The Drive & Control Company

Rexroth
Bosch Group

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Commissioning

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Editorial Department

Engineering Automation Systems Solution Integration HMI and NC Control, ToMa (SyKe/MePe)

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1 About this documentation

1.1 Validity of the documentation

General information

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

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.

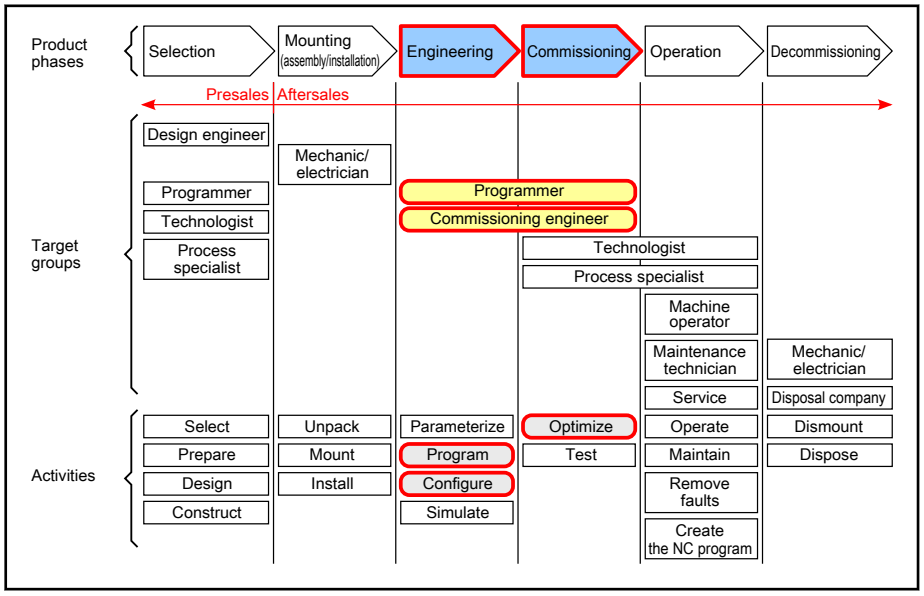

Fig. 1-1: Assigning this documentation to the target groups, product phases and target group activities

1.2 Required and supplementing documentation MTX

1.2.1 Selection/compilation

Documentation titles with type codes and part numbers

IndraMotion MTX 14VRS System Description
DOK-MTX***-SYS*DES*V14-PRRS-EN-P, R911342640
This documentation describes the Rexroth IndraMotion MTX control. It includes the designs, technical data, interfaces as well as the configuration of the control components.
IndraMotion 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 IndraMotion MTX.

Tab. 1-1: MTX documentation overview - Selection/compilation

About this documentation

1.2.2 Configuration

Documentation titles with type codes and part numbers

IndraMotion MTX 14VRS Machine Parameters
DOK-MTX***-MA*PAR**V14-RERS-EN-P, R911342630
This documentation describes design and modification of the Rexroth IndraMotion MTX parameters available. It also includes the functions of the NC configurator and its operation.
IndraMotion MTX 14VRS PLC Interface
DOK-MTX***-PLC*INT*V14-PRRS-EN-P, R911342622
This documentation describes interface signals and program function blocks for the integrated PLC.
IndraMotion MTX 14VRS Functional Description - Basics
DOK-MTX***-NC*F*BA*V14-RERS-EN-P, R911342626
This documentation describes the functions of the Rexroth IndraMotion MTX basic functions. The basic commissioning steps and the control functions are provided as description and handling instruction.
IndraMotion MTX 14VRS Functional Description - Extension
DOK-MTX***-NC*F*EX*V14-RERS-EN-P, R911342628
This documentation describes the extended functions of the Rexroth IndraMotion MTX. The basic commissioning steps and the control functions are provided as description and handling instruction.
IndraMotion MTX 14VRS Functional Description - Special Functions
DOK-MTX***-NC*F*SP*V14-RERS-EN-P, R911342624
This documentation describes the special functions of the Rexroth IndraMotion MTX. The basic commissioning steps and the control functions are provided as description and handling instruction.
IndraMotion MTX Free Form Surface Milling
DOK-MTX***-FREEFORM***-APRS-EN-P, R911341435
This documentation describes the free-form surface machining process with the MTX control. CNC programs generated by a CAD/CAM system are the basis for the entire machining process. An overview of the following topics is provided: Description of the MTX or CNC functions for free-form surface machining, NC parameterization, basic conditions when generating CNC programs with CAM software.
Rexroth IndraMotion MTX Converting MTX Projects
DOK-MTX***-PROCONV****-PRRS-EN-P, R911342484
This documentation provides support during the conversion of IndraMotion MTX 1.x projects to MTX 2G. The conversion process is described and potential challenges during the conversion are identified.

Tab. 1-2: MTX documentation overview - Configuration

1.2.3 Commissioning

Documentation titles with type codes and part numbers

Rexroth 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.
IndraMotion MTX 14VRS Commissioning
DOK-MTX***-STARTUP*V14-CORS-EN-P, R911342620
This documentation describes the commissioning of the IndraMotion 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 Basic 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 field bus and local periphery connections supported by the systems IndraLogic XLC, IndraMotion MLC and IndraMotion MTX. This documentation focuses on the configuration, parameterization, commissioning and diagnostics of the different periphery connections. The documentation 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" provides information for efficient working 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 Rexroth Engineering tools are integrated. It includes instructions on how to work with IndraWorks and how to operate the oscilloscope function.
Rexroth 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. It 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. 1-3: MTX documentation overview - Commissioning

1.2.4 Operation

Documentation titles with type codes and part numbers

Rexroth IndraMotion 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.
Rexroth IndraMotion 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.

About this documentation

IndraMotion MTX 14VRS Programming Manual
DOK-MTX***-NC**PRO*V14-RERS-EN-P, R911342634
This documentation describes the standard programming of the Rexroth IndraMotion 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.
IndraMotion 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 Rexroth IndraMotion MTX. It includes the operation of the interface, the NC program development as well as the tool management.
IndraMotion 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 Rexroth IndraMotion MTX control.
IndraMotion MTX 14VRS NC Simulation
DOK-MTX***-NC*SIM**V14-APRS-EN-P, R911379629
This documentation describes the NC Simulation for Rexroth IndraMotion MTX control.

xx Corresponding edition

Tab. 1-4: MTX documentation overview - Operation

1.2.5 OEM Engineering

Documentation titles with type codes and part numbers

Rexroth IndraMotion 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 Automation Interface. Different objects including code examples are described. The Automation Builder is also described in this manual.
Rexroth IndraMotion 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.
Rexroth IndraMotion MTX 14VRS OPC UA Communication
DOK-MTX***-OPC*UA**V14-APRS-EN-P, R911342513
This documentation describes the OPC UA communication of the IndraMotion MTX.

Tab. 1-5: MTX documentation overview - OEM Engineering

1.2.6 AddOns

Documentation titles with type codes and part numbers

Rexroth IndraMotion 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.
Rexroth IndraMotion 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 IndraMotion MTX cta and IndraMotion MTX ega.

Rexroth IndraMotion MTX Remote Condition Monitoring
DOK-MTX***-RCM*****V01-APRS-EN-P, R911334383
This documentation describes the operation of the Remote Condition Monitoring System.
Rexroth IndraMotion MTX visIREC User Documentation
DOK-MTX***-VISIREC*V01-APRS-EN-P, R911344242
This documentation describes the analysis tool visIREC. The visIREC is used to optimize the free-form surface machining process. 2D or 4D display of path-related data. 2D or 4D display of coordinate-related data. Analyzing critical areas (path and orientation deviation). Comparing the programmed and interpolated NC blocks.

xx Corresponding edition

Tab. 1-6: MTX documentation overview - AddOns

1.3 Information representation

1.3.1 Names and abbreviations

Term	Explanation
IWE	IndraWorks Engineering
IWO	IndraWorks Operation
OWL	Optical waveguide
NC	Numerical Control
OEM	Original Equipment Manufacturer
Profibus	Communication connection
Sercos	Communication connection

Tab. 1-7: Names and abbreviations used

1.4 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 dealing with 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. The decompilation of software products or the alteration of source codes is not permitted.
- Do not install or operate damaged or faulty products.
- 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 Rexroth IndraMotion 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.

Important instructions on use

☞ 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 documentations and functional descriptions.

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

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

2.2 Unintended use

The use of the Rexroth IndraMotion MTX in application areas other than those specified or described in the documentation and technical data is considered as "unintended".

The Rexroth IndraMotion 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.
- the intended applications have not expressively been released by Bosch Rexroth. Therefore, please read the information given the general safety instructions!
- The Rexroth IndraMotion 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 General information

3.1 Hardware

Each hardware supported by the "Rexroth IndraMotion MTX" system is described in detail in the "System Description" manual.

A typical MTX system consists of the following components:

- One or multiple controls (e.g. CML65) to control a tool machine
- One or multiple operating stations (e.g. VPP40) to operate and monitor a tool machine
- One or multiple field buses to connect status and control signals of the tool machine with the control
- Multiple drive control units and motors to move the traversing axes of the tool machine in a controlled motion

Example of a typical MTX system configuration

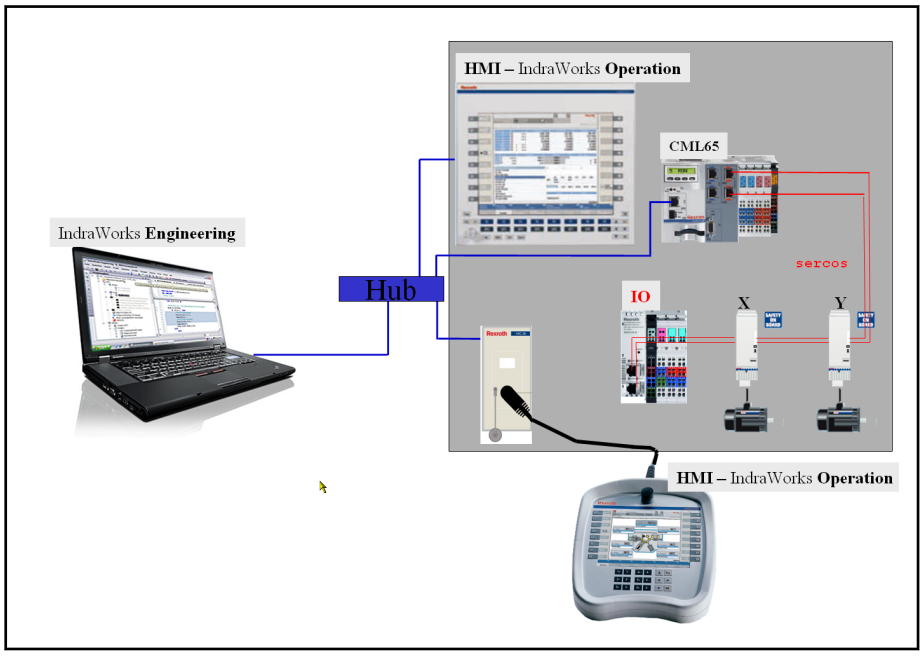

Fig. 3-1: Typical MTX system configuration

3.2 IndraWorks Operation Desktop

3.2.1 General information

All basic functions as well as the basic handling of IndraWorks Operation is described in detail in the **"IndraWorks HMI"** manual.

The MTX-specific topics for setting up and operate IndraWorks Operation in the documentation **"Standard NC operation"**.

The Operation Desktop is the main tool when working with the "IndraMotion MTX" control system. The status displays (position, velocity, override, etc.) of the drives are summarized in the NC screen.

The Operation Desktop comprises the machine operation keys (M-keys), the function keys (F-keys) and the OP-keys to switch the individual operating

General information

functions (tool management, programming screen, NC screen, channel overview, etc.). The machine operation keys affect the PLC or the interface so that PLC functions or switching functions of the interface can be triggered. "WinStudio" provide user-defined screens.

Using machine parameters, the view of the NC screen can be configured user-specifically.

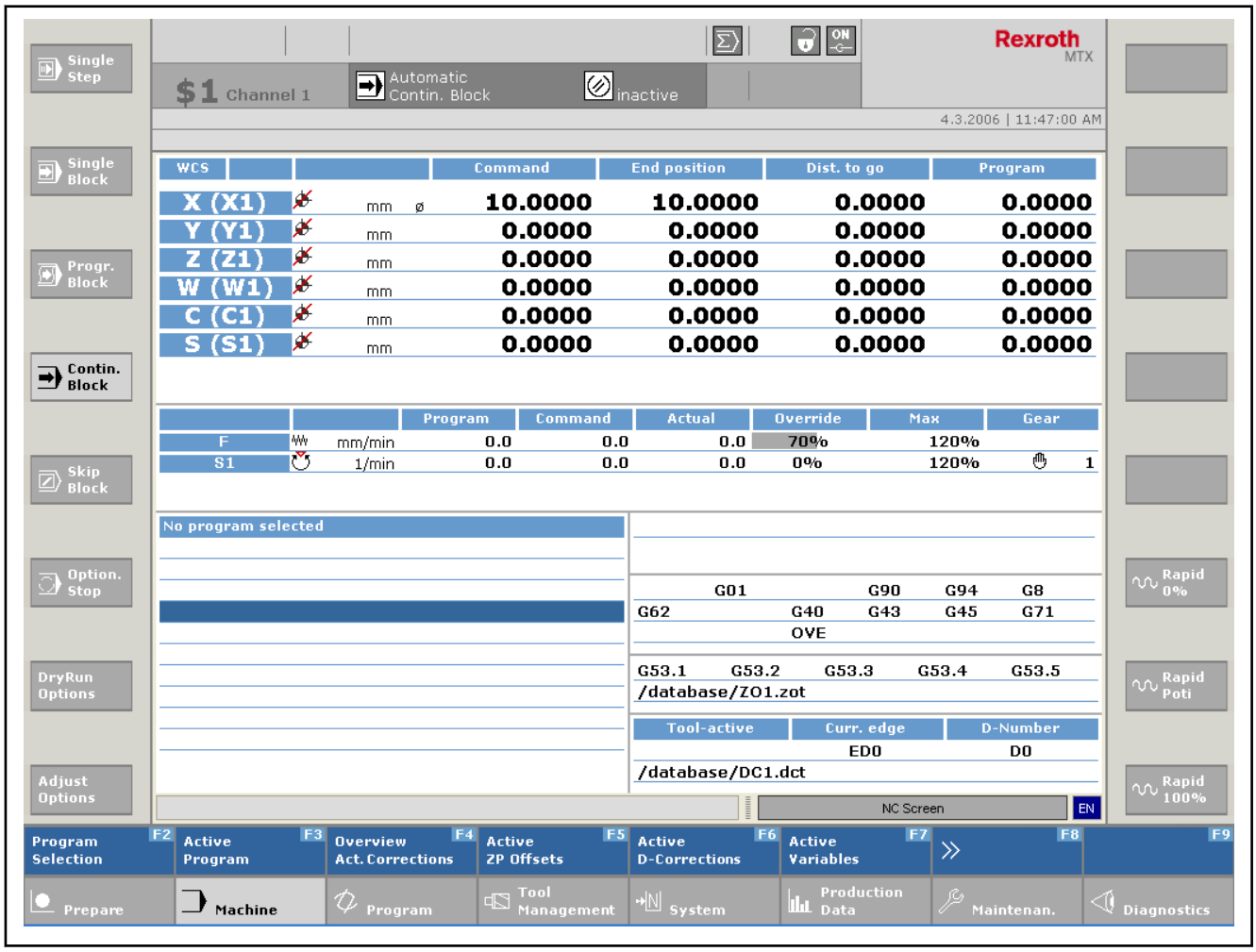

Fig. 3-2: Example of the Operation Desktop

3.3 IndraWorks - Engineering

3.3.1 General information

All basic functions as well as the basic handling of IndraWorks Engineering are described in detail in the "IndraWorks HMI" manual.

The Bosch Rexroth Engineering Tools integrate themselves into the carrier system IndraWorks.

Comprehensive functions such as project navigation and project administration as well as the creation of project and configuration data are centrally executed.

All tools for the project planning, commissioning, maintenance and diagnostics of a tool machine are provided with the Engineering Desktop:

- Creating, archiving and restoring IndraWorks projects
- Changing parameters in control and drive
- Editing PLC data
- Editing HMI data
- Export/import
- Version control of the IndraWorks project
- License management
- Language management
- etc.

3.3.2 Compatibility

General information

MTX IndraWorks projects support the version and release compatibility. This means that the current "IndraWorks Engineering" version can be used to edit all projects created with an older version.

Each project is assigned a version ID informing the user which IndraWorks installation is required to edit the project.

If a project with an older version ID is opened, it is not automatically converted. Instead, the project is operated in the so-called compatiblity mode. This means that this project can also be edited for the older IndraWorks version in case of changes made to the project. New functions causing an incompatible project change are not available.

Project created with IndraWorks Engineering 12VRS or smaller are still automatically converted as the compatbility is not yet supported in these versions!

The compatibility mode can now be explicitly modified. The project compatibility to the original version is lost.

For more detailed information, see the "IndraWorks Engineering" documentation.

Compatibility mode

The compatibility mode specifies for an IndraWork project which "IndraWorks Engineering" version is required to edit the project.

The compatibility mode can be selected when creating a project or at a later point via the property dialog of the project. It defines the possible functional scope to edit the project in the selected version.

Device version

Controls and visualization devices in the IndraWorks project have their own versionings. These versionings define the functional scope available for a device in the selected version. The device version is always smaller or equal to the compatibility mode of the project.

The device version can be selected when creating a project or at a later point via the property dialog of the device.

More information about "MTX" can be found in the chapter about the commissioning of the control of this documentation (chapter 5 "Control commissioning" on page 105).

3.3.3 User management

General information

A user management to project the project data from unauthorized changes is available in "IndraWorks Engineering".

A second user management allows to limit the access to sensitive machine operation areas in the "IndraWorks Operation".

Furthermore, the access to data block stored on the control can be limited.

Access protection for the project planning

To project project data from unauthorized change, create users and user group and assign right to the users and the user groups in "IndraWorks Engineering".

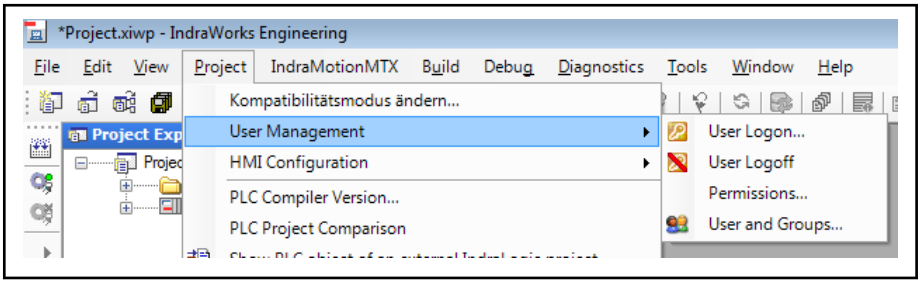

Fig. 3-3: Calling the user management to protect the project data

☞ Details about the project data protection can be found in the "IndraLogic 2G PLC Programming System" documentation in the "IndraWorks user management" chapter.

Access protection for the project planning

To facilitate access to selected functions or areas of the user interface in "IndraWorks Operation" for defined individuals, these functions or areas can be assigned rights via a seperate user management.

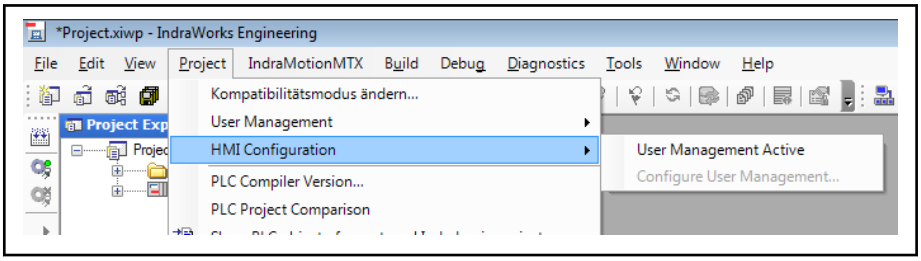

Fig. 3-4: Calling the user management for machine operation protection

☞ Details about the access protections during machine operation can be found in the "Engineering" documentation in the "IndraWorks user management" chapter.

Access protection for data on the control

Data elements on the MTX control can be assigned user levels. During the scheme definition, data blocks are assigned read or write access by entereding the attribute definitions (L1, L2, L3, L3, L5) in the data block scheme. When accessing the data block at a later point, the registered user has to have the corresponding level (L1...L5).

Which functions can be executed by the user are assiged via the group to which the user is assigned. The user receives the privileges which are determined for this group.

The following 8 standard groups of the user management are already assigned to user levels:

- Operator: L1
- Setter: L1, L2
- Maintenance: L1, L2
- Commissioning: L1, L2, L3
- Machine manufacturer: L1, L2
- Service: L1, L2, L3, L4
- Engineer: L1, L2, L3, L4, L5
- Administrator: L1, L2, L3, L4, L5

For standard groups, these functions can be displayed via "Privileges" but cannot be modified.

With this dialog , the allowed functions are determined for the freely configurable groups. This is only allowed for a member or standard group "Administrator".

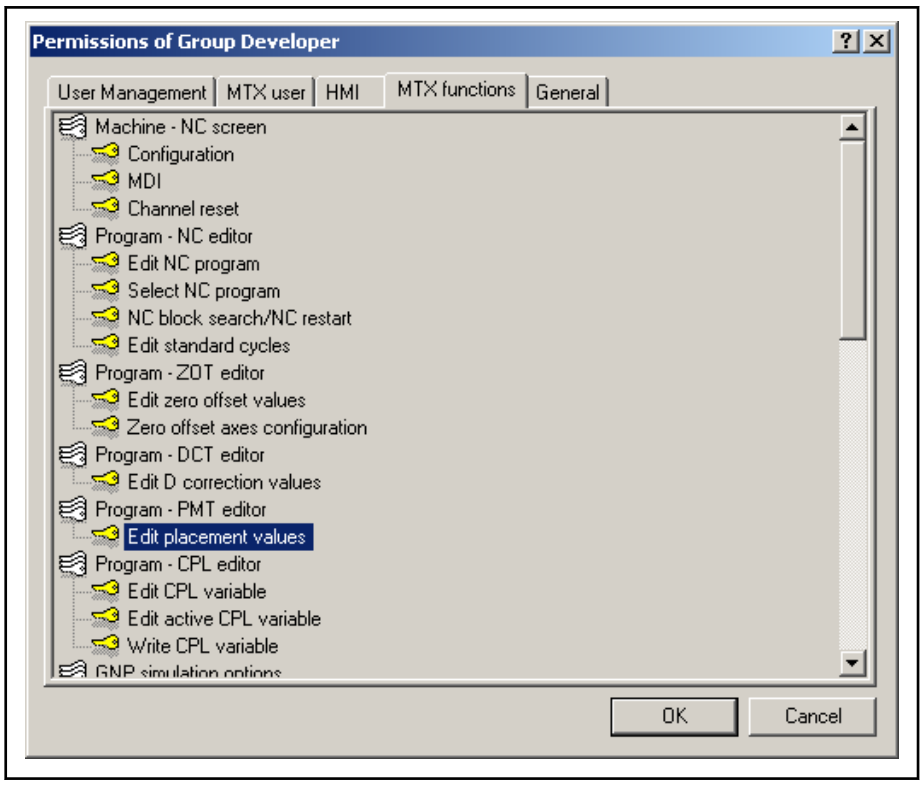

Fig. 3-5: Editing privileges/functions

General information

If the user has the privilege "X", the users which are a member of this group can execute the function "X".

Context	Group	Function	L1	L2	L3	L4	L5	L6	L7	L8
Machine	NC screen	Configuration			x	x	x	x	x	x
		MDI		x	x	x	x	x	x	x
		ChannelReset		x	x	x	x	x	x	x
Program	NC editor	EditNpg		x	x	x	x	x	x	x
		SelectNpg	x	x	x	x	x	x	x	x
		SearchBlock		x	x	x	x	x	x	x
		EditDefaultCycles		x	x	x	x	x	x	x
Program	ZOT editor	Edit		x	x	x	x	x	x	x
		Configuration			x	x	x	x	x	x
	DCT editor	Edit		x	x	x	x	x	x	x
	PMT editor	Edit		x	x	x	x	x	x	x
	MTX Navigator	Configuration		x	x	x	x	x	x	x
		DeleteFile		x	x	x	x	x	x	x
		RenameFile		x	x	x	x	x	x	x
		PasteFile		x	x	x	x	x	x	x
		NewFile		x	x	x	x	x	x	x
		EditFileOptions		x	x	x	x	x	x	x
	CPL editor	Edit		x	x	x	x	x	x	x
		EditActive		x	x	x	x	x	x	x
		WriteValue		x	x	x	x	x	x	x
Tools	General	Import		x	x	x	x	x	x	x
		Export	x	x	x	x	x	x	x	x
		IncrementalInput	x	x	x	x	x	x	x	x
		AbsoluteInput		x	x	x	x	x	x	x
		ToolInsert		x	x	x	x	x	x	x
		ToolDelete		x	x	x	x	x	x	x
		ToolMove		x	x	x	x	x	x	x
		ToolPos	x	x	x	x	x	x	x	x
		ListConfiguration			x	x	x	x	x	x
	Tool Editor	Invoke	x	x	x	x	x	x	x	x
		Configuration			x	x	x	x	x	x
IMT	General	Invoke	x	x	x	x	x	x	x	x
	MTX Configuration	Invoke			x	x	x	x	x	x

Tab. 3-1: Editing privileges/functions

3.3.4 Version control

General information

The basic handling of the version control is described in detail in the "IndraWorks Engineering" documentation.

IndraWorks Engineering allows working with version-controlled projects located on one team server. Multiple IndraWorks users can work simultaneously on such version-controlled projects.

The following MTX controls support the version control:

- IndraMotion MTX standard L45
- IndraMotion MTX standard L65
- IndraMotion MTX standard L85
- IndraMotion MTX micro

MTX project data

Version-controlled project data

The following project data is version-controlled:

- PLC project data (POUs, variable definitions, I/O configuration, function modules, etc.)
- HMI project data (screens, M- and F-keys, WinStudio, etc.)
- Drive data (offline parameterization MLD)
- FDT Container

Non-version-controlled project data

The following data is not version-controlled:

- NC project data (machine parameters, NC program, system data, etc.)
- Virtual operating panel/simulation
- Communication settings of the control

3.3.5 Archiving and restoring MTX projects

General information

An IndraWorks project consists of several parts:

- HMI data (HMI screen, F-keys, M-keys,...)
- Control data (machine data, extended data, drive data, etc.)
- PLC project

Data backup includes all data and settings generated by the machine tool manufacturer and the end user. The drive parameters (Sercos parameters) are an exception. These have to be saved before a project data backup to ensure that the parameters are recorded in the project tree. The drive parameters are then backed up with the project backup.

Archiving and restoring data of an IndraWorks project is described in detail in the "Rexroth IndraWorks Engineering" manual.

In contrast to that documentation, the control data (see chapter "Control data" on page 22) is backed up during the device data backup for the "Rexroth IndraMotion MTX".

General information

IndraWorks project (complete data backup)

Handling instruction: Data backup of the IndraWorks project (complete data backup)

This present handling instruction describes the data backup of the IndraMotion MTX control data ranges.

IndraWorks Engineering / project: Archive

1. Start the archiving function in the Engineering Desktop under the directory in the main menu "Project".
2. Follow the instructions of the wizard.

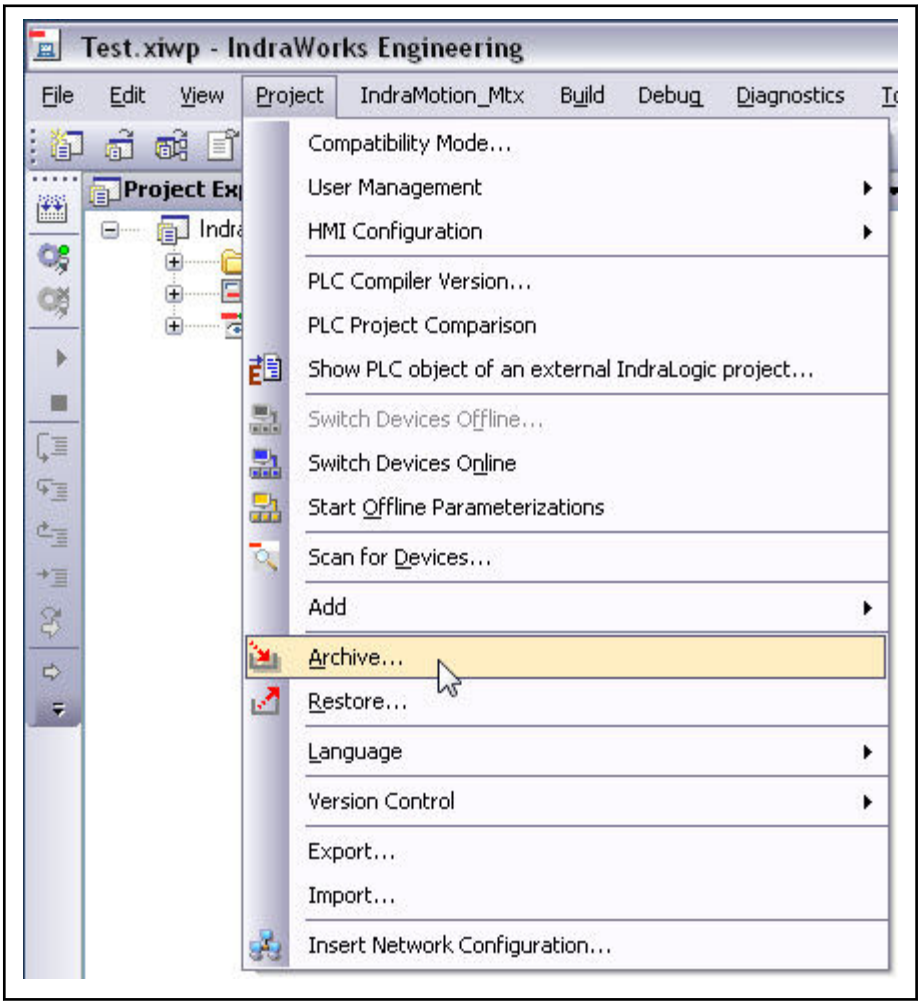

Fig. 3-6: Menu: Archive project

In this data backup variant, the following data is backed up:

- Device data (control data, extended data, drive data)
- PLC project
- HMI data

These areas cover the entire scope of control data. All data is backed up here.

If an HMI project is to be backed up, individual device data types can be deselected. This archive only contains the HMI components of the project.

		Documentation
Documentation:	IndraWorks Engineering	Archiving and restoring projects

Handling instruction: Restoring IndraWorks project data

This present handling instruction describes the restoration of IndraWorks project data.

IW Engineering / project: Restore

1. Start the function "Restore" in Engineering Desktop under the directory in the main menu "Project".
2. Follow the instructions of the wizard.

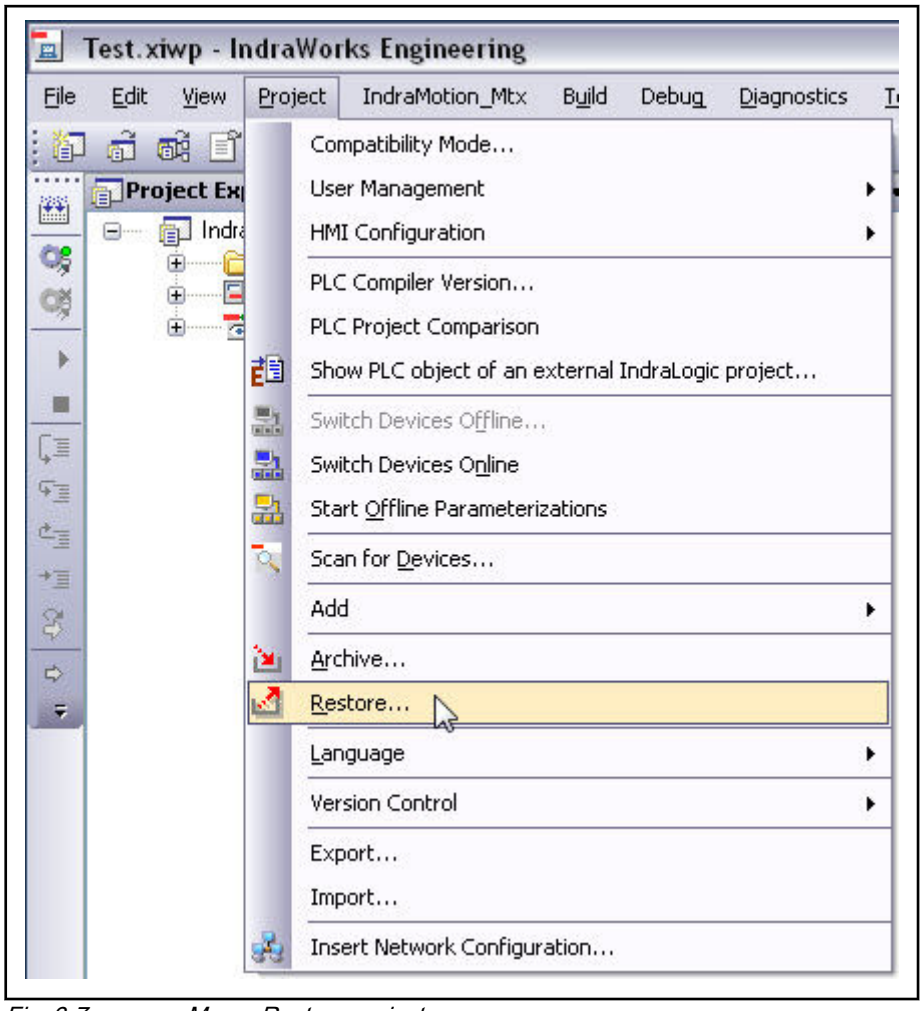

Fig. 3-7: Menu: Restore project

The device data has to be restored separately following the instruction "Restoring control data".

		Documentation
Documentation:	IndraWorks Engineering	Archiving and restoring projects

General information

Device data

The device data contains all data of a device (control) that can be archived.

- Control data
- Extended data (mount directories, user partition, user-defined directories)
- Drive data

Archiving and restoration can be started as follows (multiple options):

IndraWorks Engineering

Project node ▸ Archive / Restore

MTX project node ▸ Archive / Restore

A wizard opens to support in the following actions.

IndraWorks Operation

OP8 - Maintenance ▸ More Functions ▸ Archive Device Data...

Control data

General information

Control data can be stored as archive with the file extension "*.tar".

Archiving control data - User input

Archive Specify name and storage location of the archive to be created. Click on the button on the right of the archiving path to enter the name of a new archive file.

☞ The name of the archive file has to comply with the Windows® convention and must not be longer than 29 characters (excluding the file path).

Last archives Optionally, an existing archive file from the "last archives" list can be overwritten by selecting this archive file from the list. If an archiving path is already provided, it is additionally to be found as the first entry in the list to return to this default path at any time.

Contents Select the content to be stored in the archive. For a complete backup, select all checkboxes.

The following options can be selected:

- Machine parameters
- System data
- Tool tables
- User FEPROM file system
- RAM file system
- Permanent CPL variables
- Remanent PLC data

After completing the entries, press "Next".

Settings

- Switch PLC to STOP state before
- Switch PLC to START state afterwards

☞ To select the "Non-volatile PLC data" option, switch the PLC to the STOP state to avoid inconsistent states in the archive.

Error messages If an error occurred in a file, this file is marked as faulty.

Refer to the following table for error numbers and causes:

No.	Error message	Cause	Recovery
1	File not processed (yet)!	Internal	Contact service
2	Error while calling the stat() function!	Internal	Refer to no. 1
3	File or directory not processed!	Internal	Refer to no. 1
4	Directory could not be opened!	Internal	Refer to no. 1
5	Error reading the file!	Internal	Refer to no. 1
6	Access to file impossible!	Read-protected file	Change file protection
7	File already exists!	Internal	Refer to no. 1
8	File not available!	Internal	Refer to no. 1
9	Memory not available!	Memory in the control is full	Delete unnecessary files
10	Read-only file system!	Internal	Refer to no. 1
11	Protection different!	Internal	Refer to no. 1
12	Size different!	Internal	Refer to no. 1
13	Date different!	Internal	Refer to no. 1
14	File data different!	Internal	Refer to no. 1
15	Other differences!	Internal	Refer to no. 1
16	Date/protection not restored!	Internal	Refer to no. 1
17	Error while creating a directory!	Internal	Refer to no. 1
18	Unknown error!	Internal	Refer to no. 1
19	Error when applying machine data!	Internal	Refer to no. 1
20	Error while applying tool table!	Internal	Refer to no. 1
21	File destroyed!	A file to be archived was changed during archiving. This can be caused e.g. by a CPL program	Do not change files during archiving; e.g. deselect all CPL programs
22	Write protection canceled!	A file in the archive is write-protected. This write protection is canceled after the file restoration and has to be set by the user if desired	This is a message for the user to decide what to do about file protection
23	Error while applying remanent PLC data!	Internal	Refer to no. 1
24	Error while applying remanent PLC data!	Internal	Refer to no. 1
25	Error while applying CPL variables!	Internal	Refer to no. 1
26	RAM file system is not available in archive!	The partial archive is not in the archive	Select another archive or change the selection of the partial archives in the dialog if desired
27	User FEPROM not available in archive!	Refer to no. 26	Refer to no. 26
28	Machine data not available in archive!	Refer to no. 26	Refer to no. 26
29	Tool table not available in archive!	Refer to no. 26	Refer to no. 26
30	Remanent PLC data not available in archive!	Refer to no. 26	Refer to no. 26

General information

No.	Error message	Cause	Recovery
31	Remanent PLC data not available in archive!	Refer to no. 26	Refer to no. 26
32	Permanent CPL variables not available in archive!	Refer to no. 26	Refer to no. 26
33	PLC not in STOP state!	Internal	Refer to no. 1
34	Error while applying system data!	Internal	Refer to no. 1
35	System data not available in archive!	Internal	Refer to no. 1
36	Data contains invalid data block K1/K2!	Backup file contains data block that is not in the tool table	Refer to no. 1
37	Data does not correspond to data block schema!	Data block structure from backup file does not correspond to data block structure in tool table	Refer to no. 1

Tab. 3-2: Error messages

Restoring Control Data - User Input

Archive Click on the button to the right of the archiving path to enter name and storage location of the archive file to be restored.

☞ **Loss of data!**

Any existing files are overwritten during the restoration. Save your files by archiving before executing the restoration.

☞ The name of the file path must not contain more than 29 characters.

Last archives Optionally, select an existing archive from the "Last archives" list.

Contents Select the content to be restored.

The following contents can be selected:

- Machine parameters
- System data
- Tool tables
- User FEPROM file system
- RAM file system
- Permanent CPL variables
- Remanent PLC data

After completing the entries, press <Next>.

Settings

- Switch PLC to STOP state before
- Switch PLC to START state afterwards

Execute NC restart The data of the control data archive is only applied after an NC restart. Select the checkbox to execute an NC restart after the restoration of the archive.

Clearing RAM file system The target directories can be cleared before the archive is restored. Select the checkbox if the RAM file system is to be cleared. This option can only be selected if the archive contains the RAM file system (at least one file) and if "RAM file system" was selected.

☞ **Files which are not in the archive are lost!**

Clearing user FEPROM file system

The target directories can be cleared before the archive is restored. Select the checkbox if the USRFEP file system is to be cleared. This option can only be selected if the archive contains the FEPROM file system (at least one file) and if "User FEPROM file system" was selected.

☞ **Files which are not in the archive are lost!**

☞ If all checkboxes are selected, **only** the archive data is stored in the control after the restoration.

If there is no PLC program in the archive that can be run, it is to be compiled again and to be loaded after completion.

After completing the entries, press **Next**.

Archiving extended data

General information

Extended archiving allows any directory and file of the control computer to be created and restored as an archive with the file extension "*.zip". Thus, it is for example possible to save and restore the mount directories belonging to an MTX, the user partition of the Compact Flash medium (if available) as well as all non-control-based peripheral data.

Extended archiving can be accessed in IndraWorks Engineering via the context menu of the IndraMotion MTX device node

Archiving Extended Data - User Input

Archive

Specify name and storage location of the archive to be created.

Click on the button on the right of the archiving path to enter the name of a new archive file.

Contents

All locally mounted directories of the MTX are provided.

The user partition of the Compact Flash card (if available) is also provided.

☞ The user partition can only be backed up and restored completely. Selecting single files is not possible.

Additionally, it is possible to add and remove up to 99 user-defined folders. Thus, select the buttons "Add" or "Remove".

Permitted are:

- Local folders
  (Example: "C:\MyDocuments\MyMTXDocuments")
- UNC network shares as \\HOST\\SHARE
  (E.g.: "\\MyServer\\MyShareDirectory")

Not permitted are:

- Complete drives
  (Example: "C:\")
- Connected network drives
  (Example: "X:\")
- Windows® system folder
  (Example: "C:\WINDOWS\SYSTEM32")

General information

☞ **No check of required memory space!**

It is not checked for the required memory space! The user is responsible for the selection of the folders to be stored.

☞ **Restriction for folders of the same name!**

If multiple folders of the same name and with different drive specifications are added, only the first folder is saved.

If there are the following entries

"**C:**\MyDocuments\MyMTXDocuments" and

"**D:**\MyDocuments\MyMTXDocuments" in the list, only the folder

"**C:**\MyDocuments\MyMTXDocuments" is backed up.

Error messages If an error occurred in a file, this file is marked as faulty.

Refer to the following table for error numbers and causes:

No.	Error message	Cause	Recovery
1	File not processed (yet)!	The file has not been processed, yet.	-
2	You are not authorized!	You do not have the required authorization to perform the requested file operation	Grant authorization
3	Path is too long!	The file path is too long or does not comply with the Windows® convention	Check path
4	Path is invalid!	The file path does not exist or does not comply with the Windows® convention	Check path
5	File is write-protected!	File is write-protected and cannot be restored or overwritten	Cancel file protection
6	File not found!	File does not exist or could not be restored	Check archive content

Tab. 3-3: Error messages

Restoring Extended Data - User Input

Archive Click on the button to the right of the archiving path to enter name and storage location of the archive file to be restored.

☞ **Loss of data!**

Any existing files are overwritten during the restoration.

Save your files by archiving before executing the restoration.

☞ It is tried to restore this backup if an error occurred during the process. Before the restoration, a backup image of all target directories is created. If the user partition of the Compact Flash card is restored, the data is downloaded to the PC first.

Contents The files in the archive can optionally be displayed as list or tree. Select the files and folders to be restored by selecting and deselecting the checkboxes.

☞ The user partition can only be backed up and restored completely. Selecting single files is not possible.

Press the button **Select none** to deselect a file and **Select all** to select all files.

In the tree view, use the buttons **Expand** and **Collapse** for a better navigation.

When the entries are completed, press **Next** or **Finish**.

Clearing target directories

Target directories can be cleared before restoring the archive. Select the checkbox to clear the target directories.

☞ **Files which are not in the archive are lost!**

Drive data

General information

To transfer drive parameter sets from one machine to the other or to save them to a data carrier (e.g. a hard disk), multiple options are available for the user.

Parameter backup using:

- IndraWorks drive in the user IndraWorks project
- Command specification via the drive display on a multimedia card

How to back up data is described below, followed by how to restore drive data (drive parameters) using IW Drive.

Backing up or restoring drive parameters using a multimedia card and the commands available on the IndraDrive display are described in detail in the drive documentation "Functional Description - Loading and Saving Parameters" and are therefore not discussed.

In IW Drive, there are generally two options to backup and restore drive parameters.

Backing up and loading the drive parameters of a drive, of a selected number of drives and of all drives at the same time to the current IndraWorks project. The storage directory and the file name are assigned automatically by IndraWorks Drive.

Handling instruction: Backing up drive parameters of an axis

The present handling instruction describes how to back up the drive parameters of an individual axis or any number of axes.

IW Engineering / Sercos: Back up parameters

1. Switch the MTX online in the main menu under "Project - Online" on the Engineering Desktop.
2. Highlight the "Sercos" node in the project tree and right-click to activate the "Backup..." dialog in the context menu to start the data backup of the drive parameters.

General information

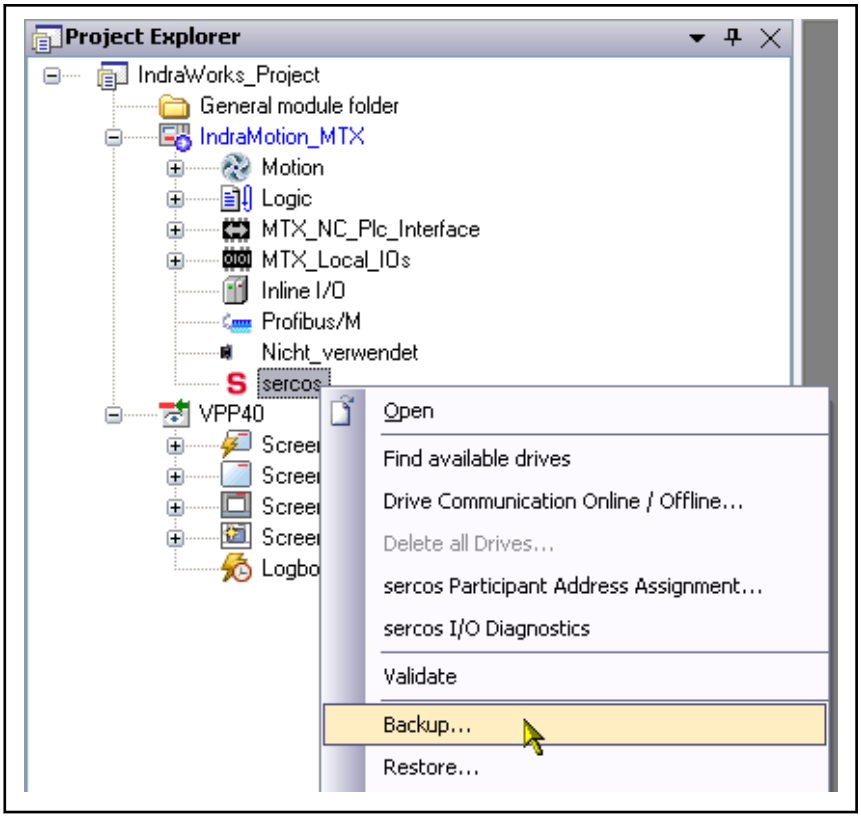

Fig. 3-8: Sercos (archiving drive parameters)

3. Select the drive(s) whose parameters are to be archived.

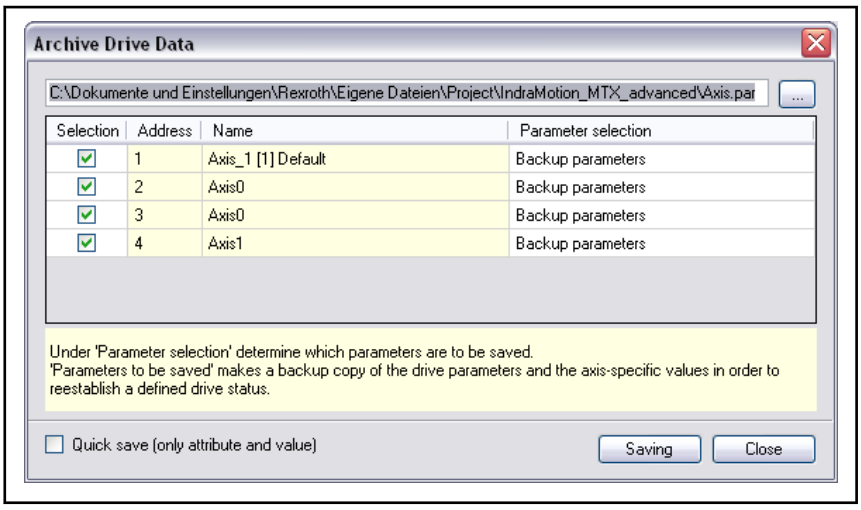

Fig. 3-9: Archive Drive Data (select drives)

After the confirmation, the selected drives are switched online and the data is exported into a parameter file. The progress is displayed comprehensively for all axes.

Fig. 3-10: Export parameters (progress bar)

The files of the drive parameter backup files have the extension "*.par". This extension is to be retained. Otherwise, restoring (importing) the parameter backup is no longer possible.

		Documentation chapter 5.12.1 "Axis commissioning" on page 314
Documentation:	IndraWorks Commissioning	Axis commissioning

Handling instruction: Restoring drive parameters of an axis

The present handling instruction describes how to restore the drive parameters of an individual axis or any number of axes.

IW Engineering / Sercos: Restore parameters

1. Switch the MTX control online in the main menu under "Project - Online" in the Engineering Desktop.
2. In the project tree under "Sercos", enable the context menu "Restore ..." to start the restoration of the drive data.

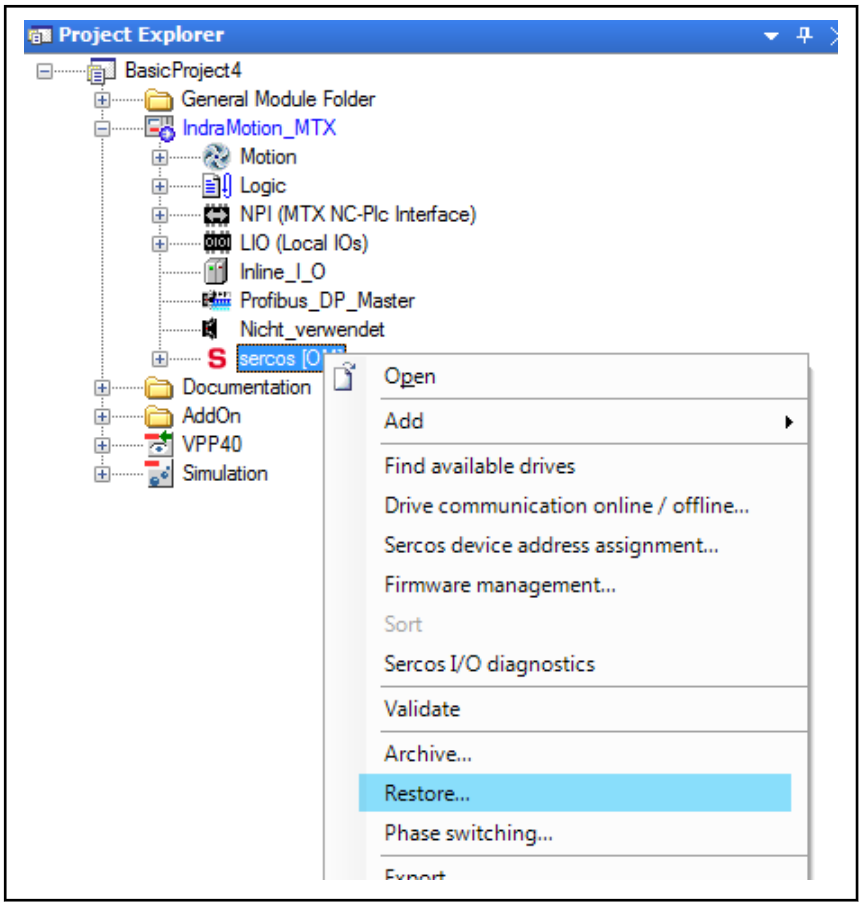

Fig. 3-11: Sercos (restore drive data)

3. Select the drive(s) whose drive parameters are to be restored. Additionally, the assignment of the exported parameter sets to the axes can be changed.

General information

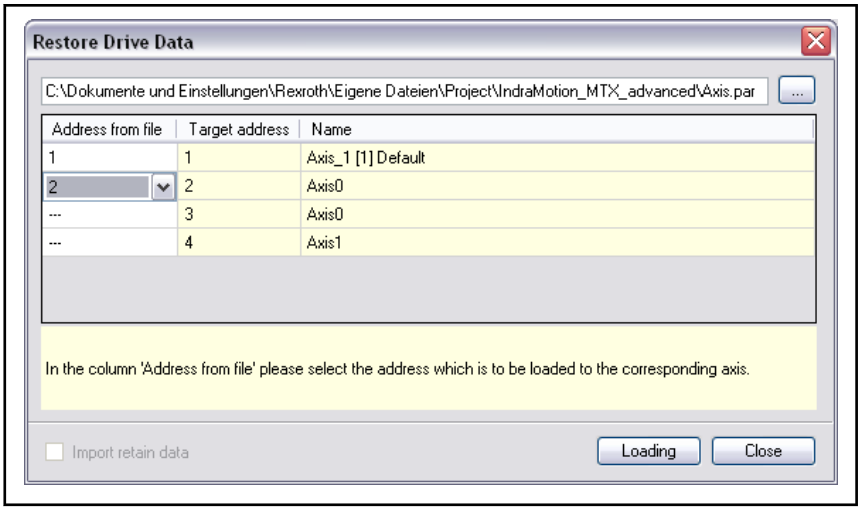

Fig. 3-12: Restore Drive Data (select drives)

4. Confirm the selection with **OK** and the restoration of the drive data starts.

   The selected drives are switched online and the data is imported into the drive. The progress is displayed comprehensively for all axes.

5. To transfer the parameters to the drive, the drives have to be switched to Sercos phase 2.

   The following error message is displayed if the drives are not in Sercos phase 2.

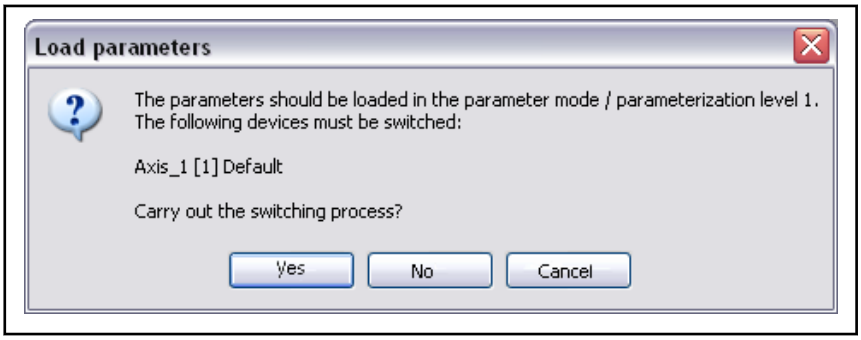

Fig. 3-13: Load parameters (error message while restoring drive parameters)

6. A phase can be switched in the context menu under the "Sercos" mode using the "Phase switching..." function.

☞ The backup files of the drive parameters have the extension "*.par". The file type is preset to "*.par" in the Explorer window.

		Documentation chapter 5.12.1 "Axis commissioning" on page 314
Documentation:	IndraWorks Commissioning	Axis commissioning

3.4 SCP analyzer

3.4.1 General information

The SCP Analyzer is an analysis tool to detect a reduced OPC or SCP communication. All client processes requesting data of a local SCPServer are displayed with their object hierarchy (processes, devices, clients, groups, items).

When the application is started, it synchronizes automatically with the local server and displays the current object hierarchy.

Save The current state of the SCPServer can be exported to a file for further processing. A file named "SCPAnalyzer.log " is created. It records and saves the current state of all SCP objects. Press the "Save" button in the toolbar or use the menu items **File ▸ Save**.

Clipboard The selected item of the group item list can be copied to the clipboard. Press the "Save to clipboard" button in the toolbar.

Always on Top The application can always be made visible via the menu items **Edit ▸ Always on Top**.

3.4.2 Display elements

SCP process tree The left process tree represents the object hierarchy with regard to the logical devices via the local SCPServer. Filter buttons in the toolbar show or hide the individual levels.

Group item list Items running dynamically in one communication group (group items) are dynamically recorded across all clients and entered into the group item list. Some measured variables are visualized there as values and some in bar representation.

- Column "Status":

  Group item or related group is active/inactive
- Column "Group Item":

  Name of the group item
- Column "Update Rate [ms]":

  Command update rate of the group items in [ms]
- Column "Cache [ms]":

  Actual update rate between the SCPServer and the logical device in [ms]
- Column "Client Update [ms]":

  Actual update rate between SCPServer and client in [ms]

3.4.3 SCP object hierarchy

Each SCP/OPC client is identified as best as possible and entered in an object tree.

Processes:

On the first level, there are the processes that communicate via the local SCPServer.

Devices:

Each process is connected to multiple logical devices (MTX, logbook, drives, etc.).

Clients:

The clients connect to logical devices.

Static items:

The static items are located below the clients.

Groups:

The created groups are located below the clients.

Group items:

The group items are located below the group.

Restriction for OPC clients

It is not possible to uniquely identify all clients communicating with the SCPServer using the OPC interface. Each OPC client logs on anonymously to the SCPServer and can only be detected as such due to a reference identifying the root and the SCPServer as pair. Thus, identifying the client name or the process ID (PID) is not possible for OPC clients. However, OPC clients can be easily identified via the items used. WinStudio uses the unique TAG definitions with a defined syntax for example and is thus noticeable.

3.4.4 Interpreting values

Column "Update Rate [ms]"

This column shows the maximum achievable command update rate of the group item. Usually, this corresponds to the group update rate in which the item is running. For example, if the item runs in a group with 100 ms, this is the maximum achievable update rate of the item.

Column "Server Cache [ms]"

This column shows the access rate of the item, i.e. the rate used by the SCPServer to monitor or query the changes of the item on the logical device. The closer the value reaches the nominal value, the larger the bar (100% = nominal).

If the SCPServer cannot access the logical device, "--" is displayed.

Column "Client Update [ms]"

This column shows the update rate of the item, i.e. the rate used by the SCPServer to transmit the changes of the item to the client.

If the item does not change, "--" is displayed.

4 HMI commissioning

4.1 Introduction

All basic functions as well as the basic handling to create and change a visualization is described in detail in the "IndraWorks HMI" manual.

(Also refer to chapter 1.2.3 "Commissioning" on page 6)

MTX-specific topics to operate an "MTX standard application" are described in the "Standard NC Operation" manual.

(Also refer to chapter 1.2.4 "Operation" on page 7)

By creating a visualization of the type "MTX standard application", an executable MTX user interface is created. That interface can be adjusted and extended by the user.

A visualization to operate and monitor a machine tool consists of multiple screens.

These screens consist of multiple elements that can be divided into two categories:

- Screen frame (ScreenFrame)
- Screen application (ScreenApplication)

The screen frame (ScreenFrame) generally consists of:

- Machine status line (header) for a compact overview on the machine state
- Operating areas (OP-panel) for a logical grouping of screens
- Function keys (F-panels) to call screen-related functions
- Machine keys (M-panels) to execute screen-related machine functions

One screen application (ScreenApplication) can be one of the following:

- A control (ACI screens) can be delivered with the system or programmed by the user
- A tool data display (DBT1 screens) for different views on the tool stock
- A system data display (SystemData screens) for different views on system data
- A WinStudio screen (WinStudio) to visualize any data
- An operating screen (Operating screens) for special operations such as traversing axes

There is node in the Project Explorer for each of the above listed elements. They can be edited at this node.

Individual elements are merged to one screen in the "Screens" node or in the "Screens MTX" node.

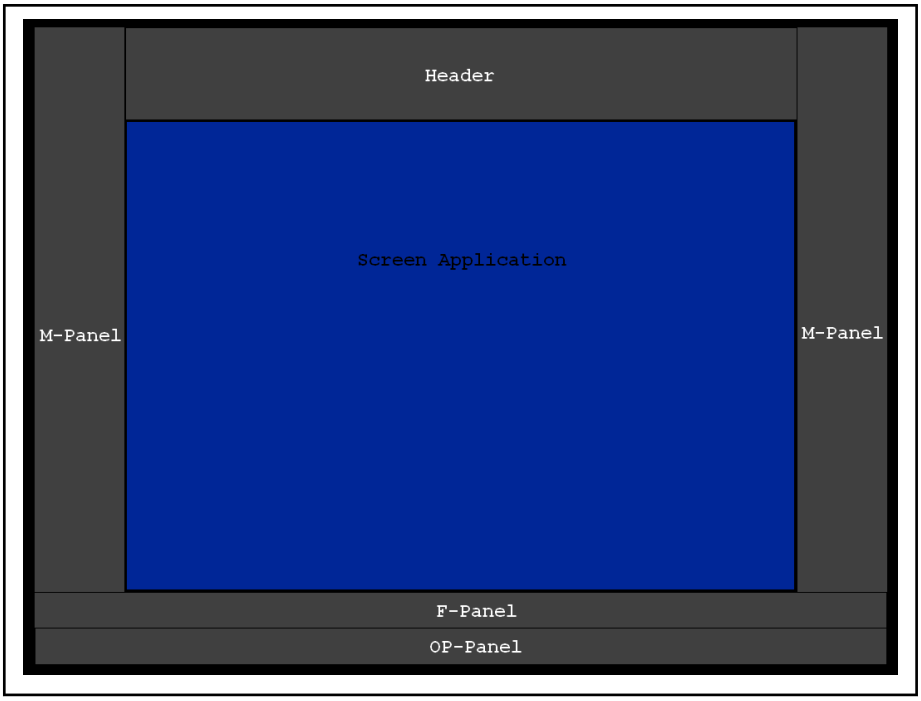

Fig. 4-1: Screen structure

4.2 ScreenFrame

4.2.1 General information

By creating a visualization of the type "MTX standard application", an executable MTX user interface is created. That interface can be adjusted and extended by the user.

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- Function keys (F-panels) to call screen-related functions
- Machine keys (M-panels) to execute screen-related machine functions

4.2.2 Header (machine status area)

General information

The machine status area (header) provides a compact overview on the machine status.

Settings in the machine status area (header) can exclusively be made on the operating station in IndraWorks Operation!

The configuration of the machine status area (Header) is described in detail in the "Standard NC Operation" manual!

In IndraWorks Engineering, this data is archived, added to version control as well as exported and imported.

Data exchange between IndraWorks Operation and IndraWorks Engineering is started via the context menu of the HMI node.

- IndraWorks Operation --> IndraWorks Engineering: Visualization Data \ Loading changes from operating station
- IndraWorks Engineering --> IndraWorks Operation: Visualization Data \ Transfer and Activate

4.2.3 OP-panel (operating keys)

General information

OP-panel = Operating keys = OP-bar

An OP-panel is a panel of eight keys located in the lower part of the screen.

OP-key = Operating key

The individual key of an OP-panel is called the OP-key. An OP-key is always part of an OP-panel.

The keys of the OP-panel are mainly used to switch the operating areas. It is additionally possible to activate an individual screen via an OP-key.

The general handling of operating areas is described in the "IndraWorks HMI" manual.

In contrast to M- and F-keys, activating functions and switching PLC variables is not possible via OP-keys.

After the creation of a standard MTX application, all keys of the OP-panel are pre-assigned with operating areas. Operating areas are configured below the "Screens" node in IndraWorks Engineering.

All functions and screen of a standard MTX application are described in detail in the "Standard NC Operation" manual.

Fig. 4-2: Example of an OP-panel

4.2.4 F-panel (function keys)

General information

F-panel = Function key bar = F-bar

A field of eight F-keys is called an F-panel. Each F-panel can be assigned to one or more screens. The F-panel is located on the lower edge of a screen, directly above the operating (OP) keys.

F-key = Function key

The individual key of an F-panel is called the F-key. An F-key is always part of an F-panel.

Fig. 4-3: Example of an F-panel

MTX standard F-panel

By creating a visualization of the type "MTX standard application", an executable MTX user interface is created. That interface can be adjusted and extended by the user. The provided screens are mandatory for correct functioning of the "MTX standard application"! To prevent accidental deleting of data, these screens are not visible in the Project Explorer but can be assigned in the operating area editor. The F-panels of the screens can be extended with functions. By deleting or renaming such an F-panel, the "MTX standard screen" the F-panel is part of would not function correctly anymore!

All affected F-panels are listed in the following chapters.

4.2.5 M-panel (machine keys)

General information

M-panel = Machine key bar = M-bar

A field of eight M-keys is called an M-panel. Each M-panel can be assigned to one or more screens. The M-panel is located at the left or right edge of a screen.

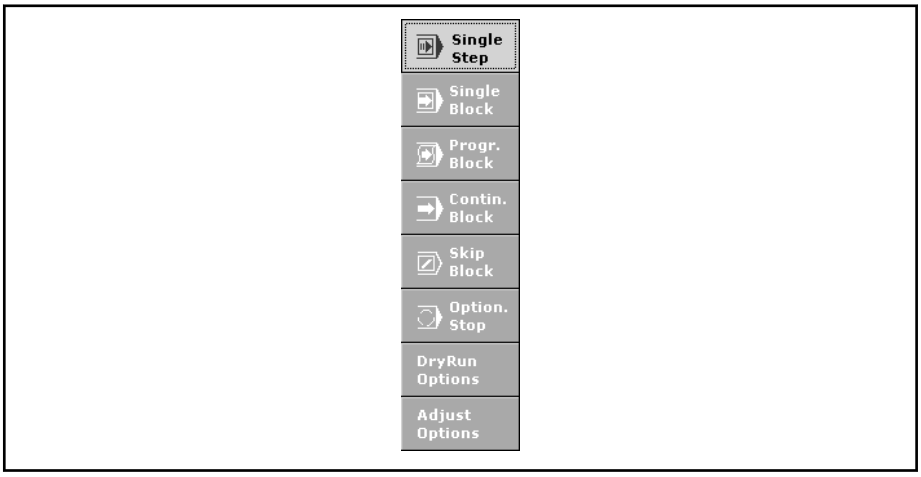

Fig. 4-4: Example of an M-panel

M-key = Machine key

A single key to the left or to the right of the BTV is called an M-key. It is always part of an M-panel.

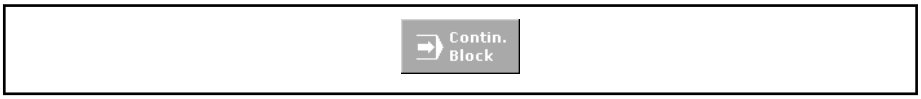

Fig. 4-5: Example of an M-key

Commissioning the M-keys

Apart from activating defined functions via the machine keys, actions in the PLC can also be triggered.

For a correct assignment between pressed M-key and PLC variable, proceed with the following steps.

Implement the PLC function block "IL_MKeys" and declare its instance in IndraWorks Engineering

1. Implement the "IL_MKeys" function block from the "RIL_HMI_Utilities" library into the PLC program.
2. The inputs L1-L8 and the inputs R1-R8 do not have to be assigned. TRUE is to be assigned to the "Enable" input. If the touch operation is also to be supported, TRUE also has to be assigned to the "TouchEnable" input.

☞ Ensure that the program is considered during the PLC program execution (e.g. calling from the main program or directly from the task).

3. The complete instance path of the declared function block "IL_MKeys", has to be available in the symbol configuration.
4. Compile PLC program and load it into the control.
5. Open the "M-Panels" dialog in IndraWorks Engineering and enter the instance path to the function block "IL_MKeys" declared in IndraLogic.
6. Close the dialog with "OK".

4.2.6 F-/M-/OP-panel function overview

Function	Applicable	Brief description
Adjustment states	F-/M-panel	Opens the first adjustment screen for the block pre-run
Axes adjustment states	F-/M-panel	Opens the adjustment screen to adjust the axis positions for the block pre-run
Adjustment states of auxiliary functions	F-/M-panel	Opens the adjustment screen to adjust the auxiliary functions for the block pre-run
Adjustment states of NC functions	F-/M-panel	Opens the adjustment screen to adjust the NC functions for the block pre-run
Adjustment states of spindles	F-/M-panel	Opens the adjustment screen to adjust the spindle states for the block pre-run
Adjustment states of tools	F-/M-panel	Opens the adjustment screen to adjust the active tool for the block pre-run
Current Close screen + Re-entry	F-/M-panel	Calling the re-entry function by closing the active screen
Active variables	F-/M-panel	Opens the variable editor with the currently active list of variables
Active D-corrections	F-/M-panel	Opens the display with the active list of D-corrections
Active zero offsets	F-/M-panel	Opens the display with the active list of ZO corrections
Active placements	F-/M-panel	Opens the placement editor with the currently active placement list
Close active screen	F-/M-panel	Closes the screen currently active in the display
System overview /detail	F-/M-panel	Opens the detailed view of the system overview
System overview/filter	F-/M-panel	Filter for the system overview
Backing up user data	F-/M-panel	Backs up user-specific settings in the Operation Desktop
Enabling the operating area	OP-panel	Switches the transmitted operating area and closes all screens of the active operating area
Operating screen information	F-/M-panel	Status display in operating screen toggles between value, text and I/O address

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Function	Applicable	Brief description
Exits IndraWorks Operation	F-/M-/OP-panel	Closes the Operation Desktop
Command to ACI screen	F-/M-panel	Via this function, different commands can be send to the ACI screen
Command to ACI screen	F-/M-panel	Via this function, different commands can be send to the ACI control
Log in user	F-/M-/OP-panel	Opens login dialog to enter the user name and password
Log out user	F-/M-/OP-panel	Logs out the logged in user
Zeros the reference position	F-/M-panel	Opens the screen to zero the reference position
Screen keyboard	F-/M-panel	
Display change	F-/M-/OP-panel	Function to change system/user screen displays
DBT2_ChangeConfig	F-/M-panel	Changes the display for DBT2 by calling a new list configuration
DBT2_ChangeQuery	F-/M-panel	Changes the display for DBT2 by calling a new list query
DBT2_Edit	F-/M-panel	Edits DBT2 data block
DBT2List	F-/M-panel	Calling a DBT2 list
Details about the connection interruption	F-/M-panel	Opens a screen with detailed information about the connection interruption
Diagnostics	F-/M-panel	Opens the dialog overview
Diagnostics/detail	F-/M-panel	Opens the detailed view of the diagnostic view
Diagnostic/filter	F-/M-panel	Opens a filter dialog to filter the dialog view
Diagnostics/Delete	F-/M-panel	Deletes the diagnostic message from the diagnostic overview
Dialog Pause and Energy mode	F-/M-panel	Opens dialog to specify a new energy mode or a pause time for the energy management in the PLC
DP diagnostics	F-/M-panel	Opens a screen to diagnose the Profibus
Level change	F-/M-panel	Function to switch the F/M-panels
Editor of active program	F-/M-panel	Opens the NC program editor with the currently active program
Energy management energy functions	F-/M-panel	Opens the screen with an overview of all energy functions and its status
Energy management events	F-/M-panel	Opens screen with events of the energy management
Energy management component information	F-/M-panel	Opens screen with energy management information about components
Energy management machine information	F-/M-panel	Opens screen with energy management information about the machine
Energy monitor	F-/M-panel	Opens the screen to display the energy consumption
Archive device	F-/M-panel	Starts archiving of control data (TAR file)
IndraWorks Engineering	F-/M-/OP-panel	Starts the Engineering Desktop
Interface PLC-NC	F-/M-panel	Opens a display showing the status of the individual interface signals between PLC and NC (channel, axis and spindle signals)
Reset channel	F-/M-panel	Initiates reset for the active channel
Switching the channel	F-/M-panel	Switches to the next channel
Circularity test	F-/M-panel	Opens the screen to execute the circle test

Function	Applicable	Brief description
Criteria analysis	F-/M-panel	Opens the criteria analysis
Power monitor	F-/M-panel	Opens the screen to display the performance data
Logbook	F-/M-panel	Opens the logbook display
Resets maximum value	F-/M-panel	
Probe 1	F-/M-panel	Opens the initialization screen for probe 1
Probe 2	F-/M-panel	Opens the initialization screen for probe 1
Initializes the probe	F-/M-panel	Opens the initialization screen for manual measurement functions
MTX system status	F-/M-panel	Opens the MTX system status to diagnose the NC control
MTX system status connection interruption	F-/M-panel	Opens the screen with detailed information about the connection interruption
MTX acr	F-/M-panel	
NC Analyzer	F-/M-panel	Starting the NC-Analyzer
NC-diagnostic monitor Show/hide	F-/M-panel	
NC editor plane change	F-/M-panel	Plane switching for cycle input masks
Cancels entries NC editor	F-/M-panel	Cancel input for cycle input masks
NC editor channel selection	F-/M-panel	Channel selection dialog for cycle input masks
Applies parameters NC editor	F-/M-panel	Parameter application for cycle input masks
Set cycle group NC Editor	F-/M-panel	Calls a cycle group
Determines the zero point	F-/M-panel	Opens screen to probe zero point
Enables the zero point table	F-/M-panel	Opens the drop-down menu to enable a zero point table
Block pre-run options	F-/M-panel	Opens the dialog to define block pre-run options
Test feed/test rapid traverse options	F-/M-panel	Opens the dialog to define block pre-run/rapid traverse options
Zero position display on/off	F-/M-panel	Sets the position display to zero
Program selection	F-/M-panel	Opens the window for program selection
Computer	F-/M-panel	Calls the calculator
Block search	F-/M-panel	Opens the screen for block search
Block search/block pre-run	F-/M-panel	Calls the operating screen for block search and block pre-run
Block pre-run	F-/M-panel	Opens the screen for block pre-run
Sercos diagnostics	F-/M-panel	Opens screen for Sercos diagnostics
Set channel	F-/M-panel	Change to a certain channel
Single Tool_Import	F-/M-panel	Opens the dialog to import of an individual tool
Language selection	F-/M-panel	Switches the interfaces/project language for OPD
PLC list	F-/M-panel	Opens the screen for PLC list display
Station selection	F-/M-panel	Opens the screen for station switching

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Function	Applicable	Brief description
System control reset	F-/M-panel	Triggers control reset for all channels
SystemData_Print	F-/M-panel	Starts printing the system data
SystemData_PrintPreview	F-/M-panel	Starts the print preview to print the system data
Keyboard code trigger	F-/M-panel	Triggers a keyboard code
Hide key	F panel	
Execute key	F panel	
TL_Active_Query_Filter	F-/M-panel	Activates the defined query filter for the tool list
TL_ActivateNextList	F-/M-panel	Function to change the focus to the next DBT list in case of several lists in a DBT screen
TL_ChangeConfig	F-/M-panel	Changes the display for tools by calling a new list configuration
TL_ChangeQuery	F-/M-panel	Changes the display for tools by calling a new list query
TL_Copy	F-/M-panel	Starts the dialog to copy a tool data block
TL_DefineQueryFilter	F-/M-panel	Opens a screen to define a query filter for tool lists
TL_Delete	F-/M-panel	Deletes the selected tool data block
TL_Edit	F-/M-panel	Starts the online tool editor
TL_Edit_Additive	F-/M-panel	Switches between the input modes "Absolute" and "Additive" in the online tool editor and the tool list
TL_Editor_Command	M-panel	Selects the next tool in the tool editor Parameter: Edit_Next_Tool
		Selects the previous tool in the tool editor Parameter: Edit_Prev_Tool
		Deletes the basic data block in the tool editor Parameter: Delete_BasicData_ToolType
		Saves the basic data block in the tool editor Parameter: Save_BasicData_ToolType
TL_Export	F-/M-panel	Starts the dialog to export tool lists or individual tools
TL_Import	F-/M-panel	Starts the dialog to import tool lists or individual tools
TL_Insert	F-/M-panel	Starts the offline editor to insert a new tool
TL_Move	F-/M-panel	Starts the dialog to move a tool data block
TL_SORT	F-/M-panel	Starts the dialog to sort the tool list
TL_SPS_Copy	F-/M-panel	Starts the function Copy tool via the PLC
TL_SPS_Delete	F-/M-panel	Starts the function Delete tool via the PLC
TL_SPS_Move	F-/M-panel	Starts the function Move tool via the PLC
ToolCursor	F-/M-panel	The current cursor position (sector and location) is written to a PLC variable
ToolCursorEditor	F-/M-panel	Tool currently edited in the tool editor (sector and location) is written to a PLC variable

Function	Applicable	Brief description
ToolList	F-/M-panel	Calls a tool list
ToolList1-16	F-/M-panel	Switches the display to the appropriate tool list Only available due to compatibility reasons Do not use anymore!
Overview on current corrections	F-/M-panel	Opens a display with an overview on the active ZOs, D-corrections and tools
Switch coordinate system	F-/M-panel	Switches the display between the machine and the tool coordinate system
Switches the technology display	F-/M-panel	
Switch variant position display	F-/M-panel	Switches between the variants for the position display defined in Operation Desktop
Variables	F-/M-panel	Opens the screen for variable display
Variables/parameters	F-/M-panel	Opens the screen to display variables and parameters
Probe tool	F-/M-panel	Opens screen to probe the tool
Re-entry	F-/M-panel	Calls the screen for re-entry in the NC program
Two channel display, currently active channel change	F-/M-panel	Switching the active channel in the two channel display
Calls the two channel display	F-/M-panel	Opens the screen for two channel display
Exits the two channel display	F-/M-panel	Exits the screen for two channel display
Two channel display channel selection	F-/M-panel	Opens the dialog to select the channel in the two channel display
Two channel display options	F-/M-panel	Opens the dialog to define the two channel display options
Two channel display: setting the passive channel	F-/M-panel	Opens the dialog to set the passive channel
Two channel display: changing the passive channel	F-/M-panel	Opens the dialog to change the passive channel
Executing the cycle	F-/M-panel	Executes the cycle in Manual mode

Tab. 4-1: Overview of the configured function on the F-, M- and OP-panel

4.3 Screen application

4.3.1 General information

By creating a visualization of the type "MTX standard application", an executable MTX user interface is created. That interface can be adjusted and extended by the user.

A visualization to operate and monitor a machine tool consists of multiple screens.

These screens consist of multiple elements that can be divided into two categories:

- Screen frame (ScreenFrame)
- Screen application (ScreenApplication)

One screen application (ScreenApplication) can be one of the following:

- A control (ACI screens) can be delivered with the system or programmed by the user
- A tool data display (DBT1 screens) for different views on the tool stock
- A system data display (SystemData screens) for different views on system data
- A WinStudio screen (WinStudio) to visualize any data
- An operating screen (Operating screens) for special operations such as traversing axes

4.3.2 ACI screens

General information

In "ACI screens" (ACI == Application Container Interface), ActiveX- or .NET-Controls can be embedded and arranged as partial screens. The "ACI screen" is then embedded as screen call of type "UserAciScreen" in one screen together with "M-panels" and "F-panels".

☞ The general handling of "ACI screens" is described in the "IndraWorks HMI" manual.

By creating a visualization of the type "MTX standard application", an executable MTX user interface is created. That interface can be adjusted and extended by the user. This also includes multiple "ACI screens". These contain different controls displaying the runtime process data of the control.

Process displays

Overview

The process displays are each provided with machine and interface-dependent parameters:

- Machine-dependent parameters are set in the NC configurator in IndraWorks Engineering. For details on the parameters, refer to "Rexroth IndraMotion MTX Machine Parameters".
- Interface-dependent parameters are set in the "Properties" dialog of the relevant displays in IndraWorks Operation.

General parameters - NC configurator

NC configurator path	MACODA	Name
/GUI/DispUnit	6020 00030	Measuring unit for the display

Tab. 4-2: General parameters for NC configurator

General parameters - Properties

Name	Values	Description
Maximum decimal digits	{10,11,12}	Specifies the maximum number of the decimal digits that can be displayed in columns. The parameter defines the width of the columns in the columns in which decimal digits are displayed
Font size	{Default,7…16}	Specifies the font size of the display. The value "optimal" determines the best font size possible

Name	Values	Description
Display title	{Yes, No}	Specifies whether the title of the display is to be displayed
Optimum line height	{Yes, No}	Specifies whether the optimum line height is to be displayed
Line separator	{Yes, No}	Specifies whether a line separator is to be displayed
Colored lines	{Yes, No}	Specifies whether the lines of the display are to be colored. This improves readability

Tab. 4-3: General parameters - Properties

Communication parameters - NC configurator

NC configurator path	MACODA	Name
-	-	-

Tab. 4-4: Communication parameters for NC configurator

Communication parameters - Properties

Name	Values	Description
Channel	{Default, 1…<Max. channle no.>}	Specifies whether the display is to be fixed on a channel. In this case, the display always shows the selected channel, irrespective of the active channel of the basic NC screen. The parameter enables the configuration of NC screens displaying information across multiple channels. In the "default" setting, the display shows information on the active channel.
Operating station (IP, host)	{default, [IP address] [host name]}	Specifies whether the display is to be set for a specified LDX device. In this case, the display always shows the selected device, irrespective of the device active in the basic NC screen. To identify a device, specify the IP address or the host name of the computer into which the device is integrated. This computer has to be registered as DCOM server. For further information on this topic, refer to the following manual: "Rexroth IndraMotion MTX integration of OEM applications". The parameter enables the configuration of NC screens displaying information across multiple devices. In the "default" setting, the display shows information on the active channel.

Tab. 4-5: Communication parameters - Properties

Position display - NC configurator

NC configurator path	MACODA	Name
/GUI/PosDisp/CoordSys/Ch[i]/Wcs	6005 00100	Coordinate system "Wcs" available in the channel
/GUI/PosDisp/CoordSys/Ch[i]/Mcs	6005 00100	Coordinate system "Mcs" available in the channel
/GUI/PosDisp/CoordSys/Ch[i]/Bcs	6005 00100	Coordinate system "Bcs" available in the channel
/GUI/PosDisp/CoordSys/Ch[i]/Acs	6005 00100	Coordinate system "Acs" available in the channel

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NC configurator path	MACODA	Name
/GUI/PosDisp/Ord/Ch[i]/ NofAxPosDisp	6005 00023	Maximum number of axes in axis display
/GUI/PosDisp/Ord/Ch[i]/Win/ Dr[j]/ModeAxChWin	6005 00022	Display axis in the channel window
/GUI/PosDisp/Ord/Ch[i]/Win/ Dr[j]/PrioAxChWin	6005 00022	Order of the axis in the channel window
/GUI/PosDisp/Ord/Ch[i]/ AddWin/Dr[j]/ModeAddAx	6005 00020	Display axis in the additional window
/GUI/PosDisp/Ord/Ch[i]/ AddWin/Dr[j]/PrioAddAx	6005 00020	Order of the axis in the additional window
/GUI/PosDisp/Ord/Ch[i]/ AddWin/ChCoordPack[j]/ ModeChPack	6005 00021	Display channel coordinate package in the additional window
/GUI/PosDisp/Ord/Ch[i]/ AddWin/ChCoordPack[j]/ PrioChPack	6005 00021	Order of the channel coordinate package in the additional window
/GUI/PosDisp/Prec/Dr[i]/ PrecPosMetr	6020 00011	Number of decimal places for axis display (metric)
/GUI/PosDisp/Prec/Dr[i]/ PrecPosInch	6020 00012	Number of decimal places for axis display (inch)

Tab. 4-6: Position display - NC Configurator

Position display - Properties - View

View

Name	Values	Description
Axis name length	{4…16}	Specifies the maximum length of the axis names that can be displayed. The parameter determines the width of the column of axis names.
Active coordinate system	{ACS, MCS, BCS, WCS)	Specifies the active coordinate system. The coordinate system can also be switched via the key <F4 coordinate system> in the menu of this display or via the key <F6 coordinate system> in the submenu of the basic NC screen. Only coordinate systems entered as existing in the NC configurator are provided.
Active variant	{1..10}	Specifies the active display variant. The variant can also be switched via the key <F2 variant> in the menu of this display or via the key <F5 variant position display> in the submenu of the basic NC screen. Available variants are set in the variant editor in the "Properties" dialog.
Channel assignment	{Yes, No}	Specifies whether an extra column is displayed showing the channel assignment of the axes.
Measuring unit	{Yes, No}	Specifies whether an extra column is displayed showing the measuring unit of the axes.

Name	Values	Description
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.
Radius in diameter programming	{Yes, No}	Specifies whether the axis positions are to be displayed as radius when programming the diameter. The parameter is only effective in the coordinate system "ACS" and for axes programmed in diameter. "r" = Axis position is a radius value "Ø" = Axis position is a diameter value
Unit symbol	{Yes, No}	Specifies whether the unit symbol [mm] or [inch] is to be displayed in the title line of the display. The parameter is only effective if the display is not in the unit mode "automatic unit according to G70/G71". This mode is set in the NC configurator (measuring unit for the display).

Tab. 4-7: Position display - Properties

Variants The variant editor is intended to create and edit display variants. Variants are optical designs with different column information created globally for all displays of this type and that can be assigned and selected individually for each display. Multiple designs can also be assigned to one variant. The variants are switched using the F-key <F2 variant> in the F-key menu of a focused display.

Display filter The displayable axes set in the NC Configurator under "/GUI/PosDisp/…" apply globally to all position displays in IndraWorks Operation. Moreover, individual axes can be shown or hidden individually for each position display using their system axis name addresses. The hiding thus overwrites the global settings in the NC configurator and the axis is never visible in this position display, although it is globally parameterized like that.

By means of this feature, it is for example possible to hide individual axes in the position display of the operation mode "Manual" as opposed to the display in the operation mode "Automatic" of the same channel.

Select the checkbox "Axis hidden" for those axes that are never to be shown in the display.

Display of the actual position in the WCS The display of the actual position in the WCS is CPU-intensive especially in case of an activated transformation on the NC-side (backward transformation required) and has thus to be activated directly via the NC configurator if required.

If a value > 0 is entered for the parameter `TRA/GuiDisp/UpdateTimePosDisp`, this axis position is calculated in the kernel in this IPO cycle. The position display indicates the real actual position of the drives in the WCS instead of "--".

Position display - Properties - Load: Velocity/acceleration

View Definition of the display of velocity and acceleration load

Name	Values	Description
Value	{Yes, No}	Specifies whether the current value is displayed as number.
Maximum value	{Yes, No}	Specifies whether the maximum value is displayed as number behind the current value and additionally as colored bar.

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Name	Values	Description
Reset maximum value		The maximum value can always be reset via the F-key "Reset peak values" in the F-keypad of the focused display or via the action of the same name. This can be assigned to an M-key for example.
Full deflection corresponds to value [%]	10...1000	Determines the % value of the maximum full deflection. To represent overshooters (>100%), determine a value higher than 100. For a better resolution of smaller values, determine a value lower than 100.
Color gradient	{various color gradient types}	Specifies the color gradient type. Various color gradient types are available. Specify the color and the change in color in relation to a certain percentage.

Tab. 4-8: Position display - Properties

Variants chapter "Position display - Properties - View" on page 44

The control first provides the values for the velocity and acceleration axis load diagnostics if these diagnostics are activated via system data entry (/SysNcDgnCtrl/AxesLoadDgn/VelLoadDgn/DgnMode = 2, .../AccLoadDgn/DgnMode = 2).

Switch off the velocity and acceleration load diagnostics using the system data entry (.../VelLoadDgn/DgnMode = 0, .../AccLoadDgn/DgnMode = 0) if these diagnostics are not required anymore! This impedes unnecessary loads of the interpolator interrupt.

Technology display - NC configurator

NC configurator path	MACODA	Name
/GUI/TechDisp/FeedDisp/PrecFeedMetr	6020 00001	Number of decimal places for feed display (metric)
/GUI/TechDisp/FeedDisp/PrecFeedInch	6020 00002	Number of decimal places for feed display (inch)
GUI/TechDisp/SpeedDisp/PrecSpSpeed	6020 00005	Number of decimal places for spindle speed
/GUI/TechDisp/Ch[i]/SpSpGrDisp[j]/SpDisp/SpIndSpDisp	6005 00030	Number of the spindle to be displayed

Tab. 4-9: Technology display for NC configurator

Technology display - Properties - View

View

Name	Values	Description
Active variant	{1..10}	Specifies the active display variant. The variant can also be switched via the key <F2 Variant> in the menu of this display. Available variants are set in the variant editor in the "Properties" dialog.
Layout	{all, feed, spindle}	Specifies the layout of the display. In the display either only spindle or only feed or all technology data can be displayed.
Spindle name length	{4…16}	Specifies the maximum length of the spindle names that can be displayed. The parameter determines the width of the column of axis names.
Unit symbol	{Yes, No}	Specifies whether the unit symbol [mm] or [inch] is to be displayed in the title line of the display. The parameter is only effective if the display is not in the unit mode "automatic unit according to G70/G71". This mode is set in the NC configurator (measuring unit for the display).

Tab. 4-10: Technology display - Properties

Variants chapter "Position display - Properties - View" on page 44

Technology display - Properties - Spindle power/torque

View Definition of the visual design of the spindle power and torque display

Name	Values	Description
Value	{Yes, No}	Specifies whether the current value is displayed as number.
Maximum value	{Yes, No}	Specifies whether the maximum value is displayed as number behind the current value and additionally as colored bar.
Reset maximum value		The maximum value can always be reset via the F-key "Reset peak values" in the F-keypad of the focused display or via the action of the same name. This can be assigned to an M-key for example. A PLC variable of type "BOOLEAN" can also be specified. If the edge changes from "False" to "True", it is also reset.
Full deflection corresponds to value [%]	10...1000	Determines the % value of the maximum full deflection. To represent overshooters (>100%), determine a value higher than 100. For a better resolution of smaller values, determine a value lower than 100.
Color gradient	{various color gradient types}	Specifies the color gradient type. Various color gradient types are available. Specify the color and the change in color in relation to a certain percentage.

Tab. 4-11: Technology display - Properties

Variants chapter "Position display - Properties - View" on page 44

HMI commissioning

Program section display - NC configurator

NC configurator path	MACODA	Name
-	-	-

Tab. 4-12: Display of program section - NC configurator

Program section display - Properties

View

Name	Values	Description
Active program	{Yes, No}	Specifies whether the name of the active subroutine is to be displayed in the title line of the display.
History	{1…10}	Specifies the number of the NC blocks of the past (history). The parameter has to be smaller than the parameter "NC blocks".
Layout	{all, bar, icon}	Specifies the layout of the display. The active NC block is only optionally highlighted in color, marked with an icon or with both visualization options.
NC blocks	{4…40}	Number of the total NC blocks to be displayed (including the history).

Tab. 4-13: Program section display - Properties

Program nesting display - NC configurator

NC configurator path	MACODA	Name
-	-	-

Tab. 4-14: Program nesting display - NC configurator

Program nesting display - Properties

View

Name	Values	Description
Layout	{indented, list}	Specifies the layout of the display. The call sequence of the NC programs can either be a list or a tree with indentations.
Program number Position	{1…15}	Specifies the maximum number of decimal places for the NC program numbers. The higher the parameter is set, the less space remains to display the subroutine paths.
Nesting depth	{0…24}	Specifies the maximum nesting depth of the call sequence.

Tab. 4-15: Program nesting display - Properties

Offset display - NC Configurator

NC configurator path	MACODA	Name
/GUI/Zotdisp/Ch[i]/NofZot-Sets	6005 00061	Number of banks to be displayed for zero offsets

Tab. 4-16: Offset display - NC configurator

Offset display - Properties

View

Name	Values	Description
ZO table name	{Yes, No}	Specifies whether the ZO table name is to be displayed
Line title	{Yes, No}	Specifies whether the line title is to be displayed

Tab. 4-17: Offset display - Properties

Offset table display - NC configurator

NC configurator path	MACODA	Name
/GUI/Zotdisp/Ch[i]/NofZot-Sets	6005 00061	Number of banks to be displayed for zero offsets
/GUI/TabDisp/PrecLinMetr	6020 00021	Number of decimal places for linear axes (metric)
/GUI/TabDisp/PrecRotMetr	6020 00021	Number of decimal places for rotary axes (metric)
/GUI/TabDisp/PrecLinInch	6020 00022	Number of decimal places for linear axes (inch)
/GUI/TabDisp/PrecRotInch	6020 00022	Number of decimal places for rotary axes (inch)

Tab. 4-18: Offset table display - NC configurator

Offset table display - Properties

View

Name	Values	Description
Number of characters in the table	{8…32}	Specifies the maximum character length of the ZO table. This parameter is not effective if the parameter "additionally information" is set to "No".
Display unit	{Default, [mm], [inch]}	Measuring unit for the 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.
Additional information	{Yes, No}	Specifies whether additional information is to be displayed. An additional column with additional information is displayed.

Tab. 4-19: Offset table display - Properties

Variants chapter "Position display - Properties - View" on page 44

Placement display - NC Configurator

NC configurator path	MACODA	Name
/GUI/Pmtdisp/Ch[i]/NofPmt-Sets	6005 00071	Number of banks to be displayed for placements

Tab. 4-20: Placement display for NC configurator

Placement display - Properties

View

HMI commissioning

Name	Values	Description
Placement table name	{Yes, No}	Specifies whether the placement table name is to be displayed
Line title	{Yes, No}	Specifies whether the line title is to be displayed

Tab. 4-21: Placement display - Properties

Placement table display - NC configurator

NC configurator path	MACODA	Name
/GUI/Pmtdisp/Ch[i]/NofPmtSets	6005 00071	Number of banks to be displayed for placements
/GUI/TabDisp/PrecLinMetr	6020 00021	Number of decimal places for linear axes (metric)
/GUI/TabDisp/PrecRotMetr	6020 00021	Number of decimal places for rotary axes (metric)
/GUI/TabDisp/PrecLinInch	6020 00022	Number of decimal places for linear axes (inch)
/GUI/TabDisp/PrecRotInch	6020 00022	Number of decimal places for rotary axes (inch)

Tab. 4-22: Placement table display - NC configurator

Placement table display - Properties

View

Name	Values	Description
Number of characters in the table	{8…32}	Specifies the maximum character length of the placement table. This parameter is not effective if the parameter "additionally information" is set to "No".
Display unit	{Default, [mm], [inch]}	Measuring unit for the display
Additional information	{Yes, No}	Specifies whether additional information is to be displayed. An additional column with additional information is displayed.

Tab. 4-23: Placement table display - Properties

Variants chapter "Position display - Properties - View" on page 44

Tool display - NC configurator

NC configurator path	MACODA	Name
-	-	-

Tab. 4-24: Tool display - NC configurator

Tool display - Properties

View

Name	Values	Description
Active variant	{1..10}	Specifies the active display variant. The variant can also be switched via the key <F2 Variant> in the menu of this display. Available variants are set in the variant editor in the "Properties" dialog.
D-correction table name	{Yes, No}	Specifies whether the NC configurator path of the D-correction table is displayed.

Name	Values	Description
Tool source	{CPL data, system data}	Specifies the data source to display the activated and preselected tool. **System data (system data mode)** The system data structure "SD.SysTool[channel]" is to be described in the channel with the PLC or NC program with location and sector of the active and preselected tool. Examples: SD.SysTool[1].ActTool.K2 = 2 SD.SysTool[1].ActTool.K1 = 1 SD.SysTool[1].PreTool.K2 = 5 SD.SysTool[1].PreTool.K1 = 1 **CPL data (CPL mode) (not recommended)** **Displaying the tool number (TN):** For each channel, one CPL variable of type INT is to be created for the active and preselected tool (e.g. in the "wmhperm.dat" file). Example:`DEF INT @ACTTOOL01;` It has to be written on the variable with the corresponding tool number (TN) from the PLC or NC. The "active tool" {ta} tool property is additionally to be set for the active tool. Important: If it is written on the CPL variable from an NC program, a WAIT instruction has to be programmed afterwards to update the display. **Displaying the tool name (SKQ):** For each channel, one CPL variable of type CHAR-ARRAY (string) is to be created for the active and preselected tool (e.g. in the "wmhperm.dat" file). Example: `DEF CHAR @ACTTOOL01(32);` It has to be written to the variable with the corresponding tool name (SKQ) from the PLC or NC. The "active tool" {ta} tool property is additionally to be set for the active tool. Important: If it is written on the CPL variable from an NC program, a WAIT instruction has to be programmed afterwards to update the display.
Edit tool source	{[profile file]}	Can only be edited if the "tool source" parameter is set to the value "CPL data". Opens the assignment file to define the CPL variables for the active and preselected tool. Changes in the file are only applied after an interface restart. If the CPL variable does not exist, nothing is displayed.
Tool changer	{chain magazine, turret}	Specifies the column labeling of the tool visualization. Chain magazine: Tool active, tool preselected Turret: Tool active, location active
Display unit	{Default, [mm], [inch]	Measuring unit for the display

Tab. 4-25: Tool display - Properties

HMI commissioning

Variants chapter "Position display - Properties - View" on page 44

Tool correction display - NC configurator

NC configurator path	MACODA	Name
/GUI/TabDisp/PrecLinMetr	6020 00021	Number of decimal places for linear axes (metric)
/GUI/TabDisp/PrecRotMetr	6020 00021	Number of decimal places for rotary axes (metric)
/GUI/TabDisp/PrecLinInch	6020 00022	Number of decimal places for linear axes (inch)
/GUI/TabDisp/PrecRotInch	6020 00022	Number of decimal places for rotary axes (inch)

Tab. 4-26: Tool correction display - NC configurator

Tool correction display - Properties

View

Name	Values	Description
Active variant	{1..10}	Specifies the active display variant. The variant can also be switched via the key <F2 Variant> in the menu of this display. Available variants are set in the variant editor in the "Properties" dialog.
Number of characters for the tool name	{8…32}	Specifies the maximum character length of the tool name. This parameter is not effective if the parameter "additionally information" is set to "No".
Tool source	{CPL data, system data}	Refer to chapter "Tool display - Properties" on page 50
Edit tool source	{[profile file]}	Refer to chapter "Tool display - Properties" on page 50
Additional information	{Yes, No}	Specifies whether additional information is to be displayed. An additional column with additional information is displayed.
Tool changer	{chain magazine, turret}	Specifies the line labeling of the tool visualization. Chain magazine: Tool active, tool preselected Turret: Tool active, location active
Display unit	{Default, [mm], [inch]	Measuring unit for the display

Tab. 4-27: Tool correction display - Properties

Variants chapter "Position display - Properties - View" on page 44

Tool correction register display - NC configurator

NC configurator path	MACODA	Name
/GUI/TabDisp/PrecLinMetr	6020 00021	Number of decimal places for linear axes (metric)
/GUI/TabDisp/PrecRotMetr	6020 00021	Number of decimal places for rotary axes (metric)
/GUI/TabDisp/PrecLinInch	6020 00022	Number of decimal places for linear axes (inch)
/GUI/TabDisp/PrecRotInch	6020 00022	Number of decimal places for rotary axes (inch)

Tab. 4-28: Tool correction register display - NC configurator

Tool correction register display - Properties

View

Name	Values	Description
Active variant	{1..10}	Specifies the active display variant. The variant can also be switched via the key <F2 Variant> in the menu of this display. Available variants are set in the variant editor in the "Properties" dialog.
Display unit	{Default, [mm], [inch]	Measuring unit for the display

Tab. 4-29: Tool correction register display - Properties

Variants chapter "Position display - Properties - View" on page 44

Input assistance display - NC configurator

NC configurator path	MACODA	Name
/GUI/TabDisp/PrecLinMetr	6020 00021	Number of decimal places for linear axes (metric)
/GUI/TabDisp/PrecRotMetr	6020 00021	Number of decimal places for rotary axes (metric)
/GUI/TabDisp/PrecLinInch	6020 00022	Number of decimal places for linear axes (inch)
/GUI/TabDisp/PrecRotInch	6020 00022	Number of decimal places for rotary axes (inch)

Tab. 4-30: Input tool display for NC configurator

Input assistance display - Properties

View

Name	Values	Description
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.
Display unit	{Default, [mm], [inch]	Measuring unit for the display

Tab. 4-31: Input tool display - Properties

Variants chapter "Position display - Properties - View" on page 44

Program coordinate display - NC configurator

NC configurator path	MACODA	Name
/GUI/TabDisp/PrecLinMetr	6020 00021	Number of decimal places for linear axes (metric)
/GUI/TabDisp/PrecRotMetr	6020 00021	Number of decimal places for rotary axes (metric)
/GUI/TabDisp/PrecLinInch	6020 00022	Number of decimal places for linear axes (inch)
/GUI/TabDisp/PrecRotInch	6020 00022	Number of decimal places for rotary axes (inch)

Tab. 4-32: Program coordinates display for NC configurator

Program coordinate display - Properties

View

HMI commissioning

Name	Values	Description
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.
Display unit	{Default, [mm], [inch]	Measuring unit for the display

Tab. 4-33: Program coordinate display - Properties

Variants chapter "Position display - Properties - View" on page 44

G-code display - NC configurator

NC configurator path	MACODA	Name
/GUI/NcCodeDisp/Ch[i]/NcCodeGr[j]	6005 00040	NC function for group

Tab. 4-34: G-code display - NC configurator

G-code display - Properties

View

Name	Values	Description
Groups per line	{2…15}	Specifies the maximum number of G-code groups per line. The parameter determines the number of lines.

Tab. 4-35: G-code display - Properties

M-code display - NC configurator

NC configurator path	MACODA	Name
/GUI/AuxFuncDisp/Ch[i]/AuxCodeGr[j]	6005 00040	NC function for group

Tab. 4-36: M-code display - NC configurator

M-code display - Properties

View

Name	Values	Description
Groups per line	{2…15}	Specifies the maximum number of M-code groups per line. The parameter determines the number of lines.

Tab. 4-37: M-code display - Properties

Precision correction display - NC configurator

NC configurator path	MACODA	Name
/GUI/TabDisp/PrecLinMetr	6020 00021	Number of decimal places for linear axes (metric)
/GUI/TabDisp/PrecRotMetr	6020 00021	Number of decimal places for rotary axes (metric)
/GUI/TabDisp/PrecLinInch	6020 00022	Number of decimal places for linear axes (inch)
/GUI/TabDisp/PrecRotInch	6020 00022	Number of decimal places for rotary axes (inch)

Tab. 4-38: Precision correction display - NC configurator

Precision correction display - Properties

View

Name	Values	Description
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.
Display unit	{Default, [mm], [inch]	Measuring unit for the display

Tab. 4-39: Precision correction display - Properties

Online correction display - NC configurator

NC configurator path	MACODA	Name
/GUI/TabDisp/PrecLinMetr	6020 00021	Number of decimal places for linear axes (metric)
/GUI/TabDisp/PrecRotMetr	6020 00021	Number of decimal places for rotary axes (metric)
/GUI/TabDisp/PrecLinInch	6020 00022	Number of decimal places for linear axes (inch)
/GUI/TabDisp/PrecRotInch	6020 00022	Number of decimal places for rotary axes (inch)

Tab. 4-40: Online correction display - NC configurator

Online correction display - Properties

View

Name	Values	Description
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.
Display unit	{Default, [mm], [inch]	Measuring unit for the display

Tab. 4-41: Online correction display - Properties

System message display - NC configurator

NC configurator path	MACODA	Name
-	-	-

Tab. 4-42: System message display - NC configurator

System message display - Properties

View

Name	Values	Description
Diagnostic type "Setup diagnostics"	{Yes, No}	Specifies whether pending messages of the diagnostic type "Setup diagnostics" are to be displayed
Diagnostic type “Error"	{Yes, No}	Specifies whether pending messages of the diagnostic type "Errors" are to be displayed
Diagnostic type "Notes"	{Yes, No}	Specifies whether pending messages of the diagnostic type "Notes" are to be displayed

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Name	Values	Description
Diagnostic type "Starting requirements"	{Yes, No}	Specifies whether pending messages of the diagnostic type "Starting requirements" are to be displayed
Diagnostic type "Warnings"	{Yes, No}	Specifies whether pending messages of the diagnostic type "Warnings" are to be displayed
Icon	{Yes, No}	Specifies whether the message is to be displayed with an icon. Refers to the diagnostic types "Errors", "Warnings" and "Notes"
Message type	{all, MTX, ProVi, SFC}	Specifies the message source or the message type **ProVi** Only ProVi messages are displayed **MTX** Only MTX messages are displayed (NC kernel, general diagnostics) **SFCs** Only SFC messages are displayed **All** All messages are displayed
Message exchange time	{500…5000}	Specifies the exchange time between the pending messages. If more messages are present than can be displayed, the messages are sorted according to their priority and then exchanged on a cyclic basis similar to a circular buffer. The parameter is not effective if the parameter "only latest message" is set to the value "yes"
Message lines	{1…20}	Specifies the maximum number of the messages displayed
Messages in color	{Yes, No}	Specifies whether the messages are to be highlighted in color when displayed
Only latest message	{Yes, No}	Specifies whether only the latest message is to be displayed. If the value of the parameter is set to "yes", the parameter has no effect on the "message exchange time"

Tab. 4-43: System message display - Properties

4.3.3 DBT1 screens (tool management)

General information

Screens providing different views on the tool stock in the tool database can be created under the "DBT1 Screens" node.

For the complete commissioning of the tool management including the creation of such screens, refer to chapter 5.10 Configuring tool management, page 137.

Validating the "DBT1 screens (tool management)"

For a general description on the validation of visualization data in the HMI, refer to the HMI manual **"DOK-IWORKS-HMI*Vxx****-APxx-EN-P"**

Checked criteria

When validating the MTX tool visualization data, the following criteria are checked:

- Specification and validity of the referenced screen elements
- Validity of the references F-/M-panel
- Validity of process variables
- Validity and existence of comments

Overview on error numbers

Each detected problem during the validation of the visualization data obtains an ID. Use this ID to find information on cause and remedy in the following table:

ID	Cause	Recovery
MTX-00010301	List name is not unique	Rename the list name
MTX-00010302	The list name contains at least one of the following characters: \ / : * ! ? "" < > |	Remove the special characters from the name
MTX-00010303	The list is not used	The list can be used in a DBT screen or called in IndraWorks Operation if an F- or M-panel key is assigned with the list call "ToolList".
MTX-00010304	The tool list configuration file was not found	Open the editor and select a list name from the selection list
MTX-00010305	F-panel or M-panel invalid	Open the editor and select a panel from the selection list
MTX-00010306	The ID of the database query is invalid	Open the editor and select a database query from the selection list
MTX-00010311	The name of the tool list configuration file is not unique	Rename the configuration file
MTX-00010312	The name of the configuration file contains at least one of the following characters: \ / : * ! ? "" < > |	Remove the special characters from the name
MTX-00010313	The configuration file is not used	The configuration file in the tool list can either be used directly or it can be called via the TL_ChangeConfig command using an M-key or F-key
MTX-00010321	The database query was not specified	Open the "Query" editor and enter a query
MTX-00010322	The database query is not used	The query can be used in a DBT list or called in IndraWorks Operation if an F- or M-panel key is assigned with the list call "TL_ChangeQuery"
MTX-00010323	The specified token was not found in the language file	To ensure that a token exists in the language file, select a text in the dialog from the list of the provided texts.

MTX-00010324	The specified text list was not found	In the editor, it can be selected from the existing lists
MTX-00010325	The specified token was not found in the language file	To ensure that a token exists in the language file, select a text in the dialog from the list of the provided texts
MTX-00010331	The text "Token" is not available in the specified resource file	To ensure that a token exists in the language file, select a text in the dialog from the list of the provided texts
MTX-00010332	The specified process variable is invalid	Select a valid process variable using the selection dialog
MTX-00010333	The specified resource could not be loaded	Select a valid resource using the selection dialog
MTX-00010341	The name of the DBT screen is not unique	Rename the screen
MTX-00010342	The name of the screen contains at least one of the following characters: \ / : * ! ? "" < > |	Remove the special characters from the name
MTX-00010351	No complete schema data set was found to check process variables	Ensure that a control is assigned to the HMI and go online with this control

Tab. 4-44: Overview on the error IDs of the validation messages

4.3.4 SystemData screens (system data displays)

General information

Individual system data structures can be visualized in freely definable lists in IndraWorks Operation using "SystemData Screens". These lists are configured in IndraWorks Engineering under the "SystemData Screens" configuration node. Such a list is then embedded as screen call of type "MtxSystemDataList" in one "screen" together with "M-panels" and "F-panels".

Configuring the system data display

A list configuration can be created in IndraWorks Engineering to visualize a system data structure via the "SystemData Screens" configuration node.

☞ Only one SD variable can be visualized in one system data screen.

Commissioning tools

ULC configurator

See chapter "ULC configurator" on page 145

XML editor

See chapter "XML file editor" on page 163

Schema editor

See chapter "Schema editor" on page 141

System data configurator

To specify the system data definitions in IndraWorks Operation, a system data configurator is available.

Definition of terms

ULC **"ULC"** stands for "**U**niversal **L**is **C**ontrol", which is the central element of the system data list configuration.

Sublist **"Sublist"** is a central term in the schema definition for the ULC. A ULC is a table editor which can be able to multiply the configured line-column definition to present an array of system data structures according to the number of array elements. In this case, a sublist stands for the presentation of a system data structure. Thus, only one sublist has to be defined to display a multidimensional system data structure.

Handling instruction: Creating a system data screen

Creating a system data screen

None

1. Create an SD list configuration

   New entry under "SystemData Screens"

2. Create / edit the F-key panel of the SD visualization
3. Create a screen definition:
   1. <New Screen>
   2. Select the "MtxSystemDataList" image type
   3. Configure the list definition
   4. It is not required to define the F-panel. The predefined F-panel is always used.
   5. Assign the screen to an operating area
4. Define the call of the SD.Screens in the operating area panel:
   1. Call the F-key configurator of the respective operating area panel
   2. Select "Image change" for the respective function key
   3. The newly created SD screen can be selected in the "Image name" box.
   4. Specify F-key labeling if required

Validating "SystemData Screens (system data displays)"

For a general description on the validation of visualization data in the HMI, refer to the HMI manual **"DOK-IWORKS-HMI*Vxx****-APxx-EN-P"**

Checked criteria *When validating the visualization data of MTX system data screens, the following criteria are checked:*

- Specification and validity of the referenced screen elements
- Validity of process variables
- Validity and existence of comments

Overview on error numbers

Each detected problem during the validation of the visualization data obtains an ID. Use this ID to find information on cause and remedy in the following table:

ID	Cause	Recovery
MTX-00010331	The text "Token" is not available in the specified resource file	To ensure that a token exists in the language file, select a text in the dialog from the list of the provided texts
MTX-00010332	The specified process variable is invalid	Select a valid process variable using the selection dialog
MTX-00010333	The specified resource could not be loaded	Select a valid resource using the selection dialog
MTX-00010401	List name is not unique	Rename the list name
MTX-00010402	The list name contains at least one of the following characters: \ / : * ! ? "" < > |	Remove the special characters from the name
MTX-00010403	The list is not used	The system data list can be used in a screen of type "MtxSystemDataList"

Tab. 4-45: Overview on the error IDs of the validation messages

4.3.5 List screens

Variable and parameter lists

General information

Variable and parameter lists can be used to display a list of different data of an MTX control in IndraWorks Operation. Supported are machine parameters, drive parameters, system data, CPL variables and PLC variables.

☞ Variable and parameter lists are exclusively created and edited on the operating station in IndraWorks Operation!

The configuration of the variable and parameter lists is described in detail in the "Standard NC Operation" manual!

☞ In IndraWorks Engineering, this data is archived, added to version control as well as exported and imported.

Data exchange between IndraWorks Operation and IndraWorks Engineering is started via the context menu of the HMI node.

- IndraWorks Operation --> IndraWorks Engineering: Visualization Data \ Loading changes from operating station
- IndraWorks Engineering --> IndraWorks Operation: Visualization Data \ Transfer and Activate

PLC list view (PLC variable lists)

General information

PLC variable lists show the contents of a global variable list from IndraLogic without including them in the symbol configuration! Additionally, they provide numerous sorting and filter options as well as detailed information on each

variable. Using the corresponding function block, it can be permanently written to values by forcing.

☞ PLC variable lists are exclusively created and edited on the operating station in IndraWorks Operation!

The configuration of the PLC variable lists is described in detail in the "Standard NC Operation" manual!

☞ In IndraWorks Engineering, this data is archived, added to version control as well as exported and imported.

Data exchange between IndraWorks Operation and IndraWorks Engineering is started via the context menu of the HMI node.

- IndraWorks Operation --> IndraWorks Engineering: Visualization Data \ Loading changes from operating station
- IndraWorks Engineering --> IndraWorks Operation: Visualization Data \ Transfer and Activate

Channel overview (channel dialog)

General information

The channel dialog shows the status of multiple channels in the configurable overviews and provides the option to switch channels. A channel filter is used to configure this overview.

☞ The filter settings of the channel dialog are exclusively created and edited on the operating station in IndraWorks Operation!

The channel dialog is described in detail in the "Standard NC Operation" manual!

☞ In IndraWorks Engineering, this data is archived, added to version control as well as exported and imported.

Data exchange between IndraWorks Operation and IndraWorks Engineering is started via the context menu of the HMI node.

- IndraWorks Operation --> IndraWorks Engineering: Visualization Data \ Loading changes from operating station
- IndraWorks Engineering --> IndraWorks Operation: Visualization Data \ Transfer and Activate

4.3.6 Programming screens

Graphical NC programming (GNP)

General information

The graphical NC programming (GNP) is a tool to define geometric elements.

☞ The graphical NC programming (GNP) can be exclusively configured on the operating station in IndraWorks Operation!

The graphical NC programming (GNP) is described in detail in the "Standard NC Operation" manual!

☞ In IndraWorks Engineering, this data is archived, added to version control as well as exported and imported.

Data exchange between IndraWorks Operation and IndraWorks Engineering is started via the context menu of the HMI node.

- IndraWorks Operation --> IndraWorks Engineering: Visualization Data \ Loading changes from operating station
- IndraWorks Engineering --> IndraWorks Operation: Visualization Data \ Transfer and Activate

NC block sequences

The **NC block sequences** are a collection of templates. Each sequence can consist of one or multiple NC blocks up to a complete program. These can be directly be inserted into the NC program when programming.

☞ NC block sequences can exclusively be executed on the operating station in IndraWorks Operation!

NC block sequences are described in detail in the "Standard NC Operation" manual!

☞ In IndraWorks Engineering, this data is archived, added to version control as well as exported and imported.

Data exchange between IndraWorks Operation and IndraWorks Engineering is started via the context menu of the HMI node.

- IndraWorks Operation --> IndraWorks Engineering: Visualization Data \ Loading changes from operating station
- IndraWorks Engineering --> IndraWorks Operation: Visualization Data \ Transfer and Activate

NC simulation

General information

The NC Simulation is a graphical tool to check part programs. Geometric aspects like dimensional accuracy of the workpiece and possible collisions are focused in this application.

☞ The NC Simulation can be exclusively configured on the operating station in IndraWorks Operation!

The NC Simulation is described in detail in the "Standard NC Operation" manual!

☞ In IndraWorks Engineering, this data is archived, added to version control as well as exported and imported.

Data exchange between IndraWorks Operation and IndraWorks Engineering is started via the context menu of the HMI node.

- IndraWorks Operation --> IndraWorks Engineering: Visualization Data \ Loading changes from operating station
- IndraWorks Engineering --> IndraWorks Operation: Visualization Data \ Transfer and Activate

NC cycle input mask

General information

Input masks allow a dialog-guided changing of selected parts of an NC program

Input masks can exclusively be created and changed on the input masks!

In IndraWorks Engineering, this data is archived, added to version control as well as exported and imported.

Data exchange between IndraWorks Operation and IndraWorks Engineering is started via the context menu of the HMI node.

- IndraWorks Operation --> IndraWorks Engineering: Visualization Data \ Loading changes from operating station
- IndraWorks Engineering --> IndraWorks Operation: Visualization Data \ Transfer and Activate

Input mask

Definition

An "input mask" is a dialog with a determined layout. In such as dialog, values (parameters) are recorded in tabular form (insertion of new calls into an NC program) or provided for correction.

Input masks also provide information on an output format. The output format establishes a connection between the program text and a specific input mask and between syntactic units and the individual lines of the input table (see chapter Syntax of mask definition - Output format, page 86).

Objective

Input masks can be used for a controlled editing of selected parts of the NC program text without using a user documentation. The programmer is supported by graphics, texts and integrated value validation mechanisms. The input masks can be directly accessed from the NC program editor (see "Rexroth IndraMotion MTX Standard NC Operation", "Inserting Functions ...").

NC blocks can be added and corrected using input masks. Moreover, comments initiated with a semicolon and functional comments on the NC Simulation can also be added and edited. However, editing CPL blocks is not possible.

Configuration

After the installation, IndraWorks Operation is already provided with a high number of input masks for standard cycles and other instructions. For individual cycles or for instructions to be frequently programmed, it can be required to define input masks (using an external text editor) or to import existing input masks.

Setting up cycles on the NC

Due to the main purpose of input masks, there is a close relation to the cycles. Thus, it is noted here that is could be necessary to set up cycles in the control. Refer to the chapter 5.9 Setting Up NC Cycles, page 135.

The following chapters provide a definition of input masks. The syntax on which the definition is based, enables the user and machine manufacturer to create their individual masks without any knowledge of a higher programming language. The visible dialog is generated from the mask definition.

The following sections contain information on maintenance and error analysis.

Signature of calls and overlapping of input masks

Call components

A distinction is made between the following components of a DIN block when a call is compiled automatically:

- Unchangeable call names (subroutine names and DIN commands) followed by a parameter list
- Parameters (either in brackets as parameter list or without brackets as DIN words)
- Other unchangeable block components without a parameter list (outside the brackets)
- Comments (also comment lines, initiated with a semicolon)

☞ The term "parameter" has a broader meaning with regard to input masks than with regard to the NC. As seen from the input masks, each block component with an input option is changeable and therefore a parameter. From the NC point of view, a parameter can also only be a command word, such as a parameter "Spindle command" with the values M3, M4, M5, etc.

Signature

The unchangeable block components, i.e., call names and constant DIN words outside the brackets, form the signature of a call. Special characters are not considered.

Example:

Signatures

- The first example includes the signature "G81".

  ```
  G81 (IX X, SL2, DT-30, RL15); Twist drilling
  ```

- The second example includes the signature "T M6".

  ```
  T[4] M6
  ```

- In the third example, the signature is "TOOL STANDARD".

  ```
  //TOOL/STANDARD,93,55,0.8,10,3\\ [""+NCF("G90")]
  ```

Signature function for the correction

The signature makes a call unique in the NC editor. The default case for input masks provides that unchangeable block components are uniquely assigned to a mask. Therefore, it uses the specific feature of signatures, its uniqueness. That means that there is only one input mask for each signature The NC program editor is responsible. However, the input mask engineer can also bypass the rule of unique assignment via the signature in multiple ways. Therefore, it is also possible to provide multiple masks for one signature.

☞ If a call has a signature, only the input masks are considered for correction purposes, since their signature is at least partially in the program line on which the current cursor position indicates. If no signature part is in the current line, corrections via input mask cannot be started from there (comment line, blank line, line without call word and without unchangeable block components). In this case, go to a line containing at least one word from the signature.

Signature function in case of overlapping input masks

As guaranteed by the system by default that only one input mask exists for each known signature, the definition of an input mask with a signature already registered causes the known input mask to be overwritten. This principle is used to allow the machine manufacturer to replace the standard cycles

and the related input masks with his own ones. Moreover, the user also can replace Bosch Rexroth input masks or input masks provided by the machine manufacturer by self-defined input masks.

Overlapping concept

In the overlapping concept, the input masks are provided in a defined hierarchy according to their origin.

The following sources are distinguished:

- User-specific input masks
- Tool-specific input masks
- Default input masks (Bosch Rexroth)

In terms of overlapping, the user masks have the highest priority. The masks of the machine manufacturer have a higher priority than those of Bosch Rexroth. It overlaps only if the signature of the corresponding input masks is identical.

The overlapping concept is the basis for the input mask adaptation with regard to its content and partially availability.

Input masks without signature

The system also restrictively define the input masks, which are only provided with changeable components in their output format. These are calls only consisting of parameters and comments. During the correction, the assignment of an NC block to an input mask is no longer unique and is performed by taking the parameters into account. During the correction, the input mask most similar to the found parameters is provided.

☞

1. Input masks without a signature are not subject to overlapping, i.e., each input mask without a signature continually increases the stock of input masks.
2. Only parameters with preceding addresses can be used in input masks without signature. The only parameter type allowed without address is the enumeration.
3. As only "soft" criteria are used when assigning NC blocks to input masks without signatures, the probability is significantly greater that several input masks with the same degree of concordance are considered for correction. For input masks without signature, always enter as many parameters possible to provide a unique mask assignment for the correction in case of input masks without signature.

Advanced systematization of calls

In addition to the differentiation criteria of calls based on the existence of a signature explained in the previous section, note the following:

Single line calls

All fixed block components and all parameters are in one line in case of a single line call. In addition, only comment lines initiated with a semicolon can be part of the call format.

Single line calls are the usual calls.

Multiple line calls

With multiple line calls, the unchangeable block components and parameters are distributed across several lines. The call can be supplemented by comment lines initiated with a semicolon.

Multiple line calls are primarily used for graphic NC programming (GNP), specifically with geometry definitions (see "Rexroth IndraMotion MTX Workshop Programming Turning and Milling ", chapter "Geometry Definitions").

Parameter composition

Parameters can be specified as follows:

1. As DIN parameter list.

The list is enclosed by round brackets. Parameters are separated by a comma. The DIN syntax applies, which means, for example, that a character string without inverted commas is expected. For further information on parameter lists, refer to "Rexroth IndraMotion MTX Programming Manual ", chapter "Parameter Transfer to Subroutines". CPL expressions and the reference to CPL variables are only possible by enclosing the expression in square brackets (see "Rexroth IndraMotion MTX Programming Manual ", chapter "Labeling CPL Elements within a Part Program"). Such CPL elements within a DIN line are also referred to as **Inline CPLs** .

The functional comments on the NC simulation only initiated with "//", are to be considered in this context like a DIN parameter list, although the Inline CPL is not allowed. Refer to "Rexroth IndraMotion MTX Workshop Programming Turning and Milling ", chapter "Additional Simulation Information in the Part Program" for functional comments on the simulation.

2. As CPL parameter list

   The entire parameter list is displayed as Inline CPL in square brackets. The parameters are separated by a comma. Each parameter value can be formulated as a CPL expression without additional brackets. A character string constant is to be enclosed with inverted commas.

3. As a sequence of DIN words.

   The parameters are directly in the line and are not summarized in a list. The parameters are separated by blank spaces, special characters (";", "(", ")", "[", "]") or with a letter following a character that is not a letter. These parameters are subject to the DIN syntax. The value assignment of addressed parameters can also be performed by CPL elements within a DIN block (Inline CPL).

Address parameters

The parameters can be provided with addresses. The significance of a value is defined by the preceding address name. Programming an address parameter is like the assignment of a value to a variable. Separator characters (spaces or assignment operators) are optionally inserted between the address and the value. Address parameters can occur in address parameter lists and in the line as DIN word (e.g., a coordinate).

☞ Address names have to be unique within each parameter list and also outside a parameter list. Only for address names "G" and "M", duplicates of the address name are allowed if additional value range limits are defined. This is required to program different G-commands or M-commands belonging to different modal G-groups or M-groups in one line (using the parameter types for integers and real numbers).

Example:

Address parameters

```
G1(RND2.5, FL150) X200 Y-26
```

If all numbers of the example are seen as parameters and thus as changeable, "RND", "FL", "X" and "Y" act as parameter addresses.

Parameters without addresses

Parameters without addresses can be used in a parameter list. The significance of a parameter is generally defined by its position within the list (counting from left to right starting from the open bracket). Therefore, these parameters are also known as **position parameters**. If individual parameters are not

assigned, several commas have to be written without parameter value to maintain the assignment of subsequent parameters according to their position.

Parameters without addresses can also occur outside a parameter list. These are only DIN commands. The NC receives its significance from the word as usual.

Example:

Parameters without addresses

Position parameters: `MYCYC["X",2,,,-3.75]`

The parameters 1, 2 and 5 are assigned. The parameters 3 and 4 are not assigned.

Parameters without address outside a parameter list:

```
G97 S2500 M3
```

If "G97" were considered as parameter and the G group would be assigned to it for spindle velocity, "G96" would also be added to the value range. As "G" is included in the value, there is no address left. This parameter is then without an address outside a parameter list. The same can be performed with spindle control command "M3". This parameter for the spindle command receives the value range M3, M4, M13 and M14 for example.

No value range listing of possible values can be specified for the S-value. The parameter for the cutting velocity or speed is therefore converted into an address parameter.

File structure - Overlapping concept in file structure

File structures are provided to implement the overlapping concept for input masks. These structure provide a storage location for each origin named.

User input masks

All files defining user masks and all further files which can be used as resources (data sources), are stored in the IndraWorks project in the <VisualizationDevice>\user\config\cycles folder.

Input masks of the machine manufacturer

The definition of the masks of the machine manufacturer and the resources are stored in the IndraWorks project in the <VisualizationDevice>\OEM\config\cycles folder.

Input masks of Bosch Rexroth

Bosch Rexroth input masks are provided by being installed in the Rexroth\IndraWorks\config\cycles folder. The text files to support multiple languages are stored in the Rexroth\IndraWorks\config folder.

Search strategy for resource files

Access to files, such as graphics, texts etc., is based on a specified search strategy. The file is initially searched for under

<VisualizationDevice>\user\config\cycles.

If the respective file is not found, it is searched in the

<VisualizationDevice>\OEM\config\cycles folder and finally in the particular folders for the installed input masks. This file search strategy allows selective overlapping of individual resources or re-using existing resources in user masks.

Online helps are searched in the language-dependent subfolders of the named folders

(<VisualizationDevice>\user\config\cycles\Help\<CountryCode>, etc.).

File structure - Mask definition files

Function of the mask definition file

The mask definition file specifies the visible content of one or several input masks (texts, graphics and helps), the behavior (checking type and value range of the parameters, default values, etc.) as well as the output format of the call.

A mask definition file is an ASCII text file with the extension ".cyc" which has to be sufficient for the syntax for input masks described in the following.

Considered mask definition files

All files with the extension ".cyc" are considered in the folders reserved for the masks of the machine manufacturer and the user masks.

The Bosch Rexroth input masks are taken from the following files of the Rexroth\IndraWorks\config\cycles folder:

- MTX.Cycles.Canned.cyc:

  Masks for standard cycles and others
- MTX.Cycles.GnpMill.cyc:

  Masks for GNP programming, parts milling and drilling
- MTX.Cycles.GnpTurn.cyc:

  Masks for GNP programming, parts turning
- MTX.Cycles.Simulation:

  Programming of functional comments on the NC simulation

Creating and editing mask definition files

The mask definition files can be edited using a simple external text editor such as WordPad.exe. Note that the editor can process ASCII files and that they use this file format only while saving. The NC text editor of IndraWorks Operation can also be used if the file was imported and then exported again (file handling functions in the Project Explorer).

How many masks should be combined in a definition file?

Any number of input masks can be combined in a cyc-file. If masks are to be transferred independently from others to another machine tool, the masks to be transferred together should be in one file. We therefore recommend to combine several masks with related topics in one file each.

File structure - Graphic files

Graphic formats

The following file formats are supported for image files:

- *.jpg
- *.bmp
- *.gif
- *.tif

A ".gif" format is recommended for drawings and ".jpg" for photos.

A standardized size of 223 x 262 pixels (width x height) is provided for an optimum display of the graphics. If images are large, sections of the images are cut off.

The graphics can be created and edited using any graphic software which supports the mentioned file formats.

No graphics defined

If there is no graphic file or if a graphic file was not provided for an input mask, the IndraWorks\config\C0.jpg is displayed. This file can also be used as template for individual images.

File structure - Support of multiple national and regional languages

The texts for headings, parameter titles and explanatory information within the input mask can be provided in one or several languages, that is in multiple national or regional languages. In case of multilingualism, it can be

switched between these languages. This takes place simultaneously when changing the set GUI language.

In general, the online helps can be provided with several languages.

Monolingual texts are directly written into the mask definition file. The available languages are significantly limited as this file is in ASCII format. Thus, use preferably language-dependent texts.

Accessing a language-dependent text

One text file can be assigned to each input masks. This file contains all texts of the input mask and all comments to be added. A text to be represented/ added is referenced via a **token**. A token is the unique reference to a specific text in a language-dependent text file. In this case, it consists of a number greater than zero with one to four digits. In the mask definition file, it is accessed with "%TNxxxx%" placeholders. xxxx stands for the maximum four-digit token number.

Language variants

A text file can be present in multiple languages. A separate file has to be created for each language. The name structure is subject to the following rule:

<langfile>_<CountryAbbreviation>.txt with

<langfile> constant part of the text file name (specified in the input mask definition) and

<CountryCode> comprises two letters for the language variant according to ISO 639-1 e.g.: "DE" for German, "EN" for English, "SV" for Swedish, "ZH" for Chinese"KO" for Korean, etc.

At least one text file has to be provided for English (<langfile>_EN.text). English is the default language if there is no text file for the currently set interface language.

Text file not available in the current language

First, the text file is specified with regard to the current interface language according to the search strategy (see chapter File Structure - Overlapping Concept in the File Structure, chapter 67). If the text file is not available in the current language, the respective English text file and then the German text file is searched analogously.

File structure for language-dependent texts

Language-dependent texts have to be provided in an ASCII file or in an UNICODE file.

Each token starts as follows:

```
|<tno>\----\0000\
```

With

<tnr> is the token number (up to four digits, leading zeros permitted).

The token numbers do not have to be arranged in ascending order and may have gaps.

The respective text is to be provided in the following line. If it is a multiline text, one line in the text file is to be provided for each line of the text.

At the beginning of the text file, the token number 0 is to be displayed and used in case of an error if the addressed token does not exist.

