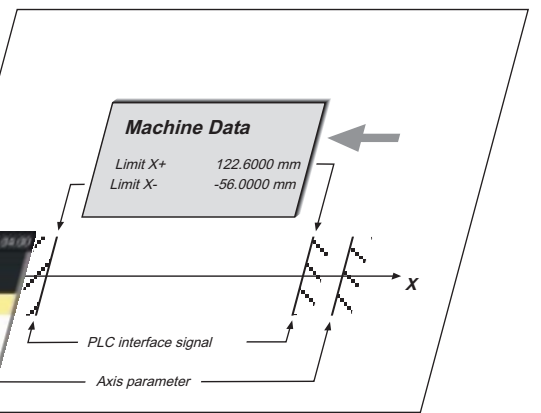
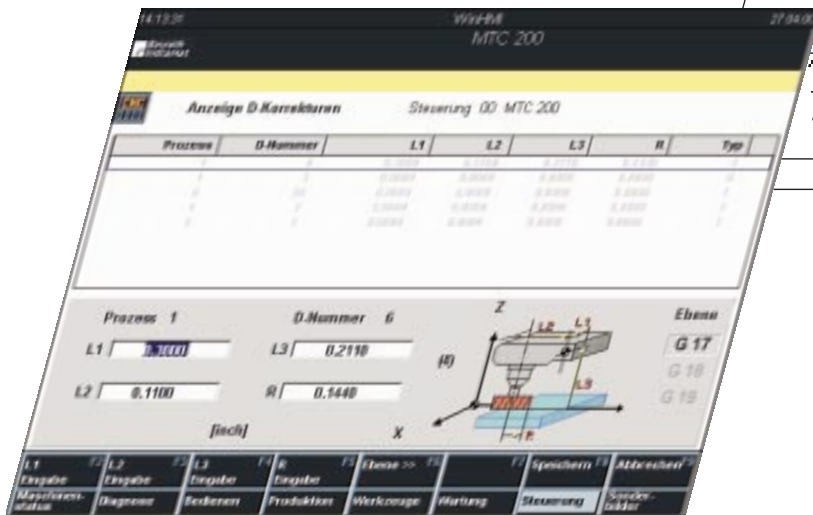


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MTC200 New Functions 19VRS

Application Manual

SYSTEM200

Title	MTC200 New Functions 19VRS
Type of Documentation	Application Manual
Document Typecode	DOK-MTC200-NEW*FUN*V19-AW02-EN-P
Internal File Reference	<ul style="list-style-type: none"> • Box 1.1-19V-EN • Document number: 120-1700-B346-02/EN
Purpose of Documentation	This documentation informs the user about the new functions in a new version. The new functions are introduced briefly.

Record of Revisions	Description	Release Date	Notes
	120-1700-B346-01/EN	08.00	New issue for 19VRS
	120-1700-B346-02/EN	11.01	Chapter 1: Modification process

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Bgm.-Dr.-Nebel-Str. 2 • D-97816 Lohr a. Main
Telephone +49 (0)93 52/40-0 • Tx 68 94 21 • Fax +49 (0)93 52/40-48 85
<http://www.boschrexroth.de/>
Dept. BRC/ESM6 (EW/DH)

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1 Modification Process

1.1 General

Compared with the previous version, all modifications of documentation are described in this chapter. A modified documentation is visible through increasing the index in type code, e.g. AW01 → AW02.

1.2 DOK-MTC200-NEW*FUN*V19-AW02-EN-P

Chapter 6.4 „Spindle RPM limitation“

Section „boundary conditions“

Incorrect: "With each change of the limits, the PLC status signal is set to '0' for a PLC cycle. "

Correction: The above block was deleted without substitution.

Chapter 6.5 „Feed Limitation“

Section „boundary conditions“

Incorrect: "With each change of the limits, the PLC status signal is set to '0' for a PLC cycle. "

Correction: The above block was deleted without substitution.

2 General Information

2.1 Purpose of this documentation

In Version 19VRS, existing functions were enhanced and new functions added. New hardware components are also available. This document describes the modifications and gives a short overview of the new software and hardware components.

