

MTX 14VRS

Multitouch

Application Description
R911384735

Edition 03



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1 About this documentation

Editions of this documentation

Edition	Release date	Note
01	2018-03	First edition
02	2019-11	chapter 7.3 "NC program creation" on page 153 extended by a new NC editor for big programs (WP-00077353)
03	2021-03	chapter 12.3 "Operating the encryption program" on page 344 : Screenshots of the MTXCrypt program updated (Defdb00209177)

Tab. 1-1: Change record

1.1 Validity of the documentation

Purpose of the documentation The Multitouch user interface of the NC control MTX is described in this documentation.

This documentation is a component of the full documentation for the MTX.

Overview on target groups and product phases The following graphic refers to the bordered activities, product phases and target groups of the present documentation.

Example: The target group "Programmer" can execute the "Configuration" in the product phase "Engineering" using this documentation.

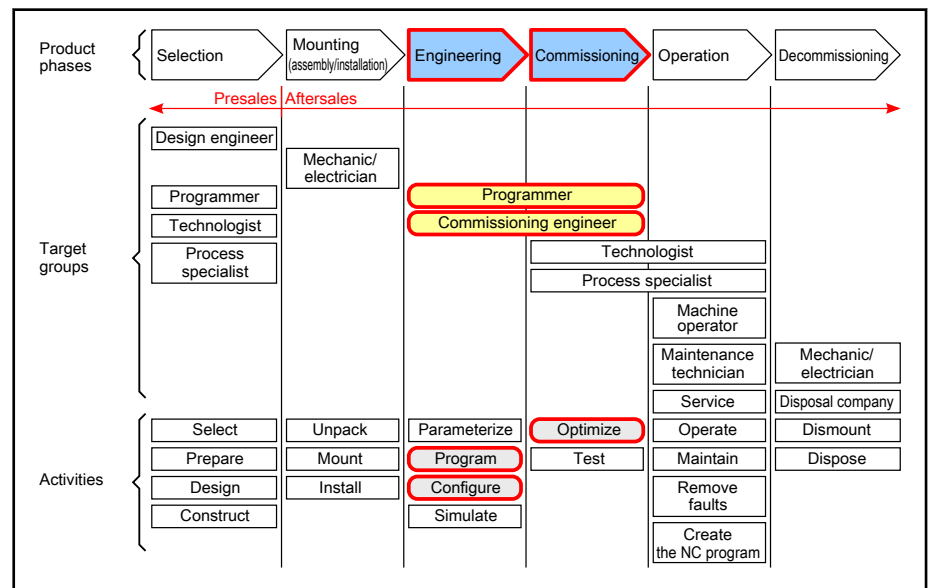


Fig. 1-1: Assigning this documentation to the target groups, product phases and target group activities

Target group This documentation is intended for users commissioning an MTX control. Apart from a complete overview, configuration of the axes and the user interface as well as the PLC data are described.

This documentation supports the user during the following phases:

- Engineering
- Commissioning

1.2 Structure

The document is structured according to the procedures. The description of the individual functions corresponds to their operation. General operating instructions come first.

1.3 Notation, fonts, symbols

The following notations are used in this documentation to actuate operating elements (buttons, keys):

Keys on the keyboard and on the operator panel

Keys on the keyboard and on the operator panel are shown in angled brackets <>, e.g. press Enter by <Enter>.

Keys that have to be pressed in **sequence** are separated by a comma, e.g. <1>, <2>, <Enter>.

Keys that are pressed **simultaneously** are combined using a plus symbol, e.g. <Ctrl>+<Alt>+<Del> or <Shift>+<Enter>.

Buttons on the user interface

Buttons in the dialogs of the user interface are highlighted by quotation marks, e.g. "OK" or "Cancel".

Menu sequences

To display menus, the individual sequential menu items are highlighted in bold and connected by triangles. For example, to go to the "Save" menu sub-item in the "File" menu: **File ▶ Save**.

1.4 Prerequisites

To operate the standard user interface of MTX according to this documentation, the control has to be configured and commissioned.

The default settings of the dialogs as delivered are described. For further configurations, refer to the "IndraMotion MTX 14VRS Commissioning", DOK-MTX***-STARTUP*V14-CORS-EN-P documentation.

1.5 Required and supplementing documentation MTX

1.5.1 Selection/compilation

Documentation titles with type codes and part numbers

MTX 14VRS System Description DOK-MTX***-SYS*DES*V14-PRRS-EN-P, R911342640 This documentation describes the MTX control. It includes the designs, technical data, interfaces as well as the configuration of the control components.
MTX 14VRS SafeLogic System Overview DOK-MTX***-SL**SYS*V14-PRRS-EN-P, R911341698 This documentation describes the use of the safety control SafeLogic in the MTX.

Tab. 1-2: MTX documentation overview - Selecting/composing

1.5.2 Configuration

Documentation titles with type codes and part numbers

MTX 14VRS Machine Parameters DOK-MTX***-MA*PAR**V14-RERS-EN-P, R911342630 This documentation describes structure and the adjustment of available parameters of the MTX. It also includes the functions of the NC configurator and its operation.
MTX 14VRS PLC interface DOK-MTX***-PLC*INT*V14-PRRS-EN-P, R911342622 This documentation describes the interface signals and the program function blocks for the integrated PLC.
MTX 14VRS Functional Description - Basics DOK-MTX***-NC*F*BA*V14-RERS-EN-P, R911342626 This documentation describes the basic functions of the MTX. The basic commissioning steps and the control functions are provided as description and handling instruction.
MTX 14VRS Functional Description - Extension DOK-MTX***-NC*F*EX*V14-RERS-EN-P, R911342628 This documentation describes the extended functions of the MTX. The basic commissioning steps and the control functions are provided as description and handling instruction.
MTX 14VRS Functional Description - Special Functions DOK-MTX***-NC*F*SP*V14-RERS-EN-P, R911342624 This documentation describes the special functions of the MTX. The basic commissioning steps and the control functions are provided as description and handling instruction.
MTX Free Form Surface Milling DOK-MTX***-FREEFORM***-APRS-EN-P, R911341435 This documentation describes the free form surface milling process with the MTX control. CNC programs generated by a CAD/CAM system are used as basis for the entire process. Overview over the following topics: Description of the MTX or CNC function for freeform surface milling, strategy during the NC parameterization process, boundary conditions when generating CNC programs with CAM software.
MTX Conversion of MTX Projects DOK-MTX***-PROCONV****-PRRS-EN-P, R911342484 This documentation provides support during the conversion of MTX 1.x projects to MTX 2G. This project planning manual provides information on how to convert a project and identifies potential difficulties during the conversion.

Tab. 1-3: MTX documentation overview - Configuring

1.5.3 Commissioning

Documentation titles with type codes and part numbers

IndraWorks 13VRS Simulation DOK-IWORKS-SIMU****V13-APRS-EN-P, R911339256 This documentation describes the functions of the simulation components View3D, virtual control panel, virtual control and its operation in IndraWorks.
MTX 14VRS Commissioning DOK-MTX***-STARTUP*V14-CORS-EN-P, R911342620 This documentation describes the commissioning of the MTX control. Apart from a complete overview, commissioning and configuration of the axes and the user interface as well as the PLC data are described.

IndraWorks 14VRS Basis Libraries IndraLogic 2G DOK-IL*2G*-BASLIB**V14-LIRS-EN-P, R911343920 This documentation describes the system-comprehensive PLC libraries.
IndraWorks 14VRS Field Buses DOK-IWORKS-FB*****V14-APRS-EN-P, R911341485 This documentation describes the field bus and local periphery connections supported by the XLC, MLC and MTX systems. The focus of this documentation lies in the configuration, parameterization, commissioning and diagnostics of different periphery connections. It is the basis for the online help.
IndraWorks 14VRS WinStudio 7.4 DOK-IWORKS-WINSTUD*V14-APRS-EN-P, R911341585 This "User Manual and Technical Reference Book" supports the user in achieving the best results with the "Rexroth WinStudio"™ software. The document provides technical information and step-by-step instructions to create web-enabled HMI/SCADA programs.
IndraWorks 14VRS Software Installation DOK-IWORKS-SOFTINS*V14-CORS-EN-P, R911344286 This documentation describes the IndraWorks installation.
IndraWorks 14VRS Engineering DOK-IWORKS-ENGINEE*V14-APRS-EN-P, R911343566 This documentation describes the use of IndraWorks in which the engineering tools are integrated. It includes instructions on how to work with IndraWorks and how to operate the oscilloscope function.
IndraWorks 12VRS FDT Container DOK-IWORKS-FDT*CON*V12-APRS-EN-P, R911334398 This documentation describes the IndraWorks FDT Container functionality. It includes the activation of the functionality in the project and working with DTMs.
IndraWorks 14VRS PLC Programming System IndraLogic 2G DOK-IWORKS-IL2GPRO*V14-APRS-EN-P, R911343571 This documentation describes the PLC programming tool IndraLogic 2G and its use. The documentation includes the basic use, first steps, visualization, menu items and editors.
IndraWorks 14VRS HMI DOK-IWORKS-HMI*****V14-APRS-EN-P, R911343569 This documentation describes the functions, configuration and operation of the user interfaces IndraWorks HMI Engineering and IndraWorks HMI Operation.

Tab. 1-4: MTX documentation overview - Commissioning

1.5.4 Operation

Documentation titles with type codes and part numbers

MTX 09VRS Shop Floor Programming Turning and Milling DOK-MTX***-SF*PROG*V09-AWxx-EN-P, R911324377 This documentation describes the operation and programming of the graphic NC programming of turning and milling as well as the workpiece simulation.
MTX 12VRS Block Pre-Run DOK-MTX***-BLK*RUN*V12-APRS-EN-P, R911334379 This documentation explains to the machine manufacturer how to setup the "Block pre-run" function at the machine for the end user.

MTX 14VRS Programming Manual

DOK-MTX***-NC**PRO**V14-RERS-EN-P, R911342634

This documentation describes the standard programming of the MTX control. Apart from the basics of NC programming, the use of NC functions according to DIN 66025 as well as the NC functions with high-level language syntax and CPL functions are described.

MTX 14VRS Standard NC Operation

DOK-MTX***-NC*OP***V14-APRS-EN-P, R911342632

This documentation describes the operation of the standard user interface of the NC control of the MTX. It includes the operation of the interface, the NC program development as well as the tool management.

MTX 14VRS Multitouch

DOK-MTX***-MULTI***V14-APRS-EN-P, R911384735

The Multitouch user interface of the NC control MTX is described in this documentation.

MTX 14VRS Standard NC Cycles

DOK-MTX***-NC*CYC**V14-PRRS-EN-P, R911342638

This documentation describes the application of the standard cycles of the different technologies for the MTX control.

MTX 14VRS NC Simulation

DOK-MTX***-NC*SIM**V14-APRS-EN-P, R911379629

This documentation describes the NC simulation for the MTX control.

xx Corresponding edition
Tab. 1-5: MTX documentation overview - Operating

1.5.5 OEM Engineering

Documentation titles with type codes and part numbers

MTX 13VRS Automation Interface

DOK-MTX***-AUT*INT*V13-APRS-EN-P, R911337274

This documentation describes the script-based access to IndraWorks project data via the interface of the Automation Interface. Different objects including code examples are described. The Automation Builder is also described in this manual.

MTX 14VRS OPC Communication

DOK-MTX***-OPC*COM*V14-PRRS-EN-P, R911342636

This documentation describes the syntax and the structure of the items for the communication with Bosch Rexroth devices.

IndraWorks OPC UA Communication

DOK-IWORKS-OPC*UA*****-APRS-EN-P, R911379309

This documentation describes the OPC UA communication of the MLC and MTX control systems.

Tab. 1-6: MTX documentation overview - OEM engineering

1.5.6 AddOns

Documentation titles with type codes and part numbers

MTX 11VRS Action Recorder

DOK-MTX***-ACR*****V11-APxx-EN-P, R911329943

This documentation describes the MTX action recorder. It includes the installation and commissioning as well as interface signals, application and operation.

MTX 14VRS Efficiency Workbench MTX cta, MTX ega

DOK-MTX***-EWB*****V14-APRS-EN-P, R911343916

This documentation describes the mode of operation and the area of application of the analysis tool MTX cta and MTX ega.

MTX Remote Condition Monitoring

DOK-MTX***-RCM*****V01-APRS-EN-P, R911334383

This documentation describes the operation of the Remote Condition Monitoring System.

MTX visIREC User Documentation

DOK-MTX***-VISIREC*V01-APRS-EN-P, R911344242

This documentation describes the analysis tool visIREC used to optimize the free form surface milling process. 2D or 4D display of path-related data. 2D or 4D display of coordinate-related data. Analysis of critical areas (path and orientation deviation). Comparing the programmed NC blocks to the interpolated NC blocks.

xx Corresponding edition
 Tab. 1-7: MTX documentation overview - AddOns

1.6 Using safety instructions

1.6.1 Structure of the safety instructions

The safety instructions are structured as follows:

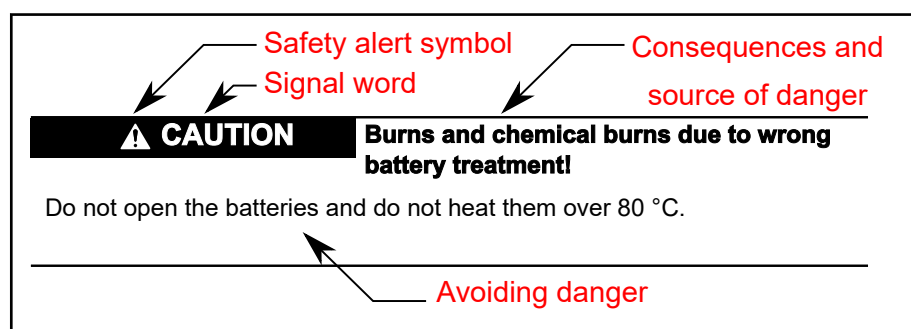


Fig. 1-2: Structure of the safety instructions

1.6.2 Explaining signal words and safety alert symbol

The safety instructions in this documentation contain specific signal words (danger, warning, caution, notice) and, if necessary, a safety alert symbol (according to ANSI Z535.6-2006).

The signal word draws attention to the safety instruction and indicates the risk potential.

The safety alert symbol (triangular safety reflector with exclamation marks), preceding the signal words Danger, Warning, Caution indicates hazards for persons.

⚠ DANGER

In case of non-compliance with this safety instruction, death or serious injury **will** occur.

⚠ WARNING

In case of non-compliance with this safety instruction, death or serious injury **can** occur.

⚠ CAUTION

In case of non-compliance with this safety instruction, minor or moderate injury can occur.

NOTICE

In case of non-compliance with this safety instruction, material damage can occur.

1.6.3 Symbols used

Pointers are displayed as follows:



This is a note.

Tips are displayed as follows:



This is a tip.

1.6.4 Explaining the signal alert symbol on the device



If this symbol is on your device, you have to observe the documentation on the device. The respective documentation informs on the type of hazard as well as the steps required to avoid this hazard.

1.7 Names and abbreviations

Term	Explanation
Zeroing	Setting the value to 0
CANopen	Field bus
CNC	Computerized Numerical Control
CPL	Customer Programming Language
DeviceNet	Field bus
Ethernet	Communication interface
IWE	IndraWorks Engineering
IWO	IndraWorks Operation
OWG	Optical waveguide
NC	Numerical Control
OEM	Original Equipment Manufacturer
PROFIBUS-DP	Field bus
Sercos	Field bus

Tab. 1-8: Terms and abbreviations

1.8 Customer feedback

Customer requests, comments or suggestions for improvement are of great importance to us. Please email your feedback on the documentations to Feedback.Documentation@boschrexroth.de. Directly insert comments in the electronic PDF document and send the PDF file to Bosch Rexroth.

2 Important instructions on use

2.1 Intended use

2.1.1 Introduction

Bosch Rexroth products are developed and manufactured according to the state-of-the-art. The products are tested prior to delivery to ensure operating safety and reliability.

The products may only be used as intended. If they are not used as intended, situations occur that result in damage to property or injury to persons.



Bosch Rexroth shall not assume any warranty, liability or payment of damages in case of damage resulting from a non-intended use of the products; the use shall solely bear all risks from unintended use of the products.

Before using Bosch Rexroth products, the following requirements have to be met to guarantee the intended use of the products:

- Anybody handling Bosch Rexroth products in any way is obliged to read and consent to the relevant safety instructions and the intended use.
- Hardware products may not be altered and have to remain in their original state; i.e. no structural changes are permitted. It is not permitted to decompile software products or alter source codes.
- Do not install damaged or defective products or use them in operation.
- It has to be ensured that the products have been installed as described in the relevant documentation.



Ensure that the data present in the control or entered or read in by the user is correct before applying it to exclude unwanted axis motion. It can be the following invalid or old data:

- Part programs
- ZO tables
- Compensation tables
- Tool tables
- Permanent CPL variables
- Remanent PLC data
- Permanent system data

2.1.2 Areas of use and application

The MTX control is used to

- program contour and machining technology (path feed, spindle speed, tool change) of a workpiece.
- guide a machining tool along a programmed path.

Feed drives, spindles and auxiliary axes of a machine tool are activated via Sercos interface.



This additionally requires I/O components for the integrated PLC which - together with the actual CNC - control the machining process as a whole and also monitors this process with regard to technical safety.

It may only be operated with the explicitly specified hardware component configurations and combinations and only with the software and firmware specified in the appropriate documents and functional descriptions.

The CNC system MTX provides the perfect CNC system solution for cutting and forming for the following technologies:

- Rotate
- Milling
- Drilling
- Grinding
- Bending
- Nibbling
- Punching
- Contour cutting
- Handling

2.2 Unintended use

Using the CNC system MTX outside the above-referenced areas of application or under operating conditions other than the conditions described in the documentation and the specified technical data, is defined as "unintended use".

The CNC system MTX must not be used if ...

- it is subjected to operating conditions not corresponding to the specified ambient conditions. Operation under water, under extreme temperature fluctuations or under extreme maximum temperatures is prohibited.
- Furthermore, the CNC system MTX shall not be used for applications not expressly approved of by Bosch Rexroth. Therefore, please read the information given in the general safety instructions!
- The CNC system MTX may not be used in systems or machines connected to the internet via an unsecure network connection. Otherwise, malfunctions or a control failure can result due to unauthorized access.

3 Operating elements

3.1 Operator panel

The following figures show a typically used operator panels.

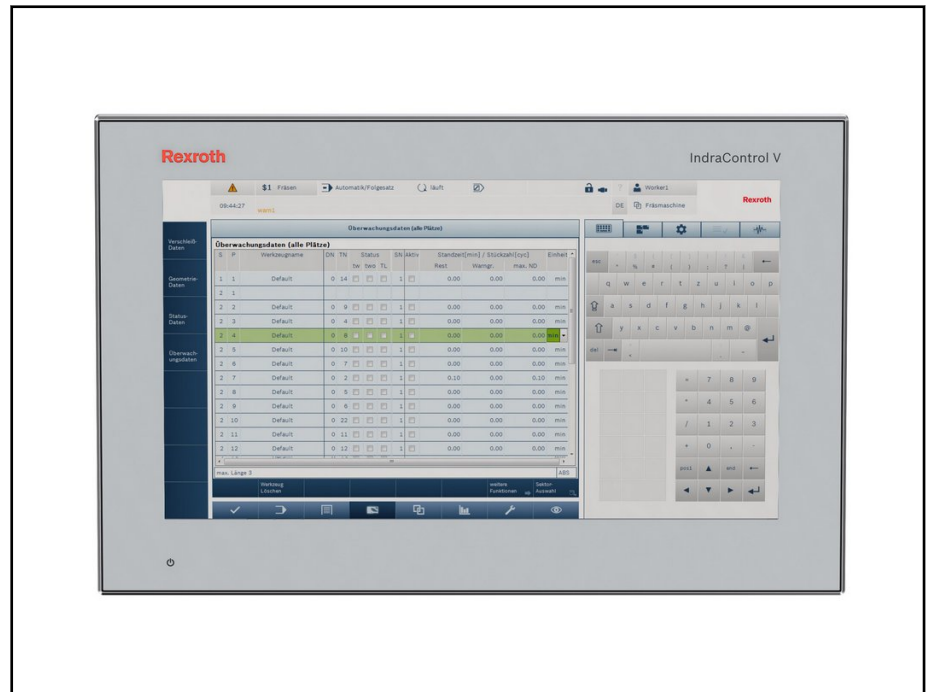


Fig. 3-1: Operator panel horizontal (VEP15)



Fig. 3-2: Operator panel vertical (VDP21)

3.2 Machine operator panel

The following figures show typically used machine operator panels.

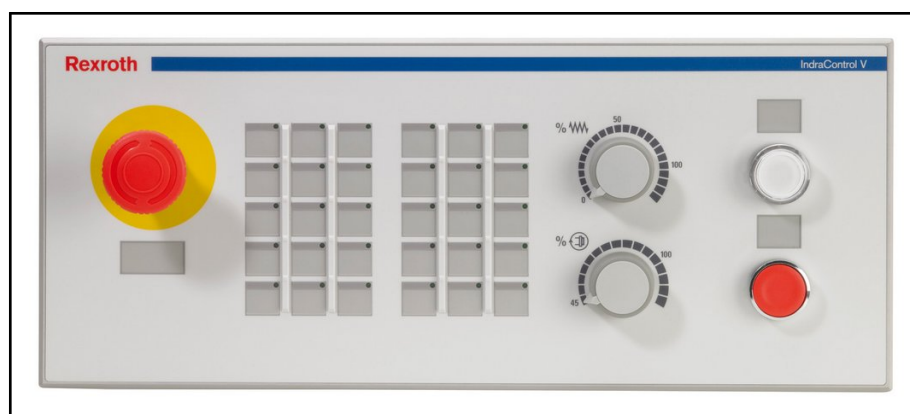


Fig. 3-3: *IndraControl V machine operator panel*

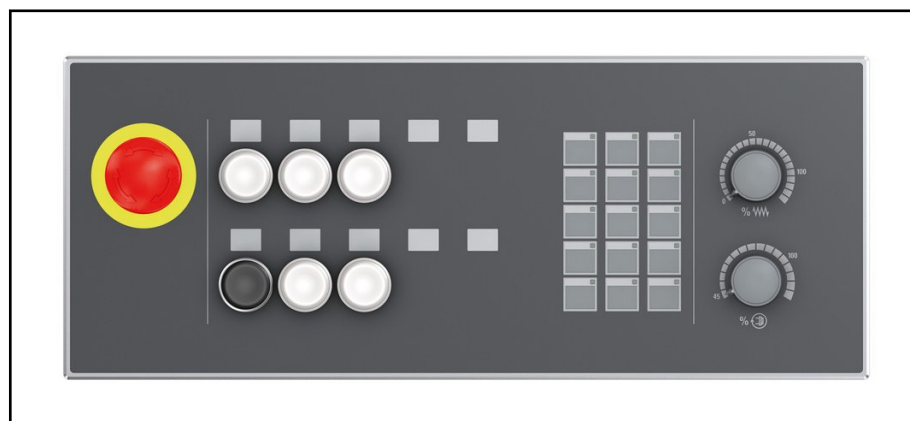


Fig. 3-4: *VAM 15.1 machine operator panel*

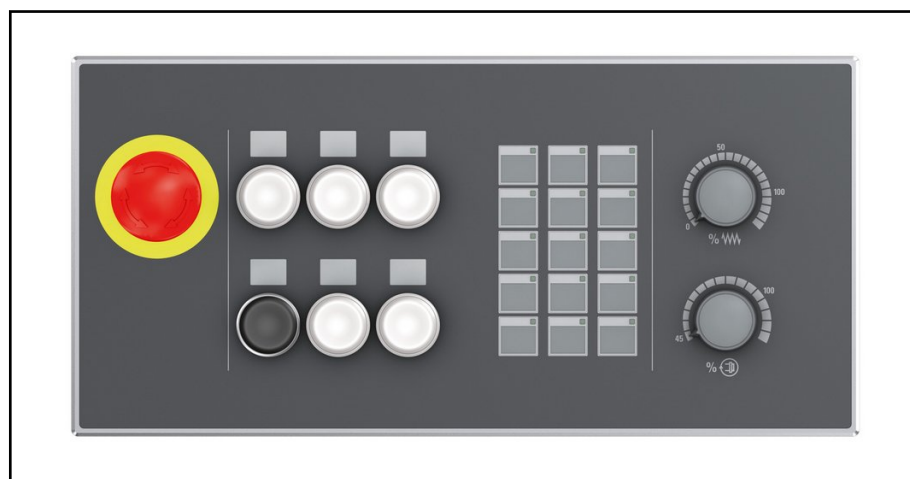


Fig. 3-5: *VAM 21.1 machine operator panel*

3.3 Basic screen layout

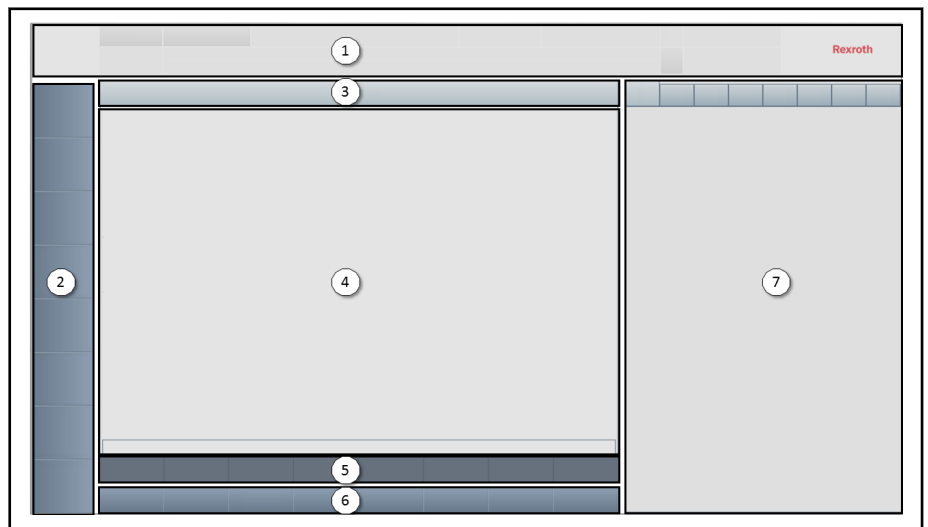
Depending on the type of installation and the display size, there are different screen layouts. The screen is divided into operating elements, the machine status area and the application area with an integrated status line.

Device types

Supported devices	visualization	Display size [inch]	Resolution	Installation options	
				Horizontal	Vertical
VEP15.x		15	HD 1366 x 768	Yes	No
VDP15.x					
VR4x15					
DR0015 + PR31					
DR0015 + PR4x					
VDP18.x		18			
DR0018 + PR31					
DR0018 + PR4x					
VEP21.x		21	HD 1920 x 1080	Yes	Yes
VDP21.x					
VR4x21					
DR0021 + PR31					
DR0021 + PR4x					

Tab. 3-1: Installation options

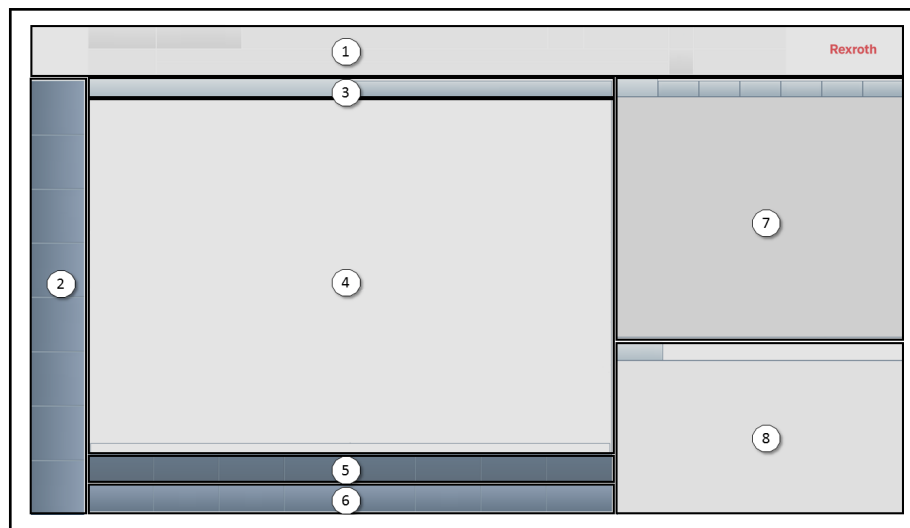
In case of horizontally installed visualization devices, the additional operating area is positioned to the right of the working area.



- (1) Header or machine status area
- (2) Machine keys (M-keys)
- (3) Task bar
- (4) Application area
- (5) Function keys (F-keys - assigned with applications and function for interface operation)
- (6) Operating area keys (OP-keys - assigned with functions to switch between operating areas)
- (7) Additional operating area

Fig. 3-6: User interface structure in horizontally installed 15' or 18' widescreen visualization device

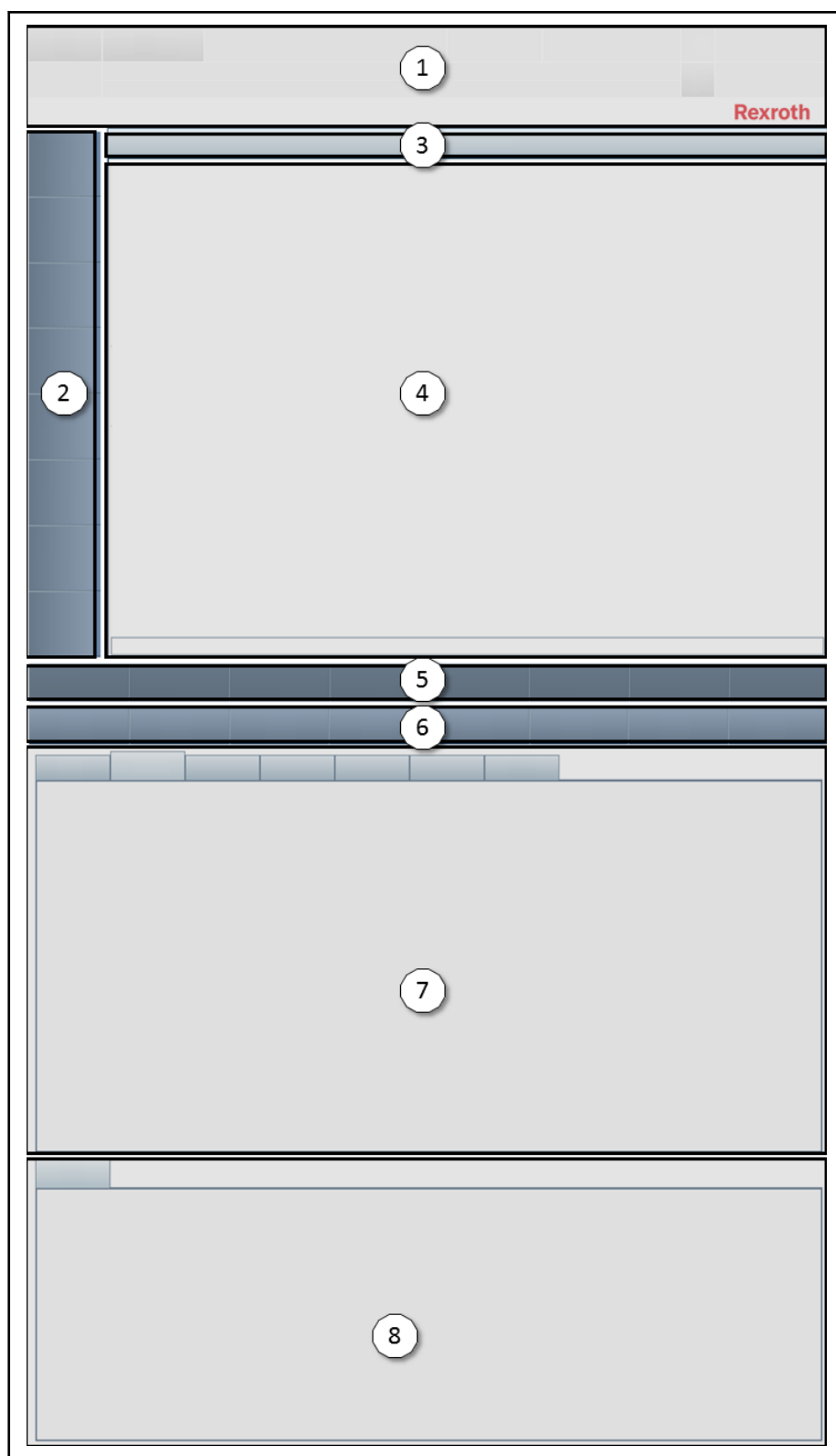
In case of the 21' variant, a virtual VAM is provided below the additional operating area.



- (1) Header or machine status area
- (2) Machine keys (M-keys)
- (3) Task bar
- (4) Application area
- (5) Function keys (F-keys - assigned with applications and function for interface operation)
- (6) Operating area keys (OP-keys - assigned with functions to switch between operating areas)
- (7) Additional operating area
- (8) Virtual VAM

Fig. 3-7: User interface structure in horizontally installed 21' widescreen visualization device

In case of vertically installed visualization devices, the additional operating area and the virtual VAM is positioned below the working area.



- (1) Header or machine status area
- (2) Machine keys (M-keys)
- (3) Task bar
- (4) Application area
- (5) Function keys (F-keys - assigned with applications and function for interface operation)

- (6) Operating area keys (OP-keys - assigned with functions to switch between operating areas)
- (7) Additional operating area
- (8) Virtual VAM

Fig. 3-8: User interface layout in case of vertically installed 21' widescreen visualization device

3.4 Operating areas and OP Keys

The complete functionality of the MTX user interface is divided into eight task-oriented operating areas.

There are specific applications within these operating areas.

Each application is assigned to one operating area. This assignment can be changed via the configuration (see documentation "IndraMotion MTX 14VRS Commissioning").

Each operating area has a start application that cannot be terminated.

The start operating area is selected in IndraWorks Engineering.

Each operating area is assigned to an <OP>-key.

Operating area	Icon	OP-key	Start application	Applications	More functions
Prepare		<OP2>	Screen with label and "Preparation" icon	Manual functions: • Probing the zero point • Probing the tool • Probing the zero point • Swiveling • Probe inclined plane • Calibrating the probe	
Machine		<OP3>	Basic NC screen • Axis position display • NC Program section display • etc.	Basic NC screen: • Overview on active corrections • Program selection • Editor of active program • Editor of active D-corrections • Editor of active zero offsets • Editor of active NC variables • Block pre-run/block search • Two-channel display • NC-Analyzer • Adjustment screens	Reset channel System control reset NC-Analyzer Switching coordinate systems Switching position display

Operating area	Icon	OP-key	Start application	Applications	More functions
Program		<OP4>	MTX Navigator: Directory and file navigator	MTX Navigator NC program editor Table editors Editor SD definition	
Tool management		<OP5>	Tool list	Tool list Tool editor	
System		<OP6>	Channel dialog	Channel dialog Switching NC channels	
Maintenance (option)		<OP7>	Screen with label and "Maintenance" icon	Circle test Project selection	Calling IndraWorks Engineering Calling remote support (option) Logging users in/out Exiting IndraWorks Archiving device data
Production data		<OP8>	Screen with label and "Production data" icon	No functionality in the default interface	Can be planned by OEM
Diagnostics		<OP9>	Diagnostic overview	Diagnostic overview Logbook PLC ↔ NC interface DP diagnostics Variable parameters Action Recorder MTX system status	Diagnostic filter Clearing errors Detailed view on errors

Tab. 3-2: Operating areas (default assignment)

Switching between operating areas

Switching is possible via the <OP>-keys or via the "Home Control" tab in the additional operating area.

By activating the operating area, the last application used of this operating area is moved to the foreground.

If the operating area was not active, the start application is called.

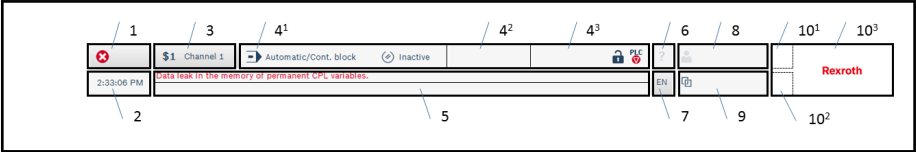
Switching between applications within the operating area

Within the operating area, press the corresponding <OP>-key to switch between the already open applications of this operating area.

3.5 Machine status area

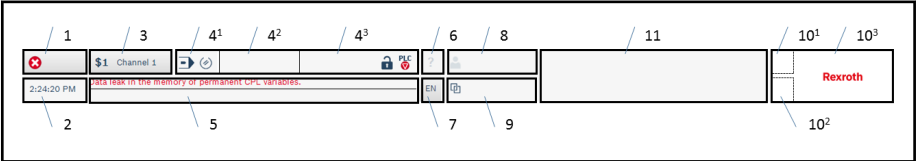
3.5.1 Layout of the machine status area

General information



- (1) Diagnostic message status
- (2) Time
- (3) Channel ID
- (4¹) Channel-dependent control states
- (4²) Channel status
- (4³) Channel-comprehensive control states
- (5) Diagnostic messages (two lines)
- (6) Help
- (7) Active language of the user interface
- (8) Active user
- (9) System description
- (10¹) Progress display
- (10²) Recording status
- (10³) Logo

Fig. 3-9: Layout of the machine status area (default)



- (1) Diagnostic message status
- (2) Time
- (3) Channel ID
- (4¹) Channel-dependent control states
- (4²) Channel status
- (4³) Channel-comprehensive control states
- (5) Diagnostic messages (two lines)
- (6) Help
- (7) Active language of the user interface
- (8) Active user
- (9) System description
- (10¹) Progress display
- (10²) Recording status
- (10³) Logo
- (11) Additional control area

Fig. 3-10: Layout of the machine status area (with additional control)

Control states across channels

Structure and contents The first machine status area displays states across channels.



Fig. 3-11: Control states

Channel states

Structure and contents

The second machine status area displays the states to operate the selected channel.

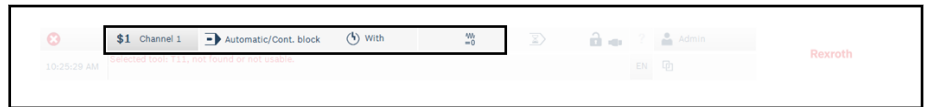


Fig. 3-12: Channel states

"Options" dialog

"Touch and hold for 2 s" the "Channel status operating mode, NC status" to open the options dialog. Use this dialog to make adjustments in the machine status area.

- Hide and change logo
- Insert additional control
- Change design
- Enter user texts for channels and machine

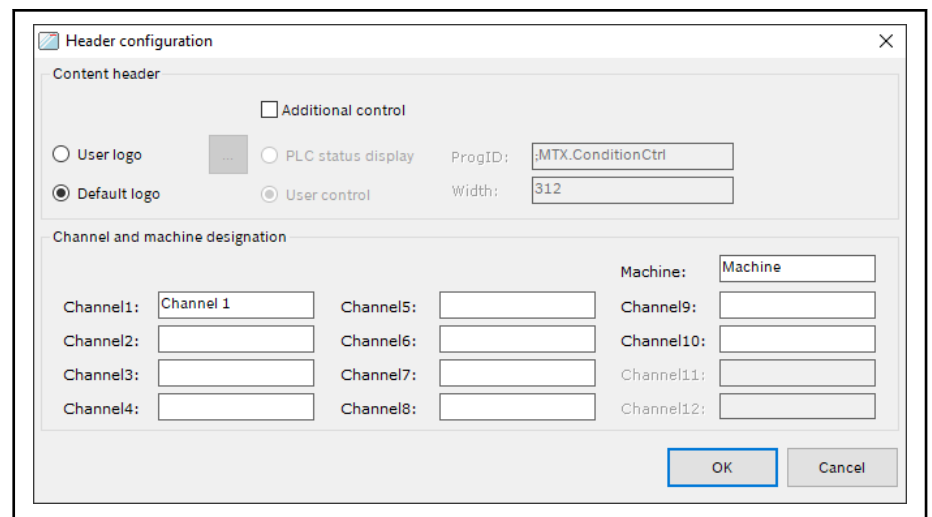


Fig. 3-13: "Options" dialog

Diagnostic messages

Structure and contents

The content of the diagnostic lines can be selected from the following categories via an Options dialog ("Touch and hold for 2 s" on text line):

- Setup diagnostics
- Errors (red background)
- Notes (green background)
- Warnings (yellow background)
- Start conditions.

The current date and time are also shown in the first line.

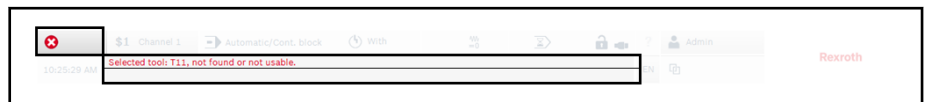


Fig. 3-14: Diagnostic messages

The following table contains a description of the message symbols displayed depending on the configuration.

Description	Icon	Explanation
Errors		The message indicates an error
Warning		The message indicates a warning
Note		The message indicates a note
Startup requirements		The message displays the start requirements
Setup diagnostics		The message displays the setup diagnostics

Tab. 3-3: Message symbols

Logo area

Structure and contents

In addition to the "Rexroth MTX" logo, the logo area contains an animation started in the waiting state of the interface (e.g. while opening an editor) and an animation activated when the action recorder starts recording.



Fig. 3-15: Logo area

3.5.2 Icon status display

Overview

Visualization of any PLC states as icons in the MTX header. The number of icons as well as the classification can be freely parameterized.

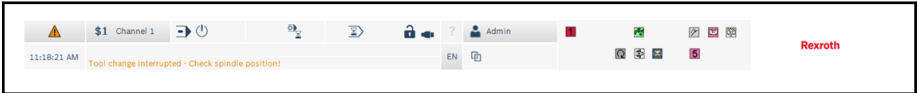


Fig. 3-16: Overview

The Bosch Rexroth UserControl with the ProgID "MTX.ConditionCtrl" is configured using a configuration file and is integrated in the MTX header. A corresponding structure has to be defined in the PLC program to control the display.

Configuration file

An array of structures is created in the PLC. Each structure element represents a placeholder (icon) in the status bar. An image (*.ico, *.jpg, *.gif, *.bmp, etc...) can be assigned to this placeholder using an icon ID.



Animated images of "GIF" format are also supported.

It is configured via the configuration file "MTX.SYS.ConditionCtrl.config.xml". It can be found in the path "%activehmiconfig%" within the IndraWorks project.

MTX.SYS.ConditionCtrl.config.xml

```

<Section name="Header">
  <IconPath></IconPath>
  <IconWidth>25</IconWidth>
  <IconHeight>25</IconHeight>
  <IconCount>20</IconCount>
  <IconGroup>1</IconGroup>
  <IconGroupDistance>3</IconGroupDistance>
  <IconsPerRow>10</IconsPerRow>
  <FlashSlow>1000</FlashSlow>
  <FlashFast>500</FlashFast>
  <PLCStructVar>Application.PLC_MAIN.sysConditionCtrl</PLCStructVar>
  <PLCBitmapVar>ID</PLCBitmapVar>
  <PLCPropertyVar>Properties</PLCPropertyVar>
  <UpdateRate>200</UpdateRate>
</Section>

```

As the UserControl can be instantiated multiple times, a configuration section is available for each instance. Section **"Header"** becomes effective in the MTX header.

The following parameters can be set here:

Parameter name	Description
IconPath	Absolute folder path in which all icons are stored. The path has to follow the Windows® convention. Example "C:\My Documents\My Icons" IndraWorks path tags, e.g. "%activehmiconfig%" or "%startup%" can also be used. Example "%activehmiconfig%\Mylcons" If this parameter does not contain a valid folder or if it is empty, the icon search order is as follows: 1. %activehmiconfig% 2. %config%
IconWidth	Width of the icon in [pixels]
IconHeight	Height of the icon in [pixels]
IconCount	Number of icons in the display
IconGroup	Activation of icon grouping. Distance between icon groups in [pixels]. The icons can be grouped optically. The number of icons has to be divisible completely by the grouping. Otherwise, grouping is ineffective. Example: IconsCount=10; IconGroup =2
IconGroupDistance	If grouping is effective. Specification of grouping distance or distance between groups
IconsPerRow	Number of icons per row. Example: IconCount = 20; IconPerRow = 10; -> display has 2 rows with 10 icons each
FlashSlow	Flashing period 1 in [ms]
FlashFast	Flashing period 2 in [ms]

Parameter name	Description
PLCStructVar	IndraLogic 2G: Complete path as follows: "Namespace.Variable". Example: Application.PLC_MAIN.sysConditionCtrl
PLCBitmapVar	Structural element for icon assignment
PLCPropertyVar	Structural element for color assignment

Tab. 3-4: Parameter

Example:

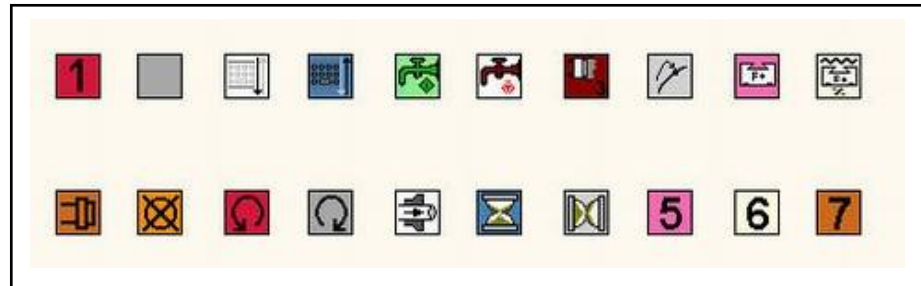


Fig. 3-17: Icons in the header

Icon assignment table

The icons are specified using their icon ID. Each icon has a file name (token) and (optionally) a tooltip. The tooltip is not language-dependent and is displayed when using the touch gesture "touch and hold" on the icon.

Values between {1.. 255} are valid as icon ID. A value of {0} means "no icon".

Program:

```
...
<!--Icon Definitions (1-255)-->
<Icons>
  <Icon ID="1" Token="ICBedUm0.gif" ToolTip=""/>
  <Icon ID="2" Token="ICBedUmA.gif" ToolTip=""/>
  <Icon ID="3" Token="ICColnAc.gif" ToolTip=""/>
  <Icon ID="4" Token="ICColOff.gif" ToolTip=""/>
  <Icon ID="5" Token="ICFut3.gif" ToolTip=""/>
  <Icon ID="6" Token="ICFut3BU.gif" ToolTip=""/>
  <Icon ID="7" Token="ICFut3G.gif" ToolTip=""/>
  <Icon ID="8" Token="ICFut4.gif" ToolTip=""/>
  <Icon ID="9" Token="ICFut4BU.gif" ToolTip=""/>
  <Icon ID="10" Token="ICFut4G.gif" ToolTip=""/>
...
```

Icon background display

The icon backgrounds are specified using their ID. Either enter an RGB value in HEX "RRGGBB" (e.g. D3D3D3) or a value of the .NET enumerator "KnownColor" (e.g. "DarkRed").



The background color applies only to icons in ".gif" format.

Program:

```
...
<!--Icon Color Definitions (0-15)-->
<IconColors>
  <Color ID="0" Value="D3D3D3"/>
  <Color ID="1" Value="LightGreen"/>
  <Color ID="2" Value="LightYellow"/>
  <Color ID="3" Value="DarkRed"/>
  <Color ID="4" Value="DarkOrange"/>
  <Color ID="5" Value="BlueViolet"/>
  <Color ID="6" Value="DarkGray"/>
...
```

```

<Color ID="7" Value="Cornsilk"/>
<Color ID="8" Value="SteelBlue"/>
<Color ID="9" Value="HotPink"/>
<Color ID="10" Value="White"/>
<Color ID="11" Value="Chocolate"/>
<Color ID="12" Value="Brown"/>
<Color ID="13" Value="Crimson"/>
<Color ID="14" Value="Black"/>
<Color ID="15" Value="White"/>
</IconColors>
...

```

Icon interface in PLC program

Display and properties of the icons are controlled by a fixed data definition in the PLC user program.

The icon interface in the PLC is a one-dimensional `ARRAY[1..n]` of `STRUCT`. Array index 1 to n corresponds to n placeholders (=IconCount).

The placeholders are numbered from left to right.

Example:

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20

Tab. 3-5: Numbering the icons

Each of these n array elements is defined as structure of two bytes: One byte for the selection of the display (255 possible icons for placeholder) and the other byte for the properties of the icon (background color, flashing frequencies). The **variable name** is defined using the configuration file in the value "PLCStructVar". The same applies to the element identifiers for ID "PLCBitmapVar" and for **Properties** "PLCPropertyVar".

PLC structure field declaration

Program:

```

TYPE sysConditionCtrl_Type :
STRUCT
  ID:      BYTE;
  Properties:  BYTE;
END_STRUCT

```

The array has to be declared in the range of the global data in the section `VAR_GLOBAL`.

PLC structure field variable

Program:

```

VAR_GLOBAL
sysConditionCtrl:  ARRAY[1..20] OF sysConditionCtrl_Type;

```

The icons are programmed in a program or function block. This is specified by the user.

Structural element "ID"

Value	Note
0	Do not display any icon (background color active)
1...255	Display icon ID 1 to 255

Tab. 3-6: ID

Structural element "Properties"

Value	Note
0..15	Background color ID (bit 0,1,2,3)
16	Icon flashes with "FlashSlow" period (bit 4)
32	Icon flashes with "FlashFast" period (bit 5)

Tab. 3-7: Properties



If both flash frequencies are selected, the flash period applies as defined in "FlashFast".

Example:

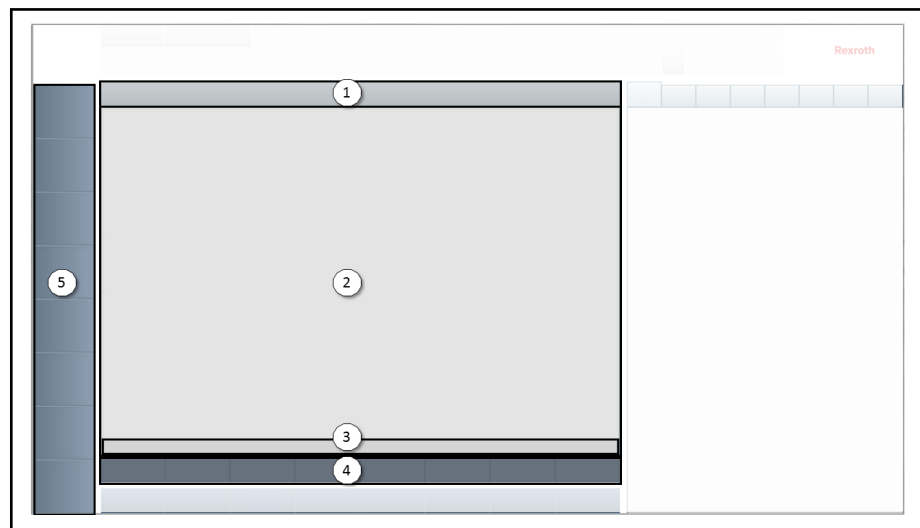
Placeholder 4 should display icon 78. It should also flash at 1 Hz and have a yellow background color.

Example

```
sysConditionCtrl[4].Bitmap:= 78;(* Icon 4: Display of map 78 *)
sysConditionCtrl[4].Property:= 18;(* Icon 4: Property yellow and flashing, 2+16=18*)
```

3.6 Application area

3.6.1 General information



- (1) Task bar
- (2) Application window
- (3) Status bar
- (4) Function keys
- (5) Machine keys

Fig. 3-18: Layout of the application area

3.6.2 Task bar

The selected operating area and the list of opened applications in this operating area is displayed in the task bar.

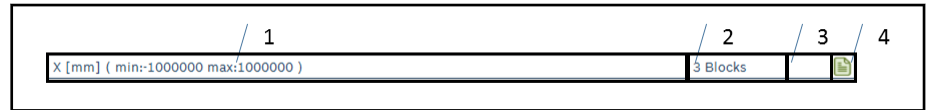
The corresponding window can be activated by clicking the corresponding field.

Use the checkbox "Show all operating areas as tab" to display either only the current or all already opened operating areas. The user can toggle between the operating areas using these display panels. This option can be selected in the configuration of the Home Control.

3.6.3 Status bar

Structure of the status bar

General information



1	Status field
2	Line/column field
3	Insertion/overwrite mode
4	Status symbol field

Fig. 3-19: Overview on the status line

The status line is divided into two areas:

- User-dependent area in which the data of the currently visible application is shown
- System area in which the global information on the operating area is displayed.

Application-dependent area

The application-dependent area consists of up to four panels whose content is determined by the corresponding application. A description of the content can be found in the corresponding application.

In general, the application-dependent area is divided into the following fields:

- Status field [1]
This field displays status messages (gray), information messages (green) and error messages (red).
This standard field exists in each application.
- Line/column field [2]
This field displays the current line and column of an editor. Additional text can be shown in other applications.
This field does not exist in every application.
- Insertion/overwrite mode [3]
For editors, this area shows whether you are in "Insertion" or "Overwrite" mode. Another text can be shown in other applications.
This field does not exist in every application.
- Status symbol field [4]
A status can be indicated here using a symbol.
This field does not exist in every application.

Function of the status field

The status field displays simple status messages

In addition, extended information can be displayed, e.g. if an action could not be carried out, as certain boundary conditions were not complied with.



Fig. 3-20: Status line with information message

In case of other errors, an error message is displayed.



Fig. 3-21: Status line with error message

In addition, there is also a status line with an advanced error message.



Fig. 3-22: Status line with advanced error message

The extended error information can be retrieved by clicking on the info symbol or by pressing the "Info" key.

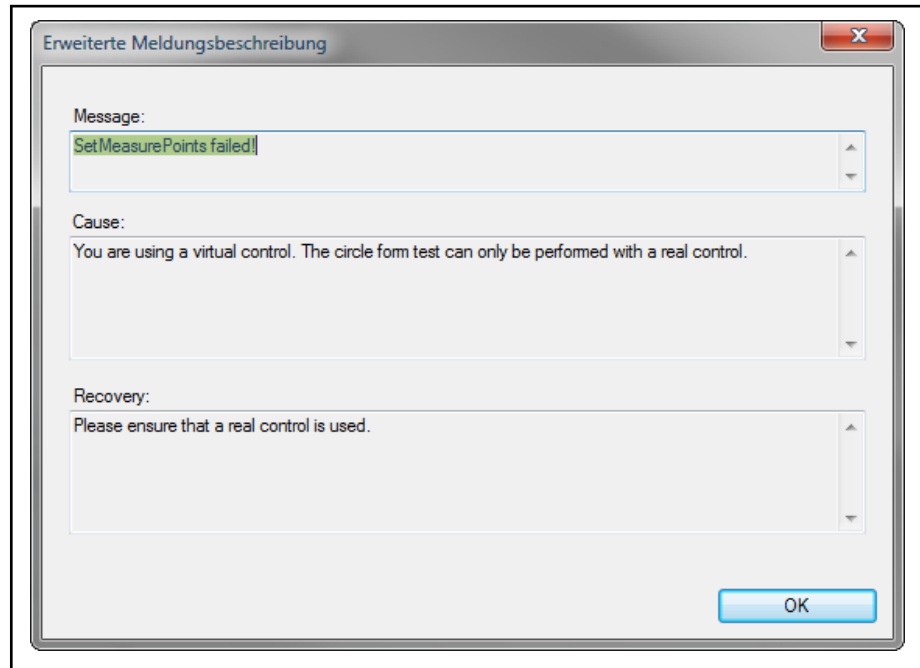


Fig. 3-23: Example of an extended error message description

3.7 Additional operating area

3.7.1 "Home Control" tab

Icon



Functions and applications are provided as tiles on this tab.

It is possible to work without OP keys when deleting the parameter Param="OPKeysVisible" of the Home Control in the configuration file of the additional operating areas (CustomCtrlConfiguration.xml).

In this case, the Home Control consists of two sections:

- Section for applications and own favorite functions (upper section)
- Section for operating areas (lower section)

Each user can customize the content of this tab with favorite functions and applications.

The tiles are provided with colored stripes symbolizing the operating area they belong to.

The Home Control can either be configured with small or with big tiles.

The Home Control assignment is user-specific and it is changed when toggled by the user. Each user can thus customize favorite functions and applications.

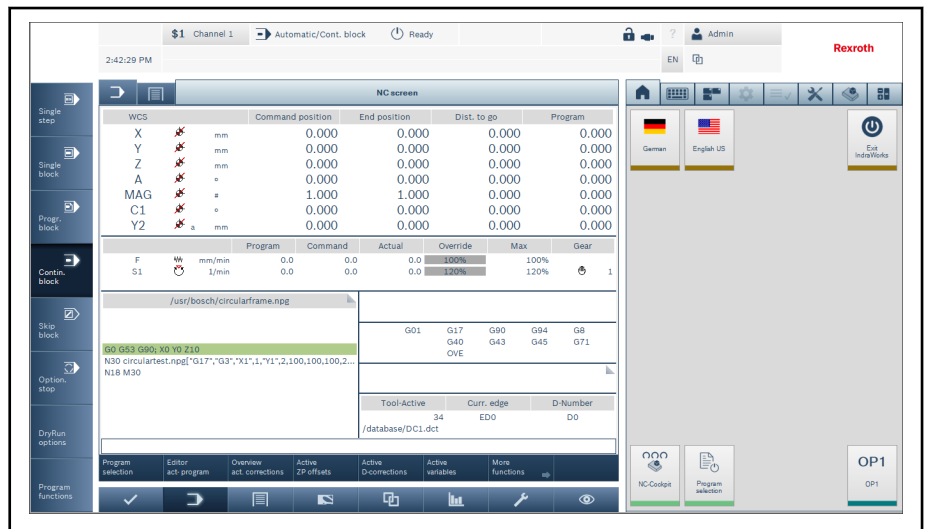


Fig. 3-24: Multi-touch operating interface with Home Control

Configuring the Home Control

Configuring the Home Control

1. Activating the configuration mode
Touch and hold 2 s the "Home" tab

Calling the configuration:

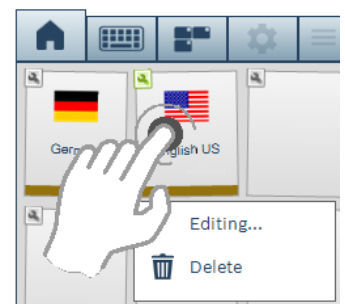


2 s "Touch and hold" on the Home Control tab.

The keys start to wobble.

Function selection via the context menu:

- Tiles small
- Tiles large
- Exit configuration



Function selection via the context menu:

- Edit
- Delete

Tab. 3-8: Enabling the Home Control configuration

The tiles move (as for the configuration of VAMs).

2. Setting the tile size
Set the tile size by selecting the respective function in the popup menu

Operating elements



Home Control with small tiles and Home Control with large tiles and operating area keys

Tab. 3-9: *Setting the tile size*

3. Configuring a tile in the section for applications
Touch the tile to be configured to open the popup menu providing functions to delete or assign with a function or application of a catalog.
4. Selecting the "Edit" function

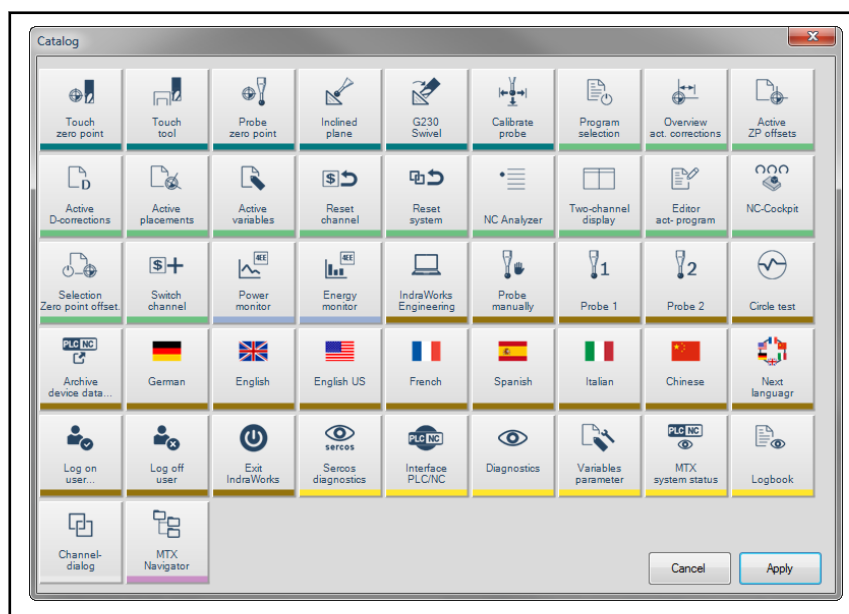


Fig. 3-25: *Function catalog*

5. Configuring a tile in the operating area section

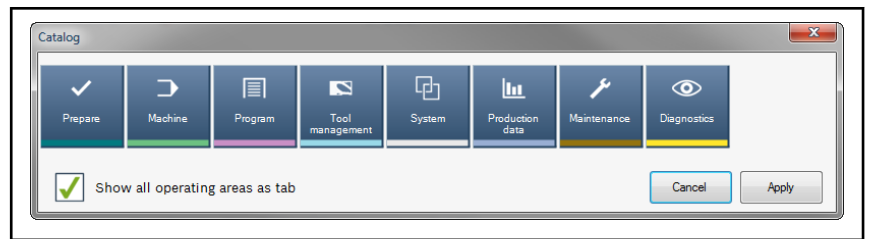


Fig. 3-26: Configuring operating areas

6. Use the checkbox "Show all operating areas as tab" to display either only the current or all already opened operating areas



Only the current operating area is displayed.

All already opened operating areas are displayed.

Thus, it can be quickly toggled between the operating areas.

Tab. 3-10: Options to display the operating areas as tab

7. Selecting the operating area to assign the operating area tile
8. Enabling the Home Control configuration

Exit the configuration of the Home Control via "Exit configuration" in the popup menu displayed again after touching the "Home" tab



To back up the configuration on the node of the visualization device, go to the IndraWorks Engineering menu **Visualization data** ► **Loading changes from operating station**.

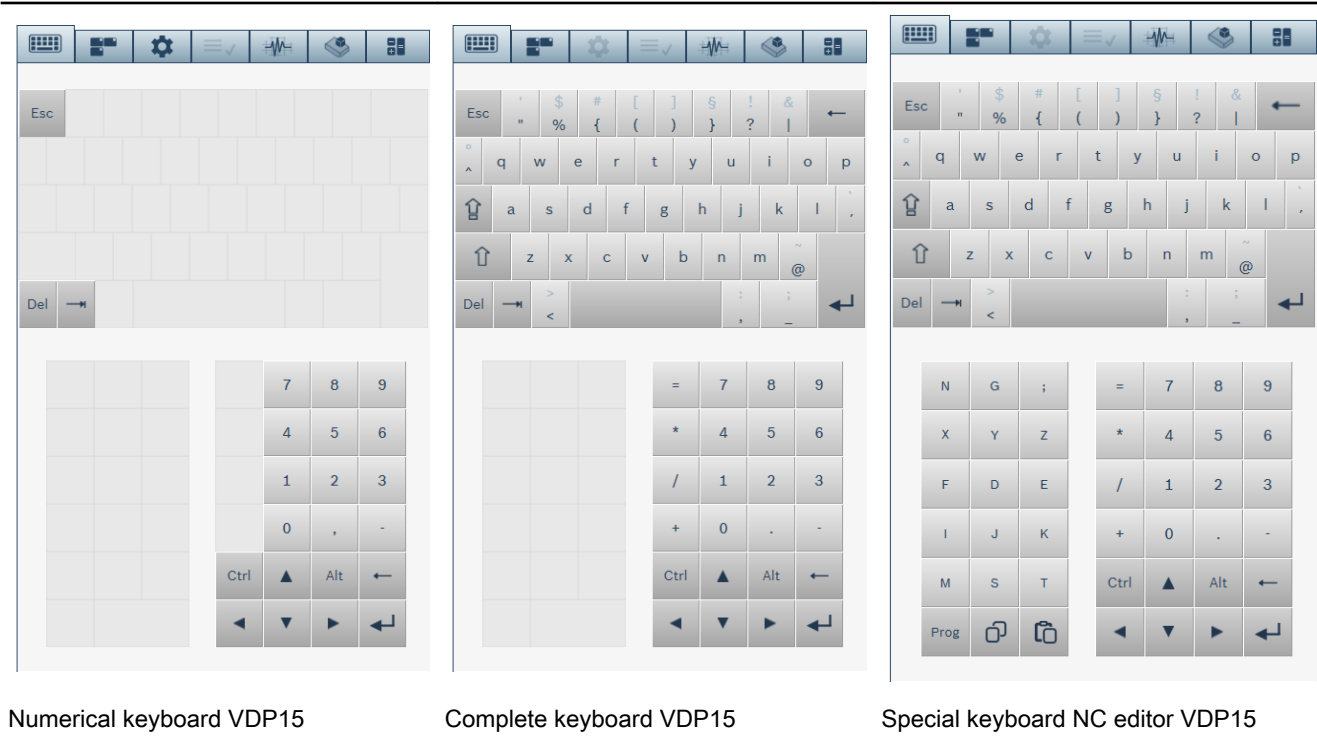
3.7.2 "ASCII keypad" tab

Icon

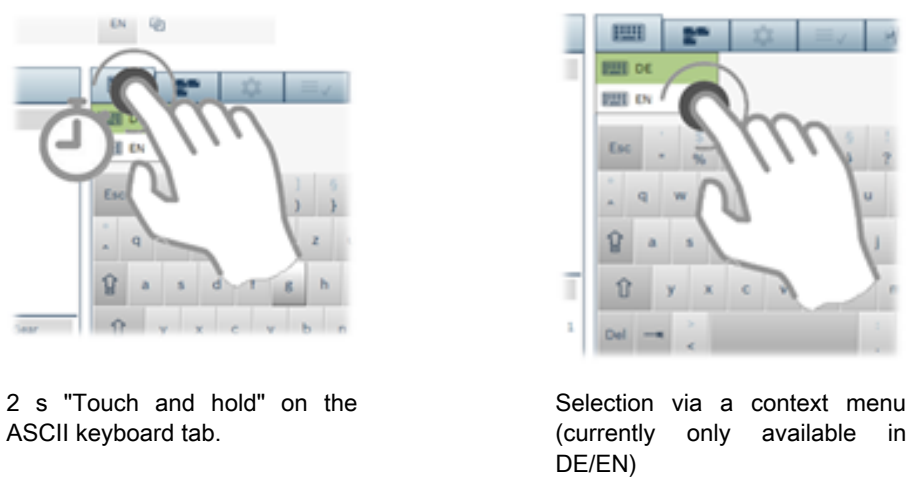


The keyboard layout depends on the visualization device resolution.

The ASCII keypad is switched depending on the context by the application. There are type-dependent keyboards for value input (complete, numerical, binary) and there are special keyboards. If a dialog is displayed, a complete keyboard is always displayed.



Tab. 3-11: Examples of keyboards
Country-specific keyboard layout switching:



Tab. 3-12: Country-specific keyboard layout switching
All keyboards are saved as XML files in the IndraWorks project under the visualization device.

3.7.3 "VAM" (virtual machine keyboard) tab



Any number of VAMs controllable via PLC can be configured.
The following VAM configurations are used by default:

- VAM Automatic (VAM_Automatic.xml)

- Continuous block/single block/program block
 - Debug
 - Block pre-run/block search
 - MDI
- VAM manual (VAM_Manual.xml)
 - Jogging/jogging in space
 - Approach reference point
 - Teach
- VAM general (VAM.xml)
 - Leaving and returning to contour

The default keyboard assignment is created by an OEM and depends on the machine operating concept.

A safe key transmission as in case of the M-keys is possible and recommended. Use the PLC function block "IL_HmiKeys" (up to 128 keys supported).

Shape and effect of the keys can be configured.

The following image shows a VAM configuration with the settings:

- 6 key lines and 4 key columns with paragraphs between the lines 1 and 2, 3 and 4 as well as 5 and 6
- 3 rectangular keys in line 1
- 1 slider with a length of 4 keys in line 4
- 1 slider with a length of 5 keys in line 4
- 4 round keys in line 6

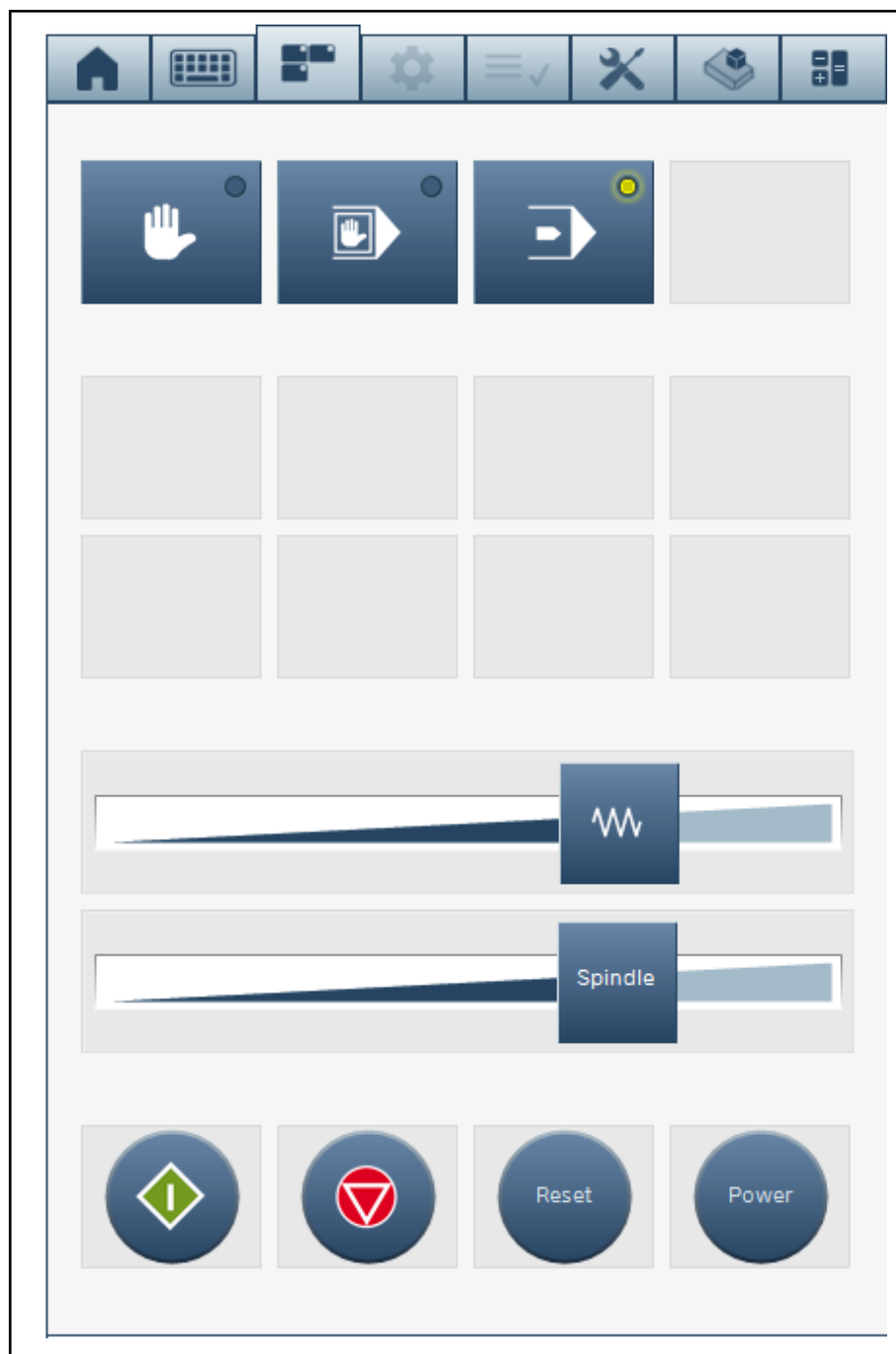


Fig. 3-27: Example of the VAM configuration

Configuring a VAM

Machine keyboard configuration

1. Activating the configuration mode
Touch and hold 2 s the "Home" tab

Calling the configuration:



2 s "Touch and hold" on the machine keyboard tab.

The keys start to wobble.

Function selection via the context menu:

- New
- Open
- Save as...
- Delete
- Events...
- Response time...
- Exit configuration



Function selection via the context menu:

- Edit
- Copy
- Paste
- Delete

Tab. 3-13: Enabling the configuration of the machine keyboards

The keys move (as for the configuration of Home Control).

2. Specifying the keyboard layout

The keyboard layout is specified upon creating a VAM. The limit values for "Number of keys per line" and "Number of lines" depend on the resolution of the visualization device.

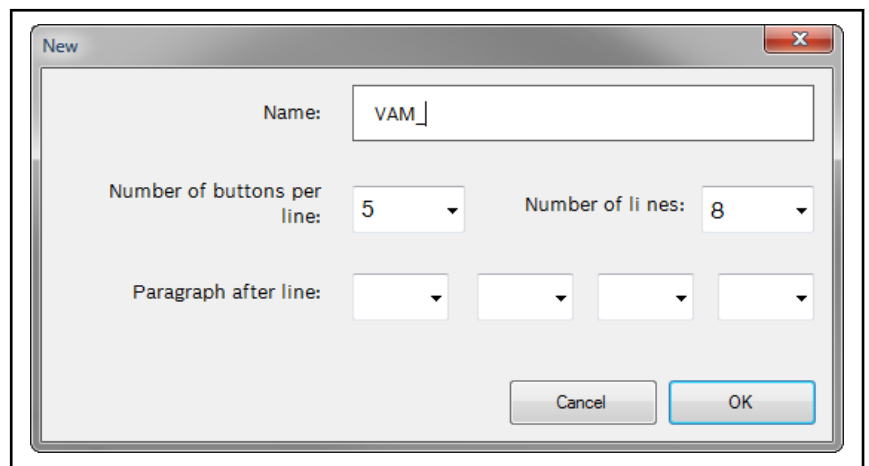


Fig. 3-28: Specifying the key matrix and the paragraphs

3. Configuration of VAM keys

Edit the selected keys via a dialog.

Using the variable selection, the required PLC variables are selected for the key states and are applied with "Double Touch".

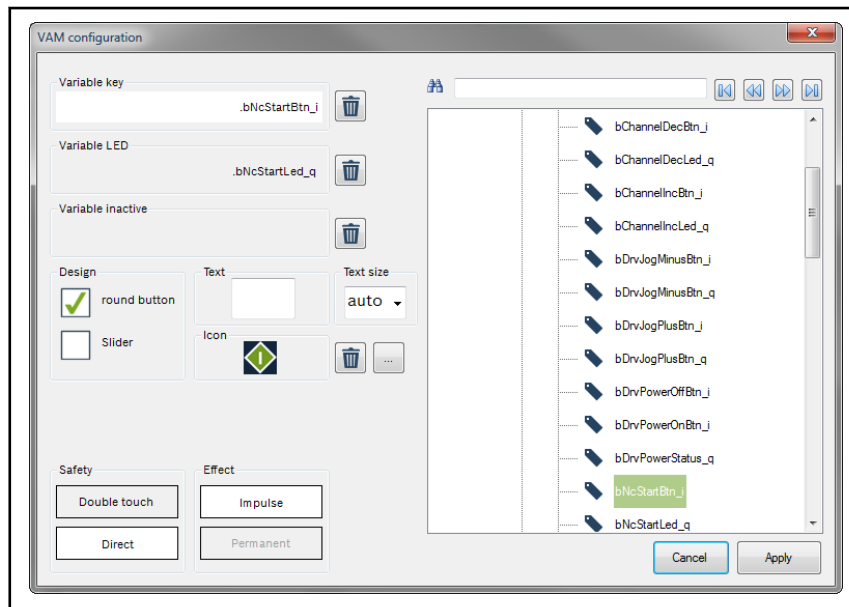


Fig. 3-29: Dialog to define a machine key

The key can be assigned with a text and an icon (32x32).

The key shape can either be "rectangular" or "round".

A key can either be configured as normal pushbutton or as slider.

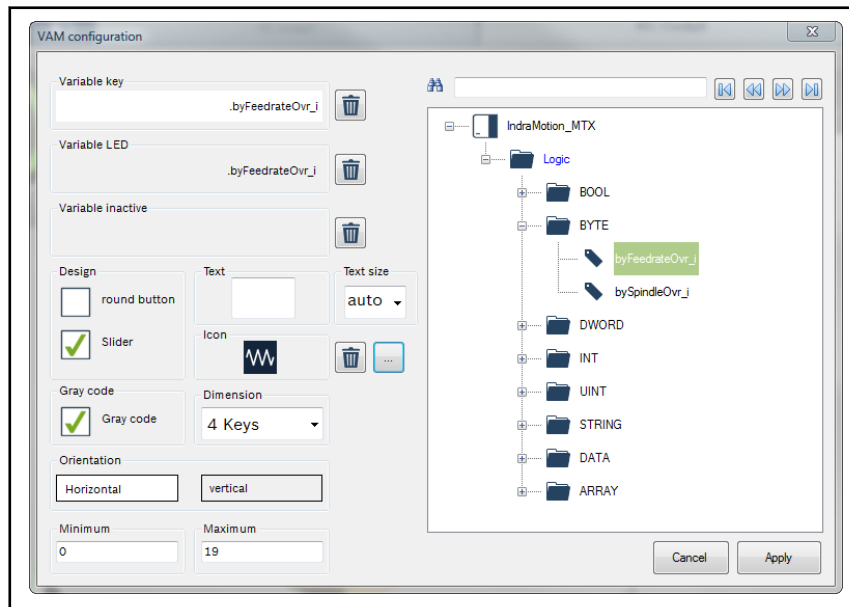


Fig. 3-30: Dialog to define a slider (specifying orientation, dimension, gray code, maximum and minimum)

When configuring a key as slider, the same variable should be assigned to "Variable key" and "Variable LED".

The keystroke can result as pulse (impulse), permanent, direct or double touch:

"Double touch"	The key is selected with the first touch (a green frame around the key flashes) and is triggered with the second touch
"Direct"	The key triggers upon the first touch
"Impulse"	Generating of an edge when releasing the key • The PLC variable is written with TRUE • The PLC variable is read until it is set to TRUE • The PLC variable is written with FALSE
"Permanent"	When pressing the key, the PLC variable is set to TRUE, when releasing the key, it is set to FALSE

Tab. 3-14: Keystroke effects

4. Setting the key response time

The response time for "direct" and "permanent" is specified in the following dialog.

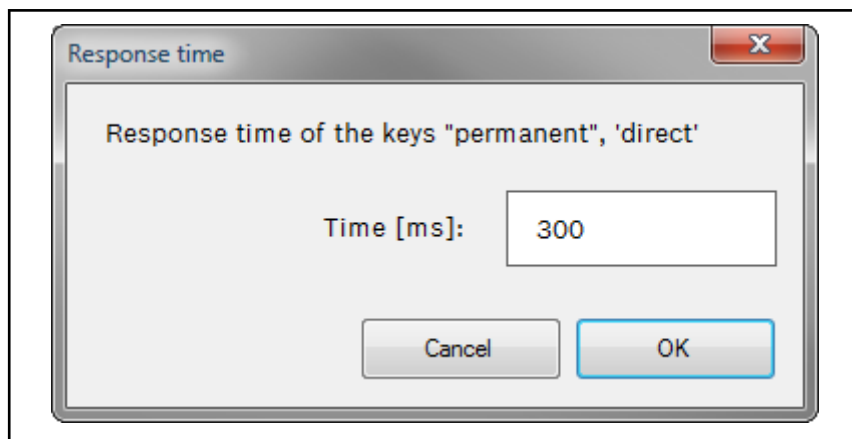


Fig. 3-31: Setting the response time

5. Configuring other user-defined VAMs

The call of more user-defined VAMs is specified via the following configuration dialog.

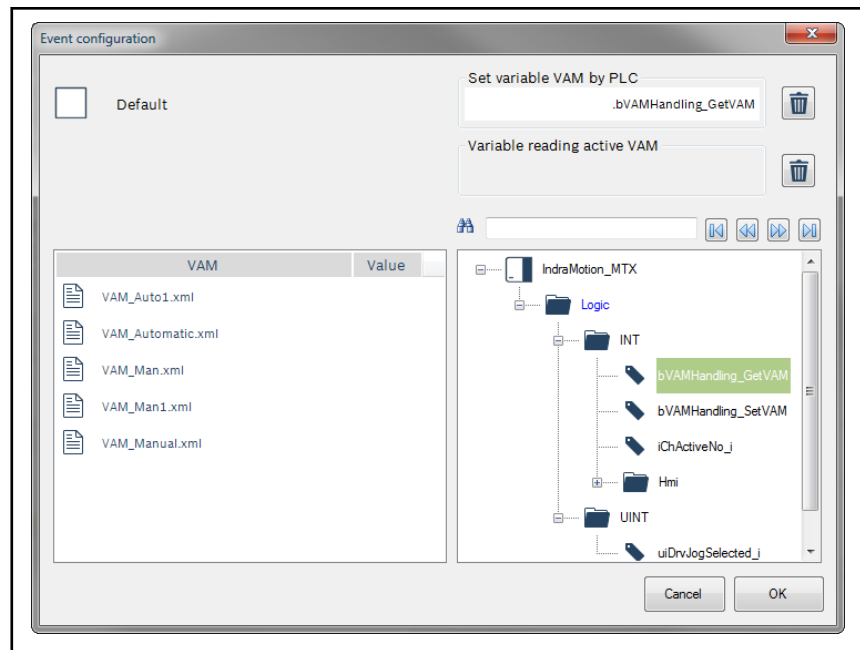


Fig. 3-32: Configuring the call of a user-defined VAM

Deselect the "Default" setting.

The selected PLC variable should be the variable to which the number of the active VAM is written.

The key assignments as well as the configuration settings are stored in the IndraWorks project and can be managed via the menu items "Export..." and "Import..." on the **Multitouch ► Virtual VAMs** node.



To back up the configuration on the node of the visualization device, go to the IndraWorks Engineering menu **Visualization data ► Loading changes from operating station**.

The configuration settings are stored in the IndraWorks project (e.g. "C:\ProgramData\IW-Projects\1\Project\VDP15\user\config\VAMs") and can be managed via the menu items "Export..." and "Import..." and on the **Multitouch ► Virtual VAMs** node.



To back up the configuration on the node of the visualization device, go to the IndraWorks Engineering menu **Visualization data ► Loading changes from operating station**.

3.7.4 "Properties" tab

Icon



This tab is assigned with a property dialog by the application. The application programmer assigns the tabs.

If the application does not use this tab, it is inactive.

Example Tool list - Properties setting "Additive" and "Filter active":

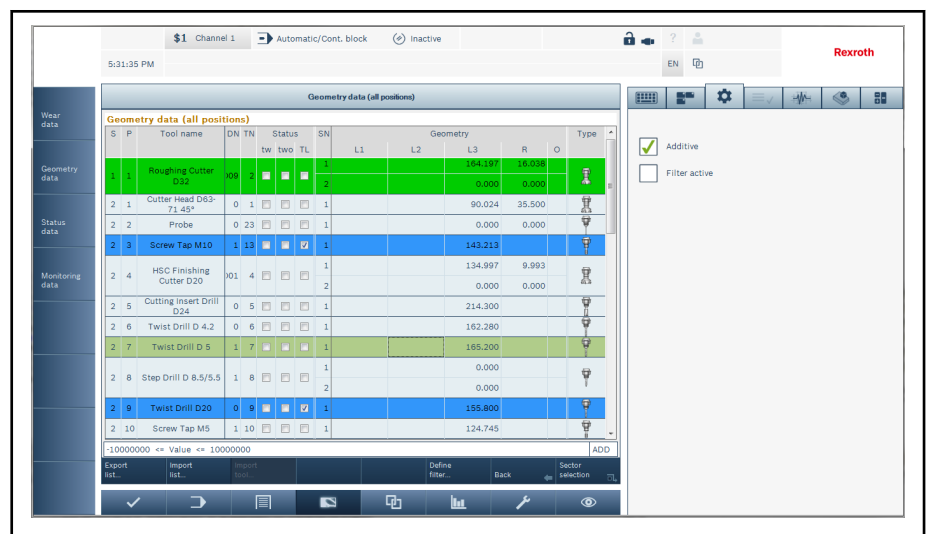


Fig. 3-33: Tool list

3.7.5 "Dialog"/"Finished part preview"/"Tool preview"

Icon dialog



Finished part preview icon



Tool preview icon



The content of this tab depends on the active application.

If the application does not use this tab, it is inactive.

Example Variable list - Selecting a variable via the combo box:

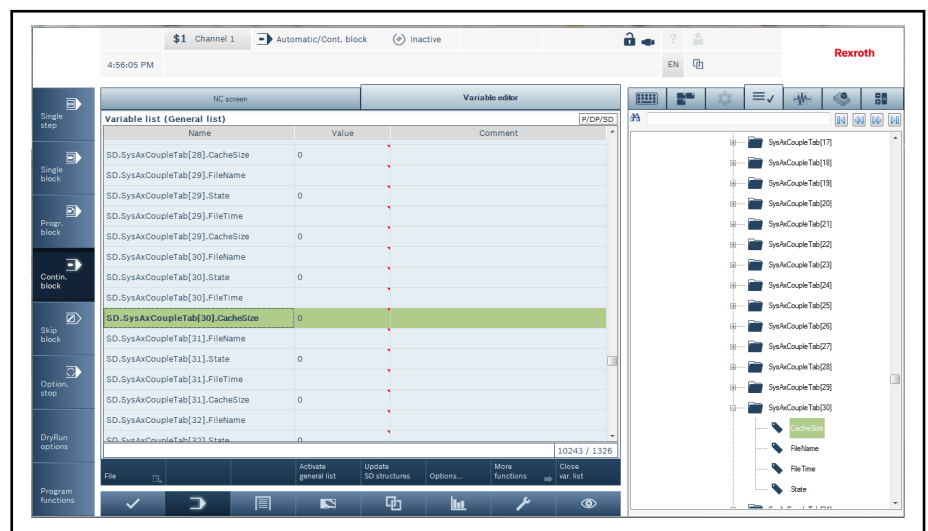


Fig. 3-34: "Dialog" tab when displaying the variable list

Example: MTX Navigator:

If there is a preview screen for the selected NC program in the MTX Navigator, this preview screen is shown in the tab.

Operating elements

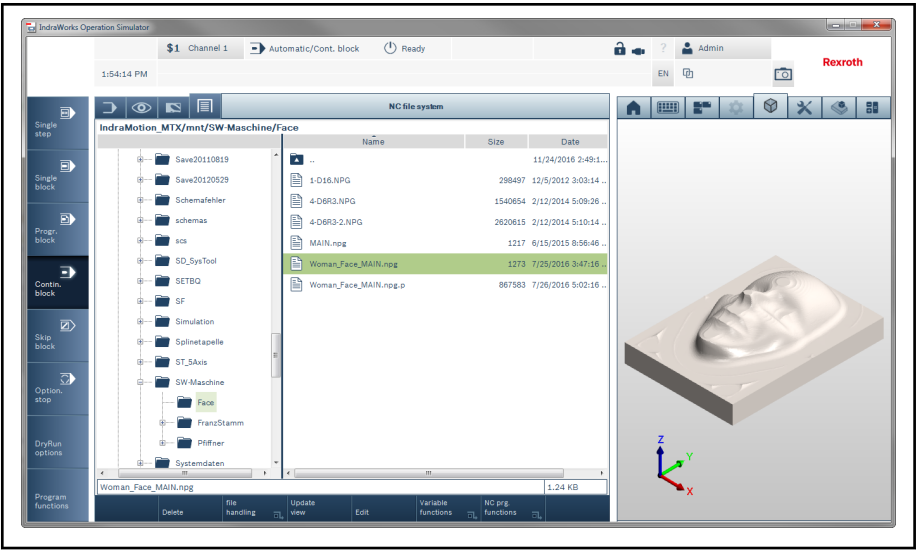


Fig. 3-35: Finished part preview in the MTX Navigator

Example Tool list:

If a preview image is available for the selected tool in the tool list, this preview image is displayed in the tab.

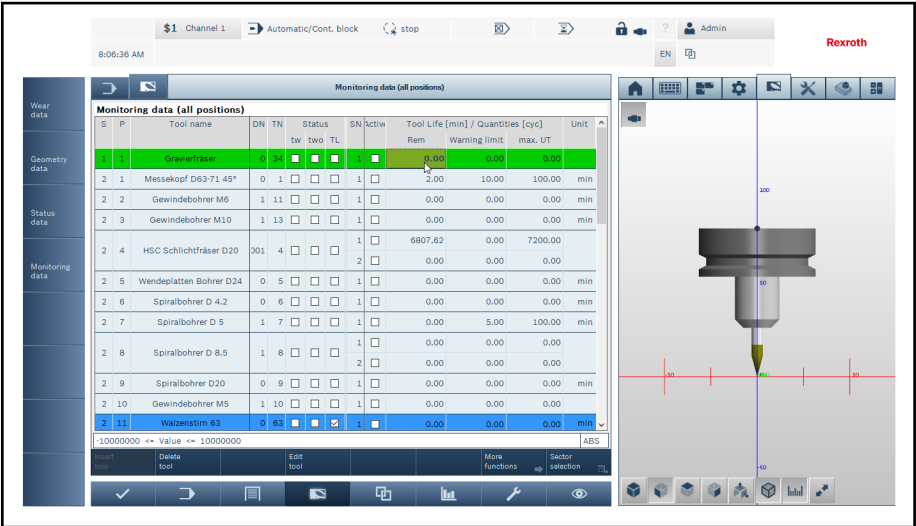


Fig. 3-36: Tool preview in the tool list

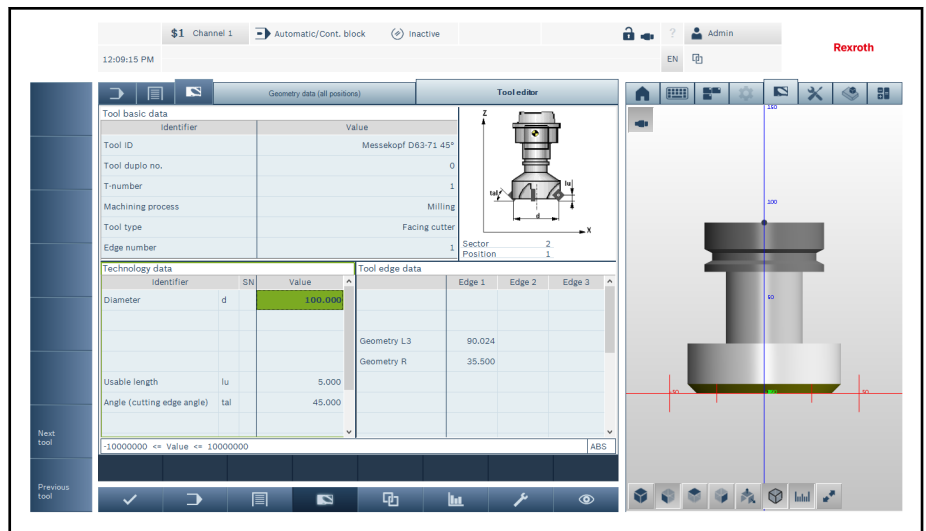


Fig. 3-37: Tool preview in the tool editor

3.7.6 "Monitor and service functions" tab

Icon



Go to the "Monitor and service functions" tab to open the following functions:

- Monitor
- Notes
- Stop watch
- Screenshot

Monitor

This tab shows the load of the individual NC tasks (only real NC, in EMU, all values = 0).

The NC kernel diagnostic monitor displays the load distribution of the individual NC kernel task. Thus, it can be efficiently identified if there is a system overload due to an incorrect user configuration or programming.

The load distribution of the following tasks is displayed in %:

- Interpolation and Sercos (IPO)
- PLC runtime
- NC and CPL block processing (SAV/CPL)
- Free capacity (IDLE)
- Remaining time of all remaining tasks such as the communication, database accesses, file server (REST).



The NC kernel diagnostic monitor can negatively affect the runtime behavior of the operating machine. Thus, the diagnostic tool is to be switched off after commissioning. A corresponding note is cyclically output in the status line.

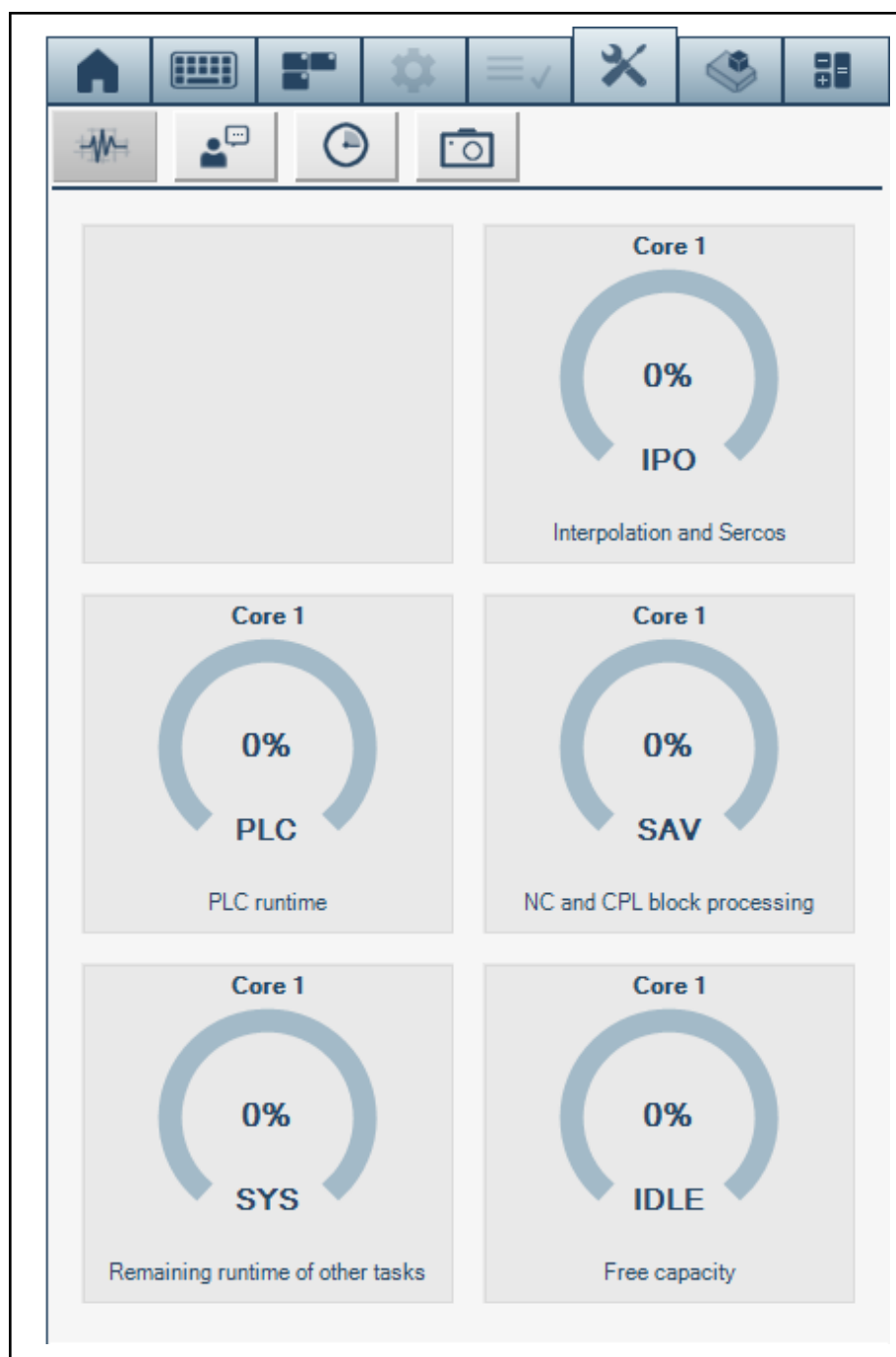


Fig. 3-38: Monitor display

Notes The note function allows to make user-specific notes and to store them on the tab.

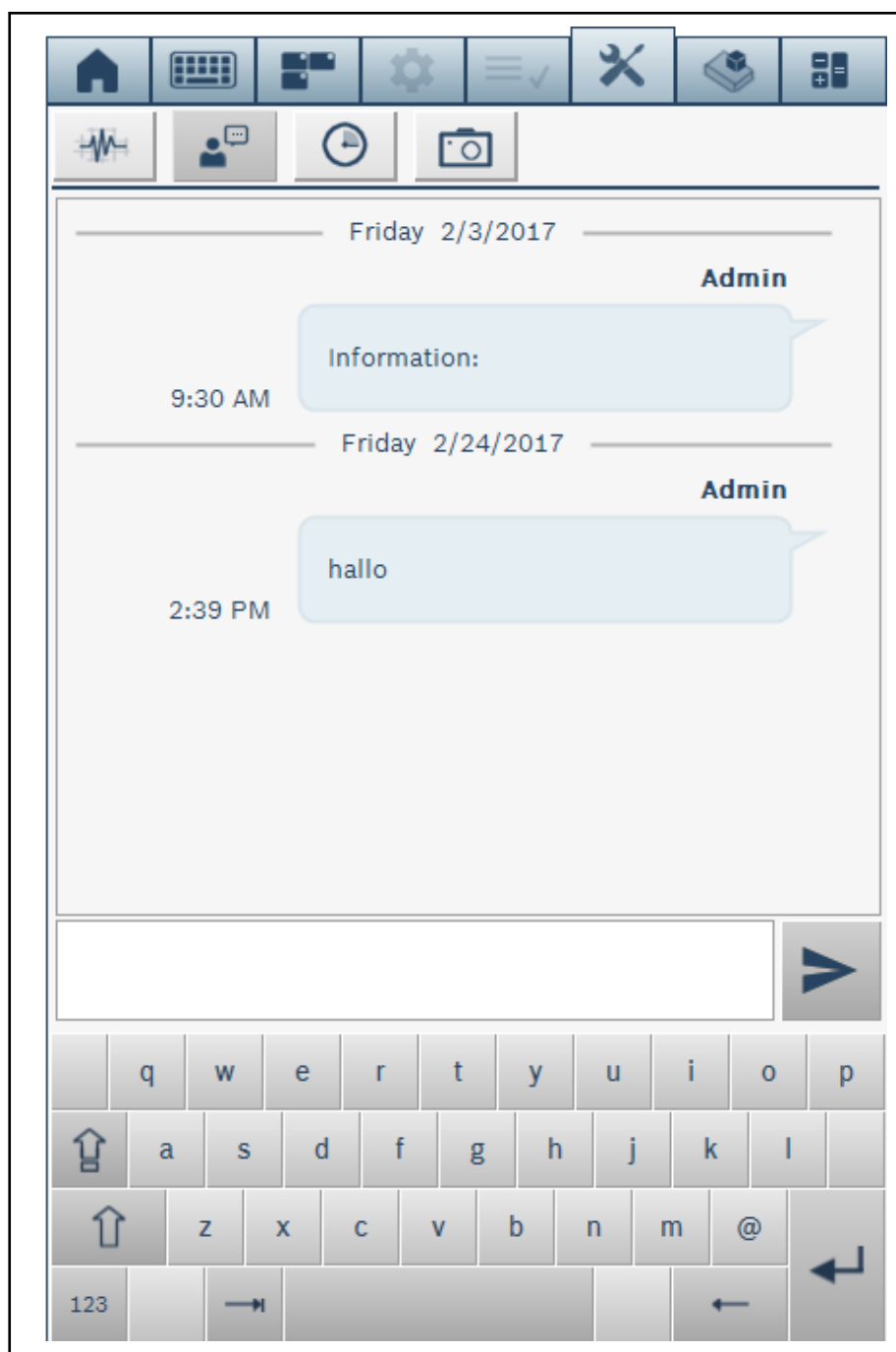


Fig. 3-39: Note function

Stop watch This function allows to measure the period with "Interim" function.

