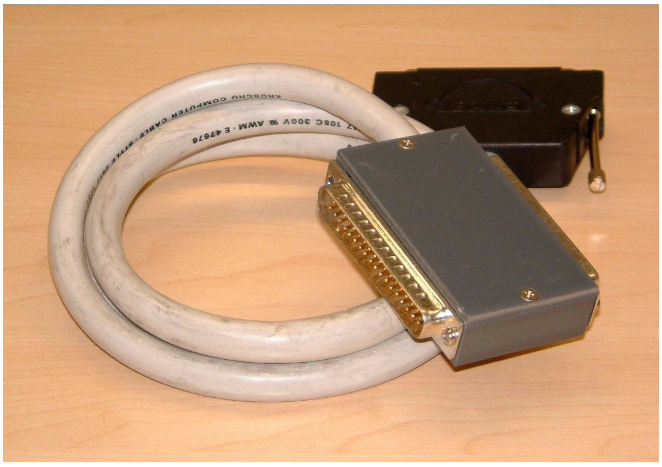
	Connecting cable, flat 50-, 40-, 34-pin Id.Nr. 375833-01
	Connecting cable, flat 26-, 20-, 16-pin Id.Nr. 375833-02

A new and an old version of the D-Sub adapter cables is available.
The older version shows disadvantages:

- The inserting depth reduce the raised-head screws on the D-Sub connector.
  An adapter connector can/must be used.
- More space is required as the adapter connector has a lateral cable outlet and the original connector must be connected directly to the adapter connector.

	D-sub adapter cable 9-pin Id.Nr. 255481-01 New version
	D-sub adapter cable 9-pin Id.Nr. 255481-01 Older version

	D-sub adapter cable 15-pin Id.Nr. 255482-01 New version
	D-sub adapter cable 15-pin Id.Nr. 255482-01 Older version
	D-sub adapter cable 25-pin Id.Nr. 255483-01 New version

	D-sub adapter cable 25-pin Id.Nr. 255483-01 Older version
	D-sub adapter cable 37-pin Id.Nr. 255484-01 New version
	D-sub adapter cable 37-pin Id.Nr. 255484-01 Older version

29.3 Universal Measuring Adapter, ID 255480-01

The universal measuring adapter ...

- Is the predecessor of the test adapter.
- It **cannot be connected to a ribbon-cable connector**!
- Has the same function as the test adapter.
- The required D-Sub adapter cables are listed with the test adapter (see "Test Adapter, ID 375830-01" on page 29 – 456).

29.4 Encoder Diagnostics Kit PWM 9, Id.Nr. 512134-01

General

The -PWM 9 phase angle measuring unit is a universal encoder for inspecting and adjusting the HEIDENHAIN **incremental** linear and angle encoders.

The PWM 9 is the successor of the PWM 8.

In principle, the PWM 9 includes the functions of the PWM 8 and the PWT (phase angle encoder).

The graphic bar display in the PWT MODE assists the quantitative and qualitative evaluation of the analog incremental signals and the reference signal. The integrated adjustment help (PWT MODE) for exposed encoders supports the mounting of the scanning head.

In the PWM MODE, you can enter the settings relevant for the PWM 9, measure the on-to-off ratio, phase angle, current consumption and encoder voltage.

For the adaptation to the different encoder signals, there exist corresponding …..

An LCD screen is used for display; it is operated via 5 soft keys.

It is possible to check the encoder output signals with an oscilloscope via 3 BNC sockets (A/B/C) which is recommended by HEIDENHAIN.

PWM 9 can be connected in series between the encoder and the subsequent electronics.

The axis functions of the machine axes are not influenced.

The PWM 9 can be used for checking and adjusting HEIDENHAIN encoders "at the working place" also without subsequent electronics.

Available functions The functionality of the PWM 9 is divided into the PWT MODE and the PWM MODE.

The most important functions of the PWM MODE:

- Display of phase angle and on-off ratio
- Display of scanning frequency
- Measurement of signal amplitude, current consumption and supply voltage of measuring system
- Display of the internal UNIVERSAL COUNTER and the rotary encoder signal periods (pulse count)
- Display for reference signal, interference signal and count direction
- Output of amplified scanning signals (interface board: 11 µApp, 1 Vpp) or of original scanning signals (interface board TTL, HTL) via 3 BNC sockets, e.g. on an oscilloscope.

The most important functions of the PWT MODE:

Bar-graphic display of

- Signal amplitude
- Signal quality
- Width of reference signal
- Position of reference signal

Check-Ref function

- Adjustment help for mounting the scanning head on exposed encoders
- Testing of encoders with distance-coded ref. marks

Note

Each **PWM 9** is delivered together with detailed **operating instructions**.
These operating instructions can be found in the Internet in German and other languages and can be downloaded at www.heidenhain.de/Services/...
A detailed explanation of the PWM 9 is part of our **Training course on measuring systems** or a special **PWM 9 training course**.
We recommend to participate in a HEIDENHAIN service training course so that you can use the PWM 9 effectively.

29.5 Mounting Help PWT 10/17/18

General

The PWT 10/17/18 phase angle test unit is designed as mounting help for scanning heads. The different signal parameters are summarized in one display.
For the detailed assessment of the signal quality, an inspection with a suitable encoder is recommended (PWM 9).

Three different PWT sets are available:

- PWT 10 encoder diagnostics kit for 11 µApp scanning heads, Id.Nr. 325411-xx
- PWT 17 encoder diagnostics kit for TTL scanning heads, Id.Nr. 325412-xx
- PWT 18 encoder diagnostics kit for 1 Vpp scanning heads, Id.Nr. 325413-xx

Available Functions

With the PWT it is possible to show the …

- Signal amplitude
- Signal quality
- Reference mark position
- Reference mark width ... in a display.

Note

Each **PWT** is delivered together with **operating instructions**.
These operating instructions can be found in the Internet in German and other languages and can be downloaded at www.heidenhain.de/Services/...
A detailed explanation of the PWT is part of our **training courses on measuring systems**.

29.6 IK 215 Adjustment and Testing Kit, Id.Nr. 547858-01

The IK 215 is a PC expansion board for inspecting and testing an absolute HEIDENHAIN encoder with EnDat or SSI interface. Parameters can be read and written via the EnDat interface.

Note

Each **IK 215 adjustment and testing kit** is delivered together with detailed **operating instructions**.
These operating instructions can be found in the Internet in German and other languages and can be downloaded at www.heidenhain.de/Services/...
A detailed explanation of the IK 215 is part of our **training courses on measuring systems**.
We recommend to participate in a HEIDENHAIN service training course so that you can use the IK 215 adjustment and testing kit effectively.

30 Machine Parameters

30.1 What is a Machine Parameter?

A contouring control must have access to specific data (e.g., traverse distances, acceleration) before it can execute its programmed instructions. You define these data in what are known as machine parameters.

This list of machine parameters is divided into groups according to topic.

Machine Parameters	Topics
10 to 999	Encoders and machines
1000 to 1399	Positioning
1400 to 1699	Operation with velocity feedforward control
1700 to 1999	Operation with following error (servo lag)
2000 to 2999	Integrated speed and current control
3000 to 3999	Spindle
4000 to 4999	Integral PLC
5000 to 5999	Data interface
6000 to 6199	3-D touch probe
6500 to 6599	Tool Measurement with triggering touch probe
7100 to 7199	Tapping
7200 to 7349	Programming and display
7350 to 7399	Color
7400 to 7599	Machining and program run
7600 to 7699	Hardware
13000 to 13999	Second spindle

If there is more than one input value for a single function (e.g., a separate input for each axis), the parameter number is extended by indices. Index zero is always axis 1, index one is axis 2, etc.

Example:

MP1010.0-8	Rapid traverse
MP1010.0	Rapid traverse for axis 1
MP1010.1	Rapid traverse for axis 2
MP1010.2	Rapid traverse for axis 3
MP1010.3	Rapid traverse for axis 4
MP1010.4	Rapid traverse for axis 5
MP1010.5	Rapid traverse for axis 6
MP1010.6	Rapid traverse for axis 7
MP1010.7	Rapid traverse for axis 8
MP1010.8	Rapid traverse for axis 1

Enter into OEM.SYS, using the code word **AXISNUMBER =**, the number of axes being used or intended, so that only the necessary index parameters are displayed.

With other machine parameters you can activate specific functions. In this case, the parameters serve as on/off switches for these functions. These parameters are bit-encoded. Each bit is assigned either to an axis or a function, e.g., MP 10 : %00000000011111 ; active axes

30.2 The Machine Parameter Editor

Introduction

For service purposes, the service technician must not only look up set values in the MP list but must also change them if necessary. The MP list is protected against unauthorized editing by a code number.
Please note the following:

DANGER

- Maschine parameters may only be changed after consultation with the machine manufacturer!
(for this reason many OEMs also determine their own MP code numbers)
- Change the machine parameters only then if the control is in the power interrupted state or if EMERGENCY STOP is pressed.
Machine parameters that concern control loops may be changed only when EMERGENCY STOP is pressed!

Note

- We recommend not to make extensive changes in the original MP list but in a test version of the MP list.
- We recommend to backup the machine data before extensive changes to the machine settings are made. --> See "Backup" on page 16 – 261.

Comments on the MPs

There may be comments to machine parameter lists. A semicolon ";" identifies a comment. Comments are not evaluated by the NC software!.

If the machine manufacturer has not commented the MP list completely or not at all, you can refer to PLC:\JH\LIES_MP.A or READ_MP.A and read the HEIDENHAIN comments on the individual parameters. LIES_MP.A or READ_MP.A is updated with each NC software update.
--> See "Meaning of the Machine Parameters" on page 30 – 473

Caution

LIES_MP.A or. READ_MP.A also includes the default values for the parameters. They are not valid for your machine; only the values in the original MP list count.

If you have a write permission, you can enter comments in the MP list yourself, beginning with a semicolon.

Subgroups of the MP list

It is also possible to call subgroups of the original MP list.
After pressing the soft key ***USER PARAMETERS***, the parameters released by the machine manufacturer are available to the operator.
After entering the code number 123, those parameters are available that have been defined by HEIDENHAIN.

Possibilities of the PLC

The PLC program of the machine manufacturer is in a position to read machine parameters and also to overwrite most of them!

During overwriting MPs by the PLC, the values are changed in the run-time memory. The values of the original MP list do not change!

Another MP file (that of course must exist on the control's hard disk) can be selected by means of the PLC.

Also so-called MP subfiles (subgroups of the original MP file with partly other values) can be activated via the PLC. The content of the indicated MP subfile is loaded into the run-time memory. All MP values not listed in this file remain unchanged.

Note

Thus it is possible that the values in the original MP file are not valid in any case.
It is possible that values in the MP list have been changed for testing purposes; with special machine functions, however, these values are overwritten by the PLC!
If necessary, ask the machine manufacturer in which special operating mode of the machine which MP files or MP subfiles are active or which parameters are overwritten by the PLC!

Remark:
Also the machine operator may change the machine settings. He will mostly increase the security, e.g., he can reduce the traverse range or the maximum speed, etc.

Calling the active machine parameter list

▶ Press the following key combination to call the active machine parameter list:

▶ Select the *Programming and Editing* operating mode

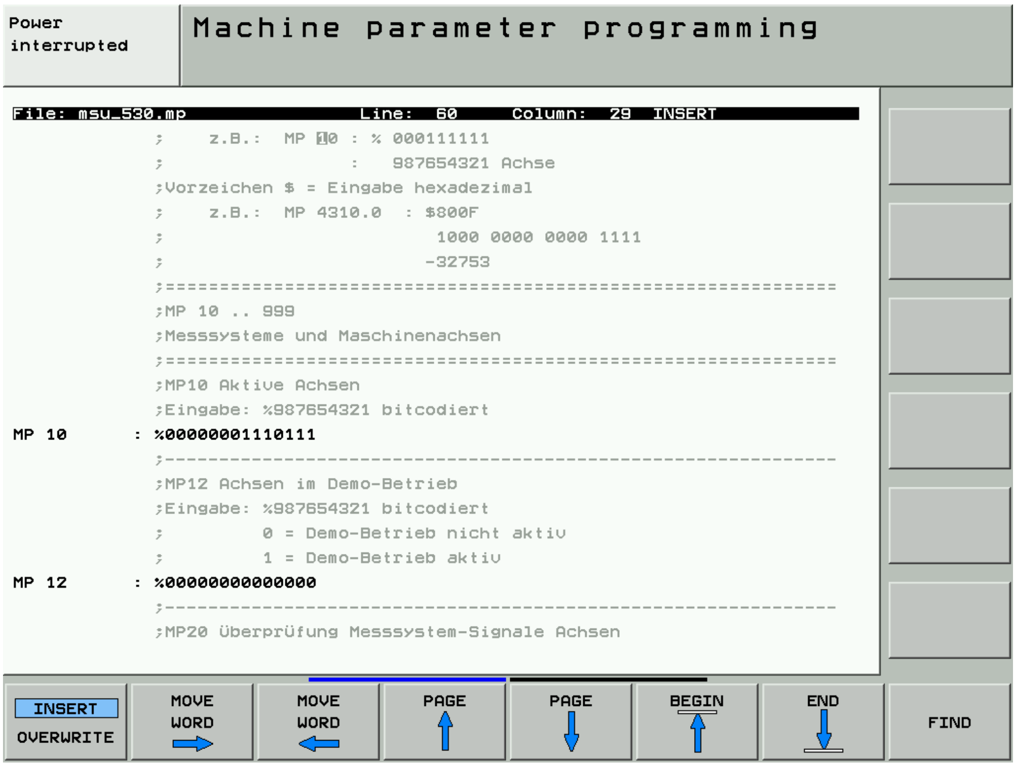
MOD

▶ Call window for code number

9 5 1 4 8 ENT

▶ Enter and confirm code number

The active machine parameter list appears on the screen in the mode *Machine Parameter Programming*.



END

▶ Exit the machine parameter mode

Note

If the message *"Line is write-protected"* is displayed when trying to edit a machine-parameter value, individual machine parameters or the complete MP list is protected against editing.
The machine manufacturer has defined an own MP code number. --> Please contact your machine manufacturer!

Input format

MP values can be shown in different formats:

- Decimal:
  There is no identifier before the value.
  Example: MP 910.0 : +1000 ; traverse range

- Binary:
  The identifier % stands before the value.
  The binary input is recommended for machine parameters for a bit-encoded activation of individual functions.
  Example: MP 10 : %00000000011111 ; active axes

- Hexadecimal:
  The identifier $ stands before the value.
  The hexadecimal input is suitable, e.g., to show great numerical values.
  Example: MP 7350 : $0808080 ; color mixture in red-green-blue for the window frame

For MP1054.x (linear distance of one motor revolution) and MP7530.x (type of dimension for transformation) also a formula may be indicated instead of a fixed value.

Create copy of original MP file

If you make extensive changes to the machine parameters for service tasks (trouble shooting, tests, etc.), we recommend not to use the original MP list.
Copy the original MP file and activate it!

▶ Enter the active machine parameter list (see previous page).