Example:

File for language-dependent texts (in this case the German language variant "MyText_DE.txt")

```
|0000\----\0000\
No text defined
|0001\----\0000\
Retraction height
```

```
|0002\----\0000\
Line 1 of a multiline text
Line 2 of a multiline text
```

Creating and editing text files

Language-dependent text files are created and edited by the user or by the machine manufacturer using a simple, external text editor (e.g., WordPad.exe). An independent provision mechanism exists for Bosch Rexroth text files.

How many text files should be provided?

Theoretically, a separate text file can be provided for every input mask. It is the recommended method since masks rarely allow re-using texts. Provide at least one text file for every cyc-file in order not to unnecessarily limit the option of transferring single input masks or input masks with related topics to other machines.

Help files in several languages

Help files for the individual languages are assigned with a mechanism similar as for the text files. The country codes are not contained in the file name. Instead, subfolders are provided which are named according to the country code (<VisualizationDevice>\user\config\cycles\Help\<CountryCode> and <VisualizationDevice>\\OEM\config\cycles\Help\<CountryCode>).

If the help file is not available in the respective language, first the English file is searched and then the German one.

Syntax of the mask definition - Structure of a mask definition

Bracketing

Each input mask starts with a

```
//%CHBEGIN%
```

line and completes with a

```
//%CHEND%
```

line.

Mask elements

Mask elements (graphics, parameters, output formats, explanatory texts, titles) are to be defined between these two lines, wherein each of the lines relevant to the definition starts with "//%" and writes on one mask element. All other lines are not considered. Preferably initiate comments with a semicolon as in an NC program.

The sequence of mask elements of a category determines the sequence in the input mask. Parameters are provided from top to bottom in the sequence as specified in the definition file for example.

Mask elements of different categories can be listed in any order and mixed line by line with other categories.

Sequence of input masks

☞ The sequence of mask elements of the same type is decisive for the structure of the input mask, but the sequence of the masks in the definition file has no effect on the sequence provided in the selection list while inserting. The default sequence is defined by the alphabetically ascending sorting of the signatures, wherein G- and M- commands are sorted in a numerically ascending order. The sequence can be modified in a dialog to adjust the input support by shifting.

Basic information on the syntax

The syntax fundamentally consists of reserved language words and placeholders enclosed in percentage symbols and constants (values, names). The reserved language words in percentage symbols determine the interpretation of the subsequent words to a large extent. At least one separating space is required between individual words, although not before and after reserved words in percentage symbols.

Names with spaces to be understood as a word (e.g. file names) can be provided with inverted commas.

Syntax of the mask definition - Reference to a language-dependent text file

If an input mask is to support several languages, a reference to a text file has to be included in the mask definition.

Syntax `//%LANG% <langfile>`

With

<langfile> Name of the text file without two-digit language code according to ISO 639-1, without extension and without path specification. Enclose the name with inverted commas if the name contains spaces.

Example:

Language-dependent text file

Reference to the MyText_EN.txt, MyText_DE.txt, MyText_RU.txt etc. text files.

```
//%LANG% MyText
```

There is also an older procedure to define language-dependent text files which are still supported due to compatibility reasons.

```
//%ID% <langfile>
```

Syntax of the mask definition - Title

Define a title in each mask definition.

Syntax `//%NAME% <title>{ %SIGN% <sign>{ <sign2>...}}`

With

<title> Title of a cycle.

The title is displayed for selection when adding and is therefore to be unambiguous for the NC programmer. A language-dependent title can be achieved by specifying a token instead of the text. A token is specified using `%TN<tno>%`, where <tno> is the token number of up to four-digits in the language file (e.g. `%TN0123%`, see chapter File Structure - Support of Multiple National and Regional Languages, page 68).

<sign> <sign2>... Apart from the call signature specified in the output format, the signature can also be extended. <sign> is a word consisting of letters, digits and "_". Separate multiple additions from each other by spaces. For more information on the signature, refer to Signature of Calls and Overlapping of Input Masks, page 64.

What is the purpose of the signature addition? The unique assignment of input masks to a program text via the signature is the basis for mask overlapping . In exceptional cases, it can be desired that several input masks with the same signature have to be kept in parallel.

This is used as follows:

- If multiple masks with different parameters are to be declared to take different cases into account, but have identical call names (e.g., different masks for G1 for a straight point-to-point move and a straight three point move).
- For masks without signature. In case of cycles without signature, the alphabetical order is solely defined by the signature addition

The signature addition is subordinate to the call signature. Therefore, the alphabetical sorting via the additional signature can only be changed to a minimum extent for masks with signature.

☞ Use only character strings not allowed as DIN words as additional signatures. Combine the signature with "_".

Example:

Title

```
//%NAME% G81 Twist drilling
```

Monolingual title

```
//%NAME% %TN0678%
```

Multilingual title with token specification

```
//%NAME% G1 - Three-point cycle %SIGN% 3_PNT_DRAFT
```

Signature addition

Syntax of mask definition - Properties of an input mask (grouping)

Objective

Each input mask can be provided with properties used by the system when creating the list of the masks available for insertion (menu scope). The specification of the same property word in several masks declares all these masks to be elements of a specific subset, the group.

Properties are differentiated allowing a grouping with regard to the following criteria:

- Thematic (contentual) or technological points of view
- Origin (user, manufacturer, standard cycle or software option)
- Availability of the input mask when inserting and correcting

The property on the origin is automatically specified by the system and does not have to be programmed.

Syntax

```
//%GROUP% <property>{ <property2>{ <property...>}}
```

With

<property> <property2>...

One word consisting of letters, digits and "_", the group name standing for a specific property. According to the table below, there are multiple predefined group names in the system. The machine manufacturer and the user can introduce any number of new group names using %GROUP% instructions that are always understood as name of a thematic/technological group. Multiple properties are separated by spaces.

Properties table

List of predefined properties

Group name	Automatic assignment	Property
CANNED	Yes, when reading from IndraWorks\config\cycles\MTX.Cycles.Canned.cyc	Origin "Standard cycle" (Bosch Rexroth)
DIN	No	Topical grouping "DIN instructions" (masks supporting DIN programming do not represent cycle calls)
DRILL	No	Grouping for "drilling" technology

Group name	Automatic assignment	Property
GNP	Yes, when reading from IndraWorks\config\cycles\MTX.Cycles.GnpMill.cyc and MTX.GnpTurn.cyc	Assignment to the software options of the graphic NC programming. Type code SWS-MTX***-RUN-NNVRS-D0-BAZ1 or SWS-MTX***-RUN-NNVRS-D0-TURN1
GRAVE	No	Grouping for "engraving" technology
MILL	No	Grouping for "milling" technology (except engraving and contour milling)
MILLCONT	No	Technology grouping for "contour milling"
OEM	Yes, when reading from the project folder <VisualizationDevice>\OEM \config\cycles	Origin of "Machine manufacturer"
PATT	No	Thematic grouping for "bore pattern"
PROBE	No	Thematic grouping for "measurement"
SAMPLE	No	Thematic grouping for "examples"
SIM	Yes, when reading from IndraWorks\config\cycles\MTX.Cycles.Simulation.cyc	Input masks for functional simulation comments belonging to the NC simulation software options.
TURN	No	Grouping for "turning" technology (except contour turning)
TURNCONT	No	Technology grouping for "contour turning"
USER	Yes, when reading from the project folder <VisualizationDevice>\user \config\cycles	Origin of "User"
_HIDDEN	No	Hides an input mask. This mask is available neither for insertion nor for deletion
_NOCORR	No	Hides a mask for correction. This mask is only available for insertion
_NOINSERT	No	Hides a mask for insertion. This mask is only available for correction. (*)
_NOGROUP	Yes	This group gets each input mask automatically if it does not belong to any contentual/technological group Never include it in a %GROUP% instruction
_OTHERGROUPS	No	This group name represents all groups not explicitly controlled via an F-key in the input support. This group name is used as filter for the function key "More cycles...". Never include it in a %GROUP% instruction

(*) Assign this property to all masks for which newer calls exist with other masks (e.g., in case of syntax change). This ensures that all newly inserted calls are based on the new pattern and the old masks are still available for correction.

Tab. 4-46: Composition of predefined properties

Example:

Properties (grouping)

The properties of a user cycle for drilling are to be defined.

```
//%GROUP% DRILL
```

As the cyc-file is saved in the <VisualizationDevice>\user\config\cycles project folder, the property "USER" for "User cycle" is automatically assigned to the mask.

Example:

Hiding the input mask

A machine manufacturer likes to hide G111 Hole circle rotary axis, since the machine is not provided with rotary axes. Therefore, the cycle mask of the standard cycle has to be hidden.

```
//%CHBEGIN%
//%GROUP% _HIDDEN
//%N% G111(%P%)
//%CHEND%
```

The machine manufacturer adds this mask definition to a cyc-file stored in the project folder <VisualizationDevice>\OEM\config\cycles.

Global mask elements - Graphics

Global mask elements are graphic dialog elements generally displayed as long as the assigned input mask is visible. Only the global graphics can be temporarily overlapped by a parameter-specific graphic.

Objective

The graphic is particularly significant for the mask design, as it is a key to explain the function of a cycle and the parameters. In principle, it is not possible to incorporate long explanatory texts into an input mask. Therefore, all possible relevant information has to be provided graphically.

Multiple global graphics

It is possible to assign multiple global graphics to an input mask. Use this option to display different machining cases (e.g., internal and external drilling) or dimensioning variants separately and thus more clearly.

Graphics are displayed independently of the set language. Thus, avoid texts in the graphics except for parameter names and, if necessary, an explanatory program code.

Syntax

```
//%GF% <graphicfile>{ <graphictitle>}
```

With

<graphicfile>

Name of a graphic file without path including the extension ".bmp", ".jpg", ".gif" or ".tif". Size of the images 223 x 262 pixels (width x height). Enclose file names with spaces in inverted commas.

<graphictitle>

If several graphics are displayed, a title has to be assigned to each graphic. This title is displayed or can be selected in the list above the graphic. The title includes the entire text after <graphicfile> up to the end of the line. To support multilingualism, a token can also be specified ("`%TNxxxx%`", see File Structure - Support of Multiple National and Regional Languages, page 68).

If only one graphic is provided for a mask, it is recommended to omit the graphic title.

Example:

Global graphics

Assign two global graphics to one cycle - one graphic for the internal machining and one graphic for the external machining.

```
//%GF% TurnOutside.gif external machining
```

```
//%GF% "Turn Inside.gif" %TN0346%
```

Global mask elements - Explanatory texts

Explanatory texts can be displayed in the lower section of the input mask.

Objective The explanations provide an overview on the syntax and on the effect of the cycle. Special features are also to be described there, such as for the default parameters.

Syntax

```
//%C% <explanation>
```

With

<explanation> Content of an explanatory line or a token. A monolingual text starts at the first character different from the space following //%C% and extends to the end of the line. Thus, no indentation can be programmed. A language-dependent text referenced via token can also comprise several lines and indentations (also refer to File Structure - Support of Multiple National and Regional Languages, page 68).

Example:

Explanatory texts

```
//%C% %TN0672%
//%C% default for parameter <ax>: Drill axis for current interpolation plane
```

Global mask elements - Online help

Help file Each input mask can be assigned to one help file only (preferably HTML help). The help can be provided in several language variants. For information on storage location and support of several language, refer to Help Files in Multiple Languages, page 70.

Syntax

```
//%HELPFILE% <helpfile>
```

With

<helpfile> Name of a help file including extension and excluding path specification. The file name extends to the end of the line so that no inverted commas are required for spaces in the name.

Help token A help token can optionally be specified for each input mask. A help token is the reference to a specific section in the online help.

Syntax

```
//%HELPTOKEN% <helptoken>
```

With

<helptoken> Identifier of a reference to a specific section in the help file. This can either be a topic ID such as "G86Boring.htm" or a keyword (search term). If your help is translated into other languages, note that the selected keyword is identical for all languages and thus not translatable.

Example:

Online help

The help file "MyCycles.chm" is to be displayed in an input mask. The corresponding section is to be reachable via the keyword "CYCLE2".

```
//%HELPFILE% MyCycles.chm
//%HELPTOKEN% CYCLE2
```

Syntax of mask definition - Default parameter types

Syntax

The following describes the parameter declarations as to be found in almost every input mask. There are also special types subject to extra syntax and therefore documented separately.

```
//%P%{%@%<pname>}{ <type>{ [<range>]}}<ptitle>
{ %D%{<behavior>}<default>}{ %GF%<graphicfile>{ <graphic-title>}}
{ %VALID%<validinfo>}
```

The syntax is explained in the following sections. Note that each parameter description has to be written into one line even if the syntax is displayed across several lines due to the space.

- Define the sequence of the parameter definition based on a reasonable procedure and not on the sequence of the position parameters. Parameters directly related or dependent on each other are defined successively.
- The method of defining parameters up to using "//%V%" is continuously supported for reasons of compatibility.

Title <ptitle>

A title is assigned to each parameter. This title has to include the parameter description in plain text along with any possible supplementary information on the unit of measurement etc. The parameter title can specify multiple languages as token for support purposes ("%TNxxxx%", see File Structure - Support of Multiple National and Regional Languages, page 68). No percentage sign can be used for a monolingual text. However, if it is required as measuring unit for example, enclose it with round or square brackets.

A constant title text extends to the end of the line or to the next percentage sign outside a bracket.

Parameter address <pname>

If the parameter is provided with an address, the address name is preferably to be specified directly behind "//%P%". The first word after "`%@%`" is applied as address name. The address name is displayed in the first column of the input table. Otherwise, a continuous index is displayed.

Address names may only consist of letters, digits and "_", but not of special characters. If NC notes are to be programmed via an input mask ("character string" parameter type, see also Character String STRING, page 79, only the following syntax variants can be used:

- Channel-specific note `(MSG<NoteText>)`:

  Address name "MSG" or
- Channel-comprehensive note `(GMSG<NoteText>)`:

  Address name "GMSG".

For NC notes, refer to "Rexroth IndraMotion MTX Programming Manual", chapter "Notes in the User Interface"

Variable address name (GNP)

If an output format begins with a parameter of the special type "DCS" (description coordinate system from graphic NC programming defining the coordinate axes active in the cycle) the significances of the axis names specified in the DCS can be used again in the subsequent parameters. The axis names become variable. That is achieved by the following placeholders instead of the constant address name:

```
%A1%
```

Name of the master axis of the plane (abscissa).

```
%A2%
```

Name of the slave axis of the plane (ordinate).

```
%A3%
```

Name of the drilling axis of the plane (applicate).

For more detailed information on the description coordinate system, refer to the "Rexroth IndraMotion MTX Programming Manual ", chapter "Geometry Definitions".

Example:

Parameter address and title

Position parameters with monolingual title

```
//%P% Contact width [%]
```

The coordinates of the first DCS master axis with a multilingual title are to be programmed as reference coordinate of a geometry definition.

```
//%P% %@%%A1% %TN3742%
```

Parameter Types and Value Ranges

A data type **<type>** can be optionally assigned to each parameter. The specification of a data type can - and has to for the enumeration type - follow the specification of a value range `<range>` in square brackets.

The data type is to follow directly after the address name or after "//%P%".

The following data types are possible:

Real number REAL

The "real number" parameter type is programmed using "`REAL`". This is also the default data type if a parameter declaration does not include any type specification.

The optional value range specification **<range>** consists of a lower value range limit followed by two points and the upper value range limit.

The specified value range limits are always within the value range. If a value range limit is not within the range, switch to a fraction number close to the real range limit. If the value range limit is an integer, enter as limitation a value either 0.01, 0.001 or 0.0001 smaller or greater than the integer already outside the value range.

If the lower or the upper value range limit is not required (value range limited on one side), change to a very small or very large number. The lower value range limit is canceled with -999, -9999 or -99999, the upper one with 999, 9999 or 99999.

Example:

Parameters of type "REAL"

A real parameter ANG should have the value range 0<=ANG<=360.

```
//%P% %@%ANG REAL[0..360] angle [deg]
```

A real position parameter should be greater than 0.

```
//%P% REAL[0.0001..99999] distance
```

A real parameter A should move in the range 90<A<180.

```
//%P% REAL [90.001..179.999] angle [deg]
```

Integer INT

For the "integer" parameter type, "**INT**" is to be specified.

The optional value range specification **<range>** consists of a lower value range limit followed by two points and the upper value range limit.

Example:

Parameters of type "INT"

An integer parameter TEC should be provided with the value range 0<=TEC<=9.

```
//%P% %@%TEC INT[0..9] Edge position
```

An integer number position parameter should be greater than 0.

```
//%P% INT[1..9999] Number of bores
```

Binary type BOOL

The "binary type" represents a logic statement which can only apply two values:

"FALSE" or "TRUE".

This parameter type is to be declared with "BOOL". It can only be used in Inline CPL parameter lists (parameter list in square brackets) and applies the values "TRUE" and "FALSE" according to CPL syntax.

The optional value range specification **<range>** is used to display plain text for the meanings "FALSE" and "TRUE". First, the text is given for "FALSE" and then, separated by a comma, for "TRUE". The texts can be defined as token or monolingual text, although no comma and no "]" are permitted for the latter.

Without any range specification, "TRUE" and "FALSE" are displayed as possible values in the input table.

Example:

Parameters of type "BOOL"

For binary parameters, the text is to be displayed "on the right" if the state is "TRUE" and "on the left" if the state is "FALSE".

```
//%P% BOOL[let, right] direction of rotation
```

The same in the multilingual version:

```
//%P% BOOL[%TN0560%, %TN0561%] %TN0562%
```

ENUM enumeration type

If a finite number of words, numbers or strings belong to the value range of a parameter, the "ENUM" enumeration type is often used. In this case, each element of the value range is defined separately including a corresponding plain text. Indicate the value first for for each element followed by a plain text separated by a space. The plain text can be declared by a token or can be monolingual, although no comma and no "]" may be included in the text. A comma is the separator between two elements.

- If the enumeration contains integers (see Integer INT, page 77), consider whether the type "INT" is not more suitable, since editing takes place in a selection list which is more difficult to operate without a mouse than a simple text field.

  The following criteria are in favor of ENUM:

  – The value range has interruptions

  - or -

  – The values are not assigned to memorable meanings (e.g. machining variants).

  The following criteria are in favor of INT:

  – The value range has no gaps

  – The value meaning can be represented more graphically than with a short plain text
- The "ENUM" type is the only valid data type for parameters without address that are displayed outside a parameter list. In this case, each value has to start with a letter.
- The type "ENUM" may only be provided with one single element in the value range. Use this parameter definition to provide multiple input masks for one cycle. By specifying only one single element in the value range, the input mask is assigned to this parameter value. In this case, the corresponding parameter is not displayed in the input table.

Example:

Parameters of type "ENUM"

A position parameter (Inline CPL) has the character string type, wherein only two values, "CCW" and "CW" are accepted.

```
//%P% ENUM["CCW" counterclockwise, "CW" clockwise] Direc-
tion of rotation
```

A parameter without an address outside a parameter list is to be used to program spindle control commands M3, M4, M5 and M19.

```
//%P% ENUM[M3 right, M4 left, M5 stop, M19 orient] Spin-
dle command
```

A position parameter has to apply the values 0, 1, 10 and 11 (similar to the binary representation of a number). It is not possible to provide the meaning as short plain text. Thus, the individual values are illustrated in a graphic. The element value is therefore repeated in plain text.

```
//%P% ENUM[0 0, 1 1, 10 10, 11 11] Variant
```

Weekday codes (two characters) are to be assigned to a parameter with address D. The parameter is to be multilingual.

```
//%P% %@%D [Mo %TN0501%, Tu %TN0502%, We %TN0503%, Th
%TN0504%, Fr %TN0505%, Sa %TN0506%, Su %TN0507%] %TN0500%
```

Character String STRING

Character stings are declared using the type specification "`STRING`".

The range specification `<range>` is always omitted in case of character strings.

Example:

Parameters of type "STRING"

A position parameter has to apply a character string.

```
//%P% STRING engraving text
```

Default values and pre-assignment

Optional pre-assignments can be implemented for each parameter when inserting a call or a default parameter behavior. The syntax elements that follow "%D%" <behavior> and <default> are therefore provided.

Pre-assignment

Due to the pre-assignment, an initialization value is entered when a call is inserted and before the mask dialog becomes visible. Pre-assignment is not important for corrections.

During pre-assignment, the only value programmed at the position of <default> is the initialization value (rather than the substitute representation in plain text for the types and BOOL!). Only the first word after %D% is accepted as initialization value. Enclose the character string in inverted commas.

Use the pre-assignment option if the same value is used frequently, particularly if this is an obligatory parameter.

Example:

Parameter pre-assignment

The direction of rotation programmed in a spindle control command is almost always clockwise (to the right).

```
//%P% [M3 right, M4 left, M5 stop, M19 orient] Spindle
command %D%M3
```

Default parameters

A "default parameter" is an optional cycle parameter, for which - if it is not programmed - a specific value from the value range of the parameter is used in the program (e.g., 60° thread edge angle if the parameter is not assigned). This differs from a similar case, in which an unassigned parameter leads to the omission of a certain function or process (e.g., no chip breaking). The latter is not a default parameter, since the default is "unassigned" and applies to each parameter in this case.

For default parameters, "unassigned" stands for a value. This value can constantly be changes (depending on options or via the context of the subroutine call depending on the previously activated interpolation plane).

Default parameters that depend on the call context cannot be implemented into the input masks. Such a condition can be the interpolation plane that is activated before the cycle for example. Document the behavior in an explanatory text (see Global Mask Elements - Explanatory Texts, page 75).

Constant default parameters

If the default value is constant, implement the default parameter behavior into the input mask. Enter "=" instead of <behavior>. is followed by the default value (<default>).

With an unassigned default parameter, the default value always is displayed in the input mask when inserting and correcting. When transferring a call to the NC program, the respective parameter is omitted if its value corresponds to the default value.

Example:

Default parameters

In a thread turning cycle, the edge angle is to be transferred via a parameter. The default value of this parameter is 60°.

```
//%P% %@%FA REAL[0..179.9999] %TN7321% %D%=60
```

Option-dependent default parameters (GNP)

There is an extension compared to the aforementioned default parameters for input masks of the graphic NC programming. The default parameter is not a constant, but it is taken from a current "Options" setting (see "Rexroth IndraMotion MTX Workshop Programming Turning and Milling", chapter "GNP Options"). This "Options" setting is accessed via placeholders resulting from the address (enclosed in percentage symbols) of a value from the file the in project folder <VisualizationDevice>\user\ config\MTXGnpConfig_000_<channel>.ini, section "[Tech_Settings]". The file structure is documented in the manual "Rexroth IndraMotion MTX Workshop Programming Turning and Milling", chapter "Options and User Settings".

Example:

Option-dependent default parameter

An address parameter AT is to be provided with the default value set in the GNP options for the tangential approach length when turning.

```
//%P% %@%AT REAL[0..9999] %TN7327% %D%=%Siabst_Tan%
```

Channel 1 is assigned to the program. The file MTXGnpConfig_000_001.ini contains:

```
[Tech_Settings]
..
Siabst_Tan = 2,
```

The default value of the parameter is 2.

Option-dependent default parameters with output condition (GNP)

Option-dependent default parameters leads to the risk that another program sequence results after modifying the options or after transferring a program to another machine. Thus, a parameter with the default value set in "Options" should not be transferred to the source code. Whether the default value is transferred can also be set using the "GNP Options" (see "Rexroth IndraMotion MTX Workshop Programming Turning and Milling", section "Tabs - General" in the chapter "GNP Options"). The following settings in file <VisualizationDevice>\user\config\ MTXGnpConfig_000_000.ini, Section "[View]", control the output (see also "Rexroth IndraMotion MTX Workshop Programming Turning and Milling", chapter "Options and User Settings"):

- "`ForceAT`"

  Responsible for the approach when turning
- "`ForceCV`"

  Responsible for the cutting variant when turning
- "`ForceTR`"

  Responsible for the edge radius when turning
- "`ForceTRV`"

  Responsible for the tool retract motion at the starting point before the cycle

If the value stored there is "1", each value is transferred to the NC program. If the value is "0", normal behavior applies, as it is the case with an option-dependent default parameter. This means that the parameter is only displayed if it is different from the default parameter.

To formulate the output condition with an option-dependent default parameter, enter "`!<placeholder_outputcondition>`" for `<behavior>` and the placeholder "`<placeholder_tech_setting>`" for `default`. Enclose each placeholder with percentage signs.

Example:

Option-dependent default parameter with output condition

An address parameter TRV is to control the retract motion to the starting point of a cycle. The default parameter is to be taken from the "GNP Options", value address "Tool_Rev_T_Out". If the parameter value corresponds to the default value, it is to be transferred to the NC program depending on the options (output condition "ForceTRV").

```
//%P% %@%TRV [0 without, 1 inclined, 2 X-Z, 3 Z-X] Retract motion %D%!%ForceTRV%%Tool_Rev_T_Out%
```

Only if found in the file MTXGnpConfig_000_000.ini

```
[View]
..
ForceTRV = 1
```

the parameter is unconditionally applied to the NC program.

Parameter-related graphics

Using an addition introduced by the "`%GF%`", an own graphic can be assigned to every parameter in an input mask, which temporarily hides the global graphic Global Mask Elements - Graphics, page 74). A parameter-related graphic is recommended if the effect of a parameter cannot be clearly represented in one or more global graphics.

<graphicfile>

Name of a graphic file without path including the extension ".bmp", ".jpg", ".gif" or ".tif". Size of the images 223 x 262 pixels (width x height). Enclosed file names with spaces with inverted commas.

<graphictitle>

As an input mask is automatically provided with multiple graphics if a graphic is parameter-related, assign a title to each graphic. These titles are displayed in the selection list above the graphic. The title includes the entire text following <graphicfile> to the end of the line or to the next reserved word enclosed by a percentage sign. To support multilingualism, a token can also be specified ("`%TNxxxx%`", see File Structure - Support of Multiple National and Regional Languages, page 68).

☞ Behavior towards parameter-related graphics changed. It is now incompatible. For MTX 10VRS and higher, there is an overlapping of the global graphic by the parameter-related graphics. Up to now, it was only necessary to activate the global graphic again in the following parameter using %GF%.

Adapt your input masks from older versions accordingly.

Example:

Parameter-related graphics

A cycle consists of two global graphics and one parameter-related graphic (to the second parameter).

```
//%P% Parameter 1
//%P% Parameter 2 %GF%GraphPar3.gif Effect of parameter 2
//%P% Parameter 3
//%GF% GraphGlob1.gif first variant
//%GF% GraphGlob1.gif second variant
```

Validation information <validinfo>

The validation of parameter values is defined irrespective of other parameters by specifying a parameter type (see Standard Parameter Types, page 76). This section shows how to provide further information (initiated via "`%VALID %`") which describes dependencies between individual parameters and how to declare a parameter to an obligatory parameter.

The validation information can trigger system-internal tests and lead to desirable, error-avoiding input obligations. Other relations are simply visualized graphically to illustrate a programming rule about one or more parameters to the programmer at a glance.

Only simple standard cases can be dealt with using the validation information. More complex relations between individual parameters have to be presented in an explanatory text.

Obligatory parameters

The declaration as obligatory parameter initially results in the parameter being labeled in the input table using the symbol . There is no test when transferring a call whether an obligatory parameter is actually filled out.

From a functional point of view and in case there is an unassigned obligatory parameter occurs in an output line, this line is inserted, even if no single parameter in this line is assigned. Without obligatory parameter labeling, a line without an assigned parameter is omitted. If this is an obligatory parameter in a parameter list, the call name and the brackets around the parameter list are also displayed. With position parameters, empty parameters are optionally filled so that the parameter list has the corresponding length for the subsequent acceptance of all mandatory parameters.

Instead of `<validinfo>`, "`MAND`" is programmed for a mandatory parameter.

Example:

Validation information of mandatory parameters

The parameter DT is a mandatory parameter.

```
//%P% %@%DT %TN2266% %VALID% MAND
```

Parameter pair

There are optional parameters which can only be programmed with one other or several other parameters. Parameters to be programmed in pairs can be identified by a symbolic string in the input mask connecting the corresponding parameters to each other. It is thus required to define all parameters of a pair amongst each other.

Instead of `<validinfo>`, "`PAIR`" is written into a parameter pair to which a list of placeholders is connected indicating on other parameters of the pair. These placeholders look as follows: `%P<pnr>%`. **<pnr>** is the continuous parameter number from top to bottom beginning with 1. When defining a pair, it is freely selectable on which parameter of the pair the references to the parameters belonging to the pair are entered.

Example:

Validation information of parameter pairs

A cycle has six parameters. The parameters 2 to 5 are to be optional and are to transfer the four corner coordinates of a machining window.

```
//%P% %@%ID INT[1..999] %TN0711%
//%P% %@%WHT %TN0712% %VALID% PAIR%P3%%P5%
//%P% %@%WHD %TN0713%
//%P% %@%WVL %TN0714%
//%P% %@%WVR %TN0715% %VALID% PAIR%P4%
//%P% %@%F REAL[0.001..99999] %TN0716%
```

In the example above, the PAIR entries are integrated in different parameters on purpose to show multiple options for a pair definition.

Param.	Comment	Value
ID	Ident of contour	1
WHT	Machining window outer border	50
WHD	Machining window inner border	20
WVL	Machining window left border	-60
WVR	Machining window right border	-25
F	Feed	

Fig. 4-6: Exemplary layout of the input table for the parameter pair

Alternative parameters

Many parameters exclude each other and cannot be programmed at the same time. This situation occurs occasionally with optional parameters, but is also possible with obligatory parameters. The only case supported within the input masks is the one that ensures that - at the most - only one parameter from an arbitrary number of parameters can be assigned. Other conditions, for example, two parameters out of three, are not implemented. The input table prevents the assignment of a second parameter from the group of alternative parameters by disabling all other input fields if a parameter is provided with a value. While correcting, a multiple assignment is detected and a corresponding error message is displayed. No additional symbols are displayed.

Instead of `<validinfo>`, "`ALT`" is written for alternatively used parameters. A list of placeholders follows indicating the alternative parameters. These placeholders look as follows: `%P<pnr>%`. **<pnr>** is the continuous parameter number from top to bottom beginning with 1. Also when defining alternative parameters, the parameter of the alternative group at which the references to the other related parameters are entered is irrelevant.

Example:

Alternative parameters

There is a turning cycle for which chip breaking can optionally be programmed. If chip breaking is to be activated, specify the distance CBD after which the chip is to be broken. In addition, program either a dwell time DWT or the number of dwell revolutions (combination of alternatively programmed parameters or parameters programmed in pairs).

```
//%P% %@%ZS %TN0801%
//%P% %@%ZE %TN0802%
```

```
//%P% %@%CBD REAL[0.0001..9999] %TN0803% %VALID% PAIR%P4%
%P5%
//%P% %@%DWT REAL[0.0001..9999] %TN0804% %VALID%ALT%P5%
//%P% %@%DWR INT[1..9999] %TN0805%
```

Param.	Comment	Value
ZS	Start coordinate	-20
ZE	End coordinate	-30
CBD	Distance per chip break	8
DWT	Dwell time during chip break	
DWR	Dwell revolutions during chip break	2

Fig. 4-7: Layout of the input table of alternative parameters for example

Syntax of Mask Definition - Special Parameter Types

Description Coordinate System "DCS"

For the graphic NC programming, the parameter type "description coordinate system" (DCS) was introduced. For more detailed information on the description coordinate system, refer to the "Rexroth IndraMotion MTX Programming Manual ", chapter "Geometry Definitions".

This parameter type does not have an address. It permits one of the planes declared in the GNP options to be selected for further programming or a new plane to be specified in DIN syntax. The DCS type implements the necessary default parameters and validation behavior. If this parameter type is used, the variable parameter names can be used in this mask for coordinate axes (%A1%, %A2% and %A3%, (see chapter File structure - Multiple National and Regional Languages, page 68) which depend on the DCS selected. The parameter type DCS cannot yet be used for the programming of an unwinding.

Syntax

```
//%DCS% <ptitle> {%GF% <graphicfile>{ <graphictitle>}}
```

With

<ptitle>

Assign a parameter title to the DCS. Specify the title as token ("%TNxxxx%") or as monolingual text.

A monolingual title text extends to the end of the line or to the next percentage sign outside a bracket.

<graphicfile>

Name of a graphic file without path including the extension ".bmp", ".jpg", ".gif" or ".tif". Size of the images 223 x 262 pixels (width x height). Enclose file names with spaces in inverted commas.

<graphictitle>

As several graphics are "automatically possible" with a parameter-related graphic, assign a title to each graphic. This title is displayed in the selection list above the graphic. The title includes the entire text after <graphicfile> to the end of the line or to the next reserved word enclosed by a percentage sign. To support multilingualism, a token can also be specified ("`%TNxxxx%`", see Chapter File Structure - Support of Multiple National and Regional Languages, page 68).

Example:

Using the DCS parameter type

An input mask is to be defined for the GNP geometry definition "Point Pattern on Pitch Circle" (PCI).

```
//%P% %@%ID INT[1..999] GeometryIdent %VALID% MAND
//%DCS% Description coordinate system
```

```
//%P% %@%%A1% Center point of main axis %VALID% MAND
//%P% %@%%A2% Center point of secondary axis %VALID% MAND
//%P% %@%R REAL[0.0001..9999] Radius %VALID% MAND
//%P% %@%NR INT[1..999] Number of points %VALID% MAND
//%P% %@%SA Angle of first point
//%P% %@%EA Angle of last point %VALID% ALT%P9%
//%P% %@%A Angular pitch
```

Parameters with Variable Binding

☞ In MTX 08VRS and lower, a special parameter type was supported. For that type, only CPL variables could be specified instead of a constant value. This data type whose definition started with "`//%VAR%`" cannot be used any longer.

Replace this type in older input masks by a default type. To assign a value via a CPL variable or a CPL expression, enclose the expression/variable with square brackets in the input field as for an Inline CPL.

Syntax of mask definition - Output format

Using the "output format", the part of the syntax of the call belonging to the input mask is defined. It includes more than the collection of the individual parameters. The output format includes the compilation of the parameters and their combination with other unchangeable block components and comments.

Objective

The output format defines the syntax of a call, which, during correction, also permits the unique input mask identification which suits a piece of program text best. The format forms the link between the NC program and the input mask.

An output format can contain any number of characters.

Syntax

```
//%N% {<format>} {<comment>}
```

With

<format>

The format of the call(s) is stored under `<format>` in the form in which it is to be displayed in the NC program. Enter the call names and the brackets enclosing the parameter lists. Unchangeable block components are displayed in their final form. Placeholders are provided for the parameters:

"`%P%`" stands for all parameters appearing in the order of their definition (see also chapter Syntax of Mask Definition - Standard Parameter Types, page 76).

If the parameters are distributed across several parameter lists or if position parameters require a different order than given in the parameter definition, control each parameter individually. Placeholders looking as follows "`%P<pnr>%`" are again used. <pnr> is the continuous parameter number from top to bottom beginning with 1.

No comma has to be inserted between the placeholders in a parameter list. The commas are automatically inserted. The insertion of spaces cannot be controlled by the format specification.

For simple and therefore single line cycle calls (see chapter Advanced Systematization of Calls, place 65), the specification of the brackets enclosing the parameter list and the placeholders can be omitted in this exceptional case. Only the call name has to be specified. For parameters without address, a parameter list in square brackets and for parameters with address, in round brackets follows automatically.

<comment> The comments initiated with a semicolon can either directly be specified or as a separate line after the call. In monolingual texts, the semicolon is written first and then the comment. If multiple languages are to be supported, a semicolon is not to be specified, but only a token as follows `%TNxxxx%` (see chapter File Structure - Support of Multiple National and Regional Languages, page 68). Comments in round brackets are not supported except for NC notes.

- If comment lines are to be added to multiline calls (via the output format or by subsequent editing), note that the number of comment lines between two DIN lines is limited to 4. Once this limit is exceeded, not all lines belonging to the format can be found during the correction. This can result in missing parameter values in the input table and double assignments when transferred to the program.
- Comments supported by multilingualism are only generated during insertion. During correction, comments remain untouched. There is also no translation into another language if a language setting - differing from the language setting during the insertion - is active when correcting the call.

Example:

Output formats

Program a cycle with position parameters. A monolingual comment is to be added to the call.

```
//%N% G84[%P%] ;Thread drilling
```

Program a cycle with address parameters. Add a multilingual comment to the call.

```
//%N% G722(%P%) %TN0722%
```

Write a functional comment to describe a tool for the simulation. The definition sequence of the parameters is to be different to the sequence in the parameter list. At the end of the line, add an unchangeable block component as Inline CPL.

```
//%N%                //TOOL/STANDARD,%P2%%P3%%P4%%P5%%P1%\\
[""+NCF("G90")]
```

A complete tool change (travel to the tool change point, tool change, a comment, an NC note and a master block) is to be provided for a lathe. The machine is provided with two spindles.

```
//%CHBEGIN%
//%NAME% Tool change
//%P% %@%X Tool change point X (diameter) %D%200
//%P% %@%Z Tool change point Z %D%250
```

```
//%P% ENUM[M105 Spindle 1, M205 Spindle 2] Spindle stop
before tool change
//%P% INT[1..12] T-number %VALID% MAND
//%P% %@%MSG STRING NC note
//%P% ENUM[DIA Diameter, RAD Radius] X-scaling %D%DIA
//%P% ENUM[G17 G17, G18 G18, G19 G19] Interpolation plane
%D%G18
//%P% %@%G REAL[54..59.6] Zero point offset %D%54.1
//%P% ENUM[G97 Speed, G96 Cutting velocity] Spindle pro-
gramming constant ... %D%G97
//%P% %@%S1 REAL[0.001..99999] 1. Spindle value %VALID%
PAIR%P11%
//%P% ENUM[M103 right, M113 right KM, M104 left, M114
left KM] First spindle command %D%M114
//%P% %@%S2 REAL[0.001..99999] Second spindle value %VAL-
ID% PAIR%P13%
//%P% ENUM[M203 right, M213 right KM, M204 left, M214
left KM] Second spindle command
//%N% G0 DIA G53 G90 G48 %P1% %P2% %P3%
//%N% ;------------ Tool change -----------
//%N% T[%P4%] M6
//%N% (%P5%)
//%N% %P6%%P7%G47%P8%%P9%%P10%%P11%%P12%%P13%
//%CHEND%
```

Configuring the NC program editor/text editors

Overview on the configurations steps

Editor types

To edit text files and NC programs, there are two editor types in IndraWorks Operation:

- NC program editor
- Text editor

The NC program editor provides additional functions for the NC programming while the text editor is more simple and also suitable for bigger files.

☞ The following steps can be made either in the NC program editor or in the text editor. Thus, it is simply called "editor" in the following description.

Configuration steps

The same options to adjust and change are provided for both editor types. During installation, each editor is provided with all functionalities and a basic layout. Thus, no configuration steps are required when working with each editor. Special user or machine manufacturer requirements can be configured. The following configurations are distinguished:

Options

The editor behavior and its layout can be set under **Tools ▸ Options ▸ Editor Options...**:

- Criteria when to use the editor types
- Tab positions
- Font

- Behavior when assigning block numbers

The options of the editor are modified in IndraWorks Operation. The settings are assigned to the Windows user currently logged in and may only be changed in exceptional cases during commissioning. Thus, these settings are not described in detail in the commissioning manual. Instead, it is referenced to the chapter "Options - Options Editor..." in the manual "Rexroth IndraMotion MTX Standard NC Operation".

Data for input support

Both editors are provided with identical input assistances. These are integrated tools that insert individual words or complete sections and partially also correct them. This procedure is dialog-guided.

Data can be provided for the following parts of the input assistance:

- The **NC block sequences** are programming templates
- The **input masks** are input tables to edit parameter values to instructions

The input masks of the user and machine manufacturer, the information on hidden input masks as well as the NC block sequences are part of the IndraWorks project.

F-keys of the input support

The function keys to insert commands/calls via input mask can be changed in their allocation. These settings are made in IndraWorks Engineering.

Two configurable F-panels are available. The following section describes the particularities when adjusting these panels.

The F-keys of the editor are part of the IndraWorks project.

F-keys for input assistance

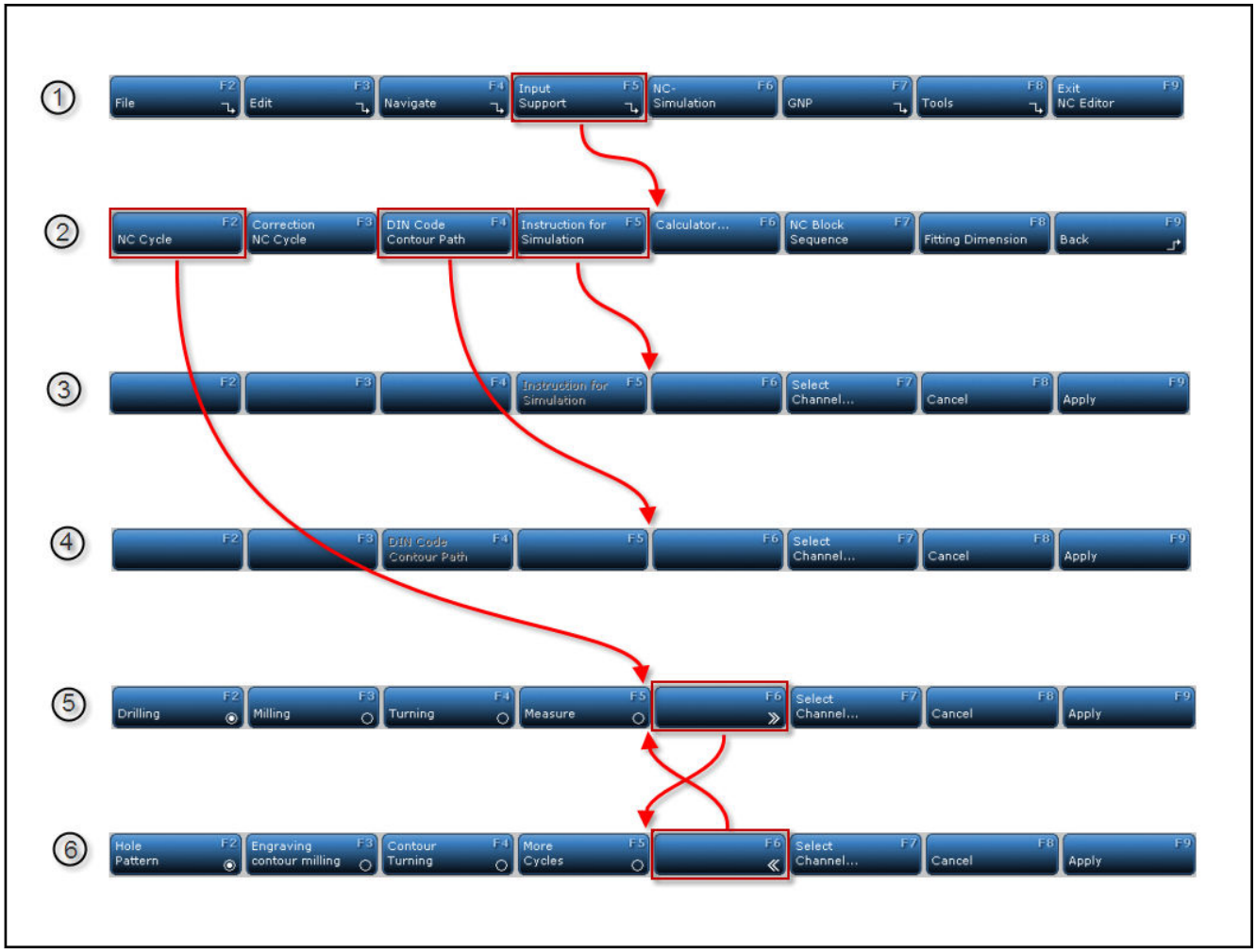
General information on F-panels

F-panels

In total, there are four F-panels to insert instructions via input masks:

1. For the configurable **"left part of the menu"**, also refer to legend (5) in the following figure. This panel named "InsertCycle1", also called left half of the menu, is the entry level when inserting cycle calls and is referred to as **"InsertCycle1"**. On this panel, group filters and different characteristics can be combined for each F-key. When pressing this key, the provided mask scope is reduced to those provided with at least one of the characteristics listed in the filter. Switching between different group filters is illustrated by the selection buttons for these keys. If the number of requested different filters does not fit on one panel, the key for switching to a subsequent level is provided
2. The subsequent level is called **"right half of the menu"** and named **"InsertCycle2"**. This panel can also be configured and has to be provided with a key for level switching back to the left menu level
3. The non-configurable panel with **instructions for simulation**
4. The non-configurable panel for **DIN instructions and contour drafts**

HMI commissioning



(1) Main level
(2) "Input support" panel
(3) "Instruction for Simulation" panel
(4) "DIN Code Contour Drafts" panel
(5) "Left half of the menu" panel (name "InsertCycle1")
(6) "Right half of the menu" panel (name "InsertCycle2")

Fig. 4-8: Overview on F-panels for insertion via input masks (default assignment shown)

F-keys *Five special functions are allowed on the configurable F-panels "InsertCycle1" and "InsertCycle2":*

- **"Set Cycle Group Editor"** to define a group filter
- **"Level Switching Editor"** to switch between the left and the right half of the menu
- **"Channel Selection Editor"** for additional limitation of the menu to one channel
- **"Cancel Entries Editor"** to discard entries
- **"Apply Parameters Editor"** to add the call to the NC program

F-panel editor The panels are adjusted in the F-panel editor in IndraWorks Engineering.

The F-panels "InsertCycle1" and "InsertCycle2" may not be deleted.

When modifying the F-panel, the following rules are to be observed (IndraWorks Engineering does not verify whether they are complied with) apart from the exclusive use of the five named functions:

Function "Set Cycle Group Editor"

"Set Cycle Group Editor"

The "Set Cycle Group Editor" function allows the key to enable a specified group filter. The "Group" combo box lists all predefined group characteristics. Select a group or enter multiple group names separated by spaces. Individual group names can also be used.

The chapter Syntax of Mask Definition - Properties of an Input Mask (Grouping), page 72 describes how the input masks are assigned to the individual groups and the significance of the predefined groups.

Rules

The following rules and particularities apply:

- F-keys with this function are automatically subject to a selection functionality
- Each key can be assigned to one graphic. Its position (preferred orientation on the bottom right, X=5 and Y=3) is used to set the selection button graphic
- F-keys, whose group filters specify an empty set, are hidden and do not have to be deleted
- Two group filters without an empty set are to be specified at least on each panel. Alternatively, all group filters may specify an empty set on the panel "InsertCycle2" or all keys with the "Set Cycle Group" function may be deleted. Both conditions cause that the "InsertCycle2" panel is not displayed in the dialog.
- A group name can be used an unlimited number of times on different F-keys.
- Always intend one F-key with the group filter "_OTHERGROUPS". This special filter is for groups that are not selected on other F-keys by a filter. If such unassigned input masks exist, these are hidden and cannot be inserted.
- Assign F-keys with group filters consecutively.

HMI commissioning

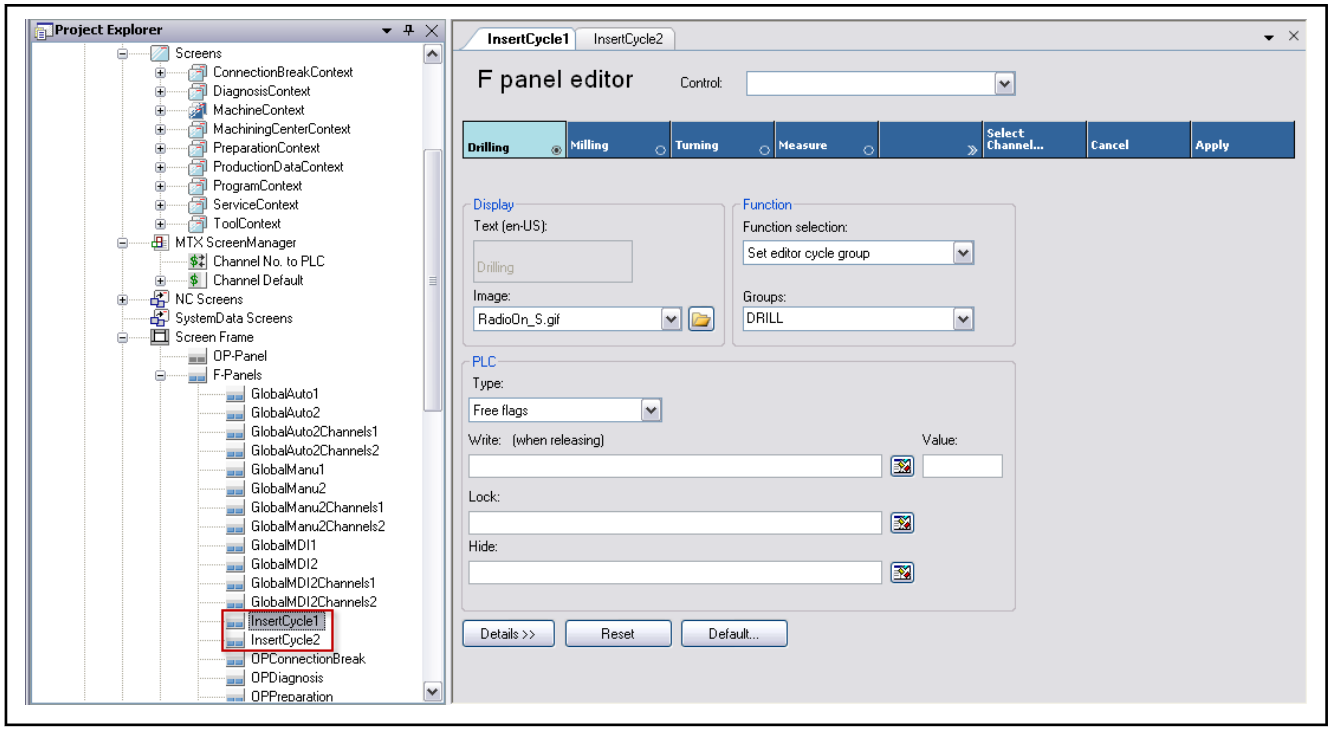


Fig. 4-9: Configuring F-keys of the input support "Set Cycle Group Editor"

Function "Level switching editor"

"Level Switching Editor"

The "Level Switching" function switches between the left and the right half of the menu. Enter the next F-panel name under "Level Name".

Rules

The following rules and particularities apply:

- The panel name always has to be the counterpart of "InsertCycle1" and "InsertCycle2" of the currently edited panel.
- If all group filters of the "InsertCycle2" label empty sets, the key to switch to the level "InsertCycle2" is hidden. In this case, it may be deleted or overwritten with the "Set Group Editor" function
- The "Level Switching Editor" function may be allocated at any position on the panel

Function "Channel selection editor"

"Channel Selection Editor"

The "Channel Selection" function enables a dialog in which a channel or the setting "channel-comprehensive" can be selected.

Rules

The following rules and particularities apply:

- If there is only one channel or the channel-related hiding of input masks is not used, the key with the "Channel Selection" function is hidden. In this case, it may be deleted or overwritten with the "Set Group Editor" function
- The "Channel Selection Editor" function may be allocated at any position on the panel. It is recommended to keep <F7>, since the channel selection is located on other non-configurable editor panels on <F7>

Function "Cancel entries NC editor"

"Cancel Entries NC Editor"

The "Cancel Entries" function quits the input mask and returns to the editor view.

Rules

The following rules and particularities apply:

- This function has to be present on each panel.
- The function can be allocated at any position on the panel. It is recommended to keep <F8>, since "Cancel Entries NC Editor" is located on other non-configurable editor panels on <F8>

Function "Apply parameters NC editor"

"Apply Parameters NC Editor"

This function applies the edited instruction to the editor and returns to the editor view.

Rules

The following rules and particularities apply:

- This function has to be present on each panel.
- The function can be allocated at any position on the panel. It is recommended to keep <F9>, since "Apply Parameters Editor" is located on other non-configurable editor panels on <F9>.

Handling instruction: Configuring the editor - Input assistance

Creating basic conditions

☞ Configuring the input assistance of the editor is optional.

Basic conditions

Ensure or create the following basic conditions:

1. An IndraWorks project is created
2. A visualization device is created in the project
3. Visualization data is transmitted and activated

Applying input masks by importing cycles

Applying input masks by importing cycles

☞ The cycle import comprises the input masks as well as the cycle subroutines stored in the NC file system. Thus, there is a partial overlapping with the chapter 135Setting Up NC Cycles, page 135.

The configuration is made in IndraWorks Operation.

If input masks are present from another project, proceed as follows:

1. Switch to the "program" operating area
2. Select an existing file with the extension ".npg" in the file list of the navigator Alternatively, a new NC program can also be created instead. Select a directory in the directory tree, press <F2 New> → <F3 NC Program>, enter any short text and complete the editor with <F9>. In this case, also select the new NC program.
3. <F8 NC Prog. Functions> → <F5 Import Cycles ...>
4. Select the import file (extension ".ncc") and press **Open**
5. Select the cycle package (origin) to be imported:
   - USER cycles are input masks and cycle files of the user
   - OEM cycles are input masks and cycle files of the machine manufacturer

   Press **OK**.

Creating Input Masks

To create an input mask, external programs of the Windows operating system or similar programs such as the file explorer, text editor and graphic editor are used. The input masks are tested in IndraWorks Operation.

HMI commissioning

Examples as templates

For MTX 12VRS or higher, examples of input masks are provided when creating a new project. These input masks are suitable for familiarizing with the mask definition technique. This is the most effective procedure to define individual masks from already existing ones.

Activating examples

The familiarization with the examples shows the possibilities of input masks and helps to specify the requirements on the input masks.

The example input masks are normally hidden and can be shown as follows:

1. Switch to the "Program" operating area
2. Open the editor To do so, select an existing file in the file list of the navigator and open it with <F6 Edit> or via the context menu. Alternatively, a new file can also be created instead. Select a directory in the directory tree and press <F2 New> → <F3 NC Program> or <F4 Text File>. The context menu can also be used instead
3. <F8 Tools> → <F8 Options> → <F4 Adjust Input Support...>
4. Select the "Examples" node on the "Availability" tab and press OK
5. <F9 Return>

Work with input masks as follows:

1. <F5 Input Support>
2. <F2 NC Cycle> → <F6 >>> → <F5 More Cycles> (This key sequence is the standard key assignment for input help)
3. Select an example (SAMPLE1 ... SAMPLE4) and enter the parameter values. Use the online help as well with <F1> to find explanations on the examples.
4. Apply with <F9> and continue with the next example starting at point 2.

Testing examples

Test the example input masks by editing all parameters and inserting calls into the NC program.

The following examples with increasing complexity are provided:

- Example 1: Simple example with position parameters without foreign language support
- Example 2: Simple example with pre-assigned address parameters, two global images and foreign language support
- Example 3: Advanced example with mandatory, standard and alternative programmed parameters or parameters programmed in pairs. Individual image per parameter
- Example 4: Multi-line example of DIN programming

Defining individual input mask

Define the first input mask as follows:

1. Create a copy of the file C:\Documents and Settings\All Users\application Data\Rexroth\IndraWorks\Project\<Visualization Device>\user\config\cycles\SampleMasks.cyc in the same directory. The copy can have any name, but the extension ".cyc" has to be kept.
2. Open the cyc file with a text editor. Select the most suitable example mask.
3. Edit the individual elements of the mask definition one after the other. First, do not use any tokens for multilingualism, but texts in your language. The line "//%LANG%" has to be converted to a comment using a semicolon in front.
4. Creates the images in a size of 223 x 263 pixels in the same directory using an external graphic editor and enters the name to the cyc file (behind %GF%).

5. Assign the mask to one or several groups (//%GROUP%).
6. Delete the masks that are not required and save the cyc file.
7. Test your input masks in the editor of IndraWorks Operation and correct them if required. The mask definition saved in the editor is always updated after closing all editors.
8. To support several languages, copy SampleMasks_EN.txt and create one text file each for your native language and at least one more for English. Fill out the token and write the token number %TNxxxx% to the cyc file. Enable the //%LANG% instruction (remove preceding semicolon) and replace the name by your text file (without country code and extension). Test the multilingualism of the input mask in the editor. Note that the multilingual support of the modified texts is only displayed after an IndraWorks Operation restart.
9. If there are online helps, copy them to the subfolder Help\<Country Code> and adjust them to the instructions //%HELPFILE% and //%HELPTOKEN%. Otherwise, the mentioned lines have to be deleted or converted to a comment using a semicolon.
10. One user mask is now defined. Any further number of input masks can be added to this or another cyc file. As machine manufacturer, move all files belonging to the just defined masks to the folder C:\Documents and Settings\All Users\Application Data\Rexroth\IndraWorks\Project\<Visualization Device>\OEM\config\cycles.

Hiding input masks

Machine manufacturers often have to remove input masks of some standard cycles, since the machine is not suitable for certain technologies or there are no axes for certain motions. In principal, input masks can be hidden in the options of the editor (IndraWorks Operation). The option is available for machine manufacturers and users if the respective user permission is granted.

To remove certain input masks from this adjustment dialog, proceed as follows:

1. Create a copy of the file C:\Documents and Settings\All Users\Application Data\Rexroth\IndraWorks\Project\<Visualization Devices>\user\config\cycles\SampleMasks.cyc in the directory C:\Documents and Settings\All Users\Application Data\Rexroth\IndraWorks\Project\<Visualization Device>\OEM\config\cycles\. The copy can have any name, but the extension ".cyc" has to be kept.
2. Open the cyc file with a text editor. Delete all example masks except the last one (SAMPLE 5).
3. Open the file IndraWorks\config\cycles\MTX.Cycles.Canned.cyc with an editor in the installation directory.
4. Copy all lines of the input mask to be hidden beginning with //%N% to the clipboard.
5. Replace the existing //%N% line with the content of the clipboard.
6. If the input mask to be suppressed is located in the line //%NAME% of an instruction %SIGN%, also transmit this line to the new cyc file.
7. Any further number of input masks to be suppressed can be added to this or another cyc file.

Example:

Example of hiding an input mask with additional signature

This is the definition of the input mask that is to be hidden:

```
//%CHBEGIN%
//%LANG% MTXCyclesCanned
//%NAME% %TN801% %SIGN%_RptPnt
//%GROUP% DIN
//%GF% Contour_Chamfer_Round_Base.gif %TN809%
//%P% %@%X REAL %TN802%
//%P% %@%Y REAL %TN803%
//%P% %@%Z REAL %TN804%
//%P% %@%CHL REAL[0..9999] %TN805% %GF% Contour_Chamfer_Length.gif %TN809% %VALID%ALT%P5%%P6%
//%P% %@%CHS REAL[0..9999] %TN812% %GF% Contour_Chamfer.gif %TN809%
//%P% %@%RND REAL[0..9999] %TN806% %GF% Contour_Round.gif %TN809%
//%P% %@%FL REAL[0.0001..99999] %TN807%
//%C% %TN811%
//%C% %TN1000%
//%C% %TN1001%
//%N% G0 (%P4%%P5%%P6%%P7%)%P1%%P2%%P3%
//%HELPFILE% MTX_StandardNCCycles.chm
//%HELPTOKEN% ncc.ContourBezelCurve.htm
//%CHEND%
```

Apply the call signature from //%N% (parameters can be omitted) and set the group characteristic "_HIDDEN". Since an additional signature was arranged with %SIGN%, add this together with the line //%NAME%.

```
//%CHBEGIN%
//%NAME% %TN801% %SIGN%_RptPnt
//%GROUP% _HIDDEN
//%N% G0
//%CHEND%
```

Loading Data from Operating Station

To backup input masks or block sequences in the "IndraWorks Engineering" project, start IndraWorks Engineering, right click on the node of the visualization device and start the process under **Visualization Data ▸ Load changes from the operating station**.

F-keys of the input support

Menu Design

At a new project, the IndraWorks Operation editor is provided with a menu structure to select groups of input masks that covers all existing and not permanently hidden input masks. There is no channel-specific restriction. If groups are irrelevant for the machine, it can be required to replace menu keys without function with menu keys with functions or to omit the "right half of the menu".

Preliminary considerations

Ask the following questions:

1. Which different group names are interesting for my project? Which groups should not be hidden?

Determine the group names known by installed and individual input masks as follows:

- Start the IndraWorks Operation desktop and switch to the "Program" operating area.
- Open the editor To do so, select an existing file in the file list of the navigator and open it with <F6 Edit> or via the context menu. Alternatively, a new file can also be created instead. Select a directory in the directory tree and press <F2 New> → <F3 NC Program> or <F4 Text File>. The context menu can also be used instead
- <F8 Tools> → <F8 Options> → <F4 Adjust Input Support...>
- All groups are listed first on the "Availability" tab. The tooltips of the group nodes indicate the respective group names.
- After pressing the key **F-Key View**, the current menu structure and the groups and input masks hidden below can be seen.

2. Is a channel-dependent reduction of the scope of the provided input masks required? "No" if there is only one existing channel.

Determining the menu design

Specify the menu structure for the two configurable panels "InsertCycle1" and "InsertCycle2". The two groups "DIN" (DIN programming, contour draft) and "SIM" (instructions for simulation) are located on panels that cannot be changed. These do not have to be considered.

The groups can be distributed on the F-keys as follows:

- No channel-related menu restriction is required.
  - If limited to one panel, six F-keys for group selection are available. Further keys are "Cancel" and "Apply".
  - In case of two panels, ten F-keys are available in total for group selection. Three keys each are reserved per panel for level switching, "Cancel" and "Apply".
- A channel-specific menu restriction is required. It applies that the scope of the provided masks can vary channel-specifically, but not the menu design.
  - If limited to one panel, five F-keys are available for group selection. The remaining three keys of the panel are required for channel selection, "Cancel" and "Apply".
  - In case of two panels, eight F-keys for group selection are available. The remaining four keys per panel are required for level switching, channel selection, "Cancel" and "Apply".

Think about the future menu structure without considering the groups to be hidden. Each function key can be assigned to several groups. Several F-keys can also be assigned to groups.

In the standard menu structure, the group filter "_OTHERGROUPS" is on the F5-key of the panel "InsertCycle2". This name stands for the remaining groups that are not selected as group filters by other F-keys. This filter should absolutely be assigned to a function key, since all new groups added at a later point in time appear under this filter. If no key is unassigned, assign this filter to a key already considered for another assignment.

Configuring Function Keys

This configuration measure is listed in IndraWorks Engineering.

Transmitting and activating data

If IndraWorks Operation is still running, close this application now.

To activate the panels in the editor, right-click on the node of the visualization device and start the process under **Visualization Data ▸ Transmit and Activate**.

Configuring in the F-panel editor

The configurable panels of the input support in the editor can be adjusted as follows:

1. Select the node **Visualization Device ▸ ScreenFrame ▸ F-Panels ▸ InsertCycle1** in the Project Explorer. That is the panel of the left half of the menu. Open the node via the context menu or double-click.
2. First, edit the keys to set the group filters:
   - If a new labeling is required, delete the key first
   - If a key for level or channel selection should be used for group selection, delete this key before as well
   - Enter a new text if necessary
   - Select an image (e.g. RadioOff_S.gif) and correct its position if required. It has to be located on the bottom right, at the position X=5 and Y=3
   - Select the function "Set Cycle Group Editor"
   - Determine a group filter under "Groups". Several group names are separated by a space
   - Repeat step 2 for all other keys for group selection. Delete keys that are not required
3. If the key for level selection is required but different compared to the standard, delete the future key and provide it with the respective image (Next_Level_S.gif or Last_Level_S.gif). The function is set to "Level Switching Editor". Select the opposite of the currently edited panel under "Panel Name".
4. Delete the key for channel selection if still available and not required.

Keys without function are hidden. They do not have to be deleted.

5. To support multiple project languages, enable more languages under **Project ▸ Language ▸ Select Project Language...** and label the keys again.
6. Repeat the points 2 to 5 for the panel "InsertCycle2". If the right half of the menu is not required, delete all keys with the function "Set Cycle Group Editor" on this panel.

Hiding Individual Groups and Input Masks

The configuration step is made in IndraWorks Operation.

Hiding and Sequence

Proceed as follows to hide specified input masks:

1. Switch to the "Program" operating area.
2. Open the editor To do so, select an existing file in the file list of the navigator and open it with <F6 Edit> or via the context menu. Alternatively, a new file can also be created instead. Select a directory in the directory tree and press <F2 New> → <F3 NC Program> or <F4 Text File>. The context menu can also be used instead
3. <F8 Tools> → <F8 Options> → <F4 Adjust Input Support...>
4. Deselect all nodes on groups and masks that are not required anymore. Go down to the channel node for a channel-specific menu restriction.
5. The key **F-Key View** can check the assignment to the keys

6. To adjust the sequence of the masks, enable the "Sequence" tab and move the masks accordingly.
7. Press **OK**.
8. Check the menu design via <F9 Return> → <F5 Input Support> → <F2 NC Cycle>.

Loading Data from Operating Station

To backup menu adjustments in the project, start IndraWorks Engineering, right click on the node of the visualization device and start the process under **Visualization Data ▸ Load Changes from Operating Station**.

4.3.7 WinStudio

"WinStudio" is a high-performance collection of automation tools to create HMI applications.

WinStudio is described in detail in an individual manual.

4.3.8 Operating screens

Operating screens are used for the manual operation using M-keys. The current position of the moved axis as well as the states of freely configurable PLC variables can be displayed. The meaning of the individual states is determined when configuring the operating screen. It is additionally displayed whether an action can be executed.

Operating screens are described in detail in the "IndraWorks HMI" manual.

4.4 Screens

A general description to create and edit "screens" is described in the "IndraWorks HMI" manual.

Screen and operating areas can be created via the "Screens" node.

Each screen has to be assigned to one operating area.

A "screen" consists of a screen frame ("ScreenFrame") and a screen application ("ScreenApplication"). The screen frame consists of different panels and the machine status area ("header"). An application created with one of the tools below the "ScreenApplication" node is located in the center of the screen.

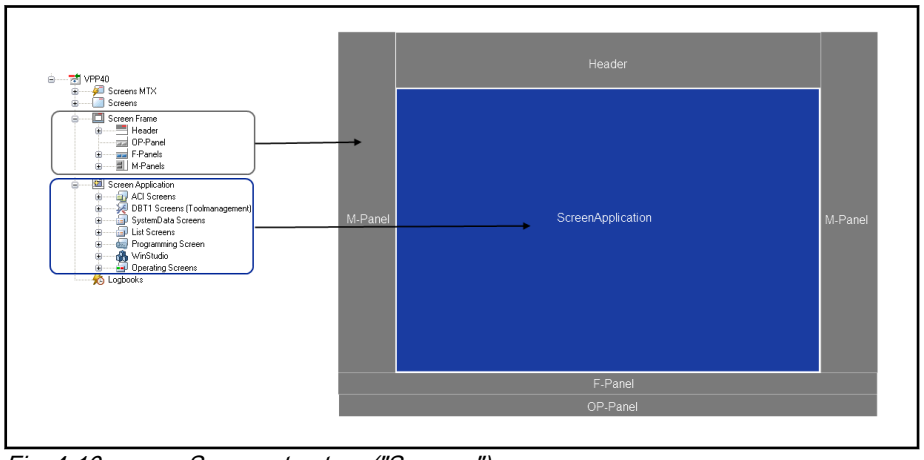


Fig. 4-10: Screen structure ("Screens")

Such a screen is composed below the "Screens" node using the "Screen - Configurator". This "Screen configurator" can be used to select the desired panel and application (out of the existing ones) and to position the screen accordingly.

"Screens" assigned to an operating area are displayed in the tree below it. The panels and applications assigned to the screen are also shown as link in the tree below the corresponding "Screens".

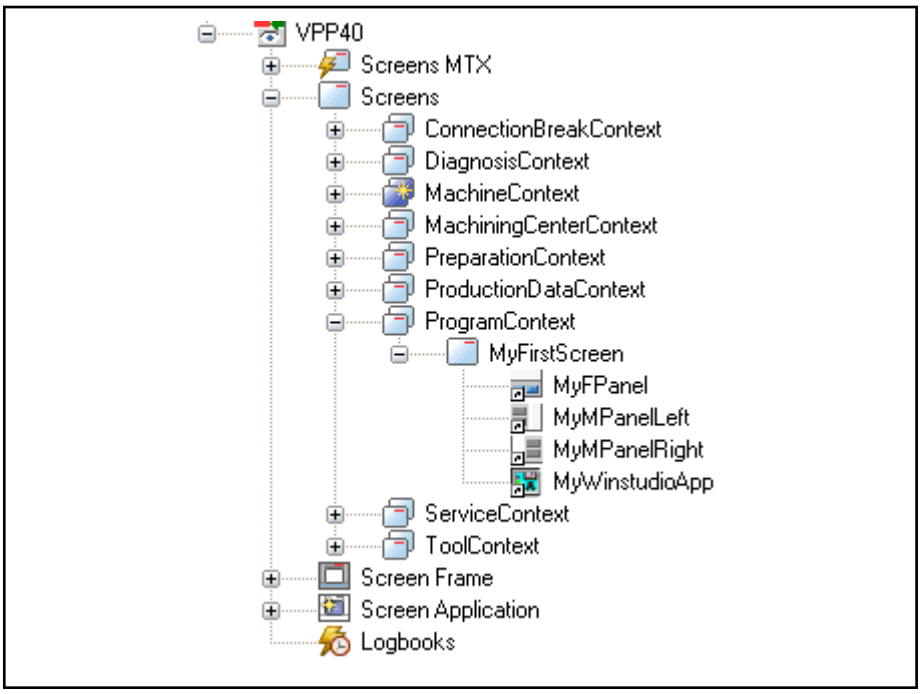


Fig. 4-11: Operating area (ProgramContext) with screen (MyFirstScreen) and assigned "panels" and application

4.5 MTX screens

4.5.1 General information

Events can be defined below the "Screens MTX" node. These events add screens defined here to IndraWorks Operation.

They are valid either for one channel or for all channels. Alternatively, the event can also be created so that it only applies if no individual events exist for one channel. For the definition, the validity range (that is the channel) is determined first. The corresponding event is then created below.

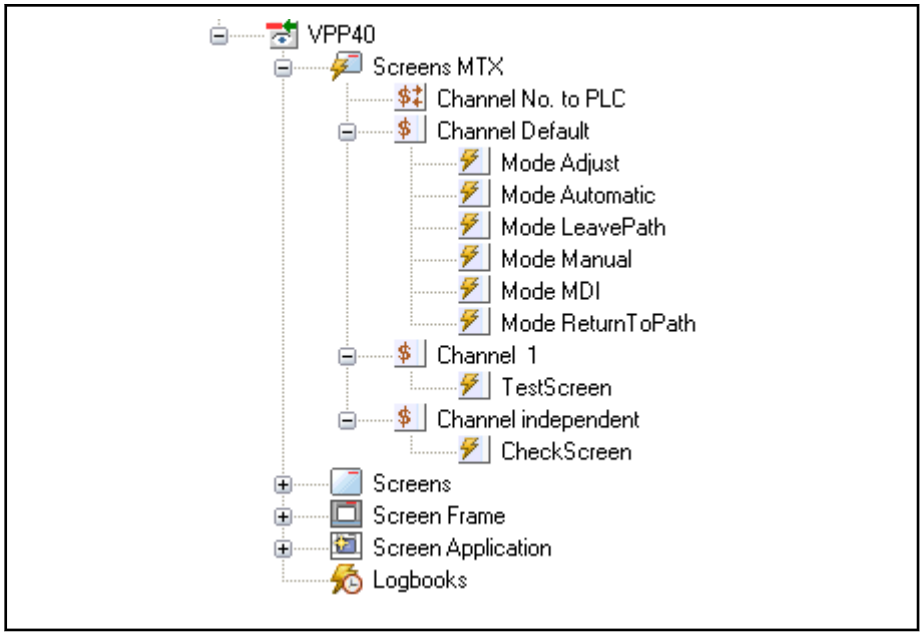


Fig. 4-12: Events

The event type can either be the state of a PLC variable (PLC) or of an SCP item (SCP). A specified operation mode of the control can additionally be selected as constant (CONST). Apart from "ACI Screens", simple "Screens" can also be assigned as screen type.

The "M-panels" assigned in "Screens" act locally. However, the "M-panels" assigned in "Screens MTX" act globally.

Local "M-panels" only remain active as long as the screen assigned to them is activated. Global "M-panels" always remain active. The only exception is if a screen with local "M-panels" is currently activated. If a screen without "M-panels" is activated, the latest activated global "M-panels" for this screen are displayed.

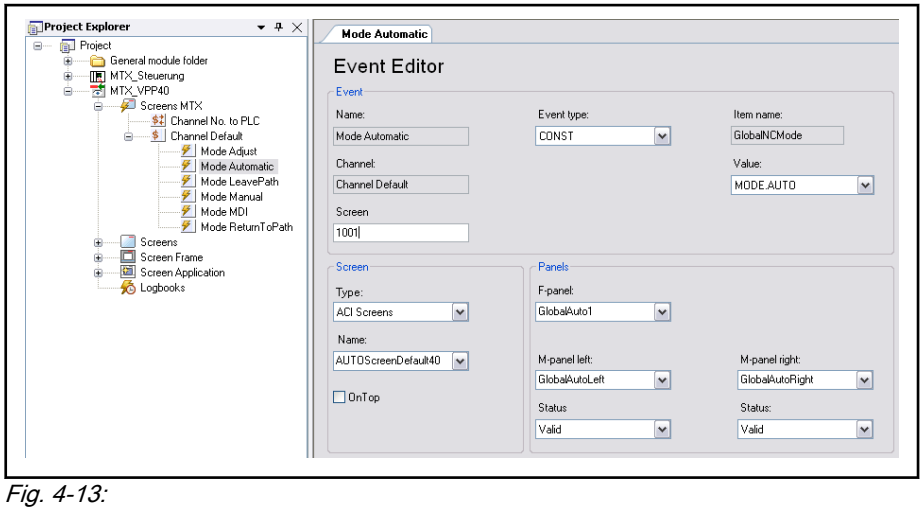


Fig. 4-13:

4.5.2 Validating MTX screens

For a general description on the validation of visualization data in the HMI, refer to the HMI manual **"DOK-IWORKS-HMI*Vxx****-APxx-EN-P"**

HMI commissioning

Checked criteria

When validating the "Screens MTX" visualization data, the following criteria are checked:

- Uniqueness and validity of the event names
- Uniqueness and validity of the screen numbers
- Specification and validity of the referenced screen elements
- Validity of the references F-/M-panel
- Validity of PLC variables
- Specification of event type, item name and item value
- Uniqueness of PLC variables to handle the active channel number in the PLC

Overview on error numbers

Each detected problem during the validation of the visualization data obtains an ID. Use this ID to find information on cause and remedy in the following table:

ID	Cause	Recovery
MTX-00010201	Event name is not unique	Rename the event
MTX-00010202	The event name contains at least one of the following characters: \ / : * ! ? " < > |	Remove the special characters from the event name
MTX-00010210	PLC variables could not be checked	Assign an MTX control to the visualization device
MTX-00010211	Screen number is not unique	Open the event editor and enter a unique screen number
MTX-00010212	ASUP number invalid	Open the event editor and select an event type from the selection list
MTX-00010213	F-panel is invalid	Open the event editor and select an F-panel from the selection list
MTX-00010214	M-panel is invalid	Open the event editor and select an M-panel from the selection list
MTX-00010215	PLC variable is invalid	Include the variable in the symbol configuration or select a valid PLC variable
MTX-00010221	Screen name was not specified	Open the event editor and select an event type from the selection list
MTX-00010222	Event type was not specified	Open the event editor and select an event type from the selection list
MTX-00010223	Item name or PLC variable not specified	Open the event editor and select an item name or a PLC variable

MTX-00010224	Item value was not specified	Open the event editor and enter an item value
MTX-00010231	The PLC variables to handle the active channel number in the PLC are identical	Open the Properties dialog and enter different PLC variables for reading and writing

Tab. 4-47: Overview on the error IDs of the validation messages

4.5.3 Active channel number - Transferring to PLC/Changing via PLC

Only one channel is active at a time in "IndraWorks Operation". Thus, all displays refer to this channel.

To report the active channel to the PLC or to change it via the PLC, proceed as follows:

1. Declare an integer variable in IndraLogic.
2. Provide this variable in the symbol configuration.
3. Enter the instance path of this variable into the "ChannelNo. to PLC" dialog.

"IndraWorks Operation" writes the number of the active channel to this variable at runtime. Alternatively, changing this variable in the PLC causes that the active channel in "IndraWorks Operation" is switched.

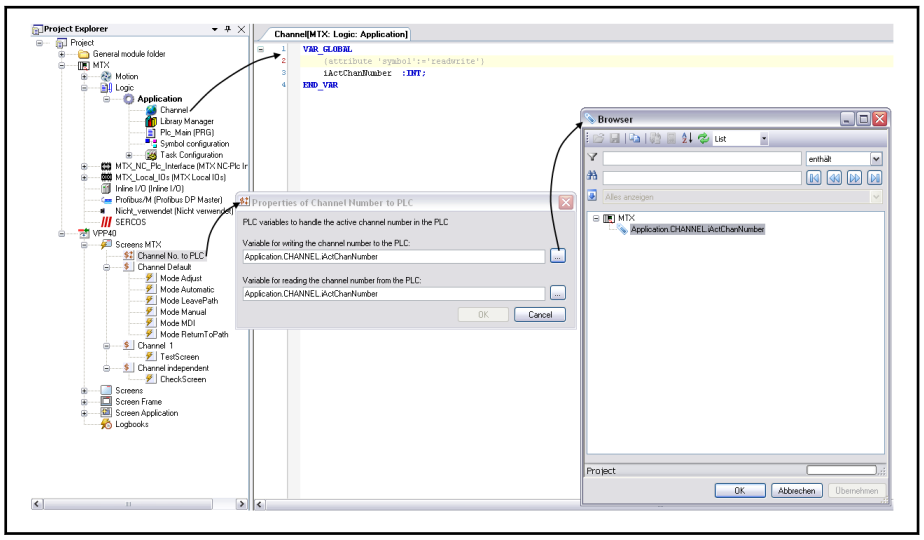


Fig. 4-14: Example of the channel number in the PLC

5 Control commissioning

5.1 Introduction

The commissioning of an MTX control is basically determined by control data, drive data and the PLC program.

Control data Control data is exclusively available in the control, but it can be stored in an archive in the IndraWorks project. They consist of all data stored in the file system of the control and of the machine parameters determining the basic response of the control. Files on the control are either NC programs or configuration files for the tool management, variable lists, D-corrections, zero points, placements and system data.

Drive parameters Drive parameters determine the basic responses of a drive. They are stored on the drive, but can also be provided via the offline parameterization in IndraWorks Engineering.

PLC program The PLC program controls the response of the periphery. It is stored as compilation on the file system while the sources for the project planning and configuration are stored in IndraWorks Engineering.

5.2 MTX control, configuration

5.2.1 Configuring the MTX

General information

☞ *This configuration is available for the following actions:*

- Wizard when creating an MTX
- Menu item **Properties** in the MTX context menu

Control commissioning

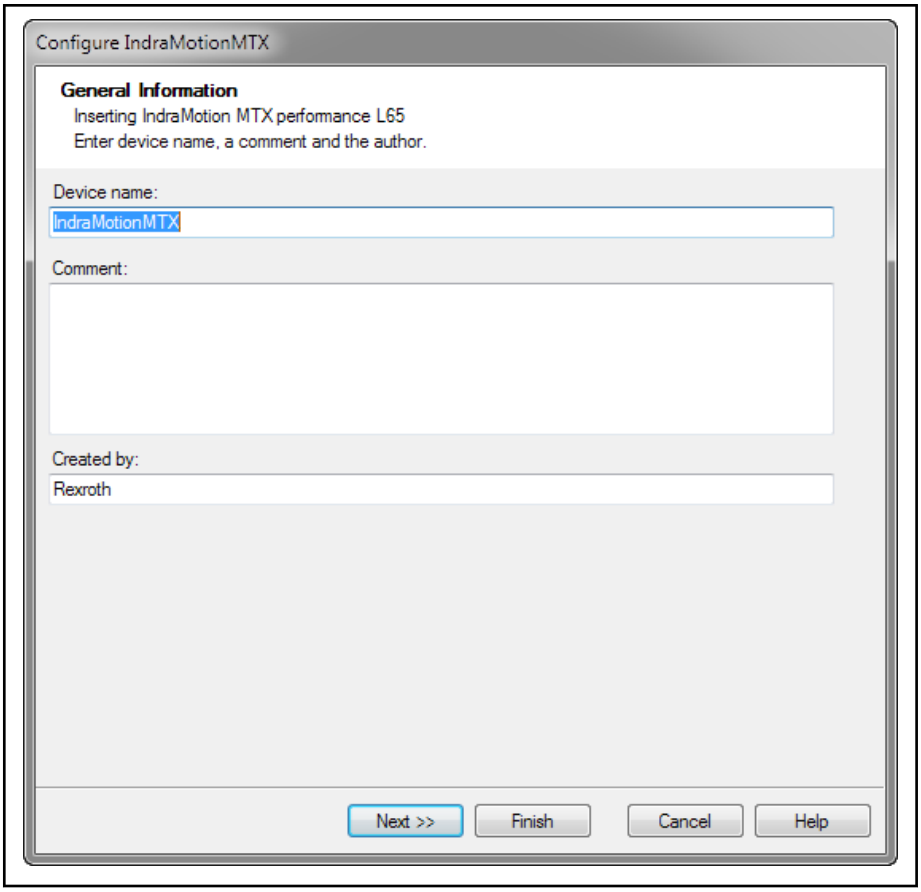


Fig. 5-1: Dialog: Configure IndraMotion MTX (General Information)

Enter the general information on the device:

- Device name:

  Name of the device displayed in the Project Explorer. The name has to comply with the IEC 61131-3 standard.
- Comment:

  Comment on the device. This is also shown as tooltip in the Project Explorer on the device.
- Created by:

  Author or editor of the device.

  The Windows user is entered as presetting.

Configuration and communication

☞ *This configuration is available for the following actions:*

- Wizard when creating an MTX
- Menu item **Properties** in the MTX context menu

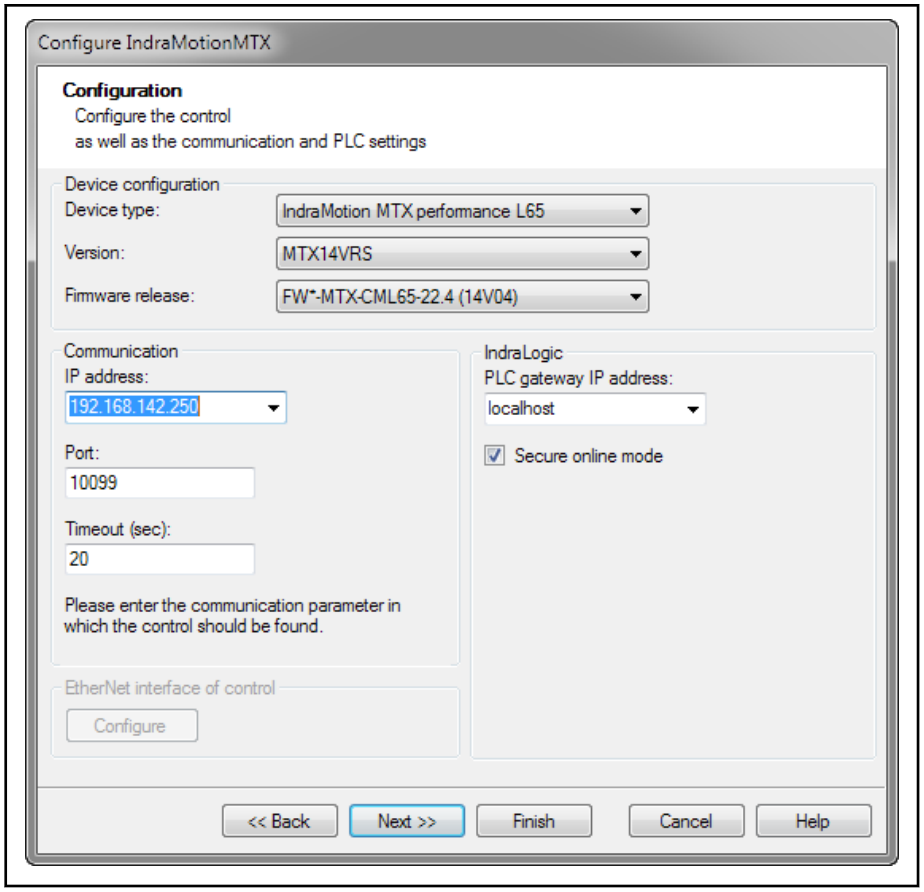


Fig. 5-2: Dialog: Configure IndraMotion MTX (configuration and communication)

Select the settings affecting the device version and the communication to the control.

The configuration is divided into four areas:

- **Device configuration**

  Select which device variant and which firmware release is to be used.

  - **Device type**

    Select the hardware of the control here.

    Upon online switching it is verified if the connected hardware is compatible with the selected hardware.

  - **Version**

    The version is used as filter to display the firmware release.

    Only versions supported in the current compatibility mode can be selected.

  - **Firmware release**

    The firmware release specifies the firmware version within the version.

    The firmware can subsequently be modified. If the project has been loaded in compatibility mode, the compatibility mode has to be updated to the current or required IndraWorks version.

- **Communication**

  - **IP address:**

IP address to reach the control.

- **Port:**

  Port to reach the control.

  Default value: 10099.

  Normally, this value does not have to be changed.

- **Timeout (s):**

  Period in which the communication requests have be answered to avoid an error report.

  Default value: 20s.

  Normally, this value does not have to be changed.

- **Ethernet interface of the control**
  - **Configuration**

    Calling the Ethernet configuration under: Ethernet configuration, page 110.

    After changing the IP address, it is immediately applied to the project.

    This function is only available if there is an online connection to the control.
- **IndraLogic**
  - **Gateway IP address**

    The gateway IP address specifies on which network participant the IndraLogic gateway is used.

    Default value: localhost. The gateway runs on the Engineering PC.
  - **Secure online mode**

    A security prompt is sent in online mode before each action causing changes in the data of the PLC runtime system.

Configuring function modules

☞ *This configuration is available for the following actions:*

- Wizard when creating an MTX
- Menu item **Properties** in the MTX context menu

☞ The options in the dialog to configure the function modules can be distinguished according to the device type.

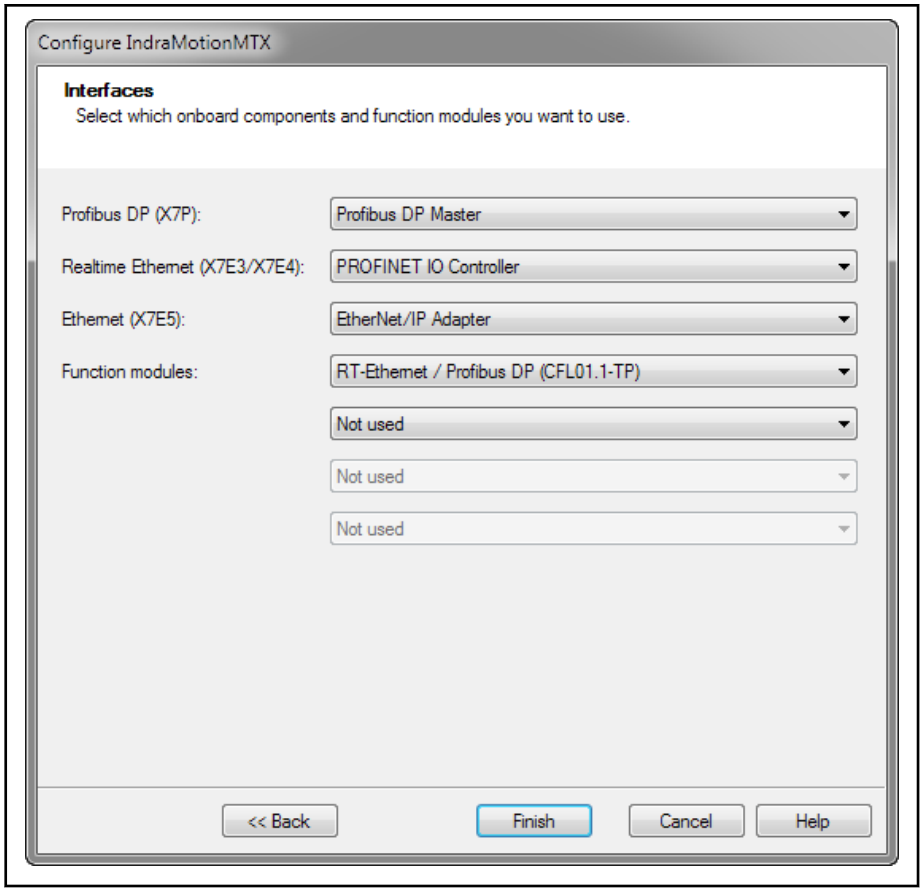


Fig. 5-3: Dialog: Configure IndraMotion MTX (function modules)

The interface and optional function modules of the control can be managed here:

- **Profibus DP configuration**

  Current Profibus configuration that can be selected when inserting the device. "Profibus DP master", "Profibus DP slave" or "Not used" can be selected.

- **Realtime Ethernet configuration**

  Current Profinet or Ethernet/IP configuration that can be selected when inserting the device. "Not used" or Profinet or Ethernet/IP interface can optionally be selected.

- **Ethernet configuration**

  Current Ethernet/IP configuration that can be selected when inserting the device. Ethernet/IP-adapter and "Not used" are the available options.

- **Function modules**

  Up to four function modules can be coupled to the "IndraMotion MTX". If required, select the function modules from the respective lists. The logic order of the created function modules has to correspond to the physical function module position at the control.

If a Safety function module (Safety CPU) is connected to the control, make sure that in the function module order, this Safety function module has to be positioned at the last or lowest position of the configured function modules.

Device data

This configuration is available for the following actions:

- Menu item **Properties** in the MTX context menu

  An existing online connection to the MTX is a prerequisite.

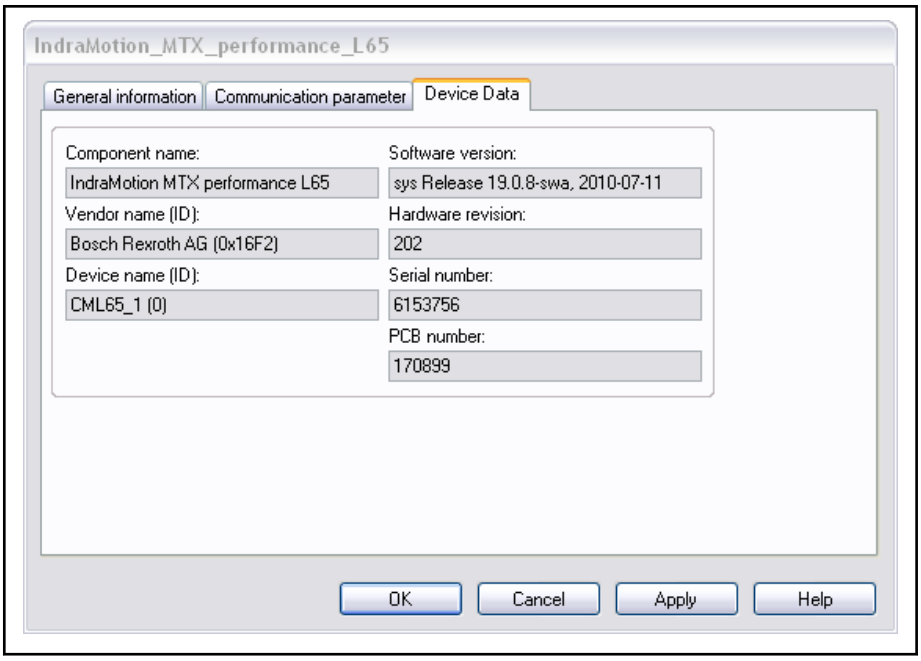


Fig. 5-4: View of device data in the MTX properties

The information on the "Electronic Label" of the control is shown here. This information is used to identify the device.

Configuring the Ethernet interface

This function is only available for MTX variants to mount the control cabinet (IndraControl L).

Open it either via the context menu or in the "Properties" dialog of the MTX on the "Communication Settings" tab.

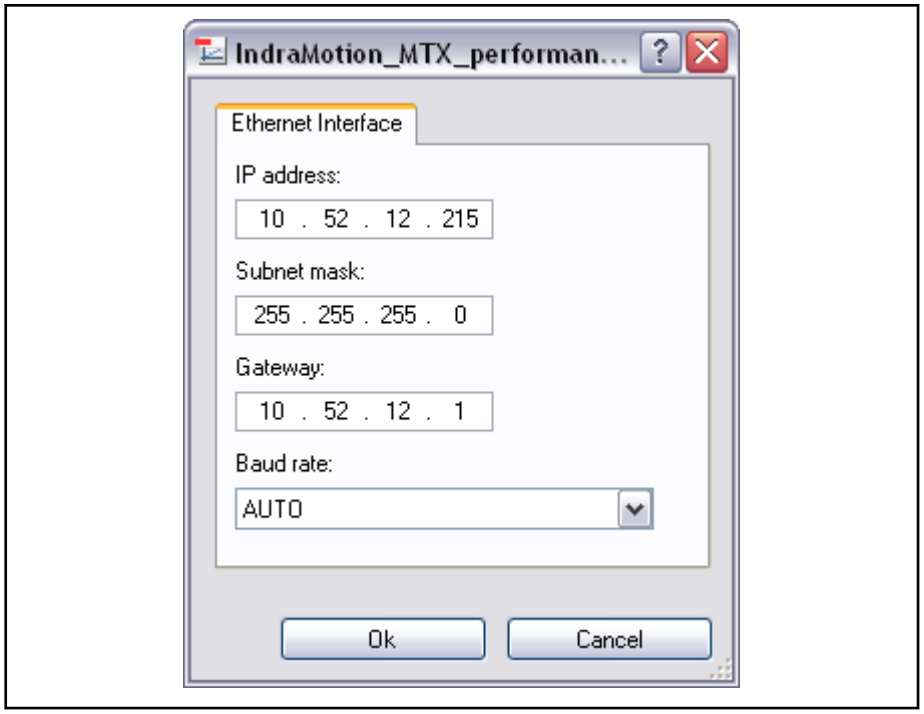


Fig. 5-5: Configuring the Ethernet interface of the MTX control

The parameters of the network interface of the control can be adjusted here:

- IP address:

  IP address used by the control to report in the network or under which it can be reached.
- Gateway:

  The control establishes a connection to the network via the gateway. Gateway and control have to be in the same subnet.
- Baud rate:

  Baud rate used by the network interface. The default setting is "AUTO" and is only to be changed if reasonable. The best configuration is automatically determined in this setting.

☞ Changes of the Ethernet interface are applied after a control restart. When the IP address changes, the setting in the project is additionally adjusted. After a successful control startup, the project can be immediately reconnected.

5.3 Adding the MTX control to the project

5.3.1 Creating a project

To create a new project, click in the start screen on "Create Empty Project".

A new project can also be created via **File ▸ New ▸ Project...**.

The following settings can be made in the wizard to create a new IndraWorks project:

- **Name**

  Freely selectable project name
- **Directory**

  Directory in which a new project is created.

The default setting is the directory "My Documents".

- **Project language**

  By selecting the project language, the language of the user texts is determined.

The newly created project is displayed in the Project Explorer with the previously defined project name.

5.3.2 Adding MTX to the project

There are the following options to create a control in the project:

- **Inserting from the library**

  Drag the device **IndraMotion MTX ▸ IndraMotion MTX performance L65** from the "Drive and Control" library to the project in the Project Explorer.

- **Inserting via context menu**

  Select the "Add" context menu item at the project node. The device can be selected from the opened list.

The wizard to configure the MTX starts subsequently (see chapter 5.2 "MTX control, configuration" on page 105).

5.4 MTX control, export and import

5.4.1 Exporting MTX nodes

Starting the process

Select **Export...** in the context menu of the MTX node.

User input

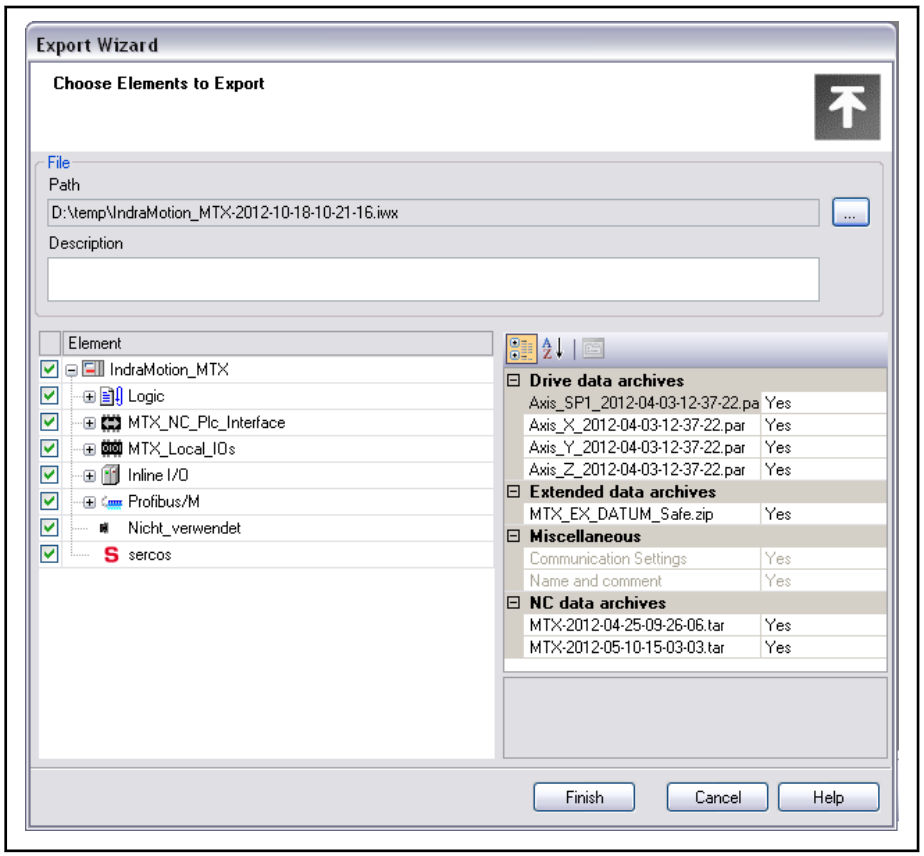


Fig. 5-6: Dialog: Export Wizard (exporting an IndraMotion MTX)

The storage location and the name of the export file are specified in the export wizard.

The project elements to be exported can be selected in the tree.

Some project elements provide and extended selection. Individual archives stored in the project can be selected and deselected for the MTX. All archives are selected by default.

The following archive types are available:

- Archives of the drive data
- Archives of the control data
- Archives of the extended data

General information such as communication settings and name are always exported and can thus not be deselected.

After the selection, press "Finish".

5.4.2 Importing MTX nodes

Starting the process

Select **Import...** in the context menu of the MTX node and then the file to be imported.

Control commissioning

User input

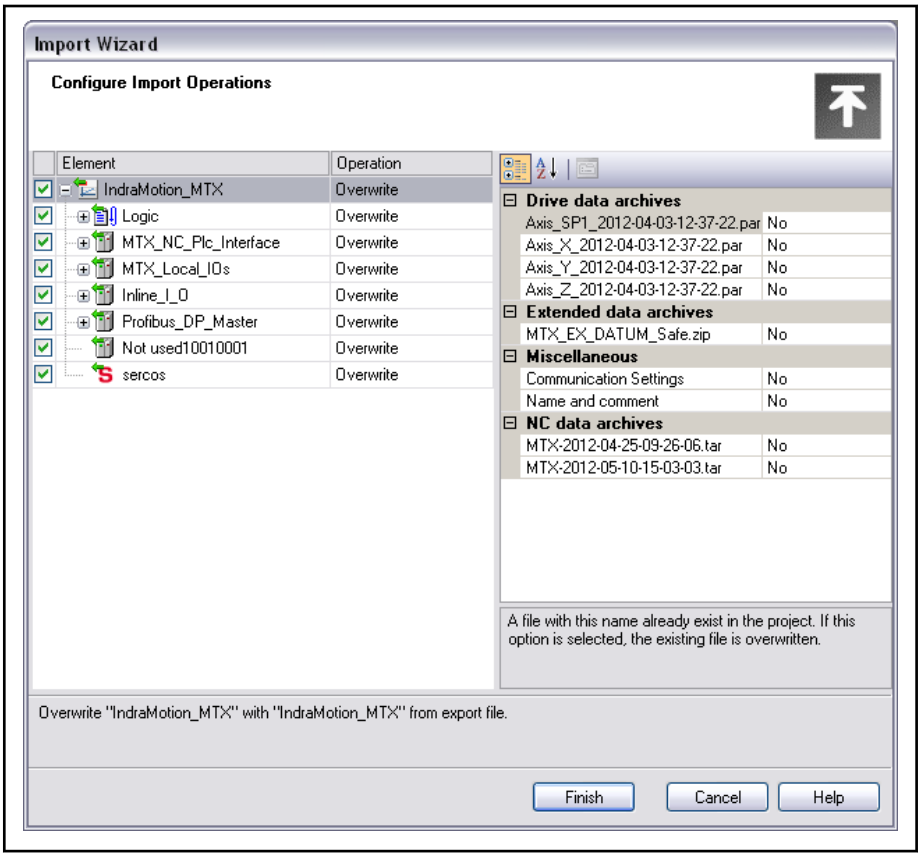


Fig. 5-7: Dialog: Configure import operations (import of an IndraMotion MTX)

All existing elements are displayed in the tree.

It can be selected for each element whether it is to be imported.

The MTX provides the following extended selection:

- **Archives**

  All archives in the export file are listed. By default, archives are only applied to the project if not an archive exists with the same name.

- **Communication settings**

  While overwriting, communication settings are only applied if selected explicitly before.

- **Name and comment**

  While overwriting, device name and comment are only applied if selected explicitly before.

User input when importing the old control generation

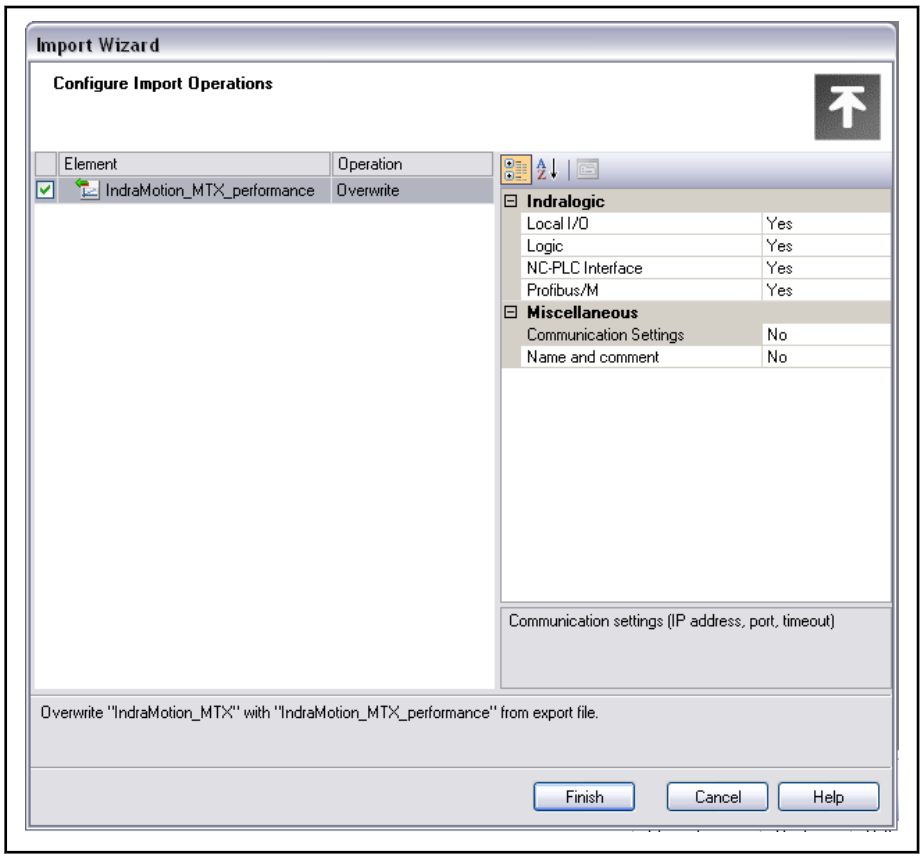


Fig. 5-8: Dialog: Configure import operations (import of an IndraMotion MTX)

Only the MTX is displayed in the tree.

The PLC parts imported by the 1G can be selected in the advanced settings.

When selecting the "Logic", the contained elements (e.g. POUs, variable lists, libraries) are subsequently selected as in case of the Logic data transfer.

5.5 MTX Emulation

5.5.1 General information

The "MTX Emulation" maps the response of an MTX control. Depending on the set control type (e.g. IndraMotion MTX performance L85), the compatible MTX-Emulation is always executed.

Thus, it is possible develop and commission a significant part without hardware, i.e. without a real MTX control.

5.5.2 Starting and completing

The "MTX Emulation" is activated and deactivated using the context menu of the control node.

Control commissioning

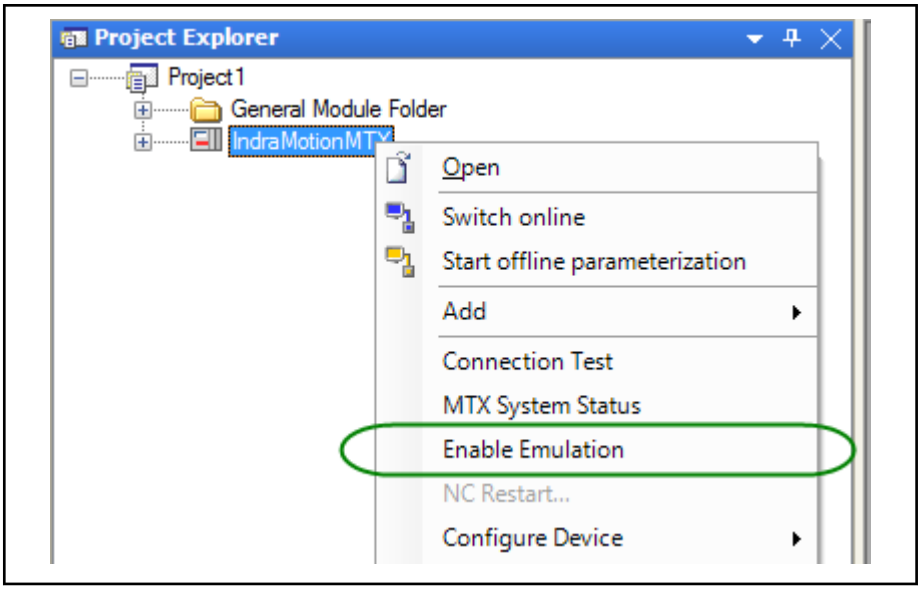


Fig. 5-9: Activating the emulation

At the control node and its context menu, it is displayed that the MTX-Emulation is active.

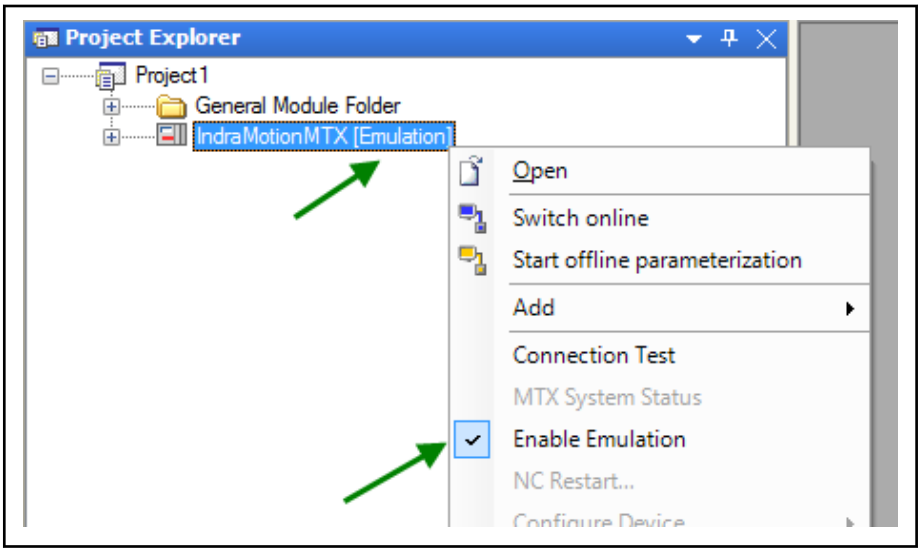


Fig. 5-10: Emulation active

As long as the MTX-Emulation is active, all control-specific actions (e.g. online, NC configuration etc) act on the MTX-Emulation and not on the configured control address (IP address).

A maximum of 10 emulations can be active simultaneously!

5.5.3 Data storage

All data (e.g. machine parameters, system data, etc.) of an MTX emulation are stored related to the project or the control but are not part of the (*.xiwp) project file and cannot be added to version control (VCS). The emulation data is contained in the export of the control. If there are several controls in a project, the data is available separately for each control.

5.5.4 Compatibility

Depending on the selected device version, the compatible emulation version is automatically started. Thus, it is ensured that the emulation data always match the selected version.

If no compatible emulation version is installed, a message is output upon start. Subsequently, a newer emulation version can be used. In this case, ensure that only functions are used that are available in the selected version.

5.6 MTX system status

5.6.1 Introduction

The MTX system status is a commissioning and diagnostic application for 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 advanced L85
- IndraMotion MTX micro

This application can be accessed via the device node context menu in IndraWorks Engineering.

☞ The control does not have to go online for this application!

After opening the application, it is displayed in IndraWorks Engineering.

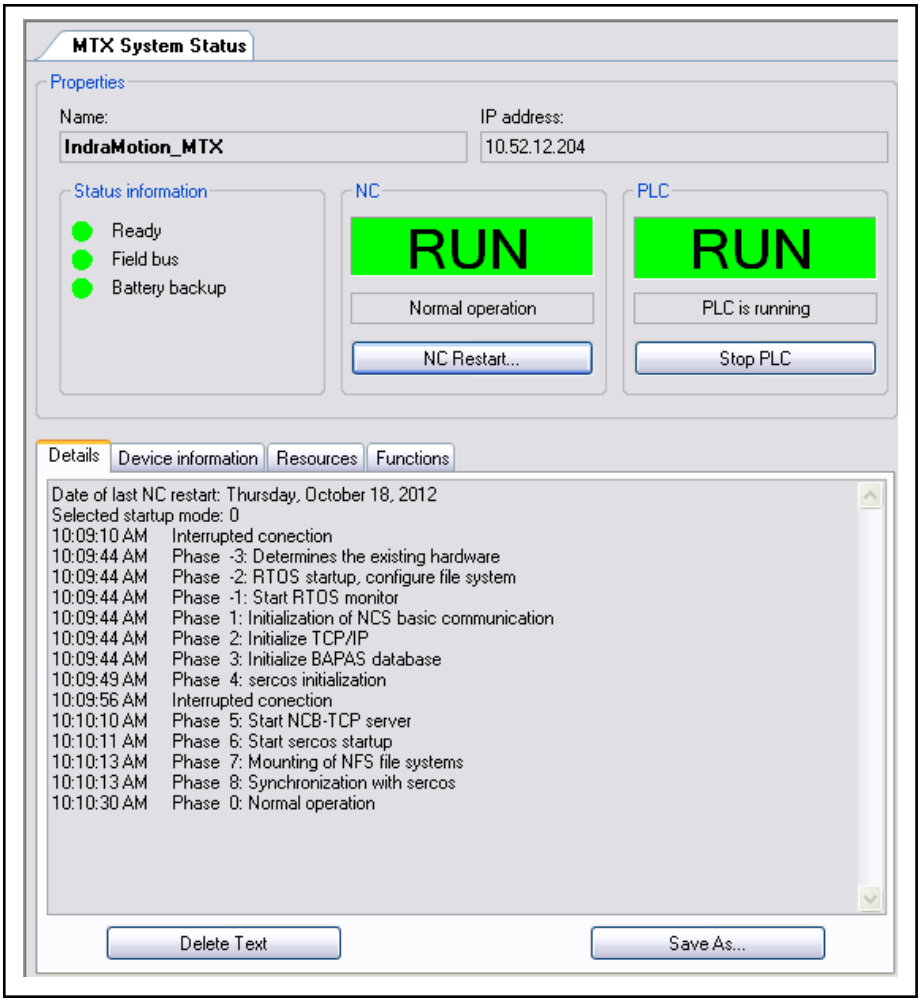


Fig. 5-11: MTX system status

The MTX system status is divided into two sections.

The general information which is divided into several sections and which is always visible to the user can be found in the upper section.

Three tabs which can be changed by the user contain various information and can be found in the lower section:

- "Details" tab
- "Device Information" tab
- "Resources" tab

5.6.2 General information

"Name and IP address" field

This is an area of the upper application section in which the following information is displayed:

- **Name**

  The name to be configured for the respective control in the project tree is displayed. A name change in the project tree becomes immediately visible in the application.

- **IP address**

  The IP address entered into the network configuration is visualized.

Field "Status info"

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

"NC" field

In this area, the NC information is displayed:

- **Status field of NC**

  This field visualizes the current NC status which is displayed in color and short form. The used abbreviations are described in chapter "Start-up" on page 122.

  This field is flashing during control startup.
- **Info field with long status name**

  The abbreviations in the status field are explained to the user in this field.
- **Button for NC restart**

  By means of this button, the user can execute an NC restart. After actuating this button, the following dialog is opened in which the user can specify the Startup mode (see chapter "Startup mode" on page 123) for the restart:

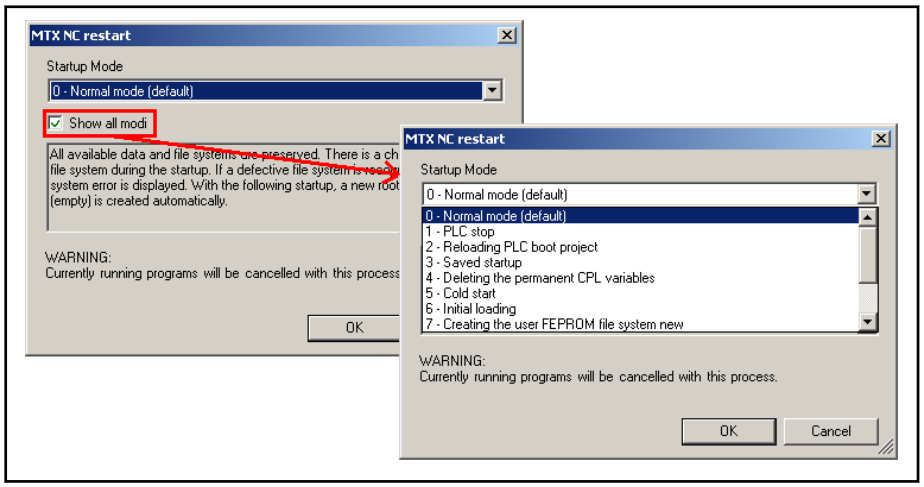


Fig. 5-12: MTX NC restart

If the checkbox "Show all modes" is not selected, the user can only chose between 3 modes.

- 0 - Normal mode (standard)
- 6 - Bootstrapping
- 7 - Creating the user FEPROM file system

Control commissioning

"PLC" field

In this area, the PLC information is displayed:

- **Status field of PLC**

  This field visualizes the current PLC status. This status is displayed in color and as a short form.

  – **RUN** is displayed on green background during normal mode in the display.

  – If the PLC is at standstill, **STOP** is displayed on red background.

- **Info field with long status name**

  The abbreviations in the status field are explained to the user in this field. The following long names exist:

  – RUN = PLC is running

  – STOP = PLC is at standstill

- **Button to start/stop the PLC**

  If the PLC is running, it can be started or stopped using this button.

5.6.3 Tabs

"Details" tab

In this tab, the results of the last control restart **executed using this application** are visualized. Date, time, phase and their meanings are displayed. The display is refreshed after each restart.

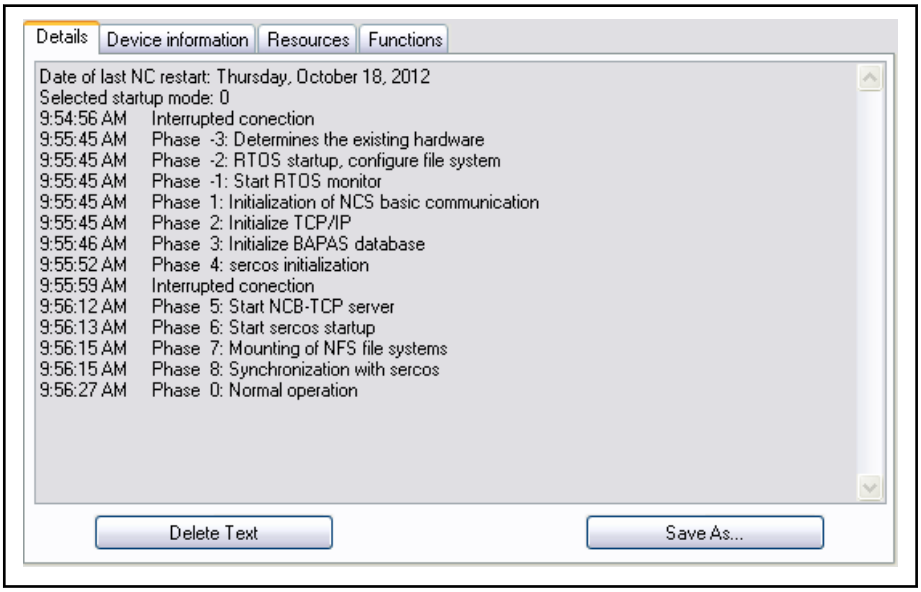


Fig. 5-13: "Details" tab

If required, this information can be saved in a *.log file. The path under which the file is to be saved is arbitrary. The application saves this information under the default name "Details.log".

"Device information" tab

The following information on the control is displayed on this tab:

- Firmware version
- Circuit board number
- Hardware version

- Serial number

For more details on the firmware version, press "Details":

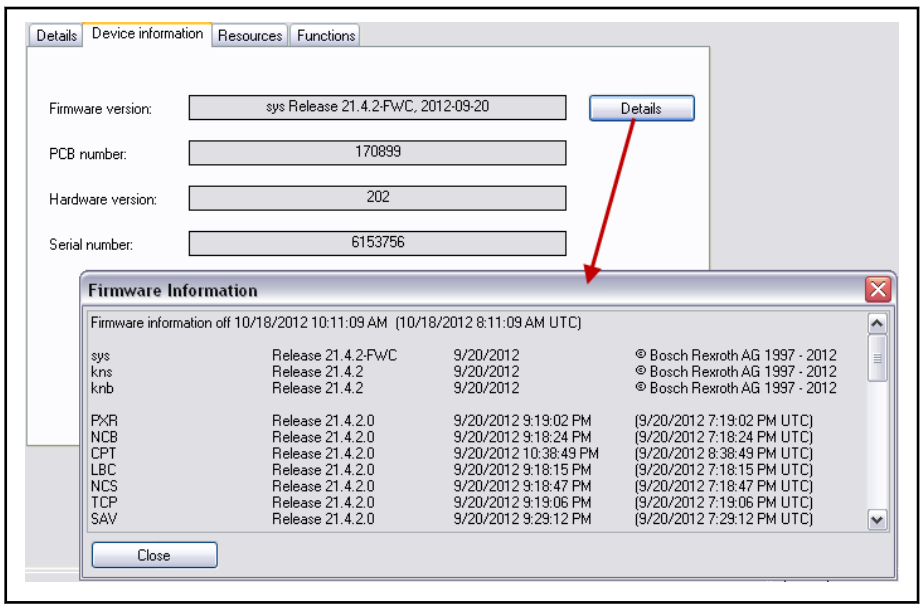


Fig. 5-14: "Device Information" tab

If no connection is established to the control, the fields on this tab are blank.

"Resources" tab

The current memory usage is displayed in this tab.

The system of the IndraMotion MTX control requires memory of the basic functions. The memory available reduces by this value.

The following information is visualized:

- Memory of the permanent CPL variables (approx. 1% of the system is assigned)
- Memory of the persistent SD data (approx. 1% of the system is assigned)
- Memory of the RAM file system (approx. 30% of the system is assigned)

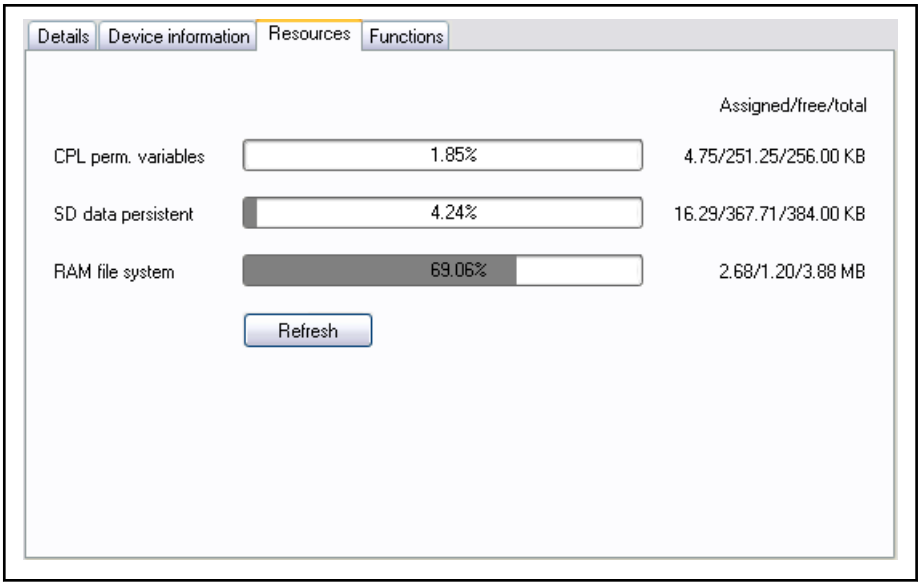


Fig. 5-15: "Resources" tab

The bar visualizes the memory consumption in per cent. For detailed information, go to the tooltips of the corresponding bars.

5.6.4 Startup configuration

Startup

The MTX starts when switching on the control or 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, configuring file systems
P: -1	Starting RTOS monitor
P: 1	Initializing the basic NCS communication
P: 2	Initializing TCP/IP
P: 3	Initializing BAPAS database
P: 4	Sercos initialization
P: 5	Starting NCB-TCP server
P: 6	Starting Sercos startup
P: 7	Mounting NFS file systems
P: 8	Synchronization with Sercos
P: 9	Sharing NCB-TCP server (communication with user interface)
RUN	Normal operation

Tab. 5-1: Display of startup phases

For critical system errors, boot panic errors or active MTX shutdown, the display changes to:

SF	A critical system fault is pending
BP	A boot panic error is pending
SD	Shutdown active

Tab. 5-2: Error status display

Startup mode

The startup mode determines the behavior of the MTX at startup.

The startup mode changes are applied at next startup.

Startup mode	Meaning
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 during the 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.
2	**Reloading the PLC boot project** The PLC boot project is loaded from the user FEPROM. Any PLC boot project that exists 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	**Deleting 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 are loaded and copied to the root file system.

Startup mode	Meaning
7	**Creating the user FEPROM file system again** The user FEPROM is created again. As a result, all the 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 activated.

Tab. 5-3: Startup mode

5.7 MTX - Setting the time and date

General information

For a correct chronological assignment of diagnostic messages, date and time of all devices in the machine network have to be identical. The adjustment of date and time of an MTX control is described in the following.

Setting date and time

1. Going online with the control
2. Call the context menu of the control and open the configuration dialog "Set time and date…" via "Configure device..."

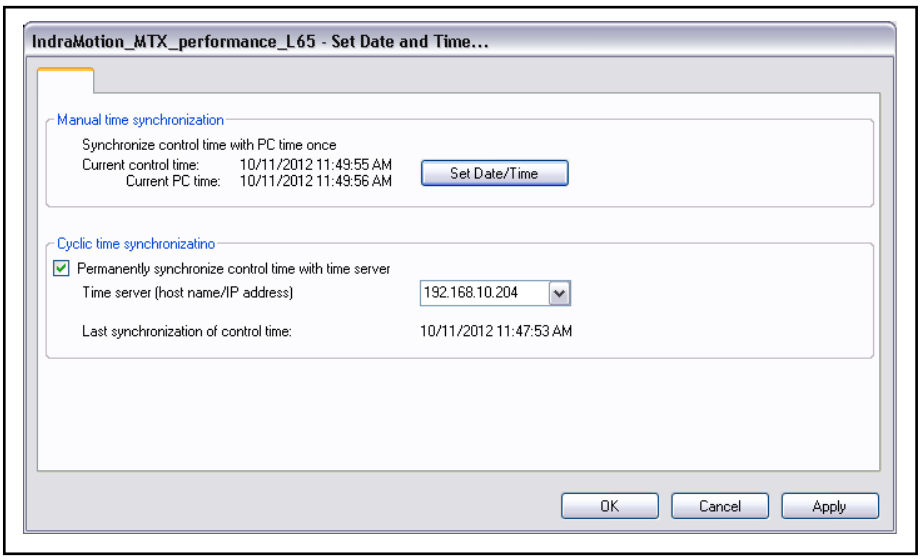


Fig. 5-16: Dialog "Set time and date"

To assign the current date and time to the control, use the options "Manual time synchronization" and "Cyclic time synchronization":

Manual time synchronization

The "Manual time synchronization" is used to apply the time setting of the visualization computer to the control using the **Ser Date/Time** button.

The display indicates the current control time and the current PLC time.

There is no further adjustment between the control time and the PC time at runtime.

Cyclic time synchronization

The "Cyclic time synchronization" can be enabled via a checkbox.

Enter the IP address of the time server in the input field. Each Windows PC in the network can be used as time server if it is configured as synchronized time source.

"Apply" saves all settings and checks the connection between the time server and the control.

If the synchronization was successful, the last synchronization point in time is displayed and the time of the control is regularly compared with the time server.

If the configuration is incorrect (e.g. time server is not configured or cannot be reached), a corresponding diagnostic message is output.

☞ The configured time server always has to be a synchronized time source. Otherwise, the control does not apply its time setting and the synchronization fails.

☞ Proceed as follows to configure the Windows computer as external time source:

1. Click on **Start**, then **Execute**, enter **regedit** and click on **OK**.
2. Select the following registration key and click on:

   HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\W32Time\Config\AnnounceFlags
3. In the screen area to the right, right-click on **AnnounceFlags** and click on **Change**.
4. Enter the value **5** in the **Value** field under **Edit DWORD value** and click on **OK**.
5. For more information, refer to **Microsoft-Support** http://support.microsoft.com/kb/314054/de.

5.8 MTX diagnostics (MZA, ProVi, VCPs)

5.8.1 Machine fault and status display (MZA)

What is MZA?

Definition In order to carry out trouble-shooting quickly in case of interruptions in the sequence of operations of machine tools, a reporting system that issues the corresponding messages to the operator in plain text is required.

Control commissioning

The Machine fault and Status Display, abbreviated MZA in the following, permits a total of 8096 messages to be displayed in the NC user interface. These can be displayed as faults, warnings or notes.

The messages are defined in plain text in a file (MZA file) and activated when the respective marker is set by the PLC sequential program.

All MZA messages can be saved as plain text in a logbook with the corresponding timestamps.

Displaying MZA messages

Description

MZA messages are displayed in message lines in the header of the user interface. By default, fault messages and warnings are shown alternatively in the upper line and notes are shown in the lower line. In addition, a corresponding bitmap is displayed if messages appear in the header. If fault messages appear, the bitmap for the fault display flashes.