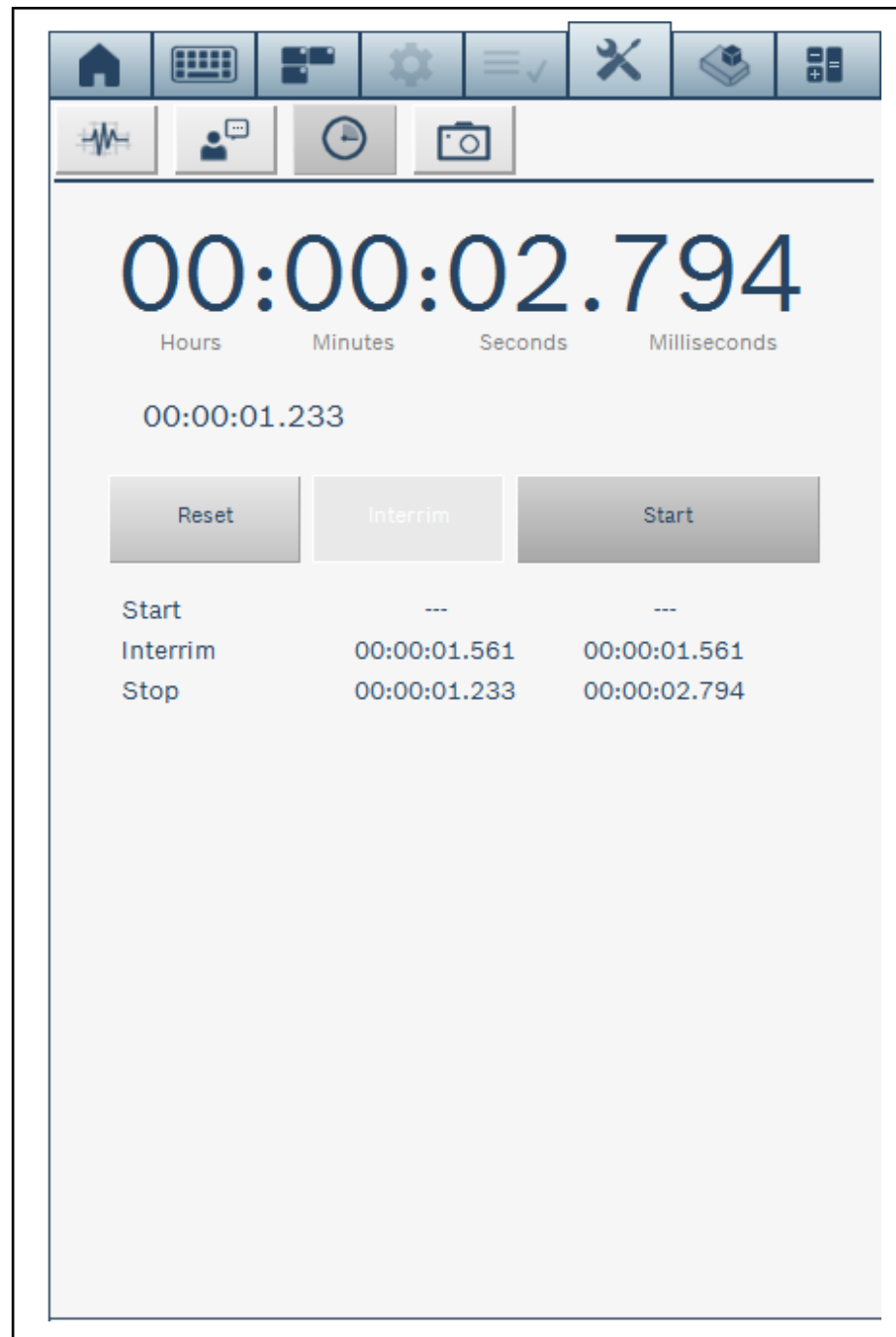


Fig. 3-40: Stop watch function

Screenshot Procedure to create screenshots:

1. Enabling the recording function via the key in the lower section of the tab
A key to create screenshots is then displayed in the header
2. "Double tap" on header key
A miniature view of the created screenshot is shown on the tab
3. "Single tap" on the miniature view

A pop-up menu is provided to save or delete the screenshot

- Disabling the recording function via the key in the lower section of the tab

The key to create screenshots in the header is not shown anymore

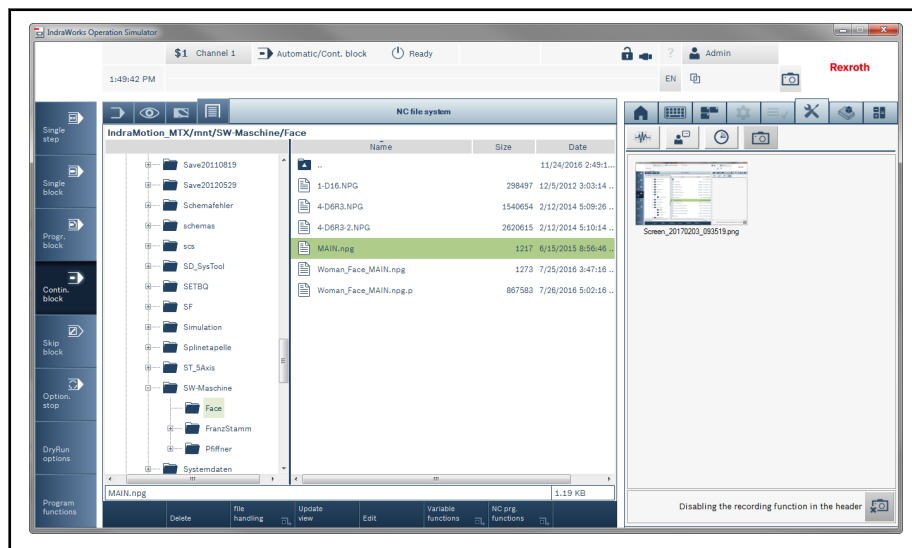


Fig. 3-41: Screenshot function

3.7.7 "NC simulation" tab or "Position and block progress display" tab

NC simulation icon



Position and block progress display icon



This tab shows the NC simulation.

For more information on the NC simulation, refer to the documentation "IndraMotion MTX 14VRS NC Simulation" (DOK-MTX***-NC*SIM**V14-APRS-EN-P, R911379629).

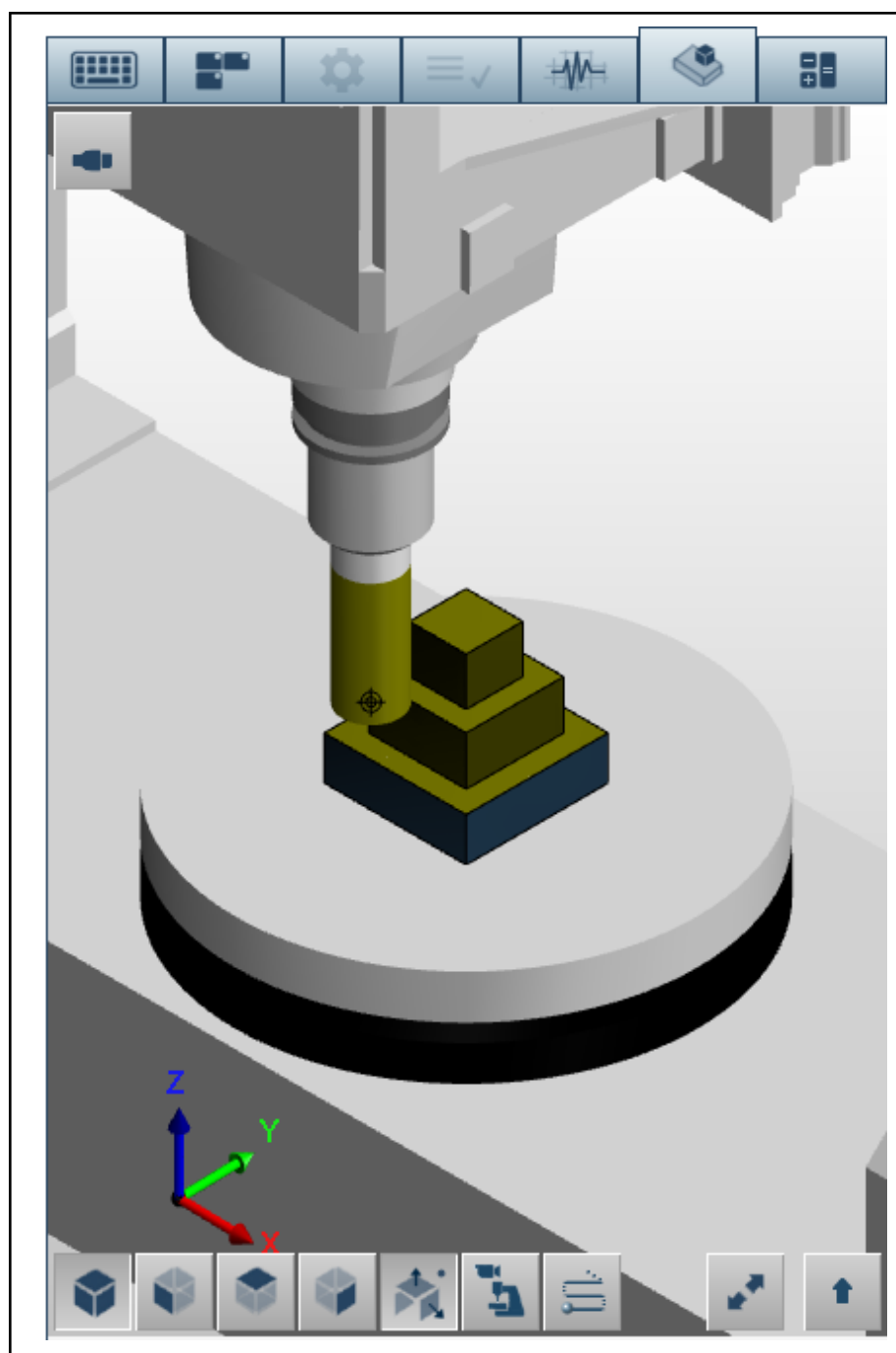


Fig. 3-42: *Simulation in the additional operating area*

If the NC cockpit display is active in the working area of the MTX user interface, the content of the tab is toggled to the "Position and block progress display".

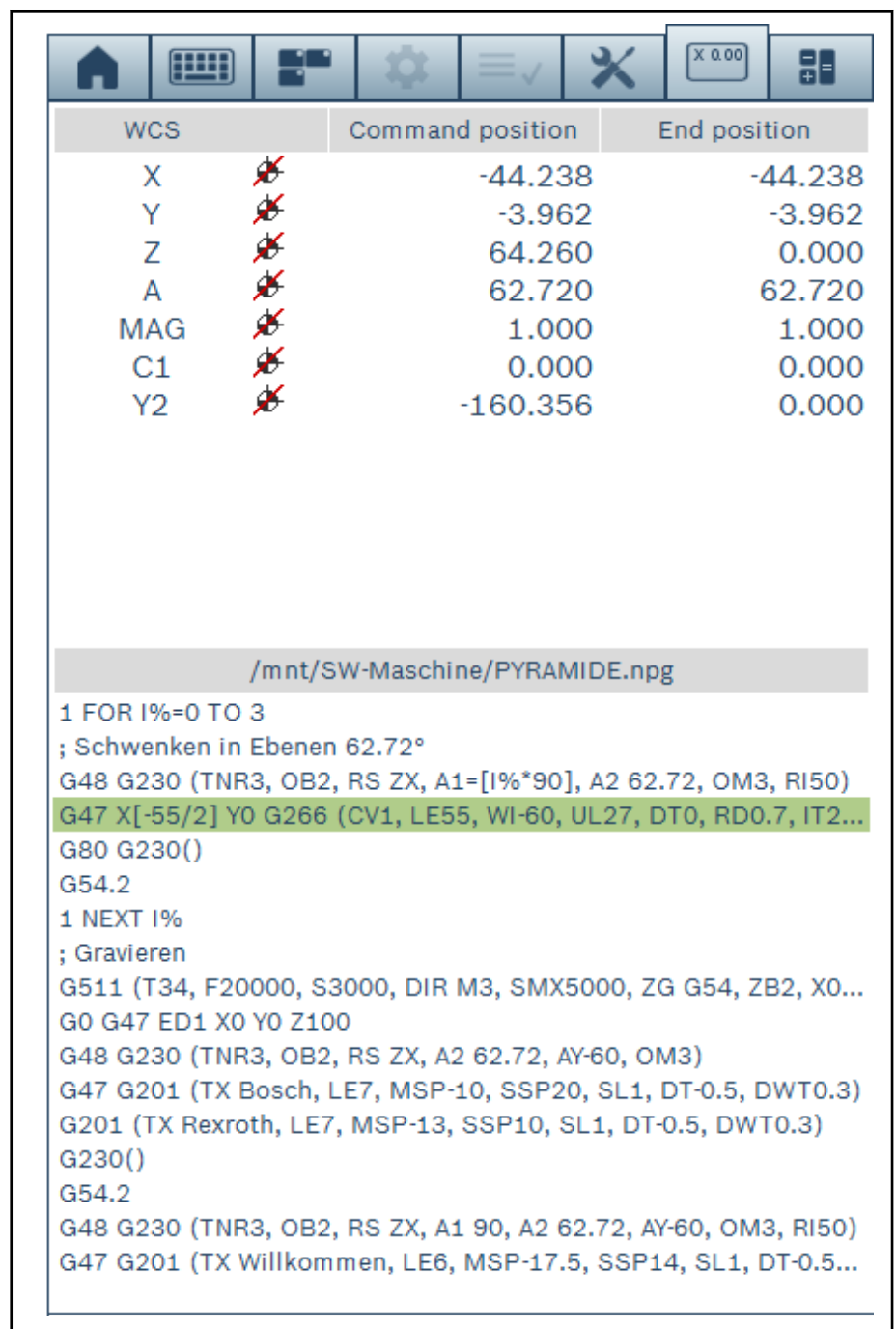


Fig. 3-43: Position and block progress display

3.7.8 "Computer" tab

Icon



This tab contains a scientific calculator with the following functions:

- Scientific calculator
- Taper computation
- Thread calculation
- Circumference

Operating elements

- Tolerance dimension
- Polar coordinates
- Speed calculation

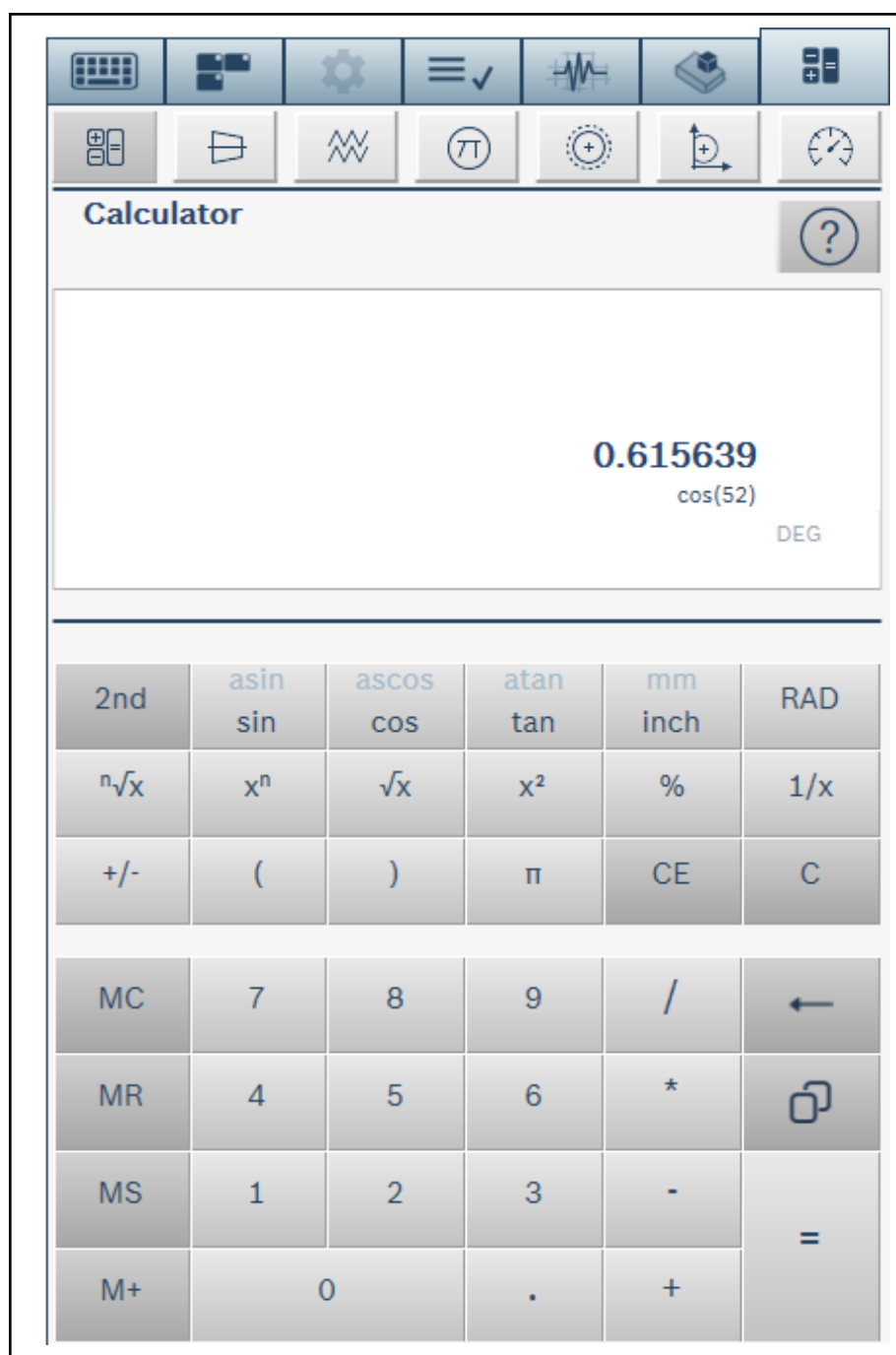


Fig. 3-44: Calculator

The results can be applied to the application using "Copy" and "Paste".

4 General operation and visualization

4.1 Visualization symbols

The following table shows and describes the symbols that are displayed.

Description	Icon	Explanation
Errors		The symbol indicates that an NC error or a ProVi error has occurred
Warning		The symbol indicates that an NC warning or a ProVi warning has occurred
		The icon indicates that, after a change in the configuration system, a system reset or system restart is required to apply the changes
		The symbol indicates conflicting versions between the interface and NC kernel
Note		The symbol indicates that an NC note or a ProVi note has been reported
Complete lock		This symbol indicates that the axis output is inhibited for all NC channels
System waiting mode		This symbol indicates that at least one NC channel is in waiting state (sum signal)
I-Remote		Remote support inactive
		Remote support active
Winlock		Winlock active
		Winlock inactive
Visualization data		This symbol indicates that new visualization data is available that is applied when restarting IndraWorks Operation
Connection state This symbol shows the connection state between user interface and control.		Online
		Insecure connection
		Connection aborted
		Communication server (SCP server) failed

General operation and visualization

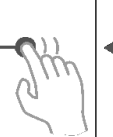
Description	Icon	Explanation
PLC error status		PLC in Stop state
		The symbol indicates that there is no symbol table
		The symbol indicates that the PLC program is changed online
Network state		The symbol indicates that a network exists and that all devices operate correctly
		The symbol indicates that a network exists and that at least one device is not online or is signaling a warning
		The symbol indicates that a network exists and that at least one device is signaling an error
Secondary mode The secondary operating modes of the machine operating mode "Automatic" are displayed as icon and as text		Continuous block
		Single block
		Single step
		Program block
		Leaving the contour
		Return to contour
		Block pre-run
		NC-Analyzer step mode
The secondary operating modes of the machine operating mode "Manual operation (setup)" are displayed as icon and as text		Approach reference point
		Jog
		Jog WCS
		There is no secondary mode in the machine operation mode "MDI". Only the symbol is shown

Description	Icon	Explanation
Channel state The status of the active NC channel is shown as symbol and text in this area.		Ready
		Running
		Stop
		Prepared
		Interrupted
		Inactive
		Reset
Test mode (dry run)		The icon indicates that a channel-specific test function (dry run) with test feed is active and test rapid traverse is active
		The icon indicates that a channel-specific test function (dry run) with rapid traverse is active
		The icon indicates that a channel-specific test function (dry run) with test feed is active
Channel settings		The signal indicates that the "Optional stop" function is active
		The signal indicates that the "Block skip (M01)" function is active

Description	Icon	Explanation
Channel in wait state		Wait states that cannot be specified by a separate bitmap are displayed using this bitmap This bitmap is also shown if more than one waiting state has occurred. All waiting states that have occurred are displayed in the tooltip using the touch gesture "Touch and hold" over the symbol or by pressing the F-key in the channel dialog
		Dwell time
		Auxiliary function subject to acknowledgement
		Block transfer inhibit
		Channel feed = 0
		Program stop (M0/M1)
		Feed hold
		Feed inhibit

Tab. 4-1: Visualization symbols

4.2 Multitouch gestures

Gesture										
Description		Single tap	Double tap	Touch and hold	Dragging with one finger	Swipe (to the left)	Spread fingers	Move fingers together	Rotate	Dragging with two fingers
HMI area	Basic screen	Select window	Open editor (context-dependent)	-	Scrolling	Next (window) content	Zoom ++	Zoom --	-	-
	Header	-	Open application (context-dependent)	Open header configuration	-	-	-	-	-	-
	Navigator	Select entry	Open editor (context-dependent)	Open context menu	Scrolling	-	-	-	-	Scrolling
	List displays	Focus cell	Start editing	-	Scrolling	-	-	-	-	-
	NC Simulation	-	No effect	No effect	Change view angle	-	Zoom in	Zoom out display	Rotate	Displacing

Tab. 4-2: Multitouch gestures

4.3 Easy-HMI / Easy user interface

4.3.1 General information

Via Easy-HMI, it is possible to provide a simple user interface with limited functionality for operation in the automated high-level production.

The entire functionality of the MTX interface is configured for this simple operation.

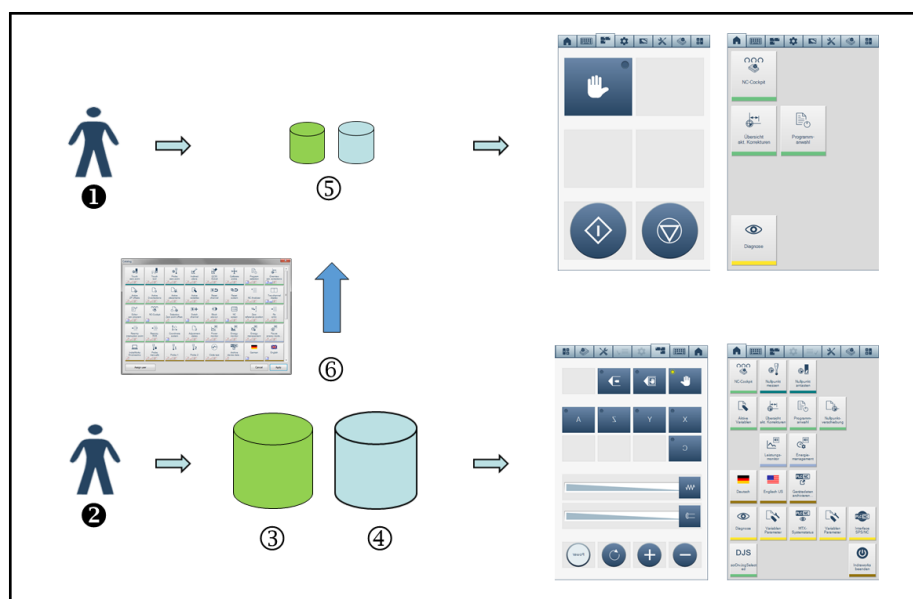
For each application, it can be selected via the configuration if this application is to be part of the user interface or if F-keys and M-keys are required.

All start applications of the operating areas without F-keys have to be configured.

OP-keys are generally not required for simple user interfaces. The applications are called via the "Home Control".

For easy operation, simple VAMs can be assigned.

It is specified in the configuration if the user uses the standard or the easy user interface. Upon user login, it can be switched from standard to simple user interface and vice versa.



- 1 Easy-HMI user
- 2 Standard user
- 3 All operating and display functions
- 4 All machine functions
- 5 Adjusted functional scope
- 6 Configurator to adjust the functionality and the assignment to the user

Fig. 4-1: Easy HMI diagram



A standard user can switch between standard and easy user interface using a tile in the Home Control.

4.3.2 Configuration

A dialog to configure the Easy-HMI can be called via the context menu of the Home Control.

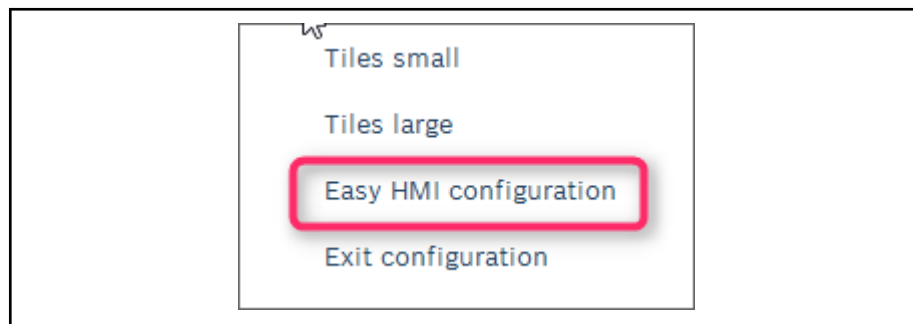


Fig. 4-2: Calling the Easy-HMI configuration

The basis is a catalog of all applications and functions available in IndraWorks Operation.

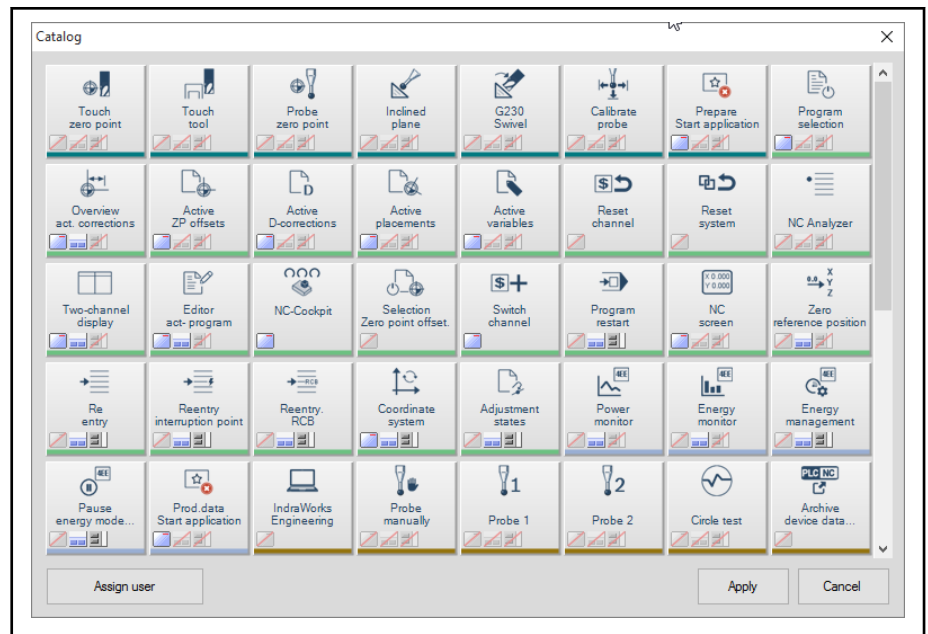


Fig. 4-3: Configuration dialog for Easy-HMI with function catalog.

In this dialog, it is specified which applications can be selected for Easy-HMI and if the application can be combined with F-keys and/or M-keys.

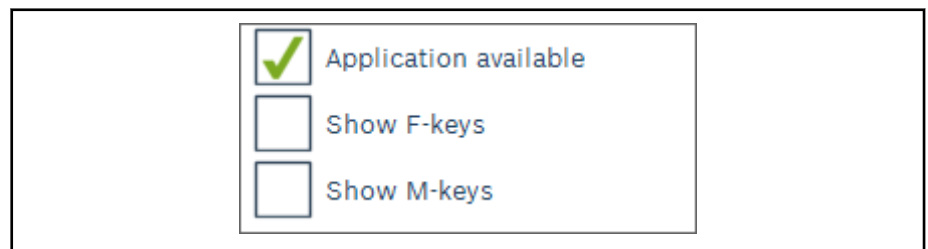


Fig. 4-4: Specifying the availability of a function in Easy-HMI

Furthermore, it is specified via the "Assign user" key, which user is assigned the easy user interface.

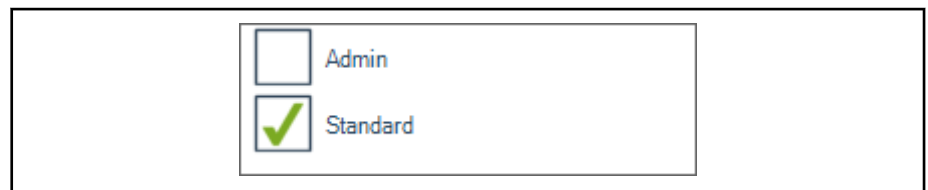


Fig. 4-5: User assignment

The standard control of the virtual VAMs uses the virtual VAMs "VAM_Automatic_Easy" and "VAM_Manual_Easy" in Easy-HMI. The user can configure simple VAMs with limited machine functionality.

4.4 Winlock

4.4.1 General information

Winlock is a software component that is started by the user interface preventing unauthorized users from switching between programs (<Alt> + <Tab>) and from accessing the Windows operating system (desktop, Start menu, taskbar).

Authorized users require the user right "Access to operating system functions".



Winlock is activated automatically by activating the user management.

4.4.2 Active Winlock

If Winlock is active, the following operations are locked:

- Switching between programs using <Alt>+<Tab>
- Displaying the Windows Start menu with <Ctrl>+<Esc> or with the Windows keys
- Moving the user interface to the background using <Alt>+<Tab>
- Closing the user interface
- Minimizing and restoring the user interface
- Operating the Windows taskbar and Windows Desktop

In addition, the following buttons are deactivated in the Windows Security dialog which is displayed by pressing the key combination <Ctrl>+<Alt>+<Del>:

- Lock computer
- Logoff
- Shut down
- Change password
- Task Manager

Every time the IndraWorks users log in or log out, the required authorization is checked again and the functions mentioned above are disabled or enabled.

An icon in the header displays if Winlock is active.

4.4.3 Deactivating Winlock

Winlock is deactivated when an authorized user logs in.

4.4.4 Closing the user interface

When an attempt is made to close the user interface, it is checked whether the logged-in IndraWorks user has the required authorization. If not, the user interface cannot be closed and a corresponding message window is displayed.

4.5 Operation modes

4.5.1 Automatic

Single block



In secondary operation mode "Single block", individual blocks of a main program or a subroutine or of a user cycle are executed after the "Start" key on the machine operating panel is pressed.

Single step



In secondary operation mode "Single step", individual blocks of a main program or subroutine and of a user cycle are executed after the "Start" key on the machine operating panel is pressed. As for "single block", but

additionally with the compensation blocks inserted by the NC (e.g. to enable the cutter radius compensation) or with the NC-internal cycles.

Program block



In secondary operation mode "Program block", individual blocks of a main program or a subroutine and of a user cycle are executed after the "Start" key on the machine operating panel is pressed. The blocks are executed individually as in "MDI". Block preview is not possible!

Continuous block



In normal mode, programs are executed in the "Continuous block", i.e. upon the NC start, the program is continuously processed.

Block search/Block pre-run

Overview

The functions "block search" and "block pre-run" simplify the testing and positioning of NC programs.

Structure of the screen layout



Fig. 4-6: Screen layout of block search/block pre-run

The "Block search" or the "Block pre-run" screen visualizes the selected NC program with the corresponding subroutines. If "Block search" or "Block pre-run" was started once before for this program, the previous target block is highlighted.

Header

The header shows the name of the application "Block search" or "Block pre-run" and the name of the NC program including the path specification.

Main area

The main area of the "Block search" or "Block pre-run" screen displays the selected NC program/subroutine.

Status bar

The status bar is divided into several areas:

- Information area
- Sequential number of the selected line
- Open applications
- Current language

Information area Information texts and error messages can be displayed in the "info area" during operation.

Line number The sequential number of the selected line is shown in the second area. The column is not assigned.



The fields "Open applications" and "Current language" are assigned by the system. If subroutines are branched, these are also entered as "Open applications". In this case, the applications cannot be toggled. Otherwise, the programs context get lost.

Functional scope of the block search

The block search provides the option to start NC processing within the selected main NC program. This function acts like an absolute jump from the program start to the target block. The selected program has to be at program start.

Using the long cursor, the operator selects the desired target block to which it is to be jumped from the program start.

After having triggered "NC start", the NC starts program processing based on the current machine and control states and starting at this block. Afterwards, it is switched to a special NC screen. The previous blocks are not executed or taken into account.

Starting the application The default M-key assignment is the "Block search" key in the "Program functions" level.

When calling Block search, the selected NC program is displayed.

The cursor is normally located on the first block in the displayed NC program. If the program has already been processed previously in the block search, the previously selected block is highlighted.

Block search to main block Generally, the block search is used to position and start a main block that contains all required geometric and technological data for a continued program operation, especially the tool replacement.

Block search on auxiliary block The block search can also be used to position and start any NC block (auxiliary block). Therefore, the operator has to set the required geometric and technological data in "MDI mode" before.

Thus, the conditions required on the machine for the actual entry block can be set up.

Selecting the target block The target block of the displayed NC program can be selected with the cursor keys.



Note that the selected NC block number must not exist several times in the NC program. The system jumps to the block number found first.

Starting the block search Press the F-key "Apply block" to start the block search and to close the application.

Functional scope of the block pre-run

Block pre-run is a function to test and position NC programs so that the operating procedure can be started at any block in the NC program/subroutine. Block pre-run is an extension of the NC function "Block search".

Block pre-run is used to create the required states in the control and at the machine. The block pre-run requires a specified target block. The target block can be located within the selected NC program as well as within a subroutine. In the function "Block search", program processing begins at the target block that is a freely selectable program block. Until then, from the first program block up to the block in front of the target block, the program blocks are processed logically with axis output as well as help functions blocked. Processing and executing NC instructions starts with the target block.



There are still restrictions for the "Block pre-run" function. Also refer to "Rexroth IndraMotion MTX 14VRS Functional Description Extension", chapter "Block pre-run".

Starting the application	The default M-key assignment is the "Block pre-run" key in the "Program functions" level. When calling Block pre-run, the selected NC program is displayed. The cursor is normally located on the first block in the displayed NC program. If the program has already been processed previously in the block search, the previously selected block is highlighted.
Opening the subroutine	Use the F-key "Open subroutine" to display the corresponding subroutine if a subroutine call was written in the selected block. If the selected block does not contain a subroutine call, this is displayed by an information text. If the selected NC block contains a GNP cycle call, the compiled GNP subroutine is opened.
Closing the subroutine	Use the F-key "Close subroutine" to close the open subroutine and to return to the calling program. An information text is displayed if no subroutines are open anymore (that means returning is not possible anymore).
Applying the block	Use the F-key "Apply block" to start the block pre-run, close the application and show the adjustment screen.
End position of the target block	At block pre-run, the starting position for the following axis adjustment between the initial position and the end position of the target block can be selected. The end position of the target block (ticked) can also be the return position from a subroutine of the target block.
Block pre-run options	The Options dialog for block pre-run can be called in the "Program functions" plane via the M-key <L7>. The following settings can be selected: • Axis position adjustment display • Enabling manual data input • Specifying the approaching strategy • Defining the adjustment programs • Defining an action block • Defining the approaching velocities • Defining the monitoring time for runtime monitoring • Saving the points of cancellation

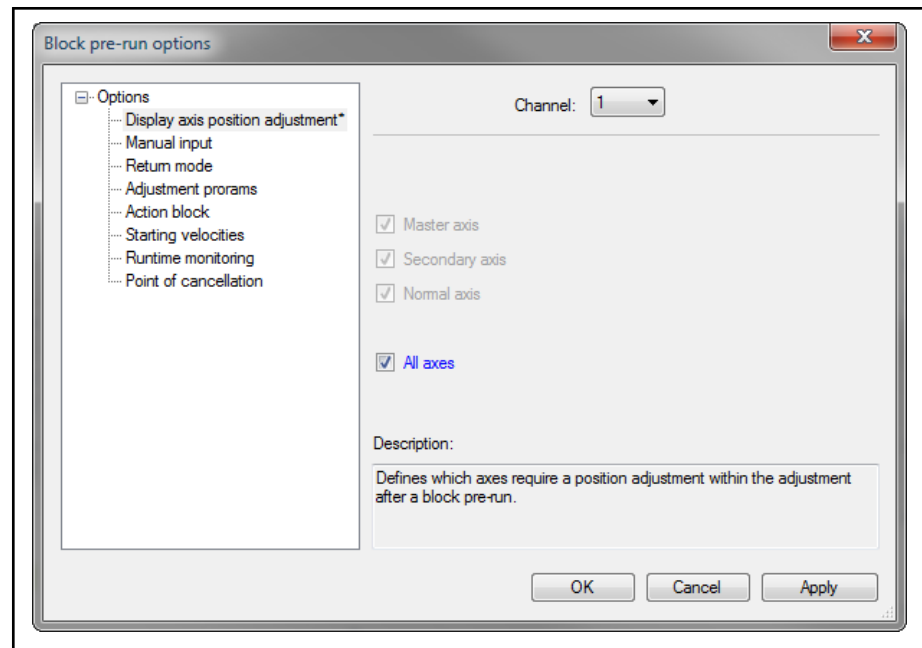


Fig. 4-7: Block pre-run option dialog

Function keys in the applications "Block search" and "Block pre-run"

The following table lists the F-key assignment of the applications "Block search" or "Block pre-run":

Functions in the main level

In the first level of the F-keypad, the following functions are contained.

- <F2>: "Open subroutine"
- <F3>: "Close subroutine"
- <F4>: A dialog to enter a character string to be searched in the complete program opens. It can be selected between upper case or lower case as well as the direction of the search. Replacement is not possible
- <F5>: A subsequent level is opened where more functions are grouped
- <F6>: "Apply block"
- <F7>: "End position of the target block" (only for block pre-run)
- <F8>: The function "Block search" or "Block search" is cancelled

Functions in the Navigation level

The "Navigate" level provides the following functions:

- <F2>: The long cursor jumps to the beginning of the file
- <F3>: The long cursor jumps to the end of the file
- <F4>: The cursor jumps to the next word. If the line is exited, the long cursor also jumps to the new line
- <F5>: The cursor jumps to the previous word. If the line is exited, the long cursor also jumps to the new line
- <F9>: Return to main level

Returning to contour with block pre-run

Overview

Returning to contour with block pre-run after program termination provides the option of continuing the processing of the NC program with as little effort as possible, if it reached or exceeded a defined and programmed NC block (returning to contour block). Define a returning to contour block by

programming the NC function "ReentContBlk()", (short form "RCB()") in the NC program.

Application

If an NC program is aborted during processing, processing has to start at a predefined position immediately. Reasons for an abort can be tool rupture, power failure, NC control error, etc. In these cases, the NC programmer can determine where (NC block) a repositioning in the NC program is reasonable. This block is marked with "RCB(1)" in the NC program. If the NC program is aborted after this block, returning to contour with block search is possible.



Returning to contour with block search after a program abort is only possible in the operation mode "Continuous block".

The function "Returning to contour with block pre-run" can be configured on an available F- or M-key. The function to be projected is "Re-entry".

The default M-key assignment is the "Re-entry" key in the "Program functions" level.

After program abort, the "Return to contour" function can be initiated after making the machine ready for start. If no re-entry point is programmed or if it was deleted by "RCB(0)", a corresponding message is issued. If another NC program was selected in the meantime, this function can also not be started.

If a re-entry point was programmed, but the NC program edits, the "Re-entry" function can be called. Only when starting the block pre-run function, an error message is issued and the function is aborted.

The "Return to contour" function cannot be called without a selected NC program.

Adjustment

General information

After the computation, the NC-internally calculated states (positions, speed, G-codes etc.) do not correspond to the ones at the machine in a real situation.

The operator has to change the real situation by an adjustment program and manual entries (manual data input) so that it corresponds to the calculated state.

The following data has to be adjusted:

- Axes
- Spindles
- Auxiliary functions
- NC functions
- Tools

Adjustment sequence after computation:

- Adjustment program - InitAdjust
- Manual adjustment via manual data input of NC blocks
- Action block (optional)
- Adjustment program - TargetAdjust (optional)
- Approaching motion
- Program entry (target block)

Adjustment screens

The adjustment state is visualized via adjustment screens.

Overview screen The screen is displayed in the operation mode "Block pre-run" after the computation started.

The total adjustment state of the respective data type is displayed as adjustment symbol next to the partial window. The adjustment symbol signals that the adjustment has not yet been carried out. The symbol is removed after a successful adjustment.

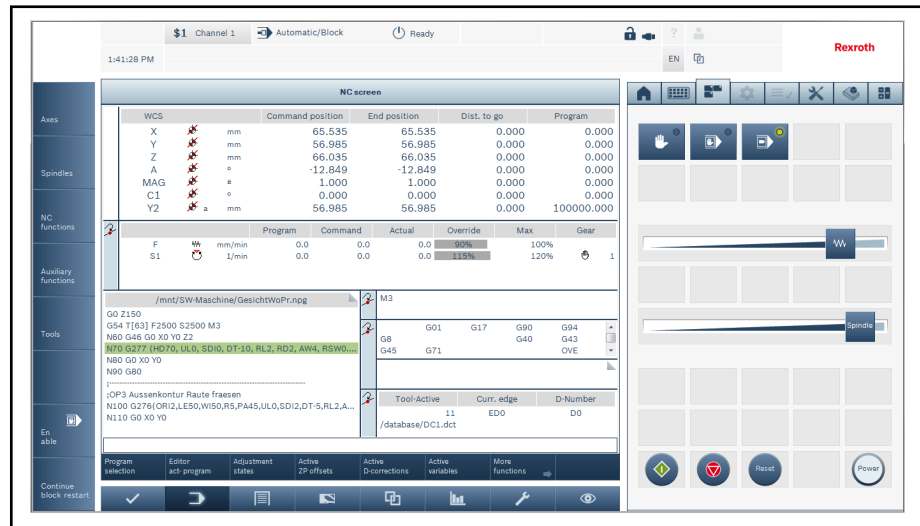


Fig. 4-8: Overview screen after the start of the adjustment program

When all data is adjusted, the adjustment screen is replaced by the automatic screen. Machining the workpiece is continued.

Applying adjustment screens Detailed information on the adjustment can be found in the adjustment screens for the individual data types. The adjustment screens are summarized in one application and can be opened with <F4> or via the machine keys <L1> to <L5>.

The application comprises five adjustment screens:

- Axes
- Spindles
- NC functions
- Auxiliary functions
- Tools

Use the keys <F2> to <F6> or the machine keys <L1> to <L5> to switch between the screens. Exit the application with <F9>.

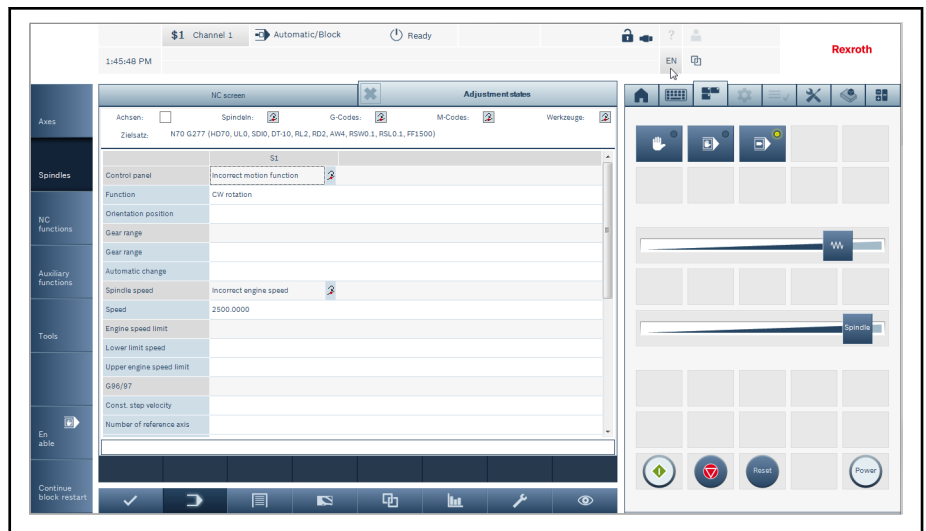


Fig. 4-9: Adjustment screen application (example: spindles)

If all data is adjusted, the application is automatically closed.

Adjustment screen: Axes

The screen contains three partial windows. The upper partial window displays the total adjustment information of all data types and the target block for a better overview.

The lower partial window visualizes the adjustment state of each individual axis as table.

There are two views (switching via <F7>):

- The adjustment information and the expected command values are shown in their interrelation
- All adjustment information is displayed as compressed and the expected command value for the adjustment is shown depending on the focused line of the adjustment information

All functions to be adjusted have to be provided with an adjustment symbol. The adjustment reason is given as text.

If the x-axis position has to be adjusted for example, this is shown by the "Incorrect position" text. The command value indicates the requested position.

A maximum of five axes can be displayed. In case of more than five axes, scrollbars are displayed.

Achsen:		Spindeln:		G-Codes:		M-Codes:		Werkzeuge:	
Zielsatz: N130 X[-55/2] Y[-55/2] G276 (LE55, WI55, UL-27, DT-54.5, AW11)									
	X	Y	Z	A	M...	C1			
Axis position	Incorrect position	Incorrect position	Incorrect position						
Command position (ACS)	-327.50000	-227.50000	-214.80300						
Axis configuration									
Target channel									
Release channel									
Axis name									
Designation									

Fig. 4-10: Adjustment screen: Axes

In case adjustment has been completed successfully, the adjustment symbols and the text are removed from the table.



To enable the axis adjustment, define in the block pre-run options for the relevant channel which axes require a position adjustment following the block pre-run.

Adjustment screen: Spindles

The screen contains three partial windows. The upper partial window displays the total adjustment information of all data types and the target block for a better overview.

The partial window in the middle visualizes the adjustment state of each individual axis as spindle.

There are two views (switching via <F7>):

- The adjustment information and the expected command values are shown in their interrelation
- All adjustment information is displayed as compressed and the expected command value for the adjustment is shown depending on the focused line of the adjustment information

All functions to be adjusted have to be provided with an adjustment symbol. The adjustment reason is given as text.

If the spindle S1 rotates to the wrong direction for example, this is indicated by the text "Incorrect motion function". The command value indicates the requested direction.

A maximum of three spindles can be displayed. In case of more than three spindles, scrollbars are displayed.

The lower partial window visualizes the adjustment state of each the spindle couplings. If no spindle coupling is active, the lower partial window is hidden.

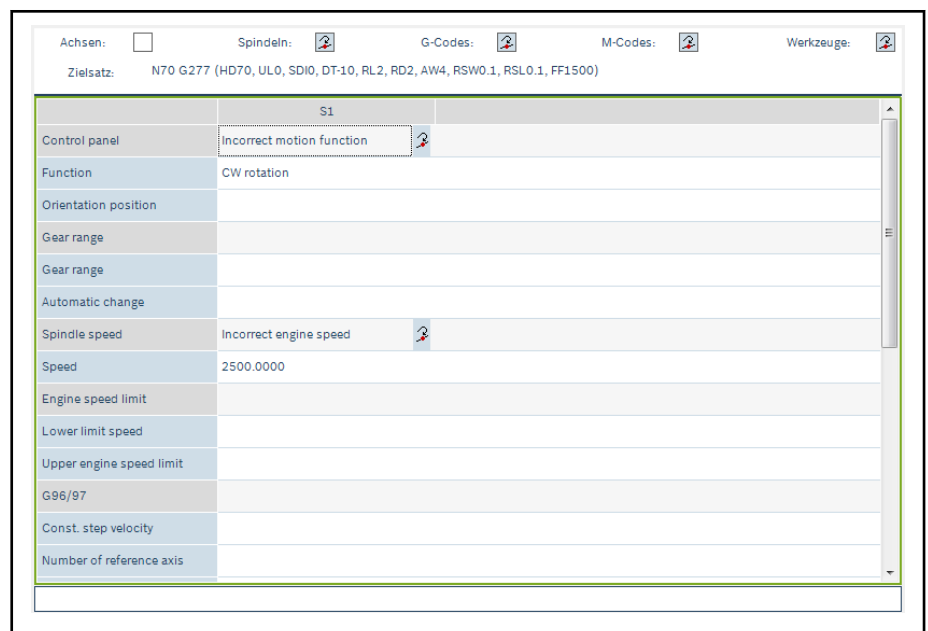


Fig. 4-11: Adjustment screen: Spindles (all command values)

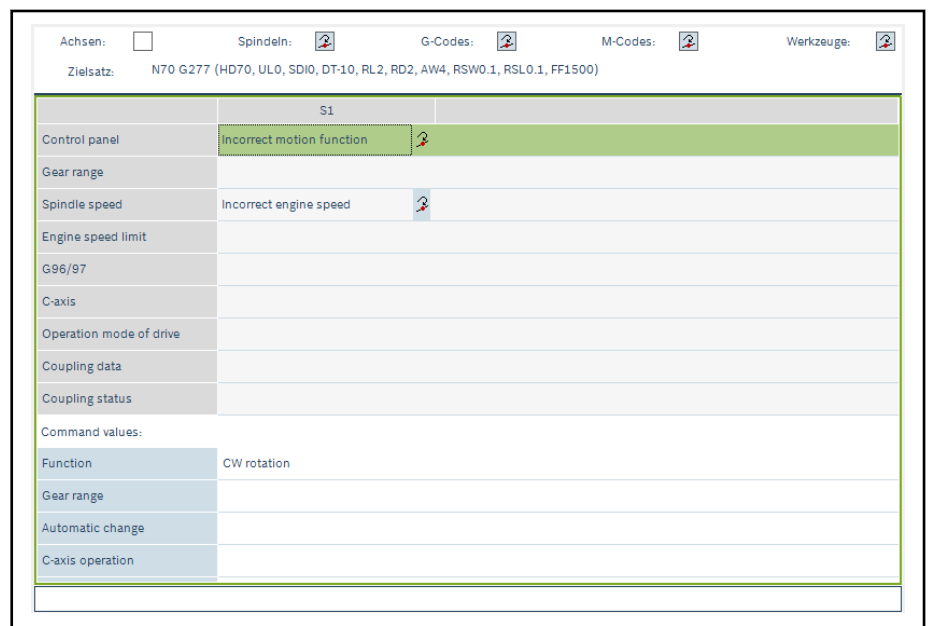


Fig. 4-12: Adjustment screen: Spindles (compact)

In case adjustment has been completed successfully, the adjustment symbols and the text are removed from the table.

Adjustment screen: NC functions

The screen contains three partial windows. The upper partial window displays the total adjustment information of all data types and the target block for a better overview.

The lower partial window visualizes the adjustment state of each NC function group. In the individual columns, the NC function group, all respective functions, the actual function and the command function are displayed. If the NC function has to be adjusted, this is signaled behind the actual function.

Axes: ☐Spindles: ☒G-codes: ☒M-codes: ☒Tools: ☒

Target block: N70 G277 (HD70, UL0, SDI0, DT-10, RL2, RD2, AW4, RSW0.1, RSL0.1, FF1500)

Group	NC functions	Actual	Command
1	CTA		
2	SME, SMD		
3	G80, G81, G82, G83, G84, G85, G86, G87, G88, G89, G165, G261, G262, G263, G266, G267, G...		G277
4	G00, G01, G2, G3, G13, G12, G10, G11, g12, g13, G33, G06, G73, G31	G01	G00
5	g408, g608, g508, G09, CFD, LNU, LND, SNU, SND, S2U, S2D, G8, G8.0, CVP	G8	G8
6	G90, G189, G91	G90	G90
7	G17, G18, G19, G20, G16	G17	G17
8	G94, G93, G95	G94	G94
9	OVD, OVE, G66	OVE	OVE
10	G71, G70	G71	G71
11	KVP		
12	FFW		
13	AAC		
14	G35, G34, G134, G234		G35
15	G61, G62		
16	PAC		
17	G79, G78	G79	G79
18	G48, G47		G47
19	G53.1, G54.1, G55.1, G56.1, G57.1, G58.1, G59.1, G52.1		G54.1

Fig. 4-13: Adjustment screen: NC functions

After a successful adjustment of the NC function (actual function = command function), the adjustment symbol is removed from the table.

Adjustment screen: Auxiliary functions

The screen contains three partial windows. The upper partial window displays the total adjustment information of all data types and the target block for a better overview.

The lower partial window visualizes the adjustment state of each auxiliary function group. In the individual columns, the auxiliary function group, all respective functions, the actual function and the command function are displayed. If an adjustment of the auxiliary function is necessary, this is signaled behind the actual function.

Achsen: ☐Spindeln: ☒G-Codes: ☒M-Codes: ☒Werkzeuge: ☒

Zielsatz: N70 G277 (HD70, UL0, SDI0, DT-10, RL2, RD2, AW4, RSW0.1, RSL0.1, FF1500)

Group	Auxiliary functions	Actual	Command
1	M3, M4, M5, M19	M4	M3
2	S		S2500
4	M11, M12, M13, M14		
5	OPID, DT, DUR		
6	M10		

Fig. 4-14: Adjustment screen: Auxiliary functions

After a successful adjustment of the auxiliary function (actual function = command function), the adjustment symbol is removed from the table.

Adjustment screen: Tools

The screen contains three partial windows. The upper partial window displays the total adjustment information of all data types and the target block for a better overview.

The lower partial window visualizes the adjustment state of the active tool, the preselected tool, the D-correction and the edge. The individual states indicate actual and command state. If an adjustment is necessary, this is signaled behind the actual state.

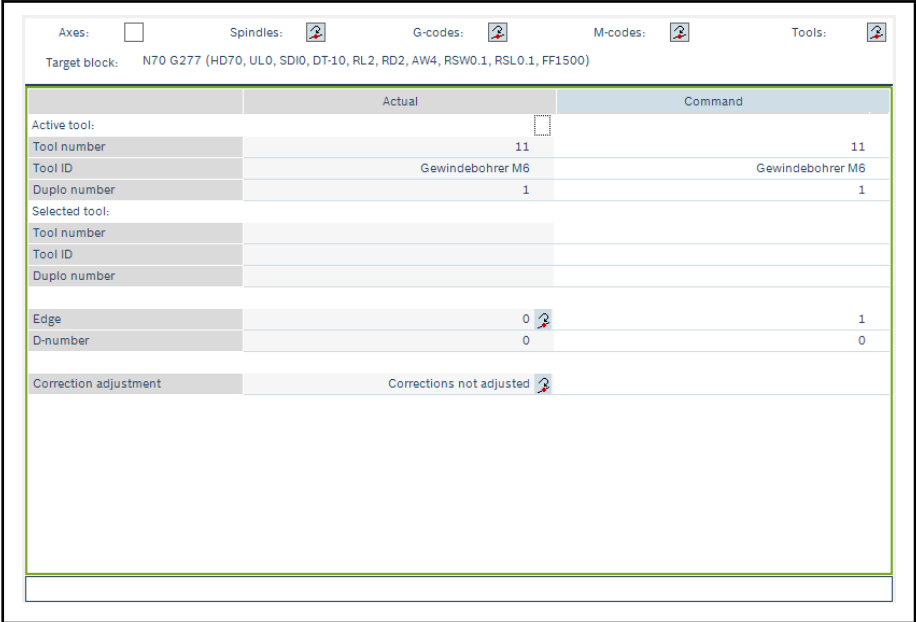


Fig. 4-15: Adjustment screen: Tools

After a successful adjustment, the adjustment symbols are removed from the table.

Manual data input

After processing the adjustment program (InitAdjust), manual data inputs can be programmed to manually adjust NC functions.

Enabling manual data input

Manual data inputs can only be programmed if the function is enabled by the operator.

This is executed using the M-key <L7> "Enable manual data input". The feedback is optically executed via the key state.

MDI editor

If the manual data input is enabled, the block progress display is automatically replaced by the MDI editor in the overview adjustment screen after the completion of the adjustment program (InitAdjust).

As for the "MDI" mode, the operator can now enter an NC block, transfer it to the NC and process it with the key "NC start" (machine panel).



When entering manual data input blocks, the same restrictions apply as for the MDI editor. Furthermore, no CPL elements and no subroutine calls can be entered.

Completing manual data input

Without previous NC block entry, the next NC start calls the action block and the adjustment program (TargetAdjust) if these are parameterized.

The manual input is completed. The manual data input editor in the adjustment screen is replaced by the block progress bar.

Leaving the contour the contour/returning to the contour

Overview

The "Leaving contour" function is required if the execution of the part program or a block sequence is to be interrupted in the "MDI block input". After leaving the contour, the work required for the program interruption can be executed.

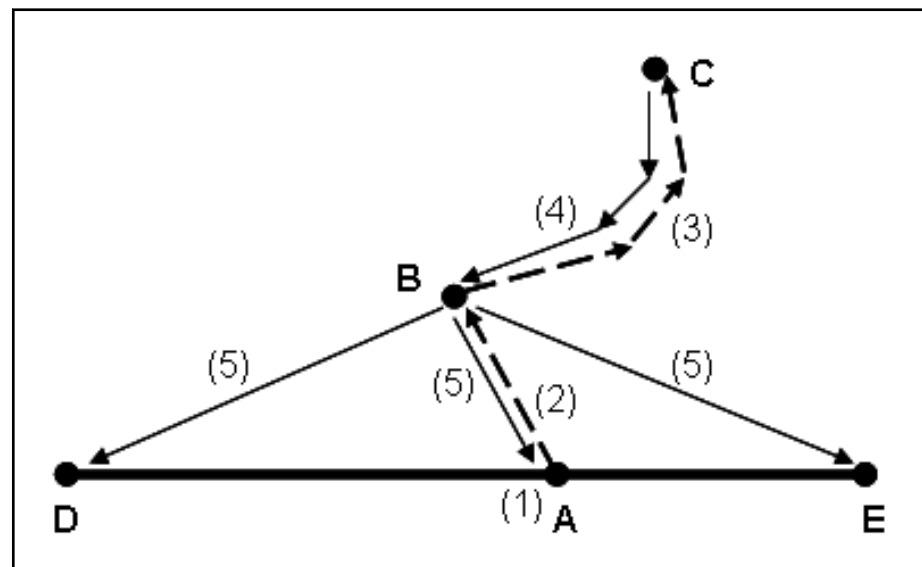
Subsequently, the contour can be approached again and the part program can continue to be executed in block sequence.

Program interruption is required for:

- Tool rupture
- Manual workpiece and tool measurement
- Visual inspection, etc.

It is returned using various strategies:

- Return to contour mode
 - Automatic approach in "Continuous block"
 - Automatic approach in "Single block"
 - Tangential approach (repositioning)
 - Direct approach
 - Approaching via return program
- Point of return
 - At the point of interruption
 - At the start of the interrupted block
 - At the end of the interrupted block



A	Point of interruption
B	Placement point
C	Leaving position
D	Start of block
E	End of block

Fig. 4-16: Principle of leaving/returning to contour

Operating steps



Processing has to be interrupted before leaving the contour!

Feed hold	Press the "Feed hold" button on the machine panel. Processing the part program is interrupted. The position where the axes come to a standstill is called the point of interruption (1).
Program functions	Press the M-key <L8> "Program functions". A new M-key level with the following functions is displayed on the left side: • <L1>: Leaving and returning to contour • <L2>: Block search • <L3>: Re-entry • <L4>: Block pre-run • <L5>: Retracing • <L6>: Manual data input • <L8>: Return
Leaving the contour	Press the M-key <L1>. The operation mode "Leaving the contour" is displayed in the machine status area. The position display has three columns: • "Command position" • "Point of interruption" • "Distance to go" The active command position is used as the point of interruption. A new M-key level with functions for returning and tap options is displayed on the left side. A new M-key level with the corresponding axis selection is displayed on the right side. The text "Move axes with jog keys away from the contour" is displayed in the status line.
Axis selection	Use the right M-key to select the axes for the jog motion. Use the left M-key to select the jog option.
Jogging to placement point	The end point of the first jog motion is saved as a preset placement point to return to contour (2).
Jogging to leaving position	The leaving position is approached using additional jog motions. The path is recorded as long as jogging continues. Each jog motion is automatically saved as NC block in a return program (3).
Returning to contour	Recording of the path is completed using the M-key <L2> "Return to contour".



From now on, any positions at the machine can be approached via jog motion without additional values being recorded.

Between leaving and returning, the work requiring an interruption of the program (e.g. manual tool replacement) can be performed.

The operation mode "Return to contour" is displayed in the machine status area.

A new M-key level with functions to select the return to contour mode and the return to contour strategy is displayed on the left side.

In the status line, the text "Recording completed! Start returning!" is displayed.

Defining strategy

Selection of the return to contour mode and return to contour strategy using M-keys:

- <L1>: Return to contour mode – Continuous block
- <L2>: Return to contour mode – Single block
- <L3>: Tangential approach (repositioning)
- <L4>: Direct approach
- <L5>: Approach via return program (path)
- <L6>: Point to return to contour – Beginning of block
- <L7>: Point to return to contour – Point of interruption
- <L8>: Point of return to contour - End of block

Returning to placement point in the mode "Continuous block"

Before actually returning to contour, "NC start" is used to process the return program up to the placement point (4).

Returning to placement point in the mode "Single block"

Before actually returning to contour, "NC start" is used to process every block of the return program up to the placement point (4).

Tangential approach

<L3> opens a dialog in which the function is activated and the radius is entered in inch or mm depending on G70/71.

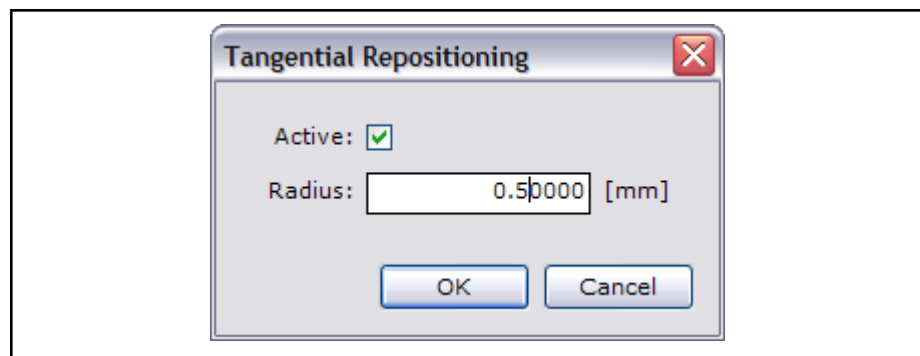


Fig. 4-17: "Tangential approach" dialog

Direct approach of placement point

If direct approach is selected, it is moved from point C to point B directly without return program.

Continuing processing

Depending on the strategy, "NC start" is used to approach the point of return and to continue processing (5). The display switches to the automatic screen with the corresponding M-keys.



- Returning to contour in more than one channel at the same time is not possible.
- Returning to contour is impossible during tapping (G63).
- After an interruption, the spindle is to be manually stopped and restarted.
- Returning to contour during a CPL waiting state is possible only after the waiting state.

Overwriting

Operating steps



Before overwriting, processing has to be interrupted, channel state has to be "stop"!

Feed hold

The "Feed hold" key at the machine panel interrupts the processing of the part program.

Program functions

The M-key level with the following functions is called via the M-key <L8> "Program functions":

- <L1>: Leaving and returning to contour
- <L2>: Block search
- <L3>: Re-entry
- <L4>: Block pre-run
- <L5>: Retracing
- <L6>: Manual data input
- <L8>: Return

Manual data input

Press the M-key <L6> and the block progress display in the NC screen is replaced by the manual input editor.

As for the "MDI" mode, the operator can now enter an NC block, transfer it to the NC and process it with the key "NC start" (machine panel).

Local and/or modal NC functions as well as axis motions can be programmed in the NC block.



When entering manual data input blocks, the same restrictions apply as for the MDI editor. Jumps and calls of subroutines with parameters are not permitted in Manual Data Input (MDI) blocks because "linking" is not supported before the MDI block is executed. However, it is possible to call a local subroutine.

Continuing program

Then, more NC blocks can be specified and processed in the MDI editor.

An "NC start" (machine panel) without previous input of an NC block causes the part program to continue.

The MDI editor in the NC screen is replaced by the block progress display.

Complete lock

Operating steps



If one or multiple channels are not in the "ready" state or "inactive", the function cannot be enabled or disabled!

DryRun options

The M-key level with the following functions is called via the M-key <L7> "DryRun options":

- <L1>: Complete lock
- <L3>: Test feed
- <L4>: Test rapid traverse
- <L7>: Options
- <L8>: Return

Complete lock Press the M-key <L1> to block the axis output for all channels. The key is shown as active and a corresponding symbol is shown in the machine state display.

Press the key again to cancel the complete lock. A dialog is displayed indicating that the system has to be reset to apply the axis position. The system reset is triggered after acknowledging the dialog with <Yes>.

Options Use <L7> to call the dialog to set the test feed and the test rapid traverse.

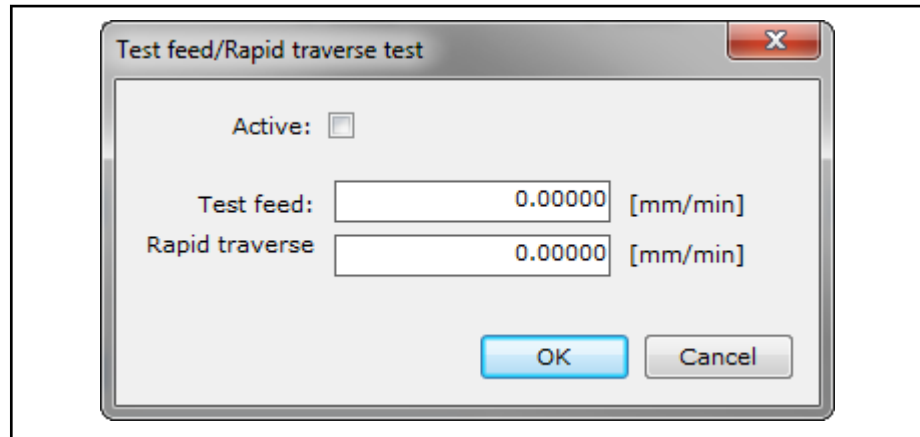


Fig. 4-18:

Select "active" to activate the feeds via the <L3> and <L4> M-keys.

4.5.2 MDI - Manual data input

MDI editor

The MDI editor (MDI = **M**anual **D**ata **I**nterface) is used to transfer one or multiple NC blocks to the NC and to process them by pressing "Start".



Prerequisites (interlocks) for the MDI mode have to be made in the PLC program. The "MDI" mode and the NC status "inactive" are required.



Fig. 4-19: MDI mode and status



Jump instructions, loops and accesses to local and global CPL variables are invalid in Manual Data Input (MDI) blocks, since "linking" is not supported before the MDI block execution.

In the standard model, a separate complete NC screen in which the focus is already on the window "MDI block input", and thus the MDI editor, is opened when the "MDI" mode is activated.

Transferring an NC block from the MDI editor to the NC (<F4> "Apply MDI block") and <F2> "Reset channel" are protected by the user management.

The MDI editor can process up to 100 NC blocks. If the number of lines exceeds the number that can be displayed in the MDI editor, a scroll bar is displayed for orientation purposes. The number of blocks in the MDI editor is checked during pasting from the clipboard and when <F4> "Apply MDI block" is pressed. If the number of NC blocks exceeds 100, a note is displayed in the status line while pasting from the clipboard (<Ctrl>+<V>). When <F4> is

pressed, a message window with the number of permitted and existing blocks is displayed.

The MDI editor can assume two different states:

- Editing permitted:
White background to enable all keyboard shortcuts of the editors (<Ctrl>+<C>, <Ctrl>+<V>, <Ctrl>+<X> etc.).
The control is in the "Inactive" state.
- Editing is not permitted:
Gray background
The control is in the "Ready", "Running", "Stopped" states or in an error state.

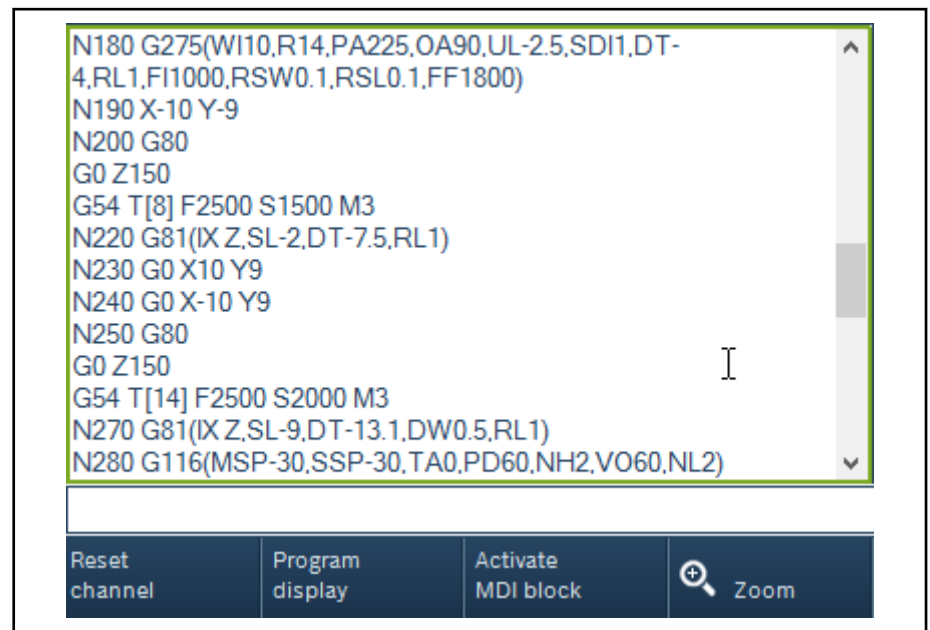


Fig. 4-20: Editing permitted



Fig. 4-21: Editing not permitted

F-keys of the MDI editor:

F-keypad level	<F2>	<F3>	<F4>	<F5>	<F6>	<F7>	<F8>	<F9>
First main plane	Reset channel	Program display	Apply MDI block	Zoom	Delete MDI editor	Next window	Options	Back

Tab. 4-3:

Function keys in the MDI editor

<F2>	Channel reset. All modal states go to their initial values.
<F3>	The NC program display is called in the same window instead of the MDI editor. This is necessary if a subroutine is called as the MDI block and the block sequence in the subroutine is to be followed. Press <F3> to leave the block display and return to the MDI editor.
<F4>	Activation (i.e. transfer to the NC) of the NC block focused in the MDI editor. If several blocks are focused, this block is enabled by NC blocks.
<F5>	Content of MDI editor is deleted.
<F6>	Zoom; the MDI editor requires the entire space between the M-keys, F-keys and the header. This is especially important for the BTV 16 if editing is to take place in existing MDI blocks before processing again.
<F7>	The MDI editor loses the focus. The next partial window is focused.
<F8>	An "Options" dialog is opened, see fig. 4-22 "Options" dialog for the MDI editor on page 72.
<F9>	MDI editor loses the focus. The main F-key level of the NC screen becomes active. The second main F-key level (<F8> and then <F7>) can be used to set the focus to the MDI editor again.

Options

The MDI editor behavior can be changed via an "Options" dialog.

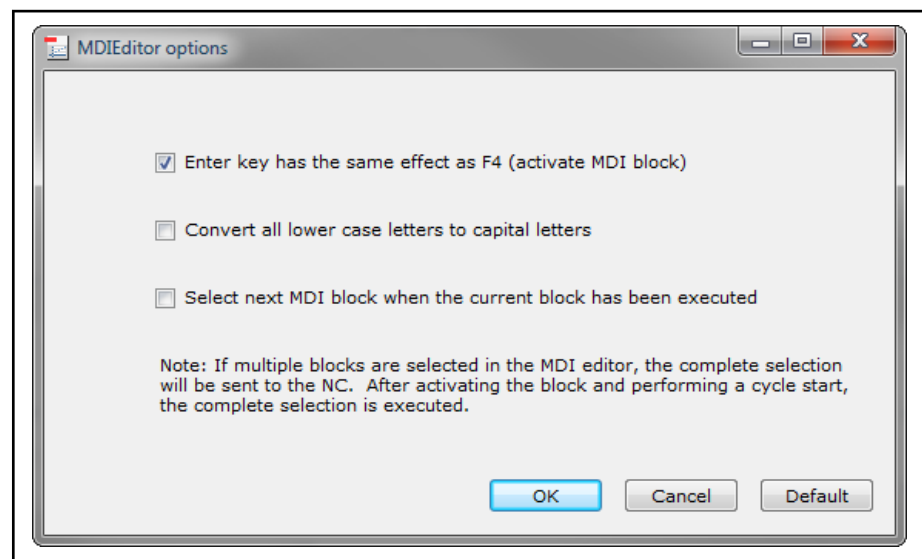


Fig. 4-22: "Options" dialog for the MDI editor

Description:

- The <Enter> key has the same function as <F4> (apply MDI block):

- <Enter> triggers the "Apply MDI block" function (default setting)
- <Enter> operates with the normal line feed function in the MDI editor
- Converting all lower-case letters into capitals:
 - Conversion "ON".
 - Conversion "OFF" (default setting).



All lower-case letters are converted in the MDI editor. The option cannot be used for subroutines called with path information, transformations or if axis names contain lower-case letters.

- Automatically preselect the next MDI block when the current block is processed:
 - If the processed MDI block is not the last NC block in the MDI editor, the next NC block is automatically preselected after the MDI block is executed (corresponds to "Single block").
 - Do not automatically preselect the next MDI block (default setting).
- The "Note" is used to draw the attention of the user to the possibility of processing of a block of NC blocks.



A block of NC blocks is always processed "en bloc" (similar to "Continuous block") in the NC.

Processing an MDI block

Procedure for processing a block:

1. Enter the block in the MDI editor.
2. With <F4> or <Enter>, the block is applied to the NC. The control is in "Ready" state and the block is highlighted. Editing is no longer possible. The text "Waiting for Start button" is displayed in the status line (see [fig. 4-21 "Editing not permitted" on page 71](#)).
3. The MDI block is processed after pressing "Start".
 - If the block was successfully processed by the NC, the control returns to the status "inactive". The next block can now be edited.
 - If the NC detects an error in the block, the error symbol is set in the header and the text "Reset channel" is displayed in the status line. The error can only be fixed by resetting the channel.

Processing multiple MDI blocks

Processing single blocks

Prerequisite: "On" has to be selected in the "Automatically preselect the next MDI block when the current block is processed" option.

- Up to 100 MDI blocks remain in the MDI editor. The cursor can be placed on one of these blocks.
- Press <F4> to apply the block on which the cursor is placed to the NC. Behavior as above.
- The MDI block is processed after pressing "Start". Behavior as above.
- If the processed block is not the last block in the MDI editor, the next block is immediately transferred to the NC. The "Start" button can be pressed again immediately.

- Press <F2> "Reset channel" to complete this cycle before the last block in the MDI editor is processed. The cursor remains on the latest block highlighted.



"Channel reset" changes the modal NC states.

Processing a block of NC blocks

Several NC blocks can be selected in the MDI editor using the <Shift> +<Arrow> or using the relevant touch gestures. Only interrelated sections of blocks can be highlighted.

- Press <F4> to apply all focused blocks to the NC. The first of these selected blocks is highlighted. The entire block of the selected NC blocks receives a different font color. Editing is no longer possible. The text "Waiting for Start button" is displayed in the status line.



Fig. 4-23: Processing a block of NC blocks (step 1)

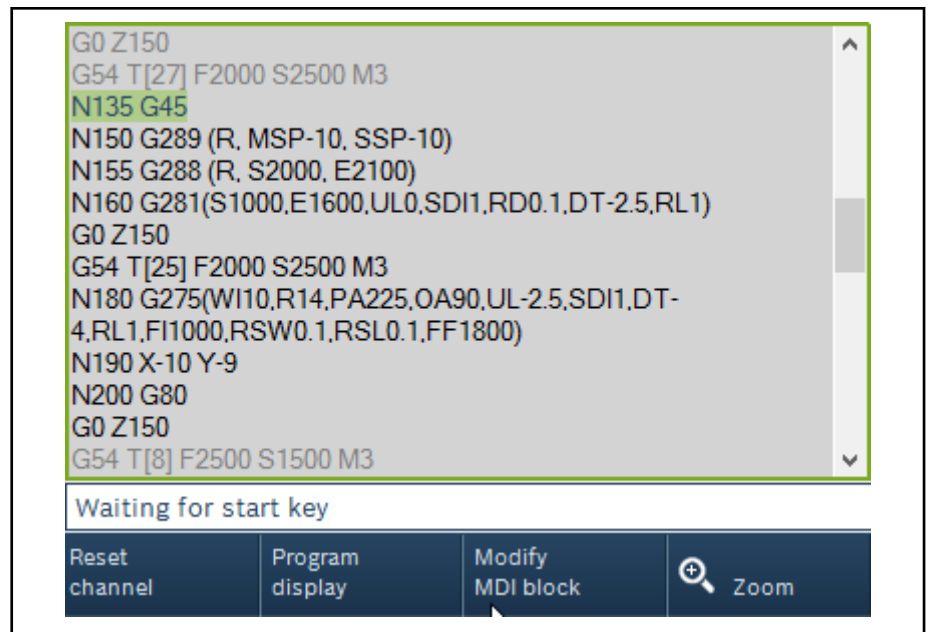


Fig. 4-24: Processing a block of NC blocks (step 2)

- All selected MDI blocks are processed "en bloc" after pressing "Start" (analog to "continuous block"). The modal states remain after the block processing.
- After all blocks are processed, the NC is in the "inactive" state. The cursor is positioned at the end of the highlighted block.

Processing a subroutine

Subroutines permitting all types of NC commands, i.e. also CPL instructions and calls of subroutines with parameters, can be called in the MDI blocks.

Example to call a subroutine: "N120 P/usr/user/Anfahren.npg".

The subroutines are processed in "Continuous block" mode. To track the block processing, press <F3> to activate the program display in the same window (see [fig. 4-25 "NC block display" on page 76](#)).

There is a special feature for the state of the program display after processing a subroutine: The last block of the subroutine is retained in the display as active block until a new block that is transferred to the NC is activated using the "Start" button. This means, the newly transferred block is only highlighted in the MDI editor if the "Start" key has been pressed.

The following applies to modal subroutines:

Both activation and call via additional traversing motions can occur only within a subroutine. Otherwise, an error message on a missing link table is issued.

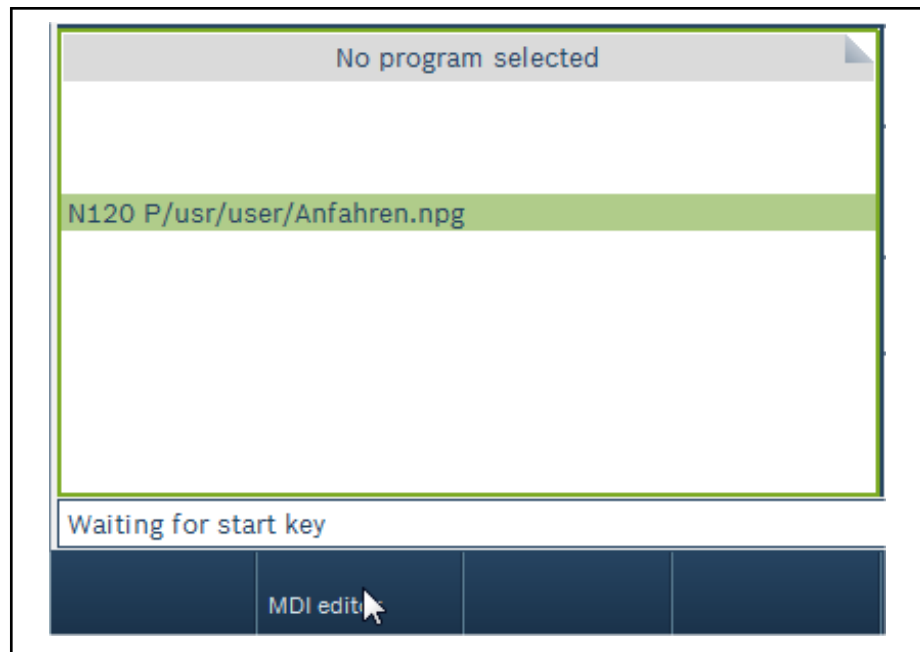


Fig. 4-25: NC block display

Applying NC blocks from the MDI editor to NC program

To apply NC blocks from the MDI editor to an NC program or to apply parts of an NC program to the MDI editor, an NC program has to be opened in the "Program" operating area using the NC editor, as it has to be an NC screen in the "Machine" operating area using the MDI editor. The NC blocks are exchanged by highlighting the desired blocks, saving them to the clipboard (<Ctrl>+<C>) and inserting them to the desired location in the MDI editor with <Ctrl>+<V>.

Leaving and returning in MDI

The leaving and automatic returning to the "automatic" mode is also available in the "MDI block input" mode.

Press the M-key <L1> "Leaving and returning" to start the function. Operation and display are identical to the "automatic" mode.

4.5.3 Manual mode

Secondary modes

In the standard, the following secondary modes can be selected via M-keys:

- "Homing"
- "Jog"
- "Jogging in coordinates"

Jog options

The following jog options can be set in the standard via M-keys:

- Continuous jogging
- Jogging 1:
- Jogging 0.1:
- Jogging 0.01:
- Jogging 0.001:

5 Machine operation

5.1 Basic NC screen

5.1.1 Overview

Different screens with window splits are available for the NC screen of the MTX NC screen. The contents of these partial windows can be assigned to user-defined displays.

By default, the Bosch Rexroth process displays are located here. These can be freely configured in the IndraWorks Engineering and adapted to the specific machine configurations.

The editor can be called directly by "Double tap" on windows with "dog ears".

If the windows has several types of content, the content can be displayed by "swiping" (to the left).

The corresponding user rights are necessary for the configuration.

The Bosch Rexroth process displays are provided with machine-dependent as well as purely interface-related parameters for an individual configuration.

- **Machine parameters** are set in the NC configurator in IndraWorks Engineering
- **Interface parameters** are set in the options dialog of the relevant displays in IndraWorks Operation



You can find further information regarding the configuration of NC screens in the documentation "IndraMotion MTX 14VRS Commissioning".

5.1.2 Position display

Display content

The position display displays axis data. Up to eight spindles per channel are supported.

WCS			Command position	End position	Dist. to go	Program
X		mm	0.000	0.000	0.000	0.000
Y		mm	0.000	0.000	0.000	0.000
Z		mm	0.000	0.000	0.000	0.000
A		°	0.000	0.000	0.000	0.000
MAG		#	1.000	1.000	0.000	0.000
C1		°	0.000	0.000	0.000	0.000
Y2	a	mm	0.000	0.000	0.000	0.000

Fig. 5-1: Position display

Column selection

The columns and variants are selected using the variant editor of the options dialog. Variants with the following column data can be defined.

- Command position
- End position
- Distance to go
- Program
- Lag
- Actual position
- \$ Command position (= channel position during system axis coupling)

- Command velocity (only ACS)
- Command speed (only ACS; available only for asynchronous, endlessly turning round axes, otherwise 0)
- Actual speed (only ACS; available only for asynchronous, endlessly turning round axes, otherwise 0)
- Maximum velocity (only ACS)



The display supports a maximum of ten variants.

If a date is not available, "—" is displayed.

The following table contains a description of the symbols displayed.

	Icon	Description	Note
Coordinate system symbols	ACS	Axis coordinate system	
	MCS	Machine coordinate system	
	BCS	Basic coordinate system	
	WCS	Tool coordinate system	
Position symbols		Axis is not referenced	The reference position of the axis is not known
		Axis is in position	The axis is located in the given position window. This symbol is only shown if the reference position of the axis is known.
Channel assignment symbols	1...12	Channel number	
	a	Asynchronous axis	
	S	Spindle	
	ŝ	Spindle inactive	
	x	Axis not defined	
Unit symbols	mm	Metric	
	Inch	Non-metric	
	o	Degree	
	∅	Diameter programming	
	#	Place programming	
	-	None	

Tab. 5-1: Displayed symbols

Coordinates

The following figure shows an overview of the coordinates / axis positions that can be displayed.

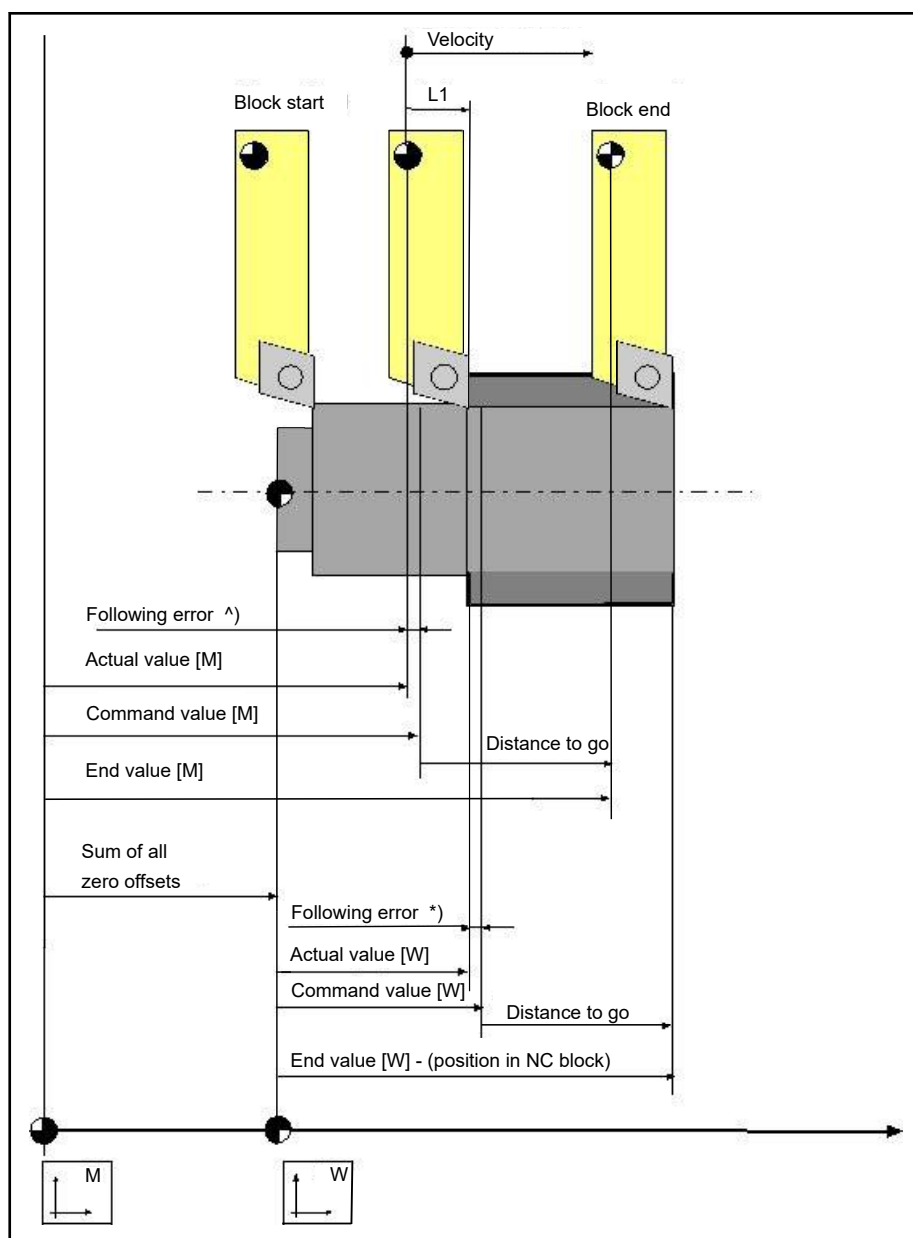


Fig. 5-2: Coordinates

Coordinate systems

The following figure shows an overview of the coordinate systems that can be displayed.

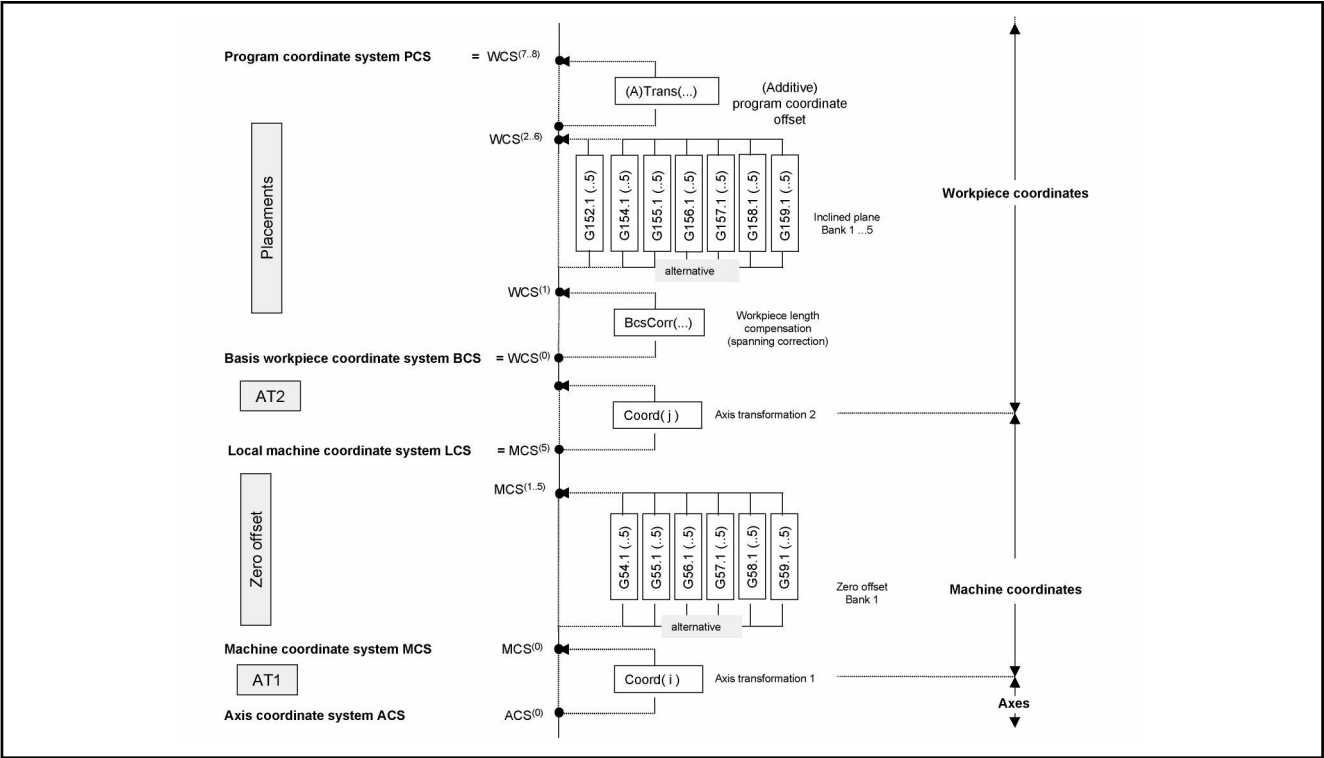


Fig. 5-3: Coordinate systems

5.1.3 Technology display

Display content

The technology display is used to show feed and spindle information. A maximum of eight spindles per channel is supported.

			Program	Command	Actual	Override	Max	Gear
F	W	mm/min	0.0	0.0	0.0	95%	100%	
S1	W	1/min	0.0	0.0	0.0	120%	120%	1

Fig. 5-4: Technology display

Column selection

The columns and variants are selected using the variant editor of the options dialog. Variants with the following column data can be defined.

- Program value
- Command values
- Override
- Maximum override
- Actual value
- Gear level
- Spindle position
- Spindle power
- Spindle torque
- Spindle group



The display supports a maximum of ten variants.
If a date is not available, "—" is displayed.

The following table contains a description of the symbols displayed.

	Icon	Description	Note
Feed symbols		G01	Feed
		G00	Rapid traverse
		G02	Circular interpolation right
		G03	Circular interpolation, counter-clockwise
		G33	Thread cutting
Spindle symbols		M3	Clockwise rotation
		M13	Clockwise rotation, coolant switched on
		M4	Counterclockwise rotation
		M14	Counterclockwise rotation, coolant switched on
		M5	Spindle stop
		M19	Spindle orientation (positioning mode)
Gear symbols		Manual	
		Automatic	
		Idle	

Tab. 5-2: Displayed symbols

Drive configuration for spindle torque and performance

The display of spindle torque and performance is done using the Sercos parameters S-0-0084 "Torque/power actual value" and S-0-0382 "Intermediate circuit performance".

These are read either using the cyclic drive telegram (see also S-0-0016 "Config. list drive telegram") or directly using the service channel from the drive.

The configuration using the cyclic telegram should be used preferably so that the service channel is not overloaded unnecessarily.

- In order to activate the transmission in the **cyclic telegram**, the Sercos configuration files, e.g. "p2ispiXX.scs" (spindle) or "p2icaxXX.scs" (spindle c-axis) have to be adapted correspondingly.

Thus, the Sercos parameters S-0-0084 and S-0-0382 have to be implemented in S-0-0016:

```
S-0-0016 = (S-0-0084, S-0-0382, ...); Torque/force
feedback value, DC bus power
```

Within the MTX, S-0-0016 is currently limited to five signals max.

If safety technology is used, five signals might not be sufficient.

In this case, the service channel executes the transfer.

- Transmission using the **service channel** is activated automatically by switching on the spindle display (technology display) in the operation desktop or by retrieving the Motion Control services

```
MCODS(111,...) => Spindle power
```

```
MCODS(110,...) => Spindle torque
```

active.

The following Sercos parameters are used to display the spindle torque and the performance:

- **S-0-0092:**

Max. torque (torque/force limit bipolar) in [%].

S-0-0092 generally results from the combination of motor and amplifier (value in the drive). In the options dialog of the technology display, one value [in (%)] can be specified for every spindle if this value corresponds to the full scale deflection of the bar. Thus, an optimum deflection range can be set for each spindle for the spindle torque bar.

- **S-0-0158:**

Max. performance (performance threshold Px) in [W].

The value is to be set valid in the p2-scs files when commissioning the spindle. S-0-0158 should be set to 1.5 times to the value of the nominal output.



The spindle service does not provide any values in the c-axis operation.



If the drive does not support the parameters S-0-0382 or S-0-0084 (e.g. Servodyn-D), a value of 0 is always displayed.

5.1.4 Program section display

Display content

The program section display shows the program section of a running NC program.

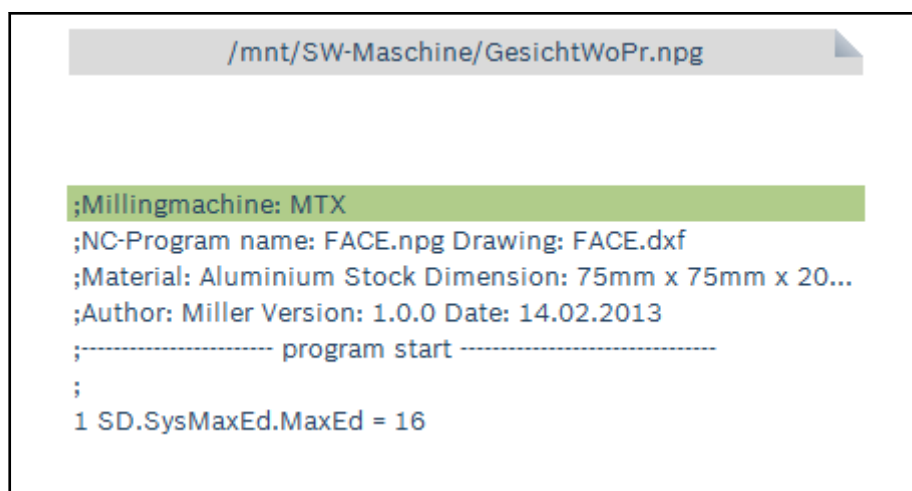


Fig. 5-5: Program section display

Program symbols The following table describes the program symbols displayed.

Icon	Description	Note
Line stored	Active NC program line	Indicates the NC command line currently processed by the NC

Tab. 5-3: Program symbols

Displaying macro contents If an NC macro was programmed in the NC block, currently hidden contents can be shown by pausing the NC program, focusing the display and pressing the <Display macro contents> button. The NC macros are displayed in color. If the program is continued or the <Hide macro contents> button is confirmed, the NC macro is hidden again.



To generally show the NC macro contents in the display, you have to have the authorization for "Display macro contents". Whether the content of certain NC macros really becomes visible, can be specified with read-only rights (technology protection). For additional information, please refer to the respective documentation.

5.1.5 Program nesting display

Display content

The program nesting display shows the subroutine nesting, including the retrieving of the line numbers and the active NC block.

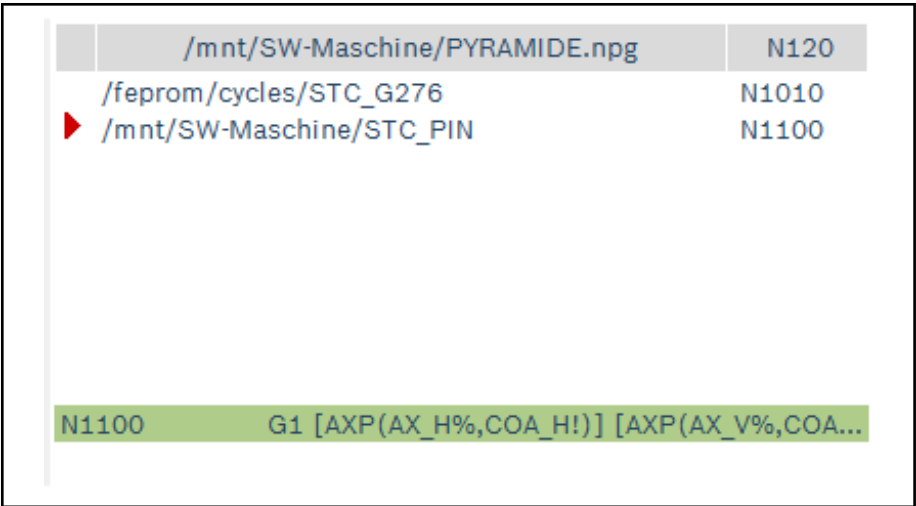


Fig. 5-6: Program nesting display

Program symbols

The following table describes the program symbols displayed.

Icon	Description	Note
	Active subroutine	Indicates the subroutine currently processed by the NC

Tab. 5-4: Program symbols

5.1.6 ZO display
Display content

The ZO display shows the zero offsets (ZO), including the ZO table name.



Fig. 5-7: ZO display

5.1.7 ZO table display
Display content

The ZO table display shows the axis zero point table values and their sum values.

ZOT bank		X	Y	Z	A	MAG
G53.1	PYRAMIDE.zot	0.000	0.000	0.000	0.000	0.000
G54.2	--	-300.000	-200.000	-381.000	0.000	0.000
G53.3	--	0.000	0.000	0.000	0.000	0.000
G53.4	--	0.000	0.000	0.000	0.000	0.000
G53.5	--	0.000	0.000	0.000	0.000	0.000
Total Σ	--	-300.000	-200.000	-381.000	0.000	0.000

Fig. 5-8: ZO table display

5.1.8 Placement display
Display content

The placement display shows active placements, including the placement table name.

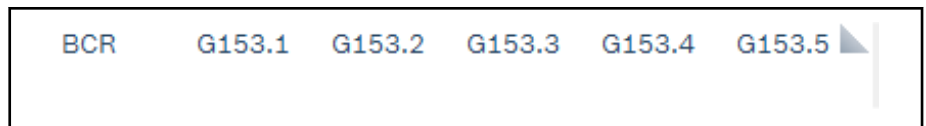


Fig. 5-9: Placement display

5.1.9 Placement table display

Display content

The placement table display shows the placement table, the BCR correction and its sum values, including the placement table name.

PMT bank		X	Y	Z	Phi [°]	Theta [°]	Psi [°]
BCR		0.000	0.000	0.000	0.000	0.000	0.000
G153.1	--	0.000	0.000	0.000	0.000	0.000	0.000
G153.2	--	0.000	0.000	0.000	0.000	0.000	0.000
G153.3	--	0.000	0.000	0.000	0.000	0.000	0.000
G153.4	--	0.000	0.000	0.000	0.000	0.000	0.000
G153.5	--	0.000	0.000	0.000	0.000	0.000	0.000
Total Σ	--	0.000	0.000	0.000	0.000	0.000	0.000

Fig. 5-10: Placement table display

5.1.10 Tool display

Display content

The Tool display is used to show tools, including the D-correction table path.

Tool-Active	Curr. edge	D-Number
34	ED0	D0
/database/DC1.dct		

Fig. 5-11: Tool display

Column selection

The columns and variants are selected using the variant editor of the options dialog. Variants with the following data can be defined:

- Tool active
- Tool name active tool
- Tool type active tool
- Preselected tool
- Tool name preselected tool
- Tool type preselected tool
- Active tool edge
- D-number index
- D-length correction L1
- D-length correction L2
- D-length correction L3
- D-radius correction R
- D-edge position
- Tool length correction L1
- Tool length correction L2
- Tool length correction L3

- Tool radius correction R
- Tool edge position
- Tool Euler angle phi
- Tool Euler angle theta
- Tool Euler angle psi



The display supports a maximum of ten variants.

If a date is not available, "—" is displayed.

5.1.11 Tool correction display

Display content

The tool correction display shows the D-correction, tool name, tool type, external tool values and cumulative correction values.

G47 G41		L1	L2	L3	R	Curr. edge/D-c...
Tool-Active	Schrupfräser ...	0.000	0.000	164.197	16.038	ED1
Tool-Presele.	--	--	--	--	--	--
D-Active	DC1.dct	0.000	0.000	0.000	0.000	D0
Total Σ	--	0.000	0.000	164.197	16.038	--

Fig. 5-12: Tool correction display (part 1)

G47 G41		Phi [°]	Theta [°]	Psi [°]	Orient.	Type
Tool-Active	Schrupfräser ...	0.000	0.000	0.000	0	Milling tool, ge...
Tool-Presele.	--	--	--	--	--	--
D-Active	DC1.dct	--	--	--	0	--
Total Σ	--	0.000	0.000	0.000	--	--

Fig. 5-13: Tool correction display (part 2)



The names of the active and preselected tools are extracted from the tool database. To display the active tool, it is imperative to set the active flag in the database from the PLC or the NC.