PGM MGT ▶ Call the program management.

▶ The cursor automatically stands on the active machinen parameter file (status M).
Otherwise set the cursor on the active file.

COPY ABC⇐XYZ ▶ Press this soft key.

▶ Enter the name of the working copies in the header, e.g., *TEST.MP*.

EXECUTE ▶ Begin the copying process.

▶ The copy is made. It is stored in the same directory as the original MP file.

Note

For reasons of safety, you can also protect the original MP file. --> Soft key *AUX: FUNCTIONS* --> *PROTECT*. A *P* is shown in the status column for "protected".

Of course, you can also make a backup of important data before the service jobs.

Activate the copy of the original MP file for test purposes

- Place the cursor on the working copy, e.g., *TEST.MP*
- Load this file into the Editor
- When the key is pressed, the iTNC 530 carries out a reset and activates the selected MP file. The original MP file is activated in the same way.

Note

In the program management, the active MP file has the entry ***M*** in the status column.

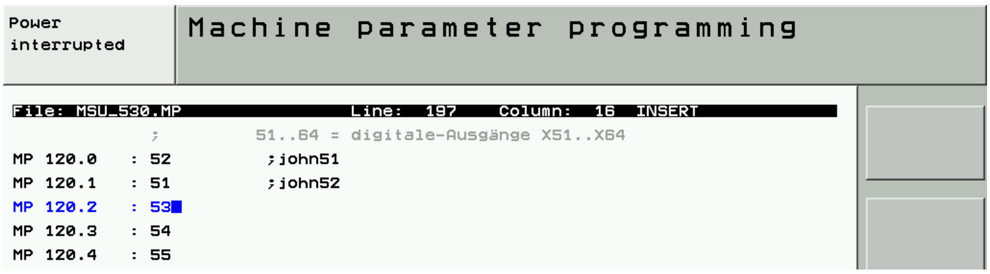
Edit and mark machine parameters

- Where ist makes sense, set the editing mode to Insert or Overwrite.

Note

For bit-coded parameters the "Overwrite" editing mode is provided, otherwise "Insert" should be selected. The original values are thus retained.
Mark the modified machine parameters to find them later again.

- Enter a semicolon (to mark a comment) after the modified parameter and subsequently an identification word (e.g., your name, company name, etc.).
- Place the cursor with the arrow key in the next line. --> The modified line is structured.



Search Machine Parameters

If you have marked the parameter …

- Press the SEARCH soft key and enter the marking word.
- With the corresponding soft key, select whether capitalization shall be of importance or not.
- Press the EXECUTE soft key. --> The editor places the cursor to the marking word.

In case the number of the parameter is known ...

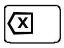
- Press the GOTO key and enter the number (without index).
- Confirm with ENTER. --> The editor places the cursor at the requested parameter.

In case the number of the parameter is known (but not the number) …

- Press the SEARCH soft key and enter the name.
- With the corresponding soft key, select whether capitalization shall be of importance or not.
- Press the EXECUTE soft key. --> The editor places the cursor on the required text. If the associated parameter is not the one you have been looking for, just press SEARCH and EXECUTE until it is found.

Delete records and marks

If you want to delete from left to right ...



▶ Press this key.

If you want to delete from right to left ...

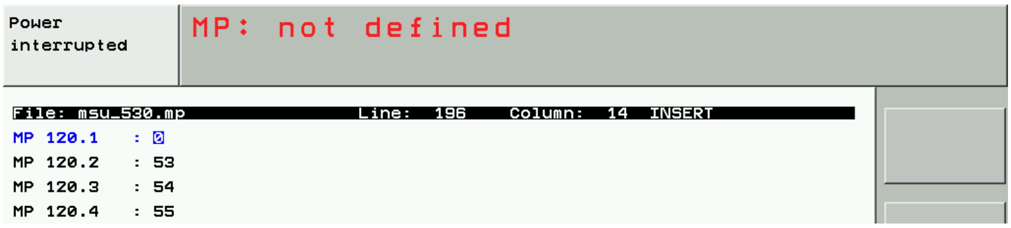
▶ Press the CE key.

Caution

Do not press the DEL key if you want to delete individual letters, words, numbers, etc. Press DEL to delete a complete line!

If you have deleted a complete line …

▶ Press the END key. --> The machine parameter editor generates the deleted parameter again and asks you for information.



▶ Enter the correct value (if required, look it up in the original MP list).

Activate the modified MP list

After you have modified parameters for service purposes:

- Place the cursor after the last modified parameter in the next line. --> The MP list is structured completely.
- Exit the machine parameter list by pressing the END key.

Missing or incorrect entries result in error messages from the control that prompt you to correct your entry. The following errors are displayed:

Input error	Meaning
0	No MP number found
1	Invalid MP number
2	No separator (:) found
3	Input value incorrect
4	MP doubly defined
6	MP cannot be stored

If the control does not recognize any errors, it automatically exits the machine parameter editor and is ready for operation.

Before that it might be necessary …

- To trigger a reset or
- To reference the axes again.
--> See “Soft key PASS OVER REFERENCE MARK” on page 18 – 302

This behavior is defined by HEIDENHAIN and cannot be influenced!

If you have reason to doubt that a changed parameter was transferred or not, the control can be rebooted manually.

Caution

After the service test, activate the original MP list again.
If the machine is operated with changed settings after consultation with the manufacturer, activate the agreed MP list, write your name (or the name of the responsible person) and the change date as comment in the list and create a current backup of the machine data. --> See “Backup” on page 16 – 261

30.3 Meaning of the Machine Parameters

Text file READ_MP.A

After entering the PLC code number and calling the program management, you find the READ_MP.A text file under PLC:\JH\ ....

The READ_MP.A includes the machine parameters with original HEIDENHAIN comments.
If the machine manufacturer has not commented the original MP list at all or not completely, you can read the meaning of the parameters in this text file!

Note

Hint:
Transfer the READ_MP.A text file to your service laptop. You can now easily read the meaning of the parameters while you have called the original MP list of the manufacturer on the control.

Caution

LIES_MP.A or. READ_MP.A also includes the default values for the parameters. They are not valid for your machine; only the values in the original MP list count.

The READ-MP.A file is a component of an NC software update.
This means that the READ_MP.A file is also updated with an NC software update.
You always have the suitable comments on the MPs of your installed NC software!

Note

In the protected area of the HEIDENHAIN website (member area) you can always find the current READ_MP.A!

Search MP numbers in READ_MP.A

Please use the SEARCH and EXECUTE soft keys to place the cursor to the requested MP number!
If you use the GOTO and ENT keys, the editor places the cursor in the line with the indicated number.

The current MPs can be read in the READ_MP.A!

On the following pages you will find the MP list (version: November 2005) as excerpt from the Technical Manual for iTNC 530 to complete this Service Manual:

30.4 List of Machine Parameters

(excerpt from the Technical Manual of iTNC 530 of November 2005)

30.4.1 Encoders and Machines

MP	Function and input	Behavior/ SW vers.
MP10	Active axes	PLC
	Format:%xxxxxxxxxxxxxx Input:Bits 0 to 13 represent axes 1 to 14 0: Axis not active 1: Axis active	RUN
MP20	Monitoring functions for the axes	PLC
	Format:%xxxxxxxxxxxxxx Input:Bits 0 to 13 represent axes 1 to 14 0: Monitoring not active 1: Monitoring active	RUN
MP20.0	Absolute position of the distance-coded reference marks	
MP20.1	Amplitude of encoder signals	
MP20.2	Edge separation of encoder signals	
MP21	Monitoring functions for the spindle	PLC
	Format:%xx Input:Bit 0 – Spindle 1 0: Monitoring not active 1: Monitoring active Bit 1 – Spindle 2 0: Monitoring not active 1: Monitoring active	RUN
MP21.0	Absolute position of the distance-coded reference marks	
MP21.1	Amplitude of encoder signals	
MP21.2	Edge separation of encoder signals	
MP100	Designation of axes	PLC
	Format:-wvucbazyxWVUCBAZYX Input:Characters 1 to 9 from the right represent axes 1 to 9	RUN
MP100.0	Traverse range 1	
MP100.1	Traverse range 2	
MP100.2	Traverse range 3	

MP	Function and input	Behavior/ SW vers.
MP110.x	Assignment of position encoder inputs to the axes Input:0: No position encoder input 1 to 6: Position encoder inputs X1 to X6 35 to 38: Position encoder inputs X35 to X38	RESET
MP111.x	Position encoder input for the spindle/spindles Input:0: No position encoder input 1 to 6: Position encoder inputs X1 to X6 35 to 38: Position encoder inputs X35 to X38	REF
MP111.0	Position encoder input for the first spindle	
MP111.1	Position encoder input for the second spindle	
MP112.x	Assignment of the speed encoder inputs to the axes Input:0: No speed encoder input 15 to 20: Speed encoder inputs X15 to X20 80 to 85: Speed encoder inputs X80 to X85	RESET
MP113.x	Speed encoder for the spindle/spindles Input:0: No speed encoder input 15 to 20: Speed encoder inputs X15 to X20 80 to 85: Speed encoder inputs X80 to X85	REF
MP113.0	Speed encoder for the first spindle	
MP113.1	Speed encoder for the second spindle	
MP115.0	Position encoder input 1 V_{PP} or 11 μA_{PP} Format:%xxxxxxxxxxx Input:Bit 0 to bit 5: Position encoder inputs X1 to X6 Bit 6 to bit 9: Position encoder inputs X35 to X38 Bit 10: No function 0: 1 V_{PP} 1: 11 μA_{PP}	RESET
MP115.1	reserved Format:%xxxxxxxxxxx Input:Enter %00000000000	
MP115.2	Input frequency of position encoder inputs Format:%xxxxxxxxxxx Input:Bit 0 to bit 5: Position encoder inputs X1 to X6 Bit 6 to bit 9: Position encoder inputs X35 to X38 Bit 10: No function With 1 V_{PP}: 0: 33 kHz 1: 350 kHz With 11 μA_{PP}: 0: 33 kHz 1: 150 kHz	

MP	Function and input	Behavior/ SW vers.
MP116.0	Only CC 424: Position encoder input 1 V_{PP} or 11 μA_{PP} Format:%xxxxxxxxxx Input:Bit 0 to bit 9: Linear encoder inputs X201 to X210 Bit 10: No function 0: 1 V_{PP} 1: 11 μA_{PP}	340 420-08, 340 422-02, 340 480-02 RESET
MP116.1	Only CC 424: Reserved Format:%xxxxxxxxxxx Input:Enter %00000000000	
MP116.2	Only CC 424: Input frequency of the position encoder inputs Format:%xxxxxxxxxxx Input:Bit 0 to bit 9: Linear encoder inputs X201 to X210 Bit 10: No function With 1 V_{PP}: 0: 33 kHz 1: 350 kHz With 11 μA_{PP}: 0: 33 kHz 1: 150 kHz	

MP	Function and input	Behavior/ SW vers.
MP120.x	Nominal speed value outputs of the axes Input:0: No servo-controlled axis 1 to 6: Analog outputs 1 to 6 at terminal X8 7 to 12: Analog outputs 7 to 12 at terminal X9 51 to 62: Digital output X51 to X62	RESET
MP121.0	Nominal speed command output of the first spindle Input:0: No servo-controlled axis 1 to 6: Analog outputs 1 to 6 at terminal X8 7 to 12: Analog outputs 7 to 13 at terminal X9 51 to 62: Digital output X51 to X62	RESET
MP121.1	Nominal speed command output of the second spindle Input:0: No servo-controlled axis 1 to 6: Analog outputs 1 to 6 at terminal X8 7 to 12: Analog outputs 7 to 13 at terminal X9 51 to 62: Digital output X51 to X62	RESET
MP130.x	Y index of the machine parameters MP2xxx.y for the axes Input: 0 to 12	PLC RUN
MP131.x	Y index of the machine parameters MP2xxx.y for the spindle(s) in operating mode 0 Input: 0 to 12	PLC RUN
MP131.0	Index for the first spindle	
MP131.1	Index for the second spindle	
MP132.x	Y index of the machine parameters MP2xxx.y for the spindle(s) in operating mode 1 Input: 0 to 12	PLC RUN
MP132.0	Index for the first spindle	
MP132.1	Index for the second spindle	
MP210	Counting direction of the encoder signals of the position encoder Format:%xxxxxxxxxxxxxx Input:Bits 0 to 13 represent axes 1 to 14 0: Positive 1: Negative	RESET

MP	Function and input	Behavior/ SW vers.
MP331.x	Distance for the number of signal periods in MP332 Input:0.0001 to +1.797693135E+308 [mm] or [°]	PLC RUN REF
MP332.x	Number of signal periods for the distance in MP331 Input:1 to +1.797693135E+308	PLC RUN REF
MP334.x	Nominal increment between two fixed reference marks on encoders with distance-coded reference marks Input:1 to 65,535 0: 1 000	PLC RUN REF
MP340.x	Interpolation factor for external interpolation Input:0 to 99 0 = 1: No external interpolation	RESET
MP410	Assignment of axis keys IV and V Input:Axis designation XYZABCUVWxyz-abcuvw–	PLC RUN
MP410.3	IV axis key	
MP410.4	V axis key	
MP420.x	Hirth coupling Input:0: No Hirth coupling 1: Hirth coupling	PLC RUN
MP430.x	Prescribed increment for Hirth coupling Input:0.0000 to 30.0000 [°]	PLC RUN
MP710.x	Backlash compensation Input:-1.0000 to +1.0000 [mm] or [°]	PLC RUN
MP711.x	Height of peaks during circular movement (analog only) Input:-1.0000 to +1.0000 [mm] (digital: 0)	PLC RUN
MP712.x	Compensation value per control loop cycle time Input:0.000000 to 99.999999 [mm] (digital: 0)	PLC RUN
MP715.x	Height of peaks during circular movement (analog only) with M105 Input:-1.0000 to +1.0000 [mm] (digital: 0)	PLC RUN
MP716.x	Compensation value per control loop cycle time with M105 Input:0.000000 to 99.999999 [mm] (digital: 0)	PLC RUN
MP720.x	Linear axis error compensation Input:–1.000 to +1.000 [mm/m]	PLC RUN
MP730	Selection of linear/nonlinear axis error compensation Format:%xxxxxxxxxxxxxx Input:Bits 0 to 3 represent axes 1 to 14: 0: Linear axis error compensation 1: Nonlinear axis error compensation	PLC RUN
MP750.x	Backlash Input:-1.0000 to +1.0000 [mm] or [°]	PLC RUN
MP752.x	Backlash compensation time Input:0 to 1000 [ms]	PLC RUN