Note: More information about the new components can be found in the updated individual documents.

2.2 Deadlines

Software version 19VRS has been released since June 2000 and can be ordered.

The availability of the hardware components mentioned in this document can differ from this deadline. Please note the specifications for the corresponding product!

2.3 Hardware requirements

User interface

The user interface of the software and firmware version 19VRS for MTC200 can be installed on the Rexroth Indramat BTV20 and BTV30 operator panels and on most standard IBM compatible PCs.

Depending on the employed operating system, the following hardware prerequisites are expected:

	MS-DOS	Windows-NT
Processor type	≥ 5x86 / 133 MHz	≥ Pentium P166
Memory	≥ 32 MB	≥ 64 MB
Display	VGA Color 640*480, minimum 256 colors	65535 colors
Hard disk	≥ 100 MB free space	≥ 250 MB free space
Floppy disk drive (optional CD-ROM)	for installation and data backup for installation	
Serial interface	RS232C or RS485 for connection to MTC200-R	
Parallel interface	Printer connection	

Fig. 2-1: Hardware requirements

There must be at least 2 free ISA bus slots available if the MTC-P and MTS-P controller components are to be included in the PC.

Depending on the required option, further hardware components (such as interface cards) will be necessary.

Note: Due to the required computing power and free memory space, the Windows NT version of the 19VRS software can **no longer** be used in the BTV01. There will only be the DOS version that can be used in the BTV01 under the 19VRS software.

Firmware

The firmware of version 19 can be used on the following hardware platforms:

Hardware type	Firmware type
MTC-P01.2-xxx	FWA-MTCP01-M01-19VRS-NN
MTC-R01.1-xxx MTC-R02.1-xxx	FWA-MTCR0*-M01-19VRS-NN FWA-MTCR0*-M01-19VRS-NN
MTS-P01.2-xx-xxx MTS-P02.2-xx-xxx	FWA-MTSP01-S01-19VRS-NN FWA-MTSP01-M01-19VRS-NN FWA-MTSP02-S01-19VRS-NN FWA-MTSP02-M01-19VRS-NN
MTS-R01.2-M1-xxx MTS-R02.2-M1-xxx	FWA-MTSR0*-M01-19VRS-NN FWA-MTSR0*-S01-19VRS-NN FWA-MTSR0*-M01-19VRS-NN FWA-MTSR0*-S01-19VRS-NN

Fig. 2-2: Supported hardware types

Version 19 does **not** support the hardware types of the MT-CNC!

2.4 Software requirements

The user interface of the 19VRS software and firmware version for MTC200 can be used under the operating systems MS-DOS (version 6.22) and Windows NT 4.0.

For operating system Windows NT 4.0, service pack 5 is required.

The installation program checks whether the required service pack has been installed!

Note: The corresponding service pack must be activated again if additional operating system components (such as a network driver) are installed subsequently!

Rexroth Indramat supplies version 19VRS only in conjunction with MS-DOS 6.22 or Windows-NT 4.0.

Some functions of Version 19 are only available under Windows NT 4.0.

Software options

Within software version 19, the functions listed in the following table will only be available as an option.

The required function must be ordered by its type designation and must be installed using the enabling code that is included in the delivery.

Function	Type
Custom Display System - CDS - configuration and runtime version	SWS-MT*BVS-PRO-18VRS-MS
Custom Display System – CDS - runtime version only	SWS-MT*BVS-RUN-18VRS-MS
Graphical NC Editor - GNE	SWS-MTC200-GNE-18VRS-MS
Online NC simulation for MS-DOS - SIM	SWS-MTC200-SIM-17VRS-MS-MS*DOS
Online and offline NC simulation{ for WindowsNT - SIM	SWS-MTC200-SIM-17VRS-MS-WIN*NT
NC User Compiler - NUC	SWS-MTC200-NUC-17VRS-MS
Multi Control Interface - MCI	SWS-MTC200-MCI-18VRS-MS-WIN*NT
SFC Sequence Modes and Diagnosis	SWS-MTC200-SKT-19VRS-MS
Fast Measurement - SME	SWS-MTC200-SME-18VRS-MS
Drill Breakage Monitoring - BBU	SWS-MTC200-BBU-18VRS-MS

Fig. 2-3: Software options

This document also contains brief descriptions of these new functions that are only available as options.