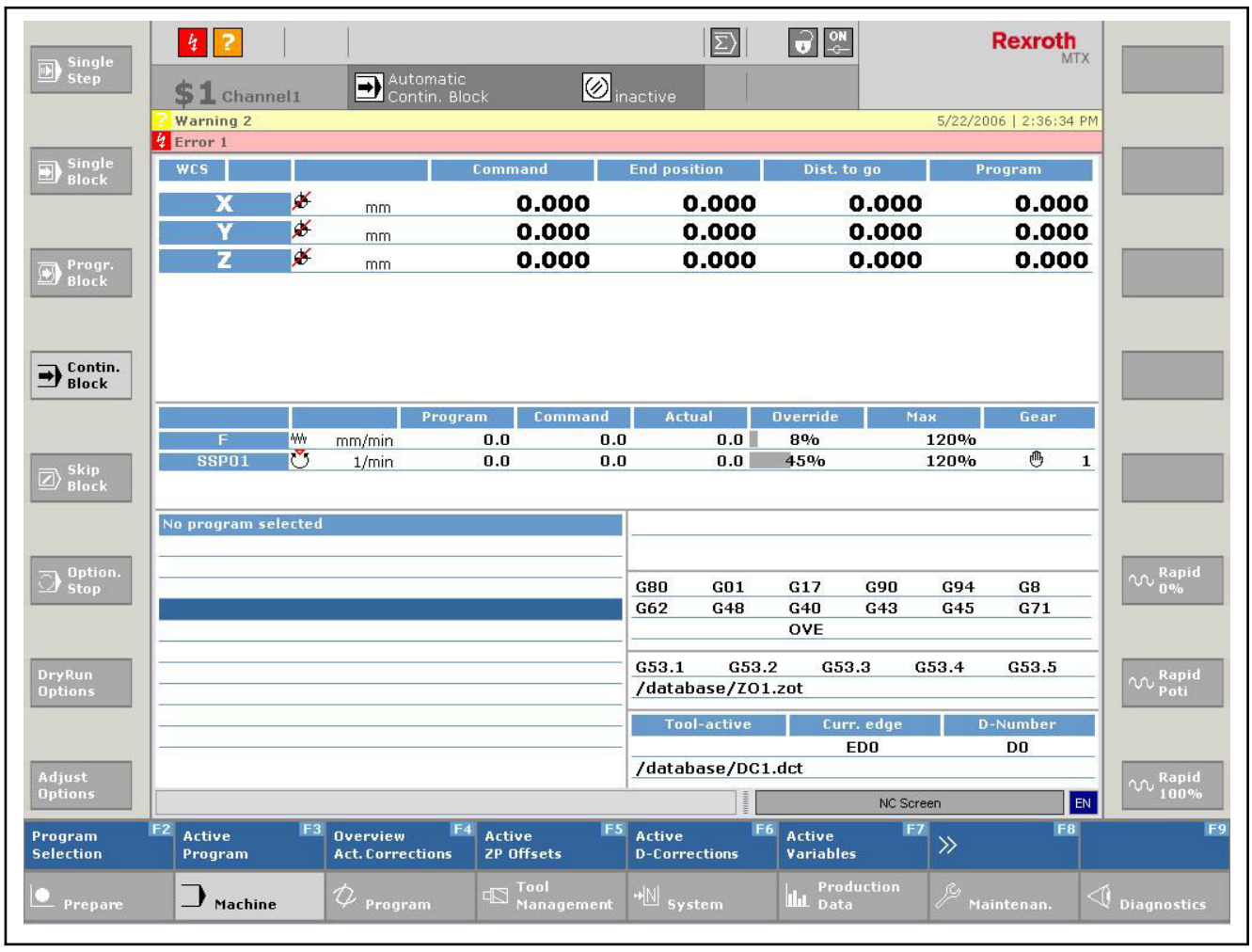
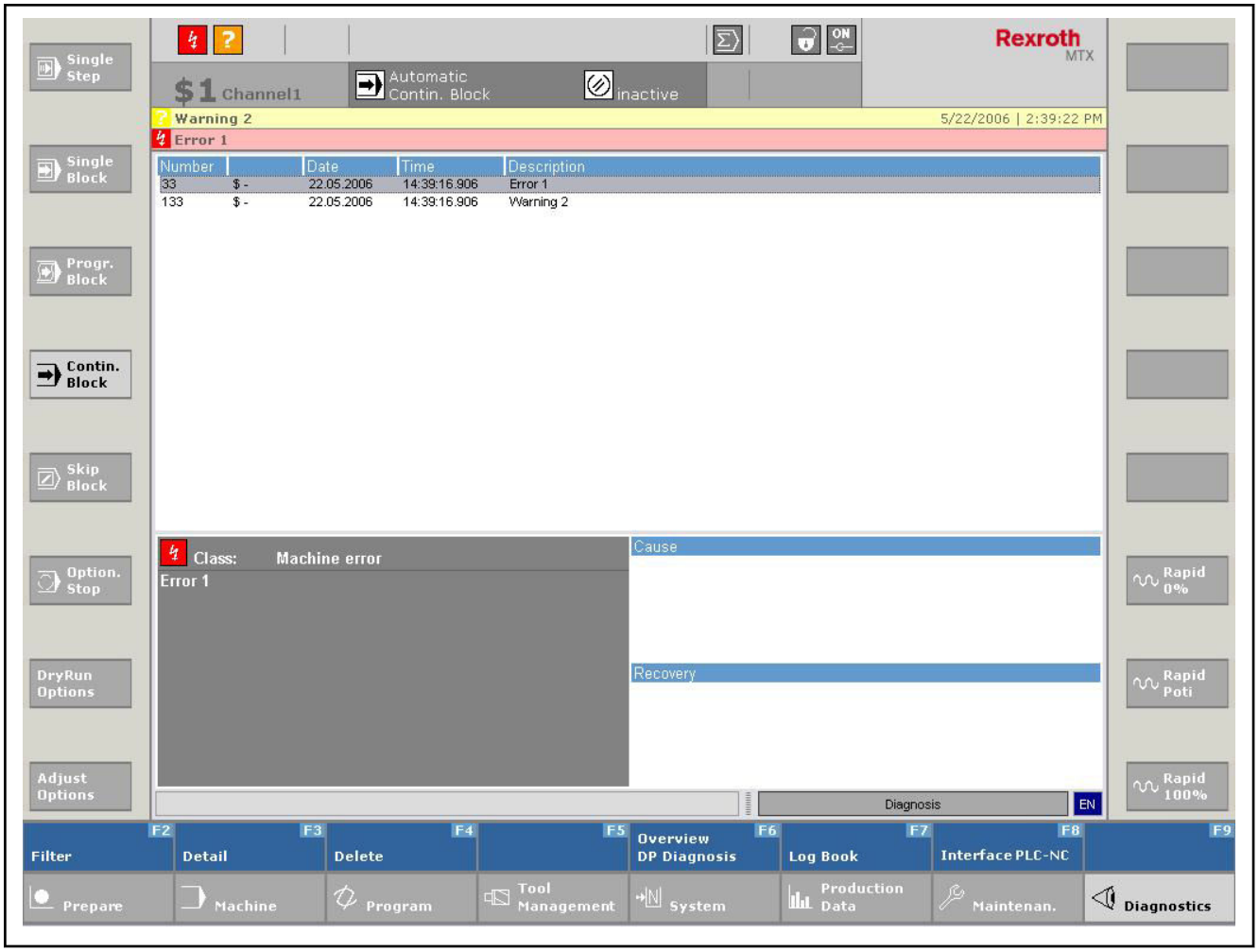


Fig. 5-17: Display of MZA messages in the header

All MZA messages that occur are displayed in the "Diagnostics" (OP9) operating area. The message that was activated last is located at the top of the list. The MZA message number (1 - 8096), the date and time of occurrence and the message text (description) are displayed for each message. In addition, cause and remedy texts can be displayed for the message.



1 Bitmap for fault message
2 Bitmap for warning
3 Bitmap for note

Fig. 5-18: Display of MZA messages in the "Diagnostics" operating area

If a message is selected using the cursor keys and <F7> Detail is then pressed, additional details regarding the selected message are displayed.

Further information about the "Diagnostics" screen of IndraWorks HMI can be found in the IndraWorks HMI documentation.

Commissioning procedure

The following steps are required to commission the MZA message system:

- Setting the parameters of the NC
- Generating the MZA text file(s)
- Configuring the PLC interface
- Programming the PLC interface

Parameterizing NC

The MZA message system is configured using the parameter **"Cycle Time"**. This parameter specifies the updating time of the message system in milliseconds. In general, an updating time of 500 ms is sufficient.

Control commissioning

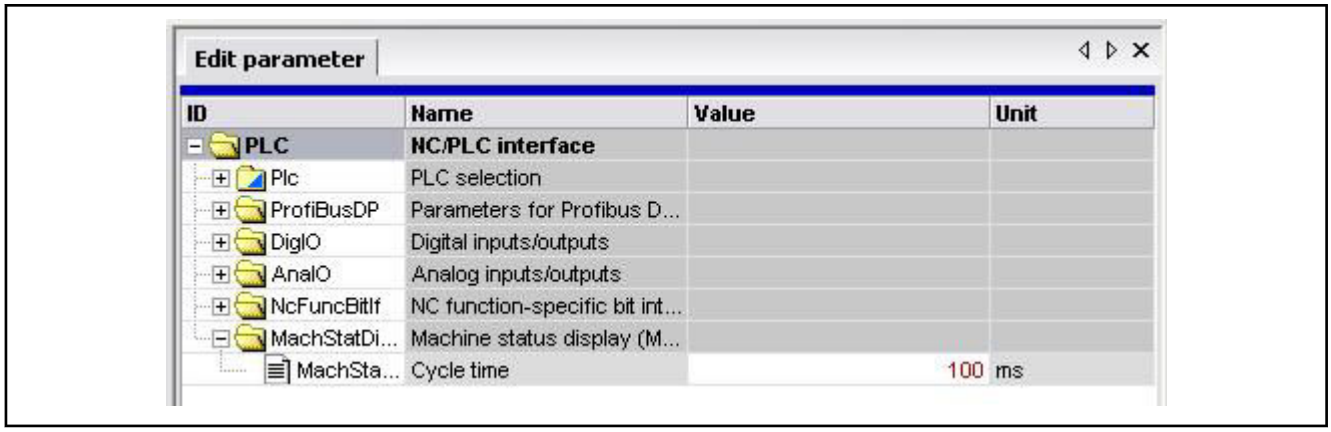


Fig. 5-19: Setting MZA message system parameters

☞ If 0 is entered under **"Cycle Time"**, no MZA messages are displayed or entered in the logbook!

Structure of MZA files

The MZA texts are entered in so-called MZA files. These are stored in the MTX file system in subdirectory **/usrfep**. The files can be saved in ANSI or UTF-8 format. The UTF-8 format is required to display Asian characters, for example.

☞ Currently, only MZA files in ANSI format can be edited using the NC Editor. Files in UTF-8 format have to be edited externally (e.g. with the Windows editor).

A separate file is generated for each language in which the MZA messages are displayed. The file name is always mzatexte.xxx; the file extension xxx has been specified as follows for each language:

☞ Directory /usrfep can be accessed only using the MTX user interface. Files can (currently) not be edited directly in this directory. Therefore, the files should be generated/saved in the /mount directory (c:\mnt). Then they can be copied from /mnt to /usrfep within the MTX interface.

Language	File extension
German	.049
English	.044
French	.033
Italian	.039
Czech	.420

Tab. 5-4: File extensions

☞ The languages German and English are always included in the scope of delivery. A corresponding language extension must be purchased as an option for every additional language.

Definition A total of 8096 messages can be defined. Each message is assigned a serial number from 1 to 8096. The number list can contain gaps.

The messages are distinguished as follows:

- Machine errors have an ID of E
- Machine warnings have an ID of W
- Machine notes have an ID of M

Precisely one ID can be assigned to each message number.

There is a message text for every message; optionally, a cause-and-remedy text can also be defined. The length of the message text is limited to 128 characters. A line break can be forced within the texts by inserting "\n". The file can contain comments in the form (<comment>).

Structure of a message line

Program:

```
(<E,M,W><1..2048>,<message text>{##<cause text>##<remedy text>})
|      |         |                |               |
|      |         |                |               | remedy text max.
|      |         |                |               | 128 characters
|      |         |                |
|      |         |                | cause text max. 128 characters
|      |         |
|      |         | message text max. 128 characters
|      |
|      | message number
|
| message type

Example:
(E200,error message number 200##cause of error 200##remedy of error 200)
(W201,warning number 201\nsecond line of warning 201)
```

Example MZA File (mzatexte.049)

Program:

```
(Fault in function group 1)
(E4, (FG1-3) +S2-A40/P100.1; AS-i Master 1: Configuration is inactive)
(E5, (FG1-4) +S2-A40/P100.1; AS-i Master 1: AS-i  Power Fault)
(E0006, (FG1-5) +S2-A40/P100.1; AS-i Master 2: Configuration is inactive)
(E7, (FG1-6) +S2-A40/P100.1; AS-i Master 2: AS-i  Power fault)

(Warnings for Function Group 7)
(W289, (FG7-0) +S2-I32.7/P151.8; circuit breaker is not switched on)
(W290, (FG7-1) +S2-I3.1/P144.2; Machine is not switched on)
(W0291, (FG7-2) +M-S96.0/P251.6; safety door 1 of the workplace is not locked)
(W292, (FG7-3) +M-S97.0/P252.2; safety door 2 of the workplace is not locked)

(Fault of the function group 11)
(E482, (FG11-1) Drive Lock X,Y,Z1,Z2-Axis; Spindle 1 HDK pressure achieved missing)
(E483, (FG11-2) Drive Lock X,Y,Z1,Z2-Axis; Spindle 2 HDK pressure achieved missing)
(E484, (FG11-3) Drive Lock X,Y,Z1,Z2-Axis; Spindle 1 speed achieved missing)
(E485, (FG11-4) Drive Lock X,Y,Z1,Z2-Axis; Spindle 2 speed achieved missing)

(Notes on the function group 10)
(M1159, (FG10-6) control reset (M25 channel 1) missing)
(M1160, (FG10-7) control reset (M25 channel 2) missing)
(M1161, (FG10-8) control reset (M25 channel 3) missing)
(M1162, (FG10-9) control reset (M25 channel 4) missing)
(M1163, (FG10-10) control reset (M25 channel 5) missing)
```

Modifications to MZA files go into effect by switching the active language or by restarting the system (soft reset).

PLC interface

The PLC interface to the MZA consists of a data structure that is configured within the PLC/CNC interface. You can choose between 2048 or 8096 messages for the width of the MZA interface.

Control commissioning

Configuration of the PLC interface

The interface is executed in the hardware configuration of the PLC/CNC interface (CyclicProcessData). The MZA interface can be inserted by clicking the right mouse button on node "CyclicProcessData". Choose between "New qMZA" for 2048 messages and "New qMZA_Ext" for 8096 messages.

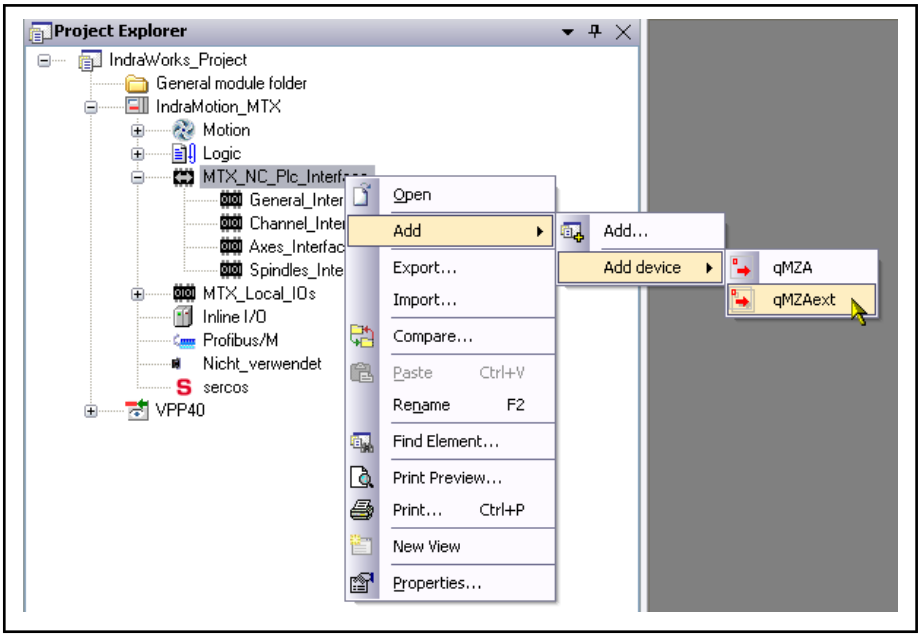


Fig. 5-20: Inserting the MZA interface

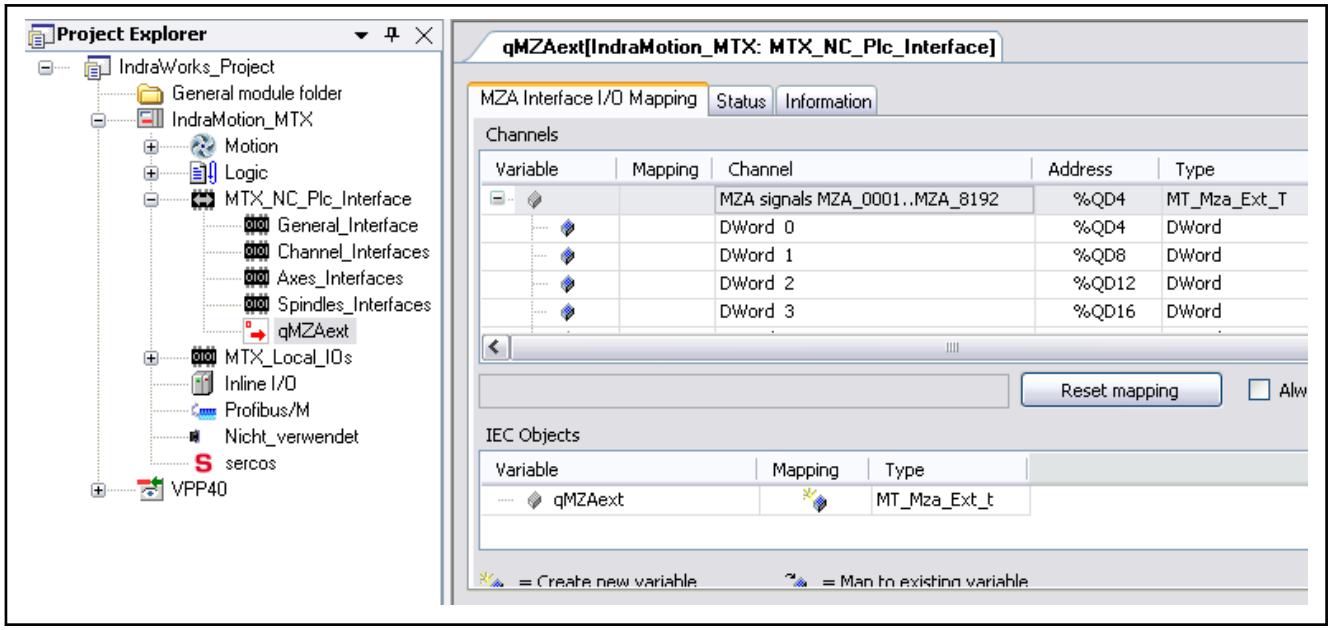


Fig. 5-21: Configuring the MZA interface

The symbolic name of the structure should be qMZA. The default address is at %QB1000.

Programming the PLC interface

General information

The "qMZA" data structure provides a separate bit for each message of the MZA. The bits are addressed using their symbolic names. The message is

shown in the diagnostics as long as the relevant bit for a message is TRUE. The time of the rising flank for the bit is entered in the logbook as "Message arrives" and the time of the falling flank is entered as "Message departs".

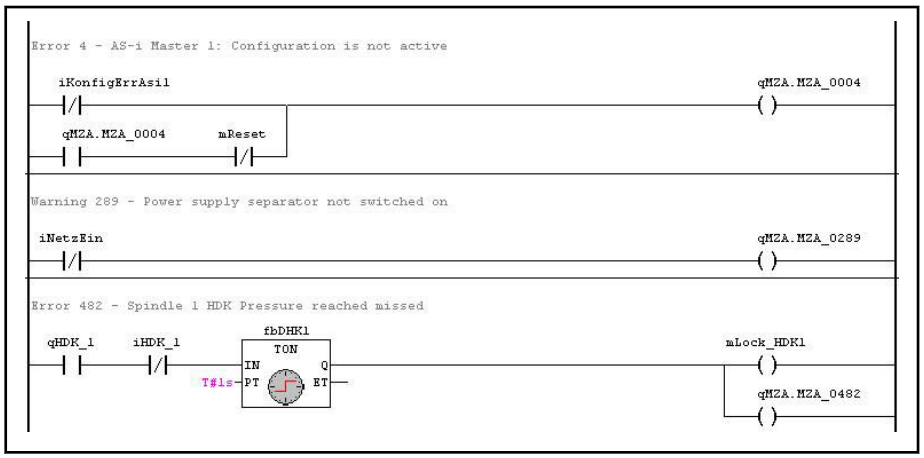


Fig. 5-22: Example of MZA programming

Handling instruction: MZA interface

This chapter describes the use of the MZA interface.

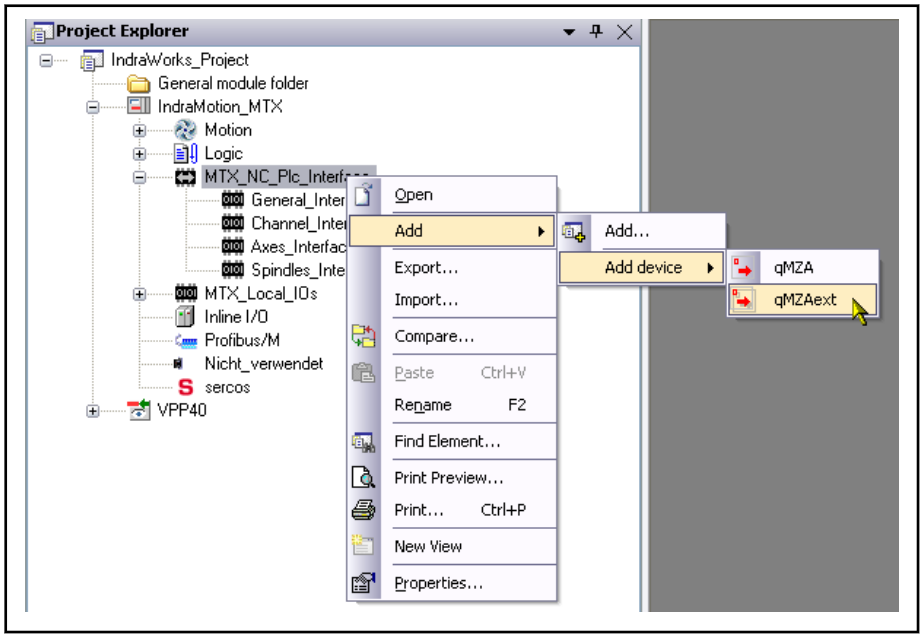


Fig. 5-23: Creating an MZA interface

IW Engineering / CyclicProcessData: Create a new MZA interface

1. Click with the right mouse button on the "CyclicProcessData" node.
2. Select the MZA interface.

   Choose between "New qMZA" for 2048 messages and "New qMZA_Ext" for 8096 messages.

		Documentation chapter 5.8.1 "Machine fault and status display (MZA)" on page 125
Documentation:	IndraWorks Commissioning	MZA diagnostics

IW Engineering / CyclicProcessData: Delete an MZA interface

1. Right-click on the "qMZA" or on the "qMZA_Ext" node.
2. Left-click and select "Delete".

		Documentation chapter 5.8.1 "Machine fault and status display (MZA)" on page 125
Documentation:	IndraWorks Commissioning	MZA diagnostics

IW Engineering / CyclicProcessData: Make changes

1. Double-click on the node "qMZA" or "qMZA_Ext"

   Additional information and configuration possibilities for the corresponding MZA interface are shown. This "Properties" dialog can change symbolic names, addresses and comments.
   The modifications are applied after exiting the dialog.

		Documentation chapter 5.8.1 "Machine fault and status display (MZA)" on page 125
Documentation:	IndraWorks Commissioning	MZA diagnostics

Handling instruction: MZA Configuration

This chapter describes how to configure the MZA.

IW Engineering / Configuration: Enable MZA

The MZA message system is configured using the parameter "Cycle Time". This parameter specifies the updating time of the message system in milliseconds. In general, an updating time of 500 ms is sufficient.

		Documentation chapter 5.8.1 "Machine fault and status display (MZA)" on page 125
Documentation:	IndraWorks Commissioning	MZA diagnostics

IW Engineering / Configuration: Disable MZA

If 0 is entered under **"Cycle Time"**, no MZA messages are displayed or entered in the logbook.

		Documentation chapter 5.8.1 "Machine fault and status display (MZA)" on page 125
Documentation:	IndraWorks Commissioning	MZA diagnostics

5.8.2 ProVi

Commissioning and programming ProVi messages

General information

ProVi messages are issued by the PLC. They can be displayed in the HMI interface. ProVi messages can also be logged in a logbook.

They can be grouped into five message types:

- Error
- Note
- Warning
- Startup prerequisite
- Setup diagnostics

All message types can be grouped into different modules.

A fault category and a message group can also be assigned to each message. ProVi messages can be programmed to be set, i.e. the message is displayed until it is reset by calling a FB (function block. The message texts can be entered in multiple languages, directly in IndraLogic.

Handling instruction: Commissioning and programming ProVi messages

There is a separate documentation for ProVi which answers all questions in detail.

The chapter "First Steps" helps the user to become familiar with ProVi.

IW Engineering: Working with ProVi

		Documentation chapter 5.8.2 "ProVi" on page 133
Documentation:	PLC program development with Rexroth IndraLogic	ProVi Diagnostics - First steps

5.8.3 Diagnostic messages on small operator panels

General information

To implement the NC diagnostics for small operator panels of the VEP, VCP and VCH series, the diagnostics texts have to be transferred from the source path **"...\Rexroth\IndraWorks\mtx\text"** to control to provide them in the PLC. A download mechanism in the IndraWorks Engineering is used for the transfer.

Downloading language files

Calling the download dialog

The download dialog is started either via the context menu of a device or via the device-specific entries in the main menu. Therefore, select **Load Diagnostic Text in Control**

Control commissioning

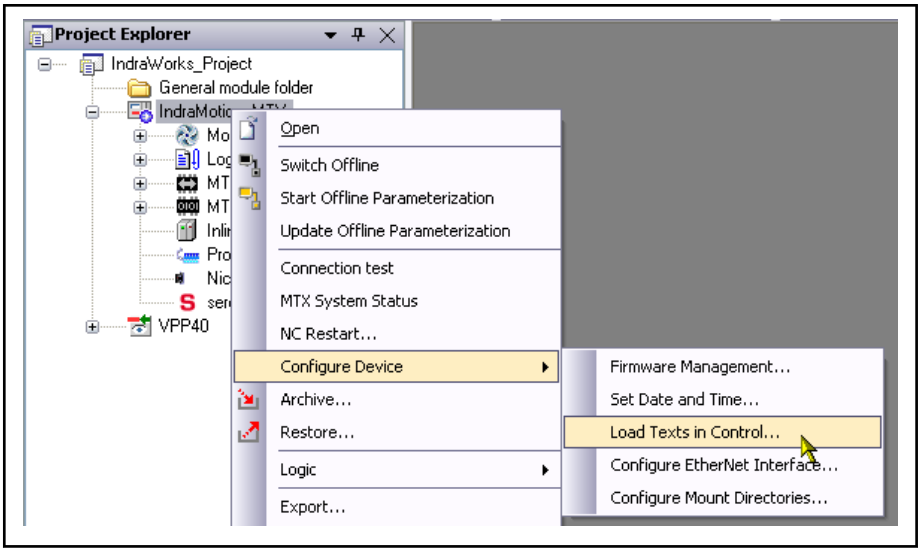


Fig. 5-24: Calling the download dialog

The download dialog provides the following functionalities:

- Loading diagnostic texts
- Displaying available diagnostic texts
- Displaying the diagnostics texts currently located in the control
- Deleting diagnostic texts in the control

Describing the dialog elements

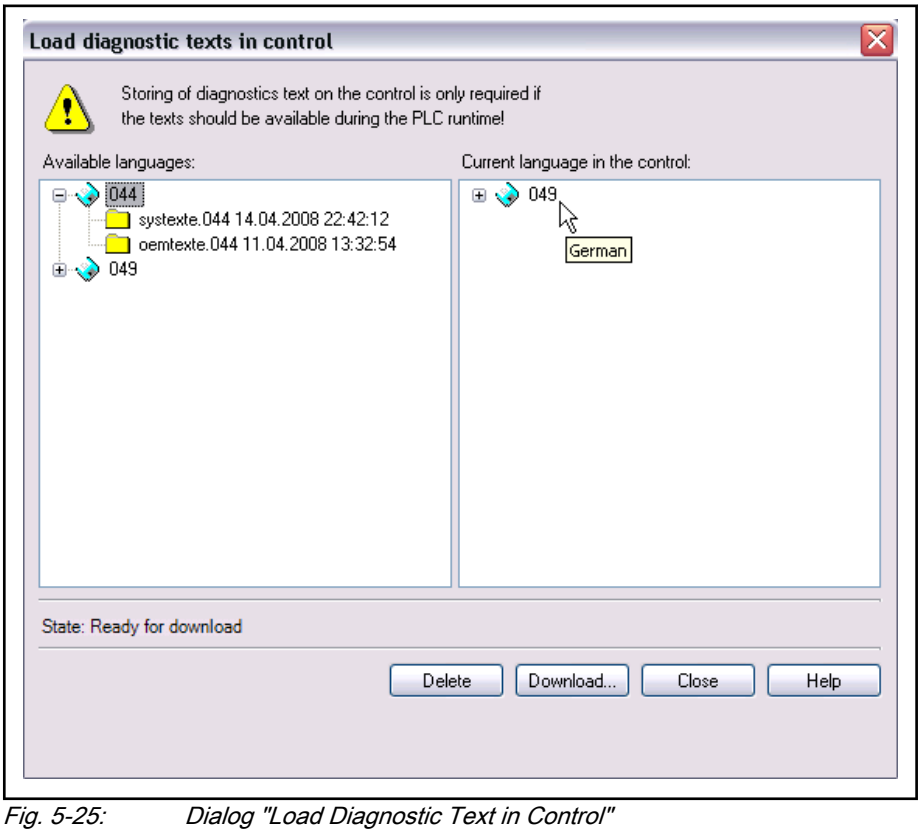


Fig. 5-25: Dialog "Load Diagnostic Text in Control"

The left window of the dialog shows the languages of the diagnostic texts available as country code for a download (a tool tip shows the language as plain text). If you open the language version tree, the corresponding language files are show with time stamp.

The language versions in the control are shown in the right window. By comparing times stamps, as possible required update can be identified.

Downloading single files is not possible. The language selected is always completely loaded with all its files available in the installation directory. Additionally, index files providing a faster access on the language files are created in the control. The progress bars informs on the download status.

Storage location of the language and index files in the control is the **"root/usrfep/text"** directory. If any files exist, they are overwritten.

The "Delete" function removes all language and index files for the selected language version in the control.

☞ If the are desired texts in the control, the **MT_DiagText** function block can be used in the PLC later on to provide an image of the NC error and the message database. Further information, the description of the function block as well as a configuration example can be found in the documentation"PLC Interface".

5.9 Setting up NC cycles

5.9.1 Input masks

To facilitate the programming of cycle calls, the input support of the editor is often used. Input masks have to be defined for cycles requiring this support. This is for the interface configuration and is not related to the function of cycles during program processing.

For how to create input masks, refer to chapter "NC cycle input mask" on page 63.

5.9.2 Parameter settings for cycle calls

The non-modal standard cycles have already been entered. Non-modal user cycles can be added here.

The modal standard cycles have already been entered. Modal user cycles can be added here.

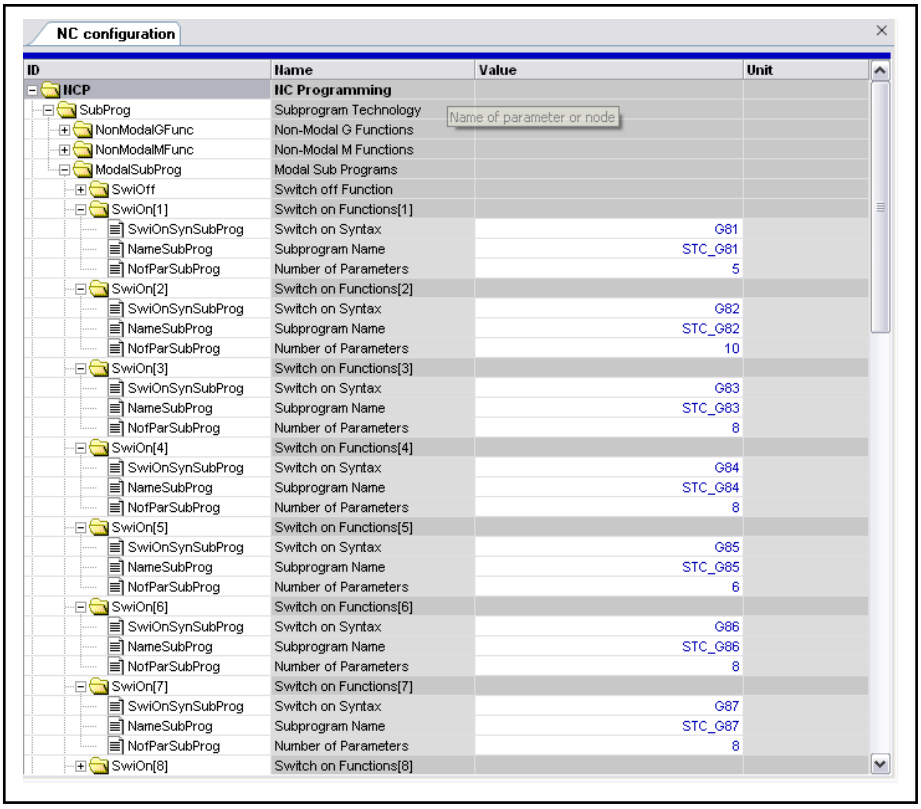


Fig. 5-26: Editing IndraWorks Engineering parameters

5.9.3 Subroutines

The subroutines (cycles) of the machine manufacturer are saved in the control file system under "root\usr\mtb\cycles".

The subroutines (cycles) of the end user are saved in the file system of the control under "root\usr\user\cycles".

5.9.4 SD variables

Some cycles can optionally operate with permanent channel-dependent SD variables. The assignment is listed in the respective cycle description. The SD variables used for the standard cycles are available. If user cycles are to be created and implemented this way, the SD variables used have to be defined.

5.9.5 Using existing projects

This section relates only to projects created with versions < MTX09V06.

There is not complete compatibility. Therefore, the user has to decide whether to continue using the existing projects in their "old" form or whether to work with standard cycles in future. **A combination of these two variants should not be used!**

The usage of individual cycles from an old version does not require any further measures. However, it is not be possible to access the installed standard cycles.

The following modifications are required to use the standard cycles in existing projects (project version >=MTC09V06):

- Adapt the search path for the cycles in the machine parameters. "NC optimization (NCO) -- FileOrg -- SrchPathSubProg". Add a new entry "/feprom/cycles" in front of the entry "/feprom".

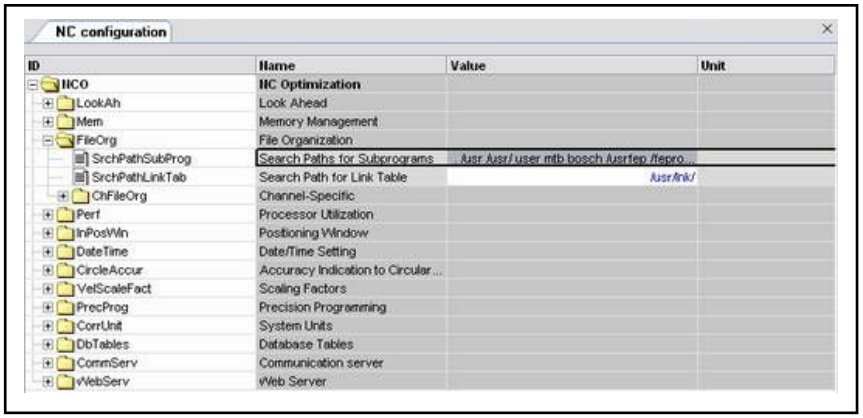


Fig. 5-27: Extending the search path

- Make standard cycle entries in the machine parameters. "NC Programming(NCP) -- SubProg -- ModalSubProg -- SwiOn[n]". Refer to chapter 5.9.2 "Parameter settings for cycle calls" on page 135. The required entries can be taken from the default values.

If, after conversion to the standard cycles, the existing user cycles have to be used as well, these should either be adapted to the addressed notation or their names should be changed in such a way that they match the intended range for user cycles. In doing so, cycle subroutines, cycle headers and definitions in the machine data also have to be adapted. It should also be noted that the cycle calls in the NC programs also have to be adapted to these changes.

5.10 Configuring the tool management

5.10.1 Basics

Tool corrections

The tool data management is of highest importance for controlling machine tools.

The tool data comprises, for example, data on:

- Tool identification
- Description of tool geometry (tool correction data)
- Tool life management
- Description of tool location (place)
- Description of tool type
- Status information
- etc.

In addition to these so-called external tool corrections, D-corrections can be used.

The following figure explains the mode of operation of external tool corrections and D-corrections.

Control commissioning

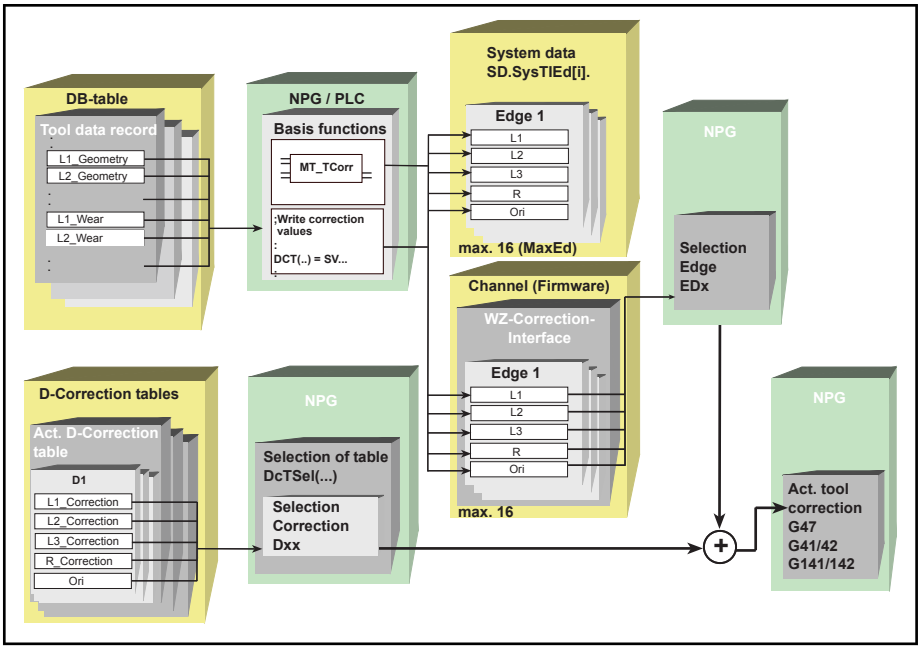


Fig. 5-28: Principle of D-corrections and external Tool corrections

The block preparation of the MTX takes the tool corrections stored in the tool correction interface into account. The tool correction interface can be written via NC (via CPL) or PLC. Within this interface, corrections for up to 16 tool edges can be stored. A correction block includes the correction values L1, L2, L3, R as well as the edge position Ori and orientation angles Phi, Theta and Psi. Use the orientation angle to position the tool at an inclined angle in space. G47 activates the MTX tool length correction and G48 deactivates it. Use ED (cyclic duration) to switch the edge or the correction data block within the tool correction interface.

The tool length corrections L1, L2 and L3 to the axes or coordinates to which the length corrections are to be applied are assigned via the configuration data. Irrespective of this setting, the effect of the tool length corrections can be changed at runtime via G47. G47 simultaneously activates the tool correction for the latest preselected edge using ED.

Data management

The data management 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.

The following figure provides an overview on the database structures and its exemplary use:

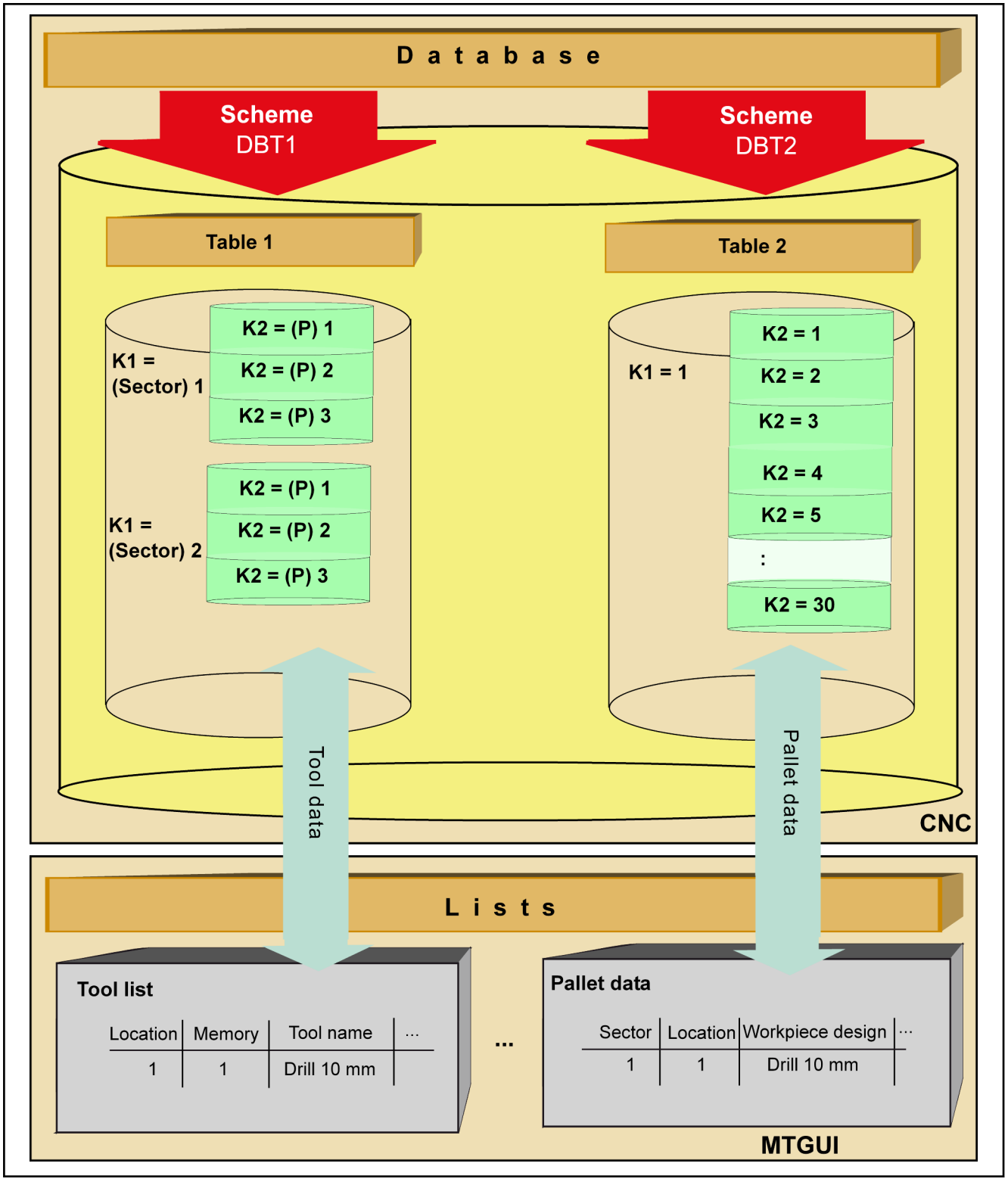


Fig. 5-29: Database structure

The tool database can be compared to a container structurally storing tool data.

The database consists of individual data blocks. Their structure can be configured user-specifically.

Array structure of a data block:

Array/ element	Identifier	Type	Description	Comment
1	K1	Integer	Sector	DS key
2	K2	Integer	Place	
3	SKQ	String	ID	Tool identification
4	IKQ1	Integer	Duplo no.	
5	IKQ2	Integer	Type	Type identification
6	IKQ3	Integer	T. No.	Tool identification
7	IQ1	Integer	Reserve	-
8	IQ2	Integer	Reserve	
9	IQ3	Integer	Reserve	
10	BQ1	Bit array (32)	P-status	Place status
11	BQ2	Bit array (32)	T-status	Tool status
12	BQ3	Bit array (32)	Technology	Type identification
13	aaa	1. freely configurable data element		
:	:	:		
n	zzz	nth freely configurable data element		

Tab. 5-5: Data block structure

A data block is uniquely identified by the two arrays "Storage"/"K1" and "Place"/"K2".

A single data block always corresponds to a place which can receive a tool. This can be specific places in the machine (e.g. spindle, gripper, charging place, discharging place) or in a magazine.

When tools are engaged into places or transferred to other places, relevant tool data in the corresponding data blocks is copied.

The number of data blocks available after re-initializing the database can be configured as well as the display of tool data in tool lists and tool editors.

Currently, the size of a data block is restricted to 4 kB.

5.10.2 General configuration tools

General information

To configure tool data management, follow the configuration steps described below in the specified sequence:

1. Specification of the database size or the number of data blocks (chapter 5.10.4 "Configuring the database" on page 175)
2. Definition of the database structure (sector/place) (chapter "Defining sector and place distribution of database table" on page 175)
3. Adjustment of the database schema (chapter "Configuring data blocks" on page 176)
4. Optional extension of the tool catalog (chapter 5.10.5 "Tool catalog" on page 204)
5. Configuration of the user interface (chapter 5.10.6 "User interface" on page 221)

Definition of terms

ULC **"ULC"** stands for "**U**niversal **L**ist **C**ontrol", which is the central element of tool list and container configuration.

Sublist **"Sublist"** is a central term in the schema definition for the ULC. A ULC is a table editor which may be able to multiply the configured line-column definition for the presentation of a (tool) data block according to the number of data blocks. In this case, a sublist stands for the presentation of a data block. Therefore, only one sublist needs to be defined for a list of several tool data blocks.

This principle can also be applied to certain parts of the (tool) data block (e.g. tool edge data, etc.).

Schema editor

General information

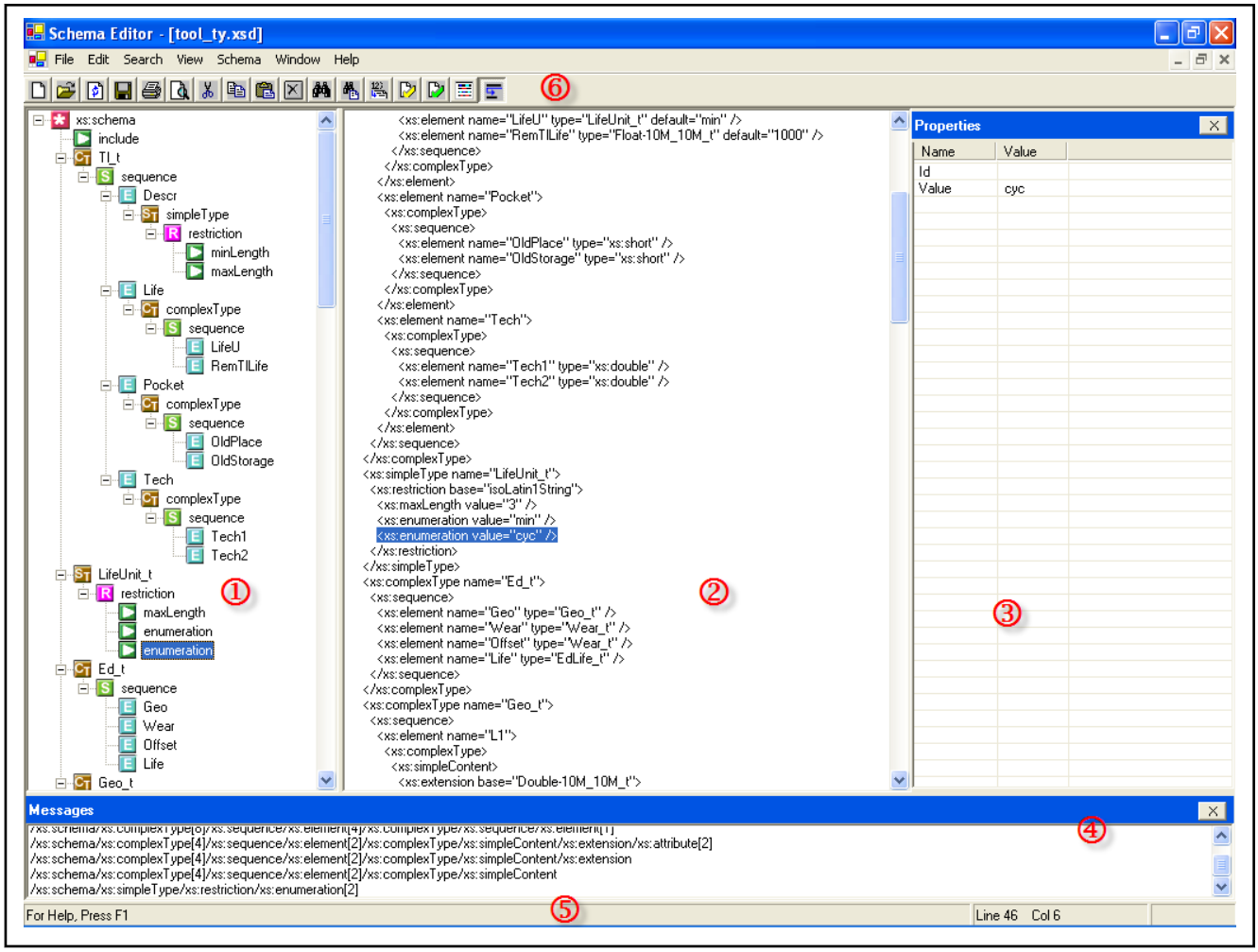
A schema editor is provided especially so that the user can see and change data block schemas.

In addition to the possibilities of schema validation and of the "style" test, this schema editor permits schema files to be clearly displayed and modified within various windows.

The figure below shows the various areas of the schema editor:

- Tree display (always present)
- Text display (always present)
- Properties window (can be optionally hidden)
- Message window (can be optionally hidden)
- Status and tool bar (can be optionally hidden)

Control commissioning



1	Tree representation
2	Text display
3	Properties window
4	Message window
5	Status bar
6	Toolbar

Fig. 5-30: MTX schema editor

Graphical Element	Description
	Root node in xsd files
	Simple type
	Complex type
	Element
	Attributes
	AnyAttribute
	AttributeGroup
	All

Graphical Element	Description
	Any
	Choice
	Group
	List
	Restriction
	Sequence
	Annotation
	Documentation
	Union
	General Symbol of: • minLength • maxLength • Include • #text • simple Content • extension • enumeration • ...

Editing in the tree view

- **Delete**:

  Select the node and use the <DEL> key or right click on **Delete**

- **Paste**:

  Right mouse key, popup **Add Child**. This menu item provides a selection of all schema elements that can be pasted under the currently selected element.

The pasted elements are immediately visible in the Text Editor. In order to change the elements, the Properties windows or the Text Editor can now be used.

Editing in the Properties window

The properties listed in this window always belong to the node selected in the tree representation. Different properties are possible from node to node. If only a limited range exists for the value of a property, this range is provided in combo boxes.

After the node has been changed, the other two views (tree and text) are updated.

Editing in the text editor

Here, anything can be entered without any limitations. By means of the button <F5> "Synchronize Tree", the tree is updated. Any errors are detected during the update and are shown in the "Messages" window. Furthermore,

you can check your text for "Good style" <F7> and for compliance with the schema conventions <F8>.

Menu items

File menu	New <Ctrl>+<N>:	Create new file; A selection can be made between XML and schema and between various Unicode character sets
	Open <Ctrl>+<O>:	Open an existing file
	Close:	Close the currently open file
	Close all:	Close all open files
	Save <Ctrl>+<S>:	Save the current file
	Save as:	Save the current file under a different name
	Print <Ctrl>+<P>:	Directly print the current file
	Print preview:	Display a print preview
	Print setup:	Set up the page to be printed
	Recent files:	List of the files opened last
	Exit:	Exit the schema editor
Edit Menu	Cut <Ctrl>+<X>:	Cut the highlighted characters in the text editor
	Copy <Ctrl>+<C>:	Copy the highlighted characters in the text editor
	Paste <Ctrl>+<V>:	Paste the highlighted characters in the text editor
	Delete text:	Delete the highlighted characters in the text editor
	Delete node:	Delete the highlighted node in the tree view
	Delete messages:	Delete the messages in the messages window
	Select all <Ctrl>+<A>:	If the text editor is active, mark the entire text from top to bottom.
	Go to line/char <Ctrl>+<G>:	Open an input window to enter the line and character number and to focus the specified character in the text editor.
	Set font:	Change the font of the text editor
	Format text:	Change the color of key words
Search Menu	Find <Ctrl>+<F>:	Open the "find" window
	Replace <Ctrl>+<Shift>+<H>:	Open the "find and replace" window
View Menu	Highlight text <Ctrl>+<H>:	Specifically switch "highlight key words" on or off. Documents up to a certain size are highlighted when opened. For performance reasons, larger files are not highlighted when opened
	WordWrap:	Switch the automatic line break on or off
	Expand tree view <Ctrl>+<Shift>+<E>:	Collapse/expand the tree and all the nodes
	Collapse tree view <Ctrl>+<Shift>+<C>:	Collapse the tree and all the nodes

	Schema view <Ctrl>+<Shift>+<S>:	Switch on or off schema view. The schema view hides certain structure nodes, e.g. the nodes of the type "simpleContent" and "complexContent" are hidden
	Synchronize tree <F5>:	Scan text and update the tree view. Scanning errors are shown in the message box
	Schema <F4>:	The schema that describes the permitted elements of the schema that is currently being processed is displayed
	Customize...:	Show/hide toolbar buttons
	Properties <Ctrl>+<Shift>+<P>:	Show/hide properties window
	Messages <Ctrl>+<Shift>+<P>:	Show/hide messages window
	Tool bar <Ctrl>+<Shift>+<P>:	Show/hide toolbar
	Status bar <Ctrl>+<Shift>+<P>:	Show/hide status bar
Schema Menu	Check style <F7>:	Checks the "style" of the document. For example, missing parentheses are found with this function
	Validate <F8>:	Checks the document against the schema on which it is based
Window menu	Cascade:	Cascade the windows
	Tile horizontally:	Arrange the windows under one another
	Tile vertically:	Arrange the windows next to one another
Help menu	Help topics <F1>:	Show the "Help" dialog
	About the schema editor:	

ULC configurator

General information

The ULC configurator has 2 types of visual presentation which, however, use the same database (configuration file), i.e. Changes in one of the configurators have the same effect on the other configurator and are also displayed.

1. Configurator for common configuration steps.
2. XML editor for special settings which cannot be selected by means of the configurator (see chapter "XML file editor" on page 163).

This chapter especially deals with the ULC configurator.

Opening or creating a configuration

Opening an existing configuration

The ULC configurator is either called by the list configurator via the configuration key or the function "Open" on the relevant entry in the branch "Form configuration".

Creating a new configuration

Using the function **New**under the node **List controls** or **Container controls**, either a new list configuration or a new container configuration can be created for the tool editor (see fig. 5-32 "Template for a new container configuration" on page 147). For this purpose, the relevant basic configuration is referred to for initial definition. Another option for creating a new configuration file is to create a configuration which is as similar as possible to basic configuration

using the function **Duplicate (copy & paste)**. After having created such a configuration, load it into the editor as described above.

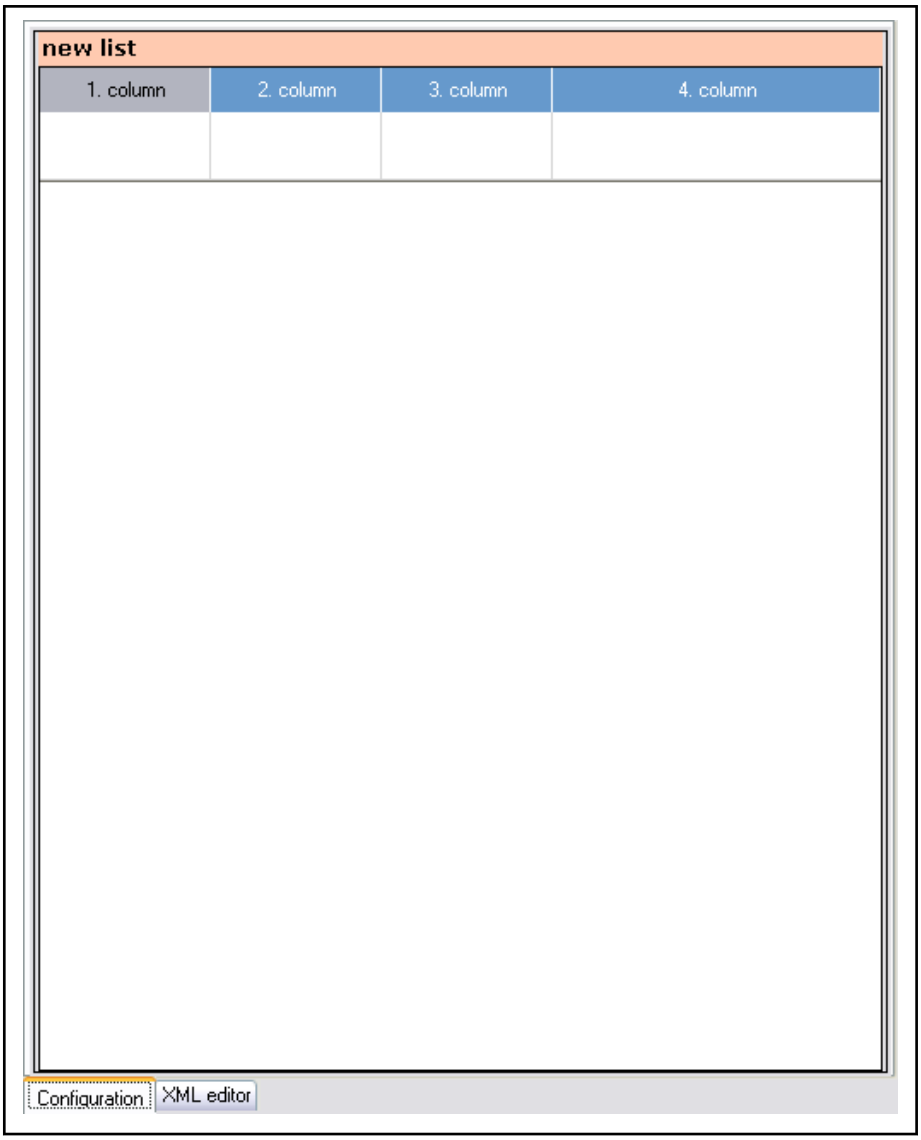


Fig. 5-31: Template for a new list configuration

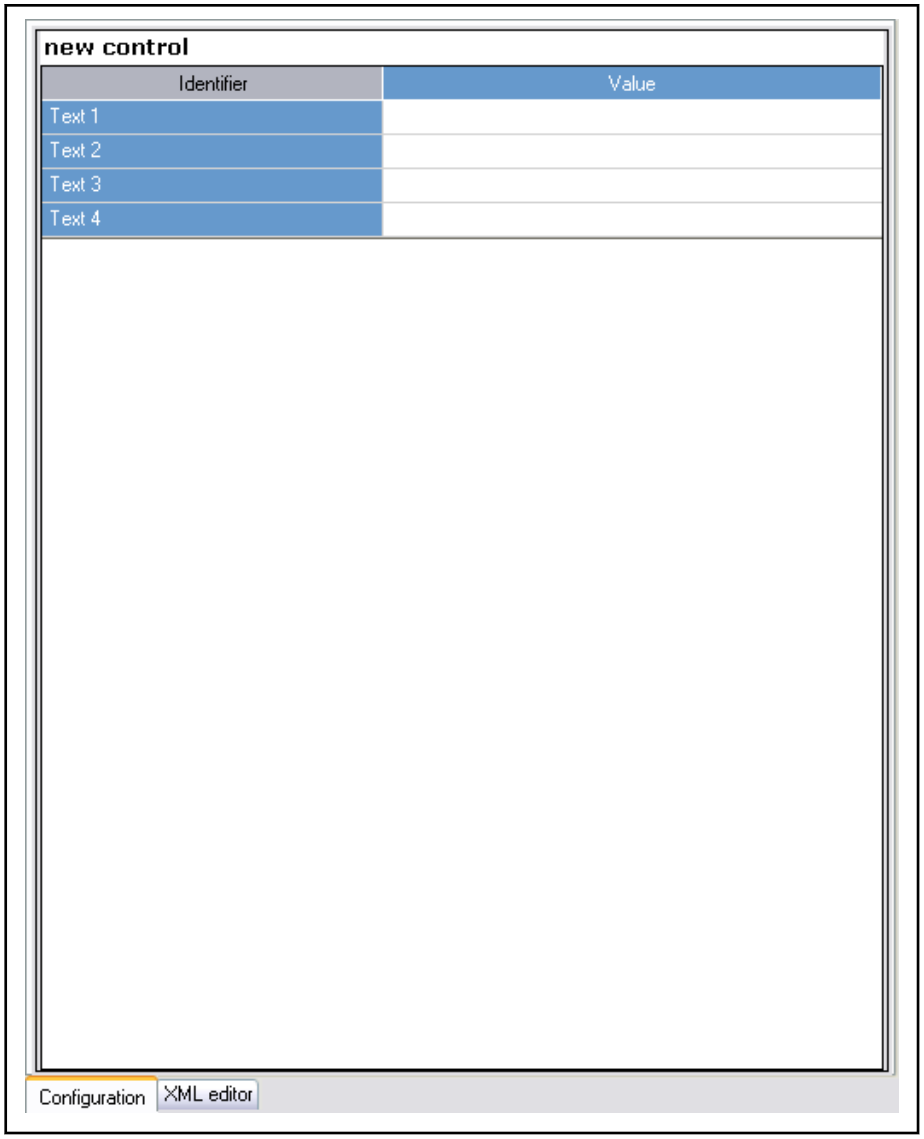


Fig. 5-32: Template for a new container configuration

Saving the changed configuration

If the configuration has been changed, the user will be asked whether the changes are to be saved or not when exiting the configuration dialog. In addition, see the current status any time by retrieving the function **Save** <Ctrl> +<S> in the pull-down menu.

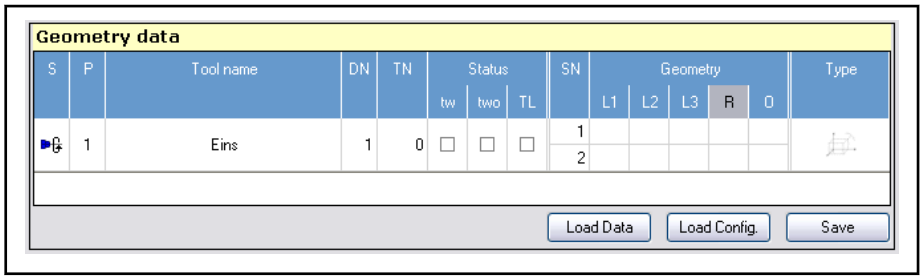


Fig. 5-33: ULC preview with function buttons

Creating the desired number of lines and columns

To obtain the desired number of lines and columns, the initial configuration must be modified. To do this, call the corresponding commands using the right mouse button and the pop-up menu. For example, to insert a column at

the front, use the right mouse button to click the first column and execute the command **Insert ▸ InsertColumn ▸ Before**.

The following commands exist:

- Insert
  - Insert column
    - Before
    - Behind
  - Insert subcolumn
    - Before
    - Behind
  - Insert row
    - Above
    - Below
- Delete
  - Column
  - Subcolumn
  - Row

In contrast to the command "Insert Column", the command "Insert Subcolumn" does not generate a complete column; instead, it generates a subcolumn that shares the topmost heading with the initial column.

Opening the cell editor

The cell editor is opened by double-clicking a cell or via the pop-up menu. When the editor is open, click another cell using the mouse and edit its data. The data of the cell that was edited previously is saved in the clipboard. The modified data block is added to the preview by pressing "Apply" or "OK".

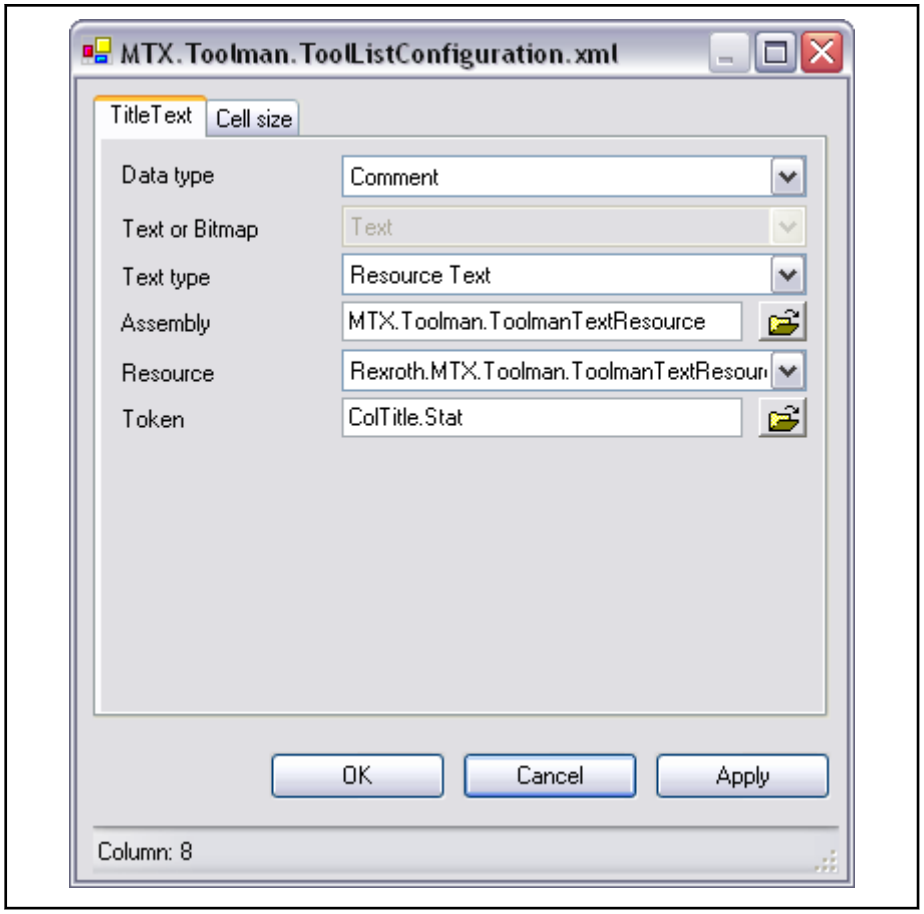


Fig. 5-34: Dialog: MTX.Toolman (editor for cells, columns, titles and global list properties)

Setting the width and height of rows and columns

The width and height can be set in two different ways. To select all settings using the mouse, enable the change mode using a right mouse-click in the popup menu **Edit column width / row height**. Now the width and height of every line and column can be modified using the mouse.

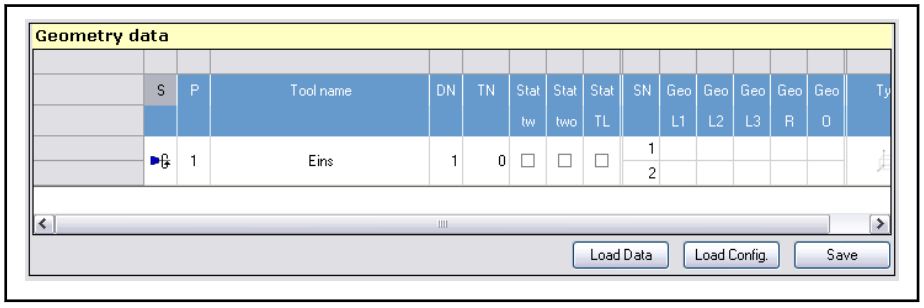


Fig. 5-35: The row height and column width can be modified directly using the mouse in this preview

The second method is using the editor. Open the editor as described above. Ensure that the cursor is not positioned over the title row, but that the row/column to be modified is selected. Open the second tab page **"CellSize"** and enter the desired values in the fields Height/Width.

Creating contents of individual cells

Logic of cell contents

In order to edit the content of individual cells, open the editor again, as described above. Ensure that only the cell whose data is to be modified is selected.

If you press "Apply", the modified data is applied to the preview, but are not permanently saved - instead, it is saved only in RAM and applied to the preview.

In general, a cell can have three states:

1. It can be empty, this means "data type = **empty cell**".

   Nothing else can be set in this case.
2. The cell can contain a comment (**comment**).
3. The cell can reflect the value of a process variable (**process variable**).

Empty cell

The cell is empty; it does not display a comment or a process value. Nothing else can be set here.

Comment

The cell displays a fixed comment. This comment can consist of a bitmap or text. In turn, the text can be permanently entered or can be language-dependent. Language-dependent texts can originate from a resource file or can be selected from a CSV file. CSV files can be edited by the user in this dialog.

If the cell is defined as a comment cell, there are several input methods:

Text or Bitmap There are 3 methods here:

Text	Only text is displayed
Bitmap	Only a bitmap is displayed
Text and bitmap	Both text and a bitmap can be specified and selected. The corresponding style can be used to specify how the text and the bitmap are displayed, i.e. on top of or next to one another. Currently, the data of the style must still be modified directly in the configuration file using an XML editor

Text type The following three selection possibilities exist:

User text	This reads out the CSV file mentioned above. If a user text is used, the elements "list name" and "token" need to be specified in addition
Textresource	The comment to be displayed is read from a resource file with text. File name and text name must be specified
Fixed comment	In this case, the text can be entered directly in field "comment"

List name This field is available only if "User text" has been selected for the text type. Either a list can be selected or a new one can be generated with "New".

☞ ⇒Although this field can be adjusted in every cell, it is global and thus always changes the content for every field!

Token (User Text) A token can be entered directly. However, it is a good idea to select the token from the list. To do this, press the "Open" button. Now a box with the list of all texts that have already been defined opens. This list can be used to not only

select texts, but also to generate new ones. A description of this list can be found in "Edit Text List".

Assembly The field "Assembly" is provided for the text type "Resource Text". The content of this field can be selected using a file dialog that opens when you press "Open" on to the right of the input field.

Resource If you have selected an assembly, all the resources in this assembly are contained in the Resource combo box, where they can be selected.

Token (Resource) If a resource that contains the texts has been selected, a token can be selected from the contained token/text pairs. Start the text list using the "Open" button. The description of this list can be found in "Edit Text List".

Comment This field is available for the text type "Fixed comment". The entered text here, is entered later in the cell.

Assembly of Image If Bitmap was selected in field "Text or Bitmap", the fields for selecting a bitmap are accessible. As has already been the case for the text assembly, a file dialog is used in "Assembly of image" to select an assembly that contains a resource with images.

Image resource If an assembly has been selected, this combo box contains the resources of this assembly so that you can select the resource.

Image Name If the selected resource contains images, they can now be selected using the text list. This text list contains the names of all the images. The description of this list can be found in "Edit Text List".

Process variable

The cell displays a process-dependent value. This value is addressed using an XPath expression. The value can be displayed as text and/or as a bitmap. It can be formatted as text and be edited in the cell. The following entries can be selected:

Process variable The XPath for the process variables is entered here.

Text or Bitmap There are three possibilities:

Text	Only text is displayed
Bitmap	Only a bitmap is displayed
Text and bitmap	Both text and a bitmap can be specified and selected. The corresponding style can be used to specify how the text and the bitmap are displayed, i.e. on top of or next to one another. Currently, the data of the style must still be modified directly in the configuration file using an XML editor

Text Format

Numerical	The text is displayed as a number that can be formatted
Text	The text is displayed as a string. Using this setting, the process value is displayed directly, without any formatting

Numerical type If the format "Numerical" has been selected for the text, the number can be specified in more detail now. The "numerical type" is used to define how the number is to be displayed:

Integer	The number is displayed as integer
Float	A digit with number of decimals is displayed
Bit	Checkboxes are displayed
Use format string	The representation of the number is specified in more detail in the field "format string"

Control commissioning

Editing mask The field "EditMask" is available for the numerical types Integer, Float and "Use format string". This field can be used to specify which form the user's entry must satisfy. Fixed characters can be assigned to the Edit field of the cell. The syntax is described in chapter "Syntax of editing mask" on page 160.

Digits Digits can only be set if "Numerical type" = "Integer". The number entered here indicates the minimum number of digits used to display the number. Missing digits are supplemented by leading zeros.

ProcVar Type *The following types can be selected:*

- System.Double
- System.Single
- System.Decimal
- System.Integer

Decimal places The minimum number of positions after the decimal point is specified here. Missing digits are filled by zeros. This field exists only if "Numerical type" = "Float".

Bit no. (0..32) This field is visible only if "Numerical type" = "Bit". Here, the bit is defined by an integer whose value you want to display as a checkbox.

Format string This field is available only if "Numerical type" = "Used format string". The entry in this field determines how the number is displayed in the cell.

The syntax is as follows:

C or c	Display as a localized currency
E or e	Display as an exponential number
F or f	Specified number of positions after the decimal point
N or n	Like F, but with separator symbols for thousands
P or p	Number is multiplied by 100 and displayed as a percentage
0	Placeholder for numeral. If no numeral is located at this position, one is inserted
#	Placeholder for numeral. A digit is displayed at this place. If there is no digit, it is not filled with a 0
.	The character "." indicates the position of the decimal separator symbol

Editable There are 4 possible values for Editable **(EditStatus)**:

0	**Yes**	Cell can be edited
1	**No**	Cell cannot be edited
2	**Call-back of the application**	The call-back mechanism is used to query the calling application whether the currently selected cell can be edited
3	**Depends on process variables**	Important for conditional editability

Edit type There are 3 options for the edit type **(EditTypeSelection)**:

Text editor	An input field is available in the edit mode
Enum combobox	If a cell is focused, it becomes a combo box whose entries must be available in the schema for the data element to be defined
User combobox	When the cell is focused, it becomes a combo box. The entries in the combo box list are queried by the embedded application using call-back

Copying cell definitions

Complete cell definitions can be transferred from a selected cell to another cell by means of the function **"Copy cell data"** and/or **"Paste cell data"**.

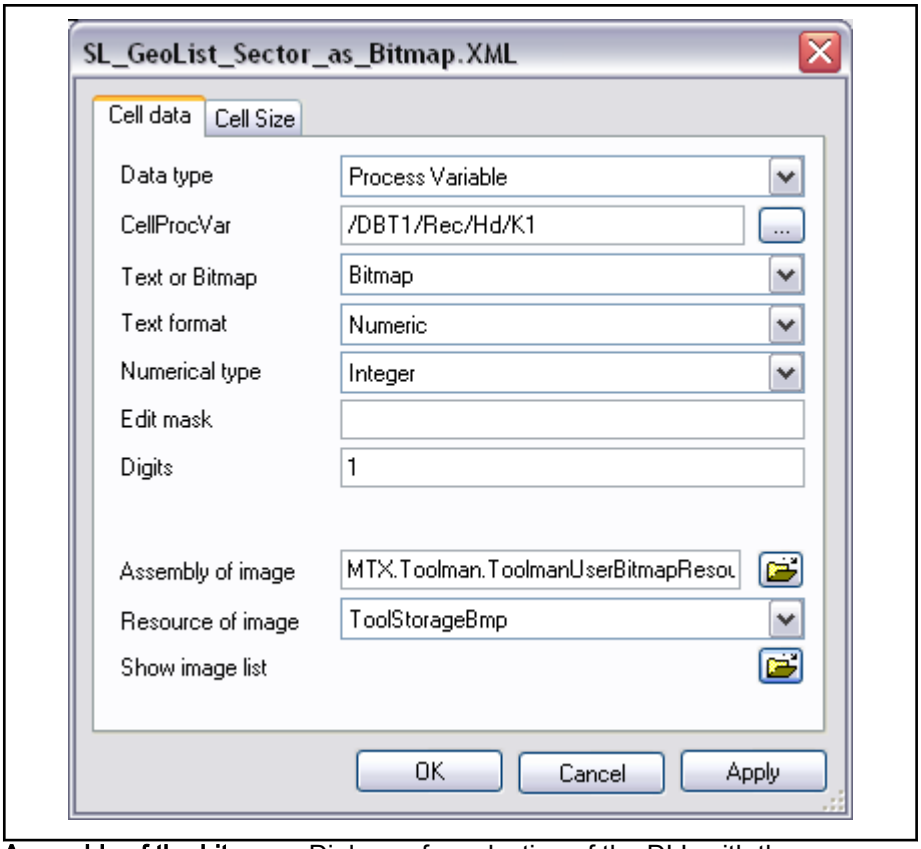
Merging cells

Vertical cell rows can be merged by highlighting them and summarizing them in one cell system using the function **Merge Cells** to be called via the pop-up menu. Use the **Split cells** function to split a highlighted cell link.

Creating process-dependent bitmap selection

Screens can also be shown subject to process variables. To this effect, a list with process values and the corresponding screen is being defined. In the configurator, there is an own configuration dialogue for the definition of the Bitmap list. When choosing the display mode "Bitmap", first choose the dll and the resource you want to choose screens from. Afterwards, define a "key - value - pair" using the dialog below. In this case, the value corresponds to the value of the variable which is linked to this cell. The value is the name of the screen from the resource. You can also indicate whether the value has to match the table value exactly or whether it has to be lower or greater.

Control commissioning



Assembly of the bitmaps Dialogue for selection of the DLL with the screens
Image resource Combo box with all resources, the dll
Show screen list Opens the dialog with the list of the values and the screens

Fig. 5-36: Configuration dialog for creating the bitmap list

List	The value pairs of process value and screen name Furthermore the screen itself is shown
Selection of radio button	Here it is determined how the process value has to be compared with the value from the list. The images are only displayed in the image above if the process value is equal to one of the values specified.
Add	The list will be extended by one entry at the end of the list
Delete	The selected entry is deleted from the list
Image	Another dialog opens in order to select a screen from the list of all screens contained in the resource
Ok	List is applied
Cancellation	Settings are discarded

Fig. 5-37: Dialog: List of keys/value pairs

Fig. 5-38: List of the screens in the selected resource

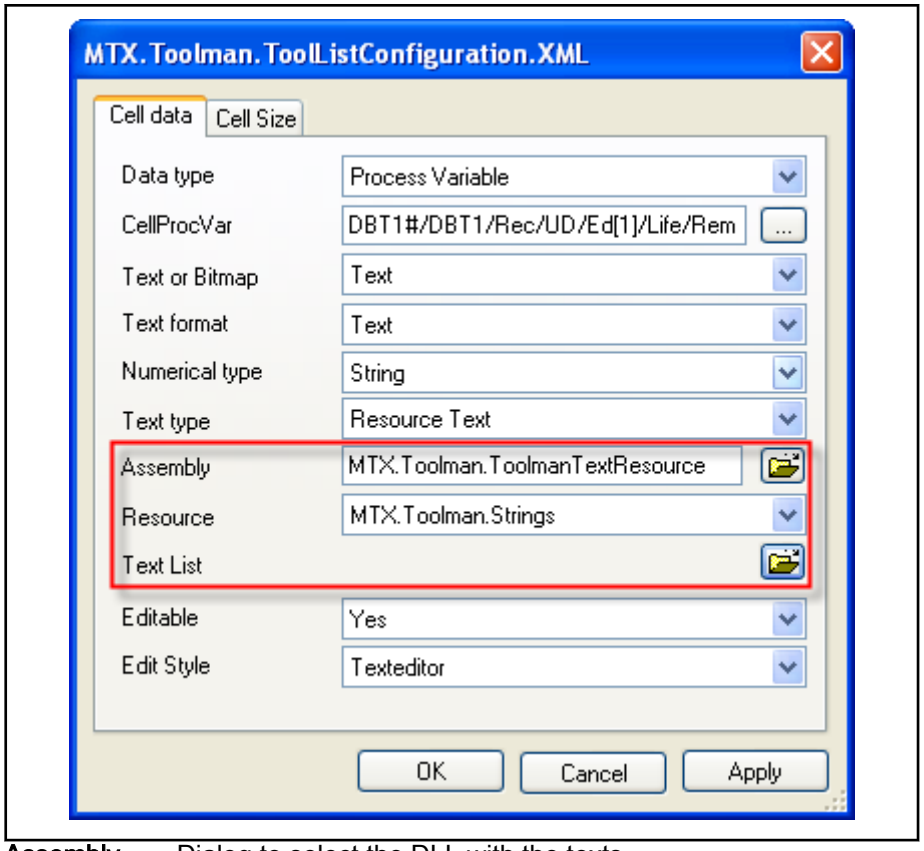
In order to select a screen, place the cursor on the desired screen and click on "OK".

Creating process-dependent text selection

Texts can also be shown depending on the process variables. Therefore, a process value list and the respective text is defined. In the configurator, there is an own configuration dialog for the text list definition. Select the text format "Text" (instead of "Numerical") to enter a list with value pairs. First, it is to be decided from where the texts are taken. There are three options (as for all text definitions): 1. Use text directly, 2. Use text of a dll (resource text) or 3. Use text from user text file.

If the resource or the user text list should be selected, the "Text List" button opens the dialog for the list creation.

Afterwards, define a "key - value - pair" using the dialog below. In this case, the value corresponds to the value of the variable which is linked to this cell. The value is the text name from the resource, the user text list or the text directly. You can also indicate whether the value has to match the table value exactly or whether it has to be lower or greater.

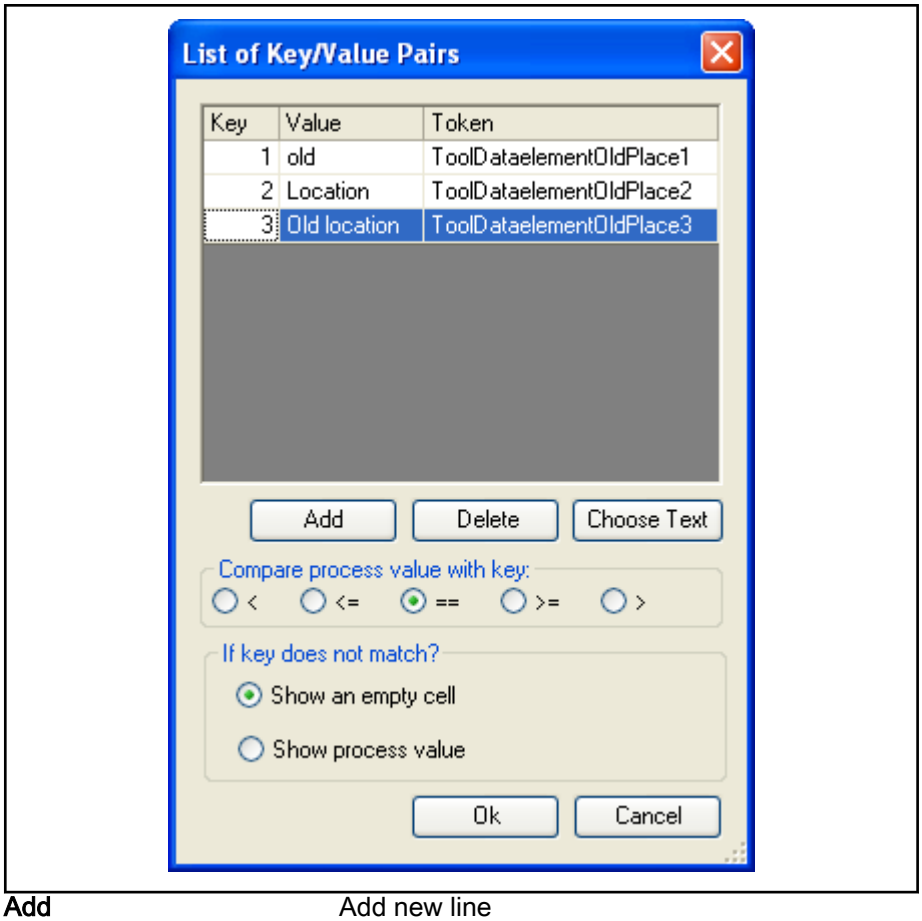


Assembly Dialog to select the DLL with the texts
Resource Combo box with all resources, the dll
Show text list Opens the dialog with the list of values and screens

Fig. 5-39: Configuration dialog to create the text list

The dialog to create a text list looks as follows:

Control commissioning



Add Add new line
Delete Delete line
Select text Select text from resource or from user text
Upper row of the button Here it is determined how the process value has to be compared with the value from the list. The images are only displayed in the image above if the process value is equal to one of the values specified.
Button "If key does not fit?" If the process value does not correspond to any of these values, either an empty line or the process value itself can be displayed.

Fig. 5-40: Dialog: List of keys/value pairs (text list creation)

Editing text list

Text lists are used to select texts from a list and to generate new ones. The texts that are selected can originate from a resource file and can be either texts or images; they can also come from a user text list. The list can be supplemented only if the texts come from a user text list.

Selecting text Double-click to select a text.

Adding text To add a new text, position the cursor over the last cell and enter a token in the first column and a text in the second column.

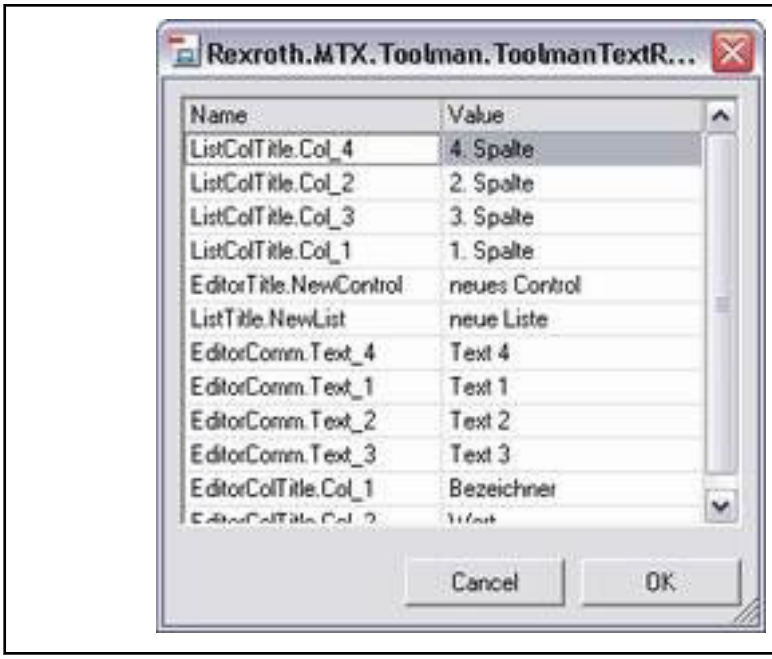


Fig. 5-41: Text list for selecting texts

Handling instruction: Define a new user text

The following handling instruction describes the procedure for defining a new user text in several languages.

Creating a user text in several languages

When creating new texts, the project language should always be the master language.

1. Create a new text (see chapter "Editing text list" on page 158)
2. **File ▸ Save all**

   A new text token is created.
   If the set project language was not the master language, the text token for the master language is generated automatically with the prefix "@@@@". Otherwise, the tokens for additional installed project languages remain empty; they can be generated externally using the functions **Project ▸ Language ▸ Export translation file...** followed by **Import translation file...**.

3. In order to generate a variant of the new text in another language within IW Engineering, the project language must be switched to the desired language.
4. The text for the new text token is displayed in the master language in the text list. The text can now be modified.
5. **File ▸ Save all**

   The new text is now available in two languages.

Screen		Documentation
Documentation:	MTX Functional Description	

Syntax of editing mask

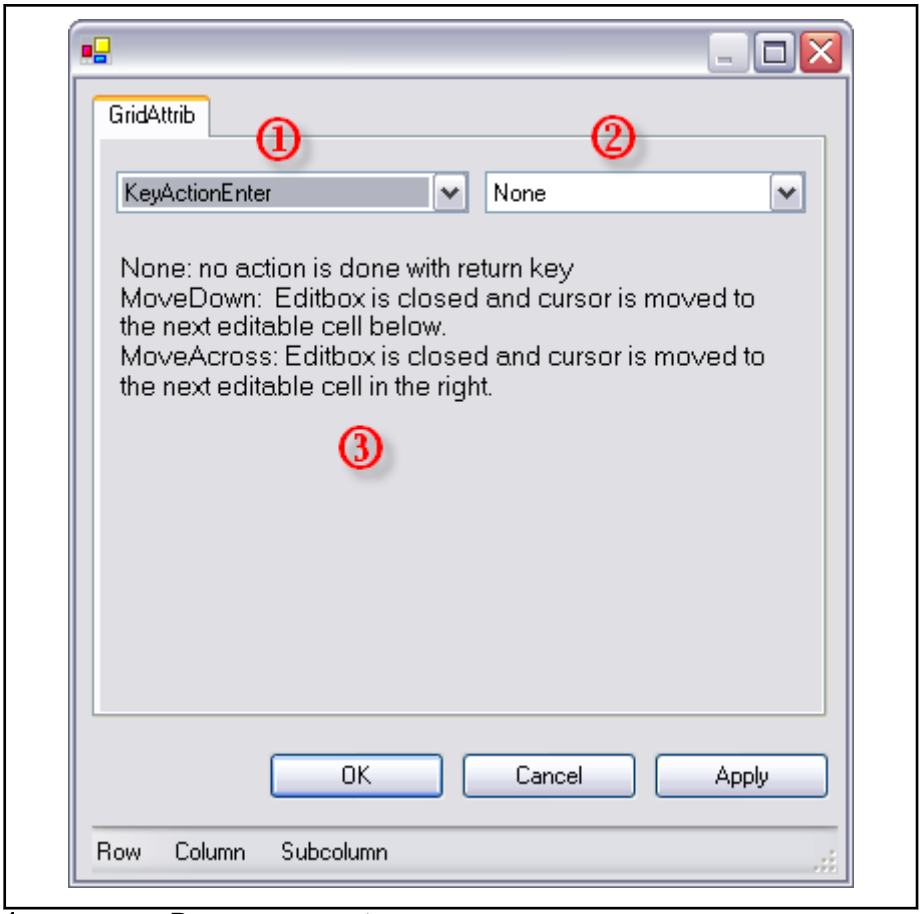
The editing mask has to consist of the following characters:

1) Wildcards	
0	Number
9	Number or space
#	Number or character
L	Letter
?	Letter or space
A	Letter or number
a	Letter, number or space
&	Any character
2) Localized characters	
.	Localized decimal point
,	Localized separating symbol for thousands
:	Localized separating symbol for time
/	Localized separating symbol for date
3) Command characters	
****	The next character will be interpreted as literal (directly as a character and not in its meaning)
>	Change letter to capital letter
<	Change letter to lowercase letter
4) Placeholder definition	
;	The next character is used as placeholder (default: underscore)

Example: EditMask = 000.00

Sets a mask that forces a three-digit number with two positions after the decimal point.

Setting general table properties



1 Process parameter
2 Value
3 Comment explaining the setting options

Fig. 5-42: Setting dialog for table attributes

General definitions (GridAttributes):

Element	Description
AllowFocusOnNonEditableCells	True: Cursor jumps to all cells False: Cursor skips all non-editable cells
AllowFreezingWithMouse	Shifting the frozen area: 0 = none 1 = Columns 2 = Rows 3 = Both
AllowMerging	True: Allow merging of cells False: Do not allow merging of cells

Control commissioning

Element	Description
AllowResizing	0 = none 1 = Columns 2 = Rows 3 = Both 4 = RowUniform 5 = BothUniform
AutoResize	Column width is set automatically when data exist.
AutoSearch	0 = none 1 = FromTop 2 = FromCursor
AllowSorting	0: Sorting not allowed 1: Single column sorting 2: Multiple column sorting
BorderStyle	1 = None 2 = FixedSingle 3 = Fixed3D 4 = Light3D
CheckRowVisibilityAtBeginning	No user setting required or reasonable
CursorKeyCanCloseEditmode	Cursor movements beyond the edge of the edit window terminates the edit mode
DrawTextFlexgridOrg	True: FlexGrid indication mode for texts and bitmaps False: ULC indication mode for texts and bitmaps
ExtendLastCol	True: The last column fills the entire area
FilenameOfDefaultValues	Name of the default setting file
GridHighlight	Defines when selected cells are highlighted: 0: Never 1: always 2: With focus
KeyActionEnter	Cursor movements after <ENTER>: 0 = None 1 = Down 2 = To the right
KeyActionTab	Cursor movement after <TAB>: 0 = None 1 = Down 2 = To the right

Element	Description
ListBackGroundColor	Background color of the list (visible only if the indicated list area is smaller than the control)
PageDownTrack	0: Data of the next page are **not** updated while the user presses <PgDn> 1: Data of the next page are updated while the user presses <PgDn>
ScrollTrack	0: The list is **not** updated while the user moves the scroll bar 1: The list is updated while the user moves the scroll bar
ShowDebugMessages	Trace message output in the debug window
ShowTraceMessages	Display of error messages
SortEmptyRowsToEnd	1: Empty entries are allocated at the end of the list; irrespective of the sorting Default value: 0
Stripline	Dividing line between fixed and scrollable area
SuppressComma	If UseNumberDecimalSeparator = False: True: Comma is replaced by point
TabCanCloseEditMode	TAB terminates edit mode
TestDOMToConfig	No user setting necessary
TestSOMToConfig	No user setting necessary
UseFixedNumberOfSubRows	1: The first sublist is checked and then used to generate the number of all SubRows. Default value: 0
UseNumberDecimalSeparator	True: The separator defined in the current country setting is used False: Point is used generally

Tab. 5-6: GritAttributes

XML file editor

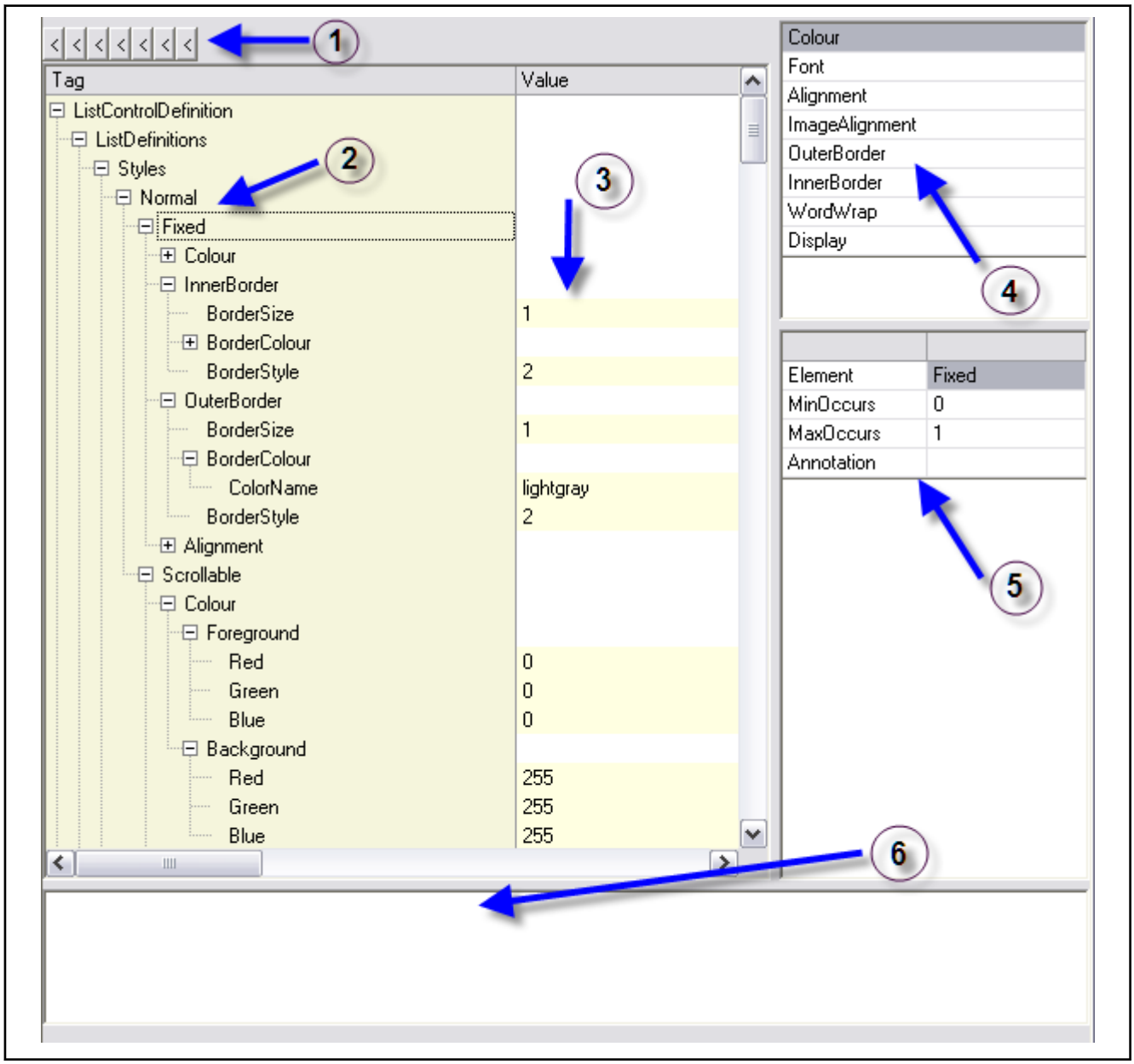
General information

The XML file editor can be accessed via the tab page "XML Editor" of the ULC configurator and can serve as a supplementary view of the tool list and tool editor control configurator.

The XML file editor is provided especially for schema-supported editing. The available version is opened only to configure tool lists and tool editors.

Control commissioning

The advantage of schema support is that nodes defined in the schema can be selected from a list; they do not have to be entered separately. In addition, values that are entered are checked whether they are appropriate for the schema.



1	Button for expanding/collapsing nodes
2	Node tree
3	Value list
4	List of possible children of the selected node
5	Attributes and comments for the selected node
6	Output window

Fig. 5-43: The tool list XML editor

The editor provides the following possibilities:

Pasting known nodes

When an element in the list of possible node children (4) is double-clicked, this element is pasted as a child in the selected node.

Editing a value

1. In the list of values (3), select a cell and double-click or press <Return> to switch to the edit mode.
2. Enter the value and confirm with <Return>.

If the selected node is defined in the schema, the entry is monitored. Only valid values may be entered.

Searching for strings

Press <Ctrl>+<F> or click with the right mouse button on "Find" to activate the search window, with which you can search for strings in the document.

Copying nodes

Select a node and, with the right mouse button, click "Copy Node". Now the node, with all the subnodes, is copied as a partial XML tree to the clipboard. From there, it can also be used differently. For example, copy the node into a text editor, modify it there, copy it back to the clipboard and paste it back into the document.

Pasting nodes

If a node was copied to the clipboard previously, it can be pasted anywhere. This procedure is not monitored by the schema! Select the node which is supposed to become a "parent" and, with the right mouse button, open the pop-up menu pressing **Paste Node**.

Moving nodes up

Select the node, press the right mouse button and select "Move node up" in the pop-up menu.

Moving nodes down

Select the node, press the right mouse button and select "Move node down" in the pop-up menu.

Deleting nodes

Select the node and use the <Del> key or right-click and select the "Delete node" in the pop-up menu.

Pasting nodes with freely definable names

Select the node, right-click and select "Add new node" in the pop-up menu. This pastes a node whose name is freely definable. This name does not have to be defined in the schema and can lead to errors during validation.

Pasting a text node

A value can be assigned to nodes that do not have subnodes as children themselves (end nodes). This occurs using a text node. Select the node, right click and select "Add new text node" in the pop-up menu. The text node that was just created can now be filled with any text.

Copying XPath to clipboard

Select the node, press the right mouse key and select "Copy XPath to clipboard" in the pop-up menu. The path from the basic node to the selected object can now be found in the clipboard.

Expanding and collapsing individual node levels

For every node level, a button used to open or close the corresponding node level is created when the XML document is loaded. If a subordinate level is expanded, all superordinate nodes are also expanded.

5.10.3 General DB configuration

Number of the DBT used

General information

All general settings for the database visualizations (e.g. tool management) are selected via the "Properties" dialog which can for instance be called via **DBTx Screens (tool management) ▸ Properties...**.

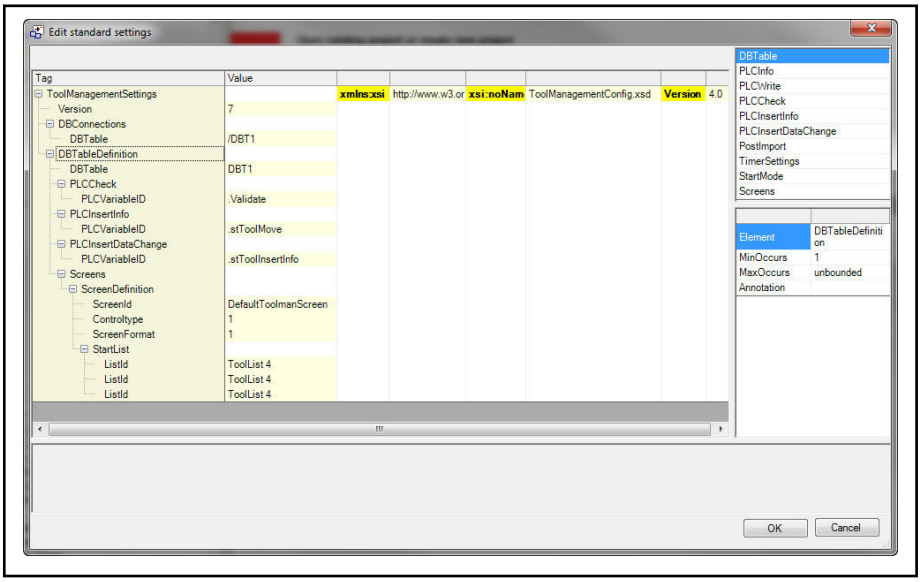


Fig. 5-44: Tool management

2. Activating database table

Currently, a maximum of two database tables can be used.

If the second database table should be used, respective settings have to be made in the file "ToolManagementConfig.xml" .

First, activate the communication in the second database table:

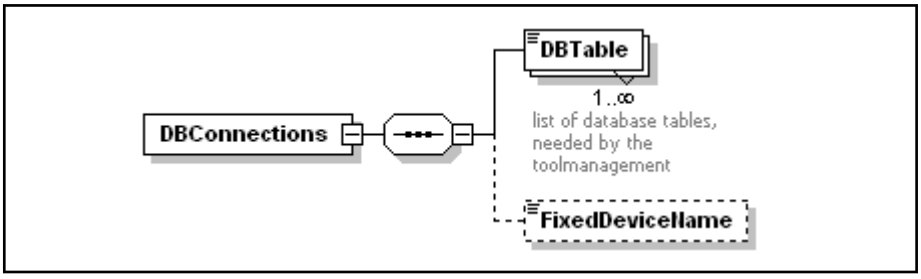
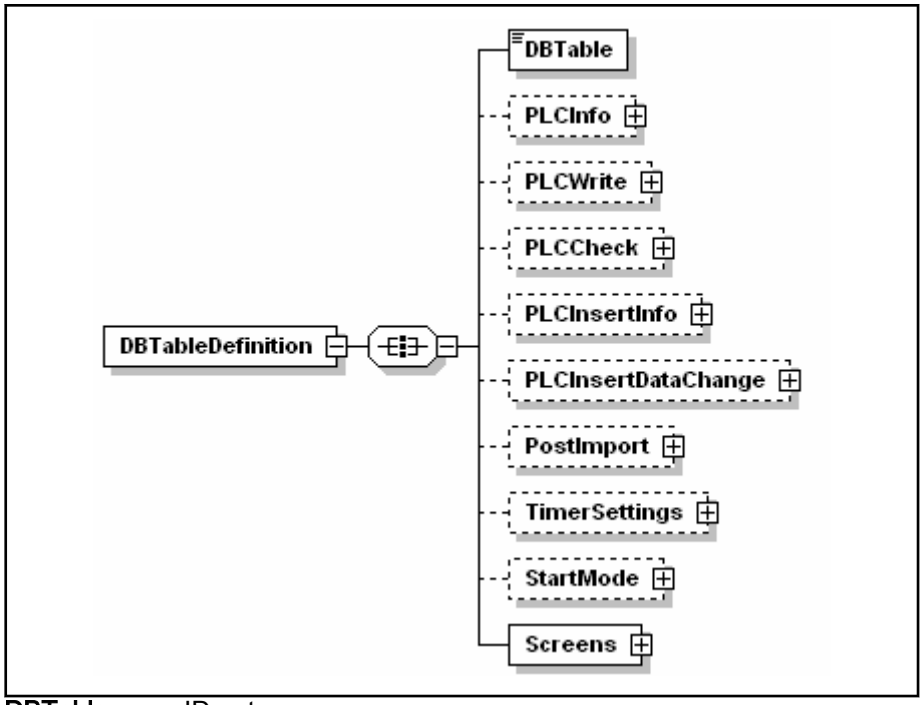


Fig. 5-45: Activating second database table

If these entries are missing under **DBConnections**, it is only communicated with the database table 1.

Furthermore, if applicable, all functional basic settings should be made for DBT2 as made for DBT1.



DBTable	ID entry
PLCInfo	Definition of the PLC variable name for the "Info" function
PLCWrite	Definition of the PLC variable name for the "Write" function
PLCCheck	Definition of the PLC variable name for the "Validate" function
PLCInsertInfo	Definition of the PLC variable name for the InsertInfo function
Post import	Definition of the "Postimport" function
TimerSettings	Low-pass filter configuration:
StartMode	Setting the edit mode used for starting
Screens	Contains screen definitions for DBT

Fig. 5-46: Structure diagram 1: ToolManagementConfig.xml

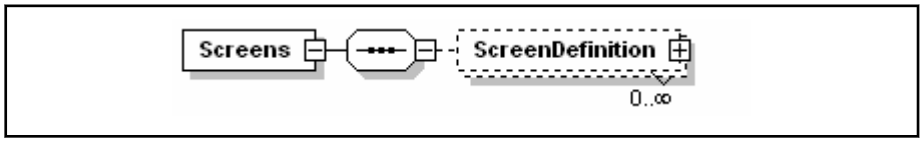
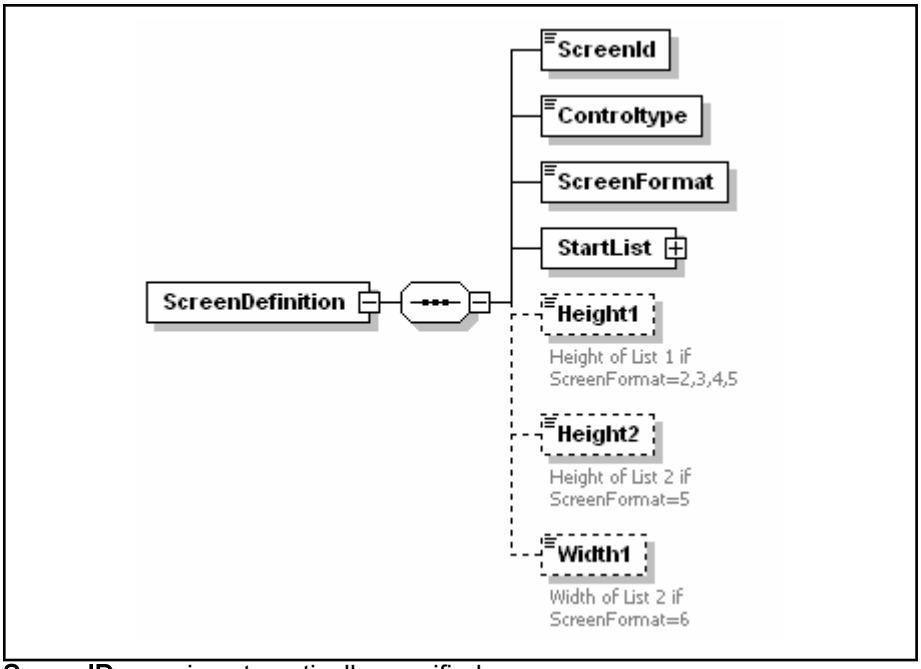


Fig. 5-47: Block diagram 2 ToolManagementConfig.xml



ScreenID is automatically specified
Controltype is automatically specified (see chapter "General information" on page 169)
ScreenFormat is automatically specified (see chapter "General information" on page 169)
StartList defines the starting list of the screen
Height1 Height of list 1 (relevant for manual size setting of the lists for ScreenFormat 2,3,4,5)
Height2 Height of list 2 (relevant for manual size setting of the lists for ScreenFormat 5)
Width1 Width of list 1 (relevant for manual size setting of the lists for ScreenFormat 6)

Fig. 5-48: Block diagram 3 ToolManagementConfig.xml

Creating a DBT2 screen in IndraWorks Engineering

To visualize the DBT2 data in the IWO, it is possible to define an own visualization screen. Furthermore, it is still possible to call and visualize DBT2 lists within the operating area tool management.

Handling instruction: Configuration to use the second database table

The following handling instruction describes the process to be followed when further database tables are to be used.

Activate communication with the second database table

1. Open the "Properties" dialog of the database applications via **DBT1 Screens (tool management) ▸ Properties...**.
2. Add the entry for the second database table under the node **"<DBConnections>"** (refer to the following Fig.).

Program:

```
<DBConnections>
    <DBTable>/DBT1</DBTable>
    <DBTable>/DBT2</DBTable>
</DBConnections>
```

Basic setting definitions of the management for the second database table

1. Open the "Properties" dialog of the database applications via **DBT1 Screens (tool management) ▸ Properties...**.
2. Add another node for the DBT2 in the same way as for partial tree **"<DBTableDefinition>"** for the DBT1 and enter all necessary entries for the second database table under this node (see example in the following figure).

Program:

```
<DBTableDefinition>
    <DBTable>DBT2</DBTable>
    <PostImport>
     <Action>
      <ProcVariableID>Hd/BQ2</ProcVariableID>
      <Operation>AND</Operation>
      <Value>FFFFFF7F</Value>
  </Action>
 </PostImport>
    <PLCCheck>
     <PLCVariableID>.Validate</PLCVariableID>
 </PLCCheck>
...
</DBTableDefinition>
```

Activation of DBT2 in the project and setting up the user interface configuration

1. Close the project to apply the changes.
2. Open the project again in IndraWorks Engineering.

   The database table 2 in the project tree does now have an individual node.
   Under this node all interface settings for the DBT2 can be made.

	Documentation	
Documentation:	MTX Functional Description	Apply new data structure

Configuring several DBT visualizations

General information

There is the possibility of visualizing the database tables in one or in several applications. This applies both for database table 1 which is exclusively intended for the management of tool data and for database table 2 which also allows for the management of other user data.

The configuration of the database is the same for all database tables (refer to chapter 5.10.4 "Configuring the database" on page 175).

The visualization of the data of one database table requires at least one visualization screen per DBT. For the DBT1 there is always a "Default ToolmanScreen". Further screens can be defined for a DB table via the menu function **New Screen...**. Depending on the node under which the new screen is created, the DBT allocation of the latter takes place.

In the following dialog all further configuration steps for the screen definition are made:

- Specifying the application type
- Specifying the list number and the display format
- Specifying the start lists

Control commissioning

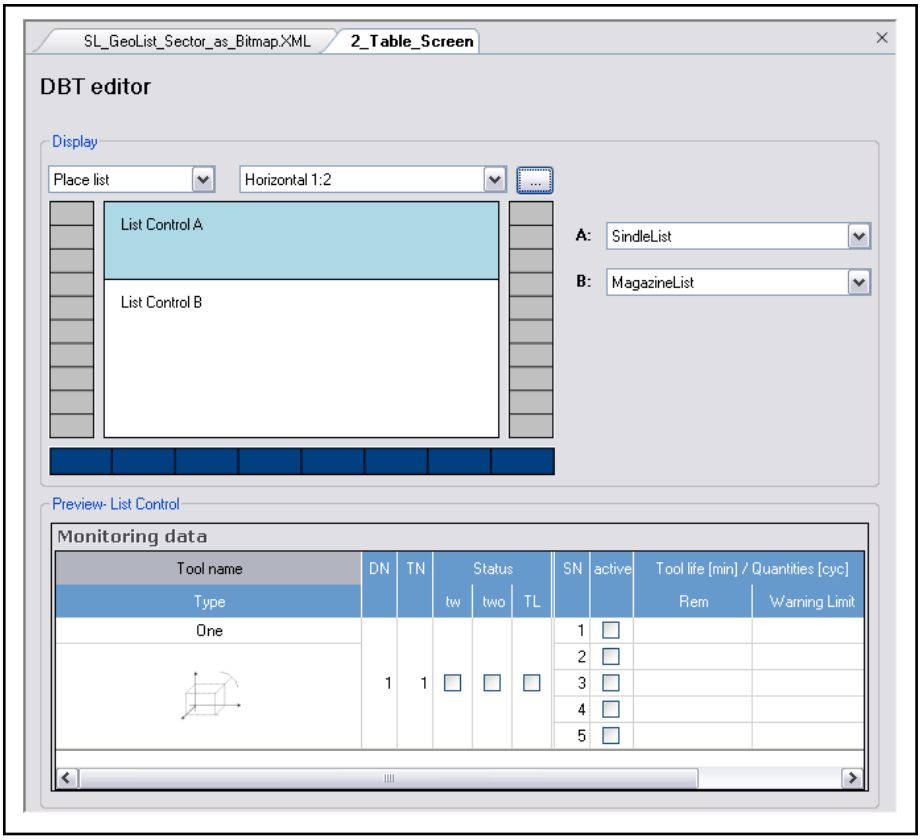
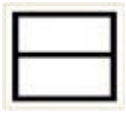
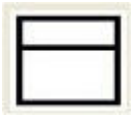
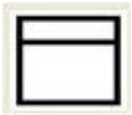
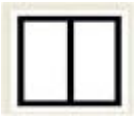


Fig. 5-49: Screen configuration

Display format	Number of lists	Properties	ScreenFormat
Default	1		1
horizontal 1:1	2		2
horizontal 1:2	2		3
horizontal 1:3	2		4

Display format	Number of lists	Properties	ScreenFormat
horizontal 1:1:1	3		5
Vertical 1:1	2		6

Tab. 5-7: Display format

If the database tables are used in different operating areas - which in turn requires the definition of different applications or screens - these applications can have the following properties.

Applications type	Exemplary use case	Properties
as place-related data block management **Controltype = 1**	Tool management Workpiece management	• SKQ as a criterion for assigned place • derived from this, the F-key and menu functions are placed actively or inactively • Evaluation of the PD attribute in the schema
as universal data block management **Control type = 2**	any data container (does only make sense for DBT2)	• All data elements are equal without downstream display and function logic. • The attributes "UA","SE" and "PD" in the schema do not have any function. • The data element BQ3 for the type-related display control is free and can be made further use of as bit array. • As opposed to the system data, the DBT2 has the effect of a data container in sectors with predefined memory and access functions typically for a database.

Tab. 5-8: Application types for database tables

There is still the possibility of visualizing both database tables via different lists in one screen.

Handling instruction: Configuration of several different applications

The following handling instruction describes the process to be followed when visualizations of database tables in different operating areas are to take place.

Creating a new DBT Screen

1. Open IndraWorks Engineering
2. Select the node **"Screens"** in the project tree under the HMI device.
3. Select **New screen...** in the menu.
4. Define the screen name in the following dialogue.

   A new node will appear in the tree with the name of the new screen.

Setting the Properties of the new DBT Screen

1. Select the node of the new screen in the tree and press <ENTER> or double-click on this node.

The screen editor for the new picture is opened.

2. In the selection box "Screen type" the type **"MTX ToolList"** is selected.
3. In the selection box "Table" the application type is selected (refer to tab. 5-8 "Application types for database tables" on page 171).

   Subject to the selection, the following is displayed in the field "Table":

Selection	Entry
DBT1 place list	DBT1 ;1
DBT2 place list	DBT2 ;1
DBT1 general list	DBT2 ;2

4. In the selection box "Operating area" the application is allocated to an operating area.

F or M-key configurations should not be made, since these take place when defining the list.

Call Definition via F-key or M-key

1. Selection of the corresponding F- or M-keypad of the operating area which the application was assigned to and which contains the key provided for the call of the application.
2. Opening the selected panel.

   F- or M-key configurator is opened.

3. Selection of the corresponding key and definition of the key labeling.
4. In the selection box "Function" **"Screen change"** is selected.

   The selection box "Screen name" becomes active.

5. The name of the newly created DBT application is selected in the selection box "Screen name".
6. Close editor and save change.

	Documentation	
Documentation:	MTX Functional Description	Apply new data structure

Configuring multiple-table screens

Creating a multiple-table screen

None

1. Create a new tool screen or DBT screen via <New Screen>.

   Depending on the node under which the new screen is created, the DBT assignment of the latter takes place.

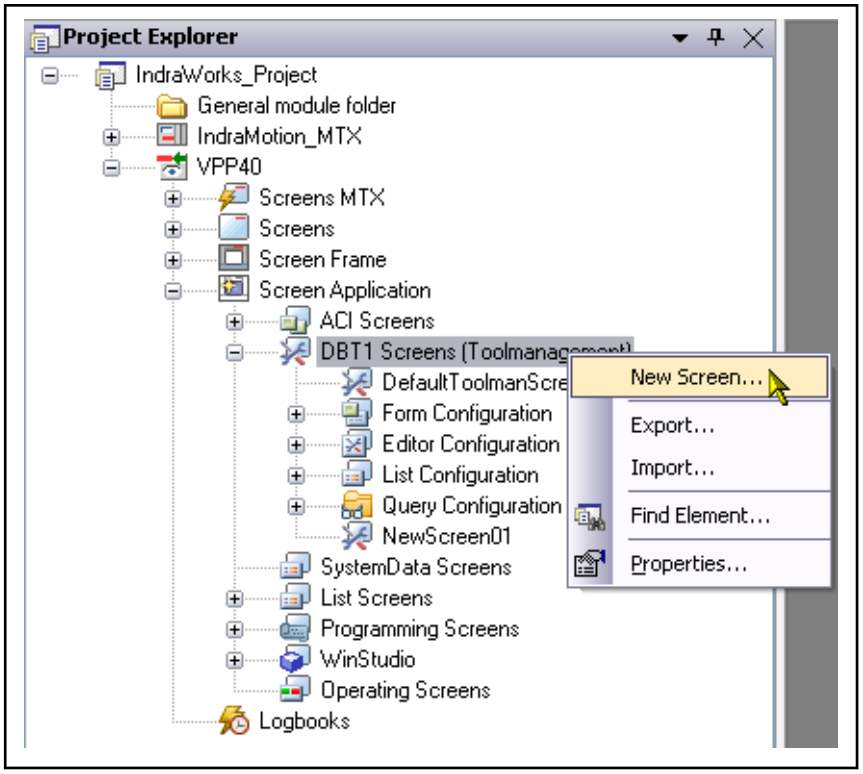
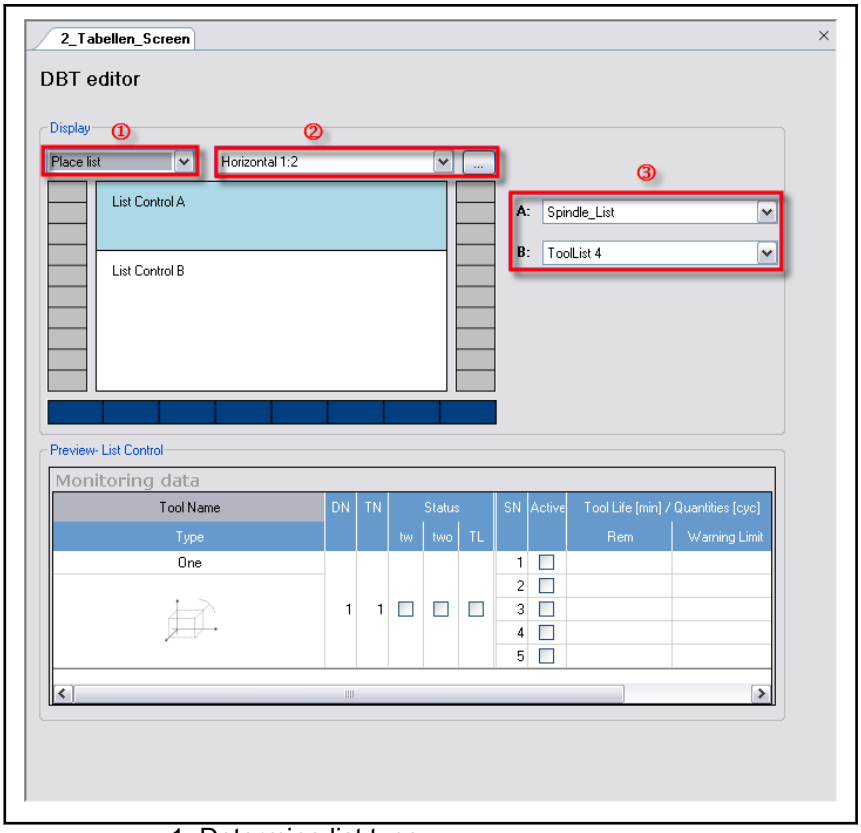


Fig. 5-50:

New entry under "DBT1 Screens (Tool Management)" or "DBT2 Screens"

2. Configure new screen

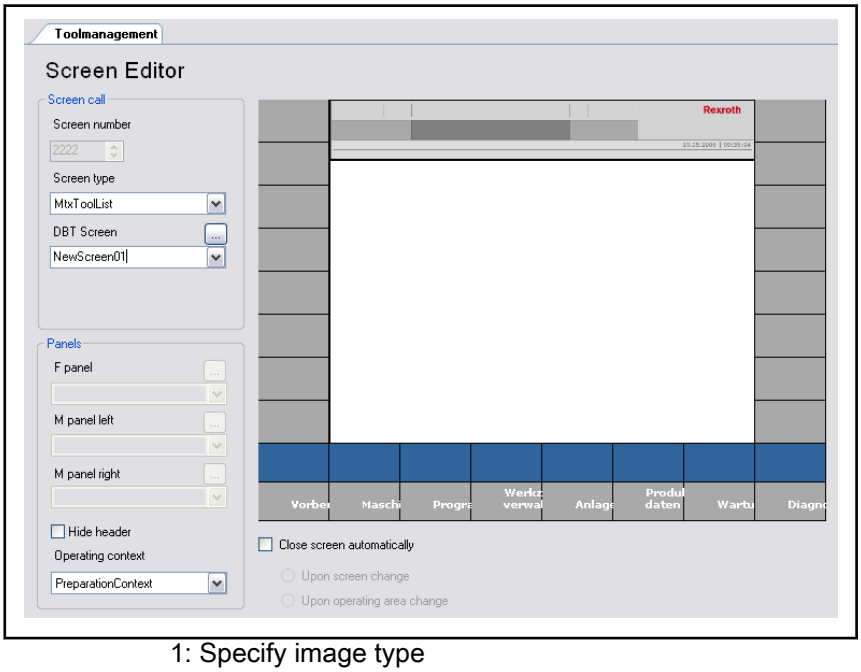
Control commissioning



1: Determine list type
2: Determine display format
3: Specify starting list(s)

Fig. 5-51: Configure new screen

3. Identify new screen for HMI device and assign to operating area.



1: Specify image type
2: Panel definition performed in list definition
3: Assign operating area

Fig. 5-52: Use DBT1 screen in screen editor

4. Opening a new screen via an F-key in the selected operating area.

5.10.4 Configuring the database

General information

Settings for a control reset in case of changes made to the database configuration:

Changes in:	Necessary action:
dbt**x**prms.dat	Control reset with restart mode 6
Changing the element structure in the tool data schema	Control reset with restart mode 6
Changing attributes/restrictions in the tool data schema	Control reset with restart mode 0

Tab. 5-9: Reset settings

☞ A control reset with restart mode 6 and a control reset with restart mode 0 and the parameter 2 = 6 in the file "dbt**x**prms.dat" always causes the deletion of all data blocks of the database table.

Defining sector and place distribution of database table

General information

The sector-place structure of the database table is specified as follows in the configuration files. For each database table, a specific file is available: for DBT1, it is the file **"dbt1prms.dat"**, and for DBT2, it is the file **"dbt2prms.dat"**.

Program:

```
; ------------------------------------------------------------
;       Configuration file for the DB table DBT1
; ------------------------------------------------------------
; general design:
; P0 P1 P2 P3 P4 P5 P6
;  |  |  |  |  |  |  |
;  |  |  |  |  |  |  +--- string: may also contain " " and \t
;  |  |  |  |  |  |               End identification is "line end"
;  +--+--+--+--+--+------ 6 int values
; P0 describes the object type and may not be modified
; Empty string marked with "."
; ";" marks comment lines At the end of a data line
; No comment must be added
;
;       ***************************
;       Configuration of the DB table
;       ***************************
; Control parameter
; P0: 0
; P1: Controls the creation of the data records in the database
;       0  Standard operation
;          Data records are only created when the tool database
;          is empty
;       6  All existing data records are deleted first and;
;          then created again according to the
;          sector configuration
0 0
; Sector configuration
; P0: 1-99 (corresponds to sectors 1 - 99)
; P1: Number of places in the sector
1 5
2 5
```

Changing the sector and place distribution is applied after a control reset with mode 6.

☞ The existing content of the database is deleted and cannot be restored! If existing tool data is required, export the data before making any change to the database. If the number of data blocks is smaller than the number of data blocks included in the export file, this file has to be adjusted using a suitable XML editor.

Handling instruction: Defining the sector and place distribution of a database table

This handling instruction describes how to modify the sector and place distribution for a database table.

IW Operation/Program: Edit the file "dbt?prms.dat"

1. Copy the file **"dbt?prms.dat"** (?:= 1 [DBT1] or 2 [DBT2]) to the mount directory (\mnt) in the control directory **"\usrfep"** or **"\feprom"**.
2. Edit the file via the editor, enter the desired values for the number of sectors and places (see the program in chapter "General information" on page 175).
3. Save file.
4. Copy the file to the **"\usrfep"** control directory.

	Flowchart	Documentation
Flowchart		Flowchart fig. 1-7
Documentation:	MTX Functional Description	Define data blocks

NC: Data transfer

1. Close IW Operation.
2. Start the control with **"Startup Mode 6"**. Use the **MTX System Status** function.

   .

☞ ⇒ It is absolutely necessary to execute an NC data backup and to import the data.

	Flowchart	Documentation
Flowchart		Flowchart fig. 1-7
Documentation:	MTX Functional Description	Define data blocks

Configuring data blocks

General information

Since the current version does not yet have a Settings dialog for configuring the user interface, the corresponding scheme or XML document files must be adjusted by means of a suitable editor (for example, see chapter "Schema editor" on page 141). This documentation proceeds on the assumption that the universally available Notepad editor is used.

To describe the tool data block schema, the following XSD schema files are installed by default in the FEPROM/scheme range of the MTX. To adjust them, copy these schema files to the Userfep/Schema directory. If there is no such directory, create it.

The files can only be edited in the mount or another Windows directory. Subsequently, copy the changed schema files to the Userfep/Schema directory. The changes in the control kernel are applied after control restart.