Column selection

The columns and variants are selected using the variant editor of the options dialog. Variants with the following column data can be defined.

- Length correction L1
- Length correction L2
- Length correction L3
- Radius correction R
- Euler angle phi
- Euler angle theta
- Euler angle psi
- Edge position
- Active tool edge
- Tool type



The display supports a maximum of ten variants.

If a date is not available, "—" is displayed.

5.1.12 Tool correction register display

Display content

The tool correction register display shows all the tool correction registers for all tool edges. The maximum edge number is 16.

	L1	L2	L3	R	Orient.
ED01	0.000	0.000	70.000	0.000	0
ED02	0.000	0.000	0.000	0.000	0

Fig. 5-14: Tool correction register display (maximum number of tool edges = 2)

Column selection

The columns and variants are selected using the variant editor of the options dialog. Variants with the following column data can be defined.

- Length correction L1
- Length correction L2
- Length correction L3
- Radius correction R
- Euler angle phi
- Euler angle theta
- Euler angle psi
- Edge position



The display supports a maximum of ten variants.
If a date is not available, "—" is displayed.

5.1.13 Precision correction display

Display content

The precision correction display is used to display the precision corrections and compensations effective in the ACS.

- Command position
- Actual position
- Temperature NC
- Spindle pitch
- Sag



The display supports a maximum of ten variants.
If a date is not available, "—" is displayed.

5.1.14 Online correction display

Display content

The online correction display is used to display the precision corrections and compensations acting in the WCS.

- Command position
- Handwheel

5.1.15 G-code display

Display content

The G-code display shows active G-codes.

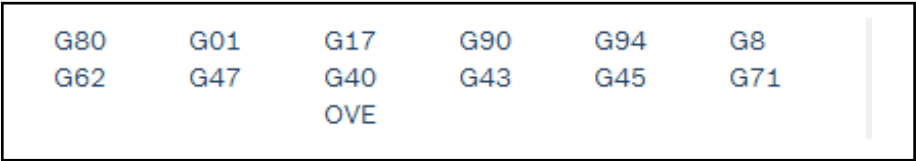


Fig. 5-15: G-code display

5.1.16 M-code display

Display content

The M-code display shows active auxiliary functions (M-codes).



Fig. 5-16: M-code display

5.1.17 Input assistance display

Display content

The input assistance display shows active input assistances.

Concerns:

- Rotation (ROT)
- Pole definition (PLS)
- Mirroring (MIR)
- Shift (SHT)
- Scaling factor (SCL)

ROT = 0.000	X	Y	Z	A	MAG	C1	Y2
PLS	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SHT	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MIR	0	0	0	0	0	0	0
SCL	1.000	1.000	1.000	1.000	1.000	1.000	0.000

Fig. 5-17: Input help display

5.1.18 Program coordinate display

Display content

The program coordinate display shows active program coordinates.

Concerns:

- Trans (TRS)
- ATrans (ATR)

	X	Y	Z	A	MAG	C1	Y2
TRS	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ATR	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total Σ	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Fig. 5-18: Program coordinate display

5.1.19 System message display

Display content

The System message display shows system messages.



Fig. 5-19: System message display

5.2 Operating functions

5.2.1 Program selection

The program is selected using the MTX Navigator.

Find The "Search" function can be used to search for files in the file system of the NC kernel and in all mounted directories of the Windows file system or on a Compact Flash (CF) card of a controller-based control.

Cancel selection This function closes the program selection without an NC program being selected.

Confirm selection This function executes a program selection with the selected NC program. The selected NC program is visualized in the NC block display (operating screen machine).



All selected NC programs are marked with an individual symbol in the list of the MTX Navigator.

- Selected NC programs in the current channel contain a

"green" symbol.



- Selected NC programs in non-selected channels contain a

"gray" symbol.



5.2.2 Editor of active program

If the NC screen or the MTX Navigator open the active program, the program is automatically reselected after the "Save query" (answer "Yes") and the "Reselection query" (answer "Yes"). It is verified that the requirements for reselection are fulfilled. If the reselection query is not answered with "Yes", the program is not saved and is thus not selected.

If the program contains GNP cycle calls, the compiler to compile these cycles is called before.

If a reselection is impossible (channel active), the channel can be reset and thus saving and reselection can be repeated.

5.2.3 Overview on active corrections

Use

All correction values used in the NC are displayed in different screens.

The application comprises four screens with the following displays:

- Correction overview 1
 - Zero offsets
 - Tool corrections
- Correction overview 2
 - Input tools
 - Program coordinates
 - Placements
- Tool correction register
- Precision corrections

Integration of the application
"Overview on active corrections" in
the operating desktop

The display is assigned to the operating area <OP3> "Machine". Pressing <F4> "Overview on active corrections" starts the application.

The display is an application with an individual F-key assignment.

Menu and title are hidden.

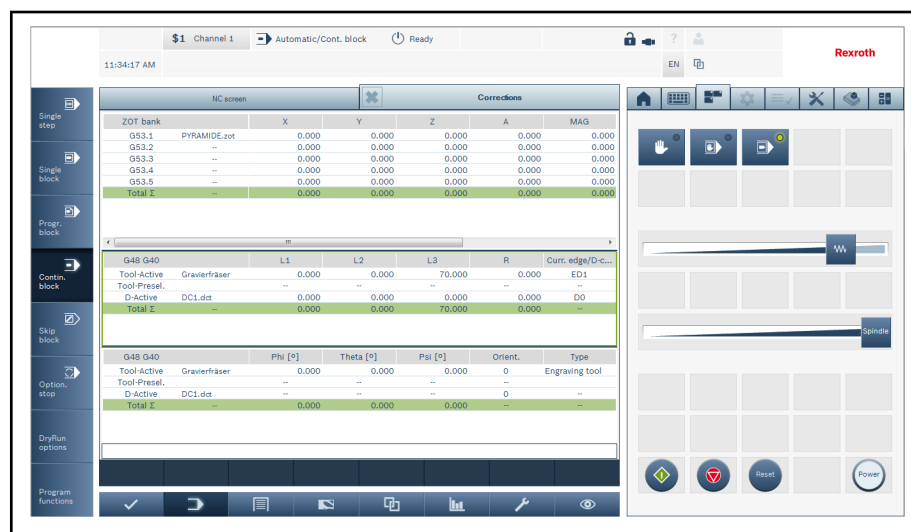


Fig. 5-20: Overview on active corrections

Principle structure of the application: Overview on active corrections

Screens The application comprises the following four screens:

- Correction overview 1
- Correction overview 2
- Tool correction register
- Precision corrections

Correction overview 1 This screen comprises the following displays:

- Active zero offsets
- Active tool corrections

NC screen		Corrections				
ZOT bank		X	Y	Z	A	MAG
G53.1	PYRAMIDE.zot	0.000	0.000	0.000	0.000	0.000
G54.2	--	-300.000	-200.000	-381.000	0.000	0.000
G53.3	--	0.000	0.000	0.000	0.000	0.000
G53.4	--	0.000	0.000	0.000	0.000	0.000
G53.5	--	0.000	0.000	0.000	0.000	0.000
Total Σ	--	-300.000	-200.000	-381.000	0.000	0.000

G47 G40		L1	L2	L3	R	Curr. edge/D-c...
Tool-Active	Schruppfräser ...	0.000	0.000	164.197	16.038	ED1
Tool-Presel.	--	--	--	--	--	--
D-Active	DC1.dct	0.000	0.000	0.000	0.000	D0
Total Σ	--	0.000	0.000	164.197	16.038	--

G47 G40		Phi [°]	Theta [°]	Psi [°]	Orient.	Type
Tool-Active	Schruppfräser ...	0.000	0.000	0.000	0	Milling tool, ge...
Tool-Presel.	--	--	--	--	--	--
D-Active	DC1.dct	--	--	--	0	--
Total Σ	--	0.000	0.000	0.000	--	--

Fig. 5-21: Correction overview 1

Correction overview 2

This screen comprises the following displays:

- Active input tools
 - Rotation angle (ROT)
 - Pole definition (PLS)
 - Shift (SHT)
 - Mirroring active (MIR)
 - Scaling factor (SCL)
- Active program coordinates
 - TRANS
 - ATRANS
- Active placements

Machine operation

NC screen						Corrections		
ROT = 0.000	X	Y	Z	A	MAG	C1	Y2	
PLS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SHT	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MIR	0	0	0	0	0	0	0	0
SCL	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.000
	X	Y	Z	A	MAG	C1	Y2	
TRS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ATR	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total Σ	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
PMT bank	X	Y	Z	Phi [°]	Theta [°]	Psi [°]		
BCR		0.000	0.000	0.000	0.000	0.000	0.000	0.000
G153.1	--	0.000	0.000	0.000	0.000	0.000	0.000	0.000
G153.2	--	0.000	0.000	0.000	0.000	0.000	0.000	0.000
G153.3	--	0.000	0.000	0.000	0.000	0.000	0.000	0.000
G153.4	--	0.000	0.000	0.000	0.000	0.000	0.000	0.000
G153.5	--	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total Σ	--	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Fig. 5-22: Correction overview 2

Tool correction register

This screen comprises the following display:

- Content of the complete tool correction register across all edges

NC screen						Corrections	
	L1	L2	L3	R	Orient.		
ED01	0.000	0.000	87.662	3.000	0		
ED02	0.000	0.000	0.000	0.000	0		
ED03	0.000	0.000	0.000	0.000	0		
ED04	0.000	0.000	0.000	0.000	0		
ED05	0.000	0.000	0.000	0.000	0		
ED06	0.000	0.000	0.000	0.000	0		
ED07	0.000	0.000	0.000	0.000	0		
ED08	0.000	0.000	0.000	0.000	0		
ED09	0.000	0.000	0.000	0.000	0		
ED10	0.000	0.000	0.000	0.000	0		
ED11	0.000	0.000	0.000	0.000	0		
ED12	0.000	0.000	0.000	0.000	0		
ED13	0.000	0.000	0.000	0.000	0		
ED14	0.000	0.000	0.000	0.000	0		
ED15	0.000	0.000	0.000	0.000	0		
ED16	0.000	0.000	0.000	0.000	0		

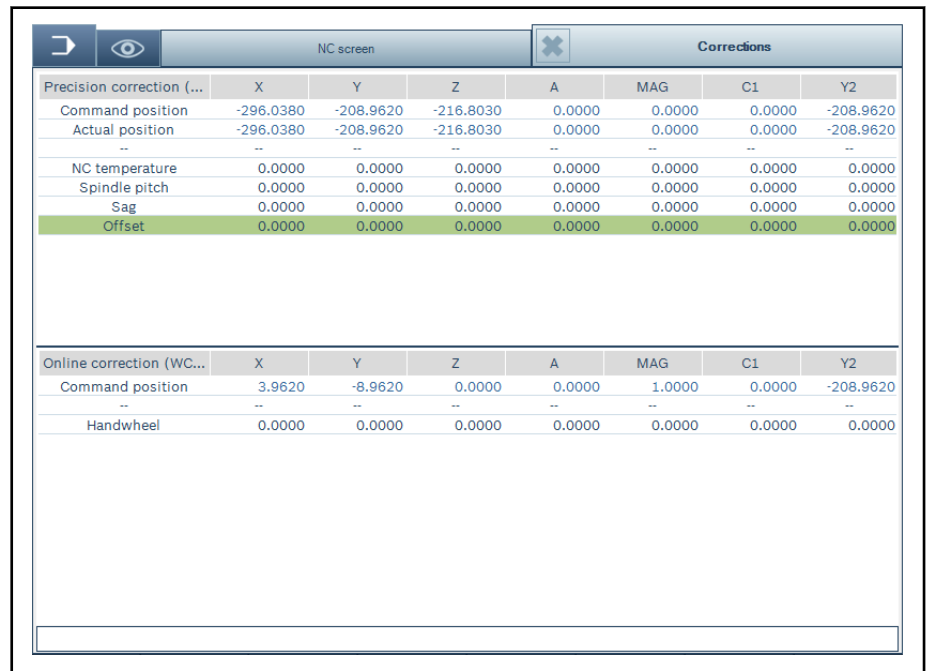
Fig. 5-23: Tool correction register

Precision corrections

This screen comprises the following displays:

- Active precision corrections effective in the ACS coordinate system
 - Temperature compensation NC
 - Lead screw compensation
 - Sag (cross compensation)
- Active online correction in the coordinate WCS

– Handwheel



Precision correction (WC...)	X	Y	Z	A	MAG	C1	Y2
Command position	-296.0380	-208.9620	-216.8030	0.0000	0.0000	0.0000	-208.9620
Actual position	-296.0380	-208.9620	-216.8030	0.0000	0.0000	0.0000	-208.9620
--	--	--	--	--	--	--	--
NC temperature	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Spindle pitch	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Sag	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Offset	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Online correction (WC...)	X	Y	Z	A	MAG	C1	Y2
Command position	3.9620	-8.9620	0.0000	0.0000	1.0000	0.0000	-208.9620
--	--	--	--	--	--	--	--
Handwheel	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Fig. 5-24: Precision corrections

Operation and navigation

The operation is executed via F-keys.

Switching between the screens

It is switched between the four screens using <F2>, <F3>, <F4> and <F5>.

F-keypad level	<F2>	<F3>	<F4>	<F5>	<F6>	<F7>	<F8>	<F9>
Main plane	Correction overview 1	Correction overview 2	Tool correction register	Precision corrections	Zero offset	Active D-corrections	More functions	Exit corrections
2. Level	Reset channel	System control reset					Back	

Tab. 5-5: Function keys in the MDI editor

F-keys main level

Apart from the shift keys for the four screens, there are further important functions in the basic level related to the corrections.

- <F2> Opening the screen "Correction overview 1"
- <F3> Opening the screen "Correction overview 2"
- <F4> Calling the screen "Tool correction register"
- <F5> Calling the screen "Precision corrections"
- <F6> Opening the editor for "active zero point offsets"
- <F7> Opening the editor for "active D-corrections"
- <F8> Additional functions (second level)
- <F9> Application "Complete"

F-keys: Additional functions

- <F2> "Reset channel" function
- <F3> "Reset system" function
- <F8> Return to main level

5.2.4 Two-channel display

Use

Integration of the Two-Channel Display in IndraWorks Operation

A display that is vertically divided shows process data and status information for two selected channels.

The operator can thus monitor two channels simultaneously.

One channel is selected as the active channel, reacting to the use of F-and M-keys.

The display is assigned to the operating area <OP3> "Machine". Press <F8> and <F9> to start the application.

Menu and title are hidden.

The display is an application which runs in parallel to the NC screen for a channel.

It is possible to switch quickly between single-channel and two-channel display by pressing <OP3> "Machine".

The functions of the F-keys depend on the NC operation mode and can be configured in IndraWorks Engineering.

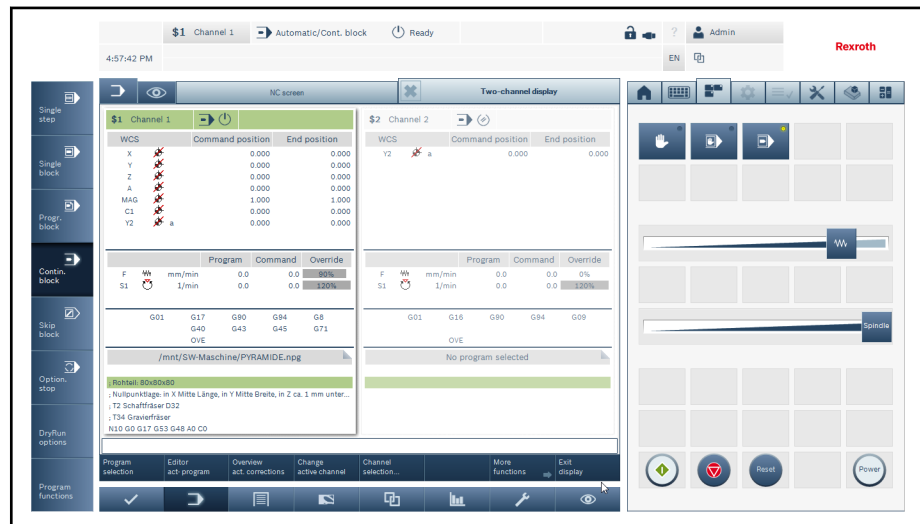


Fig. 5-25: Arrangement of the display

Principal display structure

Structure of the two-channel display

The display consists of two partial NC screens displaying process data in their partial windows. Each of these NC partial screens is assigned with a machine status area displaying the status information of the channel.

The structure of the NC partial screens and the content of the partial windows depends on the NC operation mode.

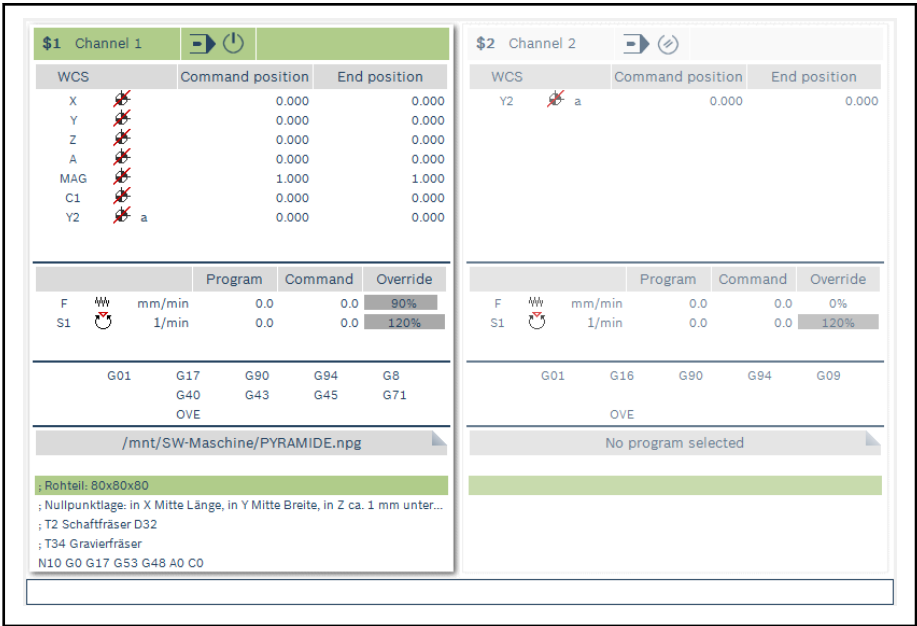


Fig. 5-26: Structure of the display

Active and passive channel

The active channel is highlighted by 3D shadows and a machine status area with strong gray tones.

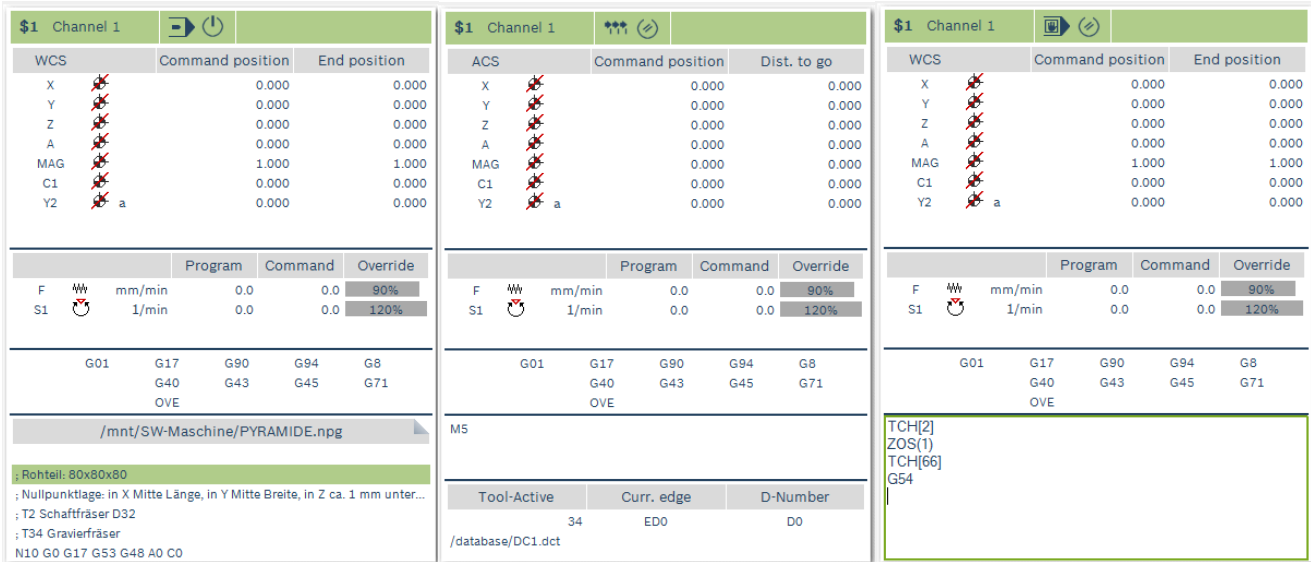
The passive channel is slightly dimmed and the machine status area is displayed in lighter shades of gray.

Operation modes

For each of the three operation modes "Automatic", "Manual" and "MDI" a partial screen is shown, optimized specially for two-channel display.

Analog to the NC screen for one channel, the content can be configured in IndraWorks Engineering.

Partial screens



Automatic

Manual

MDI

Tab. 5-6: Overview partial screens

Operation and navigation

- Operation takes place as for the NC screen for one channel.
- Active and passive channel** The F-keys and M-keys can be used in the active channel.
Press <F5> to exchange the active and the passive channel. All keys work for the new active channel.
- Operating-mode-dependent F-keys** Depending on the three operation modes "Automatic", "Manual" and "MDI", different F-keys are displayed.
The F-keys can be configured in IndraWorks Engineering.
- Partial-window-dependent F-keys** If the focus is placed on a partial window of the active channel, for instance the MDI Editor window, the F-keys pertaining to this partial window are displayed.
- Channel selection** Press <F6 Channel selection...> to open a dialog for the selection of the channel for the left and right sides.
Any change of the active channels always has an effect on the whole interface.
The active channel can also be selected via <OP6> "System".

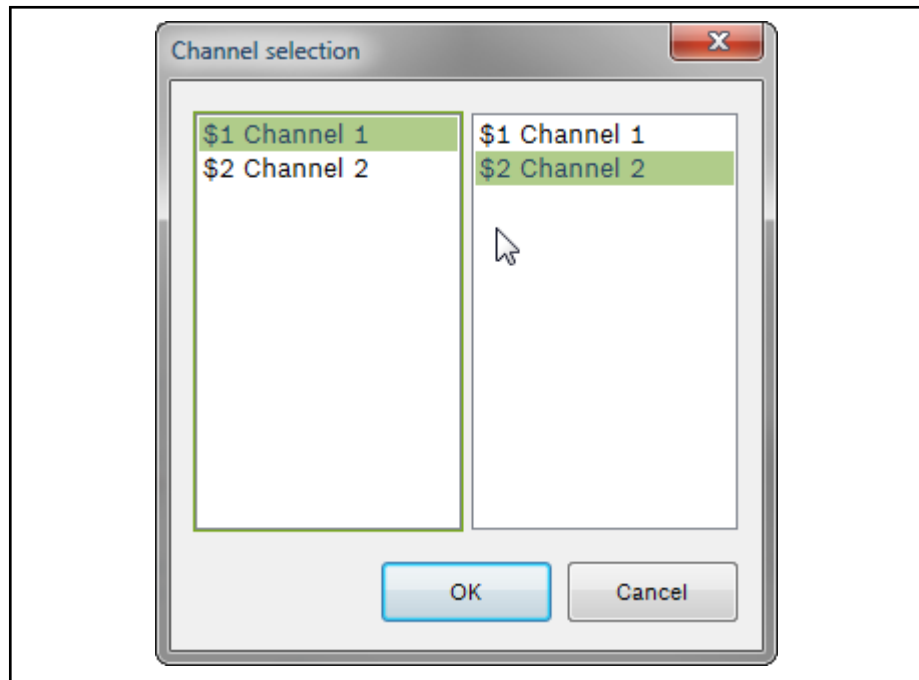


Fig. 5-27: Channel selection

- Options** Pressing <F8> "Additional functions" and <F5> "Options" opens a dialog to configure the dimming of the passive channel.
It is possible to switch off the dimming.
When the dimming is activated, it is possible to differentiate between dark and light and to set the degree of dimming.

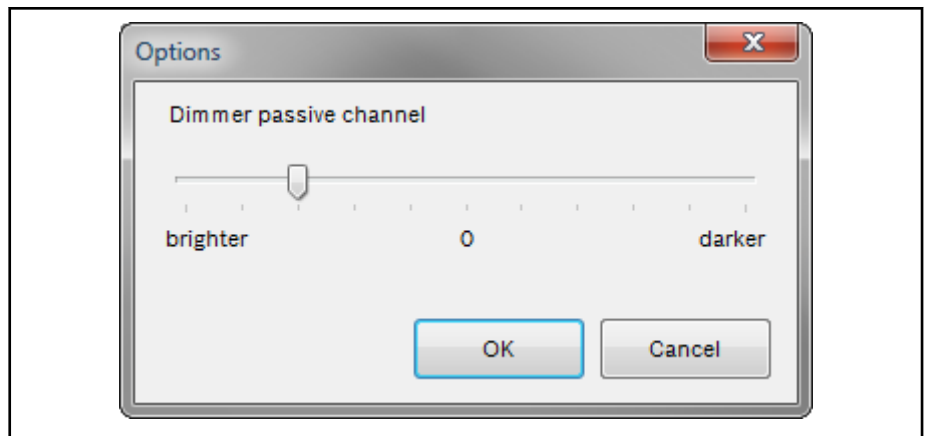
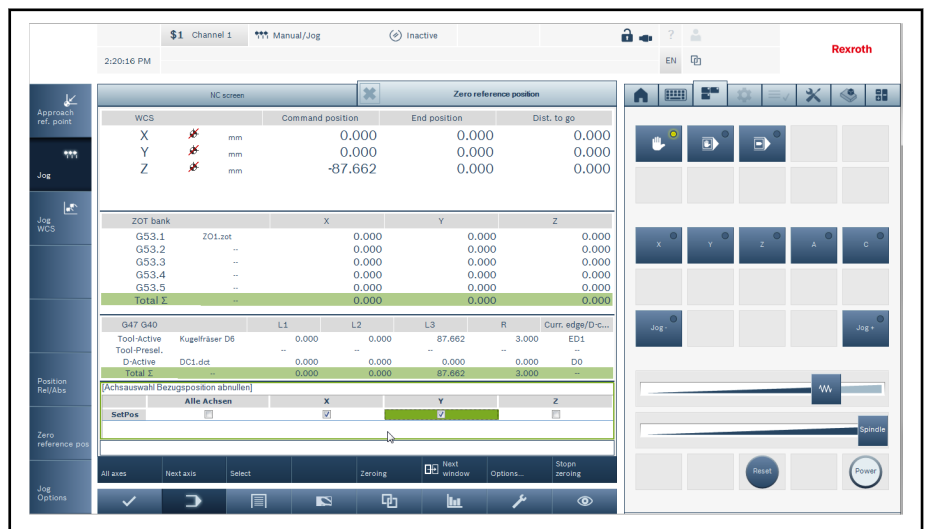


Fig. 5-28: Options

5.2.5 Setting the reference position to zero

"Zero reference position" screen



Control "Zero axis selection reference position"

The decisive display control of the "Zero Reference Position" screen is the control "Zero axis selection reference position". It is used to display and select the axes to be zeroed and for the command call for zeroing. It is focused by default.

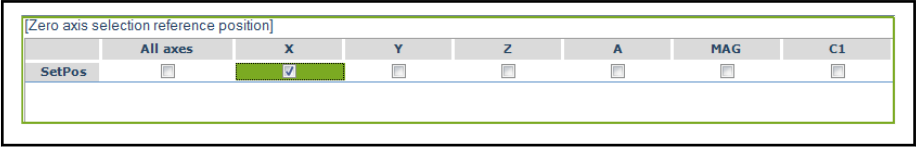


Fig. 5-30: Control "Zero axis selection reference position"

F-keypad

F-key level	<F2>	<F3>	<F4>	<F5>	<F6>	<F7>	<F8>	<F9>
First level	All Axes	Next axis	Select		Zeroing	Next win- dow	Options...	Exit zeroing

Tab. 5-7: F-keypad of the "Zero Reference Position" screen

- <F2> Selects/deselects all axes
- <F3> Focuses the selection of the next axis
- <F4> Selects/deselects the focused axis
- <F6> Calls the command for zeroing
- <F7> Focuses the next display control
- <F8> Opens the "Options" dialog of the control
- <F9> Closes the active screen

"Options" dialog "Properties - Zero axis selection reference position"

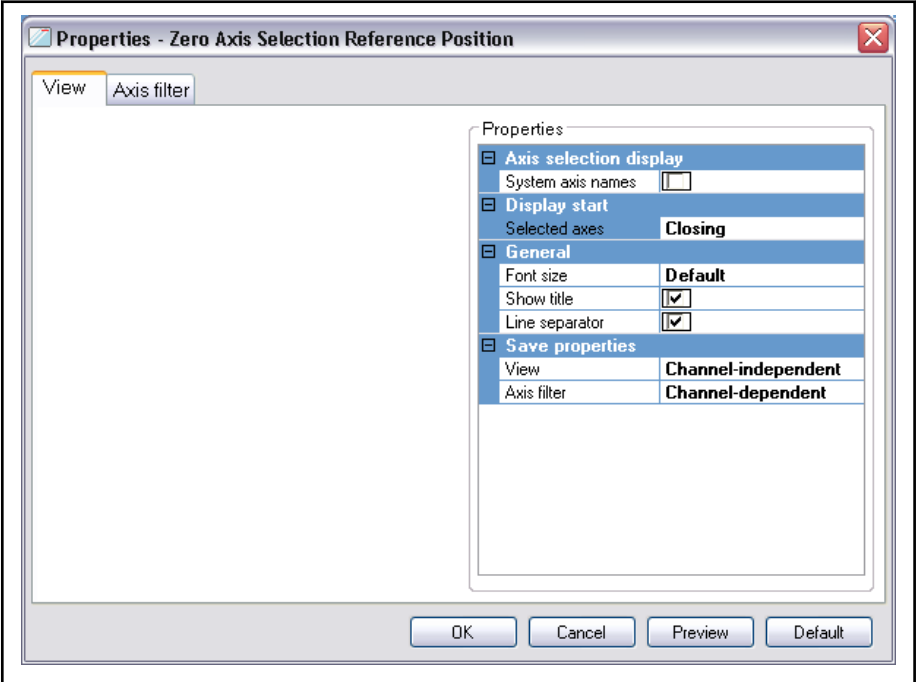


Fig. 5-31: "Options" dialog of the control "Zero Axis Selection Reference Position"

The "Options" dialog of the control "Zero Axis Selection Reference Position" contains the two tabs "View" and "Axis Filter".

Additionally, it includes the following buttons:

OK Exits the dialog and the set properties are applied.

Cancel Exits the dialog and the changed properties are discarded. If the "Preview" function was called by the user, the temporarily changed display representation is reset again.

Preview Directly changes the set view and axis filter properties temporarily in the display.

Default Sets the properties to its values in the displayed tab.

"View" tab The "View" tab includes the configurable properties influencing the display representation.

Properties (default values are displayed in bold)

	Name	Values	Description
Axis selection - Display	System axis names	{Yes, No }	Specifies whether the system axis names are to be displayed in brackets behind the channel axis names. The parameter is only effective if the channel axis name differs from the system axis name.
General information	Font size	{ Default , 8,... ..16}	Specifies the font size of the display. The "Default" value stands for the perfect font size.
	Display title	{ Yes , No}	Specifies whether the title of the display is to be displayed.
	Line separator	{ Yes , No}	Specifies whether a line separator is to be displayed.
Display start	Selected axes	{ as completed , none, all}	Specifies the axes automatically selected when starting the display.
Properties Storage	View	{channel-dependent, channel-independent }	Specifies how the properties should be saved for the view.
	Axis filter	{ channel-dependent , channel-independent}	Specifies how the properties should be saved for the axis filter.

Tab. 5-8: Configurable display properties of the control "Zero Axis Selection Reference Position"



To change the properties, the user has to have the user right "Machine - NC screen/Configuration".

"Axis filter" tab

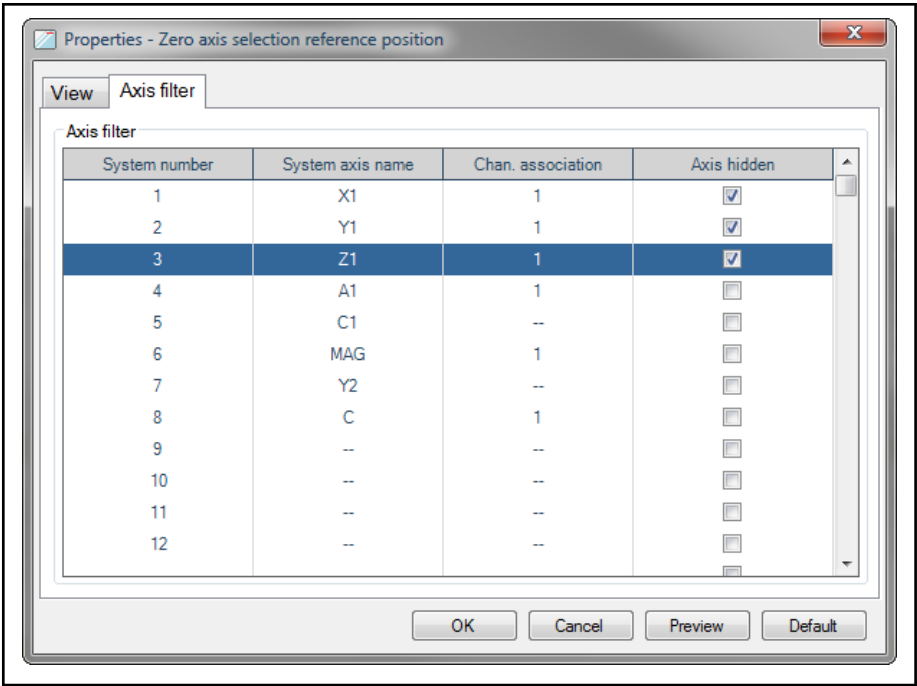


Fig. 5-32: The "Axis filter" tab in the "Options" dialog of the control "Zero Axis Selection Reference Position"

In the "Axis filter" tab, the three important characteristics "System number", "System axis name" and "Chan. association" are displayed for all axes that can be parameterized. In the "Axis hidden", column, the user can hide or show the channel-respective axes in the axis selection display by selection/deselection.

 When showing an axis in the display, the axis is automatically selected.

 To change the properties, the user has to have the user right "Machine - NC screen/Zero reference position - Axis filter".

5.2.6 More functions

- Reset channel**
- A "Channel reset" is triggered via interface signal by using <F2>"Channel reset".
- System reset**
- A "System reset" is triggered via interface signal by using <F3>"System reset".
- NC Analyzer**
- The NC-Analyzer is called to support the NC program setup when pressing the function key <F4>"NC-Analyzer".

For a more detailed description of the function, see [chapter 11.1 "The NC-Analyzer" on page 279](#)

5.3 NC Cockpit

The NC Cockpit is another application that can be displayed in the operating area of the MTX user interface.

Therefore, it is required to call the function in the Home Control tab via the tile <NC Cockpit>.

Display elements in the NC Cockpit:

- Online NC simulation

- Override display:
 - Axis override
 - Spindle override (if spindles available)
- Active NC program
- Tool active

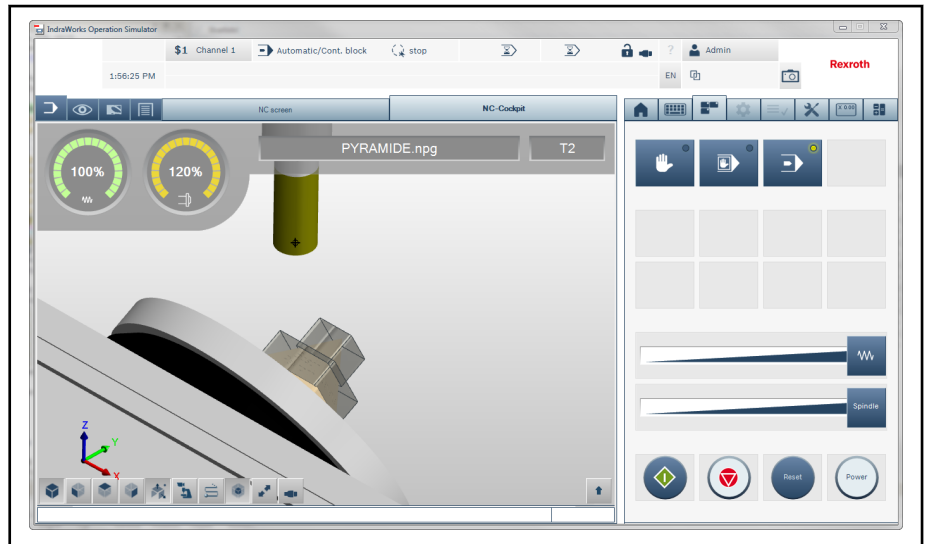


Fig. 5-33: NC Cockpit with VAM in the additional operating area

If the NC simulation has already been shown in the additional operating area before enabling the NC Cockpit, the content of the additional operating area was automatically changed to the “Position and block progress display”.

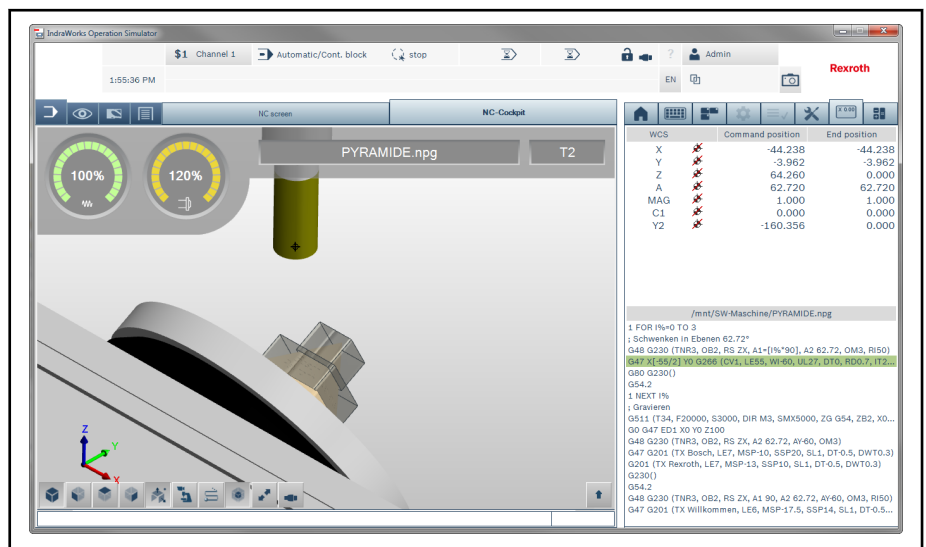


Fig. 5-34: NC Cockpit with position and block progress display in the additional operating area

5.4 NC simulation

For more information on the NC simulation, refer to the documentation "IndraMotion MTX 14VRS NC Simulation" (DOK-MTX***-NC*SIM**V14-APRS-EN-P, R911379629).

6 Preparation

6.1 Functions in manual mode

6.1.1 Probing the zero point

Overview on probing the zero point



The function "Probe zero point" is in the standard or after converting old projects. It is in the operating area "Prepare" and can be called via <F2>.

The "Probe zero point" function allows the user to determine the zero point values (G54 to G59) for the respective axes by experimental "probing" of a tool at a workpiece and to apply the result to the CNC. This results in a direct relation between the zero point determination, the workpiece dimensions and the tool correction values of the active tool.

Tool correction types

The zero point can be determined using the five different tool correction types (drilling tools, milling tools, turning tools, angle head tools and general tools) with the help of a touch probe.

Correction types

KT	Description	Tool type
0	Measuring probe	5000 ... 5999
1	Drilling tools	1000 ... 1999
2	Milling tools	2000 ... 2999
3	Turning tools	3000 ... 3999
4	Angle-head tools	CH = True
5	General tool	0

Tab. 6-1: Tool correction types

Axes and planes

The zero points for the channel axes (ChAx[1...6]) defined in the machine parameters can be determined.

Axis definitions

Macoda number	Name	Example
701000010	Axis name	X, Y, Z, U, V, W, A, B, C
701000030	Axis description	Main axis X, Y, Z, A, B, C

Tab. 6-2: Machine parameters

The planes G17, G18 and G19 are supported for "G47(ActPlane)". In case of a changed length correction values assignment by machine parameters "G47()", they are considered by the program. In case of a changed assignment of the length correction values by the NC program, (e.g. "G47 (-Z)"), the respective settings have to be adjusted accordingly in the "Probe zero point" function to calculate the desired values.



If no tool is active, the length correction values are not considered for calculation.

The radius correction values of an active tool are always considered for calculation in the active level.

Variants when probing the zero point

The values that should be considered for calculation can be preselected via the operating screen.

Settings:

- With or without tool correction values
- With or without D-correction values
- With or without active zero point offsets of the other zero offset banks
- Edge position 0 (only for turning tools, angle head tools and general tools)
- Two-point sampling

**The following applies when calculating the zero point value:**

{...}^{*} ± result of parenthesized expression has an impact on the following operation sign:

- If {...} ≤ 0 follows +
 - If {...} > 0 follows -
-

Calculating the zero point offset value (with drilling tool)

Setting								Axis group		Calculation	
KT	Tool corr.	D- corr.	Two- point	G17 && X G18 && Z G19 && Y	G17 && Y G18 && X G19 && Z	G17 && Z G18 && Y G19 && X	ORI 0	= XYZ	ABC	Calculation rule	Rel. tool/ D-corr.
1				-	-	-	-	x	x	ZPO = IW - ABS	-
	x					x	-	x		ZPO = IW - ABS - L3	L3
	x				x		-	x		Not possible	-
	x			x			-	x			
	x			-	-	-	-		x		
		x				x	-	x		ZPO = IW - ABS - DL3	L3
		x			x		-	x		Not possible	-
		x		x			-	x			
		x		-	-	-	-		x		
	x	x				x	-	x		ZPO = IW - ABS - DL3 - L3	L3
	x	x			x		-	x		Not possible	-
	x	x		x			-	x			
	x	x		-	-	-	-		x		
			x	-	-	-	-	x	x		

IW

Applied actual value

IW1

Applied actual value in point 1

IW2

Applied actual value in point 2

ZO

Current or modified zero offset

ABS

Entered distance value

Ln

Length geometry value (n=1,2,3)

R

Radius geometry value

DLn

D-correction value Ln (n=1,2,3)

DR

D-correction value R

(x)

Edge position 0 required

KT

Correction type of the used tool

||

logic OR

&&

logic AND

Tab. 6-3:

Variant zero point measurement with drilling tool

Preparation

Calculating the zero point offset value (with milling tool)

Setting								Axis group		Calculation		
KT	Tool corr.	D- corr.	Two- point	G17 && X G18 && Z G19 && Y	G17 && Y G18 && X G19 && Z	G17 && Z G18 && Y G19 && X	ORI 0	XYZ	ABC	Calculation rule	Rel. tool/ D-corr.	
2				-	-	-	-	x	x	ZPO = IW - ABS	-	
	x					x	-	x		ZPO = IW - ABS - L3	L3	
	x				x		-	x		ZPO = IW - ABS - R	R	
	x			x			-	x				
	x			-	-	-	-		x	Not possible	-	
		x				x	-	x		ZPO = IW - ABS - DL3	L3	
		x			x		-	x		ZPO = IW - ABS - DR	R	
		x		x			-	x				
		x		-	-	-	-		x	Not possible	-	
	x	x				x	-	x		ZPO = IW - ABS - DL3 - L3	L3	
	x	x			x		-	x		ZPO = IW - ABS - DR- R	R	
	x	x		x			-	x				
	x	x		-	-	-	-		x	Not possible	-	
			x	x			-	x		ZPO = (IWP1 + IWP2) / 2R		
			x		x		-	x				
			x			x	-	x		Not possible		
		x	x	-	-	-	-		x	ZPO = (IWP1 + IWP2) / 2R		

IW Applied actual value
IW1 Applied actual value in point 1
IW2 Applied actual value in point 2
ZO Current or modified zero offset
ABS Entered distance value
Ln Length geometry value (n=1,2,3)
R Radius geometry value
DLn D-correction value Ln (n=1,2,3)
DR D-correction value R
(x) Edge position 0 required
KT Correction type of the used tool
|| logic OR
&& logic AND

Tab. 6-4: Variant zero point measurement with milling tool

Calculating the zero point offset value (with lathe tool)

Setting								Axis group		Calculation		
KT	Tool corr.	D-corr.	Two-point	G17 && X G18 && Z G19 && Y	G17 && Y G18 && X G19 && Z	G17 && Z G18 && Y G19 && X	ORI = 0	XYZ	ABC	Calculation rule	Rel. tool/ D-corr.	
3				x			-	x		ZPO = IW - ABS	-	
					x		-	x				
						x	-	x		Not possible		
				-	-	-	-		x			
	x			x				x		ZPO = IW - ABS - L1	L1	
	x			x			x	x		ZPO = { IW - ABS - L1 } [*] ± R	L1 R	
	x				x			x		ZPO = IW - ABS - L2	L2	
	x				x		x	x		ZPO = { IW - ABS - L2 } [*] ± R	L2 R	
	x					x		x		Not possible	-	
	x			-	-	-	-		x			
		x		x					x		ZPO = IW - ABS - DL1	L1
		x		x				x	x		ZPO = { IW - ABS - DL1 } [*] ± DR	L1 R
		x			x				x		ZPO = IW - ABS - DL2	L2
		x			x			x	x		ZPO = { IW - ABS - DL2 } [*] ± DR	L2 R
		x					x		x		Not possible	-
		x		-	-	-	-		x			
	x	x		x					x		ZPO = IW - ABS - DL1 - L1	L1
	x	x		x				x	x		ZPO = { IW - ABS - DL1 - L1 } [*] ± (DR + R)	L1 R
	x	x				x			x		ZPO = IW - ABS - DL2	L2
	x	x				x		x	x		ZPO = { IW - ABS - DL2 - L2 } [*] ± (DR + R)	L2 R
	x	x					x		x		Not possible	-
	x	x			-	-	-	-		x		
			x		-	-	-	-				

IW
 IW1
 IW2
 ZO
 ABS

Applied actual value
 Applied actual value in point 1
 Applied actual value in point 2
 Current or modified zero offset
 Entered distance value

Preparation

Ln	Length geometry value (n=1,2,3)
R	Radius geometry value
DLn	D-correction value Ln (n=1,2,3)
DR	D-correction value R
(x)	Edge position 0 required
KT	Correction type of the used tool
	Logic OR
&&	Logic AND

Tab. 6-5: Variant zero point measurement with lathe tool

Calculating the zero point offset value (without lathe tool)

Setting								Axis group		Calculation	
KT	Tool corr.	D-corr.	Two-point	G17 && X G18 && Z G19 && Y	G17 && Y G18 && X G19 && Z	G17 && Z G18 && Y G19 && X	ORI = 0	XYZ	ABC	Calculation rule	Rel. tool/ D-corr.
0				-	-	-	-	x	x	ZPO = IW - ABS	-
	x			-	-	-	-	x	x	Not possible	
		x		x			-	x		ZPO = IW - ABS - DL1	L1
		x			x		-	x		ZPO = IW - ABS - DL2	L2
		x				x	-	x		ZPO = IW - ABS - DL3	L3
		x		-	-	-	-		x	Not possible	-
	x	x		-	-	-	-	x	x		
			x	-	-	-	-	x	x	ZPO = (IWP1 + IWP2) / 2	

IW	Applied actual value
IW1	Applied actual value in point 1
IW2	Applied actual value in point 2
ZO	Current or modified zero offset
ABS	Entered distance value
Ln	Length geometry value (n=1,2,3)
R	Radius geometry value
DLn	D-correction value Ln (n=1,2,3)
DR	D-correction value R
(x)	Edge position 0 required
KT	Correction type of the used tool
	Logic OR
&&	Logic AND

Tab. 6-6: Variants zero point probing without tool

Calculating the zero point offset value (with angle-head tool)

Setting								Axis group		Calculation	
KT	Tool corr.	D- corr.	Two- point	G17 && X G18 && Z G19 && Y	G17 && Y G18 && X G19 && Z	G17 && Z G18 && Y G19 && X	ORI 0	XYZ	ABC	Calculation rule	Rel. tool/ D-corr.
4 and 5				x			-	x		ZPO = IW - ABS	-
					x		-	x			
						x	-	x		Not possible	
				-	-	-	-		x		
	x			x			(x)	x		ZPO = { IW - ABS - L1 } [*] ± R	L1 R
	x				x		(x)	x		ZPO = { IW - ABS - L2 } [*] ± R	L2 R
	x					x	(x)	x		ZPO = IW - ABS - L3	L3
	x			-	-	-	-		x	Not possible	-
		x		x			(x)	x		ZPO = { IW - ABS - DL1 } [*] ± DR	L1 R
		x			x		(x)	x		ZPO = { IW - ABS - DL2 } [*] ± DR	L2 R
		x				x	(x)	x		ZPO = IW - ABS - DL3	L3
		x		-	-	-	-		x	Not possible	-
	x	x		x			(x)	x		ZPO = { IW - ABS - DL1 - L1 } [*] ± (DR + R)	L1 R
	x	x			x		(x)	x		ZPO = { IW - ABS - DL2 - L2 } [*] ± (DR + R)	L2 R
	x	x				x	(x)	x		ZPO = IW - ABS - DL3 - L3	L3
	x	x		-	-	-	-		x	Not possible	-
			x	x			(x)	x		ZPO = (IWP1 + IWP2) / 2 - L1	L1
			x		x		(x)	x		ZPO = (IWP1 + IWP2) / 2 - L2	L2
			x			x	-	x		Not possible	-
			x	-	-	-	-		x	ZPO = (IWP1 + IWP2) / 2	

IW
 IW1
 IW2
 ZO
 ABS
 Ln
 R
 DLn

Applied actual value
 Applied actual value in point 1
 Applied actual value in point 2
 Current or modified zero offset
 Entered distance value
 Length geometry value (n=1,2,3)
 Radius geometry value
 D-correction value Ln (n=1,2,3)

- DR

(x)

KT

||

&&
- D-correction value R

Edge position 0 required

Correction type of the used tool

Logic OR

Logic AND

Tab. 6-7: Variant zero point measurement with angle-head tool

Screen layout

General screen structure

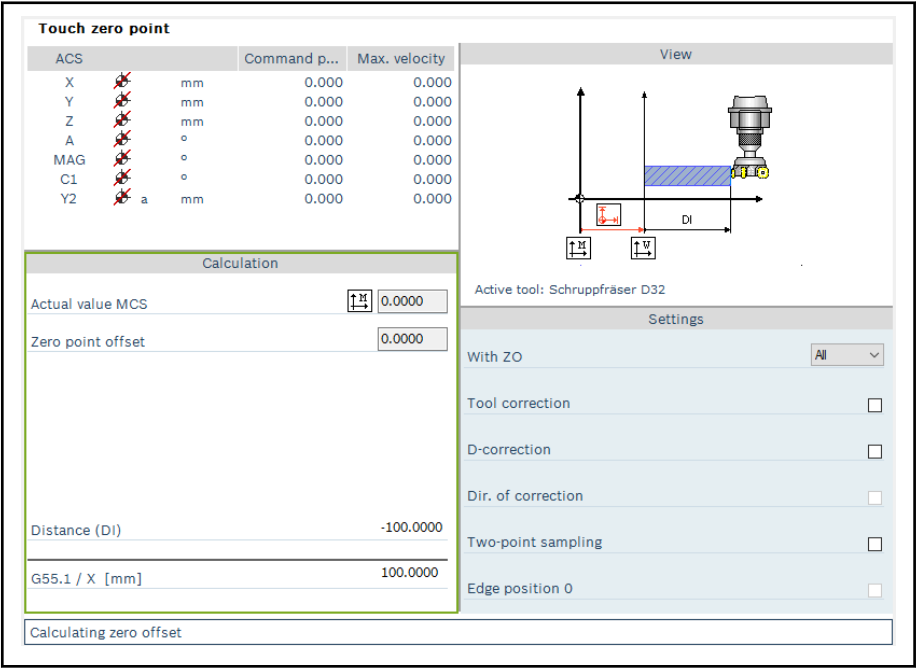


Fig. 6-1: General screen structure

The screen is divided into four windows "Searched zero point offset", "View, Calculation" and "Settings". All elements that can be set on the screen have to be operated via TAB and CURSOR keys, F-keys or touch gestures.

A focused window is highlighted in color. At the same time, the respective F-key level is enabled. The "View" window cannot be focused and is not provided with an assigned F-key level.

If the "Calculation" window is focused, the "Searched zero point offset" window is replaced by the "Position display" window. This allows monitoring of the current position values without switching to the NC screen.

To select the individual zero offset banks another window is displayed.

To determine a direction of correction deviating from the machine data, another window is displayed.

"Searched zero point offset" window

Searched zero point offset	
Zero point offset	G55 ▾
Zero point bank	1 ▾
Axis	X ▾
Plane	G17 ▾
Tool type	Milling tool ▾

Fig. 6-2: Searched zero point offset

The following setting can be made in this window:

- Zero offset (G54-G59),
- Zero offset bank (bank 1-5)
- Axis of the zero offset

The selection of the zero offset banks and the axes, is influenced by determinations in the machine parameters. Furthermore, it can be set whether sampling should be executed from two sides.

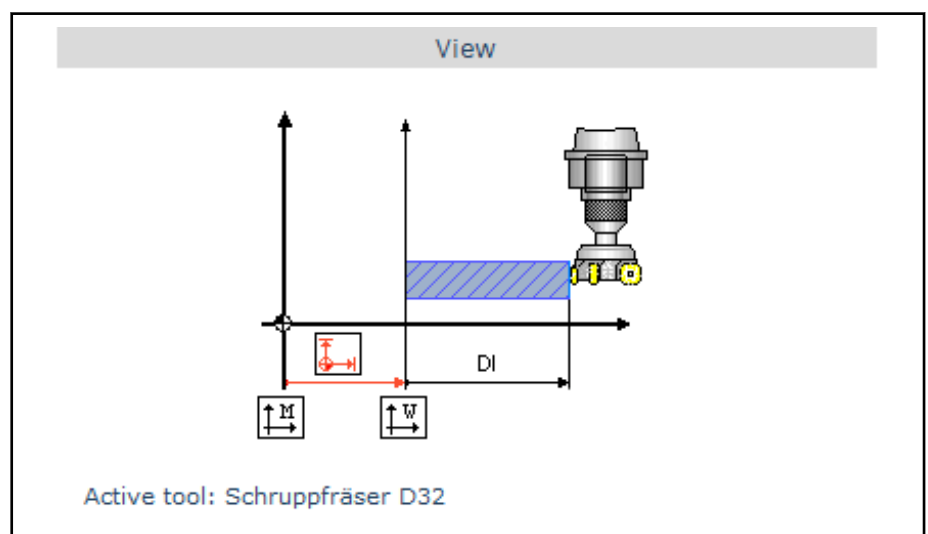
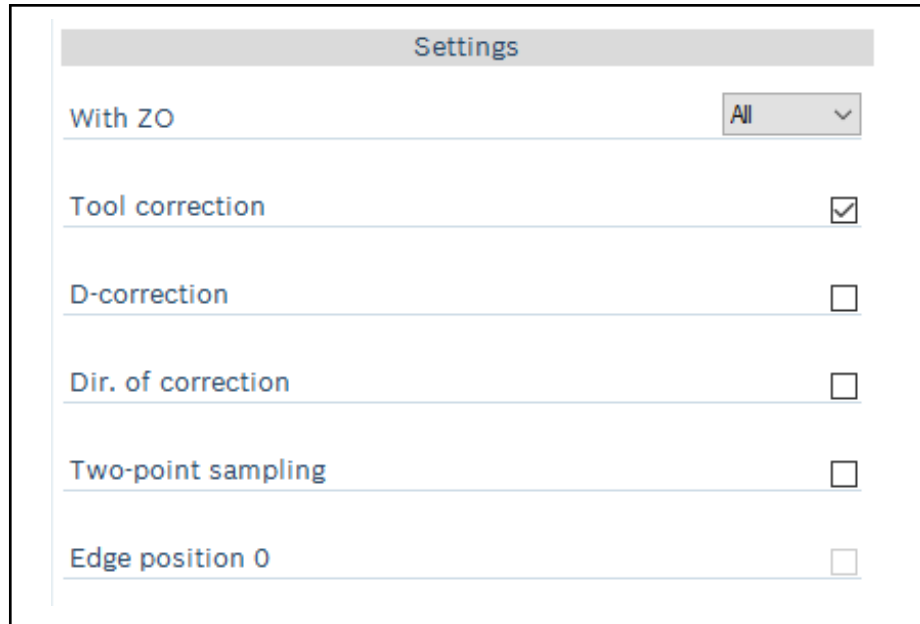
"View" window

Fig. 6-3: View

This window displays the selected dimensional chain of tool and workpiece. This window cannot be focused. In case of setting changes in other windows, it is refreshed.

"Settings" window


Settings	
With ZO	All ▼
Tool correction	☒
D-correction	☐
Dir. of correction	☐
Two-point sampling	☐
Edge position 0	☐

Fig. 6-4: Settings

In this window, the different variants for the zero point probing can be set. The settings in this window are shown the best possible in the "View" window.

By default, the active tool is set as tool type. Only if no active tool is available, this setting can be changed.

When probing the zero point with ZPO, "All, Selection and None" are distinguished. When choosing "Selection", another window is displayed used to select which zero offsets from which zero offset banks should be calculated.

Optionally, the active tool corrections and the active D-corrections can be used for calculation.

The direction of calculating the tool corrections and D-corrections is generally carried out according to the settings in the machine parameters. This presetting can be changed via "Dir. of correction". Therefore, another window is displayed in which the respective settings can be made.

For turning tools and angle head tools, it can also be measured with the edge position 0. During the measurement, the edge radius or the D-correction value of the edge radius are considered.

"Active ZPO bank" window

Settings	Active ZO bank
With ZO Selection ▾	ZO Bank1 G53 ▾
Tool correction ☒	ZO Bank2 G53 ▾
D-correction ☐	ZO Bank3 G53 ▾
Dir. of correction ☐	ZO Bank4 G53 ▾
Two-point sampling ☐	ZO Bank5 G53 ▾
Edge position 0 ☐	

Fig. 6-5: "Active ZO bank"

In this window, the active zero point offsets of the other zero offset banks can be selected/deselected individually.

"Direction of correction" window

Settings	Dir. of correction
With ZO Selection ▾	G47 ActPlane ☐
Tool correction ☒	autom. G47() ☒
D-correction ☐	Calculation L1 ☐
Dir. of correction ☒	Calculation L2 ☐
Two-point sampling ☐	Calculation L3 ☐
Edge position 0 ☐	Direction ☐

Fig. 6-6: Direction of correction

In this window, changes in the direction of correction of the length correction values (tool corrections and D-corrections) can be set. The calculation specified by the machine parameters is preset.



Settings outside the active plane have to be used with utmost care!

Operate "Probe zero point"

Opening the function

The "Probe zero point" function can be configured as MTX function. It can be assigned as key on any configurable panel (F-keys or M-keys).

An assignment under the "Prepare" operating range is recommended.

Window/F-key level	<F2>	<F3>	<F4>	<F5>	<F6>	<F7>	<F8>	<F9>
Searched zero point offset	Next ZO	Next ZO bank	Next axis	Next plane	Next tool type	Next window	Determine	Exit
Settings	<i>Change settings</i>					Next Windows	Determine	Exit
Plane change settings	With ZO	With tool correction	With D-correction	Direction of correction	Two-point sampling	Edge position 0		Back
Active ZO	Active ZO in bank 1	Active ZO in bank 2	Active ZO in bank 3	Active ZO in bank 4	Active ZO in bank 5	Next window	Determine	Exit
Direction of correction	<i>Change settings</i>					Next window	Determine	Exit
Plane Change direction of correction	G47 ActPlain	G47 ()	Calculation L1	Calculation L2	Calculation L3	Direction negative		Back
Calculation for single-sided probing		Apply actual value		Value input distance	ZO direct input	Next window	Save ZO	Exit
Calculation for two-point probing		Apply actual value 1	Apply actual value 2		ZO direct input	Next window	Save ZO	Exit

Tab. 6-8: Function keys of the function probe zero point

By selecting a window, the F-keypad is always called.

F-keys in the "Searched zero point offset" window

- <F2> The next zero point offset is selected in the drop-down box
- <F3> The next zero point offset bank is selected in the drop-down box
- <F4> The next axis is selected in the drop-down box
- <F5> The next plane is selected in the drop-down box
- <F6> The next tool type is selected in the drop-down box
- <F7> The next window is focused
- <F8> The calculation window is focused
- <F9> The Probe zero point function is exited

F-keys in the "Searched zero point offset" window (first level)

- <F2> Call of the level to change the settings
- <F7> The next window is focused
- <F8> The calculation window is focused
- <F9> The Probe zero point function is exited

Preparation

F-keys in the "Settings" window (second level)	<F2>	Select With ZPO in the selection box
	<F3>	Calculation with tool correction yes <--> no in the checkbox
	<F4>	Calculation with D-correction yes <--> no in the checkbox
	<F5>	Set direction of correction in the checkbox yes <--> no
	<F6>	Set two-point sampling checkbox yes <--> no
	<F7>	Set edge position in the checkbox yes <--> no
	<F9>	Back to "Settings" level
F-keys in the "Active ZO" window	<F2>	Set active ZO in bank 1 in the checkbox
	<F3>	Set active ZO in bank 2 in the checkbox
	<F4>	Set active ZO in bank 3 in the checkbox
	<F5>	Set active ZO in bank 4 in the checkbox
	<F6>	Set active ZO in bank 5 in the checkbox
	<F7>	The next window is focused
	<F8>	The calculation window is focused
F-keys in the "Direction of correction" window (first level)	<F9>	The Probe zero point function is exited
	<F2>	Call of the level to change the settings
	<F7>	The next window is focused
	<F8>	The calculation window is focused
F-keys in the "Direction of correction" window (second level)	<F9>	The Probe zero point function is exited
	<F2>	"G47ActPlane" set active plane
	<F3>	Set G47 () according to machine parameters
	<F4>	Set Calculation L1
	<F5>	Set Calculation L2
	<F6>	Set Calculation L3
	<F7>	Set Direction negative ja <--> no
F-keys in the "Calculation" window (one-point probing)	<F9>	Back to "Direction of correction" level
	<F3>	Apply actual value stop <--> start actual value display
	<F5>	Specify Value input distance as additional value for calculation
	<F6>	ZO direct input no calculation of the ZO value
	<F7>	The next window is focused
	<F8>	Save ZO in CNC
	<F9>	The Probe zero point function is exited
F-keys in the "Calculation" window (two-point probing)	<F3>	Apply actual value 1 stop <--> start actual value 1 display
	<F4>	Apply actual value 2 stop <--> start actual value 2 display
	<F6>	ZO direct input no calculation of the ZO value
	<F7>	The next window is focused
	<F8>	Save ZO in CNC
	<F9>	The Probe zero point function is exited
Saving data	<i>When saving data, a message is output in the status bar:</i> • A green line "ZO was saved" if saving was completed successfully • A red line "Error when saving" if saving was not successful	

Additionally, the changed zero offset becomes immediately effective if the value was saved.

6.1.2 Probing the tool

Overview on "Probe tool"



The function "Probe tool" is in the standard or after converting old projects. It is in the operating area "Prepare" and can be called via <F3>.

The "Probe tool" function allows the user to determine the tool correction values (L1, L2, L3 and R) for the active tool by an experimental "probing" of a tool at a workpiece and to apply the result to the database and to the tool correction register of the CNC. This results in a direct relation between the zero point, the workpiece dimensions and the tool correction values of the active tool.



Tool measurement is only possible for the active tool and the active edge.



The asynchronous subroutine (Asup) 8 is currently reserved to implement the setting up functions such as "Zero reference position". To avoid program conflicts, the Asup 8 may not be used for individual NC programs by the user.



In the MACODA parameter 3080 00001 "NCO/FileOrg/SrchPathSubProg"(search path for subroutines), the search path "usr/bosch" has to be entered since the NC program for "writing tool data in the correction register" is program-internally saved there.

Tool correction types

Tool measurement can be executed using the tool correction types 1 to 4 (drilling tools, milling tools, turning tools and angle head tools). For tools of type 4, the edge position 0 is a prerequisite.

Correction types

KT	Description	Tool type
1	Drilling tools	1000 ... 1999
2	Milling tools	2000 ... 2999
3	Turning tools	3000 ... 3999
4	Angle-head tools	CH = True
5	General tool	0

Tab. 6-9: Tool correction types

Axes and planes

The tool geometry for the channel axes (ChAx[1...6]) defined in the machine parameters can be determined.

Axis definitions

Macoda number	Name	Example
701000010	Axis name	X, Y, Z, A, B, C
701000030	Axis description	Main axis X, Y, Z, A, B, C

Tab. 6-10: Machine parameters

The planes G17, G18 and G19 are supported. Irrespective of the assignment of the length correction values set by the machine parameter "G47()" or by the NC program, the values determined are assigned according to the active plane.

Variants when probing the tool

The values that should be considered for calculation can be preselected via the operating screen.

Settings:

- With or without D-correction values
- With or without active zero point offsets of the other zero offset banks
- Two-point sampling



The following applies when calculating the tool correction value:

$\{...\}^* \pm$ result of parenthesized expression has an impact on the following operation sign:

- If $\{...\} \leq 0$ follows +
- If $\{...\} > 0$ follows -

Calculation of the tool correction value (with drilling tool)

Setting								Calculation	
KT	ZO	D-corr.	Two-point	G17 && X G18 && Z G19 && Y	G17 && Y G18 && X G19 && Z	G17 && Z G18 && Y G19 && X	ORI = 0	Calculation rule	Value
1						x		L3 = IW - ABS	L3
				x				Not possible	
					x			Not possible	
	x					x		L3 = IW - ZO - ABS	
	x			x				Not possible	
	x				x			Not possible	
		x				x		L3 = IW - DL3 - ABS	
		x		x				Not possible	
		x			x			Not possible	
	x	x				x		L3 = IW - ZO - DL3 - ABS	
	x	x		x				Not possible	
	x	x			x			Not possible	

IW Applied actual value
 IW1 Applied actual value in point 1
 IW2 Applied actual value in point 2
 ZO Current or modified zero offset
 ABS Entered distance value
 Ln Length geometry value (n=1,2,3)
 R Radius geometry value
 KT Correction type of the used tool
 (x) Edge position 0 required
 || Logic OR
 && Logic AND

Tab. 6-11: Variant tool measurement with drilling tool

Preparation

Calculating the tool correction value (with milling cutter)

Setting								Calculation	
KT	ZO	D-corr.	Two-point	G17 && X G18 && Z G19 && Y	G17 && Y G18 && X G19 && Z	G17 && Z G18 && Y G19 && X	ORI = 0	Calculation rule	Value
2						x		L3 = IW - ABS	L3
	x					x		L3 = IW - ZO - ABS	
		x				x		L3 = IW - DL3 - ABS	
	x	x				x		L3 = IW - ZO - DL3 - ABS	
				x				R = IW - ABS	R
					x				
	x			x				R = IW - ZO - ABS	
	x				x				
		x		x				R = IW - DR - ABS	
		x			x				
	x	x		x				R = IW - ZO - DR - ABS	
	x	x			x				
			x	x				R = (IW1 - IW2 - ABS) / 2	
			x		x				

IW

Applied actual value

IW1

Applied actual value in point 1

IW2

Applied actual value in point 2

ZO

Current or modified zero offset

ABS

Entered distance value

Ln

Length geometry value (n=1,2,3)

R

Radius geometry value

KT

Correction type of the used tool

(x)

Edge position 0 required

||

Logic OR

&&

Logic AND

Tab. 6-12:

Variants tool measurement with milling tool

Calculating the tool correction value (with lathe tool)

Setting								Calculation	
KT	ZO	D-corr.	Two-point	G17 && X G18 && Z G19 && Y	G17 && Y G18 && X G19 && Z	G17 && Z G18 && Y G19 && X	ORI = 0	Calculation rule	Value
3				x				L1 = IW - ABS	L1
				x			x	$L1 = \{ IW - ABS \}^* \pm R$	
	x			x				L1 = IW - ZPO - ABS	
	x			x			x	$L1 = \{ IW - ZO - ABS \}^* \pm R$	
		x		x				L1 = IW - DL1 - ABS	
		x		x			x	$L1 = \{ IW - DL1 - ABS \}^* \pm (R + DR)$	
	x	x		x				L1 = IW - ZO - DL1 - ABS	
	x	x		x			x	$L1 = \{ IW - ZO - DL1 - ABS \}^* \pm (R + DR)$	
					x			L2 = IW - ABS	L2
					x		x	$L2 = \{ IW - ABS \}^* \pm R$	
	x				x			L2 = IW - ZPO - ABS	
	x				x		x	$L2 = \{ IW - ZPO - ABS \}^* \pm R$	
		x			x			L2 = IW - DL2 - ABS	
		x			x		x	$L2 = \{ IW - DL2 - ABS \}^* \pm (R + DR)$	
	x	x			x			L2 = IW - ZO - DL2 - ABS	
	x	x			x		x	$L2 = \{ IW - ZO - DL2 - ABS \}^* \pm (R + DR)$	
						x		Not possible	(R)

IW Applied actual value
IW1 Applied actual value in point 1
IW2 Applied actual value in point 2
ZO Current or modified zero offset
ABS Entered distance value
Ln Length geometry value (n=1,2,3)
R Radius geometry value
KT Correction type of the used tool
(x) Edge position 0 required
|| Logic OR
&& Logic AND

Tab. 6-13: Variants tool measurement with lathe tool

Preparation

Calculating the tool correction value (with angle-head tool)

Setting								Calculation	
KT	ZO	D-corr.	Two-point	G17 && X G18 && Z G19 && Y	G17 && Y G18 && X G19 && Z	G17 && Z G18 && Y G19 && X	ORI = 0	Calculation rule	Value
4 or 5				x			(x)	$L1 = \{ IW - ABS \}^* \pm R$	L1
	x			x			(x)	$L1 = \{ IW - ZO - ABS \}^* \pm R$	
		x		x			(x)	$L1 = \{ IW - DL1 - ABS \}^* \pm (R + DR)$	
	x	x		x			(x)	$L1 = \{ IW - ZO - DL1 - ABS \}^* \pm (R + DR)$	
					x		(x)	$L2 = \{ IW - ABS \}^* \pm R$	L2
	x				x		(x)	$L2 = \{ IW - ZPO - ABS \}^* \pm R$	
		x			x		(x)	$L2 = \{ IW - DL2 - ABS \}^* \pm (R + DR)$	
	x	x			x		(x)	$L2 = \{ IW - ZO - DL2 - ABS \}^* \pm (R + DR)$	
						x	(x)	$L3 = IW - ABS$	L3
	x					x	(x)	$L3 = IW - ZO - ABS$	
		x				x	(x)	$L3 = IW - DL3 - ABS$	
	x	x				x	(x)	$L3 = IW - ZO - DL3 - ABS$	
			x	x			(x)	$R = (IW1 - IW2 - ABS) / 2 $	R
			x		x		(x)		

IW

Applied actual value

IW1

Applied actual value in point 1

IW2

Applied actual value in point 2

ZO

Current or modified zero offset

ABS

Entered distance value

Ln

Length geometry value (n=1,2,3)

R

Radius geometry value

KT

Correction type of the used tool

(x)

Edge position 0 required

||

Logic OR

&&

Logic AND

Tab. 6-14:

Variants tool measurement with angle-head tool

Screen layout

General screen structure

The diagram illustrates the general screen structure with four main windows:

- Probe tool**: A table showing axis parameters and their units/velocities.
- Chain view**: A 3D diagram of a tool and workpiece with coordinate axes.
- Calculation**: A window for inputting tool data and calculating tool offsets.
- Settings**: A window for configuring tool settings and active zero offset banks.

Probe tool				
ACS		Command p...	Max. velocity	
X		mm	0.000	0.000
Y		mm	0.000	0.000
Z		mm	0.000	0.000
A		°	0.000	0.000
MAG		°	0.000	0.000
C1		°	0.000	0.000
Y2		a mm	0.000	0.000

Calculation	
Actual value MCS	0.0000
Active ZO	10.0000
Tool radius [ED1]	3.0000 +/-R
Distance (DI)	-100.0000
Geometry L1 [mm]	87.0000

Settings		Active ZO	
Axis	Z	ZO bank 1	☒
Plane	G18	ZO bank 2	☐
With active ZO	Selection	ZO bank 3	☐
D-correction	☐	ZO bank 4	☐
Two-point sampling	☐	ZO bank 5	☐

Calculating the tool data

Fig. 6-9: General screen structure

The screen is divided into four windows "Active tool", "Chain view", "Calculation" and "Settings". All elements that can be set on the screen have to be operated via TAB and CURSOR keys, F-keys or touch gestures.

A focused window is highlighted in color. At the same time, the respective F-key level is enabled. The "Chain view" window cannot be focused and is not provided with an assigned F-key level.

If the "Calculation" window is focused, the "Active tool" window is replaced by the "Position display" window. This allows monitoring of the current axis position values without switching to the NC screen.

To select the individual zero offset banks another window is displayed.

"Active tool" window

Active tool	
Active tool	Drehstahl 10-100
Tool type	Turning tool
Tool number	66
Edge number	1
Edge position	0

Fig. 6-10: Tool active

The window indicates the active tool data. No settings can be made. No F-key level is assigned to the window.

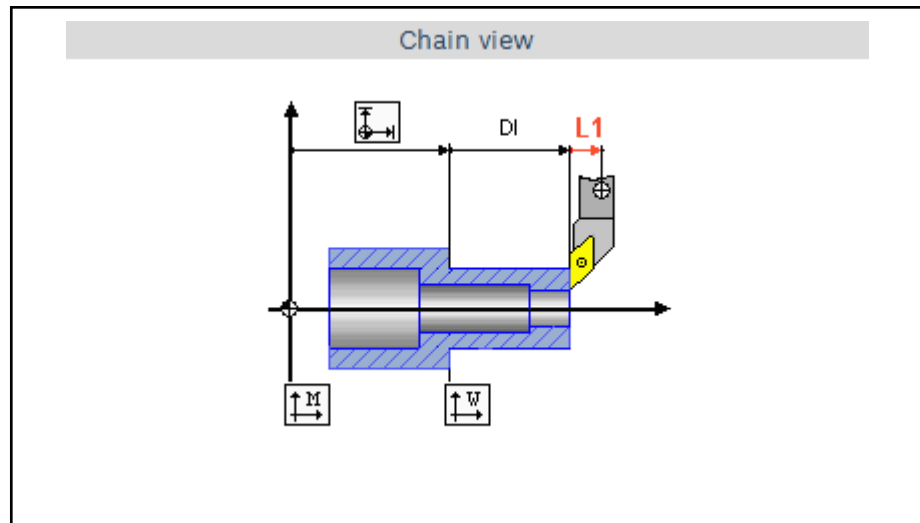
"Chain view" window

Fig. 6-11: "Chain view "

This window displays the selected dimensional chain of tool and workpiece. This window cannot be focused. In case of setting changes in other windows, it is refreshed.

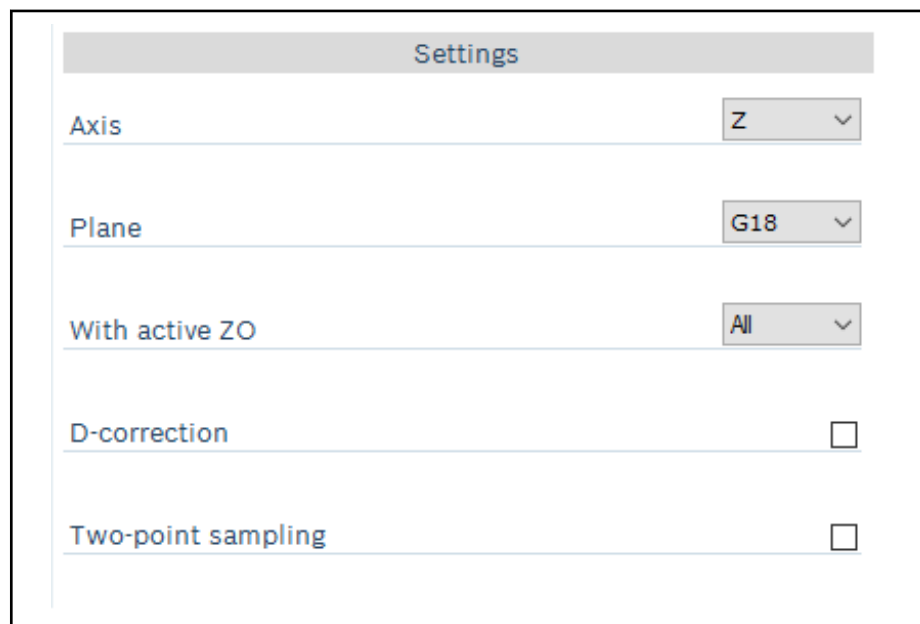
"Settings" window

Fig. 6-12: Settings

In this window, the different variants for the tool measurement can be set. The settings in this window are shown as far as possible in the "Chain view" window.

The tool correction value to be measured is selected by the selection of axis and plane.

During tool measurement with active ZO, "All, Selection and None" are distinguished. When choosing "Selection", another window is displayed used to select from which zero banks the active zero offsets should be considered for calculation.

Optionally, the active D-correction can be selected for calculation.

"Active ZPO bank" window

Settings		Active ZO	
Axis	Z	ZO bank 1	☒
Plane	G18	ZO bank 2	☐
With active ZO	Selection	ZO bank 3	☐
D-correction	☐	ZO bank 4	☐
Two-point sampling	☐	ZO bank 5	☐

Fig. 6-13: "Active ZO bank"

In this window, the active zero point offsets of the other zero offset banks can be selected/deselected individually.

"Calculation" window

Calculation	
Actual value MCS	0.0000
Active ZO	10.0000
Tool radius [ED1]	3.0000
Distance (DI)	-100.0000
Geometry L1 [mm]	87.0000

Fig. 6-14: Calculation

Preparation

In this window, the values are displayed according to their settings and the result is shown. Entering a distance can modify the result. The calculated value is written to the CNC with "Save ZO".

If the variant two-point sampling is set, the "Calculation" window as well as the respective F-key level are adjusted to these conditions.

Fig. 6-15: Two-point sampling

Operating the "Probe tool"

Opening the function

The "Tool measurement" function can be configured as MTX function. It can be assigned as key on any configurable panel (F-keys or M-keys).

An assignment under the "Prepare" operating range is recommended.

Window/F-key level	<F2>	<F3>	<F4>	<F5>	<F6>	<F7>	<F8>	<F9>
Settings	Next axis	Next plane	With active ZO	With D-correction	Two-point sampling	Next window	Measurement	Exit
Active ZO	ZO bank 1	ZO bank 2	ZO bank 3	ZO bank 4	ZO bank 5	Next window	Measurement	Exit
Calculation for single-sided probing		Apply actual value		Value input distance	Direct tool data input	Next window	Save tool data	Exit
Calculation for two-point probing		Apply actual value 1	Apply actual value 2	Value input distance	Direct tool data input	Next window	Save tool data	Exit

Tab. 6-15: Function keys of the Probe tool function

By selecting a window, the F-keypad is always called.	
F-keys in the "Settings" window	<F2> Set Next axis in the selection box
	<F3> Set Next level in the selection box
	<F4> Set ZO calculation in the checkbox
	<F5> Set D-correction calculation in the checkbox yes <--> no
	<F6> Set two-point sampling checkbox yes <--> no
	<F7> The next window is focused
	<F8> The calculation window is focused
	<F9> The Probe tool function is exited
F-keys in the "Active ZO" window	The "Active ZO" window is enabled via With active ZO ► Selection .
	<F2> Set ZO bank 1 is calculated in the checkbox yes <--> no
	<F3> Set ZO bank 2 is calculated in the checkbox yes <--> no
	<F4> Set ZO bank 3 is calculated in the checkbox yes <--> no
	<F5> Set ZO bank 4 is calculated in the checkbox yes <--> no
	<F6> Set ZO bank 5 is calculated in the checkbox yes <--> no
	<F7> The next window is focused
	<F8> The calculation window is focused
	<F9> The Probe zero point function is exited
F-keys in the "Calculation" window (one-point probing)	<F3> Apply actual value stop <--> start actual value display
	<F5> Specify Value input distance as additional value for calculation
	<F6> Direct tool data input no calculation of the ZO value
	<F7> The next window is focused
	<F8> Save tool data in CNC
	<F9> The Probe zero point function is exited
F-keys in the "Calculation" window (two-point probing)	<F3> Apply actual value 1 stop <--> start actual value 1 display
	<F4> Apply actual value 2 stop <--> start actual value 2 display
	<F6> Direct tool data input no calculation of the ZO value
	<F7> The next window is focused
	<F8> Save tool data in CNC
	<F9> The Probe zero point function is exited
Saving data	<i>When saving data, a message is output in the status bar:</i>
	• A green line "Tool data was saved" if saving was completed successfully • A red line "Error when saving" if saving was not completed successfully

6.1.3 Measurement

General information

A detailed description of this function can be found in "IndraMotion MTX 14VRS Measuring Functions" (DOK-MTX***-MES*FUN*V14-APRS-EN-P), chapter "Manual probing".

Calibrating the probe

Functions The following functions are provided:

Calibrate workpiece probe

- at a known point
- in an adjusting ring

Probing the zero point

Functions The following functions are provided:

Probe workpiece zero point

- Point
- Corner
- Boring
- Circular spigot
- Groove
- Land
- Rectangular pocket
- Rectangular pin
- Rotary axis

Preparation The probe has to be loaded via MDI before using the described measuring functions.

Only a single calibrated ball is used in the measurement program. The tool edge and the tool length compensation assigned to the ball have to be enabled before starting the measurement.

The probe has to be enabled before jogging to ensure an active collision monitoring during jogging.

- Sequence**
1. Press the OP key "Prepare" in the "Manual" operation mode.
 2. Press the F-key of the measuring task group ("Probe zero point", "Calibrate probe" etc.).
 3. Use the left M-keys to select the measuring task.
 4. In case of many measuring tasks, a zero point can be included in the chain dimensioning or a zero point is the objective for storing the result. In these cases, keys are available to select a zero point table. Select the zero point table using <F5> "Select Table". See the following information.
 5. The input table is completed with the parameter values required for the measuring task. The displayed graphic provides support and can change after an input.



The key <F2> "Start Program" is enabled after all required parameters have been entered and only in the "Jog" mode and starts the measurement.

6. Before starting the measurement, check the initial position or a safe initial position has to be manually approached (see graphics).



Only now press <F2> "Start Program" to apply the parameters in the NC. The parameters are then available for the next measuring task.

7. Execute the program with NC start. The message "Program is running" is displayed.

Some measuring function required multiple manual positioning between the measuring steps (e.g. zero point probe rotary axis or probing at an internal contour with obstacle). The different initial positions for the measuring steps are displayed by the numbers 1 to 2 or 1 to 4 in the graphics. The first initial position for point 6 has the number 1. After each measuring step, the program stops and the operator is prompted to manually approach the next position. The respective positions have to correspond to the displayed graphics with regard to axis direction and sequence. After the next position has been set, execute NC start again. Repeat until all measuring steps have been executed.

8. After the measuring steps and calculations have been completed, the program stops and the measuring result is displayed. The result is applied after actuating NC start again.

Zero point table Select a zero point table with <F5> "Select Table".

The name of the selected zero point table is displayed in the "selected zero point table" field in the position display.

The active zero point table is set to the selected zero point table with <F6> "apply current table".

The axis names in the zero point table have to correspond to the configured axis names.

Position display Display the current position values and the zero point table instead of a supported text using <F7> "Position Display". In case of a changed zero point table, the position and zero point table display is automatically displayed.

Spindle orientation In case of measuring task with alternating probing in positive and negative axis direction, the probe can be turned in the new measuring direction by means of spindle orientation so that the switching offset (calibration value) does not affect the measurement result. This procedure is called reversal measurement and facilitates accurate measurement even if a noncalibrated probe is used.

The spindle is only oriented in case of an active edge number 1. In case of a cross probe, it is assumed that the foremost calibrating ball is assigned to edge 1. Only for this edge, the reversal measurement can be performed.

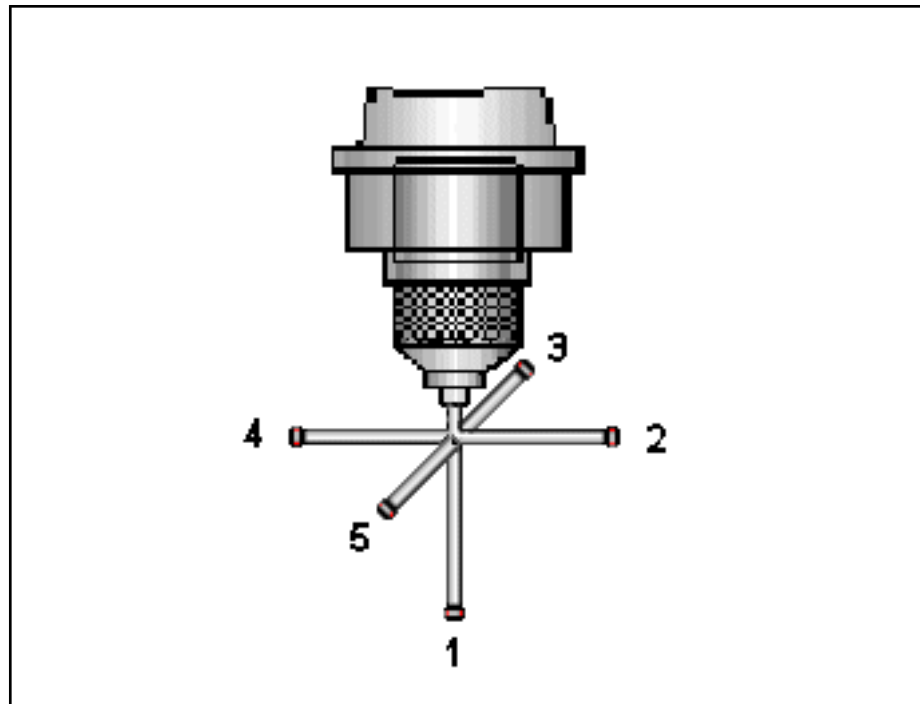


Fig. 6-16: Edge numbers at the cross probe

Inclined plane

The dialog "Inclined plane" contains functions for probing a level and swiveling in the measured level.

Call The dialog is called using <F6> "Inclined plane" in the operating area <OP2>"Prepare"

Toggle between the functions "Swiveling G230" and "Measuring for G230" using the M-keys <ML1> and <ML2>.

Functions The following functions are provided:

Inclined plane

- Probe plane manually - for cycle G230 Swiveling
- G230 Swiveling in measured plane

- Sequence**
1. Press the OP key "Prepare" in the "Manual" operation mode.
 2. Press <F7> "Inclined plane".
 3. Use the left M-key for selecting "Probe plane for cycle G230 Swiveling" (probing for G230). For this function, a plane is determined by probing three points.
 4. The input table is completed with the parameter values.



The key <F2> "Start Program" is enabled after all required parameters have been entered and only in the "Jog" mode and starts the measurement.

5. Before starting the measurement, check the initial position or a safe initial position has to be manually approached (see graphics).



Only now press <F2> "Start Program" to apply the parameters in the NC. The parameters are then available for the next measuring task.

6. Execute the program with NC start. The message "Program is running" is displayed.
At each point to be probed, the program stops and the operator is prompted to manually approach the next position. The respective positions have to correspond to the displayed graphics with regard to axis direction and sequence. After the next position has been set, execute NC start again. Repeat until all measuring steps have been executed.
7. Use the left M-keys to select "G230 Swivel in probed plane" (G230).
A reduced input mask is displayed for swiveling, only containing the specifications for a previously probed plane.
8. The input table is completed with the parameter values.



The key <F2> "Start Program" is enabled after all required parameters have been entered and only in the "Jog" mode and starts the measurement.

9. Prior to executing the cycle, check the initial position or manually approach a save initial position.



Only now press <F2> "Start Program".

6.1.4 Executing the cycle

User cycles In the operating area, <OP2>"Prepare", the key <F5> is not assigned in a new project. The key is reserved for cycles and functions the user wants to execute in the operating mode "Jog". Many non-modal cycles (standard cycles, user and machine operator cycles) and DIN block sequences for which an input mask has been defined can be assigned to the key.

Call The dialog is called using <F5> (user-defined name) in the operating area <OP2>"Prepare".

If several input masks have been assigned to the function key, the cycle can be selected in the upper check box.

After all mandatory parameters have been entered, <F2> "Start Program" becomes active.



Press <F2> "Start Program" to immediately execute the cycle. Only cycles developed as manual functions stop before the first motion and report information for the user. Thus, travel to a safe initial position first.

Configuring the executable cycles

How to configure the key Execute (user) cycle:

1. Create an input mask for a user cycle. For a detailed description, refer to "IndraMotion MTX 14VRS Commissioning" (DOK-MTX***-STARTUP*V14-CORS-EN-P), chapter "NC Cycle input mask".

Preparation

If the input mask cannot be inserted in an NC program, assign the group names `_NOINSERT` and `_NOCORR` (`//%GROUP% _NOINSERT _NOCORR ...`) (amongst potential other groups).

- Open your project in IndraWorks Engineering and tap on <Visualisation device>/Screen Frame/F-Panels/OPPreparation in the Project Explorer.
- In the F-panel editor, select <F5> and enter a name under "Text". In "Function selection", select "Execute cycle".

Under "SignatureOrName", specify which input mask(s) is/are to be called. How to call an input mask:

- Select a cycle in the drop-down menu
- Enter a group name (technology group), e.g. GRAVE for engraving
- Enter several group names. Group names are divided by spaces (e.g. MYGROUP1 MYGROUP2)

Several groups can also be defined using placeholders. The question mark (?) stands for exactly one character, the asterisk (*) for an arbitrary or empty string (e.g. MYGROUP* and comprises the groups MYGROUP, MYGROUP1 and MYGROUP11. MYGROUP?? MYGROUP?? would only call MYGROUP11 out of the groups mentioned above

- Enter a cycle signature (e.g. G201)
- Enter the signatures of several cycle that are to be separated by commas (e.g. G201, G202). No placeholders are available for signatures
- If not signature or group is specified, the group SETUP is selected by default

- Transmit and refresh the visualization data

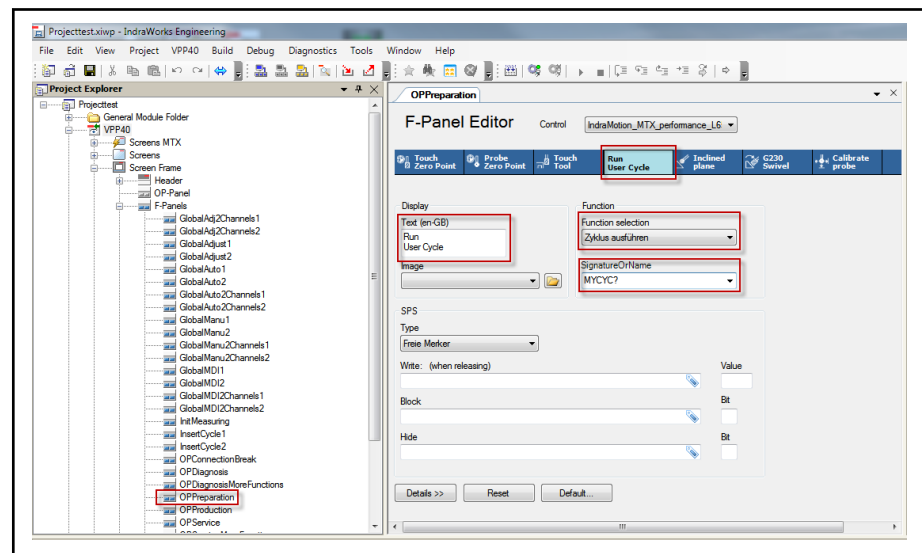


Fig. 6-17: Configuring an F-key using the function "Execute cycle".

6.1.5 Swiveling (G230)

A detailed description of this function can be found in "IndraMotion MTX 14VRS Standard NC Cycles" (DOK-MTX***-NC*CYC**V14-PRRS-EN -P), chapter "G230 Swiveling". The function corresponds to the F-key configuration "Execute cycle" (function selection) and the signature G230 and thus, the complete parameter scope of the cycle Swiveling.

Special characteristics for manual
swiveling



Press <F2> "Start Program" to immediately execute the cycle,
including possible motions.

7 Programming

7.1 Overview

This chapter describes the NC program development.

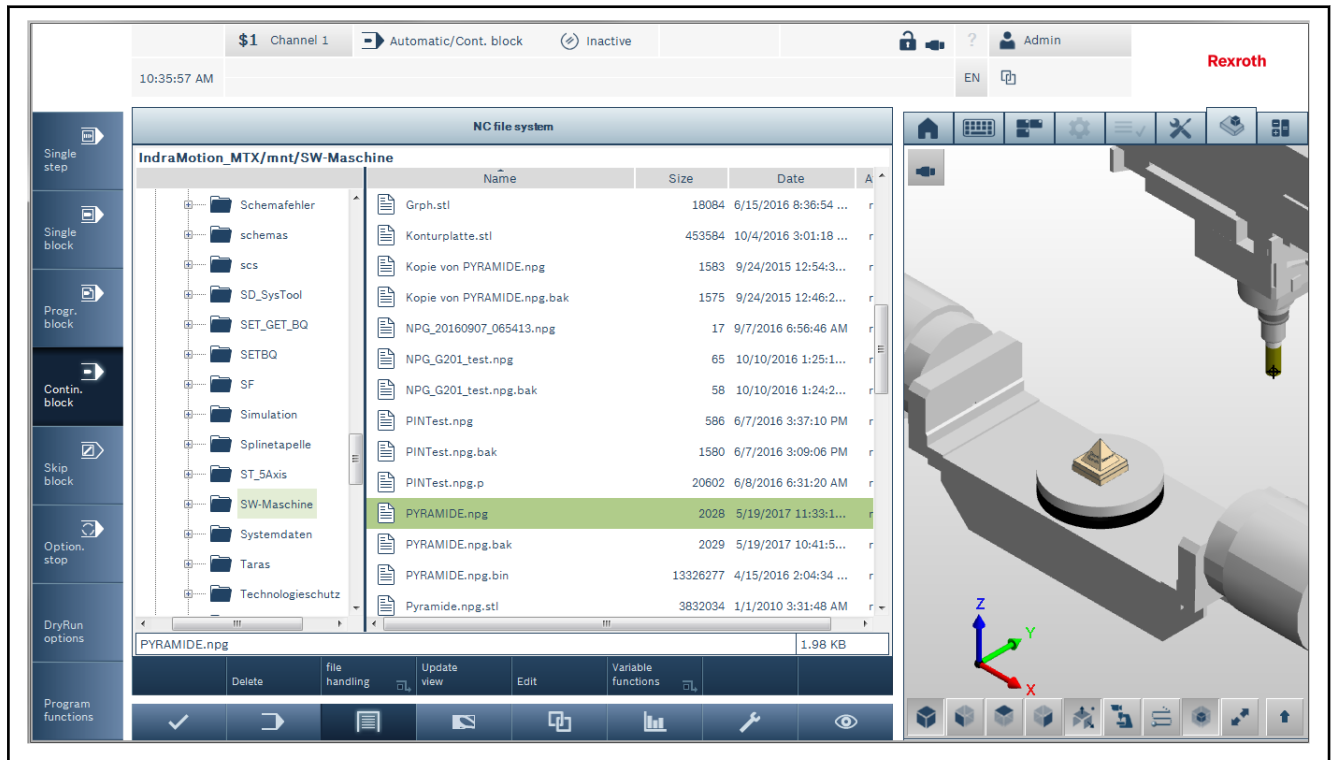


Fig. 7-1: "Programming" operating area

7.2 MTX-Navigator

7.2.1 General information

Characteristics of the MTX-Navigator

The MTX-Navigator is a directory and file navigator. It visualizes the directory and file structure of the NC control with reference to the Windows Explorer.

This navigator is provided in IndraWorks Operation as well as in IndraWorks Engineering to navigate in the NC file system.

Tree + list

In the "Tree + List" characteristics, the directory structure of the tree is displayed as tree in the left operating area. In the operating area to the right, subdirectories and files are listed.

This is used in IndraWorks Operation as well as in IndraWorks Engineering.

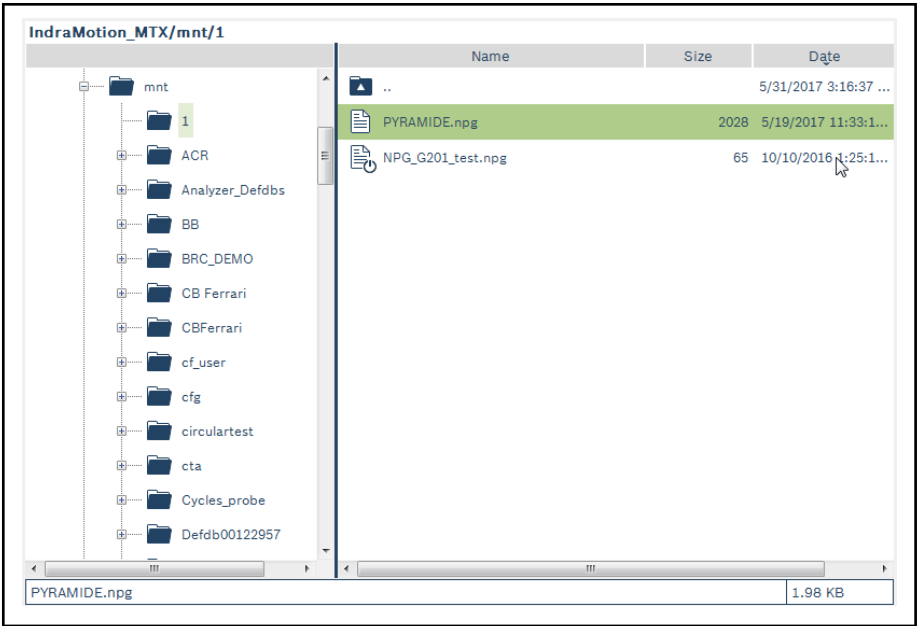


Fig. 7-2: MTX-Navigator in the "Tree + List" characteristics of IndraWorks Operation

List The subdirectories and the files are listed in the "List". This representation is only used in the "program selection" (chapter "Context-dependent functions of the MTX-Navigator" on page 138) in IndraWorks Operation.

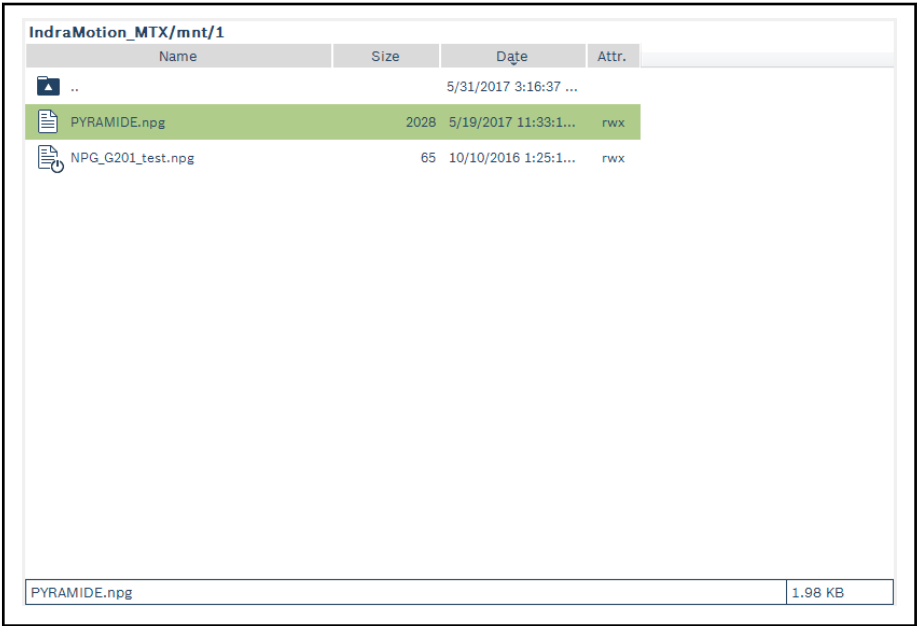


Fig. 7-3: MTX-Navigator in the characteristic "List" of IndraWorks Operation
To hide the directory tree, disable the setting "Show tree" in the additional operating area in the "Settings" tab.