MP	Function and input	Behavior/ SW vers.
MP810.x	Display mode for rotary axes and PLC auxiliary axes Input:0.0000 to 99,999.9999 [°] 0: Display +/–99 999.9999 1: Modulo value for display	PLC RUN REF
MP812	Activate software limit switches for tilting axes with modulo display, M94 and encoders with EnDat interface Format:%xxxxxxxxxxxxxx Input:Bits 0 to 3 represent axes 1 to 14: 0: Software limit switch not active 1: Software limit switch active	RESET
MP850.x	Synchronized axes Input:0: Master axis 1: Slave axis to axis 1 2: Slave axis to axis 2 3: Slave axis to axis 3 4: Slave axis to axis 4 5: Slave axis to axis 5 6: Slave axis to axis 6 7: Slave axis to axis 7 8: Slave axis to axis 8 9: Slave axis to axis 9	PLC RUN
MP855.x	Sychronization monitoring Input:0 to 100.0000 [mm] 0: Monitoring not active	PLC RUN
MP860.x	Datum for synchronous control Input:0: Datum at position after switch-on 1: Datum at reference marks 2: Axis is torque slave axis	PLC RUN
MP910.x	Positive software limit switches, traverse range 1 (default setting after power on) Input:-99,999.9999 to +99,999.9999 [mm] or [°]	PLC RUN
MP911.x	Positive software limit switches, traverse range 2 Input:-99,999.9999 to +99,999.9999 [mm] or [°]	PLC RUN
MP912.x	Positive software limit switches, traverse range 3 Input:-99,999.9999 to +99,999.9999 [mm] or [°]	PLC RUN
MP920.x	Negative software limit switches, traverse range 1 (default setting after power on) Input:-99,999.9999 to +99,999.9999 [mm] or [°]	PLC RUN
MP921.x	Negative software limit switches, traverse range 2 Input:-99,999.9999 to +99,999.9999 [mm] or [°]	PLC RUN
MP922.x	Negative software limit switches, traverse range 3 Input:-99,999.9999 to +99,999.9999 [mm] or [°]	PLC RUN

MP	Function and input	Behavior/ SW vers.
MP950.x	Datum for positioning blocks with M92 for axes 1 to 9 Input:-99,999.9999 to +99,999.9999 [mm] or [°] Values with respect to the machine datum	PLC RUN
MP951.x	Simulated tool-change position for TOOL CALL during mid-program startup (block scan) Input:-99,999.9999 to +99,999.9999 [mm] or [°]	PLC RUN
MP960.x	Machine datum Input:–1.79769313486E+308 to +1.79769313486E+308 [mm] or [°] Values with respect to the scale reference point	PLC RUN REF

30.4.2 Positioning

MP	Function and input	Behavior/ SW vers.
MP1010.x	Rapid traverse Input:10 to 300 000 [mm/min or °/min]	PLC RUN
MP1011	Limit of rapid traverse on the path Input:10 to 300 000 [mm/min or °/min]	340 420-05 PLC RUN
MP1020.x	Manual feed Input:10 to 300 000 [mm/min]	PLC RUN
MP1030.x	Positioning window Input:0.0001 to 2.0000 [mm]	PLC RUN
MP1040	Analog axes: Polarity of nominal value voltage Digital axes: Algebraic sign of the nominal speed value Format:%xxxxxxxxxxxxxx Input:Bits 0 to 13 represent axes 1 to 14 0: Positive 1: Negative	
MP1050.x	Analog axes: Analog voltage at rapid traverse Input:1,000 to 9,000 [V] Digital axes: without function Input value: 1	PLC RUN
MP1054.x	Distance of one motor revolution [mm or °] Input:Analog axes: Without function Digital axes: A formula can be entered.	
MP1060.x	Acceleration Input:0.001 to 100.000 [m/s^2 or $1000°/s^2$]	PLC RUN
MP1061	Limitation of the path acceleration Input:0.001 to 100.000 [m/s^2 or $1000°/s^2$]	340 420-05 PLC RUN
MP1070	Radial acceleration Input:0.001 to 100.000 [m/s^2 or $1000°/s^2$]	PLC RUN
MP1080.x	Analog axes: Integral factor for offset adjustment Input: Enter 0 to 65 535 Digital axes: No function Input value: 0	PLC RUN
MP1086.x	Maximum permissible jerk during single-axis movements at rapid traverse for the operating modes Program Run Full Sequence, Program Run Single Block, and Positioning with Manual Data Input Input:0: Function inactive 0.1 to 1000.0 [m/s^3 or $1000°/s^3$]	340 420-02 PLC RUN
MP1087.x	Maximum permissible axis-specific jerk for Manual mode Input:0.1 to 1000.0 [m/s^3 or $1000°/s^3$]	PLC RUN
MP1089.x	Maximum permissible axis-specific jerk for Pass Over Reference Point mode Input:0.1 to 1000.0 [m/s^3 or $1000°/s^3$]	PLC RUN

MP	Function and input	Behavior/ SW vers.
MP1090	Maximum permissible jerk on the tool path Input:0.1 to 1000.0 [m/s^3 or 1000°/s^3]	PLC RUN
MP1090.0	With machining feed rate	
MP1090.1	Beginning with feed rate from MP1092	
MP1092	Feed rate threshold from which MP1090.1 becomes effective Input:10 to 300 000 [mm/min]	PLC RUN
MP1094	HSC filters Input:0: HSC filter inactive 0.1 to 166.0: Cutoff frequency for HSC filter	
MP1095	Nominal position value filter Input:0: Single filter 1: Double filter	PLC RUN
MP1095.0	In the Program Run Full Sequence, Program Run Single Block, and Positioning With Manual Data Input operating modes	
MP1095.1	In the Manual, Handwheel, Jog Increment and Pass Over Reference Point operating modes	
MP1096	Tolerance for contour transitions at corners Input:0: No nominal position value filter 0.001 to 3.000 [mm]	PLC RUN
MP1096.0	With machining feed rate	
MP1096.1	With rapid traverse	
MP1097.x	Maximum permissible axis-specific jerk (single/HSC filter) Input:0.1 to 1000.0 [m/s^3 or 1000°/s^3]	PLC RUN
MP1098.x	Maximum permissible axis-specific jerk (double/HSC filter) Input:0.1 to 1000.0 [m/s^3 or 1000°/s^3]	PLC RUN
MP1099	Minimum filter order Input:0 to 20	PLC RUN
MP1099.0	Minimum filter configuration for single filter (MP1095 = 0)	
MP1099.1	Minimum filter configuration for double filter (MP1095 = 1)	
MP1110.x	Standstill monitoring Input:0.0010 to 30.0000 [mm]	PLC RUN
MP1120.x	Standstill monitoring when determining the field angle Input:0.0000 to 300.0000 [mm] or [°]	340 422-03, 340 480-03 PLC RUN
MP1140.x	Threshold above which the motion monitoring functions Input:Analog axes: 0.030 to 10.000 [V] Digital axes: 0.030 to 10.000 [1000 min] Recommended: 0.030 [1000 min]	PLC RUN
MP1144.x	Motion monitor for position and speed Input:Analog axes: Without function Digital axes: 0 to 99 999.999 [mm] 0: No monitoring	PLC RUN
MP1146.x	Difference between the position at shutdown and the position read in via the EnDat interface Input:0.0000 to 300.0000 [mm] or [°] 0: No difference permitted	340 420-05 PLC RUN

MP	Function and input	Behavior/ SW vers.
MP1150.0	Delay time for deleting the nominal velocity value with the erasable error message **EXCESSIVE SERVO LAG IN <AXIS>** Input:0 to 65.535 [s] Recommended: 0	PLC RUN
MP1150.1	Time period for which the monitoring function is to remain off after the fast PLC input defined in MP4130.0 is set. Input:0 to 65.535 [s] 0: Monitoring functions on Recommended: 0.2 to 0.5	
MP1150.2	Minimum time period for which the monitoring functions are to remain effective after expiration of the time from MP1150.1. Input: 0 to 65.535 [s]	
MP1320	Direction for traversing the reference marks Format:%xxxxxxxxxxxxxx Input:Bits 0 to 13 represent axes 1 to 14 0: Positive 1: Negative	PLC RUN
MP1330.x	Velocity for traversing the reference marks Input:80 to 300 000 [mm/min]	PLC RUN
MP1331.x	Velocity for leaving the reference mark end position for axes 1 to 9 (only for rotary encoders MP1350 = 2) Input:10 to 300 000 [mm/min]	PLC RUN
MP1340.x	Sequence for traversing the reference marks Input:0: No evaluation of reference marks 1 to 14: Axes 1 to 14	PLC RUN REF
MP1350.x	Sequence for finding the reference mark Input:0: Linear encoder with distance-coded reference marks (old routine) 1: Position encoder with one reference mark 2: Special type (length measurement with ROD) 3: Linear encoder with distance-coded reference marks (new routine) 4: Same as 3 except that two reference marks are evaluated 5: Encoder with EnDat interface 6: Reference pulse via fast PLC input	PLC RUN REF
MP1355	Double reference run Format:%xxxxxxxxxxxxxx Input:Bits 0 to 13 represent axes 1 to 14 0: Reference run as defined in MP1350.x 1: Double reference run	340 420-05 PLC RUN REF
MP1356.x	Distance between speed and position encoder for double reference run. Input:-99,999.999 to +99,999.999 [mm] or [°]	340 420-05 PLC RUN REF
MP1357.x	W1032 for double reference run Input:0: Reset W1032 if the reference run has been over the EnDat interface of the speed encoder 1: Reset W1032 if the reference mark was traversed with the position encoder	340 422-05, 340 480-05 PLC RUN

MP	Function and input	Behavior/ SW vers.
MP1360.x	Fast PLC input for reference pulse Input:0: No fast PLC input for reference pulse 1 to 5: Fast PLC input 1 to 5 (MP4130.x)	PLC RUN REF
MP1391	Velocity feedforward control in the MANUAL and HANDWHEEL operating modes Format:%xxxxxxxxxxxxxx Input:Bits 0 to 13 represent axes 1 to 14 0: Operation with following error (lag) 1: Operation with velocity feedforward control	PLC RUN
MP1392	Velocity feedforward in the POSITIONING WITH MANUAL DATA INPUT, PROGRAM RUN SINGLE BLOCK and PROGRAM RUN FULL SEQUENCE operating modes Format:%xxxxxxxxxxxxxx Input:Bits 0 to 13 represent axes 1 to 14 0: Operation with following error (lag) 1: Operation with velocity feedforward control	PLC RUN
MP1396.x	Feedback control with velocity semifeedforward Input:0.001 to 0.999 1: Velocity feedforward control	PLC RUN

30.4.3 Operation with Velocity Feedforward Control

MP	Function and input	Behavior/ SW vers.
MP1410.x	Position monitoring for operation with velocity feedforward control (erasable) Input:0.0010 to 30.0000 [mm] Recommended: 0.5 mm	PLC RUN
MP1420.x	Position monitoring for operation with velocity feedforward control (EMERGENCY STOP) Input:0.0010 to 30.0000 [mm] Recommended: 2 mm	PLC RUN
MP1510.x	k_V factor for velocity feedforward control Input:0.100 to 1,000.000 [(m/min)/mm]	PLC RUN
MP1511.x	Factor for static friction compensation Input: 0 to 16,777,215 [s]	PLC RUN
MP1512.x	Limitation of the amount of the static friction compensation Input:0 to 16 777 215 [counting steps]	PLC RUN
MP1513.x	Feed-rate limitation for static friction compensation Input:0 to 300 000 [mm/min]	PLC RUN
MP1515.x	k_V factor for velocity feedforward control effective after M105 Input:0.100 to 20.000 [(m/min)/mm]	PLC RUN
MP1516.x	k_V factor for velocity semifeedforward control Input:0.100 to 20.000 [(m/min)/mm]	PLC RUN
MP1521	Transient response during acceleration and deceleration Input:1 to 255 [ms] 0: Function inactive	PLC RUN
MP1522	Feed-rate smoothing Input:0 to 60 [ms] 0: Function inactive	340 422-10, 340 480-10 PLC RUN

30.4.4 Operation with Following Error (Servo Lag)

MP	Function and input	Behavior/ SW vers.
MP1710.x	Position monitoring for operation with following error (erasable) Input:0.0000 to 300.0000 [mm] Recommended: 1.2 · following error	PLC RUN
MP1720.x	Position monitoring for operation with following error (EMERGENCY STOP) Input:0.0000 to 300.0000 [mm] Recommended: 1.4 · following error	PLC RUN
MP1810.x	k_v factor for control with following error Input:0.100 to 20.000 [(m/min)/mm]	PLC RUN
MP1815.x	k_v factor for control with following error effective after M105 Input:0.100 to 20.000 [(m/min)/mm]	PLC RUN
MP1820.x	Multiplier for the k_v factor Input:0.001 to 1.00000	PLC RUN
MP1830.x	Characteristic curve kink point Input:0.000 to 100,000 [%]	PLC RUN

30.4.5 Integrated Speed and Current Control

MP	Function and input	Behavior/ SW vers.
MP2040	Axis groups (for drive enabling through X150/X151)	PLC
	Format: %xxxxxxxxxxxxxx Input: 0: Axis not assigned (disabling only through I32) 1: Axis assigned	RUN
MP2040.0-2	Axis group 1 to 3	
MP2040.3-7	Reserved, enter %00000000000000	
MP2050	Functionality of drive enabling I32 (X42/33)	
	Input: 0: Emergency stop for all axes, Module 9169 not effective 1: Emergency stop for all axes that are not excepted with Module 9169 2: I32 and Module 9169 are without functionality	
MP2100.x	Type of power module	RESET
	Input: Name of the selected power module (entered by the iTNC)	
MP2150	Signal for powerfail	
	Input: 0: AC fail 1: Powerfail and AC fail 2: reserved 3: Powerfail	
MP2160.x	Field weakening with synchronous motors	
	Input: 0: No voltage-protection module 1: Voltage-protection module present 2: Limited field weakening without voltage-protection module for EcoDyn motors	
MP2170	Waiting time between the switch-on of the drive and the drive’s standby signal	
	Input: 0.001 to 4.999 [s] 0: 2 [s]	
MP2180.x	PWM frequency	CC 422: RESET
	Input: 0: f_{PWM} = 5000 Hz 3200 to 3999: f_{PWM} = 3333 Hz 4000 to 4999: f_{PWM} = 4166 Hz (CC 424: 4000 Hz) 5000 to 5999: f_{PWM} = 5000 Hz 6000 to 7999: f_{PWM} = 6666 Hz 8000 to 9999: f_{PWM} = 8333 Hz (CC 424: 8000 Hz) 10000: f_{PWM} = 10000 Hz	CC 424: PLC, RUN
MP2182.x	Cycle time of current controller at double the fundamental PWM frequency	340 422-10, 340 480-10
	Input: 0: Cycle time = 1 / (2 · f_{PWM}) 1: Cycle time = 1 / f_{PWM}	PLC RUN
MP2190	DC link voltage U_Z	
	Input: 0 to 10,000 [V] HEIDENHAIN inverters: Non-regenerative: 565 V Regenerative: 650 V	