3 Discontinuation of features

3.1 MTC02 / MTC03

Version 19 does no longer support the types MTC02 and MTC03 of the controller product family MT-CNC.

3.2 Operating and visualizing terminal SOT

Version 19 does no longer support the operating and visualizing terminal SOT02. The functionality is replaced by the BTV05, BTV06 and the BTC06.

3.3 Analog axes

Analog axes are no longer supported due to the discontinuation of MTC02 and MTC03.

4 Hardware components

New hardware components are available or are being prepared for the MTC200 controller product family. Software version 19VRS is required to support these components.

4.1 Higher memory capacity for MTS-P and MTS-R

As standard, the PLC modules in ISA bus plug-in card format (MTS-P) and in RECO format (MTC-S) are now equipped with a 2 MB-RAM memory.

The RAM memory size is defined as follows in the type code of the modules:

1. PLC module in ISA bus plug-in card format

MTS-P0x.2-D2-...
2 = 2 MB RAM memory

2. PLC module in RECO format

MTS-R0x.2-M2-...
2 = 2 MB RAM memory

4.2 BT bus connection for BTV20.3

The BT bus can be used to connect up to four operator panels of type BTM15/16 or BTA20. The maximum length of the BT bus may be up to **50 m** (from the connection point to the last user). This applies to the connection of **only one device** and the permissible maximum number of 4 devices. It is **not** possible to directly access the I/O data of the operator panels from the PLC (e.g. %IBP*.*). Data is exclusively exchanged via the core image storage.

The address assignments required for programming can be found in the corresponding documents of the devices to be connected.