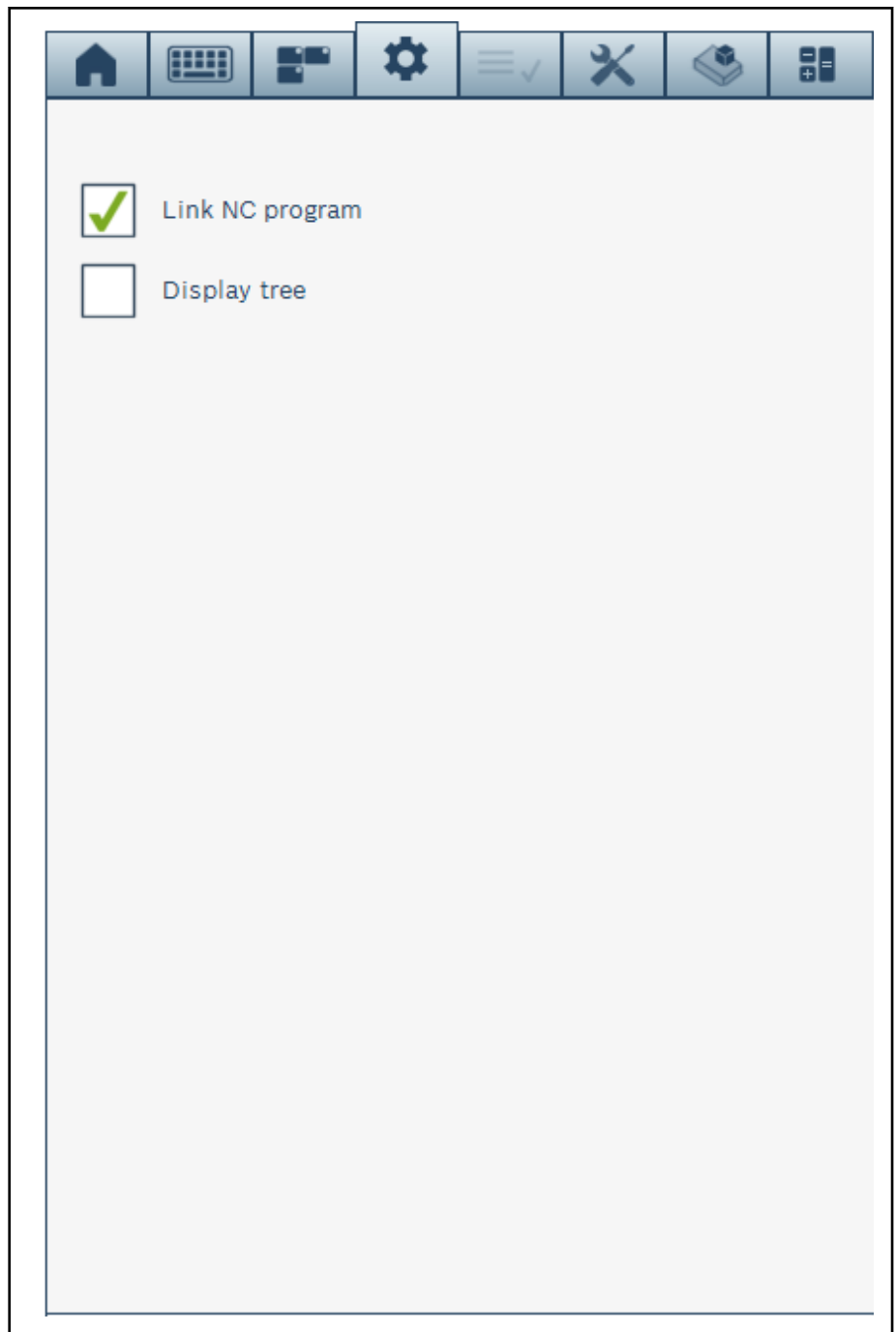


Fig. 7-4: Setting "Without tree" in the additional operating area

Object types

Basically every following object type named in the tree as well as in the list of the MTX-Navigator can be provided with its individual context menu and individual assignments of the function keys and the menu bar. This causes a change in the assignment of the function keypad and the characteristics of the menu bar or the context menu when changing between tree and list or selecting another object type.

The following object types are distinguished:

- the "root" folder in the  root tree (root = root directory = control name in the IndraWorks Engineering project)
- all other folders in the tree
- the return marker in the  list
- all other folders in the list 
- all files of the list 
- active files of the  list
- selected NC programs of the  list
- selected and active NC programs of the  list
- the list

Status bar In the status bar, the currently selected object (directory or file) is visualized. If the focus is on a directory in the tree, the number of the objects (directories and files) and the sum of the sizes of all files located directly below the selected directory is displayed.

The status bar in IndraWorks Operation is - as shown in [fig. 7-2 "MTX-Navigator in the Tree + List characteristics of IndraWorks Operation" on page 136](#) - located directly below the navigator. In IndraWorks Engineering, the general status bar of IndraWorks Engineering is used.



In IndraWorks Engineering, the status display is deleted automatically after 10 seconds.

Context-dependent functions of the MTX-Navigator

The MTX-Navigator in IndraWorks Operation is used in two different operating areas:

- In the operating area "Program"
- In the operating area "Machine"

Additionally, the navigator is also used in IndraWorks Engineering.

According to the context, the navigator provides different functions.

Context program The instance of this context is always activated as soon as the operating area "Program" is called in IndraWorks Operation. In this case, the navigator is the basic application for this operating area.

In this context, the navigator provides all functions for file editing.

The characteristic of the navigator is always "Tree + List" and cannot be switched.

Context: Program selection	The instance of this context is called and started with the operation mode "Automatic" via the <F2> "Program Selection" function in the operating area "Machine" of IndraWorks Operation. This function is not provided in other operation modes. In this context, the MTX-Navigator provides - apart from the general functions (see chapter "General functions" on page 141) - the functionalities for the program selection. By default, the MTX-Navigator is started in this context with the characteristic "List". However, the user can switch between both characteristics "Tree + List" and "List".
Context Engineering	The instance of this context is called in IndraWorks Engineering via the "NC file system" node below the "Motion" node. In this context, the navigator provides all functions for file editing. The characteristic of the navigator is always "Tree + List" and cannot be switched.

7.2.2 Operation

General information

This section describes the different operating possibilities of the MTX-Navigator.

The operation in different contexts assumes different input media. The interface is partially operated via touch gestures (operating areas "Program") and partially via keyboard (operating area "Machine"). However, an operation with the keyboard is always possible. In certain areas, using touch gestures is easier.

Context menu	For entries with an individual context menu, the menu is displayed by using "Press and hold" or by pressing <Shift>+<F10>. Within the context menu, the user can highlight an entry with the cursor buttons or by entering the underlined or the first letter or by using touch gestures and can execute the entry by pressing <Enter> or by using the touch gestures "Double tap". Via <ESC> or by using the touch action "Single tap" clicking outside the context menu, it can be closed again without executing any action.
Menu bar	The menu bar can contain individual entries with regard to the currently focused object type of the MTX-Navigator. The entries can be selected and activated using touch gestures or after pressing <F10> or <Alt>+<Letter> as for the context menus.
F-key bar	The function key bar is only available in IndraWorks Operation. It is located at the lower margin of the user interface and consists of buttons which represent the function keys <F2> to <F9>. These buttons can be triggered by pressing the corresponding function key. The assignment of the individual buttons in the MTX-Navigator depends on the currently focused object type.

Toggling between tree and list

Switch the entry focus between tree and list either by pressing <Tab> or selecting the desired object using touch gestures. It is important, since keyboard entries always refer to the currently focused entry.

Navigating in the tree

Navigation in the tree is possible via keyboard or using touch gestures. Click on the plus or minus sign at the left side of a folder or "double tap" on a folder to open or close the folder.

The cursor keys are intended to navigate via keyboard, whereas the folder currently highlighted can be opened with <CursorRight> and closed with <CursorLeft>.

Folders are placed one position upwards or downwards by the cursor keys <CursorUp> and <CursorDown>.

Additionally, it can be jumped directly to the folders by entering the first sign of the node name. Ambiguities result in a jump to the next appropriate folder.

When pressing <Backspace>, the highlighting moves to the respective super-ordinate folder in case the latter exists.

Navigating in the list

In the list, entries (folder, files or return label) are selected via the keys <CursorUp> and <CursorDown> or by "Single tap". Use the keys <CursorLeft> and <CursorRight> or "Drag with one finger" to pan the list section horizontally. Press Enter or "Double tap" to trigger the predefined command of the currently highlighted entry:

- Entry = Return marker ⇒ it is switched to the next higher level
- Entry = Folder ⇒ the directory and its content is displayed
- Entry = File ⇒ the function assigned to the file type (e.g. open editor) is carried out

Change to the next higher level as shown in the tree view via <Backspace>.

The columns of the list can be maximized or minimized using touch gestures. A column can be "hidden" by pushing together the column. To re-open these hidden columns later on, expand the column to the right by using "Touch and hold" and subsequently "Drag with one finger" over the column separator.

Sorting column and direction can only be changed by clicking one or multiple times on the corresponding column head using "Double tap". A little triangle highlights the current sorting column and indicates the selected sorting direction, whereas the apex of the triangle shows in the direction of the ascending values.



Despite the sorting, the order of the following groupings is always maintained:

- The return label is always on top
- Subsequently, all directories are listed
- The last group is the group of files

The MTX-Navigator saves all column widths as well as the sorting column and the sorting direction. This data is always saved on the hard disk when the navigator is left and exited.

Finished part preview in the additional operating area

If there is a preview file for the selected NC program in the MTX-Navigator,



the icon is displayed in the "Finished part" preview and the preview image can be displayed in the additional operating area.

Thus, a quick overview is provided during program selection and the user can cross check if the correct NC program was selected.



The preview image generation has to be enabled in the simulation settings via the setting parameter "WorkpiecePreview" with the setting value "Full" or "CreateOnly". Consequently, a file containing an NPG file name and the data extension ".p" is generated at the end of the program.

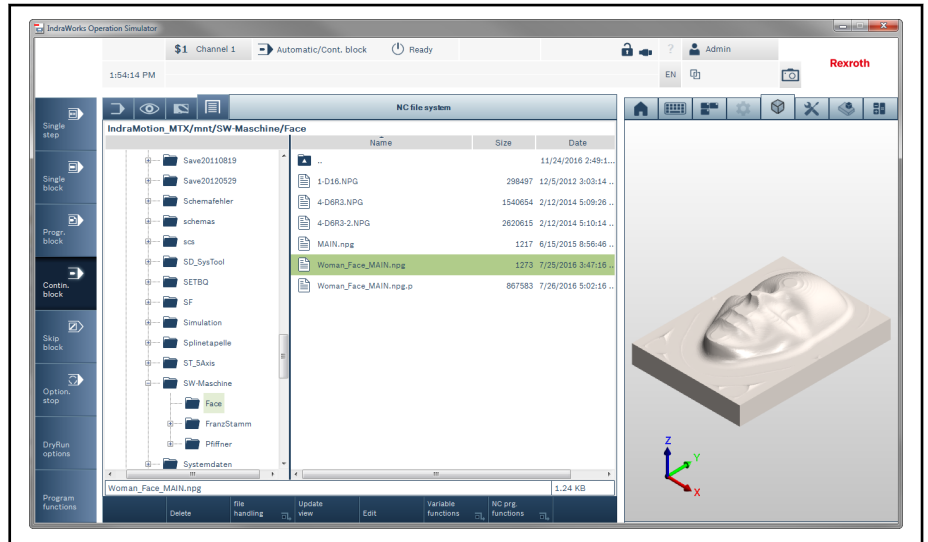


Fig. 7-5: Finished part preview in the MTX-Navigator

7.2.3 Functions

General functions



General functions do not depend on the context!

Placing file filter

Use the filter dialog to exclude certain data types from the display in the list. Thus, the selection of the files can be limited.

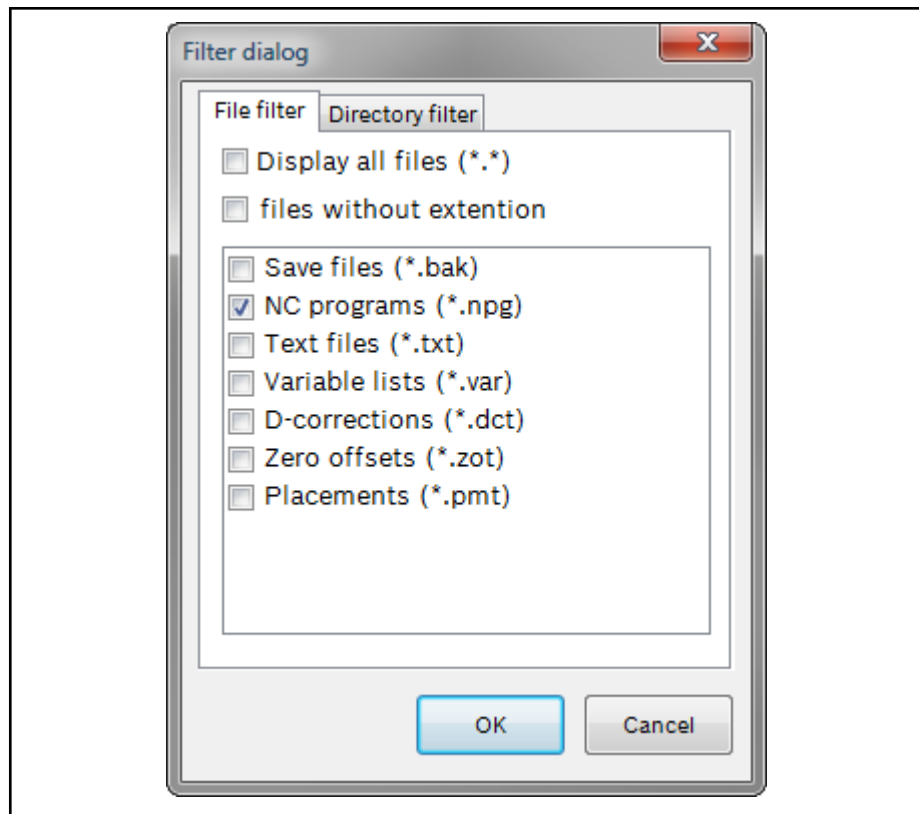


Fig. 7-6: Filter dialog for files

Only files which correspond to the file types selected in the dialog are shown. All other files are not displayed. In the example above, only NC programs are displayed.

Adding file filters The list in the filter dialog for files can be extended by the "Add filter" function. This function is called via the context menu ("Touch and hold") of the list.

Deleting file filters Entries from the list can be deleted in the file filter dialog. Note that only the elements added by the user can be deleted. The extensions specified by the installation cannot be deleted.

This function is called via the context menu ("Touch and hold") of the file filter list.

Setting editor Use this function to enable a user-defined editor for a certain file extension to be used when opening a file with this extension. By default, an internal ASCII editor is used unless a special editor was assigned.

This function is called via the context menu ("Touch and hold") of the file filter list.



This function is only available in IndraWorks Engineering.

Setting directory filter Use the filter dialog to exclude certain default directories of the control from the display in the tree. Thus, the selection of the directories can be limited.

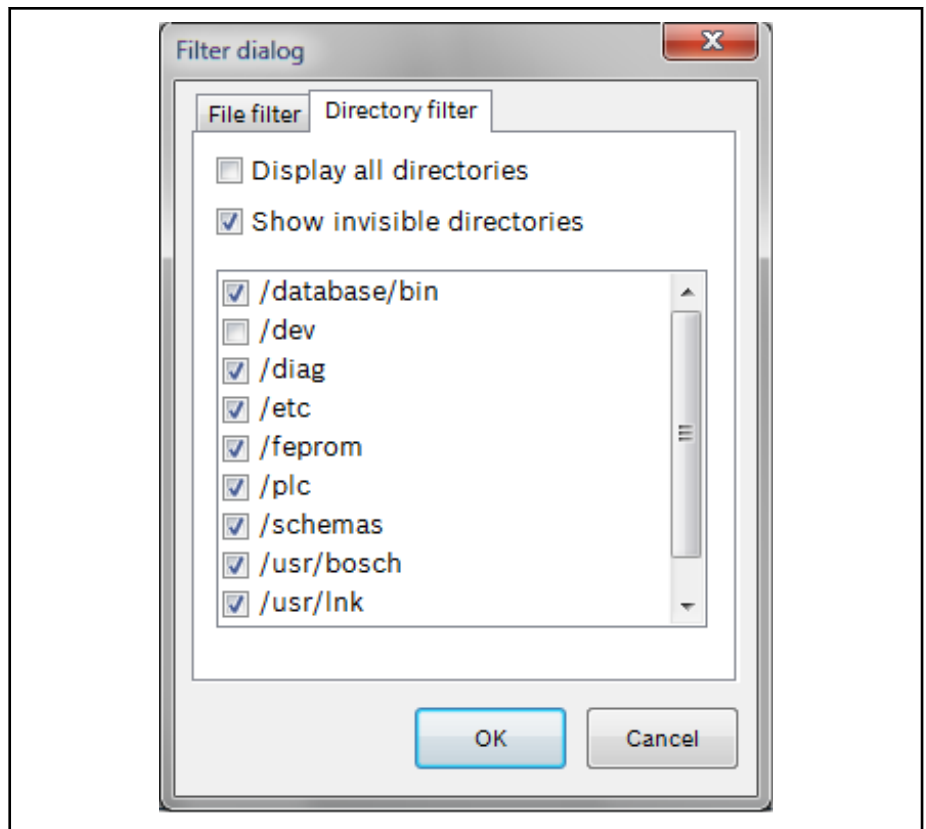


Fig. 7-7: Filter dialog for directories

All connected directories and the directories selected in the directory dialog (including mount directories) are always shown.

Adding directory filter

The list of the directories in the standard can be extended using the function "Add directory filter". In this case, it is possible to include subdirectories in the list as well. Furthermore, individual directories can be deleted from the list via the context menu.

Properties of the directory

The "Properties" dialog shows the following directory information:

- Directory name → can be changed
- Location of the directory
- File system in which the directory is located
- Used memory of the file system
- Available memory of the file system
- Memory capacity of the file system
- Creation date of the directory
- Directory attributes

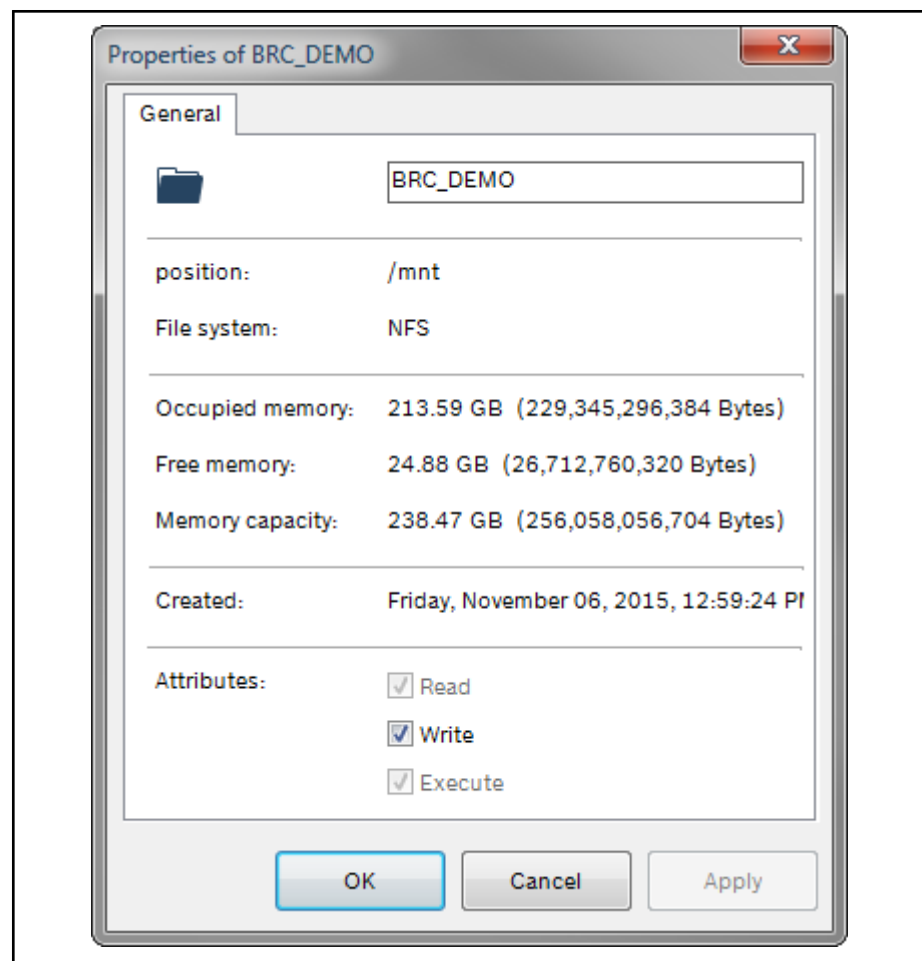


Fig. 7-8: "Properties" dialog of the directory



The attributes of the directory cannot be changed on the mount directory!

Properties of a file

The "Properties" dialog shows the following file information:

- File name → can be changed
- Location of the file
- File system in which the file is located
- File size
- Creation date, change date and date of last access
- File attributes

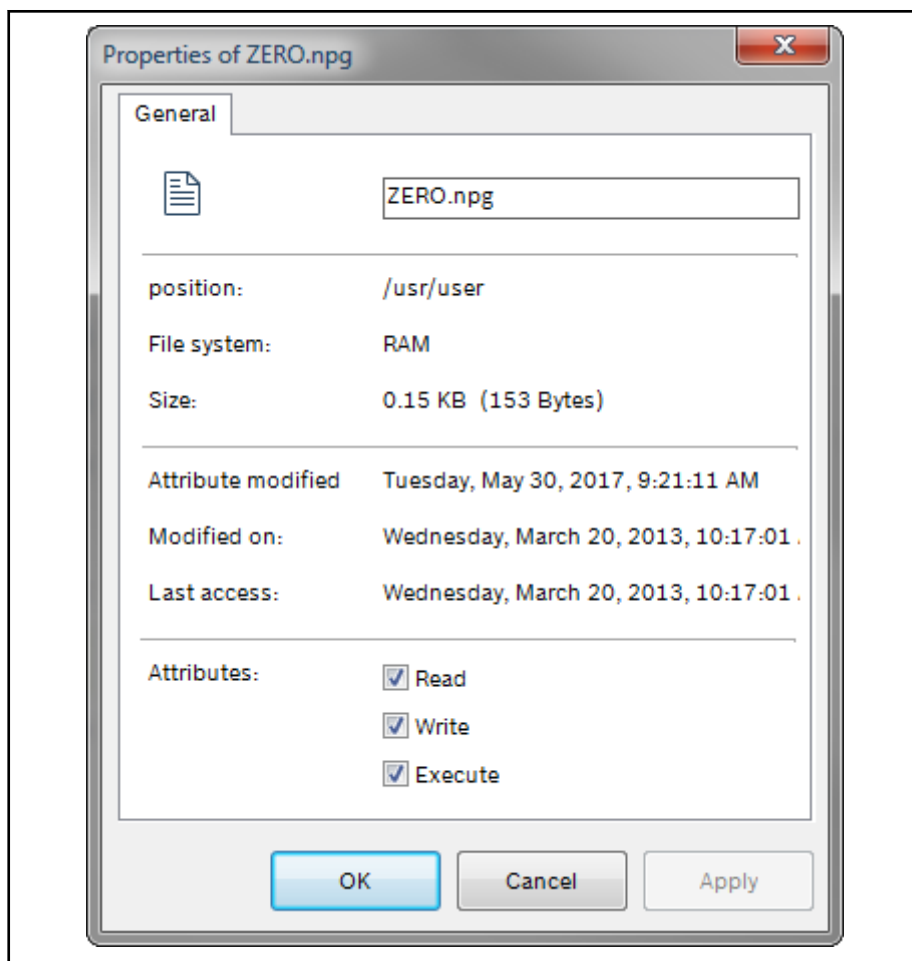


Fig. 7-9: "Properties" dialog of the file



The attributes of a file cannot be changed on the mount directory!

Importing directories/files

The user can use the "Import" dialog to import directories and/or files from the Windows file system into the file system of the NC kernel. The import function is only activated if the focus is on a directory (also the "root" directory). It is not significant whether it is in the tree or in the list. If several objects are selected in the list, the import function is deactivated. If the focus is on the "empty" list, the import function is activated.

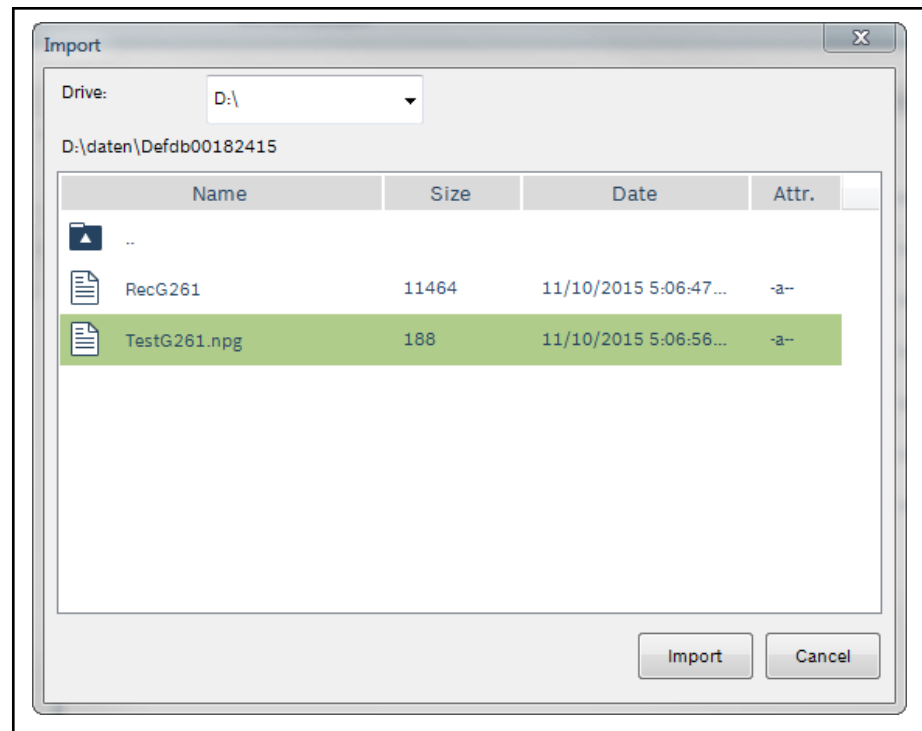


Fig. 7-10: "Import" dialog

- Upon the first call after the MTX-Navigator start, "C:" is set as default drive. The last selected directory is set as default directory for every following call (as long as the user interface was not closed).
- Several files and/or directories can be highlighted and imported. After pressing the "Import" button, all selected objects (files/directories and subdirectories and files) are copied to the selected directory in the MTX-Navigator.
- If a file with the same name already exists in the target directory, the user is asked whether he would like to overwrite or cancel the copying process for this file.
- The dialog can be used with the keyboard (i.e., also without touch gestures)!

Exporting directories/files

With the export function, directories and/or files are copied from the file system of the NC kernel to a Windows directory selected by the user. The export function is active under the following conditions:

- Not the node "root" is selected in the tree, but another directory.
- In the list, one or several file(s) / directory/is/are selected

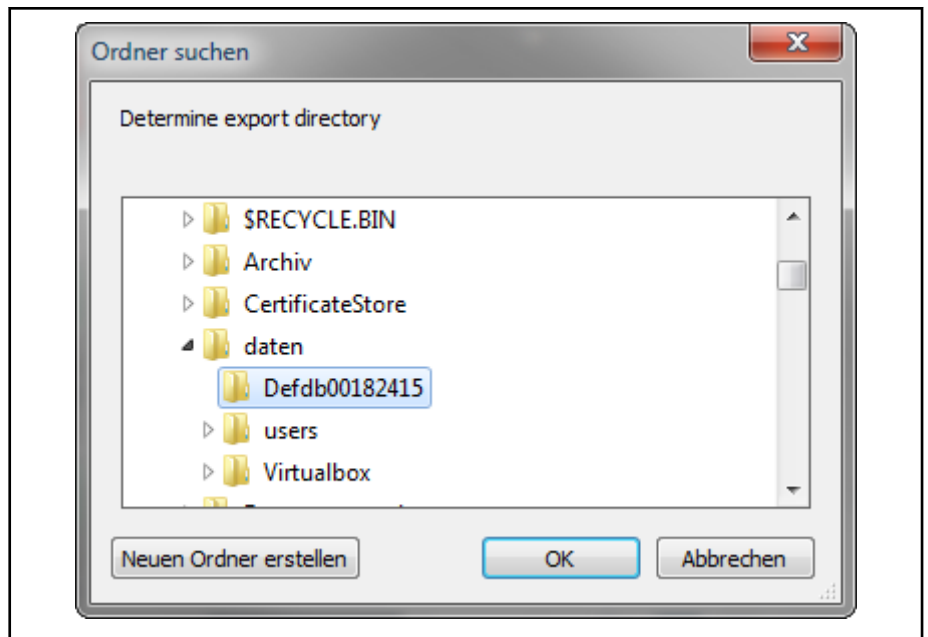


Fig. 7-11: "Export" dialog

In this dialog, the user selects the target directory in which the selected files/directories are copied from the MTX-Navigator.

If the element (file/directory) to be exported already exists in the target directory, it is overwritten without prompt.

Furthermore, the dialog provides the possibility to create a new subfolder which can immediately be selected as target directory.

Program selection functions

Link NC program	If this function is selected in the function key bar, the selected NC program is automatically linked in case of a program selection.
Show tree	This function is used to switch the view of the MTX-Navigator between "List" and "Tree + List".
Cancel selection	This function closes the program selection without an NC program being selected.
Confirm selection	This function executes a program selection with the selected NC program. The selected NC program is visualized in the NC block display (operating screen machine).



All selected NC programs are marked with an individual symbol in the list of the MTX-Navigator.

- Selected NC programs in the current channel contain a



"green" symbol

- Selected NC programs in non-selected channels contain a



"gray" symbol

Directory functions

These are functions which can only be used for directories (folders). These functions can only be called if a folder object is focused in the tree or in the list.



The directory functions are only active in the context "Program" or in IndraWorks Engineering.

New -> Directory

Use this function to create a new subdirectory in the currently selected directory. When this function is activated, a dialog is opens. Enter the name of the new subdirectory into this dialog. The maximum length of a directory name within the directory system of the NC kernel is limited to 30 characters. On the mount directory, the maximum length for a directory corresponds to the Windows conventions.

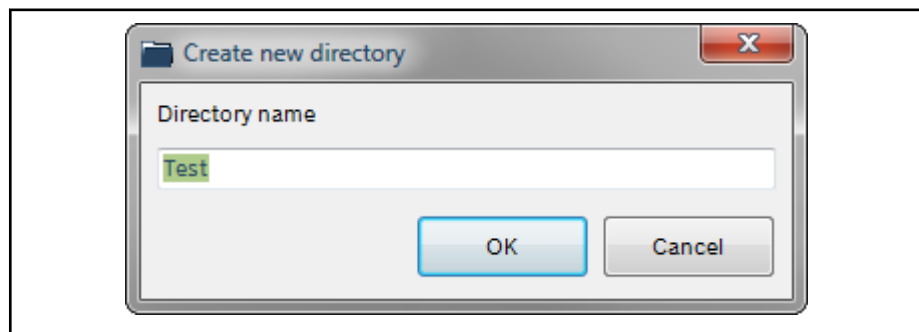


Fig. 7-12: "Create new directory" dialog

- "OK" closes the dialog and creates the directory
- "Cancel" closes the dialog and does not create a new directory
- If no name is entered and "Ok" is pressed, an error message is output
- If the name already exists in the directory, an error message is shown
- If the directory name has more than 30 characters and the file is in the directory system of the NC kernel, an error message is shown.

Deleting

The current directory and all contained subdirectories and files are deleted. The deletion has to be confirmed by the user:

Yes The directory is deleted

No Deletion is canceled

It is possible to highlight several directories and/or files in the list (multiple selection) and delete them afterwards.

During deletion, a status box is shown visualizing the progress at deletion.



The root directory cannot be deleted!

Renaming

Use this function to rename the currently selected directory. When this function is activated, a dialog is opens. The user has to enter the name of the new directory into this dialog. The default assignment in the input field is the current directory name. The maximum length of a name in the directory system of the NC kernel is limited to 30 characters. On the mount directory, the maximum length for a directory corresponds to the Windows conventions.

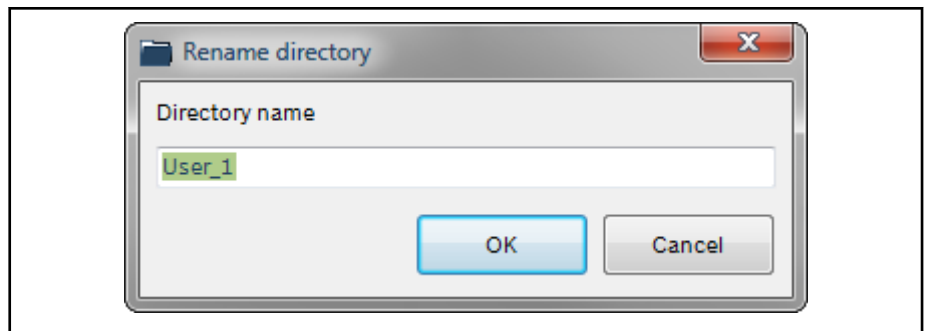


Fig. 7-13: "Rename directory" dialog

- "OK" closes the dialog is closed and renames the directory
- "Cancel" closes the dialog and the directory is not renamed
- If no name is entered and "Ok" is pressed, an error message is output
- If the name entered already exists in the directory, an error message is shown
- If the directory name has more than 30 characters and this directory is in the directory system of the NC kernel, an error message is shown.



The root directory cannot be renamed!

In case of multiple selection, directories cannot be renamed.

Copying

Use this function to save the currently selected directory in the clipboard. This function is required for the "Insert (Directory)" function. Only if an element of the "Directory" type is in the clipboard, the function "Insert (Directory)" is activated and can be selected by the user.

With each new copying, the current content of the clipboard is overwritten!



- The "root" directory cannot be copied!
- The return label cannot be copied!
- A multiple selection of directories in the list is possible.

Inserting

This function requires an element of the type "Directory" in the clipboard. Only in this case, this function is active and can be executed by the user.

When the function is selected, the program determines the source directory from the clipboard and copies the latter with all its subdirectories and files to the currently selected target directory.

If a subdirectory with the same name of the directory to be copied already exists in the target directory, the user has to decide whether the current directory is to be overwritten or whether the insertion is to be canceled using a dialog.

When inserting a directory with more than 30 characters from the Windows file system into the file system of the NC kernel, an error message is output.

Cutting

Basic function like "Copy"!

In addition, the source directory is deleted after insertion into another directory via the function "Insert (Directory)".

File functions

These are functions which can only be used for files. These functions are only activated if one or several files are selected in the list. In case of multiple selection, some functions are not activated!



File functions are only active in the context "Program" or in IndraWorks Engineering.

New This allows to create a new file of a certain type.

The following types are provided:

- NC programs
- NC variable list
- D-corrections
- Zero offsets
- Placements
- Text file

After selecting one of these types, the corresponding editor is started automatically. It is used to create and edit the file.

Deleting This function deletes the currently selected file. The deletion has to be confirmed by the user:

Yes The file is deleted.
No Deletion is canceled.



When deleting, a multiple selection is possible. In this case, all selected files are deleted!

Selected, i.e. active NC programs cannot be deleted.

Editing When operating this function, the data type of the selected file calls the corresponding editor and loads the selected file.

If the data type of the selected files is unknown, the NC program editor is started in IndraWorks Operation and a simple ASCII editor is started in IndraWorks Engineering. This editor is part of the MTX-Navigator.



In case of multiple selection, files cannot be edited.

Renaming This function renames the currently selected file. When this function is activated, a dialog is opened. The user has to enter the new file name into this dialog. The default assignment in the input field is the current file name. The maximum length of a name is limited to 30 characters. On the mount directory, the maximum length for a file corresponds to the Windows conventions.

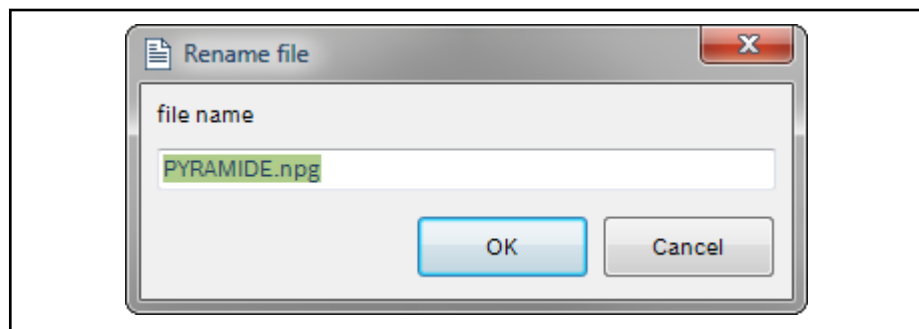


Fig. 7-14: "Rename directory" dialog

- "OK" closes the dialog and the file is renamed
- "Cancel" closes the dialog, but the file is not renamed
- If no name is entered and "Ok" is pressed, an error message is output

- If the name entered already exists in the directory, an error message is shown
- If the file name has more than 30 characters and this file is in the directory system of the NC kernel, an error message is shown.



- In case of multiple file selection, the "Rename" function is disabled.
- Selected, i.e. active NC programs may not be renamed.

Copying

This function is used to save the currently selected file in the clipboard. This function is required for the function "Insert (File)". Only if an element of type "File" is in the clipboard, the function "Insert (File)" is activated and can be selected by the user.

With each new copying, the current content of the clipboard is overwritten!



- A multiple selection of files in the list is possible.
- A mixed multiple selection of directories and files in the list is also possible.

Inserting

This function requires an element of the type "File" in the clipboard. Only in this case, this function is active and can be executed by the user.

When the function is selected, the program determines the source file from the clipboard and copies the latter to the currently selected target directory.

If a file with the same name of the file to be copied already exists in the target directory, the file name is prefixed by the text "Copy of" if source and target directory are identical. If both directories are different, the user is asked whether the file is to be overwritten in the target directory.

Cutting

Basic function like "Copy"!

In addition, the source file is deleted after being inserted into another directory using the function "Insert (File)"!

Search functions

Find

The "Find" function can be used to search for files in the file system of the NC kernel and in all mounted directories of the Windows file system or on a Compact Flash (CF) card of a controller-based control.

This function is only activated if the focus is on a directory (folder) of the tree (also the "root" directory) or the list. If several objects are selected in the list, the search function is deactivated.



The search function can be used in IndraWorks Engineering and in both IndraWorks Operation contexts.

If the "Search" function is called in a directory (folder), the following dialog is displayed:

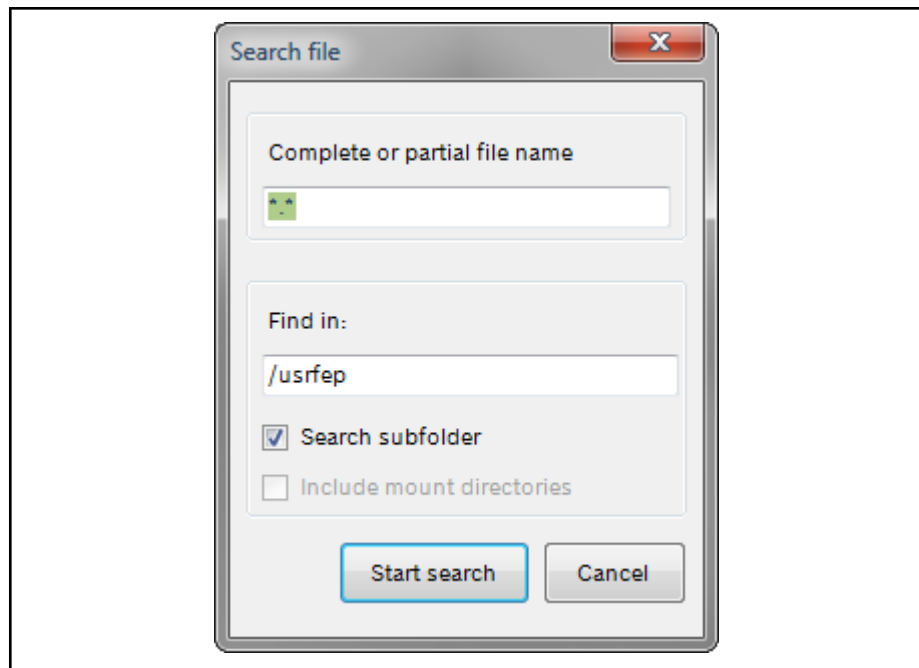


Fig. 7-15: "Find file" dialog

To search for certain files, the following settings can be made:

- Entry of a file name combined with a placeholder "*"
 - *.* - Search for all files (default setting)
 - <FileName>.<ext> - Search for a certain file
 - *.<ext> - Searches for all files with a certain extension
 - <Filename>.* - Searches for files with a certain name and any extension
 - <Filename>*.* - Searches for files starting with a certain character and with any extension
 - <Filename>*.<ext> - Searches for files starting with a certain character and with a certain extension
- Path entry

In the "Find in" field, the path of the focused directory is applied when opening the dialog. This search path can be manually adjusted by the user. It has to be observed that a valid (existing) path is entered. If the path is invalid, searching is aborted with an error.
- Search Subfolder

This checkbox can be used to limit the file search to the specified directory or to include all subdirectories (default setting).
- Include mount directories

Select this checkbox only if the selected directory is root ("/"), since only "root" can be provided with one or several mount directories and subdirectories.

If the search is started, all files with the set specifications are searched. While searching, a progress bar is displayed. At the end of the search, the node "Search Results" is newly created and automatically selected in the tree. All found files are shown in the list with their entire path. These are "links" to the original files.

Functions of the node "Search results"

Generally, the search result remains until a new search is started or explicitly completed by the user. The advantage is that it can be switched any number of times between the individual directories of the NC file system and the search result without losing the search result as it is common for other browsers. The disadvantage is that updates such as modifications or deletion of original files made after the search cannot be seen in the search result list.

Repeat search	This function starts the previous search again without displaying the search dialog. This function is especially useful if the original files were modified after the search but the search result should be up-to-date.
Complete search	This function deletes the search result list (list of links to the files found) and the "Search Results" node.

Functions of the elements (links) in the search result list

Go to	This function switches the directory to the original file and focuses it. The "Search Results" node remains.
Available file functions	The number of available file functions on the elements of the search result list is limited to the following functionalities: • Delete - To delete the original file as well as the link from the search list • Export - To export the original file • Properties - To visualize the properties of the original file All other file functions are not activated for elements of the search result list.

7.3 NC program creation

7.3.1 Overview

Editor types The editor to edit NC programs and other texts is provided in two variants:

1. Editor to edit small files
2. Editor to edit large files

An adjustable limit value is used to differ between small and large files.

The limit value for the file size can be configured in the "Editor options" dialog (see [Tab Editor type, page 168](#)).



As the editor to edit large files is only provided with a limited functionality, not all menu functions are available.

The editor to edit small files is also provided in two variants called "editor types" in the following:

- **NC program editor** with unlimited functionality to edit NC programs
- **Text editor** with limited functionality

Due to its functional limitations, the editor for large files is called text editor in the following.

Selecting the editor type for new files

For new files, the menu navigation is the decisive factor whether to open either the text editor or the NC program editor.

Selecting the editor type for existing files

The editor to edit existing files is selected automatically. The selection criteria for small files is the size of the file to be edited and the preselection "Text editor" or "NC program editor"

The preselection (whether the NC program editor or the text editor is used) is made in the "Editor options" dialog (see [Tab "Editor type", page 168](#)).

To change non-ASCII-files, the text editor is always opened.



If the editor for large files was enabled for editing, "Editor for large files with reduces functionality ready" is displayed in the status line.

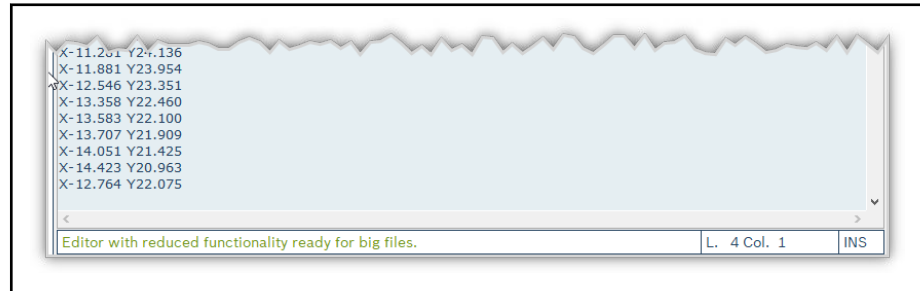


Fig. 7-16: Information in the status line

Differences The NC program editor is primarily used for programming. It can exclusively edit ASCII files. In contrast, the text editor can also edit Unicode and UTF8 files.

The NC program editor is equipped with the following additional functions compared to a simple editor:

- Syntax highlighting (colored highlighting of block components)
- Fully automatic and continuous numbering for DIN and CPL blocks that does not change jumps to block numbers
- Integration of input assistance for NC cycles

Commonalities The editor types do not differ in the remaining functions and characteristics:

- Basic mechanisms to avoid loss of data (BAK files)
- Full navigation on part program errors not influenced by insertions and deletion of texts
- Navigation: Character by character, word by word, line by line, start, end and via search function
- Scroll function via scrollbar, scrolling by using "Drag with one finger", cursor positioning and keys
- Highlighting: Character by character, word by word, line by line
- Integrated program selection after saving an active NC program
- The editors can be opened multiple times, but only one time per file. This restriction does also apply across operating areas
- New files are saved in ASCII format

Editor commands Commands can be selected via:

- Function keys
- Hotkeys

The editor complies with the Windows standard with regard to the usual shortcuts (selecting, block commands, search, etc.).

Syntax highlighting The syntax highlighting of the NC program editor displays NC block components in different colors according to their syntactic meaning and their error status.

The following is distinguished:

	• NC words • Parameter lists of instructions and subroutines in DIN context • Comments and notes • CPL instructions • Label declarations • Jump commands (conditional/unconditional jump) • Macros • GNP instructions
User management	To edit and to reselect a program, the respective user rights are required. If the user does not have these editing rights, the program can exclusively be opened in read-only mode. If user rights are missing, a user can log in again with sufficient rights.
Active NC program	If the NC screen or the MTX Navigator opens the active program, the program is automatically selected again after the "Save query" (answer "Yes") and the "Reselection query" (answer "Yes"). It is verified that the requirements for reselection are fulfilled. If the reselection query is not answered with "Yes", the program is not saved and is thus not selected. If the program contains GNP cycle calls, the compiler to compile these cycles is called before. If a reselection is impossible (channel active), the channel can be reset and thus saving and reselection can be repeated.
Cursor position after opening	After opening an active NC program, the cursor is located on the block currently processed in the NC kernel and this line is highlighted. If the editor is opened from the NC simulation, the current cursor position is identical to the latest simulated block. In case the error is program-related (part program error, GNP error, error from the simulation), the cursor is placed on the first error identified.

7.3.2 Functions under file

File - New

Hotkeys	<Ctrl>+<N>
	This function opens a new empty NC program.
Procedure	A new empty NC program is opened. The program that was currently edited remains open.

File - Open...

Hotkeys	<Ctrl>+<O>
	This function opens an existing NC program or a text file.
Procedure	A file selection dialog is displayed to select the file to be edited. The currently edited document remains open.

File - Save

Hotkeys	<Ctrl>+<S>
	Saves the document in the file system of the MTX and empties the internal error list of the editor.
Procedure	If the document was newly created, the file selection dialog is displayed to specify a new file name and to determine the storage location. At the NC program editor, the identifier is preset to "NPG_ <time stamp>" (year/month/day_hour/minute/second) and can be modified by the user. The

file extension is set to ".npg" by default (for the "NC program"). Analogously, the default names are pre-assigned with "TXT_..." and the extension with ".txt". **Cancel** aborts the "Save" function. When **Save** is pressed, the file is saved under the identifier shown.

File - Save as...

This function saves the document in the MTX file system under a new name. The editor remains open.

Procedure A file selection dialog is displayed to determine file name and memory location.

The file name is pre-assigned with the current name and can be changed by the user. **Cancel** aborts the "Save As" function. When **Save** is pressed, the program is saved to the NC program directory under the identifier shown. A message is issued if the same path and name for saving are specified. The existing file is overwritten by confirming the message with "Overwrite". "No" allows to navigate again in the file selection dialog.

File - Print...

Hotkeys <Ctrl>+<P>

This function prints the open document.

Procedure A dialog to set up the page is displayed, followed by the print preview. The number of pages per sheet can be set. The zoom icon can adjust the size accordingly. The print dialog can be closed with **Exit**. By using <Tab> or using touch gestures, navigation in this dialog is possible.

Go to the menu bar, under **File ► Print Settings...** to open the "Print Settings" dialog to configure header and footer.

Currently, the following variables can be used:

Variable	Description
PRINT_DATE	Printing date
PRINT_TIME	Printing time
COMPUTER_NAME	Current computer name
CURRENT_PAGE_NO	Current page number
CURRENT_USER	Current user name
SOFTWARE_VERSION	Software version information

Tab. 7-1: Variables for header and footer

To improve clarity, the meaning can be written in front of each variable.

Example:

Variable description

Entering a parameter: Printing date: #PRINT_DATE#

File - Exit NC editor

This function closes the editor. The editor is immediately closed if no changes have to be saved in the document or if a later empty document is present.

Procedure for a new document

For a newly created document, the "Save query" is prompted. An already pre-assigned file name according to the editor type can be seen.

Button description:

- **Yes** saves the document. A file selection dialog follows to enter identifier and storage location. **Save** in the file selection finally creates or replaces a file. Return to the editor with **Cancel**
 - **No** discards the content and closes the editor
 - **Cancel** returns to the editor without saving
- Procedure for a changed document**
- If a previously existing document containing unsaved changes is edited, a dialog prompts to decide whether to save the changes made:
- **Yes:** If the document to be saved is an **active NC program** and the reselection prompt is confirmed with **Yes**, the file is saved, the main program is selected and the editor is closed. **No** returns to the editor without saving.
- An **inactive program** is immediately saved and the editor is then closed.
- **No** discards all changes and closes the editor.
 - **Cancel** returns to the editor without saving.

File - Exit all NC editors

- This function closes all open NC editors.
- Procedure (for each editor window)**
- If an editor contains unsaved changes, a dialog is displayed, as in "Exit NC editor", prompting to decide whether to save the changes. In case of new documents, an additional prompt is displayed, asking the user to enter an identifier and a storage location.

7.3.3 Functions under edit

Edit - Undo

- Hotkeys** <Ctrl>+<Z>
- This function allows to undo the latest editing steps.
- With this function, the modifications of individual lines can be undone (delete line, insert line, editing procedures within a line, cutting, pasting and deleting blocks covering one or more lines).

Edit - Redo

- Hotkeys** <Ctrl>+<Y>
- This function allows to redo editing steps which have been undone.

Edit - Cut (Block)

- Hotkeys** <Ctrl>+<X>
- The area selected is copied to the clipboard and deleted in the document.

Edit - Copy (Block)

- Hotkeys** <Ctrl>+<C>
- The highlighted area is copied to the clipboard.

Edit - Insert (Block)

- Hotkeys** <Ctrl>+<V>
- The text in the clipboard is pasted into the document at the current cursor position.

Edit - Select line

- The current line is selected.

Edit - Select all**Hotkeys** <Ctrl>+<A>

The entire document is selected.

7.3.4 Functions under navigate**Edit - Find...****Hotkeys** <Ctrl>+<F>

Can find a specified character string in the complete document. Upper and lower case as well as the search direction can be selected.

If **Replace** is pressed after a character string is entered, the string can be replaced by another one. If the "Find" dialog is closed, continue to search in the document using the hotkey <Ctrl>+<R>.**Edit - Next error**

Moves the cursor to the next registered error and highlights the text passage. Additionally, the corresponding error message is displayed in the status bar. The error message can be hidden with <Esc>.

The function is only available if errors/warnings have been reported for this program when opening the editor or if new errors have been registered when saving with reselection or subsequent NC Simulation.

Edit - Previous error

Moves the cursor to the previously registered error and highlights the text passage. Additionally, the corresponding error message is displayed in the status bar. The error message can be hidden with <Esc>.

The function is only available if errors/warnings have been reported for this program when opening the editor or if new errors have been registered when saving with reselection or subsequent simulation.

Edit - Go to beginning of file (BoF)**Hotkeys** <Ctrl>+<Home>

Moves the cursor to the beginning of the file.

Edit - Go to end of file**Hotkeys** <Ctrl>+<End>

Moves the cursor to the end of the file.



There are a number of additional positioning, selecting, blocking and editing functions only available as hotkeys. Only the most important functions are explained.

7.3.5 Functions of the input support**Input support - NC cycle**

Overview To program cycle calls and other DIN code instructions, the NC editor is provided with an input tool - the **input masks** - especially useful for a comfortable parameter input. Input masks are tables to identify and change sizes. The input is supported by graphics, text information and a formula interpreter and secured by a parameter validation. One output format belongs to each input

mask. That output format is used to link the parameters to a syntactic unit and it is the link between program text and input table.

For more detailed information on the input masks, refer to the "Rexroth IndraMotion MTX Commissioning" manual, chapter "Defining input dialogs".

Inserting NC cycles

The <F2> "NC cycles" key branches into subordinate F-keypad levels to be primarily used to insert NC cycle calls.

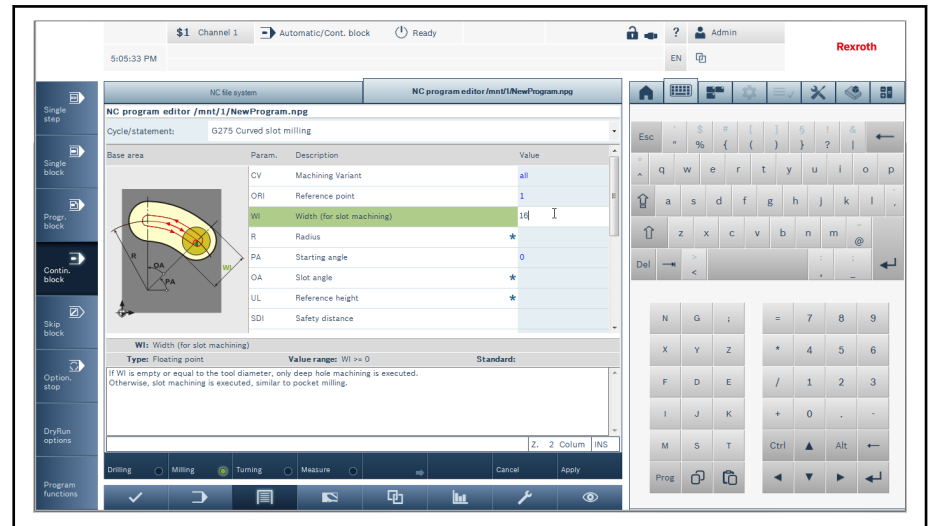


Fig. 7-17: Input assistance - Inserting an NC cycle

Variable menu structure

The input masks for insertion are provided in groups generally grouped according to topics and technological point of views (see "Rexroth IndraMotion MTX Commissioning", chapter "Properties of an input mask (grouping)"). This reduces the menu scope. A channel-related reduction of the menu scope is also possible. The menu structure - especially the F-key arrangement - can be configured (see "Rexroth IndraMotion MTX Commissioning", chapter "F-Keys of the input support"). To generally or partially hide the input masks and to affect the mask sequence, refer to the chapter [Options - Adjusting the input assistance...](#), page 164.

Even though the menu structure is variable, there are specific rules and function keys that are always available:

- A subset of cycles (one or several groups) is selected via function keys that are provided with a radio button functionality
- Up to two F-panels - the left and right half of the menu - are intended for the group selection. If the menu is split in two, there are two function keys <>>> and <<<< to switch between these levels.
- If the channel-specific hiding of input masks is set up, the function key <F7> is displayed. If no channel is assigned to the program (see "Rexroth IndraMotion MTX Programming Manual", section "Channel ID"), this key becomes active. After pressing the key, a dialog is displayed to select the desired channel the menu is to be composed for or the menu composition can be selected "across channels".

The selected channel remains its validity in all menus to insert via input masks and when inserting NC block sequences. It is displayed in the status bar.

- The F-key <F8> discards all entered parameters and causes a return to the editor view.

- The F-key <F9> transmits the call with the current parameter values to the program and returns to the editor view as well. It is not checked whether all mandatory parameters have been filled out.

Online help Each input mask can be assigned to a chapter in an online help. The chapter can be displayed with <F1>.

Input support - NC cycle correction

Correcting with an input mask The key <F3> does not only correct cycle calls, but also all instructions programmable with input masks.

Input mask selection For correction purposes, the input mask - with the output format and parameters including their value ranges matching the block component parts best at the cursor position in the program - is selected. For multi-line output format, lines in front and behind can also be used for correction. There are two exceptions:

- There are multiple input masks equivalent in their matching with the program text. In this case, a dialog is displayed to select the respective input mask.
- There is not matching input mask for the program content at the cursor position. The last operating step is ignored and a respective message is displayed in the status bar.



- When starting the correction, the cursor may not be set on an empty line and a comment line. This even applies if this line is part of the output format of an input mask. Position the cursor on a line with DIN code.
- There is no value pre-assignment during correction.
- When correcting modal cycle calls, the standard parameters are not considered. That means that the standard values are not displayed in case of empty parameters and that parameters matching with the standard are not always applied to the program.
- Hiding input masks (see [Availability tab, page 164](#)) is not active during correction.

Input support - Instructions for simulation

With <F5>, function comments for the NC simulation such as tool descriptions can be inserted using input masks. This key is only available if there is a valid license for the NC simulation.

For more information, refer to the manual "Rexroth IndraMotion MTX Workshop Programming Turning and Milling", chapter "Additional simulation information in the part program".

Input Support - Calculator...

The dialog "Calculations and tables" is activated with <F6>. See chapter [11.2 Calculations and tables, page 300](#).

Input support - NC block sequences

Overview

Use this function to insert any number of previously defined blocks into the NC program. NC block sequences can be created across channels or channel-dependently. The channel reference is only a classification criterion for the block sequences.

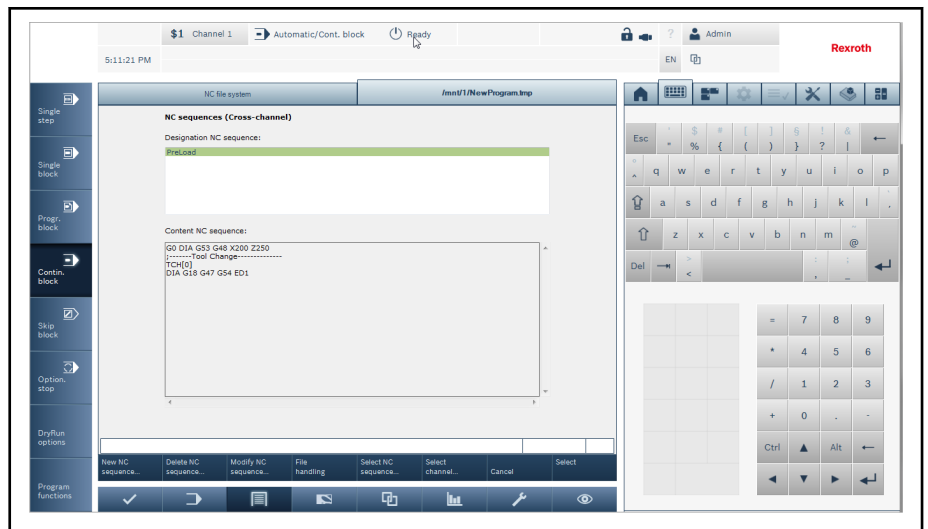


Fig. 7-18: Input assistance - NC block sequences

Channel selection when opening

When opening the NC block sequences, the following channel is selected by default:

- the channel assigned to the program (see "Rexroth IndraMotion MTX Programming Manual", section "Channel ID")
- the (valid) channel selected with <F7>
- "across channels"

Functions of the first F-keypad level

New definition

Press <F2> to define new block sequences. A dialog window opens. Enter the designation of the NC sequence into the upper space and the respective content into the lower space. The content can comprise any number of blocks.

Language-dependent texts can be used in the designation and in the NC block content (comments). Instead of a text in one language or NC sequence content or NC sequence ID, e.g. "Z333 (pallet change)", a language-dependent text can also be entered by referencing via a token number %TNxxxx%, e.g.: "Z333 (%TN7%)". For this purpose, it is required to specify the text belonging to the token in the file under "C:\My Documents\All Users\Application Data\Rexroth\IndraWorks\Project\<Visualization Device>\user\config\MTXNCSequenceUser_yy.txt" (yy=language ID, e.g.: EN for English). A maximum of ten tokens are allowed per line. Click on **Info** to display this information.

The new block sequence is always inserted into the designation list in front of the position selected with <F6> "Selected position". Confirm the NC sequence with **OK**. Exit the process with <Esc> or **Cancel**.

Delete

With <F3>, the selected sequence can be deleted. The selected NC sequence with designation and content is displayed. Confirm deletion with **OK**. Exit the process with <ESC> or **Cancel**.

Modify

With <F4>, existing block sequences can be edited. The menu navigation is as for "New definition".



All changes in the NC sequences have to be backed up in IndraWorks Engineering. Go to **Visualization Data** ► **Load changes from operating station**.

File handling

With <F5>, a new F-keypad level for file operations is opened.

Selection	With <F6>, the NC sequence can be selected. A newly created sequence is always inserted in front of the selected sequence.
Select channel...	Switch between channel-comprehensive and channel-dependent sequences with <F7>. If it is selected across channels or an existing channel is selected and then a sequence inserted, this new setting also applies when inserting via input masks as long as no channel number assigned to the program impedes this new setting.
Cancel	Exit the process and return to the NC editor via <F8> or <Esc>.
Apply	Press <F9> to copy the selected block sequence to the last cursor position in the NC program. Return to the editor view.

Functions of the second F-keypad level

Copy/Cut	With <F2> "Copy" or <F3> "Cut", all NC block sequences of the selected channel are buffered. After they have been "pasted", the sources of the NC block sequences that have been edited with "Cut" are deleted.
Export	With <F5>, all of the NC block sequences of the selected channel are saved in a file. The user can select the storage location.
Import	With <F6>, a file saved using "Export" can be pasted into the selected channel as NC block sequences.
Select channel	Switch between channel-comprehensive and channel-dependent sequences with <F7>.
Delete	With <F8>, the NC block sequences of the selected channel are permanently removed.



All changes to the NC sequences have to be backed up by **Visualization data ► Load changes from operating station**.

Back	With <F9>, return to the first F-keypad level.

Input support - Toleranced dimension

Use this function to define tolerances within the "uniform drilling/uniform shaft" system according to DIN 7154/5 and to transfer the computed results to the NC program.

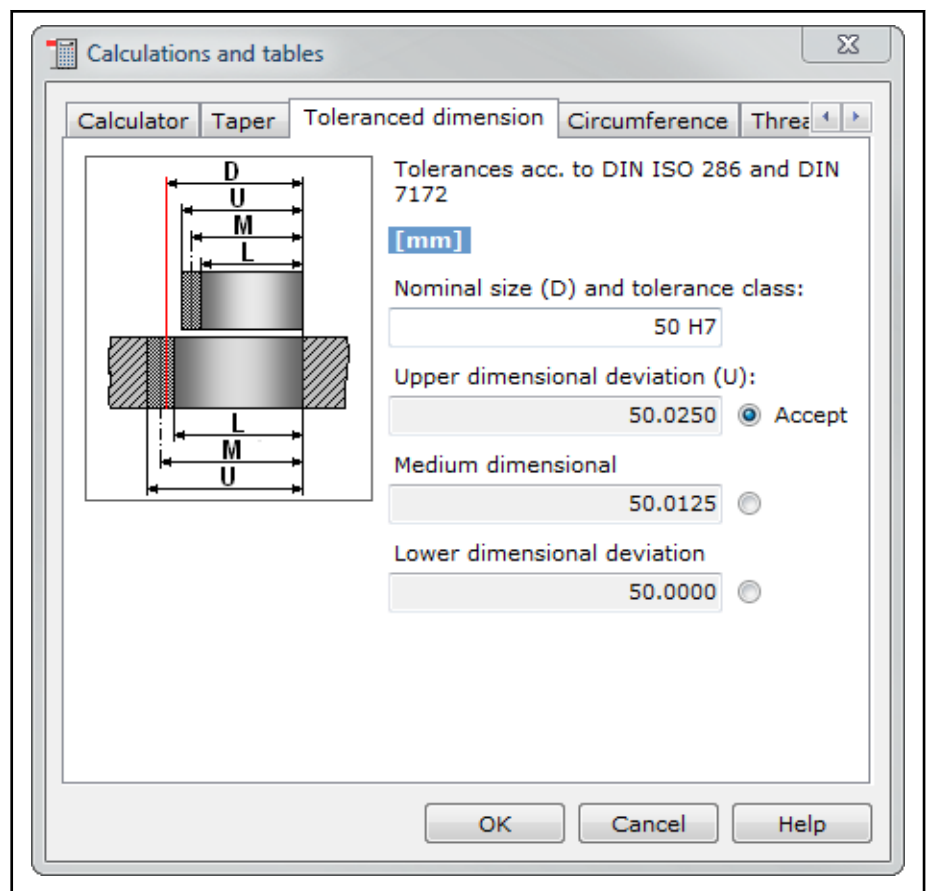


Fig. 7-19: Input assistance - Toleranced dimension

- Nominal dimension** Input of the nominal dimension in mm from 1 to 500 mm.
- Fitting** Calculate the potential result by entering the desired fitting tolerance. The selection relates to the system "uniform drilling/uniform shaft" according to DIN 7154/5 T1.
- Result** "Upper dimensional deviation", "Lower dimensional deviation" and "Medium dimensional deviation" are provided for preselection as sum of nominal dimension and tolerance.
- Cancel** Exit the process and close the dialog using <Cancel> or <Esc>.
- Apply** Press <OK> to return to the editor view and to copy the preselected result value to the last cursor position in the NC program.

7.3.6 Functions under "Tools"

NC block numbering

A starting block number can be specified. All NC blocks are renumbered with the preselected step width.

The original block numbers remain in the NC program editor if these numbers are used for targets of conditioned and unconditioned program jumps. Adapt them manually if required.

CPL block numbering

A starting block number can be specified. All NC blocks are renumbered with the preselected step width.

Tools- Step width block number...

The desired step width can be selected for automatic block numbering from 1 to 100. This applies to the numbering of NC and CPL blocks.

Automatic NC block numbering On/Off

Automatic NC block numbering is enabled or disabled. It is only effective if a program is written continuously or if blocks are inserted. NC block numbers of the current and the continuous block are used. Insert either with the preselected step width or - if there is a continuous block - with a smaller step width if required.

Automatic CPL block numbering On/Off

Automatic CPL block numbering is enabled or disabled.

It is only effective if a program is written continuously or if blocks are inserted. CPL block numbers of the current and the continuous block are used. Insert either with the preselected step width or - if there is a continuous block - with a smaller step width if required.

Options

General information

Under <Options>, make settings for the NC editor, for its integrated tools "Input support" and "Graphical NC programming" as well as for the "NC Simulation" that is directly related to the programming.

Tabs	There are four individual dialogs with tabs on which the settings or adaptations belonging together are grouped.
Operating keys	Five operating keys are provided at the bottom of the tabs. These keys are the same for all tabs.
OK	Applies all current settings and closes the dialog.
Cancel	Cancel or <Esc> discards all settings made, since the "Options" dialog was opened and all settings made since the last time the Apply button was used. The dialog is closed.
Apply	Saves all settings made so far (concerns all tabs). The settings can then not be discarded anymore.
Reset	Enables the Bosch Rexroth default settings assigned to the tab currently active.
Help	Displays the chapter belonging to the tab in the online help.
User management	All settings in the "Options" dialogs are subject to verification by user management. Settings can only be made after successful login and provided the user has the right to change the option in question. If the current user rights are insufficient, the system requests a new login.

Options - Adjust input assistance...

"Availability" tab

Settings	The availability or the hiding of the input masks can be set. The representation is given as a tree structure. Each node can either be ticked ("available") or unticked ("hidden").

The availability can be set for the following cases:

- A whole group of input masks (see "Rexroth IndraMotion MTX Commissioning", chapter "Properties of an input mask (grouping)"). All input masks assigned to this group can be completely shown or hidden. The

availability can also be set channel by channel via the context menu of the group nodes.

- An individual input mask.
- A specified channel under which the input mask is to be shown or hidden.
- A function key. All groups assigned to the F-key via the group filter are shown or hidden. The F-key nodes are only displayed after switching to the F-key view.

The input support adjustment applies to the active project (active operating station).

However, the function keys cannot be configured in this dialog. This configuration is made in IndraWorks Engineering. Refer to "IndraMotion MTX Commissioning", chapter "F-Keys of the input assistance".

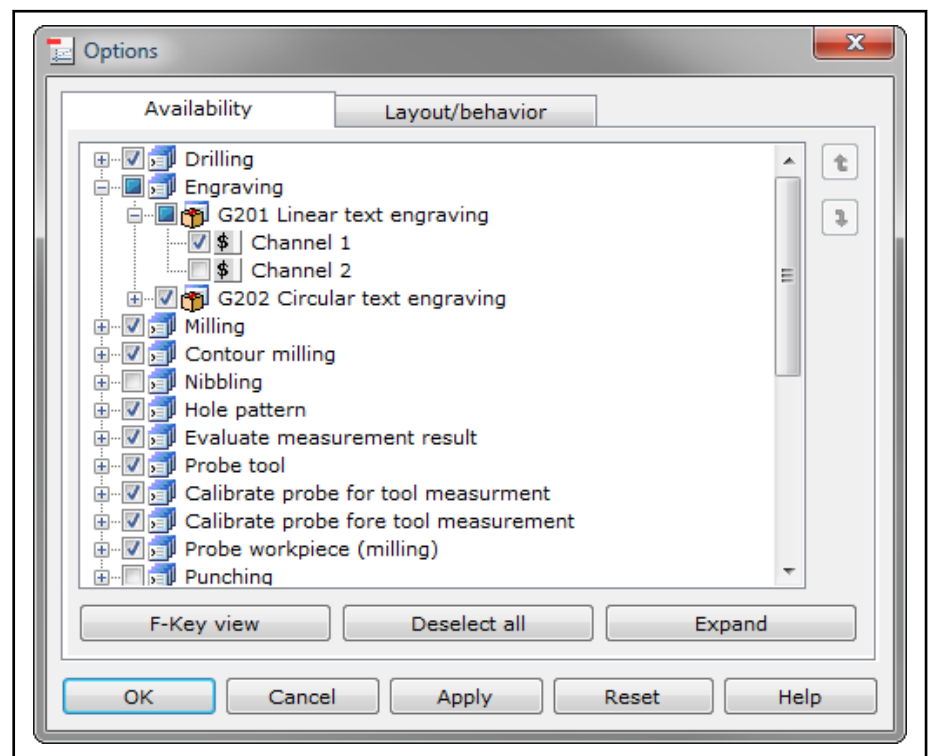


Fig. 7-20: Dialog: Adjust the input assistance ["Availability" tab (Group view)]

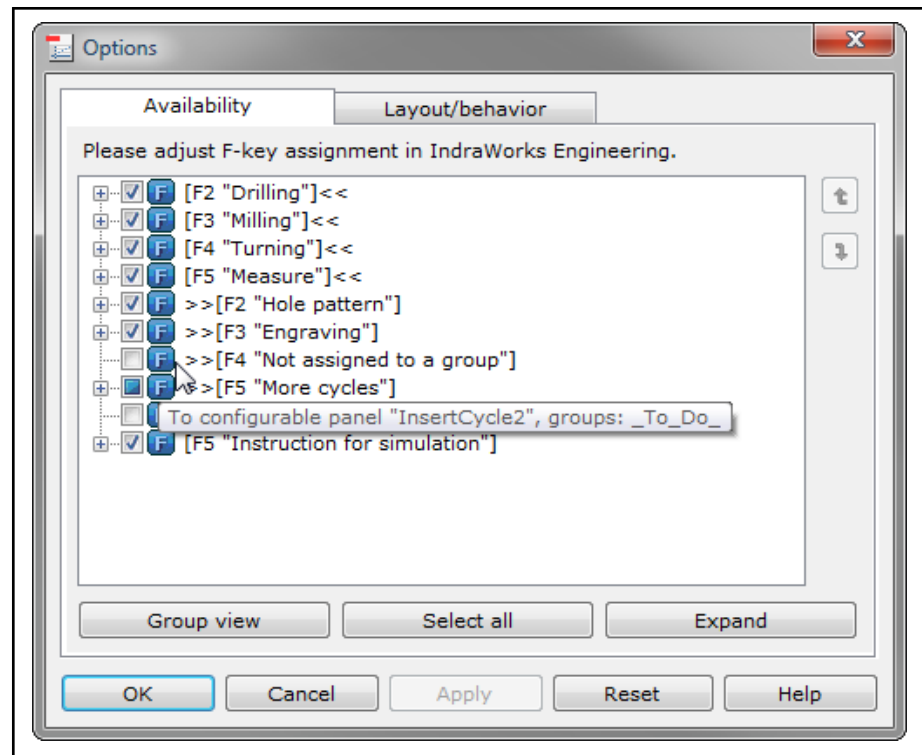


Fig. 7-21: Dialog: Adjust the input assistance ["Availability" tab (F-key view)]

Operation "Single tap" on a node to select/deselect this node and all subordinate nodes. Since the input masks are provided with a group characteristic of origin apart from the thematic/technological group, a "Single tap" also affects the other branches of the tree.

Go to the context menu of the group node for an easy channel-related hiding of a complete group.

Switch between the F-key view and group view using the keys **F-Key View** and **Group View** respectively. The F-key view shows the current menu structure.

Use the tooltips and other display elements visualizing the following information:

- F-key node: Panel name, configurability and current group filter. "<<" indicates that this F-key belongs to the left half of the menu, ">>" to the right half.
- Group node: Group name.
- Mask node: Signature. Icons with a "little man" indicate the group feature "Input mask of the user".

Select all ticks all nodes and **Deselect All** removes them again.

Expand opens all nodes **Collapse** hides all subordinate nodes.

Reset selects all input masks except GNP and examples.



- To adjust the availability of the input masks, the user right under **MTX Functions** ► **Program - NC editor** ► **Input mask selection** is sufficient.
- Backup the settings in IndraWorks Engineering. Go to **Visualization data** ► **Load changes from operating station**.

Validity of settings The new settings are applied immediately on the other tab of the dialog and they also apply for the editor when pressing **OK** or **Apply**.

"Sequence" tab

Settings The sequence, in which the input masks for insertion in the menu are listed, can be adjusted. For this purpose, all masks in a list, which are not generally hidden, are displayed. The actual sequence in the menu results from the viewing of the masks that remain due to the respective group filter and the channel-related hiding.

The set sequence within a group can also be judged in the "Availability" tab.

The input support adjustment applies to the active project (active operating station).

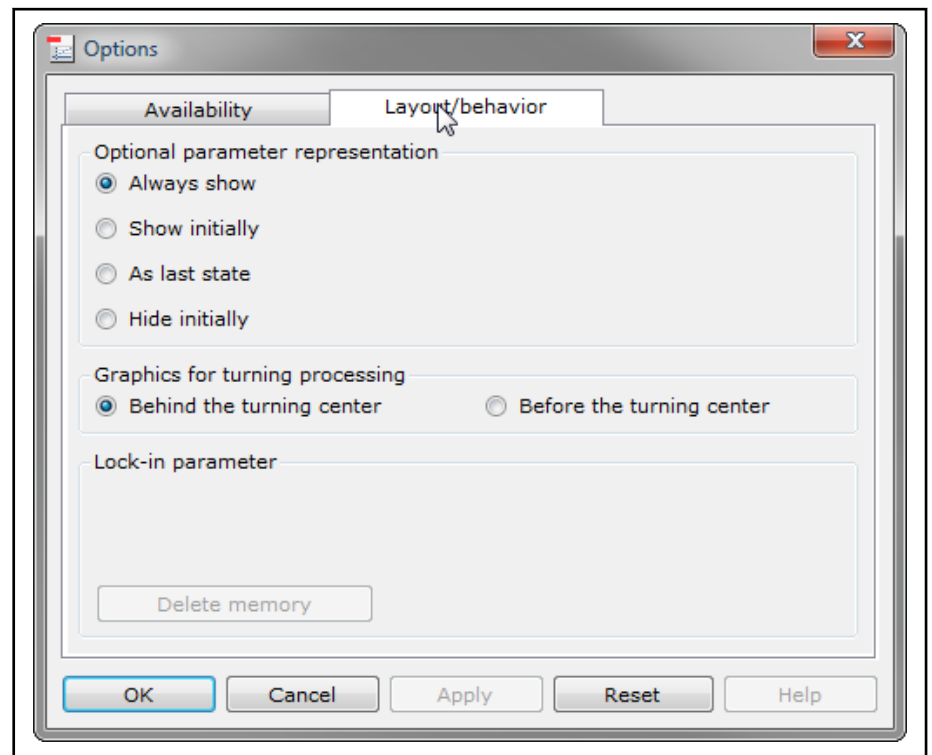


Fig. 7-22: Dialog: Adjust the input assistance ("Layout/Behavior" tab)

Operation

The two buttons with the symbols  and  move the selected input mask up or down.

Reset rearranges the signatures in alphabetical order. G- and M-commands are ascendingly sorted with regard to their numbers.



- To adjust the sequence of the input masks, the user right under **MTX Functions** ► **Program - NC editor** ► **Input mask selection** is sufficient.
- Backup the settings in IndraWorks Engineering. Go to **Visualization data** ► **Load changes from operating station**.

Validity of settings The new settings are applied immediately on the other tab of the dialog and they also apply for the editor when pressing **OK** or **Apply**.

Options - Editor options...

"Editor type" tab

Settings The criteria when to open an existing file of the NC program editor or when to use the text editor are specified on this tab. For the editor types, refer to [7.3.1 Overview, page 153](#).

The settings are assigned to the logged in Windows user.

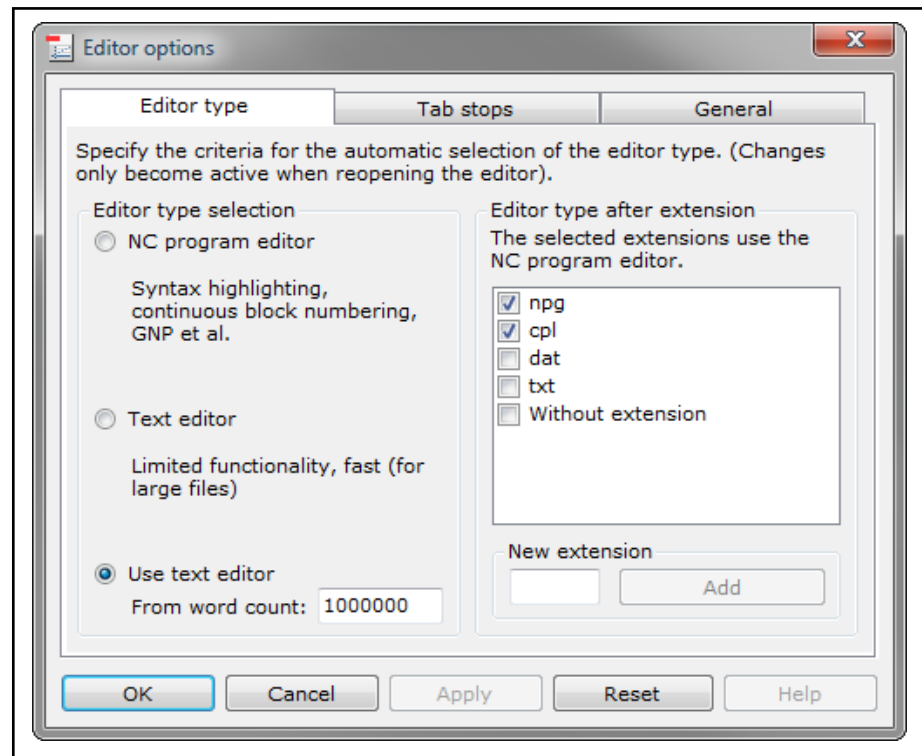


Fig. 7-23: Dialog: Editor options ("Editor type" tab)

Operation Under "Editor type selection", specify when the NC program editor is generally to be used:

- **NC program editor** enables the NC program editor if the file has a certain extension.
- **Text editor** enables the text editor in any case.
- **Use text editor from word count** enables the NC program editor if a file does not exceed a certain size and if it is provided with a certain extension. Specify the file size in the following text field.

If the text editor is not to be used exclusively, specify the number of extensions to be used for the NC program editor under "Editor type after extension". To add an extension that has not yet been displayed, enter the extension in the text field under "New extension" and click on **Add**.



To change the editor options, the user right **MTX functions ► Program - NC editor ► Edit NC program** is sufficient.

Validity of settings The new settings become only effective when opening the existing file for the next time.

"Tab stops" tab

Settings This tab defines up to ten individual tab positions. A default tab width applies for all remaining tab positions.

The settings are assigned to the logged in Windows user.

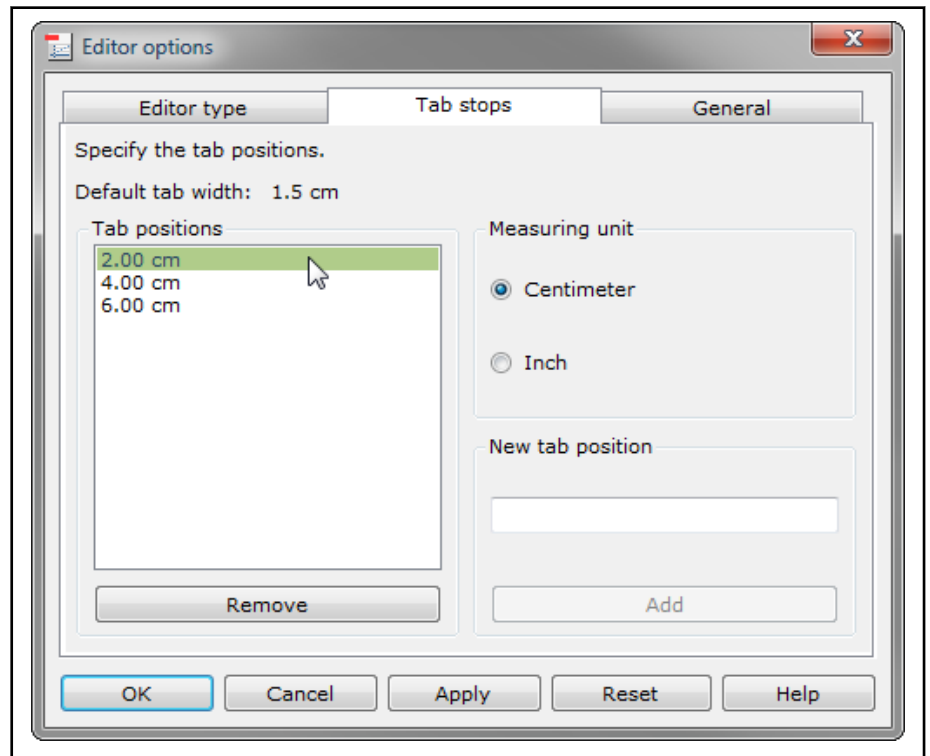


Fig. 7-24: Dialog: Editor options ("Tab stops" tab)

Operation

To add a new tab position, enter a distance in the input field under "New tab position". If required, switch to the desired measuring unit with **Centimeter** or **Inch**. Then click on **Add**.

To delete a tab position, select it and then click on **Remove**.

Reset deletes all specified positions.



To change the editor options, the user right **MTX functions ▶ Program - NC Editor ▶ Edit NC program** is sufficient.

Validity of settings

The new settings apply immediately in the current editor and in the other editors after opening them.

"General" tab

Settings

Make different settings on this tab in the following areas:

- **Bak file:** Specifies whether the editor backs up the original file content in another file before saving a file whose file name is extended with ".bak" compared to the current name.
- **Font:** A new font can be selected due to a new size or another style.
- **Block numbering:** The following has to be defined:
 - Step width
 - Starting block number of NC blocks
 - Starting block number of CPL blocks
 - Whether NC blocks are automatically numbered upon insertion (**NC blocks**)
 - Whether CPL blocks are automatically numbered at insertion (**CPL blocks**)

The settings are assigned to the logged in Windows user.

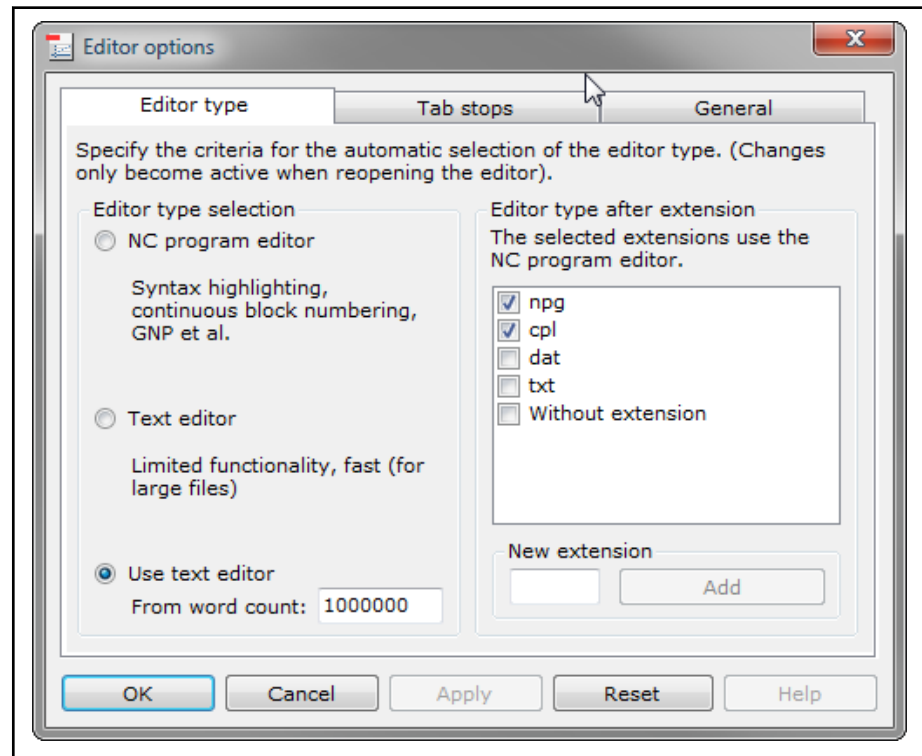


Fig. 7-25: Editor options - "General" tab



To adjust the sequence of the input masks, the user right under **MTX Functions ► Program - NC editor ► Edit NC program** is sufficient.

Validity of settings

The new settings apply immediately in the current editor and in the other editors after opening them.

The block numbers and the step widths are initial values when renumbering. They are not overwritten while renumbering (see entries under [7.3.6 Functions under tools, page 163](#)).

7.3.7 Online help: NC programming instructions

Open the online help with <F1>.

Finding a help chapter

It is searched for a section in the help that correlates with the word (rules on word separation according to the NC syntax) at the cursor position. If the cursor position points to a parameter list, it is tried to find the call name on the left of the parameter list. To avoid the algorithm to determine a keyword, the text to be found had to be highlighted before.

If the word searched for cannot be found, an introduction chapter of the programming manual is displayed. The manual search for the desired information can start from there.

7.3.8 Interruption of the connection

If the connection to the control system is interrupted, all NC Editors are closed. If edited data has not been saved at this point in time, the files are saved on the hard disk under the same name (including the path) in the directory "c:\SaveXXXXXXXX". XXXXXXXX stands for the abbreviation of the current date (year/month/day).

Example:

Save20050614 corresponds to the 14th of June 2005. After the connection has been restored, the saved files can be copied to a mount directory of the control system using the Windows Explorer.

7.4 Variable editor

7.4.1 Overview

Variable editor

The variable editor visualizes the following variables:

- Permanent variables (@)
- Definable permanent variables (@@)
- System data (SD)

Screen layout

Structure

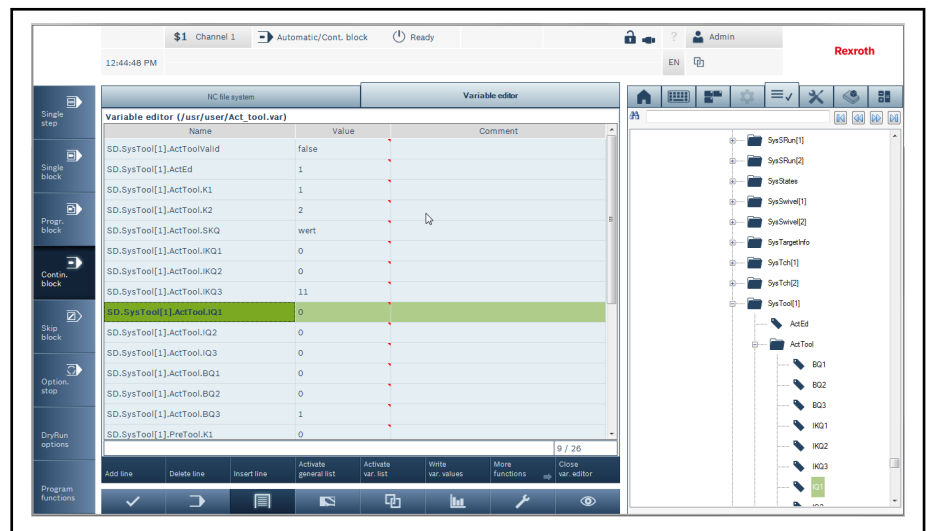


Fig. 7-26: Variable editor

The variable editor consists of the columns "Name", "Value" and "Comment".

In the "Edit online" mode under the operating area "Machine" <OP3>, the columns "Name", "Value" (control), "Value" (list) and comment are displayed.

Header

In the header, it is distinguished between:

- "Variablen editor"
 - Freely editable list in the operating area "Program" <OP4> and in the mode "Edit online" under the operating area "Machine" <OP3>.
- "Variable list"
 - Only the variable values can be edited under the operating area "Machine" <OP3>. No variables can be added or deleted.

Either the list name including the path specification is displayed in brackets or when displaying the list of all variables in the "Complete list".

Main area

The variables are displayed in a list in the main area of the variable editor.

Variable lists

List storage and list access

There are two types of variable lists:

- Display of all variables in the system (complete list).
- Display of a self-defined subset of variables

Display of all variables

An internal list of all existing variables is created. The list is displayed in the "Machine" <OP3> operating area.

Display of a subset of variables

If a subset of the existing variables is to be displayed, a list of variables is first created.

It is called in the operating area "Program" <OP4>, F-key <New>, F-key <Variable list>.

A self-edited list can be stored in the file system of the control.

If the list should be declared as "active list", there are the following options:

- In case of an opened list via the F-key <Activate variable list>
- Select the list in the MTX-Navigator and via the F-keys <F7>"Variable functions", <F3> "Activate variable list".

A variable list is declared as active if it communicates with the control and displays its current values.

The data type of a list can be identified by the file extension of the list name (*.var).



The active list is opened (all or some variables) by default in the operating area "Machine" <OP4> with the F-key <Active variables>.

7.4.2 Operating active list

Value entry

Navigation and cell selection

To enter a variable value, the desired entry cell of the value first has to be selected as follows:

- By "Single tap" in the line
- Navigate with the <cursor> keys until the desired cell is selected

The selected cell has a dark green background color.

Editing values

Starting the edit mode

Switch to the editing mode of the selected cell with one of the following actions:

- Enter a value or a character using the keyboard
- Press <Enter>
- "Double tap" on the cell

A flashing input cursor in the respective cell indicates the editing mode.

Applying a value Apply an edited value with one of the following actions:

- Press <Enter>
- Press <Tab>.
- Pressing a <Cursor> key
- "Single tap" in another cell

In the variable list, under the "Machine" <OP3> operating area, the entered value is directly written into the control after the value was applied.



If an incorrect value is entered, an error message is displayed in the status line and the selected cell remains in the editing mode. The entered value can be discarded or written again after the correction.

Discarding value entry The editing mode can be closed any time with <Esc>.
The original value is retained in the list.

Function keys in the active variable list

Overview

The following table lists all functions of the active variable list under the operating area "Machine" <OP3>:

F-keypad level	<F2>	<F3>	<F4>	<F5>	<F6>	<F7>	<F8>	<F9>
First main level	<i>File</i>	<i>Edit online*</i>		Activating complete list	Update SD structures**	Options... **	<i>More functions</i>	End variable list
Second main plane	Save system data	Load system data		Default column division			Back	
File		Open...	Save*	Save as...**	Print...		Exit all var. editors	Back
Edit online *	Add line	Delete line	Insert line	Copy	Paste			Complete editing

* This function is not provided when displaying all variables (complete list)

** This function is only provided when displaying all variables (complete list)

Tab. 7-2: *Function keys in the active variable list*

F-keys first main level All functions of the first main level <F2>, <F3> and <F8>, have a subordinate F-keypad in which additional subfunctions are grouped.

<F5> The current list is closed and opened in the complete list.

The complete list is the active variable list.

<F6> If new variables were defined or variable definitions were modified, this function must be executed again.

<F7> An "Options" dialog is opened.

Here, the variable types to be displayed can be specified.

The settings in the "Options" only influence the complete list.

The selected variable types are displayed in the header.

<F9> The variable list is closed.

		If a comment was edited or the list was changed in the "Edit online" mode, the dialog Save is called.
F-keys second main level	<F2>	All SD variables are updated and saved. The storage location is selected via a "Save as" dialog. The file has the extension "*.sds". This allows loading these saved values back into the control system at a later point in time.
	<F3>	Load a saved SD variable file into the control. It is selected via an Open dialog.
	<F5>	If the column division was changed, this function can restore the original division.
	<F8>	It is returned to the first main level.
F-keypad level "File"	<F3>	An already edited variable list can be opened via an Open dialog. Thus, it becomes the active variable list.
	<F4>	The current list is saved after the query about the current control values. The variable editor remains open.
	<F5>	The current list including the current control values can be saved under a different name. The variable list remains open. A Save as... dialog opens that can be used to navigate correspondingly.
		Edited comments are saved.
		The functions "Save" and "Save As..." are not available if the complete list is displayed.
F-keypad level "Edit online"	<F6>	The active list can be printed. Before printing, all the variables in the list are updated. The name, value and comment columns are printed.
	<F8>	All open variables are closed.
	<F9>	It is returned to the first main level.
	<F2>	A new line is added at the end of the list.
	<F3>	The line selected is removed.
	<F4>	A new line is inserted behind the selected line.
	<F5>	The content of the selected cell is copied into the clipboard.
	<F6>	The content of the clipboard is inserted into the selected cell.
	<F9>	The "Edit online" mode is closed. A query is sent whether the list should be saved. Select whether the control values or the list values should be saved.

Function keys in the variable editor

Overview

The following table lists all the functions of the variable editor:

F-key level	<F2>	<F3>	<F4>	<F5>	<F6>	<F7>	<F8>	<F9>
First main level	Add line	Delete line	Insert line	Activating complete list	Activate variable list	Write variable values	<i>More functions</i>	Close variable editor
Second main plane	<i>File</i>			Default column division	Apply value from control		Back	Close variable editor
File	New...	Open...	Save	Save as...	Print...		Exit all variable editors	Back

Tab. 7-3: Function keys in the variable editor

F-keys first main level	The function of the first main level <F8> has a subordinate F-keypad in which additional subfunctions are grouped. <F2> A new line is added at the end of the list. <F3> The line selected is removed. <F4> A new line is inserted behind the selected line. <F5> The current list is closed and the complete list becomes the active variable list. <F6> The current list is closed and becomes the active variable list. <F7> After confirming a prompt, the values of the opened list are transferred to the control. In case of error, a list with the occurring errors is displayed. If no error occurs, a respective note is displayed in the status line. <F9> Data that has not been saved is saved after the "Save" prompt. If a newly edited file is exited, the Save as... dialog opens after the "Save query" has been answered. It is possible to navigate the desired storage location.
F-keys second main level	The function of the first main level <F2> has a subordinate F-keypad in which additional subfunctions are grouped. <F5> If the column division was changed, this function can restore the original division. <F6> The current variable value is read from the control and entered under "Value" in the list for the selected line of the list. <F8> It is returned to the first main level. <F9> Data that has not been saved is saved after the "Save" prompt. If a newly edited file is exited, the Save as... dialog opens after the "Save query" has been answered. It is possible to navigate the desired storage location.
F-keypad level "File"	<F3> An already edited variable list can be opened via an Open dialog. Thus, it becomes the active variable list. <F4> The current list is saved after the query about the current control values. The variable editor remains open. <F5> The current list including the current control values can be saved under a different name. The variable list remains open. A Save as... dialog opens that can be used to navigate correspondingly. Edited comments are saved.



The functions "Save" and "Save As..." are not available if the complete list is displayed.

<F6>

The active list can be printed. Before printing, all the variables in the list are updated. The name, value and comment columns are printed.

<F8>

All open variables are closed.

<F9>

It is returned to the first main level.

Define new line

To add a new CPL variable or system variable, a variable browser is provided in the additional operating area. This variable browser is always displayed in the additional operating area after a variable list call.

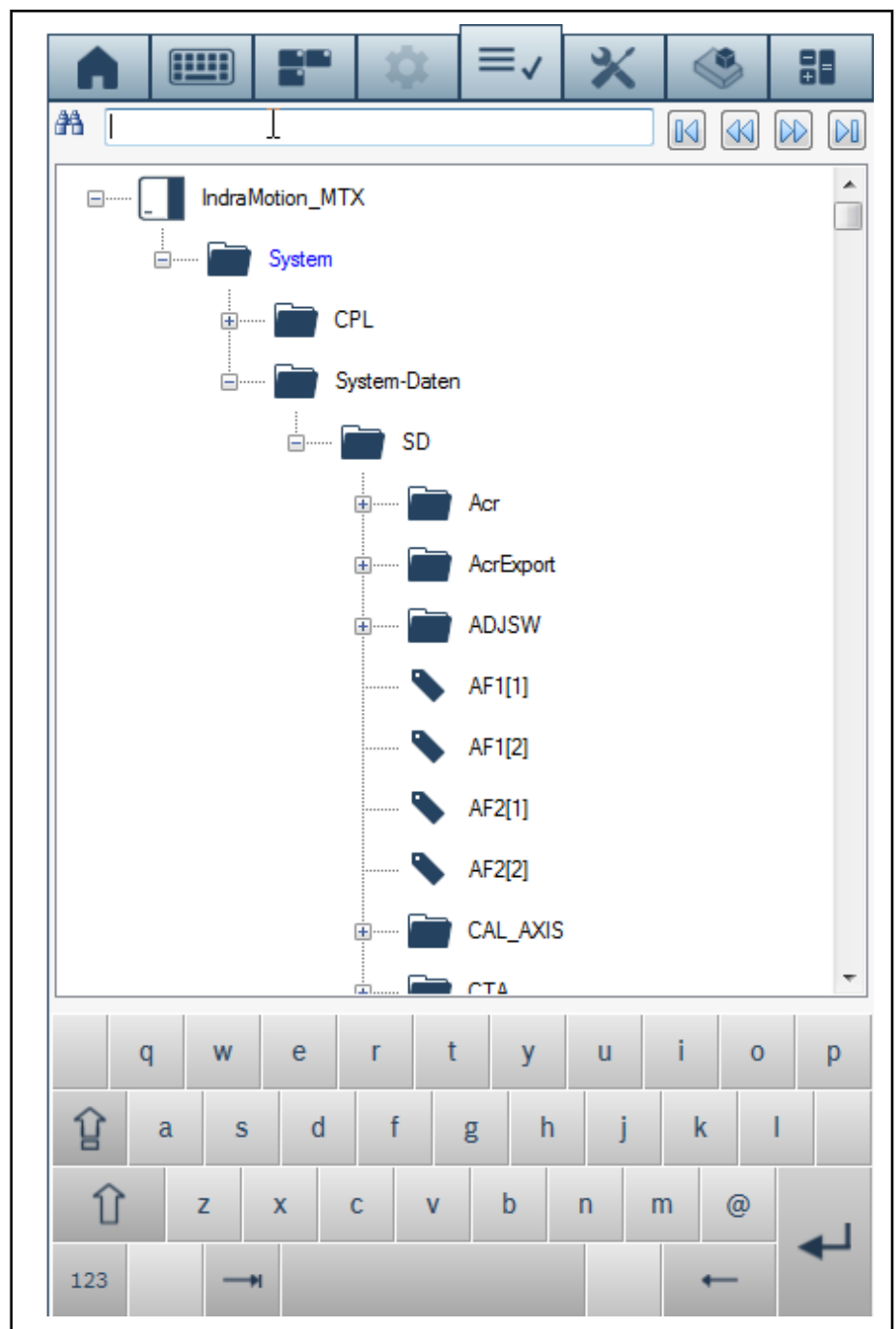


Fig. 7-27: Variable browser in the additional operating area

An input field to define a string is contained in the upper part of the variable browser. The four keys next to it are used to navigate the variable tree, based on the entered string.

Calling the variable editor

Opening an existing variable list

Calling from the MTX-Navigator

Any existing variable list can be opened via the MTX-Navigator in the operating area "Program" <OP4>.

1. Call the MTX-Navigator in the operating area "Program" <OP4>.

2. Open the desired variable list (file extension ".var") as follows:
 - "Double tap" on the list name
 - Select the list name and press <F6>
 - Select the list name and use the context menu to select the menu item "Edit"
 - Select the list name and press <Enter>.