The tool data structure is described by a hierarchically structured system of XSD files:

dbt1sd.xsd	Tool data system structure
dbt1ud.xsd	Tool user data structure
tool_ty.xsd	Tool data type collection
basic_ty.xsd	Basic data type collection

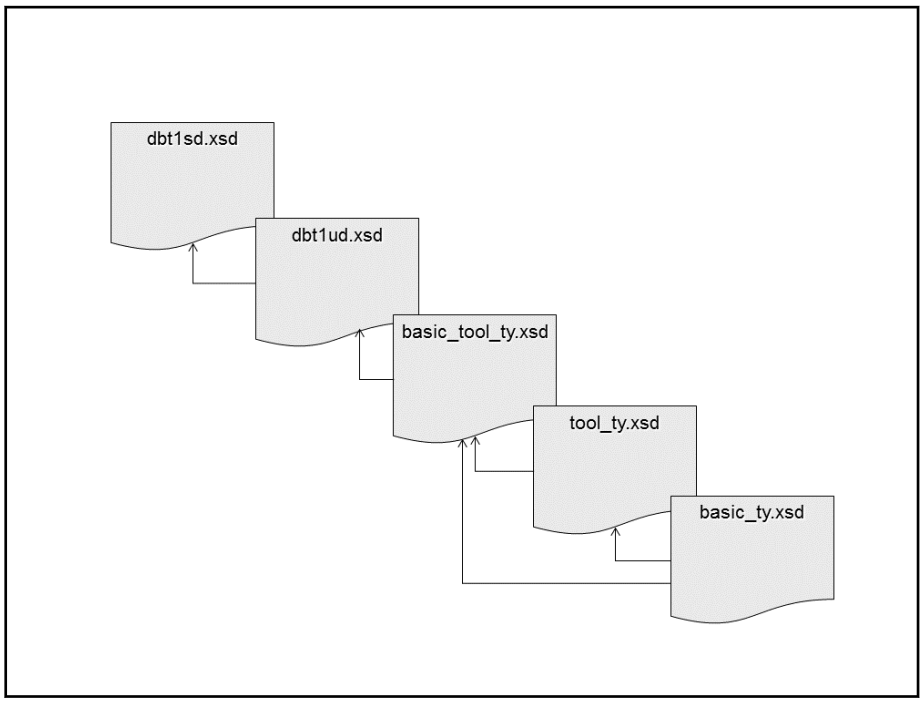
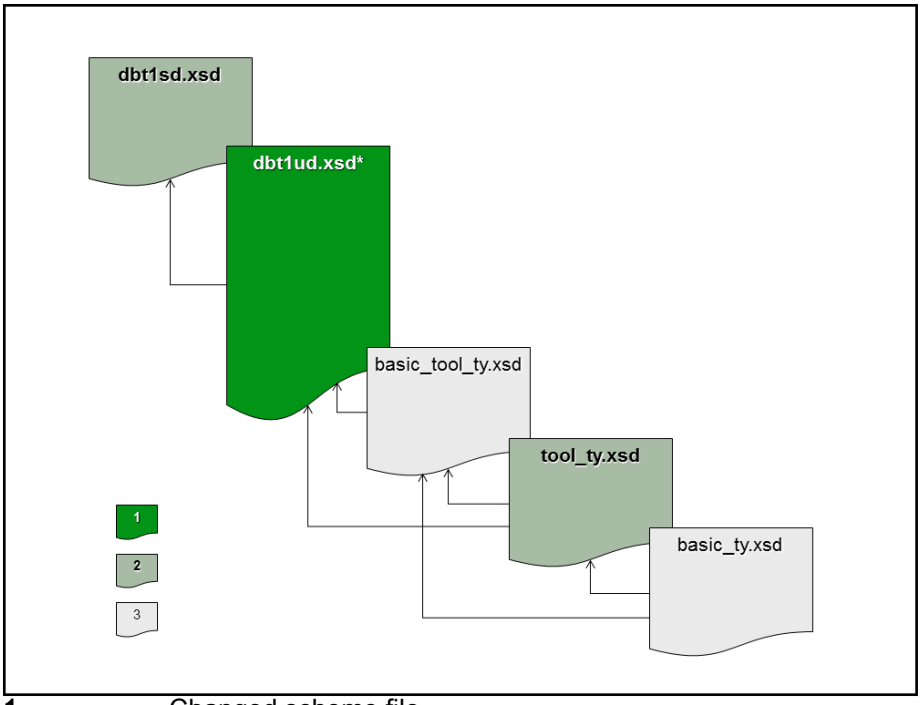


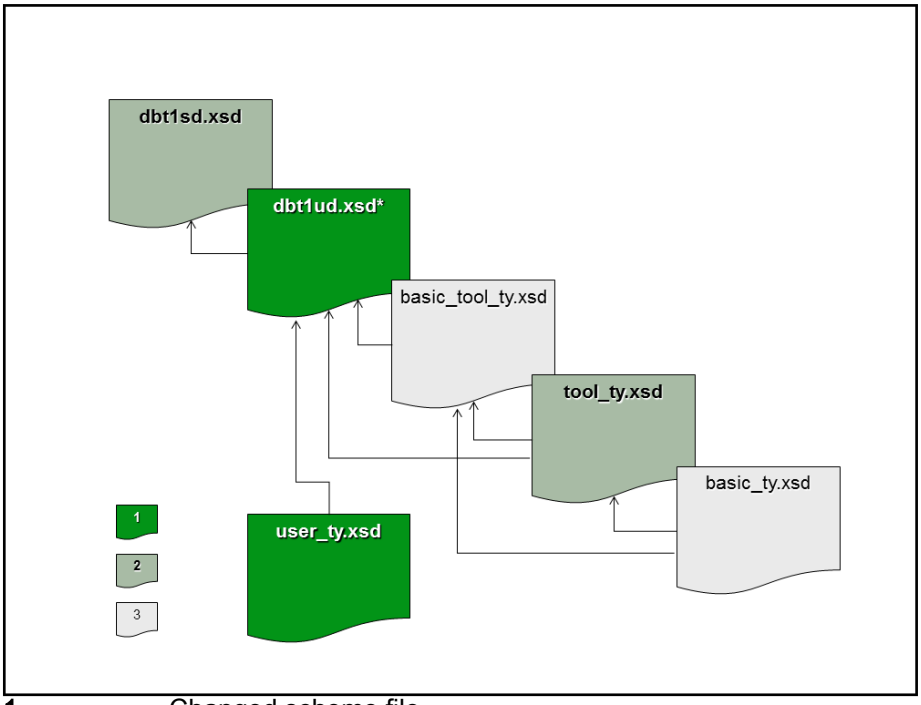
Fig. 5-53: Schema configuration (delivery state)

Control commissioning



1 Changed scheme file
2 Modifiable scheme file
3 scheme file that **cannot** be modified

Fig. 5-54: Modified schema configuration (recommended variant)



1 Changed scheme file
2 Modifiable scheme file
3 scheme file that **cannot** be modified

Fig. 5-55: Modified schema configuration

Ideally, the user only has to extend the user data structure in the "dbt1ud.xsd" file.

Tool system data structure (dbt1sd.xsd)

This file describes the system structure permanently preset in the MTX for all tool management systems implemented with database table 1. The "DBT1Hd_t" data type in this file is a standard data type preset by the system. It contains a series of basic tool data which are used by the system functions, e.g. the tool catalog, and standard functions such as place and tool search functions. Thus, the user must not change the data structure of this schema.

Include	loc:dbt1du.xsd
element	DBT1
complexType	DBT1Rec_t
complexType	DBT1Hd_t

Tab. 5-10: Content of the system structure

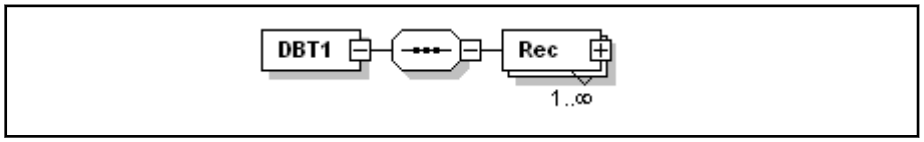


Fig. 5-56: Data block schema (1)

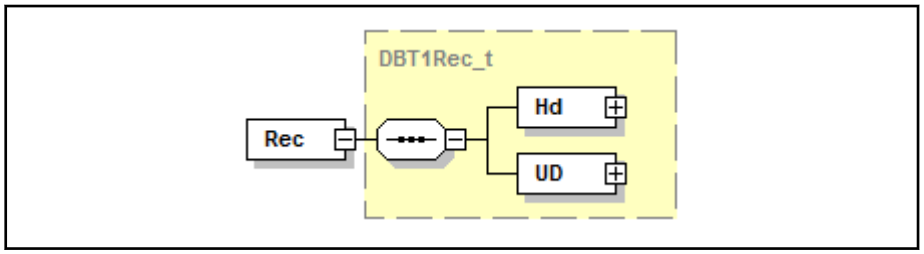


Fig. 5-57: Data block schema (2)

Control commissioning

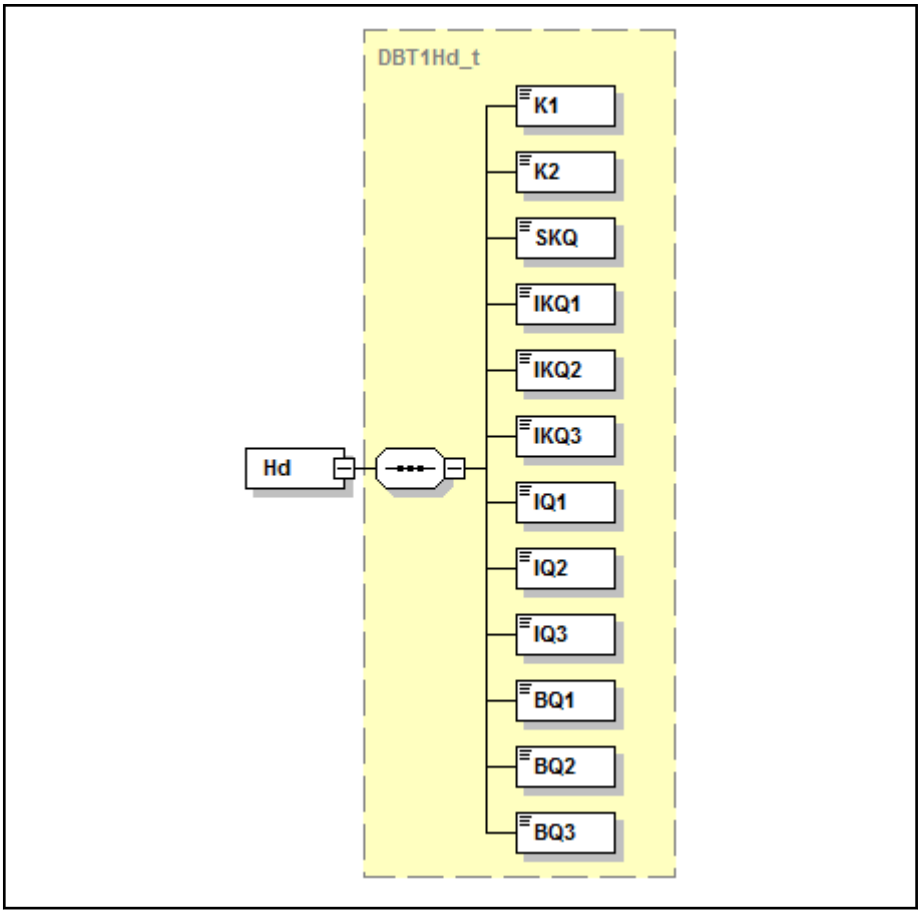


Fig. 5-58: Data block schema (3) (header schema)

The significance of the following header data elements is permanently defined for the tool data block:

K1:	Sector (memory)	Integer
K2:	Place	Integer
SKQ:	Tool ID	String
IKQ1:	Duplo number	Integer
IKQ2:	Tool type	Integer
IKQ3:	Tool number	Integer
IQ1:	Free (reserved for multi-table system)	Integer
IQ2:	Free (reserved for multi-table system)	Integer
IQ3:	Free (reserved for multi-table system)	Integer
BQ1:	Place status	Bit array
BQ2:	Tool status	Bit array
BQ3:	Tool type description	Bit array

Tool user data structure (dbt1sd.xsd)

Using the substructures predefined in the tool data type collection, this file describes the parts of the tool data structure to be modified. In the current case, the user structure consists of:

		Type from V14:	Type > V09:	Type > V04:	Type in V02:
Tool basic data structure	Tl	Tl_V14_t	Tl_V09_t	Tl_V04_t	Tl_t
Tool edge data structure	Ed		Ed_ V09_t	Ed_ V04_t	Ed_t

Tab. 5-11: Tool user data structure

These types are defined in type collection "tool_ty.xsd" and "basic_tool_ty.xsd".

The maximum number of tool edge data structures and, thus the maximum tool edge number is defined in the data block via the entry <xs:element name="Ed" maxOccurs="2">.

Include	**loc:tool_ty.xsd**
Include	**loc:basic_tool_ty.xsd**
complexType	DBT1Ud_t

Tab. 5-12: Content of the user data structure

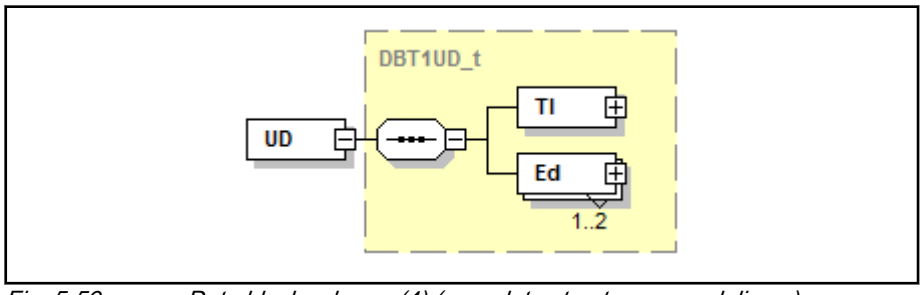


Fig. 5-59: Data block schema (4) (user data structure upon delivery)

Change of maximum number of tool edges

The number of tool edges can be changed using the following entry (maxOccurs) in this schema file:

Example:

Maximum number of tool edges = 2:

Program:

```
<xs:complexType name="DBT1UD_t">
  <xs:sequence>
    <xs:element name="Tl" type="Tl_V14_t"/>
    <xs:element name="Ed" type="Ed_V09_t" maxOccurs="2"/>
  </xs:sequence>
</xs:complexType>
```

The default tool data block was defined for up to two cutting edges. If this number should be changed, the following system data setting must be adjusted in the **SDDat.xml** file to ensure a correct display of the active tool correction in the operating area "Machine".

Program:

```
...
  <SysMaxEd>
    <MaxEd>2</MaxEd>
```

```
  </SysMaxEd>
...
```

Tool data type collection (tool_ty.xsd)

This schema file includes a collection of partial tool data structures predefined in the MTX as a standard and intended as components to define the tool user data structure. Note that all data elements in the MTX not contained in the header has to be considered as user data. This type collection was further developed for the MTX 04VRS and contains redundant data types due to compatibility reasons. These data types are labeled in the following table with "Only for V02 standard projects".

☞ If legacy projects are used without modifications, the following modification must be made in file "dbt1ud.xsd":

The following lines

...

<xs:element name="Tl" type=**"Tl_V14t"**/>

<xs:element name="Ed" type=**"Ed_V09_t"** maxOccurs="2"/>

...

are replaced by

...

<xs:element name="Tl" type=**"Tl_V09t"**/>

<xs:element name="Ed" type=**"Ed_V09_t"** maxOccurs="2"/>

...

or

...

<xs:element name="Tl" type=**"Tl_V04_t"**/>

<xs:element name="Ed" type=**"Ed_V04_t"** maxOccurs="2"/>

...

or

...

<xs:element name="Tl" type=**"Tl_t"**/>

<xs:element name="Ed" type=**"Ed_t"** maxOccurs="2"/>

...

The modified file has then to be located in directory usrfep\schemas.

To use new functions, the schemas have to be extended according to the standard of version 04.

If the new structure is used, existing PLC and CPL programs from version 02VRS have to be adapted.

		Remarks
Include	**loc:basic_ty.xsd**	
complexType	Tl_t	For V02 default projects only
simpleType	LifeUnit_t	
complexType	Tl_V04_t	New default type from V04

		Remarks
Include	**loc:basic_ty.xsd**	
complexType	Tl_V09_t	New default type from V09
complexType	Ed_t	For V02 default projects only
complexType	Ed_V04_t	New default type from V04
complexType	Ed_V09_t	New default type from V09
complexType	Geo_t	For V02 default projects only
complexType	Geo_V04_t	New default type from V04
complexType	Wear_t	
complexType	EdLife_t	For V02 default projects only
complexType	EdLife_V04_t	New default type from V04
complexType	Limits_V04_t	New default type from V04

Tab. 5-13: Content of the tool data type collection (tool_ty.xsd)

		Remarks
Include	**loc:basic_ty.xsd**	
Include	**loc:tool_ty.xsd**	
complexType	Tl_V14_t	New default type from V14
simpleType	ToolOri_t	Tool orientation

Tab. 5-14: Content of the tool data type collection (basic_tool_ty.xsd)

Only the data structure of the new default projects for V04 and higher is described below.

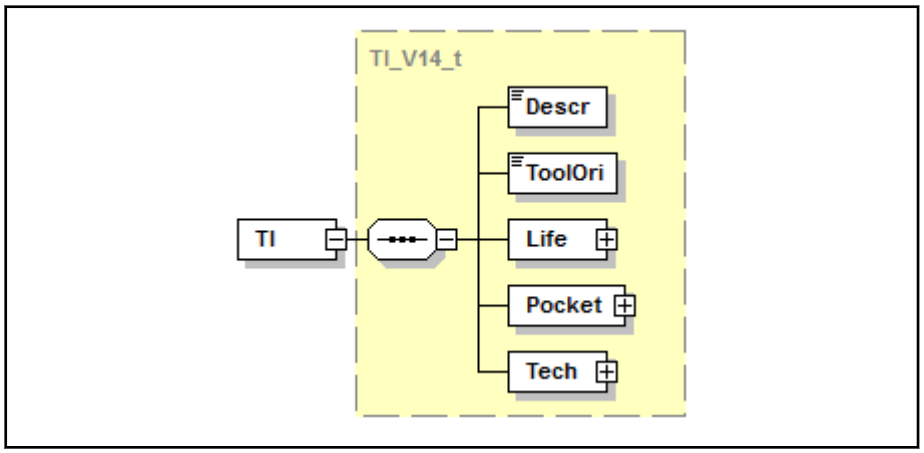


Fig. 5-60: Data block schema (5) (tool data upon delivery)

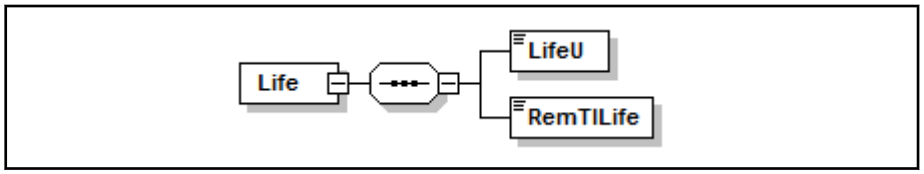


Fig. 5-61: Data block schema (6) (tool life data)

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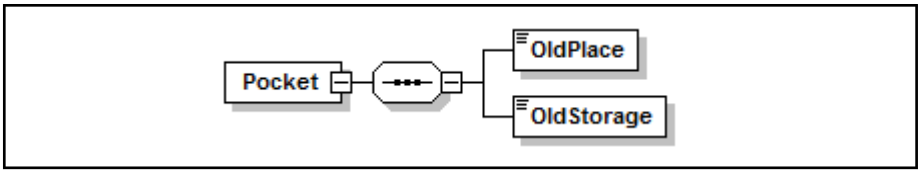

Fig. 5-62: Data block schema (7) (tool data)

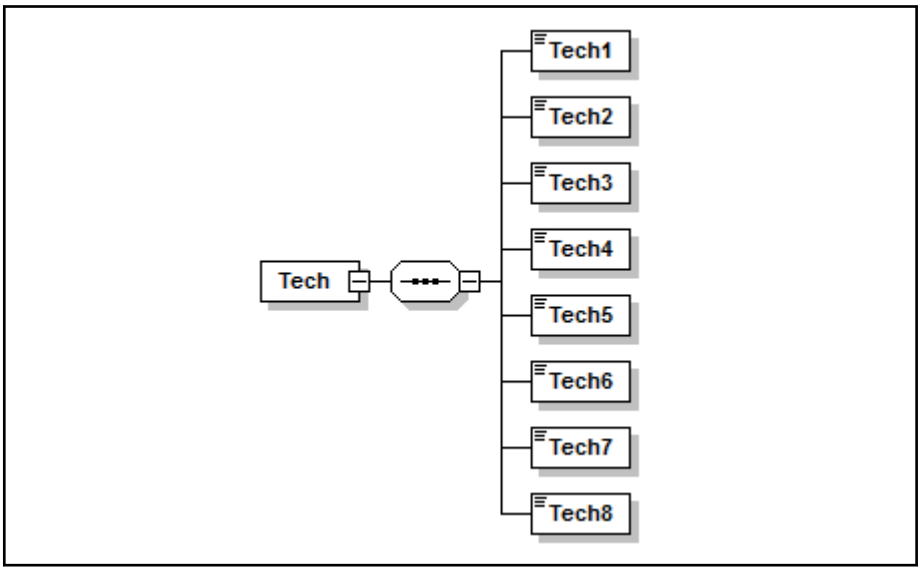

Fig. 5-63: Data block schema (8) (tool technology data)

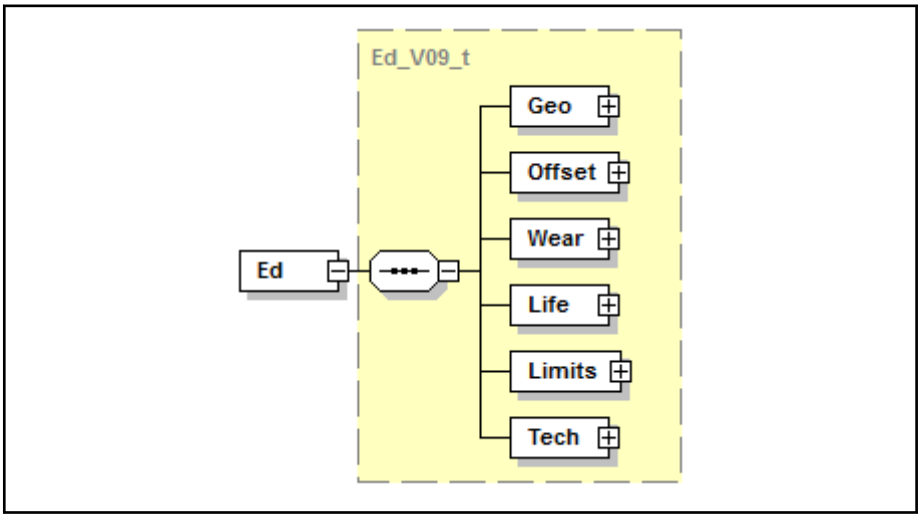

Fig. 5-64: Data block schema (9) (tool edge data upon delivery)

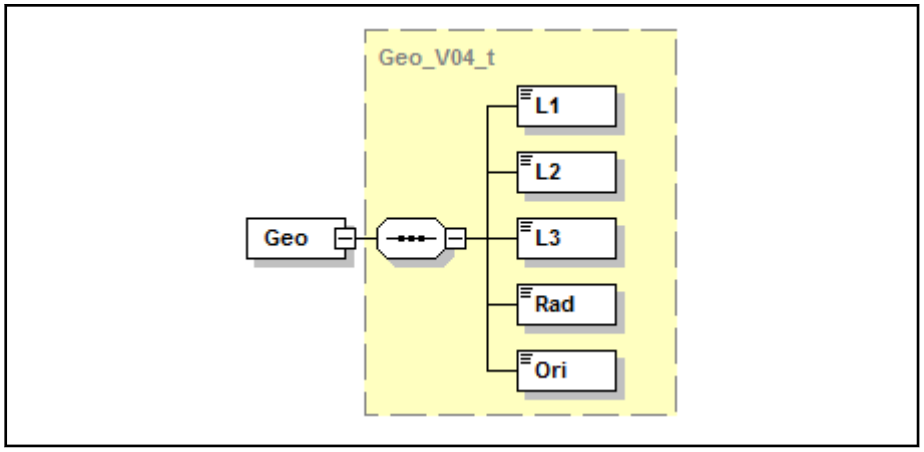

Fig. 5-65: Data block schema (10) (geometry data upon delivery)

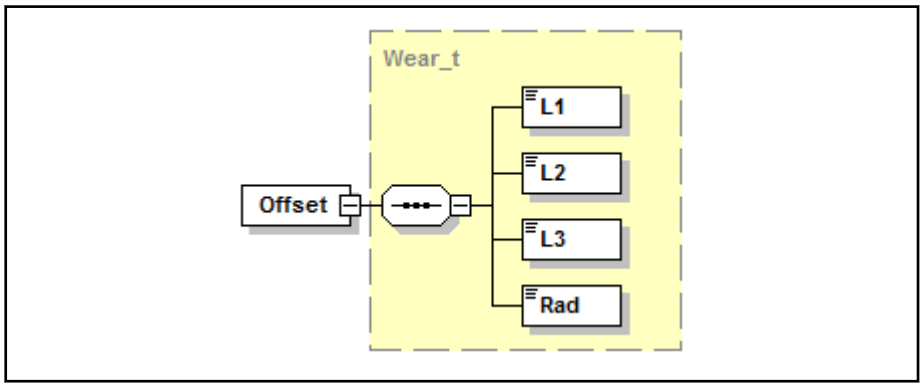

Fig. 5-66: Data block schema (11) (offset data upon delivery)

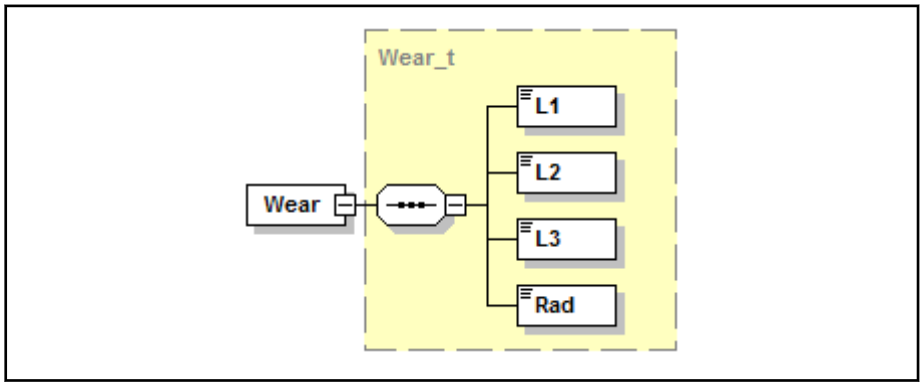

Fig. 5-67: Data block schema (12) (wear data upon delivery)

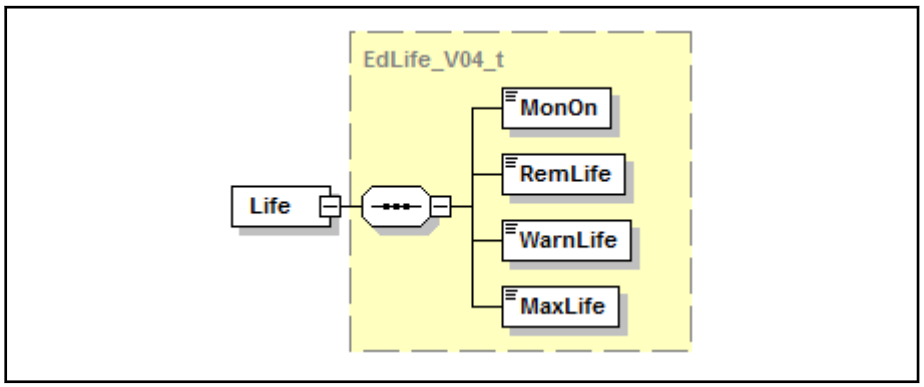

Fig. 5-68: Data block schema (13) (life data upon delivery)

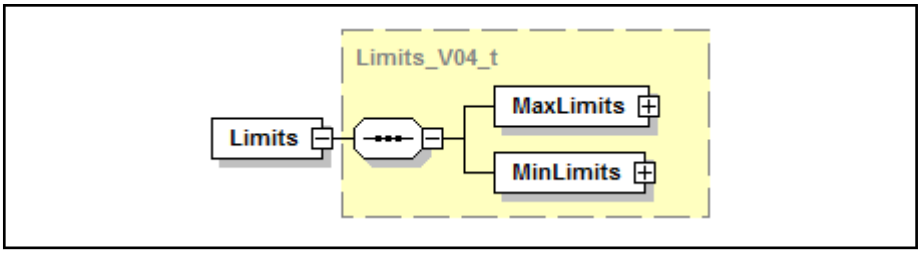

Fig. 5-69: Data block schema (13) (limit value data)

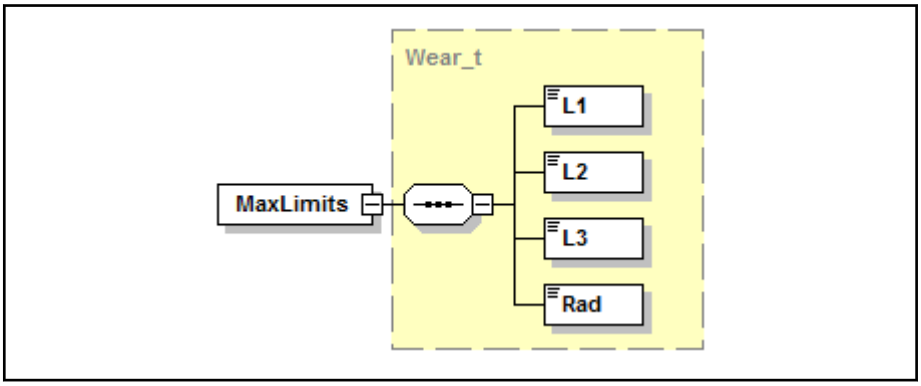

Fig. 5-70: Data block schema (14) (max. limit value data)

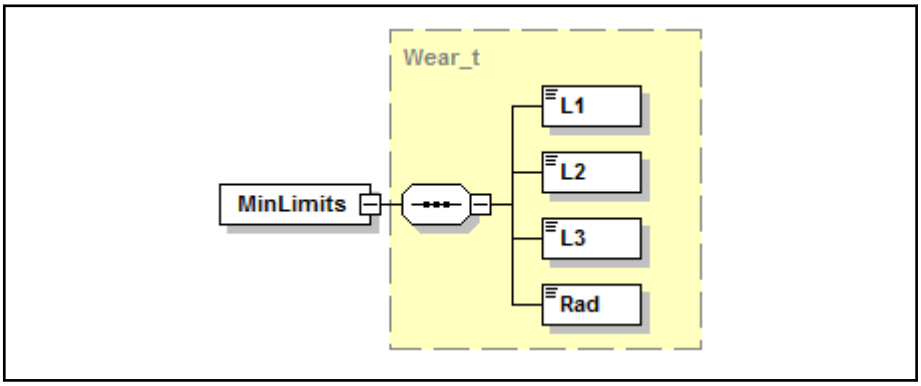

Fig. 5-71: Data block schema (15) (min. limit value data)

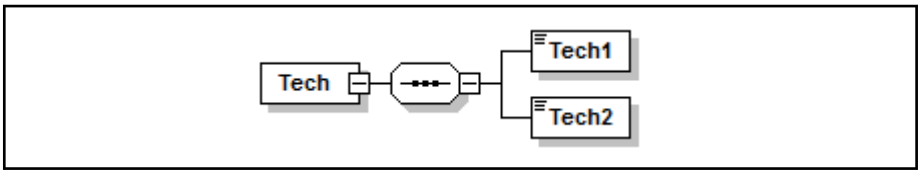

Fig. 5-72: Data block schema (16) (cutting technology data)

Basic data type collection (basic_ty.xsd)

The schema file is available for all data schema definitions used by the MTX. It cannot be changed by the user. However, the user can use these basic types in the new data structures generated in the schema file **dbt1ud.xsd**.

Defining basic settings of the tool management

The following settings are made using the attribute definitions in the schema files:

- Definition of user rights
- Additive value input for certain data elements yes/no
- Limits for value increase with additive value input
- Data element type definition (place or tool data element)

- Activation of tool-specific limit value check of input values in the PLC
- Activation of the message to the PLC on a value change in the data block
- Activation of a value change in the data block by the PLC
- Activation of the message to the PLC on inserting, deleting or moving a data block using the interface

Definition					Note			Use	
			Example						
Name	Type	Use	Default	Fixed	Description	Domain	Description	Node	Element
L1	xs:string	Optional		R	User rights for L1 users	R	Read-only	x	x
						RW	Read and write		
L2	xs:string	Optional		R	User rights for L2 users	R	Read-only	x	x
						RW	Read and write		
L3	xs:string	Optional		R	User rights for L3 users	R	Read-only	x	x
						RW	Read and write		
L4	xs:string	Optional		RW	User rights for L4 users	R	Read-only	x	x
						RW	Read and write		
L5	xs:string	Optional		RW	User rights for L5 users	R	Read-only	x	x
						RW	Read and write		
ETA	xs:string	Optional		IA	Valid editing type	Without	Only absolute without diameter		x
						IA	Incremental and absolute without diameter		
						DI	Incremental with diameter and absolute without diameter		
MaxIncIn	xs:double	Optional	0.5		Maximum growth <= Limit value				x
MaxIncEx	xs:double	Optional	0.5		Maximum growth < Limit value				x
DataType	xs:string	Optional		PD	Data type attribute	PD	Place date		x
						- or TD	Tool / workpiece date		
PLCCheck	xs:string	Optional		Lim	Type of communication with the PLC during editing	Lim	Limit value check by PLC		x
						Write	Checking and writing by PLC		
						Info	Information that writing occurred to PLC		

Tab. 5-15: User-definable data element attributes for database tables

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For completeness, the following two tables describe additional attribute definitions. However, these cannot be changed by the user during the configuration of the data block.

Definition					Note		
			Example				
Name	Type	Use	Default	Fixed	Description	Domain	Description
UA	xs:string	Optional		ID	Use attribute: • Application should be unique for the entire scheme, i.e. each value may be used only once in the scheme • The attribute is required as information source for system routines	TSt	Sector
						TPl	Place
						TID	ID element
						TT	Type element
						TC	Type code el.
						TS	Tool/part status
						PS	Place status
						TN	Number element
						DN	Duplo number element
						Rec	Record node
						Hd	Header node
						Ud	User data node
						Ed	Tool edge data node
SE	xs:Boolean	Optional		1	Significant data element • useful only for list display • If used together with UA=ID in the tool list, the data element in the list is protected	1	Char. DS valid/place occupied
U	xs:string	Optional	mm		Unit attribute	mm	
						Inch	
						Nm	
						%	
Class	xs:string	Optional		DBTAB	Assignment attribute		
V	xs:string	required		00T00	Version attribute		

Tab. 5-16: System-specific data element attributes for database tables

Definition					Note	
			Example			
Name	Type	Use	Default	Fixed	Description	Description
DbL1.1	xs:string	Optional		DBT2/Rec/Hd/K1	Link element 1 for DBTab1	Currently not used
DbL1.2	xs:string	Optional		DBT2/Rec/Hd/K2	Link element 2 for DBTab1	Currently not used
DbL2.1	xs:string	Optional		DBT3/Rec/Hd/K1	Link element 1 for DBTab2	Currently not used
DbL2.2	xs:string	Optional		DBT3/Rec/Hd/K2	Link element 2 for DBTab2	Currently not used
TbL1.1	xs:string	Optional		Root1/Rec/Hd/K1	Link element 1 for XMLTab1	Currently not used
TbL1.2	xs:string	Optional		Root1/Rec/Hd/K2	Link element 2 for XMLTab2	Currently not used
TbL2.1	xs:string	Optional		Root2/Rec{3}	Link element 1 for XMLTab2 (DS Index)	Currently not used
TbL2.2	xs:string	Optional		...	Link element 2 for XMLTab2	Currently not used

Tab. 5-17: Link attributes for database tables (in preparation)

Increase definition

The maximum valid value increase for additive value input for the corresponding data element is specified by the data attribute **MaxIncIn** or **MaxIncEx**.

Defining the input type

The following selection is available via the **ETA** attribute when defining the input type:

Without	Only absolute value input possible
IA	Additive and absolute value input
DI	additive diameter input (absolute value input without diameter), i.e. input value / 2 is added

Defining data-related user rights

Use the data attributes **L1** to **L5** to assign data element-relevant read and write rights to each user level.

These attributes can be defined for nodes and elements. The attribute definitions can structurally overlap. The definition closest to the element in the tree is valid.

Defining limit and enumeration values

Data element-relevant limit value and enumeration definitions are implemented by defining a basic type with corresponding restriction.

Example: Limit value definition:

1 ⇐ double value ⇐ 10,000,000

Program:

```
<xs:simpleType name="Double1_10M_t">
     <xs:annotation>
       <xs:documentation>Type Double 1 - 10 Mio</xs:documentation>
     </xs:annotation>
     <xs:restriction base="xs:double">
       <xs:minInclusive value="1"/>
       <xs:maxInclusive value="10000000"/>
     </xs:restriction>
</xs:simpleType>
```

Example: Enumeration definition:

0 ⇐ byte value ⇐ 3 with range of values: 1;2;3

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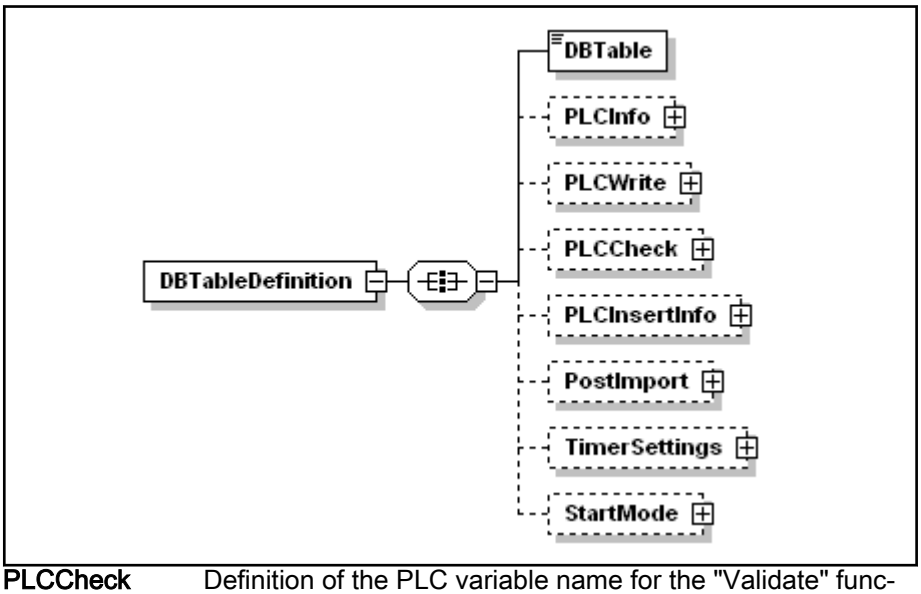
Program:

```
<xs:simpleType name="Byte0_3_t">
     <xs:annotation>
       <xs:documentation>Byte 0 - 3</xs:documentation>
     </xs:annotation>
     <xs:restriction base="xs:byte">
       <xs:minInclusive value="0"/>
       <xs:maxInclusive value="3"/>
       <xs:enumeration value="0"/>
       <xs:enumeration value="1"/>
       <xs:enumeration value="2"/>
       <xs:enumeration value="3"/>
     </xs:restriction>
</xs:simpleType>
```

Checking input value via PLC

The following settings can be made in the file **"ToolManagementConfig.xml"** in the project directory.

This file is structured as follows:



PLCCheck	Definition of the PLC variable name for the "Validate" function
PLCInfo	Definition of the PLC variable name for the "Info" function
PLCWrite	Definition of the PLC variable name for the "Write" function
Post import	Definition of the "Postimport" function
DBConnections	Activating multiple DB tables
TimerSettings	Low-pass filter configuration

Fig. 5-73: Structure diagram 1: ToolManagementConfig.xml

The data attribute **PLCCheck** of the data schema can be used to activate the input value check in terms of tool-specific limit value exceedance in the PLC for every data element using the entry**"Lim"**.

Example: Activation of limit value monitoring in the PLC in the data structure "Geo_V04_t" of the schema definition file "tool_ty.xsd":

Program:

```
<xs:element name="Rad">
    <xs:complexType>
        <xs:simpleContent>
            <xs:extension base="Double-10M_10M_t">
                <xs:attribute name="ETA" type="xs:string"
                use="optional" fixed="IA"/>
                <xs:attribute name="PLCCheck" type="xs:string"
                use="optional" fixed="Lim"/>
            </xs:extension>
        </xs:simpleContent>
```

```
    </xs:complexType>
</xs:element>
```

This function cannot be used for the bit arrays (BQ1-3) and the string elements (SKQ).

Sequence:

1. Value input in the editor or in the list.
2. After completing the input, by e.g. pressing <ENTER>, the interface (Act = TRUE) activates the PLC via the structure variable and transfers the entered value.
3. PLC checks the value to see if it exceeds the defined limit value.
4. PLC sends an acknowledgement to the interface (Act = FALSE).

   The interface expects the acknowledgement by the PLC within 500 ms (5 times the 100 ms pattern). If this acknowledgement is missing, the value is not transferred to the database. An error message is then output in the status line.

   Editing can only be closed when entering either a correct value or by pressing <ESC>.
5. In the case of positive feedback (result = 0) from the PLC, the interface writes the value change to the database. Otherwise, the interface outputs an error message in the status line and the value is not written to the database.

The PLC expects the following return values via the variable "RESULT" (applies to all following PLC functions):

Return Value	Description	Comment
<0	Reserved	Special error case
0	Value is OK	
1	Value was rejected by the PLC	Normal error without description of the cause
2	The selected place does not contain any tool	Special error case
3	The tool database is locked	Special error case
4-10	Reserved	
>10	The value was rejected by the PLC with number (e.g. tool edge number; correction value number)	Normal error case with description of the cause The error number is output to describe the cause

For all return values unequal to 0, the entered value is NOT applied. Negative return codes less than -1 may not be returned by the PLC, since these are used internally by the interface.

Structure of PLC variable:

```
TYPE stValidate:
STRUCT
    Place:          INT;            (*Place*)
```

```
    Storage:        INT;        (*Sector*)
    Act:            BOOL;       (*Activation*)
    XPath:          STRING(79); (*Data element*)
    Value:          LREAL;      (*Input value*)
    EditType:       INT;        (*Additive / absolute - not
                                 relevant!*)
    Result:         INT;        (*Error return*)
END_STRUCT
END_TYPE
```

The name of the PLC variable can be specified in the "ToolManagementConfig.xml" file under **PLCCheck/PLCVariableID** in the project directory.

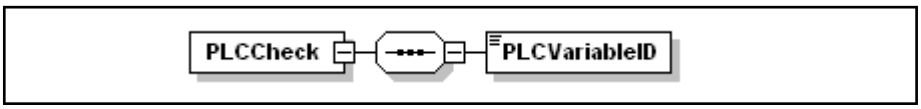


Fig. 5-74: Block diagram 2 ToolManagementConfig.xml

Program:

```
...
    <PLCCheck>
        <PLCVariableID>.Validate</PLCVariableID>
    </PLCCheck>
    <PLCInfo>
        <PLCVariableID>.TLInfo</PLCVariableID>
    </PLCInfo>
    <PLCWrite>
        <PLCVariableID>.TLDataWrite</PLCVariableID>
    </PLCWrite>
...
```

Message to PLC on value change in data block

The data attribute **PLCCheck** of the data schema can be used to activate the message of changes and the input value check for every data element to the PLC using the entry **"Info"**.

Example: activation of PLC info function in the data structure "Geo_V04_t" of the schema definition file "tool_ty.xsd":

Program:

```
<xs:element name="Rad">
    <xs:complexType>
        <xs:simpleContent>
            <xs:extension base="Double-10M_10M_t">
                <xs:attribute name="ETA" type="xs:string"
                use="optional" fixed="IA"/>
                <xs:attribute name="PLCCheck" type="xs:string"
                use="optional" fixed="Info"/>
            </xs:extension>
        </xs:simpleContent>
    </xs:complexType>
</xs:element>
```

This function can also be applied for string elements (SKQ). However, no value is assigned to the variable "Value".

Sequence:

1. Value input in the editor or in the list.
2. Interface writes the value change to the database.
3. Interface activates the PLC via a structure variable and transfers the input value.
4. PLC **can** react accordingly to the messages from the user interface.

Structure of PLC variable:

```
TYPE stChangeInfo:
STRUCT
    Place:      INT;    (*Place*)
    Storage:    INT;    (*Sector*)
    Act:        BOOL;   (*Activation*)
    XPath:      STRING(79); (*Data element*)
    Value:      LREAL;  (*Input value*)
    EditType:   INT;    (*Additive / absolute - not relevant!*)
    Result:     INT;    (*Error return - not relevant!*)
END_STRUCT
END_TYPE
```

The name of the PLC variable can be specified in the "ToolManagementConfig.xml" file under **PLCInfo/PLCVariableID** in the project directory.

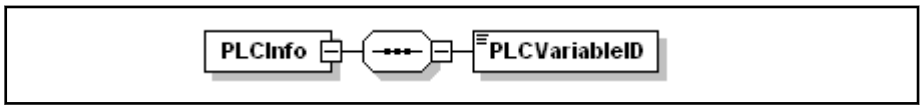


Fig. 5-75: Block diagram 3 ToolManagementConfig.xml

Program:

```
...
        <PLCCheck>
        <PLCVariableID>.Validate</PLCVariableID>
    </PLCCheck>
    <PLCInfo>
        <PLCVariableID>.TLInfo</PLCVariableID>
    </PLCInfo>
    <PLCWrite>
        <PLCVariableID>.TLDataWrite</PLCVariableID>
    </PLCWrite>
...
```

Activating value change in data block by PLC

The data attribute **PLCCheck** of the data schema can be used to activate the change message and the input value check for every data element to the PLC via the entry **"Write"**.

Example:

Activation of limit value monitoring in the PLC in the data structure "Geo_V04_t" of the schema definition file "tool_ty.xsd":

Program:

```
<xs:element name="Rad">
    <xs:complexType>
        <xs:simpleContent>
            <xs:extension base="Double-10M_10M_t">
                <xs:attribute name="ETA" type="xs:string"
                use="optional" fixed="IA"/>
                <xs:attribute name="PLCCheck" type="xs:string"
                use="optional" fixed="Write"/>
            </xs:extension>
        </xs:simpleContent>
    </xs:complexType>
</xs:element>
```

Sequence:

1. Value input in the editor or in the list.

2. After completing the input, by e.g. pressing <ENTER>, the interface (Act = TRUE) activates the PLC via the structure variable and transfers the entered value.
3. PLC checks the value to see if it exceeds the defined limit value.
4. If the test is successful, the PLC writes the value change to the database.
5. PLC sends an acknowledgement to the interface.

   PLC sends an acknowledgement to the interface (Act = FALSE).

   The interface expects the acknowledgement by the PLC within 500 ms (5 times the 100 ms pattern). If this acknowledgement does not occur, the value is written from the interface to the database. An error message is then output in the status line.
6. The interface issues a message on the success or failure of the writing procedure in the status line with regard to the value of the variable "RESULT".

Structure of PLC variable:

```
TYPE stTLDataWrite:
STRUCT
    Place:      INT;        (*Place*)
    Storage:    INT;        (*Sector*)
    Act:        BOOL;       (*Activation*)
    XPath:      STRING(79); (*Data element*)
    Value:      LREAL;      (*Input value*)
    EditType:   INT;        (*Additive / absolute*)
    Result:     INT;        (*Error return*)
END_STRUCT
END_TYPE
```

The name of the PLC variable can be specified in the "ToolManagementConfig.xml" file under **PLCWrite/PLCVariableID**.

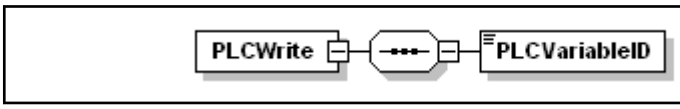


Fig. 5-76: Block diagram 4 ToolManagementConfig.xml

Program:

```
...
    <PLCCheck>
        <PLCVariableID>.Validate</PLCVariableID>
    </PLCCheck>
    <PLCInfo>
        <PLCVariableID>.TLInfo</PLCVariableID>
    </PLCInfo>
    <PLCWrite>
        <PLCVariableID>.TLDataWrite</PLCVariableID>
    </PLCWrite>
...
```

☞ This function cannot be used for string elements (SKQ).

Message to the PLC on inserting, deleting or moving a data block

The function can be activated and the name of the PLC variable can be specified in the "ToolManagementConfig.xml" file under **PLCInsertInfo/ PLCVariableID**.

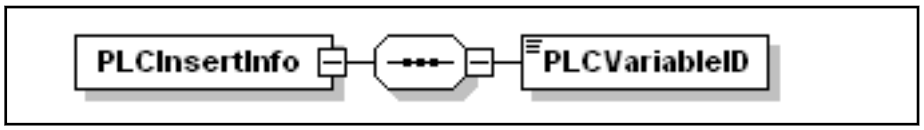


Fig. 5-77: Block diagram 5 ToolManagementConfig.xml

Program:

```
...
    <PLCCheck>
        <PLCVariableID>.Validate</PLCVariableID>
    </PLCCheck>
    <PLCInfo>
        <PLCVariableID>.TLInfo</PLCVariableID>
    </PLCInfo>
    <PLCInsertInfo>
        <PLCVariableID>.TLDeleteMoveInsertInfo</PLCVariableID>
    </PLCInsertInfo>
...
```

Structure of PLC variables

```
TYPE stInsertTool:
STRUCT
    SrcPlace :      INT;    (*Place - source*)
    SrcStorage :    INT;    (*Sector - source*)
    DstPlace :      INT;    (*Place - destination*)
    DstStorage :    INT;    (*Sector - destination*)
    Act:            BOOL;   (*Activation*)
    Value:          INT;    (*Functional ID*)
END_STRUCT
END_TYPE
```

Function ID:

Value	Function
1	Tool was inserted
2	Tool was deleted
3	Tool data blocks were imported
4	Tool was displaced

Sequence for tool list import (inserting/overwriting several data blocks - no single tool import):

1. Activating and executing tool list import
2. Interface activates PLC via structure variable:
   - SrcPlace = 0 (not relevant)
   - SrcStorage = 0 (not relevant)
   - DstPlace = 0 (not relevant)
   - DstStorage = 0 (not relevant)
   - Act = 1

- Value = 3

3. PLC sets Act = 0
4. PLC **can** react accordingly to the message from the user interface.

Sequence when inserting or copying a tool or importing a single tool:

1. Activating and executing tool import or the copy or insert function
2. Interface activates PLC via structure variable:
   - SrcPlace = n (n = number of the place on which the insertion took place)
   - SrcStorage = m (n = number of the sector into which the insertion took place)
   - DstPlace = 0 (not relevant)
   - DstStorage = 0 (not relevant)
   - Act = 1
   - Value = 1
3. PLC sets Act = 0
4. PLC **can** react accordingly to the message from the user interface.

Sequence during tool deletion:

1. Activating and executing tool deletion function
2. Interface activates PLC via structure variable:
   - SrcPlace = n (n = number of the place on which the deletion took place)
   - SrcStorage = m (n = number of the sector in which the deletion took place)
   - DstPlace = 0 (not relevant)
   - DstStorage = 0 (not relevant)
   - Act = 1
   - Value = 2
3. PLC sets Act = 0
4. PLC **can** react accordingly to the message from the user interface.

Sequence during tool displacement:

1. Activating and executing tool displacement function
2. Interface activates PLC for the first time via structure variable:
   - SrcPlace = k (k = number of the place on which the deletion took place)
   - SrcStorage = l (l = number of the sector in which the deletion took place)
   - DstPlace = n (n = number of the place to which insertion occurred)
   - DstStorage = m (n = number of the sector into which the insertion took place)
   - Act = 1
   - ID = 4
3. PLC sets Act = 0
4. PLC **can** react accordingly to the message from the user interface.

Communication between user interface and PLC during insertion

The PLC can be informed about the change of data elements while inserting a tool data block via the entry **PLCInsertDataChange/PLCVariableID** in the file "ToolManagementConfig.xml".

During this process, PLC and interface correspond next to the PLC variable structure to exchange the handshake signals via the system data structure "**SD.SysToolInsert**". This system variable structure is of type "DBT1Rec_t" and thus corresponds to the a complete tool data block.

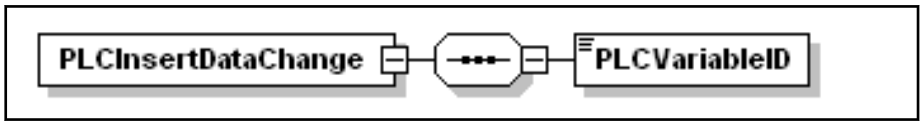


Fig. 5-78: Block diagram 6 ToolManagementConfig.xml

Program:

```
...
    <PLCCheck>
        <PLCVariableID>.Validate</PLCVariableID>
    </PLCCheck>
    <PLCInfo>
        <PLCVariableID>.TLInfo</PLCVariableID>
    </PLCInfo>
    <PLCInsertDataChange>
        <PLCVariableID>.TLInsertDataSet</PLCVariableID>
    </PLCInsertDataChange>
...
```

Structure of PLC variables

```
TYPE stInsertDataChange:
STRUCT
    Place:      INT;    (*Place*)
    Storage:    INT;    (*Sector*)
    Act:        BOOL;   (*Activation*)
    XPath:      STRING(79); (*Data element*)
    Value:      LREAL;  (*Input value*)
    EditType:   INT;    (*not relevant*)
    Result:     INT;    (*Error return*)
END_STRUCT
END_TYPE
```

Procedure in case of offline editing of a tool data block to be inserted

1. Applying the data block of the insert position from the database to SD.SysToolInsert.
2. Interface activates PLC via structure variable:
   - Place = n (n = number of the place on which the insertion took place)
   - Storage = m (n = number of the sector into which the insertion takes place)
   - Act = 1
   - XPath = '' (not relevant)
3. PLC sets Act = 0
4. Change in the editor
5. Applying change in SD.SysToolInsert

6. Message to PLC
   - Place = n (n = number of the place on which the insertion took place)
   - Storage = m (n = number of the sector into which the insertion takes place)
   - Act = 1
   - XPath = Modified data element
7. PLC reads SD.SysToolInsert
8. PLC modifies SD.SysToolInsert
9. PLC sets Act = 0
10. Interface reads modified variable SD.SysToolInsert
11. Applying data block to the database as completion of inserting process

Post-Import Function

In addition to the variable name definition described above, post-importing is configured using the file "ToolManagementConfig.xml".

If an action entry is defined in this file, a post-import function automatically follows a list or data block import.

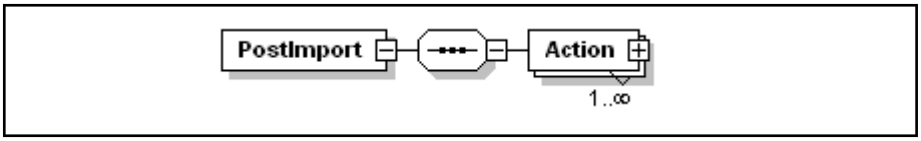


Fig. 5-79: Structure diagram 7ToolManagmentConfig.xml

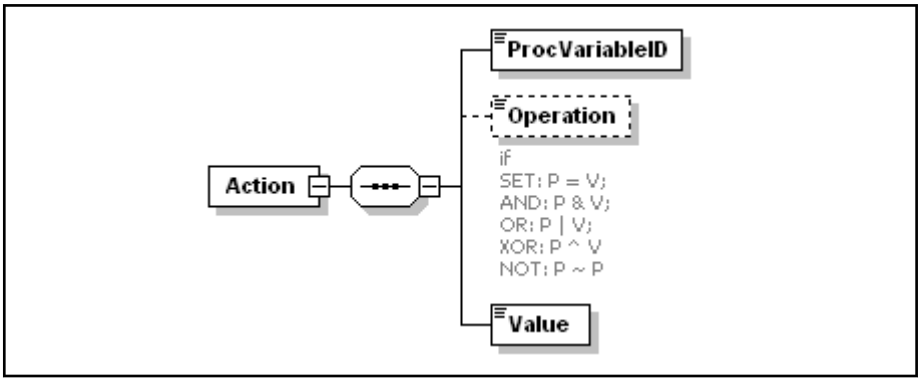


Fig. 5-80: Structure diagram 8: ToolManagmentConfig.xml

Explanation of abbreviations:		
P:	Process variable	(ProcVariableID)
V:	Value	(Value)
Permitted operations:		
SET:	Process variable receives value from "Value"	
AND:	The process variable becomes log. AND-gated with value of "Value"	
OR:	The process variable becomes log. AND-gated with value of "Value"	
XOR:	The process variable becomes log. AND-gated with value of "Value"	
NOT:	The value of the process variable is negated	

Tab. 5-18: Abbreviations and permitted operations

Data import procedure with active post-import function:

1. Import of tool list or tool data block
2. Apply the post-import function on all imported data blocks

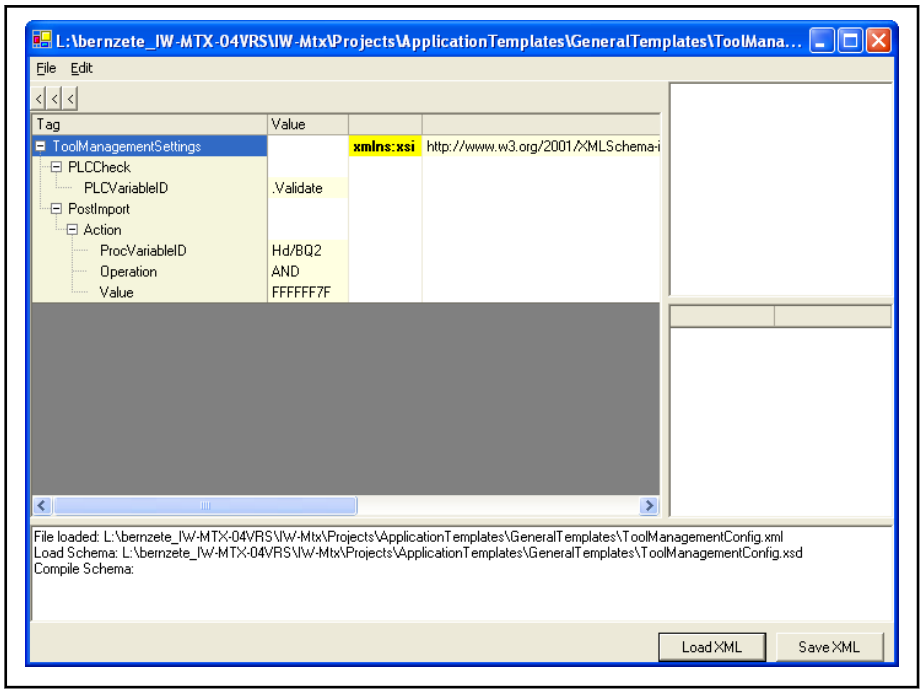


Fig. 5-81: Configuring basic tool management settings

Example:

ProcVariableID	Hd/BQ2
Operation	AND
Value	FFFFFF7F

In the example, the "Tool broken" flag (TD) is reset in all imported data blocks after the tool list import.

Activating second database table

File "ToolManagementConfig.xml" is also used to activate the communication with the second database table.

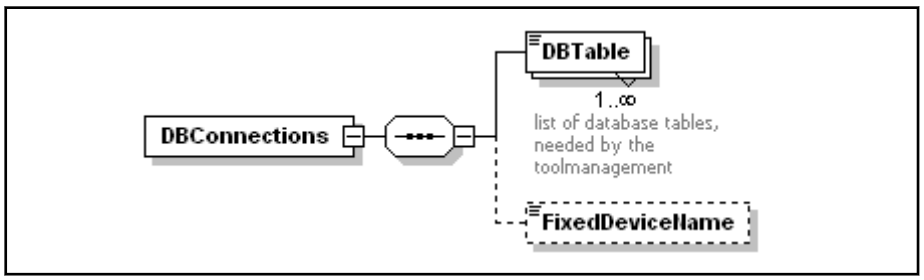


Fig. 5-82: Activating second database table

Program:

```
<DBConnections>
    <DBTable>/DBT1</DBTable>
    <DBTable>/DBT2</DBTable>
</DBConnections>
```

If these entries are missing, it is only communicated with database table 1.

If the database table is also to be displayed in IW Engineering as separate configuration node, this has to be configured by adding the following entry before creating the project in the file **MTX.MnoApplicationConfig.xml** in the

runtime directory \Library\Devices\Visualization\.ApplicationTemplates\Visualization device (e.g. BTV40).

Program:

```
...
<HmiMnO ID="MTX DB SCREENS" Text="Pallet Screens" Category="MTXPALLETSCREENS"
Assembly="MTX.Toolman.MnOPackage"
Factory="Rexroth.MTX.Toolman.MnOPackage.ToolmanMnOHandlerFactory"/>
...
```

Low-Pass Filter for Change Events

To prevent blocking the communication by, for example, the PLC if the database is modified several times in sequence very quickly, a low-pass filter for change events can be activated and dimensioned. This is also performed using the file "ToolManagementConfig.xml".

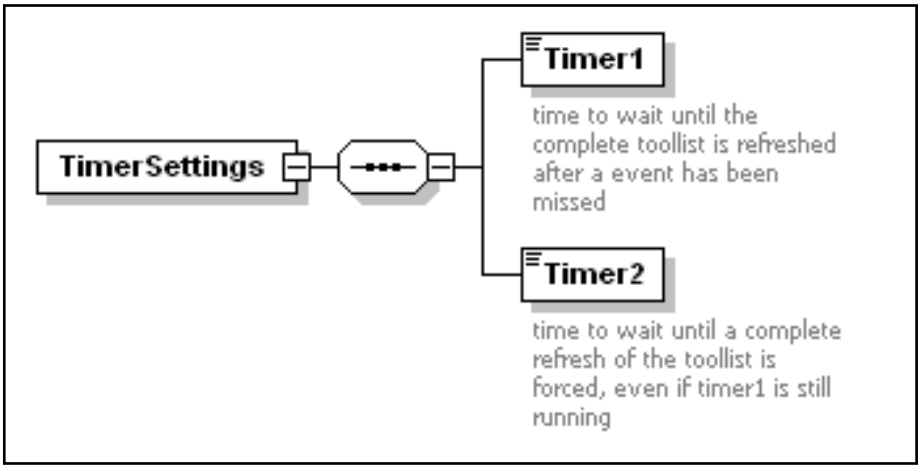


Fig. 5-83: Low-pass filter for change events

Timer 1:

This timer is started if it is determined that a change event was lost. If another event is lost during this time, the timer is restarted and tool data is not read. Otherwise, all data in the database table is read after the timer elapses.

Timer 2:

If timer 1 never counts down completely to subsequently read all data, a forced reading of all data takes place after timer 2 elapses. Therefore, timer 2 is activated when timer 1 is started for the first time and stopped each time after all data is read in the database.

Timer 1:	(small timer)	e.g.: 500 ms
Timer 2:	(large timer)	e.g.: 20 s

Setting change events to be buffered in the control

The tool list display is informed via changes in the database tables to visualize the current state. Due to performance reasons, every single change is identified by the user interface.

In case of a fast sequence of writing operations by the PLC or CPL, the user interface can only be informed completely if a sufficient number of change events is buffered in the MTX.

The number of change events to be buffered can be defined via the configuration parameter "/NCO/DBTables/DBTEventBuffSize".

Default values for data blocks

When creating data blocks, deleting their contents and displacing them, all data elements are initialized by default with 0 or an empty string. If other default values are desired, create one of the database-specific files

"dbt1dat.xml" or "dbt2dat.xml". This file has to contain a data block with the default values of the respective database table and has to be located in the "\usrfep".

Handling instruction: Modifying data block schema

The following handling instruction describes the process to be followed when the data block of a database table is to be modified.

W-Operation/program: Edit the Schema File "dbt?ud.xsd"

1. Copy the file "dbt?ud.xsd" (?:= 1 [DBT1] or 2 [DBT2]) to the control directory "\usrfep\schemas" or "\feprom\schemas" or "\root\schemas" to the mount directory (\mnt).
2. Edit file with schema editor.
3. Save file.
4. Copy the file back to the control directory "\usrfep" or "\root".

Screen		Documentation
Screen		Screen: Data block schema
Documentation	MTX Functional Description	Edit schema file

NC: Apply new data structure

1. Complete IW Operation
2. Reset control

		Documentation
Documentation	MTX Functional Description	Apply new data structure

Handling instruction: Modifying table-specific data element-relevant limit values

The following handling instruction describes the process to be followed when the limit values for the individual data elements of a tool data block (DBT1, DBT2) are to be modified.

IW-Operation/program: Edit the Schema File "dbt?ud.xsd"

1. Copy the file "dbt?ud.xsd", "dbt?sd.xsd" (?:= 1 [DBT1] or 2 [DBT2]) or "tool_ty.xsd" to the control directory "\usrfep\schemas" or "\feprom\schemas" or "\root\schemas" to the mount directory (\mnt).
2. Value range of the corresponding elements via

   <xs:minInclusive value = ".."/>

   <xs:maxInclusive value = ".."/>
3. Save file.
4. Copy the file to the control directory "\usrfep\schemas" or "\root\schemas".

Screen		Documentation
Screen		Screen: Data block schema
Documentation	MTX Functional Description	Edit schema file

NC: Apply new data structure

1. Complete IW Operation

2. Reset control

		Documentation
Documentation	MTX Functional Description	Apply new data structure

Handling instruction: Activating tool-specific limit value monitoring in user interface

The following handling instruction describes the procedure for activating tool-specific limit value monitoring for the individual data elements in the editors of the user interface.

IW-Operation/program: Edit the Schema File "dbt?ud.xsd"

For this function, the limit value data elements have to be contained in the tool data block.

1. Call the tool list configuration in the current IndraWorks Engineering project
2. "Show XML"
3. In the XML editor, search for the corresponding CellDef entry for the data element to be edited using limit value monitoring.
4. Search/insert: "RepresentationDefinitions"
5. Search/insert: "Dependency_for_Representation"
6. Search/insert: "Validation"
7. Search/insert: "DepProcessVariableID"
8. In the "Value" column, define the process variable containing the limit value.
9. Search/insert "Operation"
10. In the "Value" column, define the test condition (for the help, see the "Properties" window)
11. If further test conditions are to be defined: Search/insert "FollowingDepCondition" value = 1
12. Search/insert "Condition"
13. Continue with step 7 if the condition under step 11 is fulfilled.
14. Save file.

Screen		Documentation
Screen		Screen: Data block schema (3) (header schema)
Documentation	MTX Functional Description	Tool-specific limit values

User interface: Call the modified list display again

Screen		Documentation
Documentation	MTX Functional Description	Tool-specific limit values

Handling instruction: Creating a file with default values for database table

This handling instruction can be used to create a new file with default values for a database table.

IW Operation / tool management: Create "dbt?dat.xml" file

1. Enter the desired default values into any data block of the respective database table
2. Export this data block into the file **"dbt?dat.xml"** (?:= 1 [DBT1] or 2 [DBT2]) into the mount directory (\mnt).

		Documentation
Documentation	MTX Functional Description	Create file dbt?dat.xml

IW-Operation/program: Adapt "dbt?dat.xml" file

1. Open file in editor.
2. Replace content of data element SKQ with an empty string.
3. Save file.
4. Copy the file to the **"\usrfep"** control directory.

		Documentation
Documentation	MTX Functional Description	Adapt dbt?dat.xml file

IW-Operation/program: Modify the file "dbt?prms.dat"

1. Open file in editor.
2. Set P1 = 6
3. Save file.
4. Copy the file to the **"\usrfep"** control directory.

		Documentation
Documentation	MTX Functional Description	Modify the file “dbt?prms.dat”

Program:

```
; ------------------------------------------------------------
;       Configuration file for  DB table DBT1
; ------------------------------------------------------------
; General structure:
; P0 P1 P2 P3 P4 P5 P6
;  |  |  |  |  |  |  |
;  |  |  |  |  |  |  +--- string: may also contain " " and \t
;  |  |  |  |  |  |              End ID is "end of line"
;  +--+--+--+--+--+------ 6 int values
; P0 describes the object type and may not be modified
; Empty string is marked by "."
; ";" marked comment lines. At the end of the data line
; no comment may be added
;
;       ***************************
;       Configuration of DB table
;       ***************************
; Control parameter
; P0: 0
; P1: Controls data record creation in the database
;       0  Normal mode
;          Only if tool database is empty, data records are
;          created
;       6  First, all data records are deleted
;          and subsequently, created again according to the sector
;          configuration
0 6
; Sector configuration
; P0: 1-99 (corr. to sector 1 - 99)
; P1: Number of places in the sector
1 5
2 5
```

NC: Apply default values

1. Complete IW Operation
2. Reset control

		Documentation
Documentation	MTX Functional Description	Apply default values

IW-Operation/program: Undo the modification of the file "dbt?prms.dat"

1. Open file in editor.
2. Set P1 = 0
3. Save file.
4. Copy the file to the **"\usrfep"** control directory.

		Documentation
Documentation	MTX Functional Description	Modify the file “dbt?prms.dat”

5.10.5 Tool catalog

Definition of terms and general explanations

When working with the MTX tool management, the tool catalog has the following tasks:

- Tool type management
- Basic data management

It follows that two types of data management can be differentiated:

Tool type management:	ToolCatalog.xml
Basic data management:	ToolBDSCatalog.xml

The following image explains the terms for the following variants:

- Tool technology
- Tool type
- Tool class
- Alternate tool
- Master data block
- Basic data block

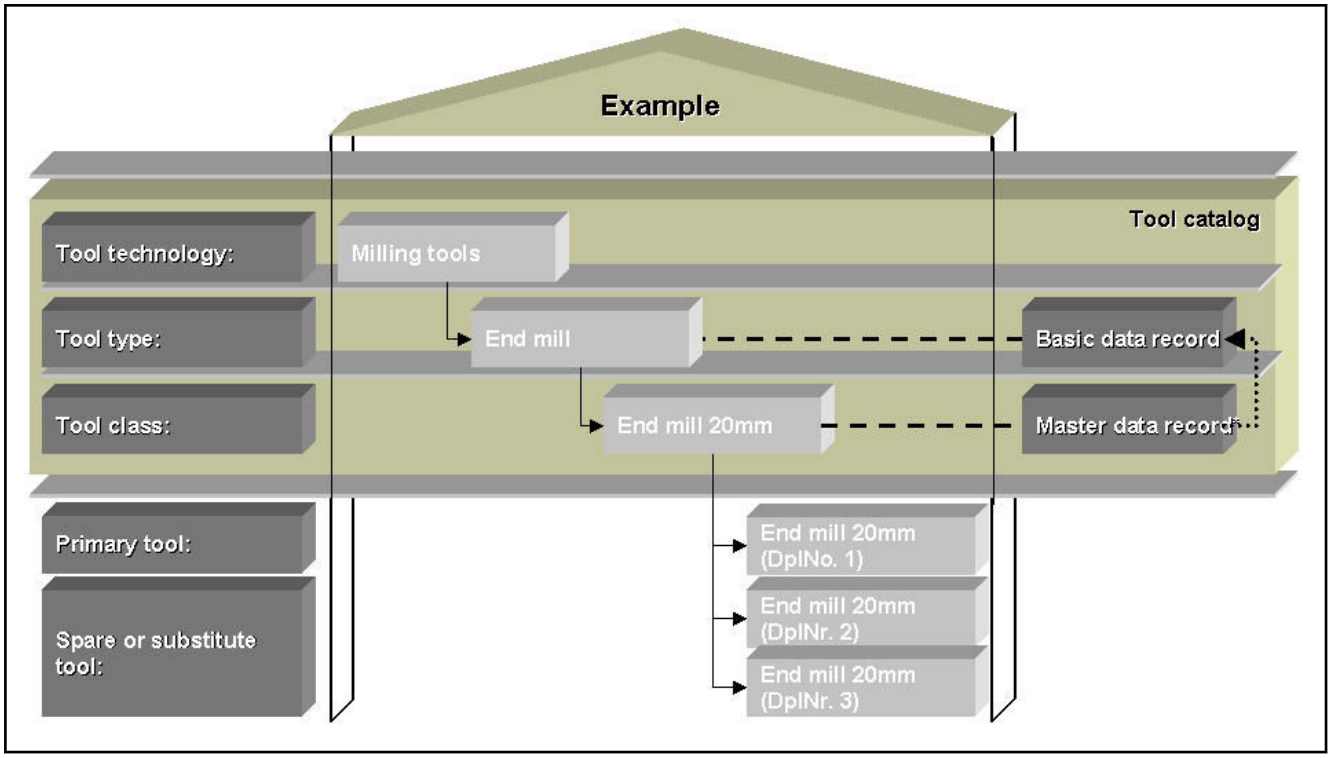


Fig. 5-84: Explanation of tool catalog terms

Tool Technology

Comprises all tool types belonging to a machining technology.

The tool catalog includes the following machining technologies:

- General machining
- Drilling
- Milling
- Rotate
- Measurement
- Special processing
- Punching

Tool Type

Describes the total of all tool classes with identical type-defining properties. The individual tool classes of a tool type differ by the tool ID. Together with the tool technologies, the tool types form the basis of the tool catalog and, thus, the basis of master tool data management. Furthermore, bitmaps are provided to go with the tool types in the tool catalog.

Tool Class

The amount of all tools with the same ID is called tool class. The individual tools of a class differ by their Duplo number.

Replacement or Alternate Tool

A replacement tool belongs to a tool class and can replace the respective primary tool if necessary. It is, for example, not blocked or worn.

Primary Tool

A primary tool is the tool of a tool class which will be used for machining at the next call-up via the T word. All other tools of the tool class are called secondary tools.

Basic Data Block

The basic data block exists exactly once for each tool type when a tool has already been defined for this type and when a basic data block has been explicitly created in this context. If an additional tool (tool class) of this type is created, the basic data block is used to initialize the data block.

Master Data Block (in Preparation)

The master data block exists exactly once for each tool class when a tool has already been defined for this class. If another tool (alternate tool) is created, the master data block is used for data block initialization. If a tool is created for a class for the first time, the data block of this tool is turned into the master data block for the tool class.

☞ Master data management is still in preparation.

Predefined tool types (Standard Types)

Currently, the user can access a collection of pre-defined tool types when creating the tool data for machining technologies:

- Drilling
- Milling
- Rotate
- Punching
- Measurement
- Special processing

These tool types are stored in the tool catalog and are characterized by the following tool properties:

Designation of the element in the tool catalog		Description	Element in the DS header
TypeNo		Type number	IKQ2
TypePic		Name of the bitmap file	-
CoTe (bits 1 - 4)	EdNo	Edge number	BQ3
Relevance of the correction values (correction type):			BQ3
CoTe (bits 8 -15)	CH	**Angle head tool**	
	L1	**1st length correction value**	
	L2	**2nd length correction value**	
	L3	**3rd length correction value**	
	R1	**big radius**	
	R2	**small radius**	
	O	**Edge position**	
	DIA	**Tool with diameter information**	

Designation of the element in the tool catalog		Description	Element in the DS header
Relevance of the technology data:			BQ3
CoTe (bits 15 - 24)	T1	**d** or **tw**	
	T2	**ds**	
	T3	**lfc** or **ll** or **tw** or **tc**	
	T4	**tl**	
	T5	**lu**	
	T6	**tp** or **ta** or **tal**	
	T7	**tac**	
	T8	**nt**	
	ET1	**de**	
	ET2	**lfc**	

Tab. 5-19: Type-defining tool data

The technology data bits T1 to T8 refer to the relevance of the tool technology data and ET1 and ET2 of the edge technology data in the standard tool data block.

As can be seen from the table, the technology data in the standard tools can have a different meaning subject to the tool type:

Technology data in standard tools

Data element	Abbreviation	Description
T1	**d**	Diameter
		Large diameter
		Milling diameter
		Outer diameter
		Outer limitation of the cutting diameter area
		Edge radius
		Nominal diameter of thread
		Diameter dimension 1
	tw	Width of trapezoid thread
T2	**ds**	Small diameter
		Shank diameter
		Drilling diameter
		Smallest diameter that can be machined
		Inner limitation of the cutting diameter area
		Countersinking diameter
		Diameter dimension 2

Control commissioning

Data element	Abbreviation	Description
T3	lfc	Chamfer length
		Length of tool tip
	ll	Loss length
		Spigot length
	tw	Tool edge width
	tc	Corner radius
		Tool tip size
		Sphere radius
		Width dimension
T4	tl	Max. cutting height
		Max. thread height
		Depth gauge
T5	lu	Usable length
		Length dimension
T6	tp	(Thread)lead
	ta	Setting angle
	tal	Orientation angle
		Angle (edge angle)
		Tool setting angle
		Angle (kappa)
		(General) Angle
		Opening angle
		Angular dimension 1
T7	tac	Apical angle
		Countersink angle
		Corner angle
		Edge angle
		Angular dimension 2
T8	nt	**Number of teeth**
ET1	de	Edge radius
		Small diameter
		Schnittlänge
		Edge dimension 1
ET2	lfe	(General) Length
		Edge dimension 2

Tab. 5-20: Significance of the technology data for standard tool types

Significance of the technology data for user-defined tool types is limited and specified as follows:

Technology data for user tools

Data element	Abbreviation	Description
T1	**d**	Diameter dimension 1 (large)
T2	**ds**	Diameter dimension 2 (small)
T3	**tc**	Width dimension
T4	**tl**	Depth gauge
T5	**lu**	Usable length
T6	**tal**	Angular dimension 1
T7	**tac**	Angular dimension 2
T8	**nt**	Number of teeth
ET1	**de**	Edge dimension 1
ET2	**lfe**	Edge dimension 2

Tab. 5-21: Significance of the technology data for user-defined tool types

For users who wish to use only a part or none of the tool catalog functions, the tool type "general tool" with the machining technology "general Machining" as well as a general drilling, milling or turning tool with a variable tool edge number for the individual technologies has been introduced. Furthermore, the two "UsedFlag" data elements can be used to deselect both individual types and technologies in the tool catalog. Then, these are not provided for selection anymore in the tool definition.

If a tool data block is created using the PLC or CPL with reference to the tool catalog, data elements IKQ2 and BQ3 must be written in accordance with the catalog definition. The "SD.SysToolType" system date provides the relevant values.

Create Data Block via PLC

If the PLC is to create tool data blocks which are compatible with the default tool catalog - e.g. by means of a Balluff BIS identification system - and which are to be entered into the database, it is recommended to determine the corresponding value pairs IKQ2 - BQ3 via a prepared system data structure **"SD.SysToolType"** and the corresponding function block and to enter them in the tool data block.

This system date is structured as follows:

SD.SysToolType structure

SysToolType[n].	TypeNo	**IKQ2** value
	Edge_variable	Signifies if the number of edges is fixed or can be edited
	BQ3_Basic	**BQ3** value

n: Number of tools in the tool catalog

Tab. 5-22: SD.SysToolType

This system date contains the value pairs for IKQ2 and BQ3 for all tools in the tool catalog.

If the user creates user-defined tools in the tool catalog, the tools also have to be entered in the system data. See **Saving system data** in chapter "Functions of the tool type ditor" on page 210.

Visualizing and configuring the tool catalog

General information

In MTX tool management, the user is provided with a default tool catalog which the user can extend by user-defined tool types. It is also possible to deactivate default tool types or tool technologies which are not required.

To configure the tool catalog, a tool type editor is available in IndraWorks Engineering.

Calling the tool type editor

The tool type editor is called under the node **DBT1 Screens (Tool management)** ▸ **Tool Catalog** ▸ **Open** in IndraWorks Engineering.

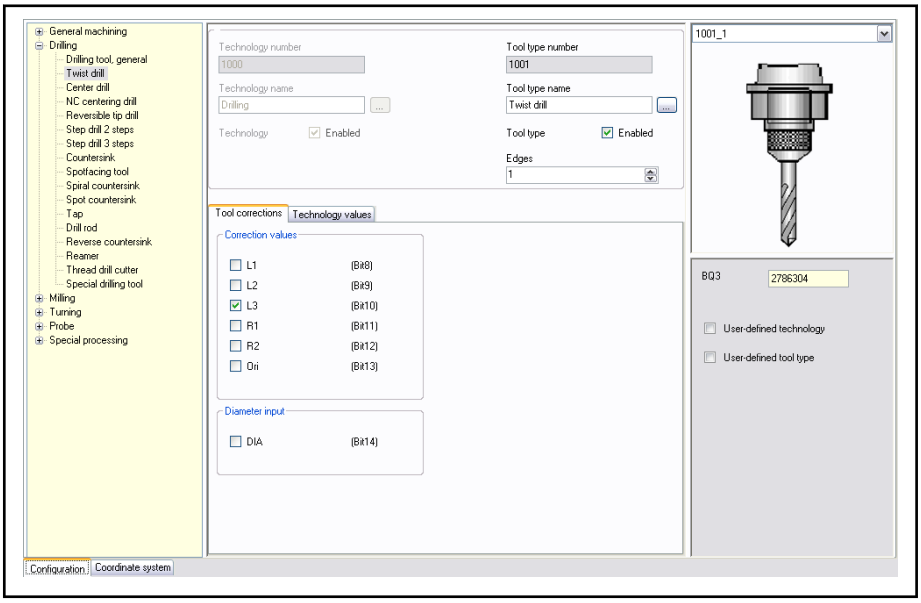


Fig. 5-85: Tool type editor

Text definitions in the tool type editor

Texts can be defined as follows in all configuration dialogs of the tool management:

- Resource text
- User text
- Fixed text

Functions of the tool type ditor

Defining tool technologies

The dialog to define a tool technology is displayed via **New** ▸ **Technology** in the application window. The first available technology number is used automatically. In the second step, the technology name has to be defined.

Fig. 5-86: Dialog window to define a tool technology

A technology for the selection in the tool editor can be enabled or disabled via the "Enabled" drop-down menu.

Creating a new tool type

The dialog to define a tool type is displayed via **New ▸ Tool type** in the application window. The first available tool type number is used automatically in the technology group. In the second step, the tool identifier has to be defined.

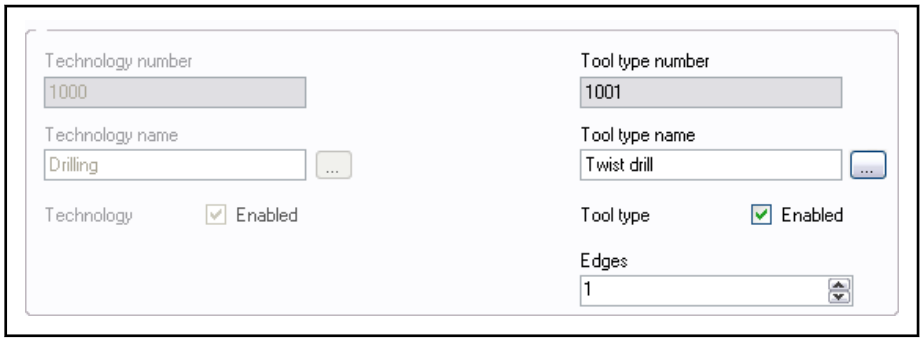


Fig. 5-87: Dialog window to define a tool type

A tool for the selection in the tool editor can be enabled or disabled via the "Enabled" drop-down menu.

Furthermore, the number of edges can be selected in a user-defined tool.

Defining/displaying tool corrections

The relevance of the different correction values can be defined in the dialog window with several tabs:

Fig. 5-88: Displaying/defining the used correction data

The relevant correction data is displayed for all predefined standard tool types. However, they cannnot be changed.

Defining/displaying technology values

The second page of the setup dialog is used to specify the relevance of the predefined technology data:

Control commissioning

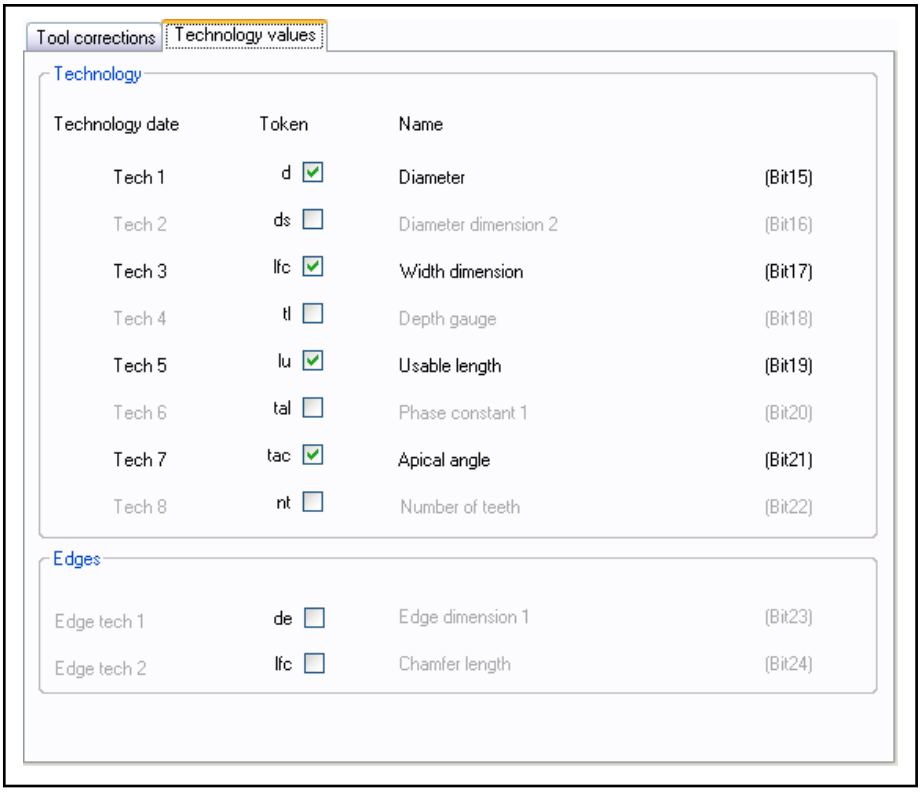


Fig. 5-89: Displaying/defining the used technology data

The relevant technology data and its description is displayed for all predefined standard tool types. However, they cannnot be changed.

Editing tool images

New tool images are selected and defined via the menu function **Image ▸ New ▸ 1 / 2 / 3**, depending on the use in the tool editor.

Tool image types

Image type	Display in tool editor during active window:
1	**"Basic tool data"** or **"tool data"** or **"tool status"**
2	**"Edge data"** or **"Edge data - Geometry limit values"**
3	**"Technology data"**

Tab. 5-23: Display of image types in the tool editor

The following dialog is displayed to define an image file

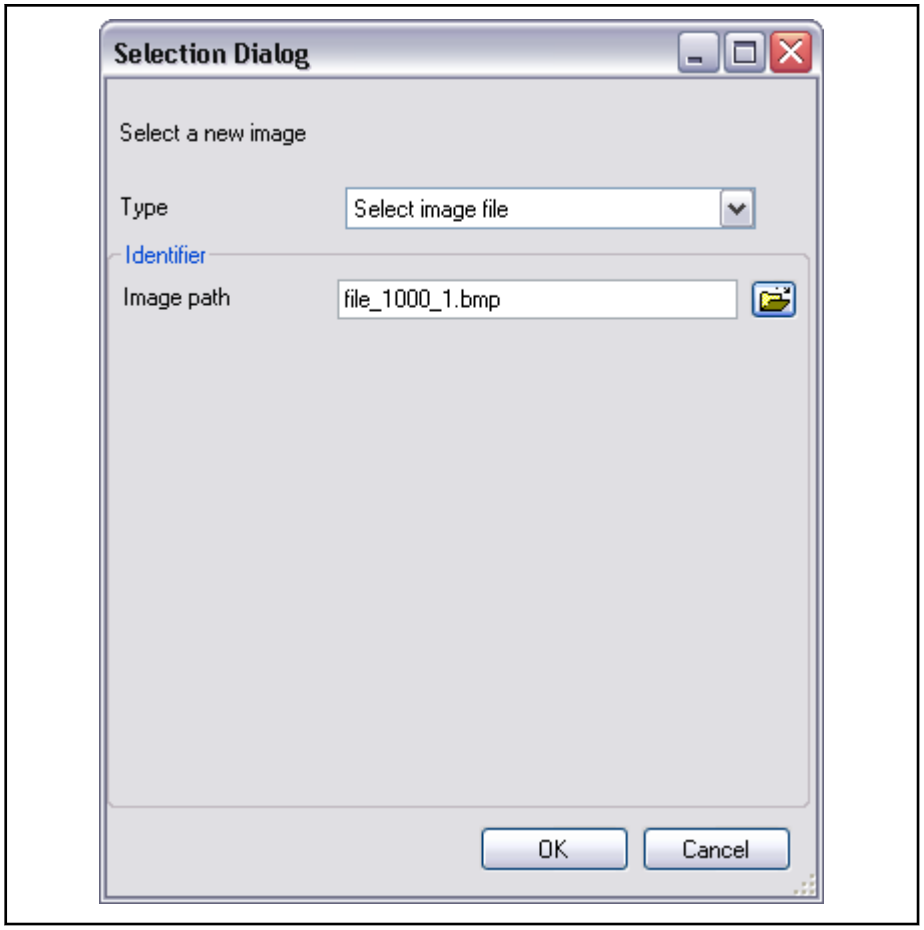


Fig. 5-90: Drop-down menu to define a tool image

Graphic files of type "*.bmp" or "*.gif" as well as image resource files can be used as source for user tool images.

☞ Images are generated again and saved in the visualization project, complying with the specified naming convention.

Save system data

Refresh the system data structure **"SD.SysToolType"** after the user tool types have been defined.

This system date contains the corresponding value pairs for IKQ2 and BQ3 for all tools in the tool catalog and is the requirement to generate tool data blocks by the PLC, compatible with the tool catalog, e.g. by means of a Balluff BIS identification system.

This is done via the menu function **Save System Data** on the "Tool Catalog" node

---

☞ Prerequisite for this function: the control device was switched online in IndraWorks Engineering.

This system date contains the value pairs for IKQ2 and BQ3 for all tools in the tool catalog.

Adjust BQ3 value

After the tool type definitions have been changed, old, exported data blocks are sporadically not compatible anymore. In these cases, the error message "Incorrect type definition" is output in the tool editor.

This function facilitates the adjustment of the BQ3 value of exported tool data blocks (tld files) to the changed tool catalog.

A tool data export file of type "*.tld" can be selected via the "Search File" dialog in the file system of the control. Subsequently, the BQ3 values are automatically refreshed in the data blocks.

Initializing the basic data block

In case of initial use of a tool type, a basic tool data block is generated for this type by the tool editor. A basic tool data block is used to initialize the user data of the tool data block upon creation of a tool of the same type. See **Basic data managment** in chapter 5.10.5 "Tool catalog" on page 204.

This function is used to generate basic data block structures for all tool types in the tool catalog. Subsequently, the basic data blocks can be prepared for the user by editing the "ToolBDSCatalog.xml" file in the visualization project using an XML file editor.

The following prompt illustrates the function.

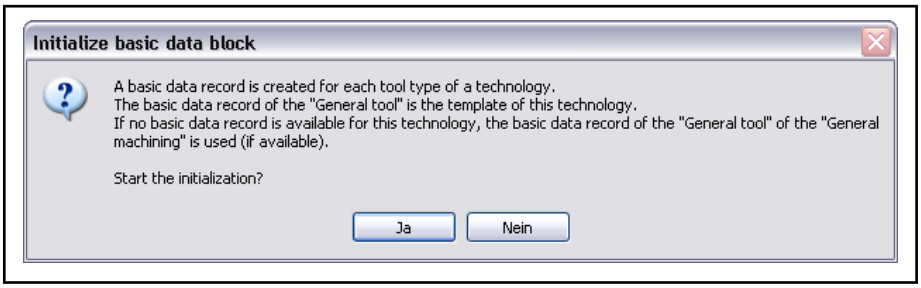


Fig. 5-91: Initializing the prompt: Basic data block

Defining the coordinate system display of the tool editor

It is possible to store the tool screen for a better illustration in a coordinate system.

On the "Coordinate system" tab, the configuration of the bit map display in the tool editor is supported.

Prerequisite for this function: the control device was switched online in IndraWorks Engineering.

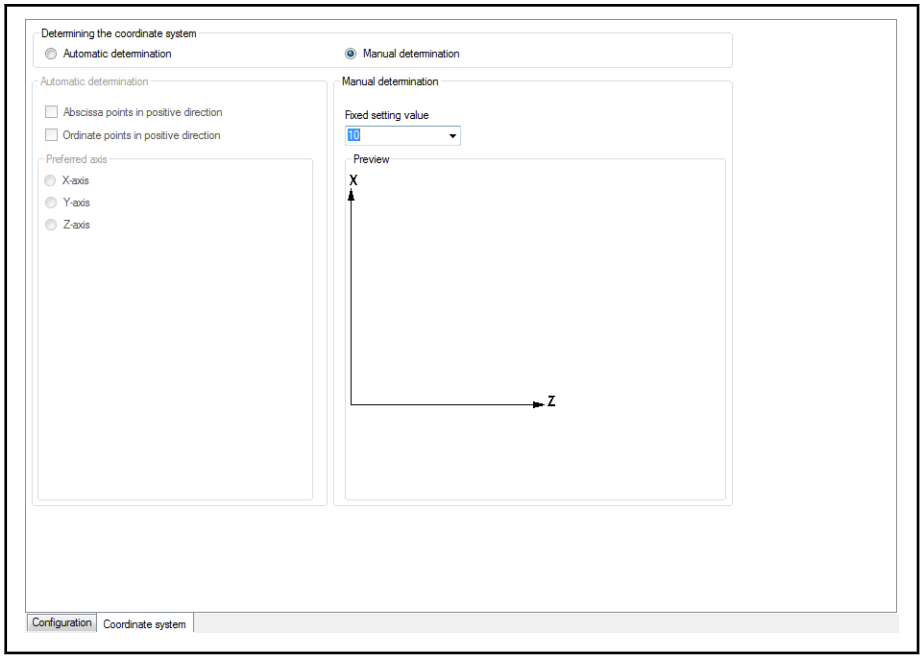


Fig. 5-92: Definition of the displayed coordinate system in the tool editor

This display is controlled via the system variable **SD.SysCoordSystem**:

SD.SysCoordSystem.	**Value**	**Description**
Value	See table	
Calc	1	Automatic determination of the coordinate system
	0	No automatic determination of the coordinate system
Horizontal	1	Abscissa in positive direction
	0	Abscissa in negative direction
Vertical	1	Ordinate in positive direction
	0	Ordinate in negative direction
X_axis_pref	1	The x-axis is the axis preferred to display the coordinate systems for milling tools
Y_axis_pref	1	The y-axis is the axis preferred to display the coordinate systems for milling tools
Z_axis_pref	1	The z-axis is the axis preferred to display the coordinate systems for milling tools

Tab. 5-24: Meaning of SD.SysCoordSystem

If no automatic determination of the coordinate system is set (SD.SysCoordSystem.Calc = 0), the stored coordinate system can be set as follows via the variable **SD.SysCoordSystem.Value**:

Control commissioning

SD.SysCoordSystem	Abscissa	Ordinate
	Direction	Direction
0	-	-
1	-	X
		Positive
2	-	X
		Negative
3	-	Y
		Positive
4	-	Y
		Negative
5	-	Z
		Positive
6	-	Z
		Negative
10	Z	X
	Positive	Positive
11	Z	X
	Negative	Positive
12	Z	X
	Negative	Negative
13	Z	X
	Positive	Negative
20	Y	X
	Positive	Positive
21	Y	X
	Negative	Positive
22	Y	X
	Negative	Negative
23	Y	X
	Positive	Negative
30	X	Y
	Positive	Positive
31	X	Y
	Negative	Positive
32	X	Y
	Negative	Negative
33	X	Y
	Positive	Negative

SD.SysCoordSystem	Abscissa	Ordinate
	Direction	Direction
40	Z	Y
	Positive	Positive
41	Z	Y
	Negative	Positive
42	Z	Y
	Negative	Negative
43	Z	Y
	Positive	Negative
50	X	Z
	Positive	Positive
51	X	Z
	Negative	Positive
52	X	Z
	Negative	Negative
53	X	Z
	Positive	Negative
60	Y	Z
	Positive	Positive
61	Y	Z
	Negative	Positive
62	Y	Z
	Negative	Negative
63	Y	Z
	Positive	Negative

Tab. 5-25: Control of the stored coordinate system via SD.SysCoordSystem.Value

Basic data management

General information

In the insertion editor, the "Store basic tool data" <F5> function can be used any time to create a basic data block for the currently selected tool type, or to overwrite an existing basic data block. If another tool of this type has been created later, the basic data block is used for data block initialization. All basic data blocks are stored in the "ToolBDSCatalog.xml" file.

The basic data block only comprises the user data of the tool data block.

Initializing the tool data block when creating a tool

Array/element	Identifier	Description	Source of initialization
1	K1	Storage	No initialization
2	K2	Place	
3	SKQ	ID	
4	IKQ1	Duplo no.	
5	IKQ2	Type	ToolCatalog.xml: **TypeNo**
6	IKQ3	T. No.	No initialization
7	IQ1	Reserve	ToolBDSCatalog.xml: **BaseDS**
8	IQ2	Reserve	
9	IQ3	Reserve	
10	BQ1	P-status	No initialization
11	BQ2	T-status	
12	BQ3	Technology	ToolCatalog.xml: **CoTe**
13	aaa	1. freely configurable data element	ToolBDSCatalog.xml: **BaseDS**
:	:	:	
n	zzz	nth freely configurable data element	

Tab. 5-26: Tool data block initialization using the basic data block

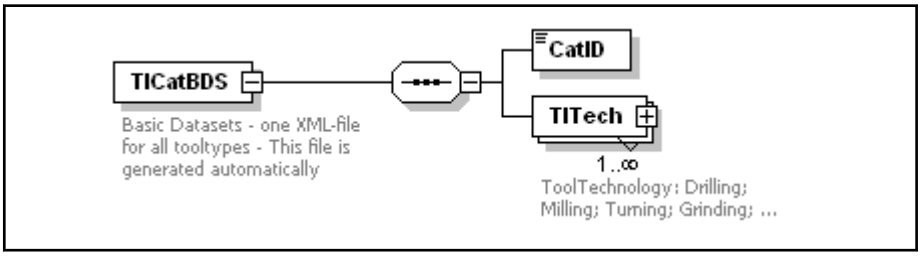


Fig. 5-93: Data scheme of tool basic data catalog (1)

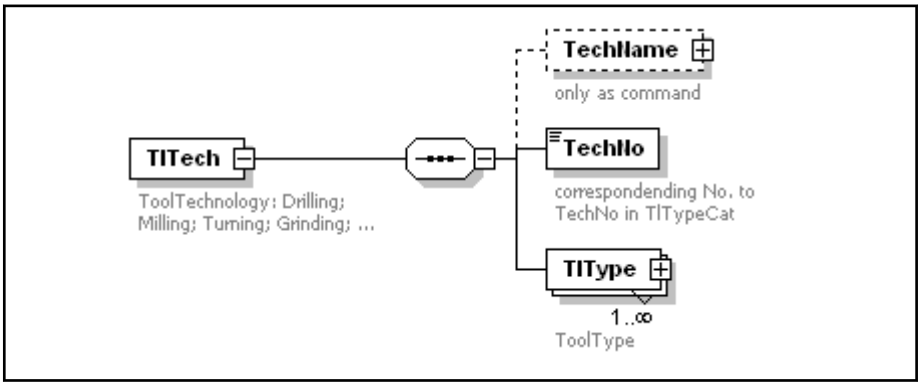


Fig. 5-94: Data scheme of tool basic data catalog (2)

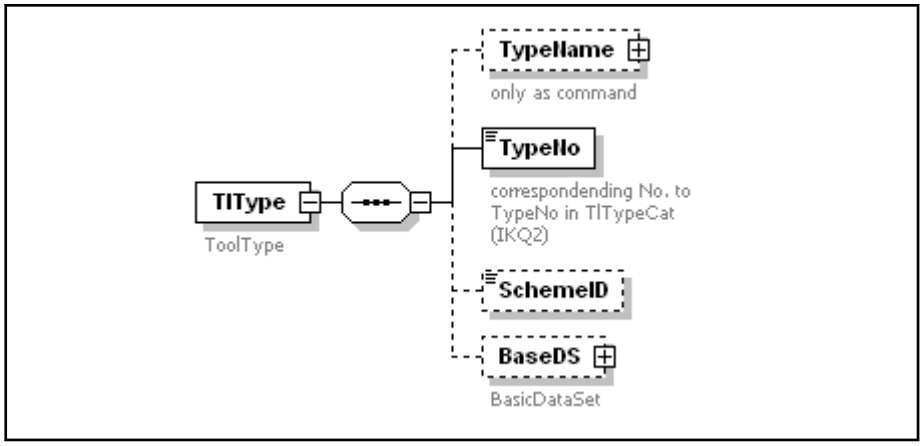


Fig. 5-95: Data scheme of tool basic data catalog (3)

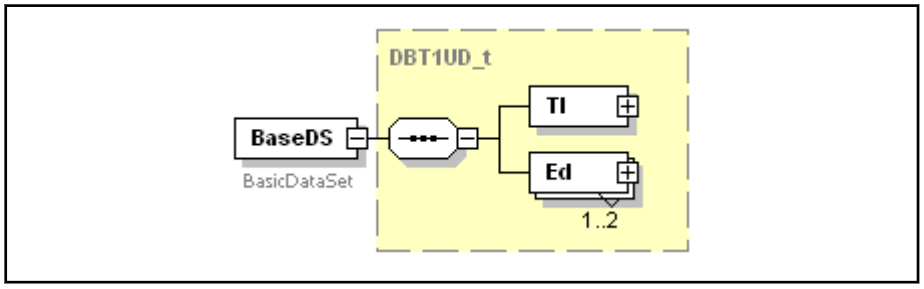


Fig. 5-96: Data scheme of tool basic data catalog (4)

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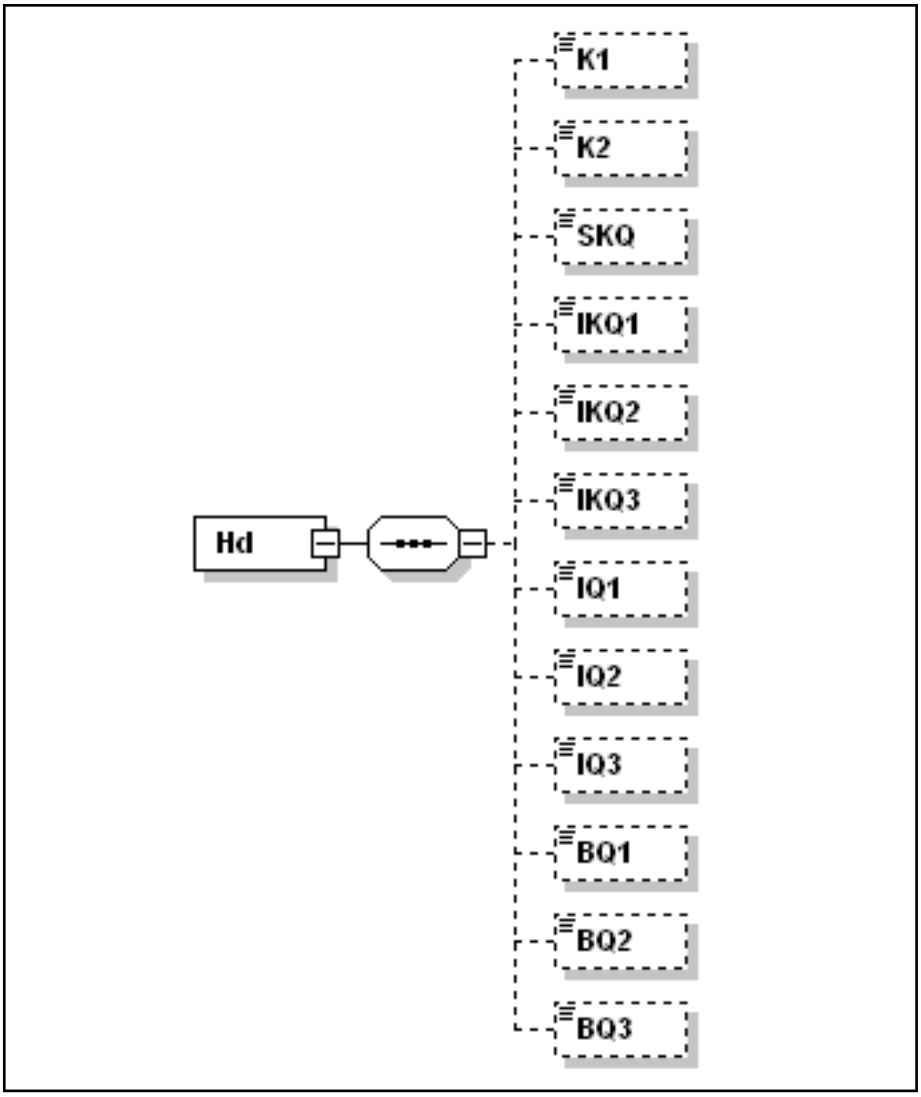


Fig. 5-97: Data scheme of tool basic data catalog (5)

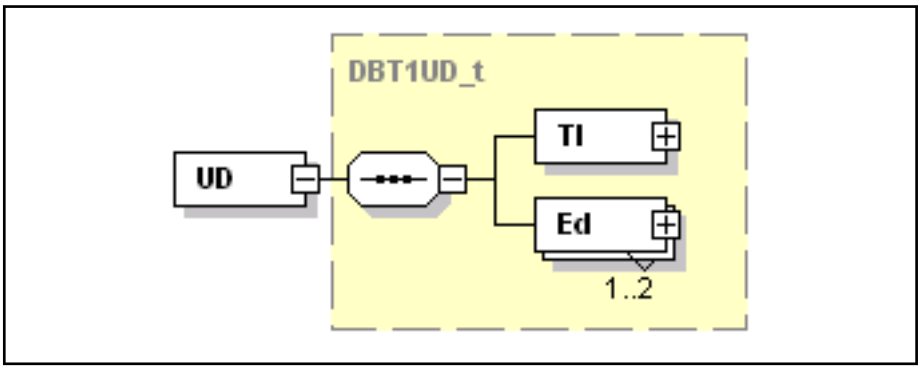


Fig. 5-98: Data scheme of tool basic data catalog (6)

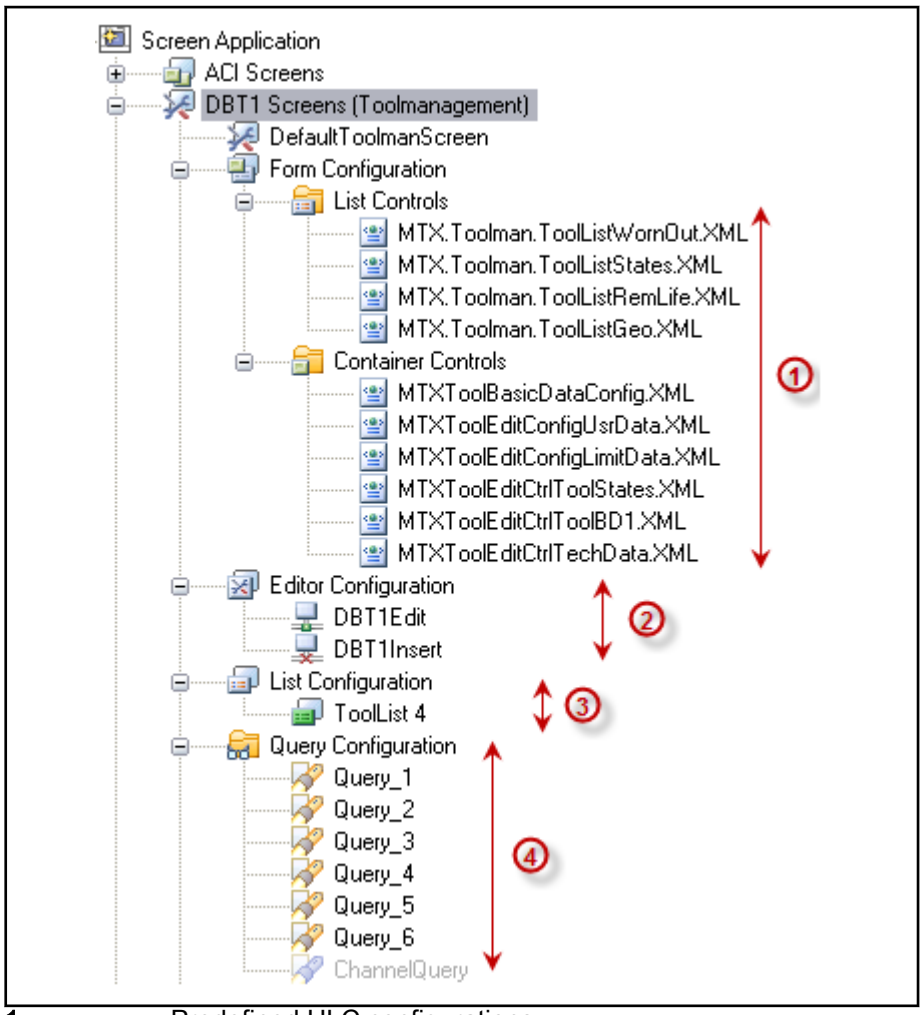
The data type "DBT1UD_t" used in the catalog scheme is the same data type which is used in the tool data scheme. This is ensured using the include instruction <xs:include schemaLocation="dbt1sd.xsd"/>.

5.10.6 User interface

General information

The configuration of the tool management user interface is carried out in IndraWorks Engineering.

After an HMI device has been created, a **"Tool Management Screens"** project node with the following structure is displayed in the project tree:



1 Predefined ULC configurations
2 Tool editors
3 Tool lists
4 Query definitions

Fig. 5-99: Project Explorer (tool management)

Called editors

1. Forms
   - List controls
     XML file editor
     (refer to chapter "XML file editor" on page 163)
     or
     ULC configurator
     (refer to chapter "ULC configurator" on page 145)
   - Container Controls

XML file editor

(refer to chapter "XML file editor" on page 163)

or

ULC configurator

(refer to chapter "ULC configurator" on page 145)

2. Editor configuration
   Editor configurator
   (refer to chapter "Configuration of tool editors" on page 244)
3. List configuration
   List configurator
   (refer to chapter 5.10.6 "User interface" on page 221)
4. Query configuration
   Query configurator
   (refer to chapter "Definition of list content" on page 223)

Configuring the tool lists

General information

In the "Tool management" operating range, various tool lists can optionally be defined with different contents and forms of representation.

Double-click on a list configuration to call the following setting dialog or use the pop-up menu function **Open**.

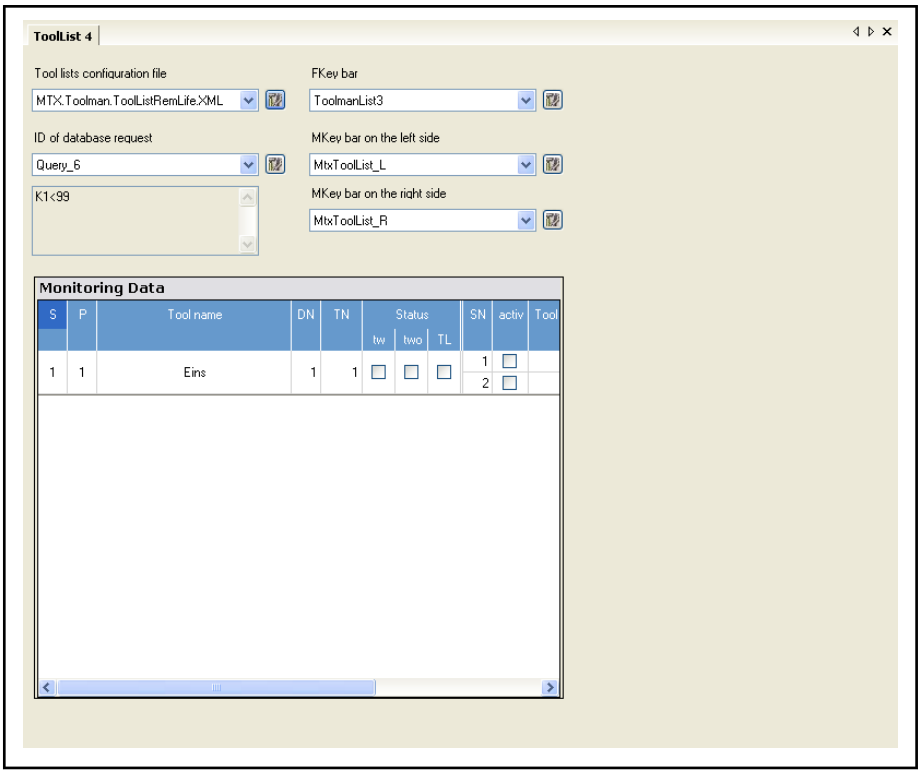


Fig. 5-100: List configurator

The lower part of the list configurator shows a preview of the list. In addition, the relevant configuration dialogs, which are described in detail in the following chapters, can be called via the configuration keys .

The **"ToolManagementApp.xml"** contains all the required list information.

The query comments are language dependent and can - as it is the case for all other language-dependent texts - be defined as follows:

- A resource text to be defined in a resource DLL or as
- user text in the user text file (MLS_StringTables.csv)

Information about the list call (list identification)

Various list views can also be called via F-keys or M-keys in the MTX. For this purpose, there are 16 defined list call functions for the list ID "ToolList 1 ... 16" (without specifying the list name). Further lists can be viewed by stating the list names in the parameter field above the function "ToolList".

Definition of list content

Here, 'list content' is understood to be the selection of the indicated tool data blocks.

The query definitions in the file specify which data blocks are to be shown in a tool list.

The key "Configuration" can be used to directly call the query configurator for modifying the selected query definition.

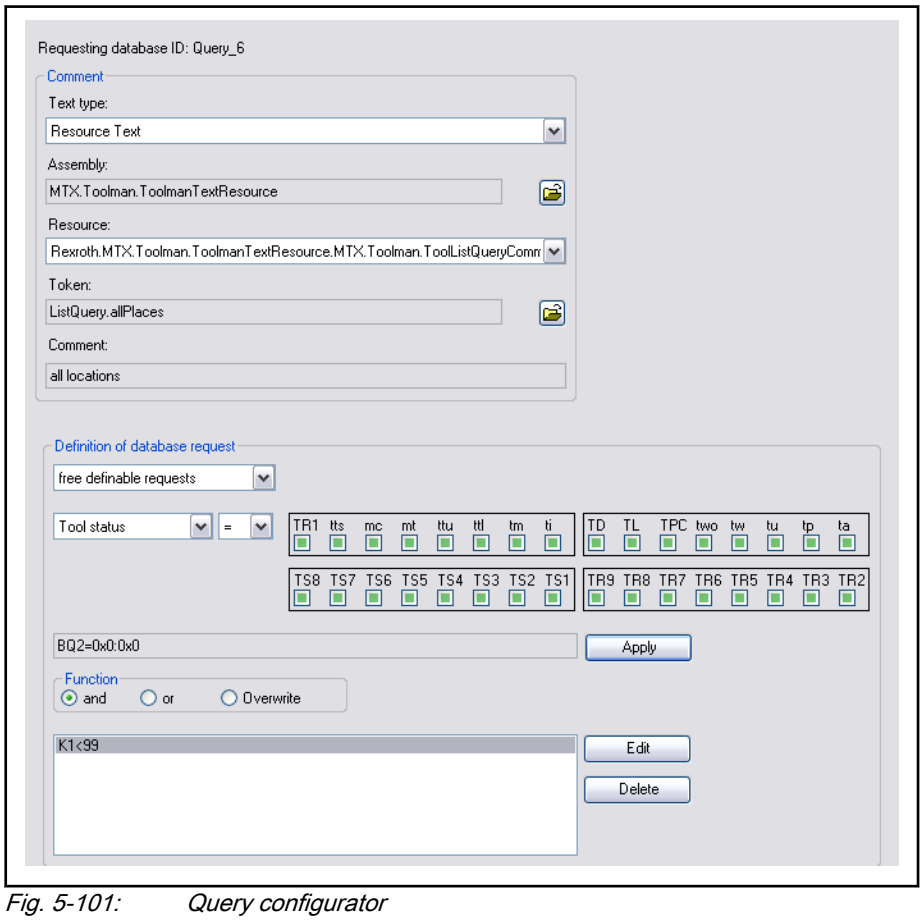


Fig. 5-101: Query configurator

The query editor allows, in addition to the actual query definition, a query comment in the "Comment" dialog. This comment is displayed next to the list title in the headline row. Both elements are linked via a query ID in the list configuration.

Furthermore, the query configurator allows to define the database query in a user-friendly manner in the "Definition of the database query" area of the dialog.

Here, the user can decide in the first selection box whether he wants to use predefined queries or to create a freely defined query. A freely defined query is created on the screen using data element "Tool status (BQ2)".

The following default predefined queries have been supplied:

Description	Query text
All worn tools	BQ2=0x10:0x10
All sectors	K1<99
Sector 1	K1=1
Sector 2	K1=2
Sector 3	K1=3
All tools	SKQ<>"

Channel-dependent database query

The tool list can be visualized with regard to the channel.

Therefore, the default query with the ID "ChannelQuery" exists in a newly created project.

This query definition is already provided with a predefined, but changeable title "**active channel**" that is displayed additionally in the list title as for each query comment.

As shown in the following figure, the query configurator for this query type has an additional input box to select the channel.

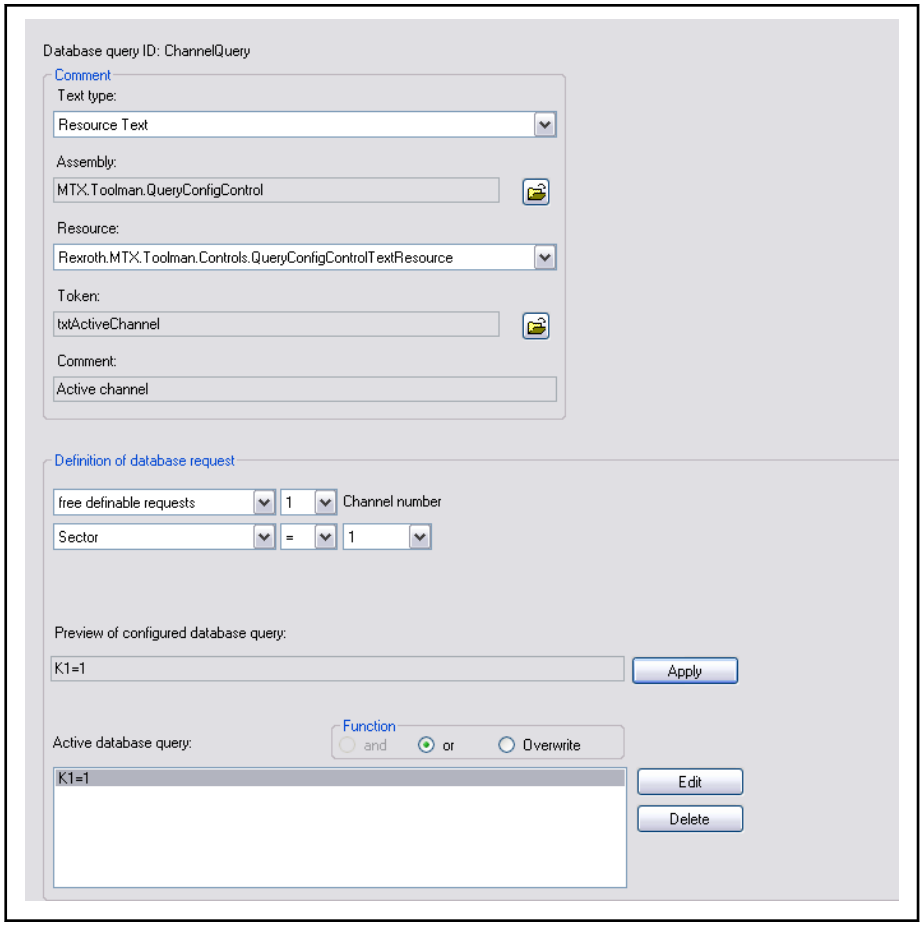


Fig. 5-102: Channel-dependent query definition

This channel-dependent query definition is saved in a channel-dependent system variable "**SD.SysChannelQuery**" which is analyzed in the tool list display at runtime.

Database queries

Using the <Edit button>, the experienced user can enter the query condition for defining the list contents with no restraints and without any configuration help.

The following compare operators are admissible. Meaning of the data elements:

Operator	Syntax	Note
Equals	<header component> **=** <value>	
Greater than	<header component> **>** <value>	Not for SKQ
Greater than or equal to	<header component> **>=** <value>	Not for SKQ
Less than	<header component> **<** <value>	Not for SKQ
Less than or equal to	<header component> **<=** <value>	Not for SKQ

Operator	Syntax	Note
Not equal to	<header component> <> <value>	
Bit mask	<Header component> = <Value> : <Mask>	Not for SKQ

Tab. 5-27: Syntax for query string

Example:

K1=1, IKQ2=1001, BQ2=0x10:0x10

In example 1, all worn twist drills are shown in sector 1.

Example:

SKQ <>

In example 2, all tools in the database are shown.

For interlinked query conditions, several QueryStr can be defined for a list.

F-key panel definition

F-keypad

The valid call panel for the tool list to be defined can be selected from the F-key configurations contained under the project node "F panels".

The key "Configuration" can be used to directly call the F-key configurator for modifying the desired F-keypad.

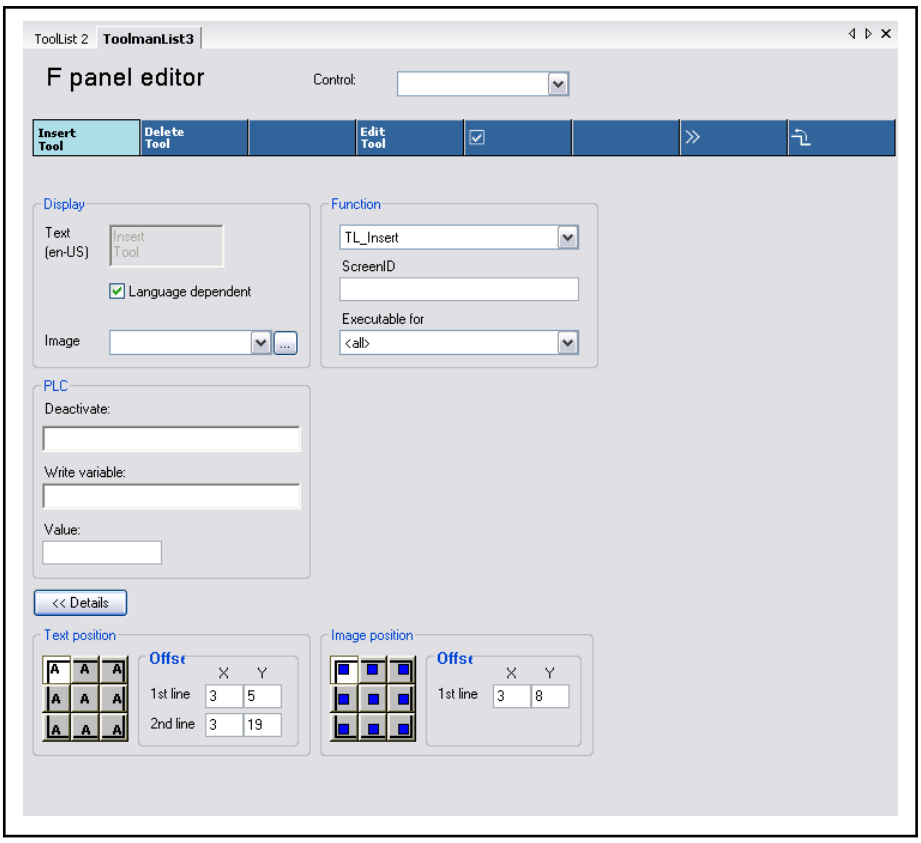


Fig. 5-103: F-key configurator

Tool management makes the following functions available for the available F-key/M-key configuration:

Name	Description	Parameter / notes
TL_Copy	Copy tool	-
TL_Delete	Delete tool	-
TL_Edit	Edit tool	-
TL_Edit_Additive	Switching additive ↔ absolute	-
TL_Export	Export list etc.	-
TL_Import	Import list	-
SingleTool_Import	Import single tool	-
TL_Insert	Insert tool	Screen ID possible
TL_Move	Move tool	Screen ID possible
TL_Editor_Command	Only applicable to M-key definitions in the tool editor	(refer to tab. 5-29 "M-key functions in the tool editor" on page 227)
TL_ChangeConfig	Modification of the list configuration	Name of the configuration file
TL_ChangeQuery	Modification of the list query	Query ID
TL_ActivateNextList	Switching to the next list if several lists are displayed	-
TL_SPS_Copy	Copy tool using PLC	PLC var
TL_SPS_Delete	Delete tool using PLC	PLC var
TL_SPS_Move	Move tool using PLC	PLC var
ToolCursor	Indicating the cursor position to the PLC	PLC var
ToolCursorEditor	Message of the tool to be edited in the editor to the PLC	PLC var
ToolList	Universal list call	ListID
ToolList 1	Call A_ToolList_1 (predef.)	-
:	:	:
ToolList 16	Call A_ToolList_16 (predef.)	-

Tab. 5-28: Function table for F-and M-key configuration

Command strings for the function TL_Editor_Command

Name	Description
Delete_BasicData_ToolType	Delete the basic data block
Save_BasicData_ToolType	Save the basic data block
Edit_Next_Tool	Selection of the next tool
Edit_Prev_Tool	Selection of the previous tool

Tab. 5-29: M-key functions in the tool editor

The following PLC data structures are required for the functions with a PLC connection:

TL_SPS_Copy

Sequence:

1. Select the tool to be copied (cursor position)
2. Enter the target place using the selection dialog

3. The interface activates the PLC using the structure variable (Act = TRUE)
4. The PLC executes the copy function (writes to the database)
5. The PLC returns an acknowledgement to the interface; in a negative case, this results in an error being output in the status bar. The interface expects this answer from the PLC within 500 ms. If no answer arrives, an error message is also issued.

Structure of PLC variable:

```
TYPE stCopy:
STRUCT
    SrcPlace :      INT;    (*Place - source*)
    SrcStorage :    INT;    (*Sector - source*)
    DstPlace :      INT;    (*Place - destination*)
    DstStorage :    INT;    (*Sector - destination*)
    Act:            BOOL;   (*Activation*)
    Value:          INT;    (*Error return*)
END_STRUCT
END_TYPE
```

TL_SPS_Delete

Sequence:

1. Select the tool to be deleted (cursor position)
2. Safety prompt via the dialog "Delete: yes/no"
3. The interface activates the PLC using the structure variable (Key = TRUE)
4. The PLC executes the delete function (writes to the database)
5. The PLC returns an acknowledgement to the interface; in a negative case, this results in an error being output in the status bar. The interface expects this answer from the PLC within 500 ms. If no answer arrives, an error message is also issued.

Structure of PLC variable:

```
TYPE stDelete:
STRUCT
    K1:             INT;    (*Sector*)
    K2:             INT;    (*Place*)
    Key:            BOOL;   (*Activation*)
    Value:          INT;    (*Error return*)
END_STRUCT
END_TYPE
```

TL_SPS_Move

Sequence:

1. Select the tool to be moved (cursor position)
2. Enter the target place using the selection dialog
3. The interface activates the PLC using the structure variable (Act = TRUE)
4. The PLC executes the copy function (writes to the database)

5. The PLC returns an acknowledgement to the interface; in a negative case, this results in an error being output in the status bar. The interface expects this answer from the PLC within 500 ms. If no answer arrives, an error message is also issued.

Structure of PLC variable:

```
TYPE stMove:
STRUCT
    SrcPlace :      INT;    (*Place - source*)
    SrcStorage :    INT;    (*Sector - source*)
    DstPlace :      INT;    (*Place - destination*)
    DstStorage :    INT;    (*Sector - destination*)
    Act:            BOOL;   (*Activation*)
    Value:          INT;    (*Error return*)
END_STRUCT
END_TYPE
```

ToolCursor

Sequence:

1. Transfer of the selected tool position (cursor position in the tool list) in the structure variables (K1 and K2).
2. The interface activates the PLC using the structure variable (Key = TRUE)
3. The PLC executes the specified function.

Structure of PLC variable:

```
TYPE stCurPos:
STRUCT
    K1:     INT;    (*Sector*)
    K2:     INT;    (*Place*)
    Key:    BOOL;   (*Activation*)
END_STRUCT
END_TYPE
```

ToolCursorEditor

Sequence:

1. Transfer of the tool position (of the tool to be edited) to the structure variables (K1 and K2).
2. The interface activates the PLC using the structure variable (Key = TRUE)
3. The PLC executes the specified function.

Structure of PLC variable:

```
TYPE stCurPos:
STRUCT
    K1:     INT;    (*Sector*)
    K2:     INT;    (*Place*)
    Key:    BOOL;   (*Activation*)
```

```
END_STRUCT
END_TYPE
```

M-key panel definition

M-keypad left and right

The valid left and right M-key panels for the tool list to be defined can be selected from the M-key configurations contained under the project node "M-panels".

The key "Configuration" can be used to directly call the M-key configurator for modifying the desired M-keypad.

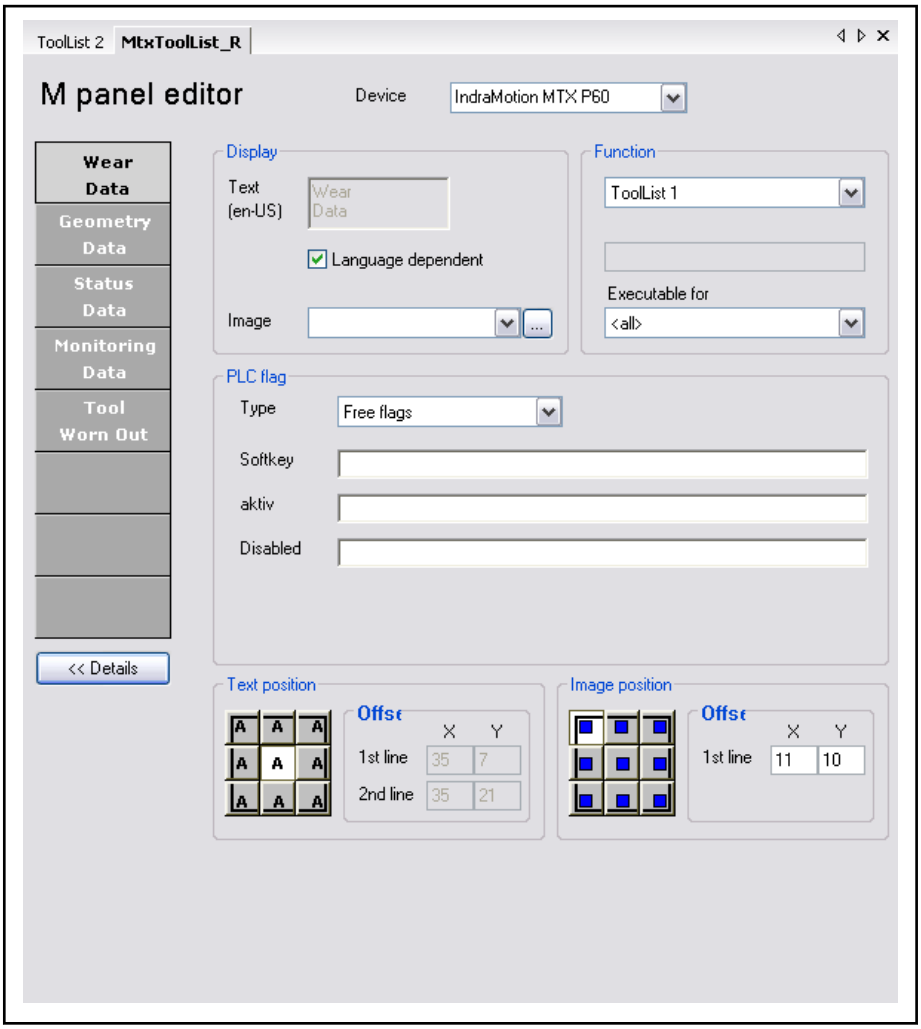


Fig. 5-104: M-key configurator

For the functions, see tab. 5-28 " Function table for F-and M-key configuration" on page 227.