MP	Function and input	Behavior/ SW vers.
MP2195	Handling of status signals from HEIDENHAIN power supply units Input:Bit 0 – Status signals that are already active during control power-up. 0: Missing signals are ignored 1: Missing signals are evaluated Bit 1– $\overline{\text{ERR.UZ.GR}}$ signal 0: Error message is not suppressed 1: Error message is suppressed Bit 2 – $\overline{\text{ERR.TMP}}$ signal 0: Error message is not suppressed 1: Error message is suppressed Bit 3 – Reserved Bit 4 – $\overline{\text{ERR.IZ.GR}}$ signal 0: Error message is not suppressed 1: Error message is suppressed Bit 5 – RDY.PS signal 0: Error message is not suppressed 1: Error message is suppressed Bit 6 – $\overline{\text{ERR.ILEAK}}$ signal 0: Error message is not suppressed 1: Error message is suppressed Bit 7 – Reserved	340 420-06
MP2200.x	Motor Input:Name of the selected motor (entered by the iTNC)	RESET
MP2202.x	Overwrite "Line count" from the motor table Input:*: Input from the motor table active 0: No speed encoder (volts-per-hertz control mode) 1 to 999,999	340 420-05 RESET
MP2204.x	Overwrite "Counting direction" from the motor table Input:*: Input from the motor table active +: Positive counting direction –: Negative counting direction	340 420-05 RESET
MP2206.x	Overwrite "Type of encoder" from the motor table Input:*: Input from the motor table active 0: No speed encoder (volts-per-hertz control mode) 1: Incremental rotary encoder with Z1 track 2: Absolute rotary encoder with EnDat interface (aligned) 3: Absolute linear encoder with EnDat interface 4: Incremental linear encoder 5: Absolute rotary encoder with EnDat interface (not aligned) 6: Incremental rotary encoder without Z1 track 7:Incremental rotary encoder with distance-coded reference marks (not aligned) 8: Incremental linear encoder with distance-coded reference marks (nonaligned)	340 420-05 RESET

MP	Function and input	Behavior/ SW vers.
MP2220.x	Monitoring functions Format:%xxxxxxxxxxxxxxxx Input:Bit 0 – Monitoring the reference mark 0: Monitoring active 1: Monitoring inactive Bit 1 – Monitoring the direction of rotation 0: Monitoring active 1: Monitoring inactive Bit 2 – Power limit of spindle with $\overline{\text{ERR.IZ.GR}}$ (only for HEIDENHAIN inverters, except UE 2xx) 0: Power limit active 1: Power limit inactive (All HEIDENHAIN inverters except UE 2xx) Bit 3 – Switching off the controller when the motor brakes are activated 0: Suppress oscillations 1: Vibrations are allowed CC 422: Bit 4 to bit 8 reserved Bit 4 – Only CC 424: Monitoring for excessive temperature 0: Active 1: Inactive Bit 5 – Only CC 424: Monitoring for insufficient temperature 0: Active 1: Inactive Bit 6 – Reserved Bit 7– Only CC 424: Monitoring of encoder input frequency 0: Active 1: Inactive Bit 8 – Only CC 424: Adjust mechanical offset by gradually increasing the k_V factor 0: Active 1: Inactive Bits 9 to 15: Reserved	PLC RUN
MP2230.x	Factor for motor current during test of motor brake Input:0.1 to 30.0 [· motor current] 0: No test of motor brakes, or motor without brake	340 420-08
MP2232.x	Maximum permissible path during test of motor brakes Input:0 to 10.0000 [mm] or [°]	340 420-08
MP2234.x	Internal triggering of the motor brakes via the PWM interface Format:%xx Input:Bit 0 – 0: Signal is transmitted 1: Signal is not transmitted Bit 1– reserved	340 422-06, 340 480-06 PLC RUN

MP	Function and input	Behavior/ SW vers.
MP2250.x	Only CC 424: Determining the field angle without motor motion Input:0: Same as input value 2 1: reserved 2: Method 2 (brakes applied) 3: Method 3 (same as Method 2, but motor brake is not applied)	340 422-03, 340 480-03 PLC RUN
MP2252.x	Only CC 424: Reserved Input:Enter 0	340 422-03, 340 480-03 PLC RUN
MP2254.x	Determining the field angle Input:0: Field angle is determined during operation; soft key has no function (without plausibility test) 1: Only CC 422: Field angle is determined via soft key; motor motion is permitted 2: Only CC 424: Field angle is determined via soft key; motor motion is permitted (with plausibility test)	340 420-09 PLC RUN
MP2256.x	Determined field angle Input:0: Field angle does not need to be determined, or has not been determined	340 422-03, 340 480-03 PLC RUN
MP2257.x	Control or encoder identification for the field angle from MP2256.x Input:0: Field angle does not need to be determined, or has not been determined	340 422-03, 340 480-03 PLC RUN
MP2302.x	Reference value for I^2t monitoring of motor Input:0 to 1000.000 [· rated current of motor] 0: I^2t monitoring of motor switched off 1: Rated current of motor as reference value	
MP2304.x	Reference value for I^2t monitoring of power module Input:0 to 1000.000 [· rated current of power module] 0: I^2t monitoring of power module switched off 1: Rated current of power module as reference value	340 420-06
MP2308.x	Time between output of the braking signal $\overline{\text{BRK}}$ and switching off of the controller (overlap time) Input: 0.001 to 0.500 [s] 0: 0.200 s	340 420-06
MP2312.x	Factor for utilization of motors Input:0 to 1,000.000 0: Factor = 1	
MP2390.x	Maximum braking power Input:0.1 to 3 000.000 [kW] 0: Braking power is not limited	

MP	Function and input	Behavior/ SW vers.
MP2392.x	Power limit Input:0: No power limit 0.1 to 3000.000 [kW]	
MP2394.x	Max. braking performance at power failure Input:0.1 to 3 000.000 [kW] 0: Braking power is not limited	
MP2396.x	Maximum torque Input:0.1 to 30,000.0 [Nm] 0: Torque is not limited	PLC
MP2420.x	Proportional factor of the current controller Input:0.00 to 9999.99 [V/A]	
MP2430.x	Integral factor of the current controller Input:0.00 to 9 999.99 [V/As]	
MP2500.x	Proportional factor of the speed controller Input:0 to 1 000 000,000 [As]	PLC RUN
MP2510.x	Integral factor of the speed controller Input:0 to 100,000,000 [A]	PLC RUN
MP2512.x	Limiting the integral-action component of the speed controller Input:0.000 to 30.000 [s] (realistic values: 0.1 to 2.0)	PLC RUN
MP2520.x	Differential component of the speed controller Input:0 to 1.0000 [As]	PLC RUN
MP2530.x	PT_2 element of the shaft speed controller (2nd-order delay) Input: 0 to 1.0000 [s]	PLC RUN
MP2540.x	Band-rejection filter for damping Input:0.0 to 18.0 [dB]	PLC RUN

MP	Function and input	Behavior/ SW vers.
MP2542.x	Only CC 424: Damping the band-rejection filter for filter 1 Input:0 to 99.0 [dB]	PLC RUN
MP2543.x	Only CC 424: Damping the band-rejection filter for filter 2 Input:0 to 99.0 [dB]	PLC RUN
MP2544.x	Only CC 424: Damping the band-rejection filter for filter 3 Input:0 to 99.0 [dB]	PLC RUN
MP2545.x	Only CC 424: Damping the band-rejection filter for filter 4 Input:0 to 99.0 [dB]	PLC RUN
MP2546.x	Only CC 424: Damping the band-rejection filter for filter 5 Input:0 to 99.0 [dB]	PLC RUN
MP2550.x	Band-rejection filter for center frequency Input:0.0 to 999.9 [Hz]	PLC RUN
MP2552.x	Only CC 424: Center frequency of band-rejection filter for filter 1 Input:0 to 30000.0 [Hz]	PLC RUN
MP2553.x	Only CC 424: Center frequency of band-rejection filter for filter 2 Input:0 to 30000.0 [Hz]	PLC RUN
MP2554.x	Only CC 424: Center frequency of band-rejection filter for filter 3 Input:0 to 30000.0 [Hz]	PLC RUN
MP2555.x	Only CC 424: Center frequency of band-rejection filter for filter 4 Input:0 to 30000.0 [Hz]	PLC RUN
MP2556.x	Only CC 424: Center frequency of band-rejection filter for filter 5 Input:0 to 30000.0 [Hz]	PLC RUN
MP2560.x	Low-pass filter Input:0: No low-pass filter 1: 1st-order low-pass filter 2: 2nd-order low-pass filter	PLC RUN
MP2560.x	Only CC 424: Filter order of the low-pass filter Input:0 to 20	340 420-09 PLC RUN

MP	Function and input	Behavior/ SW vers.
MP2562.x	Only CC 424: Filter type for filter 1 Input:0: No filter 1: PT2 low-pass filter (speed controller) 2: Band-rejection filter (speed controller) 11: PT2 low-pass filter (position controller) 12: Band-rejection filter (position controller)	PLC RUN
MP2563.x	Only CC 424: Filter type for filter 2 Input:0: No filter 1: PT2 low-pass filter (speed controller) 2: Band-rejection filter (speed controller) 11: PT2 low-pass filter (position controller) 12: Band-rejection filter (position controller)	PLC RUN
MP2564.x	Only CC 424: Filter type for filter 3 Input:0: No filter 1: PT2 low-pass filter (speed controller) 2: Band-rejection filter (speed controller) 11: PT2 low-pass filter (position controller) 12: Band-rejection filter (position controller)	PLC RUN
MP2565.x	Only CC 424: Filter type for filter 4 Input:0: No filter 1: PT2 low-pass filter (speed controller) 2: Band-rejection filter (speed controller) 11: PT2 low-pass filter (position controller) 12: Band-rejection filter (position controller)	PLC RUN
MP2566.x	Only CC 424: Filter type for filter 5 Input:0: No filter 1: PT2 low-pass filter (speed controller) 2: Band-rejection filter (speed controller) 11: PT2 low-pass filter (position controller) 12: Band-rejection filter (position controller)	PLC RUN
MP2572.x	Only CC 424: Band width of the band-rejection filter for filter 1 Input:0 to 30000.0 [Hz]	PLC RUN
MP2573.x	Only CC 424: Band width of the band-rejection filter for filter 2 Input:0 to 30000.0 [Hz]	PLC RUN
MP2574.x	Only CC 424: Band width of the band-rejection filter for filter 3 Input:0 to 30000.0 [Hz]	PLC RUN
MP2575.x	Only CC 424: Band width of the band-rejection filter for filter 4 Input:0 to 30000.0 [Hz]	PLC RUN
MP2576.x	Only CC 424: Band width of the band-rejection filter for filter 5 Input:0 to 30000.0 [Hz]	PLC RUN
MP2590.x	Braking ramp in an emergency stop Input:0.1 to 999.9 [min^{-1}/ms] 0: Function inactive	PLC RUN
MP2600.x	Acceleration feedforward control Input:0 to 100.0000 [A/(rev/s)]	PLC

MP	Function and input	Behavior/ SW vers.
MP2602.x	IPC time constant T_1 Input: 0.0001 to 1.0000 [s] 0: IPC inactive	PLC RUN
MP2604.x	IPC time constant T_2 Input: 0.0001 to 1.0000 [s] 0: IPC inactive	PLC RUN
MP2606.x	Following error in the jerk phase Input:0 to 10,000	PLC RUN
MP2607.x	Damping factor for active damping Input:0 to 30,000 0: No damping 1.5: Typical damping factor	340 422-03, 340 480-03 PLC RUN
MP2608.x	Damping time constant for active damping Input: 0 to 0.9999 [s] 0: No damping 0.005 to 0.02: Typical damping time constant	340 422-03, 340 480-03 PLC RUN
MP2610.x	Friction compensation at low speeds (effective only with velocity feedforward control) Input:0 to 30.0000 [A] 0: No friction compensation (or axis is analog)	PLC RUN
MP2610.x	Only CC 424: Low-speed friction compensation Input:0 to 30.0000 [A] (effective value) 0: No friction compensation	PLC RUN
MP2612.x	Delay of the friction compensation (effective only with velocity feedforward control) Input:0.0000 to 1.0000 [s] (typically: 0.015 s) 0: No friction compensation (or axis is analog)	PLC RUN
MP2612.x	Only CC 424: Distance before the reversal point from which a reduction of the current from MP2610.x is to go into effect. Input:0.000 to 1.000 [mm] or [°] 0: No friction compensation 0.1: Typical input value	PLC RUN
MP2614.x	Only CC 424: Distance after the reversal point from which a reduction of the current from MP2610.x is to go into effect. Input:0.000 to 1.000 [mm] or [°] 0: Friction compensation same as CC 424 0.1: Typical input value	PLC RUN
MP2620.x	Friction compensation Input:0 to 100,000 [A] 0: No friction compensation (or axis is analog)	PLC RUN
MP2630.x	Holding current Input:-30,000 to +30,000 [A]	PLC RUN
MP2900.x	Tensioning torque between master and slave for master-slave torque control (entry for the slave axis) Input:-100.00 to +100.00 [Nm]	PLC

MP	Function and input	Behavior/ SW vers.
MP2910.x	P factor of the torque controller for master-slave torque control (entry for the slave axis) Input:0.00 to 999.99 [1/(Nm · min)]	PLC
MP2920.x	Factor for variable torque distribution of the master-slave torque control (entry for the slave axis) Input:0 to 100,000 1: Master and slave axes have identical motors	PLC
MP2930.x	Speed compensation ratio for master-slave torque control (entry for the slave axis) Input:-100.00 to +100.00 [%]	PLC

30.4.6 Spindle

MP	Function and input	Behavior/ SW vers.
MP3010	Output of speed, gear range Input:0: No output of spindle speed 1: Speed code if the speed changes 2: Speed code at every TOOL CALL 3: Nominal speed value always, G code if the gear range shifts 4: Nominal speed value always, G code at every TOOL CALL 5: Nominal speed value always, no G code 6: Same as 3, but with controlled spindle for orientation 7: Same as 4, but with controlled spindle for orientation 8: Same as 5, but with controlled spindle for orientation	PLC RUN
MP3011	Function of analog output S, if MP3010 < 3 Input:0: No special function 1: Voltage is proportional to the current contouring feed rate, depending on MP3012 2: Voltage is defined as through Module 9130 3: Voltage is defined through M functions (M200 to M204)	
MP3012	Feed rate from output of an analog voltage of 10 V, MP3011 = 1 Input:0 to 300 000 [mm/min]	
MP3013.x	Characteristic curve kink points (velocity) for output of the analog voltage with M202 Input:10 to 300 000 [mm/min]	PLC RUN
MP3014.x	Characteristic curve kink points (voltage) for output of the analog voltage with M202 Input:0.000 to 9.999 [V]	PLC RUN
MP3020	Speed range for S code output Format:xxyyz xx: S code for minimum speed yy: S code for maximum speed z: Speed increment Input:0 to 99,999	PLC RUN
MP3030	Behavior of the spindle Input:Bit 0 – 0: Axis stop for TOOL CALL S 1: No axis stop for TOOL CALL S Bit 1: Zero spindle speed when switching to another gear range 0: Reduce speed to 0 1: Do not reduce speed to 0	PLC RUN
MP3120	Zero speed permitted Input:0: S = 0 allowed 1: S = 0 not allowed	PLC RUN