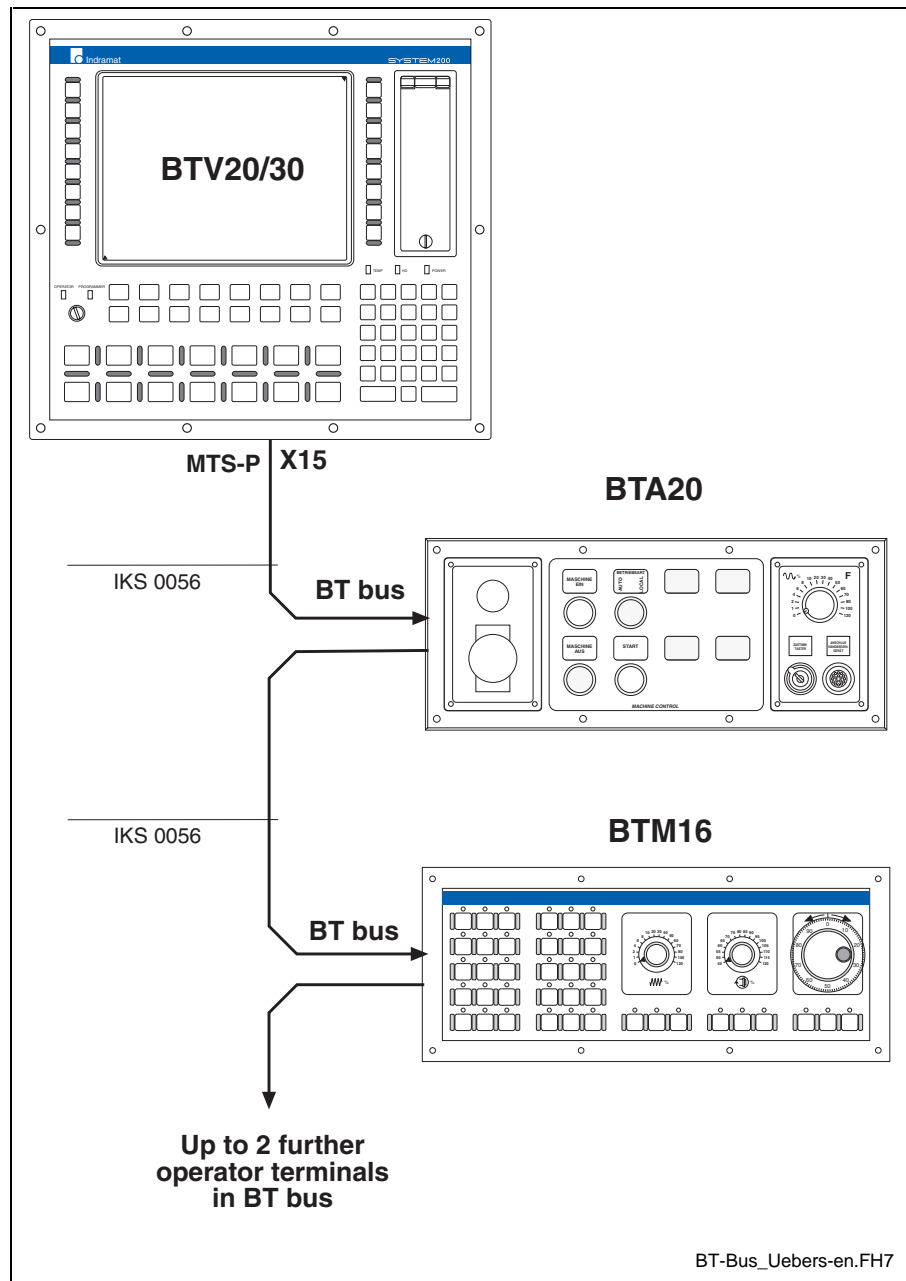


Fig. 4-1: BT bus overview

5 Software components

5.1 Graphical User Interface GUI

This software component is the enhancement of version 18 of the graphical user interface GUI.

The user interface of the 19VRS software version runs under the operating systems MS-DOS and WindowsNT. Some GUI functions, however, only run under WindowsNT.

Version 19 of the GUI can be used for the controller family MTC200. Version 19 does no longer support the controller family MT-CNC.

The GUI for the control system MTC200 is available in 2 versions:

Description	Type
MTC200 / MS-DOS	SWA-MTC200-GBO-19VRS-MS-CD*FD-MS*DOS
MTC200 / WindowsNT	SWA-MTC200-GBO-19VRS-MS-CD*FD-WIN*NT

Fig. 5-1: User interface versions

GUI version 19 requires firmware version 19 in the controller kernel.

5.2 Standardized user interface WinHMI

The user interface is based on the Microsoft Windows NT 4.0 operating system and on the MTC200 software environment of Rexroth Indramat. Version 19 is based on software version 18.

Description	Type
MTC200 / WindowsNT	SWA-MTC200-HMI-19VRS-MS-CD*FD

5.3 SWD-MTC200-004-19VRS-NN-C1.44

This firmware includes the new CNC and PLC functions of the MTC200controller family.

The firmware is loaded into flash memories via the PC.

Upon delivery, the firmware is installed according to the order specifications. In the event of a necessary update, the firmware can be reloaded via the GUI user interface.

The latest firmware on diskette is part of the delivery of the user interface SWA.

6 General functions

6.1 WinHMI

Error texts for small operating devices

Version 19 supports the visualization of the small operating devices BTV05, BTV06 and BTC06. The NC block number display and process error texts are shown. The error texts for the small operating devices BTV05, BTV06 and BTC06 are loaded into the CNC memory. The small operating devices BTV05, BTV06 and BTC06 read these texts of the CNC memory for diagnosis purposes.

This function is available by pressing OP7 "Maintenance" and F8 "Download error text".

Displaying and processing online data

Version 19 allows to display or edit online data of NC variables, NC events and D corrections. The data display is dynamic, i. e. if a value is modified via the PLC and/or NC program, the value is automatically updated.

This function is available by pressing OP8 "Control" and F6 "Further functions".

The data for each component is shown in a table. Lines can be inserted, deleted and edited by means of the F keys. The following figure shows, for example, the D correction table.