M-keypads can be assigned to the tool lists using the following 2 methods:

Prio	Variant	Implementation
1	List-specific (local) M-keys	As described above, M-keypads are assigned to the tool list in the list configurator.
2	Global M-keys	M-keypads are not assigned to either the list or the screen.

Tab. 5-30: Variants of M-key configuration

Definition of list display

Tool lists configurator

There are two ways of viewing the tool lists configurator. However, they use the same database (configuration file), i.e. changes made in the configurator have the same effect on the XML editor and vice versa, i.e changes made in the XML editor have the same effect on the configurator.

1. Configurator for common configuration steps
2. XML editor for special settings which cannot be made by means of the configurator.

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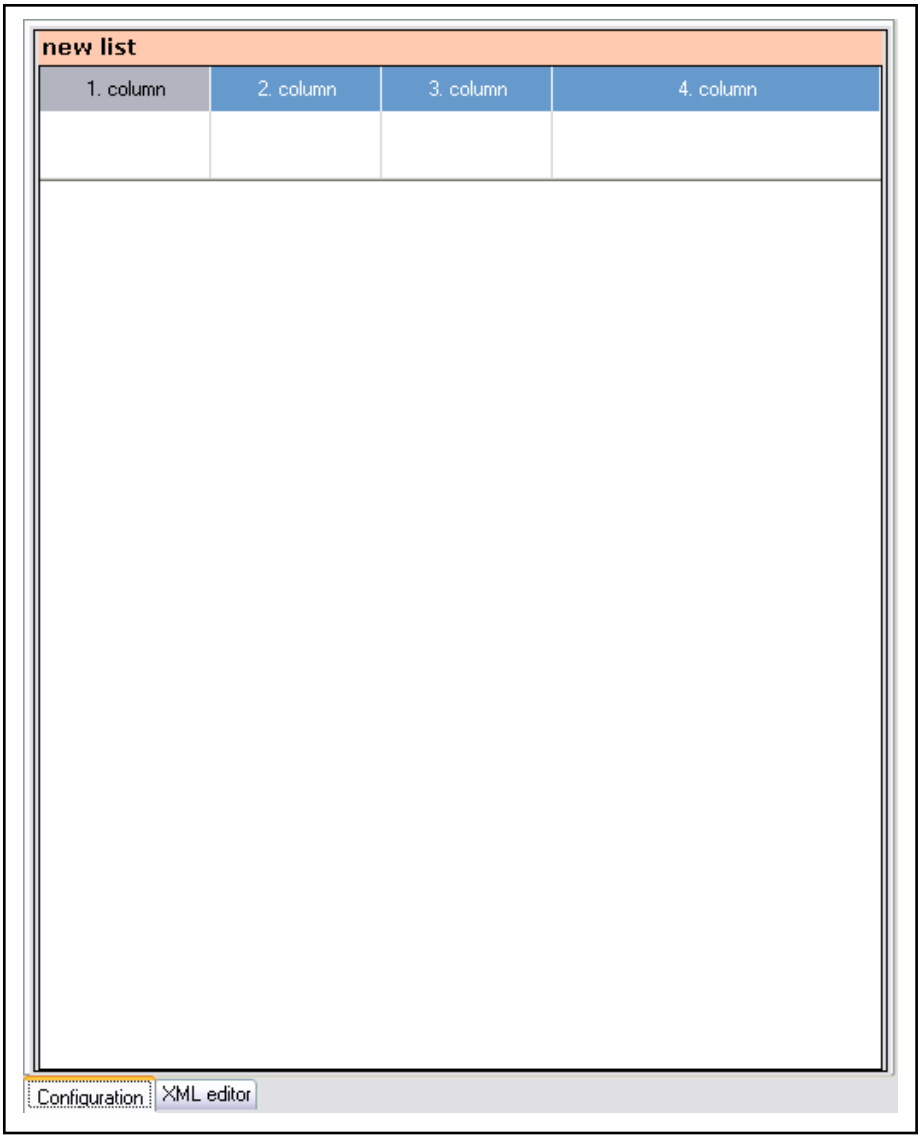


Fig. 5-105: Tool lists configurator

Most of the settings can be made using the ULC configurator (configuration) (see chapter "ULC configurator" on page 145). Only in exceptional cases do special changes need to be made directly in this configuration file using the XML editor (see chapter "XML file editor" on page 163). These cases are described in the next section.

Tool lists configuration file

The valid configuration file defining the list structure for the tool list to be defined can be selected from the controls list contained under (1).

The list structure is defined by the tool list configuration file assigned to the tool list.

All tool list configuration files are based on the schema file **"UniversalListcontrol.xsd"**.

The following overview in the appendix chapter 7.2 "Tool lists configuration file" on page 387 shows whether the list/editor control configuration file can be opened using the ULC configurator for all process parameters.

Description of application-specific display modifications outside of the ULC configurator

Setting the compressed display mode

If work is carried out with a list configuration that displays the data block in several partial lists (e.g. using **MTX.Toolman.ToolListConfiguration.xml**), the following handling instruction can be used to switch the display to a compressed version:

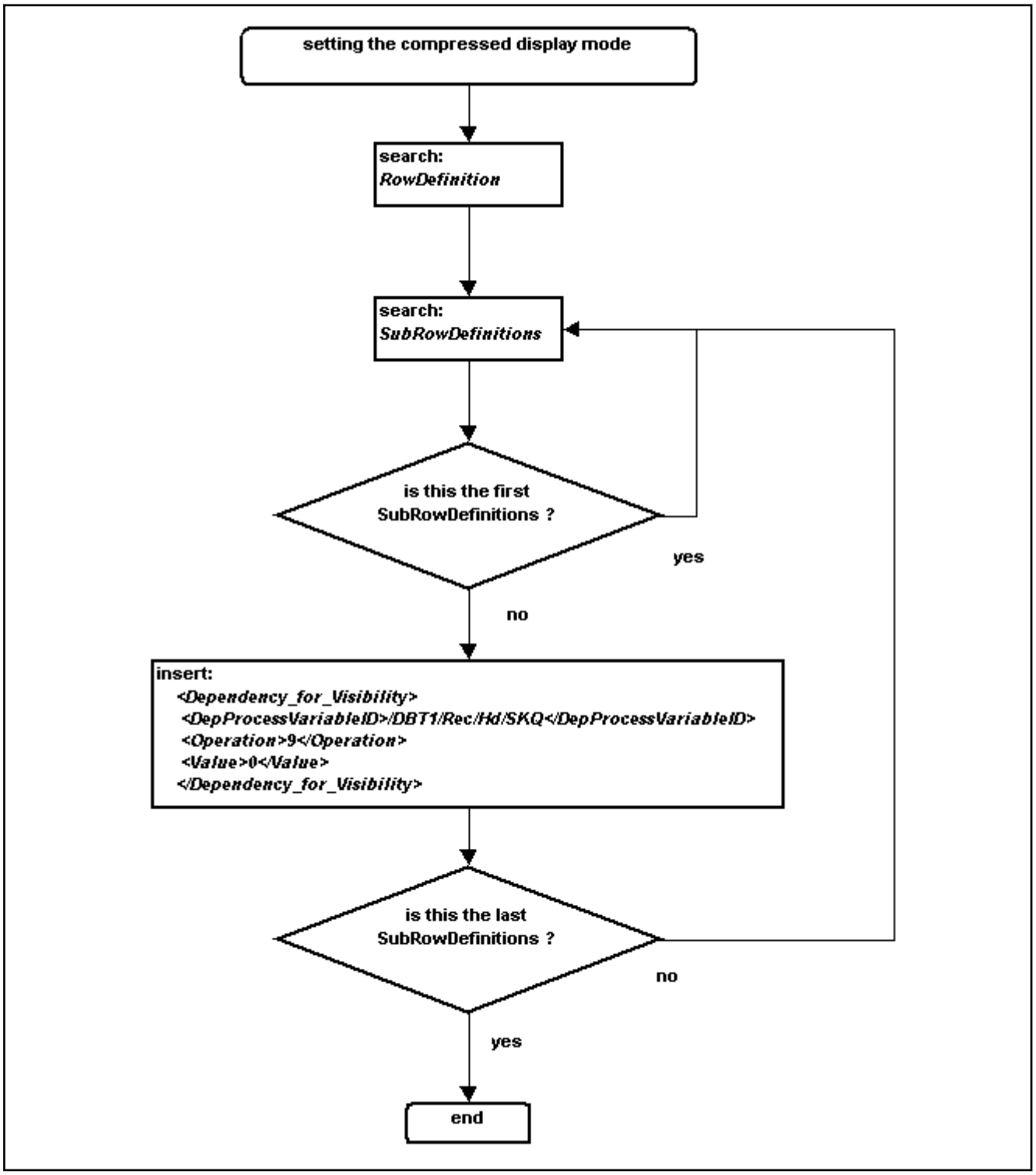


Fig. 5-106: Setting the compressed display mode

Control commissioning

Conditional Display of Cell Contents

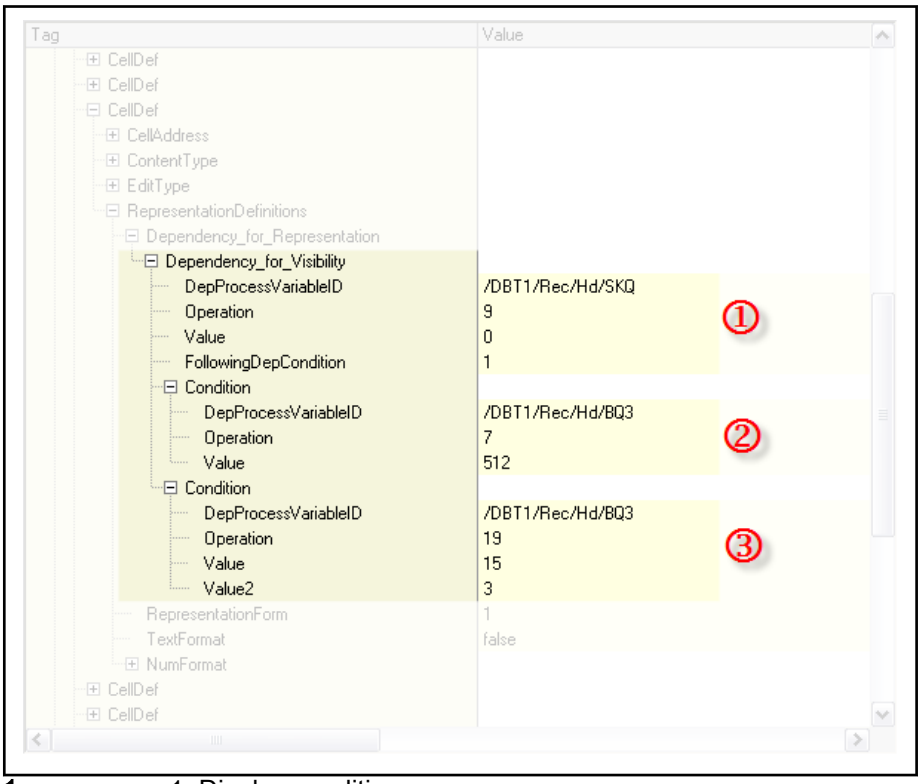
During the editor/list configuration, it is possible to define the editability of a data element depending on an additional process variable.

The setting is made in the configuration file in configuration node **"Dependency_for_Visibility"** (see P1 - P5).

☞ The prerequisites for this function is that the edit status = 3 for this cell.

Example:

The value of the tool edge-dependent data element "Geometry value L2" is displayed depending on data elements SKQ (tool name) and BQ3 (tool technology code) (determined by the CellDef node to which the "Dependency_for_Visibility" definition belongs).



1 1. Display condition
2 2. Display condition
3 3. Display condition

Fig. 5-107: Example: Conditional display of cell contents

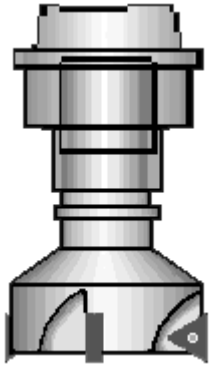
1. Display condition:	P.stringlength longer V	Tool name may not be an empty string, i.e. the place has to contain a tool
2. Display condition:	P AND V != 0	Bit 10 in the technology code word has to be set, i.e. the L2 correction value has to be relevant for the type of the displayed tool data block (see tool catalog)
3. Display condition:	(P AND V) higher or equal {MN}	The number of the subordinate column is less than or equal to the number of tool edges of the tool data block, i.e. the tool edge datum is relevant for the number of tool edges of the data block
Explanation for MN:	MN = 0	Partial list

MN = 1	Subordinate line
MN = 2	Column
MN = 3	Subordinate column

Setting Process-Dependent Bitmap Display

It is possible to display bitmaps from resource files depending on the value of a process variable in the tool list.

Since the bitmap files must be a component of a resource DLL, a default resource DLL (assembly file) is included; in turn, this contains the following bitmap resource files (resx files):

AssemblyName	BitmapResourceName	Contents	Example (original size)
MTX.Toolman.ToolmanUserBitmapResource	ToolTypes_MediumSizeBmp.resx	Tool type	
	ToolTypes_SmallSizeBmp.resx	Tool type	
	ToolTypes_IconSizeBmp.resx	Tool type	
	ToolStorageBmp.resx	Storage type	
	ToolTecTypesBmp.resx	technology type	

Tab. 5-31: Supplied bitmap libraries

Example:

Storage Type Bitmap

A bitmap is assigned to the value of K1 (sector number) using an assignment table.

Value of K1	Bitmap	Description
1		Spindle
2		Grippers
3		Magazine feeding attachment

Control commissioning

Value of K1	Bitmap	Description
4		Turret
99		Tool cabinet

Tab. 5-32: Example storage type bitmaps

Settings in the configuration file:

1. Setting: Display of the process variables as a bitmap.

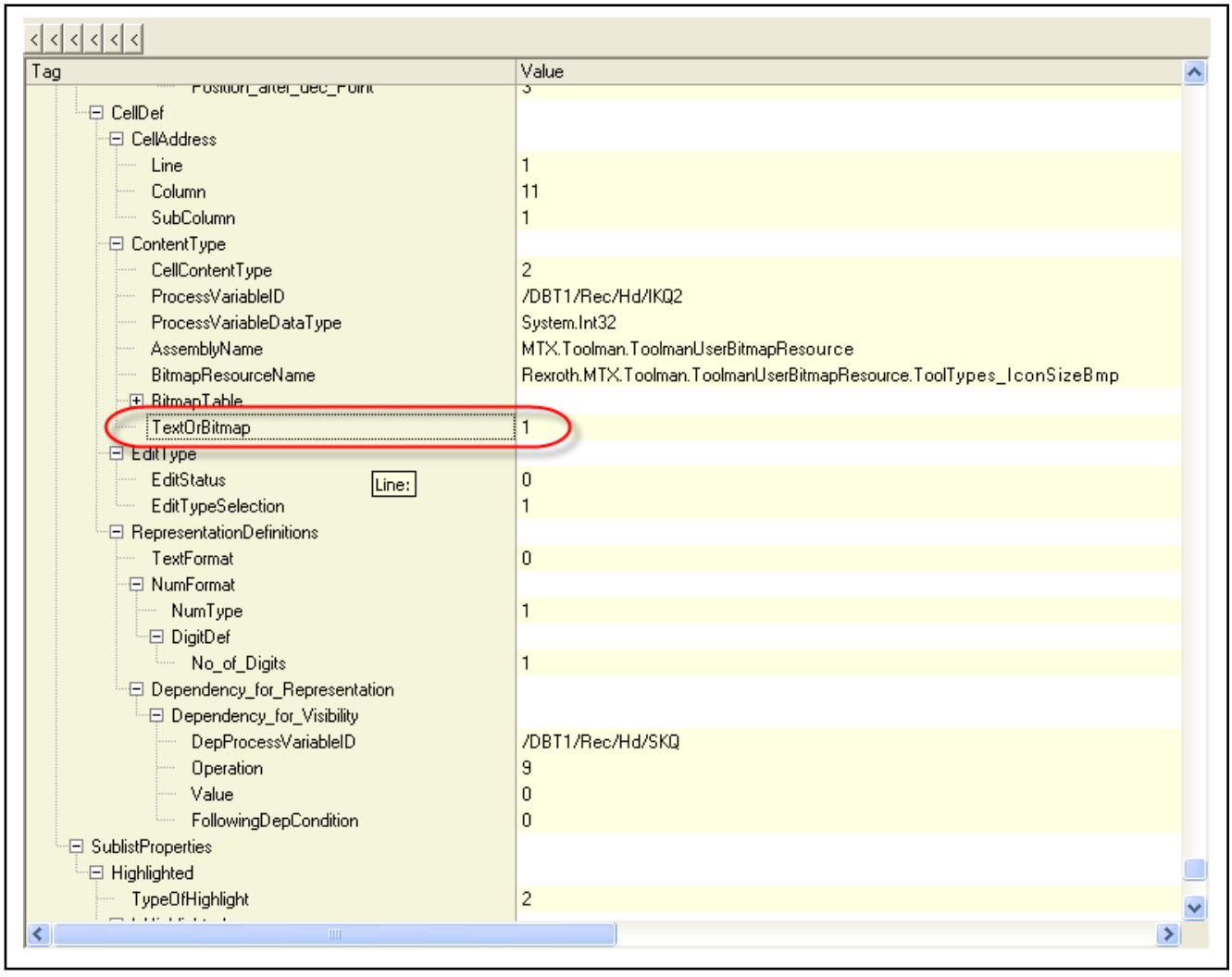


Fig. 5-108: Setting the display of the process variables as a bitmap

2. Define AssemblyName, BitmapResourceName and the bitmap table (see Q1 - Q2).

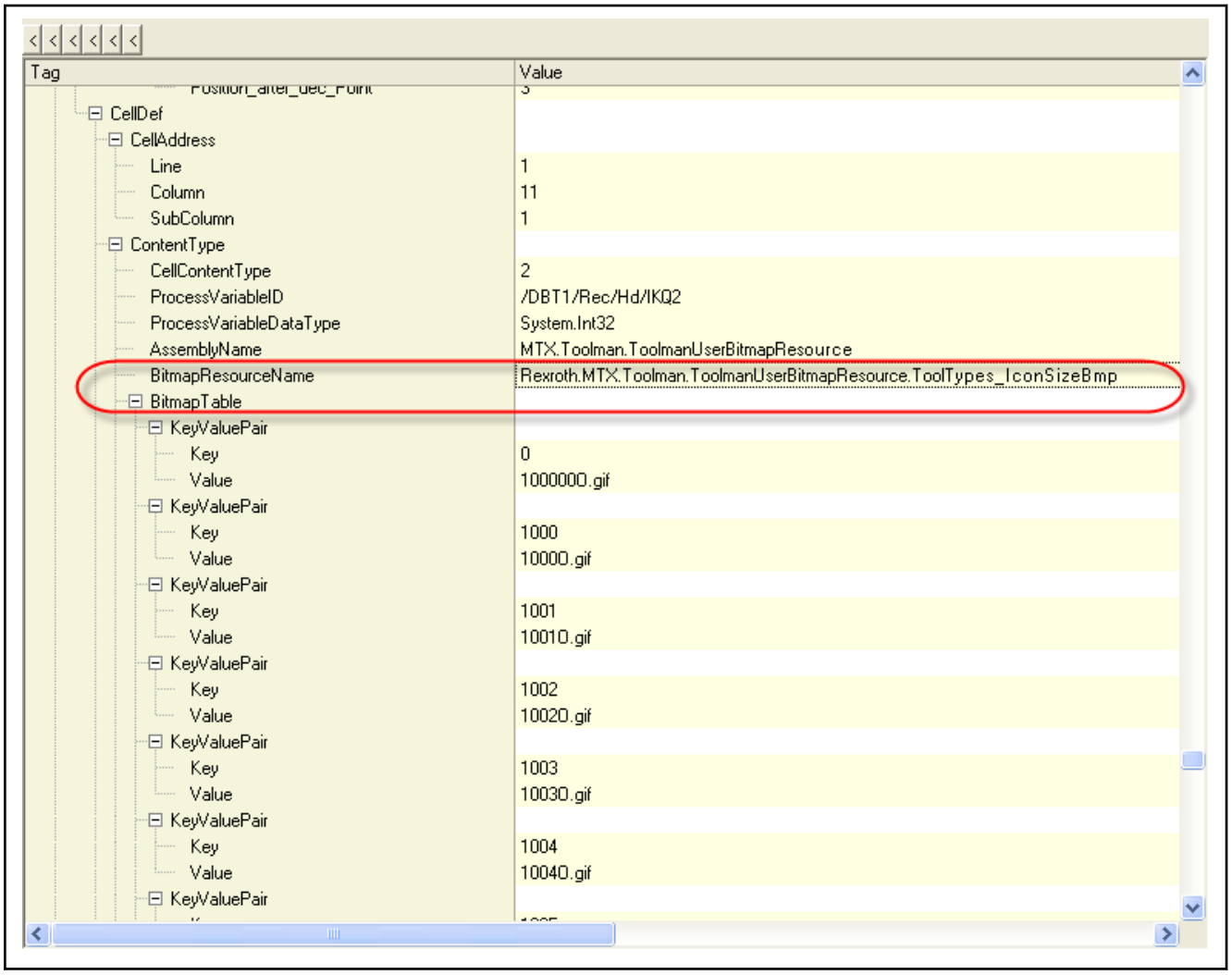


Fig. 5-109: Bitmap links

Setting Process-dependent Text Display

It is also possible to display also texts from resource files depending on the value of a process variable in the tool list.

The texts can either be firm texts or can originate from a text resource DLL or from a user text file.

Settings in the configuration file:

1. Setting: Display of the process variables as a text.
2. Via "**TextTableUse**" it can be set if the text is to be a determined text (value = 0), a resource text (value = 1) or a user text (value = 2).
3. Definition of AssemblyName, TextResourceName (in the case of resource texts being used) and the text table (see Q 1 - Q2).

Control commissioning

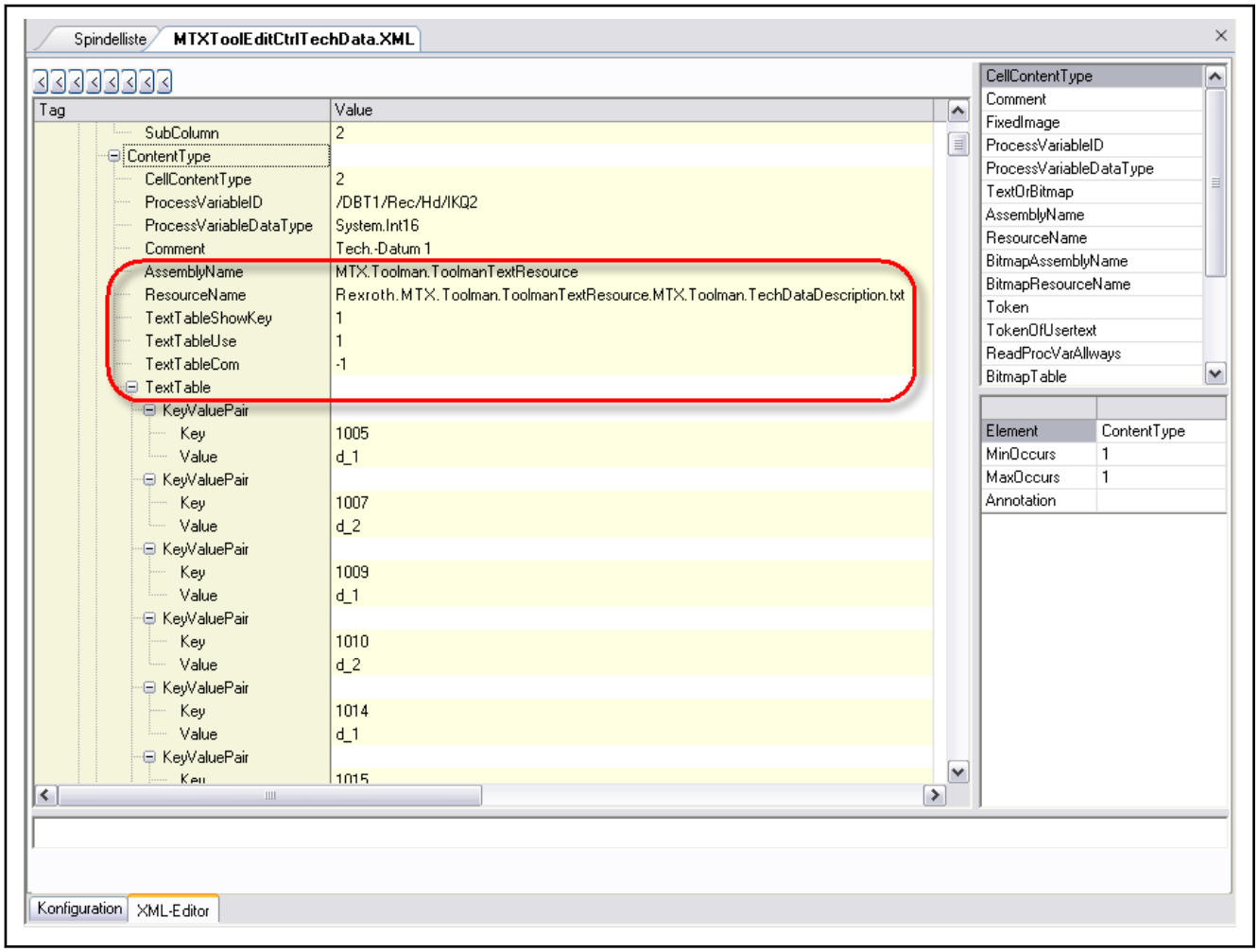


Fig. 5-110: Text references

4. Via "**TextTableShowKey**" it can be set how the display reacts in the case of the defined display conditions of the text table not being fulfilled. It can also be set if () is a resource text (value=1) or a user text (value=2).
   - Value = 0: The cell is displayed as empty
   - Value=1: The cell is displayed as if the process value = 0

Conditional Editability of Cell Contents

During the editor/list configuration, it is possible to define the editability of a data element depending on an additional process variable.

The setting is made in the configuration file in the configuration node **"EditDepend"** (see P1 - P5).

Example:

Conditional editability

The editing of a selected tool datum is permitted depending on data element BQ2 - bit 7 (Tool locked).

BQ2 AND 64 != 0

(Operation 7: P AND V != 0)

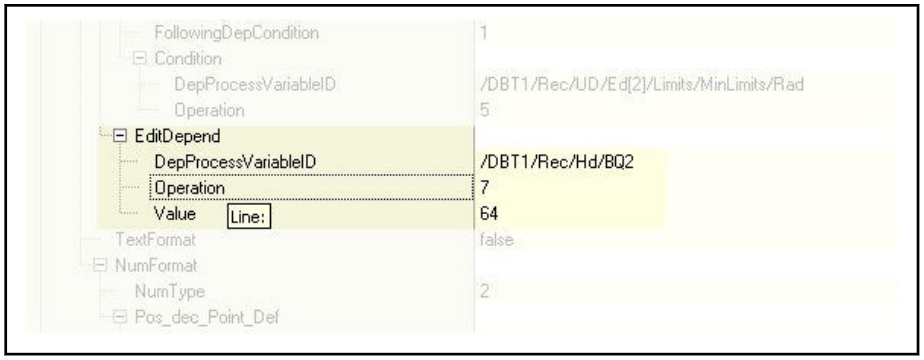


Fig. 5-111: Example of conditional editability

☞ The prerequisite for this function is that the **edit status = 3** in the edit type definition.

Highlighted Definition of Data Blocks

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.

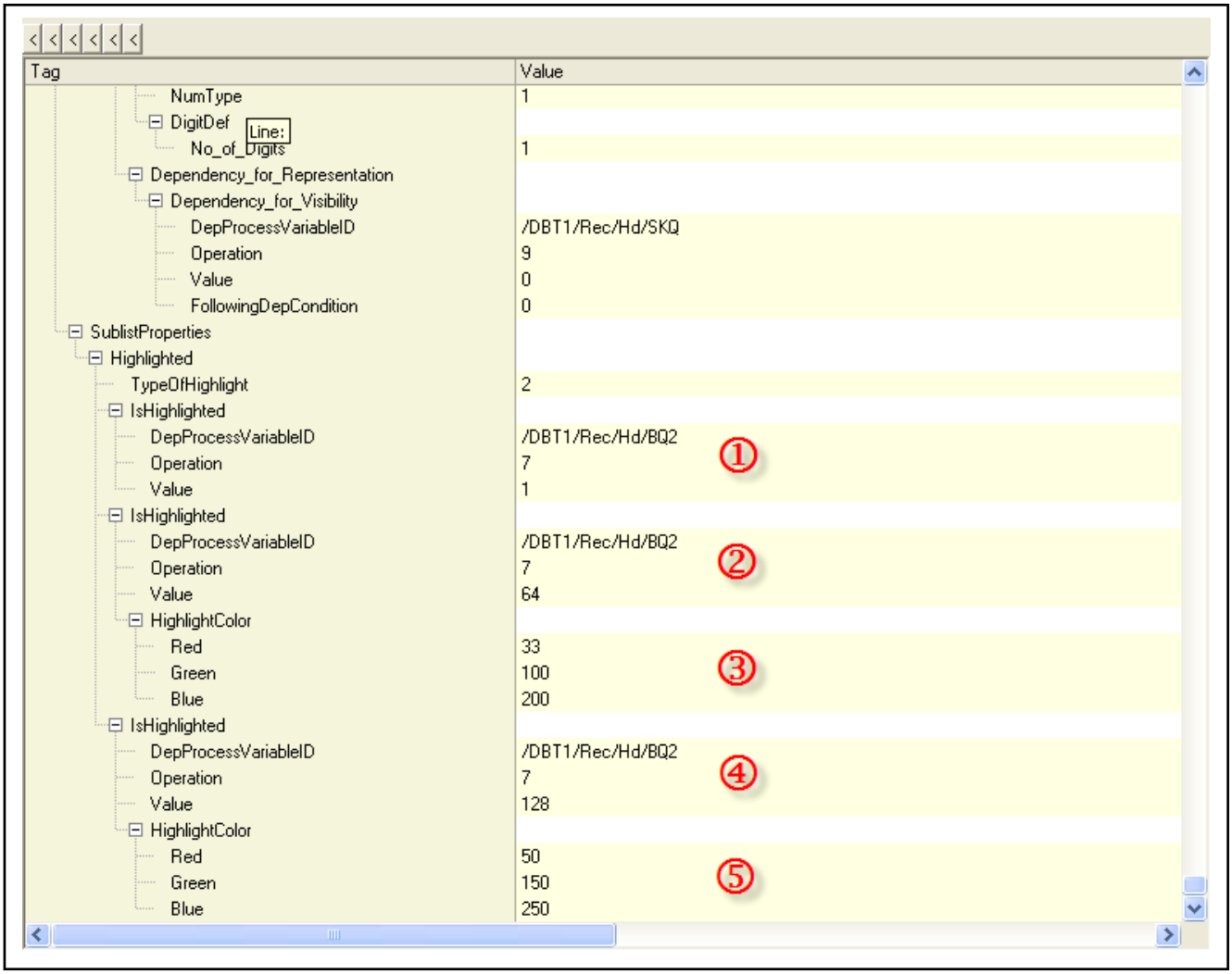
Example:

Highlighted Definitions

BQ2 - bit 0 (tool active) → background color 1

BQ2 - bit 4 (tool worn) → background color 2

Control commissioning



1 1. Highlighted condition
2 2. Highlighted condition
3 Color setting for the background color of the 2nd definition
4 3. Highlighted condition
5 Color setting for the background color of the 3rd definition

Fig. 5-112: Example of several highlighted definitions

Color settings, including the background color for the 1st definition, are always located in the configuration node **Styles/Highlighted**; the foreground color that is defined there applies to all highlighted definitions.

Definition of Value Range Checks During the Entry of Values

In addition to limit value monitoring in the PLC, it is possible to configure the tool list / tool editor in such a manner that only the entry editor carries out a value range check during entry.

If the value range is exceeded, an error message is displayed in the status bar.

As is the case for the check using the PLC, it is required that limit values be defined in the data block (see chapter 5.10.4 "Configuring the database" on page 175).

The setting for the check condition is made in the configuration file in configuration node **"Validation"** (see P1 - P5)

Also write:

instead of /DBT1/Rec/...

/DBT1/Rec[{0}]/...

Example:

Value Range Check during Entry in the Editor

(value of the limit R_{max} of tool edge 2) ≥ input value ≥ (value of the limit R_{min} of tool edge 2)

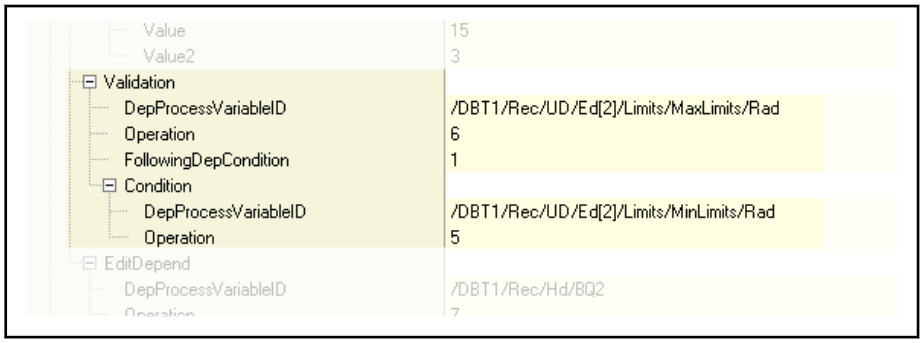


Fig. 5-113: Example of value range inspection during entry in the editor

Possible operations (generally applies to the DependencyType):

Explanation of abbreviations:		
P	Process variable	(ProcVariableID)
V	Value	(Value)
V2	2nd value	(Value 2)
Explanation for MN:	Value is preset by V2	
	MN = 0	Partial list
	MN = 1	Subordinate line
	MN = 2	Column
	MN = 3	Subordinate column
Permitted operations:		
	The value is written if:	
1	P==TRUE	Process variable log TRUE is
2	P<V	The process variable is lower than the specified value
3	P>V	The process variable is greater than the specified value
4	P==V	The process value is equal to the specified value
5	P≤V	The process value is lower than or equal to the specified value
6	P≥V	The process value is greater than or equal to the specified value
7	P∧V≠FALSE	The process variable is AND-logically linked with the specified value and the result is logic TRUE

8	˜P∧V≠FALSE	The negative process variables are AND-logically linked with the specified value and the result is logic TRUE
9	strlen(P)<V	The string length of the process variables is higher than the specified value (P of the string type, e.g. SKQ) is
10	(P∧V)<V2	Process variable is AND-logically linked with the specified first value and the result is lower than the second specified value
11	(P∧V)>V2	Process variable is AND-logically linked with the specified first value and the result is higher than the second specified value
12	(P∧V)==V2	Process variable is AND-logically linked with the specified first value and the result is equal to the second specified value
13	(P∧V)≤V2	Process variable is AND-logically linked with the specified first value and the result is lower than or equal to the second specified value
14	(P∧V)≥V2	Process variable is AND-logically linked with the specified first value and the result is higher than or equal to the second specified value
15	(P∧V)<MN[V2]	Process variable is AND-logically linked with the specified first value and the result is less than the value of the MN process variable specified by V2
16	(P∧V)>MN[V2]	Process variable is AND-logically linked with the specified first value and the result is higher than the value of the MN process variable specified by V2
17	(P∧V)==MN[V2]	Process variable is AND-logically linked with the specified first value and the result is equal to the value of the MN process variable specified by V2
18	(P∧V)≤MN[V2]	Process variable is AND-logically linked with the specified first value and the result is lower than equal to the value of the MN process variable specified by V2
19	(P∧V)≥MN[V2]	Process variable is AND-logically linked with the specified first value and the result is higher than equal to the value of the MN process variable specified by V2

Handling instruction: Configuring the list display

This handling instruction refers to the procedure described for configuring the display form of a tool list.

Configuring the list display

The following subtasks can be accomplished:

1. Adding/deleting a column
2. Adding/deleting a subcolumn
3. Changing a column or subcolumn title
4. Changing the column or subcolumn width
5. Setting the editing properties

See chapter "ULC configurator" on page 145.

		Documentation
Documentation	MTX Functional Description	Tool list configuration

IW Engineering: Data transfer

1. Save the configuration
2. Save and, if necessary, activate the project

		Documentation
Documentation	IndraWorks HMI	Data transfer

Handling instruction: Configuring the list content

The following handling instruction describes the procedure to edit the displayed content of a list.

IW Engineering/Tool list configuration: Enter or Double-Click a List Configuration

1. Selecting of list configuration files
2. Select the F-key panel and configure it, if necessary
3. Select the right and left M-key panels and configure them, if necessary
4. Define the list query

		Documentation
Documentation	MTX Functional Description	Tool list configuration

IW Engineering/Tool list configuration: Configuring the list definition

		Documentation
Documentation	MTX Functional Description	Data transfer

IW Engineering: Data transfer

1. Save the configuration
2. Save and, if necessary, activate the project

		Documentation
Documentation	IndraWorks HMI	Data transfer

Handling instruction: Creating a new list configuration

The following handling instruction describes the procedure to create a new list configuration.

IW Engineering/Tool list configuration: Pop-up or menu function "New"

A dialog to enter/select the list name is displayed. This name can be entered during the F/M-key configuration while entering the parameter **ListID** in the function **ToolList**.

Control commissioning

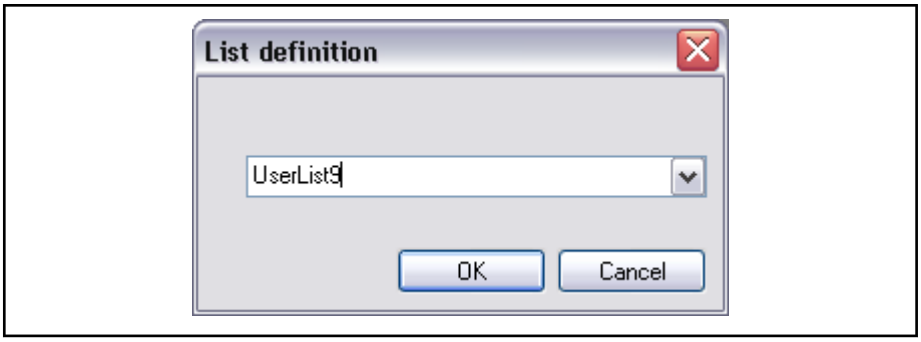


Fig. 5-114: Creating a new tool list definition

		Documentation
Documentation	MTX Functional Description	Tool list configuration

IW Engineering/Tool list configuration: Configuring the list display

		Instruction chapter "Handling instruction: Configuring the list display" on page 242
Instruction:	IndraWorks Commissioning	Configuring the list display

IW Engineering: Data transfer

Execute an HMI download

		Documentation
Documentation	IndraWorks HMI	Data transfer

Configuration of tool editors

General information

Brief description

Like the NC main screens, the tool editors function according to the ACI principle (**A**ctive **C**ontainer **I**nterface).

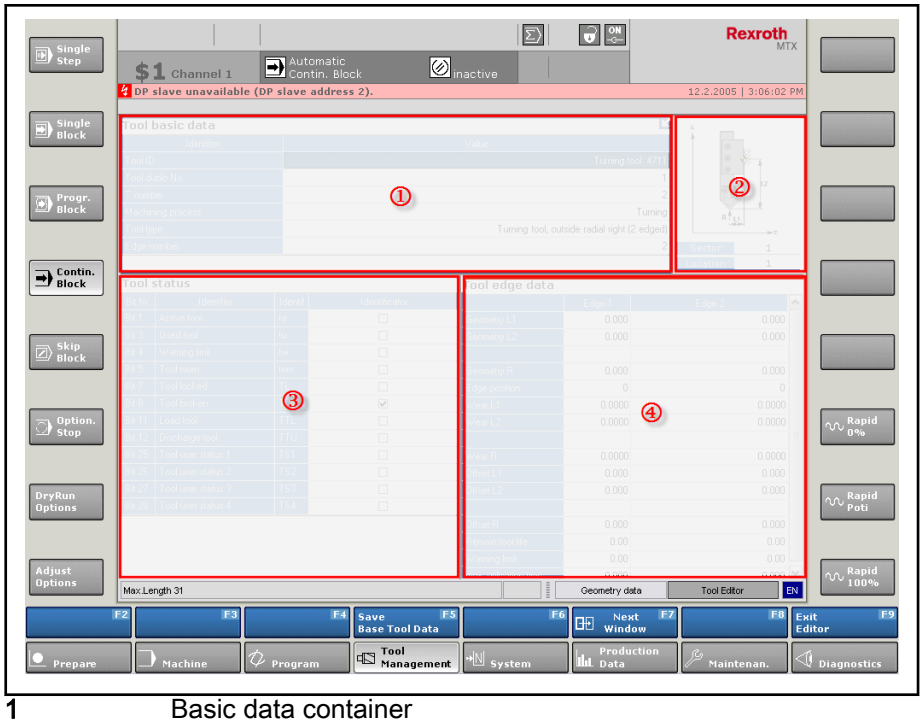
This is to say:

- They can be freely configured
- They contain several data containers which in turn can comprise several containers
- The controls can also be configured
- Navigation of the cursor, and thus editing, always takes place within the focused container only

Description

The various groups of tool data are shown using separate displays (e.g. tool edge data), so-called controls.

When it is delivered, the Tool Editor has the following screen division.



1 Basic data container
2 Bitmap container
3 General tool data container
4 Tool edge data container

Fig. 5-115: Container distribution of the tool editor

The number and assignment of containers can be changed by the user. This information is stored in the frame configuration file "MTXToolEditor_Data.xml". The control configurations of the containers are assigned as follows in a standard project.

Container No. in the figure	Listcontrol	Name of the configuration file
1	Basic data control	MTXToolBasicDataConfig.XML
2	Bitmap control	Cannot be configured and focused
3	Tool status control	MTXToolEditCtrlToolStates.XML
3	Place status control	MTXToolEditCtrlPlaceStates.XML
3	Technology data control	MTXToolEditCtrlTechData.XML
3	Tool user data control	MTXToolEditCtrlToolBD1.XML
4	Tool edge data control	MTXToolEditConfigUsrData.XML
4	Geometry limit values control	MTXToolEditConfigLimitData.XML

Tab. 5-33: Overview on all editor configuration files

If there are several controls in one container (as for the default configuration), these can be selected via <F3><Next display>.

The bitmap container is an exception. It cannot be focused and the displayed tool screen is switched via the type of the respectively activated display control.

Control commissioning

Display of a coordinate system in the bitmap container

It is possible to store the tool screen for a better illustration in a coordinate system.

This display is controlled via the system variable **SD.SysCoordSystem**.

If no automatic determination of the coordinate system is set (SD.SysCoordSystem.Calc = 0), the stored coordinate system can be set via the variable **SD.SysCoordSystem.Value**.

The coordinate system display is configured under the node **Tool Catalog ▸ Coordinate system**, see chapter "Visualizing and configuring the tool catalog" on page 210.

☞ Prerequisite for this function: the control device was switched online in IndraWorks Engineering.

As a rule, there are two groups of tool editors that can be managed separately in the project tree of Engineering Desktop under project node **"Editor Configuration"**:

Designation		Method of operation	Icon	Example
Insert type	Offline editor:	Editor for inserting a tool into the tool list		DBT1Insert
Edit type	Online editor:	Editor for modifying a tool data block		DBT1Edit

Newly created tool editors are always assigned to one of the two editor groups during creation by selecting the menu function **New Screen: Edit type** or **New screen: Insert type**; assigned to one of the two editor groups upon creation and displayed in the tree with the appropriate symbol. However, this assignment does not yet apply to new editors from old projects. However, it can be subsequently performed later on via the **Assign to Edit Screens** or **Insert Screens**.

The distribution, selection and arrangement of the tool data displays of the existing tool editors can be changed using the "Configuration" dialog. New tool editors can be created and ones that are no longer needed can be deleted.

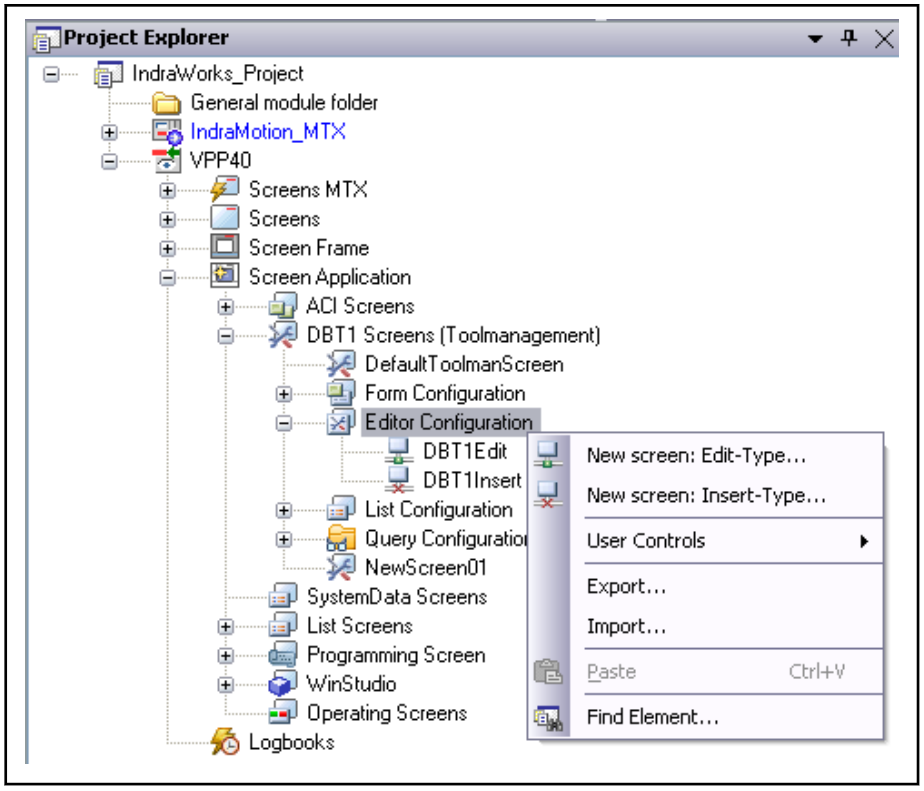


Fig. 5-116: Context menu: Editor configuration

The dialogs and functions to configure properties shared by all the tool editors as well as those to create a new tool editor, can be opened via the context menu of project node **"Editor Configuration"**.

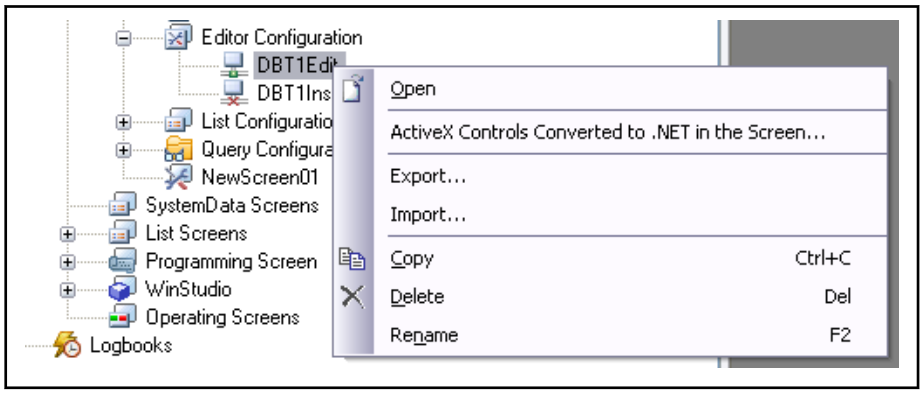


Fig. 5-117: Context menu: Configuration (tool editor)

Dialog "New Edit/Insert Screen"

A new editor can be created using the dialog **New screen**. The new editor is called in the context menu of project node **"Editor configuration"** with the entry **New screen: Edit type** or **New screen: Insert type**.

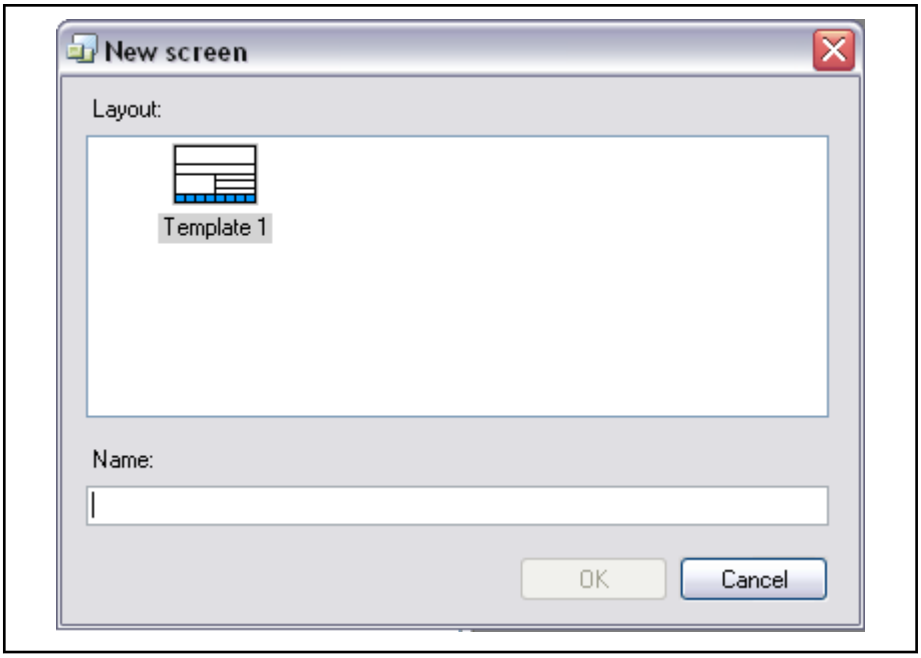


Fig. 5-118: Dialog: New screen (with layout templates)

To create a new screen, it is necessary to select a layout template and to enter a unique screen ID.

"Dataset screen editor"

The **"Dataset Screen Editor"** is called via "Open" in the context menu of the data set screen to be edited. The division of the editor into screen segments, along with their number and position, can be changed in this dialog.

For a general description on the configuration of ACI screens in the HMI, refer to the HMI manual **"DOK-IWORKS-HMI*Vxx****-APxx-EN-P"**.

☞ In case of a tool editor configuration, the following panels can be used, depending on whether an online or an offline editor is to be configured:

For an online editor:

- F-key file: **MTX.Toolman.Editor.Edit.xml**
- *possible start F-keypad:*
  - **MTXToolEdit_BasicData_ControlPanel**
  - MTXToolEdit_BasicData_ControlPanel2 (to be used only internally)
  - **MTXToolEdit_ToolStates_ControlPanel**
  - **MTXToolEdit_UserData_ControlPanel**
  - MTXToolEdit_UserData_ControlPanel2 (to be used only internally)
  - **MTXToolEdit_BitMap_ControlPanel**

For an offline editor:

- F-key file: **MTX.Toolman.Editor.Insert.xml**
- *possible start F-keypad:*
  - **MTXToolInsert_BasicData_ControlPanel**
  - **MTXToolInsert_ToolStates_ControlPanel**
  - **MTXToolInsert_UserData_ControlPanel**
  - **MTXToolInsert_BitMap_ControlPanel**

Online Editor:

F-keypad level	<F2>	<F3>	<F4>	<F5>	<F6>	<F7>	<F8>	<F9>
1. Level				Save basic data	Modify type on/off	Next window		Close editor

Tab. 5-34: MTXToolEdit_BasicData_ControlPanel

F-keypad level	<F2>	<F3>	<F4>	<F5>	<F6>	<F7>	<F8>	<F9>
1. Level		Next display				Next window		Close editor

Tab. 5-35: MTXToolEdit_ToolStates_ControlPanel

F-keypad level	<F2>	<F3>	<F4>	<F5>	<F6>	<F7>	<F8>	<F9>
1. Level		Next display			Input additive	Next window		Close editor

Tab. 5-36: MTXToolEdit_UserData_ControlPanel

F-keypad level	<F2>	<F3>	<F4>	<F5>	<F6>	<F7>	<F8>	<F9>
1. Level						Next window		Close editor

Tab. 5-37: MTXToolEdit_BitMap_ControlPanel

Control commissioning

Offline editor:

F-keypad level	<F2>	<F3>	<F4>	<F5>	<F6>	<F7>	<F8>	<F9>
1. Level				Basic data data		Next window		Close editor

Tab. 5-38: MTXToolInsert_BasicData_ControlPanel

F-keypad level	<F2>	<F3>	<F4>	<F5>	<F6>	<F7>	<F8>	<F9>
1. Level		Next display				Next window		Close editor

Tab. 5-39: MTXToolInsert_ToolStates_ControlPanel

F-keypad level	<F2>	<F3>	<F4>	<F5>	<F6>	<F7>	<F8>	<F9>
1. Level		Next display				Next window		Close editor

Tab. 5-40: MTXToolInsert_UserData_ControlPanel

F-keypad level	<F2>	<F3>	<F4>	<F5>	<F6>	<F7>	<F8>	<F9>
1. Level		Next display				Next window		Close editor

Tab. 5-41: MTXToolInsert_BitMap_ControlPanel

- If a control contains the implementation of the MTXACIInterface.dll interface, the configuration parameter that can be entered in field "Instance" can be transferred to it. If the control can display different process data or if it has various types of displays, this configuration parameter can be used during the initial instancing of the control to determine which of these instances the control should use.

Configuring the tool editor controls

The following tool editor controls can be configured as the tool lists via the ULC configurator:

- MTXToolBasicDataConfig.XML
- MTXToolEditCtrlToolStates.XML
- MTXToolEditCtrlPlaceStates.XML
- MTXToolEditCtrlToolBD1.XML
- MTXToolEditConfigUsrData.XML
- MTXToolEditConfigLimitData.XML

As opposed to the list configuration, however, only the data of one tool are displayed.

There is no way to directly call the ULC configurator from the editor configuration. The method using **Form Configuration ▸ Container Controls** must be chosen.

Configuring the M-keypads in the tool editor

The tool editors can receive their own M-keypads specific to their type with the following fixedly determined panel names:

Editor type	M-keypad	M-panel name
Insert type	Right	ToolInsertEditorLocalRight
	Left	ToolInsertEditorLocalLeft
Edit type	Right	ToolEditorLocalRight
	Left	ToolEditorLocalLeft

Tab. 5-42: Names of the M-key panels of the tool editors

Said M-keypads can be configured by the user in the M-key configurator.

For this, all keys should be defined by means of the **"TL_Editor"** function using the following subfunctions in **"CommandString"**:

Function name	CommandString	Description
TL_Editor	Edit_Prev_Tool	Search for the previous tool
	Edit_Next_Tool	Search for the next tool
	Save_BasicData_Tool-Type	Save the current data block as a basic data block
	Delete_BasicData_Tool-Type	Delete the basic data block

Tab. 5-43: Commands for the M-key functions in the tool editor

The use of other functions for the M-key configuration is possible; however, it is not recommended, since these usually do not result in a reasonable behavior of the tool editor (e.g. Delete tool).

Handling instruction: Configuring the tool editor controls

The configuration of the following tool editor controls takes place in the same way as tool list configuration, the only difference being that the data of only one tool are indicated in these lists:

- MTXToolBasicDataConfig.XML
- MTXToolEditCtrlToolStates.XML
- MTXToolEditCtrlPlaceStates.XML
- MTXToolEditCtrlToolBD1.XML
- MTXToolEditConfigUsrData.XML

This way, it is ensured that the entry **<ShowMultipleSublists>** = FALSE is set and that the entry **<PathOfMultiplicator>** remains empty.

IW Engineering: Data transfer

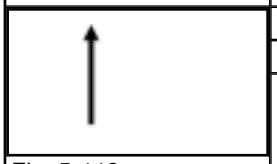
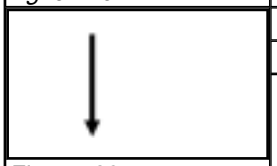
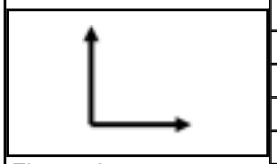
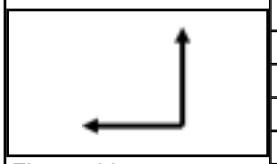
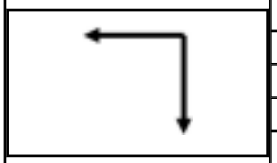
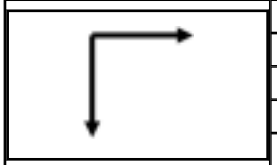
1. Save the project
2. Insert the icon

Defining the display of the coordinate system in the tool bitmap control

A coordinate system establishing an axis reference of the correction values is stored in the displayed tool bitmap.

This axis reference can be set via the system date **SD.SysCoordSystem.Value**.

Bitmap control

Coordinate system	Ordinate	Abscissa	SD.SysCoordSystem.Value
Without	-	-	0
 *Fig. 5-119:*	X	-	1
	Y	-	3
	Z	-	5
 *Fig. 5-120:*	X	-	2
	Y	-	4
	Z	-	6
 *Fig. 5-121:*	X	Z	10
	X	Y	20
	Y	X	30
	Y	Z	40
	Z	X	50
	Z	Y	60
 *Fig. 5-122:*	X	Z	11
	X	Y	21
	Y	X	31
	Y	Z	41
	Z	X	51
	Z	Y	61
 *Fig. 5-123:*	X	Z	12
	X	Y	22
	Y	X	32
	Y	Z	42
	Z	X	52
	Z	Y	62
 *Fig. 5-124:*	X	Z	13
	X	Y	23
	Y	X	33
	Y	Z	43
	Z	X	53
	Z	Y	63

Tab. 5-44: Coordinate system

The displayed coordinate system can also be determined automatically. But presettings have to be made once.

Specifications whether the value SD.SysCoordSystem.Value should be determined automatically:

SD.SysCoordSystem.Calc: 1 - Automatic value determination
0 - No automatic value determination

Specifications for the machine configuration:

Machine coordinate system:

SD.SysCoordSystem.horizontal: 1 - Abscissa in positive direction
0 - Abscissa in negative direction
SD.SysCoordSystem.vertikal: 1 - Ordinate in positive direction
0 - Ordinate in negative direction

Master axis meaning:

SD.SysCoordSystem.X_axis_pref:	1 -	X-axis exists and is preferably displayed
	0 -	X-axis does not exist
SD.SysCoordSystem.Y_axis_pref:	1 -	Y-axis exists and is preferably displayed
	0 -	Y-axis does not exist
SD.SysCoordSystem.Z_axis_pref:	1 -	Z-axis exists and is preferably displayed
	0 -	Z-axis does not exist

Tab. 5-45: SD.SysCoordSystem

That means if the value of the variables SD.SysCoordSystem.Value should be determined automatically, 1 has to be assigned to SD.SysCoordSystem.Calc. it is only then required to set the machine configuration.

Configuring the user management

General information

MTX user management is classified into

- data-related user management and
- functional user management.

Data-relevant user management allows for assignment of data element-relevant read and write privileges to the individual user groups. As described above, this is realized via attribute definitions (L1, L2, L3, L3, L5) in the data block schema.

Presently, the functional user management cannot be configured by the user.

Handling instruction: Defining data-relevant user privileges

The following handling instructions describe the process to be followed when the user privileges for the individual data elements are to be modified.

IW Operation/Program: Edit the Schema File "dbt?ud.xsd"

1. Copy the file "dbt?ud.xsd", "dbt**?**sd.xsd" (**?**:= 1 [DBT1] or 2 [DBT2]) or "tool_ty.xsd" in control directory "\usrfep\schemas" or "\feprom\schemas" or "\root\schemes" to the mount directory (\mnt).
2. Edit user rights L1 to L5 of the respective nodes or elements in the schema file by means of the XSD editor (preferably with Altova SPY).
3. Save file.
4. Copy the file back to the control directory "\usrfep" or "\root".

Figure		Documentation
Figure:		Image of data block schema
Documentation	MTX Functional Description	Edit schema file

NC: Apply new data structure

1. Complete IW Operation
2. Reset control

Figure		Documentation
Documentation	MTX Functional Description	Apply new data structure

5.10.7 Interfaces

CPL interfaces

The MTX provides the following NC commands for accessing the tool database:

☞ For the detailed syntax of the NC commands described below, please see the documentation "Rexroth IndraMotion MTX Programming Manual". Here, only the names of the NC commands are mentioned, each illustrated by one example.

TCV Provides the latest programmed tool correction values, either as a total (D-correction + external correction memory) or as a single value.

Example: Reading of the L2 tool length of the last programmed ED-correction.

Program:

```
110 TCV(2,"E")
```

DCT Read and write access to tool correction values in any D-correction tables as well as to external correction values (ED-correction). While writing, incremental modifications can also be specified.

Example:

Inch access to the "L2" correction of data block 2 of the external tool correction.

Program:

```
110 DCT("L2" ,2 ,0 ,"INCH")
```

DBSEA Search for data blocks within a database table.

The CPL function returns the header of the first data block that corresponds to the search condition. In this case, the variable returns a value of 1. The data block search starts with the data block defined using <StartKey1> and <StartKey2>. If one of the two starting keys has a value of -1, the search starts at the first data block of the database table.

Example:

Search for the tool with T-number 5 in the tool memory and save the data block that is found in structured variable "SV.Tool". Using DBSEA, only the "Header" data of a data block are read.

Program:

```
110 SV.Tool.Hd = DBSEA("/DBT1",-1,-1 ,"IKQ3=5",RECFOUND%,ERR%)
```

DBSEAX Searches for one or more data blocks in a tool database table.

The command provides a list of data block headers corresponding to the search criterion. The headers are stored in a system data array <HeaderArr> that is sorted according to K1 and K2. The parameter <ErgSize> is used to specify the maximum number of data block headers to be searched. The return value of DBSEAX provides the number of data blocks found.

DBTAB Reading or writing of data elements and data blocks

Example:

Reading the data block of sector 3, place 34 into the structured variable SV.Tool.

Program:

```
110 SV.Tool = DBTAB(”/DBT1”,3,34 ,ERR%)
```

DBTABX Can read a complete data set or a substructure of a tool database table into a CPL variable or write from the variable to the data set. Parameter <Mode> can be used to control whether all data of the data block or only tool- or place-specific data are written.

Example:

1. Reading all data of the data block of sector 3, place 34 into the structured variable SV.Tool.
2. Writing all tool data of the data block of sector 3, location 34 of the structured variable "SV.Tool". No location-specific parts are applied.

Writing tool data

Program:

```
110 SV.Tool = DBTABX("DBT1.Rec",3,34)
120 DBTABX("DBT1.Rec",3,34,1,ERRNO) = SV.Tool
```

DBTABXL Similar to DBTABX, but the data block is locked during read access; this lock is removed when the data block is written.

DBMOVE Moving data blocks within a database table.

Example:

The contents of the data block (1,1) are moved to the data block (2,2).

Program:

```
130 DBMOVE(”/DBT1”,1,1,2,2)
```

DBLOAD Via "DBLOAD", parts of a database table or a complete database table can be read from a file into the database.

Example:

The content of the data block (1,1) is read from the file "dbdaten.txt" into the database table.

Program:

```
140 DBLOAD(”/DBT1”,1,1,”/dbdaten.txt”)
```

DBSAVE Via "DBSAVE", parts of a database table or a complete database table can be saved to a file.

Example: The content of the data set (1,1) is saved to the "dbdaten.txt" file.

Program:

```
150 DBSAVE(”/DBT1”,1,1,”/dbdaten.txt”)
```

PLC interfaces

General information

To access the tool database, the MTX offers the PLC function components and structures described in the following; these are summarized in PLC library "MT_MTX.lib".

For a detailed syntax of the NC commands described below, please see the documentation "Rexroth IndraMotion MTX PLC Interface". Only the names of the PLC blocks are mentioned here.

Function blocks

MT_DbData The "MT_DbData" program component offers various functions for reading and changing tool data blocks.

MT_DbRecList The program component "MT_DbRecList" offers the possibility to search for data blocks within a database table or to delete data blocks according to a list.

MT_DbLoad By means of this program component, a database table can be read in from an XML file in whole or in part.

MT_DbSave By means of program component "MT_DbSave", a database table can be read into a file.

Here, there are the options

- to delete the file first and then to save the data blocks

-or-

- to add the data blocks at the end of the file.

Structures

By means of the structures predefined in the PLC library "MT_MTX.lib", all data blocks and data elements of the tool database can be processed in the PLC user program. The names of the PLC structures follow the names of the data types defined in the scheme files.

The following structures currently exist:

- MT_DbRecListCond_t
- MT_DBT1Rec_t
- MT_DbT1Hd_t
- MT_DBT1Ud_t
- MT_Ed_t
- MT_EdLife_t
- MT_Geo_t
- MT_GeoExtended_t
- MT_Tl_t
- MT_Wear_t

State upon delivery

Database

In the delivery state, the database tables are configured as follows:

Database size

- DBT1: 10 data blocks
- DBT2: 10 data blocks

Table division

DBT1:

- Sector 1: 5 places
- Sector 2: 5 places

DBT2:

- Sector 1: 5 places
- Sector 2: 5 places

Data schema

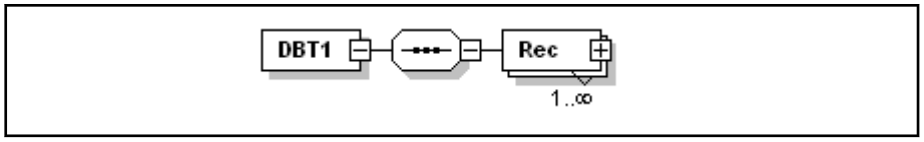


Fig. 5-125: Default configuration of the data schema (1)

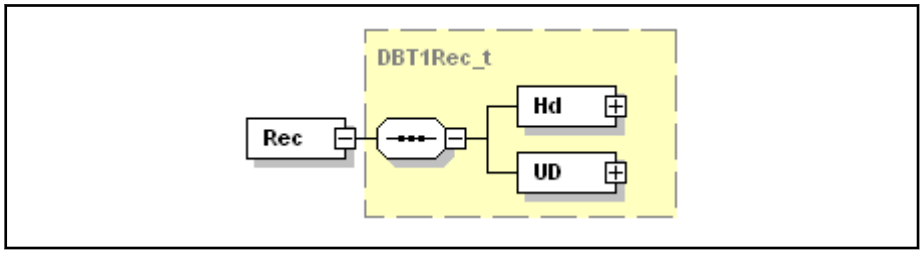


Fig. 5-126: Data scheme of default configuration (2)

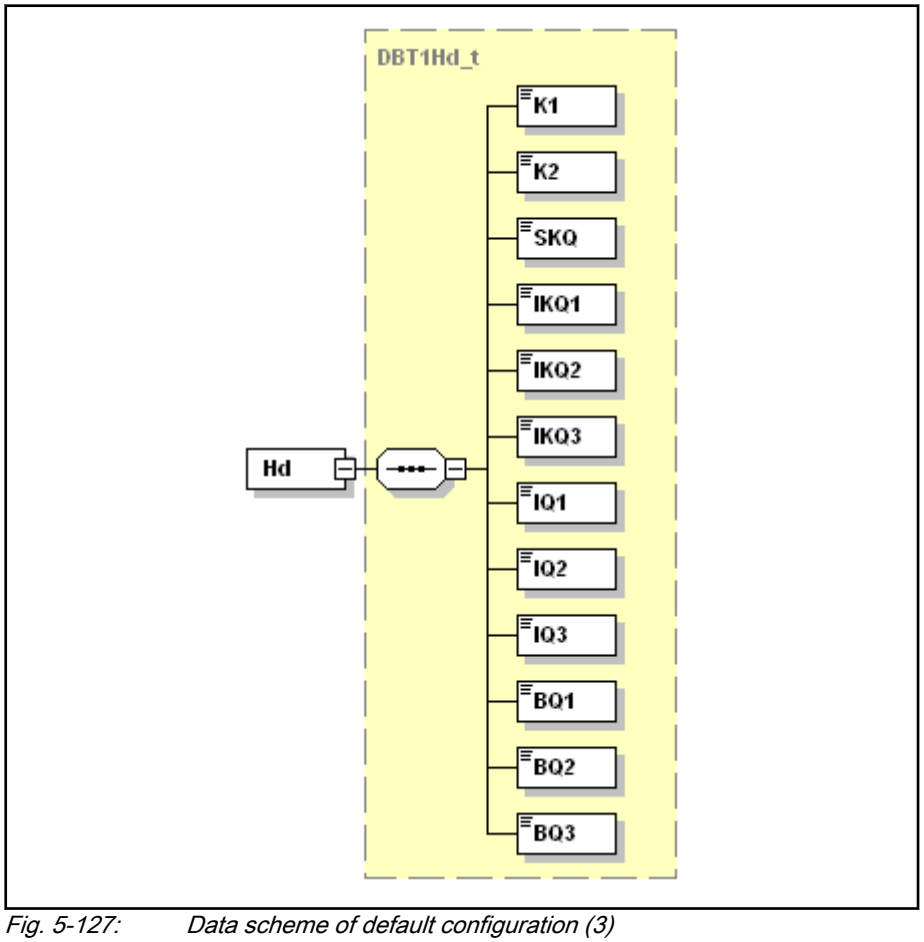


Fig. 5-127: Data scheme of default configuration (3)

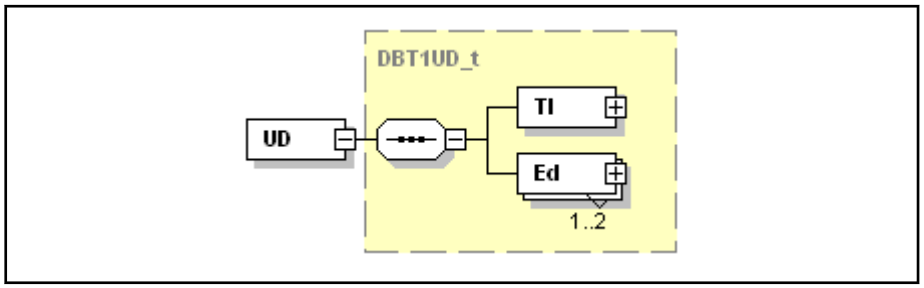


Fig. 5-128: Data scheme of default configuration (4)

Control commissioning

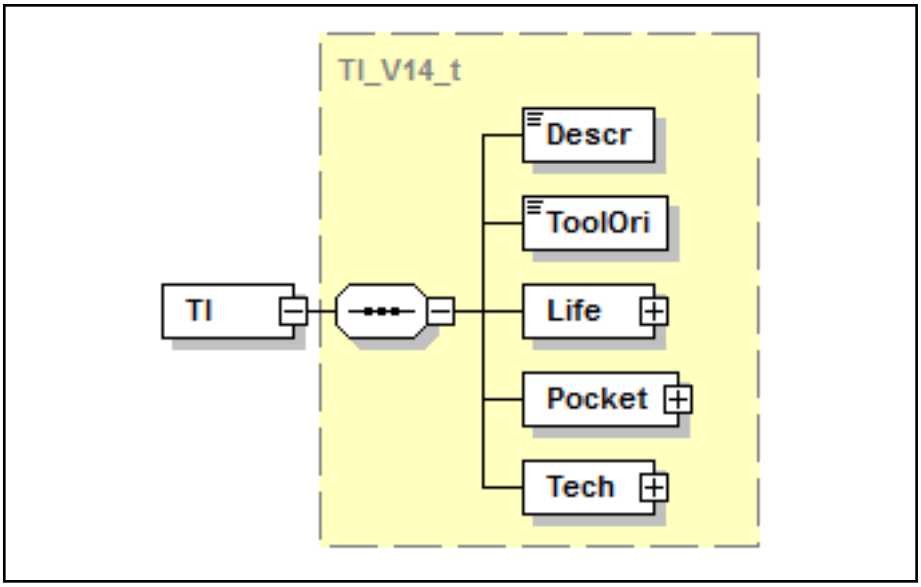


Fig. 5-129: Data scheme of default configuration (5)

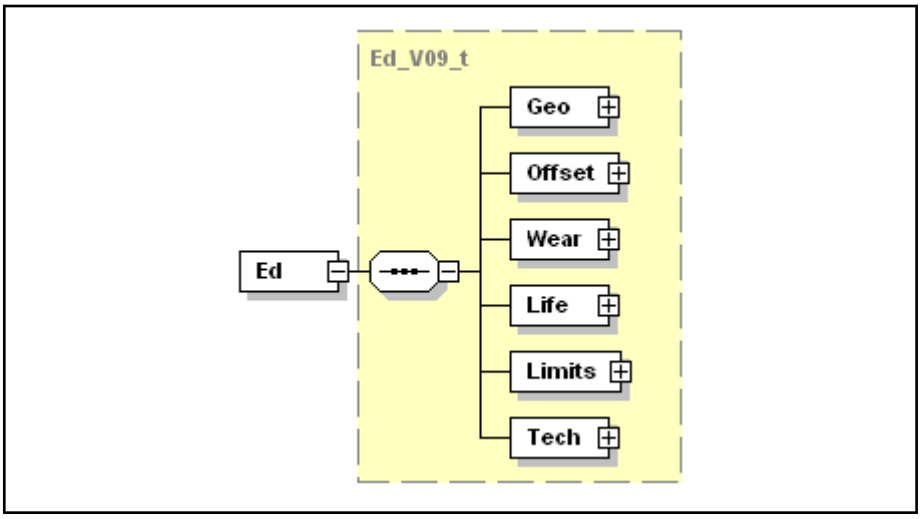


Fig. 5-130: Data scheme of default configuration (6)

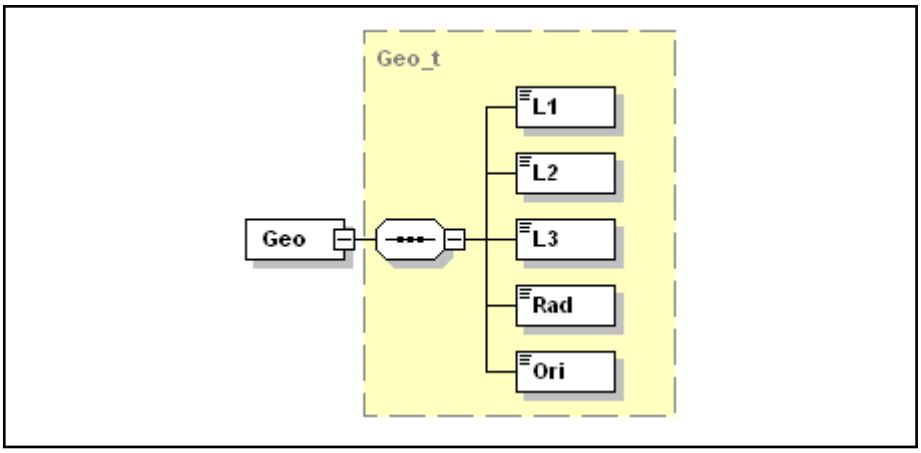


Fig. 5-131: Data scheme of default configuration (7)

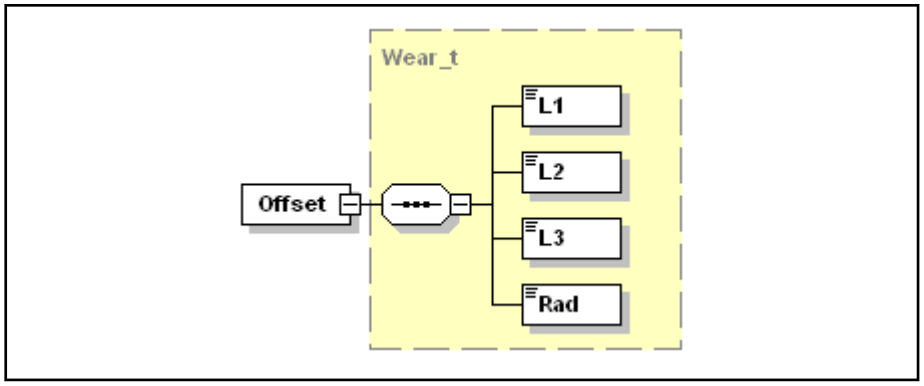


Fig. 5-132: Data scheme of default configuration (8)

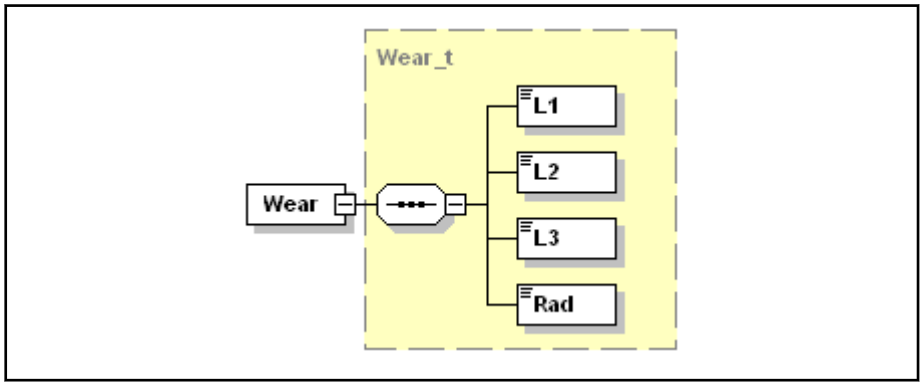


Fig. 5-133: Data scheme of default configuration (9)

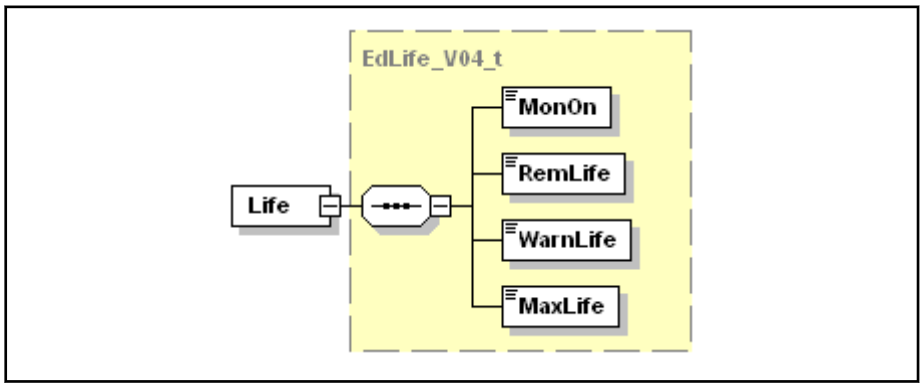


Fig. 5-134: Data scheme of default configuration (10)

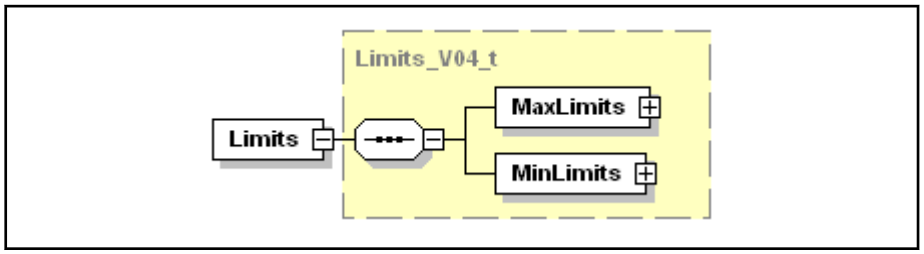


Fig. 5-135: Data scheme of default configuration (11)

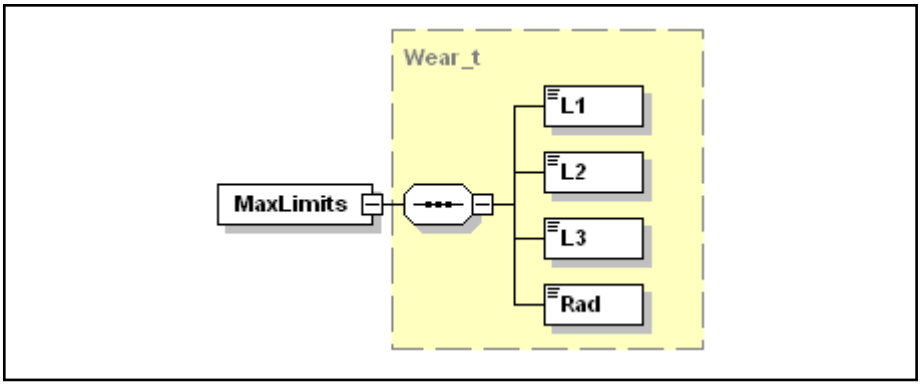


Fig. 5-136: Data scheme of default configuration (12)

Status bits

chapter 7.3.1 "Status bits" on page 396

Tool catalog

chapter 7.3.2 "Tool catalog" on page 398

Bitmap libraries

chapter 7.3.3 "Bitmap libraries" on page 483

User interface

Tool lists

The following lists are provided to the user in the supplied condition for direct use or to configure tool management:

- Geometry list
- Wear list
- Service life list
- Status list
- List of all worn tools (same layout as tool life list)

Geometry list

Column division:	Heading
Sector	S
Place	P
Tool name	Tool name
Duplo number	DN
T number	TN
Status	Status
Warning limit reached	tw
Tool Worn	two
Tool Locked	TL
Tool edge number	SN
Geometry	Geometry
L1 value	L1
L2 value	L2
L3 value	L3
Radius	R

Column division:	Heading
Edge position	O
Tool type	Type

Row division:

One line per tool edge - irrelevant lines are hidden.

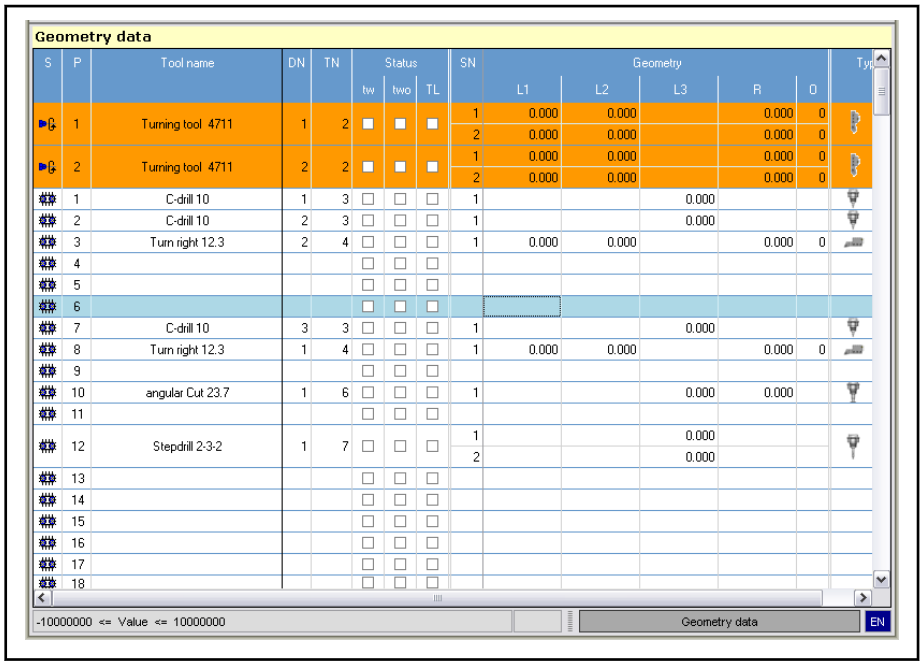


Fig. 5-137: Geometry list

Wear List

Column division:	Heading
Sector	S
Place	P
Tool name	Tool name
Duplo number	DN
T number	TN
Status	Status
Warning limit reached	tw
Tool Worn	two
Tool Locked	TL
Tool edge number	SN
Wear	Geometry
L1 value	L1
L2 value	L2
L3 value	L3
Radius	R

Row division:

One line per tool edge - irrelevant lines are hidden.

Control commissioning

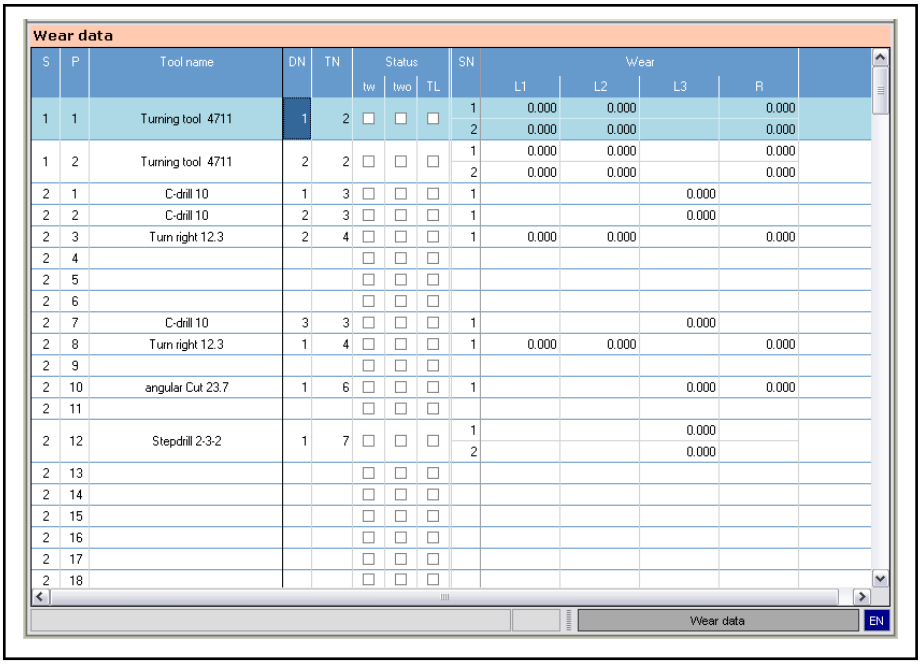


Fig. 5-138: Wear list

Tool Life List

Column division:	**Heading**
Sector	S
Place	P
Tool name	Tool name
Duplo number	DN
T number	TN
Status	Status
Warning limit reached	tw
Tool Worn	two
Tool Locked	TL
Tool edge number	SN
Monitoring status	Active
Tool life	Tool life[min] / no. of pieces[cyc]
Remaining service life	Remaining
Warning limit	Warn. lim.
Maximum utilization time	Max. UT
Time unit	Unit

Row division:

One line per tool edge - irrelevant lines are hidden.

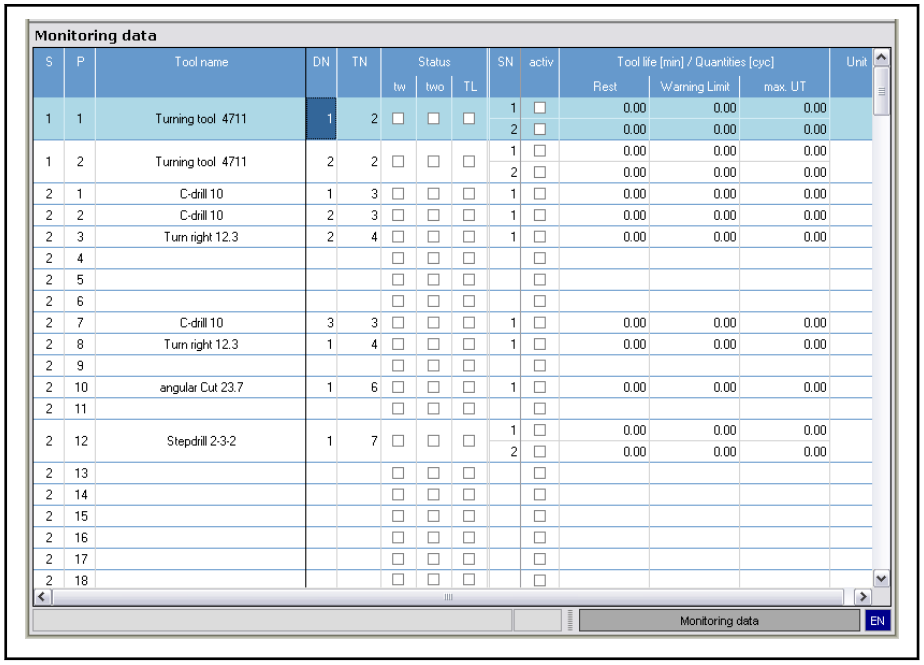


Fig. 5-139: Service life list

Status list

Column division:	Heading
Sector	S
Place	P
Tool name	Tool name
Duplo number	DN
T number	TN
Tool status	Tool status
Tool active	ta
Tool used	tu
Warning limit reached	tw
Tool worn	two
Tool locked	TL
Tool broken	TD
Tool loaded	TTL
Tool unloaded	TTU
Tool user status 1	TS1
Tool user status 2	TS2
Tool user status 3	TS3
Tool user status 4	TS4
Empty column	
Place status	Place status
Place blocked	PB
Location user status 1	PS1
Location user status 2	PS2

Control commissioning

Column division:	Heading
Location user status 3	PS3

Row division:

One line per tool edge - irrelevant lines are hidden.

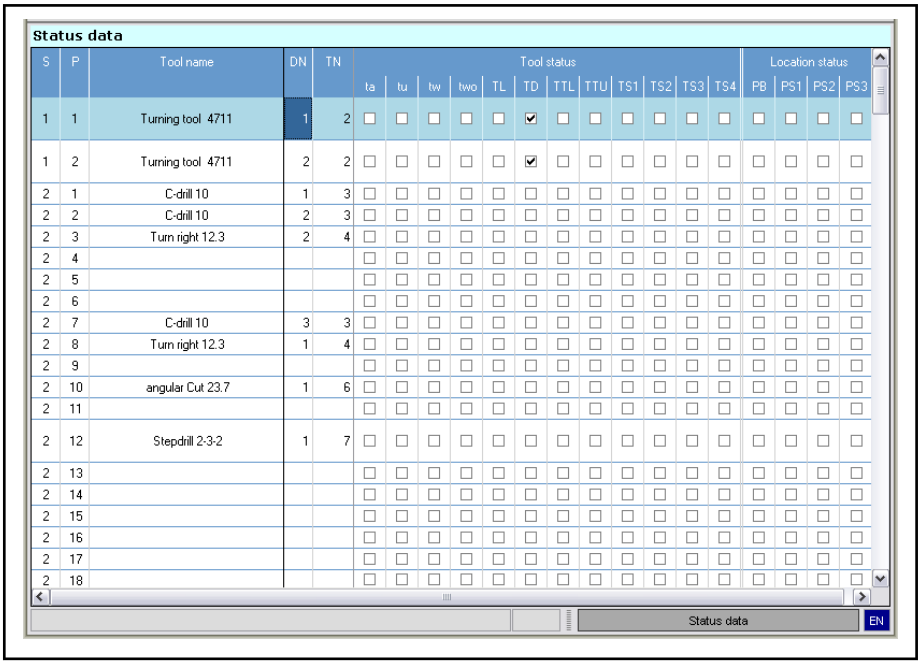


Fig. 5-140: Status list

Tool editor

The default configuration of the tool editor provides for division into 4 containers:

- *Container 1 comprises:*
  - Basic tool data control
- *Container 2 comprises:*
  - Place and tool status control
  - Tool data control
- *Container 3 comprises:*
  - Edge data control
  - Limit value data control
- *Container 4 comprises:*
  - Bitmap control (with dimensions)
  - Bitmap control (without dimensions) - only in Insert editor

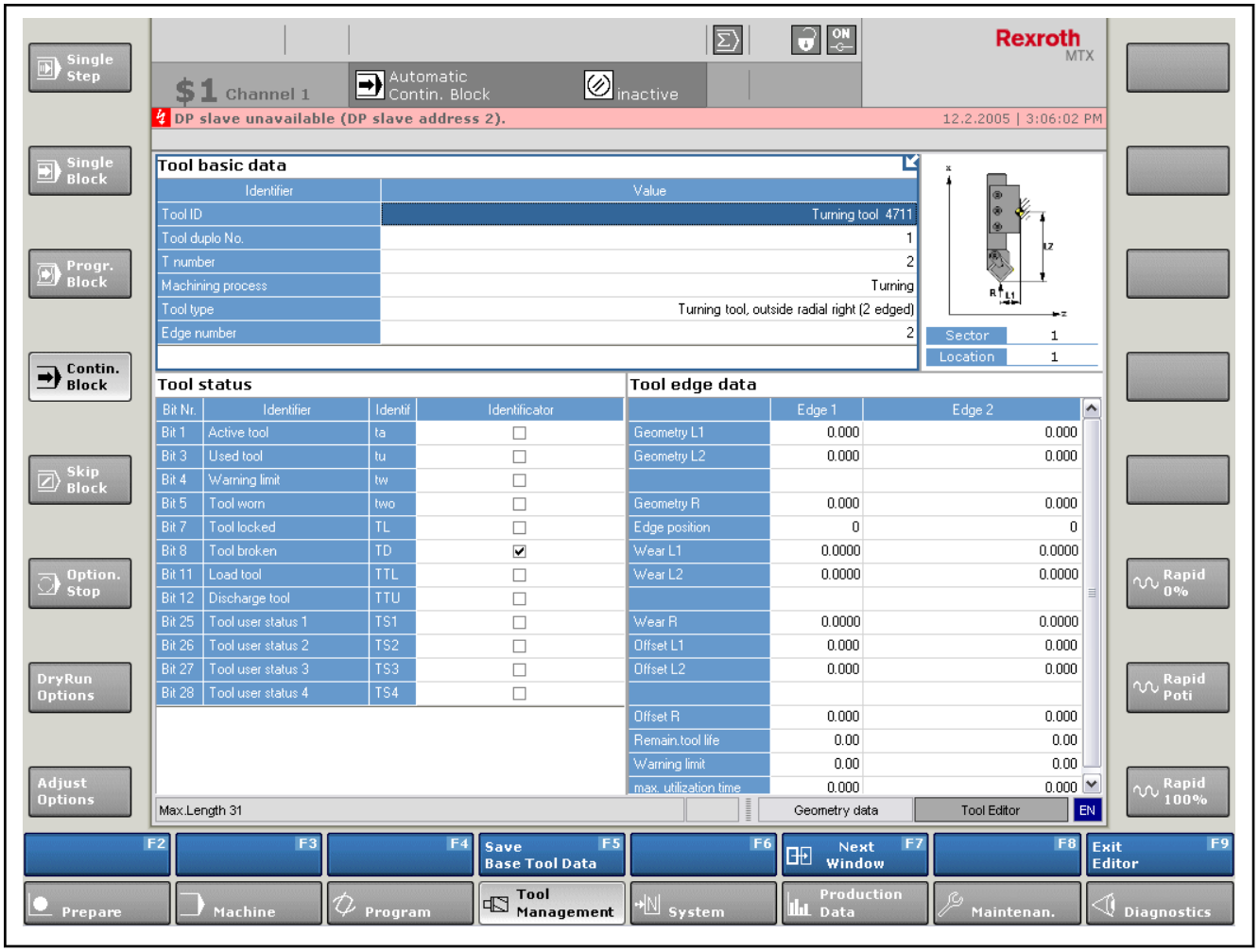


Fig. 5-141: Default tool editor configuration

5.10.8 Tool management standard tool change

General information

This document is intended for users wanting to use tool change programs at machine tools with the Bosch Rexroth control IndraMotion MTX. The functionality of the tool change cycle TCH and how to create the functionality is explained in the following.

Due to different automatic tool changer systems such as pickup or turret tool changer, the entire sequence from the configuration of the tool database up to the tool change call in the machining program is to be displayed. The user-friendly user interface IndraWorks Operation provides several standard screens to setup the tools and to correct the tool data.

Basic knowledge about NC programming and mechanic knowledge of different automatic tool change systems are required for a better understanding.

The following topics are covered:

- Program sequence
- Different calls
- Integrate the physical tool change

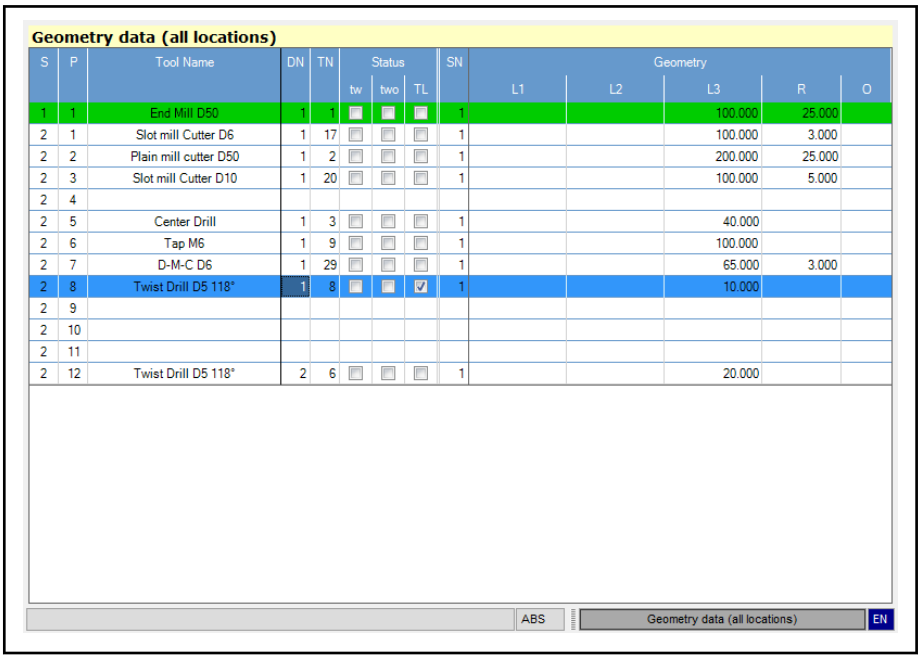
- Commissioning

Operating interface

By default, tool data is displayed and managed in the operating area OP5 "Tools" and OP3 "Machine".

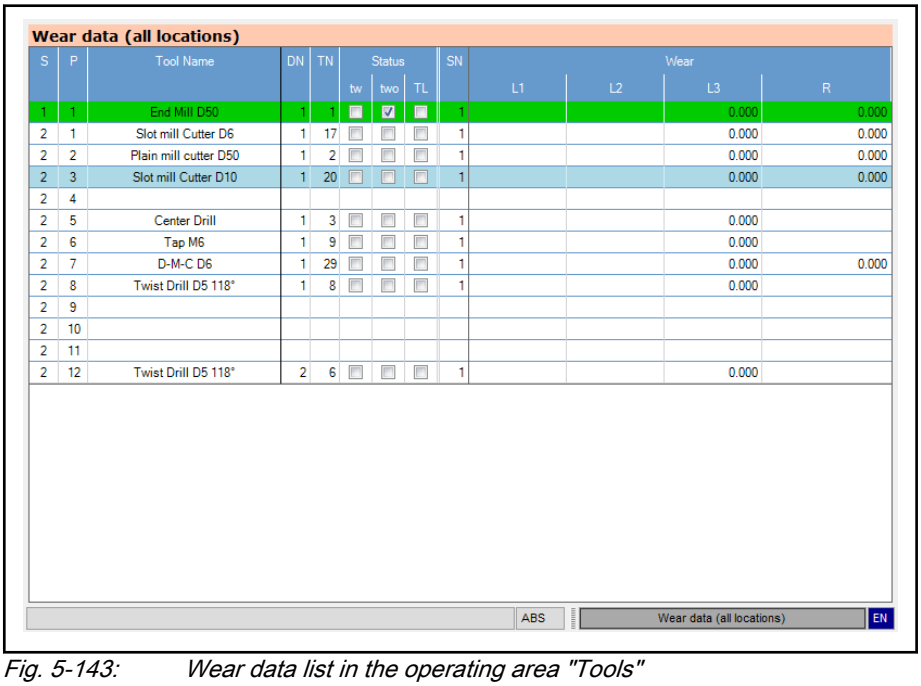
Displays in the operation area "Tools"

To display and enter the tool data in a database, different list views such as wear, geometry, status and monitoring data are available for tools and tool locations in the operating area "Tools" (OP5).



S	P	Tool Name	DN	TN	Status			SN	Geometry				
					tw	two	TL		L1	L2	L3	R	O
1	1	End Mill D50	1	1	☐	☐	☐	1			100.000	25.000	
2	1	Slot mill Cutter D6	1	17	☐	☐	☐	1			100.000	3.000	
2	2	Plain mill cutter D50	1	2	☐	☐	☐	1			200.000	25.000	
2	3	Slot mill Cutter D10	1	20	☐	☐	☐	1			100.000	5.000	
2	4												
2	5	Center Drill	1	3	☐	☐	☐	1			40.000		
2	6	Tap M6	1	9	☐	☐	☐	1			100.000		
2	7	D-M-C D6	1	29	☐	☐	☐	1			65.000	3.000	
2	8	Twist Drill D5 118°	1	8	☐	☐	☑	1			10.000		
2	9												
2	10												
2	11												
2	12	Twist Drill D5 118°	2	6	☐	☐	☐	1			20.000		

Fig. 5-142: Geometry data list in the operation area "Tools"



S	P	Tool Name	DN	TN	Status			SN	Wear			
					tw	two	TL		L1	L2	L3	R
1	1	End Mill D50	1	1	☐	☑	☐	1			0.000	0.000
2	1	Slot mill Cutter D6	1	17	☐	☐	☐	1			0.000	0.000
2	2	Plain mill cutter D50	1	2	☐	☐	☐	1			0.000	0.000
2	3	Slot mill Cutter D10	1	20	☐	☐	☐	1			0.000	0.000
2	4											
2	5	Center Drill	1	3	☐	☐	☐	1			0.000	
2	6	Tap M6	1	9	☐	☐	☐	1			0.000	
2	7	D-M-C D6	1	29	☐	☐	☐	1			0.000	0.000
2	8	Twist Drill D5 118°	1	8	☐	☐	☐	1			0.000	
2	9											
2	10											
2	11											
2	12	Twist Drill D5 118°	2	6	☐	☐	☐	1			0.000	

Fig. 5-143: Wear data list in the operating area "Tools"

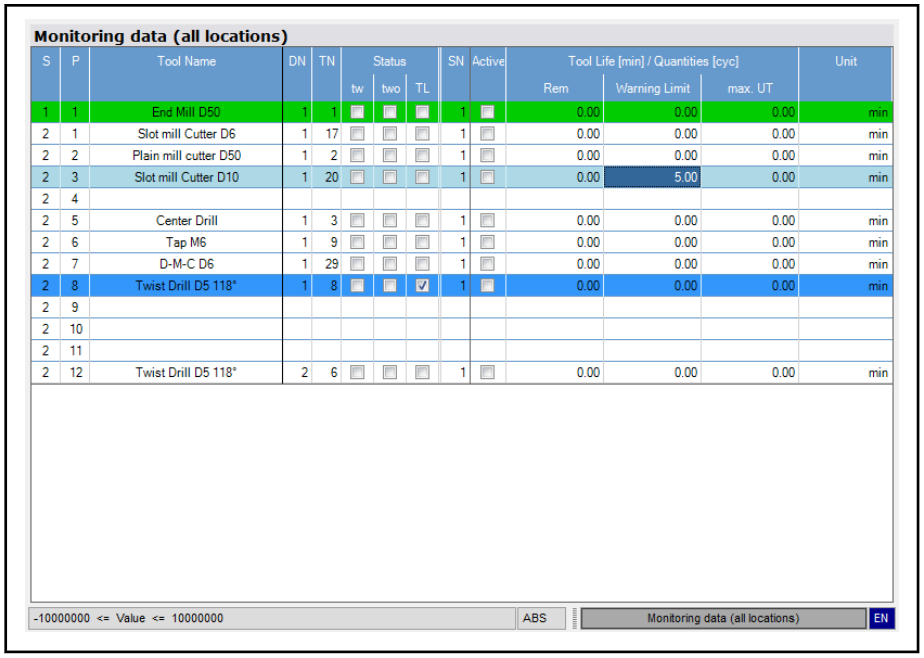


Fig. 5-144: Monitoring data list in the operation area "Tools"

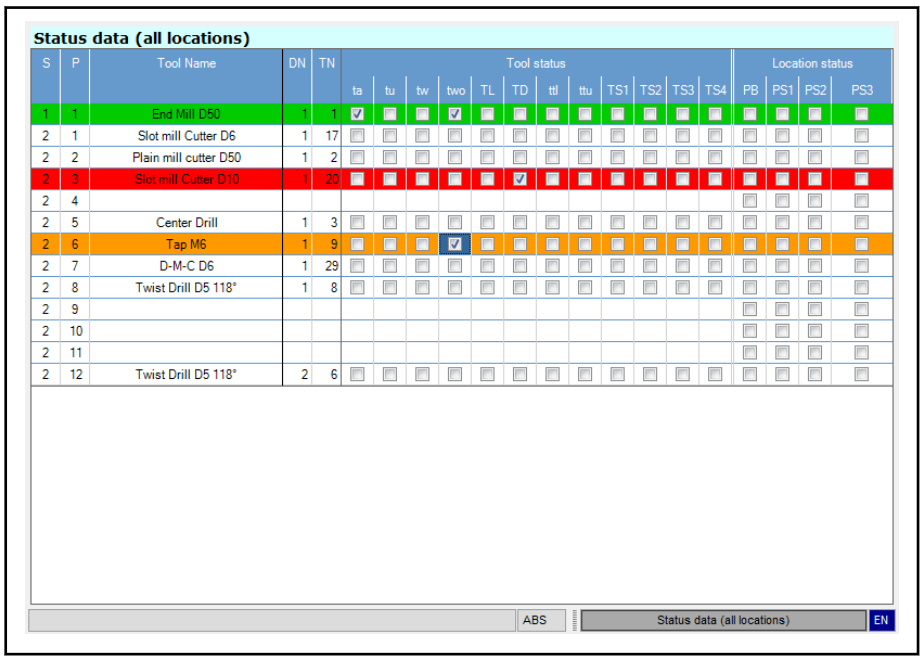


Fig. 5-145: Status data list in the operation area "Tools"

Description of color coding of tools in the list:

Line background color	Description
Light blue/dark blue	Cursor color/focus
Green	Tool active
Red	Tool broken/defective
Blue	Tool locked
Orange	Tool worn

Tab. 5-46: Description of color coding in the standard

The color coding can be changed by the user.

The tool editor is called via <F5>"Edit tool" or <F2>"Insert tool". All tool data and tool place data can be changed in the tool editor.

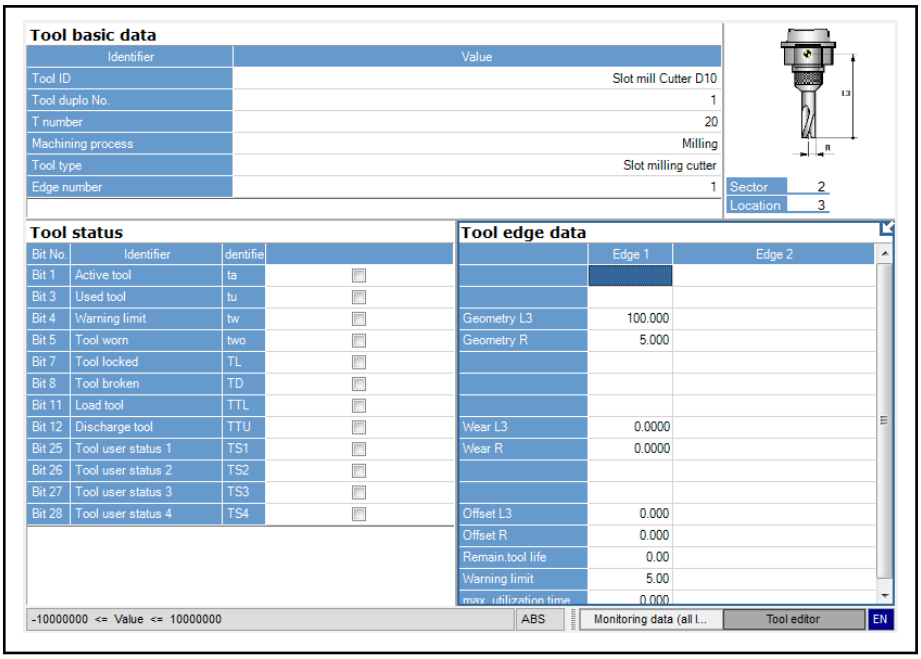


Fig. 5-146: Tool editor in operating area "Tools"

Displays in the operation area "Machine"

More standard screens for the diagnostics during setup of a workpiece show the data of the active tool and the active edge tabs, the active and preselected tool as well as the status, whether length or radius correction is activated or deactivated in the operating area "Machine" (OP3).

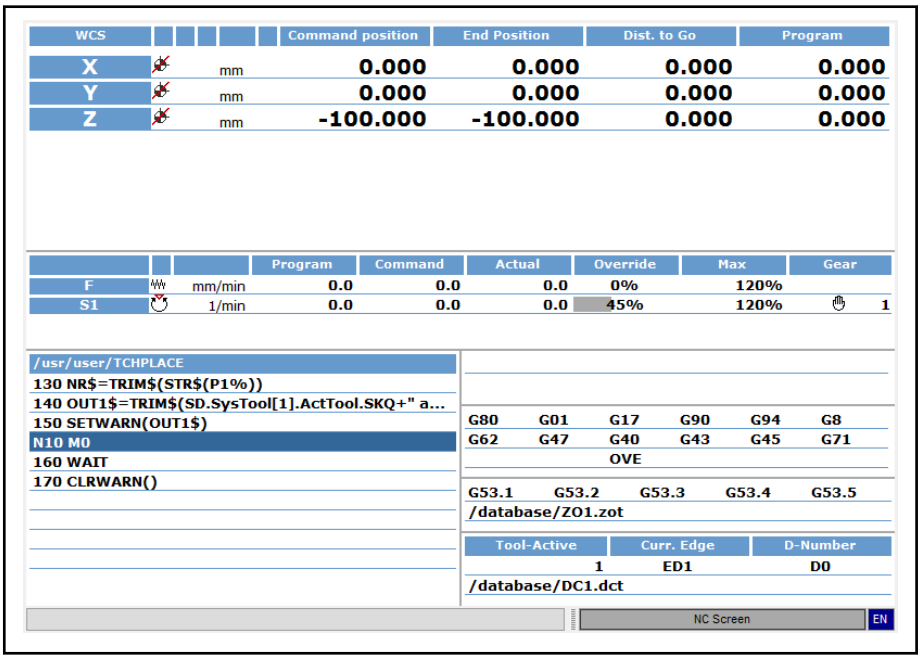


Fig. 5-147: Display of the active tool in the operating area "Machine"

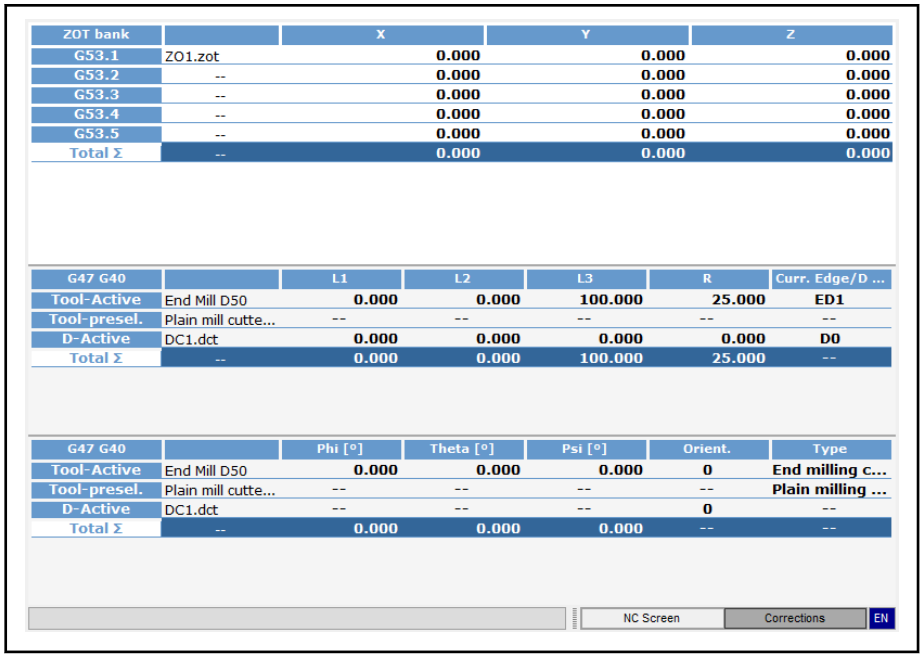


Fig. 5-148: Display of all tool correction data in the operating area "Machine"

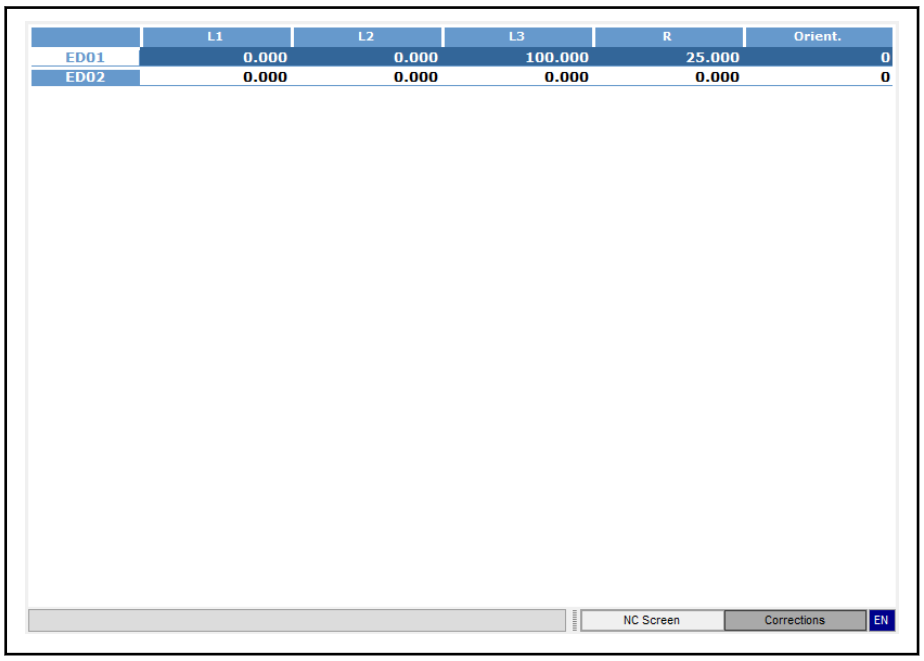
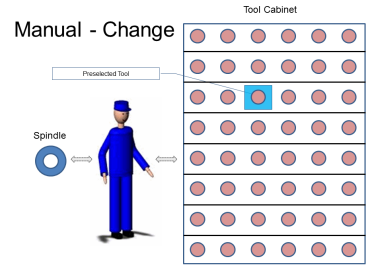
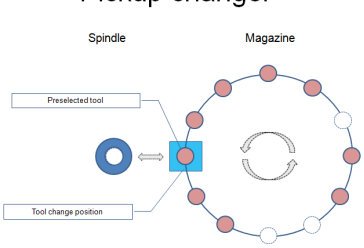
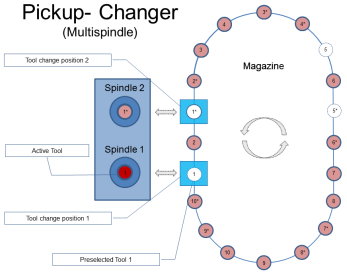


Fig. 5-149: Display of all tool correction data tabs in the operating area "Machine"

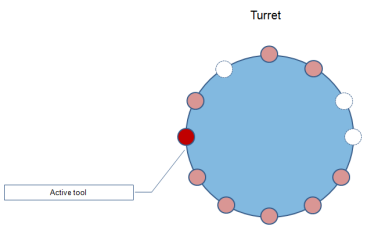
Functional description of the tool change

System examples

Control commissioning

Pickup automatic tool changer	
	Database with 2 sectors: • 1. Sector with 1 spindle location • 2. Sector with n magazine location Tool cabinet with n physical locations (out of which 1 is a transfer location)
	Database with 2 sectors: • 1. Sector with 1 spindle location • 2. Sector with n magazine location Magazine with n physical locations (out of which: 1 transfer location)
	Database with 2 sectors: • 1. Sector with 1 spindle location • 2. Sector with n magazine location Magazine with 2 * n physical locations (out of which: 2 transfer locations) The tool geometries Tx and Tx* have to be identical.

Tab. 5-47: System example Pickup automatic tool changer

Turret automatic tool changer	
	Database with 1 sector: • with n magazine locations Turret magazine with n physical locations (out of which: 1 active location)

Tab. 5-48: System example Turret changer

Properties
- Fixed logical sequence
- Physical process integrated and adjustable by simple NC subroutines
- The change program is specific to the channel and can thus be used multiple times in a control
- In Pickup mode, two database sectors are used for a channel in the tool management, in turret mode, one database sector is used

Application
- Manually operated tool changer
- Automatic tool changer

- Integrated block pre-run
- Equipping the magazine is possible via spindle and magazine
- Optionally fixed-place coded tool magazine yes/no

In case of a fixed place-coded tool magazine FPC, the tool is always put down on the magazine place it has been picked up form in contrast to the free tool magazine. When equipping via the spindle, the first available position in the magazine is searched and positioned there.

This is a property of the tool magazine and not of the tool. Fixed-place coded tools also have this property.

Pickup sequence

Standard procedures during pickup tool change:

- **Case 1: Tool is already in the spindle**
  - The spindle tool is reactivated
- **Case 2: Spindle is empty (T0 active)**
  - The preselected tool is searched for
  - The tool is loaded
  - The tool data is activated
- **Case 3: T0 is programmed**
  - The active tool is replaced
  - The tool data is deactivated
- **Case 4: The new tool is unequal to the active tool**
  - The spindle tool is replaced
  - The tool data is deactivated
  - The preselected tool is searched for
  - The preselected tool is loaded
  - The tool data is activated

Turret sequence

Standard procedures during turret tool change:

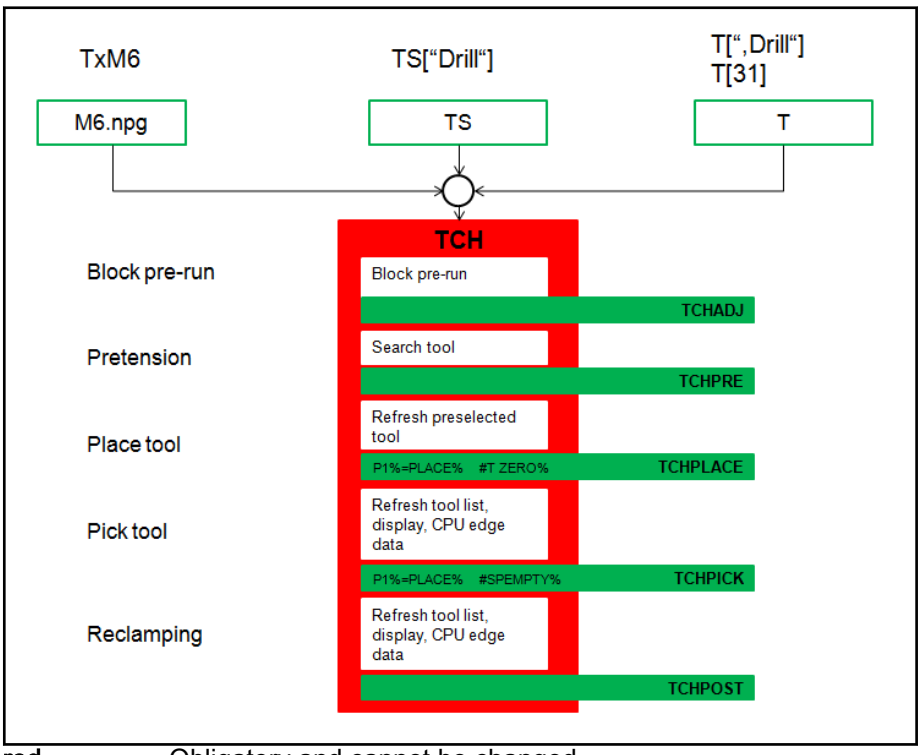
- **Case 1: Tool is already active**
  - The tool is reactivated
- **Case 2: No tool is active (T0 active)**
  - The preselected tool is searched for
  - The tool is loaded
  - The tool data is activated
- **Case 3: T0 is programmed**
  - The active tool is deactivated
- **Case 4: The new tool is unequal to the active tool**
  - The active tool is deactivated
  - The preselected tool is searched for
  - The preselected tool is activated

Control commissioning

NC subroutine TCH

General information

The following graphic displays fixed logical tool changes, the integrated call of the sequences of the physical tool change as well as possible calls of the change program.



red Obligatory and cannot be changed
Green Adjustable (application-specific)

Fig. 5-150: Length of the tool change programs

The use of TCHPRE, TCHPOST and TCHADJ is optional.

TCHxxPICK and TCHxxPLACE are obligatory (xx: channel number).

A complete tool change or only a defined batch JOB (e.g. "Activate tool and refresh display") can be called.

The tool change can be used by several channels (simultaneously). That is why the tool change program uses channel-independent system variables **SD.SysTch[$]** ($ = Kanalnummer). (See chapter "SD setup variables" on page 284)

Calling the tool change

Call via TCH

Call parameters of TCH

Optional position parameters	Description
P1%	Tool number
P2$	Tool ID
P3%	Job number

Tab. 5-49: Significance of the TCH cycle position parameters

Syntax

TCH[<NO>]	Call with tool number
or:	
TCH[,"<ID>"]	Call with tool identifier
or:	
TCH[,,<JOBNO>]	Calling a job (see chapter "NC subroutine TCH" on page 272)

☞ If the tool number and the tool identifier are transmitted in a call, an error occurs. A corresponding message is displayed.

Examples:

Call with tool number:

```
N100 TCH[45] ;Replace tool with number 45
```

Call with tool identifier:

```
N100 TCH[,”Drill D10"] ;Tool “Drill D10" is replaced
```

Optional calls

☞ For the provision of optional tool change calls, please refer to chapter Settings: Optional Calls, page 292.

T is subroutine:

Syntax

T[<NO>,"<ID>"
]

Examples:

```
N100 T[45]                        ; Replace tool with number 45
N110 …                            ; Machining
N200 T[,“Drill D10“]              ; Replace “Drill D10“
N210 …                            ; Machining
N …
N300 M30
```

TS is subroutine:

Syntax

TS["<ID>"]

Examples:

```
N200 TS[“Drill D10"] ; Replace “Drill D10"
```

T is the auxiliary function, M6 is the subroutine:

Syntax

T<NO> M6

Examples:

```
N100 T45 M6 ; Replace tool with number 45
```

Physical process

To realize different physical processes (e.g. axis identifier, axis positions, auxiliary functions etc.), the user can program these in the following 4 subroutines.

Tool header TCHPRE

Task: Tool header

By specifying a program name in the **SD.SysTch[$].SETUP.PREPRG** ($ = channel number) variable, the user can integrate a subroutine as leader.

In the leader, axes that are not required can be traveled to a safe, collision-free positions or automatic coolant or probe switch offs can be programmed.

☞ TCHPRE is not executed if the tool is already in the spindle.

Traversing motion to put the tool down TCHPLACE

Task: Put tool down

Steps:	Condition:	Variable assignment:
Bring place to put tool down to transfer position		P1%=MAGPLACE%
Preposition XY		
Move in Y		
Clamp magazine tool (WZ)		
Release tool spindle		
Retract Z		
Move out Y	In case of follow-on tool:	SD.SysTch[$].EXTERNAL.TOOL_FOL=FALSE

Traversing motion to pick tool up TCHxxPICK (xx: channel number).

Task: Pick tool up

Steps:	Condition:	Variable assignment:
Bring pick up location to transfer location		P1%=PREPLACE%
Position X,Y,Z in front of the magazine door	If the tool has not been put down before	
Move in Y	If the spindle is empty:	SD.SysTch[$].EXTERNAL.SPEMPTY=TRUE
Pick up location z-axis		
Move out Y		

Tool trailer TCHPOST

Task: Tool trailer

By specifying a program name in the **SD.SysTch.SETUP.POSTPRG** variable, the user can integrate a subroutine as tool trailer.

In the tool trailer, states (e.g. positioning window, accelerations, etc.) that have been switched in the tool change program, can be programmed for machining.

☞ TCHPOST is not executed, if no follow-on tool is programmed or if the tool is already in the spindle.

Examples for adjusting the physical process

SET is contained in folder SET1 to SETx and contains example programs and variable lists for different tasks, to facilitate commissioning of the system.