MP	Function and input	Behavior/ SW vers.
MP3130	Polarity of the nominal spindle speed Input:0: M03 positive, M04 negative 1: M03 negative, M04 positive 2: M03 and M04 positive 4: M03 and M04 negative	PLC RUN
MP3140	Counting direction of spindle position encoder output signals Input:0: Positive counting direction with M03 1: Negative counting direction with M03	PLC RUN
MP3142	Line count of the spindle position encoder Input:100 to 30000 [lines]	PLC RUN
MP3143	Mounting configuration of the spindle position encoder Input:0: Position encoder directly on the first spindle 1: Position encoder via transmission (ratio in MP3450.x and MP3451.x); X30 pin 1: reference pulse 2: Position encoder via transmission (ratio in MP3450 and MP3451); X30 pin 1: reference pulse release 3: Same as input value 1, except that the second reference pulse is evaluated.	PLC RUN
MP3210.0-7	Analog nominal spindle voltage at rated speed for the gear ranges 1 to 8 Input:0 to 100,000 [V] Digital spindle motor revolutions at rated speed for the gear ranges 1 to 8 Input:0 to 100.000 [1000 min^{-1}]	PLC RUN
MP3240.1	Analog spindle: Minimum nominal value voltage Input:0 to 9.999 [V] Digital spindle: Minimum motor speed Input:0 to 9.999 [1000 min^{-1}]	PLC RUN
MP3240.2	Analog spindle: Spindle jog voltage for gear shifting (M4009/M4010) Input:0 to 9.999 [V] Digital spindle: Motor speed for gear shifting (M4009/ M4010) Input:0 to 9.999 [1000 min^{-1}]	
MP3310 MP3310.0 MP3310.1	Limitation for spindle speed override Input:0 to 150 [%] Upper limit Lower limit	PLC RUN
MP3411.0-7	Ramp gradient of the spindle with M03 and M04 for gear ranges 1 to 8 Input:Analog axes: 0 to 1.999 [V/ms] Digital axes: 0 to 1.999 [1000 rpm/ms]	PLC RUN

MP	Function and input	Behavior/ SW vers.
MP3412	Multiplication factor for MP3411.x	PLC
	Input:0.000 to 1.999	RUN
MP3412.0	With M05	
MP3412.1	With oriented spindle stop	
MP3412.2	With tapping with floating tap holder	
MP3412.3	With rigid tapping	
MP3415	Overshoot behavior of the spindle with M03, M04 and M05	PLC
	Input:0 to 1000 [ms]	RUN
MP3415.0	With M03, M04 and M05	
MP3415.1	For oriented spindle stop	
MP3415.2	With tapping	
MP3415.3	With rigid tapping	
MP3420	Spindle positioning window	PLC
	Input:0 to 360.0000 [°]	RUN
MP3430	Deviation of the reference mark from the desired position (spindle preset)	PLC
	Input:0 to 360 [°]	RUN
MP3440.0-7	k_V factor for spindle orientation for gear ranges 1 to 8	PLC
	Input:0.1 to 10 [(1000°/ min) /°]	RUN
MP3450.0-7	Number of spindle position-encoder revolutions for gear ranges 1 to 8	PLC
	Input:0 to 65,535 0: No transmission	RUN
MP3451.0-7	Number of spindle revolutions for gear ranges 1 to 8	PLC
	Input:0 to 65,535 0: No transmission	RUN
MP3510.0-7	Rated speed for the gear ranges 1 to 8	PLC
	Input:0 to 99 999.999 [min^{-1}]	RUN
MP3515.0-7	Maximum spindle speed for gear ranges 1 to 8	PLC
	Input:0 to 99 999.999 [min^{-1}]	RUN
MP3520.0	Speed activation through marker M4011	PLC
	Input:0 to 99 999.999 [min^{-1}]	RUN
MP3520.1	Spindle speed for oriented stop	
	Input:0 to 99 999.999 [min^{-1}]	

30.4.7 Integral PLC

MP	Function and input	Behavior/ SW vers.
MP4000.0-31	Options for the conditional compilation of the PLC program	
MP4020	PLC functions Format:%xxxxxxxxxxxxx Input:Bit 0 to bit 4: Reserved Bit 5: Single or double spindle operation 0: Single-spindle operation 1: Double-spindle operation Bit 6 – Reserved Bit 7 – Transferring the values of the Pt 100 inputs 0: Accept values at a change rate of 1 K/s 1: Accept results immediately Bit 8 – Behavior after an ext. emergency stop 0: "Approach position" is not automatically activated 1: "Approach position" is automatically activated Bit 9 – Behavior of a simulated key 0: Simulated key is transferred immediately to the NC 1: Simulated key is processed first by an active PLC window before being transferred to the NC Bit 10 – Behavior of a locked key 0: Locked key only works on the active PLC window 1: Locked key works on neither the active PLC window nor on the NC Bit 11 – PLC counter in MP4120.x 0: Input in PLC cycles 1: Input in seconds Bit 12 – Font size in PLC window 0: Automatic adaptation of font size to screen 1: Font size for BF 120	RESET
MP4030	Assignment of physical to logical PL Input:0: First logical PL 1: Second logical PL 2: Third logical PL 3: Fourth logical PL	PLC RUN
MP4030.0	First physical PL	
MP4030.1	Second physical PL	
MP4030.2	Third physical PL	
MP4030.3	Fourth physical PL	

MP	Function and input	Behavior/ SW vers.
MP4040	Set PLC output after shutdown	340 420-03 PLC RUN
MP4041	Time after shutdown until setting of the PLC output from MP4042 Input: 0 to 1000 [s]	340 420-03 PLC RUN
MP4042	PLC output to be set after shutdown Input: 0 to 31	340 420-03 PLC RUN
MP4043	Switch off outputs that cannot be switched off by emergency stop after 250-ms delay Input: %xxxxxxxxxxxxxxxx Bits 0 to 15 correspond to O0 to O15 0: Do not switch off output with delay 1: Switch off output with delay	340 422-07, 340 480-07 Only until 340 422-09, 340 480-09 PLC RUN
MP4044	Switch off outputs that cannot be switched off by emergency stop after 250-ms delay Input: %xxxxxxxx Bits 0 to 7 correspond to O16 to O23 0: Do not switch off output with delay 1: Switch off output with delay	340 422-07, 340 480-07 Only until 340 422-09, 340 480-09 PLC RUN
MP4045	Switch off outputs that cannot be switched off by emergency stop after 250-ms delay Input: % xxxxxxx Bits 0 to 6 correspond to O24 to O30 0: Do not switch off output with delay 1: Switch off output with delay	340 420-08 Only until 340 422-09, 340 480-09 PLC RUN
MP4050.0-8	Traverse distance for lubrication of axes 1 to 9 Input: 0 to 99 999.999 [m or 1000°]	PLC RUN
MP4060.0-3	Outputs that are to be switched off with the delay from MP4061.x when all outputs are switched off Input: 0 to 30 –1: Do not switch off output with delay	340 422-09, 340 480-09 PLC
MP4061.0-3	Delay time for switching off the outputs in MP4060.x Input: 0 to 5,000 [s]	340 422-09, 340 480-09 PLC
MP4070	Compensation amount per PLC cycle for lagged-tracking axis error compensation Input: 0.0001 to 0.5000 [mm]	PLC RUN
MP4110.0-47	Run time PLC timer T0 to T47 Input: 0 to 1,000,000.000 [s]	PLC RUN
MP4111.96-x	Run time PLC timer T96 to x (defined in OEM.SYS) Input: 0 to 1,000,000.000 [s]	PLC RUN

MP	Function and input	Behavior/ SW vers.
MP4120.0-47	PLC counter preset value Input: 0 to 1 000 000.000 [s or PLC cycles, depending on MP4020, bit 11]	PLC RUN
MP4130.0 MP4130.1 MP4130.2-5	Number of the high-speed PLC input for switching off the monitoring functions reserved Numerical designation for fast PLC inputs Input:0 to 255 [no. of the PLC input]	
MP4131.0 MP4131.1 MP4131.2-5	Activation criterion for fast PLC input for switching off the monitoring functions reserved Activation criterion for fast PLC inputs Input:0: Activation at low level 1: Activation at high level	
MP4210.0-47	Setting a number in the PLC (D768 to D956) Input:-99,999.9999 to +99,999.9999	
MP4220.0-4	Setting a number in the PLC (W960 to W968) Input:10 to 30,000	
MP4230.0-31	Setting a number in the PLC (Module 9032) The number of indexes can be increased via an entry in OEM.SYS. Input:-99,999.9999 to +99,999.9999	
MP4231.0-31	Setting a number in the PLC (Module 9032) Input:-99,999.9999 to +99,999.9999	
MP4310.0-6	Setting a number in the PLC (W976 to W988, M4300 to M4411) Input:10 to 30,000	

30.4.8 Configuration of the Data Interface

MP	Function and input	Behavior/ SW vers.
MP5000	Disable data interfaces	PLC
	Input:0: No interface disabled 1: RS-232-C/V.24 interface disabled 2: RS-422/V.11 interface disabled 3: RS-232-C/V.24 and RS-422/V.11 interfaces disabled	RUN
MP5020	Configuration of the data interface	PLC
	Format:%xxxxxxxx Input:Bit 0 – 0: 7 data bits 1: 8 data bits Bit 1 – 0 : Any BCC character 1 : BCC not control character Bit 2 – 0: Transmission stop by RTS not active 1: Active Bit 3 – 0: Transmission stop by DC3 not active 1: Active Bit 4 – 0: Character parity even 1: Odd Bit 5 – 0: Character parity not desired 1: Desired Bit 6 = 0, Bit 7 = 0: 1 stop bit Bit 6 = 1, Bit 7 = 0: 2 stop bits Bit 6 = 0, Bit 7 = 1: 1 stop bit Bit 6 = 1, Bit 7 = 1: 1 stop bit	RUN CN123
MP5020.0	Operating mode EXT1	
MP5020.1	Operating mode EXT2	
MP5020.2	Operating mode EXT3 (PLC)	
MP5020.3	Operating mode EXT4 (PLC)	
MP5030	Data transmission protocol	PLC
	Input:0 = standard data transfer protocol 1 = blockwise transfer 2 = without protocol (only for MP5030.2)	RUN CN123
MP5030.0	Operating mode EXT1	
MP5030.1	Operating mode EXT2	
MP5030.2	Operating mode EXT3 (PLC)	
MP5030.3	Operating mode EXT4 (PLC)	

MP	Function and input	Behavior/ SW vers.
MP5040	Data transfer rate in operating mode EXT3 or EXT4 (data transfer through PLC) Input:0: 110 bps 1: 150 bps 2: 300 bps 3: 600 bps 4: 1200 bps 5: 2400 bps 6: 4800 bps 7: 9600 bps 8: 19200 bps 9: 38400 bps 10: 57600 bps 11: 115 200 bps	PLC RUN
MP5040.0	Operating mode EXT3 (PLC)	
MP5040.1	Operating mode EXT4 (PLC)	

30.4.9 3-D Touch Probe

MP	Function and input	Behavior/ SW vers.
MP6010	Selection of the touch probe Input:0: Touch probe with cable transmission (TS 120, TS 220) 1: Touch probe with infrared transmission (TS 632) 2: Touch probe with infrared transmission (TS 440, TS 640)	PLC CN123
MP6120	Probing feed rate Input:1 to 3000 [mm/min]	PLC RUN CN123
MP6130	Maximum measuring range Input:0.001 to 99,999.9999 [mm]	PLC RUN CN123
MP6140	Setup clearance over measuring point Input:0.001 to 99,999.9999 [mm]	PLC RUN CN123
MP6150	Rapid traverse in probing cycle Input:10 to 20,000 [mm/min]	PLC RUN CN123
MP6160	M function for probing from opposite directions Input:–1: Spindle orientation directly by NC 0: Function inactive 1 to 999: Number of the M function for spindle orientation through PLC	PLC RUN CN123
MP6161	M function for orienting the touch probe before every measuring process Input:–1: Spindle orientation directly by the NC 0: Function inactive 1 to 999: Number of the M function	PLC RUN CN123
MP6162	Orientation angle Input:0 to 359.9999 [°]	PLC RUN CN123
MP6163	Minimum difference between the current spindle angle and MP6162 before executing an oriented spindle stop Input:0 to 3.0000 [°]	PLC RUN CN123
MP6165	Orient the probe before approaching with Cycle 0 or 1, or with manual probing Input:0: Probe is not oriented before each probing 1: Probe is oriented and always deflected in the same direction	PLC RUN CN123

MP	Function and input	Behavior/ SW vers.
MP6170	Number of measurements in a programmed measurement (touch probe block) Input:1 to 3	PLC RUN CN123
MP6171	Confidence range for programmed measurement (MP6170 > 1) Input:0.002 to 0.999 [mm]	PLC RUN CN123
MP6180	Coordinates of the ring gauge center for Probing Cycle 2 with respect to the machine datum (traverse range 1) Input:0 to +99 999.9999 [mm]	PLC CN123
MP6180.0	X coordinate	
MP6180.1	Y coordinate	
MP6180.2	Z coordinate	
MP6181	Coordinates of the ring gauge center for Probing Cycle 2 with respect to the machine datum (traverse range 2) Input:0 to +99 999.9999 [mm]	PLC CN123
MP6181.0	X coordinate	
MP6181.1	Y coordinate	
MP6181.2	Z coordinate	
MP6182	Coordinate of the ring gauge center for Probing Cycle 2 with respect to the machine datum (traverse range 3) Input:0 to +99 999.9999 [mm]	PLCCN123 CN123
MP6182.0	X coordinate	
MP6182.1	Y coordinate	
MP6182.2	Z coordinate	
MP6185	Distance of probing point below ring top surface during calibration Input:+0.001 to +99 999.9999 [mm]	PLC CN123

30.4.10 Tool Measurement with TT

MP	Function and input	Behavior/ SW vers.
MP6500	Tool measurement with TT 130 Format: %xxxxxxxxxxxxxxx Input: Bit 0 – Cycles for tool measurement 0: Disabled 1: Not locked Bit 1 – 0: Tool radius measurement allowed. Tool length measurement with rotating spindle 1: Tool radius measurement and individual tooth measurement disabled Bit 2 – 0: Tool length measurement with rotating spindle (bit 1=1) 1: Tool length measurement with rotating spindle, only if a tool radius offset (**TT: R-OFFS**) has been entered in the tool table Bit 3 – 0: Tool measurement with spindle orientation 1: Tool measurement without spindle orientation. Individual tooth measurement not possible. Tool radius measurement possibly faulty. Bit 4 – 0: Automatically determine speed 1: Always use minimum spindle speed Bit 5 – NC stop during **Tool checking** 0: The NC program is not stopped when the breakage tolerance is exceeded. 1: If the breakage tolerance is exceeded, the NC program is stopped and the error message **Tool broken** is displayed. Bit 6 – NC stop during **tool measurement** 0: The NC program is not stopped when the breakage tolerance is exceeded. 1: If the breakage tolerance is exceeded, the NC program is stopped and the error message **Touch point inaccessible** is displayed.	PLC RUN