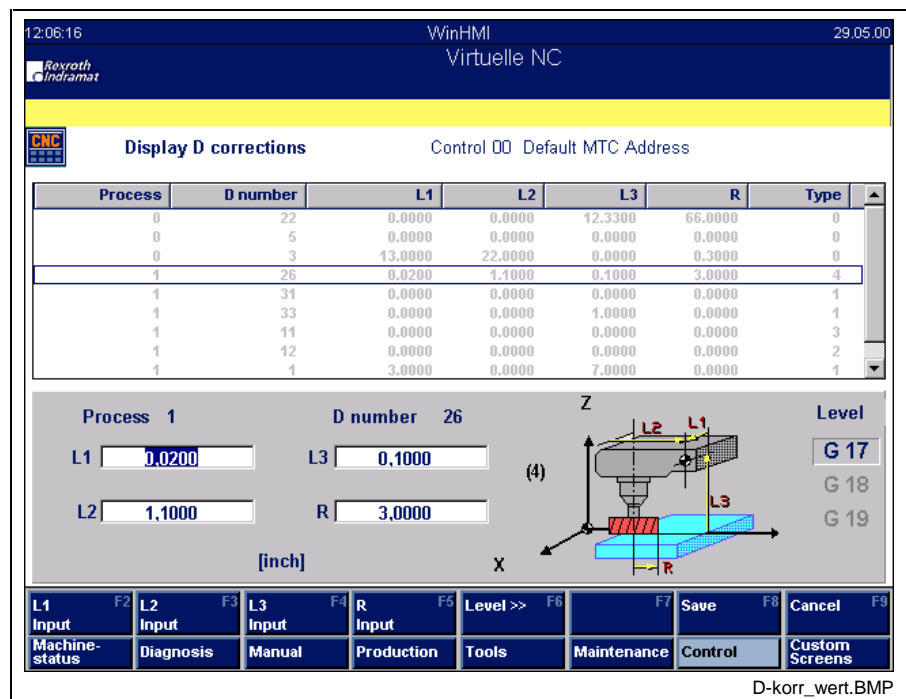


Fig. 6-1: Display and edit D corrections

6.2 Data backup Backup/Restore

EDP systems are no static systems. Data is created, modified, moved or deleted permanently. Components are added or removed, updates are executed, settings are modified. Furthermore, user data and system data exist. The Rexroth Indramat programs "Backup" and "Restore" are available for the backup and restore of these data and settings.

User data is saved on the local hard disk or an external data storage medium (server, MO, diskettes) by the data backup program. After a system crash it will be possible to restore the data.

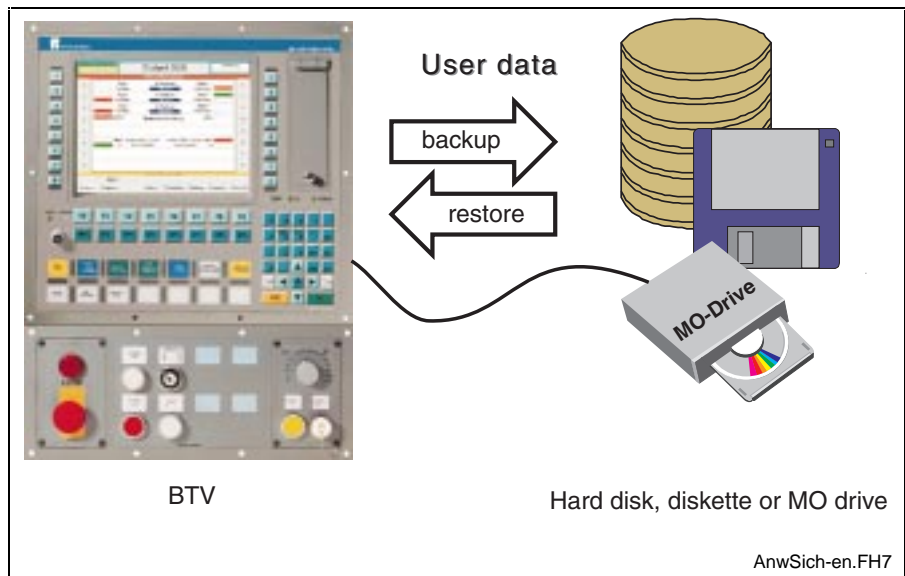


Fig. 6-2: Backup and restore user data

Procedure

By means of an archive program, data files on the hard disk are saved and can be restored if necessary. During archiving, the files are compressed and copied to the data storage medium. For archiving diskettes, hard disks or MO drives can be used as data storage mediums.