SET1 Milling MANUAL with dialog

Tool header

```
1000 GOTO .NOCOM
; ------------------------------------------------
; Program name:    TCHPRE
; Version:         2.0.0.0
; Task :           Leader
; Note:
;                  Is not executed if the tool
;                  is already in the spindle
; Name:            JK
; TCH Version:     2.0.0.0
; Application:     Manually operated tool changer milling machine 2 sectors
; date:            01/10/14
; ------------------------------------------------
1010 .NOCOM
```

Put tool down

```
100 GOTO .NOCOM
; ------------------------------------------------------------------------
; Program name:  TCHPLACE
; Version:             2.0.0.0
; task:            Place tool:
; Steps variables:
; -  Bring place to put tool down to transfer position P1%=MAGPLACE%
; - XY Pre-positioning
; - Move in Y
; - Clamp tool magazine
 ; - Release tool spindle
; - Retract Z
; - Move out Y if follow on tool SD.TCH.EXTERNAL.TOOL_FOL=FALSE
; Name:           JK
; TCH Version:    2.0.0.0
; Application:    Manually operated tool changer milling machine 2 sectors
; date:     01.10.14
; ------------------------------------------------------------------------
110 .NOCOM Remove
120 DIM OUT1$(130) : DIM NR$(2)
130 NR$=TRIM$(STR$(P1%))
140 OUT1$=TRIM$(SD.SysTool[1].ActTool.SKQ+" from spindle and place in tool cabinet position:"+NR$+")
150 SETWARN(OUT1$)
N10 M0
160 WAIT
170 CLRWARN()
```

Pick tool up

```
100 GOTO .NOCOM
; ------------------------------------------------------------------------
; Program name:  TCHPICK
; Version:            2.0.0.0
; task:           Pick tool:
; steps variables:
; - Set pick up place to transfer position P1%=PREPLACE%
; - If previously the tool has not been placed down:
; - Position X,Y,Z in front of the tool magazine door
; - Move in Y SD.TCH.EXTERNAL.SPEMPTY=TRUE
; - Pick up position Z-axis
; - Move out Y
; Name:           JK
; TCH Version:  2.0.0.0
; Application:    Manually operated tool changer milling machine 2 sectors
; date:   01.10.14
; ------------------------------------------------------------------------
110 .NOCOM
120 DIM OUT1$(130) : DIM NR$(2)
130 NR$=TRIM$(STR$(P1%))
140 Remove OUT1$=TRIM$(SD.SysTool[1].PreTool.SKQ+" from tool cabinet position:"+NR$+"  and clamp in spindle")
150 SETWARN(OUT1$)
N10 M0
160 WAIT
170 CLRWARN()
```

Control commissioning

Tool trailer

```
1000 GOTO .NOCOM
; -------------------------------------------------
; Program name:     TCHPOST
; Version:          2.0.0.0
; Task :            Trailer
;            Note:
;                     Is not executed
;                     if no follow-on tool is programmed
;                     or
;                     if the tool is already in the spindle.
; Name:             JK
; TCH Version:      2.0.0.0
; Application:      Manually operated tool changer milling machine 2 sectors
; Date:             01/10/14
; -------------------------------------------------
1010 .NOCOM
```

SET2 Milling AUTOMATIC without motions

Tool header

```
1000 GOTO .NOCOM
; -------------------------------------------------
; Program name:       TCHPRE
; Version:            2.0.0.0
; Task :              Leader
;          Note:
;                      Is not executed
;                      if the tool is already in the spindle.
; Name:               JK
; TCH Version:        2.0.0.0
; Application:       Simulator milling machine 2 sectors
; Date:              01/10/14
; -------------------------------------------------
1010 .NOCOM
```

Put tool down

```
1000 GOTO .NOCOM
; -------------------------------------------------
; Program name:  TCHPLACE
; Version:             2.0.0.0
; task:             Place tool:
; Steps variables:
; -  Bring place to put tool down to transfer position P1%=MAGPLACE%
; - XY Pre-positioning
; - Move in Y
; - Clamp tool magazine
 ; - Release tool spindle
; - Retract Z
; - Move out Y if follow on tool SD.TCH.EXTERNAL.TOOL_FOL=FALSE
; Name:           JK
; TCH Version:    2.0.0.0
; Application:    Simulator milling machine 2 sectors
; date:     01/10/14
; -------------------------------------------------
1010 .NOCOM
1020 DUMMY%=P1%
```

Pick tool up

```
1000 GOTO .NOCOM
; -------------------------------------------------
; Program name:  TCHPICK
; Version:            2.0.0.0
; task:           Pick tool:
; steps variables:
; - Set pick up place to transfer position P1%=PREPLACE%
; - If previously the tool has not been placed down:
; - Position X,Y,Z in front of the tool magazine door
; - Move in Y SD.TCH.EXTERNAL.SPEMPTY=TRUE
; - Pick up position Z-axis
; - Move out Y
; Name:           JK
; TCH Version:  2.0.0.0
; Application:    Simulator milling machine 2 sectors
; date:   01/10/14
; -------------------------------------------------
```

```
1010 .NOCOM
1020 DUMMY%=P1%
```

Tool trailer

```
1000 GOTO .NOCOM
; ------------------------------------------------
; Program name:      TCHPOST
; Version:           2.0.0.0
; Task:              Trailer
;       Note:
;             Is not executed
;             if no follow-on tool is programmed
;             or
;            if the tool is already in the spindle.
; Name:              JK
; TCH Version:       2.0.0.0
; Application:       Simulator milling machine 2 sectors
; Date:              01/10/14
; ------------------------------------------------
1010 .NOCOM
```

SET3 Milling AUTOMATIC with motions

Tool header

```
1000 GOTO .NOCOM
; ------------------------------------------------
; Program name:         TCHPRE
; Version:              2.0.0.0
; Task:                 Leader
;          Note:
;                Is not executed
;                if the tool is already in the spindle.
; Name:                 JK
; TCH Version:          2.0.0.0
; Application:          Milling machine 2 sectors
; Date:                 01/10/14
; ------------------------------------------------
1010 .NOCOM
```

Put tool down

```
1000 GOTO .NOCOM
; ------------------------------------------------
; Program name:  TCHPLACE
; Version:             2.0.0.0
; task:            Place tool:
; Steps variables:
; -  Bring place to put tool down to transfer position P1%=MAGPLACE%
; - XY Pre-positioning
; - Move in Y
; - Clamp tool magazine
 ; - Release tool spindle
; - Retract Z
; - Move out Y if follow on tool SD.TCH.EXTERNAL.TOOL_FOL=FALSE
; Name:           JK
; TCH Version:    2.0.0.0
; Application:    Milling machine 2 sectors multi-spindle
; date:     01/10/14
; ------------------------------------------------------------------------
1010 .NOCOM
N100 M19 S0 ; Spindle orientation at 0 degrees
N110 G76 G0 Z-100 ; pick position Z-axis
N120 G76 G0 X-300 Y0 ; Position X-, Y-axis in front of tool magazine door
N130 M206 ; Signal Start tool change at PLC
N140 M110 ; Open tool magazine door
N150 G76 G0 MAG[P1%] ; approach empty magazine position
N160 M224 ; Open MAG gripper
N170 WAIT
N180 G76 G0 Y200 ; Transfer position Y-axis
N190 M225 ; Close MAG gripper
N200 M212 ; Open tool clamp
N210 G76 G0 Z0 ; Via tool position Z-axis
;-------------------------------
; If no follow-on tool is programmed, then:
1020 IF SD.TCH.EXTERNAL.TOOL_FOL=FALSE THEN
N220 M213 ; Close tool clamp
1030 WAIT
N230 G76 G0 Y0                      ; Retract Y-axis
```

Control commissioning

```
N240 M111                                          ; Close magazine cover
1030 ENDIF
;--------------------------------
```

Pick tool up

```
1000 GOTO .NOCOM
; ------------------------------------------------
; Program name:  TCHPICK
; Version:            2.0.0.0
; task:           Pick tool:
; steps variables:
; - Set pick up place to transfer position P1%=PREPLACE%
; - If previously the tool has not been placed down:
; - Position X,Y,Z in front of the tool magazine door
; - Move in Y SD.TCH.EXTERNAL.SPEMPTY=TRUE
; - Pick up position Z-axis
; - Move out Y
; Name:         JK
; TCH Version:  2.0.0.0
; Application:  Milling machine 2 sectors and multi-spindle
; date:   01.10.14
; ------------------------------------------------------------------------------
1010 .NOCOM
N100 G76 G0 MAG[P1%]            ; Position MAG axis
;--------------------------------
; If spindle is empty, then:
1010 IF SD.TCH.EXTERNAL.SP_EMPTY=TRUE THEN
N110 G76 G0 X-300 Y0 Z0 ; Position X,Y,Z-axis in front of tool magazine door
N120 M213              ; Close tool clamp
N130 M19 S0                                                    ; Spindle orientation
N140 M110 ; Open magazine door
N150 M206 ; Signal Start tool change at PLC
N160 WAIT
N170 G76 G0 Y200 ; Transfer position Y-axis
N180 M212 ; Tool clamp OPEN
1110 ENDIF
;--------------------------------
N190 G76 G0 Z-100 ; Pick position Z-axis
N200 M213 ; Close tool clamp
N210 M224 ; Open MAG gripper
1120 WAIT
N220 G76 G0 Y0 ; Position Y-axis in front of tool magazine door
N230 M225 ; Close MAG gripper
N240 M111 ; Close tool magazine door
;--------------------------------
```

Tool trailer

```
1000 GOTO .NOCOM
; ------------------------------------------------
; Program name: TCHPOST
; Version:      2.0.0.0
; Task:         Trailer
;        Note:
;            Is not executed
;            if no follow-on tool is programmed
;            or
;            if the tool is already in the spindle.
; Name:         JK
; TCH Version:  2.0.0.0
; Application:  Milling machine 2 sectors
; Date:         01/10/14
; ------------------------------------------------
1010 .NOCOM
```

SET4 Turning AUTOMATIC with motions *Tool header*

```
1000 GOTO .NOCOM
; ------------------------------------------------
; Program name:   TCHPRE
; Version:        2.0.0.0
; Task:           Leader
;           Note:
;              Is not executed
;              if the tool is already in machining position.
; Name:           JK
; TCH Version:    2.0.0.0
```

```
; Application:    Turning machine 1 sector
; <fate: 01/10/14
; ------------------------------------------------
1010 .NOCOM
```

Put tool down

```
1000 GOTO .NOCOM
; ------------------------------------------------
; Program name:   TCHPLACE
;    Version:        2.0.0.0
;    task:        Place tool:
; Steps variables:
; -  Bring place to put tool down to transfer position P1%=MAGPLACE%
; - XY Pre-positioning
; - Move in Y
; - Clamp tool magazine
 ; - Release tool spindle
; - Retract Z
; - Move out Y if follow on tool SD.SysTch.EXTERNAL.TOOL_FOL=FALSE
; Name:           JK
; TCH Version:    2.0.0.0
; Application:    Turning machine 1 sector
; date:     09.10.14
; ------------------------------------------------------------------------
1010 .NOCOM
1 IF P1%=NUL THEN : SETERR("TCHPLACE: Error P1%") : ENDIF
;**********************; Synchronize REM data transfer
1 WAIT
```

Pick tool up

```
1000 GOTO .NOCOM
; ------------------------------------------------
; Program name:   TCHPICK
;    Version:        2.0.0.0
;    task:        Pick tool:
; steps variables:
; - Set pick up place to transfer position P1%=PREPLACE%
; - If previously the tool has not been placed down:
; - Position X,Y,Z in front of the tool magazine door
; - Move in Y SD.SysTch.EXTERNAL.SPEMPTY=TRUE
; - Pick up position Z-axis
; - Move out Y
; Name:           JK
; TCH Version:    2.0.0.0
; Application:      Turning machine 1 sector
; date:    09/10/14
; ------------------------------------------------------------------------
1010 .NOCOM
;****************
;unlock revolver
;****************
    M305
     TUR_UNL1
    WAIT
    WAX(TUR)
    WAIT

;**********************
 N100 G76 G0 TUR[P1%] ; Position MAG axis
;****************
;lock revolver
;****************
    RAX(TUR)
    WAIT
    TUR_LOC1
    WAIT

;**********************; Synchronize REM data transfer
1 WAIT
```

Tool trailer

```
1000 GOTO .NOCOM
; ------------------------------------------------
; Program name:    TCHPOST
; Version:         2.0.0.0
; Task:            Trailer
```

Control commissioning

```
;           Note:
;                    Is not executed
;                    if no follow-on tool is programmed
;                    or
;                    if the tool is already in machining position.
; Name:             JK
; TCH Version:      2.0.0.0
; Application:      Turning machine 1 sector
; Date:             01/10/14
; ------------------------------------------------
1010 .NOCOM
```

TCH at block pre-run

Tool adjustment

During the calculation run in the block pre-run, the tool lengths in the respective tool are provided in the TCH program. The subroutines TCHxxPICK and TCHxxPLACE (xx: channel number) are not called.

Example:

```
TCH[1]
M8
G54 X…
…
G0 X100 Y200 Z300 M5
;Standard target position calculation run
TCH[2]
M8
;Target block
G55 X10 Y20 Z30…
```

Thus, the target position for the adjustment is the position programmed before the tool change call. If this target position would be approached, the position would be incorrect for the already adjusted tool (T2).

To avoid this, the target position calculation run has to be programmed in a subroutine that is called in the calculation run.

Adjusting the block pre-run TCHADJ

In the **TCHADJ** subroutine, a machine-fixed position is specified for the calculation run.

The name of the subroutine has to be entered in **SD.SysTch[$].SETUP.ADJM6PRG** (see chapter "SD setup variables" on page 284).

TCHADJ:

```
G76 X-300 Y-200 Z0 ; Fixed position in the machine for TCH calculation run
```

Thus, the target position was moved during the calculation run to the tool change position in the machine by the user.

Now, the target position for the already adjusted tool (T2) is correct.

Example:

```
TCH[1]
M8
G54 X…
…
G0 X100 Y200 Z300 M5     ;Standard target position calculation run)
TCH[2]                   ;User target position calculation run
M8                       ;Target block
G55 X10 Y20 Z30…
```

The block pre-run variants apply to all tool change calls (T, TS and T with M6), as TCH is always used as central subroutine.

Calling TCH jobs

General information

Jobs are sequences integrated in the TCH that can be started by the NC or the PLC.

NC syntax:

TCH(,,JobNo)

PLC:

Set variables and start ASUP

The following jobs are available:

Job 1:	Activate tool on location when releasing the turret disk
Job 2:	Activate tool on location when clamping the turret disk
Job 3:	In the function leave contour and return to contour, the changed geometry data of the tool have to be activated

NC call

In the function "leave contour and return to contour", the changed geometry data of the tool have to be activated (re-entry ASUP).

The name of the subroutine has to be entered in **SD.SysReentry.NameOfAsup**.

Reactivate tool data.

Example TCH_REENTRY:

```
;_____________________________________________________
;
; TCH_REENTRY
; 08/10/2014 JK
; Task:      Applying the tool geometry data of the active tool
;            for the function path and return to contour
; Process:   Is called automatically during leaving and returning to contour
;            if: SD.SysReentry.NameOfAsup=TCH_REENTRY
;_____________________________________________________
; 100 DIM WZL$(4) : DIM WZR$(4) : DIM WZ3R$(4)
110 WZL$=NCF("G47") : WZR$=NCF("G40") : WZ3R$=NCF("G140")
N10 G40 G48 G140
120 SETWARN("Tool length and radius are reactivated")
N20 M0
N30 TCH(,,3)
N40 [WZL$][WZR$][WZ3R$]
130 CLRWARN()
```

PLC call

Homing of turret disk

Transfer turret position at reference position of the turret disk to activate an available tool or to deactivate corrections if no tool is available.

Sequence:

1. PLC writes
   - SD.SysTch[$].INTERNAL.PLC.MagPos=1

     and
   - SD.SysTch[$].INTERNAL.PLC.JobNo=2
2. PLS starts TCHASUP

Jogging of turret disk

Jogging of the turret disk in manual mode at lathe from location 4 to location10.

Sequence:

Activate tool on location when releasing the turret disk

1. PLC writes

- SD.SysTch[$].INTERNAL.PLC.MagPos=4
  and
- SD.SysTch[$].INTERNAL.PLC.JobNo=1

2. PLS starts TCHASUP
   Activate tool on location when clamping the turret disk
3. PLC writes
   - SD.SysTch[$].INTERNAL.PLC.MagPos=10
     and
   - SD.SysTch[$].INTERNAL.PLC.JobNo=2
4. PLS starts TCHASUP

Example TCHASUP:

```
;_____________________________________________________________
;
; TCHASUP ---
; 08.11.2014 JK
; Task:
; Jog turret in manual mode
; Process: 1. PLC writes
; SD.TCH[1].INTERNAL.PLC.MagPos
; and
; SD.SysTch[1].INTERNAL.PLC.JobNo
; 2. PLC starts TCHASUP
;
; Is started when releasing the turret disk JobNo=1 (deactivating)
; and restarted when locking the turret disk JobNo=2 (activating)
;_____________________________________________________________
;
100 WAIT(,200)
110 CASE SD.TCH.INTERNAL.PLC.JobNo OF
120 LABEL 1
;130 PRN#(0,"deactivating")
N30 TCH(,,1)
N40 RAX(TUR)
N50 WAIT
 150 LABEL 2
;160 PRN#(0,"activating")
N80 TCH(,,2)
180 OTHERWISE
190 SETERR("Error SD.TCH.INTERNAL.PLC.JobNo")
200 ENDCASE
;****************
;210 PRN#(0,"Done")
;****************
```

Commissioning

General information

The system is commissioned in the steps explained in detail in this chapter:

Commissioning steps

1. Configuring the database
2. Definition of the SD setup variable
3. Provide and if required, adjust NC subroutines
4. Select optional calls

Configuring the database

The size and database division is set in the "/usrfep/dbt1prms.dat" file. The database is divided into sectors and places. A sector represents physical machine units in which the tools can be contained.

The following steps are required if the database has to be adjusted:

Configuring the database

These steps are carried out in IW Engineering.

1. Copy "dbt1prms.dat" from FEPROM to "usr\user".
2. Make changes in the copied "dbt1prms.dat" (see the following program listing).
3. Copy the changed "dbt1prms.dat" from "mnt" to "usrfep".
   If there is another file with the same name, rename the file.
4. Create tar file (archiving of control data).
5. Subsequently, reimport Tar file (restoring the control data).
   Now, the database changes are active.

Example: Pickup

Sector 1 is a tool spindle in which 1 tool can be loaded.

Sector 2 is a chain magazine in which 20 tools can be loaded.

dbt1prms.dat

```
; ------------------------------------------------------------
;         Configuration file for database table DBT1
; ------------------------------------------------------------

; general structure:
; P0 P1
;  |  |
;  +--+--- 2 int values
;
; P0 describes the type of object and must not be modified.
;
; ";" indicates a comment line.
; In a data line no comment is allowed.


;
;    ******************************
;     Configuration of database table
;    ******************************

; For modifying the number of data records in a database table all
; records are deleted first. Afterwards they are newly-created
; corresponding sector configuration.
; This is only done during startup of NC.

; Control parameter
; P0: 0
; P1: Controls creation of data records in database table
;     0 Normal operation
;       Only when database table is empty, the records are created.
;     6 Deletes all existing records and creates new records
;       corresponding sector configuration.
0 0


; Sector configuration
; P0: 1-99 (equals sector 1 - 99)
; P1: Number of places within sector
1 1
2 20
```

Example: Turret

Sector 1 is a circular magazine in which 12 tools can be loaded.

dbt1prms.dat

```
; ------------------------------------------------------------
;         Configuration file for database table DBT1
; ------------------------------------------------------------

; general structure:
; P0 P1
;  |  |
;  +--+--- 2 int values
;
```

Control commissioning

```
; P0 describes the type of object and must not be modified.
;
; ";" indicates a comment line.
; In a data line no comment is allowed.


;
;    ******************************
;     Configuration of database table
;    ******************************

; For modifying the number of data records in a database table all
; records are deleted first. Afterwards they are newly-created
; corresponding sector configuration.
; This is only done during startup of NC.

; Control parameter
; P0: 0
; P1: Controls creation of data records in database table
;     0 Normal operation
;       Only when database table is empty, the records are created.
;     6 Deletes all existing records and creates new records
;       corresponding sector configuration.
0 0


; Sector configuration
; P0: 1-99 (equals sector 1 - 99)
; P1: Number of places within sector
1 12
```

Setting the maximum number of edges

The number of tool edges can be changed using the following entry "maxOccurs" in the scheme file "dbt1ud.xsd":

Example:

Number of tool edges = 3:

Program:

```
<xs:complexType name="DBT1UD_t">
  <xs:sequence>
    <xs:element name="Tl" type="Tl_t"/>
    <xs:element name="Ed" type="Ed_t" maxOccurs="3"/>
  </xs:sequence>
</xs:complexType>
```

The default tool data block was defined for up to two cutting edges. If this number should be changed, the following system data setting must be adjusted in the **SDDat.xml** file to ensure a correct display of the active tool correction in the operating area "Machine".

Program:

```
...
  <SysMaxEd>
    <MaxEd>3</MaxEd>
  </SysMaxEd>
...
```

The content of the tool data set is preconfigured by default and can be adjusted, if required (see chapter 5.10.4 "Configuring the database" on page 175).

SD setup variables

The variable elements of the structured variables of type TCH_t, required for the program TCH is summarized in the scheme "sdtch.xsd" as individual SD variable type. The SD.SysTch variable is channel-dependent and has the substructures SETUP, EXTERNAL and INTERNAL.

The SETUP substructure is used to

- select the automatic tool changer type, the number of spindles and the position offset for multiple spindle machines
- to assign the sectors for spindles and magazines
- select the magazine type FPC
- define the 3 search conditions for the tools as well as the program names for tool header and tool trailer

Name	Type	Length	Description
SD.SysTch[$].SETUP.MODE	INTEGER		Automatic tool changer type: 1=Pickup 2= Turret
SD.SysTch[$].SETUP.SPINDLES	INTEGER		Number of spindles
SD.SysTch[$].SETUP.SPOFFSET	INTEGER		Position offset multiple-spindle
SD.SysTch[$].SETUP.SPISEC	INTEGER		Sector number spindle
SD.SysTch[$].SETUP.SPIPLA	INTEGER		Place number of the spindle
SD.SysTch[$].SETUP.MAGSEC	INTEGER		Sector number magazine
SD.SysTch[$].SETUP.MAGFIX	BOOL		FPC magazine
SD.SysTch[$].SETUP.SEARCH1	STRING	21	Search condition 1
SD.SysTch[$].SETUP.SEARCH2	STRING	21	Search condition 2
SD.SysTch[$].SETUP.SEARCH3	STRING	21	Search condition 3
SD.SysTch[$].SETUP.PREPRG	STRING	16	Program name of tool header (optional)
SD.SysTch[$].SETUP.POSTPRG	STRING	16	Program name of tool trailer (optional)
SD.SysTch[$].SETUP.ADJM6PRG	STRING	16	Program name Block pre-run (optional)

$: Channel number

Tab. 5-50: SETUP system data for tool change

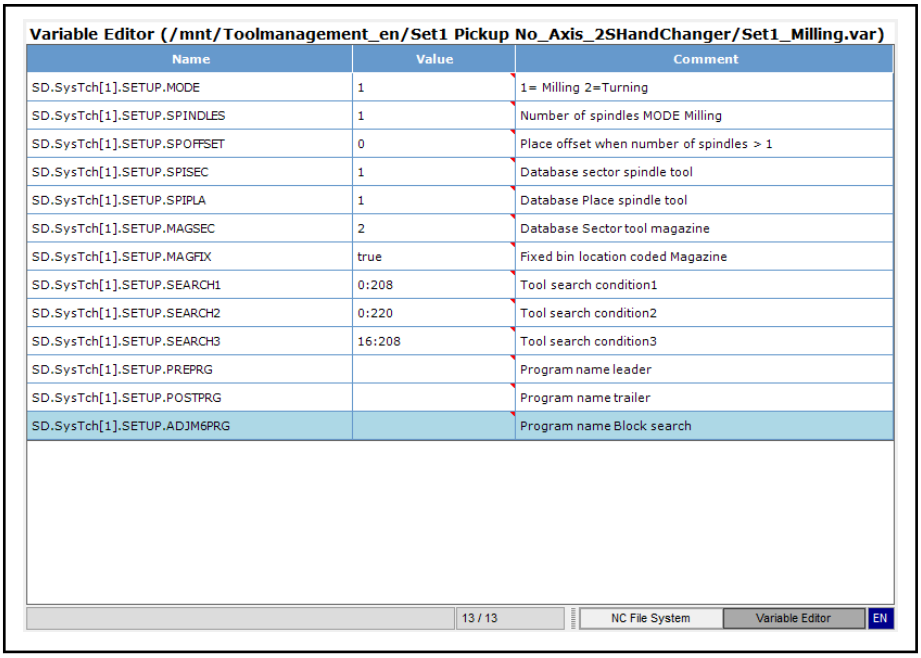
The substructure EXTERNAL is provided by the TCH program to structure program sequences in the TCHxxPICK and TCHxxPLACE (xx: channel number) user programs.

Name	Type	Description
SD.SysTch[$].EXTERNAL.TOOL_FOL	BOOL	Follow-on tool
SD.SysTch[$].EXTERNAL.SP_EMPTY	BOOL	Spindle is empty

$: Channel number

Tab. 5-51: EXTERNAL system data for tool change

Control commissioning



Variable Editor (/mnt/Toolmanagement_en/Set1 Pickup No_Axis_2SHandChanger/Set1_Milling.var)

Name	Value	Comment
SD.SysTch[1].SETUP.MODE	1	1= Milling 2=Turning
SD.SysTch[1].SETUP.SPINDLES	1	Number of spindles MODE Milling
SD.SysTch[1].SETUP.SPOFFSET	0	Place offset when number of spindles > 1
SD.SysTch[1].SETUP.SPISEC	1	Database sector spindle tool
SD.SysTch[1].SETUP.SPIPLA	1	Database Place spindle tool
SD.SysTch[1].SETUP.MAGSEC	2	Database Sector tool magazine
SD.SysTch[1].SETUP.MAGFIX	true	Fixed bin location coded Magazine
SD.SysTch[1].SETUP.SEARCH1	0:208	Tool search condition1
SD.SysTch[1].SETUP.SEARCH2	0:220	Tool search condition2
SD.SysTch[1].SETUP.SEARCH3	16:208	Tool search condition3
SD.SysTch[1].SETUP.PREPRG		Program name leader
SD.SysTch[1].SETUP.POSTPRG		Program name trailer
SD.SysTch[1].SETUP.ADJM6PRG		Program name Block search

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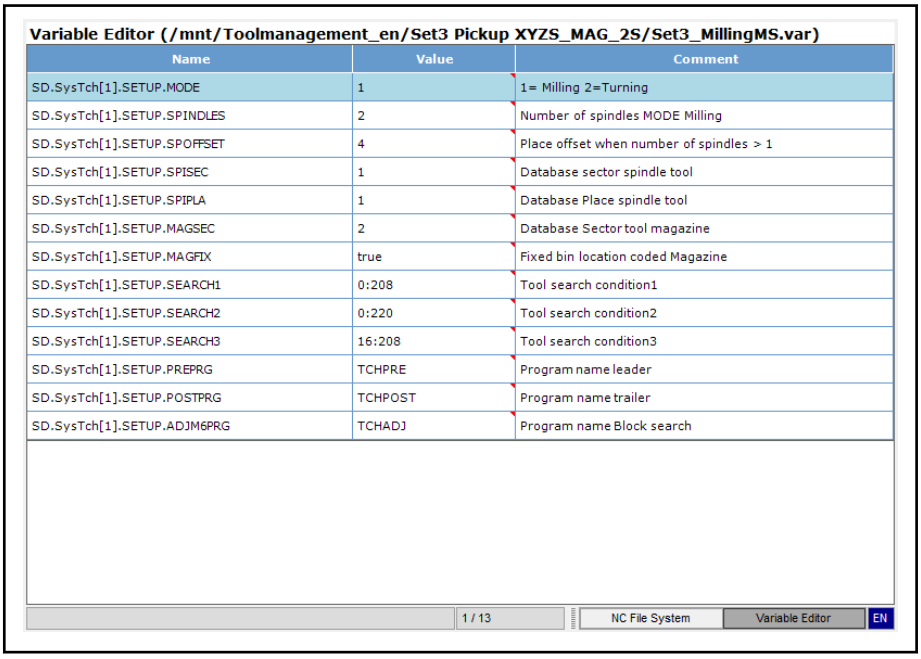
Fig. 5-151: Example Setup for milling machine "single-spindle machine"



Variable Editor (/mnt/Toolmanagement_en/Set3 Pickup XYZS_MAG_2S/Set3_MillingMS.var)

Name	Value	Comment
SD.SysTch[1].SETUP.MODE	1	1= Milling 2=Turning
SD.SysTch[1].SETUP.SPINDLES	2	Number of spindles MODE Milling
SD.SysTch[1].SETUP.SPOFFSET	4	Place offset when number of spindles > 1
SD.SysTch[1].SETUP.SPISEC	1	Database sector spindle tool
SD.SysTch[1].SETUP.SPIPLA	1	Database Place spindle tool
SD.SysTch[1].SETUP.MAGSEC	2	Database Sector tool magazine
SD.SysTch[1].SETUP.MAGFIX	true	Fixed bin location coded Magazine
SD.SysTch[1].SETUP.SEARCH1	0:208	Tool search condition1
SD.SysTch[1].SETUP.SEARCH2	0:220	Tool search condition2
SD.SysTch[1].SETUP.SEARCH3	16:208	Tool search condition3
SD.SysTch[1].SETUP.PREPRG	TCHPRE	Program name leader
SD.SysTch[1].SETUP.POSTPRG	TCHPOST	Program name trailer
SD.SysTch[1].SETUP.ADJM6PRG	TCHADJ	Program name Block search

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Fig. 5-152: Example Setup for milling machine "multi-spindle machine"

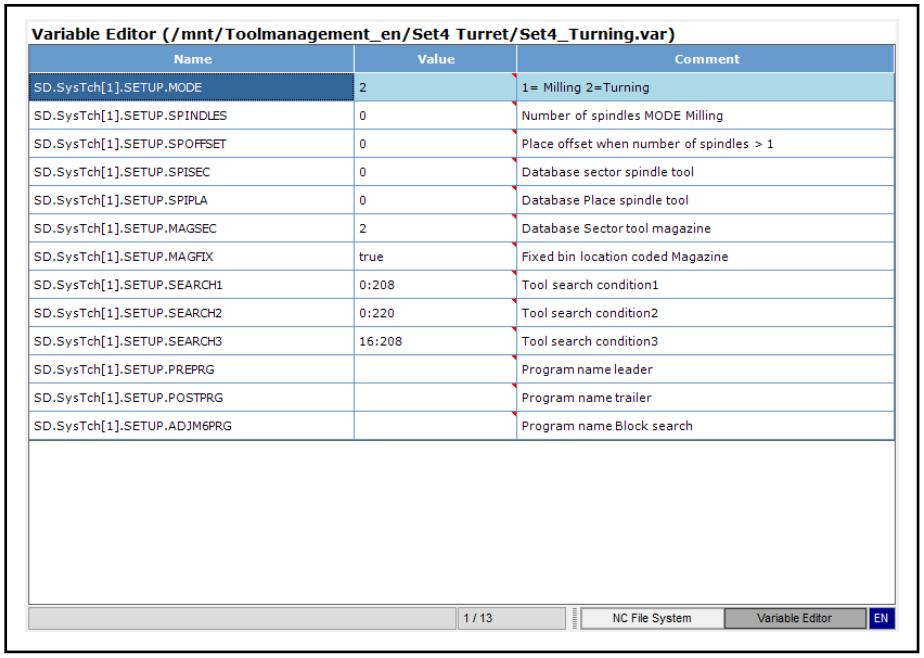


Fig. 5-153: Example Setup for Lathe

3 scans always take place. Thus, search condition 1, search condition 2 and search condition 3 must be specified.

Adjusting the search condition

The search condition 1 to 3 are defined by using the tool status bit BQ2. This is done using two numbers, separated by a colon (e.g. 16:208).

Description of the numbers:

- Number after the colon: Total number of bit significance that has to be taken into consideration in the search condition
- Number after the colon: Represents a binary mask for the number after the colon

The description and the significances are contained in the following list.

Tool status:

Bit no.	Designation	Brief descr.	Description
1	ActiveTool	ta	Tool active
2	PrimaryTool	tp	Primary tool
3	UsedTool	tu	Used tool
4	WarnLimit	tw	Warning limit reached
5	WornOut	two	Tool worn
6	PlaceCoded	TPC	Fixed place-coded tool
7	Locked	TL	Tool locked
8	Defective	TD	Tool defective
9	Ignore	ti	Ignore tool
10	Measured	tm	Probe tool
11	ToLoad	ttl	Tool loaded

Control commissioning

Bit no.	Designation	Brief descr.	Description
12	ToUnload	ttu	Tool unloaded
13	MasterTool	mt	Master tool
14	ToolChange	tc	Tool change
15	SisterTool	ts	Alternate tool
16	HeavyTool	TH	Heavy tool
17	NonEditable	tne	Tool cannot be edited
25	UserStatus 1	TS1	Tool user status 1
26	UserStatus 2	TS2	Tool user status 2
27	UserStatus 3	TS3	Tool user status 3
28	UserStatus 4	TS4	Tool user status 4
29	UserStatus 5	TS5	Tool user status 5
30	UserStatus 6	TS6	Tool user status 6
31	UserStatus 7	TS7	Tool user status 7
32	UserStatus 8	TS8	Tool user status 8

Tab. 5-52: Tool status (BQ2)

Example 1 Searching for new tool that is not worn, locked or broken.

Calculation of the number after the colon

The following bits have to be taken into consideration:

Bit 5	Tool worn	2^4	16
Bit 7	Tool locked	2^6	64
Bit 8	Tool broken	2^7	128
Total number of significances:			**208**

Calculation of the number in front of the colon

The following bits have to be taken into consideration:

Bit 5	Tool worn	2^4	FALSE	0
Bit 7	Tool locked	2^6	FALSE	0
Bit 8	Tool broken	2^7	FALSE	0
Total number of significances:				**0**

The result for the entry in SD.SysTch[$].SETUP.SEARCHx is **0:208**.

If the search does not return a new tool, residual machining can take place with an already worn tool (see example 2).

Example 2 The already worn tool (with the properties worn, not locked and not broken) is to be loaded again.

Calculation of the number after the colon

The following bits have to be taken into consideration:

Bit 5	Tool worn	2^4	16
Bit 7	Tool locked	2^6	64
Bit 8	Tool broken	2^7	128
Total number of significances:			**208**

Calculation of the number in front of the colon

The following bits have to be taken into consideration:

Bit 5	Tool worn	2^4	TRUE	16
Bit 7	Tool locked	2^6	FALSE	0
Bit 8	Tool broken	2^7	FALSE	0
Total number of significances:				**16**

The result for the entry in SD.SysTch[$].SETUP.SEARCHx is **16:208**.

If the search does not return a new tool, residual machining can take place with an already worn tool.

Activating the SD variables

Creating and activating a new variable list

1. Generate a variable list under <OP3>"Program" using the variable structure SD.SysTch[$].SETUP.

   In the example, SD.SysTch[1] is used for channel1.

2. Enter the calculated values.
3. Subsequently, write these values with <F7>"Write var. values" to the control.

Optionally, use the variable list of the example project or of the templates.

This is recommended as the variable list contains supporting comments.

Providing the NC subroutines

The subroutines and variable lists are contained in the example project "**Basic project with VAM and VPP**".

☞ The folders "SET1..." to "SET4... " contain example programs and variable lists for different tasks, to facilitate commissioning of the system.

The missing programs are required for the tool change and are to be copied to a user-defined directory (e.g. "/usr/mtb").

The directory has to be specified in the following machine parameter:

Macoda no.:	Name:	ID:
3080 00001	Search	NCO/FileOrg/ SrchPathSubProg

Control commissioning

Source	File name	Task	Note
For all variants:			
General information	M6.npg	Subroutine for call via M6	Setting Macoda parameters 3090 00003/4 is required
	TS	Subroutine for call via TS	
	T	Subroutine for call via T	
	Toolchange_TCH.npg	Example program for a tool change call with TCH	
	Toolchange_TSx.npg	Example program for a tool change call with TS	
	Toolchange_TxM6.npg	Example program for a tool change call with M6	
	TCHASUP	Job 1 (only for turning) Activate tool on place	Register TCHASUP in Ch$Ini.prg with ASPSET
		Job 2 (only for turning) Activate tool on place	
	TCH_REENTRY	Job 3 Reactivate tool data	User name in SD.SysReentry.NameOfAsup defined
	TCHADJ	Block pre-run (optional)	User name in SD.SysTch[$].SET-UP.ADJM6PRG defined
And additionally for manually operated tool changer milling machine 2 sectors:			
Set1 Pickup No_Axis_2SHand-Changer	TCHPICK	Traversing motion Pick tool up	Program name fixed Renaming to "TCH$PICK" required
	TCHPLACE	Traversing motions Put tool down	Program name fixed Renaming to "TCH$PLACE" required
	TCHPOST	Tool trailer (optional)	User name in SD.SysTch[$].SET-UP.POSTPRG defined
	TCHPRE	Tool header (optional)	User name in SD.SysTch[$].SETUP.PREPRG defined
	Set1_Fräsen.var	SD initialization	
Or for Simulator milling machine 2 sectors:			

Source	File name	Task	Note
Set2 Pickup No_Axis_2S	TCHPICK	Traversing motion Pick tool up	Program name fixed Renaming to "TCH$PICK" required
	TCHPLACE	Traversing motions Put tool down	Program name fixed Renaming to "TCH$PLACE" required
	TCHPOST	Tool trailer (optional)	User name in SD.SysTch[$].SETUP.POSTPRG defined
	TCHPRE	Tool header (optional)	User name in SD.SysTch[$].SETUP.PREPRG defined
	Set2_Fräsen.var	SD initialization	
Or for milling machine 2 sectors and multi-spindle machine:			
Set3 Pickup XYZS_MAG_2S	TCHPICK	Traversing motion Pick tool up	Program name fixed Renaming to "TCH$PICK" required
	TCHPLACE	Traversing motions Put tool down	Program name fixed Renaming to "TCH$PLACE" required
	TCHPOST	Tool trailer (optional)	User name in SD.SysTch[$].SETUP.POSTPRG defined
	TCHPRE	Tool header (optional)	User name in SD.SysTch[$].SETUP.PREPRG defined
	Set3_FräsenMS.var	SD initialization for multiple spindle machine	
	Set3_Fräsen.var	SD initialization for single-spindle machine	
Or for lathe 1 sector:			

Control commissioning

Source	File name	Task	Note
Set4 Turret	TCHPICK	Traversing motion Pick tool up	Program name fixed Renaming to "TCH$PICK" required
	TCHPLACE	Traversing motions Put tool down	Program name fixed Renaming to "TCH$PLACE" required
	TCHPOST	Tool trailer (optional)	User name in SD.SysTch[$].SETUP.POSTPRG defined
	TCHPRE	Tool header (optional)	User name in SD.SysTch[$].SETUP.PREPRG defined
	Set4_Drehen.var	SD initialization	

$: Channel number

Settings: Optional calls

T[<NO>,"<ID>"] **T is subroutine**

Copy the provided subroutine "T" to the search path.

☞ T cannot be parameterized as auxiliary function.

TS["<ID>"] **TS is subroutine**

Copy the provided subroutine "TS" to the search path.

T<NO> M6 **T is auxiliary function, M6 is subroutine**

☞ T has to be parameterized as auxiliary function.

Copy the provided subroutine "M6.npg" to the search path.

The following parameters have to be adjusted, if required.

1. Non-modal M-functions

To call an NC program using an M-function, a program name has to be assigned to the M-function.

Macoda no.:	Name:	ID:	Value
3090 00003	M-code number	NCP/SubProg/NonModalMFunc/MFunc /MFuncCode	6
3090 00004	Subroutine name	NCP/SubProg/NonModalMFunc/MFunc /MFuncSubProg	M6.npg

2. Auxiliary class definitions

The "T" auxiliary function is made known to the system.

1. Select a free class.
2. Editing Parameters

Macoda no.:	Name:	ID:	Value
3010 00040	Enable auxiliary function	AUXF/ClassDef/ Class[1..30]/EnableAux-Func	Yes
3010 00030	Name	AUXF/ClassDef/ Class[1..30]/AuxFunc-Name	T
3010 00040	Channel de-pendency	AUXF/ClassDef/ Class[1..30]/AuxFuncCh-Dep	Channel-depend-ent auxiliary func-tion
3010 00040	Type	AUXF/ClassDef/ Class[1..30]	Int
3010 00090	Acknowledge-ment require-ment	AUXF/ClassDef/ Class[1..30]/Int/AcknInt	Test “No” Machine “Yes”
3010 00080	Index	AUXF/ClassDef/ Class[1..30]/Int/IndInt	0

3. Increase the number of integer auxiliary functions by 1.

Macoda no.:	Name:	ID:	Value
3010 00010	Integer auxiliary function	AUXF/NofAuxFunc/ ChDep/ChDepInt	Current value +1

4. Enter the address.

Macoda no.:	Name:	ID:	Value
3333301	Address of inte-ger auxiliary functions	AUXF/PlcIf/ChDep/ChIf/ AddrChDepInt	Address value

3. Auxiliary group definition

The "T" auxiliary function is made known to the system.

Macoda no.:	Name:	ID:	Value
3010 01000	Channel Depend-ency	GrChDep	channel-dependent auxiliary function
3010 01000	Auxiliary Function 1	GrAuxFunc[1]	T

Notes to create a user-defined tool change

When creating user-defined tool change programs, note that several settings have to be selected to guarantee a correct tool information display (cf. chapter 5.10.8 "Tool management standard tool change" on page 265). These settings are also realized in the previously described standard tool change program (TCH).

Control commissioning

Relevant system data The following system data are described when activating or preselecting a tool:

Name	Type	Length	Description	
SD.SysTool[$].ActToolValid	BOOLEAN		Important for tool life count: 0: Data record of the SD.SysTool[$].ActTool structure is invalid or no tool is active 1: Data record of the SD.SysTool[$].ActTool structure is valid or a tool is active	Written by the NC program (TCH)
SD.SysTool[$].ActEd	INTEGER		Number of the active edge	Written by the system
SD.SysTool[$].ActTool.K1	**SHORT**		**Sector number of the active tool**	Data record header of the active tool Type: DBT1Rec_t
SD.SysTool[$].ActTool.K2	**SHORT**		**Place number of the active tool**	
SD.SysTool[$].ActTool.SKQ	STRING	32	ID of the active tool	
SD.SysTool[$].ActTool.IKQ1	INTEGER		Duplo no of the active tool	
SD.SysTool[$].ActTool.IKQ2	INTEGER		Type no. of the active tool	
SD.SysTool[$].ActTool.IKQ3	INTEGER		T.-no of the active tool	
SD.SysTool[$].ActTool.IQ1	INTEGER		IQ1- Value of the active tool	
SD.SysTool[$].ActTool.IQ2	INTEGER		IQ2- Value of the active tool	
SD.SysTool[$].ActTool.IQ3	INTEGER		IQ3- Value of the active tool	
SD.SysTool[$].ActTool.BQ1	INTEGER		Status of the active tool location	
SD.SysTool[$].ActTool.BQ2	INTEGER		Status of the active tool	
SD.SysTool[$].ActTool.BQ3	INTEGER		BQ3- Value of the active tool	
SD.SysTool[$].PreTool.K1	**SHORT**		**Sector number of the preselected tool**	Data record header of the preselected tool Type: DBT1Rec_t
SD.SysTool[$].PreTool.K2	**SHORT**		**Location number of the preselected tool**	
SD.SysTool[$].PreTool.SKQ	STRING	32	ID of the preselected tool	
SD.SysTool[$].PreTool.IKQ1	INTEGER		Duplo no of the preselected tool	
SD.SysTool[$].PreTool.IKQ2	INTEGER		Type no. of the preselected tool	
SD.SysTool[$].PreTool.IKQ3	INTEGER		T-no of the preselected tool	
SD.SysTool[$].PreTool.IQ1	INTEGER		IQ1 value of the preselected tool	
SD.SysTool[$].PreTool.IQ2	INTEGER		IQ2 value of the preselected tool	
SD.SysTool[$].PreTool.IQ3	INTEGER		IQ3 value of the preselected tool	
SD.SysTool[$].PreTool.BQ1	INTEGER		Status of the preselected tool location	
SD.SysTool[$].PreTool.BQ2	INTEGER		Status of the preselected tool	
SD.SysTool[$].PreTool.BQ3	INTEGER		BQ3- Value of the preselected tool	

$: Channel number

Tab. 5-53: System data for tool displays

☞ If the channel number is not written by the NC program, the number is automatically set by the calling channel.

The system data are only relevant for displays in the basic screens of the "Machine" operating area if in the *Tool display* and *Tool correction display properties* as *Tool source, System data* has been defined.

The following system data are to be written during the block pre-run:

Name	Type	Length	Description	
SD.SysToolSRun[$].ActTool.K1	**SHORT**		**Sector number of the active tool**	Data record header of the active tool Type: DBT1Rec_t
SD.SysToolSRun[$].ActTool.K2	**SHORT**		**Place number of the active tool**	
SD.SysToolSRun[$].ActTool.SKQ	STRING	32	ID of the active tool	
SD.SysToolSRun[$].ActTool.IKQ1	INTEGER		Duplo no of the active tool	
SD.SysToolSRun[$].ActTool.IKQ2	INTEGER		Type no. of the active tool	
SD.SysToolSRun[$].ActTool.IKQ3	INTEGER		T.-no of the active tool	
SD.SysToolSRun[$].ActTool.IQ1	INTEGER		IQ1- Value of the active tool	
SD.SysToolSRun[$].ActTool.IQ2	INTEGER		IQ2- Value of the active tool	
SD.SysToolSRun[$].ActTool.IQ3	INTEGER		IQ3- Value of the active tool	
SD.SysToolSRun[$].ActTool.BQ1	INTEGER		Status of the active tool location	
SD.SysToolSRun[$].ActTool.BQ2	INTEGER		Status of the active tool	
SD.SysToolSRun[$].ActTool.BQ3	INTEGER		BQ3- Value of the active tool	

Control commissioning

Name	Type	Length	Description	
SD.SysToolSRun[$].PreTool.K1	**SHORT**		**Sector number of the preselected tool**	Data record header of the preselected tool Type: DBT1Rec_t
SD.SysToolSRun[$].PreTool.K2	**SHORT**		**Location number of the preselected tool**	
SD.SysToolSRun[$].PreTool.SKQ	STRING	32	ID of the preselected tool	
SD.SysToolSRun[$].PreTool.IKQ1	INTEGER		Duplo no of the preselected tool	
SD.SysToolSRun[$].PreTool.IKQ2	INTEGER		Type no. of the preselected tool	
SD.SysToolSRun[$].PreTool.IKQ3	INTEGER		T-no of the preselected tool	
SD.SysToolSRun[$].PreTool.IQ1	INTEGER		IQ1 value of the preselected tool	
SD.SysToolSRun[$].PreTool.IQ2	INTEGER		IQ2 value of the preselected tool	
SD.SysToolSRun[$].PreTool.IQ3	INTEGER		IQ3 value of the preselected tool	
SD.SysToolSRun[$].PreTool.BQ1	INTEGER		Status of the preselected tool location	
SD.SysToolSRun[$].PreTool.BQ2	INTEGER		Status of the preselected tool	
SD.SysToolSRun[$].PreTool.BQ3	INTEGER		BQ3- Value of the preselected tool	

$: Channel number

Tab. 5-54: System data for block pre-run

☞ If the channel number is not written by the NC program, the number is automatically set by the calling channel.

Identifying the active tool

To identify the active tool in the tool list, set the tool status bit "ta" for the active tool and reset it for the deactivated tool.

5.11 Motion

5.11.1 NC file system (MTX Navigator)

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" characteristic, the directory structure is shown as tree on the left. The subdirectories and files are listed on the right.

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

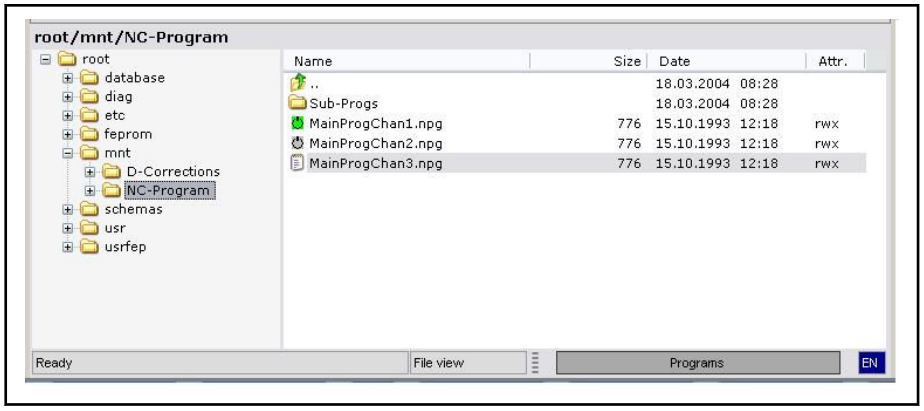


Fig. 5-154: MTX Navigator in the characteristic "Tree + List" of IndraWorks Operation

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 298) in IndraWorks Operation.

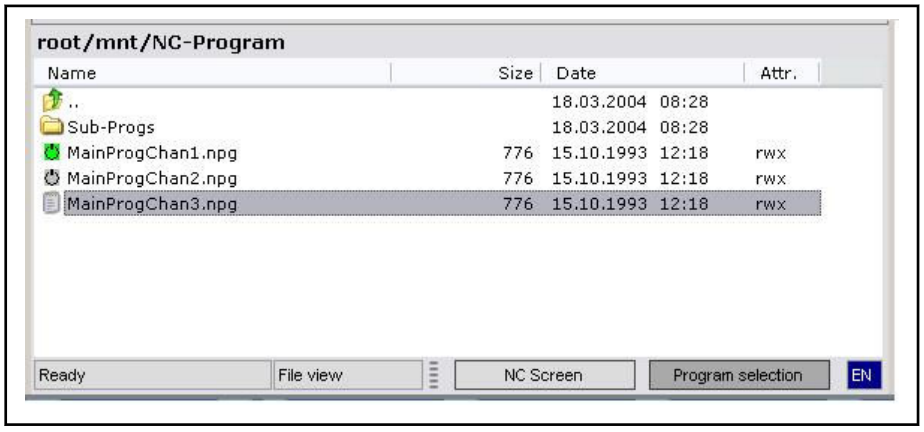


Fig. 5-155: MTX Navigator in the characteristic "List" of IndraWorks Operation

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 folder "root" in the tree (Root = the root directory)
- all other folders in the tree
- the return flag in the list
- all other folders in the list
- all files 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 following is additionally displayed:

- the number of the objects (directories and files) and
- the sum of the sizes of all files

The sum is located directly below the selected directory.

The status bar in IndraWorks Operation is - as shown in fig. 5-154 " MTX Navigator in the characteristic Tree + List of IndraWorks Operation" on page 297 - 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 300) - 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.

Operation

General information

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

The operation in different contexts proceeds on the assumption of different entering media. The interface is partially operated via mouse (operating areas "Program" and in IndraWorks Engineering) and partially via keyboard (operating area "Machine"). However, an operation with the keyboard is always possible. In certain areas, operation with the mouse is easier.

Context menu

For entries with an own context menu, right-click or press <Shift>+<F10> to display it.

Within the context menu, the user can highlight an entry with the mouse, the cursor buttons or by entering the underlined or the first letter and can execute

it via <Enter> or the mouse. Via <ESC> or by 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 via mouse 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. The function key bar 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 via left-click button or 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 with the mouse. The switch is important, since keyboard entries always refer to the currently focused entry. To navigate in the list and if the focus is currently on the tree, only press <Tab> to focus in the list. The tree entry is then focused again with the <Tab> key.

Navigating in the tree

Keyboard or mouse can be used to navigate in the tree. Individual folders can be directly clicked on for highlighting. Click on the plus or minus sign at the left side of a folder or double-click 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 expanded with <CursorRight> and collapsed 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.

Use the keys <PgUp>, <PgDn>, <Pos1> and <End> to jump one screen page upwards or downwards or to the first or last folder in the tree.

When pressing <Backspace>, the highlighting moves to the respective superordinate 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 the mouse. Use the keys <CursorLeft> and <CursorRight> to shift the list section horizontally.

Press "Enter" or double-click to trigger the predefined command of the currently highlighted entry:

- Entry = Return label ⇒ change to next higher level.
- Entry = Folder ⇒ it is placed and displaced in the corresponding directory.
- Entry = File ⇒ function assigned to the file type (e.g. open editor) is executed.

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

Press <Ctrl>+<A> to highlight all entries of the list (multiple selection). Use the keys <Shift> and <Ctrl> together with the <Space> key, to select or deselect areas of entries or several individual entries.

Press <PgUp>, <PgDn>, <Pos1> and <End> to jump one screen page up or down or to the first or last entry in the list.

The columns of the list can be maximized or minimized by the mouse. A column can be "hidden" by completely pushing together the column with the mouse. To re-open these hidden columns later on, move the mouse from the right to the corresponding column separator and zoom out the column to the right while keeping the left mouse button pressed.

Sorting column and direction can only be changed by clicking one or multiple times on the corresponding column head. 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.

☞ *In spite of sorting, the order of the following groupings is always maintained:*

- The return label is always at the top.
- Afterwards, all directories are shown.
- The last group is the group of the 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.

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.

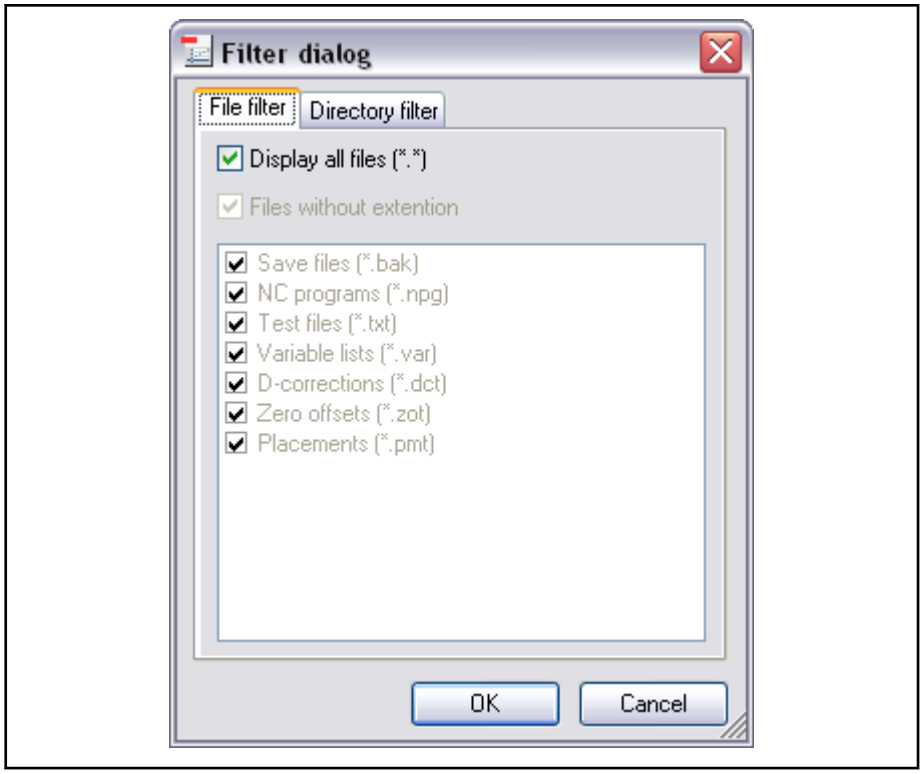


Fig. 5-156: Filter dialog for files

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.

Add file filter

The list in the filter dialog for files can be extended by the "Add filter" function. This function is called via the context menu (right mouse button) of the list.

Delete file filter

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 extension specified by the installation cannot be deleted.

This function is called via the context menu (right mouse button) of the file filter list.

Set 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 (right mouse button) 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.

Control commissioning

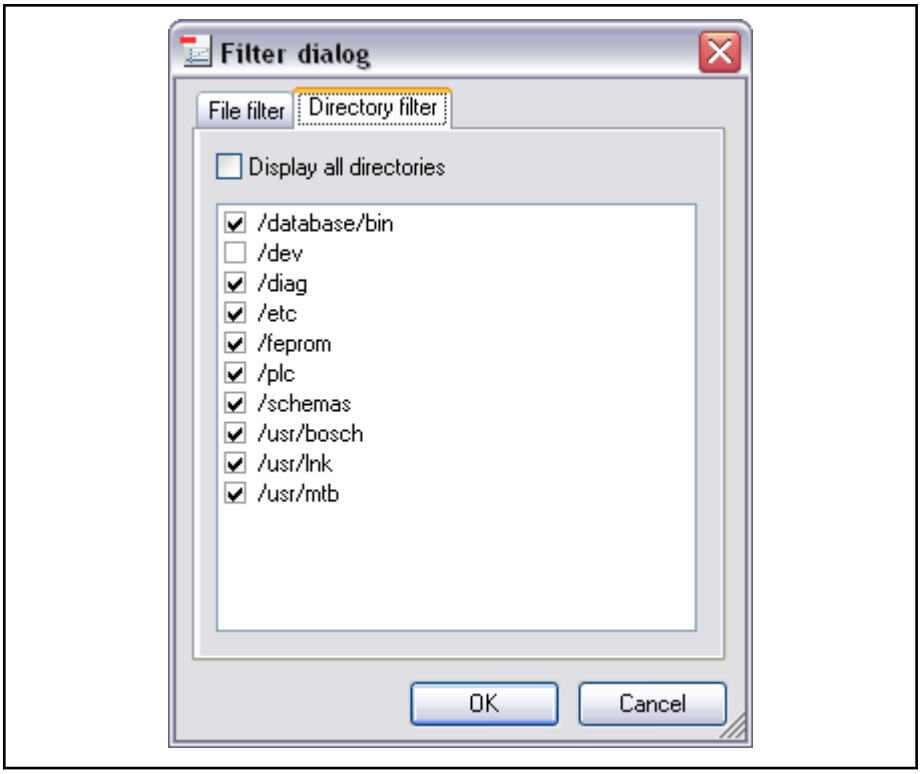


Fig. 5-157: Filter dialog for directories

All connected directories and the directories selected in the directory dialog (including mount directories) are always shown.

Add 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
- Assigned memory of the file system
- Free memory of the file system
- Memory capacity of the file system
- Creation date of the directory
- Directory attributes

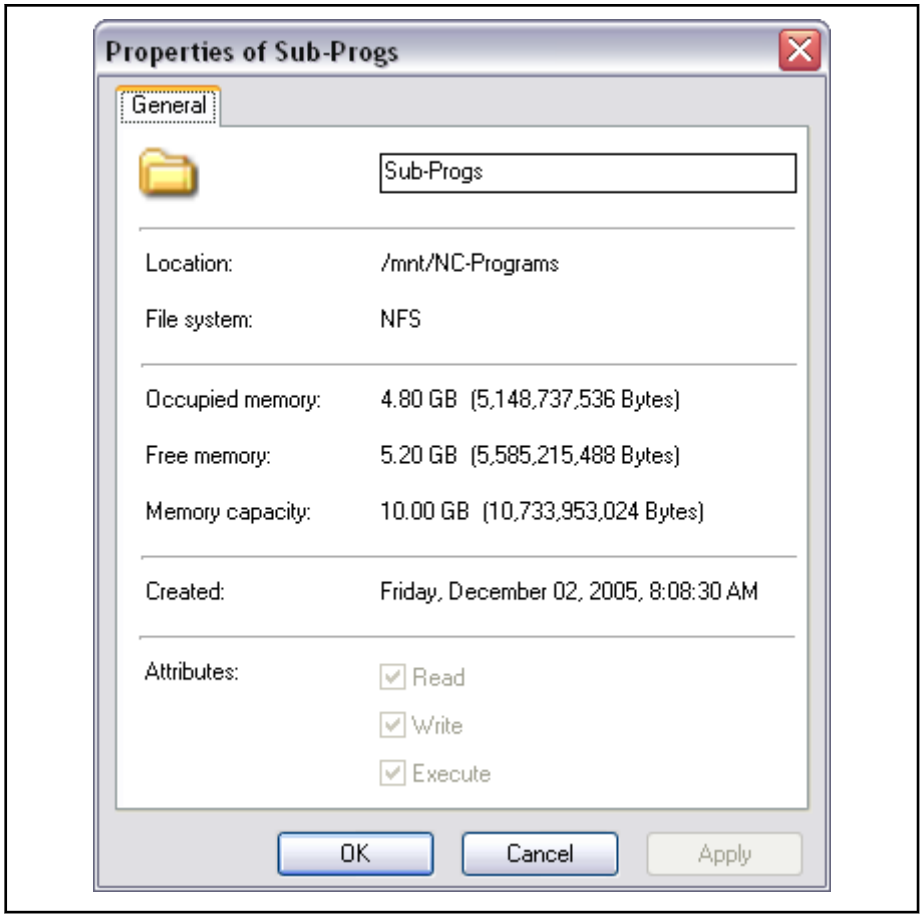


Fig. 5-158: Properties dialog of the directory

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

Control commissioning

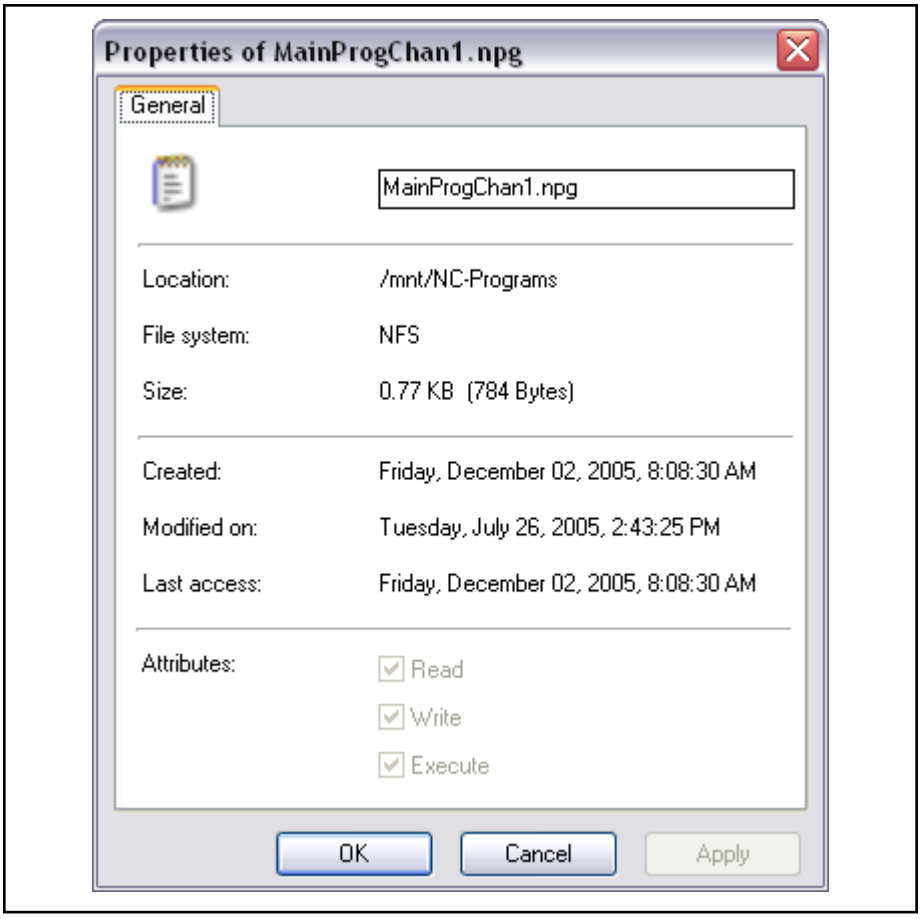


Fig. 5-159: "Properties" dialog of the file

☞ 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.

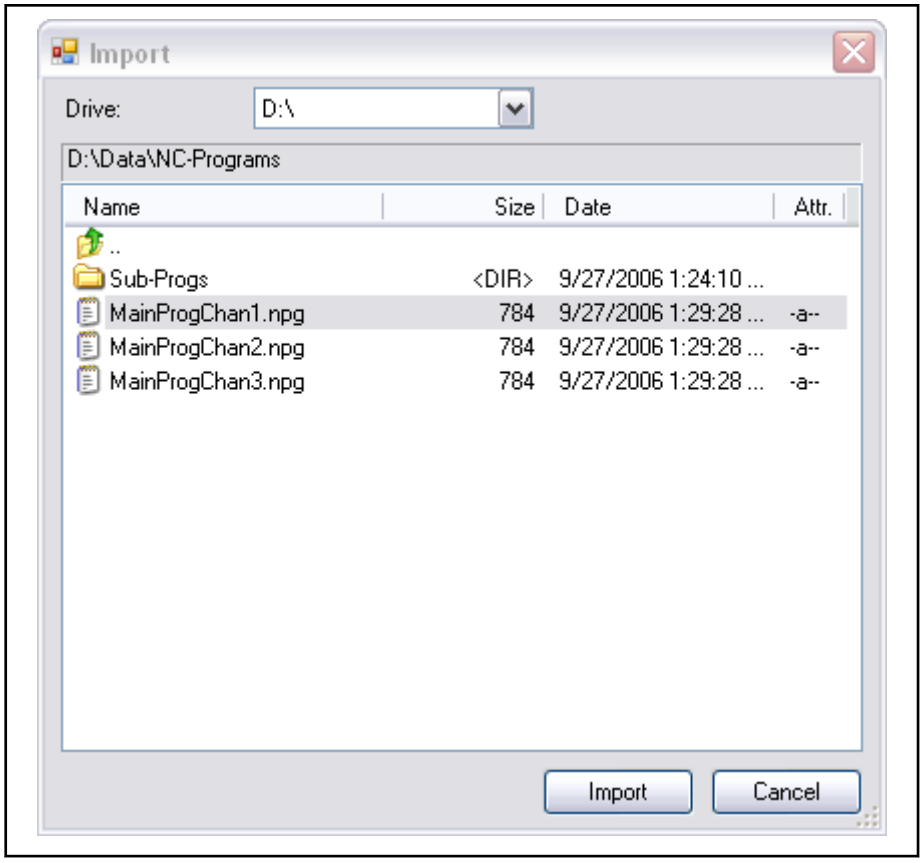


Fig. 5-160: "Import" dialog

- During the first call after the MTX Navigator start, "C:" is set as default drive. . The last selected directory is placed 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 operated with the keyboard (i.e. also without a mouse)!

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 is/are selected

Fig. 5-161: "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 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. 5-162: Dialog: Create new directory

- Close the dialog by clicking on **OK** and create 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.

Delete

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!

Rename

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. 5-163: Dialog: Rename directory

- **OK** closes the dialog is closed and renames the directory.

- Click on **Cancel** to close the dialog. 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.

Copy 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.

Insert 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.

Cut 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 activated 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.

Delete 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.

Edit 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.

Rename This function renames the currently selected file. When this function is activated, a dialog is opens.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. 5-164: Dialog "Rename file"

- Close the dialog by clicking on **OK** and rename the file.
- Click on **Cancel** to close the dialog. 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 - that means active - NC programs may not be renamed.

Copy 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.

Insert 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.

Cut 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 "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.

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:

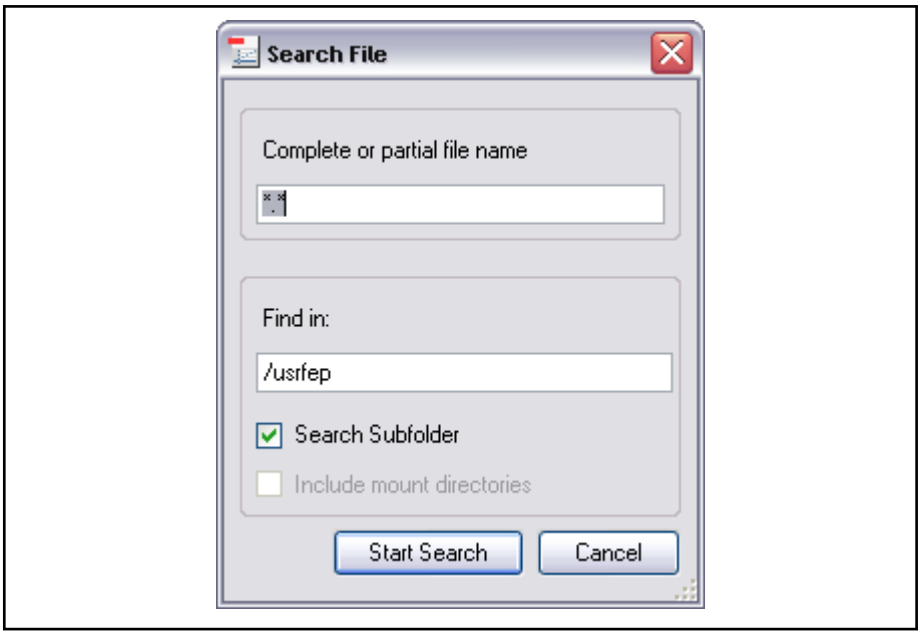


Fig. 5-165: "Search File" dialog

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>** - Search for all files with a certain extension
- **<FileName>.*** - Search for files with a certain name and any extension
- **<FileName>*.*** - Search for files starting with certain characters and any extension
- **<FileName>*.<ext>** - Search for files starting with certain characters and with certain extension

- Entering a path

  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. Are files found in the list are displayed with their complete path. These are "links" to the original files.

Functions of the "Search Results" node

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 loosing 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.

5.11.2 NC configuration (machine parameters)

The NC is configured via machine parameters.

Double-click on the "NC configuration" node to start a tool structurally representing the number of parameters and displaying a corresponding online help for each highlighted parameter.

The configuration of the machine parameters is described in detail in the "Machine Parameters" manual.

5.11.3 Mount directories

General information

The IndraMotion MTX works with a control-internal file system. The control can access files and directories outside the control via mount directories.

The following targets can be mounted:

- Directories of the flash card of a control
- USB stick in a PC
- Directories on the hard disk of a PC
- Network drive of a PC

The "mount directories" are used for the backup as well as for the general archiving and data exchange. The NC user interface can directly access up to ten mount directories.

Configuring mount directories

It is mounted via the "Network File Service" (NFS). Thus, a "Bosch Rexroth NFS client" runs in the IndraMotion MTX control.

To access data of a PC (USB stick, directories, network drives), the "Bosch Rexroth NFS server" has to run on this PC. This server is installed when installing IndraWorks on the PC.

To access directories of the flash card in the control, a "Bosch Rexroth NFS server" is additionally running on the control.

*The **mount configuration of the NCS client** is executed in IndraWorks Engineering:*

1. Go online with the control
2. Open the context menu of the control node and select the menu item ("Configure Device" \ "Configure Mount Directories...")
3. The mount configuration is executed in the following dialog. Use the three keys on the top right to create a new configuration and to edit or delete a configuration selected in the list.

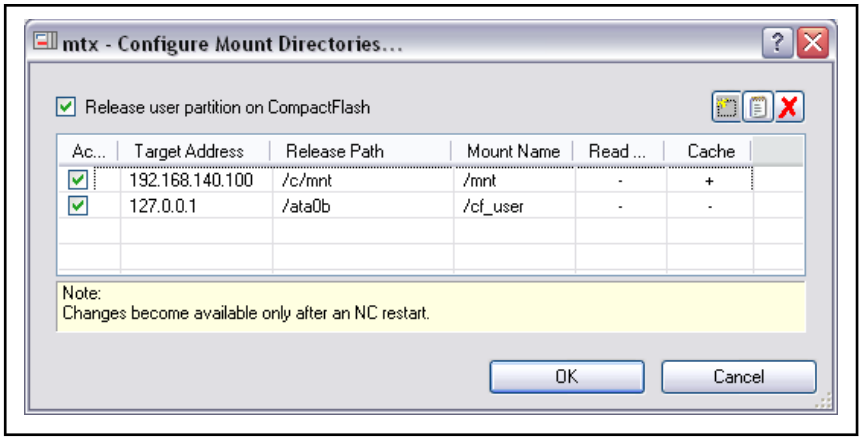


Fig. 5-166: Mount configuration dialog

Column meaning:

- Active: An existing mount configuration can be enabled via the checkbox in this column.
- Target address: IP address of the device on which the directory to be mounted is located [the "Bosch Rexroth NFS server" has to run on this device (PC)].
- Release path: Path to the directory to be mounted
- Mount name: Name of the mounted directories as it is to be displayed in the file system of the control
- Read-only: A plus sign (+) indicates that the access authorization of the control to the mounted directory is read-only. A minus sign (+) indicates that the access authorization of the control to the mounted directory is read and write.
- Cache: Directory to be cached (only cache directory possible)

4. Confirm the dialog with **OK** and the configuration to the "Bosch Rexroth NFS **Client**" is transmitted to the control. To apply the configuration, restart the control.
5. Press **OK** to transfer the configuration to the "Bosch Rexroth NFS **Server**" as well. This is only possible if the server is running on the same PC than IndraWorks Engineering. If this is not the case, configure the NFS server manually on the PC on which the directories to be mounted are located.

   Open the "Export.us" file on the PC for editing purposes (storage "Export.us": C:\Documents and Settings\Rexroth\IndraWorks\MTX or C:\Documents and Settings\Rexroth\IndraWorks\MTX).

   The "Export.us" file contains the directory to the path to be mounted as well as the IP addresses of the controls which are permitted to access this directory. The "localhost" entry indicates the access from the MTX Emulation.

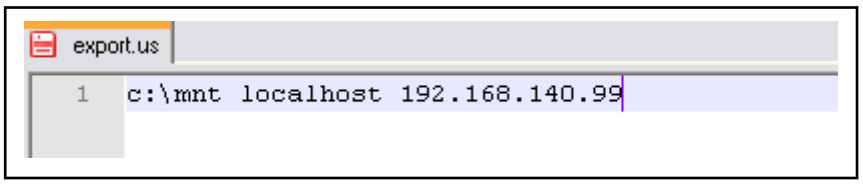


Fig. 5-167: NFS server, example configuration Export.us

After saving the file, the new configuration has to be declared to the "Bosch Rexroth NFS server". Go to the task bar for the corresponding

symbol. Right-click on this symbol to open the context menu. Execute "Reload Export.us" to declare the new configuration to the NFS server.

Fig. 5-168: "Bosch Rexroth NFS server" in the task bar

Fig. 5-169: Context menu of the "Bosch Rexroth NFS server" in the task bar

This completes the configuration of the mount directories.

☞ The control tries to mount the configured directories at startup. If the corresponding "Bosch Rexroth NFS server" or the directors does not exist, the control startup can take longer.

5.12 Sercos

5.12.1 Axis commissioning

Commissioning tools

NC Configurator - Machine parameters

General information

The Engineering Desktop is the main tool for modifying and configuring data and settings of the MTX control system. When the Engineering Desktop was started using the "IndraWorks Engineering" icon, the following screen is displayed.

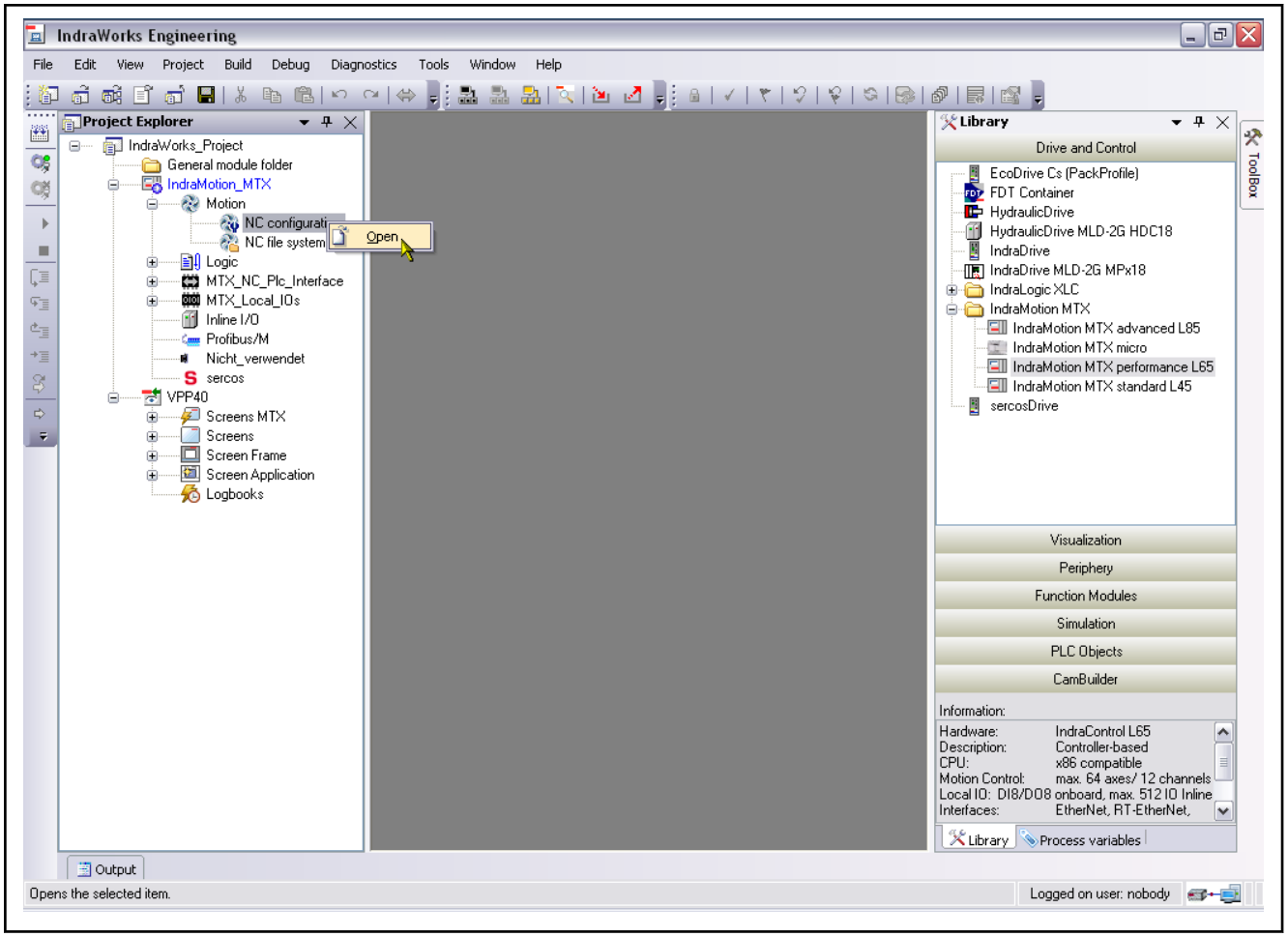


Fig. 5-170: Engineering desktop

The Project Explorer (left column) is used to navigate through the individual topic areas.

The NC configuration is used to commission the NC axes. The configurator is started via the context menu of the "NC Configuration" node.

Control commissioning

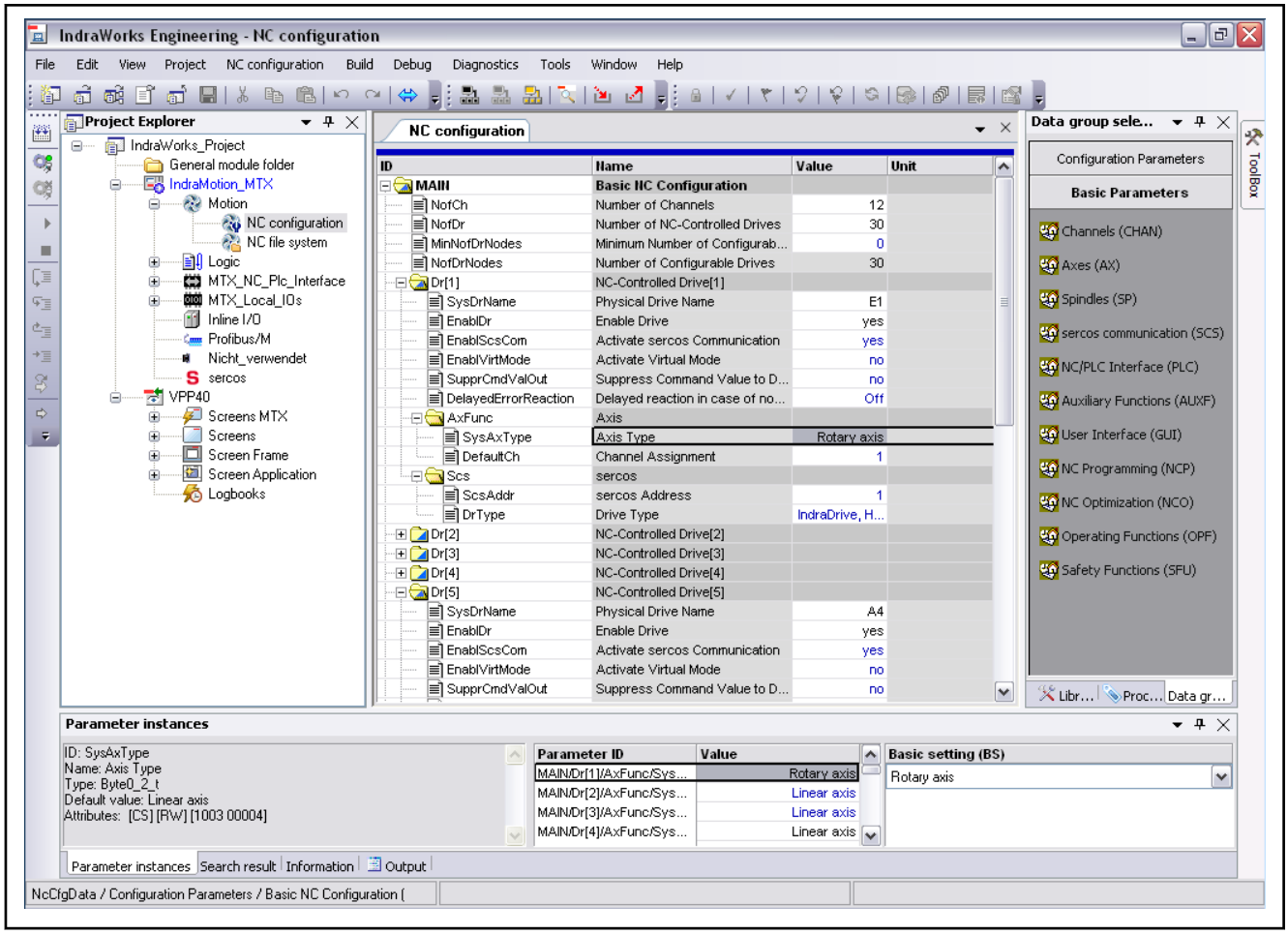


Fig. 5-171: "NC configuration" node

The desktop is divided into several sections:

- Project Explorer (left column)
- "Edit Parameter" window (centered)
- Data group selection (right column)

Selecting parameters

The section to be edited can be selected in the "Data group selection" column under "Basic Parameters".

Important to commission the drives are:

- Main configuration (MAIN)
- Axes (AX)
- Spindles (SP)
- Sercos Communication (SCS)

The optional parameters can be selected in the section "Setup Configuration Data". These parameter ranges cover specific topics, such as "electronic couplings", "measuring" and "traversing to fixed stop". They are only displayed in "Optional Parameters" after their selection.

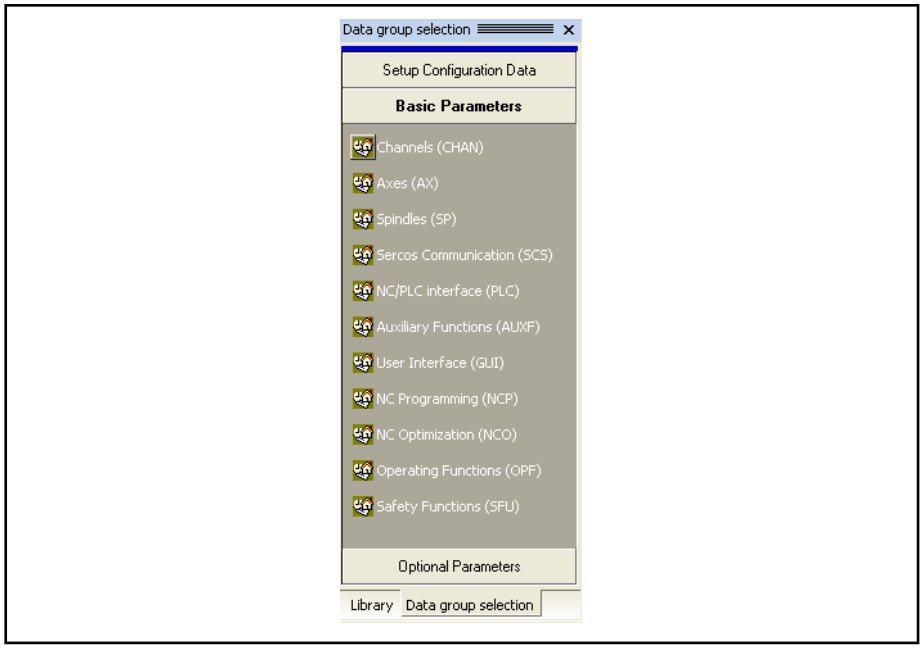


Fig. 5-172: Basic parameters

The "Configuration" tool is described in the manual "Bosch Rexroth IndraMotion MTX Machine Parameters". Only the important steps to commission the drives are described in the following section.

Finding parameters

The configuration parameters relevant to commission the drives are described in a later chapter.

To find the listed parameters more quickly, a search function is available in the main menu under **Edit\Find**. This search function can also be started using the shortcut <Ctrl> + <F3>.

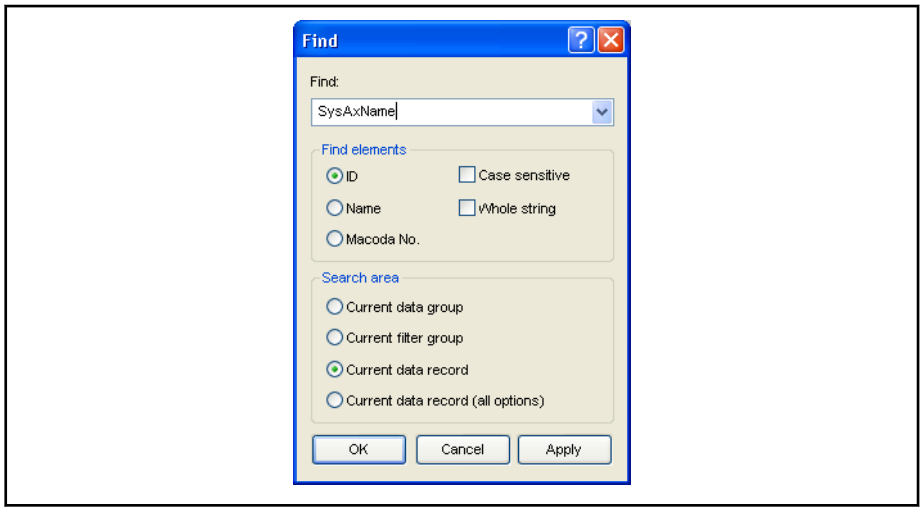


Fig. 5-173: "Find" menu

The search for "SysAxName" is exemplarily shown. The search results are displayed in Engineering Desktop under the tab **Search Results** in the lower part of the screen. Double-click on a search result to jump to the corresponding parameter.

NC Editor - SCS files

The SCS files are important when commissioning the drives. They are used for the Sercos initialization of the connected drives while the control is starting up.

The handling of the SCS files and the configuration syntax are described in the chapter SCS handling, on page 337 of this documentation.

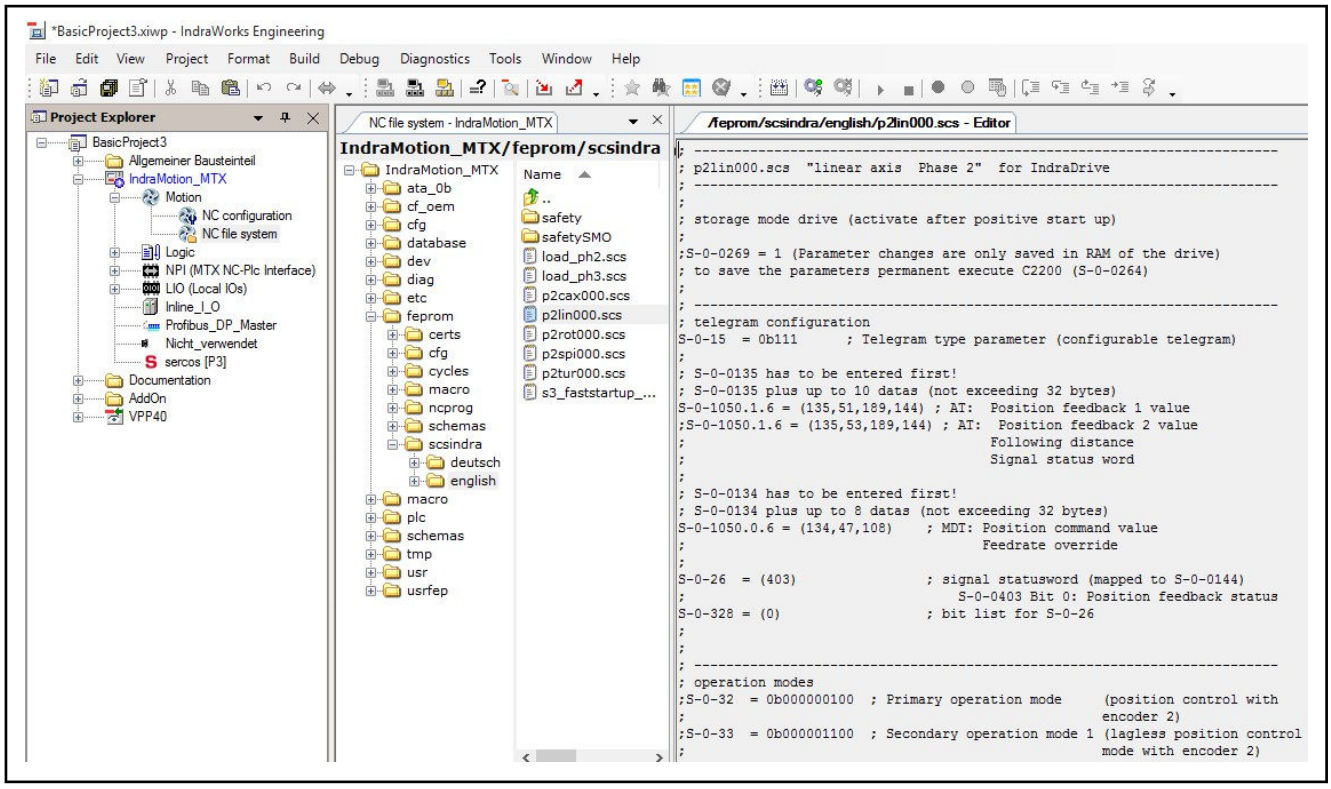


Fig. 5-174: Editor for Sercos files

The "IndraMotion MTX" control system can already provide SCS example files located in the control directory "//root/feprom/scsindra/" ("root" stands for the control name). Copy the examples to the directory "//root/" and adjust them to its application.

Double-click on the SCS files to open and edit them.

Sercos master

General information

After opening the Engineering Desktop, it cannot be communicated via the non-cyclic service channel of the Sercos ring. To be able to edit drive data, the control has to go "online" first. For this function, go to the icon in the toolbar or click in the main menu under "Project - Online". If the Sercos ring is at least in Phase 2, all the associated drives are also created in the project. However, communication is not yet active.

The communication with the drives is already activated when the drive is selected. Alternatively, it is possible to use the context menu of the Sercos node to go online simultaneously with several drives.

The following functions are provided at the Sercos node.

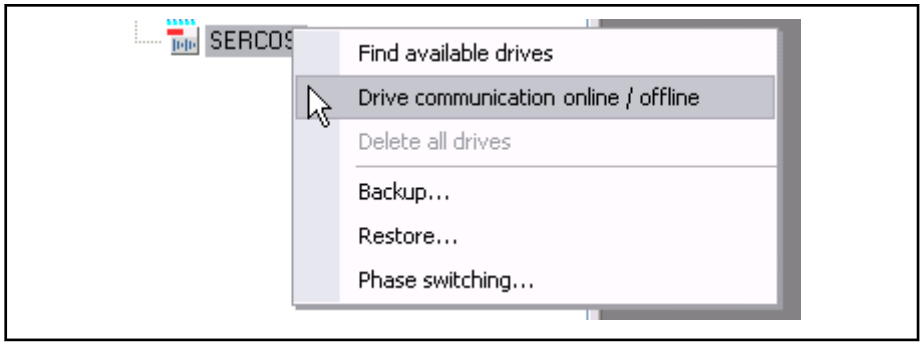


Fig. 5-175: Sercos context menu

- **Find available drives:**

  All drives configured in the NC data are created. If required, a switch to Sercos phase 2 is triggered upon request. This function is already triggered when the control goes online.

- **Drive communication online/offline:**

  This function establishes and cancels the communication with the drives. In a dialog, the drives can be selected for going online. This function implicitly includes searching for drives if not all configured drives are in the project.

- **Archive:**

  A dialog opens in which the drives are selected for backup. Furthermore, it can be determined whether all parameters or only the changed parameters are to be backed up. The selected drives go online accordingly.

- **Restore:**

  In a dialog, the drives, for which a previously created archive is to be written back again, are selected. The selected drives go online accordingly.

- **Phase switching:**

  A dialog to switch the Sercos phase opens.

- **Sercos device address assignment:**

  It is possible to set the Sercos address of the bus device. The devices are identified via their position in the ring

  chapter "Sercos device address assignment" on page 320

- **Firmware management**

  The firmware of several Sercos devices can be replaced without data loss.

  chapter "Firmware download on Sercos devices" on page 324

Behavior when going online

The behavior of the drives when the control goes online can be set in the "Properties" of the Sercos node.

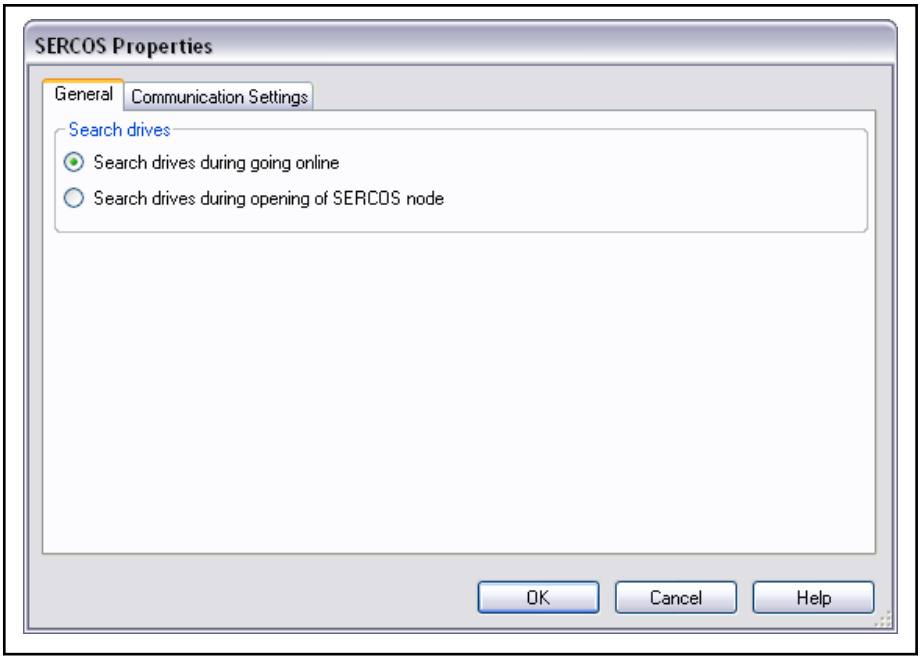


Fig. 5-176: Find Sercos settings for the drive

Before a communication can be established with the drives, the basic configuration of the drives in the project has to be compared and, if necessary, updated with the drives available at the control. This process might take several seconds depending on the number of devices at the Sercos ring. Thus, it can be selected when the adjustment is to be made.

- Search drive during going online (default)

  When the control goes online, it is searched for drives. It can be immediately used for operation.

- Search drives during opening of Sercos node

  When the control goes online, the Sercos node collapses. The drive configuration is not checked. To access the drive parameterization, the Sercos node is expanded. Only at this point in time, a check is made.

  This setting can be very reasonable especially if there is a high number of drives in the ring and if the drive parameterization is rarely required.

Sercos device address assignment

Therefore, the control has to be online.

This function compares the configuration of the devices in the project with the devices actually found in the control.

The data from the project is displayed on the left.

The data of the real bus devices is displayed on the right. It is shown in the sequence of the devices in the ring.

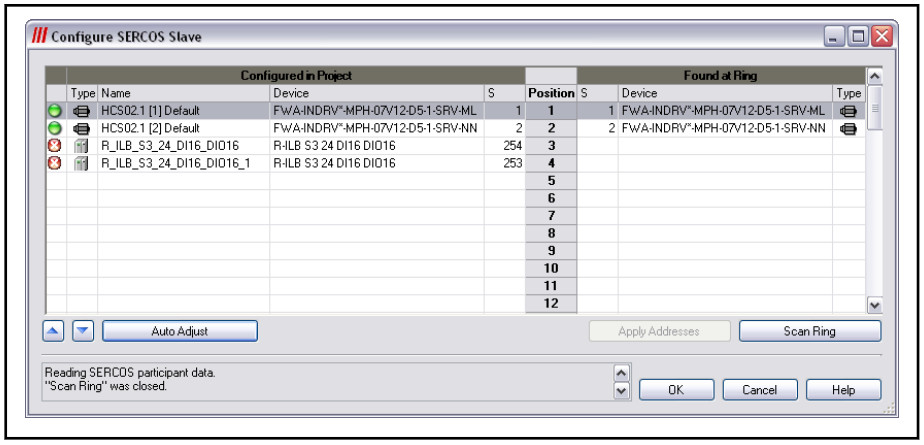


Fig. 5-177: Dialog to configure Sercos devices

Column description

- **Project - Type:**

  Type of device: Drive or I/O

  I/Os can be activated/deactivated by clicking on the icon. Clicking does not work for drives.

- **Project - Name:**

  Name of the device in the project.

- **Project - Device:**

  Name of device: Drive firmware or I/O type

- **Project - S (Sercos address):**

  Configured Sercos address of the device.

  This address can be changed for I/Os. The configured Sercos address of a drive can only be changed in the NC configurator. Changed addresses are displayed in "**bold**".

- **Control - Type:**

  Type of device: Drive or I/O

- **Control - Device:**

  Name of device: Drive firmware or I/O type

- **Control - S (Sercos address):**

  Set Sercos address of device.

  A new Sercos address is set for the device. Changed addresses are displayed in "**bold**".

Describing operating elements:

- **Project - Arrow up;**

  Moves the selected device one up in the project.

- **Project - Arrow down;**

  Moves the selected device one down in the project.

- **Project - AUTO:**

  Sorts the configured devices to achieve a high number of matching cases.

- **Control - Scan ring**

  The data of the devices at the ring are read in again.

- **Control - Apply addresses**

The changed addresses are written to the devices and a new Sercos startup is executed.

Status information

The status of the respective place is given as colored icon in the first column. More information on the respective status is given when keeping the mouse pointer on the icon for a moment (tooltip).

There are the following status messages:

- **Gray**

  The ring has not yet been scanned. The status is unknown.

- **Green**

  The configuration of the device in the ring does not match the device.

- **Yellow**
  - The device name does not match.

    There is another I/O device at the ring as expected in the project.
  - Firmware does not match.

    The firmware version of the drive in the ring is different than expected in the project.
  - The Sercos addresses do not match.

    The device on the control matches with the configured device, but not with the address. The Sercos address can be adjusted in the project or at the device.

- **red**
  - The Sercos address is used multiple times.

    A Sercos address exists multiple times. The Sercos addresses have to be corrected until they are unique.
  - No device was found at this position.

    A configured device was not found at the ring. An I/O can be deactivated in the project
  - No device is configured at this position.

    An unconfigured device was found at the ring. Either the device has to be removed from the ring or added to the project.
  - The configured device type does not fit to the hardware found.

    A drive is configured in the project, but an I/O is available in the ring or vice versa.

Using the Sercos UC channel

General information

Drive can directly be activated with Sercos via their IP address. This allows to directly execute a firmware or PLC download for example via the Sercos interface. Furthermore, tasks such as parameterization backups are normally faster.

Activating IP channel

To use IP communication, certain settings have to be made. These can be found in the properties of the "Sercos" node. The provided options differ whether being in online or offline mode.

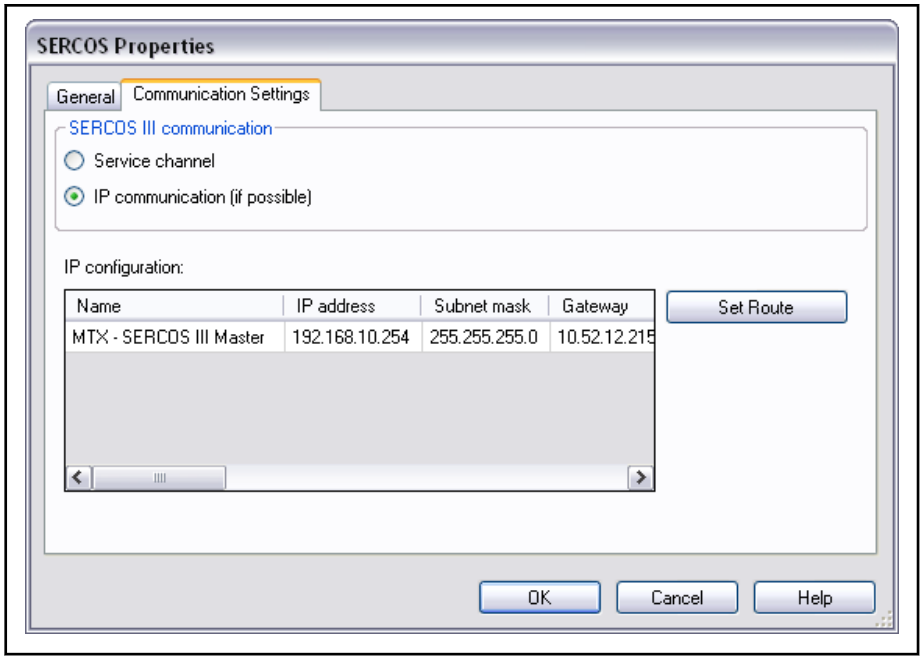


Fig. 5-178: Activating IP communication

It can be selected whether the IP channel is to be used. If no IP connection is established to the drive, the service channel is automatically used. If problems occur with this setting, it can also be specified to always use the service channel. This information is saved in the project.

To use the IP channel, the Engineering PC must be familiar with the subnet of the drives. If this is not the case, use the **Set Route** button. Select this function to enable the route to the drives.

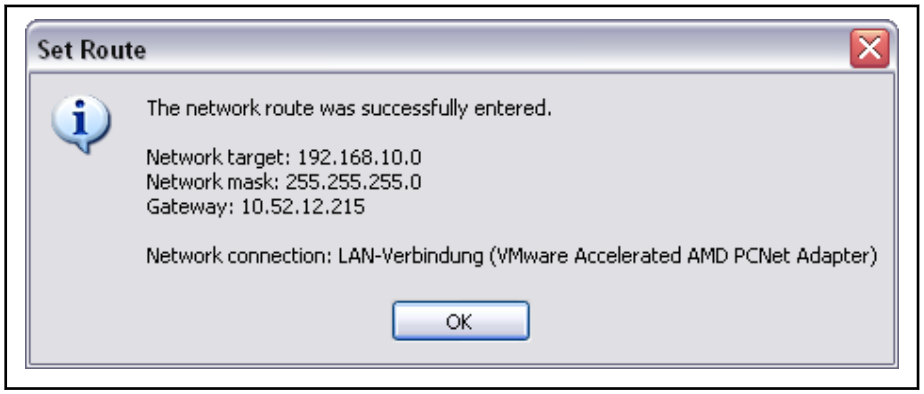


Fig. 5-179: "Set Route" was carried out

The IP channel can now be used. When going online next time with the drive, it communicates via IP channel.

- Administrator rights are required to set the route.
- A route set this way is deleted upon the next PC restart and has to be created again.

- Another option to configure the route to the drives is provided by the command "route" in the Microsoft prompt. It can be also specified via parameters that the route remains after a PC restart. For more information on this command, refer to the Windows help. The function used in the dialog corresponds to this call:

  ```
  route add 192.168.0.0 10.52.12.215 -mask 255.255.255.0
  ```

- For more options, contact your network administrator.

  The subnet to be routed in is determined by the address of the Sercos master. ("IP configuration of the master " on page 324). The gateway is the control.

IP configuration of the master

Open "Advanced" at the Sercos master to select different settings.

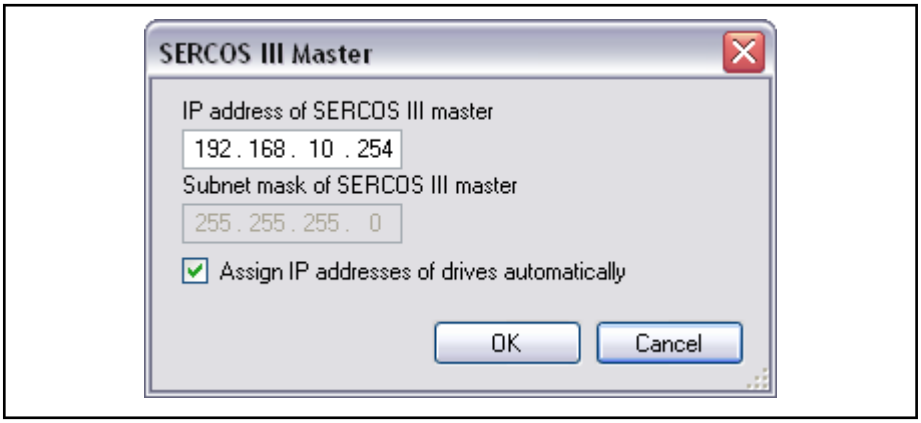


Fig. 5-180: Advanced setting of the Sercos master

- **IP address:**

  IP address of the Sercos master interface (upon delivery: 192.168.143.254)

- **Subnet:**

  The subnet cannot be modified and is set to the value 255.255.255.0

- **IP addresses of the drives are automatically assigned:**

  If this option is activated (delivery state), a permitted IP address is assigned to each drive during Sercos startup. This IP address consists of the subnet and the Sercos address of the drive (e.g.: IP address of the master: 192.168.143.254, Sercos address of the drive: 4, IP address of the drive: 192.168.143.4).

  If this option is not enabled, the address has to be specified once correctly for each drive.

Firmware download on Sercos devices

Target

The firmware of multiple Sercos devices is to be exchanged without loss of data.

Prerequisites

- It is one of the following devices:
  - Drives supporting the firmware download via TFTP (firmware ≥ MPx16)
  - Drives used as PLC device and supporting the firmware download via TFTP
  - Sercos III gateway for SafeLogic compact (SLC-3-GS3S00300)

  - Supplier (PowerSupply HMV0x, KMV0x)
  - From the control firmware version 14V14: All Sercos devices reporting the class "SCP_TFTP = 16#0E01" in the parameter S-0-1000 "SCP type and version". The class "SCP_NRTPC=16#1801" has to be reported additionally to specify a matching IP address
- Only for control firmware versions < 14V14: The control and the computer - on which IndraWorks is installed - are located in the same subnet
- The control is switched online
- The devices are connected to the control and enabled

Procedure

Read the release notes for the respective firmware first.

In this example, the control runs in **BB RUN** and the axes are active.

It is recommended to follow this sequence:

1. Stop all active axes and ensure that no axes start during the firmware download.
2. Go to the context menu of the “Sercos” node to open the firmware management. The following window lists all available Sercos devices.

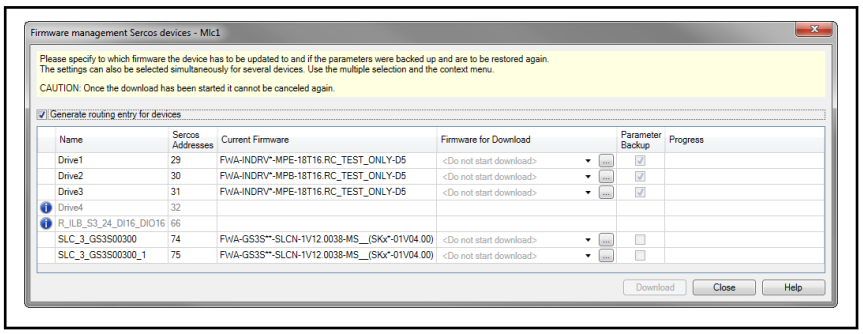


Fig. 5-181: "Firmware Management Sercos Devices" dialog

3. Only for control firmware versions < 14V14: Select whether to generate a routing entry for the devices. A routine entry is required to access the devices from the PC. If a routine entry has already been created, this options does not have to be selected.
4. Select the devices for the download. Select a firmware for the download. To select multiple devices at a time, click on these devices with the <Ctrl> key pressed and select a firmware for the download via the context menu.

   Then, specify the firmware to be downloaded. Either select the firmware for each device from the drop-down list or press **...** to find another firmware file. To use the same firmware for multiple devices, click on the devices with the <Ctrl> button pressed and select an already used or a new firmware via the context menu.

   At the end, specify the devices for which the parameters are backed up before the download and restored after the download. The parameter backup can only be selected for devices supported for the parameter backup.

   Devices, which cannot be selected for the download, are shown in grey and have an information icon with a tooltip stating why the download is not possible for this device.

5. Click on **Download** to start the process. You are then prompted whether to stop the PLC. After confirming, the download starts.

NOTICE **Once started, the process cannot be canceled.**

During this process, do not switch off the control voltage of the devices or cancel their connection. This can cause irreparable damage to the devices.

6. After transferring the firmware to the devices, it is automatically tried to restart them. If this is not possible, as the device is for example not supported, restart the devices manually. A message is displayed listing the devices to be restarted. Start the devices by switching off and on the control voltage and acknowledge the message with **OK**.

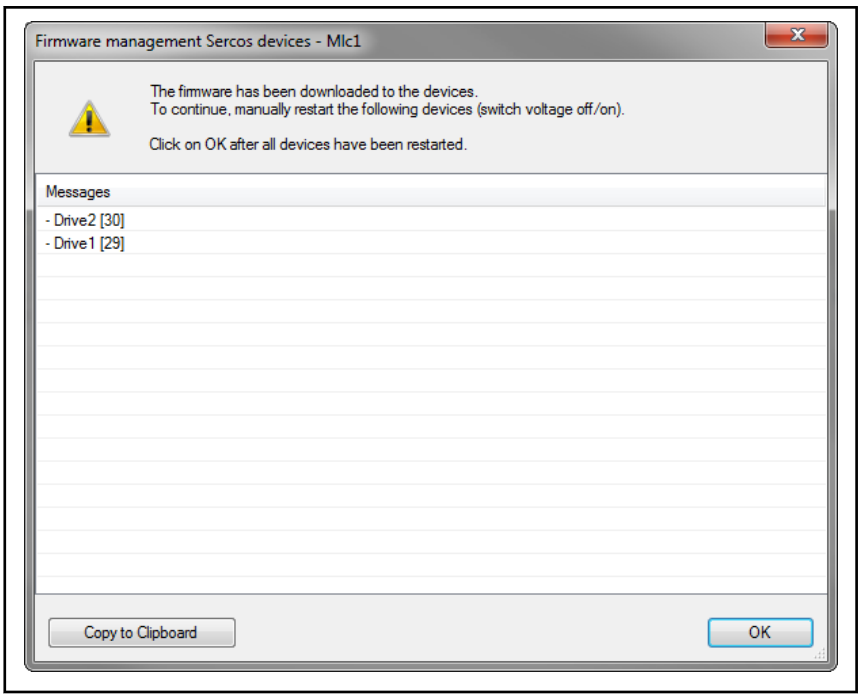


Fig. 5-182: Message to restart the Sercos devices

7. Subsequently, the function packages of the drives are restored. If might be required to restart some devices. If this restart cannot be executed automatically, a message is displayed, stating which drives have to be started again manually. Start the corresponding drives by switching off and on the control voltage and acknowledge the message with **OK**.
8. The previously archived parameters are restored. If not all parameters can be restored, a list of the parameters, which could not be restored, is displayed.

☞ In case of another firmware, drive parameters might have been changed or even omitted.

The result of the download is displayed at the end. If errors or warnings occurred, the already archived parameters can be saved to a file. This file can be manually imported again via the parameter import (context menu of the control -> Parameters -> Import...).

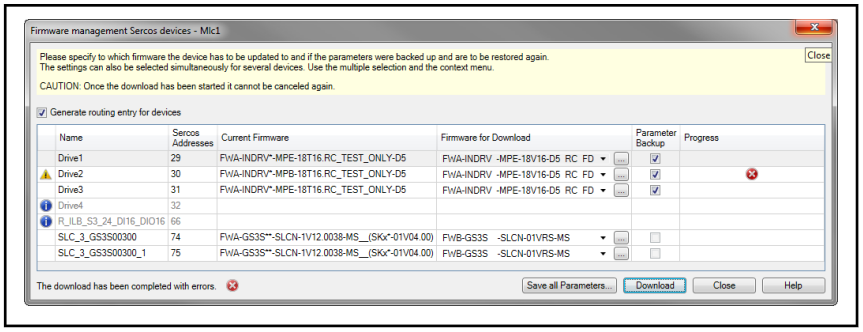


Fig. 5-183: "Firmware Management Sercos Devices" dialog – Result

Drive commissioning

Overall procedure

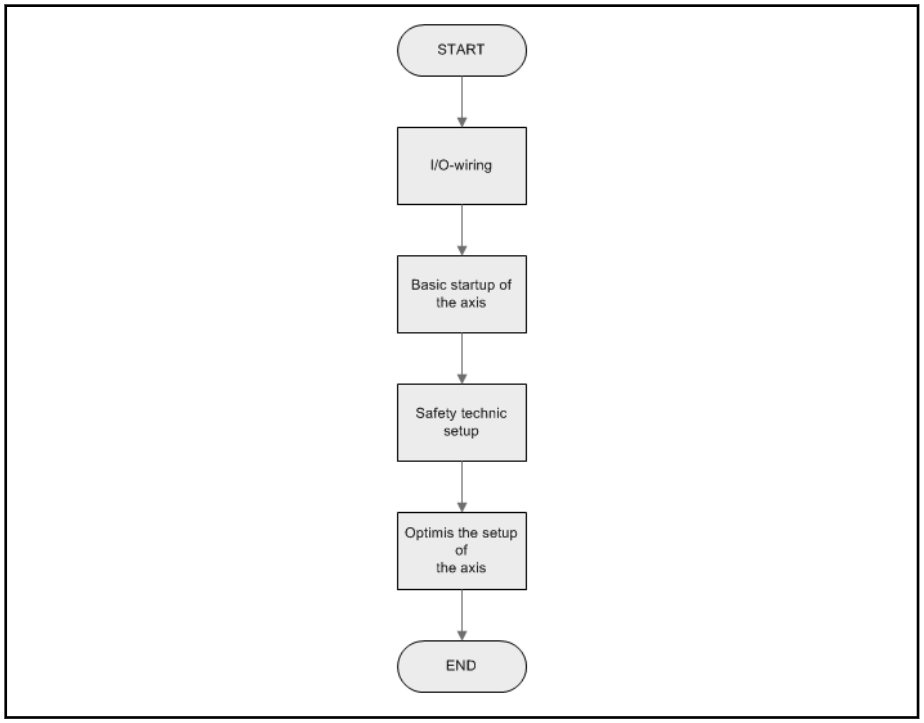


Fig. 5-184: Drive commissioning procedure

I/O wiring

General information

⚠ CAUTION **Danger of personnel injuries and machine damage due to incorrect wiring!**

Wiring only according to the guidelines of Bosch Rexroth!

Handling instruction: I/O wiring

General wiring of the drives to prepare for commissioning.

Drives: Wiring the inputs and outputs, power wiring

Wire the drives according to the guidelines of Bosch Rexroth.

☞ Follow the instructions of the IndraDrive documentation to ensure proper use of the drives.

Handling instruction: Activating the E-Stop Function

Before the axis can be operated with the "IndraMotion MTX" NC control, it must be ensured that the safety equipment is functioning properly.

System/machine: Check E-stop circuit

1. Check E-stop circuit
2. Check the safety engineering of the drives and set the parameters accordingly if required.

☞ Observe the safety instructions on electrical drives.

		Documentation
Documentation:	Rexroth IndraDrive drive system	Control circuits for power connection

Handling instruction: General drive commissioning

Before commissioning, operate the drives of the system/machine together with the control but without the NC, if possible.

This comprises the following steps:

IW Drive: Drive commissioning

- Mechanical installation of drive amplifiers
- Electrical wiring of motor, drive amplifier and control
- Commissioning of the overall electrical system and the switch cabinet
- Basic commissioning of drives without NC
- Basic settings of axis with IW Drive

☞ Refer to the drive documentation for information about commissioning of the drives.

The drives are optimized together with the control at a later point in time (after the control commissioning).

		Documentation
Documentation:	Rexroth IndraDrive drive system	

Drive-side parameterization

General information

To parameterize the drives, enable the communication. This is done by means of the menu point "Drive communication online/offline". There, the necessary drives are selected and switched online. Depending on the number of the drives selected, it might take a while.

During initial activation, the drives existing in the system are created in the project.

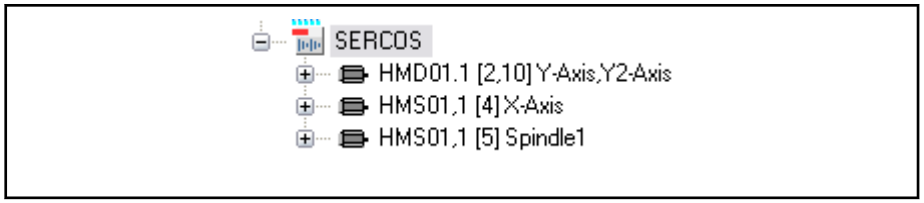


Fig. 5-185: Project tree with drives

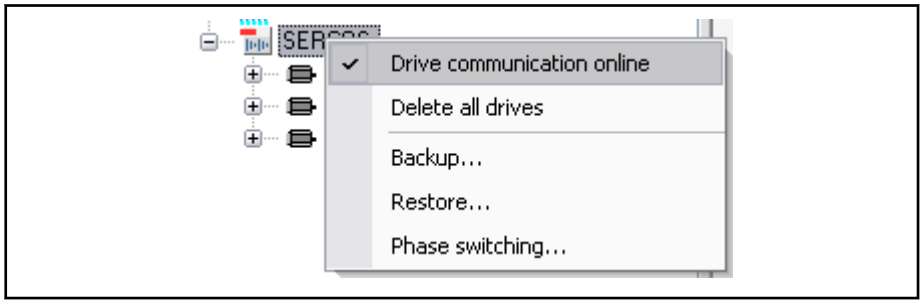


Fig. 5-186: Context menu "Drive communication online"

The current phase is highlighted in green in the upper part of the dialog. By clicking on a phase (0 to 4), switching to the relevant Sercos phase is possible. If one of the drives is in parameterization mode ("PM mode"), it is displayed in line "Sercos phase", after phase 4.

The appropriate phase is selected via the buttons "Parameterize" and "Operation". Ongoing phase switching is indicated with a progress bar.

Furthermore, the functions to be executed during phase switching can be selected:

- Delete error of state class 1
- Transfer SCS files to Sercos phase 2
- Transfer SCS files to Sercos phase 3

A status message is displayed at the end of switching or if errors occur.

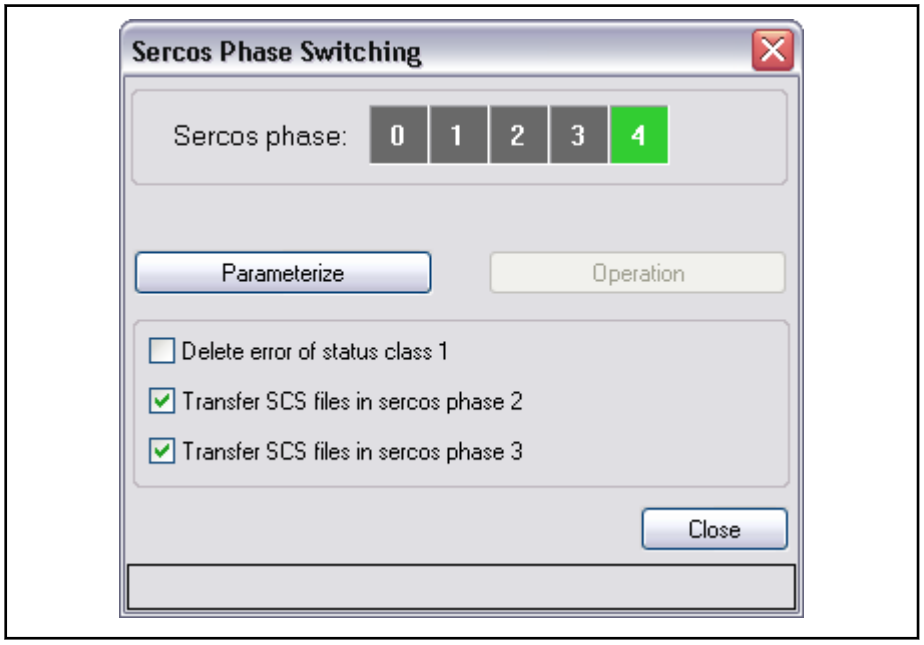


Fig. 5-187: Phase switching dialog

In case of IndraDrive drives, all relevant parameters can be transferred to phase P2. The parameter transfer in phase P3 is not applicable.

Handling instruction: Parameterizing drives in IW Drive

IW Engineering/Project tree: Extend IW data structure

1. Switch the control "Online" in order to be able to create drives

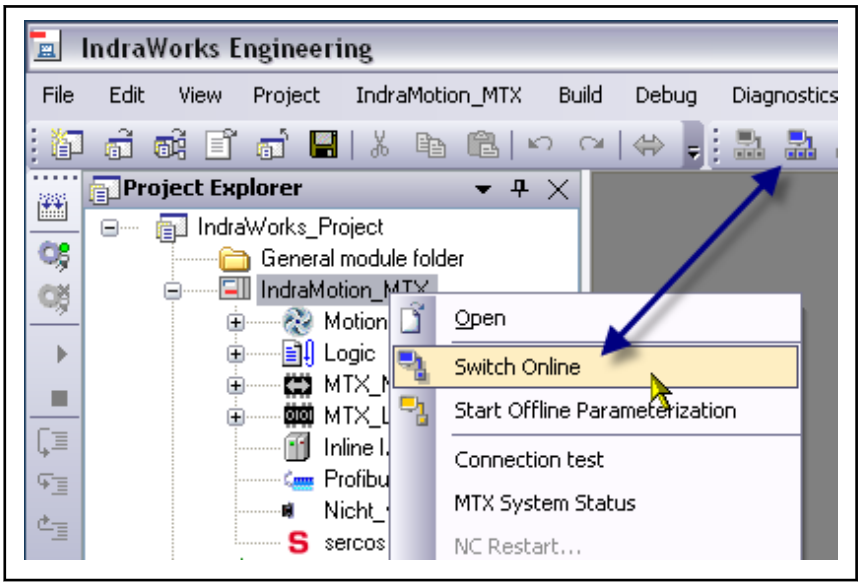


Fig. 5-188: Going online with the control

2. Creating drives automatically
3. The function "Drive communication online/offline" can be started by clicking the right mouse button on the "Sercos" node.

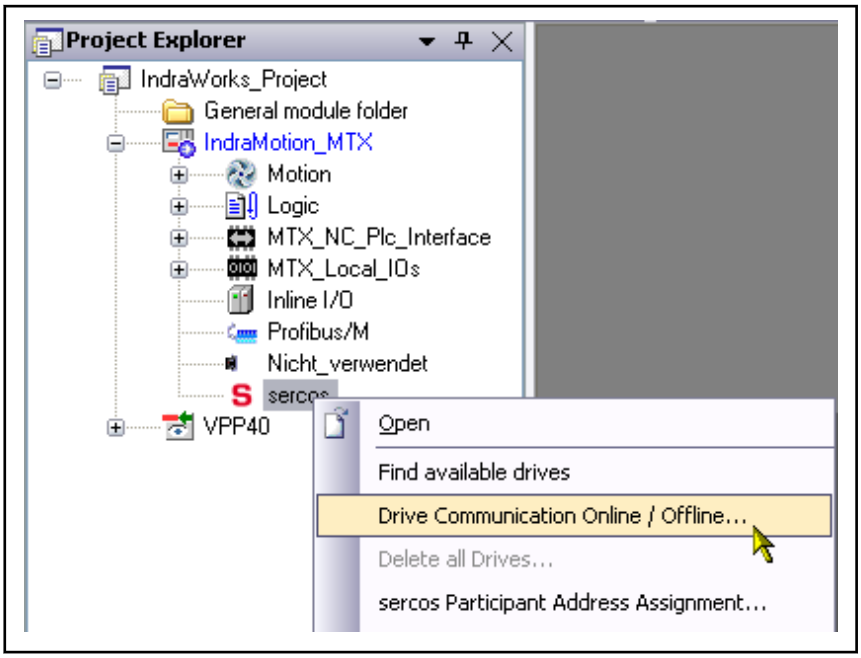


Fig. 5-189: Creating drives

To completely create the tree structure of the drives, you can first switch all the drives "Online". Only the drives that you want to edit need to be selected.

This function may take several minutes. The duration depends on the number of selected axes.

The successful creation of all the axes is then displayed as follows.

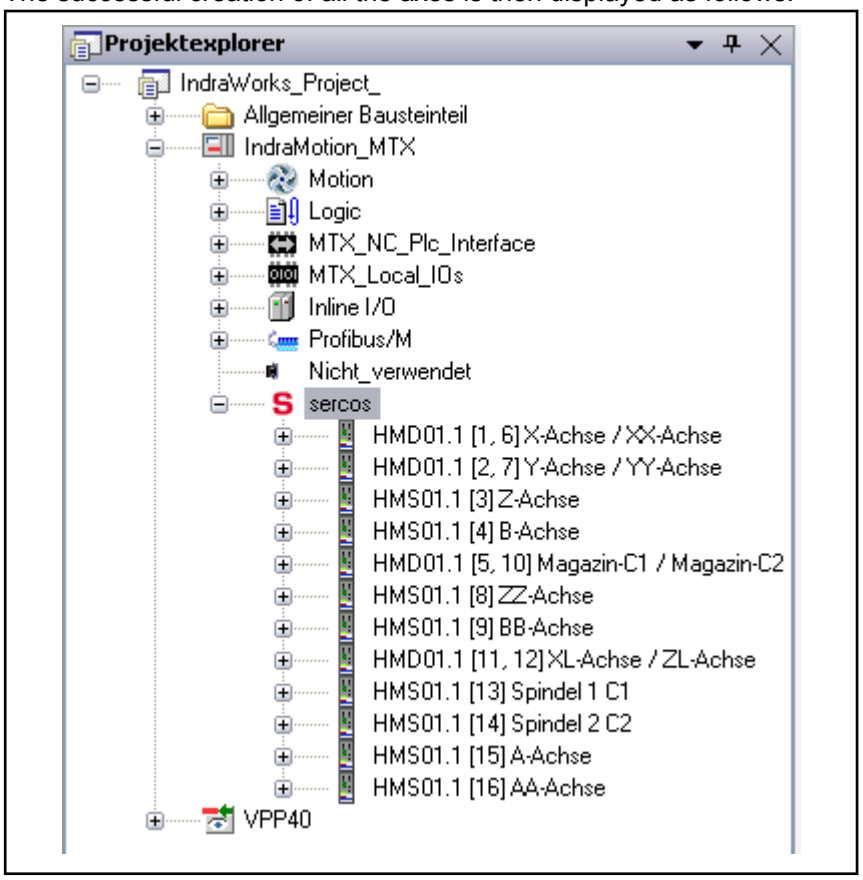


Fig. 5-190: Displaying drives

The data structure in Engineering Desktop must be supplemented so that you can access the parameters of the drive. This is required when changing or archiving the drive parameters.

All the drives that have been created in the Configurator should also be created in the IndraWorks data structure.

		Documentation
Documentation:	IndraWorks Commissioning	Axis commissioning

General axis commissioning

Handling instruction: Traversing the axis with control

After the axis has been configured, traverse it with the control. Before the axis is moved in Automatic mode, various basic settings should be checked.

IW-Operation/operating mode "Jogging": Manual traversing of the axis

1. Check the traveling direction and the display
2. Homing
3. Set the zero point of the axis
4. Determine and set the zero point on the machine (in the case of absolute encoders)

☞ The override potentiometer should be set to a low value before starting the axis so that dangerous situations cannot occur.

IW-Operation/operating mode "Automatic": Move axis with test program

1. Create a test program for the axis (if desired, adapt/use the delivered test program)
2. Start the test program and test the axis
3. Circularity test

☞ Before the drive is operated in "Automatic" mode, "MDI" mode can be used to selectively start an NC block.

IW Engineering/Sercos: Optimizing the drives

Optimize the drive with IW-Drive

☞ A final optimization of the drives should be carried out by trained personnel.

Control commissioning

Overall procedure

In general, the steps shown in the following diagram are required to add NC axes to an existing control configuration.