MP	Function and input	Behavior/ SW vers.
MP6500	Tool measurement with TT 130 Format:%xxxxxxxxxxxxxxx Input:Bit 7 – Reserved Bit 8 – Probing routine 0: Probe contact is probed from several directions 1: Probe contact is probed from one direction Bit 9 – Automatic measurement of the direction of the probe contact basic rotation (bit 8 = 1) 0: Basic rotation is not measured 1: Basic rotation of the probe element is automatically measured Bit 10 – Probing routine (bit 8 = 1) 0: Pre-positioning to starting point in all three principal axes 1: Pre-positioning to starting point in the tool axis and in the axis of the probing direction (MP6505) (bit 9 = 0) Bit 11 – **Tool checking** and changing in the tool table 0: After **Tool checking** the tool table is changed 1: After **Tool checking** the tool table is not changed Bit 12 – PLC datum shift 0: Do not include 1: Include Bit 13 – 0: Tool is measured in the tilt position in which the tool touch probe was also calibrated 1: Tool is measured in another tilt position Bit 14 – Tool measurement with number of teeth = 0 0: Tool measurement with rotating spindle 1: Tool measurement with stationary spindle	PLC RUN
MP6505	Probing direction for tool radius measurement for 3 traverse ranges Input:0: Positive probing direction of the angle reference axis (0° axis) 1: Positive probing direction in the +90° axis 2: Negative probing direction of the angle reference axis (0° axis) 3: Negative probing direction in the +90° axis	PLC RUN CN123
MP6505.0	Traverse range 1	
MP6505.1	Traverse range 2	
MP6505.2	Traverse range 3	
MP6507	Calculation of the probing feed rate Input:0: Calculation of the probing feed rate with constant tolerance 1: Calculation of the probing feed rate with variable tolerance 2: Constant probing feed rate	PLC RUN CN123
MP6510	Permissible measuring error for tool measurement with rotating tool Input:0.002 to 0.999 [mm]	PLC RUN CN123
MP6510.0	First measurement error	
MP6510.1	Second measurement error	

MP	Function and input	Behavior/ SW vers.
MP6520	Probing feed rate for tool measurement with non-rotating tool Input:1 to 3,000 [mm/min]	PLC RUN CN123
MP6530	Distance from the tool end to the top of the probe contact during tool radius measurement for 3 traverse ranges Input:0.001 to 99.9999 [mm]	PLC RUN CN123
MP6530.0	Traverse range 1	
MP6530.1	Traverse range 2	
MP6530.2	Traverse range 3	
MP6531	Diameter or edge length of the TT 130 probe contact for 3 traverse ranges Input:0.001 to 99.9999 [mm]	PLC RUN
MP6531.0	Traverse range 1	
MP6531.1	Traverse range 2	
MP6531.2	Traverse range 3	
MP6540	Safety zone around the probe contact of the TT 130 for pre-positioning Input:0.001 to 99,999.9999 [mm]	PLC RUN CN123
MP6540.0	Safety clearance in tool axis direction	
MP6540.1	Safety clearance in the plane perpendicular to the tool axis	
MP6550	Rapid traverse in probing cycle for TT 130 Input:10 to 300 000 [mm/min]	PLC RUN CN123
MP6560	M function for spindle orientation during individual tooth measurement Input:–1: Spindle orientation directly by NC 0: Function inactive 1 to 999: Number of the M function for spindle orientation by PLC	PLC RUN CN123

MP	Function and input	Behavior/ SW vers.
MP6570	Max. permissible surface cutting speed at the tooth edge Input:1.0000 to 129.0000 [m/min]	PLC RUN CN123
MP6572	Maximum permissible speed during tool measurement Input:1 to 1000 [min^{-1}] 0: 1000 [rpm^{-1}]	PLC RUN CN123
MP6580.0-2	Coordinates of the TT 130 probe contact center with respect to the machine datum (traverse range 1) Input:–99 999.9999 to +99 999.9999 [mm]	PLC RUN CN123
MP6581.0-2	Coordinates of the TT 130 probe contact center with respect to the machine datum (traverse range 2) Input:–99 999.9999 to +99 999.9999 [mm]	PLC RUN CN123
MP6582.0-2	Coordinates of the TT 130 probe contact center with respect to the machine datum (traverse range 3) Input:–99 999.9999 to +99 999.9999 [mm]	PLC RUN CN123
MP6585	Monitoring the position of the rotary and additional linear axes during the tool measurement cycles Format:%xxxxxx Input:0: Axis is not monitored 1: Axis is monitored Bit 0 – A axis Bit 1 – B axis Bit 2 – C axis Bit 3 – U axis Bit 4 – V axis Bit 5 – W axis	PLC RUN CN123
MP6586	Ref. coordinate for monitoring the position of the rotary and additional linear axes during the tool measurement cycles Input:–99 999.9999 to +99 999.9999 [mm or °]	PLC RUN CN123
MP6586.0	A axis	
MP6586.1	B axis	
MP6586.2	C axis	
MP6586.3	U axis	
MP6586.4	V axis	
MP6586.5	W axis	

30.4.11 Tapping

MP	Function and input	Behavior/ SW vers.
MP7110.0 MP7110.1	Minimum for feed-rate override during tapping Input:0 to 150 [%] Maximum for feed-rate override during tapping Input:0 to 150 [%]	PLC RUN
MP7120.0 MP7120.1 MP7120.2	Dwell time for reversal of spindle rotational direction Input: 0 to 65.535 [s] Advanced switching time of the spindle during tapping with coded spindle-speed output Input: 0 to 65.535 [s] Spindle slow-down time after reaching the hole depth Input: 0 to 65.535 [s]	PLC RUN
MP7130	Run-in behavior of the spindle during rigid tapping Input:0.001 to 10 [°/min]	PLC RUN
MP7150	Positioning window of the tool axis during rigid tapping Input:0.0001 to 2 [mm]	PLC RUN
MP7160	Spindle response during Cycles 17, 207 and 18 Format:%xxxxx Input:Bit 0 – Oriented spindle stop with Cycles 17 and 207 0: Oriented spindle stop before execution of the cycle 1: No oriented spindle stop before execution of the cycle Bit 1 – Spindle speed 0: Spindle speed is not limited 1: Spindle speed is limited so that it runs with constant speed approx. 1/3 of the time Bit 2 – Spindle in position feedback control 0: Spindle operated without position feedback control 1: Spindle operated with position feedback control Bit 3 – Acceleration feedforward control 0: Active 1: Not active Bit 4 – 0: Tool axis tracks the spindle 1: Tool axis and spindle interpolated	PLC RUN CN123

30.4.12 Display and Operation

MP	Function and input	Behavior/ SW vers.
MP7210	Programming Station Input:0: Controlling and programming 1: Programming station with PLC active 2: Programming station with PLC inactive	CN123
MP7212	Power interrupted message Input:0: Acknowledge message **Power interrupted** with CE key 1: **Power Interrupted** message does not appear	PLC RUN CN123
MP7220	Block number increment for ISO programs Input:0 to 250	PLC RUN CN123
MP7224	Lock specific file types Input:0: Do not disable 1: Disable Bit 0 – HEIDENHAIN programs *.H Bit 1 – ISO programs *.I Bit 2 – Tool tables *.T Bit 3 – Datum tables *.D Bit 4 – Pallet tables *.P Bit 5 – Text files *.A Bit 6 – HELP files *.HLP Bit 7 – Point tables *.PNT	PLC RUN CN123
MP7224.0	Disabling soft keys for file types	
MP7224.1	Protecting file types	
MP7224.2	Disable the EDIT ON/OFF soft key	340 422-07, 340 480-07
MP7225	Disable Windows drives in the TNC file manager Format:ABCDEFGHIJKLMNOPQRSTUV-WXYZ Input:If there are more than one drive, they are entered without spaces, e.g. MP7225 = CDE	340 480-06 PLC RUN
MP7226.0	reserved	PLC
MP7226.1	Size of the datum table Input:0 to 255 [lines]	RUN CN123
MP7229	Depiction of the NC program	PLC
MP7229.0	Line number for program testing Input:100 to 9999	RUN CN123
MP7229.1	Program length up to which FK blocks are permitted Input:100 to 9999	

MP	Function and input	Behavior/ SW vers.
MP7230	Dialog language Input:0: English 1: German 2: Czech 3: French 4: Italian 5: Spanish 6: Portuguese 7: Swedish 8: Danish 9: Finnish 10: Dutch 11: Polish 12: Hungarian 13: reserved 14: Russian (Cyrillic characters) 15: Chinese (simplified) 16: Chinese (traditional) 14, 15 and 16 only with the MC 422B and BF 150	PLC RUN CN123
MP7230.0	NC conversational language, soft keys for OEM cycles	
MP7230.1	PLC conversational language (user parameters)	
MP7230.2	PLC Error Messages	
MP7230.3	Help files	
MP7235	Time difference to Universal Time (Greenwich Mean Time) Input:–23 to +23 [hours]	Only until 340 480-03 SZCN12312 3 RESET

MP	Function and input	Behavior/ SW vers.
MP7237 MP7237.0 MP7237.1 MP7237.2	Displaying and resetting the operating times Display PLC operating times Input:Bit 0 to 12 corresponds to PLC operating times 1 to 13 0: Do not display 1: Display Resetting PLC operating times with the code number 857282 Input:Bit 0 to 12 corresponds to PLC operating times 1 to 13 0: Do not reset 1: Reset Resetting NC operating times with the code number 857282 Input:Bit 0 – No function Bit 1 – "Machine on" operating time Bit 2 – "Program run" operating time 0: Do not reset 1: Reset	PLC RUN
MP7238.0-12	Dialog messages for PLC operating times 1 to 13 Input:0 to 4095 Dialog no. from the file (OEM.SYS)	PLC RUN
MP7245	Disabling auxiliary cycles Input:0: Auxiliary cycles disabled 1: Auxiliary cycles permitted	PLC RUN
MP7246	Machine parameter with multiple function Input:%xxx Bit 0 – Paraxial positioning blocks 0: Permitted 1: Disabled Bit 1 – Clear with DEL key 0: Does not need confirmation 1: Must confirm via soft key Bit 2 – Tool usage file 0: Do not generate 1: Generate	PLC RUN
MP7251	Number of global Q parameters starting from Q99 (up to Q60) that are transferred from the OEM cycle to the calling program. Input:0 to 40	PLC RUN
MP7260	Number of tools in the tool table Input:0 to 30,000	CN123
MP7261.0-3	Number of pockets in the tool magazine 1 to 4 Input:0 to 254	CN123
MP7262	Maximum tool index number for indexed tools Input:0 to 9	CN123

MP	Function and input	Behavior/ SW vers.
MP7263	Pocket table Format:%xx Input:Bit 0 – 0: Show POCKET TABLE soft key 1: Hide POCKET TABLE soft key Bit 1 – Output of the columns for file functions 0: Output only the displayed columns 1: Output all columns	CN123

MP	Function and input	Behavior/ SW vers.
MP7266	Elements of the tool table Input:0: No display 1 to 99: Position in the tool table	CN123
MP7266.0	16-character alphanumeric tool name (NAME)	
MP7266.1	Tool length L	
MP7266.2	Tool radius R	
MP7266.3	Tool radius 2 for toroidal cutter (R2)	
MP7266.4	Oversize in tool length (DL)	
MP7266.5	Oversize in tool radius (DR)	
MP7266.6	Oversize in tool radius 2 (DR2)	
MP7266.7	Locked tool? (TL)	
MP7266.8	Replacement tool (RT)	
MP7266.9	Maximum tool age , M4543 (TIME1)	
MP7266.10	Maximum tool age TOOL CALL (TIME2)	
MP7266.11	Current tool age (CUR.TIME)	
MP7266.12	Comment on the tool (DOC)	
MP7266.13	Number of tool teeth (CUT)	
MP7266.14	Wear tolerance for tool length (LTOL)	
MP7266.15	Wear tolerance for tool radius (RTOL)	
MP7266.16	Cutting direction of the tool (DIRECT)	
MP7266.17	Additional information for PLC, module 9093 (PLC)	
MP7266.18	Tool offset for tool length (TT:LOFFS)	
MP7266.19	Tool offset for tool radius (TT: ROFFS)	
MP7266.20	Breakage tolerance for tool length (LBREAK)	
MP7266.21	Breakage tolerance for tool radius (RBREAK)	
MP7266.22	Tooth length (LCUTS)	
MP7266.23	Plunge angle (ANGLE)	
MP7266.24	Tool type (TYP)	
MP7266.25	Tool material (TMA)	
MP7266.26	Cutting-data table (CDT)	
MP7266.27	PLC value (PLC-VAL)	
MP7266.28	Probe center offset in reference axis (CAL-OF1)	
MP7266.29	Probe center offset in minor axis (CAL-OF2)	
MP7266.30	Spindle angle during calibration (CAL-ANG)	
MP7266.31	Tool type for pocket table (PTYP)	340 420-02
MP7266.32	Maximum shaft speed [rpm] (NMAX)	340 422-03, 340 480-03
MP7266.33	Retract tool (LIFTOFF)	340 422-06, 340 480-06
MP7267	Elements of the pocket table Input:0: No display 1 to 99: Position in the pocket table	CN123
MP7267.0	Tool number (T)	
MP7267.1	Special tool (ST)	
MP7267.2	Fixed pocket (F)	
MP7267.3	Locked pocket (L)	
MP7267.4	PLC status (PLC)	
MP7267.5	Tool name (TNAME)	
MP7267.6	Comment on the tool (DOC)	

MP	Function and input	Behavior/ SW vers.
MP7267.7 MP7267.8 MP7267.9 MP7267.10 MP7267.11 MP7267.12 MP7267.13 MP7267.14 MP7267.15 MP7267.16 MP7267.17	Tool type for pocket table (PTYP) Value 1 (P1) Value 2 (P2) Value 3 (P3) Value 4 (P4) Value 5 (P5) Reserve pocket (RSV) Pocket above locked (LOCKED_ABOVE) Pocket below locked (LOCKED_BELOW) Pocket at left locked (LOCKED_LEFT) Pocket at right locked (LOCKED_RIGHT)	340 420-02
MP7270	Feed rate display in the operating modes MANUAL OPERATION and ELECTRONIC HANDWHEEL Input:0: Display of axis feed rate through pressing an axis direction key (axis-specific feed rate from MP1020) 1: Display of axis feed rate also before an axis direction key is pressed (smallest value from MP1020 for all axes)	PLC RUN CN123
MP7280	Decimal character Input:0: Decimal comma 1: Decimal period	PLC RUN CN123
MP7281	Depiction of the NC program Input:0: All blocks completely 1: Current block completely, others line by line 2: All blocks line by line; complete block when editing	PLC RUN CN123
MP7285	Tool length offset in the tool-axis position display Input:0: Tool length is not offset 1: Tool length is offset	PLC RUN CN123
MP7289	Position display step for the spindle Input:0: 0.1° 1: 0,05° 2: 0,01° 3: 0,005° 4: 0,001° 5: 0,0005° 6: 0,0001°	PLC RUN CN123
MP7290.0-8	Position display step for axes 1 to 9 0: 0.1 mm or 0.1° 1: 0.05 mm or 0.05° 2: 0.01 mm or 0.01° 3: 0.005 mm or 0.005° 4: 0.001 mm or 0.001° 5: 0.0005 mm or 0.0005° 6: 0.0001 mm or 0.0001°	PLC RUN CN123