The selected variable list is opened in the variable editor.

Calling the variable editor

Any existing variable list can be directly opened from an already started variable editor.

1. Press <F8> to switch to the 2nd main level and press <F2> to switch to the file functions.
2. Press the <F3> function key.
A dialog opens in which the desired variable list can be selected.
3. Confirm the selection of the variable list with "OK".

Another variable list editor with the selected variable list opens.

Creating a new variable list

Calling from the MTX-Navigator

1. Select the directory in which the new variable list is to be created in the MTX-Navigator using touch gestures or via the <Cursor> keys.
2. Press <F2 New> and then <F6> in the sublevel of the F-keypad or select the menu item **New, Variable list** in the context menu.

A dialog for creating a new variable list opens.

Calling the variable editor

1. Press <F8> to switch to the 2nd main level and press <F2> to switch to the file functions.
2. Press <F2>.
3. Enter the name of the variable list.
By default, an automatically generated list name is shown "VAR_ <DateStamp>" (year/month/day_hour/minute_second).
4. Close the dialog with "OK".

A variable list is created and opened in the variable list editor.

Activating a list using the Navigator

It is possible to use the navigator to quickly activate a variable list. Navigate to a file with the extension "*.var" and press the F-key "Variable functions". The required function can be called in the subsequent level.

It is differentiated between:

- Activating complete list
The complete list is activated. When changing to the operating area "Machine", this list is displayed by pressing the F-key "Active variables".
- Activate variable list
The selected list is activated. When switching to the "Machine" operating area, this list is displayed by pressing the F-key "Active variables".
- Write variable values

After confirming a prompt, the values of the selected list are transferred to the control.

In case of error, a list with the occurring errors is displayed.

If no error occurs, a respective note is displayed in the status line.

Configuring functions to quickly activate variable lists

The configuration of fast functions to quickly activate variable lists is carried out in IndraWorks Engineering (commissioning). The functions can be applied to both F-keys and M-keys. To do this, the "Variables" function is assigned to one key. Either a path or a specific list can be entered in text field "Path or list name". If only one list is entered, it is displayed as soon as the key is pressed. If a path is entered, a list of all the variable lists existing in this path is shown when the key is pressed. When a list is selected, it is immediately displayed.

Interruption of connection

If the connection to the control is interrupted, all variable editors are closed. If edited data has not been saved at this point in time, the files are saved on the hard disk under the same name (including the path) in the directory

"c:\SaveXXXXXXXX".

"XXXXXXXX" stands for the abbreviation of the current date (year/month/day).

Example:

20050614 corresponds to June 14, 2005.

After the connection has been restored, the saved files can be copied to a mount directory of the control using the Windows Explorer.

7.5 Editor to define SD variables

7.5.1 Use

This application is used to comfortably define SD variables. The variable definition is stored in files of type "SDDefxxx.xml".

The defined variables are available in the control if the definition files are saved in one of these directories:

- Root directory of the control
- /feprom
- /usrfep

Changes in definition files become only active upon an NC restart.

Integration of the editor to define SD variables in the operating desktop

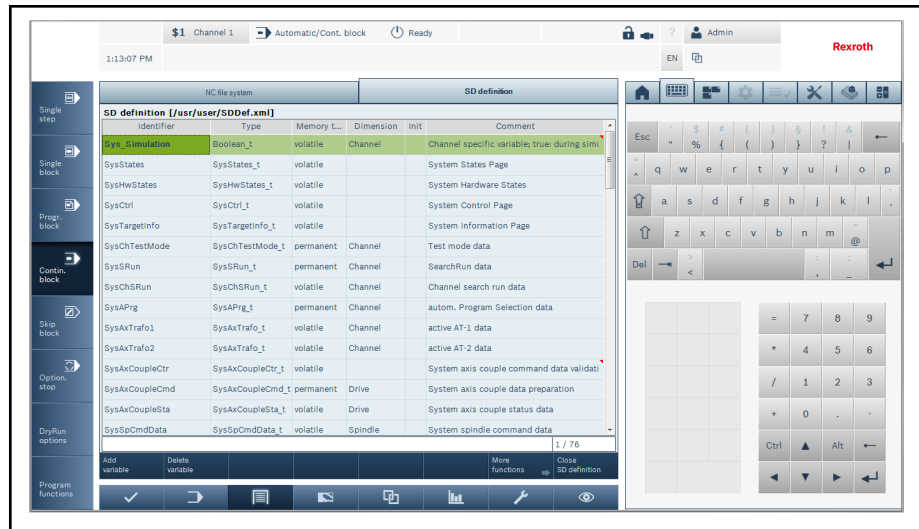


Fig. 7-28: Integration of the definition of SD variables in the operating desktop

The display is an application with an individual F-key assignment.

Menu and title are hidden.

The editor to define SD variables is assigned to the operating area "<OP4> Program". The call can also be carried out via the MTX-Navigator.

- Open existing file:
 - Select SDDefxxx.xml with <cursor> keys, <F6> "Edit"
 - "Double tap" on the "SDDefxxx.xml" file
- Create new file:
 - Select directory, <F2 New> "New", <F8> "More functions", <F3> "SD definition"
 - Context menu of the directory ("Touch and hold"), New, SD definition

7.5.2 General structure of the editor to define SD variables

Editor structure

SD definition [/feprom/SDDef.xml]					
Identifier	Type	Memory t...	Dimension	Init	Comment
Sys_Simulation	Boolean_t	volatile	Channel		Channel specific variable; true: during simu
SysStates	SysStates_t	volatile			System States Page
SysHwStates	SysHwStates_t	volatile			System Hardware States
SysCtrl	SysCtrl_t	volatile			System Control Page
SysTargetInfo	SysTargetInfo_t	volatile			System Information Page
SysChTestMode	SysChTestMode_t	permanent	Channel		Test mode data
SysSRun	SysSRun_t	permanent	Channel		SearchRun data
SysChSRun	SysChSRun_t	volatile	Channel		Channel search run data
SysAPrg	SysAPrg_t	permanent	Channel	X	autom. Program Selection data
SysAxTrafo1	SysAxTrafo_t	volatile	Channel		active AT-1 data
SysAxTrafo2	SysAxTrafo_t	volatile	Channel		active AT-2 data
SysAxCoupleCtr	SysAxCoupleCtr_t	volatile			System axis couple command data validati
SysAxCoupleCmd	SysAxCoupleCmd_t	permanent	Drive		System axis couple data preparation
SysAxCoupleSta	SysAxCoupleSta_t	volatile	Drive		System axis couple status data
SysSpCmdData	SysSpCmdData_t	volatile	Spindle		System spindle command data

Fig. 7-29: Editor structure

The editor consists of a list with six columns:

- Identifier
- Type
- Memory type
- Dimension
- Init
- Comment

Input options in the individual columns

Each column has its individual input options. There are freely editable input fields and predefined selection lists.

- Identifier
 - Freely editable SD variable name
- Type
 - Selection from a list of all data types defined in the schema files
- Memory type
 - Selection between volatile and permanent
- Dimension
 - Selection between Channel, Drive and Spindle
 - Freely editable dimension
- Init (no entry)
 - Information whether there is an initialization value defined for the variable in the "SDdatxxx.xml" file
- Comment
 - Freely editable comment

More information

If there is further information on cell contents, the cell is marked with a red triangle. The information is displayed when "Touching and holding" or selecting the cell with the <cursor> keys via tooltips.

Two options for further information:

- Text for column width too long

SysAxSRun	SysAxSRun_t	volatile	Drive	Channel axis search run data	
SysMaxEd	SysMaxEd_t	volatile	Drive	Max. number of tool edges for HMI	Comment: Image of NC-kernel tool correction data (read only)
SysTool	SysTool_t	permanent	Channel	Active tool, active edge and prepared tool	
SysToolEd	SysToolEd_t	volatile	16,Channel	Image of NC-kernel tool correction data (r...	

Fig. 7-30: Text for column width too long

- Display of the initialization values in the "Init" column

SysChSpActData	SysChSpActData_t	volatile	Channel	Channel channel spindle actual data	
SysChSpSRun	SysChSpSRun_t	volatile	Channel	data	Init: /feprom/SDDat.xml SD.SysMaxEd.MaxEd=2
SysAxSRun	SysAxSRun_t	volatile	Drive	Channel axis search run data	
SysMaxEd	SysMaxEd_t	volatile	Drive	Max. number of tool edges for HMI	

Fig. 7-31: Display of the initialization value

Error display

Already defined variables referring to a type that is not available in the schema files anymore are colored in red. If the incorrect line is focused, an error message is displayed in the status line.

SD definition [/usr/user/SDDef.xml]					
Identifier	Type	Memory t...	Dimension	Init	Comment
SysNcBehav	SysNcBehav_t	permanent			Control data for general channel indepen...
SysSwivel	SysSwivel_t	permanent	Channel		Data of cycle G230 Swiveling
SysCorrRefrDis	UnsignedInt_t	permanent			Disables mtx corrections refresh logic
SysDisCyBlkWrn	Int_t	permanent			Disables cycle time warning
SysTouchTL	SysTouchTool_t	permanent			Werkzeug-/Nullpunktantasten
SysTouchZP	SysTouchZP_t	permanent			Werkzeug-/Nullpunktantasten
SysSercCfgInfo	SysSercCfgInfo_t	permanent			Checksum of sercos Config. File
SysScsDevice	SysScsDevice_t	volatile	315		List of connected sercos devices
SysScsIpAdr	SysScsIpAdr_t	permanent			IP address MTX and subnet
SysScsDrPar	SysScsDrPar_t	permanent	Drive		Sercos drive parameter settings for auto...
SysTch	TCH_t	permanent	Channel		Variablendefinition MTX-Werkzeugwechse..
SysRipStack	SysRipStack_t	volatile			Size of Rawipo-Stack
SysSimProg	SimProg_t	permanent	Channel		Interaction between simulation and NC p...
SysSDForce	SysSDForce_t	permanent			Control structure for single and repeated ..
myTest_1	SysCtrlLock_t	permanent			
Type "SysCtrlLock_t" not defined!					77 / 77

Fig. 7-32: Type not defined

7.5.3 Operation and navigation

It is operated via F-keys and cursor keys.

The cursor keys are used to navigate between the cells within the list.

Focused editable cells are dark green

An editable cell becomes an input field by:

- Entering a value
- Press <Enter>
- "Double tap"

F-keypad level	<F2>	<F3>	<F4>	<F5>	<F6>	<F7>	<F8>	<F9>
First main level	Add variable	Delete variable					More functions	Close SD definition
Second main plane	File						Back	
File			Save	Save as...	Print...			Back

Tab. 7-4: Function keys in the SD definition editor

F-keys first main level

All functions of the first main level <F8>, have a subordinate F-keypad in which additional subfunctions are grouped.

- <F2> A new variable is added at the end of the list
- <F3> The selected variable is removed
- <F9> The editor is closed

F-keys second main level

The functions of the second main level <F2>, have a subordinate F-keypad in which additional subfunctions are grouped.

- <F8> It is returned to the first main level

F-keypad level "File"

- <F4> The current list is saved after the query about the current control values. The variable editor remains open

- <F5>** The current list can be saved under a different name. The variable list remains open. A **Save as...** dialog opens that can be used to navigate correspondingly
- <F6>** The active list can be printed. The following columns are printed: Name, value and comment
- <F9>** It is returned to the second main level

Close, save, NC restart

When closing the application, the file is saved after prompt. If the list is incomplete, an error box is displayed and the incorrect lines are colored in red.

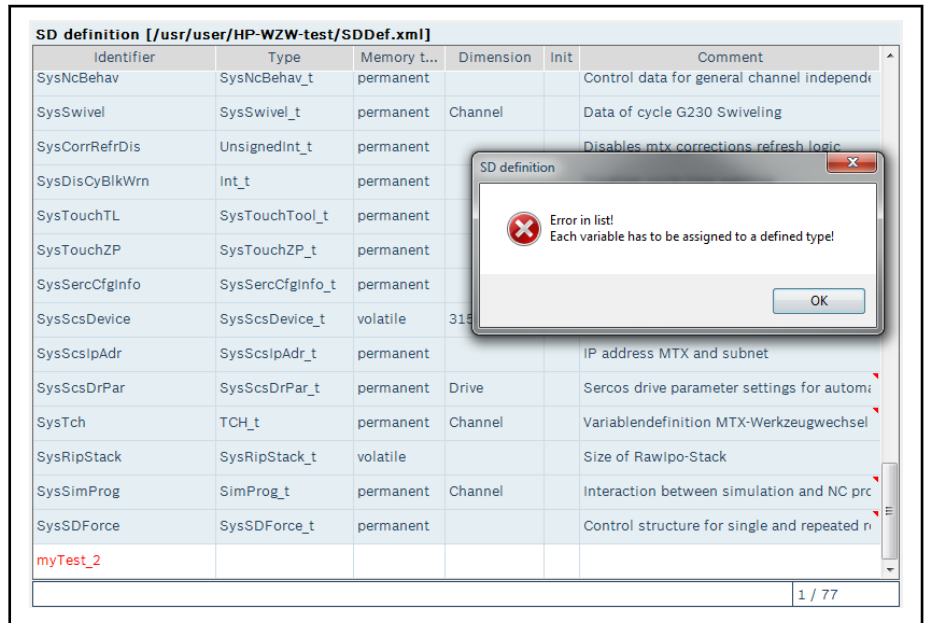


Fig. 7-33: List incorrect

Since changes in the SDDef file only become active after an NC restart, the NC restart is automatically provided after saving the file.

"Save As" dialog

To save the file under a different name or under a different directory, use the dialog **Save As**.

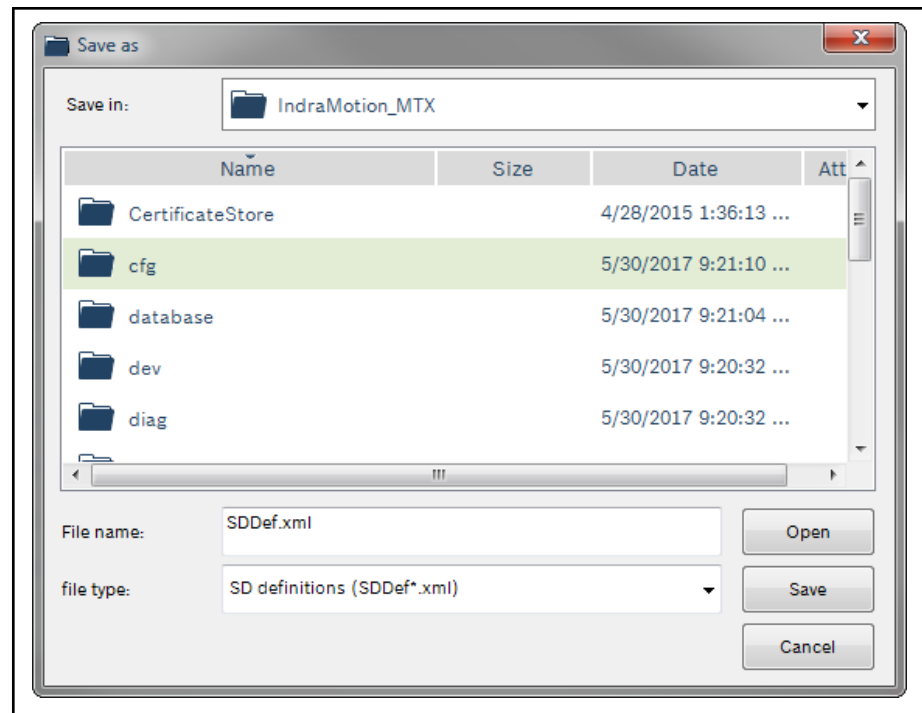


Fig. 7-34: Save As...

7.6 D-corrections, zero offsets and placements

7.6.1 Overview

Editors for NC Data

The acronym "Table editors" summarizes the editors of the following NC data types:

- D-corrections
- Zero offsets
- Placements

Table editors are used to visualize and enter correction data of the individual NC data tables.

Screen layout

Structure

All table editors have a similar screen layout and similar operation.

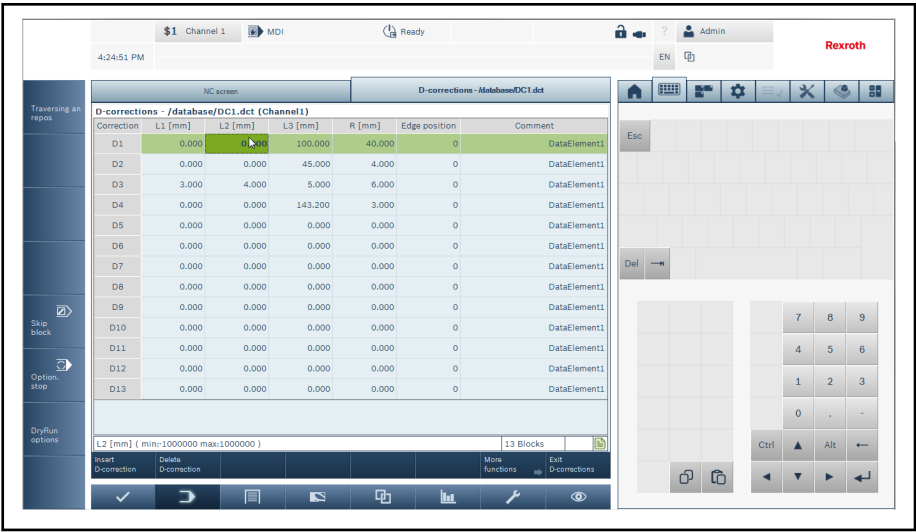


Fig. 7-35: Screen layout of a table editor

Title line

The title line displays the name of the table editor used, the directory and the file name of the table.

Main area

Correction values of an NC data table can be displayed and modified in the main area of the table editor.

The correction blocks of an NC data table are displayed in the lines of the table and the respective values of a correction block are shown in the columns of the table.

Status line



Fig. 7-36: Status line in the table editor

The status line of the table editors is divided into various areas:

- Information area
- Number of data blocks
- Additive value input
- Table active
- List of open windows in this operating area
- Current language

Info area

By default, the info area displays the table name including the path specification for the open table. Information texts and error messages can also be displayed during operation.

Number of data blocks

The number of displayed correction data blocks is shown in the second array.

Additive value input

The mode "Additive value input" is indicated in the third array by the text "ADD" (see [chapter "Additive value input" on page 187](#)).

Table active

A green symbol in the fourth status field indicates the active table. Otherwise, the symbol is gray.



The fields "Open windows" and "Current language" are assigned by the system.

NC data tables

File storage and file access

NC data tables are stored in the file system of the NC kernel. The table editors directly access the tables in the NC kernel. If correction values are modified using the table editor, these modifications are immediately written to the corresponding table in the NC kernel.

If correction values in the NC data tables are modified (e.g. using the CPL program), all table editors currently accessing the corresponding NC data table are notified. This ensures that the table editors always show the current correction values.



Values written to the active table are valid for the next access of the NC block preparation.

Table templates

A table template for each data type is in the "/database/" directory. These tables are used to generate additional NC data tables.



If no other NC data table has been activated using an NC program, the table templates are active.

Data type	Template
D-corrections (.dct)	/database/DC1.dct
Zero offsets (.zot)	/database/ZO1.zot
Placements (.pmt)	/database/PM1.pmt

Tab. 7-5: Table templates

Table names

The data type of a table can be determined based on the file extension of the table name.

Data type	File extension
D-corrections	Dct (D correction table)
Zero offsets	Zot (z ero o ffset table)
Placements	Pmt (p lacement table)

Tab. 7-6: File extensions of tables

7.6.2 Operating Value input

Navigating and selecting cells

To enter a correction value, the desired entry cell of the value first has to be selected as follows:

- "Single tap" in the cell
- Navigate with the <cursor> keys until the desired cell is selected
- Navigate via F-keys

The selected cell has a dark green background color.

Editing values

Start editing mode Switch to the editing mode of the selected cell with one of the following actions:

- Enter a value or a character using the keyboard
- Press <Enter>
- "Double tap" on the cell

A flashing input cursor in the respective cell indicates the editing mode.

Applying a value Apply an edited value with one of the following actions:

- Press <Enter>
- Press <Tab>
- Press a <Cursor> key
- "Single tap" in another cell

After applying the value, the entered value is directly written to the NC data table in the NC kernel.



If an incorrect value is entered, an error message is displayed in the status line and the selected cell remains in the editing mode. The entry can be cancelled or the value can be written again after the input correction.

Canceling value input Cancel the editing mode at any time as follows:

Pressing <Esc>.

The original value is retained in the table.

Additive value input

The "Additive value input" mode is used to enter correction values added to the existing value.

Activating or deactivating the additive value input

The "Additive value input" can be enabled and disabled in the additional operating area in the "Properties" tab.

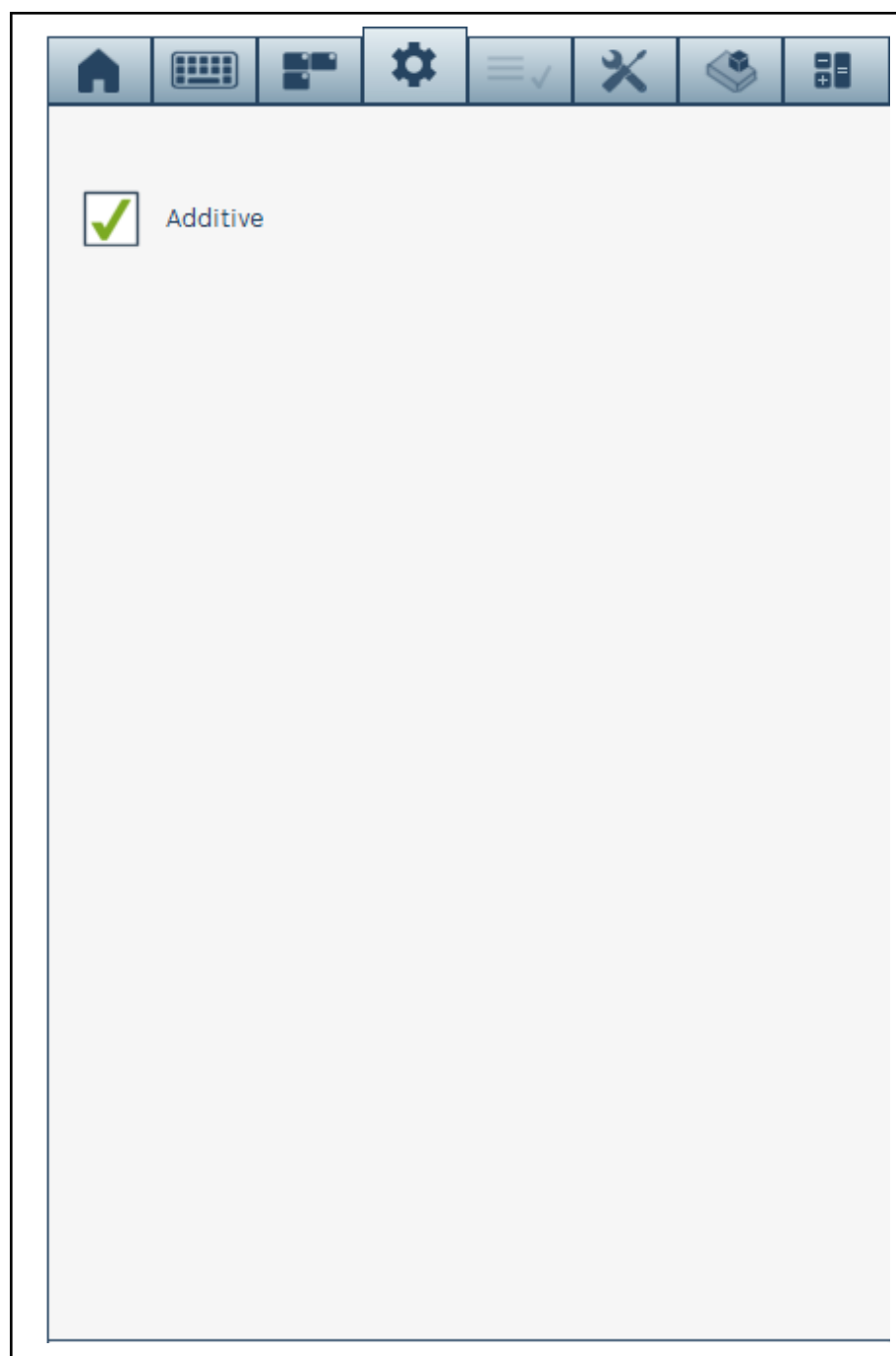


Fig. 7-37: Setting "Additive" in the additional operating area



The "Additive value input" is not intended for all cells. Whether "Additive value input" is active for the selected cell is indicated by the text "ADD" in the status line.

Subtracting values

To subtract a value from an existing value, enter a value with a leading minus sign when "Additive value input" is active.

Arithmetic operations

Simple arithmetic operations with several levels of parentheses can also be carried out when entering data in the "Additive value input" mode.

7.6.3 Zero point offsets

General information on zero offsets

The zero offset editor is used for visualization and to enter the zero point values of individual axes. A comment with a maximum of 32 characters can be assigned to each correction value. If the offset applies to a specific channel only, this is displayed in an additional title line.

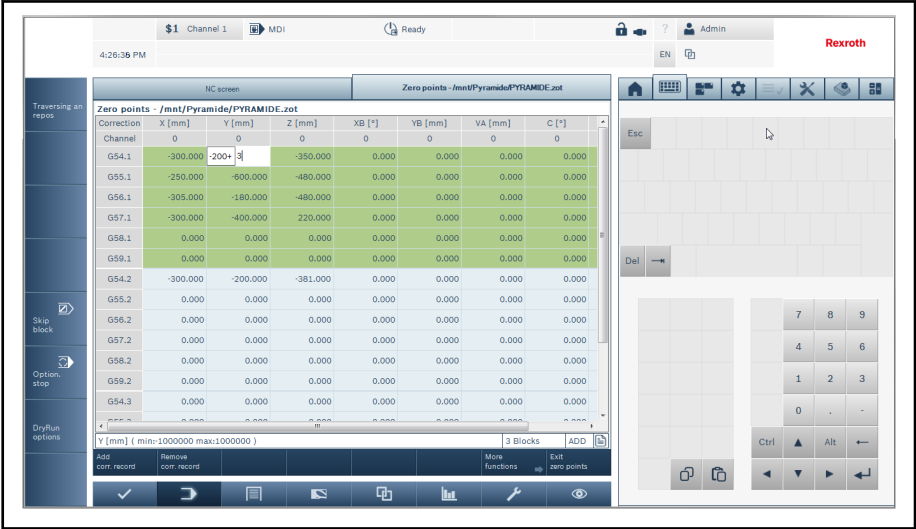


Fig. 7-38: Zero offset editor

- Number of correction banks** A zero offset table can contain a maximum of 5 correction records, each of which contains offset values G54.x to G59.x.
- Axes** A zero offset table can contain a maximum of 64 axes.
- Measuring unit of the table (mm/ inch)** The measuring unit of a zero offset table can be detected by the column headers of the axes ([mm] or [inch] for linear axes, [°] for rotary axes).



The measuring unit of a zero offset table is already determined from parameter 9020 00010 of the configuration data during the creation of the table and is stored with the table.
- Number of decimal places** The number of decimal points displayed is specified by the parameters 6020 00021 and 6020 00022 in the configuration data.

Zero offset editor

Operating the zero offset editor

Only the functions that affect the zero offset editor are described here. The general operation of a table editor is described in [chapter 7.6.2 "Operating" on page 186](#).

Function keys in the zero offset editor

The following table shows all function keys of the zero offset editor:

F-keypad level	<F2>	<F3>	<F4>	<F5>	<F6>	<F7>	<F8>	<F9>
First main level	Add correction record	Remove correction record					<i>More functions</i>	Exit zero points
Second main plane	<i>File</i>					<i>Tools</i>	Back	Exit zero points
File	New...	Open...		Save as...	Print...		Exit zero offsets	Back
Tools	Insert axis...	Delete axis	Edit axis...					Back

Tab. 7-7: Function keys in the zero offset editor

F-keys first main level All functions of the first main level <F8>, have a subordinate F-keypad in which additional subfunctions are grouped.

<F2> A new correction record is added at the end of the list.

<F3> The selected correction record is removed.

<F8> The second main level is called.

<F9> The editor is closed.

F-keys second main level The functions of the second main level <F2>, have a subordinate F-keypad in which additional subfunctions are grouped.

<F2> The "File" level is called.

<F8> It is returned to the first main level.

F-keypad level "File" <F2> This is used to create a new table and to display it in a new table editor. Amongst other things, a name for the new table has to be entered in a dialog .

<F3> This is used to open a new table editor with the given table name.

<F5> The current table can be saved under a different name. In doing so, the table editor remains open. A **Save as...** dialog opens to navigate correspondingly.

<F6> The print dialog for printing the current table is opened.

<F9> It is returned to the second main level.

F keys "Tools" level <F2> The dialog to insert a new axis is called.
 <F3> The dialog to delete the selected axis is called.
 <F4> The dialog to edit the selected axis is called.
 <F9> It is returned to the second main level.

Calling the zero offset editor

Open existing zero offset table Open any existing zero offset table in the operating area "Program OP4" using the MTX-Navigator or directly from an already started zero offset editor.

To open a zero offset table from the MTX-Navigator:

1. Call the MTX-Navigator in the operating area "Program OP4".
2. Open the desired zero offset table (file ending .zot) as follows:
 - "Double tap" on the table name
 - Select the table name and press <F6 Edit>

- Select the table name and select the menu item **Edit** via the context menu.
- Select the table name and press <Enter>

The selected zero offset table opens in the zero offset editor.

To open an existing zero offset table from an already started zero offset editor:

1. Press <F8> to switch to the second F-keypad level and click on <F2 File...> to switch to the file functions.
2. Press <F3 Open....>.

A dialog opens in which the desired zero offset table can be selected.

3. Confirm the selection of the zero offset table with "OK".

Another zero offset editor with the selected zero point table opens.

Opening active zero offset table

The active zero offset table can be opened via the NC screen in the operating area "Machine <OP3>".

1. Open NC screen in the operating area "Machine <OP3>".
2. Press <F5 Active zero points>.

The zero offset editor with the active zero offset table opens.



If no zero offset table is active, a corresponding message is displayed in the status line of the NC screen.

Creating a new zero offset table

Create a new zero offset table either using the MTX-Navigator or via an already open zero offset editor. By default, a newly created zero offset table has one correction record.

Calling from the MTX Navigator

1. Select the directory, in which the new zero offset table is to be created, in the MTX Navigator using touch gestures or the cursor keys.
 2. Press <F2 New> and <F7 Zero offsets> in the sublevel of the F-keypad.
- or -

Select the menu item **New ► Zero offsets** in the context menu.

A dialog (see [fig. 7-39 "Dialog to create a new zero offset table" on page 192](#)) opens to create a new zero offset table (continue with point 3).

Calling from the zero offset editor

1. Press <F8> to switch to the second F-keypad level and press <F2 File...> to switch to the file functions.
2. Press the <F2 New...> key.

A dialog opens to create a new zero offset table (see [fig. 7-39 "Dialog to create a new zero offset table" on page 192](#)).

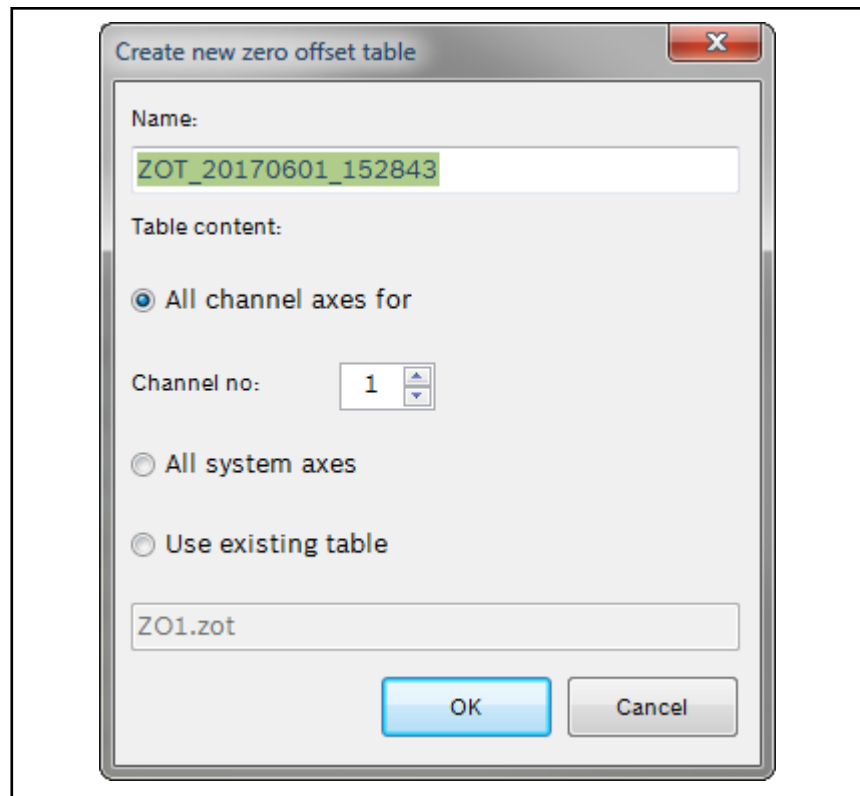


Fig. 7-39: Dialog to create a new zero offset table

The following options are available when creating a new zero offset table:

- All channel axes of a channel (Channel assignment):
A zero offset table with the axes of the selected channel is created.
 - All system axes (Assignment for all axes):
The created zero offset table contains all the configured axes of the system.
 - Using an existing table (template):
Any zero offset table can be specified as template to create a new table.
3. Enter the name of the zero offset table. An automatically generated table name is displayed as default
 4. If several channels are configured, select the desired channel with the "Channel axes" selection field.
- or -
 - Select "system axes"
 - or -
 - Use an existing table as template for a new table (see ["Using table templates" on page 192](#))
 5. Close the dialog with "OK".

A zero offset table with the selected configuration is created and opened in the zero offset editor.

Using table templates Proceed as follows to use any zero offset table as template:

1. Open the **New** dialog (see [fig. 7-39 "Dialog to create a new zero offset table" on page 192](#)) as described above.
2. If necessary, enter a new name for the zero offset table.
3. Select "Template" in the **New** dialog.

The input field for the name of the template (default: "ZO1.zot") is enabled. If the default "ZO1.zot" is not used, a name with the path specification of another zero offset table can be entered. If a table name is entered without path specification, it is searched for the template in the path "/database".

4. Confirm entry with "OK".

The new table opens in the zero offset editor. The number of correction banks and correction values is applied from the given template.

Functions on the main level of the zero offset editor

<F2 Add correction record>

<F2 Insert correction record> can be used to add new zero point data blocks to the table. New data blocks are attached at the end of the table.



Zero offset data blocks are continuously numbered (correction record 1-5).

<F3 Remove correction record>

<F3 Remove correction record> removes the last zero offset data block.

Additive value input

"Additive value input" can be used to enter correction values to be added to the existing value (see [chapter "Value input" on page 186](#)).

Menu: Tools

<F2 Insert axis>

<F2 Insert axis> inserts a new axis at any location.

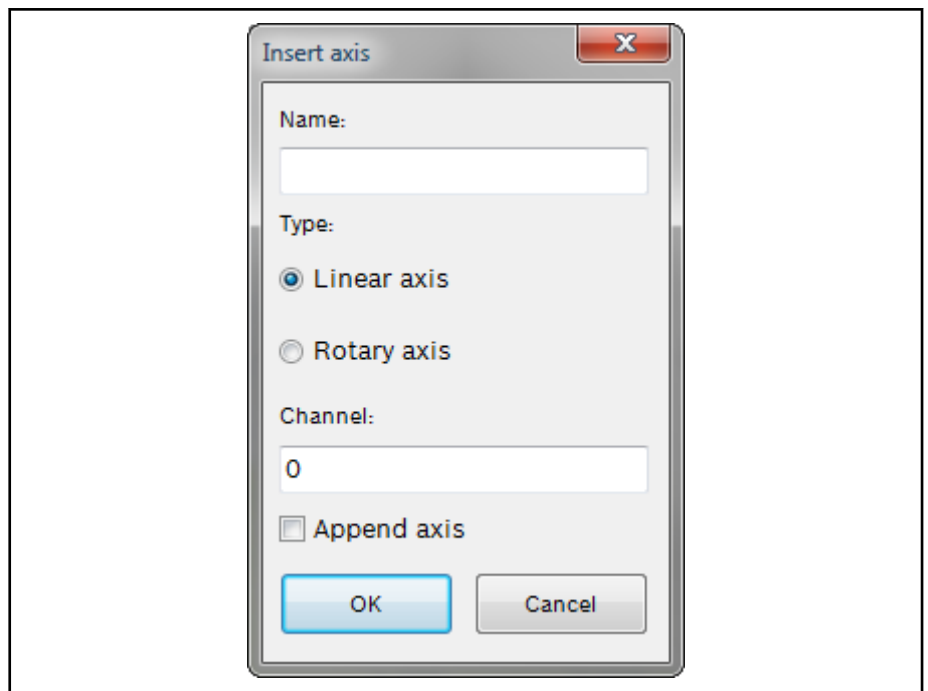


Fig. 7-40: Dialog to insert a new axis

1. Select the axis in front of which the new axis is to be inserted (i.e. any cell of the axis has to be selected).
2. Press <F2 Insert axis>.

The selected axis is highlighted. The dialog **Insert Axis** opens (see [fig. 7-40 "Dialog to insert a new axis" on page 193](#)).

3. Enter the axis name (maximum of eight characters).
4. Select the axis type "Linear axis" or "Rotary axis".
5. Specify a special channel ("0" for all) if necessary.
6. If the axis is to be attached, select "Attach axis" as well.
7. Complete the entry with "Ok".

The new axis is inserted according to the settings.



- To attach the new axis at the end, select any cell.
- Cancel the **Insert axis** dialog at any time with <Cancel>.

<F3 Delete axis>

Deletes an axis from the zero offset table.

1. Select the desired axis (i.e. any cell of the axis has to be selected).
2. Press the <F3 Delete axis> key.

The selected axis is highlighted and a safety prompt about the deletion of the axis is displayed.

3. Confirm deletion with "Yes".

The selected axis is deleted.

- or -

Cancel deletion with "No".

The "Delete axis" function is cancelled.

<F4 Edit axis>

Change axis name and axis type of an axis with <F4 Axis>.

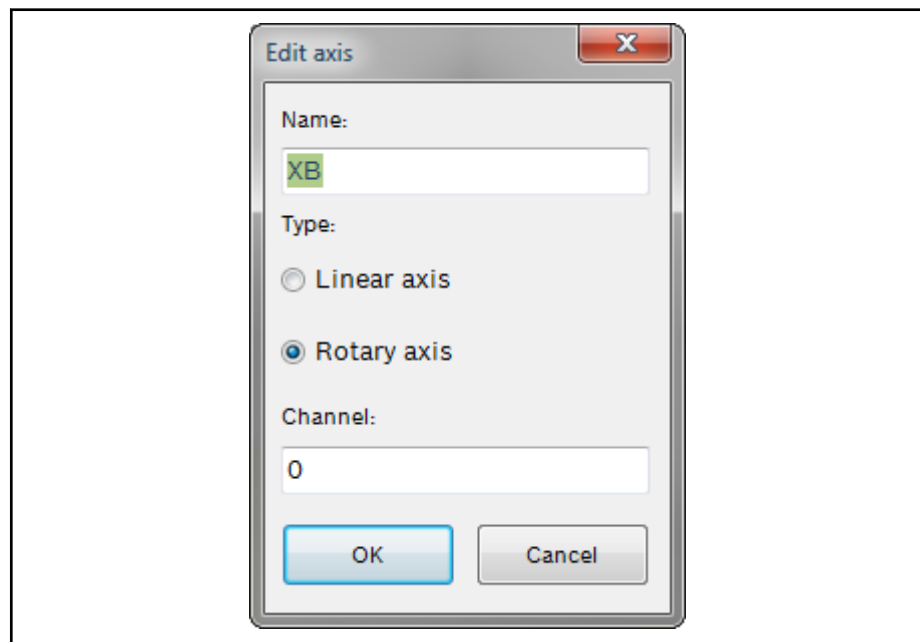


Fig. 7-41: Dialog to edit an axis

1. Select the desired axis (i.e. any cell of the axis has to be selected).
2. Press <F4 Edit axis>.

The selected axis is highlighted and a dialog **Edit axis** to change axis name and axis type is displayed (see [fig. 7-41 "Dialog to edit an axis" on page 194](#)).

- 3. Edit the axis name if necessary.
 - 4. Select a new axis type if necessary.
 - 5. Specify a special channel ("0" for all) if necessary.
 - 6. Complete the editing with "OK".
- Changes to the axis become immediately visible in the table.



Cancel the "Edit axis" dialog at any time with "Cancel".

7.6.4 D-corrections

General information on D-corrections

The D-correction editor can display and change the length correction values L1, L2, L3, the radius correction value R and the edge position for the various D-correction data blocks. In addition, a comment with a maximum of 32 characters can be assigned to each correction block.

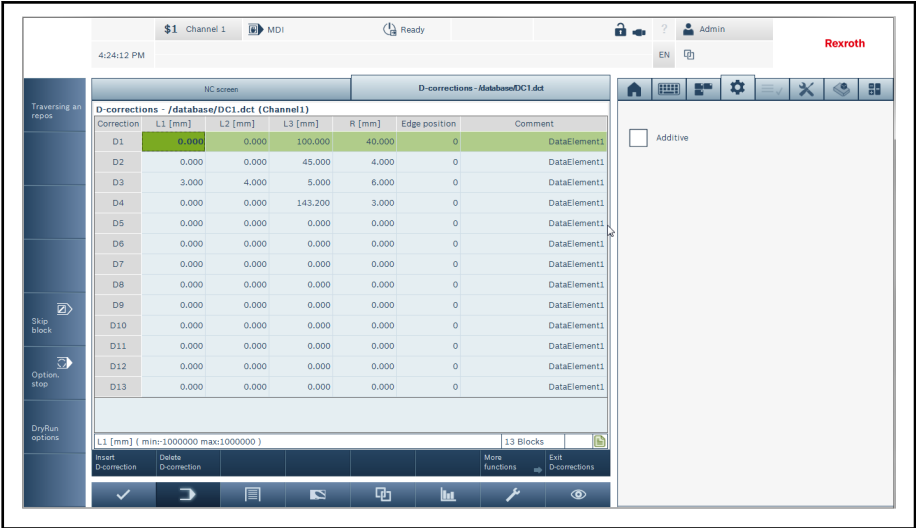


Fig. 7-42: D-correction editor

Number of correction blocks

A D-correction table can contain a maximum of 99 D-correction data blocks (D1-D99). The number of D-correction tables is unlimited.

Measuring unit of the table (mm/ inch)

The measuring unit of a D-correction table can be determined based on the column headers of L1, L2, L3 and R ([mm] or [inch]).



The measuring unit of a D-correction table is already determined from the parameter 9020 00010 of the configuration data during the creation of the table and is stored with the table.

Number of decimal places

The number of decimal points displayed is specified by the parameters 6020 00021 and 6020 00022 in the configuration data.

Operating the D-correction editor

General information

Only the functions affecting the D-correction editor are described. The general operation of a table editor is described in [chapter 7.6.2 "Operating" on page 186](#).

Function keys in the D-correction editor

The following table shows all function keys of the D-correction editor:

F-keypad level	<F2>	<F3>	<F4>	<F5>	<F6>	<F7>	<F8>	<F9>
First main level	Add correction block	Remove correction block					<i>More functions</i>	Complete D-corrections
Second main plane	<i>File</i>						Back	Complete D-corrections
File	New...	Open...		Save as...	Print...		Complete all D-corrections	Back

Tab. 7-8: Function keys in the D-correction editor

F-keys first main level

All functions of the first main level <F8>, have a subordinate F-keypad in which additional subfunctions are grouped.

- <F2> A new correction data block is added at the end of the list
- <F3> The selected correction data block is removed
- <F8> The second main level is called.
- <F9> The editor is closed

F-keys second main level

The functions of the second main level <F2>, have a subordinate F-keypad in which additional subfunctions are grouped.

- <F2> The "File" level is called.
- <F8> It is returned to the first main level.

F-keypad level "File"

- <F2> This is used to create a new table and to display it in a new table editor. Amongst other things, a name for the new table has to be entered in a dialog
- <F3> This is used to open a new table editor with the specified table name
- <F5> The current table can be saved under a different name. In doing so, the table editor remains open. A **Save as...** dialog opens that can be used to navigate correspondingly
- <F6> The print dialog for printing the current table is opened
- <F9> It is returned to the second main level.

Calling the D-correction editor**Open existing D-correction table**

Open any existing D-correction table in the operating area "Program OP4" via the MTX-Navigator or directly from an already started D-correction editor.

To open a D-correction table from the MTX-Navigator:

1. Call the MTX-Navigator in the operating area "Program <OP4>".
2. Open the desired D-correction table (file extension.dct) as follows:
 - "Double tap" on table name.
 - or -
 - Select the table name and press <F6 Edit>.
 - or -
 - Select the table name and select the menu item **Edit** via the context menu.
 - or -

Select table name and press <Enter>.

The selected D-correction table opens in the D-correction editor.

To open an existing D-correction table from an already started D-correction editor:

1. Press <F8> to switch to the second F-keypad level and click on <F2 File...> to switch to the file functions.
2. Press <F3 Open....>.

A dialog opens to select the desired D-correction table.

3. Confirm the selection of the D-correction table with "OK".

Another D-correction editor with the selected D-correction table opens.

Opening active D-correction table

The active D-correction table can be opened via the NC screen in the "Machine<OP3>" operating area.

1. Open NC screen in the "Machine <OP3>" operating area.
2. Press the <F6 Active D-corrections> key.

The D-correction editor with the active D-correction table opens.



If no D-correction table is active, a message is displayed in the status bar of the NC screen.

Creating a new D-correction table

Create a new D-correction table either via the MTX Navigator or an already open D-correction editor. A newly created D-correction table has one D-correction "D1" by default. Alternatively, any D-correction table can be used as template to create a new table.

Calling from the MTX Navigator

1. Directory in which the new D-correction table is to be generated. Select the directory in the MTX-Navigator using touch gestures or the <Cursor>keys.
2. Press <F2 New> and then <F6 D-corrections> in the sublevel of the F-keypad.

- or -

Select the menu item **New ► D-Corrections** in the context menu.

A dialog (see [fig. 7-43 "Dialog to create new D-correction table" on page 198](#)) opens to create a new D-correction table (continue with point 3).

Calling from the D-correction editor

1. Press <F8> to switch to the second F-keypad level and click on <F2 File...> to switch to the file functions.
2. Press the <F2 New...> key.

A dialog opens to create creating a new D-correction table (see [fig. 7-43 "Dialog to create new D-correction table" on page 198](#)).

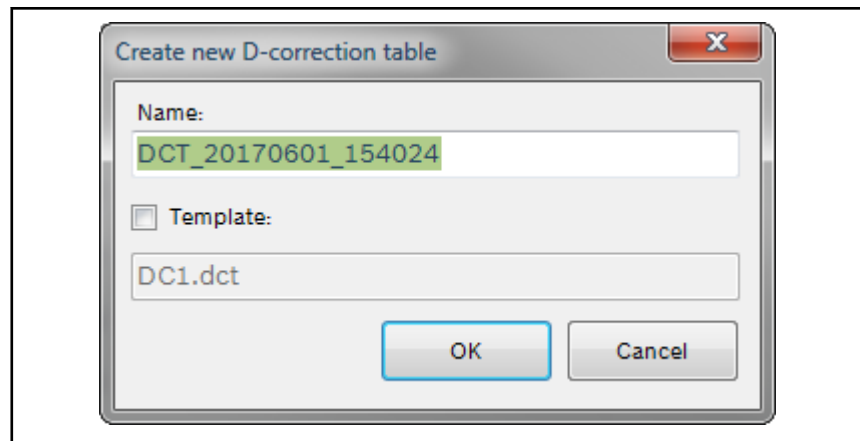


Fig. 7-43: Dialog to create new D-correction table

3. Enter the name of the D-correction table. An automatically generated table name is displayed as default
4. Close the dialog with "OK".

A D-correction table is created and opened in the D-correction editor.

Using table templates

Proceed as follows to use any D-correction table as template:

1. Open the **New** dialog (see [fig. 7-43 "Dialog to create new D-correction table" on page 198](#)) as described above.
2. If required, enter a new name for the D-correction table.
3. Select "Template" in the **New** dialog.

The input field for the name of the template (default: "DC1.dct") is enabled. If the default template "DC1.dct" is not to be used, a name including the path specification of another D-correction table can be entered.

If a table name is entered without path specification, it is searched for the template in the path "/database".

4. Confirm entry with "OK".

The new table opens in the D-correction editor. The number of D-correction blocks and D-correction values is assumed from the given template.

Functions on the main level of the D-correction editor

<F2 Insert correction block>

With <F2 Insert correction block>, new D-correction data blocks can be added. New data blocks are attached at the end of the table.



D-correction data blocks are assigned continuously (D1-D99).

<F3 Remove correction block>

<F3 Delete correction bank> is used to remove the last placement data block.

Additive value input

<Additive value input> can be used to enter D-correction values added to the existing value (see [section chapter "Value input" on page 186](#)).

7.6.5 Placements

General information on placements

The placement editor is used to display and enter offset values (X, Y, Z) and turning angles (phi, theta, psi). A comment with a maximum of 32 characters can be assigned to each correction value.

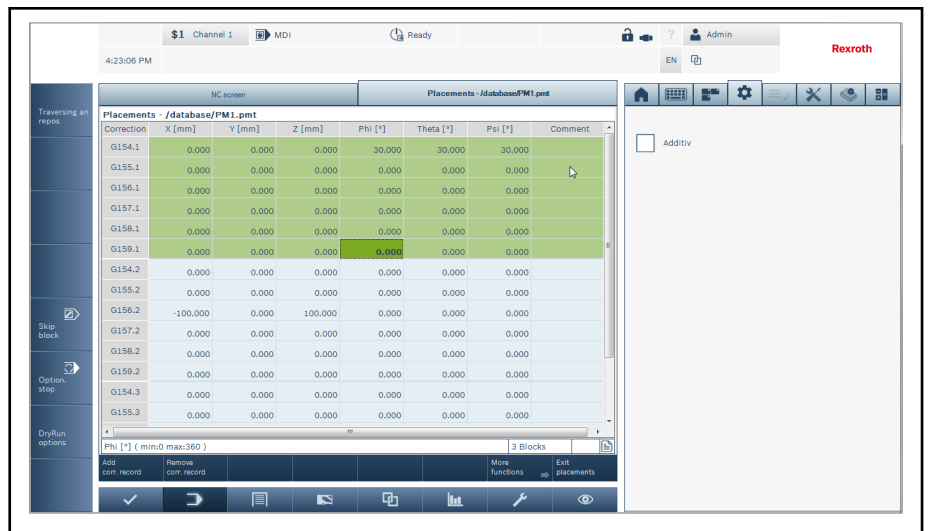


Fig. 7-44: Placement editor

Number of correction banks

A placement table can contain a maximum of five correction records, each of which contains offset values G154.x to G159.x.

Measuring unit of the table (mm/ inch)

The measuring unit of a placement table can be determined based on the column headers of X, Y and Z ([mm] or [inch]). The turning angles phi, theta and psi have the unit [°].



The measuring unit of a D-correction table is already determined from the parameter 9020 00010 of the configuration data during the creation of the table and it is stored with the table.

Number of decimal points

The number of decimal points displayed is specified by the parameters 6020 00021 and 6020 00022 in the configuration data.

Operating the placement editor**General information**

Only the functions affecting the placement editor are described. The general operation of a table editor is described in [chapter 7.6.2 "Operating" on page 186](#).

Function keys in the placement editor

The following table shows all function keys of the placement editor:

F-keypad level	<F2>	<F3>	<F4>	<F5>	<F6>	<F7>	<F8>	<F9>
First main level	Add correction record	Remove correction record					More functions	Exit placements
Second main plane	File						Back	Exit placements
File	New...	Open...		Save as...	Print...		Exit all placements	Back

Tab. 7-9: Function keys in the placement editor

F-keys first main level

All functions of the first main level <F8>, have a subordinate F-keypad in which additional subfunctions are grouped.

<F2>

A new correction record is added at the end of the list

	<F3>	The selected correction record is removed.
	<F8>	The second main level is called.
	<F9>	The editor is closed
F-keys second main level		The functions of the second main level <F2>, have a subordinate F-keypad in which additional subfunctions are grouped.
	<F2>	The "File" level is called.
	<F8>	It is returned to the first main level
F-keypad level "File"	<F2>	This is used to create a new table and to display it in a new table editor. Amongst other things, a name for the new table has to be entered in a dialog
	<F3>	This is used to open a new table editor with the specified table name
	<F5>	The current table can be saved under a different name. In doing so, the table editor remains open. A Save as... dialog opens that can be used to navigate correspondingly
	<F6>	The print dialog for printing the current table is opened
	<F9>	It is returned to the second main level

Calling the placement editor

Opening existing placement table

Open any existing placement table in the operating area "Program <OP4>" via the MTX-Navigator or directly from an already started placement editor.

To open a placement table from the MTX-Navigator:

1. Call the MTX-Navigator in the operating area "Program <OP4>".
2. Open the desired placement table (file extension.pmt) as follows:
 - "Double tap" on table name.
- or -
 - Select the table name and press <F6 Edit>.
- or -
 - Select the table name and select the menu item **Edit** via the context menu.
- or -
 - Select the table name and press <Enter>.

The new placement table is opened in the placement editor.

To open an existing placement table from an already started placement editor:

A second placement editor with the selected placement table opens.



If the entered name of the placement table does not exist, a corresponding error message is displayed in the status line.

Opening active placement table

Open the active placement table via the NC screen in the operating area "Machine <OP3>" via a key to be configured by the user.

1. Open NC screen in the "Machine <OP3>" operating area.
2. Press <Fx Active placements>.

The placement editor with the active placement table opens.



If no placement table is active, a corresponding message is displayed in the status line of the NC screen.

Changes in the placements become only active after reselection of the placement table or after program restart.

Creating a new placement table

Create a new placement table either via the MTX Navigator or via an already open placement editor. By default, a newly created placement table has one correction record. Alternatively, any placement table can be used as template to create a new table.

Calling from the MTX Navigator

1. Select the directory in which the new placement table is to be created in the MTX-Navigator using touch gestures or via the cursor keys.
2. Press <F2 New> and then <F8 Placements> in the sublevel of the F-keypad.

- or -

Select the menu item **New ► Placements** in the context menu.

A dialog opens (see [fig. 7-45 "Dialog to create a new placement table" on page 201](#)) to create a new placement table (continue with point 3).

Calling from the placement editor

1. Press <F8> to switch to the second F-keypad level and press <F2 File...> to switch to the file functions.
2. Press the <F2 New...> key.

A dialog opens to create a new placement table (see [fig. 7-45 "Dialog to create a new placement table" on page 201](#)).

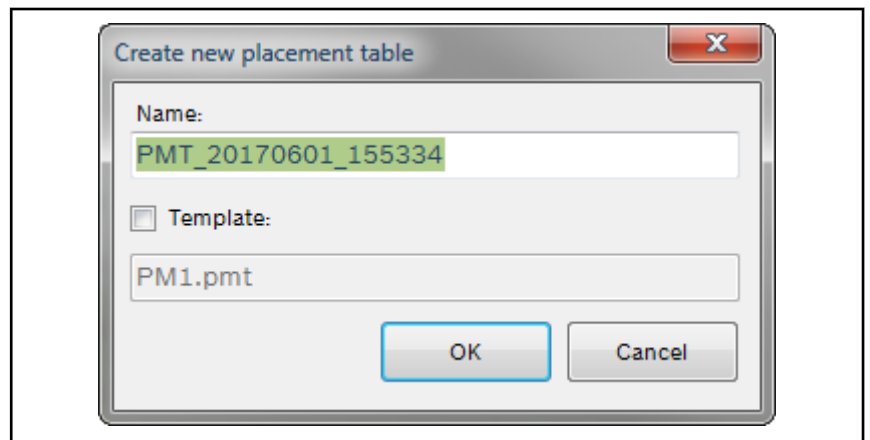


Fig. 7-45: Dialog to create a new placement table

3. Enter the name of the placement table. An automatically generated table name is displayed as default
4. Close the dialog with "OK".

A placement table is created and opened in the placement editor.

Using table templates

Proceed as follows to use any placement table as template:

1. Open the **New** dialog (see [fig. 7-45 "Dialog to create a new placement table" on page 201](#)) as described above.
2. If necessary, enter a new name for the placement table.
3. Select "Template" in the **New** dialog.

The input field for the name of the template (default:"PM1.pmt") is enabled. If the default template "PM1.pmt" is not to be used, a name with the path specification of another placement table can be entered. If a ta-

ble name is entered without path specification, it is searched for the template in the path "/database".

4. Confirm entry with "OK".

The new table opens in the placement editor. The number of correction banks and correction values is applied from the given template.

Functions on the main level of the placement editor

<F2 Add correction record>

<F2 Insert correction record> can be used to add new placement data blocks to the table. New data blocks are attached at the end of the table.



Placement data blocks are continuously numbered (correction bank 1-5).

<F3 Remove correction record>

<F3 Delete correction record> is used to remove the last placement data block.

Additive value input

<Additive value input> can be used to enter correction values to be added to the existing value (see [chapter "Value input" on page 186](#)).

8 Tool management

8.1 Overview

8.1.1 General information

Managing tool data is of high significance for the control of machine tools. Among other things, the tool data covers:

- Tool identification
- Correction value calculation
- Tool life management
- Type definition

The tool data blocks are divided into two parts in the MTX:

- System data for the unique identification of tools
- User tool data for application-specific tool data

When the "Tools" operating area is activated, the tool list defined as the start list is displayed first. The information required is saved in file **"ToolManagementApp.xml"** and in the referenced list configuration files. Starting from this list, more configured list displays can be called via F-key or M-key functions or the list configuration or the content (list query) can be changed. To edit a data block, call the tool editor from the selected entry in the tool list.

8.1.2 Data management

The data of the external tool corrections is managed in a database. The database is subdivided into database tables. Currently, two database tables are available. By default, database table 1 is used to manage data of the external tool corrections. Accordingly, database table 2 is available to manage pallet data for example.

8.1.3

Screen layout

General information

Überwachungsdaten (alle Plätze)													
S	P	Werkzeugname	DN	TN	Status			SN	Aktiv	Standzeit(min) / Stückzahl(cyc)		max. ND	Einheit
					tw	two	TL			Rest	Warngr.		
1	1	Schrupfräser D32	009	2				1	☐	7200.00	0.00	7200.00	min
										0.00	0.00	0.00	
2	1	Messekopf D63-71 45°	0	1				1	☐	2.00	10.00	100.00	min
2	2	Messtaster	0	23				1	☐	100.00	0.00	0.00	min
										0.00	0.00	0.00	
2	3	Gewindebohrer M10	1	13			☒		☐	0.00	0.00	0.00	min
2	4	HSC Schlichtfräser D20	001	4				1	☐	6807.62	0.00	7200.00	
										0.00	0.00	0.00	
2	5	Wendeplatten Bohrer D24	0	5				1	☐	0.00	0.00	0.00	min
2	6	Spiralbohrer D 4.2	0	6				1	☐	0.00	0.00	0.00	min
2	7	Spiralbohrer D 5	1	7				1	☐	0.00	5.00	100.00	min
2	8	Spiralbohrer D 8.5	1	8				1	☐	0.00	0.00	0.00	min
										0.00	0.00	0.00	
2	9	Spiralbohrer D 12.0	0	9				1	☐	0.00	0.00	0.00	min

-100000000 <= Wert <= 100000000

ABS

- 1
- Title bar
- 2
- Status bar
- 3
- Application window (tool list or tool editor)

Fig. 8-1: Screen layout tool management

Header

In the tool list, the tool list name as well as the list query name are displayed.

1	2
Monitoring data	all positions

- 1
- Title of list configuration (display structure)
- 2
- Title of list query (content)

Fig. 8-2: Tile line in the tool list display

In the tool editor, each individual input window has a title line, displaying the name of the tool editor control.

Status line

-100000000 <= Value <= 100000000	ABS
1	2

- 1
- Information area (value range for value input)
- 2
- Input mode (additive, absolute, diameter)

Fig. 8-3: Status line in tool management

Information area

If a limit value is defined for the tool data element selected in the list using cursor navigation, the input limits are displayed in the information area.

Limit values can be defined as follows:

- Data element-related in a scheme
- Tool and data element-related in the list configuration

- Input mode** The mode "Additive value input" is identified by the text "ADD" (see [Additive value input, page 206](#)).
 The "Absolute value input" mode is identified by the text "ABS".
 The "Diameter value input" mode is identified by the "DIA" text (see [Diameter input, page 206](#)).

8.1.4 General operation

Navigating and selecting cells

To enter a correction value, the following options are available to select the desired input cell:

- "Single tap" in the cell
- Navigate with the <cursor> keys until the desired cell is selected

The selected cell has a dark green background color.

The selected cell has a light green background color.

Edit values

- Starting the edit mode** Switch to the editing mode of the selected cell with one of the following actions:

- Enter a value or a character using the keyboard
- Press <Enter>
- "Double tap" on the cell

A flashing input cursor in the respective cell indicates the editing mode.

- Apply value** Apply an edited value with one of the following actions:

- Press <Enter>
- Press <Tab>
- Press a <Cursor> key
- "Single tap" in another cell

After applying the value, the entered value is directly written to the NC data table in the NC kernel.



If an incorrect value is entered, an error message is displayed in the status line and the selected cell remains in the editing mode. The entry can be cancelled or the value can be written again after the input correction.

- Cancel value input** The editing mode can be cancelled at any time as follows:

- Press <Esc>

The original value is retained in the table.

- Conditional editability** During the editor/list configuration, it is possible to define the editability of a data element depending on an additional process variable.

Example:

Conditional editability

Depending on data element BQ2 - bit 0 (Tool active), editing of the selected tool data can be prohibited.

Additive value input

Enabling or disabling the additive value input

The "Additive value input" mode is used to enter correction values added to the existing value.

The "Additive value input" can be activated/deactivated as follows:

- The **Additive** checkbox can be enabled and disabled in the additional operating area in the "Properties"  tab
- If configured in the menu, set or reset using the menu function **Edit ► Additive**

Diameter input

If input mode "Additive" is activated and if diameter input for the selected data element in the scheme was permitted using the data attribute "ETA = DI" and if the ID for diameter input (ToolCatalog/TITech/TIType/CoTo/DIA) was set in the tool catalog for the tool to be edited, the additive value is input as diameter value, i.e. half of the input value is added.



The additive value input is not intended for every cell; it can be specified in the scheme file. Whether Additive value input is active for the selected cell is indicated by the text "ADD" in the status line.

Subtracting values

To subtract a value from an existing value, enter a value with a leading minus sign when "Additive value input" is active.

Arithmetic operations

Simple arithmetic operations with several levels of parentheses can also be carried out when entering data in the "Additive value input" mode.

Tool preview

For standard tool with valid technology data, the simulated tool can be displayed in the additional operating area in the tool list as well as in the tool editor in the "Tool preview"  tab.

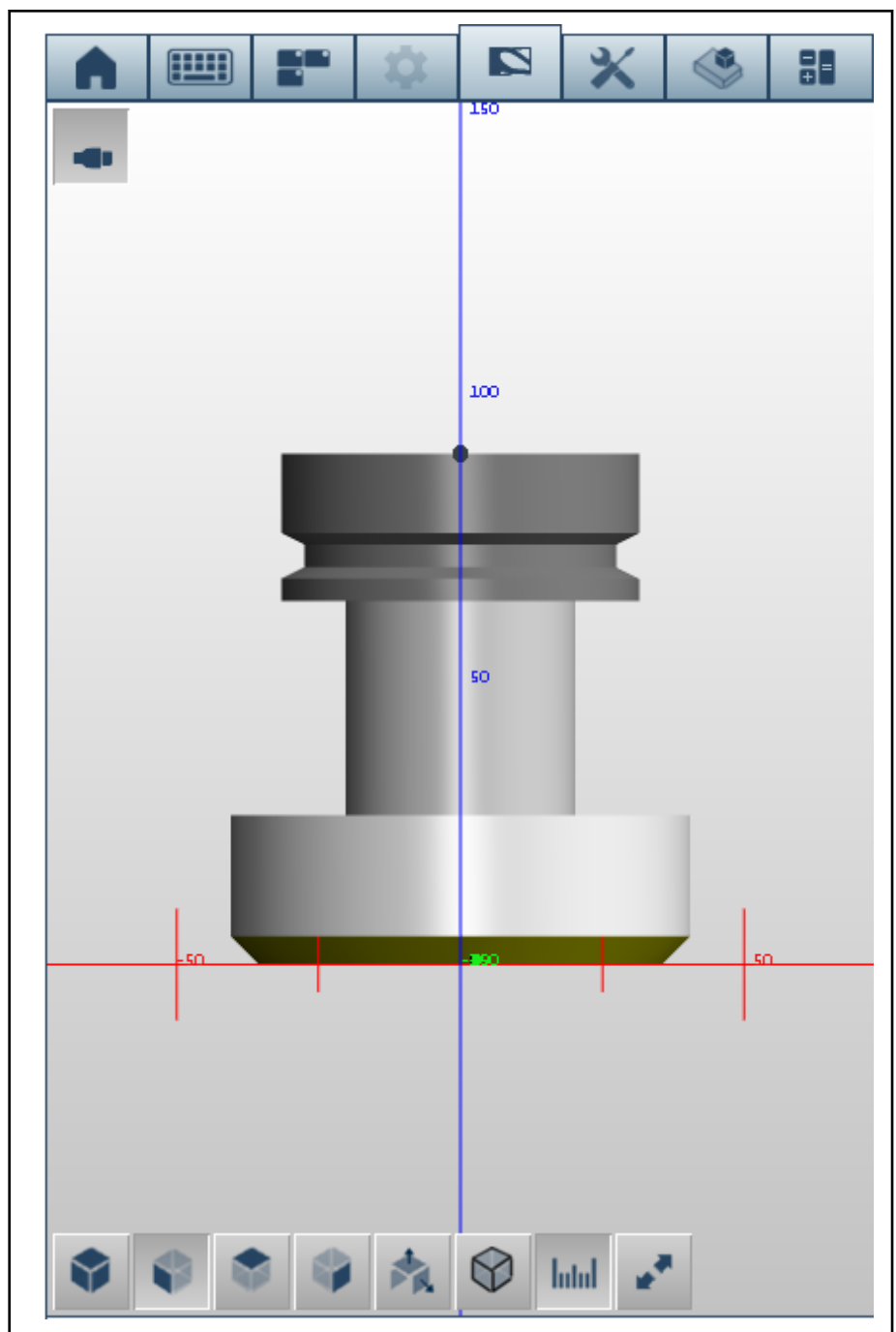


Fig. 8-4: Tool preview (face-milling cutter)

The tool preview features the following display options:

- with dimension
- with coordinates cross
- without dimension and coordinate cross

8.2

Tool list display

8.2.1

Screen layout

Structure of the tool list

All tool lists show a number of tool data blocks resulting from the list definition as table. The data of a data block is shown in a group of lines consisting of one or more lines (also called a partial list or a sublist) in the tool list. The tool data is always displayed according to location, i.e. each partial list is an (occupied or unoccupied) tool location. Depending on the list definition, tool lists can differ according to number and properties of the displayed data blocks and according to their method of display and the contained data elements.



1 Fixed table area
2 Frozen table area
3 Scrollable area
Fig. 8-5: Screen layout of a tool list

Functions of the table areas

Fixed table area:	no cursor navigation possible	Always visible
Frozen table area:	Cursor navigation possible	Always visible
Scrollable table area:	Cursor navigation possible	not always visible

Main area (Tool list)

Data elements of a tool data table can be displayed and modified in the main area of the tool list.

The tool data blocks of a tool data table are displayed in the lines/line groups (partial lists) of the table.

The main area can be divided into three parts in the tool list configuration (see fig. 8-5 Screen layout of a tool list, page 208):

1. Fixed, non-editable table area:

This table area contains data that cannot be edited and which is used to identify the data blocks.

2. Frozen, editable table area:

This table area contains data that can be edited and which is nevertheless used to identify the data blocks. Thus, they always have to be visible.

3. Scrollable table area:

This part of the table contains all other data that can be edited.

The two fixed table areas are to be kept as small as possible so that extensive scrolling is prevented.

Function keys of tool list

When entering the operating area Tolls, the F-key level is called by default as first level of the F-key level of the tool list. The first level is defined in the "HMI.FKeys.ToolmanList3.xml" file and the second level is defined in the "HMI.FKeys.ToolmanList2.xml" file. Both can be modified by the user in the F-key configurator of IndraWorks Engineering.

F-keypad level	<F2>	<F3>	<F4>	<F5>	<F6>	<F7>	<F8>	<F9>
First level	Add tool ¹	Delete tool ²		Edit tool ²			More functions	Sector selection
Second plane	Export list	Import list	Import tool ²			Define filter...	Back	Sector selection

1 Function is only available if the tool location is empty

2 Function is only available if the tool location is assigned

Tab. 8-1: Function keys in the tool table editor

Press <F8> to switch between the levels.

Press <F9> to activate the user-configurable F-keypad for the sector selection:

F-keypad level	<F2>	<F3>	<F4>	<F5>	<F6>	<F7>	<F8>	<F9>
Sector selection	All sectors	Sector 1	Sector 2	Tool list	Worn tools			Back

Tab. 8-2: User function keys in the tool management

It is also possible to define your own user screen as the entry screen for the operating area. Upon delivery, it is entered directly via the latest selected tool list.

M-keys for tool list display

In the default configuration, all list displays have their own M-keypads with the following functions:

M-key	Function
<L1>	Wear data display
<L2>	Geometry data display
<L3>	Status data display
<L4>	Monitoring data display

Tab. 8-3: M-key assignment for tool list

The M-key configuration can be selected in the following IndraWorks Engineering files:

All tool lists:	MtxToolList_L.Visu.xml MtxToolList_L.xml

Tab. 8-4: M-key definitions of the tool list

If no M-key pads were assigned to the tool list definition, "global" M-keys are applied.

8.2.2 List contents

Here, 'list content' is understood to be the selection of the indicated tool data blocks.

The query definitions in the "ToolManagementApp.xml" file specify the data blocks to be displayed in a tool list.

In the MTX, the F- or M-keys can be freely assigned to up to 16 predefined list displays in the F- or M-key configurator. Additional list displays are possible, but not provided in the configuration dialog. They have to be entered manually into the configuration file of the corresponding F-key pads or M-key pads (see definition "HMI.Fkeys.ToolmanApp1.xml" above).

Channel-dependent tool list display

The tool list can be visualized channel-dependently.

Thus, use "ChannelQuery" for the database query of the list.

This query can be defined in the query configurator in IndraWorks Engineering. An individual query is defined for each channel read at channel switching results in a new channel-dependent tool list display.

A channel-dependent list is labeled by default in the list title by the addition "(active channel)".

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A channel-dependent list is labeled by default in the list title by the addition "(active channel)".

8.2.3 Display formats

The list structure is controlled by a tool list configuration file entered into the "ULCConfigFile" data element of the corresponding action definition in the "ToolManagementApp.xml" file. Upon delivery, the configuration file "MTX.Toolman.ToolListConfiguration.xml" is always assigned to the tool lists.

By default, the tool lists have the following display formats:

- Geometry list
- Wear list
- Tool life list
- Status list

As opposed to all other lists that display all tools of the selected sectors, this list contains a special query definition to select worn tools.

Highlighted format

It is possible to highlight tool data blocks in the tool list depending on a process variable. As many displays as desired can be implemented.

Example:

Highlighted format

1. BQ2 - bit 0 (Tool active) background color 1
2. BQ2 - bit 4 (Tool worn) background color 2
3. etc.

Bitmap format

It is possible to display the values of process variables as bitmap in the tool list.

Example:

Bitmap format

A bitmap is assigned to the value of K1 (sector number) using an assignment table.

Value	Bitmap	Description
1		Spindle
2		Grippers
3		Magazine
4		Turret
99		Cabinet

Tab. 8-5: Example of the bitmap table

In the following image, both display formats are represented. The tool type is represented by a bitmap.

Geometry data (all positions)															
S	P	Tool name	DN	TN	Status			SN	Geometry					Type	^
					tw	two	TL		L1	L2	L3	R	O		
1	1	Schrupfräser D32	009	2	☐	☐	☐	1			164.197	16.038			
											0.000	0.000			
2	1	Messekopf D63-71 45°	0	1	☐	☐	☐	1			90.024	35.500			
2	2	Gewindebohrer M6	1	11	☐	☐	☒	1			135.561				
2	3	Gewindebohrer M10	1	13	☐	☐	☐	1			143.213				
2	4	HSC Schlichtfräser D20	001	4	☐	☐	☐	1			134.997	9.993			
								2			0.000	0.000			
2	5	Wendeplatten Bohrer D24	0	5	☐	☐	☐	1			214.300				
2	6	Spiralbohrer D 4,2	0	6	☐	☐	☐	1			162.280				
2	7	Spiralbohrer D 5	1	7	☐	☐	☐	1			165.200				
2	8	Spiralbohrer D 8,5	1	8	☐	☐	☐	1			191.900				
								2			0.000				
2	9	Spiralbohrer D20	0	9	☐	☐	☒	1			155.800				
2	10	Gewindebohrer M5	1	10	☐	☐	☐	1			124.745				
-10000000 <= Value <= 10000000															
														ABS	

Fig. 8-6: Geometry data display

List content:

Tool management

Column	Displayed data element	Always visible	Editable	Special features	Area
1	Sector	Yes	no		Fixed
2	Place	Yes	no		
3	Tool name	Yes	no		
4	Duplo number	Yes	Yes		Frozen
5	T-number	Yes	Yes		
6	Status	-	-	Main column	
6.1	Warning limit reached	Yes	no	Checkbox display	
6.2	Tool worn	Yes	no		
6.3	Tool locked	Yes	Yes		
7	Empty column	-	-	Dividing line	
8	Tool edge number	Yes	no	Sublines are displayed depending on the value	
9	Geometry	-	-	Main column	Scrollable
9.1	L1 value	no	Yes	Only displayed if the tool and the tool edge exist and if the value is relevant for this type	
9.2	L2 value	no	Yes		
9.3	L3 value	no	Yes		
9.4	Radius value	no	Yes		
9.5	Edge position	no	Yes		
10	Empty column	-	-	Dividing line	
11	Tool type	no	no	As bitmap	

Tab. 8-6: Contents of geometry list

Wear data (all positions)													
S	P	Tool name	DN	TN	Status	SN	Wear						
					tw	two	TL		L1	L2	L3	R	
1	1	Gewindebohrer M6	1	11	☒	☒	☒	1			0.000		
2	1	Messekopf D63-71 45°	0	1	☐	☐	☐	1			0.000	0.000	
2	2												
2	3	Gewindebohrer M10	1	13	☒	☒	☒	1			0.000		
2	4	HSC Schlichtfräser D20	001	4	☐	☐	☐	1			0.000	0.000	
								2			0.000	0.000	
2	5	Wendeplatten Bohrer D24	0	5	☐	☐	☐	1			0.000		
2	6	Spiralbohrer D 4.2	0	6	☐	☐	☐	1			0.000		
2	7	Spiralbohrer D 5	1	7	☐	☐	☐	1			0.100		
2	8	Spiralbohrer D 8.5	1	8	☒	☒	☒	1			0.000		
								2			0.000		
2	9	Spiralbohrer D20	0	9	☐	☐	☐	1			0.000		
2	10	Gewindebohrer M5	1	10	☐	☐	☐	1			0.000		
2	11												
-100000000 <= Value <= 100000000													ABS

Fig. 8-7: Wear data display

List content:

Column	Displayed data element	Always visible	Editable	Special features	Area
1	Sector	Yes	no		Fixed
2	Place	Yes	no		
3	Tool name	Yes	no		
4	Duplo number	Yes	Yes		Frozen
5	T-number	Yes	Yes		
6	Status	-	-	Main column	
6.1	Warning limit reached	Yes	no	Checkbox display	
6.2	Tool worn	Yes	no		
6.3	Tool locked	Yes	Yes		
7	Empty column	-	-	Dividing line	
8	Tool edge number	Yes	no	Sublines are displayed depending on the value	
9	Wear	-	-	Main column	Scrollable
9.1	L1 value	no	Yes	is only displayed if the tool and the tool edge exist and if the value is relevant for this type	
9.2	L2 value	no	Yes		
9.3	L3 value	no	Yes		
9.4	Radius value	no	Yes		

Tab. 8-7: Contents Wear list

Monitoring data (all positions)													
S	P	Tool name	DN	TN	Status			SN	activ	Tool Life [min] / Quantities [cyc]			Unit
					tw	two	TL			Rem	Warning limit	max. UT	
1	1	Schrupfräser D32	9	2	☐	☐	☐	1	☐	7200.00	0.00	7200.00	min
					☐	☐	☐	2	☐	0.00	0.00	0.00	
2	1	Messekopf D63-71 45°	0	1	☐	☐	☐	1	☐	2.00	10.00	100.00	min
2	2												
2	3	Gewindebohrer M10	1	13	☐	☐	☒	1	☐	0.00	0.00	0.00	min
2	4	HSC Schlichtfräser D20	1	4	☐	☒	☐	1	☐	6807.62	0.00	7200.00	
					☐	☐	☐	2	☐	0.00	0.00	0.00	
2	5	Wendeplatten Bohrer D24	0	5	☐	☐	☐	1	☐	0.00	0.00	0.00	min
2	6	Spiralbohrer D 4.2	0	6	☐	☐	☐	1	☐	0.00	0.00	0.00	min
2	7	Spiralbohrer D 5	1	7	☐	☐	☐	1	☐	0.00	5.00	100.00	min
2	8												
2	9	Spiralbohrer D20	0	9	☐	☐	☒	1	☐	0.00	0.00	0.00	min
2	10	Gewindebohrer M5	1	10	☐	☐	☐	1	☐	0.00	0.00	0.00	
2	11	Gewindebohrer M6	1	11	☐	☐	☐	1	☐	0.00	0.00	0.00	
-100000000 <= Value <= 100000000													ABS

Fig. 8-8: Service life data display

List content:

Tool management

Column	Displayed data element	Always visible	Editable	Special features	Area
1	Sector	Yes	no		Fixed
2	Place	Yes	no		
3	Tool name	Yes	no		
4	Duplo number	Yes	Yes		Frozen
5	T-number	Yes	Yes		
6	Status	-	-	Main column	
6.1	Warning limit reached	Yes	no	Checkbox display	
6.2	Tool worn	Yes	no		
6.3	Tool locked	Yes	Yes		
7	Empty column	-	-	Dividing line	
8	Tool edge number	Yes	no	Sublines are displayed depending on the value	
9	Enabling monitoring	no	Yes	Checkbox display	
10	Service life/number of pieces	-	-	Main column	
10.1	Remaining tool life	no	Yes	Only displayed if the tool and the tool edge exist and if the value is relevant for this type	
10.2	Warning limit	no	Yes		
10.3	Max. service life	no	Yes		
9.4	Time unit	no	Yes		

Tab. 8-8: Contents Service life list

Status data (all positions)																				
S	P	Tool name	DN	TN	Tool status												Position status			
					ta	tu	tw	two	TL	TD	ttl	ttu	TS1	TS2	TS3	TS4	PB	PS1	PS2	PS3
1	1	Schrupfräser D32	9	2	☒	☒	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
2	1	Messekopf D63-71 45°	0	1	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
2	2				☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
2	3	Gewindebohrer M10	1	13	☐	☒	☐	☐	☒	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
2	4	HSC Schlichtfräser D20	1	4	☐	☒	☐	☒	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
2	5	Wendeplatten Bohrer D24	0	5	☐	☒	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☒	☐	☐	☐
2	6	Spiralbohrer D 4.2	0	6	☐	☒	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
2	7	Spiralbohrer D 5	1	7	☐	☒	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
2	8				☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
2	9	Spiralbohrer D20	0	9	☐	☒	☐	☐	☒	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
2	10	Gewindebohrer M5	1	10	☐	☒	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☒	☐	☐	☐
2	11	Gewindebohrer M6	1	11	☐	☒	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

ABS

Fig. 8-9: Status list display

List content:

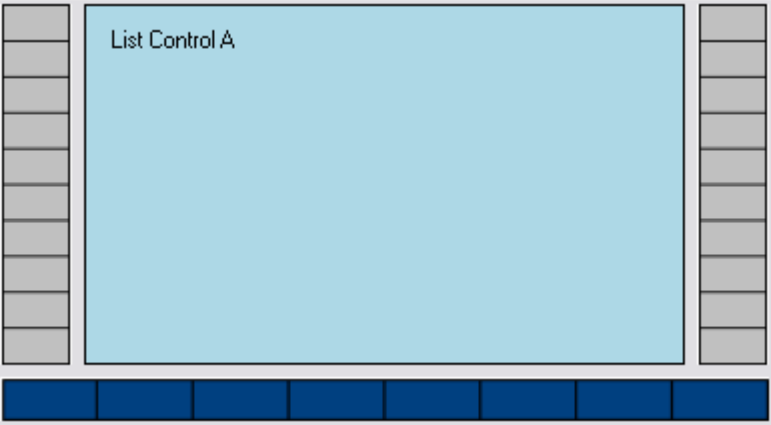
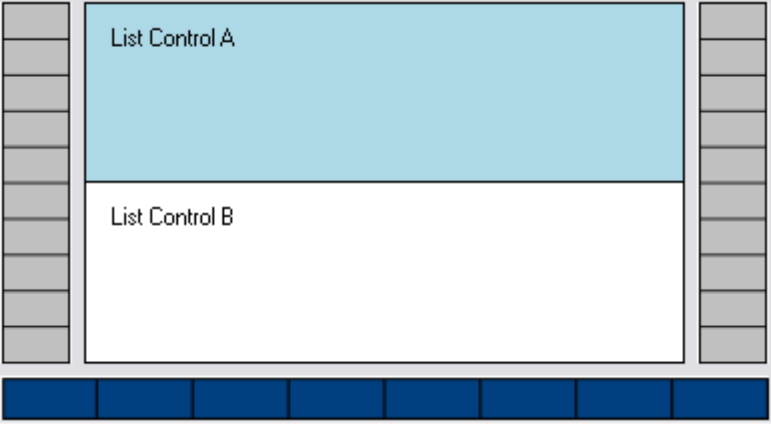
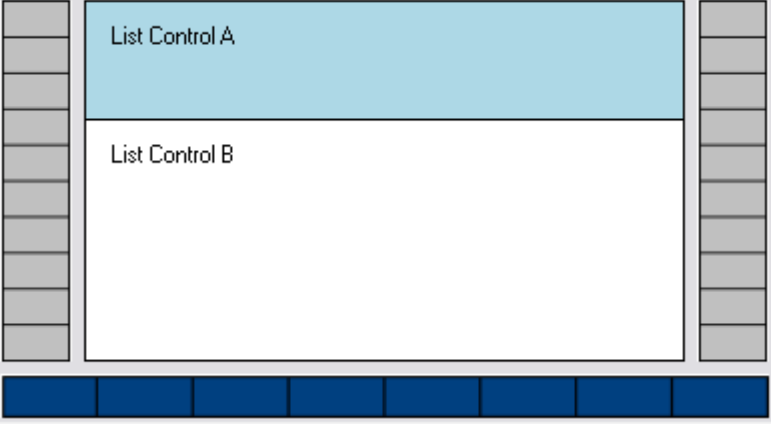
Column	Displayed data element	Always visible	Editable	Special features	Area
1	Sector	Yes	no		Fixed
2	Place	Yes	no		
3	Tool name	Yes	no		
4	Duplo number	Yes	Yes		Frozen
5	T-number	Yes	Yes		
6	Tool status	-	-	Main column	Scrollable
6.1	Tool active (ta)	Yes	no	Checkbox display	
6.2	Tool used (tu)	Yes	no		
6.3	Warning limit reached (tw)	Yes	no		
6.4	Tool worn (two)	Yes	no		
6.5	Tool blocked (TB)	Yes	Yes		
6.6	Tool defective (TD)	Yes	Yes		
6.7	(TTL)	Yes	Yes		
6.8	(TTU)	Yes	Yes		
6.9-6.12	Tool user status	Yes	Yes		
7	Location status	-	-	Main column	
7.1	Location blocked (PB)	Yes	Yes	Checkbox display	
7.2-7.4	Location user status	Yes	Yes		

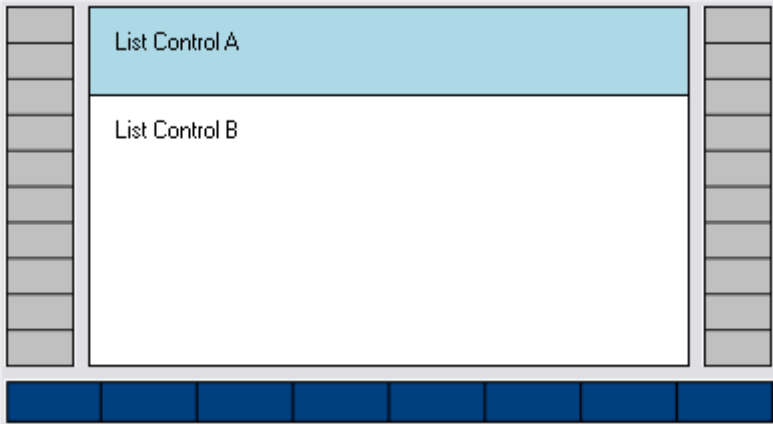
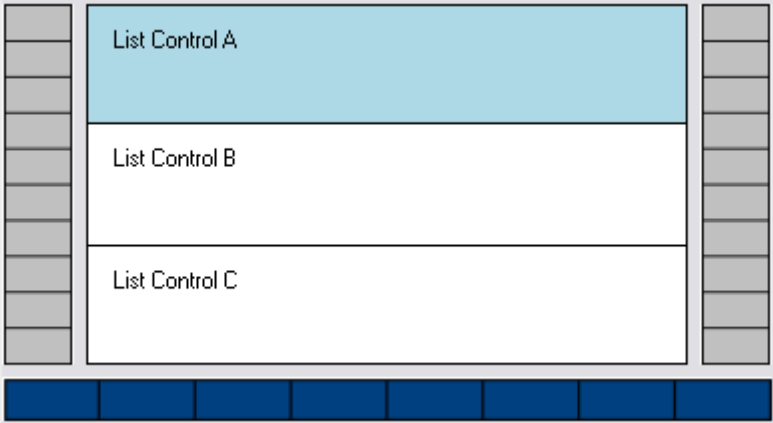
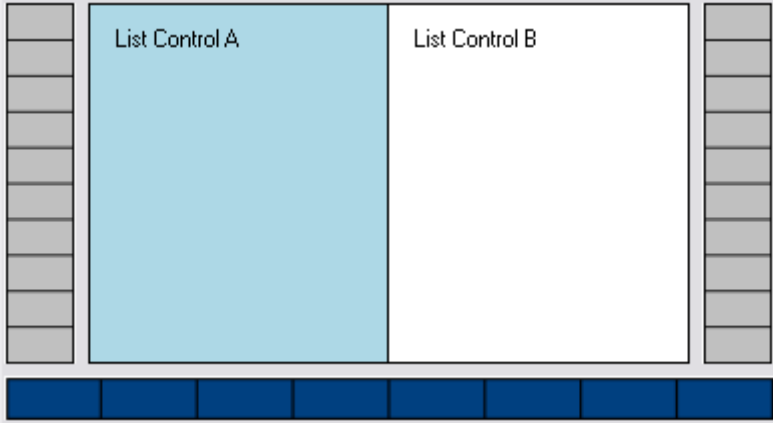
Tab. 8-9: Contents of the status list

Displaying multiple lists in one screen

Several differently configured lists can be displayed in one tool management screen.

One of the following display variants can be selected when configuring the screen. The dimensions of the lists cannot be modified.

Variant	Screen layout
	Displaying a list as full screen (Standard version)
	Horizontal 1:1
	Horizontal 1:2

Variant	Screen layout
 The diagram shows a screen layout with a light blue header bar at the top containing the text 'List Control A'. Below this is a white area containing the text 'List Control B'. The screen is flanked by vertical grey bars on both sides, each with 10 segments. At the bottom is a dark blue horizontal bar with 8 segments.	Horizontal 1:3
 The diagram shows a screen layout with a light blue header bar at the top containing the text 'List Control A'. Below this are two white areas, each containing the text 'List Control B' and 'List Control C' respectively. The screen is flanked by vertical grey bars on both sides, each with 10 segments. At the bottom is a dark blue horizontal bar with 8 segments.	Horizontal 1:1:1
 The diagram shows a screen layout with a light blue area on the left containing the text 'List Control A' and a white area on the right containing the text 'List Control B'. The screen is flanked by vertical grey bars on both sides, each with 10 segments. At the bottom is a dark blue horizontal bar with 8 segments.	Vertical 1:1

Tab. 8-10: Displaying multiple lists

The following figure shows an application example of a tool management screen with two tables.

\$1 Channel 1

Automatic/Cont. block

Inactive

Rexroth

10:06:51 AM

EN

Monitoring data (Spindle)

Monitoring data (Spindle)

Tool name	DN	TN	Status	SN	Active	Tool Life [min]	Quantities [cyc]	Unit
Type	tw	two	TL			Rem	Warning limit	max. UT
Gewindebohrer M8	1	1				0.00	0.00	0.00
	2	2				0.00	0.00	0.00
	3	3				0.00	0.00	0.00

Monitoring data (Tool magazine)

S	P	Tool name	DN	TN	Status	SN	Active	Tool Life [min]	Quantities [cyc]	Unit
		Type	tw	TL				Rem	Warning limit	max. UT
2	1	Messkopf D63-71 45°	0	1				2.00	10.00	100.00
2	2									
2	3	Gewindebohrer M10	1	1				0.00	0.00	0.00
2	4	HSC Schlichtfräser D20	301	4				6807.62	0.00	7200.00
2	5	Wendelplatten Bohrer D24	0	5				0.00	0.00	0.00
2	6	Spiralbohrer D 4.2	0	6				0.00	0.00	0.00
2	7	Spiralbohrer D 5	1	7				0.00	5.00	100.00
2	8	Spiralbohrer D 6.5	1	8				0.00	0.00	0.00

10000000 << Value <= 100000000

ABS

100 80 60 40 20 0

100

80

60

40

20

0

Fig. 8-10: Tool management screen with two tables (screen layout, horizontal 1:2)

8.2.4 Functions in the tool list display

The functions of the F-keys are described in the corresponding table editor.

<F2 Insert tool>

Calling the tool editor to create a new tool data block. Use touch gestures in the taskbar to return to the tool list. However, the taskbar cannot be edited, since the database remains blocked. The list can be only edited after closing the new tool editor.

In the default configuration, the function can also be retrieved using the menu function **Edit ► Add tool**.

<F5 tool>

Calling the tool editor to edit an existing tool data block. Use the taskbar to return to the tool list. The database does not remain locked. However, the <F5 Edit tool> function can only be called again after exiting the tool editor.

In the default configuration, the function can also be called using the menu function **Edit ► Edit tool**.

<F3 Delete tool>

To delete the tool data block in the database, confirm the prompt "Delete tool".

In the default configuration, the function can also be called using the menu function **Edit ► Delete tool**.



The <F3 Delete tool> function resets all data elements indicated in the data scheme as tool data, i.e.

- "0" is written to numerical values
- Boolean values are set to "FALSE"
- An "empty string" is written to strings

This function also exists as PLC function.

<F4 Move>

The following box to select the sector and location provides a free data block/tool storage position as target position to offset a tool data block.

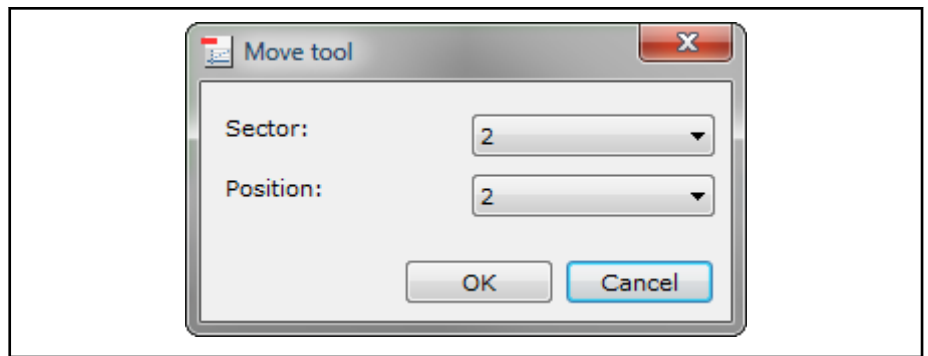


Fig. 8-11: Checkbox sector/location to offset the tool

In the default configuration, the function can also be called using the menu function **Edit ► Offset tool**.



The "Offset tool" function moves all data elements indicated in the data scheme as tool data to an available location in the database table.

This function also exists as PLC function.

Copying tool

Via the menu bar **Edit ► Copy tool**, the "Copy tool" function can be activated as a pure interface function. The following box to select the sector and location provides a free data block/tool storage position as target position for the duplicated tool.

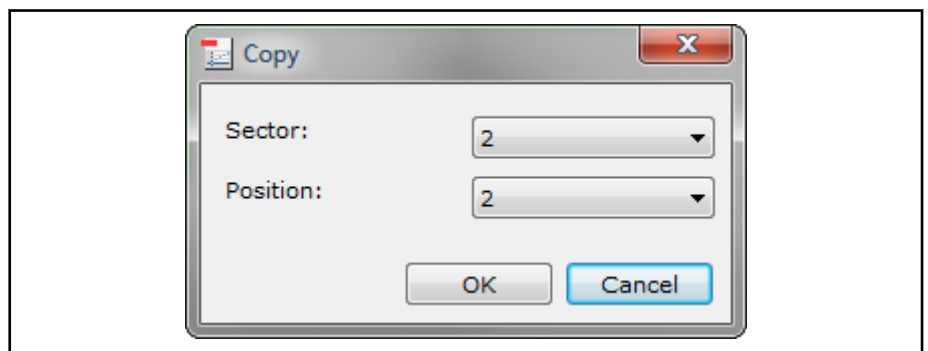


Fig. 8-12: Checkbox sector/location to offset the tool

In the default configuration, the function can also be called using the menu function **Edit ► Copy tool**.



The "Copy tool" function duplicates all data elements indicated in the data scheme as tool data to an available location in the database table.

This function also exists as PLC function.

Sorting tool list

The following setting dialog can be used to configure and activate list sorting according to three decreasingly prioritized sorting criteria. For multiline sorting columns within one sublist, the corresponding subline to be sorted can be specified. At the same time, this dialog can also be used to restore the original "unsorted" list display.

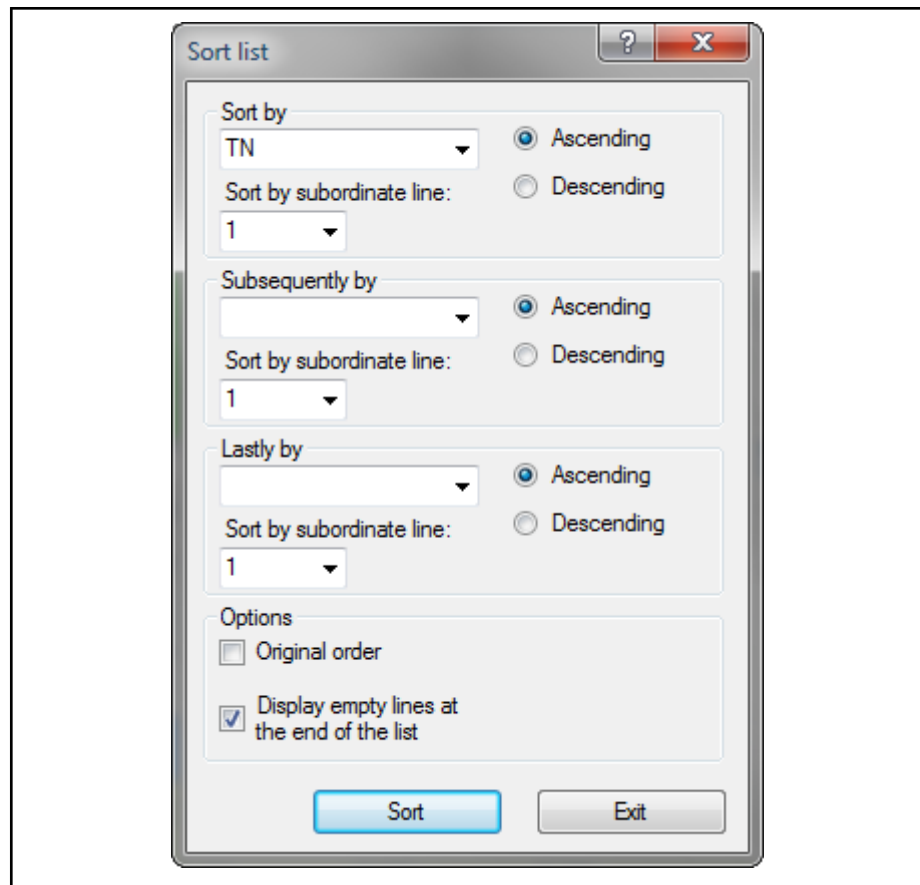


Fig. 8-13: Setting dialog to sort the tool list

In the example, the tool list is sorted first according to the T-number, then according to the sector number and then according to the location number in ascending order.

Empty locations are shown at the end of the list.

If the "Original order" checkbox is activated, sorting is switched off.

In the default configuration, the function can also be called using the menu function **Edit ► Sort tool list**.



Dynamic updating of the sorting order is executed in the list display after value modification. To accomplish this, the sorting dialog has to be called again.

Filters active

The list display can be filtered according to the condition defined in the setting dialog.

The **Filter active** checkbox can be enabled and disabled in the additional operating area in the "Properties"  tab

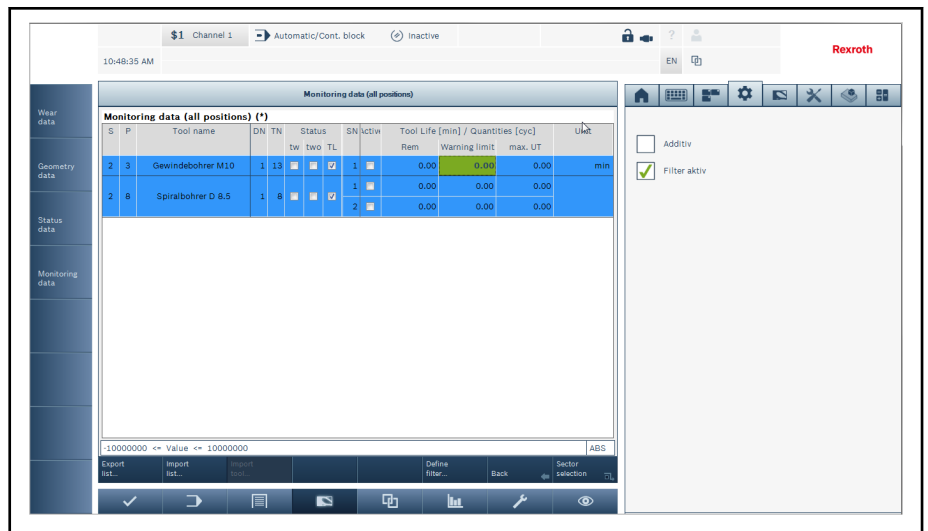


Fig. 8-14: Tool list with enabled filter function (all locked tools)

A filtered list is indicated in the list title by "(*)".

In the default configuration, the function can also be called using the menu function **Edit ► Filter active**.



The function is only active if a filter condition was activated before.

Define filter (F5)

The list display can be filtered according to the header data elements:

K1:	Sector
K2:	Place
SKQ:	Tool name
IKQ1:	Duplo number
IKQ2:	Tool type
IKQ3:	Tool number
IQ1:	Reserve 1
IQ2:	Reserve 2
IQ3:	Reserve 3
BQ1:	Place status
BQ2:	Tool status

The data elements used in the basic query of the current list configuration cannot be filtered. Thus, these are grayed out in the filter definition dialog.

The individually selected filter conditions are like an AND operation.

The filter settings can be adjusted in the following setting dialog.