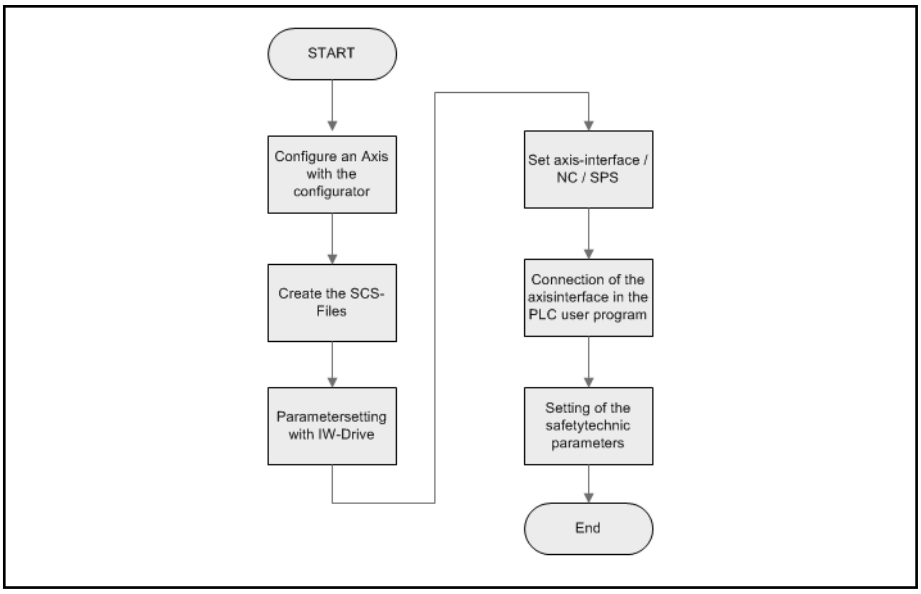


Fig. 5-191: Axis commissioning procedure

Control-side machine parameters

General information

Channels/axes must be created for a new project and a project extension. When the channel/axis structure is created, the parameters of the channels/axes are specified and default values are set. An axis or a channel can only be displayed or configured if a parameter set exists. Proceed as follows to configure channels/axes:

1. Open the editor for parameter configuration

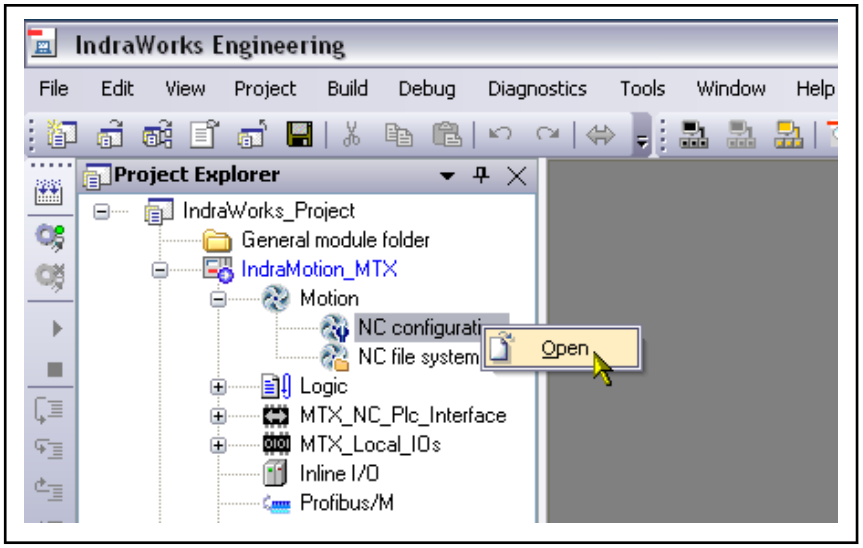
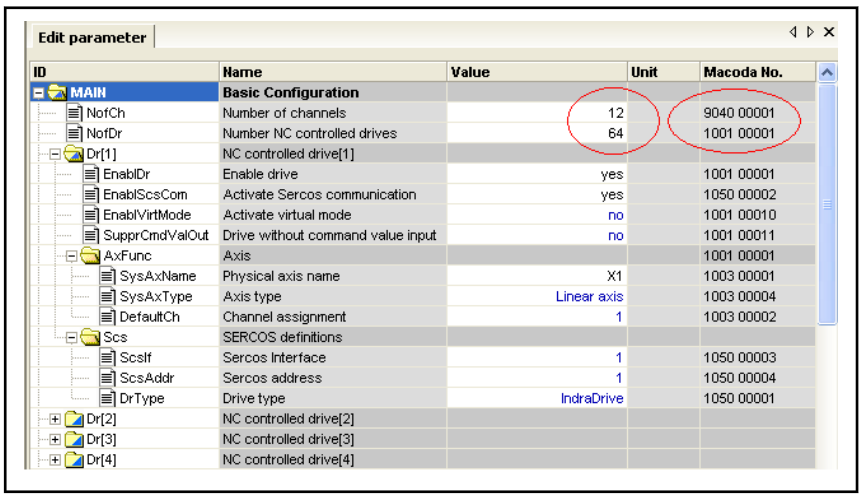


Fig. 5-192: Opening the configurator

2. Create channel/axis structure

   No channels exist in a newly created IndraWorks project. Configure the channel before configuring the axis parameters.



ID	Name	Value	Unit	Macoda No.
MAIN	Basic Configuration			
NofCh	Number of channels	12		9040 00001
NofDr	Number NC controlled drives	64		1001 00001
Dr[1]	NC controlled drive[1]			
EnablDr	Enable drive	yes		1001 00001
EnablScsCom	Activate Sercos communication	yes		1050 00002
EnablVirtMode	Activate virtual mode	no		1001 00010
SupprCmdValOut	Drive without command value input	no		1001 00011
AxFunc	Axis			1001 00001
SysAxName	Physical axis name	X1		1003 00001
SysAxType	Axis type	Linear axis		1003 00004
DefaultCh	Channel assignment	1		1003 00002
Scs	SERCOS definitions			
ScsIf	Sercos Interface	1		1050 00003
ScsAddr	Sercos address	1		1050 00004
DrType	Drive type	IndraDrive		1050 00001
Dr[2]	NC controlled drive[2]			
Dr[3]	NC controlled drive[3]			
Dr[4]	NC controlled drive[4]			

Fig. 5-193: Setting the number of channels and axes

3. To set the number of channels/axes, modify the entry accordingly (see fig. 5-193 " Setting the number of channels and axes" on page 333). The channels and axes are automatically created by the system.
4. Add channel parameter structure
5. Press the right mouse button on the "CHAN" node and a menu opens. In this menu, a channel can be created/added under "New".

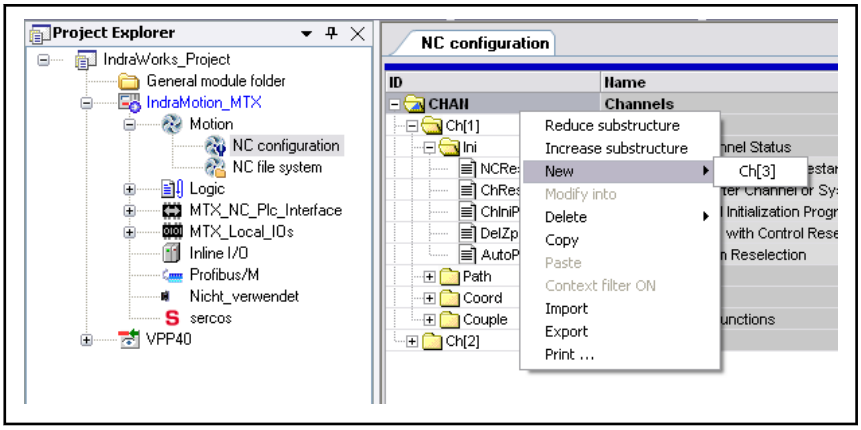


Fig. 5-194: Creating a channel structure

6. Add axis parameter structure

   If channels exist, axes can be created below the "MAIN" node. This is accomplished by clicking on the "MAIN" node with the right mouse button. During the axis selection, ensure that the correct axis type is configured. The following axis types are available in the menu:

   - AxFunc[i] for linear and rotary axes (i =<system drive no.>)
   - SpFunc[i] for spindle (i = <system drive no.>)
   - AxFunc/SpFunc[i] for spindles/C-axes (i = <system drive no.>)

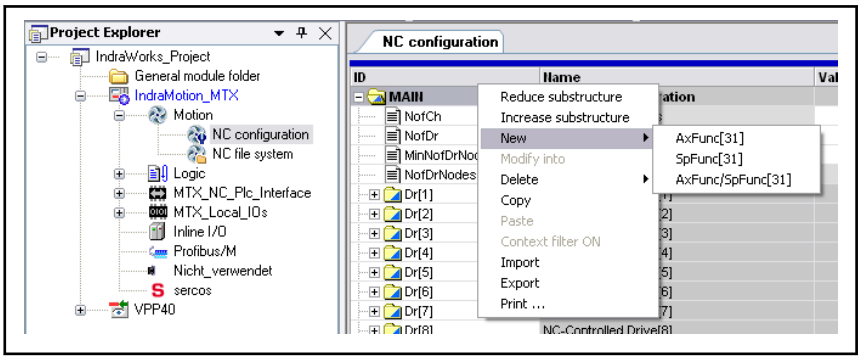


Fig. 5-195: Creating an axis parameter structure

7. Change in parameters are indicated via a change of the symbol at the "NC Configuration" node. Depending on the parameter to be changed, either a reset or a control restart is to be executed before they are applied. The tooltip at the "NC Configuration" node indicates the necessary. When completing the NC configurator, it is possible to execute the corresponding function immediately via a dialog.

Handling instruction: Creating a channel/axis

Add a drive to the created/restored project. The general operation of IndraWorks is described in the manual "Bosch Rexroth IndraMotion MTX IndraWorks".

IW-Engineering/Configuration: Create a channel/axis

1. Creating a Channel
2. Create an axis/spindle

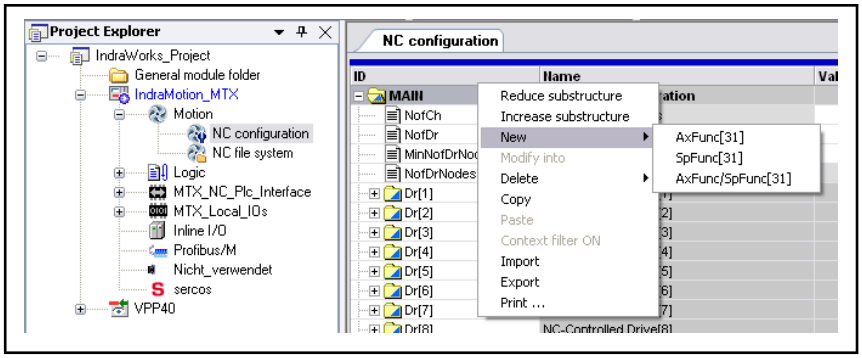


Fig. 5-196: Creating a channel/axis

☞ An axis can only be created if a channel was created before.

		Documentation
Documentation:	IndraWorks Engineering	Working with Projects and Devices

Handling instruction: Configuring the axis parameters

The relevant axis parameters for the relevant machine data are checked or the recorded value is entered.

1. Set the NC parameters according to the machine data.
2. Check and, if necessary, modify the axis parameters and Sercos parameters.

☞ No double addresses must be assigned to the parameter [Addr]. The addresses must be identical to the physical drive addresses.

Default settings can be retained.

3. Restart the control after the parameters have been checked.

IW-Engineering/configuration: Editing parameters

1. Open the configuration tool to edit the parameters
2. Check/edit the following parameters:
   - **SysAxType** "Axis type" (1003 00004)
   - **SysAxName** "Physical axis name" (1003 00001)
   - **TravLim(1)/TravLim(2)** "Traversing distances"
   - **MaxVel** "Maximum velocity" (1005 00002)
   - **MaxAcc** "Maximum acceleration" (1010 00001)
3. Edit the parameters for Sercos master communication
4. Edit axis/spindle parameters

Control commissioning

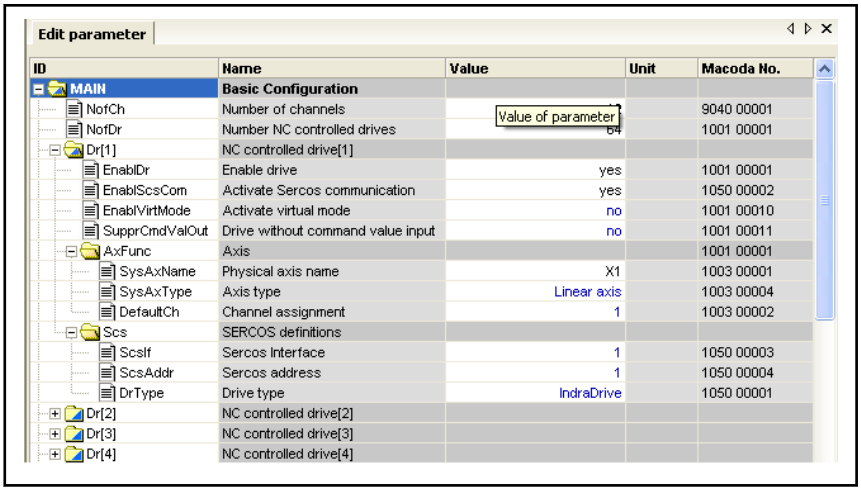


Fig. 5-197: Configurator for axis parameters (AX)

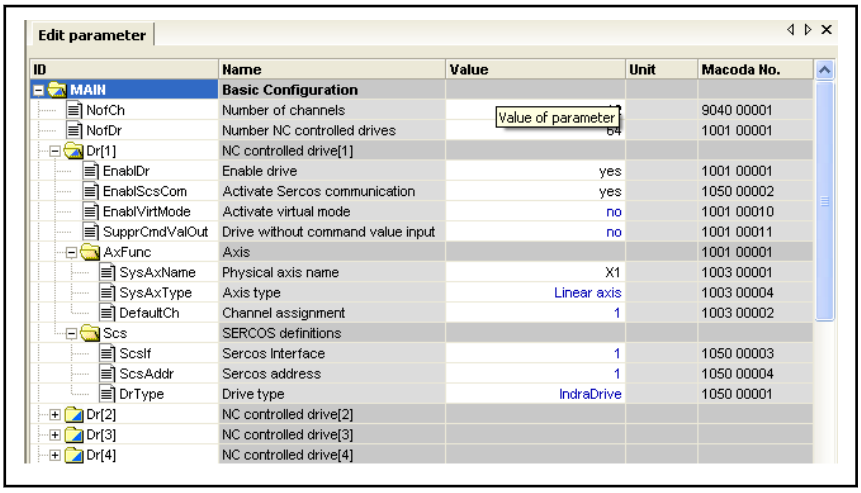


Fig. 5-198: Configurator for spindle parameters (SP)

To avoid dangerous situations, check all parameters for correctness.

		Documentation
Documentation:	MTX Configuration	NC Configurator

IW-Engineering/configuration: Applying Parameters

Restart the NC to transfer the modified NC parameters.

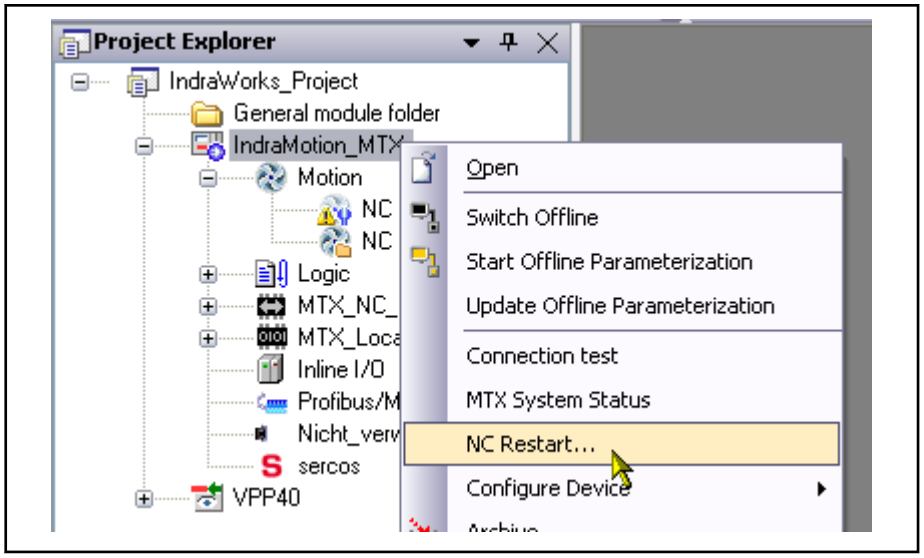


Fig. 5-199: NC restart

When using the NC emulation:

Exit EMU with a value of 14 and restart.

		Documentation
Documentation:	MTX Configuration	Editing machine parameters

SCS handling

General information

The NC provides a number of functions which significantly simplify handling with the connected Sercos drives:

- Sercos initialization for all connected Sercos drives during control start-up
- Automatic parameter download for all connected Sercos drives during control startup
- Program-controlled read-only access to the Sercos parameters of all connected drives using CPL commands SCS (..) and SCSL (..)
- Program-controlled write access to the Sercos parameters of all connected drives using "WriteId" (WID)
- *Selectable debug functions can be used to log the following functions when starting up the NC:*
  - The Sercos parameters transmitted in the phases 2 and 3
  - The Sercos timing in phase 3

Detailed information on these CPL commands can be found in the "IndraMotion MTX Programming Manual".

Sercos initialization

The tasks of the Sercos initialization of the NC are as follows:

- Closing all Sercos rings. Thus, it is checked whether the Sercos transfer lines are OK

- Structure of the Sercos timing and the communication channels to the connected drives
- Starting up the phases of all Sercos drives up to phase 4 (cyclic operation is enabled)

☞ The Sercos initialization can be executed either with or without automatic parameter download in the drive.

Relevant configuration parameters:

SpInd		(1001 00001)
ENAVirtMode		(1001 00010)
SysAxName	"Physical axis name"	(1003 00001)
DefaultCh	"Channel assignment"	(1003 00002)
SysAxType	"Axis type"	(1003 00004)
DrType	"Drive type"	(1050 00001)
ENAScsCom	"Enable drive in the ring"	(1050 00002)
ScsIf	"Number of the Sercos ring"	(1050 00003)
ScsAddr	"Sercos address"	(1050 00004)
KindAutoTime[1)]	"Type of automatic transmission time calculation"	(1050 00010)
TransTime (see footer 1)	"Transmission time of the drive telegrams"	(1050 00011)
TransTimeMdt (see footer 1)	"Transmission point in time of master data telegrams"	(1050 00012)
EnableTestMode	"Enabling test mode"	(1050 00020)
ScsTimeOut	"Time monitoring for Sercos startup"	(1050 00021)
ModeScsFiles	"Download Sercos data in phase 3"	(1050 00022)
OpticTransPow (see footer 1)	"Optical transmission power stage"	(1050 00031)
ScsBaudRate (see footer 1)	"Sercos transmission rate"	(1050 00032)
ScsCycTime	"Sercos cycle time"	(9030 00001)

Configuring SCS files

Starting parameterization and initialization:

- Switch off the power supply to the drives!
- The listed parameters must be adapted to the application.

  The "Automatic Calculation of Transmission Time" (1050 00010) function is used to simplify the Sercos commissioning.

  If "Automatic Calculation of Transmission Time" is enabled, the following applies:

  – At startup, the NC automatically calculates the Sercos transmission points in time T1 to T4 from the telegram lengths (AT, MDT) and from the drive protection times (T1min, TATMT, TMTSG, T4min)

1) This parameter is not supported anymore

Abbreviation	Designation
AT	Drive telegram
MDT	Master data telegram
TATMT	
TMTSG	

- The following do not apply anymore:

  TransTime

  "Transmission Point in Time of Drive Telegrams" (1050 00011)

  TransTimeMdt

  "Transmission Point in Time of Master Data Telegrams" (1050 00012)
- The configured Sercos addresses must be identical to the Sercos addresses set on the drives. To do this, refer to the documentation on the drives.
- Trigger control reset

When parameter downloading is active, the current drive parameters are overwritten by parameter values in the Sercos files of the NC. If the Sercos files are not adapted, unintended drive reactions or dangerous machine states can result.

Thus, disable the automatic parameter download for all drives for which there are presently no adapted Sercos files in the NC.

- After the control startup, check the Sercos phase of the drives on the drive itself. Ideally, the drives should display phase "4".

  If phase "4" is not displayed, the following has to be considered:

  – Drive displays phase "0":

    The NC cannot close the ring (the transmitted MST does not return to the NC). Verify if all Sercos devices in the ring are active and if the Sercos connections are installed correctly.

  – Drive displays phase "1":

    The NC cannot find a specified drive. Check whether all Sercos addresses parameterized in the NC correspond to those of the drives.

  – Drive displays phase "2":

    The NC was not able to establish a communication channel or a correct timing to the drive, or the drive could not be switched to phase "3" due to a parameterization problem. Check the drive parameterization (if an automatic parameter download is activated, check the respective Sercos file for phase 2 in the NC. If applicable, activate the logging function for transmitted Sercos parameters, see chapter "Logging transmitted Sercos parameters" on page 343).

  – Drive displays phase "3":

    The drive could not be switched to phase 4 due to a parameterization or timing problem. Check the drive parameterization (if automatic parameter download is activated, check the respective Sercos file for phase 3 in the NC. If applicable, activate the logging function for transmitted Sercos parameters, see chapter "Logging transmitted Sercos parameters" on page 343).

☞ If the parameters of drives are not set correctly, the power supply must remain switched off.

Creating Sercos files (SCS files)

Automatic parameter downloading is always activated (by default) in the IndraMotion MTX NC control. If the parameter download is active, the NC can completely parameterize connected drives at startup. Prerequisite: Correctly adjusted Sercos files (*.scs) in the NC. Sercos files are saved in ASCII format.

From version MTX 14V12, creating an scs file for the drive type "IndraDrive, HNC100-3X" (DrType, 1050 00001) is not required. The control determines all Sercos scs parameters (usually contained in the scs files) automatically, using configuration parameters and a new machine parameter group "Sercos Parameter (SCSP)" and transmits the determined Sercos parameters to the drive. Scs files can still be used. All Sercos parameter assignments in the scs files overwrite the automatically generated Sercos parameters.

The two files "load_ph2.scs" and "load_ph3.scs" are significant for the parameter download. Specify in these files which Sercos files are transmitted to which drives via the "use..." command.

The following files are used for transmission:

- File "load_ph2.scs" in phase 2
- File "load_ph2.scs" in phase 3

Syntax of the "use" command:

use <FileName> **for** (<Number>[,<Number>])

- use

  Download command

  – If the command is in "load_ph2.scs", the content of <FileName> is sent in phase 2

  – If the command is in "load_ph3.scs", the content of <FileName> is sent in phase 3

- <FileName>

  Sercos file whose content is to be transmitted to the drive <Number>

- <Number>

  System drive index (if <File name>If is to be transmitted to several drives, separate the individual numbers by commas)

Example:

Excerpt from the file "load_ph2.scs"

use p2ilin00.scs for (1,2,3) ; Parameter file for linear axis

use p2ilin01.scs for (4,9) ; Parameter file for a linear axis with an external encoder

☞ The parameter **ModeScsFiles** "Download Sercos Data in Phase 3" (1050 00022) specifies the behavior of the NC for all Sercos files entered in "load_ph3.scs". If hiding is permitted, the files are sent to the corresponding drive only when required.

All files which can be used for the automatic download in "load_ph2.scs" and "load_ph3.scs" via the "use" command can include:

- comment lines
- Lines for drive parameterization

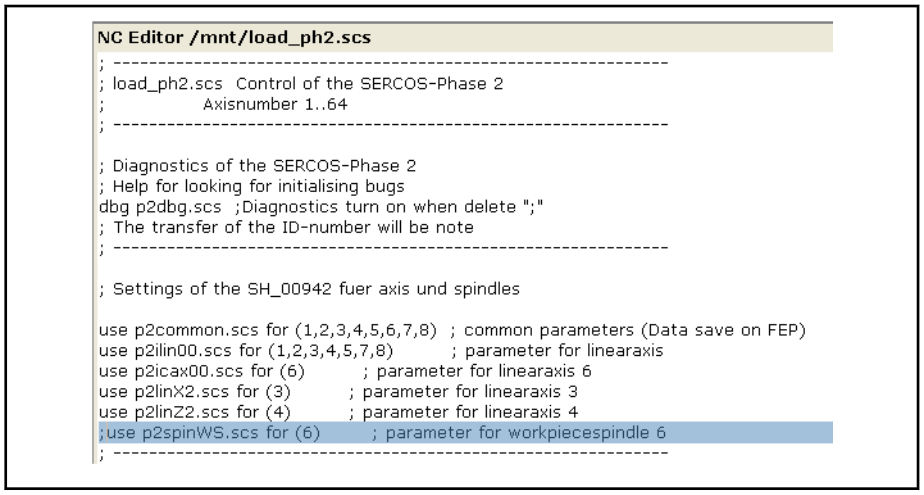


Fig. 5-200: Example of a Sercos file

Comment lines **always** start with a semicolon (;). The NC interprets all characters from the semicolon up to the end of the line as comment. Comments are not transferred to the drives. They are used to improve structure and clarity.

Lines for the drive parameterization are structured as follows:

<ID number > = <Value> [; <CommentText >]

The following applies:

- <ID number>:

  Sercos parameter in the format S-x-xxxx.x.x or P-x-xxxx.x.x (S- and P-parameters). Refer to the drive documentation for available Sercos parameters

- <Value>:

  Parameter value in the following formats:

  Decimal: e.g. 500

  Binary: e.g. 0b ...

  String: e.g. "Text"

  Parameter list: e.g. (S-0-0047, S-0-0189)

- <CommentText>:

  Comment; has to be separated from<Value> by at least one space and one semicolon

Example:

;This is a comment line (comment)

S-0-0121 = 1 ;Input revolutions (parameter with com.)

S-0-0122 = 1 (decimal value)

S-0-0032 = 0b0011 (binary value)

S-0-0142 = "Application block" (string)

S-0-0016 = (S-0-0051, S-0-0189) (ID list)

If **all** adapted Sercos files (*.scs) required for your application are already available, copy all relevant Sercos files into the "root directory" ("/") of the NC

(for the directory structure, see the "IndraWorks" documentation). To enable or disable, proceed as described in the following sections.

If **no** Sercos files (*.scs) have been generated for your application, create new files in the "root directory" ("/") of the NC by means of the editor, or copy the example files enclosed in the delivery into the "root directory" ("/") and adapt them to your requirements (see Handling Instruction). The example files are located in the directory "//root/usrfep/".

Activating:

1. Remove the character ";" in the files "load_ph2.scs" and/or "load_ph3.scs" to the left of the relevant "use" commands.

   As a result, the NC will no longer interpret these lines as comment lines but as download commands the next time it is started.

2. Save the modified file(s)
3. Create a backup copy of the file(s)

Example:

Automatic download (in phase 2) of the files

- "p2linall.scs" in the drives with the system drive numbers 1, 2 and 4
- "p2lin3.scs" in the drive with the system drive number 3

Excerpt from the file "load_ph2.scs"

```
;
use p2linall.scs for (1,2,4)
use p2lin3.scs for (3)
;
```

Disabling:

1. Set the character ";" in the files "load_ph2.scs" and/or "load_ph3.scs" to the left of the relevant "use" commands.

   As a result, the NC will no longer interpret these lines as download commands, but as comment lines the next time that it is started.

2. Save the modified file(s)
3. Create a backup copy of the file(s)

Example:

Automatic downloading is to be deactivated for both files from the example shown above:

Excerpt from the file "load_ph2.scs"

```
;
;use p2linall.scs for (1,2,4)
;use p2lin3.scs for (3)
;
```

☞ If backup copies of all relevant Sercos files exist in the "user FEPROM" ("/usrfep"), it is not sufficient to merely delete or rename the relevant Sercos files in the "root directory" ("root") to deactivate automatic parameter downloading. The NC also searches for these files in the "user FEPROM (usrfep)" if it cannot find them in the "root" directory.

Logging transmitted Sercos parameters

All Sercos parameters transmitted in phase 2 or phase 3 can be logged for diagnostic purposes. Program the "dgb" command in the "load_ph2.scs" file (for phase 2) or in the "load_ph3.scs" file (for phase 3).

Prerequisite:

The "dbg" command has to be programmed prior to the first "use" command.

Syntax of the "dbg" command:

dbg <FileName>

- dbg

  "Create log" command

  – If the command is in "load_ph2.scs", the logging function is activated in phase 2

  – If the command is in "load_ph3.scs", the logging function is activated in phase 3

- <FileName>

  Name of the file which is to be in the log

Activating:

1. The function can be activated by removing the character ";" to the left of the "dbg" command in the file "load_ph2.scs" or "load_ph3.scs".

   As a result, the NC will no longer interpret the line as a comment line, but as a command to log the Sercos parameters the next time that it is started.

2. The file has to be saved when exiting the editor.

Disabling:

1. The function can be deactivated by setting the character ";" to the left of the "dbg" command in the file "load_ph2.scs" or "load_ph3.scs".

   Thus, the NC will interpret the line as a comment line the next time that the control starts up.

2. The file has to be saved when exiting the editor.

☞ The diagnostic function is already in the Sercos files delivered by Bosch Rexroth.

Logging Sercos timing

For diagnostic purposes, the NC can log the Sercos timing starting from phase 3. To do so, program the "opt" command in the "loadph3.scs" file.

Prerequisite:

The "opt" command has to be programmed after the last "use" command.

"opt" command syntax:

opt -m <FileName>

- opt -m

  "Logging of Sercos timing" command
- <FileName>

  Name of the file which is to be in the timing log

☞ This function should only be used during commissioning!

Activating:

1. The function can be activated by removing the character ";" to the left of the "opt" command in the file "load_ph3.scs".

   As a result, the NC will no longer interpret the line as a comment line, but as a command to log the Sercos timings the next time that it starts up.

2. The file has to be saved when exiting the editor.

Disabling:

1. The function can be deactivated by setting the character ";" to the left of the "opt" command in the file "load_ph3.scs".

   Thus, the NC will interpret the line as a comment line the next time that the control starts up.

2. The file has to be saved when exiting the editor.

Handling instruction: Creating SCS file

IW-Engineering/file system: Adapt SCS files

1. Select root directory

   Required SCS files (templates under root/feprom/scsindra/...):

   - load_ph2.scs
   - load_ph3.scs
   - p2common.scs
   - p2xxxx000.scs – This file can have another name, depending on the drive.
2. Copy file "p2xxx000.scs" as many times as there are drives in the ring and name them according to the names of the drives.

   Identical drive types can be addressed using one SCS file:

   - lin ;for linear axis
   - rot ;for rotary axis
   - spin ;for spindle
   - cax ;for the C-axis (spindle with rotary axis functions)
3. Double-click on the SCS files to open and adapt them

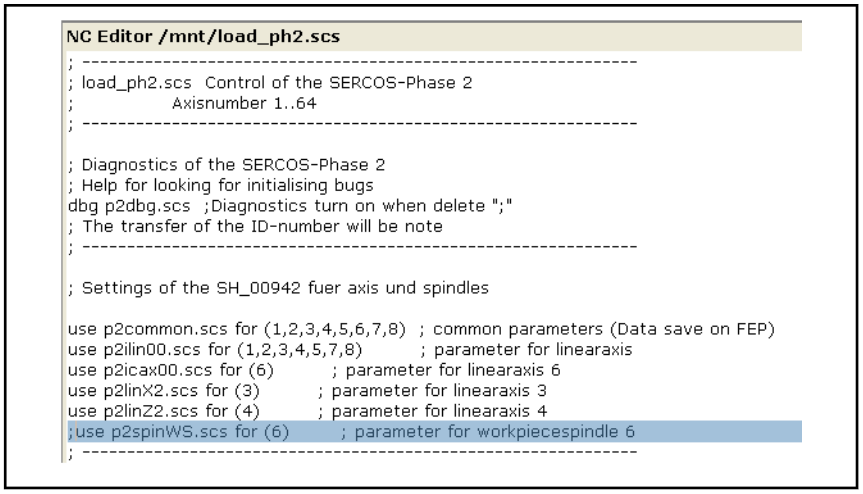


Fig. 5-201: Example of a Sercos file

☞ The SCS templates (files) are stored in the root directory of the control.

The file "load_ph3.scs" primarily consists of remarks; only one log file is activated with the entry "dbg p3dpg.scs". This diagnostic file logs the data transfer to the drive. This diagnostic file can also be activated in the SCS file "load_ph2.scs".

If it is stored elsewhere in the file structure of the control, ensure that the data is not accidentally overwritten in another location.

Handling instruction: Activate an NC restart

After the SCS files have been successfully configured, an NC restart must be activated so that the control can read the current SCS files and start up the drives.

IW Engineering/Configuration: Activate an NC restart

Activate an NC restart

☞ Only after the NC control is restarted, the modified data (parameters, SCS files) is applied.

PLC commissioning

Activating axes/spindles in PLC user program

General information

The required connection of the inputs and outputs on the axis and the channel interface and the creation of the axis and channel interface are described in this handling instruction.

Handling instruction: Creating a channel/axis/spindle interface

This handling instruction describes the creation of a channel/axis/spindle interface in IndraLogic.

IW Engineering/IndraLogic: Creating a channel interface

This handling instruction describes how the user can create and connect a channel interface.

		Instruction
Instruction:	PLC data configuration	Channel interface

IW Engineering/IndraLogic: Creating an axis interface

This handling instruction describes how the user can create and connect an axis interface.

		Instruction
Instruction:	PLC data configuration	Axis interface

IW Engineering/IndraLogic: Creating a spindle interface

This handling instruction describes how the user can create and connect a spindle interface.

		Instruction
Instruction:	PLC data configuration	Spindle interface

Offline parameterization

There is the option to parameterize the drive parameters offline instead of parameterizing them online. Therefore, the control has to be switched to offline parameterization.

The offline parameterization is only relevant for drive data. Control data cannot be parameterized offline.

Prerequisites:

To use the offline parameterization, offline data has to be generated first.

That can be carried out as follows (MTX is online):

- Call the function **Update Offline Parameters** at the MTX node
- Call the function **Adjust offline data** at the drive node
- Going offline with the MTX

  When going offline with the MTX, the data of all drives online at this point in time are compared with each other. This function depends on the setting in the "Options" dialog (see fig. 5-202 "Options dialog: Offline parameterization of the MTX" on page 347).

Data adjustment

When going online with the drive, all possibly existing offline data is compared to the data in the drive. Differences are displayed and can be applied in the drive or in the offline parameterization. This behavior can be disabled in the **Options** dialog (see fig. 5-202 "Options dialog: Offline parameterization of the MTX" on page 347).

Options

To set up the offline parameterization, there are two settings in the **Options**(**Tools ▸ Options**).

Checks can be switched off when going online/offline.

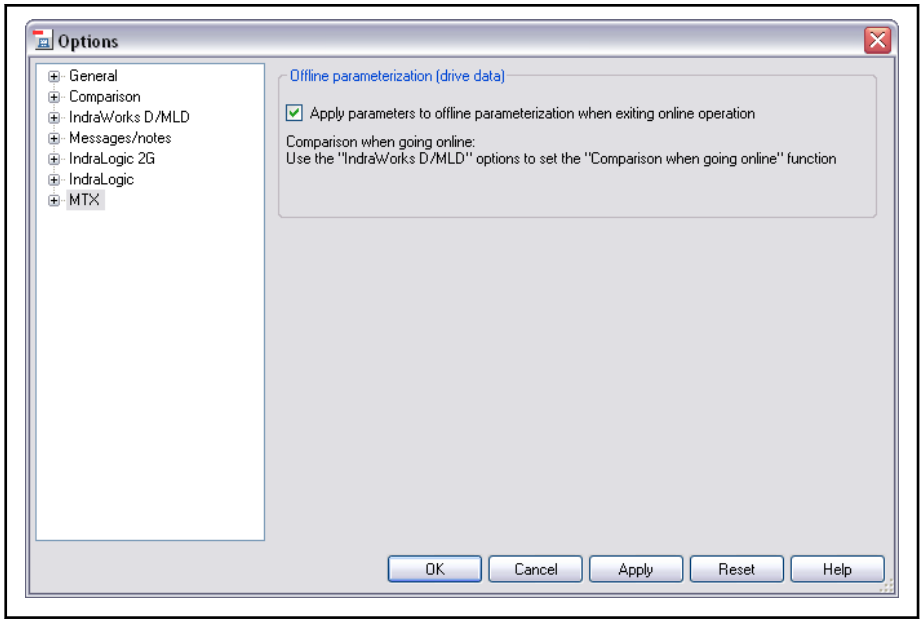


Fig. 5-202: "Options" dialog: Offline parameterization of the MTX

Using the offline parameterization

First, the control has to be switched to offline parameterization.

The individual drives can also be switched to offline parameterization via mouse click or via the function **Drive communication online/offline**. The drive data can also be archived.

Other options of the offline parameterization of a drive are described more in detail in the drive documentation.

Sercos fast startup

Use the fast startup function to avoid the transfer of Sercos parameters that already have the correct parameter value in the drive.

Thus, the Sercos startup is accelerated in case of an unmodified system configuration.

The function calculates the checksum of the entire system configuration and saves this checksum as system date. Upon the control startup, the new checksum is calculated and compared to the saved checksum.

Configure and activate Sercos fast startup

The "s3_faststartup_list.scs" file contains all Sercos parameters that are not transferred during a fast startup. All Sercos parameters in scs files contained in S-0-0192 (IDN list of operating data to be backed up) can be included in "s3_faststartup_list.scs". An example file can be found in the "/root/feprom/scsindra" control directory. By copying the "s3_faststartup_list.scs" file to the root or user feprom, the fast startup function is activated.

The following system settings are taken into consideration when generating the checksum:

- System configuration (MACODA)
- Sercos parameters (SCSP)
- Sercos scs files
- Per drive, checksum of operating data (S-0-0531) to be backed up

The current checksum is saved in the "SysSercCfgInfo.SercConfigChecksum" system date.

5.12.2 Sercos device failure

Sercos ring behavior in case of Sercos device failure

From MTX version 13V06, the Sercos ring behavior in case of Sercos device failure changed.

The Sercos device failure does not necessarily result in a complete Sercos communication cancellation. After a Sercos device failure or a failure of parts of the Sercos ring, communication with all other Sercos devices that can physically still be reached is maintained.

Possible causes of failure:

- Sercos device switch off
- Disconnecting a Sercos connection line
- Failure in Sercos device

The user can display the remaining Sercos devices in the IndraWorks Operation screen "Sercos diagnostics".

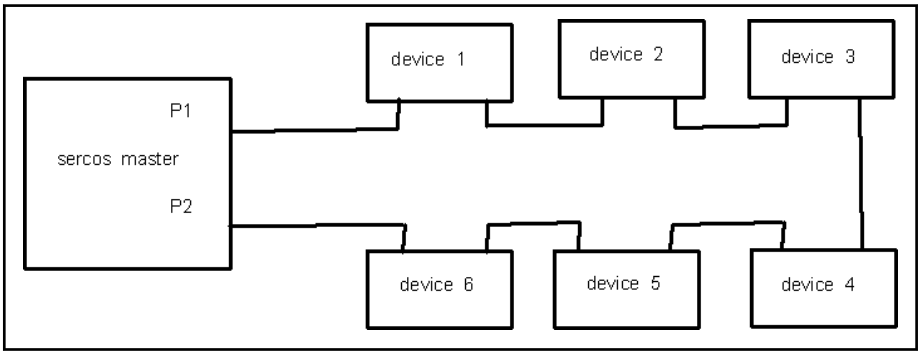


Fig. 5-203: Sercos ring in "ring topology"

In the figure above, a Sercos ring with 6 Sercos devices is shown. The Sercos ring is connected to the master ports P1 and P2 ("ring topologies"). The Sercos data is redundantly sent from both master ports and also received at both master ports.

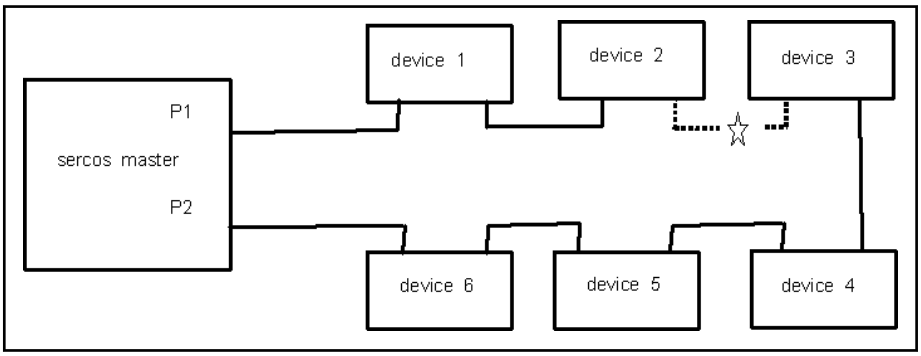


Fig. 5-204: Sercos ring with interruption

In the figure above, the Sercos connection between Sercos device 2 and Sercos device 3 is interrupted. The redundant communication ("ring topology" is changed to "line topology") is lost but the Sercos master can still communicate with all Sercos devices.

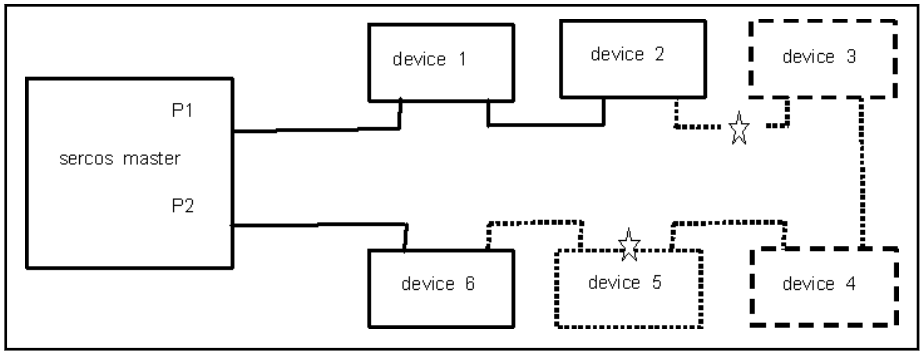


Fig. 5-205: Figure 3, Sercos device failure

In figure 3, the connection line of the Sercos devices 5 fails, e.g. due to a failure of the 24V supply. Now, the Sercos devices 3,4 and 5 cannot be contacted anymore. The Sercos ring still remains in Sercos phase CP4.

Error reaction

The Sercos device failure results in an error message and an error reaction. The error reaction in the MTX depends on the device type. The failed Sercos device executes the parameterized error reaction or the error reaction specified by the manufacturer in case the communication is interrupted.

A question mark is displayed in the control display if not all Sercos devices can be contacted.

MTX display: "P 4 RUN" --> "P 4? RUN"

Error reaction in MTX in case of Sercos drive failure

The corresponding NC channel or the running NC program is set to standstill by decelerating all NC channel axes.

Error reaction in MTX in case of Sercos I/O device failure

The input data of the Sercos I/O device received at the PLC interface are reset.

Deleting the Sercos communication error

A failed Sercos device can report back independently as soon as the cause of failure has been removed. The control resumes the communication to the reporting Sercos device after a single device startup phase after CP4 (hotplug).

The single device start-up after CP4 is only possible for Sercos devices supporting hotplug.

Sercos drives that have been included in the Sercos ring again can only be traversed after a reset and after the Sercos communication error has been deleted. Sercos I/O devices do not require deleting of errors.

Startup of the Sercos ring despite missing Sercos devices

If not all parameterized Sercos devices report back during the activation phase of the control after a waiting time of several minutes, the Sercos ring is still runs up to CP4. Handle missing Sercos devices like failed Sercos devices.

The missing Sercos devices can report back via hotplug if the Sercos configuration is saved in the control. The Sercos configuration is saved after a successfully completed Sercos CP4 startup with all parameterized Sercos devices.

5.12.3 Drive-integrated Safety Engineering

Basic method of functioning

The commissioning of the integrated safety engineering is briefly described in this chapter. An extensive explanation, with additional sample applications, can be found in the documentation **"Rexroth IndraDrive Integrated Safety Technology According to IEC 61508"** (part no. R911327664).

Description

With regard to the use of safety engineering, it is distinguished between:

- **normal mode** and
- **Special mode**

In the special mode, the following is possible:

- **Special mode with standstill ("Safe standstill")**
- **A special mode with motion ("Safe motion")**

"Safe Stop 1" or "Safe Stop 2" can be configured for special mode with standstill.

Regardless of whether the operation is normal or special, "Safe Stop 1 (EMERGENCY STOP)" can also be used as Safe stop:

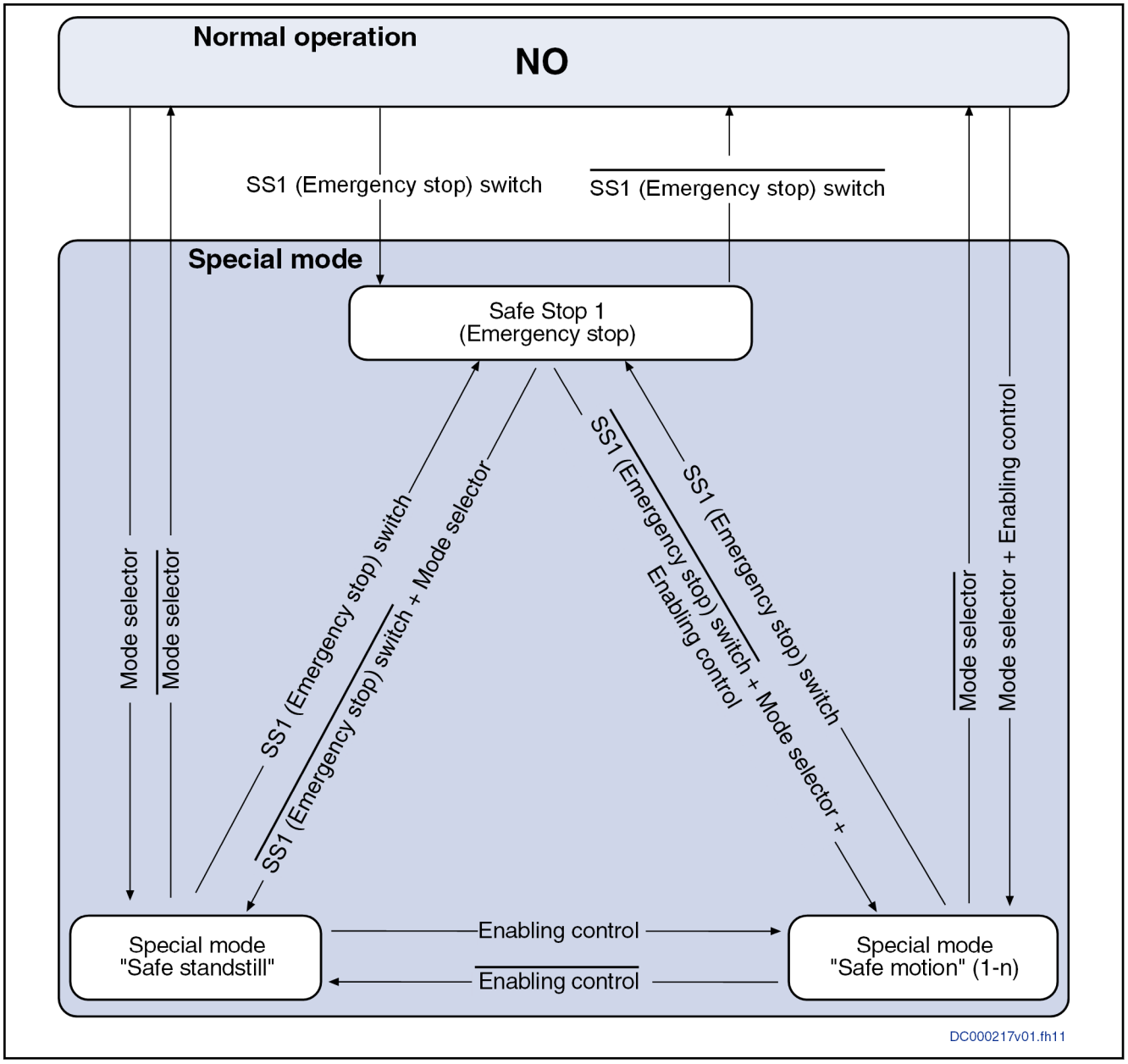


Fig. 5-206: Safety engineering operation modes

Overview of the operating modes

"Safe standstill" Safety functions

Safe Stop 1

"Safe Stop 1" corresponds to stop category 1 according to EN 60204-1.

The drive cannot generate torque/force and thus cannot generate dangerous movements. No monitorings are active in "Safe Stop 1".

When the drive lock is active, "SS1" is shown on the display of the Rexroth IndraDrive control device.

Safe Stop 2

"Safe Stop 2" corresponds to stop category 2 according to EN 60204-1.

In safety function "Safe Stop 2", a dual-channel monitor prevents the drive from carrying out dangerous movements due to errors.

When the drive lock is active, "SS2" is shown on the display of the Rexroth IndraDrive control device.

Control commissioning

Safe Stop 1 (EMERGENCY STOP)

"Safe Stop 1 (EMERGENCY STOP)" corresponds to stop category 1 according to EN 60204-1.

The safety function "Safe Stop 1 (EMERGENCY STOP)" corresponds to the safety function "Safe Stop 1" but it is canceled by actuating an enabling device.

When the drive lock is active, "SS1 ES" is shown on the display of the Rexroth IndraDrive control device.

This is used, for example, in spindle drives to exchange tools manually and to handle axes for movements by hand.

"Safe motion" Safety functions

Safely limited velocity

In the safety function "Safely limited velocity", a dual-channel monitor prevents the drive from exceeding the specified velocity limit values (P-0-3244, P-0-3254, P-0-3264, P-0-3274).

When the movement lock is active, "SMM" is shown on the display of the Rexroth IndraDrive control device.

A motion is enabled using an enabling device (ED). The actuation time of the enabling device is monitored.

For more safety functions, refer to documentation "Rexroth IndraDrive Integrated Safety Technology According to IEC 61508" (part no. R911327664).

In special mode "Safe Motion", the operation between Motion 1 and Motion 2 can be switched using the SI switch 1 (S1).

Example: Installation and PLC Interface

Application structure

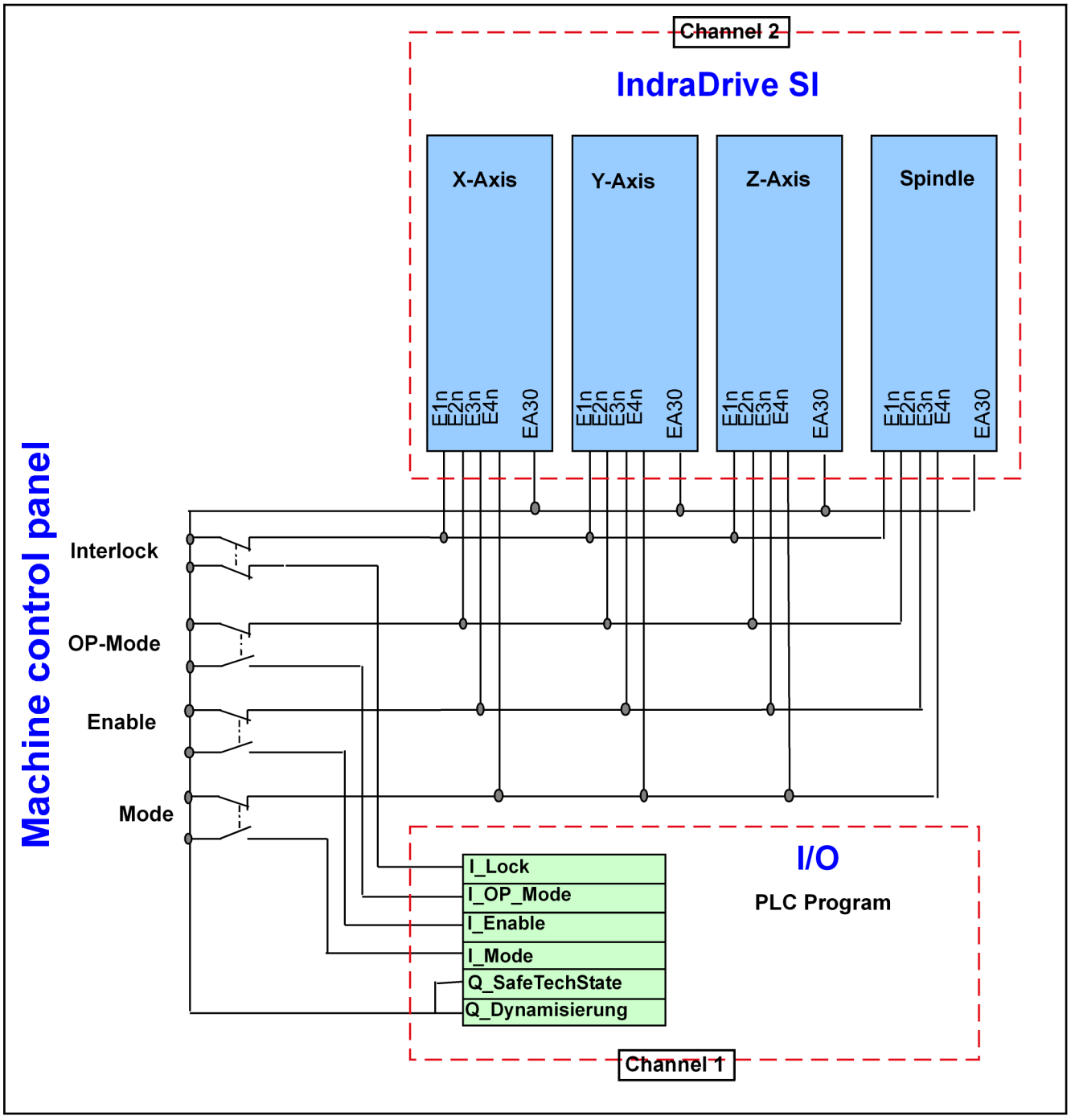


Fig. 5-207: Wiring

Example The safe 2-channel activation of the safety engineering occurs in channel 1 using a standard input of the PLC I/O level and in channel 2 directly by the safety module of the drive control devices (see previous figure).

Since the safety functions should be applied for all axes and spindles simultaneously, the input signals of all control devices (signals of safety module channel 2) are to be cross-connected.

For channel 1 (PLC I/O level), the safety signals can be passed on in the PLC user program. Therefore, a total of only one input per input signal is required for all the axes.

Due to the dynamization of the signals that is required for safety engineering, all sensors for activating the safety functions are to be supplied using dynamization signal "Q_Dynamization".

The signal that is required for this purpose is to be generated in the PLC user program and provided for all drives via I/O30.

When the dynamization signal is generated, observe the dynamization limit values parameterized in the IndraWorks Drive (period duration and pulse duration) under consideration of the runtimes in the PLC and peripherals. If the values are exceeded, the drives are switched off and an error is issued.

☞ It is recommended that dynamization be executed as "isolated dynamization". As a result, the dynamization pulse can be set to 50 ms, which shortens the reaction times.

PLC program part

Assign the signals as follows in the PLC user program:

Safety-oriented machine function	Short	I/O signal
Safe Stop 1 (EMERGENCY STOP)	SS1 ES	qAX_SafDrvLock
Special mode (for open safety equipment)	BA	qAx_SafOpModeSwitch
Acknowledgement key (for movement when safety equipment is open)	CK	qAx_SafEnablCtrl
Switching to safe movement	S1	qAx_SafSwitch1
Dynamization	DYN	qAx_SafTecState

Tab. 5-55: Interface signals

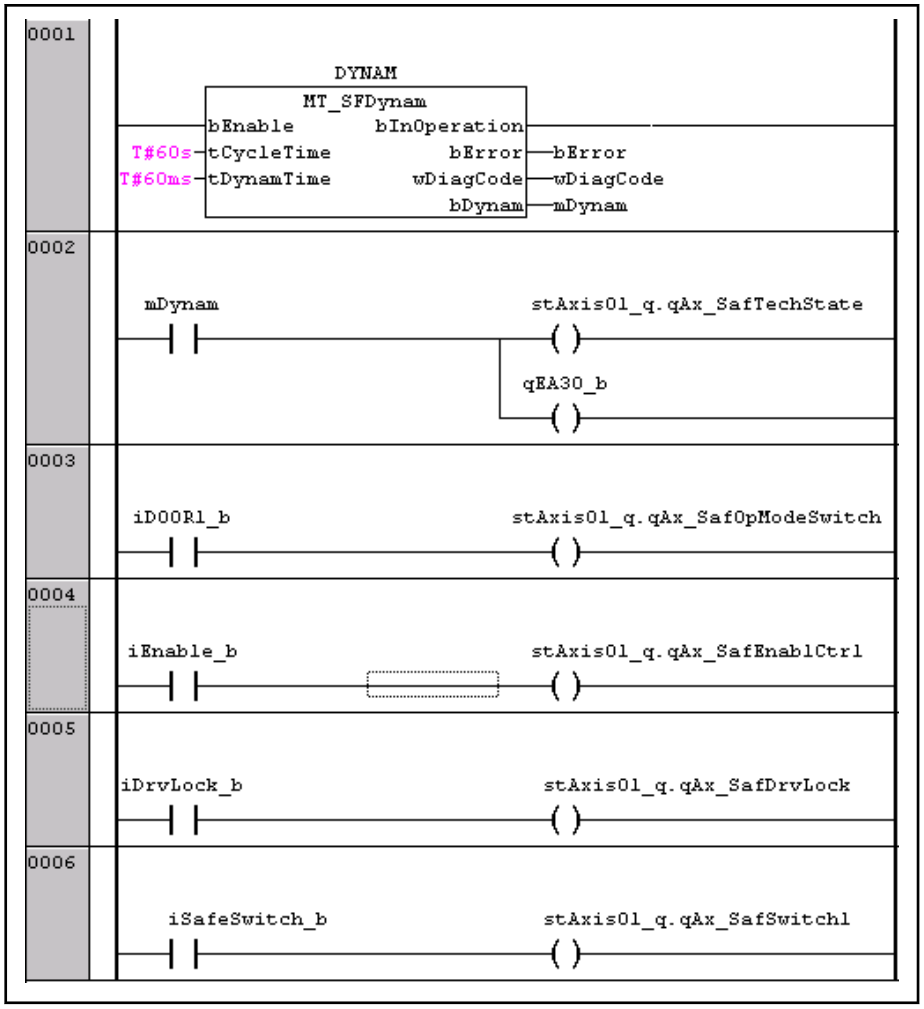


Fig. 5-208: PLC program example

SCS configuration

General information

In the SCS files for axes with safety engineering, make the divergent setting for the parameters for Sercos communication depending on the axis type:

Excerpt from an SCS file:

Program:

```
;------------------------------------------------------------ ; Configuratio
```

Handling instruction: Commissioning of Safety Engineering

Following is a description of the step-by-step commissioning of the Rexroth IndraDrive safety engineering integrated into the drive using Rexroth IndraMotion MTX.

IW Engineering/IndraLogic: Adjusting the PLC program

		Instruction chapter "Handling instruction: Adjusting the PLC program" on page 356
Instruction:		Adjusting the PLC program

IW Operation/Program: Configuration of SCS files

		Instruction chapter "Handling instruction: Configuration of SCS files" on page 357
Instruction:		Configuration of SCS files

IW Engineering/Configuration: Setting the machine parameters

		Instruction chapter "Handling instruction: Setting the machine parameters" on page 358
Instruction:		Setting the machine parameters

IW Engineering/Sercos: Activating the Safety Engineering in the drive

		Instruction chapter "Handling instruction: Activating the Safety Engineering in the drive" on page 358
Instruction:		Activating the Safety Engineering in the drive

Handling instruction: Adjusting the PLC program

This handling instruction describes the adaptation of the PLC program to activate the safety engineering.

IW-Engineering/IndraLogic: Inserting interface signals and dynamization

1. Double-click the "IndraLogic" node in Engineering Desktop.
   The PLC is opened.

☞ We recommend that programming be carried out in a separate subroutine in programming language LD. This should be kept as brief as possible.

2. To generate the dynamization impulse, incorporate the block "FB Dynam" in the PLC program and activate it according to the times desired for dynamization.

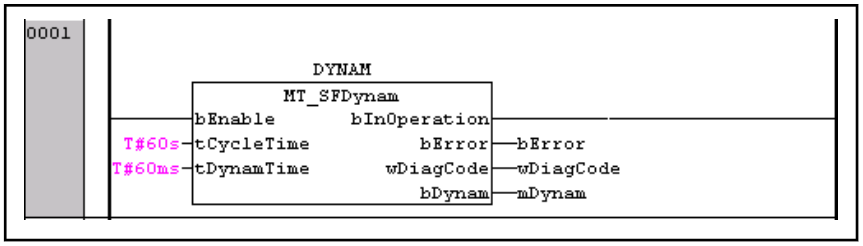


Fig. 5-209: FB_Dynam

3. Furthermore, the interface signals for selecting the desired safety functions are to be wired in the PLC program.

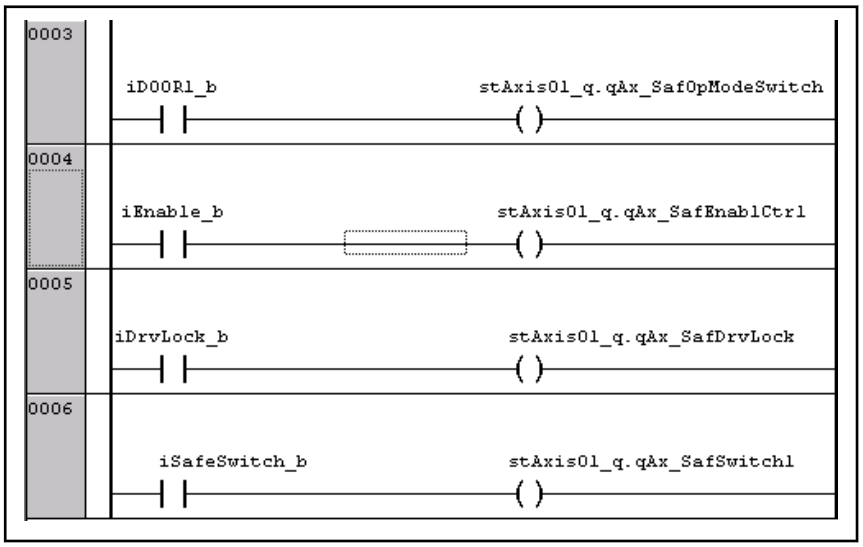


Fig. 5-210: Interface signals

4. The dynamization impulse must also be transferred to the PLC interface. On the outside, the dynamization output serves as the supply for the selection signals of the 2nd channel.

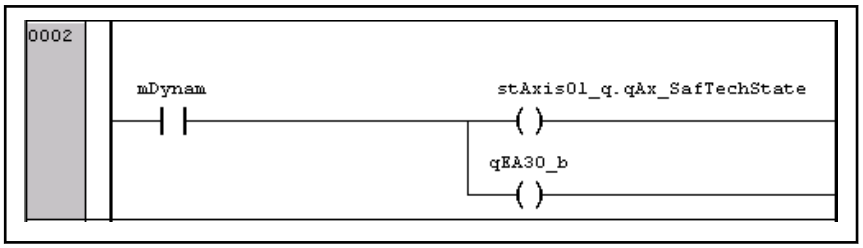


Fig. 5-211: Dynamization interface

		Documentation
Documentation:	IndraLogic programming	Safety engineering

Handling instruction: Configuration of SCS files

This handling instruction describes the changes that must be made to the SCS files to activate the safety engineering.

IW Operation Desktop/Program: Adjust SCS files

Open the SCS files and enter the parameters to be transferred.

The SCS files are located in root or userfep.

Example excerpt from an SCS file:

Program:

```
;------------------------------------------------------------ ; Configuration of cyc
```

		Instruction chapter "Handling instruction: Configuration of SCS files" on page 357
Instruction:		Create SCS files

Handling instruction: Setting the machine parameters

The handling instruction describes the configurations of the relevant machine parameters for the safety engineering.

IW operation desktop/configuration: Setting the machine parameters

1. The safety engineering function has to be activated using parameter **EnablSafe** "Safety engineering (SAFE)" in the setup (SUP).
2. In the menu **Select Data Group**, select the new item "Safety Engineering (SAFE)".
3. If necessary, set the following parameters for each drive:
   - **EnablSafeTech** set "Enable intelligent safety engineering" (1001 00002) to "yes" for activation.
   - **SupprSafeTechNc** "Hide safety engineering in the NC" (1001 00003)
   - **VelWeightFact** "Scaling factor for safe velocities" (1001 00004)
4. Common for all drives (up to MTX14V06):

   NofSafeLimSpeed "Number of used and safely limited velocities" (1001 00005)

		Documentation
Instruction:	Instruction chapter "Handling instruction: Activating the Safety Engineering in the drive" on page 358	Editing machine parameters
Documentation:	IndraDrive Integrated Safety Engineering	Enabling safety engineering

Handling instruction: Activating the Safety Engineering in the drive

This handling instruction describes the activation of safety engineering in the drive using Rexroth IndraWorks Engineering.

IW Engineering/Sercos: Activate safety engineering in the drive

In the last step, the safety engineering is activated in the drive using IndraWorks Drive and the safety engineering wizard.

1. After switching the drives to online, open the folder "Drive-integrated safety technology" in the corresponding drive node.

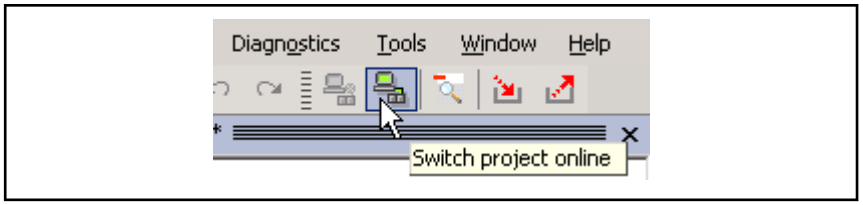


Fig. 5-212: Going online

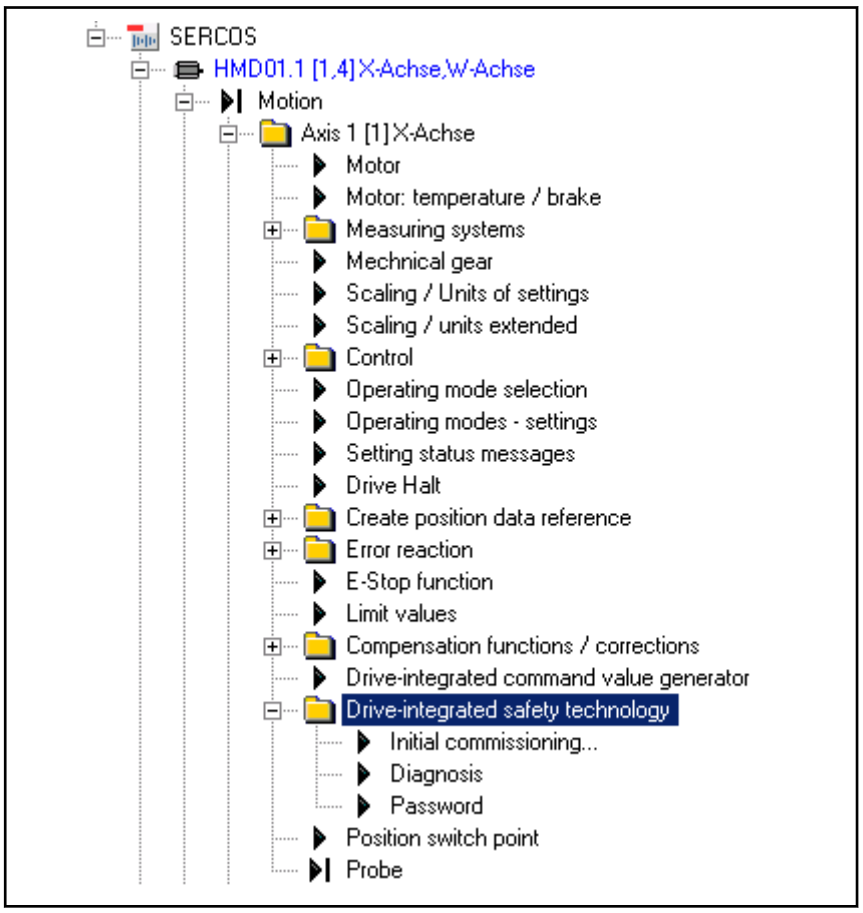


Fig. 5-213: Drive-integrated safety technology

2. Double-click "Initial commissioning" to start the safety engineering wizard of IndraWorks Drive. The wizard guides you through the configuration of the safety engineering within the drive. The number of steps depends on your specific settings.

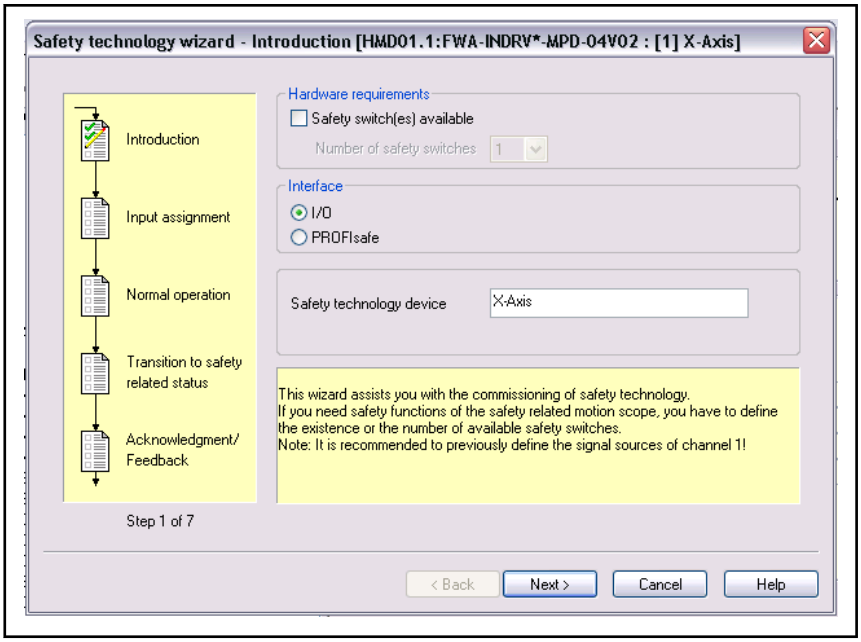


Fig. 5-214: Safety engineering wizard

		Documentation
Documentation:	IndraDrive Integrated Safety Engineering	Enabling safety engineering

"NC ready" bit (P-0-3212 bit 11)

Since axes/spindles have to be moved within a wide velocity/speed range, the transfer times have thus to be set sufficiently high. To reduce this transfer time in case of low velocities/speeds, bit 11 of the parameter P-0-3212 can be used.

If this bit is set, the drive immediately acknowledges the safe state.

The "NC Ready" bits are set from the PLC application. Thus, the interface signal **"qAx_SafRedTransTime"** or **"qSp_SafRedTransTime"** are stored on the axis/spindle interface. It is reported to the drive that the adaptation to the command value system is completed.

☞ The bit has to be reset if the selected safety engineering operating state is enabled or after an application-dependent consistent time.

⚠ WARNING

If the "NC Ready" bit is set before the drive reached its selected safe operating state, the drives are set to standstill and error messages of the safety engineering are reported.

Also refer to the functional and application description "Rexroth IndraDrive Integrated Safety Technology", chapter "Transition to safety-related status".

Using the "NC ready" bits

1. To transmit the bit from the control to the drive, it has to be configured in the SCS file in the signal status word (S-0-0027/S-0-0329).

   S-0-0027 = (....,P-0-3212,...)

S-0-0329 = (.....,11,...)

2. To set the bit, either the interface signal **"qAx_SafRedTransTime"** or the interface signal **"qSp_SafRedTransTime"** is used in the PLC.

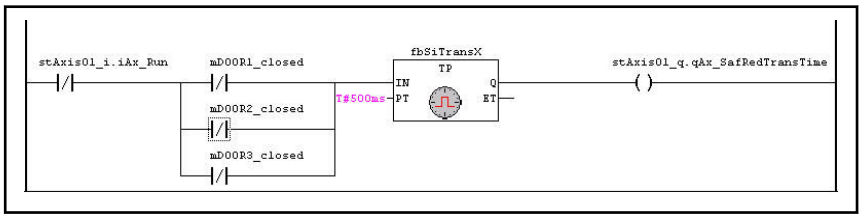


Fig. 5-215: PLC program

Schematic representation

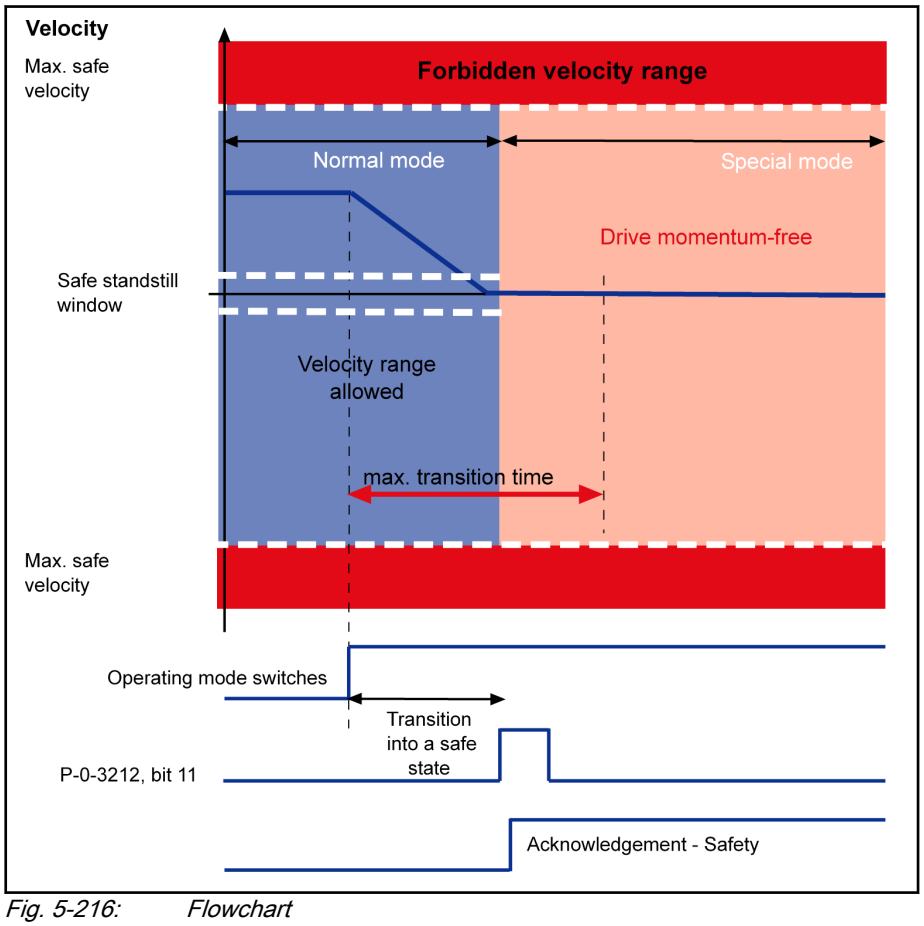


Fig. 5-216: Flowchart

⚠ DANGER **Risk of injury**

An unintended use of the bit can lead to hazardous situations.

Example:

A high-speed spindle is to be switched to ASP and the bit is set while the spindle still rotates with a dangerous velocity.

Consequence:

The drive immediately acknowledges the safe state. The safety engineering immediately identifies the error, switches off the power and the spindle spins. It is now possible that the protecting door is already unlocked even though the spindle is still dangerous.

Control commissioning

Parameterizing the Safety Engineering in the drive

Typical report of an axis with Safety Engineering

Normal operation				**OK**
P-0-3234	Safety related maximum speed	41000.000	mm/min	
Transition to safety related status				**OK**
P-0-3210	Transition to safety related status	NC-controlled		
P-0-3220	Tolerance time transition from normal operation	0.5	s	
P-0-3221	Max. tolerance time for different channel states	0.3	s	
P-0-3225	Tolerance time transition from safety rel. oper.	0.2	s	
Acknowledgment/ Feedback				**OK**
P-0-3210	Safety related feedback ...	for control PLC		
Dynamization				**OK**
P-0-3210	Dynamization source	Slave		
P-0-3210	Kind of dynamization	common source		
P-0-3223	Time interval for dynamization of safety function selection	60.0	s	
P-0-3224	Duration of dynamization pulse of safety function selection	0.2	s	
Error reaction				**OK**
P-0-3210	Reaction to F7 error	Velocity command value reset		
Drive interlock				**OK**
P-0-3233	Velocity threshold for safety related halt	10.000	mm/min	
Safety related operational stop				**OK**
P-0-3230	Monitoring window for safety related operational stop	1.0000	mm	
Safety related motion				**OK**
P-0-3239	Max. activation time of enabling control for safety related motions (SBBs)	common		
P-0-3222	Max. activation time of enabling control	30.0	s	
Safety related motion 1				**OK**
P-0-3244	Safety related reduced speed 1	2000.000	mm/min	

Fig. 5-217: SI report

The safety-relevant parameters parameterized in the SI wizard are clearly presented in the safety engineering report. How reasonable values are determined is shown in the following.

For a detailed description of the individual parameters, refer to the corresponding parameter description

P-0-3234, Safety-related maximum velocity

The parameter defines a velocity limit that applies to normal mode as well as to special mode (SBB, SBH). Thus, set the maximum permitted velocity for the drive here.

P-0-3210, Transition to safety-related status

The parameter is used to configure safety functions. When using the safety engineering and the MTX, set this parameter to "NC-controlled". The control then reacts on the operation mode changes and reduces the velocity or stops the drive.

P-0-3220 Tolerance time transition from normal operation

The parameter defines the maximum time provided during the transition from normal mode to a safety function. After that time, the command value system of the drive has to be adapted to the new safety function. This time can be computed as follows:

$$P\text{-}0\text{-}3220 > \left(\frac{P\text{-}0\text{-}3234}{MP101000001*1000}\right) + t_{control}$$

$$t_{control} = 2*PLCScan + 2*IPO + IPO*SHAPE$$

Fig. 5-218:

Typical value for this parameter: 0.5 s - 0.8 s

P-0-3221 Max. tolerance time for different channel states

The parameter defines the maximum permissible time while the input/selection signals (SI states) of the two monitoring channels can differ from each other. When overwriting the time, the error message **"F3141 Plausibility error, selection“** is generated.

This parameter value depends on the selected hardware and the signal runtimes. The valid value range is between 0.1 s and 2 s.

P-0-3225 Tolerance time transition from safe mode

The parameter defines the maximum time provided during the transition from a safety function to another safety function. After that time, the command value system of the drive has to be adapted to the new safety function.

$$P\text{-}0\text{-}3225 > \left(\frac{P\text{-}0\text{-}3244}{ACCEL*1000}\right) + t_{control}$$

$$t_{control} = 2*PLCScan + 2*IPO + IPO*SHAPE$$

Fig. 5-219:

Typical value for this parameter: 0.2 s - 0.5 s

ACCEL describes the axis acceleration (max. or jog) in this formula. The correct acceleration value can be selected after the following:

```
IF (MP1010 00001 < MP1010 00002) OR MP1010 00002=0 THEN
ACCEL = MP1010 00001
ELSE
ACCEL = MP1010 00002
ENDIF
```

MP1010 00001: Maximum axis acceleration (m/s^2)

MP1010 00002: Jog acceleration in (m/s^2)

P-0-3282 Safely monitored delay

For the NC-controlled transitions from normal mode or special mode "motion" (SBB) to the" safe standstill" (SH) or the "safe operational stop" (SBH) or "safe drive interlock" (drive inhibit) (ASP), the drive monitors whether it can reach the standstill or the velocity limit of the selected special mode within the "tolerance time transition" (P-0-3220 or P-0-3225). Therefore, check that the deceleration ramp defined in "P-0-3282" is maintained.

```
IF (MP1010 00001 < MP1010 00002) OR MP1010 00002=0 THEN
P-0-3282 = MP1010 00001
ELSE
P-0-3282 = MP1010 00002
ENDIF
```

P-0-3210, Dynamization source

Source for the dynamization signal. When using the safety engineering and the MTX, set this parameter to "Slave". The dynamization signal has to be created in the PLC.

P-0-3210 Kind of dynamization

The parameter "Kind of dynamization" is to be set to "Common source".

P-0-3223 Time interval for dynamization of safety function selection

This parameter defines the cycle time during which a mandatory dynamization takes place. The value range of this parameter is between 1 and 3600 seconds.

A typical parameter value is 60 s.

P-0-3224 Duration of dynamization pulse of safety function selection

The parameter defines the maximum period of the dynamization pulse. The value range is between 0.1 and 1 s.

An externally generated dynamization signal (typical for MTX) can also be shorter, but may not fall below the minimum pulse duration of 30 ms.

With a typical value of 0.1 s in the drive, the period of the pulse in the PLC can be set to **50 ms**.

The "Period selection of the dynamization pulse" affects the system ability to react, since the evaluation of the safety signals is stopped during the dynamization. Thus, do not choose a very long period.

P-0-3233, Velocity threshold, safe standstill

The parameter defines a velocity threshold either for the special mode "Standstill" or "Drive interlock" (drive inhibit).

Typical values:

- Linear axis: 25 - 50 mm/min
- Spindle: 5 rpm

P-0-3230 Monitoring window for safe operational stop

The parameter defines the maximum valid traversing distance related to the actual value available when SBH was activated.

Typical values:

- Linear axis: 1 mm
- Spindle: 1 degree

P-0-3222 Max. activation time of enabling control

The numerical value entered into the parameter P-0-3222 defines the maximum permissible period of the enabling device. The value range is between 0 and 3600 s.

Typical values: 30 - 60 s

P-0-3244 Safely reduced velocity 1

The parameter P-0-3244 defines the velocity threshold (bipolar) always active in the special mode "Safe motion 1" (SBB1).

Typical values:

- Linear axis: 2000 mm/s
- Spindle: 50 rpm

The same applies to the parameters:

- P-0-3254 Safely limited velocity 2
- P-0-3264 Safely limited velocity 3
- P-0-3274 Safely limited velocity 4

5.13 Safety

5.13.1 MTX control, commissioning of SafeLogic

Introduction

The Safety function module provides the resources to process safety engineering application programs. It extends the function control to a safety control and facilitates processing of the functional application and the safety application on the same control. The Safety function module is available for IndraControl Lx5 compact controls.

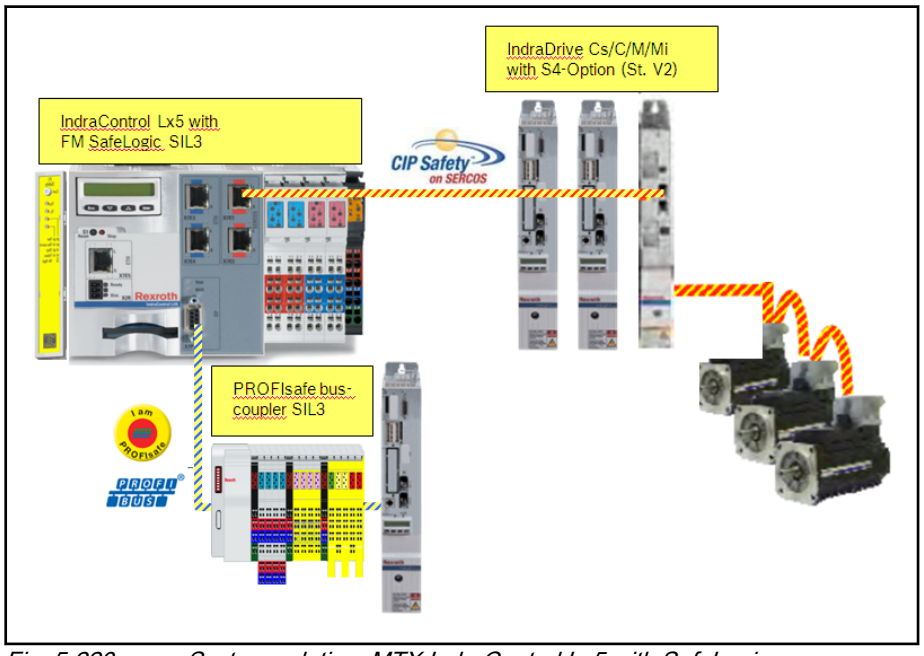


Fig. 5-220: System solution: MTX IndraControl Lx5 with SafeLogic

Standard and Safety periphery (Safety I/O, safe drives, ..) can be operated at the same communication system. Safety protocols transfer the safe data.

Detailed information about MTX safety engineering is contained in the documentation "Rexroth IndraMotion MTX SafeLogic System Overview".

Mounting

Extension modules can be connected to the left side of the MTX control using the function module pin.

Control commissioning

The Safety function module is positioned at the left side, as last module.

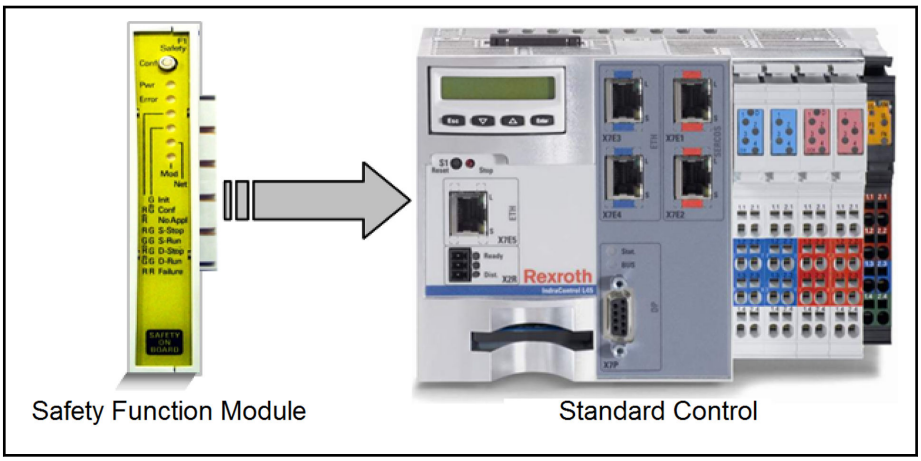


Fig. 5-221: Function module SafeLogic for IndraControl Lx5 controls

Detailed information regarding the assembly is contained in chapter "Assembly and Installation" in the "Rexroth IndraMotion MTX SafeLogic System Overview".

Detailed information regarding the Safety function module is contained in chapter "Safety CPU (CFL01.1-F1)" in "Rexroth IndraControl Lxx 13VRS Function Modules".

Configuration

The SafeLogic configuration as function module is available for the following actions:

- Wizard when creating an MTX
- Menu item "Properties" in the MTX context menu

The SafeLogic can be configured as function module in the dialog to configure the function modules.

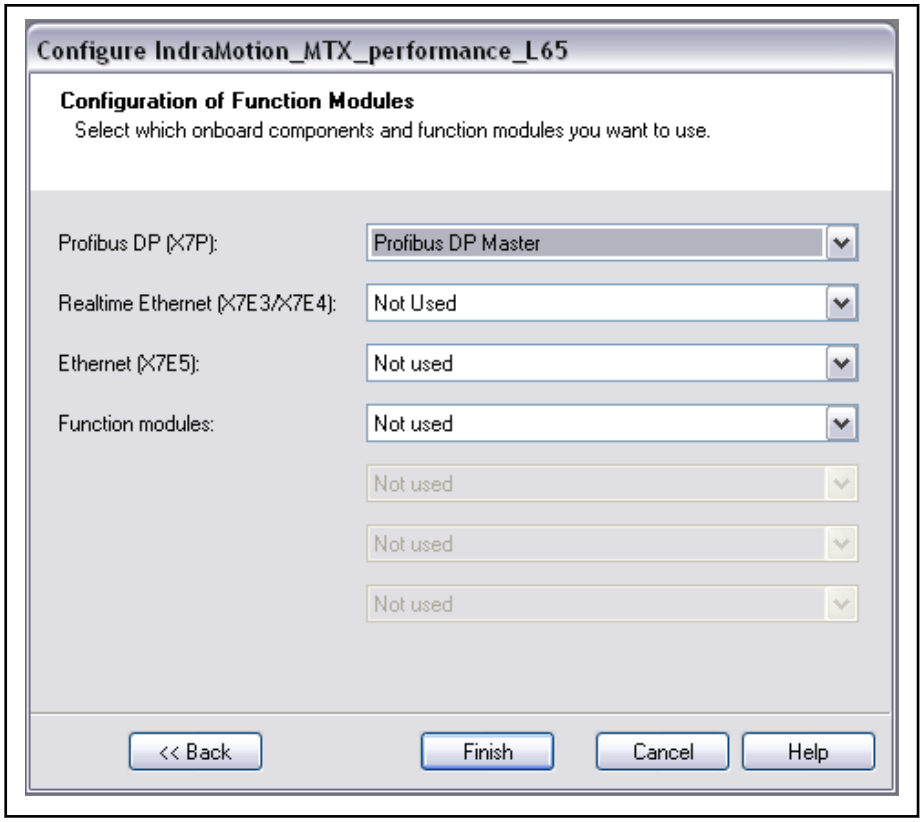


Fig. 5-222: Dialog: Configure IndraMotion MTX (function modules)

The Safety function module is configured as last or lowest module.

For detailed information about the configuration, refer to chapter 5.2 "MTX control, configuration" on page 105.

General information

Project structure

A yellow object with the name Safety CPU is displayed below the control in the project tree after the Safety function module configuration. The objects required for the PLC application generation are automatically generated below the Safety function module node.

The SafeLogic system is completely integrated in IndraWorks. All components can be accessed via the IndraWorks standard functionality.

Control commissioning

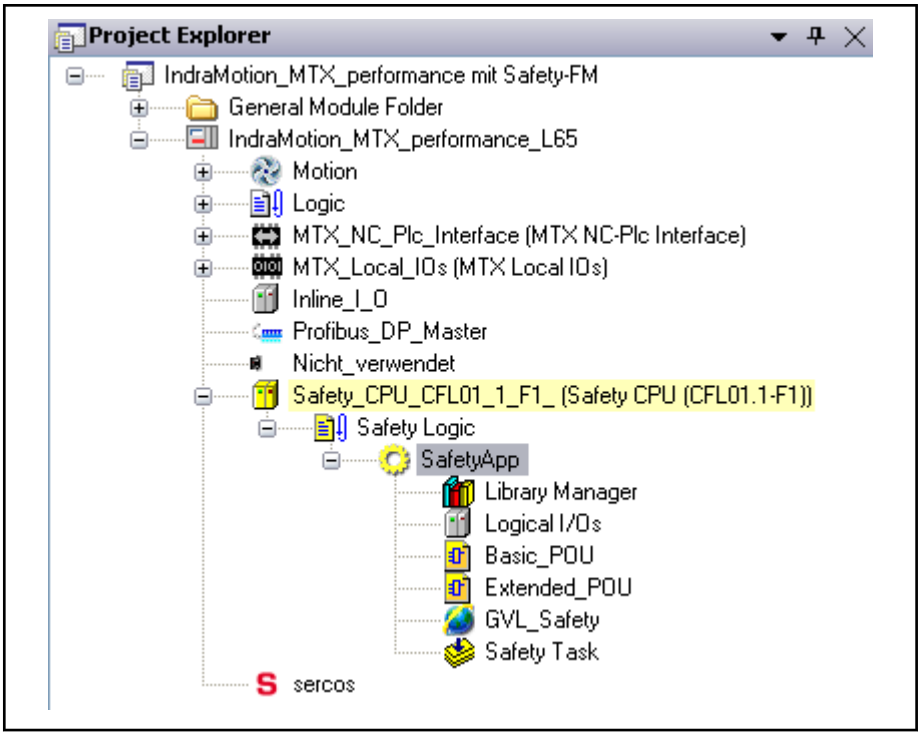


Fig. 5-223: Safety application in the Project Explorer

A project is created and the interface is operated according to the IndraWorks operating concept. IndraWorks commands that are not provided in Safety are visible but cannot be activated.

Yellow Safety structures

Safety objects and Safety Editors are highlighted by yellow structures in the project structures and can clearly be distinguished by the corresponding standard objects and editors.

Additionally, safe signal flows are also highlighted in yellow. This supports and facilitates the following Safety application operations:

- Development
- Verification
- Acceptance test

The following objects or node points are available below the Safety function module exactly once:

- Safety logic:

  Logic node point of the Safety control below which exactly one Safety application can be used.

- SafetyApp:

  Node point under which the Safety application objects are located.

  Object specifying the execution version of the code and the current pin of the application.

  The object editor manages the list of the objects currently part of the Safety application.

- Library manager:

  Contains the libraries available on the inserted safety control.

- Logic I/Os:

  Node point to which logic I/O objects can be added. The added logic I/Os are used to exchange data and I/Os with the standard control

- Safety task:

  This object lists all programs that can be loaded and executed to the control.

The following objects can be added below the application:

- Basic POU (Safety):

  POU (program or function block) with programming level Basic
- Extended POU (Safety):

  POU (program or function block) with programming level Extended
- Global Variable List (Safety):

  Declaration of the global variables only valid in the Safety application

All objects can be write-protected via the user management.

Logic programming

A Safety application is programmed:

- in POUs (program organization units)
- in GVLs (Global Variable Lists)
- in the task object

The program code is implemented in the IEC 61131-3 language LD (ladder diagram) in the POUs. An LD is characterized by unambiguity, easy detection of programming errors and a clear data flow.

The user interface and the handling of the SafeLogic LD editor corresponds to the LD editor of the standard control with regard to the user control and the handling.

Language scope

The language scope of the LD is limited according to the language subset Basic and Extended. The selection for the language scope Basic Level or Extended Level is specified upon recreation of a POU (program or function block) by the developer.

☞ Detailed information about the different programming levels is contained in the documentation "Rexroth IndraMotion MTX SafeLogic System Overview".

- In the **Basic Level**, a Safety application can easily be implemented and subsequently verified by linking the already certified function block of the PLCopen library ("SafetyPLCopen")
- **Extended Level** offers additional operators (Boolean, mathematical, amongst others) and conditioned jumps/returns to create comprehensive Safety applications. These applications have to run through a more complicated verification process.

Data types

The following data types are available in SafeLogic:

- *Standard data types*
  - BOOL
  - INT
  - DINT
  - WORD
  - TIME
- *Safety data types*
  - SAFEBOOL

- SAFEINT
- SAFEDINT
- SAFEWORD
- SAFETIME

Operators

SafeLogic provides the following operators:

Operators in the Basic Level

- AND (2 inputs)
- AND (3 inputs)
- OR (2 inputs)
- OR (3 inputs)

Operators in the Extended Level

- *Boolean operators*
  - AND (2 inputs)
  - AND (3 inputs)
  - OR (2 inputs)
  - OR (3 inputs)
  - XOR
  - NOT
- *Mathematical operators*
  - ADD (2 inputs)
  - ADD (3 inputs)
  - SUB
  - MUL
  - DIV
  - EQ
  - NE
  - LT
  - LE
  - GT
  - GE
- *Other operators*
  - SEL
  - MUX

Safe data flow

The safe data flow of the LD programming is highlighted in SafeLogic as follows:

- Constants and variables declared as constant are highlighted in yellow
- Variables with safe data type (SAFExxx) are highlighted in yellow
- Data flow of SAFE values in SAFE variables and inputs are indicated by thick yellow lines
- Function blocks are highlighted in yellow if they have at least one SAFE output
- Operator boxes are filled in yellow if the output is SAFE

  This is the case under the following conditions:

- In case of the AND operator: if the output is SAFE, if at least 1 input is SAFE
- all other operators, including conversion: the output is SAFE if all inputs are SAFE

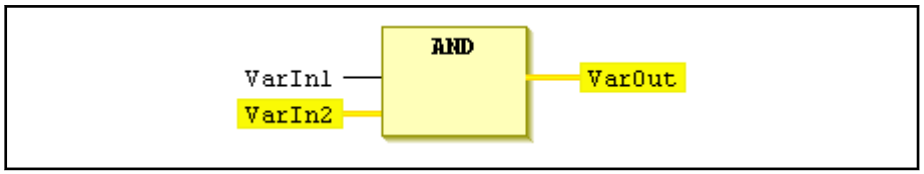


Fig. 5-224: Example for a safe data flow: Operator AND with unsafe variable VarIn1, SAFE variables: VarIn2 and VarOut

I/Os

The Safety function module does not have any connections for periphery devices. The Safety-compatible periphery is connected to the bus systems of the standard control.

The I/O signals that are to be processed on the Safety function module are configured in the programming system. The input signals intended for the Safety function module are filtered from the pool of all I/O data on the standard control and are transmitted to the Safety function module. The output signals are transmitted to the standard control by the Safety function module and are included in the pool of all I/O data by the standard control. Thus, it is required, that a consistent I/O configuration is available on the standard control and the Safety control. In case the I/O configuration is not identical, it is displayed in the IndraWorks Project Explorer at the Safety function module node. This is indicated by the "Caution symbol" that is superimposing the control icon.

☞ In case of I/O configuration consistency, no data is exchanged between the periphery and the Safety function module.

Data is exchanged between the standard control and the Safety function module via the same mechanism as the data exchange with the periphery. This means that no data can be exchanged between the standard control and the Safety function module in case of I/O configuration inconsistency.

I/O accesses

The mapping variables are edited on the "Mapping page" of the logic I/Os and are available for code implementation as variable of category "Global Variable".

☞ Detailed information about the safe data exchange between SafeLogic and the standard control are contained in the "Rexroth IndraMotion MTX SafeLogic System Overview" documentation.

5.13.2 Commissioning drives with CIP Safety on Sercos

Introduction

CIP Safety on Sercos is a protocol based on the CIP Safety mechanism to transmit safety-relevant signals via Sercos interface. The CIP Safety on Sercos protocol has been defined in cooperation with the ODVA (Open DeviceNet Vendor Association) and is certified according to IEC 61508 to SIL 3. An additional safety bus is not needed. The safe data are transmitted in real time with the standard data of the Sercos interface network. The integration of drive, periphery and safety bus as well as the standard Ethernet in a single network facilitates handling and reduces the hardware and installation

costs. Integrated Safety controls and homogeneous Safety solutions can easily be implemented.

Enabling CIP Safety on Sercos on a drive

Preconditions to implement the following steps: An MTX project with created drives.

The different steps to create an MTX project with SL and to commission the drives are described in chapter 5.13.1 "MTX control, commissioning of SafeLogic" on page 365 or chapter 5.12.1 "Axis commissioning" on page 314.

To enable the CIP Safety on Sercos configuration on a drive, the drive node has to be created. This is automatically executed if the drive is switched "online".

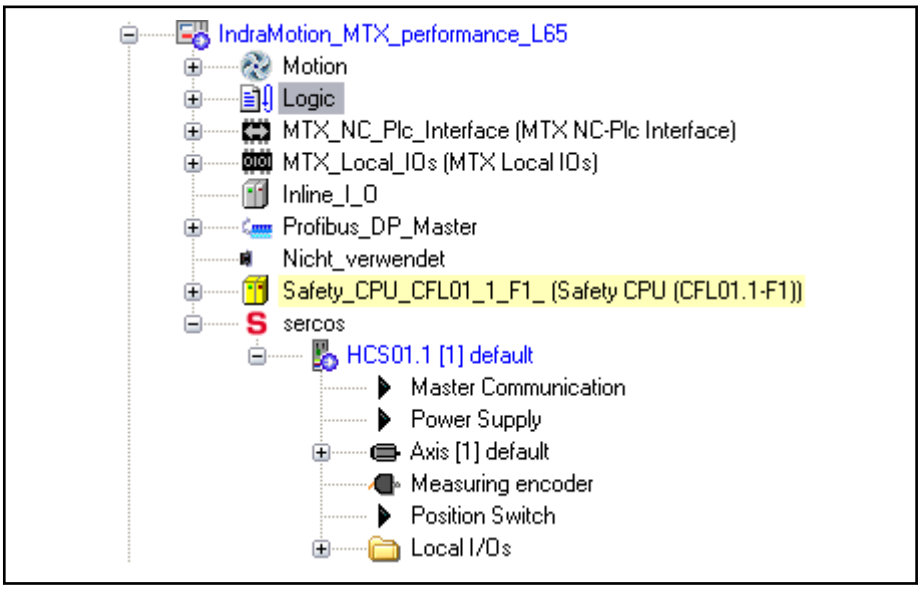


Fig. 5-225: Drive node active

To enable CIP Safety on Sercos on a drive, switch the MTX offline. Subsequently, CIP Safety on Sercos can be configured on the axis node of the drive.

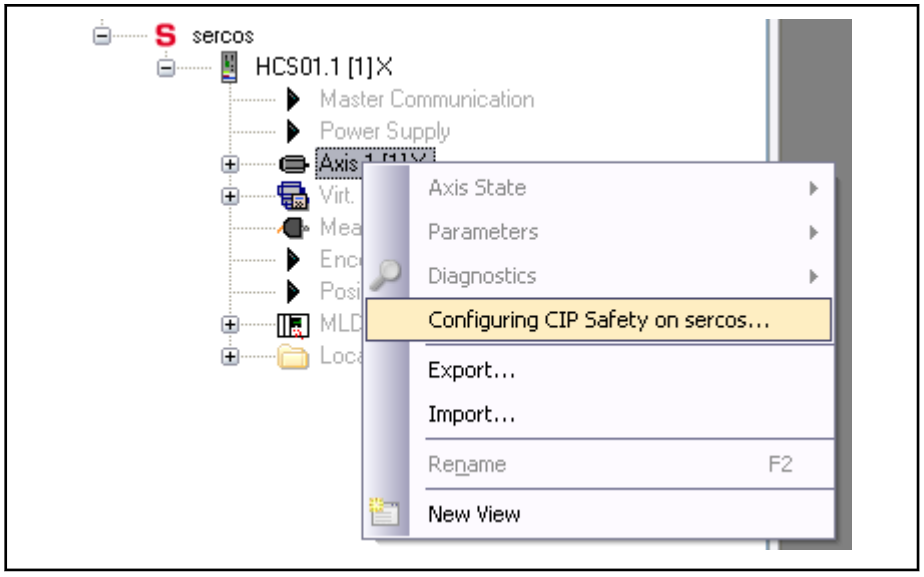


Fig. 5-226: Dialog to select the CIP Safety on Sercos configuration

In the following dialog, CIP Safety is enabled and the drive for SafeLogic is selected. One of several Safety profiles can be selected in the drop-down menu. Depending on the selected profile, different Safety functions of the drive can be used.

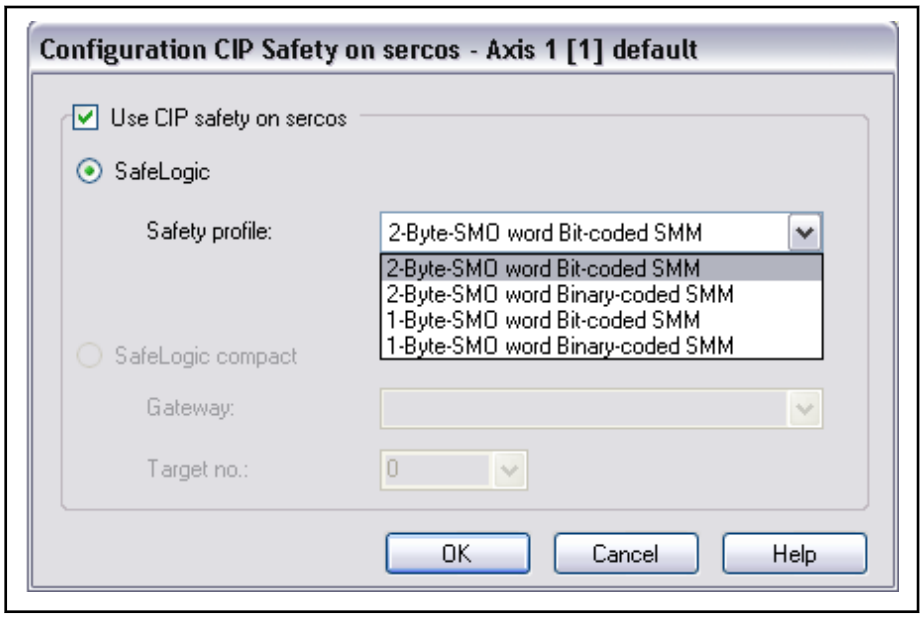


Fig. 5-227: CIP Safety on Sercos configuration dialog

The available Safety profiles are described in the documentation "Rexroth IndraDrive Integrated Safety Engineering from MPx-1x (Safe Motion)", chapter "Safe Bus Communication".

After the desired Safety profile has been selected and the configuration has been confirmed with OK, 2 elements are created in the SafetyApp under the node logic I/Os for the corresponding axis. Per axis, it is one "Control" element used to control the safety operation mode selection and one "Status" element in which the axis feedback to the corresponding state is output. In these 2 elements, the logic I/Os of the axis, different settings for CIP Safety

on Sercos and the actuation of the safety functions of the drive can be selected.

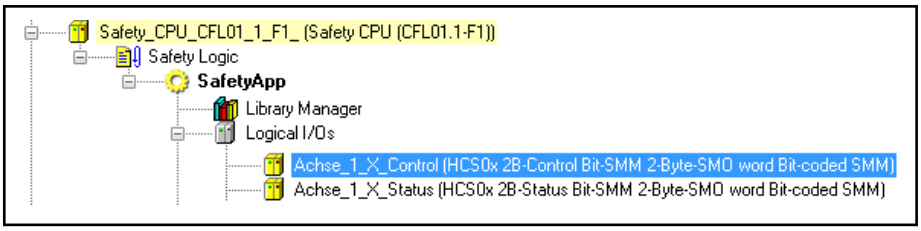
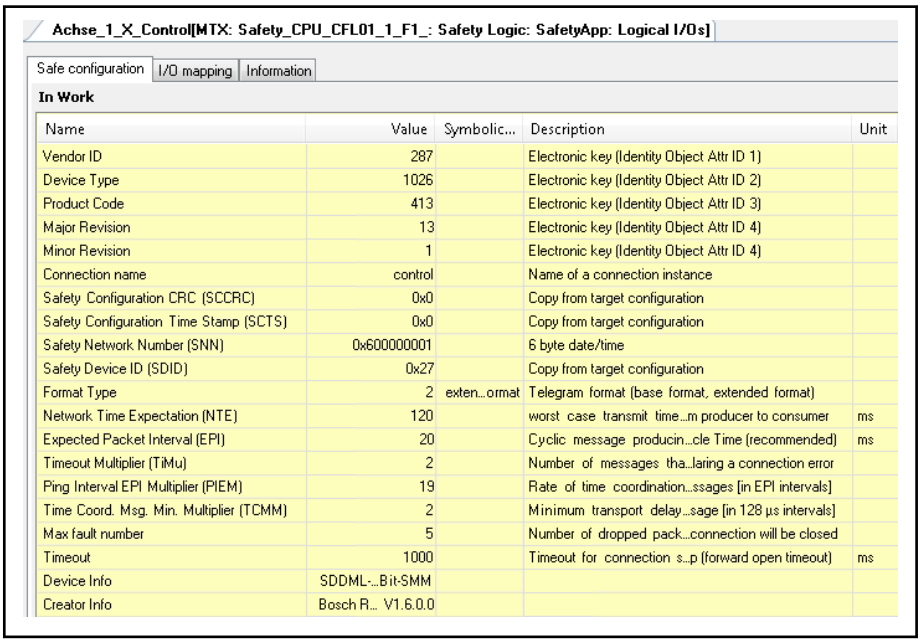


Fig. 5-228: Selecting the settings

The drive configuration is described in SafeLogic is described in the next chapter.

Drive configuration in SafeLogic (logic I/Os)

A window with 3 tabs opens by double-clicking on the logic I/Os of an axis. In the tab "Safe configuration", only two parameters are to be set.



Name	Value	Symbolic...	Description	Unit
Vendor ID	287		Electronic key (Identity Object Attr ID 1)	
Device Type	1026		Electronic key (Identity Object Attr ID 2)	
Product Code	413		Electronic key (Identity Object Attr ID 3)	
Major Revision	13		Electronic key (Identity Object Attr ID 4)	
Minor Revision	1		Electronic key (Identity Object Attr ID 4)	
Connection name	control		Name of a connection instance	
Safety Configuration CRC (SCCRC)	0x0		Copy from target configuration	
Safety Configuration Time Stamp (SCTS)	0x0		Copy from target configuration	
Safety Network Number (SNN)	0x600000001		6 byte date/time	
Safety Device ID (SDID)	0x27		Copy from target configuration	
Format Type	2	exten...ormat	Telegram format (base format, extended format)	
Network Time Expectation (NTE)	120		worst case transmit time...m producer to consumer	ms
Expected Packet Interval (EPI)	20		Cyclic message producin...cle Time (recommended)	ms
Timeout Multiplier (TiMu)	2		Number of messages tha...laring a connection error	
Ping Interval EPI Multiplier (PIEM)	19		Rate of time coordination...ssages (in EPI intervals)	
Time Coord. Msg. Min. Multiplier (TCMM)	2		Minimum transport delay...sage (in 128 µs intervals)	
Max fault number	5		Number of dropped pack...connection will be closed	
Timeout	1000		Timeout for connection s...p (forward open timeout)	ms
Device Info	SDDML-...Bit-SMM			
Creator Info	Bosch R... V1.6.0.0			

Fig. 5-229: Dialog "Safe configuration"

The parameter "Safety Network Number (SNN)" and "Safety Device ID (SDID)" are assigned once upon initial commissioning of the drive and have to be applied. Typically, all axes are in the same Safety network and thus have the same SNN. The SDID is the unique and unambiguous ID of an axis and thus differs for all axes. The parameters have to be adjusted for the logic I/O of the status and the control.

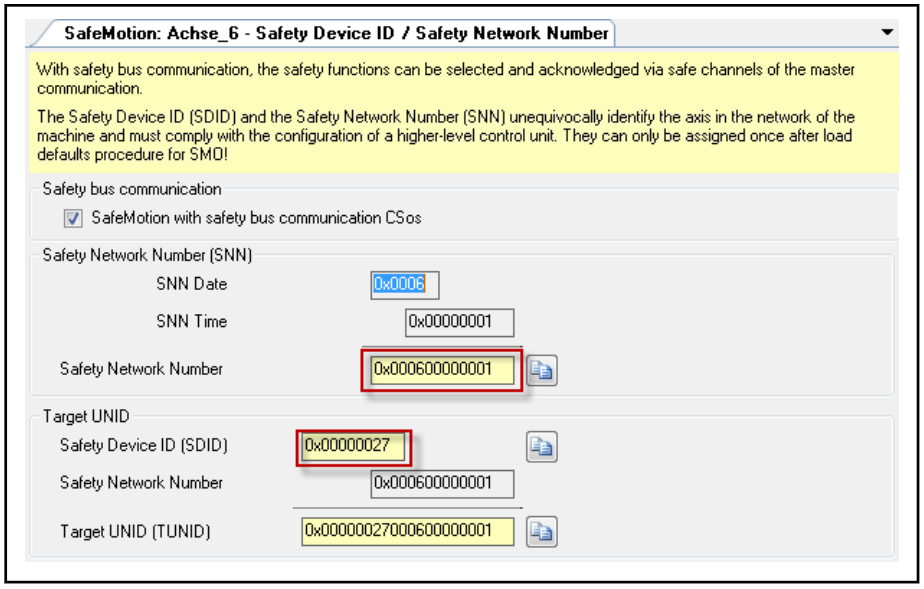


Fig. 5-230: Drive commissioning dialog

After these settings have been selected, the variables with which the corresponding control or status signals are to be processed by SafeLogic have to be entered in the next tab "I/O mapping".

Functions linked to the respective control or status bit on the drive are listed in the "Description" column.

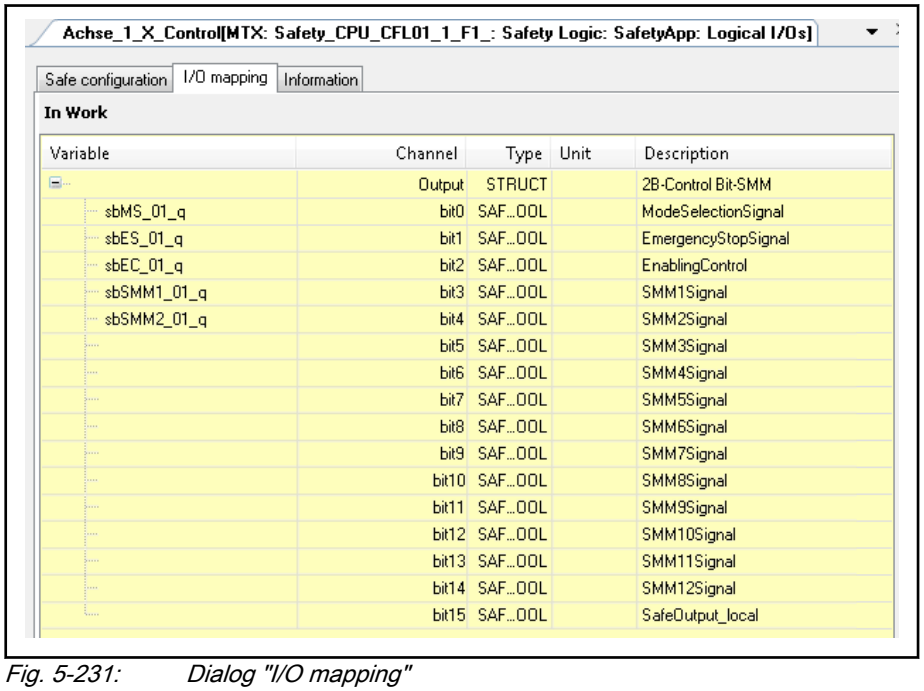


Fig. 5-231: Dialog "I/O mapping"

If, e.g. the variable sbES_q is connected in the SafeLogic application, the function is triggered or revoked in the drive of the EMERGENCY STOP.

Enabling the Safety Engineering in the MTX

To enable the safety engineering in the control, the dialog to configure the safety engineering has to be enabled. The dialog is enabled in the NC configuration under "Selecting optional parameters (SUP)". After the parameter "SUP/FuncGr[1]/EnablSafe" has been set to "Yes", the configuration dialog "Safety Engineering (SAFE)" under "Optional parameters" becomes visible.

In this dialog, the following parameters have to be adjusted, if required:

- Set EnablSafeTech "Enable intelligent safety engineering" (1001 00002) to "Yes" for activation
- SupprSafeTechNc "Hide safety engineering in the NC" (1001 00003)
- VelWeightFact "Scaling factor for safe velocities" (1001 00004)

Common for all drives (up to MTX14V06):

- NofSafeLimSpeed "Number of used and safely limited velocities" (1001 00005)

Adjusting the relevant SCS files

The following parameters have to be entered in the list of S-0-1050.1.6 of the SCS file:

- P-0-3231 (SMO: Operating state)
- P-0-3262 (SMO: Selected operating state)

Example:

S-0-1050.1.6 = (135,51,189,144,P-0-3231,P-0-3262) ;

☞ By processing the control and status signals for safety functions in SafeLogic, the corresponding NC PLC interface signals of axes or spindles are not taken into consideration anymore.

These interface signals cannot be used anymore in connection with SafeLogic.

"NC Ready" bit (P-0-3261.0.1 bit 0)

Since axes/spindles have to be moved within a wide velocity/speed range, the transfer times have thus to be set sufficiently high. To reduce the transfer time in case of low velocities/speeds, bit 0 of parameter P-0-3261.0.1 can be used.

If this bit is set, the drive immediately acknowledges the safe state.

The "NC Ready" bits are set from the PLC application. Thus, the interface signal **"qAx_SafRedTransTime"** or **"qSp_SafRedTransTime"** are stored on the axis/spindle interface. It is reported to the drive that the adaptation to the command value system is completed.

☞ Via the "NC-Ready" signal in "P-0-3261.0.1, SMO: State machine control word, functional", the control unit may signal the end of the transition process of safety technology. The SMD safety function will then immediately terminate the transition and not wait for expiry of the transition time (P-0-3280.0.2 or P-0-3280.0.3 or P-0-3280.0.4).

The "NC-Ready" signal is evaluated dynamically, i.e. in an edge-triggered way. The safety technology detects a valid edge (0-1 transition), if the signal before had been "0" for at least 10 ms.

If the transition process is terminated ahead of time via the "NC-Ready" signal, although the target velocity of the selected safety function has not yet been reached, the error "F7052 Selected target velocity exceeded" is generated and the drive is decelerated.

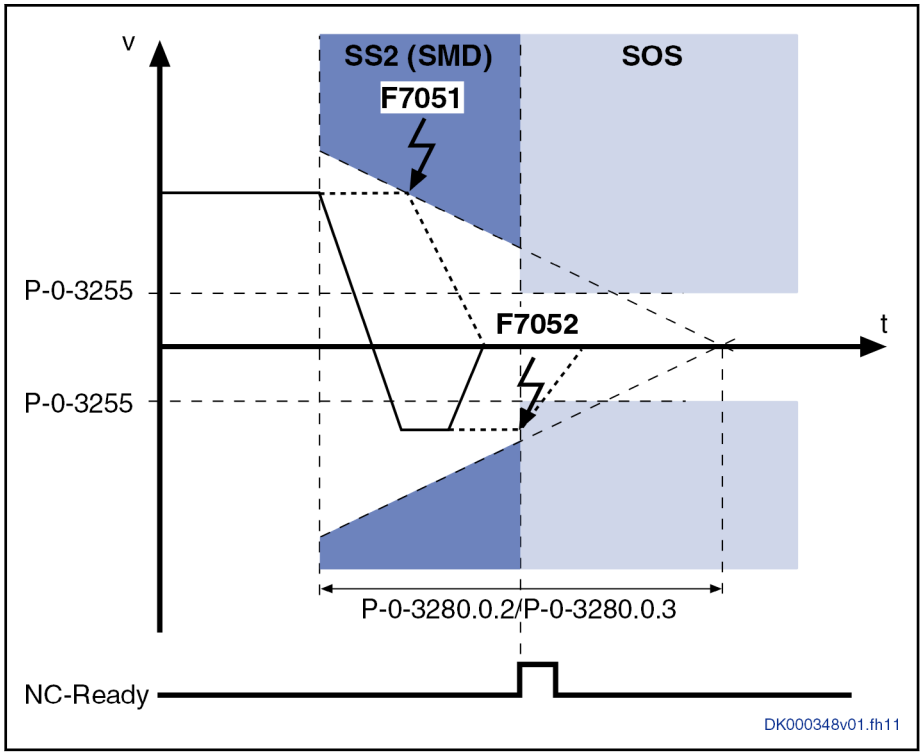


Fig. 5-232: "NC ready" bit

Also see "Rexroth IndraDrive Integrated Safety Engineering from MPx-1x (Safe Motion)", chapter "Transfer to safe state".

Using the "NC ready" bits

1. To transmit the bit from the control to the drive, it has to be configured in the SCS file in the signal status word (S-0-0027/S-0-0329).

   S-0-0027 = (....,P-0-3261.0.1,...)

   S-0-0329 = (.....,0,...)

2. To set the bit, either the interface signal **"qAx_SafRedTransTime"** or the interface signal **"qSp_SafRedTransTime"** is used in the PLC.

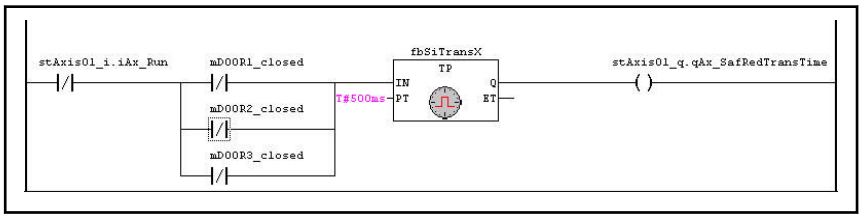


Fig. 5-233: PLC program

⚠ DANGER **Risk of injury**

An unintended use of the bit can lead to hazardous situations.

Example:

A high-speed spindle is to be switched to "Safe Stop 1 (EMERGENCY Stop)" (SS1 ES) and the bit is set while the spindle still rotates at a dangerous velocity.

Consequence:

The drive immediately acknowledges the safe state. The safety engineering immediately identifies the error, switches off the power and the spindle spins. It is now possible that the protecting door is already unlocked even though the spindle is still dangerous.

Commissioning the Safety Engineering on a drive

☞ Commissioning the Safety Engineering is described in the documentation "Rexroth IndraDrive Integrated Safety Engineering from MPx-1x (Safe Motion)", chapter "Initial commissioning".

6 VAM simulator

6.1 General description

The VAM simulator replaces the real VAM 40 and VAM 41 when working with the MTX Simulator. The appearance and functions replicate the real VAMs. In the current version, the texts are available in English and German.

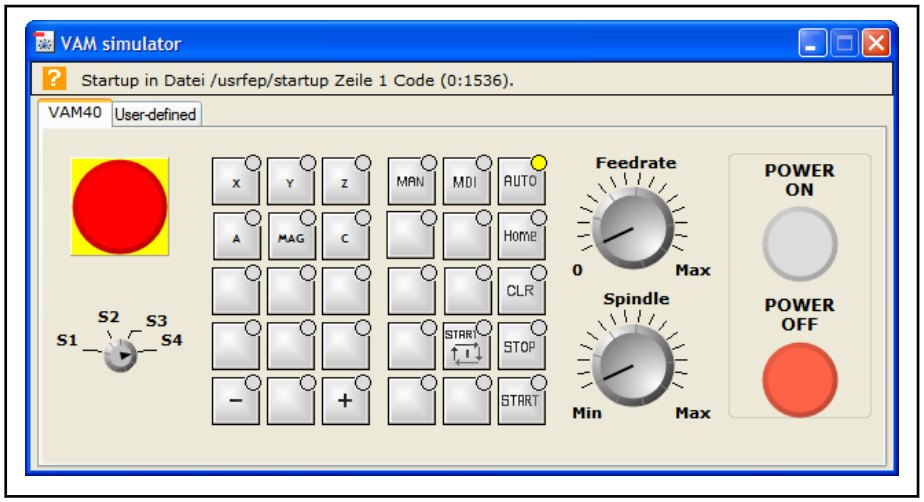


Fig. 6-1: VAM simulator VAM 40

6.2 Configurator

The VAM simulator is configured in IndraWorks Engineering.

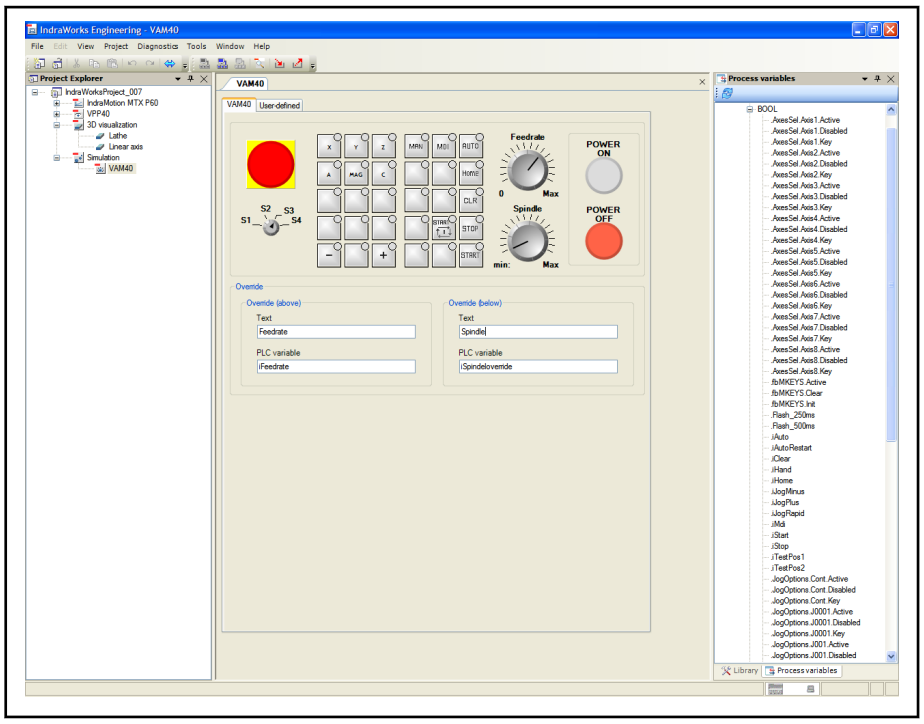


Fig. 6-2: Configuration in IndraWorks

Project Node "Simulation" with subnode "VAM40" or "VAM41"

Double-click on the project node of a virtual user panel to call the configuration screens. The top half of the screen shows the image of the virtual user

panel while the configuration screen of the element selected in the image is shown in the bottom half.

Configuration screen of the E-Stop

Only the PLC variable for a later communication can be created on the E-Stop screen.

Configuration screen of the key-operated switch

The individual switch settings are labeled and the PLC variables are assigned on the configuration screen of the key-operated switch.

Override: Configuration side

The configuration screen of the override is used to label and assign the PLC variables.

Configuration page of the keypads

This is used to assign the PLC variables and to label the keypads with texts or prepared images. Each individual key can be assigned by entering a text or by dragging and dropping an image from the symbol list.

☞ Depending on the selected type (VAM 40 or VAM 41), the following different functions are available.

Configuration screen of the quick-stop module

The configuration screen of the quick-stop module can be used to make various settings for the two keys:

- Key labeling
- Function

  Since the keys of the real VAM 40 are wired via the hardware and the switches are equipped with NC and N.O. contact, these settings can also be selected here.
- Assigning PLC variables

The configuration screen for the freely configurable elements

In the configuration screen of the eight freely configurable elements, the following ones can be selected:

- LED
- Button with LED
- Button without LED
- Switch with two positions
- Switch with three positions

  The center position has no function.

These elements can be labeled and assigned with PLC variables.

☞ Since the keys of the real VAM 41 are wired via the hardware and the switches are equipped with NC and N.O. contact, these settings can also be selected here.

6.3 The application

The application is separate; it is used to control the PLC program in the IndraMotion MTX Emulation. This can be started independently of IndraWorks Engineering or IndraWorks Operation. When the VAM simulator is started, the configuration is read from the currently active project.

☞ The VAM simulator communicates directly with the Emulation. IndraWorks Operation or IndraWorks Engineering do not have to be started.