MP	Function and input	Behavior/ SW vers.
MP7291	Display of axes on the screen Format:SXYZABCUVWxyzabcuvw- Input:Characters 1 to 9 from the right represent lines 1 to 9 Character 10 is spindle S which is always output in line 10.	PLC RUN
MP7291.0	Display in traverse range 1	
MP7291.1	Display in traverse range 2	
MP7291.2	Display in traverse range 3	
MP7294	Disable axis-specific “Datum setting” in the preset table Format:%xxxxxxxxxxxxxx Input:Bits 0 to 13 represent axes 1 to 14 0: Not disabled 1: Disabled	340 422-01, 340 480-02 PLC RUN CN123
MP7295	Disable “Datum setting” Format:%xxxxxxxxxxxxxx Input:Bits 0 to 13 represent axes 1 to 14 0: Not disabled 1: Disabled	PLC RUN CN123
MP7296	“Datum setting” through axis keys Input:0: Datum can be set by axis keys and soft key 1: Datum can be set only by soft key	PLC RUN CN123
MP7300	Erasing the status information, tool data and Q parameters Input:0: Erase the status information, Q parameters and tool data when a program is selected. 1: Erase the status information, Q parameters and tool data if a program is selected and in the event of M02, M30, and END PGM. 2: Erase the status information and tool data if a program is selected. 3: Erase the status information and tool data if a program is selected and in the event of M02, M30, END PGM. 4: Erase the status information and Q parameters if a program is selected. 5: Erase the status information and Q parameters if a program is selected and in the event of M02, M30, END PGM. 6: Erase the status information if a program is selected and in the event of M02, M30, END PGM. 7: Erase the status information if a program is selected and in the event of M02, M30, END PGM.	PLC RUN CN123

MP	Function and input	Behavior/ SW vers.
MP7310	Graphic display mode Format:%xxxxxxxx Input:Bit 0 – Projection in three planes: 0: German-preferred projection 1: US-preferred projection Bit 1 – Rotating the coordinate system in the working plane by 90°: 0: No rotation 1: Rotation by +90° Bit 2 – BLK form after datum shift: 0: Shifted 1: Not shifted Bit 3 – Display of the cursor position: 0: Not displayed 1: Displayed Bit 4 – Reserved Bit 5 – Reserved Bit 6 – Reserved Bit 7 – Reserved	PLC RUN CN123
MP7315	Tool radius for graphic simulation without TOOL CALL Input:0.0000 to 99,999.9999 [mm]	PLC RUN CN123
MP7316	Penetration depth of the tool Input:0.0000 to 99,999.9999 [mm]	PLC RUN CN123
MP7317 MP7317.0 MP7317.1	M function for graphic simulation Beginning of graphic simulation Input:0 to 88 Interruption of the graphic simulation Input:0 to 88	PLC RUN CN123
MP7330.0-15	Specifying the user parameters 1 to 16 Input:0 to 9999.00 (no. of the user parameter)	PLC RUN
MP7340.0-15	Dialog messages for user parameters 1 to 16 Input:0 to 4095 (line number of the PLC dialog message file)	PLC RUN

30.4.13 Colors

MP	Function and input	Behavior/ SW vers.
MP7350	Window frames	PLC RUN
MP7351 MP7351.0 MP7351.1 MP7351.2	Error texts Priority 0 (error) Priority 1 (warning) Priority 2 (information)	340 422-06, 340 480-06 PLC RUN
MP7352 MP7352.0 MP7352.1 MP7352.2	“Machine” operating mode display Background Text for operating mode Dialog	PLC RUN
MP7353 MP7353.0 MP7353.1 MP7353.2	“Programming” operating mode display Background Text for operating mode Dialog	PLC RUN
MP7354 MP7354.0 MP7354.1 MP7354.2 MP7354.3	“Machine” program text display Background General program text Active block Background, not current window, comments, and unused machine parameters in the machine parameter file	PLC RUN
MP7355 MP7355.0 MP7355.1 MP7355.2 MP7355.3	“Programming” program text display Background General program text Active block Background, not current window, comments, and unused machine parameters in the machine parameter file	PLC RUN
MP7356 MP7356.0 MP7356.1 MP7356.2	Status window and PLC window Background Axis positions in the status display Status display other than axis positions	PLC RUN
MP7357 MP7357.0 MP7357.1 MP7357.2 MP7357.3	“Machine” soft-key display Background Text color Inactive soft-key row Active soft-key row	PLC RUN
MP7358 MP7358.0 MP7358.1 MP7358.2 MP7358.3	“Programming” soft-key display Background Text color Inactive soft-key row Active soft-key row	PLC RUN

MP	Function and input	Behavior/ SW vers.
MP7360	Graphics: 3-D view and plan view	PLC
MP7360.0	Background	RUN
MP7360.1	Surface	
MP7360.2	3-D: Front face	
MP7360.3	Text display in the graphics window	
MP7360.4	3-D: Lateral face	
MP7360.5	Lowest point of blank form	
MP7360.6	Highest point of blank form (below surface)	
MP7361	Graphics: Projection in three planes	PLC
MP7361.0	Background	RUN
MP7361.1	Top view	
MP7361.2	Front and side view	
MP7361.3	Axis cross and text in the graphic display	
MP7361.4	Cursor	
MP7362	Additional status display in the graphics window	PLC
MP7362.0	Background of graphic window	RUN
MP7362.1	Background of status display	
MP7362.2	Status symbols	
MP7362.3	Status values	
MP7363	Programming graphics	PLC
MP7363.0	Background	RUN
MP7363.1	Resolved contour	
MP7363.2	Subprograms and frame for zooming	
MP7363.3	Alternative solutions	
MP7363.4	Unresolved contour	
MP7363.5	Rapid traverse movements	
MP7364	Color of the help illustrations for cycles	PLC
MP7364.0-6	Colors 1 to 7 of the graphic program used	RUN
MP7364.7	Line color (color 8 of the graphic program)	
MP7364.8	Color for highlighted graphic elements if defined in the help illustration	
MP7364.9	Background	
MP7365	Oscilloscope	340 420-02
MP7365.0	Background	PLC
MP7365.1	Grid	RUN
MP7365.2	Cursor and text	
MP7365.3	Selected channel	
MP7365.4-9	Channel 1 to 6	
MP7366	Pop-up window (HELP key, pop-up menus etc.)	PLC
MP7366.0	Background	RUN
MP7366.1	Text or foreground	
MP7366.2	Active line	
MP7366.3	Title bar	
MP7366.4	Scroll-bar field	
MP7366.5	Scroll bar	
MP7366.6-14	Reserved	

MP	Function and input	Behavior/ SW vers.
MP7367 MP7367.0 MP7367.1-7 MP7367.8-14	Large PLC window Background Colors 1 to 7 (Color 8: MP7350) Color 9 to 15	PLC RUN
MP7368 MP7368.0 MP7368.1 MP7368.2 MP7368.3	Pocket calculator Background Background of displays and keys Key texts (“os” in “cos”) Key symbols	PLC RUN
MP7369 MP7369.0 MP7369.1 MP7369.2 MP7369.3 MP7369.4 MP7369.5 MP7369.6	Directory tree in PGM MGT Text background Text Text background of the active folder Line color of the tree structure Folders Drives Text background of the heading in the browser window	PLC RUN
MP7370 MP7370.0 MP7370.1-15	Small PLC window Background Color 1 to 15	340 420-05 PLC RUN
MP7392	Screen saver Input:1 to 99 [min] 0: No screen saver	PLC RUN CN123

30.4.14 Machining and Program Run

MP	Function and input	Behavior/ SW vers.
MP7410	Scaling cycle in two or three axes Input:0: Scaling cycle is effective in all three principal axes 1: Scaling cycle is effective only in the working plane	PLC RUN CN123
MP7411	Tool data in the touch probe block Input:Bit 0 – 0: Use the calibrated data of the touch probe 1: Use the current tool data from the last TOOL CALL Bit 1 – 0: Only one set of touch probe calibration data 1: Use the tool table to manage more than one set of touch probe calibration data	PLC RUN CN123
MP7420	Cycles for milling pockets with combined contours Format:%xxxxx Input:Bit 0 – Milling direction for channel milling: 0: Counterclockwise for pockets, clockwise for islands 1: Clockwise for pockets, counterclockwise for islands Bit 1 – Sequence for rough-out and channel milling (only for SL 1): 0: First channel milling, then pocket rough-out 1: First pocket rough-out, then channel milling Bit 2 – Merging of listed contours: 0: Contours are merged only if the tool-center paths intersect 1: Contours are merged if the programmed contours intersect Bit 3 – Rough-out and channel milling to pocket depth or for every infeed 0: Each process uninterrupted to pocket depth 1: Both processes for each pecking depth before proceeding to the next depth Bit 4 – Position after completion of the cycle: 0: Tool moves to the same position as before the cycle was called 1: Tool only moves in the tool axis to the “clearance height”	PLC RUN CN123
MP7430	Overlap factor during pocket milling Input:0.001 to 1.414	PLC RUN CN123

MP	Function and input	Behavior/ SW vers.
MP7431	Arc end-point tolerance Input:0.0001 to 0.016 [mm]	PLC RUN CN123
MP7440	Output of M functions Format:%xxxxxxx Input:Bit 0 – Program stop with M06 0: Program stop with M06 1: No program stop with M06 Bit 1 – Modal cycle call M89 0: Normal code transfer of M89 at beginning of block 1: Modal cycle call M89 at end of block Bit 2 – Program stop with M functions: 0: Program stop until acknowledgment of the M function 1: No program stop: No waiting for acknowledgment. Bit 3 – Switching of k_V factors with M105/ M106: 0: Function is not in effect 1: Function is effective Bit 4 – Reduced feed rate in the tool axis with M103: 0: Function is not in effect 1: Function is effective Bit 5 – Reserved Bit 6 – Automatic activation of M134 0: M134 must be activated in the NC program 1: M134 is automatically activated when an NC program is selected.	PLC RUN CN123
MP7441	Error message during cycle call Format:%xxx Input:Bit 0 – 0: Error message **Spindle ?** is not suppressed 1: Error message **Spindle ?** is suppressed Bit 1: Reserved, enter 0 Bit 2 – 0: Error message **Enter depth as negative** is suppressed 1: Error message **Enter depth as negative** is not suppressed	PLC RUN CN123
MP7442	Number of the M function for spindle orientation in the cycles Input:1 to 999: Number of the M function 0: No oriented spindle stop –1: Oriented spindle stop by the NC	PLC RUN CN123
MP7450	Offsetting the tool change position from MP951.x in block scan Format:%xxxxxxxxxxxxxx Input:Bits 0 to 3 represent axes 1 to 14: 0: Do not offset 1: Offset	PLC RUN

MP	Function and input	Behavior/ SW vers.
MP7460.x	reserved	340 422-10, 340 480-10 PLC RUN CN123
MP7461.x	reserved	340 422-10, 340 480-10 PLC RUN CN123
MP7451.0-8	Feed rate for returning to the contour for axes 1 to 9 Input:10 to 300 000 [mm/min]	PLC RUN
MP7470	Maximum contouring tool feed rate at 100% override Input:0 to 300 000 [mm/min] 0: No limitation	PLC RUN CN123
MP7471	Maximum velocity of the principal axes during compensating movements through M128 or TCPM Input:0 to 300 000 [mm/min]	PLC RUN CN123
MP7475	Reference for datum table Input:0: Reference is workpiece datum 1: Reference is machine datum (MP960.x)	PLC RUN CN123
MP7480	Output of the tool or pocket number	PLC RUN
MP7480.0	With TOOL CALL block Input:0: No output 1: Tool number output only when tool number changes 2: Output of tool number for every TOOL CALL block 3: Output of the pocket number and tool number only when tool number changes 4: Output of pocket number and tool number for every TOOL CALL block 5: Output of the pocket number and tool number only when tool number changes. Pocket table is not changed. 6: Output of pocket number and tool number for every TOOL CALL block. Pocket table is not changed.	
MP7480.1	With TOOL DEF block Input:0: No output 1: Tool number output only when tool number changes 2: Output of tool number for every TOOL DEF block 3: Output of the pocket number and tool number only when tool number changes 4: Output of pocket number and tool number for every TOOL DEF block	

MP	Function and input	Behavior/ SW vers.
MP7481.x	Sequence for new and returned tool when changing tools Format: %xxxx 0: First, output the pocket of the tool to be returned 1: First, output the pocket of the new tool Input: Bit 0: New tool from magazine 1 Bit 1: New tool from magazine 2 Bit 2: New tool from magazine 3 Bit 2: New tool from magazine 4	340 420-06 PLC RUN
MP7481.0	Tool from magazine 1 to be returned	
MP7481.1	Tool from magazine 2 to be returned	
MP7481.2	Tool from magazine 3 to be returned	
MP7481.3	Tool from magazine 4 to be returned	
MP7482	Pocket coding of the tool magazine Format: %xxxx 0: Variable pocket coding 1: Fixed pocket coding Input: Bit 0: Magazine 1 Bit 1: Magazine 2 Bit 2: Magazine 3 Bit 3: Magazine 4	340 420-06 PLC RUN
MP7490	Functions for traverse ranges Format: %xxxx Input: Bit 0 – 0: Display one traverse range with MOD 1: Display three traverse ranges with MOD Bit 1 – 0: Each traverse range has its own datum (and 3 memories for the positions of the swivel head) 1: One datum for all traverse ranges Bit 2 – Calibration data: touch probe for workpiece measurement: 0: One set of calibration data for all traverse ranges 1: Every traverse range has its own set of calibration data Bit 3 – Calibration data: touch probe for tool measurement: 0: One set of calibration data for all traverse ranges 1: Every traverse range has its own set of calibration data	PLC RUN
MP7492.x	Number of axis in which the same datum is to be set during Datum Setting (with active preset table) Input: 0 to 9 –1: Do not set a datum	340 422-03, 340 480-03 PLC RUN
MP7492.0 MP7492.13	Datum set in the first axis to Datum set in the 14th axis	
MP7494	Axes for which an exact stop is to occur after positioning Format: %xxxxxxxxxxxxxx Input: Bits 0 to 13 represent axes 1 to 14 0: No exact stop 1: Exact stop	340 422-06, 340 480-06 PLC RUN