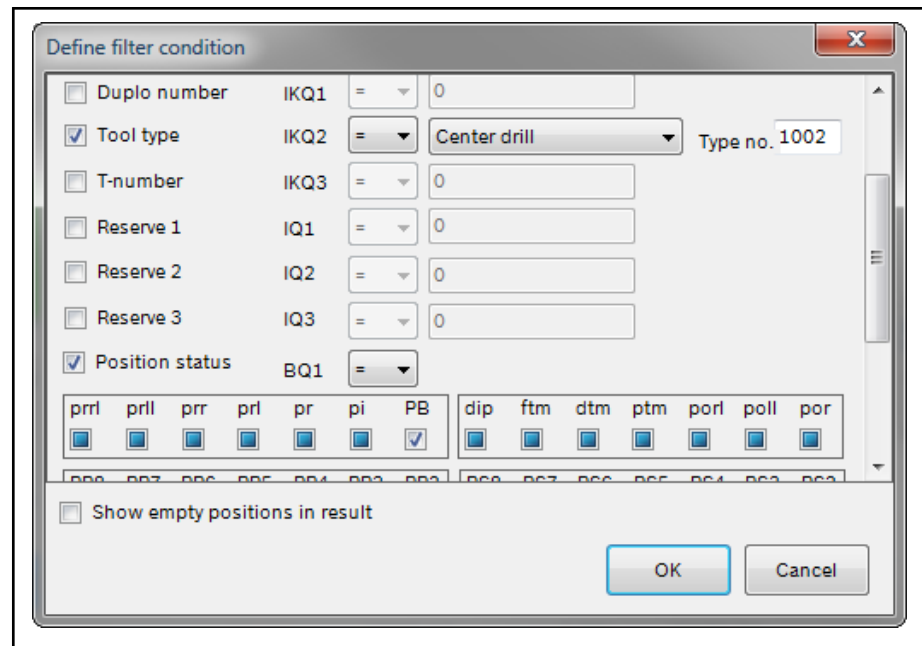


Fig. 8-15: Setting dialog to filter the tool list

In the default configuration, the function can also be called using the menu function **Edit ▶ Define filter**.



A filter condition becomes only active if at least one checkbox was selected in the dialog.

<F2 Export list>

During a tool (list) export, it can be selected between the following export functions in a selection dialog:

- Exporting a single data block
- Exporting the entire database table
- Exporting the currently shown list
- Exporting a self-defined selection of sectors

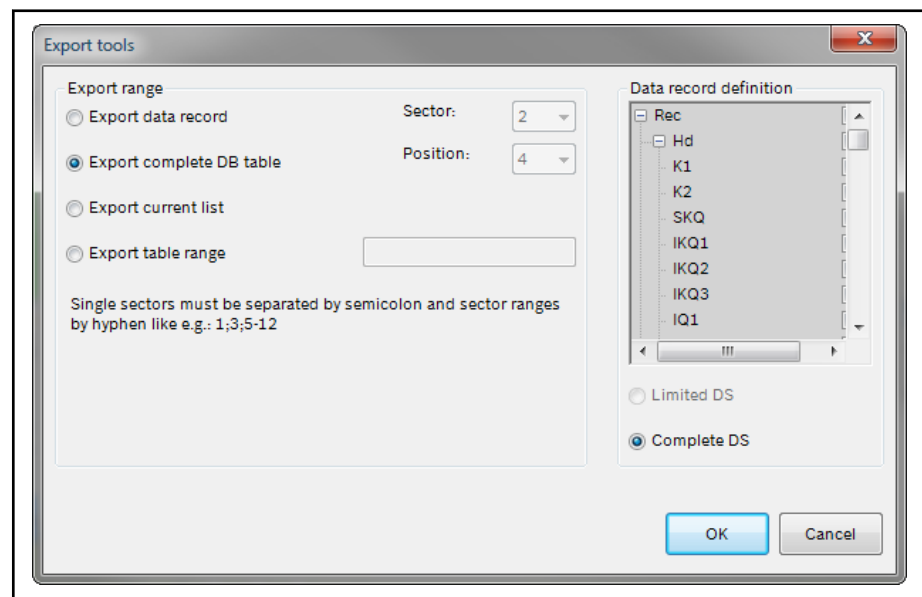


Fig. 8-16: Selection dialog of the export function

After entering a file name in the file selection dialog, a TLD file is written to the NC file system (for example, a mount directory).

This file can also be saved as .xml file or without extension.

In the default configuration, the function can also be called using the menu function **Edit ► Export list**.

<F4 Import tool>

A single tool data block can be imported using the <Import tool> function. This data block can be deleted from the tool file found in the file selection dialog.

If this file was created using the export mode "Export single data block", the selection list naturally contains only one data block.

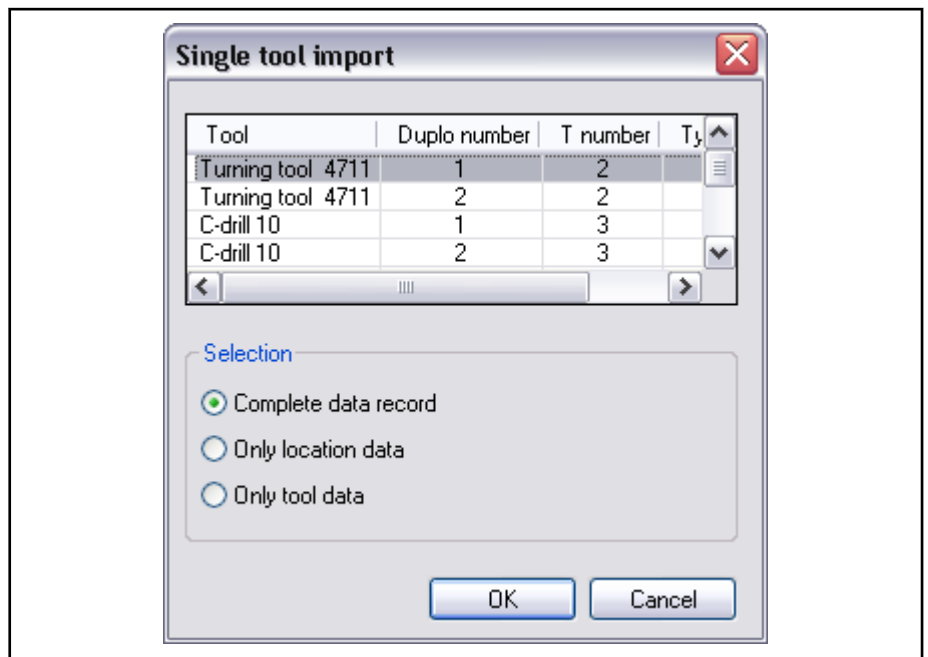


Fig. 8-17: Selection dialog "Single tool import" function

In the default configuration, the function can also be called using the menu function **Edit ► Import single tool**.

<F3 Import list>

After selecting an XML file in the NC file system (for example, a mount directory), it is read and then written to the database table. The user can decide which data is to be imported in the following dialog:

- Complete data block
- Only location data
- Only tool data

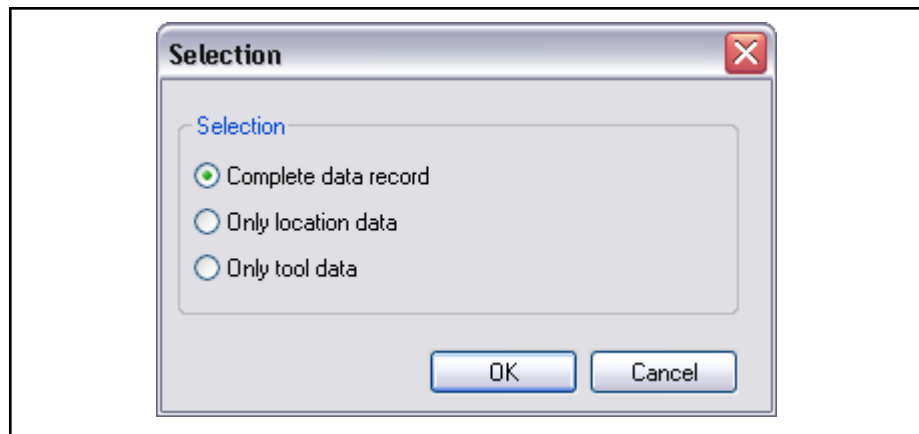


Fig. 8-18: Selection dialog for the "Import function"

In the default configuration, the function can also be called using the menu function **Edit ► Import list**.



When importing a tool list, ensure that the XML document file to be read is suitable for the configuration of the database table in terms of the number of sectors and locations and the data structure.

Opening a post import function

It is possible to follow the import of a tool list with a configurable handling routine for all imported data blocks.

This post import function can be set in the file "ToolManagementConfig.xml".

Changing level

Switch between the first and the second level of the F-keypad using <F8>.

The key  switches to the second level and  returns to the first level.

Returning to main level

Press  to go to the superordinate level of the tool list display.

This key level can be defined by the user and permits switching between various list displays.

Number of decimals

The number of displayed decimals is specified by the list/editor configuration.

Additive value input

"Additive value input" can be used to enter correction values to be added to the existing value (see [chapter "Additive value input" on page 206](#)).

Opening next list

In case of several lists, change between the lists using the configurable F-key function "TL_ActivateNextList".

Exiting view

A screen, additionally defined to the default tool management application by the user, can be exited using the configurable F-key function <Close active screen>. This is not possible for the default tool management application. After the tool management was called once, this screen remains active until the user interface is closed. (exception: Closing the application via the menu function **Window ► Window ► Close window**).

Printing

The edited list can be printed. All data, comments and headlines in the list are printed. The table areas that are always displayed are also printed on each page.

In the default configuration, the function can also be called using the menu function **Edit ► Print tool list**.

Sequence:

A dialog to set up the page and the NC program is displayed in a print pre-view. The number of pages per sheet can be set. The zoom icon can adjust

the size accordingly. The print dialog can be closed with "Exit". By using <Tab> or using touch gestures, navigation in this dialog is possible.

Set up page:

Header and footer can be configured in the global options under **Tool ► Options ► General ► Print**.

Currently, the following variables can be used:

- Current page number
- Doc_Name
- Doc_Type
- Print_Date
- Print_Time
- Device_Name
- Editor

The remaining variables cannot be analyzed.

To improve clarity, the meaning can be written in front of each variable.

Example: Input of a parameter: Date of printing: #PRINT_DATE#

8.3 Tool editor

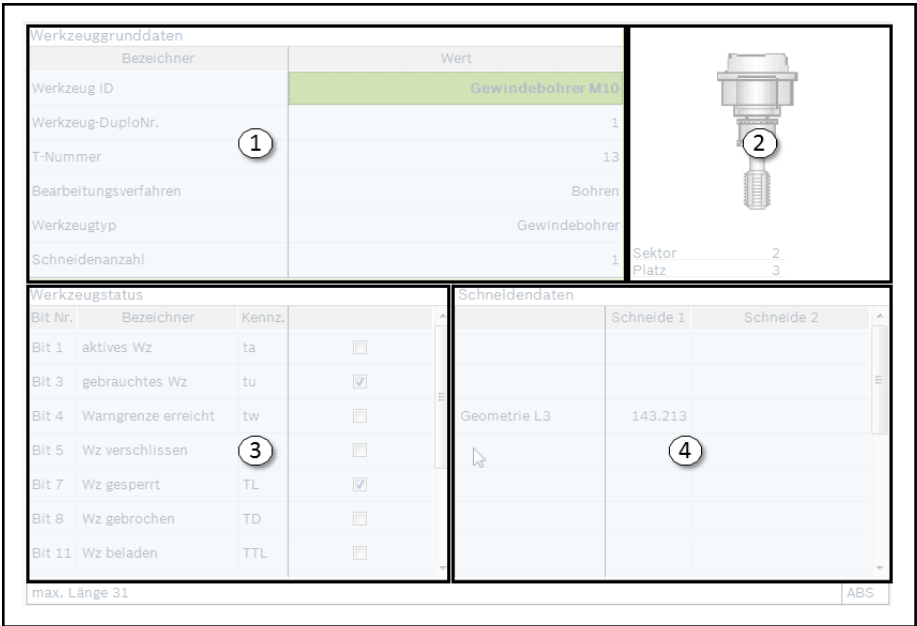
8.3.1 Screen layout

Structure of the tool editor

Overview

As the NC main screens, the tool editors function according to the ACI principle (ActiveContainer Interface).

- The tool editor is freely configurable
- The tool editor contains several data containers that can contain several controls
- The controls can also be configured
- The navigation of the cursor, and thus the editing, only takes place in the focused container



- 1
- Basic data container (contains a control)
- 2
- Bitmap container
- 3
- Status and tool data container (contains two controls)
- 4
- Status time container (contains two controls)

Fig. 8-19: Container distribution of the tool editor

8.3.2 Container contents

As can be seen in [fig. 8-19Container layout of the tool editor, page 226](#), the tool editor is structured in a number of display containers to be configured.

The number, arrangement, size and content of the containers can be configured. The content is defined via the assigned controls.

A separate F-key panel can be assigned to each control.

However, these panels cannot be edited in the F-key configurator. They can be found in predefined F-key files.

The configuration can be selected in IndraWorks Engineering.

Upon delivery, the tool editor is configured as follows:

Container No. in the figure	Control	Contents
1	Basic data	Tool name
		Duplo no.
		T. No.
		Tool technology
		Tool type
		Edge number
2	Bitmap and sector/location display	Tool type as bitmap
		Sector no.
		Loc. no.

Container No. in the figure	Control	Contents
3	Location and tool status	Tool status bits: 1;3;4;5;7;8;11;12;
		User status bits: 25;26;27;28
		Location status bit:
		2
3	User tool data	Description
		Angle head tool
		Tool orientation
		Time unit
		Tool life
		Old sector
		Old location
3	Technology data	Technology date 1
		Technology date 2
		Technology date 3
		Technology date 4
		Technology date 5
		Technology date 6
		Technology date 7
		Technology date 8
		Edge technology date 1
		Edge technology date 2

Container No. in the figure	Control	Contents
4	Tool edge data	Geometry L1
		Geometry L2
		Geometry L3
		Geometry radius
		Edge position
		Wear L1
		Wear L2
		Wear L3
		Wear radius
		Offset L1
		Offset L2
		Offset L3
		Offset radius
		Remaining tool life
		Warning limit
		Max. service life
		Service life flag
4	Geometry limits	Max L1 value
		Min L1 value
		Max value L2
		Min value L2
		Max value L3
		Min value L3
		Max radius value
		Min radius value

Tab. 8-11: Editor data

8.3.3 Function keys of tool editor

When starting the tool editor, first the partial window "Basic tool data" is enabled using the F-keypad. By tapping on a different display window, the window becomes active which in turn enabled the corresponding F-keypad.

8.3.4 M-keys for tool editor

Tool editor:	HMI.MKeys.ToolEditorLocalLeft.Visu.xml HMI.MKeys.ToolEditorLocalLeft.xml
Insert tool editor:	HMI.MKeys.ToolInsertEditorLocalLeft.Visu.xml HMI.MKeys.ToolInsertEditorLocalLeft.xml

Tab. 8-12: M-key definitions in the tool editor

8.3.5 Differences in behavior between adding and editing

Adding a tool When adding a tool, the entire data block is first edited offline, i.e. without accessing data on the control. When the data block is edited completely, the user is requested to decide whether to transfer the data block to the control.

When a new tool data block is created, the tool catalog for the new tool can be used to select a tool type from a list of predefined tool types. If a basic data block for this tool type exists in the catalog, it is used to initialize the data block. For more detailed information, refer to [chapter 8.3.6 "Basic data" on page 229](#).

Edit tool When "editing a tool", the modified data is immediately written to the tool database of the control. Therefore, there is no query as when adding a tool.

8.3.6 Basic data

Tool basic data	
Identifier	Value
Tool ID	End Mill D50
Tool duplo no.	1
T-number	1
Machining process	Milling
Tool type	End milling cutter
Edge number	1

Fig. 8-20: Display of tool basic data

F-key level	<F2>	<F3>	<F4>	<F5>	<F6>	<F7>	<F8>	<F9>
Tool editor				Saving the basic tool data	Change type			Close editor
Insert tool editor				Saving the basic tool data				Close editor

Tab. 8-13: Function keys for basic tool data display

8.3.7 Location and tool status data

Tool status			
Bit No.	Identifier	Identifie	
Bit 1	Active tool	ta	☐
Bit 3	Used tool	tu	☐
Bit 4	Warning limit reached	tw	☐
Bit 5	Tool worn	two	☐
Bit 7	Tool locked	TL	☐
Bit 8	Tool broken	TD	☐
Bit 11	Load tool	TTL	☐

Fig. 8-21: Tool status display

F-key level	<F2>	<F3>	<F4>	<F5>	<F6>	<F7>	<F8>	<F9>
Tool editor		Next display						Close editor
Insert tool editor		Next display						Close editor

Tab. 8-14: Function keys for tool status display

8.3.8 User tool data

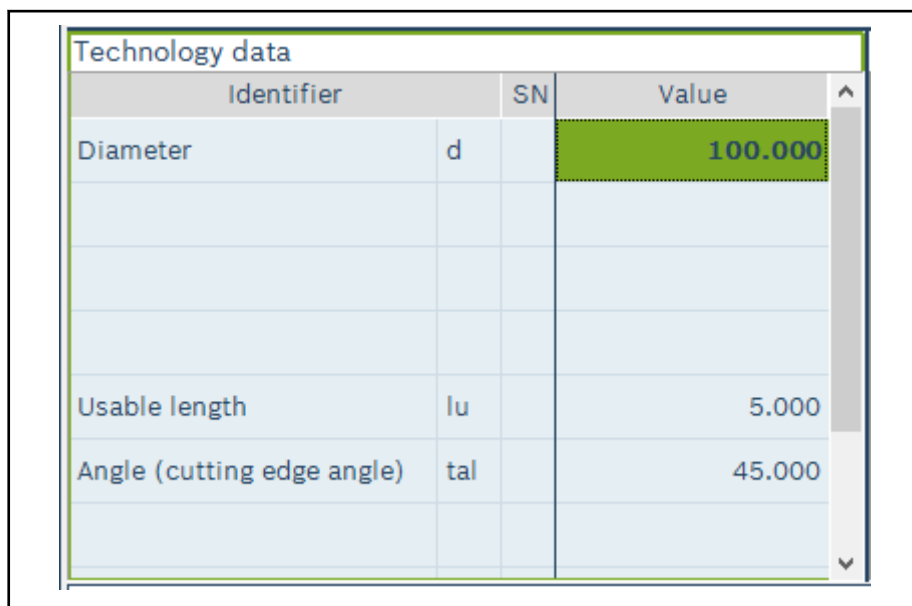
Tool data	
Identifier	Value
Description	
Angle head tool	☐
Tool orientation	undefined
Time unit	min
Tool life	0.00
Old sector	2
Old position	7

Fig. 8-22: Tool data display

F-key level	<F2>	<F3>	<F4>	<F5>	<F6>	<F7>	<F8>	<F9>
Tool editor		Next display			Input additive			Close editor
Insert tool editor		Next display						Close editor

Tab. 8-15: Function keys for tool status display

8.3.9 Technology data



Identifier	SN	Value
Diameter	d	100.000
Usable length	lu	5.000
Angle (cutting edge angle)	tal	45.000

Fig. 8-23: Technology data display

F-key level	<F2>	<F3>	<F4>	<F5>	<F6>	<F7>	<F8>	<F9>
Tool editor		Next display			Input additive			Close editor
Insert tool editor		Next display						Close editor

Tab. 8-16: Function keys for technology data display

8.3.10 Edge data

Tool edge data			
	Edge 1	Edge 2	Edge 3
Geometry L1	0.000		
Geometry L2	0.000		
Geometry L3	49.957		
Geometry R	10.990		
Edge position	0		
Wear L1	0.0000		
Wear L2	0.0000		

Fig. 8-24: Tool edge data display

F-key level	<F2>	<F3>	<F4>	<F5>	<F6>	<F7>	<F8>	<F9>
Tool editor		Next display			Input additive			Close editor
Insert tool editor		Next display						Close editor

Tab. 8-17: Function keys for edge data display

8.3.11 Geometry limit values

Edge data - Geometry limit values				
		Edge 1	Edge 2	Edge 3
L3				
R	Max value	0.000		
	Min value	0.000		

Fig. 8-25: Display of limit value data

F-key level	<F2>	<F3>	<F4>	<F5>	<F6>	<F7>	<F8>	<F9>
Tool editor		Next display			Input additive			Close editor
Insert tool editor		Next display						Close editor

Tab. 8-18: Function keys for limit value data display

8.3.12 Bitmap display

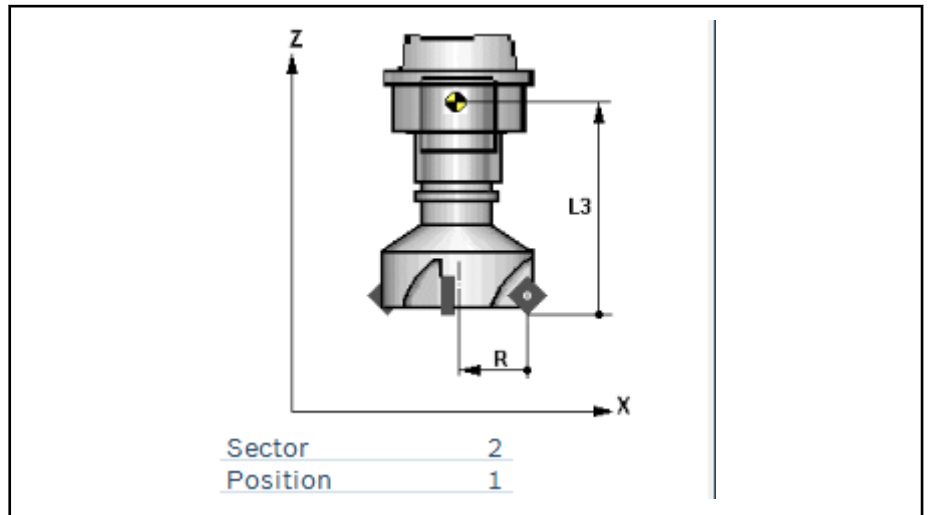


Fig. 8-26: Bitmap and memory location display

It is not possible to enter values into this data container.

F-key level	<F2>	<F3>	<F4>	<F5>	<F6>	<F7>	<F8>	<F9>
Tool editor (first level)							Switch level	Close editor
Tool editor (second level)	G17	G18	G19	Active plane			Back	
Insert tool editor								Close editor

Tab. 8-19: Function keys for bitmap display

8.3.13 Functions in the tool editor

<F3 Next display>

Contains the focused display window of several controls and can move the next display to the foreground via this function.

<F6 Modify type on/off>

This function is available only for editing an already existing tool. It can be used to specifically switch type modification on and off.



When the tool type is changed, all user data is deleted (all data under DBT1/Rec/UD).

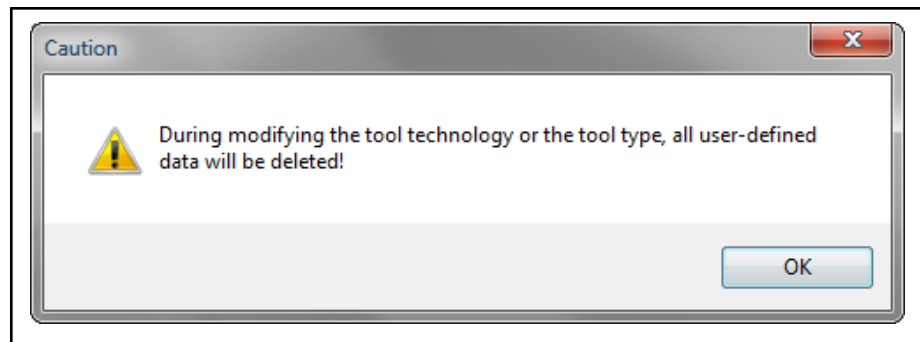


Fig. 8-27: Warning: Caution - Data is deleted!

<F5 Save tool basic data>

This function is only available if a basic data control is activated.

It permits influencing a tool basic data block belonging to the current tool type by applying the data block of the current tool as new basic data block to the tool catalog.

The basic data block is part of the IndraWorks project.

The following message is intended to explain the effects of the function when it is continuously worked with the tool catalog.

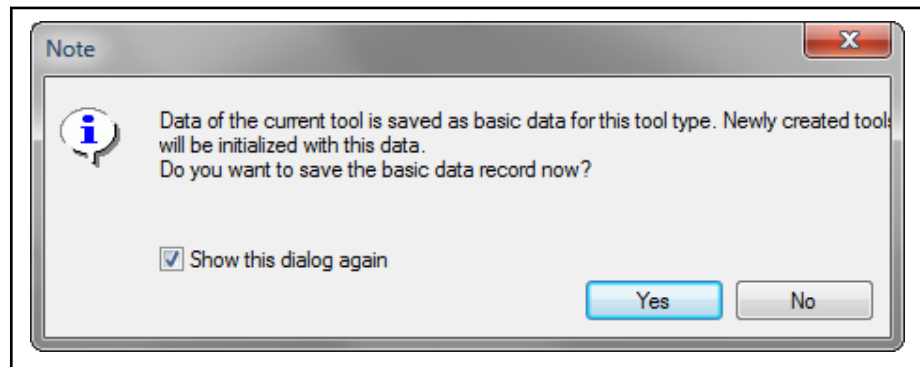


Fig. 8-28: Message when saving basic tool data

If the box for "Show this dialog again" is unticked, the query for the duration of the IndraWorks session is not displayed anymore.

8.3.14 M-keys in the tool editor

When "editing the tool", separate M-keypads with the following functions are provided in the default configuration:

Next tool (L7) This function is used to search the visible area of the tool memory in the tool list for the next tool and then to show its data.

Previous tool (L8) This function is used to search the visible area of the tool memory in the tool list for the previous tool and then to show its data.

When "adding a tool", empty M-keypads are applied in the default configuration.

M-keys can be configured in IndraWorks Engineering.

9 System switching

9.1 Channel dialog

9.1.1 Use

The channel dialog has two tasks:

- Switching between operation and display channels
- Display the selected channel information of all channels of a control (channel overview)

Channels hidden via the configuration are not shown.

Integration of the channel dialog in the user interface

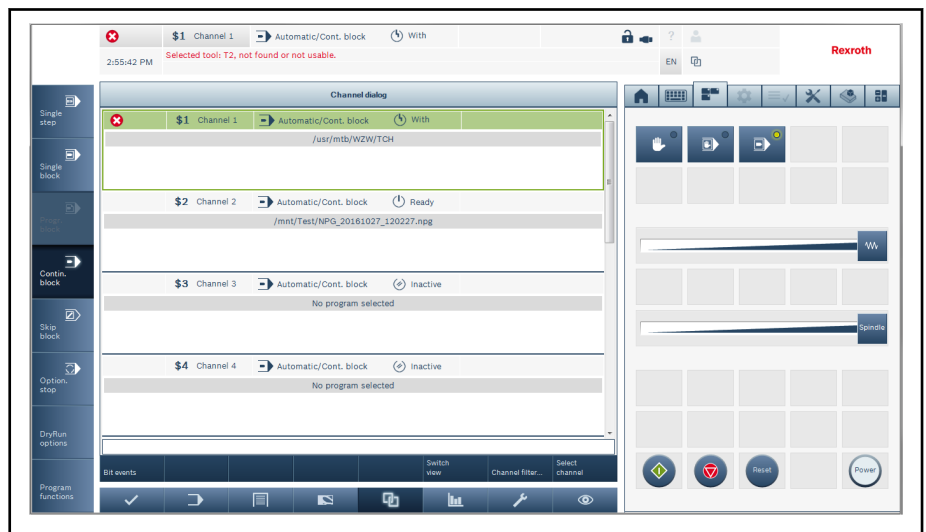


Fig. 9-1: Channel dialog in the user interface

The channel dialog is an application with individual F-key assignment.

Menu and title are hidden.

The channel dialog is opened via the <OP6> "System" key.

The M-keys act as "global M-keys" on the channel that is displayed in the machine status area (active channel).

9.1.2 General structure of the channel dialog

Depending on the number of channels, two display variants are possible. Use <F7> to switch to a display.

If there are more channels than can be displayed in the default setting, a compact display is also provided.

Structure of the default channel dialog

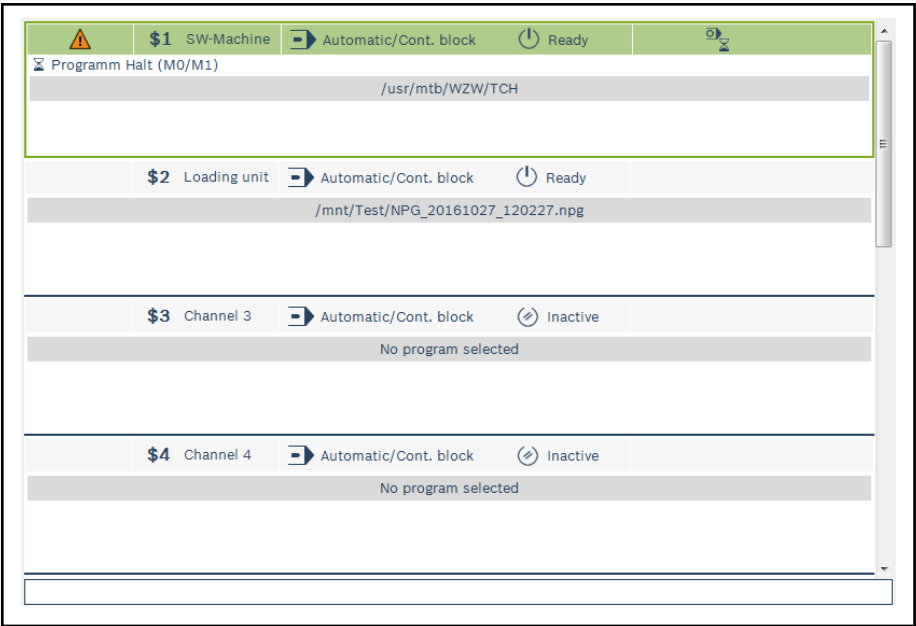


Fig. 9-2: Default structure of the channel dialog

The default channel dialog shows three to four channel windows at the same time (depending on the screen resolution).

Structure of the compact channel dialog

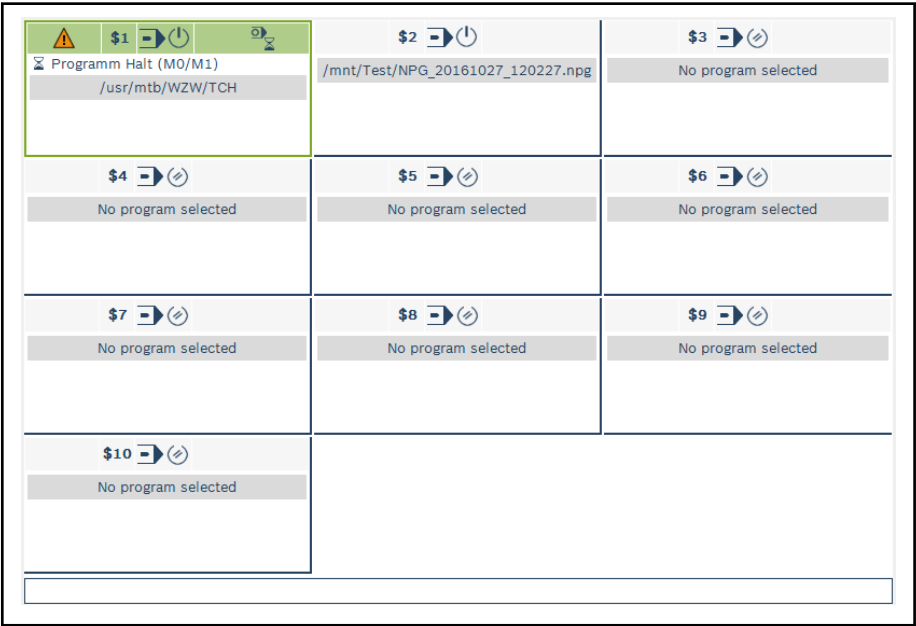


Fig. 9-3: Compact structure of channel dialog

The compact channel dialog displays eight to twelve channel windows at the same time (depending on the screen resolution).

If fewer channels are configured in the system, the channel windows remain empty.



The compact channel dialog can only be used if there are more than four channels.

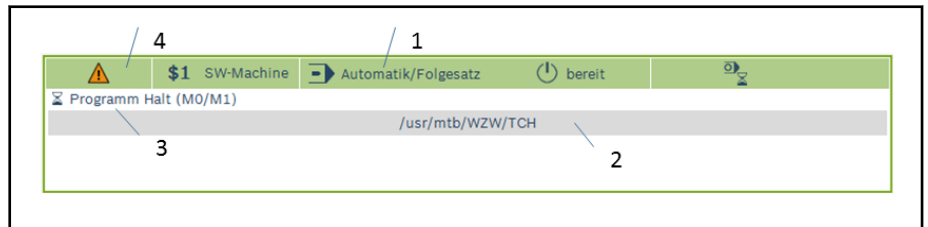
The active channel is highlighted within the channel dialog (1).

The focus is always on one channel window. F-keys act on this window. It is highlighted by a light green background and a dark green frame (2).

When the channel dialog is called, the active channel is focused.

The representation variant selected last is retained after the control is switched off.

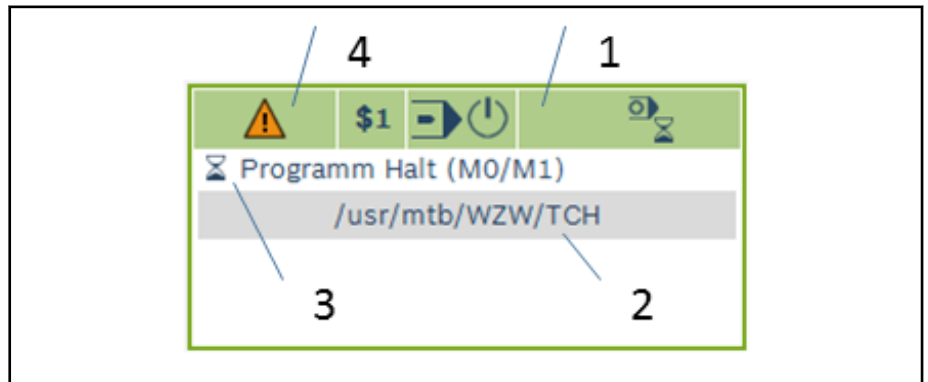
Structure of the default channel window



- 1 Channel information
- 2 Display of the active NC program name
- 3 Display of the last NC notes
- 4 Errors, warnings and notes of the channel (cancellation of the sum signal for the machine status area)

Fig. 9-4: Default channel window

Structure of the compact channel window



- 1 Channel information
- 2 Display of the active NC program name
- 3 Display of the last NC notes
- 4 Errors, warnings and notes of the channel (cancellation of the sum signal for the machine status area)

Fig. 9-5: Compact channel window

Structure of the default channel information



Fig. 9-6: Default channel information

The default channel information has the same structure and contents as the channel-specific part of the machine status area.

Structure of the compact channel information



Fig. 9-7: Channel information

In the compact display, the channel information does not show any text for the operation mode and the channel status.

The states "Test mode", "Optional stop" and "Skip NC block" are not shown in this display.

9.1.3 Channel waiting states

Display of the channel waiting states

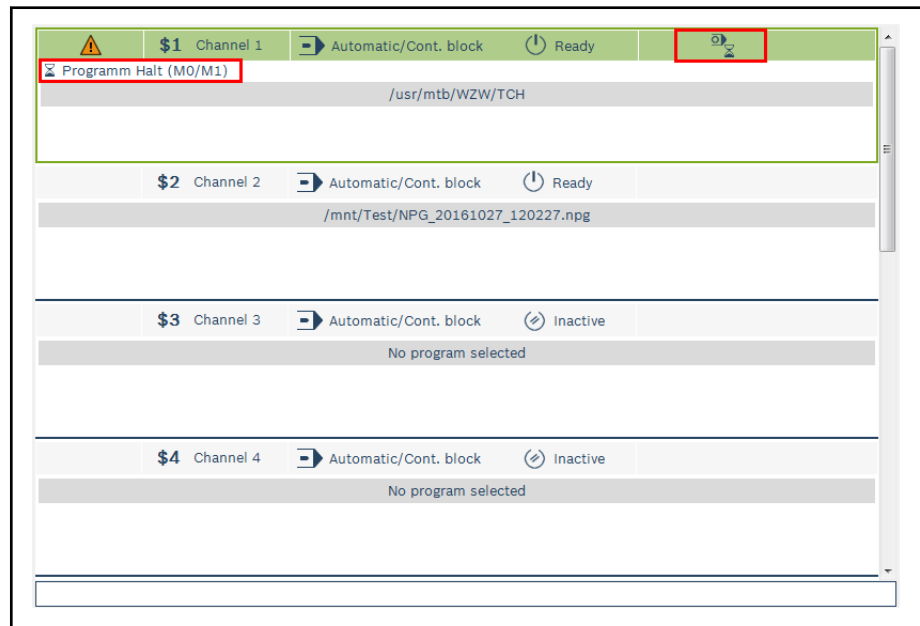


Fig. 9-8: Display of the channel waiting states

If a channel is in waiting state, the display of the NC notes are reduced and a line with the active waiting states is displayed.

In the compact representations, it is possible that not all existing waiting states can be displayed in one line. In this case, all channel waiting states are displayed in a "tooltip" with <F2> or by "Touch and hold" the symbol. The "tooltip" is displayed for approx. 10 seconds.

Waiting for bit event (channel synchronization)

If the channel waits for a bit event, the logic of the bit events programmed in the NC program is displayed additionally. The bits set are highlighted in green. "|" stands for OR and "&" for AND.

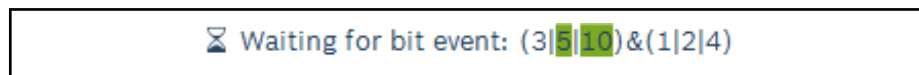


Fig. 9-9: Display of the waiting state: Bit event

An overview on the state of all 96 bits can be retrieved under <F8> "More functions", <F2> "Bit events". In this display, the bits set are highlighted in green.

Bit event overview					
Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6
Bit 7	Bit 8	Bit 9	Bit 10	Bit 11	Bit 12
Bit 13	Bit 14	Bit 15	Bit 16	Bit 17	Bit 18
Bit 19	Bit 20	Bit 21	Bit 22	Bit 23	Bit 24
Bit 25	Bit 26	Bit 27	Bit 28	Bit 29	Bit 30
Bit 31	Bit 32	Bit 33	Bit 34	Bit 35	Bit 36
Bit 37	Bit 38	Bit 39	Bit 40	Bit 41	Bit 42
Bit 43	Bit 44	Bit 45	Bit 46	Bit 47	Bit 47
Bit 49	Bit 50	Bit 51	Bit 52	Bit 53	Bit 54
Bit 55	Bit 56	Bit 57	Bit 58	Bit 59	Bit 60
Bit 61	Bit 62	Bit 63	Bit 64	Bit 65	Bit 66
Bit 67	Bit 68	Bit 69	Bit 70	Bit 71	Bit 72
Bit 73	Bit 74	Bit 75	Bit 76	Bit 77	Bit 78
Bit 79	Bit 80	Bit 81	Bit 82	Bit 83	Bit 84
Bit 85	Bit 86	Bit 87	Bit 88	Bit 89	Bit 90
Bit 91	Bit 92	Bit 93	Bit 94	Bit 95	Bit 96

Fig. 9-10: Dialog: Overview on bit events

9.1.4 Operation and navigation

Operation is carried out via F-keys, <cursor> keys and <Enter>.

A channel window is always selected. The F-keys act on this channel window.

The channel is focused using the <cursor> keys or "Single tap".

F-keypad level	<F2>	<F3>	<F4>	<F5>	<F6>	<F7>	<F8>	<F9>
Main level	Bit events					Switch view	Channel filter...	Apply channel
Bit events								Exit overview

Tab. 9-1: Function keys in the system overview

F-keys main level

The most important function are in the main level.

If there is not enough space to display channels, extra F-keys are displayed. These can be used to quickly switch between the blocks.

Use "Double tap" to apply the focused channel as active channel and immediately change to the "Machine" operating area.

<F2> Calling the bit event display

<F7> Toggling between normal and compact view

<F8> Display of the channel filter dialog

<F9> Focused channel becomes active

F-keys - Bit events

<F8> Return to main plane

Channel filter

Individual channels can be hidden from the display via the channel filter dialog. This function is only effective in the channel dialog.

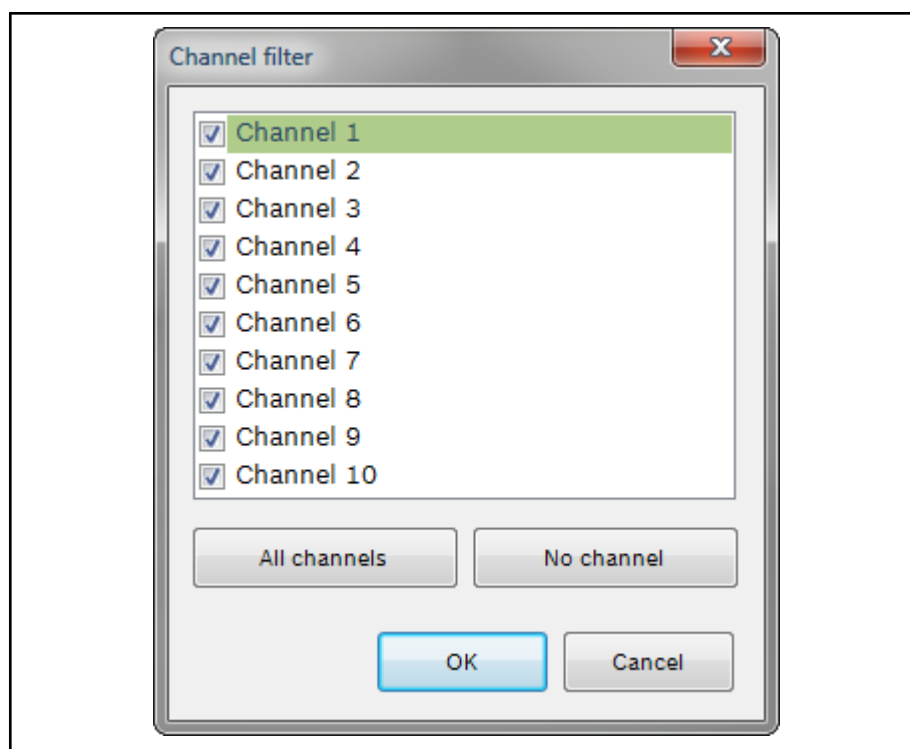


Fig. 9-11: Dialog: Channel filter

10 Diagnostics

10.1 Diagnostic display

10.1.1 Overview

Press <OP9> to activate the diagnostic display.

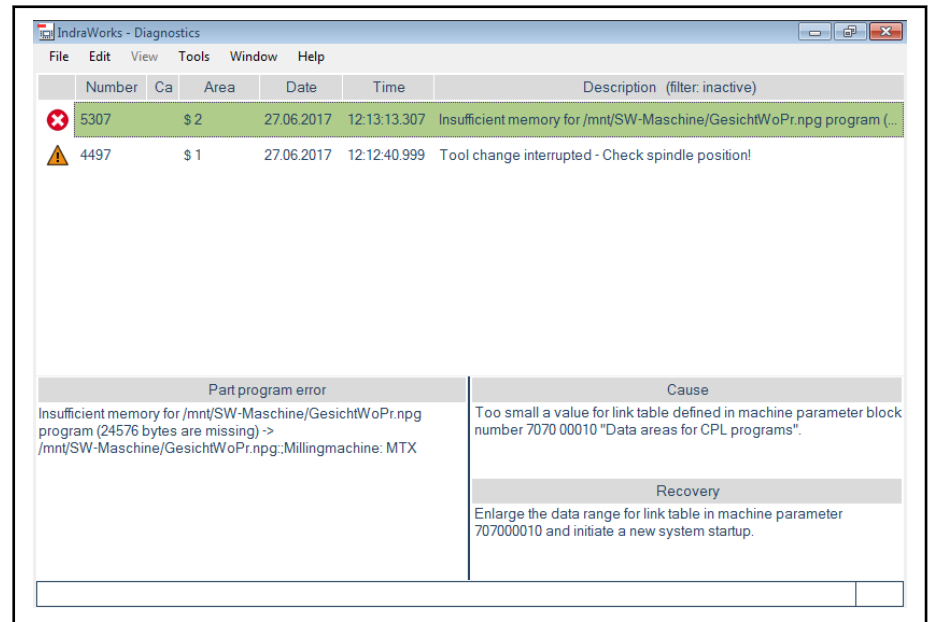
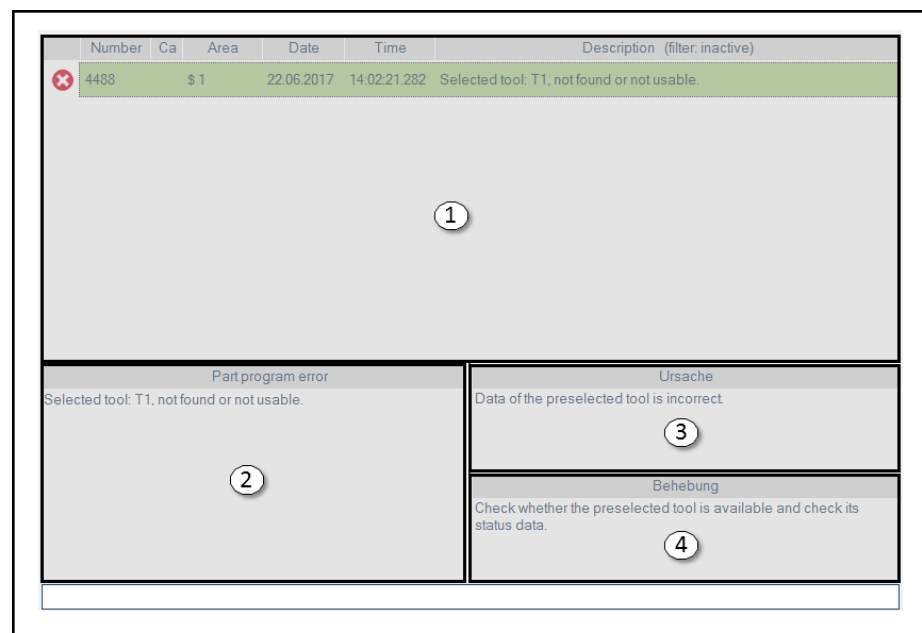


Fig. 10-1: Diagnostic display



The delivery scope of IndraWorks HMI depends on the installed control system. While the IndraMotion MTX scope of delivery includes preconfigured screens for operating NC machines, in IndraMotion MLC/IndraLogic XLC only the <OP9> key can be used for calling the diagnostic screen.



- 1 Message list
- 2 Short info
- 3 More information: Cause
- 4 More information: Recovery

Fig. 10-2: Screen layout of diagnostic screen

The start screen of the diagnostics is divided into four areas:

Message list field ① The diagnostic messages of the assigned control (see header) are displayed here. Listed are:

- The message number
- The existence of criteria analysis data (CA)
- The module number for ProVi messages of the channel number for MTX messages
- The time stamp of occurrence
- The brief description entered by the user

Short info ② Display of short text of the selected message. A symbol represents the message type:

- Errors
- Warning
- Message
- Setup diagnostics
- Startup requirements

More information: Cause ③ Representation of the extended information. User texts are saved there which explain the cause of the message in detail.

More information: Recovery ④ Display for notes on problem recovery.

10.1.2 Operation and navigation

The cursor or navigation keys can be used to scroll through messages of the filtered overview list.

F-keypad level	<F2>	<F3>	<F4>	<F5>	<F6>	<F7>	<F8>	<F9>
First main level		Delete	<i>Detail</i>	Filters...		Logbook	<i>More functions</i>	
Second main level	DP Diagnostic overview	Interface PLC-NC	Variable parameters	MTX acr *	MTX system state **	Sercos diagnostics	Back	
Detail	Current entry	Previous entry	Next entry	Oldest entry	Criteria analysis		<i>More functions</i>	Exit

* This function is only available if the software option "Action recorder" is activated

** This function is only available if a real control is used

Tab. 10-1: *Function keys in the diagnostic display*

F-keys of the first main level The most important functions are contained in the first and second main level.

- <F3> Deletes the selected diagnostic message
- <F4> Call of the detailed view of the selected diagnostic message
- <F5> Calls the filter dialog
- <F7> Calls the logbook display
- <F8> Return to second main level

F-keys of the second main level The most important functions are contained in the first and second main level.

- <F2> Calls the Profibus diagnostics
- <F3> Calls the PLC/NC interface display
- <F4> Calls the variable/parameter list display
- <F5> Calls the action recorder display
- <F6> MTX system state display
- <F7> Calls the Sercos diagnostics
- <F8> Return to first main level

F-keys of the "Detail" level The most important functions are contained in the first and second main level.

- <F2> The latest entry is now displayed
- <F3> The previous entry is displayed
- <F4> The next entry is displayed
- <F5> The oldest entry is now displayed
- <F6> Calls the criteria analysis
- <F7> Calls the Sercos diagnostics
- <F8> Return to first main level

10.1.3 Filter

Use <F1> on the diagnostics screen to filter by errors, warnings and messages. The active filtering is shown by the F-key labeling:

Press <F1> to switch through the various filter modes.

- **All <F1>**
No filtering. All diagnostic messages are displayed
- **Error <F1>**

Only messages of the "Error" type are displayed

- **Warning <F1>**

Only messages of the "Warning" type are displayed

- **Message <F1>**

Only messages of the "Message" type are displayed

Number	Ca	Area	Date	Time	Description (filter: inactive)
5307	\$ 2		27.06.2017	12:13:13.307	Insufficient memory for /mnt/SW-Maschine/GesichtWoPr.npg program (...)
Part program error			Cause		
Insufficient memory for /mnt/SW-Maschine/GesichtWoPr.npg program (24576 bytes are missing) -> /mnt/SW-Maschine/GesichtWoPr.npg:Millingmachine: MTX			Too small a value for link table defined in machine parameter block number 7070 00010 "Data areas for CPL programs".		
			Recovery		
			Enlarge the data range for link table in machine parameter 707000010 and initiate a new system startup.		

Fig. 10-3: Diagnostic display filtered according to errors

In the example above, the "error" filter is activated, so that only messages with error characteristics are displayed.

10.1.4 Detailed view

Press <F2> to switch between the detailed view and the overview.

The selected message is prepared and displayed with additional information in the detailed view.

Cause					
Too small a value for link table defined in machine parameter block number 7070 00010 "Data areas for CPL programs".					
Recovery					
Enlarge the data range for link table in machine parameter 707000010 and initiate a new system startup.					
Selected info					
✖	Insufficient memory for /mnt/SW-Maschine/GesichtWoPr.npg program (24576 bytes are missing) -> /mnt/SW-Maschine/GesichtWoPr.npg:Millingmachine: MTX				Type: MTX
					Class: Error
					Channel: \$ 2
					Date: 27.06.2017
					Time: 12:13:13.307

Fig. 10-4: Detailed view of the diagnostics

The windows "Cause" and "Recovery" are zoomed windows of the windows of the overview.

In the "Selected information", more information about the messages are displayed. Different additional information is displayed according to the message types (e.g. ProVi).

Type:	ProVi
Class:	prgMainProgram (PRG)
POU instance	
Action	
Network/line	5

Fig. 10-5: Additional information for a ProVi message

The additional information describes the ProVi message type and its origin in the program.

10.1.5 HTML information

The cause information and the recovery information for a ProVi message cannot only be provided as text, but also as HTML. The HTML link is displayed in the area of the recovery text of the overview. By selecting the ProVi message and <F3> "Detail", the content of the specified file is part of the detailed view.

Number	Ca	Area	Date	Time	Description (filter: inactive)
8002			05.01.2018	11:11:42.789	Nc {VAR (strChanName)} / ready for NC Start
Nc {VAR (strChanName)} / ready for NC Start					Cause
					Recovery

Fig. 10-6: Overview in the operating area "Diagnostics with HTML information"

The areas "Cause" and "Recovery" in the detailed view with HTML information are replaced by an HTML site. An F-panel is shown for the detailed view with HTML information. The four F-keys in the F-panel are used to scroll the HTML site. The F-panel used to navigate between the individual diagnostics can be reached via a second F-panel level. If the detailed information including the HTML information is called from the diagnostic overview, the panel used for scrolling the HTML page is shown. The panel for navigation can be reached by switching the level. If the detailed information including the HTML information from the detailed view is called (e.g. by next entry, previous entry...), the navigation panel and the panel for scrolling can be accessed via a panel change.

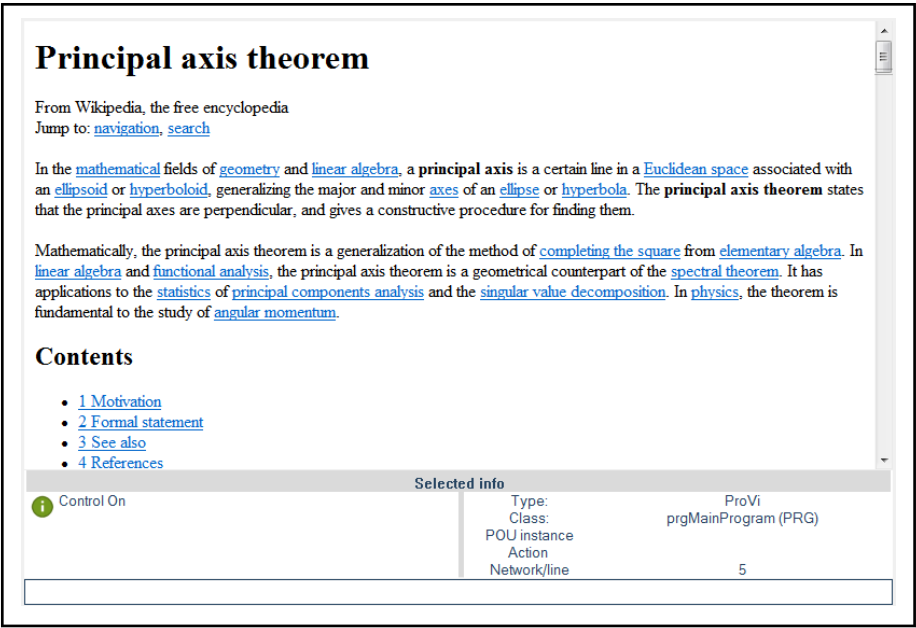


Fig. 10-7: Detailed view with HTML information

The cursor or the four navigation keys can be used to scroll through the HTML page in the panel level HTML pages.



The level change via <F8>"More functions" is only enabled if the ProVi message contains HTML information.

If the HTML file was not found, a default site with the message "<Path> \<FileName> was not found" is output.

10.1.6 Connection interruption

If the communication to the control is interrupted, no diagnostic messages can be displayed. This is for example the case if the connecting cable was removed. The display of the diagnostic messages is deleted when the connection is interrupted. As soon as the connection is established again, the display updates automatically.

10.2 Logbook

10.2.1 Logbook selection

Open logbook Logbooks are configured in IndraWorks Engineering. Any number of logbooks can be combined with any controls. If more than one logbook was configured, a selection dialog is opened when opening the logbook (<F7>).

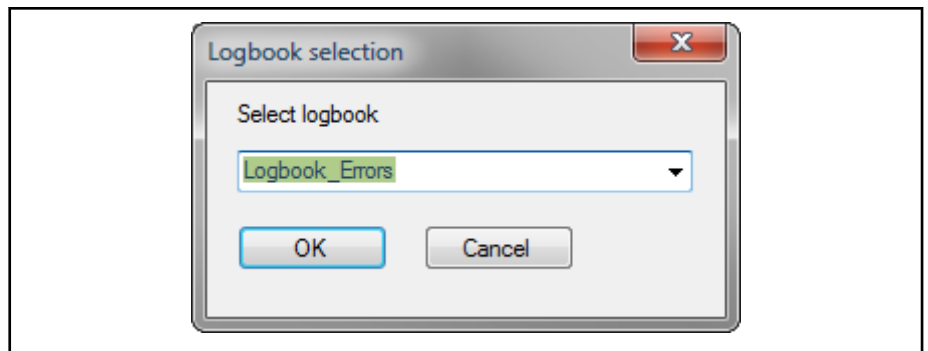


Fig. 10-8: Selection dialog "Logbook"

If only one logbook is configured, the selection dialog is not displayed but the logbook is immediately activated.

If no logbook is configured, a warning message is displayed.

Logbook functions

A logbook can be selected with <F5> "Selection". <F9> closes the logbook display and returns to the diagnostic display.

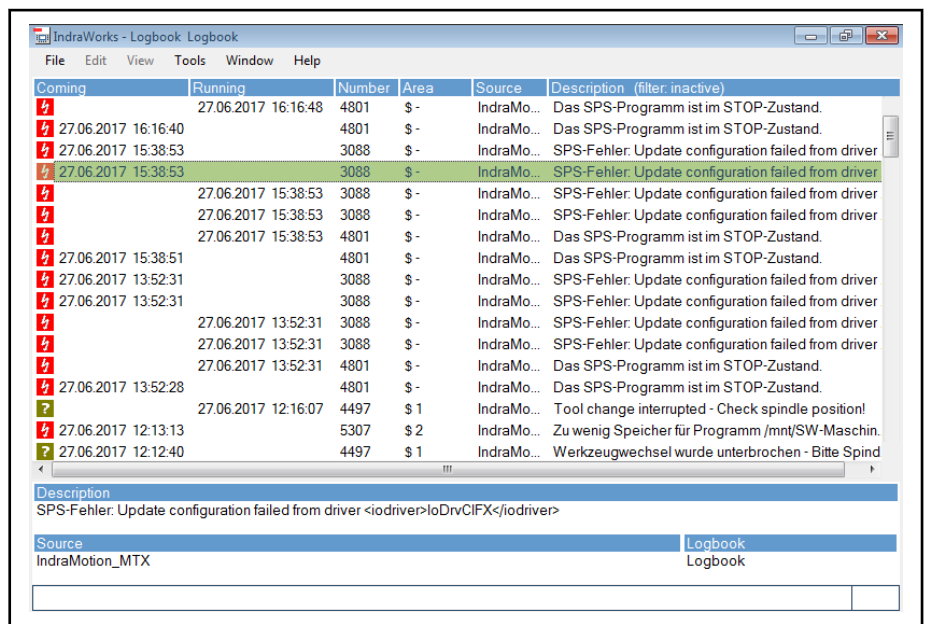


Fig. 10-9: Logbook display

10.2.2 Deleting a logbook

The delete function is enabled with <F4> "Delete". All messages displayed due to the current filter settings are deleted. The display is updated after the deletion.

10.2.3 Updating the display

The logbook display indicates the messages statically. Press <F6> "Update" to refresh the screen.

10.2.4 Export

Press <F2> "Export" to show the "Export" dialog.

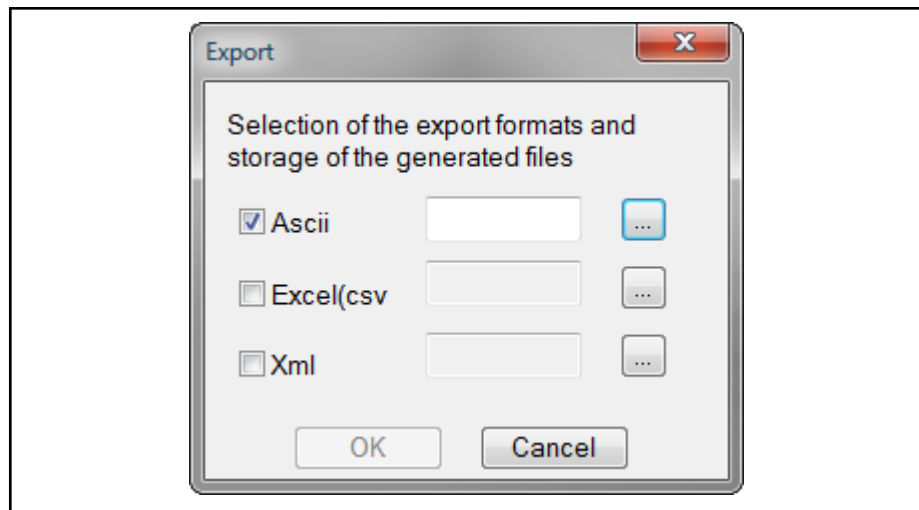


Fig. 10-10: Export dialog "Logbook"

In the export dialog, the following formats can be selected:

- ASCII
- CSV
- XML

The path and the name of the file to be exported is specified in the input field. **OK** executes the export. The current filter settings are used. Information on the filter settings is saved in the ASCII and XML files.

10.2.5 Filters

Press <F3> "Filter" to display the Filter dialog.

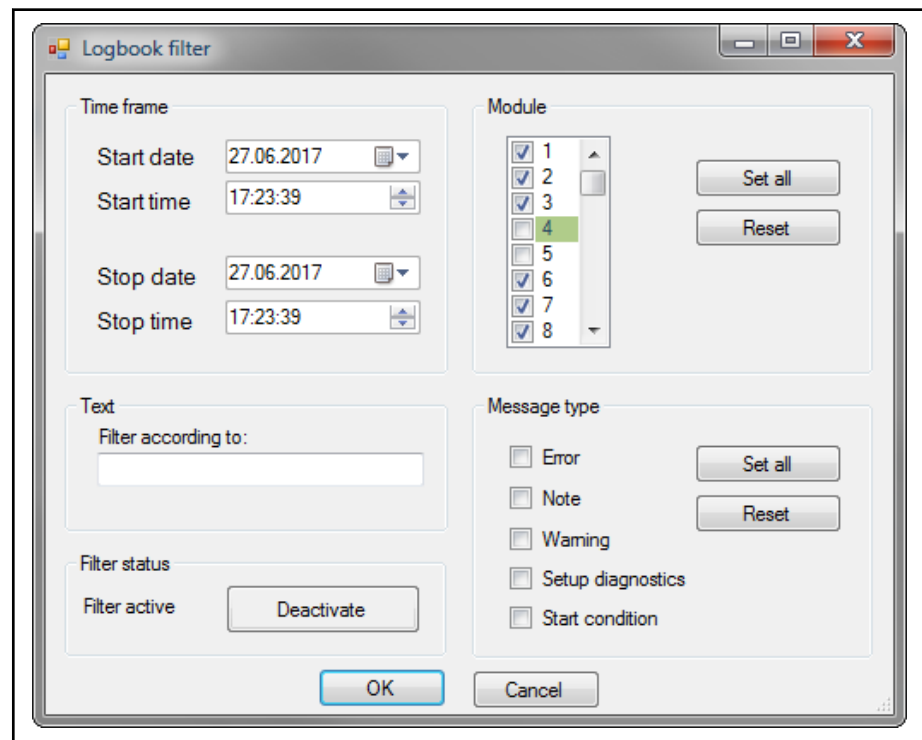


Fig. 10-11: Filter dialog "Logbook"

The selection of the logbook messages can be restricted in the "Filter" dialog.

Enter start time and end time in the "time window". Then, only messages within this period specified are displayed.

The "Source" field defines the control whose messages are considered.

Define the module numbers and the type of messages that are included in the log in "Module" and/or "Message type". The five message classes and the 99 modules may be combined in any way.

In "Text", the existing messages are scanned with regard to a given text. Only messages containing the given text are displayed.

Enable or disable the filter with the **Enable** and/or **Disable** button.

OK enabled the filters.

All settings are deleted when IndraWorks Operation is closed and the filter is disabled by default.

10.3 Field bus diagnostics

The field bus diagnostic display is embedded in the general representation of the diagnostics. The bus states of a Profibus DP connected to the control are displayed in the field bus diagnostics. Two views are available. The overview display provides an overview of the field buses configured in IndraWorks Engineering. The detailed view contains more detailed information about the individual bus devices selected in the overview.

The field bus diagnostics is called in two steps from the basic diagnostics view. In the first step, the key assignment of the function keys is switched using <F8>.

Subsequently, the field bus diagnostics is called using <F2>.

After calling the field bus diagnostics, an overview of the currently configured Profibus DP is displayed.

The window is divided into three areas:

- In the upper area, the bus master state, the name of the control as well as the ident number are displayed
- In the center part of the screen contains the legend of the DP slave states as well as an overview of the number of the failed and the malfunctioning slaves
- In the lower part of the screen, the current bus configuration including all slaves is displayed. Each slave is displayed with the bus address and its current state

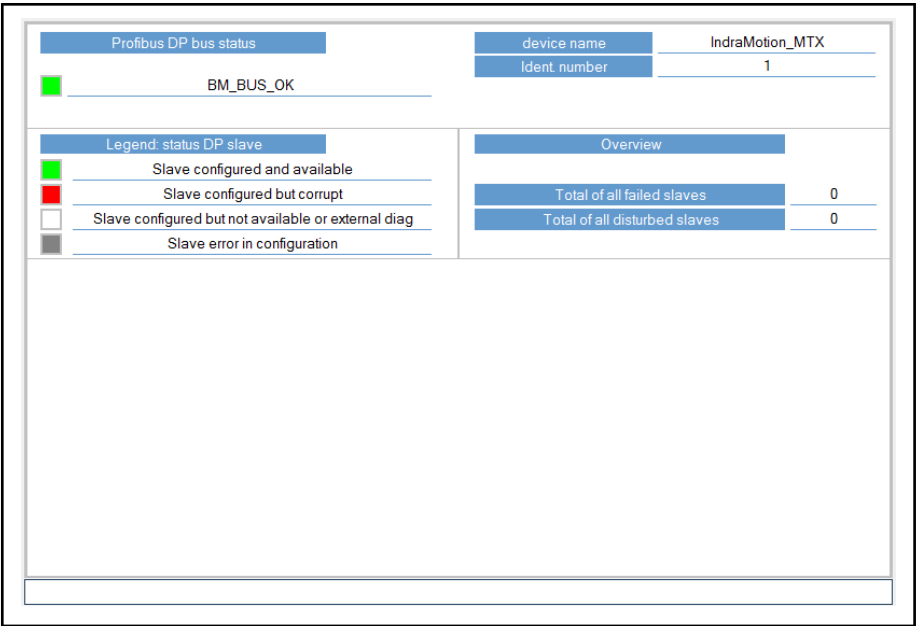


Fig. 10-12: Overview Profibus DP diagnostics

F-keys of the field bus diagnostics

F-keypad level	<F2>	<F3>	<F4>	<F5>	<F6>	<F7>	<F8>	<F9>
Main level			Detail					Exit
Detail	First device	Previous device	Next device	Last device				Exit

Tab. 10-2: Function keys of the field bus diagnostics

- <F2> The first device is displayed
- <F3> The previous device is displayed
- <F4> The next device is displayed
- <F5> The last device is displayed
- <F9> Return to main level

For more information about each bus device, refer to the detailed view. The detailed view is available for each slave and is displayed for the selected (black frame) bus device. Select the slave using the touch gestures or arrow keys. The detailed view is called via <F4>.

Once activated, the detailed view is displayed on the center and lower area of the overview screen. The representation provides information about the current bus device state, the slave address, the slave number and the status of the station. An error number transmitted by the control as well as the hexadecimal coded channel error text is displayed depending on the bus device.

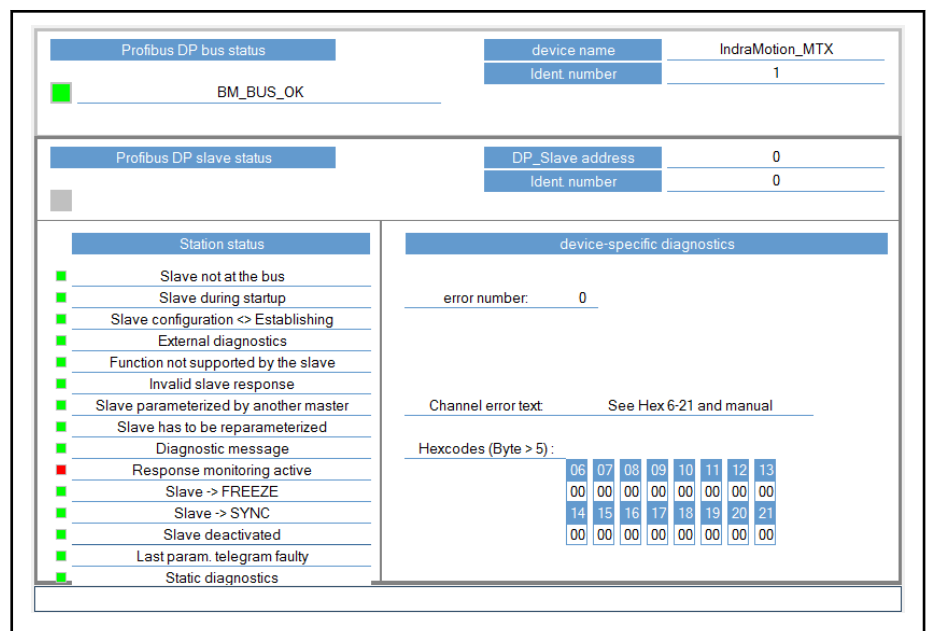


Fig. 10-13: Detailed view of a bus device

To access the detailed view of another slave, the user does not have to go back to the overview but can toggle between the detailed views of the bus devices using <F2> to <F5>.

Go back to the overview with <F9>. This key closes the detailed diagnostic view.

10.4 NC-PLC interface signals

10.4.1 Use

The "Interface signals" display shows the status of all input and output signals of the internal interface between NC and PLC.

The signals are arranged according to the following signal groups:

- Global signals
- Channel signals
- Axis signals
- Spindle signals

The signals are arranged byte by byte in a group and displayed in plain text (logical name, description of signal). Signals, currently logically true, are inversely displayed (i.e. highlighted in dark green).

Arrangement of the interface signals on the operating desktop

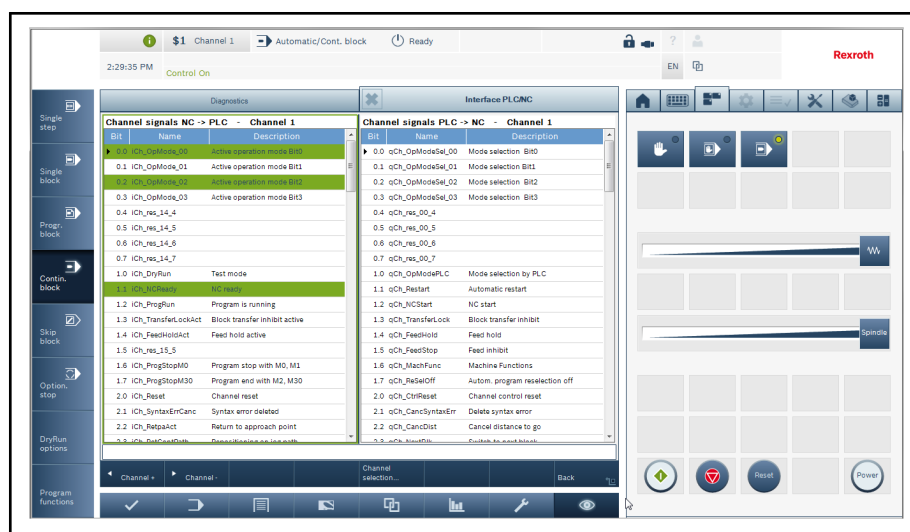


Fig. 10-14: Interface signals in the user interface

The display of the interface signals is an application with individual F-key assignment.

Menu and title are hidden.

The interface signals are assigned to the operating area <OP9 Diagnostics>. Press <F8> to start the application.

10.4.2 Basic structure of the interface signal display

Structure of the interface signals display

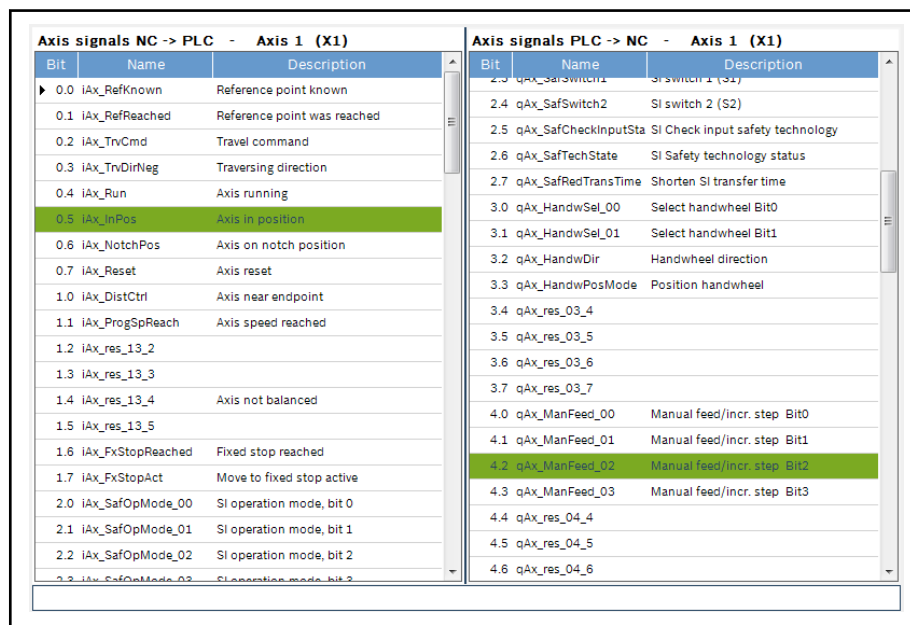


Fig. 10-15: Structure interface signal display (example axis signals)

The display consists of two lists.

The list on the left shows the NC → PLC signals and the right list shows the PLC → NC signals for the selected signal group.

Each line of the list visualizes a signal. The signal numbering in the list starts with 0.0.

The focused list is indicated by a green frame.

Press <F6 Combined display> to open a list display to which the user can assign any combination of signal types.

10.4.3 Operating and navigation

The operation is executed via F-keys and <cursor> keys.

Use the <cursor> keys to scroll within the list.

The <cursor> keys always act on the focused list.

F-keypad level	<F2>	<F3>	<F4>	<F5>	<F6>	<F7>	<F8>	<F9>
Main level	Channel signals	Axis signals	Spindle signals	Global signals	Combined display			Close interface
Channel signals	Channel +	Channel -			Channel selection...			Back
Axis signals	Axis +	Axis -			Axis selection			Back
Spindle signals	Spindle +	Spindle -			Spindle selection			Back
Global signals								Back
Combined display							Signal type selection...	Back

Tab. 10-3: Function keys of the interface signal display

F-keys of the main level

The signal group can be selected in the main level.

When a signal group is selected, the list is automatically focused and the associated F-key levels are shown.

- <F2> The signal group "Channel signals" is now displayed
- <F3> The signal group "Axis signals" is now displayed
- <F4> The signal group "Spindle signals" is now displayed
- <F5> The signal group "Global signals" is now displayed
- <F6> Combined signal groups are now displayed
- <F9> The interface display is closed. It is returned to the diagnostic display.

F-keys: Channel signals

- <F2> The interface of the next channel is displayed
- <F3> The interface of the previous channel is displayed
- <F6> The channel selection dialog is opened
- <F9> Return to main level

F-keys of the axis signals

- <F2> The interface of the next axis is displayed
- <F3> The interface of the previous axis is displayed
- <F6> The axis selection dialog is opened
- <F9> Return to main level

F-keys: Spindle signals

- <F2> The interface of the next spindle is displayed
- <F3> The interface of the previous spindle is displayed
- <F6> The spindle selection dialog is opened
- <F9> Return to main level

F-keys Global signals

- <F9> Return to main level

F-keys Combined display

- <F8> Press this key to open a dialog in which the signal types for the left and right list can be selected.

<F9> Return to main level

10.5 Variable and parameter lists

10.5.1 Use

The application shows selected variables and parameters in a preconfigured list of 22 lines and five columns.

The values of these variables and parameters can be changed online within the list.

Categories and subcategories

Categories and subcategories of variables and parameters are shown in the following table.

Icon	Category	Subcategory
	NC variables	CPL variables SD variables
	PLC variables	All data types e.g. BOOL, integer etc.
	Machine parameters	All parameter types e.g. axis parameters, spindle parameters, channel parameters
	Drive parameters	Data Status

Tab. 10-4: Categories and subcategories

Arrangement of the variable and parameter lists in IndraWorks Operation

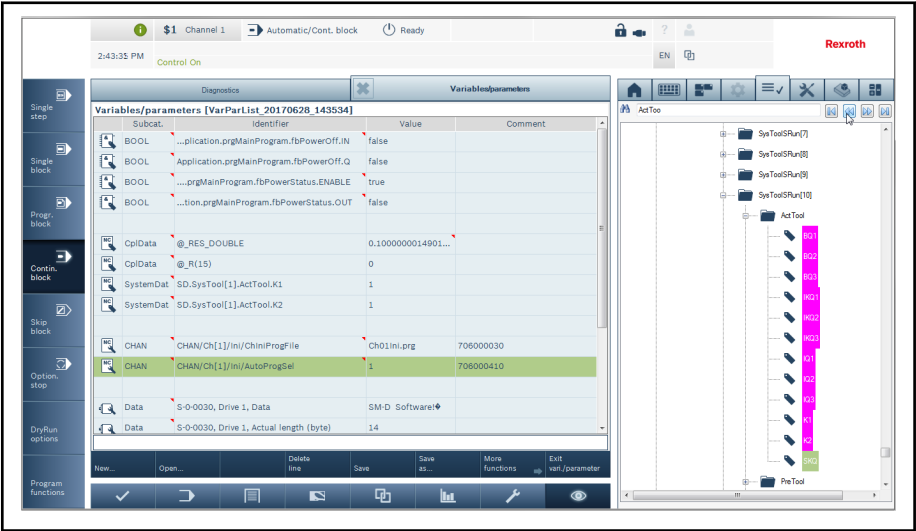


Fig. 10-16: Arrangement of the variable and parameter lists in IndraWorks Operation

The application has an individual F-key assignment.
Menu and title are hidden.
The variable and parameter lists are assigned to operating area <OP 9 Diagnostics>. Press <F9> to start the application.

10.5.2 Basic structure of the variable and parameter lists

Structure of the list display

	Subcat.	Identifier	Value	Comment
	BOOL	...plication.prgMainProgram.fbPowerOff.IN	false	
	BOOL	Application.prgMainProgram.fbPowerOff.Q	false	
	BOOL	prgMainProgram.fbPowerStatus.ENABLE	true	
	BOOL	...tion.prgMainProgram.fbPowerStatus.OUT	false	
	CplData	@_RES_DOUBLE	0.1000000014901...	
	CplData	@_R(15)	0	
	SystemDat	SD.SysTool[1].ActTool.K1	1	
	SystemDat	SD.SysTool[1].ActTool.K2	1	
	CHAN	CHAN/Ch[1]/Ini/ChIniProgFile	Ch01Ini.prg	706000030
	CHAN	CHAN/Ch[1]/Ini/AutoProgSel	1	706000410
	Data	S-0-0030, Drive 1, Data	SM-D Software!	
	Data	S-0-0030, Drive 1, Actual length (byte)	14	

Fig. 10-17: Structure of the list display

The screen consists of a list with the following five columns:

- Category (symbol representation)
- Subcategory
- Identifier
- Value
- Comment

Each of the 22 lines can be assigned to a variable or parameter.

More information

If there is further information on cell contents, the cell is marked with a red triangle. The information is displayed when using "Touch and hold" or when selecting the cell with the cursor keys via tooltips and status bar.

Machine parameters contain the following further information:

- Macoda ID
- Parameter name

	CHAN	CHAN/Ch[1]/Ini/ChIniProgFile		
	CHAN	CHAN/Ch[1]/Ini/AutoProgSel	1	706000410

Fig. 10-18: Machine parameters: Display for more information

Drive parameters contain the following further information:

- Parameter name
- Unit
- Minimum value
- Maximum value
- Attribute



Icon	Name	Path	Value	Unit
NC	CHAN	CHAN/Ch[1]/Ini/ChiniProgFile		
NC	CHAN	CHAN/Ch[1]/Ini/AutoProgSel		
Data	S-0-0036, Drive 1		-6.6109	

Fig. 10-19: Drive parameters: Display for more information

If the text in a line is too long, it is cut off ("...") and labeled and displayed as further information.

If a variable or parameter is entered into the list but no longer in the active project, the value is labeled with "???" and referred to in the further information.

10.5.3 Operating and navigation

The operation is executed via F-keys and cursor keys.

The cursor keys are used to navigate between the cells within the list.

Entry of values Focused editable cells are dark green.

An editable cell becomes an input field by entering a value, presinsg the <Return> key or by using "Double tap".

The entered value is applied with <Return> and transferred to the NC, PLC or drive.



Machine parameters:

For some machine parameters, the change is only applied after "NC restart" or "System reset". A corresponding note is given via a flashing symbol in the machine status area and a message in the status line. A key to trigger the function is available under "Additional functions".

PLC variables:

PLC variables are written once. PLC variables can only be forced in IndraWorks Engineering!

Incorrect entries are marked with the red color of the entry field as well as by a message in the status line.

Cancel the value input with <Esc>.

F-keypad level	<F2>	<F3>	<F4>	<F5>	<F6>	<F7>	<F8>	<F9>
Main level	New...	Open...		Delete line	Save	Save as...	More functions	Exit Var/parameter
More functions	File				Reset function *	Information comment	Back	
File	Export...	Import...	Delete list		Print			Back

Tab. 10-5: Functions keys of the Var/parameter list

F-keys of the main level The basic level contains the key functions to create and manage the list.

<F2> Create a new list

<F3> Open an existing list from the active project

<F4> Select a variable or a parameter via browser dialog

<F5> Delete line

	<F6>	Save the current list in the active project
	<F7>	Save the current list under a different name in the active project
	<F8>	More functions (second level)
	<F9>	Application Complete
F-keys: Additional functions	This level contains additional functions for the list management.	
	<F2>	The "File" level is called.
	<F6>	If required, it is assigned with "NC restart" or "System reset" to activate modified machine parameters
	<F7>	Apply further information into the comment cell
	<F8>	Return to main level
F-keypad level "File"	This level contains additional functions for the list management.	
	<F2>	Export the active list into the file system of the PC
	<F3>	Import a list from the file system of the PC
	<F4>	Delete lists from the active project
	<F6>	Print list
	<F7>	Save the current list under a different name in the active project
	<F9>	Return to level "More functions"

Variable browser

The variable browser is displayed in the "Dialog"   tab and is intended to select the corresponding variables or parameter for the display of the selected line of the list.

Category, subcategory, variables and parameters are displayed as tree in the variable browser.

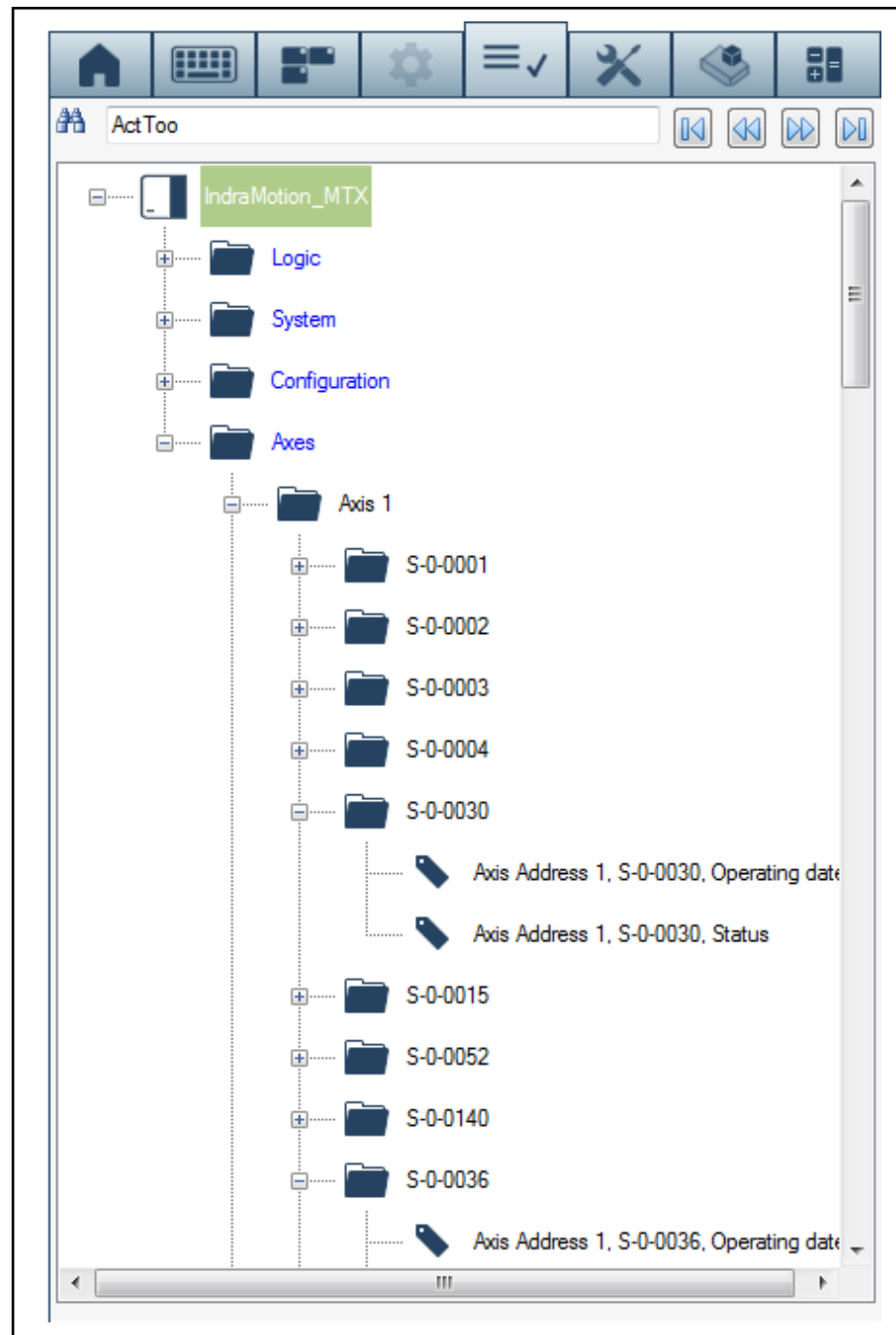


Fig. 10-20: Variable browser

Variables or parameters are selected by navigating in the tree. Search functions facilitate the search.

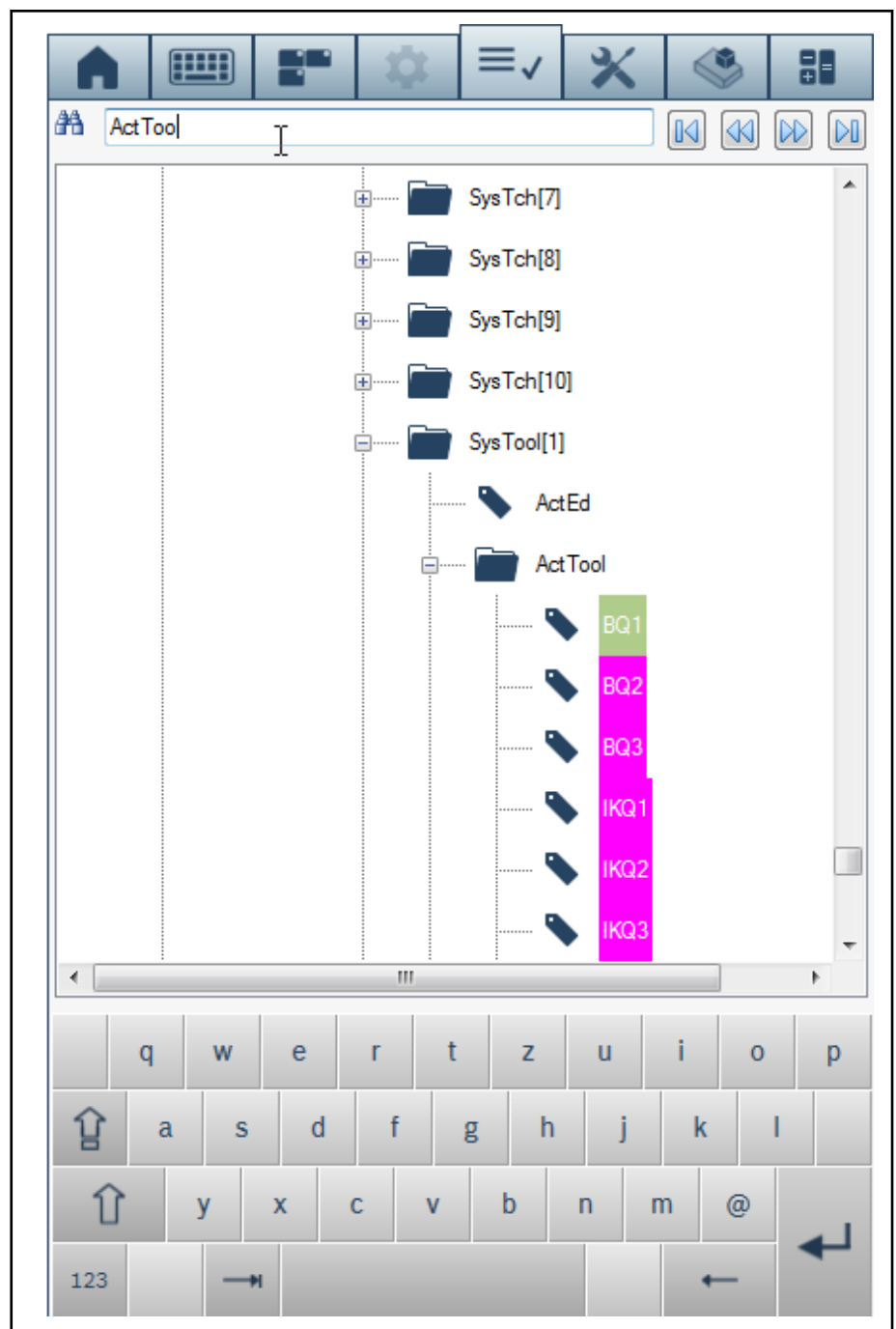


Fig. 10-21: Search function in variable browser

Use "Double tap" to apply the variable or parameter to the list. The next empty line is focused and the variable browser remains open.

Open, Save As, Delete dialog

The lists created are stored in the active project:

"...\ProjectName\VisualizationName\user\config\VarParLists"

The "Open", "Save" and "Delete" dialogs are used for file management. The "Open" dialog is shown in the figure. The "Save As" and "Delete" dialogs are similar.

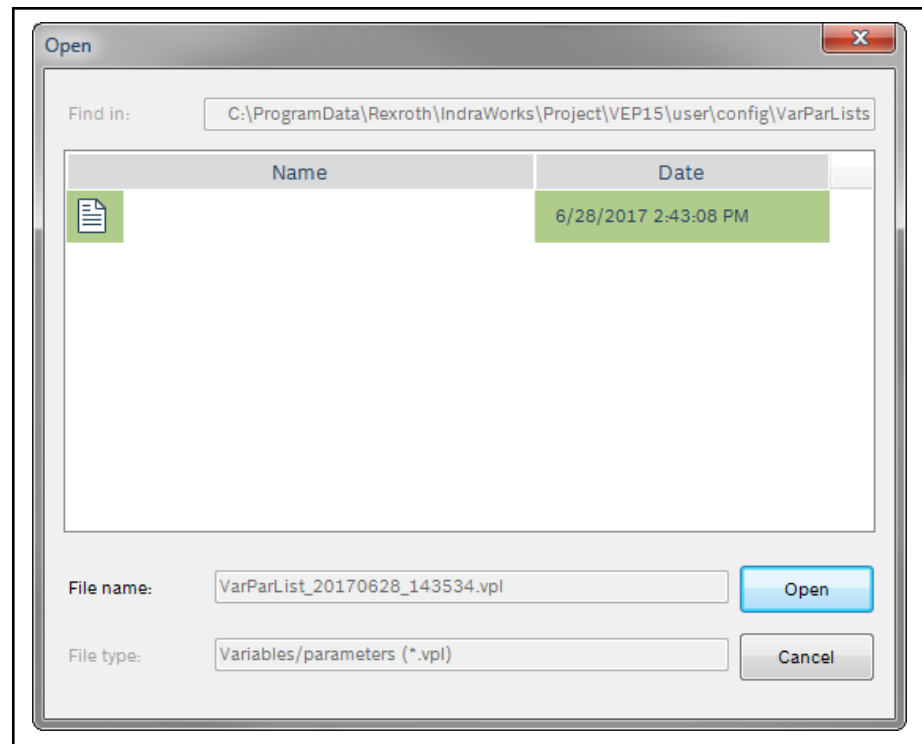


Fig. 10-22: "Open" dialog

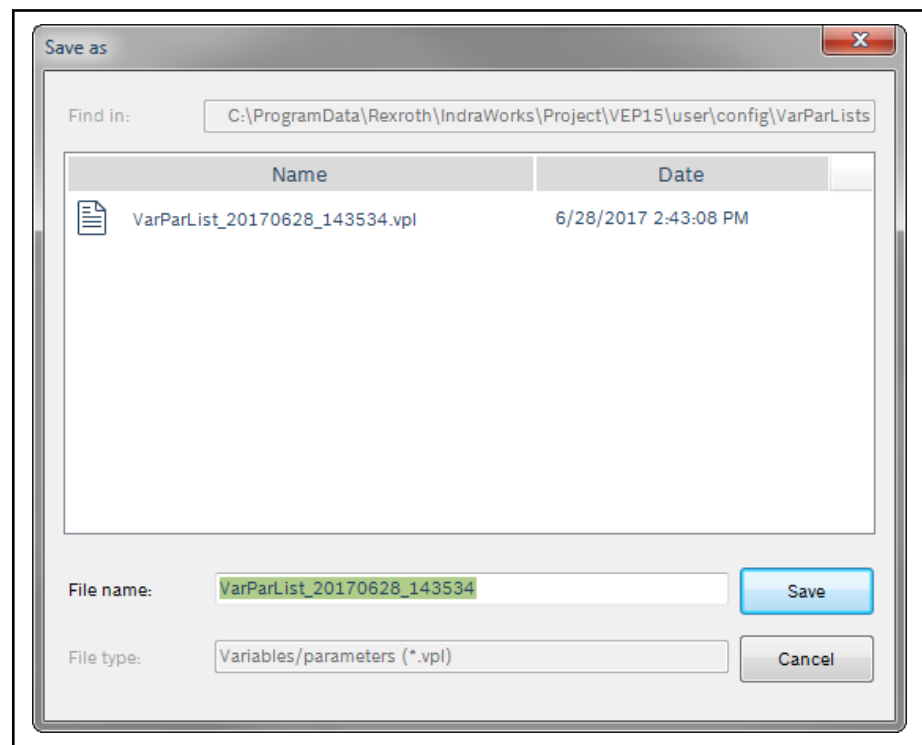


Fig. 10-23: "Save Project As" dialog

"Import" and "Export" dialog

The generated lists can be exported from the active project to the file system of the PC and imported from the file system to the active project.

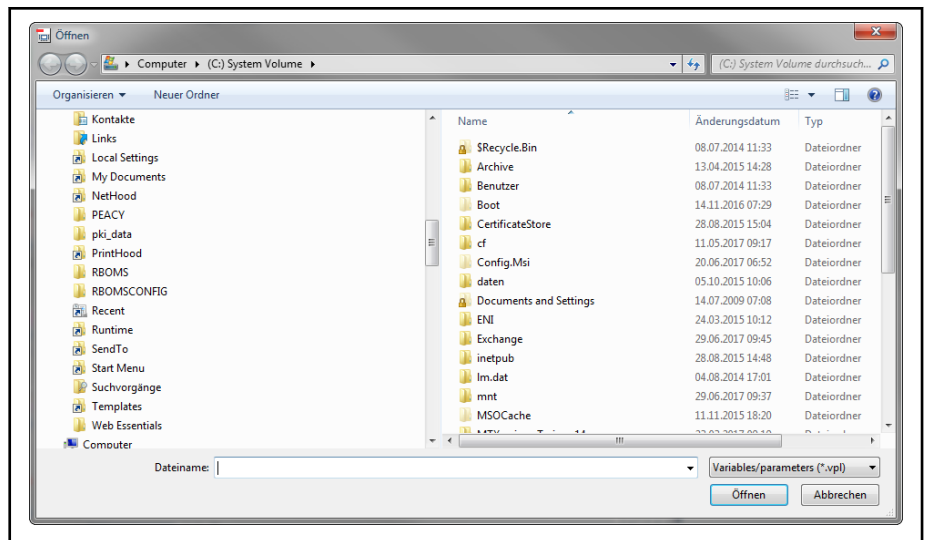


Fig. 10-24: "Import" dialog

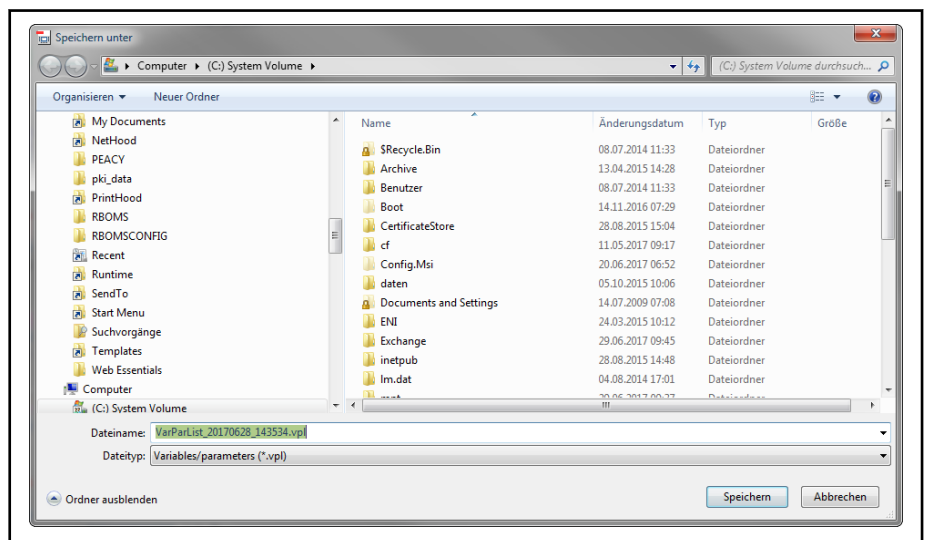


Fig. 10-25: "Export" dialog

10.6 MTX system status

10.6.1 Introduction

The MTX system status is a commissioning and diagnostic application for PC-based MTX controls.

This application controls, monitors and visualizes the state of the following component groups:

- IndraMotion MTX standard L45
- IndraMotion MTX performance L65
- IndraMotion MTX performance L75
- IndraMotion MTX advanced L85



The function MTX system status cannot be called anymore when using an emulation.

The MTX system status is embedded in the diagnostic display and can be opened via <F5> after calling the diagnostic display with <OP9>.

After calling the application, it is displayed as shown below.

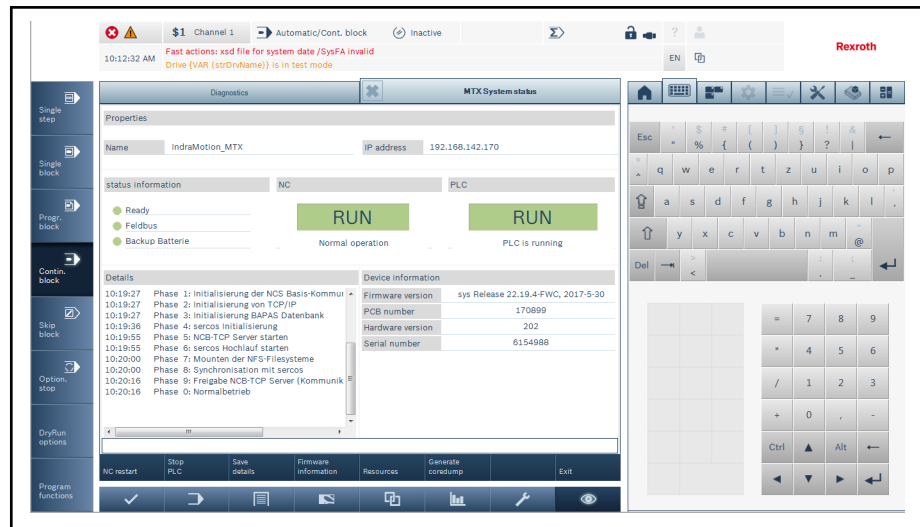


Fig. 10-26: MTX system status

The MTX system status is divided into three sections.

The upper section "Properties" contains general information on:

- **Name:**
The name configured for the respective control in IndraWorks Engineering is displayed
- **IP address:**
The IP address entered into the network configuration is displayed

The middle section displays the following:

- **Status Information:**
The status information of the control is displayed via red and green LEDs (see [chapter 10.6.3 "Status information" on page 263](#))
- **NC:**
In this section, the NC information is displayed (see [chapter 10.6.4 "NC" on page 263](#))
- **PLC:**
In this section, the PLC information is displayed (see [chapter 10.6.5 "PLC" on page 264](#))

The lower section is split in two:

- The results of the last control restart executed with this application are displayed on the left (see [chapter 10.6.6 "Saving details" on page 265](#))
- The device information is displayed on the right

10.6.2 Operation and navigation

F-keypad level	<F2>	<F3>	<F4>	<F5>	<F6>	<F7>	<F8>	<F9>
Main level	NC restart	Stop PLC	Save details	Information on the Firmware	Resources	Create core dump		Exit
		Start PLC			Information			

Tab. 10-6: Functions keys of the Var/parameter list

F-keys of the main level

The basic level contains the key functions to create and manage the list.