7 Appendix

7.1 Basic data type collection

SimpleType	ann:	BaseType	Restrictions					
			Facets				Patterns	Enum.
			MinInc	MaxInc	Min. Length	Max. Length		
LifeUnit_t		Iso Latin 1 String				3		min cyc
ToolOri_t	Tool Orientation (new since 14V16)	xs:int						0 17 18 19

Tab. 7-1: Basic data types of the tool data type collection (tool_ty.xsd und basic_tool_ty.xsd)

SimpleType	ann:	BaseType	Restrictions					
			Facets				Patterns	Enum.
			MinInc	MaxInc	Min. Length	Max. Length		
isoLatin1String	Iso Latin 1 String	xs:string						
isoStr31_t	Iso Latin 1 String 0 - 31	isoLatin1String			0	31		
isoStr16_t	Iso Latin 1 String 0 - 16	isoLatin1String			0	16		
isoStr99_t	Iso Latin 1 String 0 - 99	isoLatin1String			0	99		
isoStr512_t	Iso Latin 1 String 0 - 512	isoLatin1String			0	512		
Str1_t	Type String 0 - 1	isoLatin1String			0	1		
Str2_t	Type String 0 - 2	isoLatin1String			0	2		
Str3_t	String 0 - 3	isoLatin1String			0	3		
Str6_t	String 0 - 6	isoLatin1String			0	6		
Str8_t	String 0 - 8	isoLatin1String			0	8		
Str8_NoUmlaut_t	String 0 - 8	isoLatin1String			0	8	[^äöüß]*	
Str16_t	String 0 - 16	isoLatin1String			0	16		
Str32_t	String 0 - 32	isoLatin1String			0	32		
Str80_t	String 0 - 80	isoLatin1String			0	80		
Str240_t	Type String 0 - 240	isoLatin1String			0	240		
Str240_ NoUm-laut_t	Type String 0-240 without äöüß	isoLatin1String			0	240	[^äöüß]*	
Byte_t	Type Byte	xs:byte						
UnsignedByte_t	Type Unsigned Byte	xs:unsigned-Byte						

Appendix

SimpleType	ann:	BaseType	Restrictions					
			Facets				Patterns	Enum.
			MinInc	MaxInc	Min. Length	Max. Length		
Byte0_1_t	Byte 0 or 1	xs:byte	0	1				0 1
Byte0_2_t	Byte 0 - 2	xs:byte	0	2				0 1 2
Byte0_3_t	Byte 0 - 3	xs:byte	0	3				0 1 2 3
Byte0_4_t	Byte 0 - 4	xs:int	0	4				0 1 2 3
Byte0_5_t	Byte 0 - 5	xs:byte	0	5				0 1 2 3 4
Byte0_6_t	Byte 0 - 6	xs:byte	0	6				0 1 2 3 4 5 6
Byte0_7_t	Byte 0 - 7	xs:byte	0	7				0 1 2 3 4 5 6 7

Appendix

SimpleType	ann:	BaseType	Restrictions					
			Facets				Patterns	Enum.
			MinInc	MaxInc	Min. Length	Max. Length		
Byte0_8_t	Byte 0 - 8	xs:byte	0	8				0 1 2 3 4 5 6 7 8
Byte0_32_t	Byte 0 - 32	xs:byte	0	32				
Byte1_2_t	Byte 1 or 2	xs:byte						1 2
Byte1_3_t	Byte 1 - 3	xs:byte	1	3				1 2 3
Byte1_4_t	Byte 1 - 4	xs:byte	1	4				1 2 3 4
Byte1_8_t	Byte 1 - 8	xs:byte	1	8				1 2 3 4 5 6 7 8

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SimpleType	ann:	BaseType	Restrictions					
			Facets				Patterns	Enum.
			MinInc	MaxInc	Min. Length	Max. Length		
Byte1_12_t	Byte 1 - 12	xs:byte						1 2 3 4 5 6 7 8 9 10 11 12
Byte-1_7_t	to be omitted	xs:byte	-1	7				
Byte0_10_t	Byte 0 - 10	xs:byte	1	10				0
Byte0_99_t	Byte 0 - 99	xs:byte	0	99				
Byte1_99_t	Byte 1 - 99	xs:byte	1	99				
Byte0_100_t	Byte 0 - 100	xs:byte	0	100				
Short_t	Type Short	xs:short						
UnsignedShort_t	Type Unsigned Short	xs:unsigned-Short						
Int_t	Type Int	xs:int						
UnsignedInt_t	Type Unsigned Int	xs:unsignedInt						
Int0_999_t	To be omitted	xs:int	0	999				
Int0_9999_t	To be omitted	xs:int	0	9999				
Int0_1T_t	Int 0 - 1000	xs:unsignedInt	0	1000				
Int0_10T_t	Int 0 - 10000	xs:int	0	10000				
Int0_100T_t	Int 0 - 100000	xs:int	0	100000				
Int0_32767_t	To be omitted	xs:int	0	32767				
Int0_65535_t	Int 0 - 65535	xs:int	0	65535				
Int0_1M_t	Type Int 0 - 1000000	xs:int	0	1000000				
Int_goet_0_t	Type Int minIncl 0	xs:int	0					
Float_t	Type Float	xs:float						
Float-10_10_t	Type Float -10 - 10	xs:float	-10	10				
Float0_100_t	Type Float 0 - 100	xs:float	0	100				

Appendix

SimpleType	ann:	BaseType	Restrictions					
			Facets				Patterns	Enum.
			MinInc	MaxInc	Min. Length	Max. Length		
Float-100_100_t	Type Float -100 - 100	xs:float	-100	100				
Float-10M_10M_t	Type Float -10 Mio - +10 Mio	xs:float	-10000000	10000000				
Double_t	Type Double	xs:double						
Double0_10_t	Type Double 0 - 10	xs:double	0	10				
Double0_100_t	Type Double 0 - 100	xs:double	0	100				
Double0.01_100_t	Type Double 0.01_100	xs:double	0.01	100				
Double0_1T_t	Type Double 0 - 1000	xs:double	0	1000				
Double0_180_t	Type Double 0 - 180	xs:double	0	180				
Double0_360_t	Type Double 0 - 360	xs:double	0	360				
Double-180_180_t	Type Double -180 - 180	xs:double	-180	180				
Double0_10T_t	Type Double 0 -10000	xs:double	0	10000				
Double0_100T_t	Double 0 - 100000	xs:double	0	100000				
Double1_10M_t	Type Double 1 - 10 Mio	xs:double	1	10000000				
Double-10M_10M_t	Type Double -10 Mio - +10 Mio	xs:double	-10000000	10000000				
Double_goet_0_t	Type Double minIncl 0	xs:double	0					
Boolean_t	Type Boolean	xs:boolean						
Ovr_t	Type Override 0 - 150	xs:float	0	150				
Pos_t	Type Position (-1 Mio - +1 Mio)	xs:double	-1000000	1000000				
Dist_t	Type Position (0 - 1 Mio)	xs:double	0	1000000				
Vel_t	Type Velocity 0 - 1000 Mio [Axis Velocity]	xs:double	0	10000000000				
SpSpeed_t	Spindle Speed 0 - 100000	xs:double	0	100000				
Acc_t	Acceleration 0 - 1000 [Axis Acceleration]	xs:double	0	1000				
SpAcc_t	Spindle Acceleration 0 - 100000	xs:double	0	100000				
JumpVel_t	Jump Velocity 0 - 100 000	xs:double	0	100000				
JumpAcc_t	Jump Acceleration 0 - 200	xs:float	0	200				
Torq_t	Torque 0 - 1000 [%]	xs:float	0	1000				
Sp_t	Spindle 0 - 8	xs:byte	0	8				

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SimpleType	ann:	BaseType	Restrictions					
			Facets				Patterns	Enum.
			MinInc	MaxInc	Min. Length	Max. Length		
ChSp_t	Spindle 0 - 8	xs:byte	0	32				
ChAx_t	Channel Axis (0 - 8)	xs:unsigned-Byte	0	8				
Ax_t	Lin. and rot. Axis (0 - 99)	xs:byte	0	99				
Dr_t	NC-controlled Axis Drives (0 - 99)	xs:byte	0	99				
Prec_t	Type Precision (0 .. 7)	xs:byte	0	7				
Ch_t	Type Channels (0 ..60)	xs:byte	0	60				
CS_t	Type Coordinate System	isoLatin1String				3		WCS MCS BCS
AxFun_t	Type Axis Functionality (later limit it to 0, 1, 2, 3 (Designation Main Axis X, Y, Z))	xs:int						
SpGr_t	Type Spindle Group 0 - 4	xs:byte	0	4				
DigBuff_t	Type Digitizing Buffers 20 - 2000	xs:unsignedInt	20	2000				
ResDigBuff_t	Type Reserved Dig. Buffer 5 - 100	xs:unsignedInt	5	100				
Blk_t	Block 3 - 999	xs:int	3	999				
CpuTimeBl-Prep_t	Cpu Time for Block Preparation 50 - 100	xs:byte	50	100				
OpFiles_t	Open Files 5 - 60	xs:int	5	60				
BuffNfs_t	NFS Buffer 2048 - 4194304	xs:int	2048	4194304				
CplStack_t	CPL Stack 1024 - 524288	xs:int	1024	524288				
BuffSizeExBl_t	Buffer Size External Block	xs:int	0	1048576				
MinLenCorn-Round_t	Min Block Length for Corner Rounding	xs:float	2	90				
MaxAngCorn-Round_t	Max Angle for Corner Rounding	xs:double	0	45				
NofAuxFun_t	Number of Auxiliary Functions	xs:int	0	1536				
SercBaudeRate_t	Sercos Baud Rate	xs:byte						2 4 8 16
TrTimeMdt_t	Transmission Time MDT	xs:unsignedInt	62	65535				

SimpleType	ann:	BaseType	Restrictions					
			Facets				Patterns	Enum.
			MinInc	MaxInc	Min. Length	Max. Length		
CycTime_t	Sercos Cycle Time = IPO cycle time	xs:unsignedInt	100	64000				
TrTimeMdt_t	Transmission Time MDT	xs:unsignedInt	62	65535				
CycTime_t	Sercos Cycle Time = IPO cycle time	xs:unsignedInt	100	64000				
DbHd_t	Data Base Header	isoLatin1String				4		IKQ1 IKQ2 IKQ3 IQ1 IQ2 IQ3
DECMV4_t	decimal with sign (4 bytes)	xs:double	-2147483648	2147483648				
DECMV2_t	decimal with sign (2 bytes)	xs:double	-32768	32768				
DECOV4_t	decimal without sign (4 bytes)	xs:double	-4294967296	4294967296				
DECOV2_t	decimal without sign (2 bytes)	xs:double	-65536	65536				
IDN_t	Sercos-Ids	xs:string			8	8	[SP][-][0-9][-][0-9](4.4)	

Tab. 7-2: Contents of the basic data type collection (basic_ty.xsd)

7.2 Tool lists configuration file

The following overview shows whether the list/editor control configuration file can be opened using the ULC configurator for all process parameters.

					Ⓐ	Ⓑ
	ListControlDefinition	ListDefinitions		»1		
		SubListDefinitions		»13		
1»	ListDefinitions	ListTitle	**TitleType**	»2		
		Styles	**comRepDefType**	»7		
		GridAttributes		»12		
2»	**TitleType**	TitleText				+
		AssemblyName				+
		ResourceName				+

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					Ⓐ	Ⓑ
		Token			+	
		TokenOfUsertext			+	
		Alignment	**AlignmentType**	»3		
		Font	**FontType**	»4		
		Color	**CellColour**	»5		
		Height			-	A
3»	**AlignmentType**	Align_vertical			o	B1
		Align_horizontal			o	B2
4»	**FontType**	FontID			o	C1
		FontSize			o	C2
		FontStyle			o	C3
5»	**CellColour**	Foreground	**ColourType**	»6		
		Background	**ColourType**	»6		
6»	**ColourType**	Red			-	D1
		Green			-	D2
		Blue			-	D3
		ColorName			o	D4
7»	**comRepDefType**	Normal	**Style**	»8		
		Selected	**Style**	»8		
		Highlighted	**Style**	»8		
		Empty	**Style**	»8		
		ColumnTitle	**ColumnTitleType**	»11		
		SubColumnTitle	**ColumnTitleType**	»11		
8»	**Style**	Fixed	**SubStyle**	»9		
		Scrollable	**SubStyle**	»9		
9»	**SubStyle**	Color	**CellColour**	»5		
		Font	**FontType**	»4		
		Alignment	**AlignmentType**	»3		
		ImageAlignment	**AlignmentType**	»3		
		OuterBorder	**BorderType**	»10		
		InnerBorder	**BorderType**	»10		
		WordWrap			-	E
		Display			-	F

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					Ⓐ	Ⓑ
10»	**BorderType**	BorderSize			-	G
		BorderColour	**ColourType**	»6		
		BorderStyle			-	H
11»	**ColumnTitleType**	Color	**CellColour**	»5		
		Font	**FontType**	»4		
		Alignment	**AlignmentType**	»3		
		ImageAlignment	**AlignmentType**	»3		
		InnerBorder	**BorderType**	»10		
		WordWrap			-	E
12»	GridAttributes	BorderStyle			+	
		Stripline	**BorderType**	»10		
		FilenameOfDefaultValues			+	
		AllowFocusOnNonEditableCells			+	
		ShowTraceMessages			+	
		ShowDebugMessages			+	
		AllowMerging			+	
		ListBackGroundColor	**ColourType**	»6		
		KeyActionEnter			+	
		KeyActionTab			+	
		AllowFreezingWithMouse			+	
		AllowResizing			+	
		AutoSearch			+	
		ExtendLastCol			+	
		AutoResize			+	
		UseNumberDecimalSeparator			+	
		SuppressComma			+	
		CursorKeyCanCloseEditmode			+	
		TabCanCloseEditMode			+	
		DrawTextFlexgridOrg			+	
		AllowSorting			+	
		ScrollTrack			+	
		PageDownTrack			+	
		TestDOMToConfig			+	
		TestSOMToConfig			+	
		UserStringTableID			-	J
		GridHighlight			+	
		CheckRowVisibilityAtBeginning			+	

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					Ⓐ	Ⓑ
		SortEmptyRowsToEnd			-	V
		UseFixedNumberOfSubRows			-	W
		TextEditor	»47			
13»	SubListDefinitions	ScopeDefinition	**ScopeDefinitionType**	»14		
		ColumnDefinitions	**CommonColumnDefini-tionsType**	»15		
		ColumnGeneralAttributes	»23			
		RowDefinition	»26			
		CellDefinitions	**CellDefinitionsType**	»29		
		SublistProperties	»41			
14»	**ScopeDefinitionType**	PathOfMultiplicator			-	K1
		ShowMultipleSublists			-	K2
		NoOfFixedColumn			-	K3
		NoOfScrollableColumn			-	K4
		NoOfFrozenColumn			-	K5
		NoOfFrozenRow			-	K6
15»	**CommonColumnDefinition-sType**	ColDef	**ColumnDefinitionType**	»16		
16»	**ColumnDefinitionType**	PathOfMultiplicator			-	L1
		ColTitle	**ColumnTitleStyle**	»17		
		SubColumnDefinitions	**SubColumnDefinition-sType**	»18		
17»	**ColumnTitleStyle**	TitleText			+	
		ProcessVariableID			+	
		AssemblyName			+	
		ResourceName			+	
		Token			+	
		TokenOfUsertext			+	
18»	**SubColumnDefinitionsType**	SubColDef	»19			
19»	SubColDef	PathOfMultiplicator			-	L2
		SubColTitle	**ColumnTitleStyle**	»20		
		SubColWidth			+	
		CellRanges	»21			
		ColSortFlag			-	M

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					Ⓐ	Ⓑ
		SortRow			-	N
20»	**ColumnTitleStyle**	TitleText			+	
		ProcessVariableID			+	
		AssemblyName			+	
		ResourceName			+	
		Token			+	
		TokenOfUsertext			+	
21»	CellRanges	CellRange	»22			
22»	CellRange	FirstRangeCellNo			+	
		LastRangeCellNo			+	
23»	ColumnGeneralAttributes	ColumnTitleAtributes	»24			
		SubColumnTitleAtributes	»25			
24»	ColumnTitleAtributes	ColumnTitleHeight			+	
25»	SubColumnTitleAtributes	ColumnTitleHeight			+	
26»	RowDefinition	SubRowDefinitions	»27			
27»	SubRowDefinitions	PathOfMultiplicator			-	L3
		SubRowHeight			+	
		Dependency_for_Visibility	**DependencyType**	»28		
28»	**DependencyType**	DepProcessVariableID			-	P1
		Operation			-	P2
		Value			-	P3
		Value2			-	P4
		FollowingDepCondition			-	P5
		Condition	**DependencyType**	»28		
29»	**CellDefinitionsType**	CellDef	»30			
30»	CellDef	CellAddress	**CellAddressType**	»31		
		ContentType	**CellContentType**	»32		
		EditType	**CellEditType**	»36		
		RepresentationDefinitions	»37			

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					Ⓐ	Ⓑ
31»	**CellAddressType**	line			+	
		Column			+	
		SubColumn			+	
32»	**CellContentType**	CellContentType			+	
		Comment			+	
		FixedImage			+	
		ProcessVariableID			+	
		ProcessVariableDataType			+	
		TextOrBitmap			+	
		AssemblyName			+	
		ResourceName			+	
		BitmapAssemblyName			+	
		BitmapResourceName			+	
		Token			+	
		TokenOfUsertext			+	
		ReadProcVarAllways			-	T
		BitmapTable	»33			
		BitmapTableCom			+	
		BitmapTableShowKey			-	
		TextTable	»34			
		TextTableCom			-	
		TextTableUse			-	
		TextTableShowKey			-	
33»	BitmapTable	KeyValuePair	»35			
»34	TextTable	KeyValuePair	»35			
34»	KeyValuePair	Key			o	Q1
		Value			o	Q2
36»	**CellEditType**	EditStatus			o	U
		EditTypeSelection			+	
37»	RepresentationDefinitions	Dependency_for_Representation	»38			
		TextFormat			+	
		NumFormat	**NumFormatType**	»39		

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					Ⓐ	Ⓑ
38»	Dependency_for_Representation	Dependency_for_Visibility	**DependencyType**	»28		
		Validation	**DependencyType**	»28		
		EditDepend	**DependencyType**	»28		
39»	**NumFormatType**	NumType			+	
		DigitDef	»40			
		Pos_dec_Point_Def	»41			
		FormatString			+	
		EditMask			+	
40»	DigitDef	No_of_Digits			+	
		DepVar			+	
41»	Pos_dec_Point_Def	Position_after_dec_Point			+	
		DepVar			+	
42»	SublistProperties	Highlighted	»43			
		SublistActions	»45			
43»	Highlighted	TypeOfHighlight			-	R
	IsHighlighted	IsHighlighted	»44			
44»	IsHighlighted	**DependencyType**	»28			
		HighlightColor	**ColourType**	»6		
45»	SublistActions	Action	»46			
46»	Action	TypeOfAction			-	S
		IsCondition	**DependencyType**	»28		
47»	TextEditor	TextAlignment			-	O1
		Font	»48			
48»	Font	FontStyle			-	O2

Explanations of the process parameters that cannot, or only to a degree, be opened using the ULC configurator (indicated by **-** or **o**).

Ⓑ		Explanation	Remarks
A		Height of table title line	
B	1	Horizontal arrangement	

Appendix

Ⓑ		Explanation		Remarks
	2	Vertical arrangement		
C	1	Font		
	2	Font size		
	3	Font style		
D	1	Color setting	Red value	
	2		Green value	
	3		Blue value	
	4		Color name	Log. from color helper definition
E		Automatic line break		
F		Type of display		
G		Line width		
H		Line type		
J		Name of user text file		
K	1	Multiplication process variable		Multiplication of partial lists
	2	Display of partial lists		
	3	Number of fixed columns		
	4	Number of scrollable columns		Total number of main columns
	5	Number of frozen columns		
	6	Number of frozen lines		
L	1	Multiplication process variable		Multiplication of main columns
	2			Multiplication of subordinate columns
	3			Multiplication of subordinate lines
M		Column sorting permitted		
N		Line sorting permitted		
O	1	Text alignment		
	2	Font type		
P	1	Dep. on process variable		
	2	Operation / condition		

Appendix

Ⓑ		Explanation	Remarks
	3	Value	
	4	2. Wert	(Multiplication process variable)
	5	Subsequent condition	
Q	1	Value of process variables	for bitmap table and text table
	2	Bitmap name or text token name	
R		Highlighted type	Currently not relevant
S		Action type	Currently not relevant
T		Control flag for reading the process variables	
U		This is the editability setting in the ULC configurator	Mode 3 cannot be selected (necessary for conditional editing)
V		Type of sorting	To achieve that empty locations are always displayed at the end of the list
W		Specified number of partial lists	The number of sublines of the first partial list determines the number for all partial lists

Appendix

7.3 Interfaces

7.3.1 Status bits

BQ2 - Tool status bits (tool identification)

Data element	Status group	Designation	Brief descr.	Bit no.	Description	Can be changed in MTGUI
BQ2	Tool status	ActiveTool	ta	1	Tool active	no
		PrimaryTool	tp	2	Primary tool	no
		UsedTool	tu	3	Used tool	no
		WarnLimit	tw	4	Warning limit reached	no
		WornOut	two	5	Tool worn	no
		PlaceCoded	TPC	6	Fixed location-coded tool	Yes
		Locked	TL	7	Tool locked	Yes
		Defective	TD	8	Tool defective	Yes
		Ignore	ti	9	Ignore tool	no
		Measured	tm	10	Probe tool	no
		ToLoad	ttl	11	Tool loaded	no
		ToUnload	ttu	12	Tool unloaded	no
		MasterTool	mt	13	Master tool	no
		ToolChange	tc	14	Tool change	no
		SisterTool	ts	15	Alternate tool	no
		HeavyTool	TH	16	Heavy tool	Yes
		NonEditable	tne	17	Tool cannot be edited	no
		Reserve 1		18	Reserve	
		Reserve 2		19	Reserve	
		Reserve 3		20	Reserve	
		Reserve 4		21	Reserve	
		Reserve 5		22	Reserve	
		Reserve 6		23	Reserve	
		Reserve 7		24	Reserve	
		UserStatus 1	TS1	25	Tool user status 1	Yes
		UserStatus 2	TS2	26	Tool user status 2	Yes
		UserStatus 3	TS3	27	Tool user status 3	Yes
		UserStatus 4	TS4	28	Tool user status 4	Yes
		UserStatus 5	TS5	29	Tool user status 5	Yes
		UserStatus 6	TS6	30	Tool user status 6	Yes
		UserStatus 7	TS7	31	Tool user status 7	Yes
		UserStatus 8	TS8	32	Tool user status 8	Yes

Tab. 7-3: BQ2 - Tool status

Appendix

BQ1 - Location status bits

Data element	Status group	Designation	Brief descr.	Bit no.	Description	Can be changed in MTGUI
BQ1	Place status	Free	pf	1	Free location	no
		Blocked	PB	2	Blocked location	Yes
		Ignore	pi	3	Ignore location	no
		Reserved	pr	4	Reserve location	no
		ReservedLeft	prl	5	Left half-location reserved	no
		ReservedRight	prr	6	Right half-location reserved	no
		ReservedLeftLower	prll	7	Left lower half-place reserved	no
		ReservedRightLower	prrl	8	Right lower half-location reserved	no
		OccupiedLeft	pol	9	Left half-location assigned	no
		OccupiedRight	por	10	Right half-location assigned	no
		OccupiedLeftLower	poll	11	Left lower half-location assigned	no
		OccupiedRightLower	porl	12	Right lower half-location assigned	no
		PlaceTypeMonitoring	ptm	13	Location type machining	no
		DeviceTypeMonitoring	dtm	14	Device type machining	no
		FormTypeMonitoring	ftm	15	Form type machining	no
		DeviceInPlace	dip	16	Device in location	no
		Reserve 1		17	Reserve	
		Reserve 2		18	Reserve	
		Reserve 3		19	Reserve	
		Reserve 4		20	Reserve	
		Reserve 5		21	Reserve	
		Reserve 6		22	Reserve	
		Reserve 7		23	Reserve	
		Reserve 8		24	Reserve	
		PlaceUserStatus 1	PS1	25	Location user status 1	Yes
		PlaceUserStatus 2	PS2	26	Location user status 2	Yes
		PlaceUserStatus 3	PS3	27	Location user status 3	Yes
		PlaceUserStatus 4	PS4	28	Location user status 4	Yes
		PlaceUserStatus 5	PS5	29	Location user status 5	Yes
		PlaceUserStatus 6	PS6	30	Location user status 6	Yes
		PlaceUserStatus 7	PS7	31	Location user status 7	Yes
		PlaceUserStatus 8	PS8	32	Location user status 8	Yes

Tab. 7-4: BQ1 - Location status

Appendix

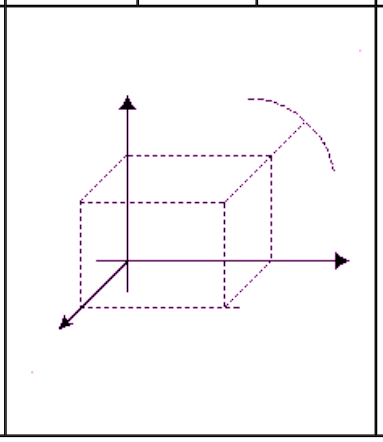
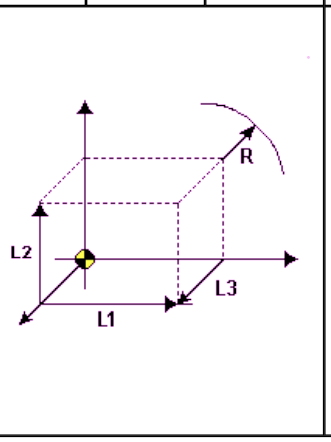
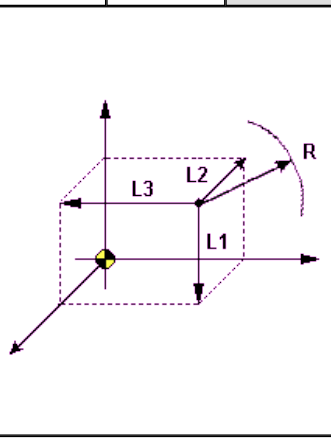
BQ3 - Technology status bits

Data element	Status group	Designation	Brief descr.	Bit no.	Description
BQ3	Technology status	NoOfEdges	EdNo	1	Edge number (1...16) Value range: 0 - 15
				2	
				3	
				4	
		Reserve 1	TCR1	5	Reserve
		Reserve 2	TCR2	6	Reserve
		Reserve 3	TCR3	7	Reserve
		CorrVal CH	CH	8	Angle head tool
		CorrVal L1	L1	9	L1 - Correction
		CorrVal L2	L2	10	L2 - Correction
		CorrVal L3	L3	11	L3 - Correction
		CorrVal R1	R1	12	R1 - Correction
		CorrVal R2	R2	13	R2 - Correction
		CorrVal O	O	14	Edge position
		CorrVal DIA	DIA	15	Correction value (L2) as diameter value
		ToolTech 1	T1	16	Tool technology value 1
		ToolTech 2	T2	17	Tool technology value 2
		ToolTech 3	T3	18	Tool technology value 3
		ToolTech 4	T4	19	Tool technology value 4
		ToolTech 5	T5	20	Tool technology value 5
		ToolTech 6	T6	21	Tool technology value 6
		ToolTech 7	T7	22	Tool technology value 7
		ToolTech 8	T8	23	Tool technology value 8
		EdgeTech 1	ET1	24	Edge technology value 1
		EdgeTech 2	ET2	25	Edge technology value 2
		Reserve 5		26	Reserve
		Reserve 6		27	Reserve
		Reserve 7		28	Reserve
		Reserve 8		29	Reserve
		Reserve 9		30	Reserve
		Reserve 10		31	Reserve
		Reserve 11		32	Reserve

Tab. 7-5: BQ3 - Technology status bits

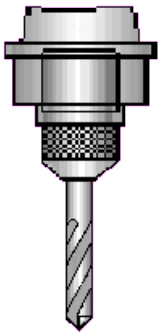
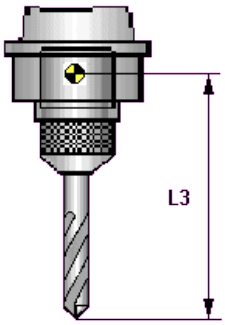
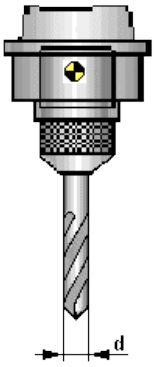
7.3.2 Tool catalog

Appendix

Technology		General processing							
Tool type name		General tool							
Tool type	IKQ2	0000							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		can be set from 1 - 16							
Reserve	BQ3 (Bit 5 ...7)	**TRC1**	**TRC2**	**TRC3**					
Correction type	BQ3 (Bit 8 ...15)	CH	**L1**	**L2**	**L3**	**R1**	**R2**	**O**	**DIA**
Tool technology data	BQ3 (Bit 16 ... 23)	**T1**	**T2**	**T3**	**T4**	**T5**	**T6**	**T7**	**T8**
		d	ds	tw	tl	lu	tal	tac	nt
		Diameter	Small diameter	Tool edge width	Depth gauge	Usable length	Orientation angle	Apical angle	Number of teeth
Edge technology data	BQ3 (Bit 24 ... 25)	**ET1**	**ET2**						
		de	lfe						
		Edge dimension 1	Edge dimension 2						
Reserve	BQ3 (Bit 26 ... 32)	**TRC4**	**TRC5**	**TRC6**	**TRC7**	**TRC8**	**TRC9**	**TRC10**	
Screen									

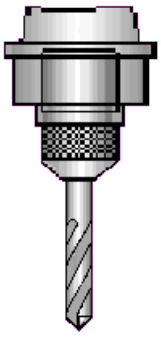
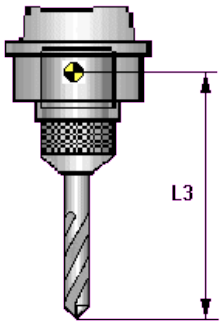
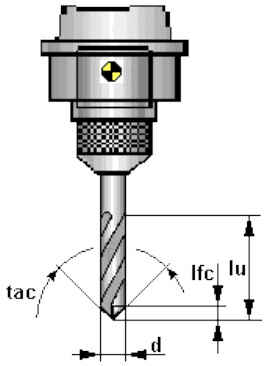
Tab. 7-6: 0000

Appendix

Technology		Drilling tools							
Tool type name		Drilling tool, general							
Tool type	IKQ2	1000							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		can be set from 1 - 16							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8...15)	**CH**[2)]	**L1**[1)]	**L2**[1)]	**L3**	R1	R2	O	DIA
Tool technology data	BQ3 (Bit 16 ... 23)	**T1**	T2	T3	T4	T5	T6	T7	T8
		d							
		Diameter							
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

1): Active if CH = TRUE (angle head tool)
2): Value can be defined in the tool editor
Tab. 7-7: 1000

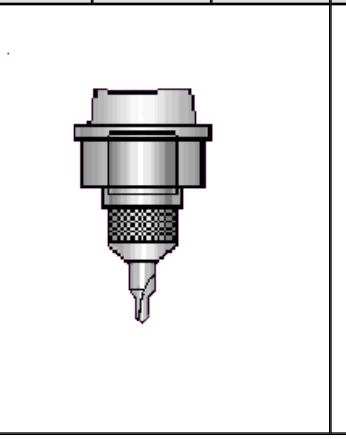
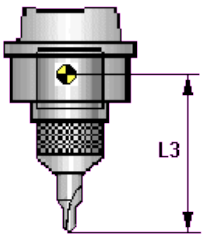
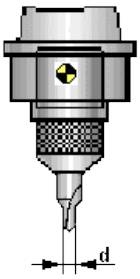
Appendix

Technology		Drilling tools							
Tool type name		Twist drill							
Tool type	IKQ2	1001							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		1							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	**CH**[2]	**L1**[1]	**L2**[1]	**L3**	R1	R2	O	DIA
Tool technology data	BQ3 (Bit 16 ... 23)	**T1**	T2	**T3**	T4	**T5**	T6	**T7**	T8
		d		lfc		lu		tac	
		Diameter		Chamfer length		Usable length		Apical angle	
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

1): Active if CH = TRUE (angle head tool)
2): Value can be defined in the tool editor

Tab. 7-8: 1001

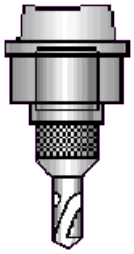
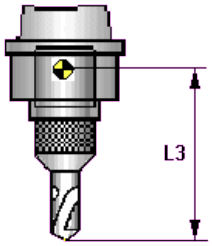
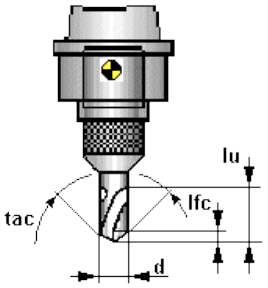
Appendix

Technology		Drilling tools							
Tool type name		Center drill							
Tool type	IKQ2	1002							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		1							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	**CH[2)]**	**L1[1)]**	**L2[1)]**	**L3**	R1	R2	O	DIA
Tool technology data	BQ3 (Bit 16 ... 23)	**T1**	T2	T3	T4	T5	T6	T7	T8
		d							
		Diameter							
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

1): Active if CH = TRUE (angle head tool)
2): Value can be defined in the tool editor

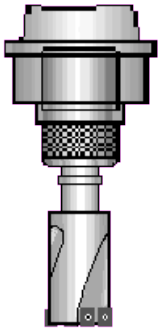
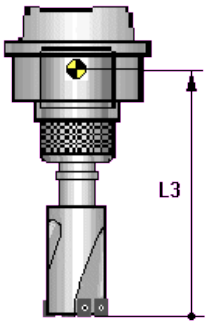
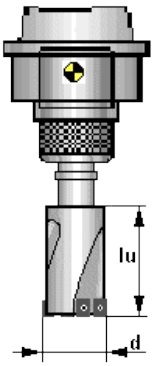
Tab. 7-9: 1002

Appendix

Technology		Drilling tools							
Tool type name		NC spot drill							
Tool type	IKQ2	1003							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		1							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	**CH**[2]	**L1**[1]	**L2**[1]	**L3**	R1	R2	O	DIA
Tool technology data	BQ3 (Bit 16 ... 23)	**T1**	T2	**T3**	T4	T5	T6	**T7**	T8
		d		lfc				tac	
		Diameter		Chamfer length				Apical angle	
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

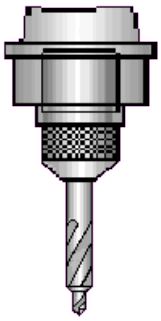
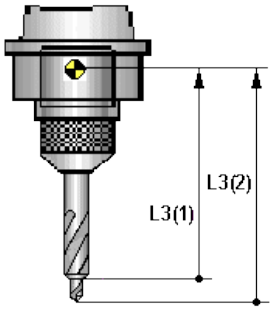
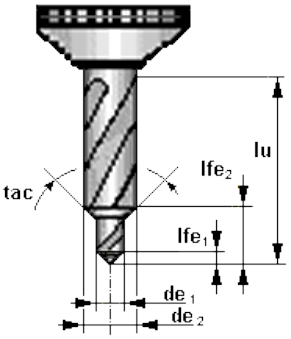
1): Active if CH = TRUE (angle head tool)
2): Value can be defined in the tool editor
Tab. 7-10: 1003

Appendix

Technology		Drilling tools							
Tool type name		Reversible tip drill							
Tool type	IKQ2	1004							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		1							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	**CH**[2)]	**L1**[1)]	**L2**[1)]	**L3**	R1	R2	O	DIA
Tool technology data	BQ3 (Bit 16 ... 23)	**T1**	T2	T3	T4	T5	T6	T7	T8
		d				lu			
		Diameter				Usable length			
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

1): Active if CH = TRUE (angle head tool)
2): Value can be defined in the tool editor
Tab. 7-11: 1004

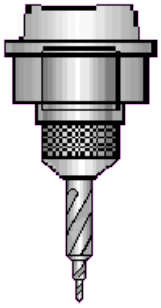
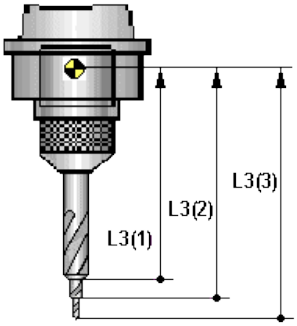
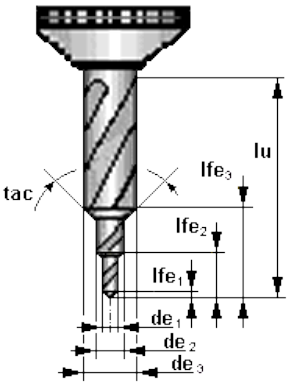
Appendix

Technology		Drilling tools							
Tool type name		Step drill 2 steps							
Tool type	IKQ2	1005							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		2							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	**CH**[2]	**L1**[1]	**L2**[1]	**L3**	R1	R2	O	DIA
Tool technology data	BQ3 (Bit 16 ... 23)	T1	T2	T3	T4	**T5**	T6	**T7**	T8
						lu		tac	
						Usable length		Counter-sink angle	
Edge technology data	BQ3 (Bit 24 ... 25)	**ET1**	**ET2**						
		de	lfe						
		Diameter	Cut length						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

1): Active if CH = TRUE (angle head tool)
2): Value can be defined in the tool editor

Tab. 7-12: 1005

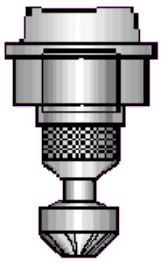
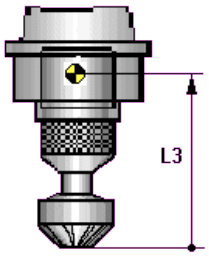
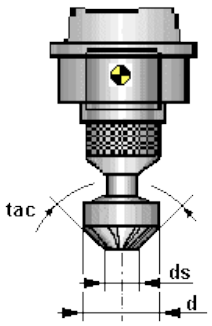
Appendix

Technology		Drilling tools							
Tool type name		Step drill 3 steps							
Tool type	IKQ2	1006							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		3							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	**CH**[2)]	**L1**[1)]	**L2**[1)]	**L3**	R1	R2	O	DIA
Tool technology data	BQ3 (Bit 16 ... 23)	T1	T2	T3	T4	**T5**	T6	**T7**	T8
						lu		tac	
						Usable length		Counter-sink angle	
Edge technology data	BQ3 (Bit 24 ... 25)	**ET1**	**ET2**						
		de	lfe						
		Diameter	Cut length						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

1): Active if CH = TRUE (angle head tool)
2): Value can be defined in the tool editor

Tab. 7-13: 1006

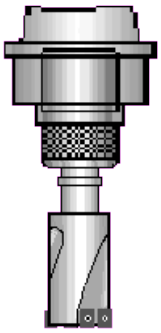
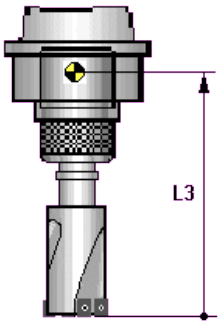
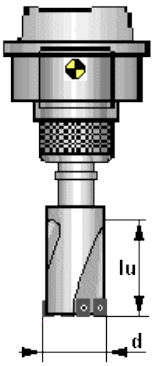
Appendix

Technology		Drilling tools							
Tool type name		Countersink							
Tool type	IKQ2	1007							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		1							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	**CH**[2]	**L1**[1]	**L2**[1]	**L3**	R1	R2	O	DIA
Tool technology data	BQ3 (Bit 16 ... 23)	**T1**	**T2**	T3	T4	T5	T6	**T7**	T8
		d	ds					tac	
		Large diameter	Small diameter					Countersink angle	
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

1): Active if CH = TRUE (angle head tool)
2): Value can be defined in the tool editor

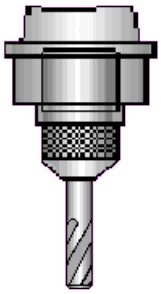
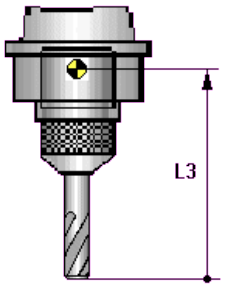
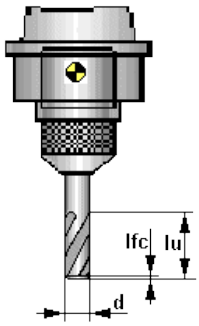
Tab. 7-14: 1007

Appendix

Technology		Drilling tools							
Tool type name		Plane countersink							
Tool type	IKQ2	1008							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		1							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	**CH**[2)]	**L1**[1)]	**L2**[1)]	**L3**	R1	R2	O	DIA
Tool technology data	BQ3 (Bit 16 ... 23)	**T1**	T2	T3	T4	**T5**	T6	T7	T8
		d				lu			
		Diameter				Usable length			
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

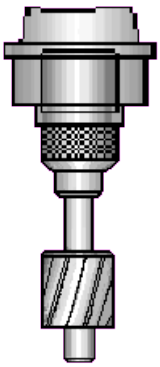
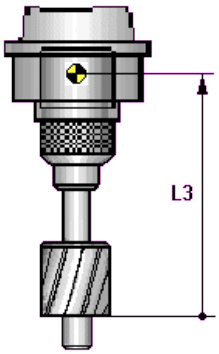
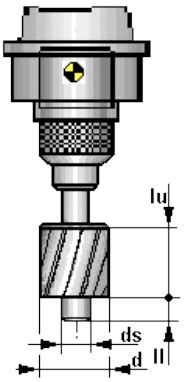
1): Active if CH = TRUE (angle head tool)
2): Value can be defined in the tool editor
Tab. 7-15: 1008

Appendix

Technology		Drilling tools							
Tool type name		Spiral countersink							
Tool type	IKQ2	1009							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		1							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	**CH**[2)]	**L1**[1)]	**L2**[1)]	**L3**	R1	R2	O	DIA
Tool technology data	BQ3 (Bit 16 ... 23)	**T1**	T2	**T3**	T4	**T5**	T6	T7	T8
		d		lfc		lu			
		Diameter		Chamfer length		Usable length			
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

1): Active if CH = TRUE (angle head tool)
2): Value can be defined in the tool editor
Tab. 7-16: 1009

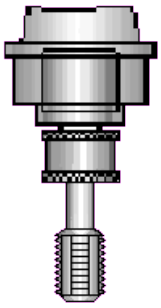
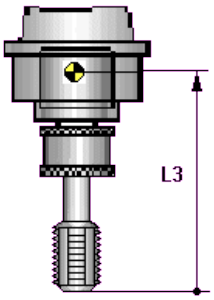
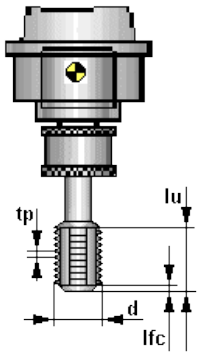
Appendix

Technology		Drilling tools							
Tool type name		Counterbore							
Tool type	IKQ2	1010							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		1							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	**CH**[2)]	**L1**[1)]	**L2**[1)]	**L3**	R1	R2	O	DIA
Tool technology data	BQ3 (Bit 16 ... 23)	**T1**	**T2**	**T3**	T4	**T5**	T6	T7	T8
		d	ds	ll		lu			
		Large diameter	Small diameter	Spigot length		Usable length			
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

1): Active if CH = TRUE (angle head tool)
2): Value can be defined in the tool editor

Tab. 7-17: 1010

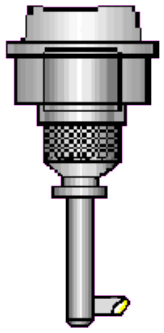
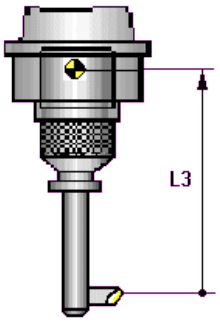
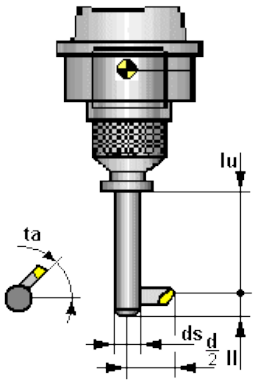
Appendix

Technology		Drilling tools							
Tool type name		Tap							
Tool type	IKQ2	1011							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		1							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	**CH**[2]	**L1**[1]	**L2**[1]	**L3**	R1	R2	O	DIA
Tool technology data	BQ3 (Bit 16 ... 23)	**T1**	T2	**T3**	T4	**T5**	**T6**	T7	T8
		d		lfc		lu	tp		
		Diameter		Chamfer length		Usable length	Thread pitch		
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

1): Active if CH = TRUE (angle head tool)
2): Value can be defined in the tool editor

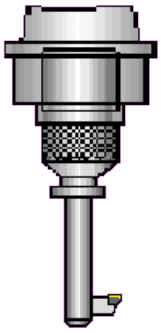
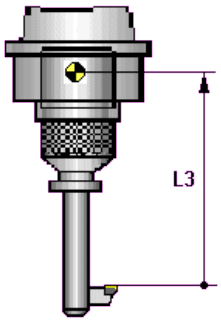
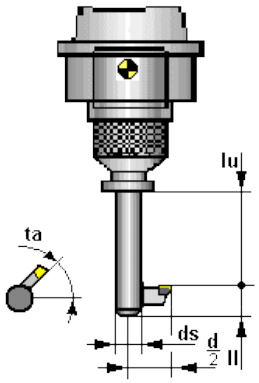
Tab. 7-18: 1011

Appendix

Technology		Drilling tools							
Tool type name		Boring bar							
Tool type	IKQ2	1012							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		1							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	**CH**[2]	**L1**[1]	**L2**[1]	**L3**	R1	R2	O	DIA
Tool technology data	BQ3 (Bit 16 ... 23)	**T1**	**T2**	**T3**	T4	**T5**	**T6**	T7	T8
		d	ds	ll		lu	ta		
		Diameter	Shank diameter	Loss length		Usable length	Setting angle		
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

1): Active if CH = TRUE (angle head tool)
2): Value can be defined in the tool editor
Tab. 7-19: 1012

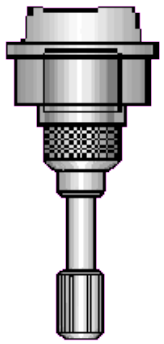
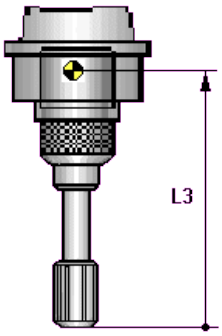
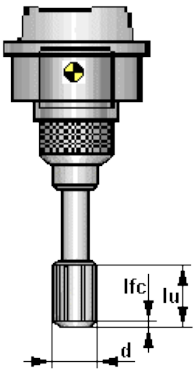
Appendix

Technology		Drilling tools							
Tool type name		Reverse Countersink							
Tool type	IKQ2	1013							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		1							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	**CH**[2]	**L1**[1]	**L2**[1]	**L3**	R1	R2	O	DIA
Tool technology data	BQ3 (Bit 16 ... 23)	**T1**	**T2**	**T3**	T4	**T5**	**T6**	T7	T8
		d	ds	ll		lu	ta		
		Diameter	Shank diameter	Loss length		Usable length	Setting angle		
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

1): Active if CH = TRUE (angle head tool)
2): Value can be defined in the tool editor

Tab. 7-20: 1013

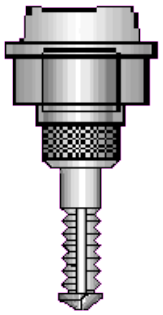
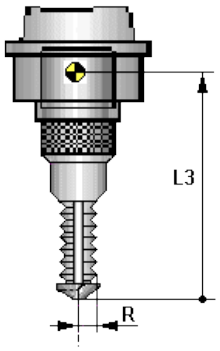
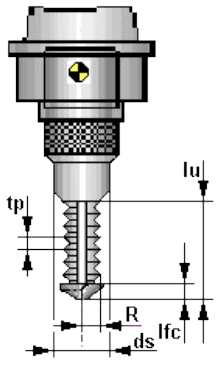
Appendix

Technology		Drilling tools							
Tool type name		Reamer							
Tool type	IKQ2	1014							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		1							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	**CH**[2)]	**L1**[1)]	**L2**[1)]	**L3**	R1	R2	O	DIA
Tool technology data	BQ3 (Bit 16 ... 23)	**T1**	T2	**T3**	T4	**T5**	T6	T7	T8
		d		lfc		lu			
		Diameter		Chamfer length		Usable length			
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

1): Active if CH = TRUE (angle head tool)
2): Value can be defined in the tool editor

Tab. 7-21: 1014

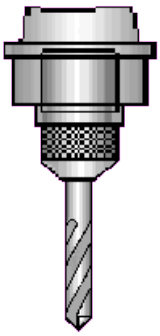
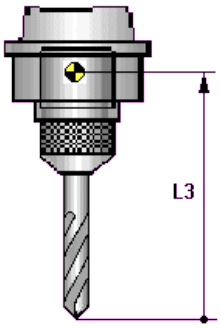
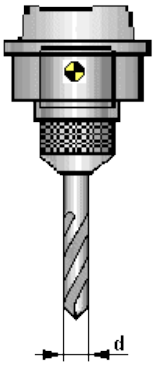
Appendix

Technology		Drilling tools							
Tool type name		Drill and thread milling cutter							
Tool type	IKQ2	1015							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		1							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	**CH**[2]	**L1**[1]	**L2**[1]	**L3**	**R1**	R2	O	DIA
Tool technology data	BQ3 (Bit 16 ... 23)	**T1**	**T2**	**T3**	T4	**T5**	**T6**	T7	T8
		d	ds	lfc		lu	tp		
		Nominal diameter of thread	Counter-sinking diameter	Length of tool tip		Usable length	Thread pitch		
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

1): Active if CH = TRUE (angle head tool)
2): Value can be defined in the tool editor

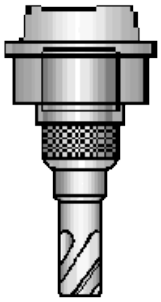
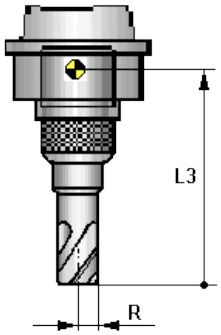
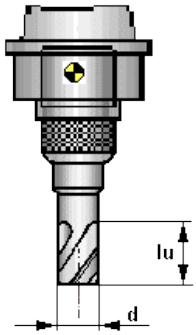
Tab. 7-22: 1015

Appendix

Technology		Drilling tools							
Tool type name		Special drilling tool							
Tool type	IKQ2	1016							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		can be set from 1 - 16							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	**CH**[2]	**L1**[1]	**L2**[1]	**L3**	R1	R2	O	DIA
Tool technology data	BQ3 (Bit 16 ... 23)	**T1**	T2	T3	T4	T5	T6	T7	T8
		d							
		Diameter							
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

1): Active if CH = TRUE (angle head tool)
2): Value can be defined in the tool editor
Tab. 7-23: 1016

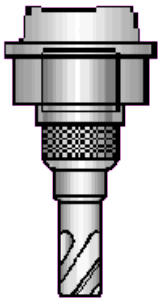
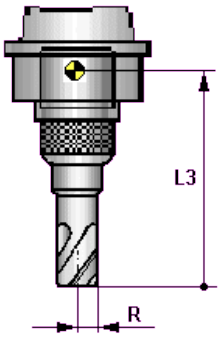
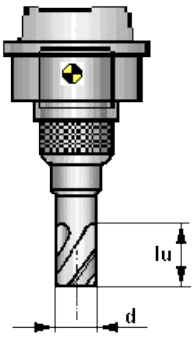
Appendix

Technology		Milling tools							
Tool type name		Milling tool, general							
Tool type	IKQ2	2000							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		can be set from 1 - 16							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	**CH**[2]	**L1**[1]	**L2**[1]	**L3**	**R1**	R2	O	DIA
Tool technology data	BQ3 (Bit 16 ... 23)	**T1**	T2	T3	T4	**T5**	T6	T7	**T8**
		d				lu			nt
		Diameter				Usable length			Number of teeth
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

1): Active if CH = TRUE (angle head tool)
2): Value can be defined in the tool editor

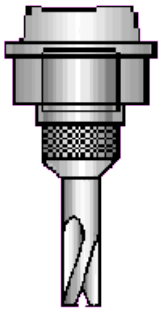
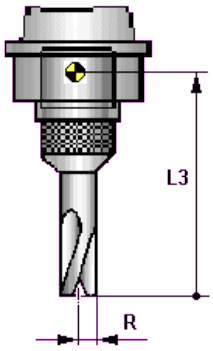
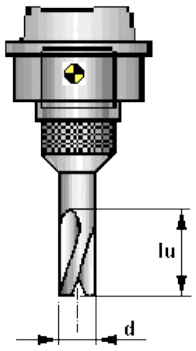
Tab. 7-24: 2000

Appendix

Technology		Milling tools							
Tool type name		End mill							
Tool type	IKQ2	2001							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		1							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	**CH**[2)]	**L1**[1)]	**L2**[1)]	**L3**	**R1**	R2	O	DIA
Tool technology data	BQ3 (Bit 16 ... 23)	**T1**	T2	T3	T4	**T5**	T6	T7	**T8**
		d				lu			nt
		Diameter				Usable length			Number of teeth
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

1): Active if CH = TRUE (angle head tool)
2): Value can be defined in the tool editor
Tab. 7-25: 2001

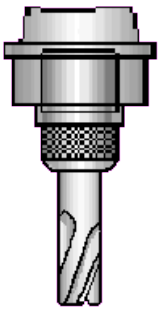
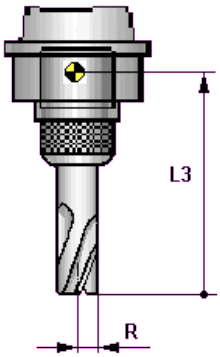
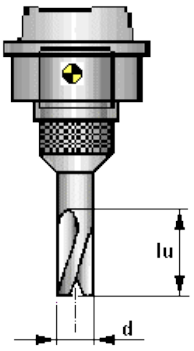
Appendix

Technology		Milling tools							
Tool type name		Groove milling cutter							
Tool type	IKQ2	2002							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		1							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	**CH**[2]	**L1**[1]	**L2**[1]	**L3**	**R1**	R2	O	DIA
Tool technology data	BQ3 (Bit 16 ... 23)	**T1**	T2	T3	T4	**T5**	T6	T7	**T8**
		d				lu			nt
		Diameter				Usable length			Number of teeth
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

1): Active if CH = TRUE (angle head tool)
2): Value can be defined in the tool editor

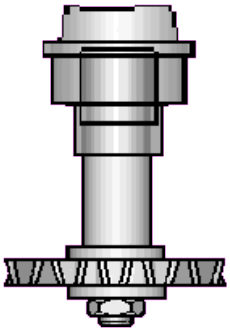
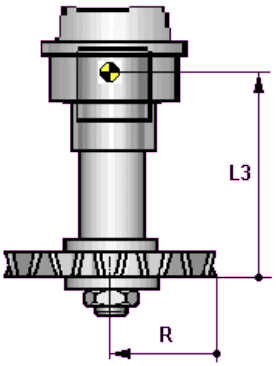
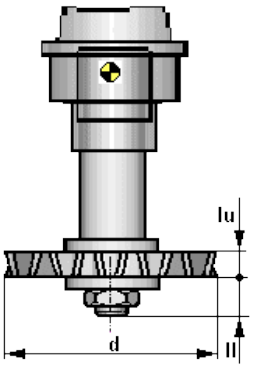
Tab. 7-26: 2002

Appendix

Technology		Milling tools							
Tool type name		Long-hole milling cutter							
Tool type	IKQ2	2003							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		1							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	**CH**[2)]	**L1**[1)]	**L2**[1)]	**L3**	**R1**	R2	O	DIA
Tool technology data	BQ3 (Bit 16 ... 23)	**T1**	T2	T3	T4	**T5**	T6	T7	**T8**
		d				lu			nt
		Diameter				Usable length			Number of teeth
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

1): Active if CH = TRUE (angle head tool)
2): Value can be defined in the tool editor
Tab. 7-27: 2003

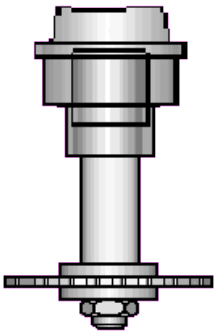
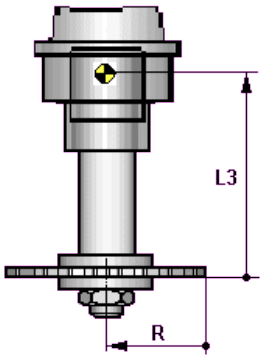
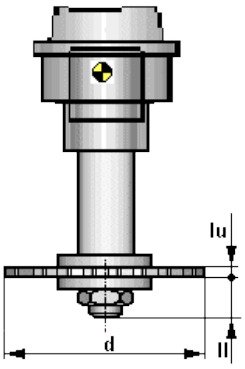
Appendix

Technology		Milling tools							
Tool type name		Disk milling cutter							
Tool type	IKQ2	2004							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		1							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	**CH**[2)]	**L1**[1)]	**L2**[1)]	**L3**	**R1**	R2	O	DIA
Tool technology data	BQ3 (Bit 16 ... 23)	**T1**	T2	**T3**	T4	**T5**	T6	T7	**T8**
		d		ll		lu			nt
		Diameter		Loss length		Usable length			Number of teeth
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

1): Active if CH = TRUE (angle head tool)
2): Value can be defined in the tool editor

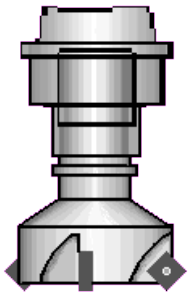
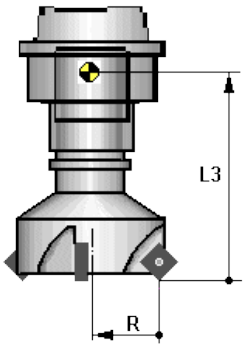
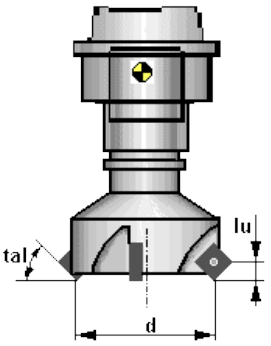
Tab. 7-28: 2004

Appendix

Technology		Milling tools							
Tool type name		Saw blade							
Tool type	IKQ2	2005							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		1							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	**CH**[2)]	**L1**[1)]	**L2**[1)]	**L3**	**R1**	R2	O	DIA
Tool technology data	BQ3 (Bit 16 ... 23)	**T1**	T2	**T3**	T4	**T5**	T6	T7	**T8**
		d		ll		lu			nt
		Diameter		Loss length		Usable length			Number of teeth
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

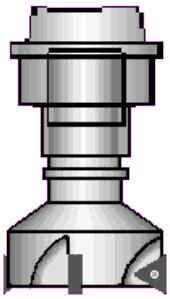
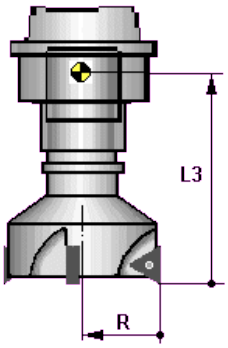
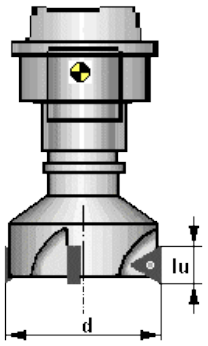
1): Active if CH = TRUE (angle head tool)
2): Value can be defined in the tool editor
Tab. 7-29: 2005

Appendix

Technology		Milling tools							
Tool type name		Face-milling cutter							
Tool type	IKQ2	2006							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		1							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	**CH**[2)]	**L1**[1)]	**L2**[1)]	**L3**	**R1**	R2	O	DIA
Tool technology data	BQ3 (Bit 16 ... 23)	**T1**	T2	T3	T4	**T5**	**T6**	T7	**T8**
		d				lu	tal		nt
		Diameter				Usable length	Edge angle		Number of teeth
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

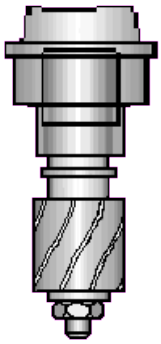
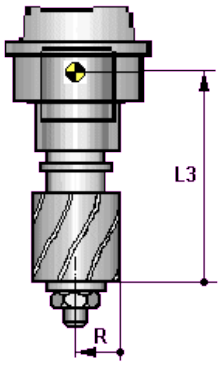
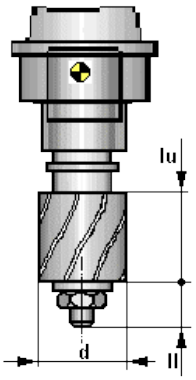
1): Active if CH = TRUE (angle head tool)
2): Value can be defined in the tool editor
Tab. 7-30: 2006

Appendix

Technology		Milling tools							
Tool type name		Corner milling cutter							
Tool type	IKQ2	2007							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		1							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	**CH**[2]	**L1**[1]	**L2**[1]	**L3**	**R1**	R2	O	DIA
Tool technology data	BQ3 (Bit 16 ... 23)	**T1**	T2	T3	T4	**T5**	T6	T7	**T8**
		d				lu			nt
		Diameter				Usable length			Number of teeth
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

1): Active if CH = TRUE (angle head tool)
2): Value can be defined in the tool editor
Tab. 7-31: 2007

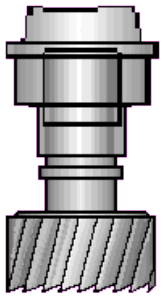
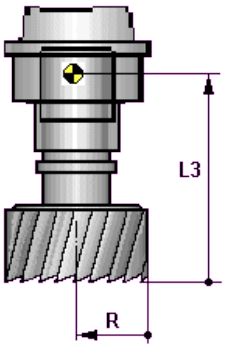
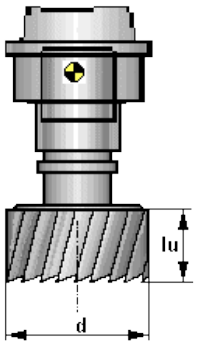
Appendix

Technology		Milling tools							
Tool type name		Plain milling cutter							
Tool type	IKQ2	2008							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		1							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	**CH**[2)]	**L1**[1)]	**L2**[1)]	**L3**	**R1**	R2	O	DIA
Tool technology data	BQ3 (Bit 16 ... 23)	**T1**	T2	**T3**	T4	**T5**	T6	T7	**T8**
		d		ll		lu			nt
		Diameter		Loss length		Usable length			Number of teeth
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

1): Active if CH = TRUE (angle head tool)
2): Value can be defined in the tool editor

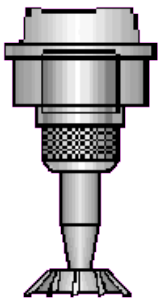
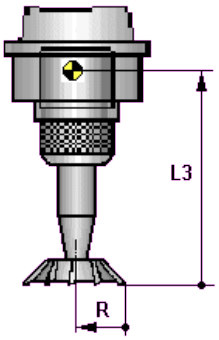
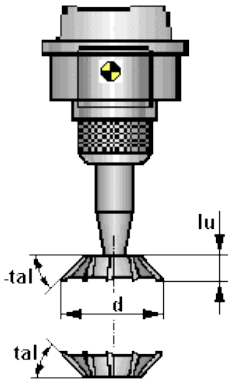
Tab. 7-32: 2008

Appendix

Technology		Milling tools							
Tool type name		Shell end mill							
Tool type	IKQ2	2009							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		1							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	**CH**[2)]	**L1**[1)]	**L2**[1)]	**L3**	**R1**	R2	O	DIA
Tool technology data	BQ3 (Bit 16 ... 23)	**T1**	T2	T3	T4	**T5**	T6	T7	**T8**
		d				lu			nt
		Diameter				Usable length			Number of teeth
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

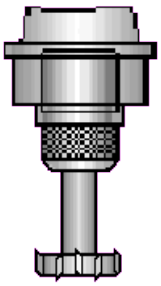
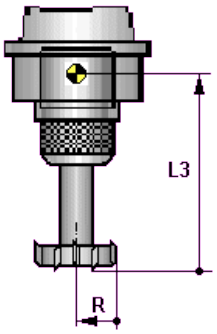
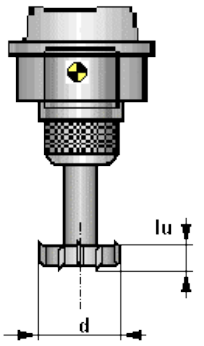
1): Active if CH = TRUE (angle head tool)
2): Value can be defined in the tool editor
Tab. 7-33: 2009

Appendix

Technology		Milling tools							
Tool type name		Angular milling cutter							
Tool type	IKQ2	2010							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		1							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	**CH**[2]	**L1**[1]	**L2**[1]	**L3**	**R1**	R2	O	DIA
Tool technology data	BQ3 (Bit 16 ... 23)	**T1**	T2	T3	T4	**T5**	**T6**	T7	**T8**
		d				lu	tal		nt
		Outer diameter				Usable length	Angle (kappa)		Number of teeth
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

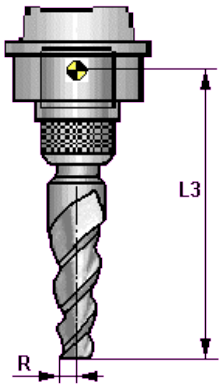
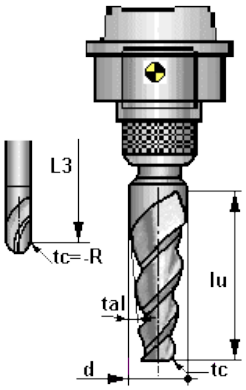
1): Active if CH = TRUE (angle head tool)
2): Value can be defined in the tool editor
Tab. 7-34: 2010

Appendix

Technology		Milling tools							
Tool type name		T groove cutter							
Tool type	IKQ2	2011							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		1							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	**CH**[2)]	**L1**[1)]	**L2**[1)]	**L3**	**R1**	R2	O	DIA
Tool technology data	BQ3 (Bit 16 ... 23)	**T1**	T2	T3	T4	**T5**	T6	T7	**T8**
		d				lu			nt
		Diameter				Usable length			Number of teeth
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

1): Active if CH = TRUE (angle head tool)
2): Value can be defined in the tool editor
Tab. 7-35: 2011

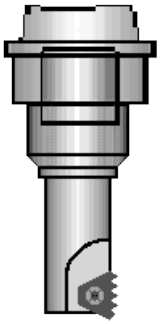
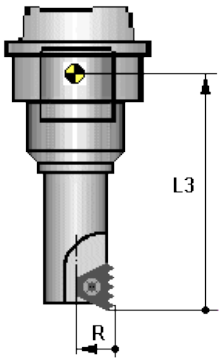
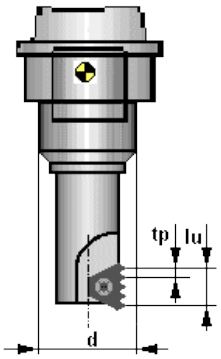
Appendix

Technology		Milling tools							
Tool type name		Diesinking cutter							
Tool type	IKQ2	2012							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		1							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	**CH**[2]	**L1**[1]	**L2**[1]	**L3**	**R1**	R2	O	DIA
Tool technology data	BQ3 (Bit 16 ... 23)	**T1**	T2	**T3**	T4	**T5**	**T6**	T7	**T8**
		d		tc		lu	tal		nt
		Shank diameter		Sphere radius		Usable length	Angle		Number of teeth
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

1): Active if CH = TRUE (angle head tool)
2): Value can be defined in the tool editor

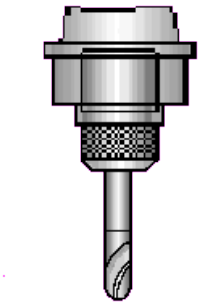
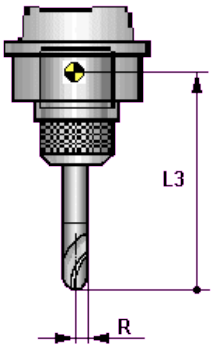
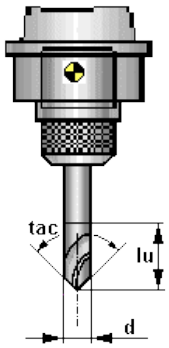
Tab. 7-36: 2012

Appendix

Technology		Milling tools							
Tool type name		Thread milling cutter							
Tool type	IKQ2	2013							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		1							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	**CH**[2)]	**L1**[1)]	**L2**[1)]	**L3**	**R1**	R2	O	DIA
Tool technology data	BQ3 (Bit 16 ... 23)	**T1**	T2	T3	T4	**T5**	**T6**	T7	**T8**
		d				lu	tp		nt
		Shank diameter				Usable length	Thread pitch		Number of teeth
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

1): Active if CH = TRUE (angle head tool)
2): Value can be defined in the tool editor
Tab. 7-37: 2013

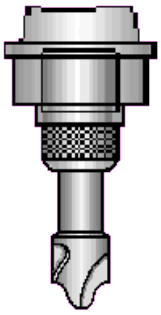
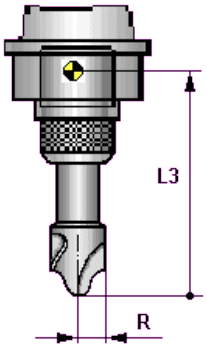
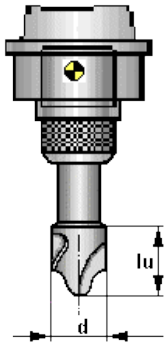
Appendix

Technology		Milling tools							
Tool type name		Engraving tool							
Tool type	IKQ2	2014							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		1							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	**CH**[2]	**L1**[1]	**L2**[1]	**L3**	**R1**	R2	O	DIA
Tool technology data	BQ3 (Bit 16 ... 23)	**T1**	T2	T3	T4	**T5**	T6	**T7**	**T8**
		d				lu		tac	nt
		Outer diameter				Usable length		Apical angle	Number of teeth
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

1): Active if CH = TRUE (angle head tool)
2): Value can be defined in the tool editor

Tab. 7-38: 2014

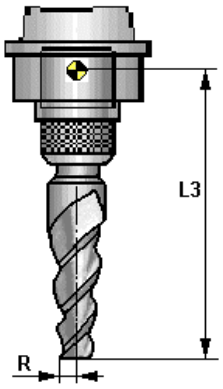
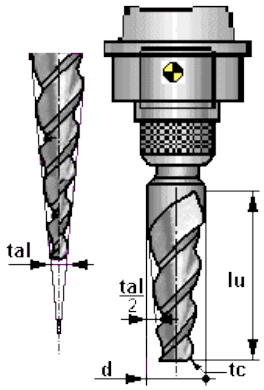
Appendix

Technology		Milling tools							
Tool type name		Special milling tool							
Tool type	IKQ2	2015							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		can be set from 1 - 16							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	**CH**[2)]	**L1**[1)]	**L2**[1)]	**L3**	**R1**	R2	O	DIA
Tool technology data	BQ3 (Bit 16 ... 23)	**T1**	T2	T3	T4	T5	T6	T7	**T8**
		d							nt
		Diameter							Number of teeth
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

1): Active if CH = TRUE (angle head tool)
2): Value can be defined in the tool editor

Tab. 7-39: 2015

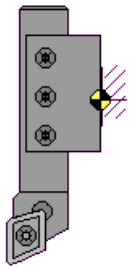
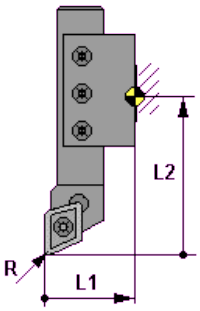
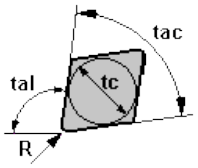
Appendix

Technology		Milling tools							
Tool type name		Conical milling cutter							
Tool type	IKQ2	2016							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		1							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	**CH**[2)]	**L1**[1)]	**L2**[1)]	**L3**	**R1**	R2	O	DIA
Tool technology data	BQ3 (Bit 16 ... 23)	**T1**	T2	**T3**	T4	**T5**	**T6**	T7	**T8**
		d		tc		lu	tal		nt
		Shank diameter		Sphere radius		Usable length	Opening angle		Number of teeth
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

1): Active if CH = TRUE (angle head tool)
2): Value can be defined in the tool editor

Tab. 7-40: 2016

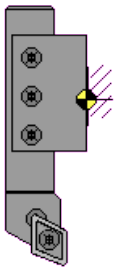
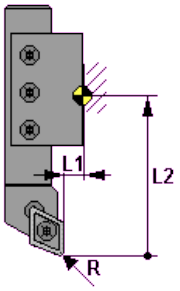
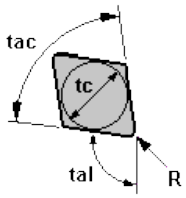
Appendix

Technology		Lathe tools							
Tool type name		Turning tool, general							
Tool type	IKQ2	3000							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		can be set from 1 - 16							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	**CH**[2)]	**L1**	**L2**	**L3**[1)]	**R1**	R2	**O**	**DIA**
Tool technology data	BQ3 (Bit 16 ... 23)	T1	T2	**T3**	T4	T5	**T6**	**T7**	T8
				tc			tal	tac	
				Tool tip size			Tool setting angle	Corner angle	
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

1): Active if CH = TRUE (angle head tool)
2): Value can be defined in the tool editor

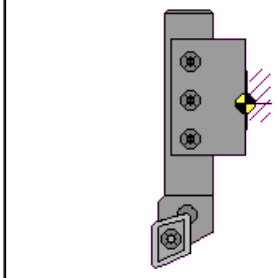
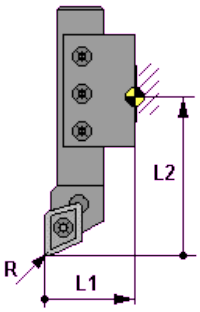
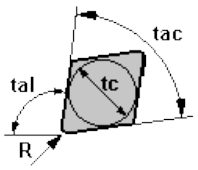
Tab. 7-41: 3000

Appendix

Technology		Lathe tools							
Tool type name		Turning tool, outside radial right							
Tool type	IKQ2	3001							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		1							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	**CH**[2]	**L1**	**L2**	**L3**[1]	**R1**	R2	**O**	**DIA**
Tool technology data	BQ3 (Bit 16 ... 23)	T1	T2	**T3**	T4	T5	**T6**	**T7**	T8
				tc			tal	tac	
				Tool tip size			Tool setting angle	Corner angle	
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

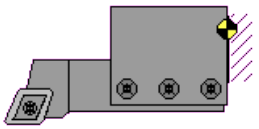
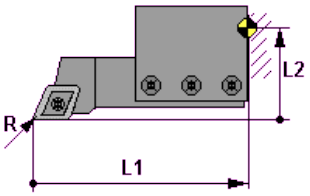
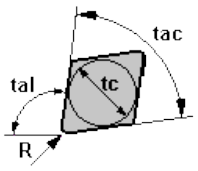
1): Active if CH = TRUE (angle head tool)
2): Value can be defined in the tool editor
Tab. 7-42: 3001

Appendix

Technology		Lathe tools							
Tool type name		Turning tool, outside radial left							
Tool type	IKQ2	3002							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		1							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	**CH**[2)]	**L1**	**L2**	**L3**[1)]	**R1**	R2	**O**	**DIA**
Tool technology data	BQ3 (Bit 16 ... 23)	T1	T2	**T3**	T4	T5	**T6**	**T7**	T8
				tc			tal	tac	
				Tool tip size			Tool setting angle	Corner angle	
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

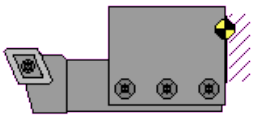
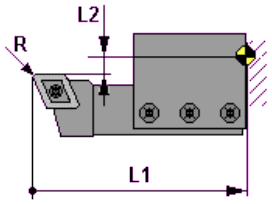
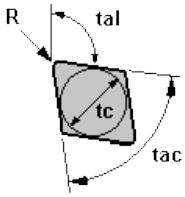
1): Active if CH = TRUE (angle head tool)
2): Value can be defined in the tool editor
Tab. 7-43: 3002

Appendix

Technology		Lathe tools							
Tool type name		Turning tool, outside axial right							
Tool type	IKQ2	3003							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		1							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	**CH**[2)]	**L1**	**L2**	**L3**[1)]	**R1**	R2	**O**	**DIA**
Tool technology data	BQ3 (Bit 16 ... 23)	T1	T2	**T3**	T4	T5	**T6**	**T7**	T8
				tc			tal	tac	
				Tool tip size			Tool setting angle	Corner angle	
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

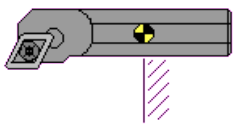
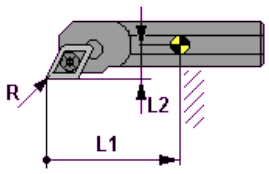
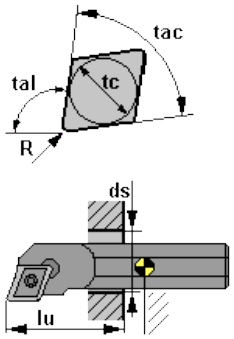
1): Active if CH = TRUE (angle head tool)
2): Value can be defined in the tool editor
Tab. 7-44: 3003

Appendix

Technology		Lathe tools							
Tool type name		Turning tool, outside axial left							
Tool type	IKQ2	3004							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		1							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	**CH**[2)]	**L1**	**L2**	**L3**[1)]	**R1**	R2	**O**	**DIA**
Tool technology data	BQ3 (Bit 16 ... 23)	T1	T2	**T3**	T4	T5	**T6**	**T7**	T8
				tc			tal	tac	
				Tool tip size			Tool setting angle	Corner angle	
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

1): Active if CH = TRUE (angle head tool)
2): Value can be defined in the tool editor
Tab. 7-45: 3004

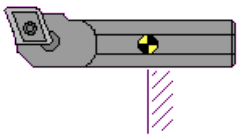
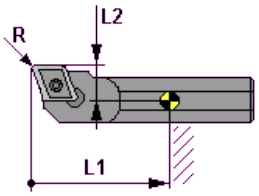
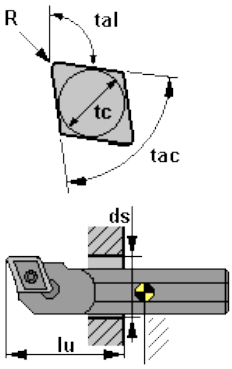
Appendix

Technology		Lathe tools							
Tool type name		Turning tool, inside right							
Tool type	IKQ2	3005							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		1							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	**CH**[2]	**L1**	**L2**	**L3**[1]	**R1**	R2	**O**	**DIA**
Tool technology data	BQ3 (Bit 16 ... 23)	T1	**T2**	**T3**	T4	**T5**	**T6**	**T7**	T8
			ds	tc		lu	tal	tac	
			Smallest diameter that can be machined	Tool tip size		Usable length	Tool setting angle	Corner angle	
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

1): Active if CH = TRUE (angle head tool)
2): Value can be defined in the tool editor

Tab. 7-46: 3005

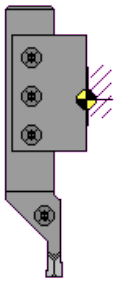
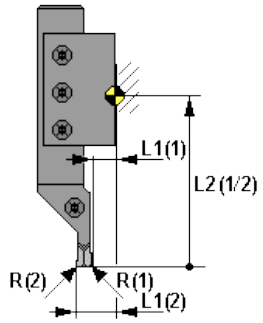
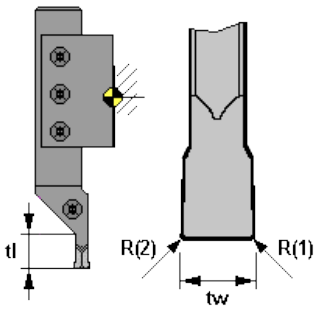
Appendix

Technology		Lathe tools							
Tool type name		Turning tool, inside left							
Tool type	IKQ2	3006							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		1							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	**CH**[2)]	**L1**	**L2**	**L3**[1)]	**R1**	R2	**O**	**DIA**
Tool technology data	BQ3 (Bit 16 ... 23)	T1	**T2**	**T3**	T4	**T5**	**T6**	**T7**	T8
			ds	tc		lu	tal	tac	
			Smallest diameter that can be machined	Tool tip size		Usable length	Tool setting angle	Corner angle	
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

1): Active if CH = TRUE (angle head tool)
2): Value can be defined in the tool editor

Tab. 7-47: 3006

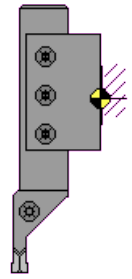
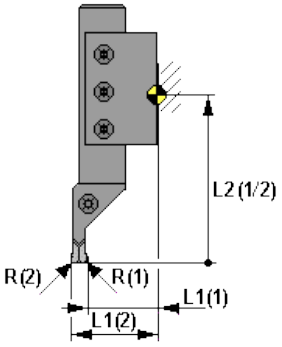
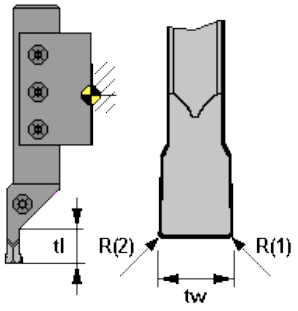
Appendix

Technology		Lathe tools							
Tool type name		Plunging turn tool, outside right							
Tool type	IKQ2	3007							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		2							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	**CH**[2]	**L1**	**L2**	**L3**[1]	**R1**	R2	**O**	**DIA**
Tool technology data	BQ3 (Bit 16 ... 23)	T1	T2	**T3**	**T4**	T5	T6	T7	T8
				tw	tl				
				Tool edge width	Maximum grooving depth				
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

1): Active if CH = TRUE (angle head tool)
2): Value can be defined in the tool editor

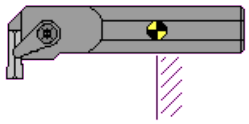
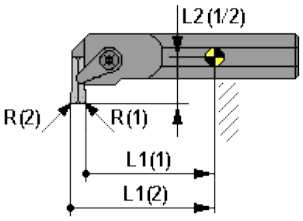
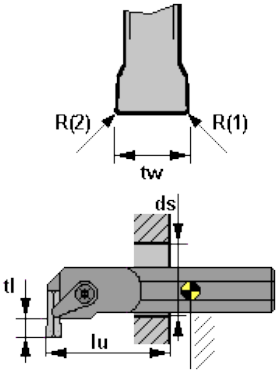
Tab. 7-48: 3007

Appendix

Technology		Lathe tools							
Tool type name		Plunging turn tool, outside left							
Tool type	IKQ2	3008							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		2							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	**CH[2)] CH**	**L1**	**L2**	**L3[1)]**	**R1**	R2	**O**	**DIA**
Tool technology data	BQ3 (Bit 16 ... 23)	T1	T2	**T3**	**T4**	T5	T6	T7	T8
				tw	tl				
				Tool edge width	Maximum grooving depth				
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

1): Active if CH = TRUE (angle head tool)
2): Value can be defined in the tool editor
Tab. 7-49: 3008

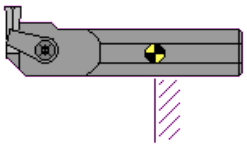
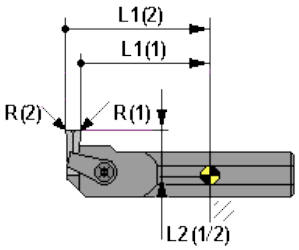
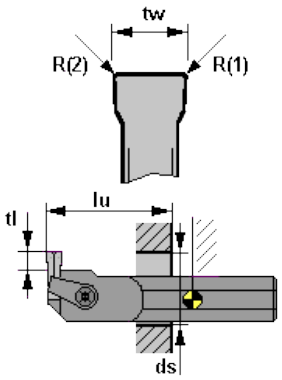
Appendix

Technology		Lathe tools							
Tool type name		Plunging turn tool, inside right							
Tool type	IKQ2	3009							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		2							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	**CH**[2]	**L1**	**L2**	**L3**[1]	**R1**	R2	**O**	**DIA**
Tool technology data	BQ3 (Bit 16 ... 23)	T1	**T2**	**T3**	**T4**	**T5**	T6	T7	T8
			ds	tw	tl	lu			
			Smallest diameter that can be machined	Tool edge width	Maximum grooving depth	Usable length			
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

1): Active if CH = TRUE (angle head tool)
2): Value can be defined in the tool editor

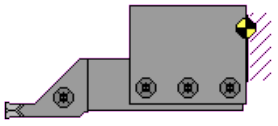
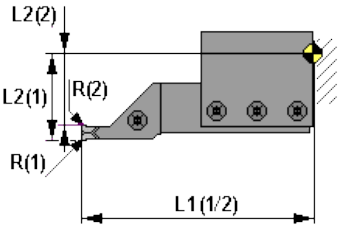
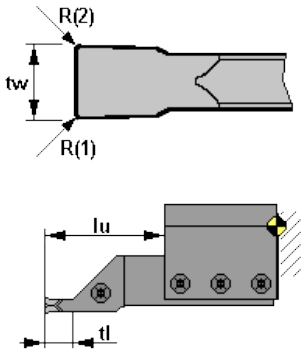
Tab. 7-50: 3009

Appendix

Technology		Lathe tools							
Tool type name		Plunging turn tool, inside left							
Tool type	IKQ2	3010							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		2							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	**CH**[2]	**L1**	**L2**	**L3**[1]	**R1**	R2	**O**	**DIA**
Tool technology data	BQ3 (Bit 16 ... 23)	T1	**T2**	**T3**	**T4**	**T5**	T6	T7	T8
			ds	tw	tl	lu			
			Smallest diameter that can be machined	Tool edge width	Maximum grooving depth	Usable length			
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

1): Active if CH = TRUE (angle head tool)
2): Value can be defined in the tool editor
Tab. 7-51: 3010

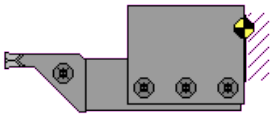
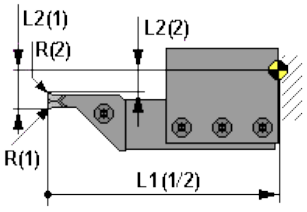
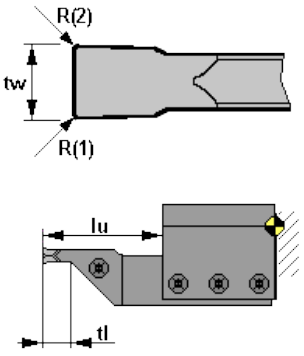
Appendix

Technology		Lathe tools							
Tool type name		Plunging turn tool, axial right							
Tool type	IKQ2	3011							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		2							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	**CH**[2]	**L1**	**L2**	**L3**[1]	**R1**	R2	**O**	**DIA**
Tool technology data	BQ3 (Bit 16 ... 23)	**T1**	**T2**	**T3**	**T4**	**T5**	T6	T7	T8
		d	ds	tw	tl	lu			
		Outer limitation of the cutting diameter area	Inner limitation of the cutting diameter area	Tool edge width	Maximum grooving depth	Usable length			
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

1): Active if CH = TRUE (angle head tool)
2): Value can be defined in the tool editor

Tab. 7-52: 3011

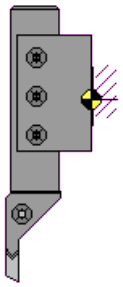
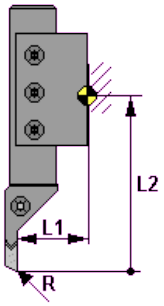
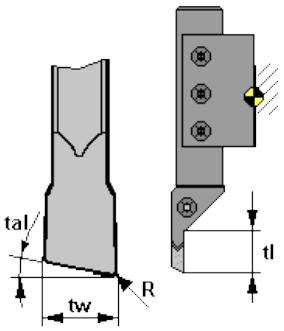
Appendix

Technology		Lathe tools							
Tool type name		Plunging turn tool, axial left							
Tool type	IKQ2	3012							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		2							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	**CH**[2)]	**L1**	**L2**	**L3**[1)]	**R1**	R2	**O**	**DIA**
Tool technology data	BQ3 (Bit 16 ... 23)	**T1**	**T2**	**T3**	**T4**	**T5**	T6	T7	T8
		d	ds	tw	tl	lu			
		Outer limitation of the cutting diameter area	Inner limitation of the cutting diameter area	Tool edge width	Maximum grooving depth	Usable length			
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

1): Active if CH = TRUE (angle head tool)
2): Value can be defined in the tool editor

Tab. 7-53: 3012

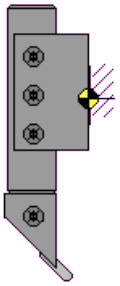
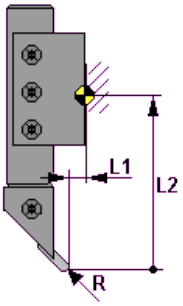
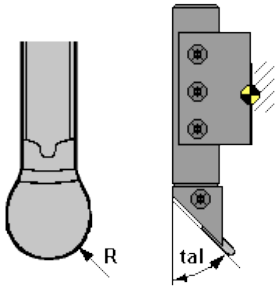
Appendix

Technology		Lathe tools							
Tool type name		Cut-off tool							
Tool type	IKQ2	3013							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		1							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	**CH**[2)]	**L1**	**L2**	**L3**[1)]	**R1**	R2	**O**	**DIA**
Tool technology data	BQ3 (Bit 16 ... 23)	T1	T2	**T3**	**T4**	T5	**T6**	T7	T8
				tw	tl		tal		
				Tool edge width	Maximum grooving depth		Edge angle		
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

1): Active if CH = TRUE (angle head tool)
2): Value can be defined in the tool editor

Tab. 7-54: 3013

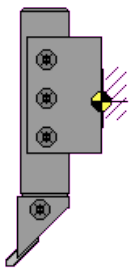
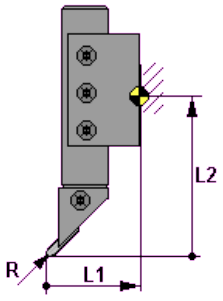
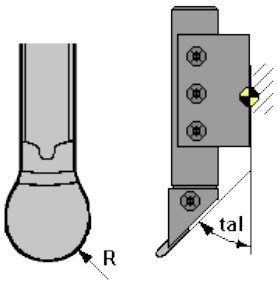
Appendix

Technology		Lathe tools							
Tool type name		Form turning tool, right							
Tool type	IKQ2	3014							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		1							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	**CH**[2)]	**L1**	**L2**	**L3**[1)]	**R1**	R2	**O**	**DIA**
Tool technology data	BQ3 (Bit 16 ... 23)	**T1**	T2	T3	T4	T5	**T6**	T7	T8
		d					tal		
		Outer limitation of the cutting diameter area					Orientation angle		
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

1): Active if CH = TRUE (angle head tool)
2): Value can be defined in the tool editor

Tab. 7-55: 3014

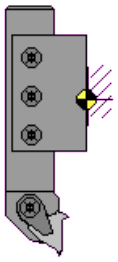
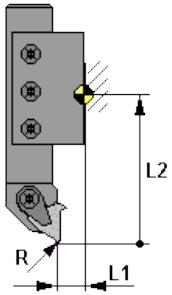
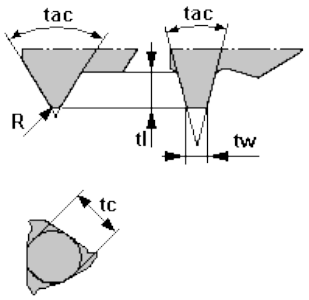
Appendix

Technology		Lathe tools							
Tool type name		Form turning tool, left							
Tool type	IKQ2	3015							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		1							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	**CH**[2]	**L1**	**L2**	**L3**[1]	**R1**	R2	**O**	**DIA**
Tool technology data	BQ3 (Bit 16 ... 23)	**T1**	T2	T3	T4	T5	**T6**	T7	T8
		d					tal		
		Outer limitation of the cutting diameter area					Orientation angle		
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

1): Active if CH = TRUE (angle head tool)
2): Value can be defined in the tool editor

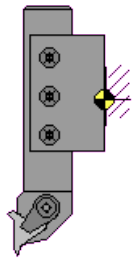
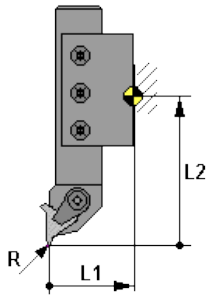
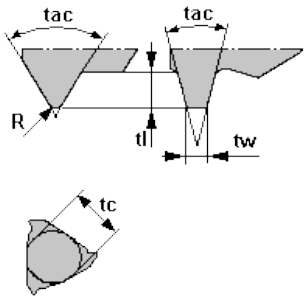
Tab. 7-56: 3015

Appendix

Technology		Lathe tools							
Tool type name		Thread turning tool, outside right							
Tool type	IKQ2	3016							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		1							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	**CH**[2)]	**L1**	**L2**	**L3**[1)]	**R1**	R2	**O**	**DIA**
Tool technology data	BQ3 (Bit 16 ... 23)	**T1**	T2	**T3**	**T4**	T5	**T6**	**T7**	T8
		tw		tc	tl		tp	tac	
		Width of trapezoid thread		Tool tip size	Maximum thread depth		Thread pitch	Edge angle	
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

1): Active if CH = TRUE (angle head tool)
2): Value can be defined in the tool editor
Tab. 7-57: 3016

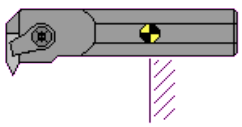
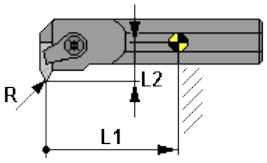
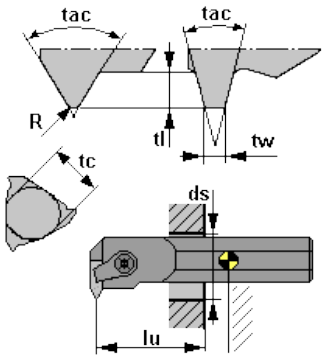
Appendix

Technology		Lathe tools							
Tool type name		Thread turning tool, outside left							
Tool type	IKQ2	3017							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		1							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	**CH**[2]	**L1**	**L2**	**L3**[1]	**R1**	R2	**O**	**DIA**
Tool technology data	BQ3 (Bit 16 ... 23)	**T1**	T2	**T3**	**T4**	T5	**T6**	**T7**	T8
		tw		tc	tl		tp	tac	
		Width of trapezoid thread		Tool tip size	Maximum thread depth		Thread pitch	Edge angle	
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

1): Active if CH = TRUE (angle head tool)
2): Value can be defined in the tool editor

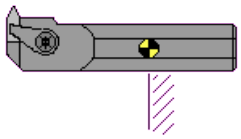
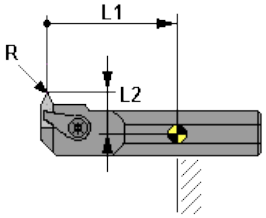
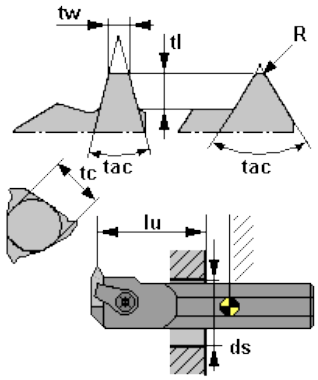
Tab. 7-58: 3017

Appendix

Technology		Lathe tools							
Tool type name		Thread turning tool, inside right							
Tool type	IKQ2	3018							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		1							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	**CH**[2)]	**L1**	**L2**	**L3**[1)]	**R1**	R2	**O**	**DIA**
Tool technology data	BQ3 (Bit 16 ... 23)	**T1**	**T2**	**T3**	**T4**	**T5**	**T6**	**T7**	T8
		tw	ds	tc	tl	lu	tp	tac	
		Width of trapezoid thread	Smallest diameter that can be machined	Tool tip size	Maximum thread depth	Usable length	Thread pitch	Edge angle	
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

1): Active if CH = TRUE (angle head tool)
2): Value can be defined in the tool editor
Tab. 7-59: 3018

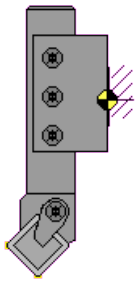
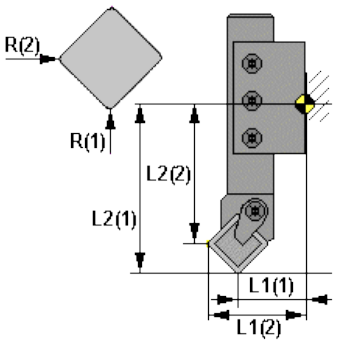
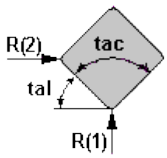
Appendix

Technology		Lathe tools							
Tool type name		Thread turning tool, inside left							
Tool type	IKQ2	3019							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		1							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	**CH**[2]	**L1**	**L2**	**L3**[1]	**R1**	R2	**O**	**DIA**
Tool technology data	BQ3 (Bit 16 ... 23)	**T1**	**T2**	**T3**	**T4**	**T5**	**T6**	**T7**	T8
		tw	ds	tc	tl	lu	tp	tac	
		Width of trapezoid thread	Smallest diameter that can be machined	Tool tip size	Maximum thread depth	Usable length	Thread pitch	Edge angle	
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

1): Active if CH = TRUE (angle head tool)
2): Value can be defined in the tool editor

Tab. 7-60: 3019

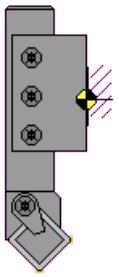
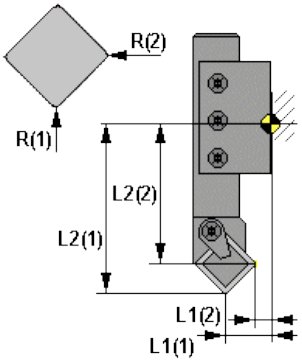
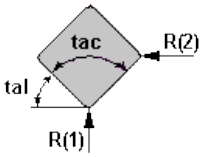
Appendix

Technology		Lathe tools							
Tool type name		Special turning tool							
Tool type	IKQ2	3020							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		can be set from 1 - 16							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	**CH**[2]	**L1**	**L2**	**L3**[1]	**R1**	R2	**O**	**DIA**
Tool technology data	BQ3 (Bit 16 ... 23)	T1	T2	T3	T4	T5	**T6**	**T7**	T8
							tal	tac	
							Tool setting angle	Corner angle	
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

1): Active if CH = TRUE (angle head tool)
2): Value can be defined in the tool editor

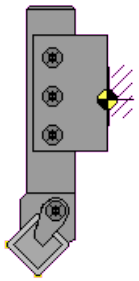
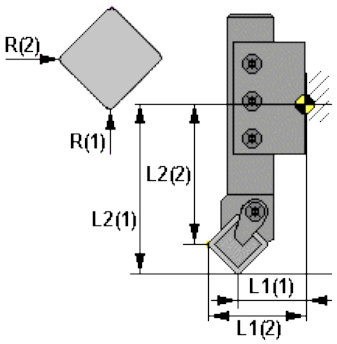
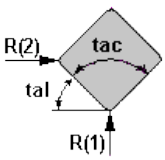
Tab. 7-61: 3020

Appendix

Technology		Lathe tools							
Tool type name		Turning tool, outside radial right (2S)							
Tool type	IKQ2	3021							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		2							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	**CH**[2)]	**L1**	**L2**	**L3**[1)]	**R1**	R2	**O**	**DIA**
Tool technology data	BQ3 (Bit 16 ... 23)	T1	T2	T3	T4	T5	**T6**	**T7**	T8
							tal	tac	
							Tool setting angle	Corner angle	
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

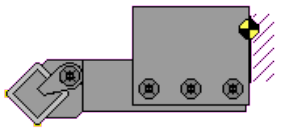
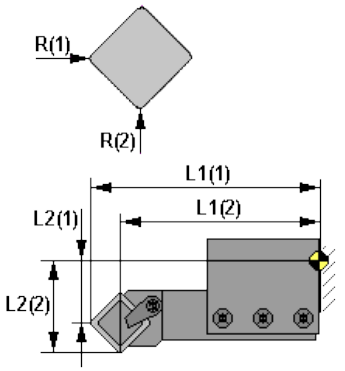
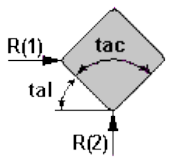
1): Active if CH = TRUE (angle head tool)
2): Value can be defined in the tool editor
Tab. 7-62: 3021

Appendix

Technology		Lathe tools							
Tool type name		Turning tool, outside radial left (2S)							
Tool type	IKQ2	3022							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		2							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	**CH**[2]	**L1**	**L2**	**L3**[1]	**R1**	R2	**O**	**DIA**
Tool technology data	BQ3 (Bit 16 ... 23)	T1	T2	T3	T4	T5	**T6**	**T7**	T8
							tal	tac	
							Tool setting angle	Corner angle	
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

1): Active if CH = TRUE (angle head tool)
2): Value can be defined in the tool editor
Tab. 7-63: 3022

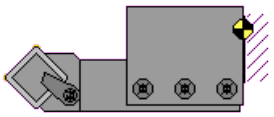
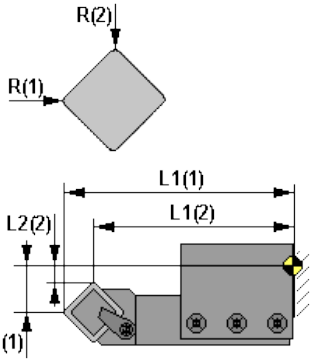
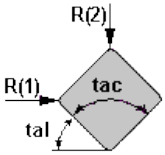
Appendix

Technology		Lathe tools							
Tool type name		Turning tool, outside axial right (2S)							
Tool type	IKQ2	3023							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		2							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	**CH**[2]	**L1**	**L2**	**L3**[1]	**R1**	R2	**O**	**DIA**
Tool technology data	BQ3 (Bit 16 ... 23)	T1	T2	T3	T4	T5	**T6**	**T7**	T8
							tal	tac	
							Tool setting angle	Corner angle	
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

1): Active if CH = TRUE (angle head tool)
2): Value can be defined in the tool editor

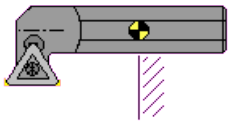
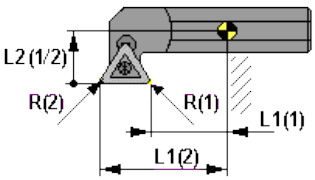
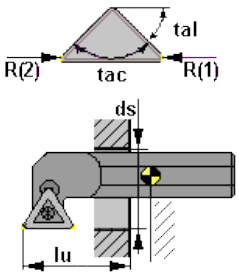
Tab. 7-64: 3023

Appendix

Technology		Lathe tools							
Tool type name		Turning tool, outside axial left (2S)							
Tool type	IKQ2	3024							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		2							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	**CH**[2]	**L1**	**L2**	**L3**[1]	**R1**	R2	**O**	**DIA**
Tool technology data	BQ3 (Bit 16 ... 23)	T1	T2	T3	T4	T5	**T6**	**T7**	T8
							tal	tac	
							Tool setting angle	Corner angle	
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

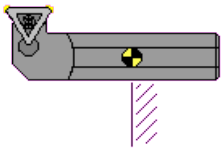
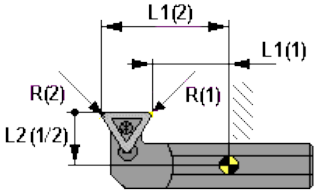
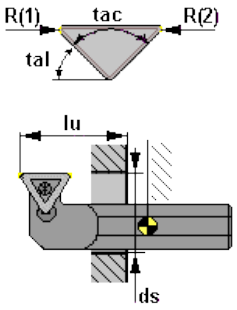
1): Active if CH = TRUE (angle head tool)
2): Value can be defined in the tool editor
Tab. 7-65: 3024

Appendix

Technology		Lathe tools							
Tool type name		Turning tool, inside right (2S)							
Tool type	IKQ2	3025							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		2							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	**CH**[2]	**L1**	**L2**	**L3**[1]	**R1**	R2	**O**	**DIA**
Tool technology data	BQ3 (Bit 16 ... 23)	T1	**T2**	T3	T4	**T5**	**T6**	**T7**	T8
			ds			lu	tal	tac	
			Smallest diameter that can be machined			Usable length	Tool setting angle	Corner angle	
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

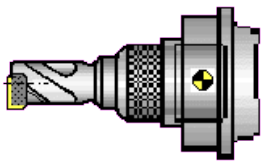
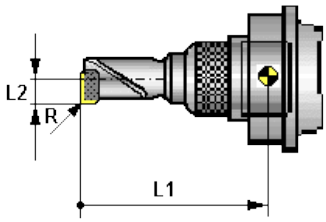
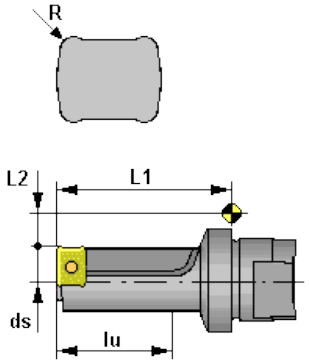
1): Active if CH = TRUE (angle head tool)
2): Value can be defined in the tool editor
Tab. 7-66: 3025

Appendix

Technology		Lathe tools							
Tool type name		Turning tool, inside left (2S)							
Tool type	IKQ2	3026							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		2							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	**CH**[2]	**L1**	**L2**	**L3**[1]	**R1**	R2	**O**	**DIA**
Tool technology data	BQ3 (Bit 16 ... 23)	T1	**T2**	T3	T4	**T5**	**T6**	**T7**	T8
			ds			lu	tal	tac	
			Smallest diameter that can be machined			Usable length	Tool setting angle	Corner angle	
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

1): Active if CH = TRUE (angle head tool)
2): Value can be defined in the tool editor
Tab. 7-67: 3026

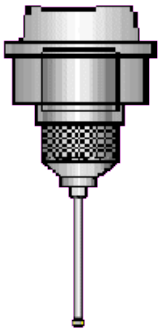
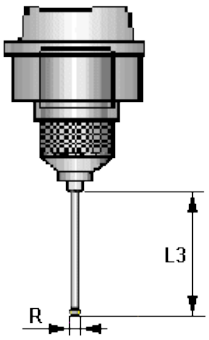
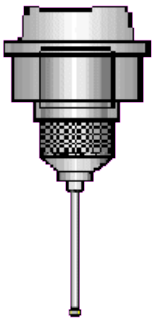
Appendix

Technology		Lathe tools							
Tool type name		EcoCut							
Tool type	IKQ2	3027							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		1							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	**CH**[2]	**L1**	**L2**	**L3**[1]	**R1**	R2	**O**	**DIA**
Tool technology data	BQ3 (Bit 16 ... 23)	T1	**T2**	T3	T4	**T5**	T6	T7	T8
			ds			lu			
			Drilling diameter			Usable length			
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

1): Active if CH = TRUE (angle head tool)
2): Value can be defined in the tool editor

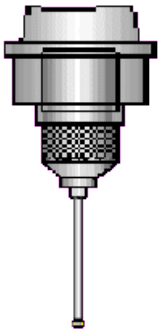
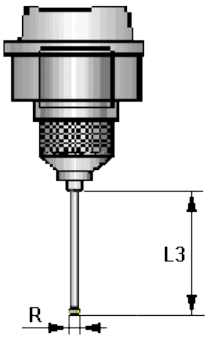
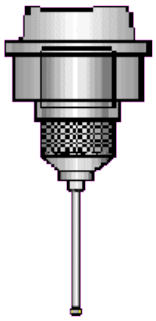
Tab. 7-68: 3027

Appendix

Technology		Touch probe							
Tool type name		Probe, general							
Tool type	IKQ2	5000							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		can be set from 1 - 16							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	CH	L1	L2	**L3**	**R1**	R2	O	DIA
Tool technology data	BQ3 (Bit 16 ... 23)	T1	T2	T3	T4	T5	T6	T7	T8
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

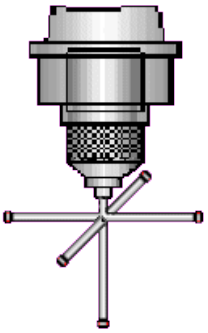
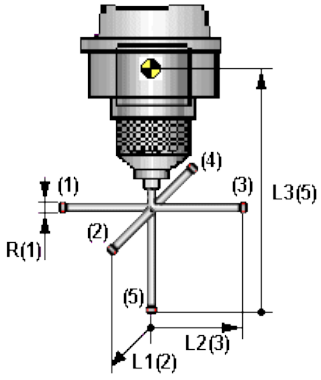
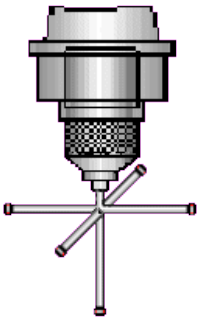
Tab. 7-69: 5000

Appendix

Technology		Touch probe							
Tool type name		Mono probe							
Tool type	IKQ2	5001							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		1							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	CH	L1	L2	**L3**	**R1**	R2	O	DIA
Tool technology data	BQ3 (Bit 16 ... 23)	T1	T2	T3	T4	T5	T6	T7	T8
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

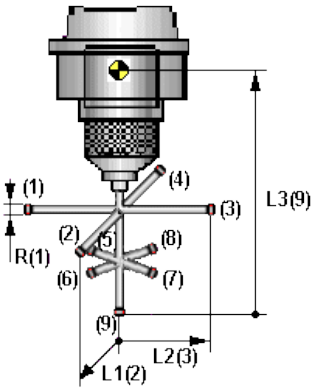
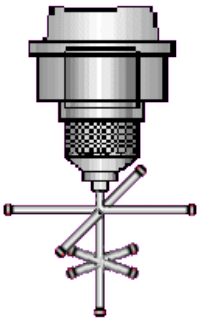
Tab. 7-70: 5001

Appendix

Technology		Touch probe							
Tool type name		Spring-return joystick switch							
Tool type	IKQ2	5002							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		5							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	CH	**L1**	**L2**	**L3**	**R1**	R2	O	DIA
Tool technology data	BQ3 (Bit 16 ... 23)	T1	T2	T3	T4	T5	T6	T7	T8
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

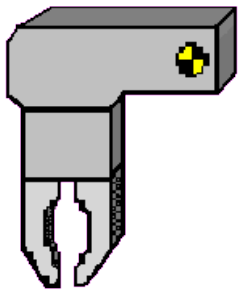
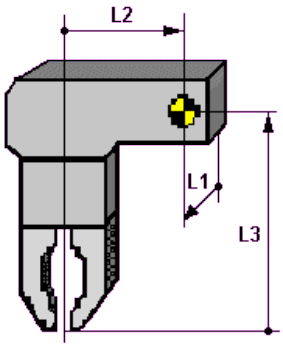
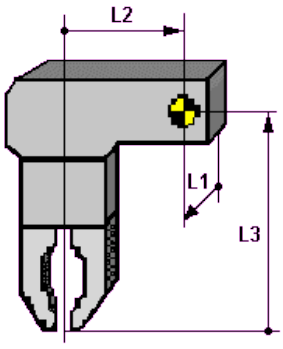
Tab. 7-71: 5002

Appendix

Technology		Touch probe							
Tool type name		Special probe							
Tool type	IKQ2	5003							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		can be set from 1 - 16							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	CH	**L1**	**L2**	**L3**	**R1**	R2	O	DIA
Tool technology data	BQ3 (Bit 16 ... 23)	T1	T2	T3	T4	T5	T6	T7	T8
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

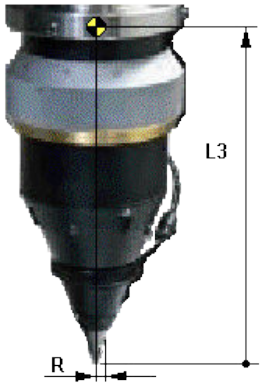
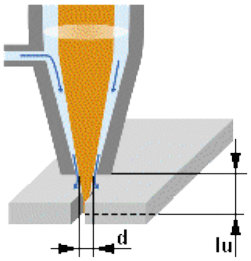
Tab. 7-72: 5003

Appendix

Technology		Special tools						
Tool type name		Grippers						
Tool type	IKQ2	6000						
Edge number	BQ3 (Bit 1 - 4)	EdNo						
		can be set from 1 - 16						
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3				
Correction type	BQ3 (Bit 8 ...15)	CH	**L1**	**L2**	**L3**	R1	R2	O	DIA
Tool technology data	BQ3 (Bit 16 ... 23)	T1	T2	T3	T4	T5	T6	T7	T8
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2					
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen								

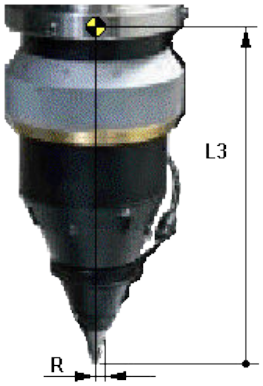
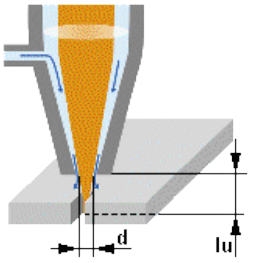
Tab. 7-73: 6000

Appendix

Technology		Special tools							
Tool type name		Beam cutting tool							
Tool type	IKQ2	6001							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		1							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	CH	L1	L2	**L3**	**R1**	R2	O	DIA
Tool technology data	BQ3 (Bit 16 ... 23)	**T1**	T2	T3	T4	**T5**	T6	T7	T8
		d				**lu**			
		Diameter dimension 1				**Length dimension**			
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

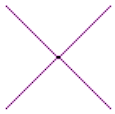
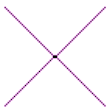
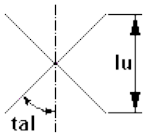
Tab. 7-74: 6001

Appendix

Technology		Special tools							
Tool type name		AMT							
Tool type	IKQ2	6002							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		1							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	CH	L1	L2	**L3**	**R1**	R2	O	DIA
Tool technology data	BQ3 (Bit 16 ... 23)	**T1**	T2	T3	T4	**T5**	T6	T7	T8
		d				**lu**			
		Diameter dimension 1				**Length dimension**			
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

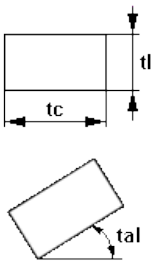
Tab. 7-75: 6002

Appendix

Technology		Punching							
Tool type name		Punching tool, general							
Tool type	IKQ2	7000							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		1							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	CH	L1	L2	L3	**R1**	R2	O	DIA
Tool technology data	BQ3 (Bit 16 ... 23)	T1	T2	T3	T4	**T5**	**T6**	T7	T8
						lu	tal		
						Length dimen-sion	Angular dimen-sion		
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

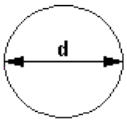
Tab. 7-76: 7000

Appendix

Technology		Punching							
Tool type name		Rectangular stamp							
Tool type	IKQ2	7001							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		1							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	CH	L1	L2	L3	R1	R2	O	DIA
Tool technology data	BQ3 (Bit 16 ... 23)	T1	T2	**T3**	**T4**	T5	**T6**	T7	T8
				tc	tl		tal		
				Width dimension	Depth gauge		Angular dimension		
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

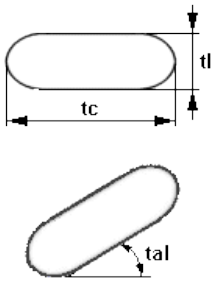
Tab. 7-77: 7001

Appendix

Technology		Punching							
Tool type name		Circular stamp							
Tool type	IKQ2	7002							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		1							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	CH	L1	L2	L3	**R1**	R2	O	DIA
Tool technology data	BQ3 (Bit 16 ... 23)	T1	T2	T3	T4	T5	T6	T7	T8
		d							
		Diameter dimen-sion							
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

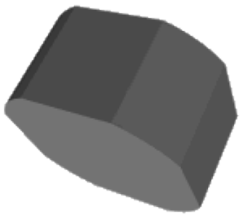
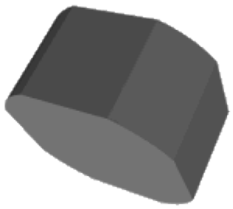
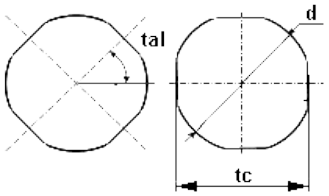
Tab. 7-78: 7002

Appendix

Technology		Punching							
Tool type name		Elongated hole stamp							
Tool type	IKQ2	7003							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		1							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	CH	L1	L2	L3	R1	R2	O	DIA
Tool technology data	BQ3 (Bit 16 ... 23)	T1	T2	**T3**	**T4**	T5	**T6**	T7	T8
				tc	tl		tal		
				Width dimension	Depth gauge		Angular dimension		
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

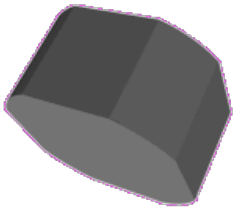
Tab. 7-79: 7003

Appendix

Technology		Punching							
Tool type name		Circle fourfold flattened							
Tool type	IKQ2	7004							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		1							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	CH	L1	L2	L3	R1	R2	O	DIA
Tool technology data	BQ3 (Bit 16 ... 23)	**T1**	T2	**T3**	T4	T5	**T6**	T7	T8
		d		tc			tal		
		Diameter		Width dimension			Angular dimension		
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

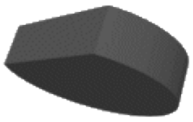
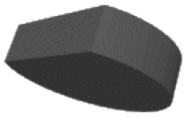
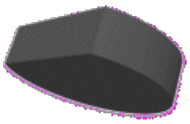
Tab. 7-80: 7004

Appendix

Technology		Punching							
Tool type name		Square, rounded							
Tool type	IKQ2	7005							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		1							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	CH	L1	L2	L3	R1	R2	O	DIA
Tool technology data	BQ3 (Bit 16 ... 23)	T1	**T2**	**T3**	**T4**	T5	**T6**	T7	T8
			ds	tc	tl		tal		
			Diameter dimension	Width dimension	Depth gauge		Angular dimension		
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

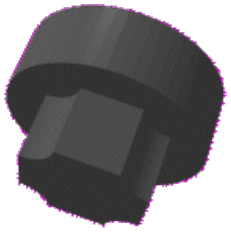
Tab. 7-81: 7005

Appendix

Technology		Punching							
Tool type name		Circle single flattened							
Tool type	IKQ2	7006							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		1							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	CH	L1	L2	L3	R1	R2	O	DIA
Tool technology data	BQ3 (Bit 16 ... 23)	**T1**	T2	T3	**T4**	T5	**T6**	T7	T8
		d			tl		tal		
		Diameter			Depth gauge		Angular dimen-sion		
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

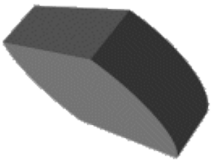
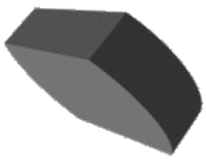
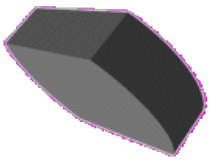
Tab. 7-82: 7006

Appendix

Technology		Punching							
Tool type name		Square, fourfold circular slit							
Tool type	IKQ2	7007							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		1							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	CH	L1	L2	L3	R1	R2	O	DIA
Tool technology data	BQ3 (Bit 16 ... 23)	T1	**T2**	T3	**T4**	T5	**T6**	T7	T8
			ds		tl		tal		
			Diameter dimen-sion		Depth gauge		Angular dimen-sion		
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

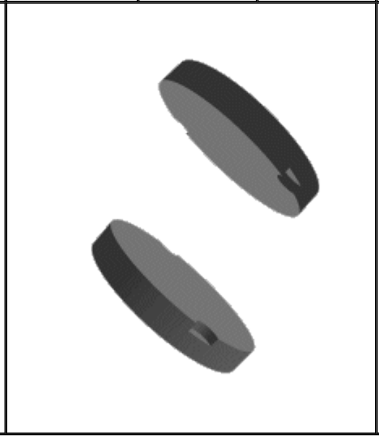
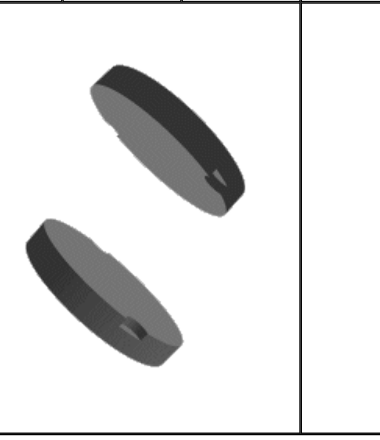
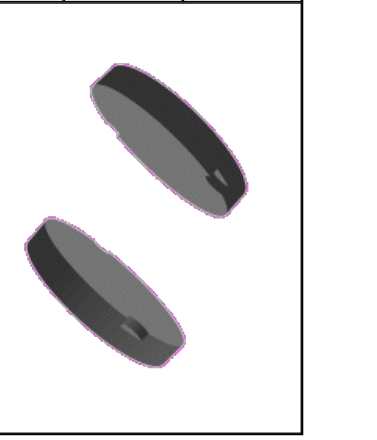
Tab. 7-83: 7007

Appendix

Technology		Punching							
Tool type name		Circle double flattened							
Tool type	IKQ2	7008							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		1							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	CH	L1	L2	L3	R1	R2	O	DIA
Tool technology data	BQ3 (Bit 16 ... 23)	**T1**	T2	T3	**T4**	T5	**T6**	T7	T8
		d			tl		tal		
		Diameter			Depth gauge		Angular dimen-sion		
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

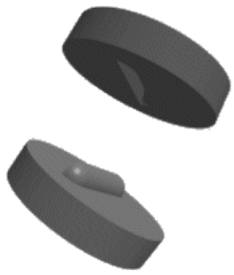
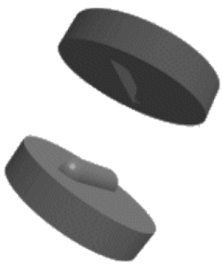
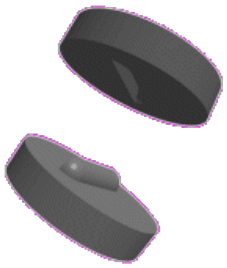
Tab. 7-84: 7008

Appendix

Technology		Punching							
Tool type name		Printing plate							
Tool type	IKQ2	7009							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		1							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	CH	L1	L2	L3	R1	R2	O	DIA
Tool technology data	BQ3 (Bit 16 ... 23)	T1	T2	T3	T4	T5	T6	T7	T8
		d							
		Diameter dimen-sion							
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

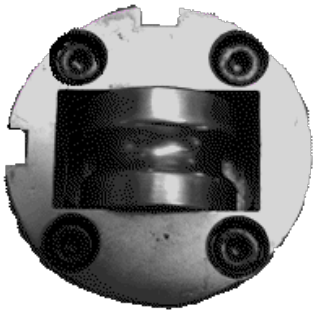
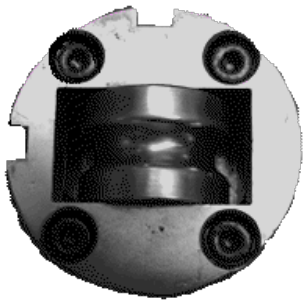
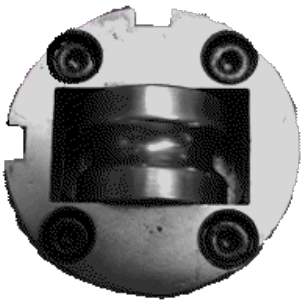
Tab. 7-85: 7009

Appendix

Technology		Punching							
Tool type name		Ventilation slot							
Tool type	IKQ2	7010							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		1							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	CH	L1	L2	L3	**R1**	R2	O	DIA
Tool technology data	BQ3 (Bit 16 ... 23)	T1	T2	T3	**T4**	**T5**	**T6**	T7	T8
					tl	lu	tal		
					Depth gauge	Length dimen-sion	Angular dimen-sion		
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

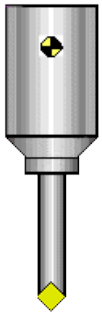
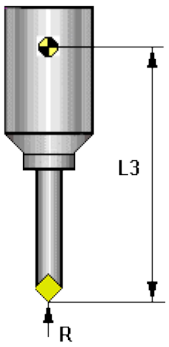
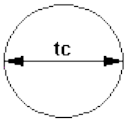
Tab. 7-86: 7010

Appendix

Technology		Punching							
Tool type name		Rolling attachment							
Tool type	IKQ2	7011							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		1							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	CH	L1	L2	L3	R1	R2	O	DIA
Tool technology data	BQ3 (Bit 16 ... 23)	T1	T2	T3	**T4**	**T5**	**T6**	T7	T8
					tl	lu	tal		
					Depth gauge	Length dimen-sion	Angular dimen-sion		
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

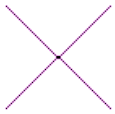
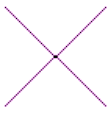
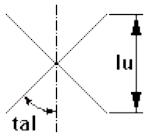
Tab. 7-87: 7011

Appendix

Technology		Punching							
Tool type name		Signing tool							
Tool type	IKQ2	7012							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		1							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	CH	L1	L2	**L3**	**R1**	R2	O	DIA
Tool technology data	BQ3 (Bit 16 ... 23)	T1	T2	**T3**	T4	T5	T6	T7	T8
				tc					
				Width dimension					
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

Tab. 7-88: 7012

Appendix

Technology		Punching							
Tool type name		Forming tool, general							
Tool type	IKQ2	7013							
Edge number	BQ3 (Bit 1 - 4)	EdNo							
		1							
Reserve	BQ3 (Bit 5 ...7)	TRC1	TRC2	TRC3					
Correction type	BQ3 (Bit 8 ...15)	CH	L1	L2	L3	R1	R2	O	DIA
Tool technology data	BQ3 (Bit 16 ... 23)	T1	T2	T3	T4	**T5**	**T6**	T7	T8
						lu	tal		
						Length dimen-sion	Angular dimen-sion		
Edge technology data	BQ3 (Bit 24 ... 25)	ET1	ET2						
Reserve	BQ3 (Bit 26 ... 32)	TRC4	TRC5	TRC6	TRC7	TRC8	TRC9	TRC10	
Screen									

Tab. 7-89: 7013

Element	Techn. label	Description	Type dependency of the meaning
L1		1st length correction value	-
L2		2nd length correction value	-
L3		3rd length correction value	-
R1		Large radius	-
R2		Small radius	-
O		Edge position	-
DIA		Tool with diameter information	-

Element	Techn. label	Description	Type dependency of the meaning
T1	d	Diameter	Drilling and milling tools
		Large diameter	
		Milling diameter	
		Outer diameter	
		Outer limitation of the cutting diameter area	Lathe tools
		Edge radius	
T2	ds	Small diameter	Drilling tools
		Shank diameter	
		Drilling diameter	
		Smallest diameter that can be machined	Lathe tools
		Inner limitation of the cutting diameter area	
T3	lfc	Chamfer length	Drilling and milling tools
	ll	Loss length	
	tw	Tool edge width	Div. turning tools
		Width of trapezoid thread	
	tc	Corner radius	Div. milling tools
		Tool tip size	Div. turning tools
T4	tl	Max. cutting height	Lathe tools
		Max. thread height	
T5	lu	Usable length	-
T6	tp	(Thread) lead	Drilling, milling or turning tools
	ta	Setting angle	Div. drilling tools
	tal	Orientation angle	Div. turning tools
		Angle (edge angle)	Div. milling or turning tools
		Tool setting angle	Div. turning tools
		Angle (kappa)	Div. milling tools
		Angle	
T7	tac	Apical angle	Drilling and milling tools
		Countersink angle	
		Corner angle	Lathe tools
		Edge angle	
T8	nt	Number of teeth	Milling tools
ET1	ds	Small diameter (edge-dependent)	Step drill

Tab. 7-90: Tool catalog key

7.3.3 Bitmap libraries

The following bitmap libraries are contained when delivered:

Appendix

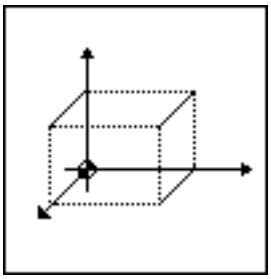
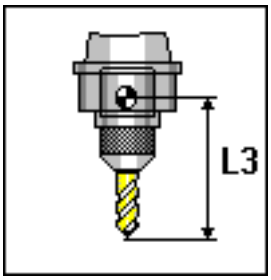
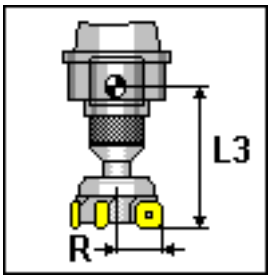
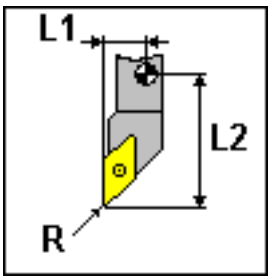
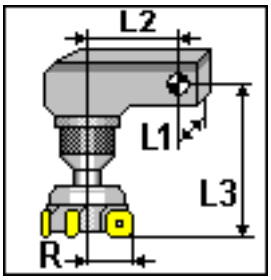
BitmapResourceName	Bitmap name (value)	Example (original size)	Explanation
ToolStorageBmp.resx	spindle16_g.gif		Spindle
	slot16_g.gif		Turret
	magazin16_g.gif		Magazine
	grip16_g.gif		Grippers
	schrank.gif		Tool cabinet

Tab. 7-91: Bitmap library of tool memory

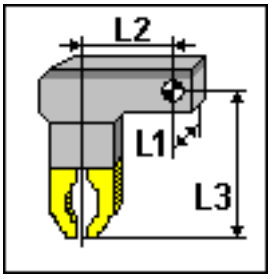
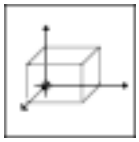
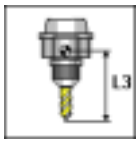
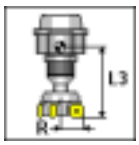
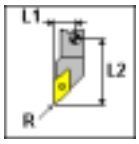
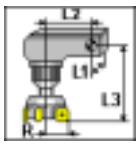
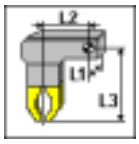
BitmapResourceName	Bitmap name (value)	Example (original size)	Explanation
ToolTecTypesBmp.resx	drill16_g.gif		Drilling
	mill16_g.gif		Milling
	turn16_g.gif		Rotate
	grind16_g.gif		Grinding
	cut16_g.gif		Tool edges
	form16_g.gif		Reshaping
	erode16_g.gif		Eroding
	nibble16_g.gif		Nibbling
	punch16_g.gif		Punching
	screw16_g.gif		Screwing
	weld16_g.gif		Welding
	wrench16_g.gif		-
	mtctds_TOOL_g.gif		-
	special16_g.gif		-
	tool16_g.gif		-

Tab. 7-92: Bitmap library of tool technology

Appendix

BitmapResourceName	Bitmap name (value)	Example (original size)	Explanation
ToolCorrTypeBmp.resx	CorrType_0.gif		Correction type 0 (General tool type)
	CorrType_1.gif		Correction type 1 (Drilling tools)
	CorrType_2.gif		Correction type 2 (Milling tools)
	CorrType_3.gif		Correction type 3 (Turning tools)
	CorrType_4.gif		Correction type 4 (Special milling tools)

Appendix

BitmapResourceName	Bitmap name (value)	Example (original size)	Explanation
	CorrType_5.gif		Correction type 5 (Special tools)
	CorrType_0_k.gif		Correction type 0 (General tool type)
	CorrType_1_k.gif		Correction type 1 (Drilling tools)
	CorrType_2_k.gif		Correction type 2 (Milling tools)
	CorrType_3_k.gif		Correction type 3 (Turning tools)
	CorrType_4_k.gif		Correction type 4 (Special milling tools)
	CorrType_5_k.gif		Correction type 5 (Special tools)
	CorrType_0_kk.gif		Correction type 0 (General tool type)
	CorrType_1_kk.gif		Correction type 1 (Drilling tools)
	CorrType_2_kk.gif		Correction type 2 (Milling tools)
	CorrType_3_kk.gif		Correction type 3 (Turning tools)
	CorrType_4_kk.gif		Correction type 4 (Special milling tools)

BitmapResourceName	Bitmap name (value)	Example (original size)	Explanation
	CorrType_5_kk.gif		Correction type 5 (Special tools)
	Kt1k.gif		Correction type 1 (Drilling tools)
	Kt2k.gif		Correction type 2 (Milling tools)
	Kt3k.gif		Correction type 3 (Turning tools)
	Kt4k.gif		Correction type 4 (Special milling tools)
	Kt5k.gif		Correction type 5 (Special tools)

Tab. 7-93: Bitmap library of tool correction types

BitmapResourceName	Bitmap name (value)	Example (original size)	Explanation
ToolStatusBmp.resx	checkbox_false.gif		
	checkbox_true.gif		
	hookred.gif		
	hookwhite.gif		
	ledgreen.gif		
	ledred.gif		
	ledyellow.gif		
	stateundefined16.gif		Undefined
	statealarm16.gif		Alarm
	statedisabled16.gif		Inactive
	stateok16.gif		OK

Tab. 7-94: Bitmap library of status messages

☞ In addition, there are three more bitmap libraries (see tab. 5-31 "Supplied bitmap libraries" on page 235) to display tool types in different sizes.

8 Service and support

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- 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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