MP	Function and input	Behavior/ SW vers.
MP7500	Tilt working plane (inactive preset table) Format: %xxxxxxxxx Input: Bit 0 – "Tilted working plane" 0: Off 1: On Bit 1 – 0: Angles correspond to the position of the tilting axes of the head/table 1: Angles correspond to the spatial angle (the iTNC calculates the position of the tilted axes of the head/table) Bit 2 – 0: The tilting axes are not positioned with Cycle19 1: The tilting axes are positioned with Cycle 19 Bit 3 – 0: The current tilting-axis position is taken into account with respect to the machine datum 1: The 0° position is assumed for the first rotary axis Bit 4 – 0: Compensate mechanical offset during exchange of the spindle head when calling M128, M114, TCPM or "tilted working plane" 1: Compensate mechanical offset during PLC datum shift Bit 5 – 0: The current tilting-axis position is taken into account with respect to the machine datum 1: The tilting-axis position that was entered with the 3-D ROT soft key applies. Bit 6 – 0: Spatial angle C is realized through a rotation of the coordinate system. 1: Spatial angle C is realized through a rotation of the table	PLC RUN
	Bit 7 – 0: The current tilting-axis position is taken into account with respect to the machine datum 1: The active tilting-axis position is a) derived from the tilting angles in the 3D ROT window if manual tilting is active b) derived from the reference coordinates of the rotary axes if tilting is inactive Bit 8 – 0: The tilting axis positioning is considered depending on bit 3, bit 5 and bit 7 1: If manual tilting is active, the datum to be set for the principal axes X, Y and Z is recalculated back to the home position of the tilting element	

MP	Function and input	Behavior/ SW vers.
MP7500	Tilt working plane (active preset table) Format:%xxxxxxxxx Input:Bit 0 – “Tilted working plane” 0: Off 1: On Bit 1 – 0: Angles correspond to the position of the tilting axes of the head/table 1: Angles correspond to the spatial angle (the iTNC calculates the position of the tilted axes of the head/table) Bit 2 – 0: The tilting axes are not positioned with Cycle19 1: The tilting axes are positioned with Cycle 19 Bit 3 – No function Bit 4 – No function Bit 5 – Test of the tilting axis during “datum setting” in X, Y and Z 0: Current tilting-axis position must fit the defined tilting angles 1: No test Bit 6 – 0: Spatial angle C is realized through a rotation of the coordinate system. 1: Spatial angle C is realized through a rotation of the table Bit 7 – No function Bit 8 – No function Bit 9 – Reserved	340 422-01, 340 480-02 PLC RUN
MP7502	Functionality of M144/M145 Input:%xxx Bit 0 – 0: M144/M145 not active 1: M144/M145 active Bit 1 – M144/M145 in the automatic modes 0: M144/M145 active 1: M144 is activated automatically at the start of an NC program. It can only be deactivated with M145 during an NC program. Bit 2 – M144/M145 in the manual modes 0: M144/M145 not active 1: M144/M145 active	PLC RUN
MP7510 MP7510.0-14	Transformed axis Format:%xxxxxx Input:0: End of the transformation sequence Bit 0 corresponds to axis X Bit 1 corresponds to axis Y Bit 2 corresponds to axis Z Bit 3 corresponds to axis A Bit 4 corresponds to axis B Bit 5 corresponds to axis C Transformation 1 to transformation 15	PLC RUN

MP	Function and input	Behavior/ SW vers.
MP7520	Additional code for transformation	PLC
	Format:%xx Input:Bit 0 – Tilting axis 0: Swivel head 1: Tilting table Bit 1 – Type of dimension in MP7530.x 0: Incremental dimension for swivel head 1: Absolute with respect to the machine datum for tilting table	RUN
MP7520.0-14	Transformation 1 to transformation 15	
MP7530	Type of dimension for transformation	PLC
	Input:Entry of a formula is possible, 0: Free tilting axis	RUN
MP7530.0-14	Transformation 1 to transformation 15	
MP7550	Basic setting of the tilting device	PLC
	Input:-99,999.9999 to +99,999.9999	RUN
MP7550.0	A axis	
MP7550.1	B axis	
MP7550.2	C axis	

30.4.15 Hardware

MP	Function and input	Behavior/ SW vers.
MP7600.0	Only CC 422: Position controller cycle time = MP7600.0 · 0.6 ms Input:1 to 20 Proposed input value: 3 (= 1.8 ms) Proposed input value for basic version: 6 (= 3.6 ms)	RESET
MP7600.1	Only CC 422: PLC cycle time = MP7600.1 ·Position controller cycle time = MP7600.0 · MP7600.1 · 0.6 ms Input:1 to 20 Proposed input value: 6 (= 10.8 ms) Proposed input value for basic version: 3 (= 10.8 ms)	
MP7602	Only CC 424: PLC cycle time Input:0 to 60 [ms] 0 to 10: 10.8 ms	340 422-03, 340 480-03
MP7620	Feed-rate override and spindle speed override Format:%xxxxxxx Input:Bit 0 – Feed-rate override if rapid traverse key is pressed in **Program Run** mode. 0: Override not effective 1: Override effective Bit 1 – No function Bit 2 – Feed-rate override if rapid traverse key and machine direction button are pressed in **Manual mode** 0: Override not effective 1: Override effective Bit 3 – Feed-rate override and spindle speed override in 1% increments or according to a non-linear characteristic curve 0: 1% steps 1: Nonlinear characteristic curve Bit 4 – No function Bit 5 – Reserved Bit 6 – Feed-rate smoothing 0: Not active 1: Active Bit 7 – Reserved	PLC RUN
MP7621	reserved	
MP7640	Handwheel Input:0: No handwheel 1: reserved 2: HR 130 3: reserved 4: reserved 5: Up to three HR 150 via HRA 110 6: HR 410 7 to 10: Reserved 11: HR 420	PLC RUN

MP	Function and input	Behavior/ SW vers.
MP7641	Handwheel settings Format:%xxxxxxxxxxxxxxx Input:Bit 0 – HR 410: Entry of interpolation factor 0: Through iTNC keyboard 1: Through PLC Module 9036 Bit 1 – HR 420: With detent positions 0: Without detent positions 1: With detent positions Bit 2 – HR 420: Axis direction keys and rapid traverse 0: Controlled by the NC 1: Controlled by the PLC Bit 3 – HR 420: NC Start / NC Stop 0: Controlled by the NC 1: Controlled by the PLC	PLC RUN

MP	Function and input	Behavior/ SW vers.
MP7645	Initializing parameter for handwheel	PLC
MP7645.0	Assignment of the keys on handwheel HR 410 Input:0: Evaluation of the keys by NC, including LEDs 1: Evaluation of the keys by PLC	RUN
MP7645.0	Assignment of a third handwheel via axis selector switch S2, when MP7645.2 = 0 Input:0: Switch position 1 (at the left stop) 3rd handwheel axis Z Switch position 2 3rd handwheel axis IV Switch position 3 3rd handwheel axis V 1: Switch position 1 3rd handwheel axis X Switch position 2 3rd handwheel axis Y Switch position 3 3rd handwheel axis Z Switch position 4 3rd handwheel axis IV Switch position 5 3rd handwheel axis V 2: Switch position 3 3rd handwheel axis Z Switch position 4 3rd handwheel axis IV Switch position 5 3rd handwheel axis V	
MP7645.1	Fixed assignment of third handwheel if MP7645.2 = 1 Input:1: Axis X 2: Axis Y 4: Axis Z 8: Axis IV (MP410.3) 16: Axis V (MP410.4)	
MP7645.2	Assignment of a third handwheel via axis selector switch or MP7645.1 Input:0: Assignment by axis selection switch according to MP7645.0 1: Assignment by MP7645.1	
MP7645.3-7	No function	
MP7650	Handwheel counting direction for each axis Input:Bits 0 to 13 represent axes 1 to 14 0: Negative counting direction 1: Positive counting direction	PLC RUN
MP7660	Threshold sensitivity for electronic handwheel Input:0 to 65 535 [increments]	PLC RUN
MP7670	Interpolation factor for handwheel Input:0 to 10	PLC RUN
MP7670.0	Interpolation factor for low speed	
MP7670.1	Interpolation factor for medium speed (only HR 410)	
MP7670.2	Interpolation factor for high speed (only HR 410)	

MP	Function and input	Behavior/ SW vers.
MP7672.x	reserved	340 422-06, 340 480-06 PLC RUN
MP7671	Handwheel feed rate in the Handwheel operating mode with HR 410 Input:0 to 1000 [% of MP1020]	PLC RUN
MP7671.0	Low speed	
MP7671.1	Medium speed (only HR 410)	
MP7671.2	High speed (only HR 410)	
MP7680	Machine parameter with multiple function Format:%xxxxxxxxxxxxxxx Input:Bit 0 – Memory function for axis-direction keys with M4562: 0: Not saved 1: Saved if M4562 is set Bit 1 – Returning to the contour 0: Not active 1: Active Bit 2 – Block scan 0: Not active 1: Active Bit 3 – Interruption of block scan for STOP or M06: 0: Interruption 1: No interruption Bit 4 – Inclusion of programmed dwell time during the block scan: 0: Include the dwell time 1: Do not include the dwell time Bit 5 – Start of calculation for block scan 0: Start from block with cursor 1: Start from beginning of program Bit 6 – Tool length in blocks with normal vectors: 0: Without R2 from tool table (south pole) 1: With R2 from tool table (center of sphere) Bit 7 – Inserting a defined rounding arc or spline: 0: Defined rounding arcs are always inserted 1: Defined rounding arcs are always inserted if the acceleration from MP1060.x or MP1070 was exceeded.	PLC RUN

MP	Function and input	Behavior/ SW vers.
MP7680	Machine parameter with multiple function	PLC
	Bit 8 – Insertion of rounding arc or cubic spline 0: Rounding arc is inserted. 1: A cubic spline is inserted instead of a rounding arc. Bit 9 – Constant jerk on spline (bit 8 = 1) 0: No constant jerk 1: Constant jerk Bit 10 – Cutter-radius-compensated outside corners 0: Insertion of a circular arc 1: Insertion of a spline curve Bit 11 – Behavior of M116 0: Rotary axis is parallel to linear axis 1: Any position of rotary axis to linear axis Bit 12 – Behavior of Cycle 28 0: Standard behavior 1: The slot wall is approached and departed tangentially; at the beginning and end of the slot a rounding arc with a diameter equal to the slot width is cut Bit 13 – Behavior during program interruption with axis movement 0: Automatic activation of **APPROACH POSITION** 1: Do not automatically activate **APPROACH POSITION** Bit 14 – Behavior of NC start after NC stop and internal stop 0: NC start permitted 1: NC start only permitted after block scan GOTO Bit 15 – NC Start if program is aborted 0: NC start permitted 1: NC Start not permitted (message window)	RUN
MP7681	M/S/T/Q transfer to the PLC during block scan	PLC
	Format:%xxxx Input:Bit 0 – 0: Transfer M functions to the PLC during block scan. 1: Collect M functions and transfer them to the PLC after block scan. Bit 1 – 0: Transfer T code to the PLC during block scan 1: Transfer last T code to the PLC after block scan Bit 2 – 0: Transfer S or G code to the PLC during block scan 1: Transfer S or G code to the PLC after block scan. Bit 3 – 0: Transfer FN19 outputs to the PLC during block scan 1: Transfer last FN19 outputs to the PLC after block scan.	RUN

MP	Function and input	Behavior/ SW vers.
MP7682	Machine parameter with multiple function Format: %xxxxxxxx Input: Bit 0 – Incremental block after TOOL CALL 0: With length compensation 1: Without length compensation Bit 1 – Reference value for calculating the preset during datum setting 0: Actual value is calculated 1: Nominal value is calculated Bit 2 – Traverse path of rotary axes with modulo display 0: Positioning without passing over zero 1: Positioning on the shortest path Bit 3 – Reserved, enter 0 Bit 4 – Tolerance of rotary axes with M128 or TCPM 0: With consideration of head dimensions 1: Without consideration of head dimensions Bit 5 – Feed rate with M128 or TCPM 0: Feed rate refers to tool tip 1: Feed rate from interpolation of all axes involved Bit 6 – Behavior with TOOL DEF strobe 0: Depending on the NC program, the TOOL DEF strobe must be acknowledged by the PLC (TOOL DEF within a contiguous contour) 1: TOOL DEF strobe must always be acknowledged by the PLC Bit 7 – Block elements TOOL CALL and S in ISO blocks 0: Machine as programmed 1: Machine at beginning of block (block display does not change)	PLC RUN

MP	Function and input	Behavior/ SW vers.
MP7683	Executing pallet tables and NC programs Format: %xxxxx Input:Bit 0 – No function Bit 1 – **Program Run, Full Sequence** mode 0: During the start, a complete NC program is run. 1: At the start all NC programs are executed up to next pallet. Bit 2 – **Program Run, Full Sequence** mode 0: As defined in bit 1 1: All NC programs and pallets up to the end of the table are executed. Bit 3 – When the end of the table is reached, the process begins again with the first line. 0: Function is not in effect 1: Function is effective (bit 2=1) Bit 4 – Editing the active pallet table 0: Active pallet table cannot be edited. 1: In the **Program Run, Full Sequence** and **Program Run, Single Block** modes, the current pallet table can be edited. Bit 5 – AUTOSTART soft key 0: Do not display soft key 1: Display soft key Bit 6 – Display of pallet table and NC program 0: Both simultaneously in a split screen 1: Pallet table or NC program individually Bit 7 – AUTOSTART function 0: AUTOSTART function by NC 1: AUTOSTART function by PLC	PLC RUN

MP	Function and input	Behavior/ SW vers.
MP7684	Nominal position value filter (bit 0 to bit 4) and path control with M128 or TCPM (bit 5 to bit 7 permitted) Format:%xxxxxxxx Input:Bit 0 – Nominal position value filter 0: Include acceleration 1: Do not include the acceleration Bit 1 – Nominal position value filter 0: Include the jerk 1: Do not include the jerk Bit 2 – Nominal position value filter 0: Include the tolerance 1: Do not include the tolerance Bit 3 – Nominal position value filter 0: Include the radial acceleration 1: Do not include the radial acceleration Bit 4 – Nominal position value filter 0: Include curvature changes 1: Do not include curvature changes Bit 5 – Feed-rate reduction at corners with M128 or TCPM 0: Include only maximum compensation movement 1: Do not include compensation movements Bit 6 – Feed-rate reduction at corners with M128 or TCPM 0: Include compensation movements depending on the entry in bit 5 1: Include all compensation movements Bit 7 – Reserved Bit 8 – Reserved	PLC RUN
MP7690	Evaluation of the electronic ID labels Input:%xx Bit 0 – HEIDENHAIN power modules 0: Active 1: Inactive Bit 1 – HEIDENHAIN synchronous motors 0: Active 1: Inactive Bit 2 – Reserved	340 422-06, 340 480-06
MP7691	Size of a log file with operating system messages. Can only be evaluated by HEIDENHAIN. Set MP7691 = 0. Input:0: Function inactive 1 to 10 [MB]	340 420-05

30.4.16 Second Spindle

MP	Function and input	Behavior/ SW vers.
MP13010 to MP13520	Machine parameter block for the second spindle Input:Function and input range are identical with MP3010 to MP3520.	

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