- <F2>** Displays the dialog to trigger an NC restart
- <F3>** Start and stop of the PLC program
- <F4>** Startup information backup to a file in the file system of the PC
- <F5>** Displaying detailed information on the firmware
- <F6>** Resource display of file system of the control
Optionally:
Displays information about the control startup and the hardware
- <F7>** Calls a dialog to create a coredump
- <F9>** Application Complete

10.6.3 Status information

The status information of the control is displayed using red and green LEDs:

- **Ready**
Green LED = Ready signal is 1
Red LED = Ready signal is 0
Gray LED = Ready signal is not supported by the control
- **Field bus**
Green LED = Field bus function ok
Red LED = Problem with field bus
- **Backup battery**
Green LED = Correct buffer battery state
Red LED = Buffer battery discharged or buffer battery not available

10.6.4 NC

The NC display in the middle section is provided with the following:

- **NC status field:**
This field visualizes the current NC status which is displayed in color and short form. The used abbreviations are described in [chapter 10.6.10 "Startup configuration" on page 267](#). This field is flashing during control startup
- **Information field with detailed status description:**
The abbreviations in the status field are explained in this field

Use <F2> to restart the NC. Use this F-key to open the following dialog. In this dialog, the startup mode (see [chapter 10.6.10 "Startup configuration" on page 267](#)) can be specified for a restart.

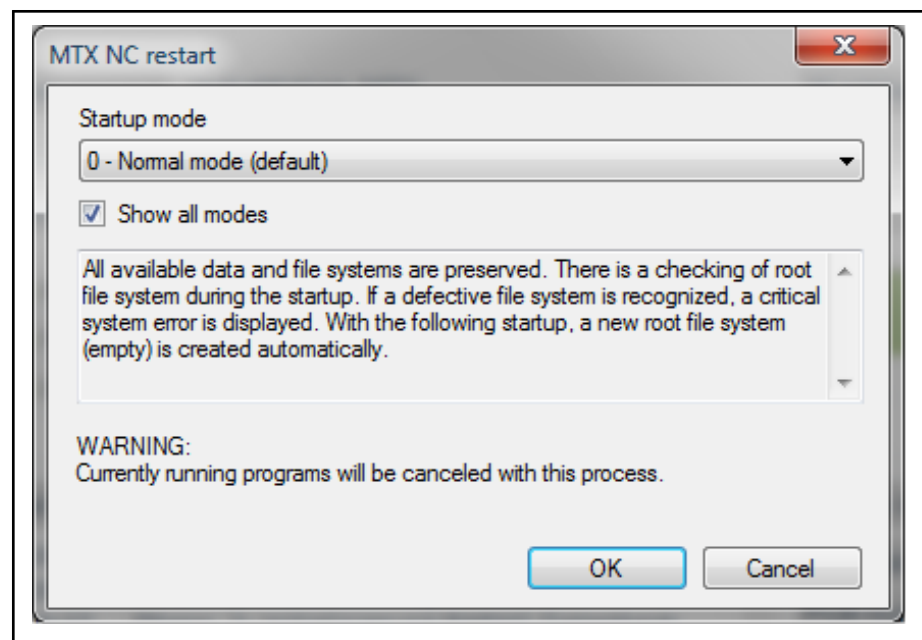


Fig. 10-27: NC restart

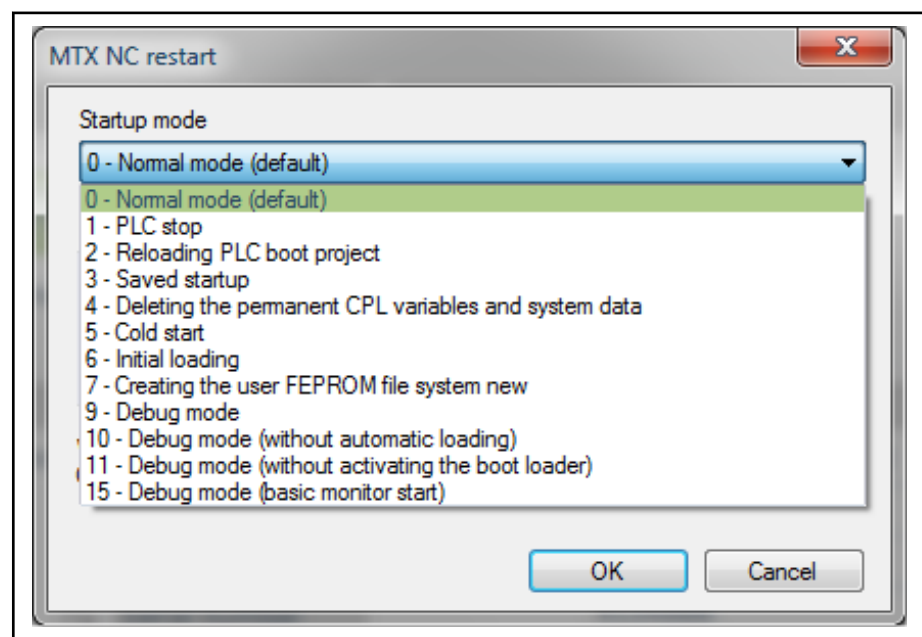


Fig. 10-28: NC restart (startup mode selection)

If the checkbox "Show all modes" is not selected, the user can only chose between three modes.

0	Normal mode (default)
6	Bootstrap
7	Creating the user FEPR0M file system

10.6.5 PLC

The PLC display in the middle section contains the following areas:

- PLC status field:**
 This field visualizes the current PLC status displayed in color and short form.

- "RUN" is displayed on green background during normal mode
- If the PLC is at standstill, STOP is displayed on red background
- **Information field with detailed status description:**
The abbreviations in the status field are explained in this field. The following long names exist:
 - RUN = PLC is running
 - STOP = PLC is at standstill

If the PLC is running, use <F3> to stop the PLC (and vice versa).

10.6.6 Saving details

The results of the last control restart **executed with this application** are visualized in the lower section on the left.. Date, time, phase and their meanings are displayed. The display is refreshed after each restart.

If required, this information can be saved in a "*.log" file with <F4>. The path under which the file is to be saved is arbitrary. The application saves this information under the default name "Details.log".

10.6.7 Firmware information

Use <F5> to open a window with the following data:

- Software version of MTX kernel
- Software version of the subsystems
- Version information about the Windows software components

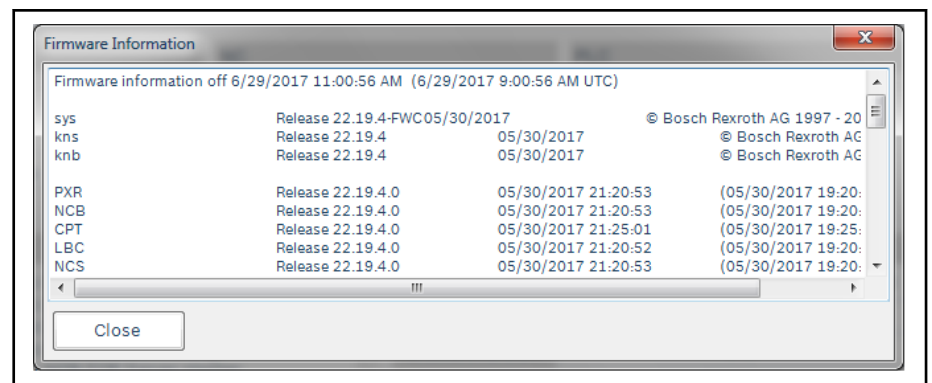


Fig. 10-29: Information on the Firmware

Software version of MTX kernel	Returns information on the general software version of the MTX kernel as well as a copyright message (version of the basic software and the customer upgrades).
Software version of the subsystems	Provides information about software versions of the subsystems in the MTX kernel. The following data is provided for each subsystem: • Subsystem name • Release number • Time stamp
Windows software components	Provides version information on the Windows software components which (under Windows) provide the communication interface for the MTX kernel. This includes: • The NCS interface (ncstyp3.dll)

- The text management (tsvtyp3.dll)
- The logical device MTX (SCPBrickDevice.dll, SCPBrickComponent.dll)
- FIS (FisServer.dll)

The following data is provided for each component:

- Subsystem name
- Release number
- Time stamp

10.6.8 Resources

The current memory allocation is embedded into the diagnostic display and can be opened with <F7>.

The following information is visualized:

- Permanent CPL variables
- Persistent SD data
- Used memory of the RAM file system

The bar visualizes the memory consumption in percent. For detailed information, go to the tooltip of the corresponding bar.

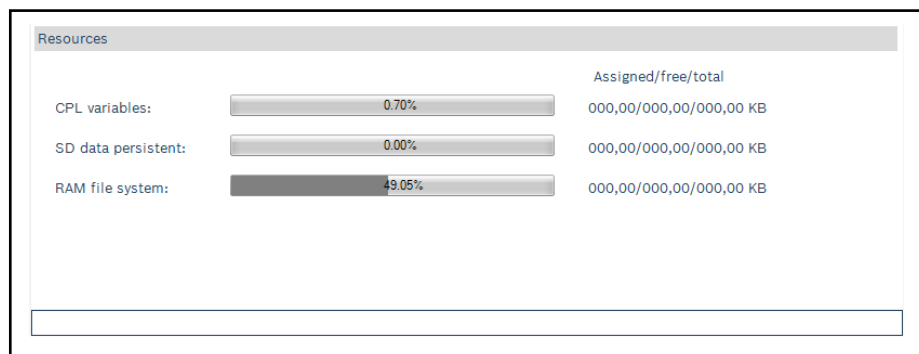


Fig. 10-30: Resource display

10.6.9 Information

More information can be displayed by pressing <F7>.

The following information is visualized:

- Startup information
- Device information:
 - Firmware version
 - Hardware ID:
 - PCB number
 - Hardware version
 - Serial number

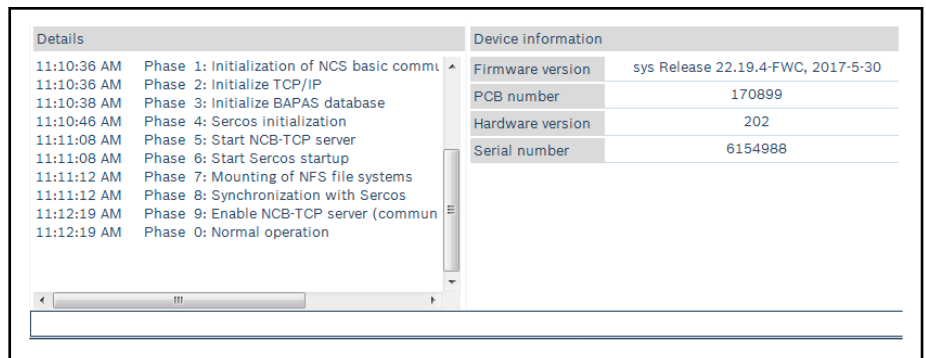


Fig. 10-31: Information

10.6.10 Startup configuration

Startup

MTX starts when switching on the control or while triggering an NC restart. The startup occurs synchronized in 12 phases displayed in the MTX system status:

P: -3	Determining the existing hardware
P: -2	RTOS startup, configure file systems
P: -1	Starting RTOS monitor
P: 1	Initializing the basic NCS communication
P: 2	Initializing TCP/IP
P: 3	BAPAS database initialization
P: 4	Sercos initialization
P: 5	Starting NCB-TCP server
P: 6	Starting Sercos startup
P: 7	Mount NFS file systems
P: 8	Synchronization with Sercos
P: 9	Sharing NCB-TCP server (communication with user interface)
RUN	Normal operation

Tab. 10-7: Display of startup phases

Startup mode

The startup mode determines the behavior of the MTX at startup.

The startup mode changes are only applied upon the next startup.

Startup mode	Description
0	Normal operation All existing data and file systems are retained. The root file system is checked at startup. If a defective file system is detected, a critical system error is displayed. A new empty root file system is automatically created at next startup.
1	PLC stop The behavior corresponds to Startup mode 0 with the difference that the PLC remains in the STOP state and the PLC user program is not processed.

Startup mode	Description
2	Reload the PLC boot project The PLC boot project is loaded from the user FEPROM. Any possible PLC boot project in the root file system is discarded. Otherwise, the behavior corresponds to the startup mode 0.
3	Save startup In rare cases, due to faulty machine parameter specifications, a control startup can be impossible. Startup mode 3 carries out a startup in this error situation irrespective of the set machine parameters. A startup with the minimum configuration is executed. The machine parameters set are ignored. After the startup, the invalid machine parameter settings can be corrected and a new startup with Startup mode 0 can be carried out.
4	Delete the permanent CPL variables The permanent CPL variables are deleted. Otherwise, the behavior would correspond to Startup mode 0.
5	Cold start The power-up management logic is not run through. Otherwise, the behavior would correspond to Startup mode 0.
6	Bootstrap A new root file system is created. As a result, all old file system data is lost. If an intact user FEPROM file system is available, the PLC boot project and the configuration data is loaded from this file system.
7	Develop the user FEPROM file system The user FEPROM is created again. As a result, all old file system data is lost. This is required for example if a user FEPROM file system is defective. The root file system is retained. The permanent CPL variables are deleted.
9	Debug mode This is normally for debugging if the control does not automatically boot after a reset. After the basic monitor has been initialized, the boot loader is enabled and the subsystems are automatically loaded.
10	Debug mode (without automatic loading) After the basic monitor has been initialized, the boot loader is enabled. Further loading can take place via TCP/IP.
11	Debug mode (without activating the boot loader) The basic monitor is initialized. Further loading can take place via TCP/IP.
15	Debug mode (basic monitor start) Only the basic monitor is enabled.

Tab. 10-8: Startup mode

10.7 PLC variable list

10.7.1 Use

The "PLCListView" application visualizes PLC variables located in a file in the IndraLogic export format "XML".



No variable structures are visualized.

The variables can be inputs, outputs and internal variables ("flags").

They are displayed in a list. They can be displayed in different ways (filtered, classified, etc.).

The values are displayed in different formats (binary, decimal, hex.).

The application supports the detailed view of each variable and provides the option to write and fix it in position. Writing and fixing is protected against unauthorized access via the user management.

Additionally, a comfortable search function with additional filters and an individual result list is provided.

Variables can be highlighted via selection functions. They can be saved as new file and opened separately later on (grouping).

A counting function to display value changes can be enabled for commissioning purposes.

The following PLC variable categories are displayed:

	Input
	Output
	Flag

 Only default types (BOOL, BYTE, INT, REAL, ...) are displayed as flags. Structures and arrays are hidden.

Integration of the PLC variable list
in IndraWorks Operation

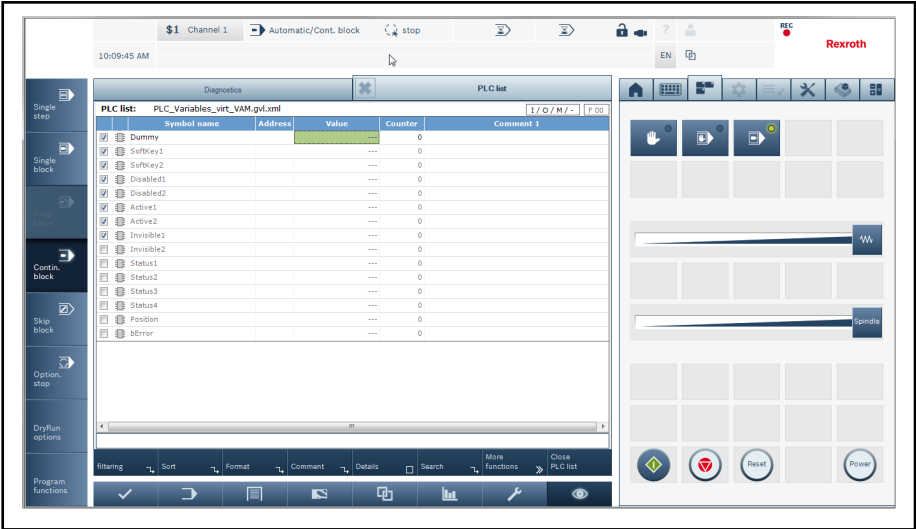


Fig. 10-32: Integration of the PLC variable list in IndraWorks Operation

The display is an application with individual F-key assignment.

Menu and title are hidden.

The PLC variable list is not part of the default user interface. This application must be configured on a function key and assigned to an operating area by OEM using IndraWorks Engineering.

10.7.2 General structure of the PLC variable list

Structure of the list display

	Symbol name	Address	Value	Counter	Comment 1
☒	Dummy		---	0	
☒	SoftKey1		---	0	
☒	SoftKey2		---	0	
☒	Disabled1		---	0	
☒	Disabled2		---	0	
☒	Active1		---	0	
☒	Active2		---	0	
☒	Invisible1		---	0	
☐	Invisible2		---	0	
☐	Status1		---	0	
☐	Status2		---	0	
☐	Status3		---	0	
☐	Status4		---	0	
☐	Position		---	0	
☐	bError		---	0	

Fig. 10-33: Structure of the list display

The list header contains three types of information:

- List name
- Active filter
- Fixing status

The PLC variable list consists of seven columns:

- Checkbox for selection (grouping, saving)
- Category (symbol representation)
- PLC variable name
- Absolute address
- Variable values
- Modification counter
- Comment



Variables that are not in the symbol tables, are displayed in grey and "---" is indicated as value.

10.7.3 Operation and navigation

The operation is executed via F-keys and cursor keys.

The cursor keys are used to navigate between the cells within the list.

F-keys: Basic level The basic level contains the key functions to create and manage the list.

F Filter	F Sort	F Format	F Comment	F Details	F Find	F More functions	F End PLC list
Call sublevel "Filter"	Call sublevel "Sort"	Call sublevel "Format"	Call sublevel "Comment"	Opens a status dialog with all detailed information on the variable selected	Call sublevel "Find"	More functions (second level)	Application complete

Tab. 10-9: F-keys: Basic level

F-keys: Filter level This level contains all filter functions.

F2 Inputs	F3 Outputs	F4 Flag	F5 Show selection	F6 Save selection	F7 Selection delete all	F8 Selection set all	F9 Back
Filter acc. to inputs	Filter acc. to outputs	Filter acc. to flags	Display only selected variables	Save selection in export file	Cancel selection for all variables	Set selection for all variables	Back to basic level

Tab. 10-10: F-keys: Filter level

F-keys: Sort level This level contains all sorting functions.

F2 as list order	F3 Symbol name A -> Z	F4 Symbol name Z -> A	F5 Absolute address 0 -> 9	F6 Absolute address 9 -> 0	F7	F8	F9 Back
Sort acc. to occurrence in export file	Sort in ascending order acc. to symbol name	Sort in descending order acc. to symbol name	Sort in ascending order acc. to address	Sort in descending order acc. to address			Back to basic level

Tab. 10-11: F-keys: Sort level

F-keys: Format level This level contains all formatting functions.

F2 as data type	F3 Binary	F4 Decimal	F5 Hex	F6	F7	F8	F9 Back
Format - control-internal data type	Format - binary value	Format - decimal value	Format - hexadecimal value				Back to basic level

Tab. 10-12: F-keys: Format level

F-keys: Comment level The displayed comment can be selected in this level.

F2 Comment 1	F3 Comment 2	F4 Comment 3	F5 Comment 4	F6	F7	F8	F9 Back
Display: Comment 1	Display: Comment 2	Display: Comment 3	Display: Comment 4				Back to basic level

Tab. 10-13: F-keys: Format level

F-keys: Find level This level contains all search functions.

Diagnostics

F2 Search down	F3 Search up	F4 Symbol name	F5 Address	F6 Comment	F7 Show hits	F8	F9 Back
Search down from cursor position	Search up from cursor position	Activate/deactivate search in the Symbol Name column	Activate/deactivate search in the Address column	Activate/deactivate search in the Comment column	Shows only matches in an extra list		Back to basic level

Tab. 10-14: F-keys: Find level

F-keys: Additional functions This level contains additional functions for the list management.

F2 Open list...	F3 Open default list	F4 Change value	F5	F6 Modification counter active	F7 Modification counter: single reset	F8 Back	F9
Open export file	Open default list	Call sublevel "Change value"		Activation/Deactivation of the modification counter	Resets an individual modification counter	Back to basic level	

Tab. 10-15: F-keys: Additional functions

F-keys: Change level value This level comprises all functions required for the value input.

F2 Enable: Write value	F3	F4 Enable: Fix value	F5 Cancel individual fixing	F6 Cancel all fixings	F7 Show fixing	F8	F9 Back
Allows writing the selected variables		Allows fixing the selected variables	Cancels fixing the selected variables	Cancels all fixings	Displays only fixed variables		Back to basic level

Tab. 10-16: F-keys: Change level value

Displaying details Selecting the "Details" function separates the screen in two partial windows.

The upper window displays the list as before.

The lower window displays an overview on all information of the selected variable.

The display format for the value can be selected freely and irrespective of the list display.

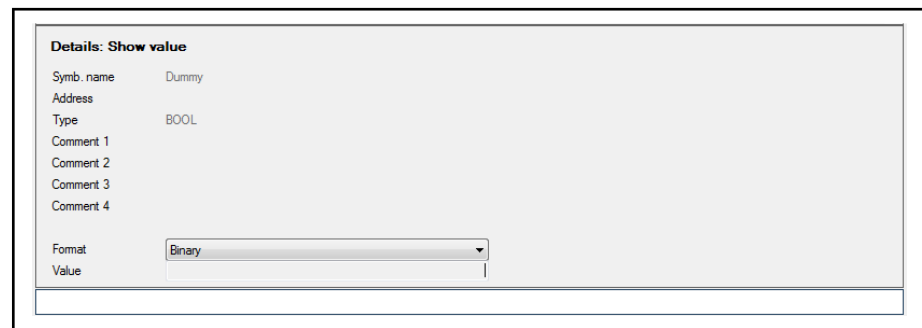


Fig. 10-34: Partial window: Details

Write value The "Enable: Write value" function can only be selected if the user is authorized.

Selecting the function separates the screen in two partial windows.

The upper window displays the list as before.

The lower window displays an overview on all information of the selected variable. In input fields for the value input is enabled for editing.

The input format for the value can be selected freely and irrespective of the list display.

The entered value is applied with **OK** and transferred to the PLC.

Details: write value

Symb. name: Dummy

Address:

Type: BOOL

Comment 1:

Comment 2:

Comment 3:

Comment 4:

Format: Binary

Value:

Fig. 10-35: Write value

Incorrect entries are marked with the red color of the entry field as well as by a message in the status line.

Details: write value

Symb. name: Dummy

Address:

Type: BOOL

Comment 1:

Comment 2:

Comment 3:

Comment 4:

Format: Binary

Value:

Impermissible value!

Fig. 10-36: Incorrect input

Esc cancels the value input and the current variable value is indicated in the input field.

Fixing value

The "Enable: Fixing value" function can only be selected under the following conditions:

- The user has to be authorized
- There have to be the respective prerequisites in the PLC program (function blocks).

Selecting the function separates the screen in two partial windows.

The upper window displays the list as before.

The lower window displays an overview on all information of the selected variable. In input fields for the value input is enabled for editing.

In contrast to the "Enable: Write value" function, the value is fixed in the PLC and cannot be overwritten by the PLC program.

The input format for the value can be selected freely and irrespective of the list display.

The entered value is applied with **OK** and transferred to the PLC.

In the list, the fixed variable is stored in red background color. The number of fixed variables is display in the list header.

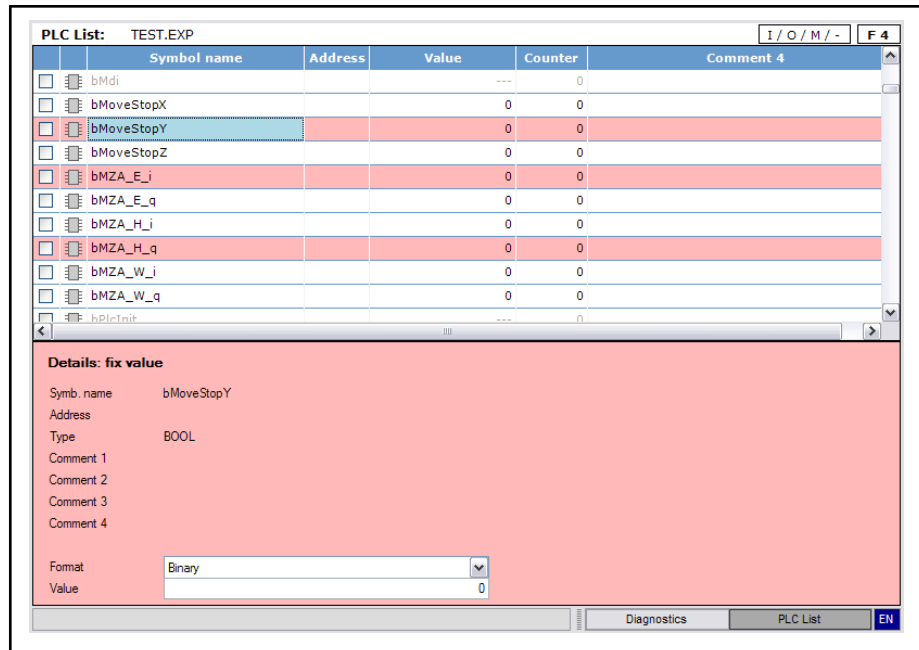


Fig. 10-37: Fixing value

Incorrect entries are marked with the red color of the entry field as well as by a message in the status line.

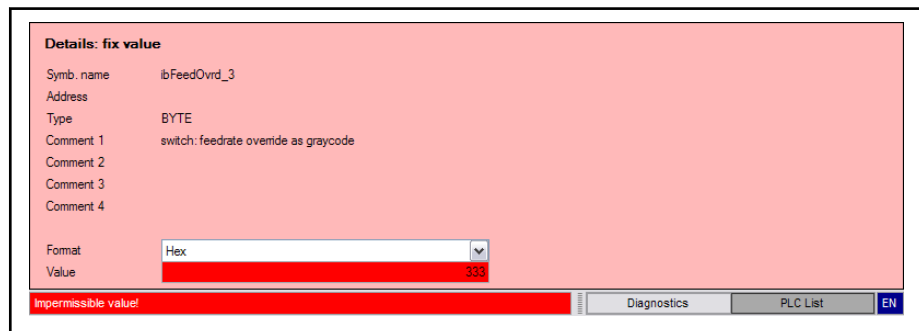


Fig. 10-38: Incorrect input

Esc cancels the value input and the current variable value is indicated in the input field.

The fixing can be canceled as follows:

- For the individual variable via the "Cancel individual fixing" function
- For all variables via the "Cancel all fixings" function
- PLC reset

Dialog "Open" and "Save"

The dialogs "Open" and "Save" are used for the file management of PLC lists in the IndraLogic export format "XML".

The lists created are stored in the active project: "...\\ProjectName\\Name Visualization\\user\\config\\PLCLists".

PLC lists can be created by selecting certain variables from the list displayed. The variable is selected with the **space bar** or by one of the functions of the F-key level "Filter".

The "Save selection" function is displayed in the "Save As" dialog and the variables selected are saved as individual list.

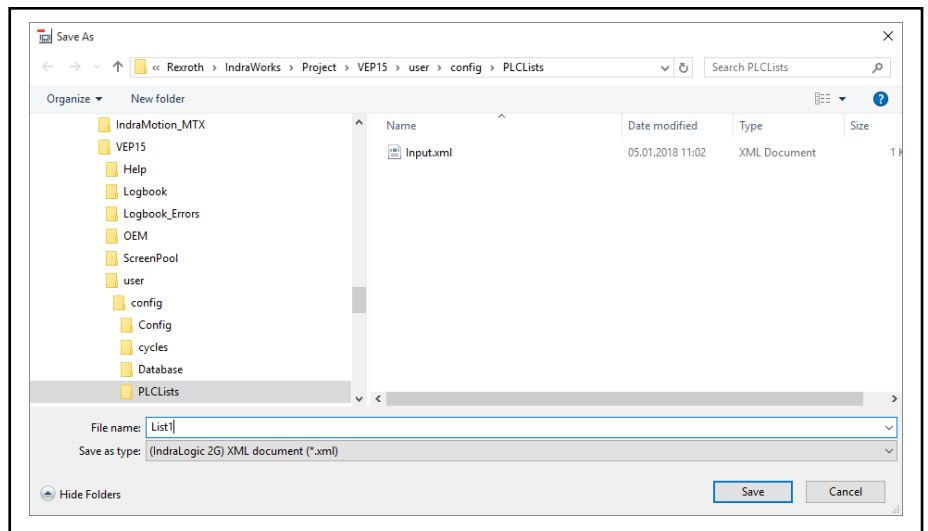


Fig. 10-39: Save as...

The "Open" dialog is displayed when selecting the "Open list..." function. This dialog can be used to select an already saved PLC list in the IndraLogic export format "XML".

This dialog is structured like the "Save As" dialog.

10.8 Sercos diagnostics

10.8.1 Use

The application shows an overview of all Sercos devices in a list with nine columns. The displayed information is used to quickly diagnose problems in the Sercos ring.

Placement of Sercos diagnostics in operation desktop

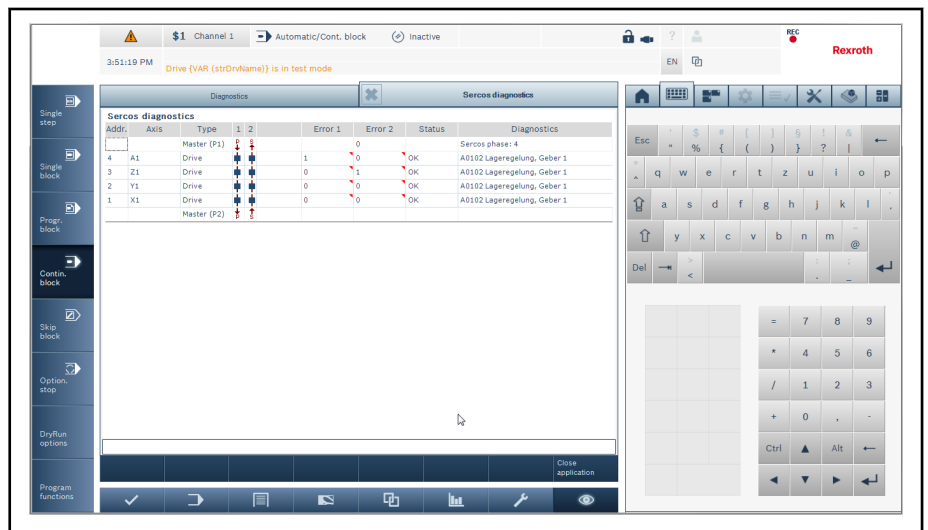


Fig. 10-40: Placement of Sercos diagnostics in operation desktop

The display is an application with an individual F-key assignment.

Menu and title are hidden.

The Sercos diagnostics is assigned to operating area "OP 9 Diagnostics". Press <F8> "More functions" and <F7> "Sercos diagnostics" to start the application.

10.8.2 General structure of the Sercos diagnostics

Structure of the list display

Sercos diagnostics								
Addr.	Axis	Type	1	2	Error 1	Error 2	Status	Diagnostics
		Master (P1)	P	P		0		Sercos phase: 4
4	A1	Drive	↓	↓	0	0	OK	A0012 Steuer- und Leistungsteil betriebsb
3	Z1	Drive	↓	↓	0	2	OK	A0012 Steuer- und Leistungsteil betriebsb
2	Y1	Drive	↓	↓	1	0	OK	A0012 Steuer- und Leistungsteil betriebsb
1	X1	Drive	↓	↓	1	0	OK	A0012 Steuer- und Leistungsteil betriebsb
		Master (P2)	S	S				

Fig. 10-41: Structure of the Sercos diagnostic display

The screen consists of a list with the nine columns:

- Address
- Axis
- Type
- Two columns to represent the topology
- Two columns for error counters
- Status
- Diagnostics

Each Sercos device is assigned one line. The control (master) contains one line each at the start and end of the list for both ports P1 and P2.

Address Display of the Sercos address set at the device.

Axis Display of the axis ID assigned to a drive via the machine parameters of the control.

In case of master and I/Os, this column remains blank.

Type Display of Sercos device type - master, I/O or drive.

Parameter S-0-1302.00.01, bit 16-30 is the basis for this information.

Topology Display of the topology of all Sercos devices between the ports P1 and P2 of the control. The signal flow is represented as icons. Possible topologies: Ring, double line, line.

If there is a connection established between P1 to the first device, from the first to the second device and from the nth device to P2, a ring is established.

If the ring is separated at a random position, a double line is generated.

If only P1 or P2 is connected to the devices, a line is generated.

Parameter S-0-1045, bit 10-13 is the basis for this information.

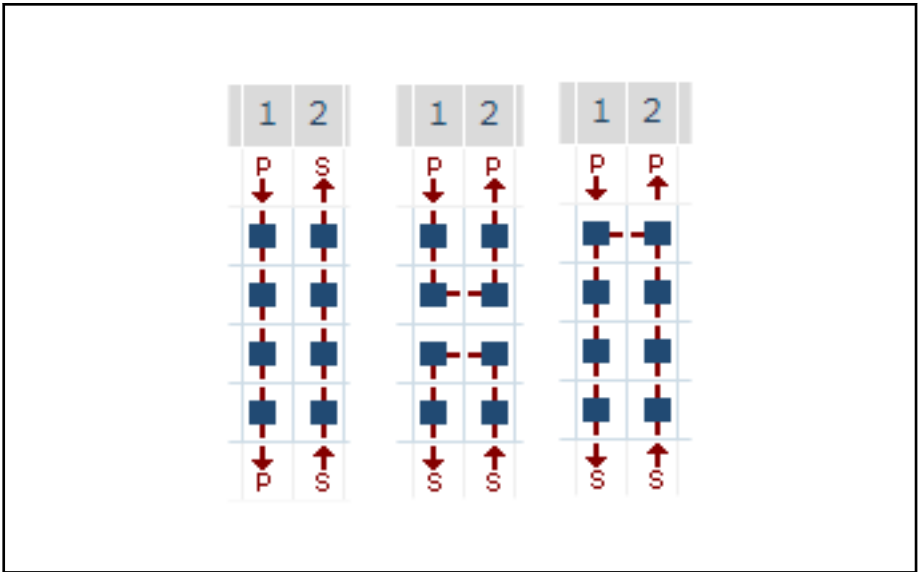


Fig. 10-42: Ring, double line, line

Error counter Display of error counters for port 1 and 2 of all devices. Parameter S-0-1035.0.1 is the basis for this information. If this parameter is not implemented, S-0-1035 is read. In this case, the cell is marked with a red triangle. The tooltip with the corresponding information is displayed when using "Touch and hold" or when selecting the cell using the cursor keys.

Sercos diagnostics									
Addr.	Axis	Type	1	2	Error 1	Error 2	Status	Diagnostics	
		Master (P1)	P	S		0	OK	Sercos phase: 4	
4	A1	Drive	P	S	0	0	OK	A0012 Steuer- und Leistungsteil betriebsb	
3	Z1	Drive	P	S	0	0	OK	A0012 Steuer- und Leistungsteil betriebsb	
2	Y1	Drive	P	S	0	1	OK	A0012 Steuer- und Leistungsteil betriebsb	
1	X1	Drive	P	S	0	0	OK	A0012 Steuer- und Leistungsteil betriebsb	
		Master (P2)	S	P					

Fig. 10-43: Tooltip

The CPL variable @_SERCOS_TELERR is the basis for the error counter of the control.

Status Display of the status information of the Sercos device - Ok, warning, error. Parameter S-0-0390, bit 16-19 is the basis for this information.

Diagnostics Display of diagnostic messages of the Sercos device. Parameter S-0-0095 is the basis for this information. In the first line (master P1), the Sercos phase is displayed.

10.8.3 Operation and navigation

The operation is executed via F-keys and cursor keys.

The cursor keys are used to navigate between the cells within the list.

F-keys In the F-key level, only the F9 key is assigned to exit the application.

11 Extended functionality

11.1 The NC-Analyzer

11.1.1 Overview

Purpose of NC-Analyzer

With the NC-Analyzer, NC programs and possible errors in the programming can easily be found in the programming.

The NC-Analyzer is part of the MTX interface.

Properties of the NC-Analyzer

NC-Analyzer

- can be applied to programs in CPL format (Customer Programming Language) and DIN 66025 format
- takes subroutine programming into consideration
- contains editor functions for executable programs
- supports all CPL variable formats
- supports multidimensional CPL variables (arrays)
- supports local, global and permanent variables
- can set breakpoints on NC blocks (max. 20 can be active simultaneously)
- can set breakpoints to variables
- can change variable values during program runtime
- can monitor up to 40 simultaneously active variables automatically (watch)

Troubleshooting in the program

The NC-Analyzer answers the following questions:

- Where in the program did the errors occur for the first time?
- What are the consequences of this error on the program?
- What are the consequences on other variables or program parts?
- How important is the error for the program?

The NC Analyzer provides the possibility to systematically select all relevant variables and to track its content step-by-step during the runtime of a program.

By setting breakpoints, the program can be stopped at user-defined breakpoints during runtime to query individual variable values and to check monitored variables for their contents.

At a breakpoint, each variable can be assigned with different values. Thus, other scenarios can also be tested in the program. In case of an incorrect assignment of a variable by the program, the variable can experimentally be assigned with the "correct" value.

The nesting structure of main programs and subroutine can be tracked and monitored in the "Stack" window.

The program run can be tested using user-specific messages (MSG, GMSG,...) in the "Output" window.

11.1.2 Starting the NC-Analyzer

Start NC-Analyzer

The NC-Analyzer is started via the second F-key level with <F4> in the standard screen.

The NC-Analyzer can also be configured in the user screens on F-keys or M-keys.

The NC-Analyzer uses one configuration file. Upon the first call or by default, a default setting is used. However, user-defined configuration files can be generated and used upon start.

When starting the NC-Analyzer, the wait dialog "Connect" is displayed and the NC state is indicated. Subsequently, the second dialog "Wait" is displayed.

If no connection is established, IndraWorks Operation is closed and the NC-Analyzer cannot be started. If the connection is interrupted while the NC-Analyzer is running, the NC-Analyzer disconnects and shuts down.



The wait dialog "Wait" is only displayed on the screen in case of a channel change, browsing the file system of the NC, etc.

Working area

Using the "Save working area" function, all relevant setup data of an NC-Analyzer session can be saved:

- Name of active CPL or DIN program
- Active breakpoints in the main program or subroutines (only active breakpoints can be saved)
- List of monitored variables

Save working area Press <F3> in the top F-key level. The file dialog is opened and by default, the configuration path of the user is selected. Any path and/or file name can be entered.

In the working area file, active breakpoints and variables to be monitored are saved.

Load working area *If the working area to be loaded contains variables in the watch window, they are loaded if the following points apply:*

- The program selected in the NC complies with the program name saved in the working area
- The variables are still included in the program

If the working area contains breakpoints, they are loaded if the following points apply:

- The program selected in the NC complies with the program name saved in the working program
- The program has not been edited in the mean time
- Analyzer mode is enabled

In case of a running NC-Analyzer, an available configuration file can be called at any time and its settings can be applied if the NC program, the configuration file refers to is loaded. Otherwise, the message is output that all breakpoints saved in the configuration file could not be loaded.



Loss of data!

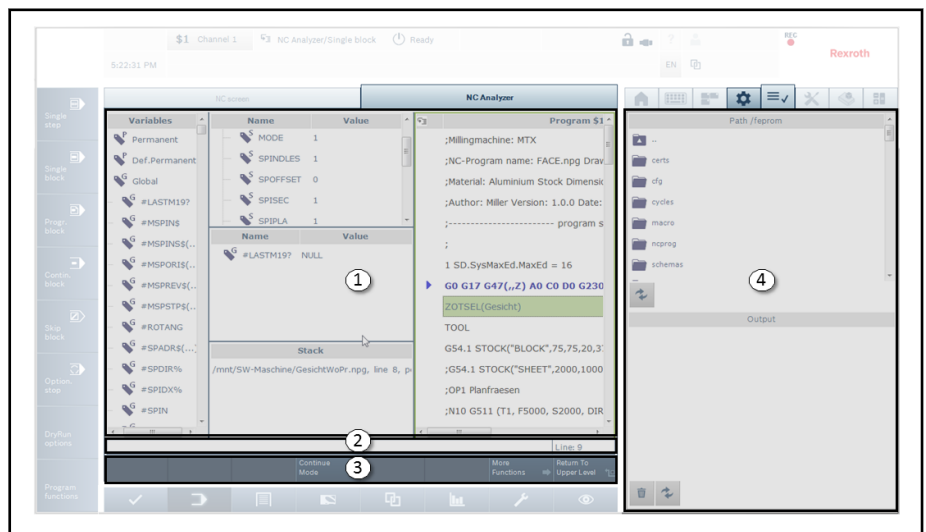
When loading a different configuration file, all changes made in the NC-Analyzer will be lost.

11.1.3 User interface

Overview

The NC-Analyzer window contains the following areas:

- Title bar, header information and status line
- Working area to visualize program data and potential inputs
- F-keypad



- 1 Working area
- 2 Status bar
- 3 F-keypad
- 4 Area for additional information distributed on two tabs

Fig. 11-1: Overview NC-Analyzer

Status bar

The line number depending on the cursor position is displayed in the status bar in the program display window.

Header information

The following is displayed in the header of the program window:

- **Channel number**, number of the currently active channel
- **Current operation mode as icon**
- **Name and path of the displayed program**

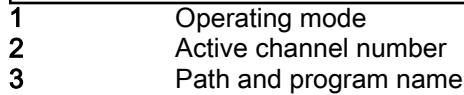


Fig. 11-2: Header program window

The screenshot displays the Siemens STEP 7 HW Config software interface, showing the configuration of a PLC (PS 307 5A) and its associated hardware components. The interface is divided into three main panes:

- Variable Declaration:** This pane on the left lists the variables declared in the project. It includes a list of variables such as `SysAxSRun`, `SysTool[1]`, `ActTool`, `K1`, and `K2`. The variable `SysTool[1]` is highlighted with a red circle (1).
- Tool Configuration:** This pane in the middle shows the configuration for the selected tool, `SysTool[1]`. It displays the tool's name, its value, and the configuration for its sub-tools, `ActTool` and `K1`, `K2`. The tool `ActTool` is highlighted with a red circle (2).
- Ladder Logic:** This pane on the right shows the ladder logic for the PLC. It displays a network with a call to the `SysTool[1]` tool, which is highlighted with a red circle (3). The network also includes a call to the `ActTool` tool, which is highlighted with a red circle (4).

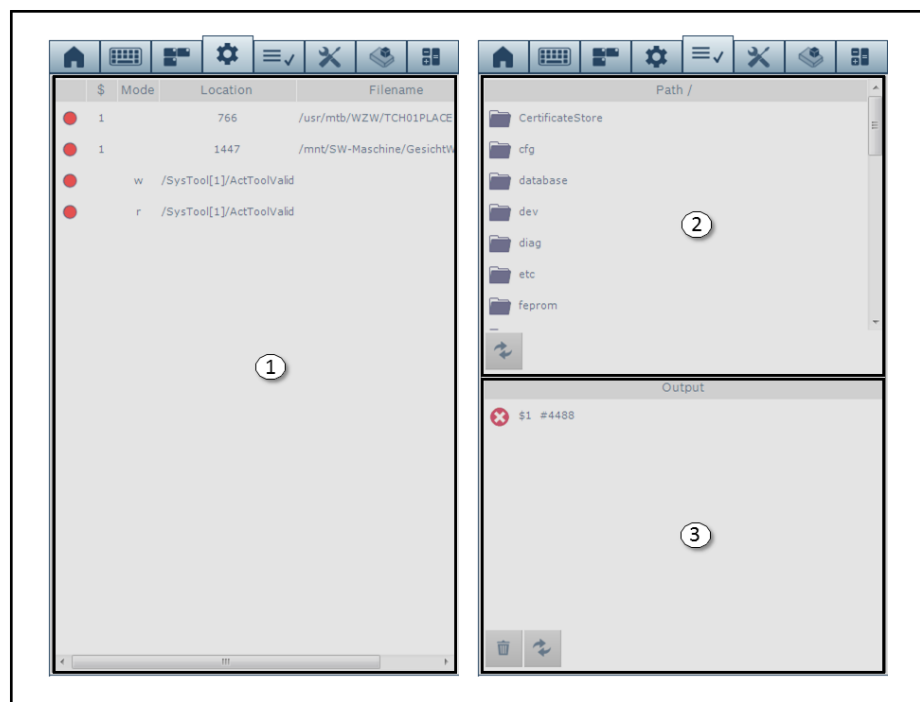
The bottom status bar indicates the current line of the ladder logic is **Line: 235**.

1	Variable lists
2	Watch window
3	Quick watch window
4	Stack display
5	Program window

Fig. 11-3: Working area NC-Analyzer

The individual windows of the working areas are enabled by tapping. The F-keypad below the working area changes due to the different functions of the window.

No.	Window in the NC-Analyzer	Function	Possible inputs
1	Variables	<i>CPL variables structured according to the following groups:</i> • Permanent • Defined permanent • Global • Local • System variables	Selects variable to be monitored. They are displayed in the "Watch" window.
2	Watch	Watch variables: Selected variables list. The current values are displayed in the "Watch values" window.	Deletes variables that are not to be monitored anymore
	Watch values	Display values und refresh: Variable values display in "Watch" window during program runtime.	Edits variable values (except for simple string variables) during program runtime
3	Quick watch	Show current variable value: Selected variables list. The current values are displayed in the "Quick watch values" window. The values are not refreshed. The quick watch window is emptied with the next NC step.	Deletes variables that are not to be monitored anymore
	Quick watch values	Show current values: Variable values display in "Quick watch" window during program runtime.	Edits variable values (except for simple string variables) during program runtime
4	Stack	Select subroutine: Displays subroutine nesting of the selected NC program.	Selects a subroutine from the currently active subroutine structure
5	Program	Program window: <i>Displayed are:</i> • The operation mode as icon, the channel (\$x) as well as the program name including the path • Program code • The block processed during runtime • Breakpoints Read-protected programs are not displayed.	• Search text • Set, delete, enable, disable breakpoints



- 1 Breakpoint table in the "Properties" tab
 2 File window in the "Dialog" tab
 3 Display window in the "Dialog" tab

Fig. 11-4: Area for additional information

No.	Window in the NC-Analyzer	Function	Possible inputs
1	Breakpoints	Display all program breakpoints Display all variable breakpoints	Deletes a breakpoint Enables/disables a breakpoint by "Double tap" on the breakpoint icon
2	File	File system: File system date display of the control	Selects a program to be displayed in the "Program" window (this is not a program selection in the control)
3	Output	Status display: Displays messages (MSG, GMSG, etc.) and errors of the NC program and the NC-Analyzer	Deletes displays

F-keypad

Depending on the active window in the working area, the F-keypad assignment changes (see the following table).

Active keys are labeled in which, inactive keys are grayed out, e.g. due to a set option.

A window is selected by tapping.

F-keypad level	<F2>	<F3>	<F4>	<F5>	<F6>	<F7>	<F8>	<F9>
Main level	Channel selection	Save working area	Load working area		NC-Analyzer debug mode		Reset properties	Exit NC-Analyzer
					Restore operation mode			
Variable level		Set breakpoint	Quick watch	Add to watch			Close substructure	Back to upper level
							Extend substructure	
Watch/QuickWatch level		Edit variable	Delete watch	Delete all variables			Close substructure	Back to upper level
							Extend substructure	
Program first level				Debug single block			<i>More functions</i>	Back to upper level
				Debug program				
Second level of program	Find...	Delete all breakpoints	Enable all breakpoints		Open sub-routine	Open active program	Back	Back to upper level
			Disable all breakpoints					
Stack level								Back to upper level

Tab. 11-1: Function keys in the NC-Analyzer

F-keys main level**<F2>**

Calling the channel selection dialog

<F3>

Saves the settings of the working area in the file system of the PC

<F4>

Loads saved settings of the working area from the file system of the PC

<F6>

Switchover to debug mode and switch back to the current operation mode

<F8>

Reset window properties

<F9>

The Analyzer is closed

By tapping the window in the working area, the following sublevels are activated.

F-keys Variable level**<F3>**

Sets a breakpoint on the selected variable

<F4>

Adds the selected variable to the quick watch window

<F5>

Adds the selected variable to the watch window

<F8>

Closes or extends the substructure

<F9>

Return to main level

F-keys Watch/QuickWatch level**<F3>**

Opens the input editor for the variable value

<F4>

Deletes the selected variable/variable structure in the watch or quick watch window

	<F5>	Deletes all variables in the watch or quick watch window
	<F8>	Closes or extends the substructure
	<F9>	Return to main level
F-keys First level Program	<F5>	Switchover to operation mode "Debug single block" or "Debug: Program"
	<F8>	Calls second level Program
	<F9>	Return to main level
F-key second level Program	<F2>	Calls the search function
	<F3>	Deletes all breakpoints (also variable breakpoints)
	<F4>	Enables/disables all breakpoints (also variable breakpoints)
	<F6>	Opens a subroutine
	<F7>	Reopens the current program
	<F8>	Return to first level Program
	<F9>	Return to main level
F-keys level Stack	<F9>	Return to main level

Search text

An alphanumerical string is searched in the NC program when using <F2> in the "Program" window.

Reset window properties

Window widths can always be reset to default values using touch gestures. Reactivate default values using the F-Key <F8> in the top F-key level.

Resetting the window properties does not affect breakpoints or the selected variables.

11.1.4 NC-Analyzer mode of operation

General information

The following overview shows the procedure when working with the NC-Analyzer:

Seq. no. No.	Procedure
1	Select the program
2	Start the NC-Analyzer
3	Load configuration files (optional)
4	Channel selection (optional)
5	Navigation to corrupt program part or if required the subroutine in the NC-Analyzer
6	Set breakpoints at assumed fault positions
7	Select variables for monitoring
8	Start NC program
9	Monitor values of the selected variables and error analysis
10	Debugging of affected program parts in the editor of the control

Seq. no. No.	Procedure
11	Test program for more errors and verify that the found error is debugged
12	Backup configuration (settings) for further NC-Analyzer sessions

Select program

Open the program selection using the OP key "Machine", F-key <F2>. The NC program to be processed is selected.

- Only one program can be processed at a time.
- To process a program, the file attribute of the program has to be set accordingly. In the "File" window, a symbol for the file attribute prepends each file.
- The program displayed in the NC-Analyzer can only be processed if it is active in the selected control and the selected channel.
- If the selected program is edited in the control, all changes are immediately implemented in the NC-Analyzer (incl. the monitored variables and subroutines).



Loss of data!

- By selecting a different program for processing, it is simultaneously also loaded to the NC-Analyzer. Changes in the previous program are lost.
- Breakpoints and monitored variables are lost after a "Channel reset".

Channel selection

Use <F2> to switch the channel in the NC-Analyzer.

Processing the NC program using the NC-Analyzer

The NC-Analyzer is started after the program is selected.

Start NC-Analyzer mode

The NC program must not be started yet.

Use <F6> to start the NC-Analyzer, the F-Key changes to "Operation mode archive file".

The new operating mode **"NC-Analyzer program"** is displayed in the header for information purposes.

Analyzer setting:

- NC-Analyzer single step:
If the Analyzer mode is active, select the "Program" window and enable the single step mode with <F5>. The program is executed sequentially, i.e. execute "NC start" after each step to continue the program.
- Continue NC-Analyzer:
Enabling the "Program" window. When actuating <F5>, the F-Key changes to "Debug single block" .

The program is executed in "Continuous block mode"  until a breakpoint is encountered which interrupts the program execution. After this interruption, the program can be continued with "NC start" as long as no error is reported.

Start NC program Execute "NC start". The selected program is started and continued after holding the program sequence, according to the set Analyzer mode.
After having deselected and reselected the NC program, the Analyzer mode has to be set again.

Exit Analyzer mode The Analyzer mode is exited with <F6> in the top F-key level. The previously set operating mode  is displayed again in the header.

Show NC programs

Program window In the "Program" of the NC-Analyzer, the currently selected NC program is displayed if no other file was selected from the directory in the **File** window.
If no NC program is selected in the NC, the **Program** window remains empty.

File window **Select program in stack:**
The "File" window represents the file system of the control. Each available file can be displayed via the file selection in the "Program" window.
Only active programs can be edited with the NC-NC-Analyzer.
In the "File" window, the program can be selected.



The "Update files" key updates the directory content.

If the cursor is positioned on a file, "Double tap" to show the file in the program window.



To show a program in the **Program** window, set the file attribute "Read" (r).

Use the **Stack** window to access the selected NC program again.

Select subroutine in stack:

Via the stack, subroutines can be accessed that are organized in a nesting depth of seven in relation to a main program.

The subroutine can be displayed in the currently active call structure if it was canceled by an error, by "M0" or by an active breakpoint. In this case, execution of all other programs that called the subroutine is also canceled.

The names of all programs active in the call structure are displayed in the "Stack" window. A program can be selected and displayed with "Double tap" in the "Program" window.

In the selected program, local variables can be monitored and if required, new breakpoints can be set. The call structure in the stack provides information via which program nesting the selected program can be called.

Enable the "Stack" window.

Select one of the programs (subroutines) in the "Stack" window and "Double tap".

An arrow in the program block currently to be processed in which block processing is contained points to the last "calling" active program.

Navigating the subroutines

Navigating in active subroutines is also possible in the "Program" window. Immediately after the program has been selected, a subroutine can be selected. The "Program" window is enabled. Using the <Cursor> keys or "Single tap", it is positioned to an NC block containing a subroutine call. By switching to the next F-key level and by pressing <F6>, the subroutine is displayed. If

there is no block in the subroutine call, a message is output. Return to the active program with <F7>.

Setting breakpoints and editing

Breakpoints can be used in the NC-Analyzer in different channels in DIN and CPL programs. The breakpoint stops block processing in continuous block mode. At this point, variable values can be checked and changed manually, if required.

The breakpoint is visualized as circle symbol at the NC block at which the NC-Analyzer is to stop.

The variable information in the "Values" window refers to all blocks to be processed until the breakpoint.

All following blocks, including the block with the breakpoint have not yet been included in the processing of the program.

Breakpoints are used as follows:

- To test explicit points in the program if the user does not know the cause of error
- To test nested subroutines if the error occurred in a subroutine

The following table shows the options to control breakpoints:

Breakpoint	Effect	F-keys
Set	Breakpoint is set and active. The NC-Analyzer stops in front of an NC block, marked by a set breakpoint.	Set breakpoint
Delete	Breakpoint is removed completely.	Delete breakpoint
Disable	The set breakpoint does not have any function and does not stop the program. The marking, however, is retained.	Disable breakpoint
Enable	Disabled breakpoint is enabled again. The NC-Analyzer stops in front of an NC block, marked by a set breakpoint.	Enable breakpoint
Delete (all breakpoints)	All breakpoints of the program displayed in the "Program" window are removed completely.	Delete all break-points
Disable (all breakpoints)	All set breakpoints of the program displayed in the "Program" window do not have any function. The marking, however, is retained.	Disable all break-points
Enable (all breakpoints)	All inactive breakpoints are enabled again. The NC-Analyzer stops in front of all NC blocks marked with breakpoints.	Enable all break-points
Back up	Backup all breakpoint positions for later processing with reproducibility.	Save working area

Setting and enabling breakpoints

The number of active breakpoints is limited to 20. A breakpoint can be set at any NC block of the program and/or subroutine in different channels.

When 20 breakpoints are set, new breakpoints are set to inactive. Additionally, a message is output.

Only after one of the 20 breakpoints has been disabled, an inactive breakpoint can be enabled or a new active breakpoint can be set.

The color of the circle symbol shows if a breakpoint is active (red) or inactive (white).

- Select the "Program" window.
- Use the <Arrow> keys or "Single tap" and select the program block at which a breakpoint is to be set in the "Program" window. To set a breakpoint, tap on the left margin. A red dot (breakpoint is set and enabled) is displayed. Tap on the red dot a second time to disable the breakpoint.



Breakpoints can only be enabled in "NC-Analyzer mode". Otherwise, an error message is displayed and the breakpoint is disabled (white).



Breakpoints are not taken into consideration if they are set in a line containing "ELSE" or "ENDIF".

Disabling and deleting breakpoints

Enable "Program" window.

To disable a breakpoint, tap on the red dot once.

In case of several breakpoints in the program, disable all breakpoints using <F4> in the second F-key bar.



To delete a breakpoint, use  in the breakpoint table in the "Properties" tab or delete the breakpoint by tapping on the disabled breakpoint (blue circle).

In case of several breakpoints in the program, delete all breakpoints using <F3> in the second F-key bar.



Disabling and deleting of all breakpoints only refers to the program displayed in the **Program** window.

Listing all available breakpoints:

In the "Properties" tab of the additional working area, a table shows the breakpoints of all programs and subroutines including their properties:

- Status active/inactive
- Channel assignment of the selected program(s)
- Read/write mode in variable breakpoints
- Position (position of the line marked with breakpoint related to the start of the program).
- Name and path of the program containing the breakpoint

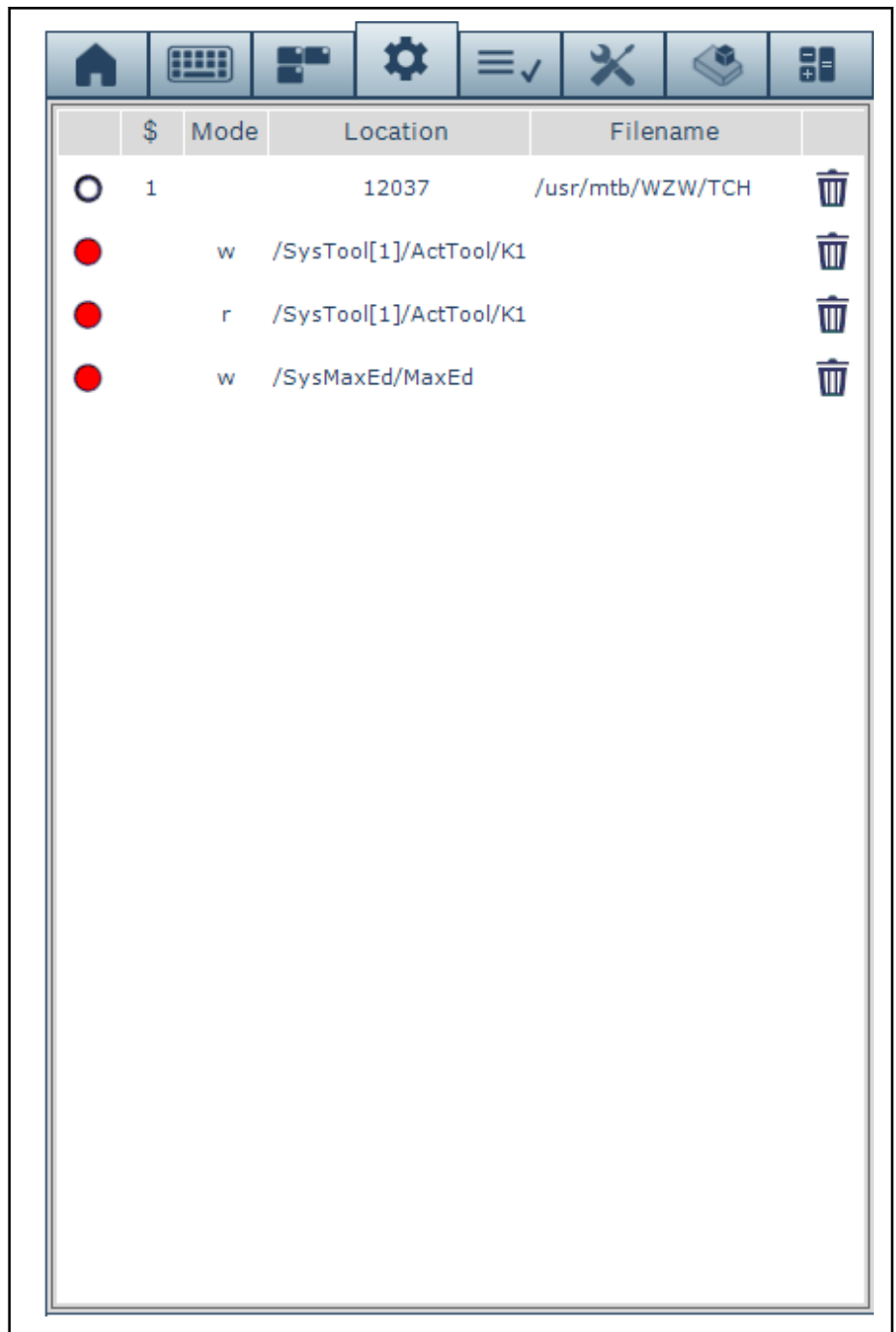


Fig. 11-5: Breakpoint dialog in the additional operating area

Additionally, breakpoints can be enabled, disabled and deleted in this table.

Loading active breakpoints from the configuration file

If all active breakpoints are saved in the NC-Analyzer working area of an NC program and if you want to load the breakpoints to the NC-Analyzer (using <F4> in the top F-key level), the NC-Analyzer mode has to be active.

Otherwise, the saved breakpoints are set to inactive.

Monitoring and editing variables

For individual program variables, it can be checked if the logic value assignment has been executed correctly by the program.

Variable groups:

- Permanent variables
- Definable permanent variables
- Global variables
- Local variables
- System data

The variable groups are listed in the "Variables" window.

Displaying individual variables

When selecting a program, all variables of a program are automatically classified according to their variable group and organized under the respective group.

By "Single tap" on the <+> sign or by using the arrow keys <←>/<→> or by using the <F8> key, the list can be collapsed or expanded.

If the cursor is positioned on one of the expanded variables, the grayed out F-keys <Set breakpoint>, <Quick Watch> or <Add to watch> are active.

Variable to be monitored:

The NC-Analyzer uses the following variables to monitor variable values:

- Watch: Permanent monitoring during write operations
- Quick watch: One time query of variable value

Quick watch list:

Quick watch shows the current variable value. The display is immediately deleted again after continuing or starting a program in the "Quick watch values" window as the variable value is only of importance at a certain position in the program. Thus, a breakpoint has to be set at a position in the IndraWorks project.

Watch list:

The variable values are kept up-to-date in this list.

Adding variables

The monitoring list in the "Watch/Quick Watch" window is composed of selected variables.

The variables are displayed in the order in which they have been included in the list. The list can be expanded or reduced by adding or removing variables.

Which variable is to be added for monitoring in the "Watch/Quick watch" window and which information is to be filtered, depends on the problem in the program.

Arrays can either be added completely or only partially to the monitoring window.

Restriction:

A maximum of 40 variables can be added to the monitoring list simultaneously. When trying to add more variables to the list, a warning is reported. Already available variables have to be deleted first before new variables can be added.

Deleting variables from watch list

The "Watch/Quick Watch" window is enabled - select the variable to be deleted and remove it using the F-key <F4>.

Use <F5> to delete all variables in the window.

Editing variable values

Individual values of variables or string characters can be changed during the program test.



CPL string constants (e.g. A\$) cannot be changed.

Procedure:

- Enable the "Watch values" or "Quick Watch values" window
- Select the variables to be edited
- Press the F-key <F3> "Edit variable"
- Enter new value and confirm

An incorrect entry is rejected with a warning.



The value "NUL" is assigned to a variable if the content has been deleted using <Backspace> or <Delete> and if no new signs or values have been entered.

The value "NUL" cannot be assigned to permanent variables.

Breakpoints on variables

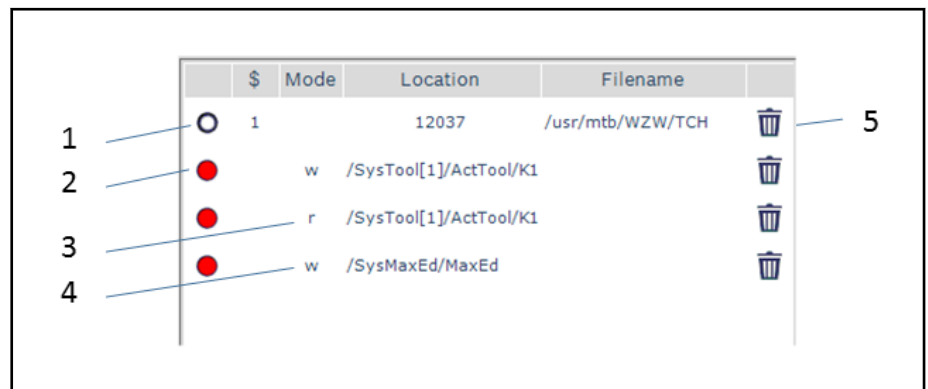
If a breakpoint is set to a variable, the NC program execution is interrupted in the following cases:

- The program line of the NC program containing operations with this variable is reached
- The variable value changes, for example by setting values in the NC program

The variables to which a breakpoint is set are displayed in the **List breakpoints** dialog.

Two modifications can be set for each variable:

- "Write" mode
- "Read" mode



- 1 Breakpoint inactive (program breakpoint)
- 2 Breakpoint active (variable breakpoint)
- 3 Breakpoint on "Read" variable
- 4 Breakpoint on "Write" variable
- 5 Delete breakpoint

Fig. 11-6: Functions in the breakpoint dialog

The program execution is interrupted for the "Read" mode if the variable was read, e.g. in the NC program (visible in the "Program window").

The user receives a message about the interrupted program due to a breakpoint on a variable:

(#121) The breakpoint on the <Variable name> variable was reached. Access mode: Write!

(#122) The breakpoint on the <Variable name> variable was reached. Access mode: Read!

After the box has been acknowledged, program processing is resumed.

If a variable is contained in the array, the breakpoint can be set to such a variable.

The program is interrupted in two cases:

- By reaching an NC block that uses an element of this array.
- By changing the element value of the array.



A breakpoint can only be set to the complete array not to a single element.



Breakpoints on variables are not considered when they are used in a single-line CPL loop.

Example: Breakpoint on #FIELD variable is not active:

```
7 FOR I%= 1 TO 3 #FIELD(I%)= I% NEXT I%
```

In case of a multi-line loop, the breakpoint of the #FIELD variable is active:

```
7 FOR I%= 1 TO 3
8 #FIELD(I%)= I%
9 NEXT I%
```

Special feature when using breakpoints on permanent variables:

Permanent variables (permanent and variables defined as permanent) are not used in NC program. If a breakpoint is set to such a variable, the NC program execution is interrupted if the variable value does not change: This can either be implemented by the NC or in processing mode by using the NC-Analyzer.

Breakpoints on variables have an impact on the available number of variables to be monitored in the "Watch mode". For example, if there ten active breakpoints on variables, the user cannot set more than 30 variables in the "Watch mode".

If the available number of active breakpoints on variables is exceeded, a warning is displayed on the screen.

To set a breakpoint on a variable, proceed as follows:

- Activate the "Variable window" via "Navigation" or "Next window"
- Use <F8> to select individual elements of variable structures
- The access mode for the breakpoint is specified in the "Breakpoint" dialog. By default, the "Write mode" is set

To enable/disable or change the access mode of a breakpoint on a variable, the "Breakpoint" dialog has to be called. Changes can be made via dialog buttons.

Example:

```
18 B=1
19 A=0
20 A=B+5
```

21 A=7

22 A=10

23 C=A

In "Write" mode, the variable value A is refreshed each time as the variable contains a new value in each line.

In "Read" mode, however, only the display of variable A in line 23 is refreshed as only the value of this line is read out.

Messages in "Output" window

Show messages

When using the NC-Analyzer, messages of the NC and the NC-Analyzer are displayed in the "Output" window. This is important as an error is often reported by an NC runtime error message. In the "Output" window, an NC error is displayed with only this error number. For more information, refer to the working area "Diagnostics" of the standard operating interface of the control.

In the "Output" window, all control messages are displayed, including text and symbol:

- Errors
- Warnings
- Notes (PRN#(0,...), MSG, GMSG)

In case of errors and warnings, the symbol color indicates the message status:

- Background color of the symbol: red -> Message is pending
- Background color of the symbol: blue -> Message was deleted or was read

Delete messages in the "Output" window

Enabling the "Output" window. Delete all messages using <F4>.

Active program after program stop

If an active program has been canceled due to an error, a static inventory of the variables used for all active programs can be performed using the NC-Analyzer. Thanks to the stack, local variable states valid at the time of the subroutine call can be analyzed in subroutines.

To perform this inventory, the canceled program in the NC has to be selected.

Breakpoints cannot be set in this state as the Analyzer mode is not active in the NC-Analyzer. When trying to switch to Analyzer mode, an error message is displayed.

Start the NC-Analyzer

- Start the NC-Analyzer
- *Select the channel with the corrupt program*
 - The position the NC program was stopped at due to an error is displayed in the "Program" window of the NC-Analyzer.
 - The call structure (in case of a subroutine nesting in the NC program) is displayed in the "Stack" window
 - Subroutines can be selected in the "Stack" window and can be displayed via <F5> in the "Program" window to analyze the program variables

By using this information, the error can often be found.

At least the program area containing the error is known and can be analyzed in Analyzer mode.

Test program

Before continuing machining, it is recommended that the program is free from errors. The NC-Analyzer can be useful as the values of the used variables can be called at any time during the program sequence.

Messages of the NC-Analyzer

System and user messages of the NC-Analyzer are represented in popup windows with error text classification.

Type	Class	Description
System error_ • Error • Critical error	Fatal system error *) → Critical error	Internal error - operation of the control is not possible anymore The NC-Analyzer closes automatically after an acknowledgement.
	Minor system error *) → Error	Internal error - a subarea of the control cannot be used anymore The user can decide whether he wants to continue with the NC-Analyzer.
Warning	System warning	Warning in a subarea of the NC-Analyzer, e.g. configuration files could not be loaded
by the user program Information: • In general	System information	E.g. number of breakpoints exceeded
	Programmed note	Programmed note by NC program: • (MSG) • PRN'(0,...)
Input error	Operator error	E.g. variable value invalid

*) In case of system errors, contact the service, if required.

Tab. 11-2: Error class NC-Analyzer

User reactions to errors and messages

In case of information, warning and in case "minor" system errors, the following measures can be executed:

- Discard messages or errors as long as the NC-Analyzer can still be used or as long as it still provides information about debugging.
- Restart interface
- Contact service

In case of "fatal" system error:

- Restart interface
- Contact service

Error messages

Number of error message and message text	Cause	User recommendation
Messages when it was tried to enter incorrect values		
(#9) Invalid value	Input value of the edited variable does not match the variable type.	Input of a value conforming to the required variable type (also see CPL programming manual)

Number of error message and message text	Cause	User recommendation
The value NUL cannot be assigned to a permanent CPL variable. The old value is restored.	A permanent CPL variable cannot be assigned the value NUL.	Enter a valid value for the permanent CPL variable or accept the old value.
Messages about forbidden user actions		
(#8) File is write-protected.	An attempt to save a read-only file.	Continue (it is not possible to save read-only files).
(#23) It is not possible to set the current variable value. (IVariable::SetVarValue)	An attempt to edit an individual CPL constant element.	Continue
(#86) It is not possible to set the current variable value. (IVariable::UndefVar)	An attempt to edit a CPL constant.	Continue
(#43) It is not possible to set the test function mode. (IDryRunMode::SetDryRunMode)	An attempt to cancel the DryRunMode mode in case of a running NC emulator.	Continue as DryRunMode is always set in case of a running NC emulator.
Messages regarding problems when setting breakpoints and when setting the variable for monitoring		
(#12) The number of breakpoints is limited. It is not possible to enable a breakpoint or to set a new breakpoint.	The number of active breakpoints was exceeded.	Delete or disable one or several active breakpoints.
(#2) It is not possible to execute the desired operations in the breakpoint dialog.	An attempt to enable breakpoints of an inactive program by means of the "Breakpoints" dialog.	Continue or select the program with the desired breakpoint(s) and execute the desired action.
	Attempt to change the access mode of breakpoints at variables of an inactive flow program.	Continue or select the program with the desired breakpoint(s) and execute the desired action.
(#14) It is not possible to generate or enable a breakpoint.	An attempt to set a breakpoint in an inactive flow program.	The breakpoint remains inactive (also if the flow program becomes active).
(#89) It is not possible to enable a breakpoint or to set an active breakpoint as the current NC mode is not the NC-Analyzer mode.	An attempt to either enable or to set the breakpoint while NC-Analyzer mode was not set.	Set NC-Analyzer mode . Execute the desired actions with breakpoints.
	An attempt to set the active breakpoint in the inactive program. NC-Analyzer mode was not set.	Select the desired program as active. Set NC-Analyzer mode . Execute the desired actions with breakpoint(s).
(#92) It is not possible to enable a breakpoint an active breakpoint as the test mode is not set.	An attempt to set the active breakpoint using touch gestures if DryRunMode was not set.	Set DryRunMode (NC-Analyzer mode should also be set). Set the breakpoint.

Extended functionality

Number of error message and message text	Cause	User recommendation
(#13) The number of variables to be monitored and breakpoints on variables is limited. It is currently not possible to select another variable for asynchronous monitoring or to set a breakpoint on a variable.	The number of monitored variables or breakpoints on variables was exceeded.	Delete as many variables as required from the list of asynchronous monitoring. Delete or enable as many breakpoints on variables as required.
Messages for reaching breakpoints on variables		
(#121) The breakpoint on variable "variable name" is reached. Access mode: Write!	The program interruption at breakpoint.	Continue
(#122) The breakpoint on variable "variable name" is reached. Access mode: Read!	The program interruption at breakpoint.	Continue
Messages regarding problems when loading information from the configuration file		
(#88) It is not possible to set one or several breakpoints after loading a configuration file. The breakpoints are deleted from the breakpoint list.	No active NC program when loading information from the configuration file.	Loading information from the configuration file only possible after a flow program has been selected.
	NC-Analyzer mode was not set.	Set NC-Analyzer mode (DryRunMode) should also be set). Loading information from the configuration file.
	The configuration file was written with a different flow program.	Continue (information about breakpoints of this configuration file are lost). If it is required to save information about breakpoints that have been written to the configuration file the application was started with, save the file under a different name without closing the application. It is recommended to compose configuration files for NC programs and to start the programs only with their individual configuration files (for example, it is possible to use the flow program name as name of the configuration file: TEST.CPL test.cld). The message is not displayed if this recommendation is complied with.
	The NC program has been changed after the configuration file was changed.	Continue (information about breakpoints of this configuration file are lost).

Number of error message and message text	Cause	User recommendation
(#90) When loading the configuration file, it is not possible to set active breakpoints as the test mode is not set.	DryRunMode was not set.	Set DryRunMode and tap on the Total lock window. (NC-Analyzer mode should also be set). Loading information from the configuration file.
Messages about connection problems with the NC		
(#20) The number of variables cannot be determined. (IVariable::GetNumberOfVariable)	Timeout too low.	Close and restart the application.
(#22) The current variable value cannot be determined. (IVariable::GetVarValue)	Timeout too low.	Close and restart the application.
(#28) The current NC status cannot be determined. (INcsChannel::GetNc-State)	Timeout too low.	Close and restart the application.
(#32) The current NC mode cannot be determined (INcsChannel::GetNcMode)	Timeout too low.	Close and restart the application.
(#50) The call stack depth cannot be determined. (IProgChain::GetProgChainDeep)	Timeout too low.	Close and restart the application.
(#51) The subroutine parameters cannot be determined. (IProgChain::GetSubProgLevel)	Timeout too low.	Close and restart the application.
(#80) The connection to the NC was interrupted.	The connection to the NC was interrupted.	Close the application and restart it to re-establish the connection.
(#69) The connection to the NC cannot be established. (INcConnect::Connect)	The connection to the NC cannot be established.	Close the application and restart it to re-establish the connection.
(#33) The requested NC mode cannot be set. (INcsProcess::SetOpMode)	NC mode was changed (e.g. by another application).	Continue and set the desired NC mode after a reselection and the start of the flow program.

Tab. 11-3: Reasons for messages: OLE errors, software issues of NC or MTX Analyzer applications or installation issues

Abbreviations

NC

Numerical Control (system)

CNC	Computerized Numerical Control
CPL	Customer Programming Language
PC	Personal Computer
DDP	Desktop Development Platform
SCP	Scalable Communication Platform

11.2 Calculations and tables

11.2.1 Introduction

Purpose of the calculator

The dialog "Calculations and tables", shortly called "Calculation", is a means for performing calculations and for looking for values in tables that are frequently needed, especially in the creation of part programs (thread table, fit

sizes). The dialog can be accessed via "Calculator"  in the additional working area.



No warranty is assumed for the correctness of all table values.

A calculator for general calculations and different calculation forms is provided for frequently recurring geometric and technological calculations.

The computer provides the option to directly insert the result in the entry field last focused. Apart from that, the result can be directly used at any place by inserting the content of the clipboard.

The calculator is also used when entering values as mathematical expressions in different input dialogs of the user interface.

Operating and inserting values

Possibilities of inserting results There are two possibilities to transfer results to input fields and/or editors:

- Paste from the clipboard
- Direct pasting to an editing field when closing the calculator

Pasting from the clipboard As soon as a value is selected with "Copy", it is automatically copied to the clipboard and is available anywhere in the system, in the PC or also in an editor when shutting the PC down. The result is pasted using <Ctrl>+<V> and/or an equivalent F-key to paste from the clipboard. The usage of the clipboard is the most universal operation to transfer a result and is generally possible in all text editors and text fields. This method of pasting is **always available**.

OK "OK" inserts the selected results or also several values shown on a calculation form and closes the dialog (direct paste). "OK" is disabled as long as no result has been selected and/or an entry error is pending.

Cancel "Cancel" closes the calculator without directly inserting a result afterwards. If a result has been selected by "Copy" in advance, it can be pasted from the clipboard.

Close The "Close" button is shown if the pasting is only possible via the clipboard. It closes the "Calculator" dialog.

Calculation If an input field in the calculation forms is edited, the fields mathematically depending on this field are automatically emptied. From this temporary empty-

ing, you can very well see the mathematical relations of the individual variables. Calculation of the depending variables from the specifications is initiated with the return key (<Enter>). With the calculator, you can also use the result key (<=> key or shortcut <=>).

- Correcting errors** Incorrect entries that are indicated by a display or an error field can generally (except for the calculator) be corrected by an immediate text field change or by discarding the latest entry using <Esc>.
- Selecting a result** After the calculation, the calculation forms (again except for the calculator) show several numerical values that can be considered for the result transfer. The desired result has to be selected using "Copy" on the right (for the calculator the "COPY" key). You can also set the focus into the respective text field and copy the value displayed there using <Ctrl>+<C>. It is also possible to select one part of the shown content by marking it in advance. The selection by copying the value enables the "OK" button for direct pasting. Calculation forms without buttons allow for the analysis of all visible and relevant values in the target dialog and their recording (insertion) as entries.
- Inserting the result** As described above, direct insertion is initiated using the "OK" button if available. Otherwise, insert the clipboard content.

11.2.2 Calculator

Overview

- Application target** Operation and layout of the implemented calculator are based on devices as they are used in schools and offices. The capacity is tailored to the requirements in the technical area, particularly the part programming, and thus lies between a simple standard calculator and a scientific calculator.
- Layout** The calculator is located in the "Calculator" tab.
It has a result display, status displays and a keyboard with a classification into:
- Operating and function keys with double assignment
 - Keys for the memory
 - Numeric keypad
 - Keys for the arithmetic operators (basic arithmetic operations).



Fig. 11-7: Calculator layout (standard operation mode)

Performing a calculation

Numerical entry

Numbers are entered as follows:

- Enter the numbers and the decimal separator in the order from left to right. A leading zero in front of the decimal separator does not have to be entered.
- For the numerical entry, the numbers <0> to <9> are available as short-cuts. The decimal separator can be entered using the "point" or "comma" key. You can also use the numeric keypad if the <Num> key has been pressed.

- A negative sign can only be entered if the display does not equal zero. For the change of sign, you can use the "+/-" key and/or the shortcut <F9>.
- No switch from the floating point representation (i.e. the decimal point separates the fraction from the integer) to the exponential representation (mantissa followed by the exponent of the power of ten) by operation is not intended. An operand is always entered in the floating point representation. Calculation results with very large and very small amounts can be shown in exponential notation ($x \times 10^y$ is shown as xEy, e.g. 4.56E-07).

Simple calculation

Simple calculations in the basic arithmetic operations are performed as follows:

1. Enter the first operand as described.
2. Tap on "+" in order to add, on "-" in order to subtract, on "×" in order to multiply and on "÷" in order to divide.
The specified operators can also be entered using the numeric keypad and the shortcuts <+>, <->, <*> and </>.
3. Enter the next operand.
4. Enter more operators and operands, if applicable.
After another operator has been entered, the interim result is shown in the display.
5. Click on the result key ("="). You can also use the <Return> key, the <Enter> key or the shortcut <=>.
6. After the calculation, the result is available for the automatic insertion. For this purpose, the dialog must show one "OK" button and one "Cancel" button. In order to be able to transfer the result using the clipboard, press the "COPY" key. The status display now shows "COPY" - indication that a value has been saved to the clipboard and that it currently still complies with the display.

Priority rules and brackets

The calculator considers the operators' priority. For an order deviating from the priority rules, brackets have to be used. For this purpose, the keys "[" and "]" and/or the shortcuts for the left bracket <(>, <[>, <{ > and <}>, <]>, <}> for the right bracket are available. The number of currently open brackets is shown in the central status display.

When entering a right bracket, the interim result of the expression in brackets is shown.

You can use brackets as often as you want and open as many brackets as you want.

Example:

Brackets and priority of operations

$2+8 \times 3=$ is to be calculated. Complying with the priority rules, $2+(8 \times 3)=26$ is calculated. To calculate $(2+8) \times 3=30$, put the addition in brackets.

Continuous calculation

You can at any time use the displayed result of a calculation as first operand for the next calculation. Thus, entry of the first operand is omitted. You can use this procedure in many cases instead of brackets.

Functions

The functions always use the displayed value as argument and immediately show the function value. I.e., the Reverse Polish Notation applies to functions, i.e. the order argument and then the function itself.

Example:

Functions

The sine of 30° is to be calculated.

For this purpose, you enter "3" "0" "sin" "=" and get 0.5.

If the argument is an expression, set the argument in brackets.

In the example $\sin(28+4.5)$, enter "•" "(" "2" "+" 8 "+" "4" "•" "5" ")" "sin".

Second key assignment

The function keys are assigned twice. Usually, the second key assignment is the corresponding reverse function of the first level assignment. The second key assignment is activated using the "2nd" key whereas the labeling changes, as well. The second key assignment only applies to one operation or one shortcut. The second key assignment can also be activated by keeping the <shift> key pressed.

Example:

Second key assignment with functions

The arc sine of 0.5 is to be calculated.

Enter "•" "5" "2nd" "asin" "=" and you get 30.

Trigonometric functions

The trigonometric functions either work with degree measure or radian measure (radian). The currently active unit can be seen in the status display. "DEG" stands for degree, "RAD" for radian. You can switch between the angle units by using the <RAD> and/or <DEG> keys. Switchover of the angle unit is accompanied by a new labeling of the function keys relating to the angle unit according to the new status.

Conversion between degree measure and radian measure

You can convert a display value into degree or radian as follows:

1. Adjust the currently set angle unit to the unit that you associate with the display value. For converting a value from degree into radian, tap on "RAD", otherwise on "DEG".
2. Now press "2nd" and "►rad" or "►deg" for the actual conversion. As for each other function, the result is displayed immediately.

Calculation of percentage

Using the key sequence "2nd" "%", the displayed figure is converted from a figure into a percentage by dividing it by 100.

If "%" is pressed after an arithmetic operation, additions, reductions and percentages can be calculated as follows:

- Adding an addition, i.e. addition of n% to x:
x "+" n "%" "="
- Settling a reduction, i.e. subtraction of n% from x:
x "-" n "%" "="
- Multiplication by a percentage, multiplication of x by n%:
x "x" n "%" "="
- Division by a percentage, i.e. division of x by n%:
x "÷" n "%" "=".

Exponentiation and extraction of roots with any exponent

Exponentiation and root extraction with any exponent does not constitute a function, in contrast to square and square root. The exponentiation/root extraction is an operator analog to those for the basic arithmetic operations and for the performance, you need a first and a second operand.

In the exponentiation, the first operand is the base and the second operand is the exponent.

In the root extraction, the operands are called "radicand" and "exponent of a root".

For the exponentiation x^n , you enter x "x" n , for the root $\sqrt[n]{x}$ analogously x "2nd" " $\sqrt[n]{x}$ " n . Here, you can use brackets, as well if the operands consist of an expression.

Mathematic constants In the classic operation mode, the calculator only offers the constant π (Pi) that can be activated using the " π " key or the <P> shortcut.

Errors and correction of entries

Errors Errors in the calculation can be caused by:

- An undefined operation
- A function call with an inadmissible argument
- By a number overflow in the final or in an interim result

In all these situations, "Error" is displayed in the display in order to signal the error status. Subsequently, delete the error before continue working.

Reset The calculator including the stored interim results and the repetition memory is reset using the <C> key or the <Del> shortcut. The same operation is to be used for deleting an error. A reset will not influence the user memory or the set modes.

Delete the display value Using the <CE> key, the display value is deleted without the interim results and the entered operands being lost. After the <CE> key was pressed, reset the display to "0", continue by once again entering the operand.

Overwriting an operator Operators that have been entered wrongly by accident cannot be deleted. It is, however, possible to enter the correct modifier directly after having entered the wrong modifier. Thus, the operator is overwritten.

This correction possibility applies to "+", "-", "x", "÷" "xⁿ" and " $\sqrt[n]{x}$ ".

Deleting a character The numbers and the decimal separator shown in the display can be deleted individually from right to left using the "X" key. The related shortcut is the <backspace> key (<Backspace>).

Repeating calculations

Repeating the last operation You can repeat the last operation of a simple calculation several times in form of the continued calculation without having to enter the last operand and the last operator repeatedly.

For this, proceed as follows:

1. Enter the first operand
2. Press the operator key
3. Enter the second operand
4. Press "="
5. Press "=" as often as you want to repeat the operation

Example:

Repeating the last operation

3 is to be subtracted from 8 two times, i.e. $8-3-3=2$.

For performing the calculation press "8" "-" "3" "=" "=".

Repeating the last operands

If in a simple calculation, the second operand is not specified, the display value will be used as second operand.

Example:

Repeating the last operand

The third power of (-2), i.e. $(-2)^3$ is to be calculated. In this connection, $(-2) \times (-2) \times (-2)$ is to be used.

For this purpose, you enter "2" "+/-""x" "=" "=".

Using shortcuts

For most of the calculator's keys, there are also shortcuts.



The shortcuts in the following table show the characters visible on the computer keyboard. In this connection, the arrangement of the characters on the keyboard has not been considered. I.e. in order to enter them, single characters must be activated while simultaneously pressing a modifier key like the <shift key>, <Alt> or <Alt Gr>. The modifier keys are not listed in the table unless a capital letter is required.

Description	Key	Shortcut
Second keypad	"2nd"	<Shift key> (keep it pressed)
Sine	"sin"	<S>
Arcus sine	"2nd" "asin"	<Shift key>+<S>
Cosine	"cos"	<C>
Arcus cosine	"2nd" "acos"	<Shift key>+<C>
Hyperbolic tangent	"tan"	<T>
Arcus tangent	"2nd" "atan"	<Shift key>+<T>
Copying the display value	"COPY"	<Ctrl>+<C>
Reset	"C"	<Del>
nth power	"x^n"	<^>
Square root	"√x"	<@>
Reciprocal	"1/x"	<r>
Percent	"%"	<%>
Changing the sign	" +/- "	<F9>
Left bracket	"["	"(" - or - "[" - or - "{"

Description	Key	Shortcut
Right bracket	"})"	"}" - or - "}" - or - "}"
Pi	"π"	<P>
Delete the last character		<Backspace> (Backspace)
Numbers 0...9	"0"... "9"	<0>...<9>
Decimal separator	"."	<.> - or - <,>
Division	"÷"	</>
Multiplication	"x"	<*>
Subtraction	"_"	<->
Addition	"+"	<+>
Calculate	"="	<=> - or - <Return key> - or - <Enter>

Tab. 11-4: Calculator shortcuts

Working with RAM

General information on the memory

By means of the memory, numbers of the display can be buffered in all operation modes and called for further use.

The content of the memory is neither influenced by closing the "Calculations and Tables" dialog nor by a reset.

Whether the memory is currently containing a number can be detected from an "M" in the status display.

Using the memory

You can work with the memory as follows:

- In order to save a displayed number, tap on "MS".
- In order to call a saved number back into the display, tap on "MR".
- The memory is deleted using "MR".
- In order to add a displayed number to the number in the memory, tap on "M+". Using "MR", the achieved sum can be displayed.

11.2.3 Taper calculations

Overview

Tasks

Taper calculations are often necessary in turning.

The following tasks can be solved using this calculation form:

- Conversion between the taper relation and the setting angle (half taper angle) in both directions
- Calculation of the diameters at the taper ends with given taper relation/setting angle

Layout The form for taper calculations can be found on the "Taper" tab.

The form provides editable text fields for the numerical values. Behind the text fields that are in the fore and can be considered for a value transfer, buttons for copying purposes are located.

Taper

Taper Ratio (1/X):

Setting Angle ($\alpha/2$):

Taper Length (L): Small Diameter (D1): Large Diameter (D2):

1 2 3 4 5 6 7 8 9 0

(/ * + - ^ .)

ABC Del SIN COS TAN ← ↻ ↩

Fig. 11-8: Form for taper calculations

Performing taper calculations

Converting taper per unit in angle	If the taper relation is given, then you can calculate the setting angle. The numerical value X must be entered into the first text field ($X > 0$). Alternatively to a number, you can also specify an expression (see Syntax for expressions) or a standardized taper relation. Standardized taper relations: • Morse tapers MK0, MK1, MK2, MK3, MK4, MK5 and MK6 • Steep tapers SK30, SK40, SK50 and SK60 Using the return key or by changing the focus, you can initiate the calculation. The setting angle is displayed in the two text fields located below in °, as decimal figure as well as in arc minutes and arc seconds.
Converting angle in taper per unit	If you want to determine the taper relation from a setting angle, you must enter the setting angle ($0 < \alpha/2 < 90^\circ$) in the second or third text field, depending on the question whether the angle is specified decimally or in degrees, minutes and seconds. The entry field for the decimal specification also accepts an expression. After the calculation that can be initiated using the return key or by changing the focus, the taper relation will be shown in the first text field.
Determining big diameter	In order to determine the large diameter D2, the taper relation or the setting angle have to be entered, as have the taper length and the small diameter. The order is of no importance. If the focus leaves the field of the last entry or if return is pressed after the last entry, the large diameter can be seen from the last text field.
Determining small diameter	In order to determine the large diameter D1, taper relation/setting angle and the taper length have to be specified in any order. Finally, the large diameter D2 is entered. If afterwards, the focus leaves the entry field and/or if now, the return key is pressed, the small diameter will appear in the last but one text field.

Errors

Error causes	Errors are caused in the entry of values and/or expressions. The following causes can be considered: • Inadmissible mathematical operations • Syntax error • Exceedance of a value range
Error display	In the lower part of the form, an error message is displayed, either with reference to the violated value range or as format error. The focus is automatically reset to the faulty entry field.
Error recovery	Using the <Esc> key, you can reject the latest entry or edit the entry field specified in the error message.

11.2.4 Toleranced dimension table

Overview

Tasks	The toleranced dimension table allows for the determination of an allowance for a given nominal size and the tolerance field as it can be found as measure in a drawing. The table is based on the preference tolerances from DIN ISO 286 and/or DIN 7154 and DIN 7155 for the hole basis system and/or the shaft basis system in the nominal size range from 1 to 500 mm. The following allowances (in mm) are shown:

- Upper deviation
- Medium allowance
- Lower deviation

Layout The form for the toleranced dimension table is located on the "Toleranced dimension" tab.

Tolerance Dimension

Tolerances acc. to DIN ISO 286 and DIN 7172 [mm]

Nominal Size (D) and tolerance class:

50j6

Upper dimensional deviation (U):

50.011

Medium dimensional deviation (M):

50.003

Lower dimensional deviation (L):

49.995

1 2 3 4 5 6 7 8 9 0

(/ * + - ^ .)

ABC Del SIN COS TAN ← ↻ ↩

Fig. 11-9: Form for using the tolerance dimension table

Preference tolerances The following tolerance fields are listed for shafts:

a11, c11, d9, e8, f7, f8, g6, h5, h6, h9, h11, j6, k6, n5, m6, n6, r5, r6, s6, s8, u8, x8, and x11.

The following tolerance fields are listed for holes:

A11, C11, D10, E9, F7, F8, G6, G7, H6, H7, H8, H11, J6, J7, K7, M6, M7, N6, N7, P6, R7, S7, X9 and X11.



To enter characters when describing the tolerance class, switch the keyboard to character input using the <ABC> key.

Finding an allowance

Entering nominal size and tolerance field

Enter the nominal size followed by the tolerance field. In this connection, spaces are admissible. Expressions are not allowed.

Example:

Allowances for a boring: 60 H6

Allowances for a shaft: 22.5 f8

Using the return key or by changing the focus, the determination of the allowance is initiated.

Transferring the allowance

Select one of the three listed allowances and press "Copy".

Errors

Error causes

The following causes in the entry can be considered:

- Invalid specification
- Nominal size outside the range from 1 to 500 mm
- You have tried to determine a non-preference tolerance

Error display

With all error causes, a uniform error message is displayed in the lower part of the form. The focus is automatically reset to the entry field.

Debugging

Using the <Esc> key, you can reject the latest entry or edit the entry field.

11.2.5 Circumferential calculations

Overview

Tasks

The circumferential calculation is most often used for programming radial processing types if programming takes place in a coordinate system to be transformed - here the unwinding - and the positions on the circumference are available as angles. With a given reference diameter (unwinding diameter), you can fulfill the following tasks:

- Conversion of an angular pitch into a circumferential coordinate
- Conversion of a circumferential coordinate into an angular pitch.

Layout

The form for circumferential calculations is located on the tab labeled with "Circumference".

The form provides editable text fields for the numerical values. Behind the text fields that are in the fore and can be considered for a value transfer, buttons for copying purposes are located.

Circumference

Reference diameter (D):

50

Angle (α) [°]:

60

Circumference coordinate (Y):

26.17994

1 2 3 4 5 6 7 8 9 0

(/ * + - ^ .)

ABC Del SIN COS TAN ← ↻ ↵

Fig. 11-10: Form for circumference calculations

Performing circumference calculations

Calculating the circumferential coordinate

For calculating the circumferential coordinate, the reference diameter and the angular pitch must be entered in any order. Mathematical expressions are allowed in every entry field (see [Syntax for expressions](#)). If the focus leaves the field of the last entry or if return is pressed after the last entry, the circumferential coordinate can be seen from the last text box.

Calculating the angle

If the angular pitch is to be determined, enter the reference diameter and the circumferential coordinate into the corresponding fields in any order. If the focus leaves the field of the last entry or if return is pressed after the last entry, the related angle can be seen from the central text field.

Errors

Error causes	Errors are caused in the entry. The following causes can be considered: • Inadmissible mathematical operations • Syntax error
Error display	In case of an error, an error message is displayed in the lower part of the form referring to a format error. The focus is automatically reset to the faulty entry field.
Debugging	Using the <Esc> key, you can reject the latest entry or edit the entry field specified in the error message.

11.2.6 Thread table

Overview

Tasks	The thread table makes almost all thread dimensions available whereas different types of cylindrical threads have been considered. The table supports you in: • The programming of thread cutting processes (external/internal) • The programming of tapping • The determination of the pre-drilling diameter • The description of a thread cutting tool for the simulation The thread table only returns length dimensions in mm.
Layout	The tab for the thread table is labeled with "Thread". The form provides combo and text boxes for the thread selection. Behind the text fields that are in the fore and can be considered for a value transfer, buttons for copying purposes are located.

Thread

Thread Type :

Thread Size : M24 Pitch (P): 3 Rounding (R): 0.433

Nominal Diameter (D): 24 Core Diameter (D1): 20.752 Core Diameter (D3): 20.319

Depth of Thread (H1): 1.624 Depth of Thread (H3): 1.84 Pre-drilling Diameter : 21

1 2 3 4 5 6 7 8 9 0

(/ * + - ^ .)

ABC Del SIN COS TAN ← ↻ ↩

Fig. 11-11: Form for thread table



If the thread table form is displayed without "Copy" keys, all relevant thread dimensions in the calling dialog will be entered at the corresponding positions using the "OK" key.

Finding thread parameters

Standardized thread

Finding the information on a standardized thread that is listed in the table:

1. Select the thread type in the upper combo box.
2. Select the thread size in the upper combo box.

3. Take the desired dimensions from the boxes located below. The "--" display means that the information concerned is not available in the table.

Special threads

If a thread is not in the table, proceed as follows:

1. Select the thread type in the upper combo box.
2. Enter the nominal/external diameter. Here, expressions are allowed (see [Syntax for expressions](#)).
3. Enter the pitch. Expressions are allowed.
4. Take the desired dimensions from the boxes located below. The "--" display means that the information concerned is not available in the table and/or that the information cannot be calculated from the thread dimensions.

Errors**Error causes**

Errors are caused in the entry of values and/or expressions.

The following causes can be considered:

- Inadmissible mathematical operations
- Syntax error
- The exceedance of a value range ($P \leq 0$, $D \leq 0$).

Error display

An error field is displayed. The focus is automatically reset to the faulty entry field.

Debugging

Using the <Esc> key, you can reject the latest entry or edit the entry field specified in the error message.

11.2.7 Polar coordinates**Overview****Tasks**

The "Polar coordinates" tab supports you in the calculation of chamfers and/or not axially parallel paths or other coordinates e.g. centers of circles) if the Cartesian coordinates are not given. Apart from that, distances between points and the ascent angle of a straight line through two given points can be determined.

This calculation form covers the following tasks:

- Calculation of the Cartesian coordinates of a point from its polar coordinates (radius and angle).
- Calculation of the polar coordinates of a point from its Cartesian coordinates.
- Calculation of a polar coordinate and a Cartesian coordinate if one polar coordinate and one Cartesian coordinate are given.

In all calculations, the location of the pole (origin of the polar coordinate system) is regarded as being given in Cartesian coordinates.

Layout

The form for the calculations of the working values can be found on the "Polar c." tab.

The form provides editable text fields for the numerical values. Behind the text fields that are in the fore and can be considered for a value transfer, buttons for copying purposes are located. The pushbuttons labeled ">>" and "<<" allow for switching between the specification in absolute Cartesian coordinates and increments. By checking the box in front of "Turning", you activate the turning coordinate system with the vertical axis in the diameter unit.

Fig. 11-12: Polar coordinates form

Conversion between Cartesian and polar coordinates

Calculating Cartesian coordinates

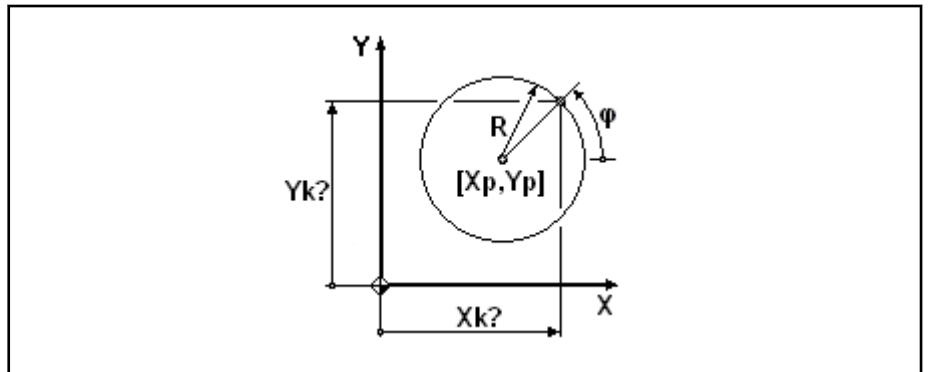


Fig. 11-13: Calculating Cartesian coordinates from polar coordinates

You can calculate the Cartesian coordinates from the polar coordinates as follows:

1. Ensure that the coordinate system on which your calculation is based is activated. For diameter programming check "Turning".
2. Enter the pole coordinates. As in all entry fields, expressions are allowed (see [Syntax for expressions](#)).
3. Enter the angle coordinate and the radius in the provided fields. The order of the entry is of no importance.
4. Initiate the calculation using the return key or by changing the focus.

Calculating polar coordinates

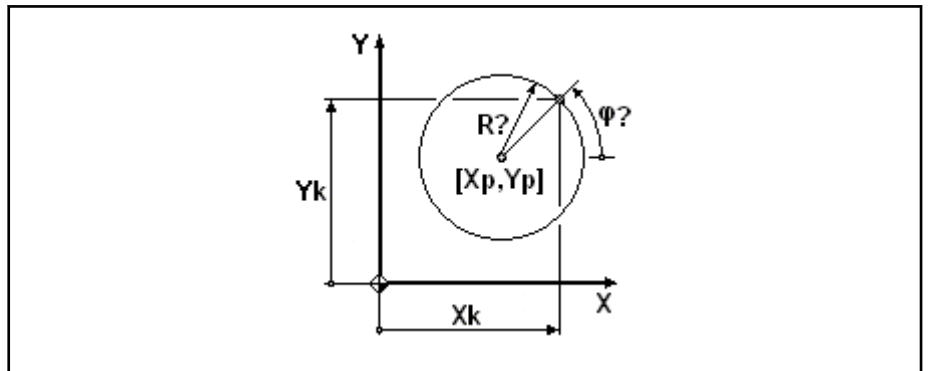


Fig. 11-14: Calculation of polar coordinates from Cartesian coordinates

You can calculate the polar coordinates from Cartesian coordinates as follows:

1. Ensure that the coordinate system on which your calculation is based is activated. For diameter programming check "Turning".
2. Enter the pole coordinates. As in all entry fields, expressions are allowed.
3. Enter the horizontal and the vertical Cartesian coordinates in any order. If only the distance of the point to the pole is known, activate ">>" in order to switch over to the incremental entry. Enter the distance with sign and always as radius dimension.
4. Initiate the calculation using the return key or by changing the focus.

Trigonometric calculations

Calculating a Cartesian coordinate and the radius

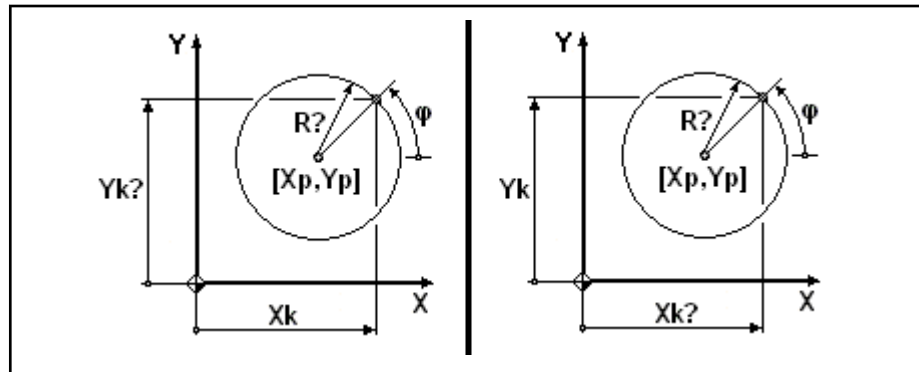


Fig. 11-15: Calculating a Cartesian coordinate and the radius

The specified calculation from an angle coordinate or a Cartesian coordinate is performed as follows:

1. Ensure that the coordinate system on which your calculation is based is activated. For diameter programming check "Turning".
2. Enter the pole coordinates. As in all entry fields, expressions are allowed (see [Syntax for expressions](#)).
3. Enter the angle coordinate in the provided field.
4. Enter the given horizontal and/or vertical Cartesian coordinate. If only the distance of the point to the pole is known, activate ">>" in order to switch over to the incremental entry. Enter the distance with sign and always as radius dimension.
5. Initiate the calculation using the return key or by changing the focus.

Calculating a Cartesian coordinate and the angle coordinate

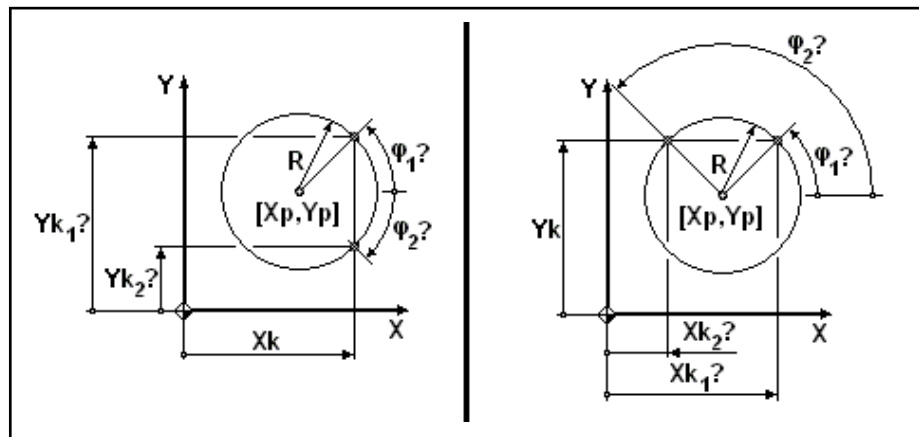


Fig. 11-16: Calculation of a Cartesian coordinate and the angle coordinate

The specified calculation from a radius and a Cartesian coordinate is performed as follows:

1. Ensure that the coordinate system on which your calculation is based is activated. For diameter programming check "Turning".
2. Enter the pole coordinates. As in all entry fields, expressions are allowed.
3. Enter the radius in the provided field.
4. Enter the given horizontal and/or vertical Cartesian coordinate. If only the distance of the point to the pole is known, activate ">>" in order to

switch over to the incremental entry. Enter the distance with sign and always as radius dimension.

5. Initiate the calculation using the return key or by changing the focus.
6. In this task, there are usually two solutions. By activating the "Another solution" button, switch to the desired solution.

Errors

Error causes	The following error causes can be considered: • Inadmissible mathematical operations • Syntax error • Exceedance of a value range • The entry values do not allow for the geometric calculation
Error display	In the bottom left corner of the form, an error message with the corresponding reference to the error cause is displayed. In value range and format errors, the focus is automatically reset into the field of the latest entry.
Debugging	Using the <Esc> key, you can reject the latest entry or edit the entry field specified in the error message. If the error has occurred in the geometric calculation, the error can also be removed by changing another entry field.



An error state in the geometric calculation may occur more often in repeated calculations of identical tasks after the first given parameter of the next calculation has been recorded. The interim condition before completion of all new entries can hardly be avoided and gives no cause for concern.

11.2.8 Calculations on speed and feed

Overview

Tasks	Calculations on speed and feed, shortly called working values, are very often necessary in the part programming with machining, particularly if working values are taken from tables and must be converted to the respective situation. This calculation form covers the following tasks: • Conversion between cutting velocity and speed with known diameter in both directions • Conversion between feed velocity and feed per tooth and/or rotation with known speed in both directions • Conversion of operate values between the metric and the Anglo-American metric system
Layout	The form for the calculations of the working values can be found on the "F,S" tab. The form provides editable text fields for the numerical values. Behind the text fields that are in the fore and can be considered for a value transfer, buttons for copying purposes are located.

Speed

Diameter (D) [inch]: 40 Cutting Velocity (Vf) [ft/min]: 23.066

Speed (N) [1/min]: 22.4408 Number of Teeth: 4

Feed per Tooth (fz) [inch]: 0.0125 Feed Velocity (Vf) [inch/min]: 0.35

☒ Metric System Inch

1 2 3 4 5 6 7 8 9 0

(/ * + - ^ .)

ABC Del SIN COS TAN ← ↻ ↵

Fig. 11-17: Form for calculations on speed and feed

Calculating the cutting velocity/speed

Calculating speed The speed can be calculated as follows:

1. Ensure that the metric system suitable for your entries is active. For the Anglo-American metric system, "Metric system Inch" must be checked.
2. Enter the diameter and the cutting velocity in the provided fields. In this connection, expressions are allowed (see [Syntax for expressions](#)). The order of the entry is of no importance.
3. Initiate the calculation using the return key or by changing the focus.

4. If conversion into the other metric system is necessary, activate "Metric system Inch".
- Calculating cutting velocity** The cutting velocity can be calculated as follows:
1. Ensure that the metric system suitable for your entries is active. For the Anglo-American metric system, "Metric system Inch" must be checked.
 2. Enter the diameter and the speed in the provided fields. In this connection, expressions are allowed. The order of the entry is of no importance.
 3. Initiate the calculation using the return key or by changing the focus.
 4. If conversion into the other metric system is necessary, activate "Metric system Inch".

Feed calculations

- Calculating the feed** The feed can be calculated as follows:
1. Ensure that the metric system suitable for your entries is active. For the Anglo-American metric system, "Metric system Inch" must be checked.
 2. Enter the speed. If the speed is not known, it is to be calculated from the cutting velocity. Refer to [Calculating the cutting velocity/speed](#).
 3. Enter the number of teeth 1 if you want to get the feed per rotation; otherwise, enter the number of teeth of the tool.
 4. Enter the feed speed.
 5. Initiate the calculation using the return key or by changing the focus.
 6. If conversion into the other metric system is necessary, activate "Metric system Inch".
- Calculating feed velocity** The feed speed can be calculated as follows:
1. Ensure that the metric system suitable for your entries is active. For the Anglo-American metric system, "Metric system Inch" must be checked.
 2. Enter the speed. If the speed is not known, it is to be calculated from the cutting velocity. Refer to [Calculating the cutting velocity/speed](#).
 3. Enter the number of teeth 1 if you know the feed per rotation; otherwise, enter the number of teeth of the tool.
 4. Enter the feed.
 5. Initiate the calculation using the return key or by changing the focus.
 6. If conversion into the other metric system is necessary, activate "Metric system Inch".

Errors

- Error causes** Errors are caused in the entry of values and/or expressions. The following causes can be considered:
- Inadmissible mathematical operations
 - Syntax error
 - Exceedance of a value range
- Error display** In the lower part of the form, an error message is displayed, either with reference to the violated value range or as format error. The focus is automatically reset to the faulty entry field.
- Debugging** Using the <Esc> key, you can reject the latest entry or edit the entry field specified in the error message.

11.2.9 Using the calculator functions in dialogs

General information

Selected dialogs use the calculator function for a user-friendly input of results of complicated mathematic calculations.

The input field is an editable text field for entering mathematic expressions.

The text entry is recommended for more complex expressions as the expression can be completely seen and checked before the calculation. The text mode is also recommended when using recurring expressions with changing numbers. For this purpose, the last expression should be copied into the display using the clipboard and the new operands should then be entered by editing.

Performing a calculation

Entering an expression	In the beginning, the focus has to be set to the text field (display). The expression is entered using the keyboard. Alternatively, the expression can be inserted from the clipboard using the <Ctrl>+<V> shortcuts. The expression must comply with the syntax rules listed in the following sections.
Calculating expression	Tap on the <Enter> key. The value is calculated and applied to the entry field.
Trigonometric functions	The trigonometric functions either work with degree or radian. An expression with several trigonometric functions in which both angle units are used simultaneously cannot be calculated directly.

Syntax for expressions

Basics	The syntax for mathematical expressions largely complies with the CPL language (Customer Programming Language). Apart from that, there are only a few extensions and some programming aids. The syntax generally applies to all text entry fields for numerical values in IndraWorks Operation if they are connected to the interpretation of expressions as well as within the "Calculations and tables" dialog.
General rules	In general, the following applies: • The entry logic corresponds to the algebraic notation whereas the order of the operators is considered. • Upper and lower cases can be used arbitrarily. • An expression may include any number of spaces at any position. The spaces will be ignored.
Format for numbers	To the format of numbers, the following applies: • As decimal separator both, the point and the comma can be used. • Leading zeros in front of the decimal separator can be omitted (e.g. - . 668 instead of -0.668). • A positive sign can generally be omitted. A negative sign must be written whereas here, brackets around the negative figure - as it is usual as opposed to arithmetic - can be omitted (e.g. -3.2*-4 instead of (-3.2)*(-4), SIN-30 instead of SIN(-30)). It must, however, generally be noted in the single case that the operators for addition and subtraction are identical with the signs and that the operators must generally be maintained.

- Numbers can also be written down in exponential notation. The mantissa is to be followed by an "E" or an "e" introducing the exponent. The mantissa may contain a decimal separator. The exponent must be integer and must not include a decimal separator (examples: $-13.783\text{E}-10$, $.55\text{e}+4$ and $2,345\text{E}12$).

Operators The following operators can be used in expressions:

- Addition: +
- Subtraction: -
- Multiplication: *
- Division: /
- Power: ^



- The operator for the multiplication can be omitted in front of function names, in front of constants and after brackets (e.g. $5(3.4-66)$ instead of $5*(3.4-66)$, $(3120+750).5$ instead of $(3120+750)*.5$, $-50\text{SIN}30$ instead of $-50*\text{SIN}30$). The asterisk must, however, not be omitted if it is followed by a sign (e.g. $(22-1.5)*-30$ must not be simplified and become $(22-1.5)-30$).
- For roots $\sqrt[n]{x}$, you have to switch to the power with the reciprocal radicand as exponent $x^{(1/n)}$. For the square root, you can also use the "SQRT" function.

Priority rules and brackets

The interpretation of the expressions complies with the priority rules for operators.

The order of the calculation applies (with decreasing priority):

- Function call (with succeeding argument)
- Power
- Multiplication and division
- Addition and subtraction.

Operations with operators equal with regard to the order are calculated in the order from left to right.

If for the calculation, an order deviating from these rules is to be used, brackets must be set around the preferred part of the expression. In this connection, only round brackets are admissible. You can use as many brackets as you want and open as many brackets within one expression as you want, however always in pairs, i.e. one left bracket and then one right bracket per level. Deviation from the parity of the brackets can be seen in the central status display.

Example:

Fraction

$$\frac{ab}{cd}$$

In case of a fraction such as $\frac{ab}{cd}$ there are often errors as multiplication and division are of the same priority and thus performed from left to right. Numerator and denominator must, however, in each case be calculated from the quotient.

Without brackets, i.e. $a*b/c*d$, the calculation according to the priority rules would incorrectly be $((a*b)/c)*d$.

Apart from the expression $(a*b) / (c*d)$ exactly converted into the syntax, the following expressions would lead to the correct result, as well:

$a*b / (c*d)$ and $a*b/c/d$.

Functions and constants

Functions The following functions can be used within one expression:

Name	Description	Value range of the argument	Value range of the function value
ABS	Absolute value	Rational number	$y \geq 0$
ACOS	Arcus cosine	$-1 \leq x \leq 1$	$0 \leq y \leq 180$ and/or π
ASIN	Arcus sine	$-1 \leq x \leq 1$	$-90 \leq y \leq 90$ and/or $-\pi/2 \leq y \leq \pi/2$
ATAN	Arcus tangent	rational number	rational number
COS	Cosine	rational number	$-1 \leq y \leq 1$
INT	Conversion to an integer by cutting off the decimal fraction	rational number	Integer number
ROUND	Rounding up or down to the next integer. With a decimal fraction of exactly 0.5, the next even number is returned	rational number	Integer number
SIN	Sine	rational number	$-1 \leq y \leq 1$
SQRT	Square root	$x \geq 0$	$y \geq 0$
TAN	Hyperbolic tangent	$x \neq n*90$ and/or $x \neq n*\pi/2$ with $n \neq 0$	rational number

Tab. 11-5: Compilation of the implemented functions

Function call A function call always consists of the function name followed by the argument. In this connection, the argument does not have to be put into brackets, also if it has a sign unless it is an expression.

Constants You can fall back on the value of mathematical and other constants using their constant names.

The following constants are available:

Name	Description	Value
PI	Constant π	3.14159265358979
KI	Conversion factor from inch to mm	25.4 [mm/inch]

Tab. 11-6: Compilation of the implemented constants

Correcting entries

Errors Errors in the calculation can be caused by:

- an undefined operation
- a function call with an inadmissible argument
- by a number overflow in the final or an interim result
- brackets that are not arranged equally
- Syntax error

With all these causes, an error message is displayed in the display in order to signal the error status.

Editing expression Before the calculation, the expression can be modified arbitrarily and in an unlimited manner by means of editing using the keyboard. For the deletion, the <backspace> and the <Del> key are available.

11.3 EnergyMonitor

11.3.1 Overview

Purpose of EnergyMonitor

With the EnergyMonitor, the energy consumption of a machine as well as of individual function modules (electric drives and auxiliary equipment, e.g. hydraulic pumps, cooling lubricant system etc.) are summed up and monitored over defined time spans.

The EnergyMonitor is part of the MTX interface.

Properties of the EnergyMonitors

The EnergyMonitor indicates the energy consumption of the

- last ten measurements as bar chart
- individual drives
- individual ancillary components

Components

The EnergyMonitor consists of the following sections:

- Header
- Main screen
- F-key pads

11.3.2 Commissioning the EnergyMonitors

Prerequisites

The EnergyMonitor contains the data to be displayed via the PLC function block "MT_4EEGuiMonitor". Integrate the respective function block into the PLC program and connect it (also refer to "IndraMotion MTX 14VRS PLC Interface").

11.3.3 Working with the EnergyMonitor

Starting the EnergyMonitors

Use <F2> to start the EnergyMonitor under production data. The EnergyMonitor can also be configured in user screens on F-keys or M-keys.

Total energy consumption

After calling the EnergyMonitor, the latest ten energy measurements are shown as bar chart. The latest measurement is always shown on the right side. Each individual measurement shows the proportionate consumption of the Sercos drives as well as the entered auxiliary equipment. If required, the measurement period can be optionally shown with <F2>. This is especially useful to monitor the production/part manufacturing. Optionally, functions to execute or suppress energy and time measurements can be configured via M-keys.



Fig. 11-18: Total energy consumption

In the menu, the individual energy measurement can be selected with the arrow keys. If required, the selected measurement can be analyzed more in detail. The energy consumption of the individual drives can be seen more in detail with <F4> and the energy consumption of the individual auxiliary equipment with <F5>.



Fig. 11-19: Energy consumption of the drives

Energy consumption of the drives

The menu to display the energy consumption of the individual Sercos drives is opened using <F4>. In the menu, the individual energy consumption bars of the individual drives can be selected with the arrow keys.

Energy consumption of the ancillary components

The menu to display the energy consumption of the individual ancillary components is opened using <F5>. In the menu, the individual energy consumption bars of the individual ancillary components can be selected with the arrow keys.



Fig. 11-20: Energy consumption of the ancillary components

11.4 PowerMonitor

11.4.1 Overview

Purpose of PowerMonitor

With the PowerMonitor, the power consumption (real power) of a machine as well as of individual function modules (electric drives and ancillary components, e.g. hydraulic pumps, cooling lubricant system etc.) are monitored over defined time spans.

The PowerMonitor is part of the MTX interface.

Properties of the PowerMonitor

The PowerMonitor indicates:

- the total power of the machine, either as bar diagram changing with time or as progress bar with time lapse
- the performance of individual drives
- the performance of ancillary components

Component parts

The EnergyMonitor consists of the following sections:

- Partial screen of the NC basic screen
- F-key pads

11.4.2 Commissioning of PowerMonitor

Prerequisites

The PowerMonitor receives the data to be displayed via the PLC function block "MT_4EEGuiMonitor". Integrate the respective function block into the PLC program and connect it (also refer to "IndraMotion MTX 14VRS PLC Interface").

Configure the PowerMonitor in the basic standard screen. Call the monitor in the basic standard screen via the second F-key level with <F7> and <F3> after selecting the program display window. Subsequently, show the configuration menu with <F8> and process the configuration menu according to the following subchapters.

Configuring the PowerMonitors - General information

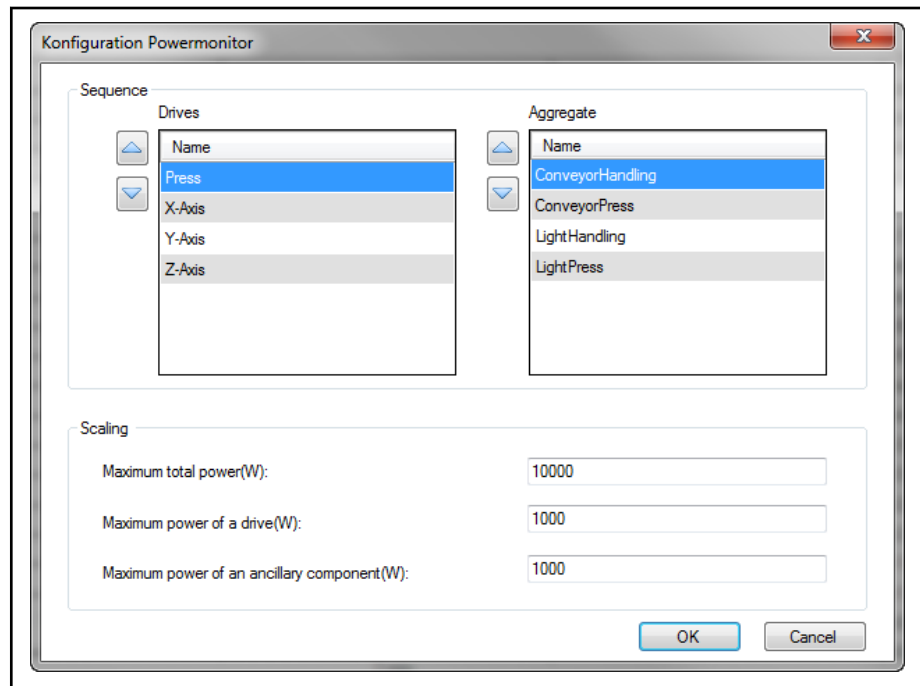


Fig. 11-21: Configuring the PowerMonitors - General information

Enter the maximum total drive power, the maximum single drive power as well as the maximum power of the individual ancillary components under "General". Furthermore, the display order of the drive as well as the ancillary components for the different power rating displays can be specified by using the arrow keys.

11.4.3 Working with the PowerMonitor

Starting the PowerMonitor

In the basic standard screen, the PowerMonitor can be shown via the second F-key level with <F7> and <F3>.

The PowerMonitor can also be configured in user screens on F-keys or M-keys.

Total power

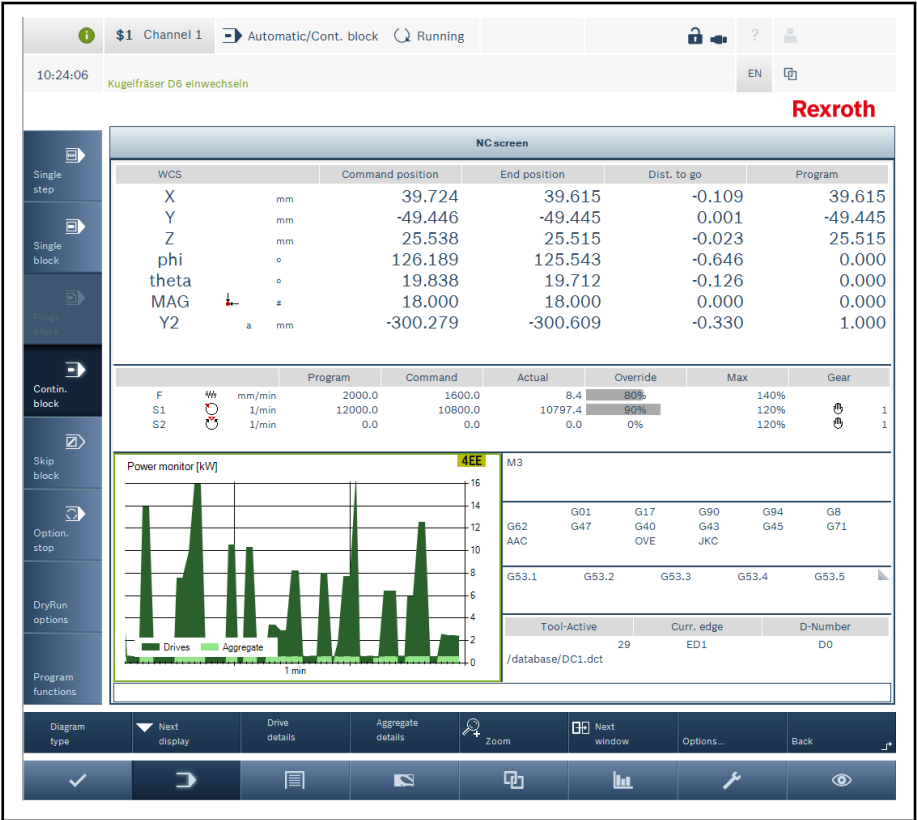


Fig. 11-22: Total power (process bar with time lapse)

The total power of the machine, either be indicated as bar diagram changing with time or as progress bar with time lapse. In both forms of display, the consumption of the drives as well as the consumption of the ancillary components is displayed. Switching between the two forms of display is possible using <F2>.

Performance of drives

The menu of the power rating display of the individual Sercos drives is opened using <F4>. In the menu, the bar indicating the performance of the individual drives can be selected with the arrow keys.

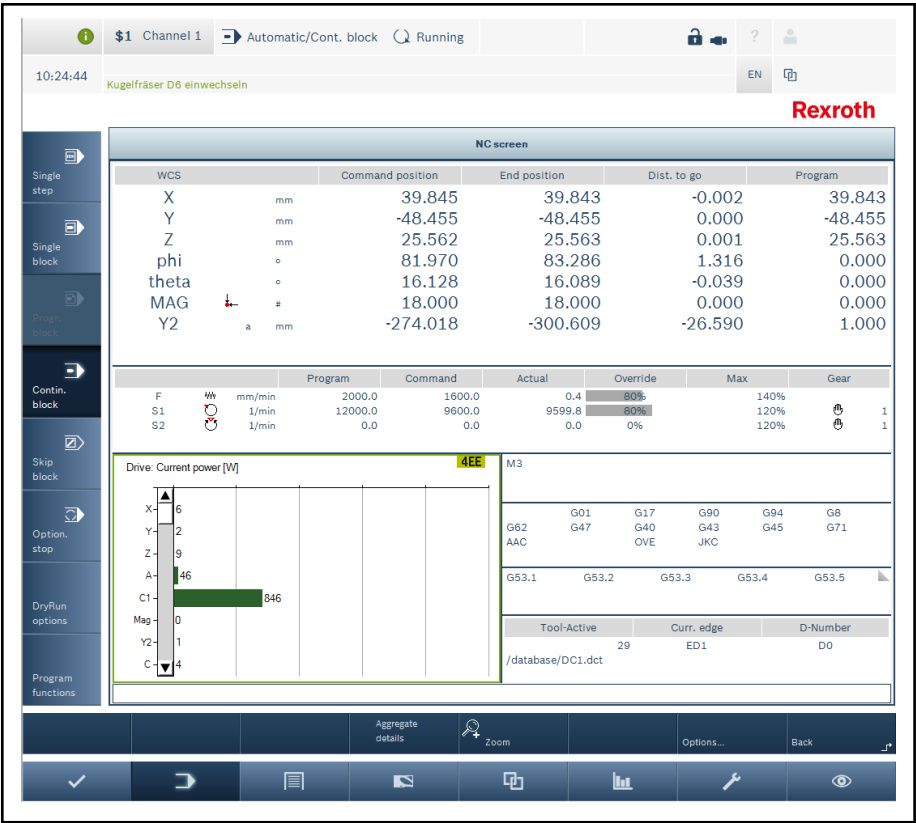


Fig. 11-23: Performance of the drives

Performance of the ancillary components

The menu of the power rating display of the individual ancillary components is opened using <F5>. In the menu, the bar indicating the power of the individual ancillary components can be selected with the arrow keys.

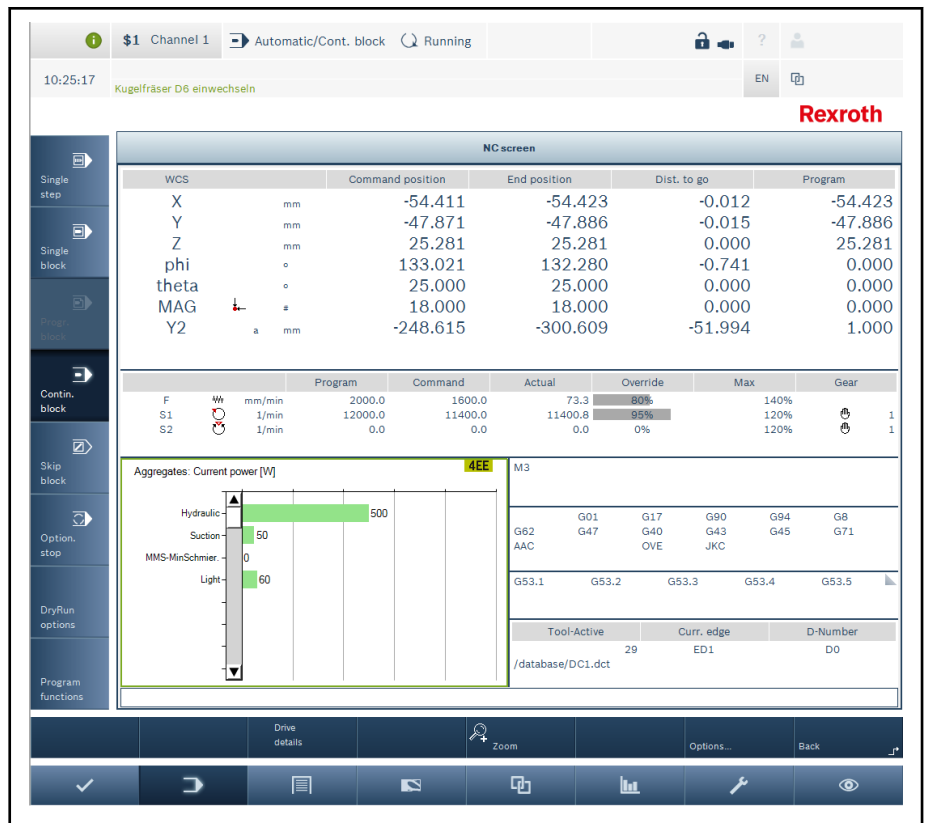


Fig. 11-24: Performance of the ancillary components

Zoom

If required, the representation can be zoomed using <F6>. In particular, this is recommended to display individual performances of the drives as well as individual ancillary components.

With <F6>, the original display size is shown again.

11.5 EnergyManagement

11.5.1 Overview

Purpose of EnergyManagements

Use the EnergyManagement to track control and status data of the machines and components. Furthermore, the states of individual events as well as energy saving functions can be monitored.

The EnergyManagement is part of the MTX interface.

Properties of the EnergyManagements

The EnergyManagement comprises the following screens:

- Machine information
- Component information
- Events
- Energy saving functions (of individual components including the machine)
- Idle time/energy mode specification

Component parts

The screens of the EnergyManagement can be found under **Production data ► EnergyManagement**.

11.5.2 Working with the EnergyManagement (idle time or energy mode)

Requirements

The idle time or the energy mode can be specified under "Production data". Call the "Idle time or energy mode" with <F7>.

Idle time or energy mode specification

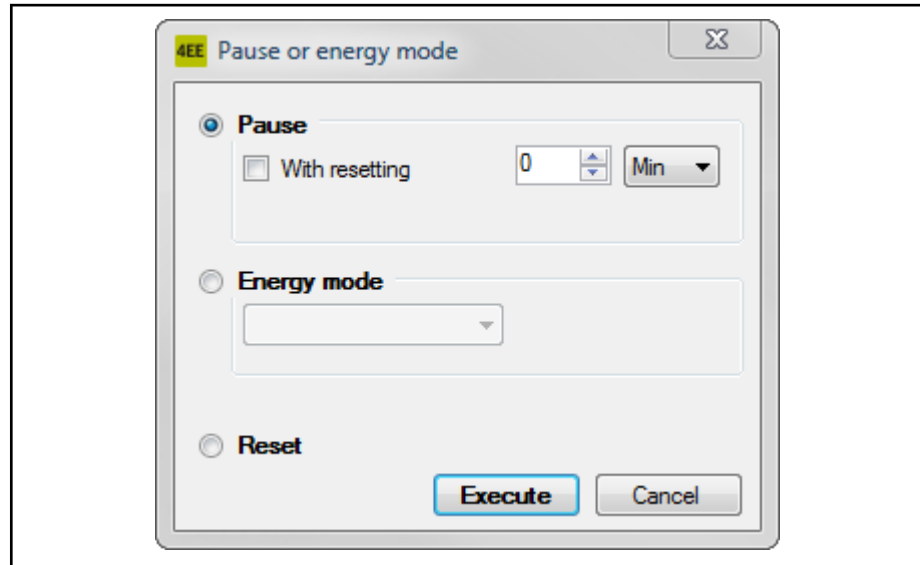


Fig. 11-25: Configuring the "idle time or energy mode" window

Within the window, either an idle time or an energy mode can be specified. If the program is to be paused, either an idle time with or without reset can be selected using the checkbox. If a pause with reactivation is selected, an automatic switchover to the "Operational" energy mode takes place once the pause time has elapsed.

11.5.3 Working with the EnergyManagement

Machine information

Use <F2> to open the menu to display the machine information.

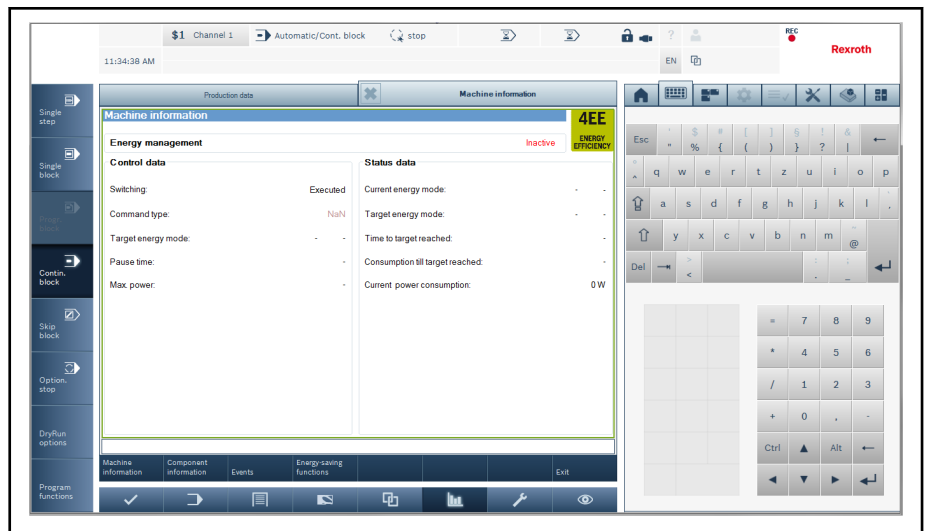


Fig. 11-26: Machine information

The menu shows control as well as status data of the machine.

The following information is provided below the control data:

- "Switching" indicates if an energy mode switching is active
- "Command type" indicates the specification type (direct specification of an energy mode or an idle time with or without reset)
- "Target energy mode" specifies the energy mode to be traversed if the command type is a direct energy mode specification
- "Idle time" shows the duration of the idle time. The idle time is used to calculate the target energy mode within the energy management

The energy management displays the following below the status data:

- "Current energy mode" shows the active energy mode of the machine
- "Target energy mode" specifies the energy mode calculated by energy management. The target energy mode is possibly not identical to the target energy mode specified by the user (on the left side). Usually, a different specification with a higher priority (e.g. by an MES system) is used
- "Time until target mode is reached" shows the duration until switching is completed
- "Time until target mode is reached" shows the energy consumption until switching is completed
- "Current Power consumption" specifies the average performance of the active energy mode

Component information

Use <F3> to open the menu to display the component information.

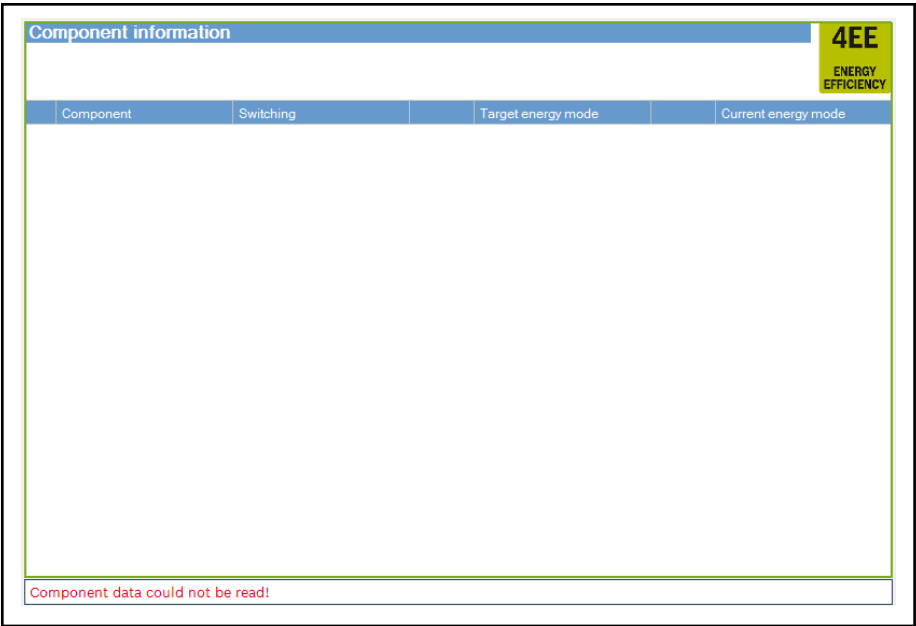


Fig. 11-27: Component information

The menu indicates if switching has to take place for individual components. It also displays the target energy mode including the current energy mode.

Events

Use <F4> to open the menu to display events.

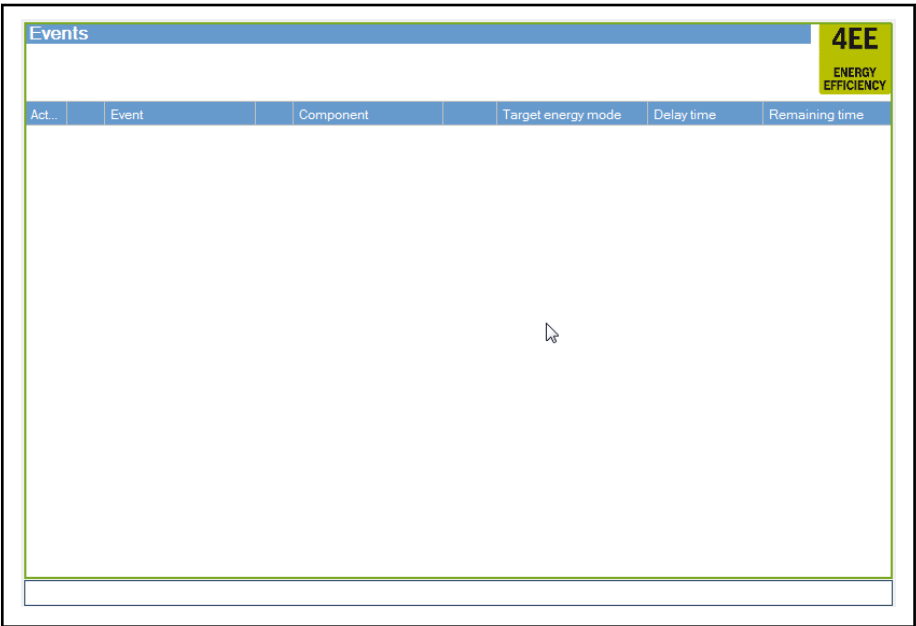


Fig. 11-28: Events

For individual events, the menu displays the status - active or inactive - as well as the target energy mode including the delay time and the remaining time until the event becomes active.

Energy saving functions

Use <F5> to open the menu to display the energy saving functions.

Energy-saving functions		4EE ENERGY EFFICIENCY
Energy-saving function	Component	Partial load operation [%]

Fig. 11-29: Energy saving functions

For individual energy saving functions, the menu indicates to which components they belong to as well as the partial load operation.

11.6 Circle test

11.6.1 Use

During the evaluation of machine tools, the accuracy attained by the machined parts is especially important in addition to the performance and an environmental friendly behavior.

To continuously ensure the accuracy of machine tools down to a few hundredths or thousandths of millimeters, the machine or the machining center is measured with the circle test in regular intervals.

On one hand, the history of the machines is documented as of the time of acceptance; on the other hand, measuring enables preventive maintenance.

The circle test contains the following functions:

- Development of an NC test program after the selection of two axes each of the active channel and further specifications on the definition of the traversing motions
- Display of the machine state for the circle test
- Measurement start
- Display measuring results after traversing motion
- Analyze and backup measuring results
- Display of old measurements with the possibility to compare them with the current measuring results

11.6.2 Operation and navigation

The circle test is started in the operating range "Maintenance" via <F6>.

For projects created with older versions, the F-key is not assigned and has to be configured first. For instructions, see [chapter 11.6.3 "Configuring the circle test on F-keys"](#) on page 339.

Extended functionality

F-keypad level	<F2>	<F3>	<F4>	<F5>	<F6>	<F7>	<F8>	<F9>
Configuration type (main level)	Start measurement	Load measurement	Save measurement	Load configuration	Saving the configuration		<i>Back to measurement *</i>	Exit circle test
Measurement plane	Start measurement	Load measurement	Save measurement	Load measurement	Print result	Zoom	<i>Back to configuration</i>	Quadrant - error correction
				Unload measurement				
Zoom level		Select diagram **	Cursor backward	Cursor forward		Zoom level back	Zoom 1: 1	Back

*

This function is only available in case of an available or loaded measurement.

**

This function is only available in case of several available measurements.

Tab. 11-7:

Function keys in the diagnostic display

F-keys of the configuration level

<F2>	Starts the measurement
<F3>	Loads a saved measurement
<F4>	Saves a measurement
<F5>	Loads a saved configuration
<F6>	Saves a configuration
<F8>	Switches to the measurement plane if the plane has already been active
<F9>	Exits the circle test function

F-keys of the measurement level

The measurement plane becomes active automatically after completion of a measurement.

<F2>	Starts and stops the measurement
<F3>	Loads a saved measurement with all settings related to axis selection, feed and radius
<F4>	Saves a measurement with all settings related to axis selection, feed and radius
<F5>	Loads a saved measurement to the currently loaded measurement to compare them with each other. The scaling of the measurement loaded is adapted to the current measurement. Unloading a measurement in case of two available measurements.
<F6>	Prints the measurement(s) Calling print preview. The document can be printed. The configuration data is also printed.
<F7>	Calls the zoom functions (zoom level)
<F8>	Returns to configuration level
<F9>	Calls the dialog for "Quadrant error correction"

F-keys of the zoom level

<F3>	Selects diagram for processing It switches between the two loaded curves.
<F4>	Moves cursor backwards on the diagram

- The cursor moves backwards in the zoomed curve with regard to time
- <F5>** Moves cursor forward on the diagram
- The cursor moves forward in the zoomed curve with regard to time.
- <F7>** One zoom level back
- The previously selected zoom area is displayed again.
- <F8>** Restores original size
- The measurement is displayed on the full screen again.
- <F9>** Returns to measurement level
- The following user screen is visible after calling the circle test:

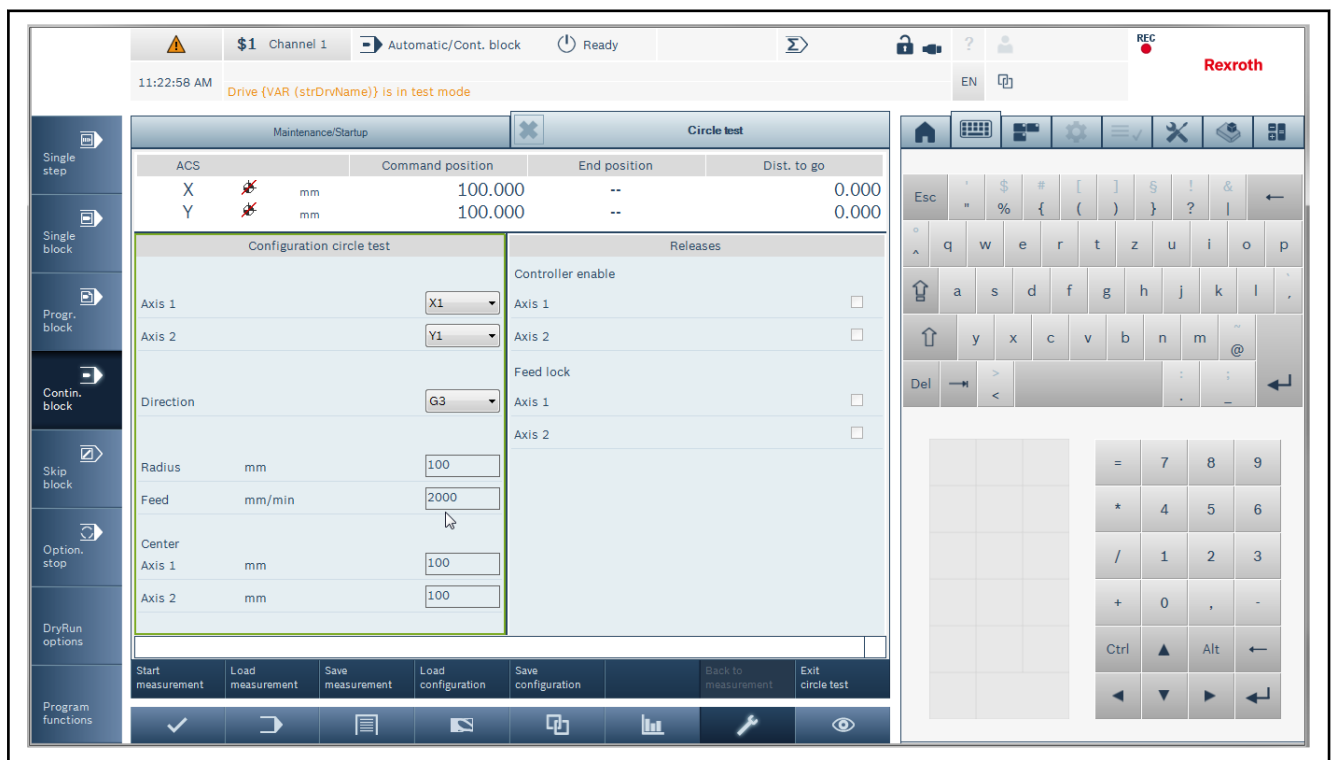


Fig. 11-30: Configuration of circle test

Test execution

Precondition: The machine has to be in Automatic mode!

1. Select axes.
2. Determine rotational direction, feed, circle center and diameter.
3. Start circle test with <F2>.

The necessary NC program is generated and loaded automatically.

4. After the circle test has been started, start the NC program.
5. The test is executed automatically. After the result has been displayed, either the analysis can be executed or the test can be restarted.

For a better evaluation, it can be zoomed within the circle diagram. Therefore, use "Touch and hold" on the left upper corner and drag it to the lower right. To see the complete curve again, press <F7> "Header zoom", then <F8> "Zoom 1:1".

Extended functionality

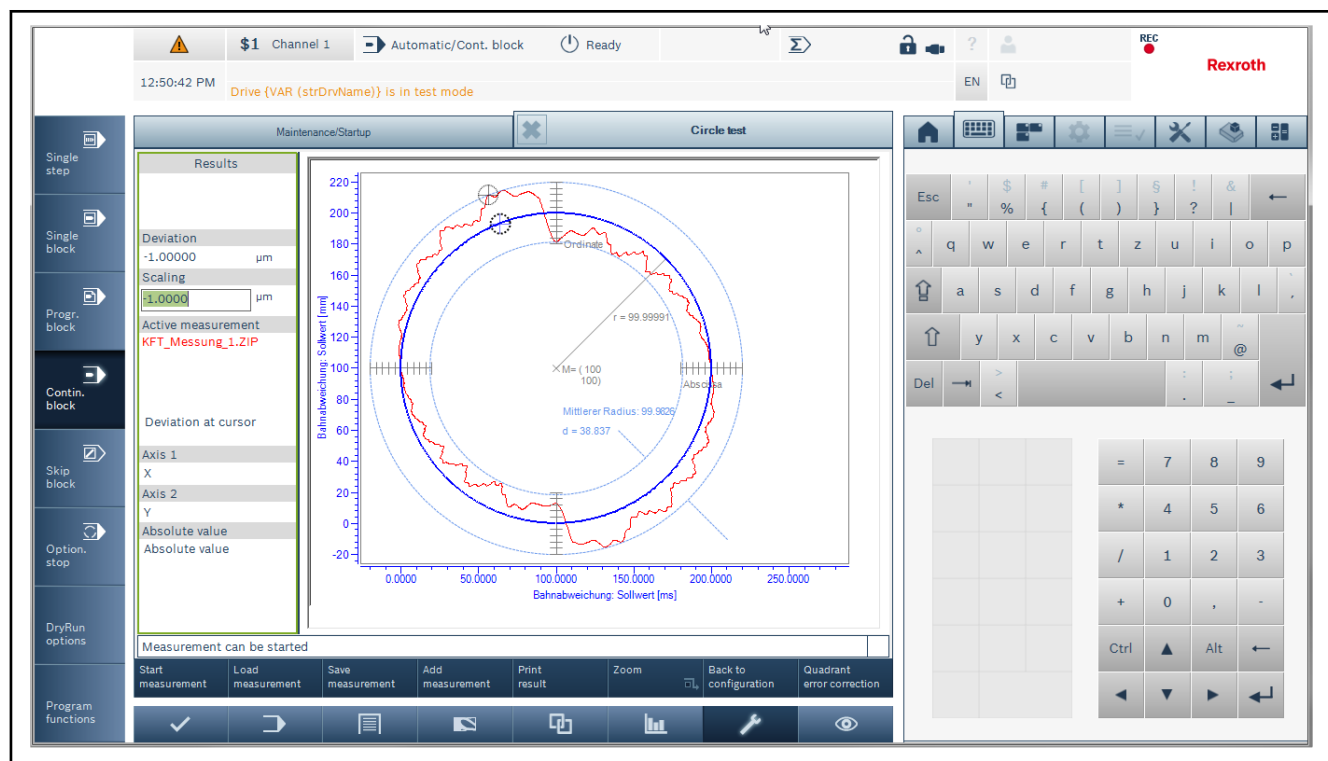


Fig. 11-31: Measurement display of circle test

Changing scaling

To show the deviation of the actual curve from the command curve, this deviation is deliberately exaggerated. To obtain an impression of the qualitative deviation, so-called scaling rings drawn with an adjustable distance (scaling) are inserted. If this scaling is modified, the curve is recalculated and then re-drawn. The curve is always displayed in such a manner that all measuring values are located within the screen area. This results in a relatively large scaling in case of large deviations.

The result can be documented via <F6> "Print result".

Quadrant error correction

This dialog is used to enter the drive parameters P435 - P439 for error correction at the quadrant intersections of the circle. To change the parameters, the drive has to be in "Closed loop" and the optional servo package needs to be switched on.

The following quadrant error correction dialog opens:

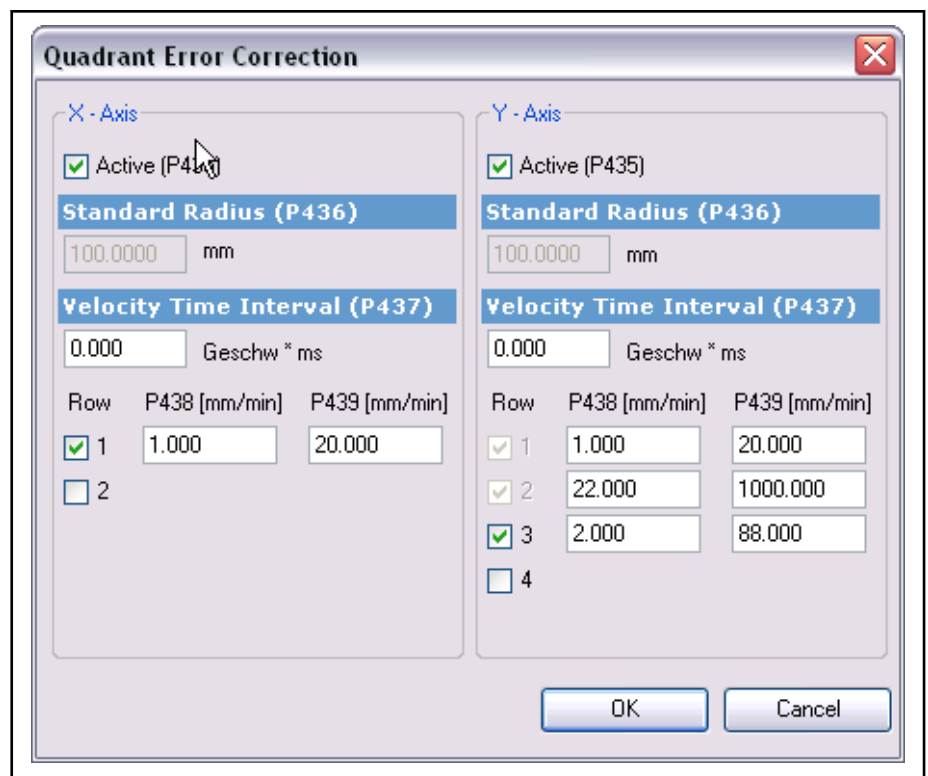


Fig. 11-32: Quadrant error correction

11.6.3 Configuring the circle test on F-keys

The circle test was not called in earlier projects. Proceed as follows to call it via F-keys:

1. The following line has to be entered into the file HMI.ScreenData.XML:
`<ScreenInfo Name="MtxCircularTest" ScreenType="MtxCircularTestApplication" Visible="true">`
2. Find an empty F-key in the Engineering desktop and assign the "Circle test" function to it (see IndraWorks documentation).
3. Assign the circle test to an operating area.

In IndraWorks Engineering, open the HMI node context menu and call "Update HMI data". The entry for the circle test is shown in the screen list.

The screen can also be assigned to the desired operating area.

Go to the OP-panel editor, open the operating range editor and move the circle test screen from the left into the right list.

11.7 Remote support

11.7.1 Use

With the help of the function "Remote support", it is now possible to access remote machine tool control systems and to execute diagnostics or maintenance.

The remote support software consists of the following components:

1. UltraVNC server on the MTX control system.
2. UltraVNC viewer on the remotely-controlled "service PC".

3. Optional: Mirror Driver (can be installed additionally on the device that is remotely supported to decrease the CPU load)

All components have to be installed on the devices involved.



For more detailed information on the installation of the UltraVNC, refer to the documentation "UltraVNC Installation Instructions".

To use the remote support functions on the CNC system MTX, you need the following user rights:

- You have to be logged in as main user or administrator in Microsoft Windows™.
- The user currently logged in to IndraWorks has to have the "remote support" user authorization.



To remotely support with UltraVNC, a TCP/IP connection has to be possible between the PCs involved via the port 5900.

11.7.2 Operating

General information

Under <OP8> "Maintenance", <F2>, a dialog to activate and deactivate the remote support function is available in the MTX user interface.



For more detailed information on the UltraVNC, refer to the documentation "UltraVNC Installation Instructions".

Dialog to activate and deactivate

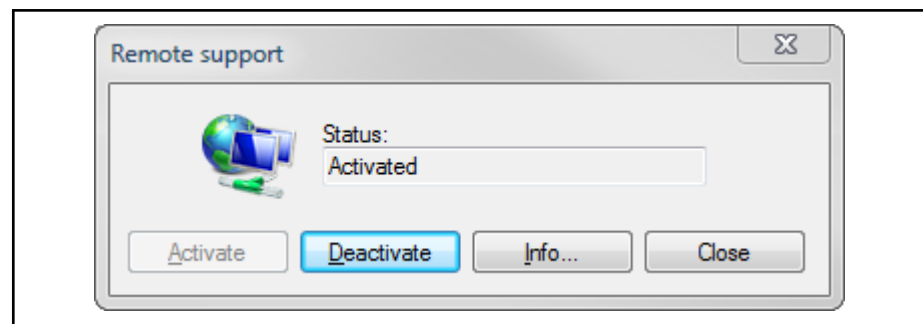


Fig. 11-33: Dialog to activate and deactivate

Activating

This function activates the remote support software, i.e. this machine tool control PC can be accessed from a service PC with installed remote support control software.

Deactivate:

This function deactivates the remote support software.

The machine tool control PC cannot be accessed via the remote support.

11.7.3 Display in the machine status area

The status of the remote support is displayed within the machine status area.

"Remote support active"

The status "Remote support active" is displayed in the machine status area

by the symbol .

"Remote support inactive" The status "Remote support inactive" is displayed in the machine status area by the symbol .

11.7.4 Related documentation

For more information on the remote support, refer to the documentation "IndraWorks 14VRS Remote Support" (DOK-IWORKS-REMOTE**V14-APRS-EN-E).

12 NC program encryption

12.1 Overview

The NC program encryption is intended to protect technological knowledge against unauthorized access.

The user can make cycles, part programs or subroutines unreadable via an encryption mechanism.

The original text has to be backed up as unencrypted version outside the NC file system to remain available for the author.

It is encrypted outside the control system via a program sent upon delivery.

After loading the encrypted data to the control after the encryption, they are invisibly decrypted during processing.

The encryption program allows implicitly to provide the data with a copy protection. In this case, the encrypted NC programs can only be processed on the selected control.

Furthermore, an encryption comment can be entered during the encryption which can then be displayed in the operating area Programs in the file property dialog to re-identify the encrypted program.



An emulation is required to process encrypted programs.

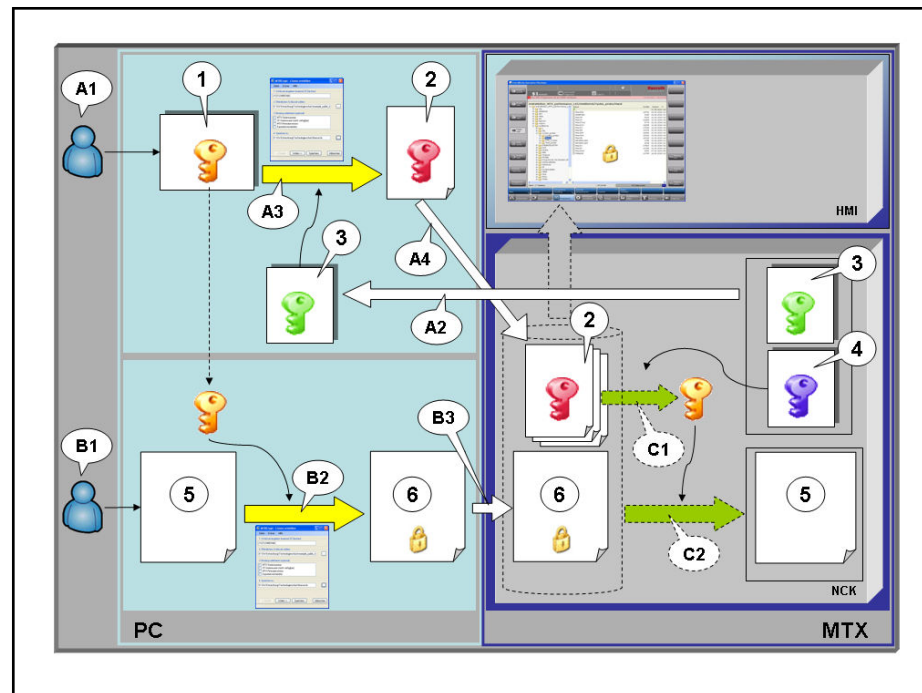
The NC program compiler function has to be disabled. Thus, GNP programs or programs containing GNP program parts cannot be encoded.

12.2 Basic procedure

[fig. 12-1 "Principle of program decryption" on page 344](#) shows the basic procedure of a program encryption.

Two steps are required to prepare the program encryption:

1. Generating the key **(A)** (one time only)
2. Program encryption **(B)**



- A1 First step of key generation: Generating the SK
 A2 Second step of key generation: Transmitting the PK to the PC
 A3 Third step of key generation: Generating the CK
 A4 Fourth step of key generation: Transmitting the CK to the control
 B1 First step of program encryption: Generating the NC program
 B2 Second step of program encryption: Encrypting the NC program
 B3 Third step of program encryption: Transferring the encrypted NC program to the control
 C1 Internal decryption of CK
 C2 Internal decryption of NC program
 1 Symmetric key (SK)
 2 Coded key (CK) - Multiple storage possible
 3 Public key (PK)
 4 Private key
 5 Unencrypted or decrypted NC program
 6 Encrypted NC program

Fig. 12-1: Principle of program decryption

The programs are stored in the result as encrypted files in the file system. They are coded with a symmetric code. The symmetric code is also stored as file in the file system of the control. It was coded with an asymmetric procedure.

Generation and transfer of the coded key are unique.

NC programs have to be encrypted and transferred for each program.

12.3 Operating the encryption program

The encryption program provided upon delivery can be installed separately on any PC.

The user can thus generate a coded key as well as encrypt NC program parts to be protected.

Both encryption results have to be subsequently transferred from this PC to the control.

Apart from the optional use of the copy protection, the generation of the coded key is unique.

However, the encryption of NC programs can be required multiple times (depending on the processing stage).

It is also possible to store multiple coded keys in the control.

Opening the encryption program

Call the encryption program via the start menu **Programs** ► **Rexroth** ► **IndraWorks...** ► **MTXTools** ► **FileEncryption**.

Key generation

The second tab in the dialog for program encryption is used to generate the coded key in the control.

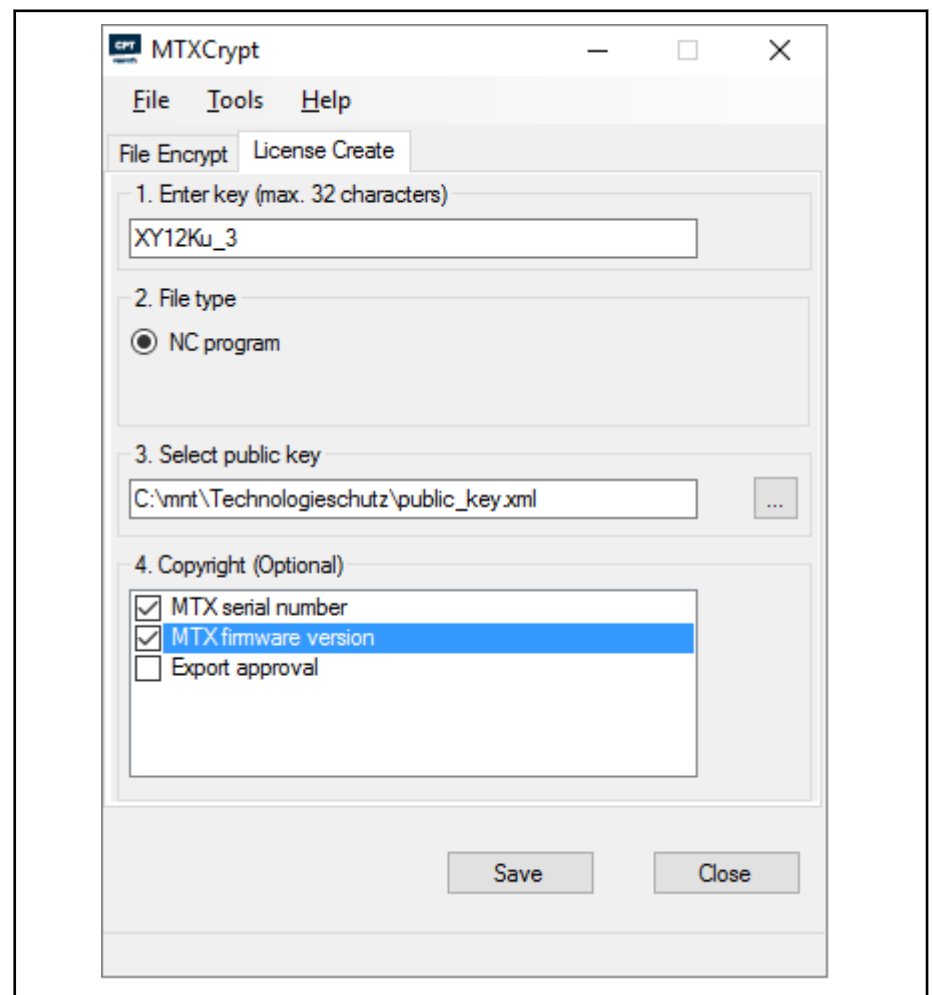


Fig. 12-2: Dialog for the key generation

Proceed as follows to generate a coded key:

1. Generate a symmetric key as password with up to 32 characters.
You are responsible for managing multiply-defined keys.
Refer to [fig. 12-1 "Principle of program decryption" on page 344 \(A1\)](#).
2. Define the storage location of the public key the user read out from the control.
The public key is a file with the name "public_key.xml" in the "root" directory of the control.

Refer to [fig. 12-1 "Principle of program decryption" on page 344 \(A2\)](#).

3. Optional definition of copy protection bindings.
4. Define the storage location for the coded key on the PC.
5. Generate and store the coded key on the PC.

Refer to [fig. 12-1 "Principle of program decryption" on page 344 \(A3\)](#).

6. Transfer the coded key to the control.

The coded key is a file with any file name and the extension ".lic". The file has to be stored in the control directory "root" or in "usrfep".



Multiple different keys can be stored.

Search order in case of keys with identical file names: 1. "root" and 2. "usrfep".

Refer to [fig. 12-1 "Principle of program decryption" on page 344 \(A4\)](#).

7. Restart NC

The copy protection can be bound to:

- the serial number of the control
- the number of the CF card
- the MTX firmware version
- the export approval

Thus, the user can fixedly bind an NC Program to one or multiple machines. If the copy protection binding is abandoned, the encrypted NC program can be copied to other machines together with the coded key.

Program encryption

The first tab of the dialog is used for program encryption.

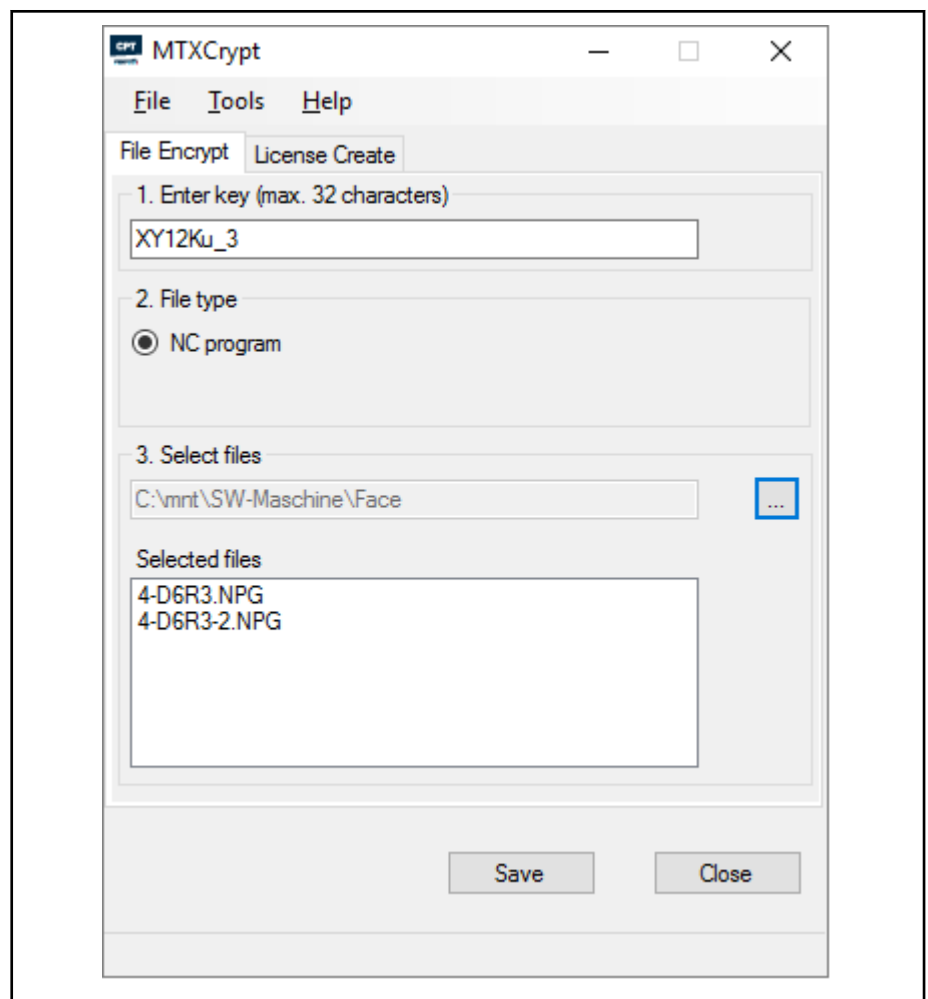


Fig. 12-3: Dialog for the program encryption

Proceed as follows when encrypting an NC program:

1. Create an NC program intended for encryption.
Define the storage location of the NC program.
Refer to [fig. 12-1 "Principle of program decryption" on page 344 \(B1\)](#).
2. Enter the previously defined and already coded and stored symmetric key into the control.
3. Provide the storage location of the NC program to the encryption program using a "Find File" dialog.
Multiple times can be simultaneously provided for encryption.
4. Defining the storage location of the encrypted program on the PC.
5. Optionally, an encryption comment can be entered.
6. Generating and storing the encrypted program on the PC.
Refer to [fig. 12-1 "Principle of program decryption" on page 344 \(B2\)](#).
7. Transferring the encrypted program to the control.
Refer to [fig. 12-1 "Principle of program decryption" on page 344 \(B3\)](#).



An encrypted program can only be interpreted internally by the control using the private and the coded key.

There is no encryption possible on the PLC or the user interface.

The user is responsible for managing the unencrypted source programs.

Entering an encryption comment

After pressing <Save>, the dialog to enter an encryption comment is displayed.

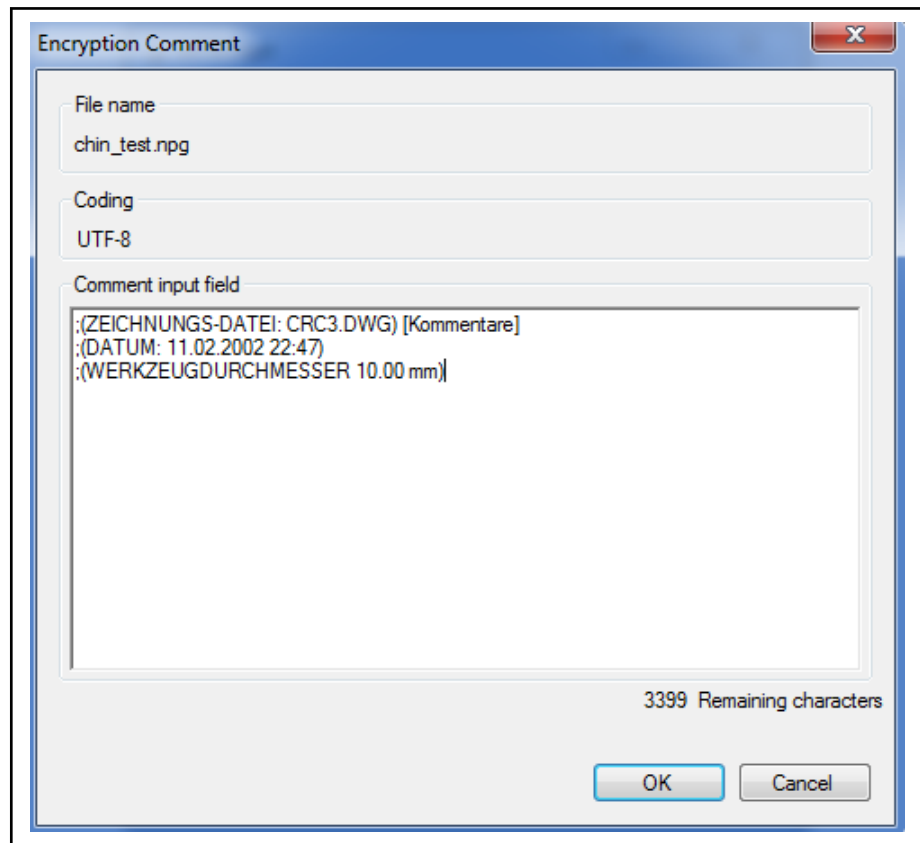


Fig. 12-4: Dialog to enter an encryption comment

The input is optional. Press <Cancel>, to cancel the encryption operation and to return to the calling page.

The checkbox in the lower part of the dialog window is only displayed if several programs have been selected for encryption. It also facilitates applying the encryption comment for all programs without calling this dialog again.



The first consecutive comment block in the NC program is a comment suggestion and can be changed within the framework of the visualized specifications.

12.4 Handling encrypted programs in the control

Encrypted programs are labeled in the file header and cannot neither be read in the user interface of the control nor on the PC.

When using encrypted programs, all visual applications of the control output a message that the program is not encrypted and cannot be displayed.

If an encrypted program is selected for processing without activating the corresponding key in the control, the following is displayed in the message line of the header "No valid key for encrypted file <PathName>".

The key has subsequently to be transferred to the control and the control has to be reset. (refer to [chapter 12.3 "Operating the encryption program" on page 344](#)).

12.5 Displaying the encryption comment

In the "Program" operating area, an encryption comment entered during the encryption can be displayed via the file property dialog in the MTX Navigator.

Opening the encryption comment

1. <OP4>"Program"
2. Searching and selecting the encrypted program in the list display of the MTX Navigator
3. Opening the menu function **Properties...**
4. Selecting the display page **Additional information**

In the properties dialog, the comment defined in the encryption dialog is displayed.



If there is no encryption comment, the message "Encryption information could not be found!" is displayed.

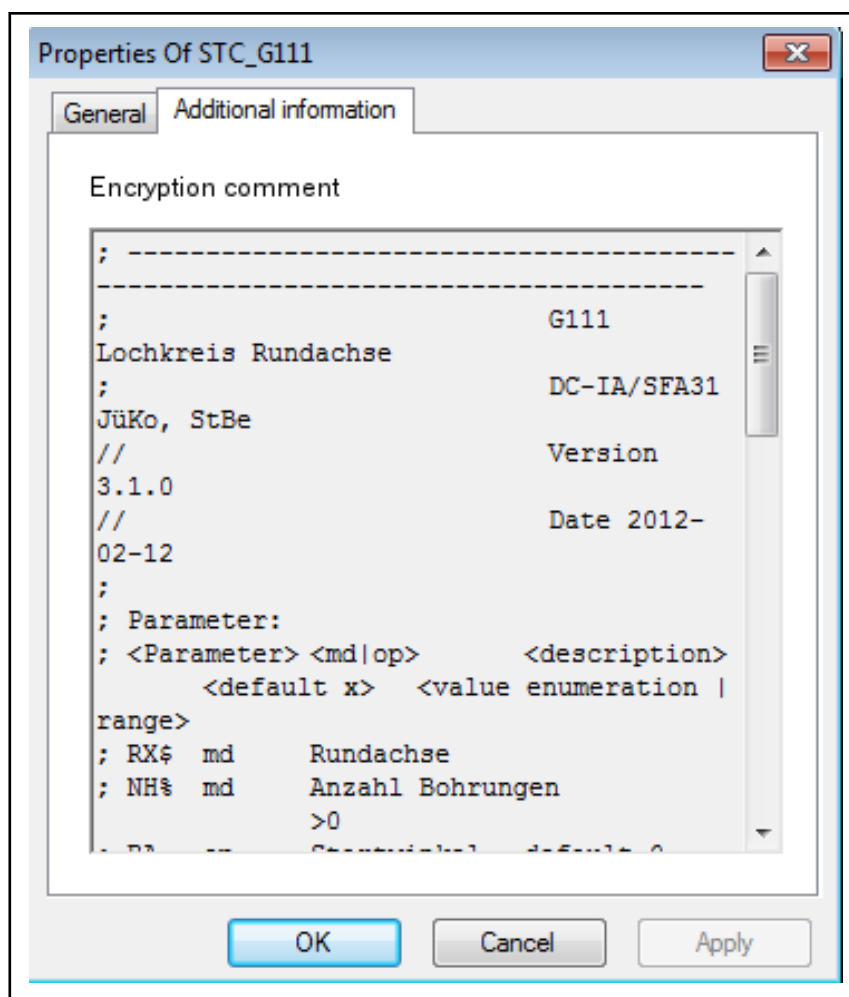


Fig. 12-5: Encryption comment

12.6 Language selection

Select another language via the menu **Tools ► Language**. The active language is labeled in the selection menu.

13 DXF import

13.1 Application

The DXF import can automatically convert the contour of a workpiece from an AutoCAD drawing in DXF format to NC code. The generated contour description is saved in an NPG file and can be directly used in the MTX control. The DXF import compiles the selected contour to the widespread DIN 66025 blocks (G-code).



The DXF import supports the DXF files up to the version AC1021. This corresponds to the AutoCAD release 2007/08.

The present documentation is intended to simplify the contour extraction from a DXF file. The chapter is structured to represent the consecutive required machining steps.

1. Loading DXF file
2. Defining basic settings
3. **Optional:** Display optimization
4. Determining the coordinate reference point
5. Selecting contour with starting point definition
6. Generating NC code (acc. to DIN 66025) and backing up the result file



Only one NC code can be generated for a coherent contour using this operating sequence.



The program supports the NC technologies turning and milling.

The following basic elements can be selected as contour from the DXF format:

- LINE (straight line)
- CIRCLE (full circle)
- ARC (arc)

These three primitives completely define the geometry of a workpiece in all technical drawings.

13.2 Opening the DXF file

There are different ways to open the DXF file. Depending on the operating type, the following variants are available:

- Via the menu items **File ► Open**
- Via the shortcut <CTRL+O>
- Via the toolbar
- Via the F-key <F2> "Open"

Each of the listed operating actions calls the same dialog used to select the corresponding file.

After loading the file, its content is graphically displayed on the screen (see [chapter 13.2 "Opening the DXF file" on page 351](#)).



Fig. 13-1: DXF drawing

13.3 Basic settings

To define the basic settings of the DXF import, open the following dialog.

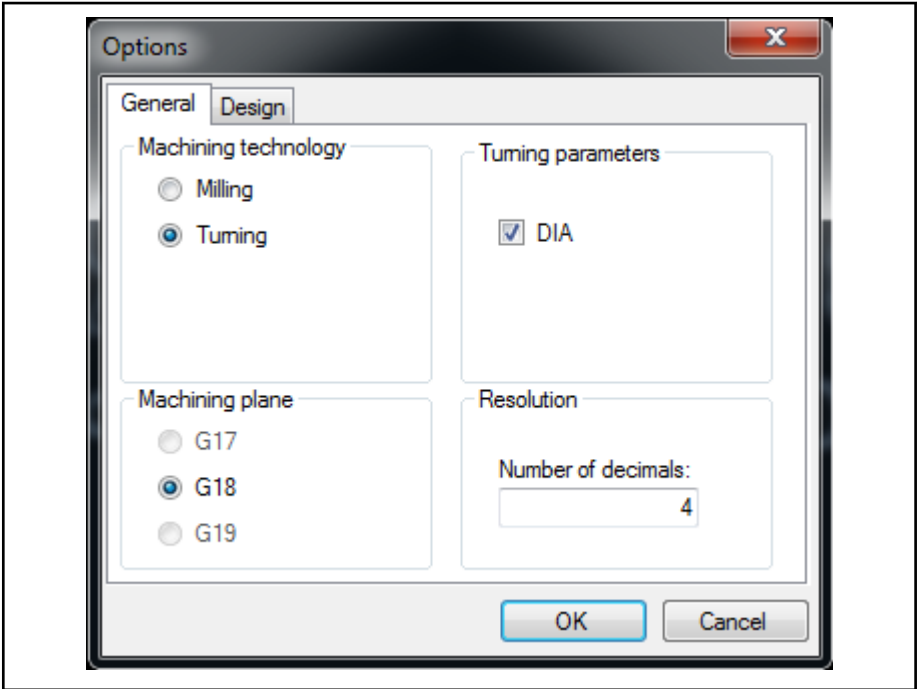


Fig. 13-2: Dialog to define the basic settings

The following settings can be made in this dialog:

Process parameter	Parameters	Remarks
Machining technology	Milling	
	Turning	

Process parameter	Parameters	Remarks
Machining plane	G17	
	G18	Fixedly set when turning
	G19	
Turning parameters	DIA: Yes/No	Diameter machining Only permitted for turning
Resolution	Number of decimal places	
Background color of the drawing level		
F-keypad	Display: Yes/No	
The dialog can be called:		
• Via <F3> "Settings" • Via the menu items Tools ► Options		

13.4 Optimizing representation

Different functions to optimize the representation are available for a fast and simple contour selection.

Setting the layer

In addition to the workpiece geometry, the DXF drawings contain several elements that are not required for the contour selection such as dimensionings, tables and labels. The DXF import can hide unimportant information on the layer setting.



The layer is selected with regard to the creator of the drawing.

- Via the menu items **View ► Select Plane** or
- press <F7> "Select Plane"

to display the active layers of the drawing and to select them.

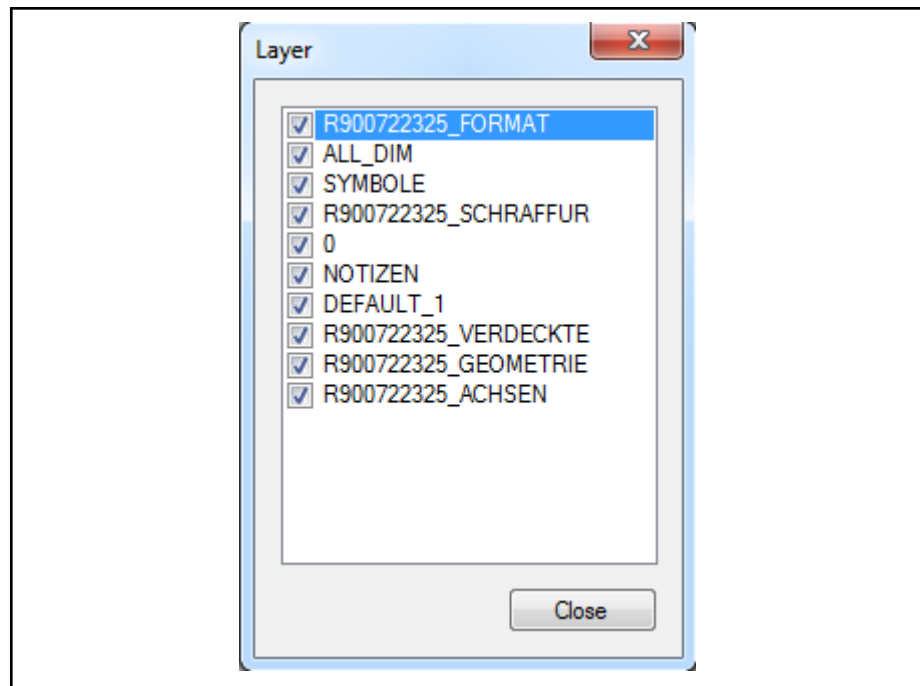


Fig. 13-3: Dialog: Level



The layers can be shown or hidden by selecting their names in the open window. The representation is automatically updated in the background.

Showing and hiding dimensioning

If the drawing has a dimensioning level, it can be shown or hidden via the toolbar button <Show/Hide Dimensioning>.

Zoom

The zoom function is used to freely scale the drawing. This function can be accessed as follows:

- Via the menu items **View ► Zoom In** or **Zoom Out**,
- Via the toolbar button <Zoom in> <Zoom out>
- Press the <+> key to zoom in and <-> to zoom out
- Use the F-key shortcut <F5> "View" and then <F5> "Zoom in" or <F6> "Zoom out" or
- Via the mouse wheel



Note that the scaling of the image refers to the center point of the window. The current cursor position is the reference point for the zoom function when using the mouse wheel. In case of the "Keyboard Navigation", the scaling also refers to the position of the mouse pointer.

Displacing

To improve the editing of a selected part of the drawing, the image area can be moved in any direction. This can be performed as follows:

- Cursor keys <Up>, <Down>, <Left>, <Right>
- Right-click and move it with the mouse



Keep the right mouse button pressed. Move the image area in the selected direction at the same time. The activation of the moving function is displayed via a cursor as long as the right mouse button is pressed.

Adjusting window This function allows to perfectly adjust the window section to the original size of the drawing.

The function can be called as follows:

- Use the F-key shortcut <F5> "View" and then <F4> "Adjust Window"
- Via the menu items **View ► Adjust Window**
- Via the shortcut <CTRL> and <F>
- Via the toolbar button <Adjust Windows>

Coordinate window The "coordinate window" function is intended to display and change the coordinates of each contour element. Thus, small errors and inadequacies in the drawing can be corrected using this function.

The display dialog can be used to show and hide the following operating actions:

- <F6> "Coordinate Window"
- Menu items **View ► Coordinate Window**
- Toolbar button <Coordinate Window>

After calling the function for the first time, the following dialog is displayed indicating that an element has to be selected.

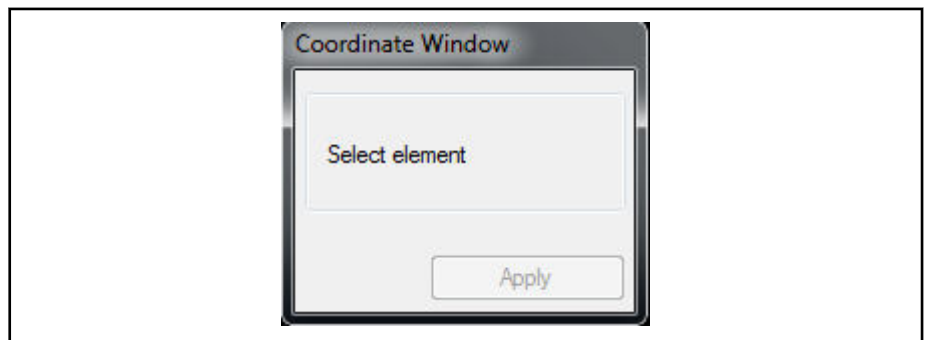


Fig. 13-4: Select element

Depending on the type of the selected element, the following window types are displayed:

- Element type "Line"

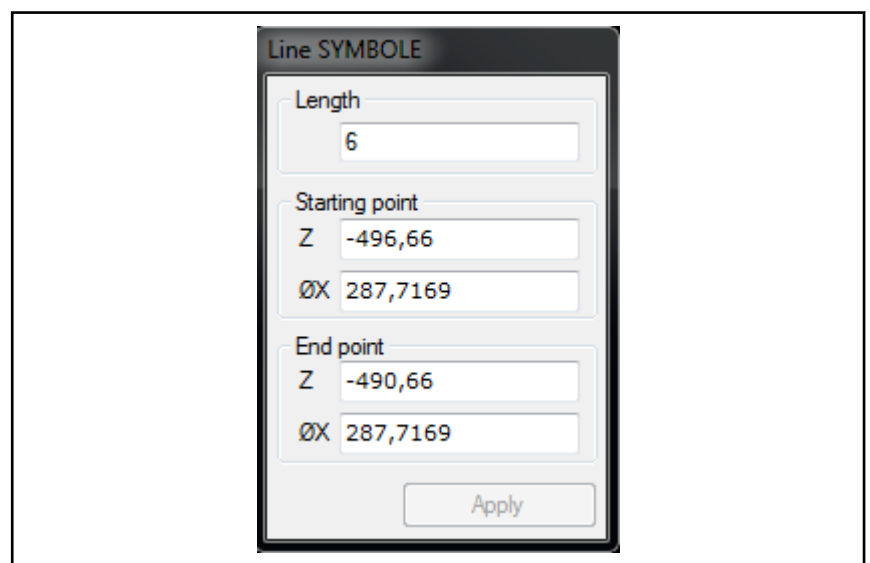


Fig. 13-5: Coordinate window "Line"

- Element type "Circle"

The image shows a software dialog box titled "Circle SYMBOLE". It contains two main sections: "Center" and "Radius". In the "Center" section, there are two input fields: "Z" with the value "-478,1041" and "ØX" with the value "240,8811". In the "Radius" section, there is one input field with the value "2,5". At the bottom right of the dialog is an "Apply" button.

Fig. 13-6: Coordinate window "Circle"

- Element type "Arc"

The image shows a software dialog box titled "Arc ALL_DIM". It contains several sections for defining an arc: "Angle" with "SA: 0" and "I/O: 65"; "Starting point" with "Z: -338,2642" and "ØX: 176,0613"; "End point" with "Z: -380,6304" and "ØX: 309,0645"; "Center" with "Z: -411,6406" and "ØX: 176,0613"; and "Radius" with the value "73,3763918048". An "Apply" button is located at the bottom right.

Fig. 13-7: Coordinate window "Arc"

Deleting irrelevant drawing elements

Use either the function **Part Element Selection** or **Selection of Elements** to highlight irrelevant drawing elements for the contour definition and to subsequently delete them via <Del>.



Deleted elements can only be restored by reloading the file.

13.5 Determining the coordinate reference point

Defining coordinate reference point

The coordinate reference point can be newly determined as follows:

- Use the F-key shortcut <F4> "Edit" and then <F4> "Coordinate system" and <F3> "Define Zero Point"
- Via the menu items **Edit ► Coordinate System ► Define Zero Point**
- Via the toolbar button <Define zero point>

It can be implemented as follows:

Starting point element	The starting point of the selected element is the new reference point
End point element	The end point of the selected element is the new reference point
Center point element	The center point of the selected element is the new reference point
Mouse position	The new reference point is set to the current mouse cursor position.
Intersection element	The next intersection of the selected element is the new reference point
Point entry	A dialog to enter the coordinates of the new reference point is called.



If all contour elements are very close to each other, use the zoom function.

To reset the reference point (corresponds to the zero point of the drawing), use the "Default Start Point" function.

The "Zero Point Definition" remains active until it is replaced by calling another function.

Resetting coordinate reference point

Use this function to reset the coordinate reference point to the position defined in the drawing.

This function can be called via the following operating actions:

- Use the F-key shortcut <F4> "Edit" and then <F4> "Coordinate System" or <F4> "Reset Starting Point"
- Via the menu items **Edit ► Coordinate System ► Reset Zero Point**
- Via the toolbar button <Reset zero point>

13.6 Determining the starting point of the contour

The determination of the starting point of the contour defines the starting position of the contour machining.

Prerequisite: The determined contour starting point is a prerequisite to the automated generation of the NC code.



The contour starting point can be defined at any visible intersection of basic elements.

Determining starting point of contour

To determine the starting point of the contour, the "Set Contour Start Point" function has to be selected. This function can be accessed as follows:

- Via the menu items **Edit ► Contour**
- Via the toolbar

- Via <F4> "Edit", then <F3> "Contour" and <F4> "Set Cont. Start Point". When the function is enabled, the mouse pointer changes to a - cursor.



Select the contour starting point to allow a collision-free approach to the workpiece.

If all contour elements are very close to each other, use the zoom function.

If the contour starting point is to be reset, the selected point is to be selected again.

"Set Contour Start Point" remains enabled until it is replaced by calling another function.

13.7 Selecting the contour

13.7.1 General information

Selecting the basic drawing elements defines the contour for later processing. The DXF import provides different selection methods.

The determination of the starting point of the contour defines the starting position of the contour machining. The determined contour starting point is a prerequisite to generate the NC code.

13.7.2 Manual contour selection

The DXF import provides two options for the manual contour selection. The first option is to highlight a complete object. The second option allows the selection of partial lines and partial circles located between specified intersections.



Expand a selection area by keeping the left mouse button pressed. Elements completely located in this section are all subsequently highlighted.



If all contour elements are very close to each other, use the zoom function.

To deselect the selected contour element, select the selected object again.

The corresponding selection function remains active until it is replaced by calling another function.

The methods for the manual contour selection are called:

- Via the F-key shortcut <F4> "Edit" and then <F3> "Contour" or <F3> "Contour Selection"
- Via the menu items **Edit ► Contour ► Contour Selection**
- Via the toolbar button <Contour Selection>

Selecting complete elements

This variant is a default selection method. The objects saved in the DXF file as basic elements are selected.

This function is called via the subfunction **Selection of Elements**.



All visible elements as well as their parts between the intersections can be selected.

Note that:

- there are no gaps between contour elements (a selected contour has to be closed from the starting point to the end point).
- each contour element has exactly two neighboring elements. An exception occurs if it is the first or the last element of the defined contour.
- the determined contour starting point has to be in contact with one contour element.

Part element selection

Use the described function to select element parts not separately saved as drawing objects. The part element selection mode can be used to select the following possible parts of an object:

- Partial object between two intersections
- Partial object between one intersection and one end point of the same object

This function is called via the subfunction **Part Element Selection**.

Starting point definition

This function is used for the manual contour definition. In case of the automatic contour tracking, the starting point is determined at the beginning of the contour definition. The starting point can subsequently only be changed by resetting the contour definition.

This function can be called via the following operating actions:

- Via the F-key shortcut <F4> "Edit" and then <F3> "Contour" or <F4> "Define Contour Starting Point"
- Via the menu items **Edit ► Contour ► Define Contour Starting Point**
- Via the toolbar button <Define Contour Starting Point>

The contour starting point can be determined via the corresponding subfunctions **End Point Element** or **Starting Point Element** of a selected element.

13.7.3 Automatic contour tracking

When the contour is tracked, possible following elements of a selected contour element are provided to the operator.

This function can be called via the following operating actions:

- Via the F-key shortcut <F4> "Edit" and then <F3> "Contour" and <F3> "Contour Selection" and the corresponding subfunction <F5> "Start Contour Tracking, Left" or <F6> "Start Contour Tracking, Right"
- Via the toolbar button <Contour Tracking>

Proceed with the following steps:

1. Start contour tracking
2. Determine the direction of contour tracking. This defines the contour starting point automatically

The first contour element is selected and possible following elements are highlighted.

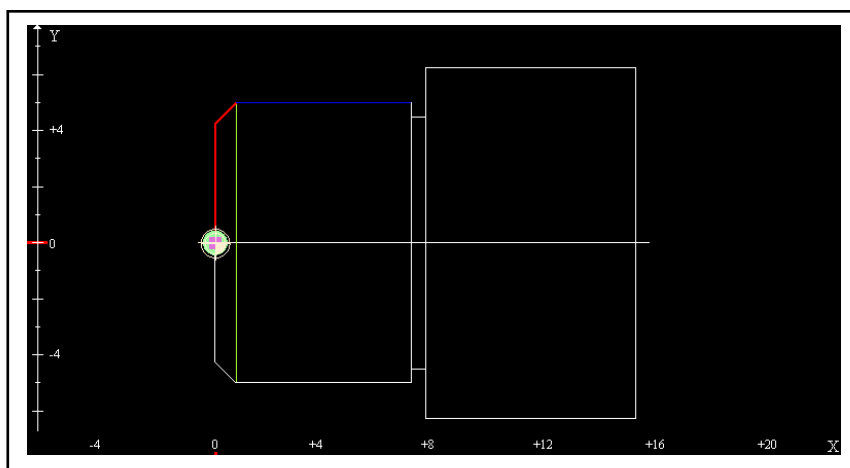


Fig. 13-8: Contour tracking

3. Select the following element

The next contour element is selected. This step can be repeated until all required elements are highlighted.

4. Stop the contour definition

The selected contour elements are presented as element chain. The contour definition is then completed.

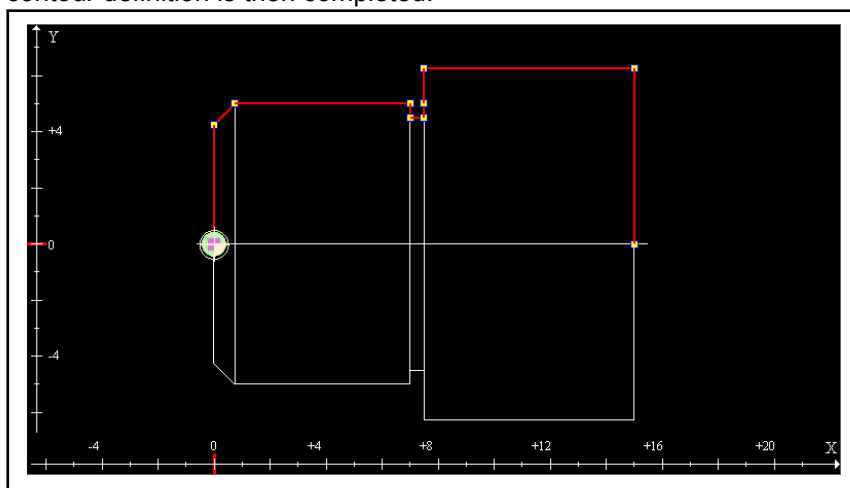


Fig. 13-9: Element chain

5. Start the DIN G-code generation

13.7.4 Resetting the contour

The function allows to reset the selected contour elements and can be called via the following operating actions:

- Via the F-key shortcut <F4> "Edit" and then <F3> "Contour" or <F5> "Reset Contour"
- Via the menu items **Edit** ► **Contour** ► **Reset Contour**
- Via the toolbar button <Reset contour>

13.8 Generating NC code

With the DXF import, the contour is compiled as NC blocks and these are saved in an NPG file.

Prerequisite:

- At least one contour element has to be selected.
- The contour starting point has to be determined.
- The contour starting point has to be in contact with one contour element. The point of contact is located at the end or starting point of the contour element.
- The contour element chain may not be interrupted (the select total contour may not have any gaps).
- One contour element has two neighboring elements. An exception occurs if it is the first or the last element of the defined contour.



If this is not possible, the automatic NC code generation has to be performed in multiple steps.

Calling the NC code generation

- Via the menu items **Generate ► DIN G-Code**
- Via the toolbar <DIN G-Code>
- Via the F-key <F8> "DIN G-code"

Saving result

The function first opens a "Save As" dialog to define the storage location.

The result is subsequently visualized via a standard editor for checking purposes.

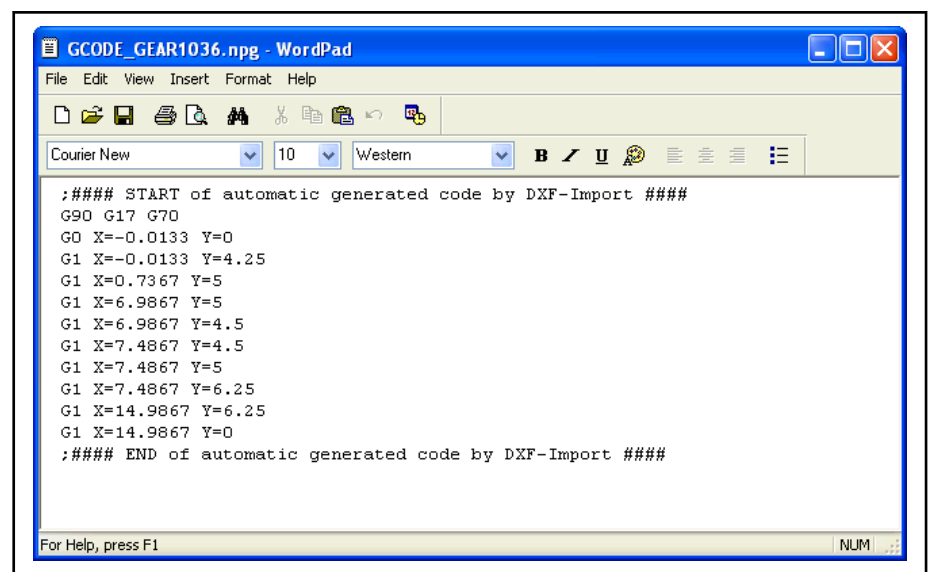


Fig. 13-10: Visualizing NC code generation

The output file can subsequently be edited using the NC editor in IndraWorks after importing them into the control.

13.9 Language selection

Select another installed language via the menu items **Tools ► Language**.

14 Appendix

14.1 Keyboard shortcuts

The implemented shortcuts for special editing functions are shown. They correspond to the Windows standard.

Key / shortcuts	Explanation
<Home>	Moves the cursor to the beginning of the line.
<End>	Moves the cursor to the end of the line.
<Ctrl>+<C>	Copies the selection into the clipboard.
<Ctrl>+<X>	Cuts the selection and moves it to the clipboard.
<Del>	Deletes the selection or the character.
<Backspace>	Deletes the selection or the character to the left of the cursor.
<Enter>	Inserts a line.
Double-click	Highlights a word at the current cursor position in the editor view.
<Ctrl>+<End>	Moves the cursor to the end of the file.
<Ctrl>+<Shift>+<End>	Extends the selection to the end of the file.
<Ctrl>+<Home>	Moves the cursor to the beginning of the file.
<Ctrl>+<Shift>+<Home>	Extends the selection to the beginning of the file.
<Ins>	Switches between pasting and replacing text.
<Shift>+<Home>	Extends the selection to the beginning of the current line.
<CursorDown>	Moves down the cursor by one line.
<Shift>+<CursorDown>	Extends the selection downwards by one line.
<Shift>+<End>	Extends the selection to the end of the current line.
<CursorUp>	Moves up the cursor by one line.
<Shift>+<CursorUp>	Extends the selection upwards by one line.
<PgDn>	Moves down the cursor by one page.
<Shift>+<PgDn>	Extends the selection downwards by one page.
<PgUp>	Moves up the cursor by one page.
<Shift>+<PgUp>	Extends the selection upwards by one page.
<Ctrl>+<V>	Pastes the clipboard content at the current position.
<Ctrl>+<A>	Highlights the entire document.
<Ctrl>+<CursorDown>	Moves the content of the window down by one line.
<Ctrl>+<CursorUp>	Moves the content of the window up by one line.
<Ctrl>+<Del>	Deletes one word to the right of the cursor.
<Ctrl>+<R>	Find Next

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<Ctrl>+<Backspace>	Deletes one word to the left of the cursor.
<Ctrl>+<CursorLeft>	Moves the cursor to the left by one word.
<Ctrl>+<Shift>+<CursorLeft>	Extends the selection to the left by one word.
<Ctrl>+<CursorRight>	Moves the cursor to the right by one word.
<Ctrl>+<Shift>+<CursorRight>	Extends the selection to the right by one word.
<Ctrl>+<Z>	Undoes the last action (modification of one or more lines).
<Ctrl>+<Y>	Redoes the action cancelled last.
<Ctrl>+<F>	Searches the indicated text.
<Ctrl>+<R>	Find Next

Tab. 14-1: *Shortcuts for special editor functions*

15 Service and support

Our worldwide service network provides an optimized and efficient support. Our experts offer you advice and assistance should you have any queries. You can contact us **24/7**.

Service Germany Our technology-oriented Competence Center in Lohr, Germany, is responsible for all your service-related queries for electric drive and controls.

Contact the **Service Hotline** and **Service Helpdesk** under:

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Fax: **+49 9352 18 4941**
E-mail: service.svc@boschrexroth.de
Internet: <http://www.boschrexroth.com>

Additional information on service, repair (e.g. delivery addresses) and training can be found on our internet sites.

Service worldwide Outside Germany, please contact your local service office first. For hotline numbers, refer to the sales office addresses on the internet.

Preparing information To be able to help you more quickly and efficiently, please have the following information ready:

- Detailed description of malfunction and circumstances
- Type plate specifications of the affected products, in particular type codes and serial numbers
- Your contact data (phone and fax number as well as your e-mail address)

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Notes

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