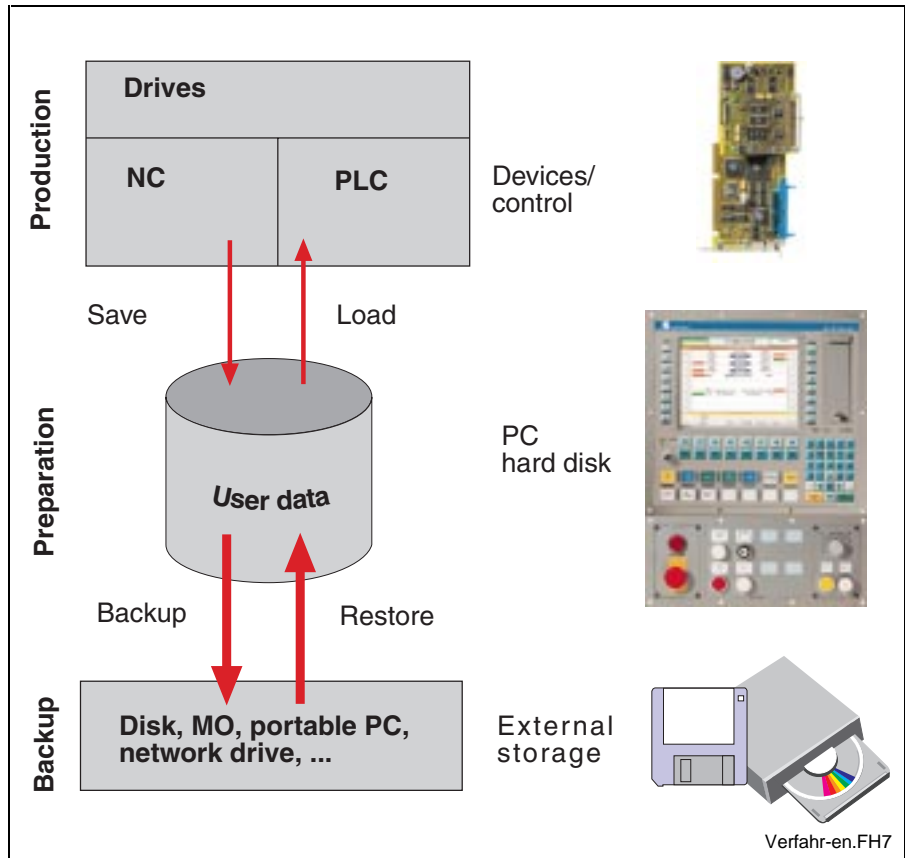


Fig. 6-3: Archiving procedure

Preparation

Before carrying out a backup, the data modified within the control (NC variables, NC events, D corrections, tool lists, zero offset data, machine data, remanent PLC data) must be saved on the hard disk. The SERCOS parameters have to be saved, too. For this, the corresponding menus are available or the archive function in the GUI can be used. The remanent PLC data must be saved with the block commands in the PLC.

Saving (backup)

The backup is carried out in two steps. The data to be saved is indicated in a batch file. First, all data to be saved is copied to a temporary directory on the local hard disk. In addition to the temporary directory, the structure file "archive.asl" is created. This structure file includes all necessary information about the saved data (e. g. origin, date etc.). The files are not compressed unless all files to be saved are available. The complete content of the temporary directory is always compressed. The result is a ZIP file. A ZIP file which exceeds the size of the storage medium selected will be divided automatically among multiple data storage mediums. When the compressing is completed, the temporary directory and all sub-directories are deleted.

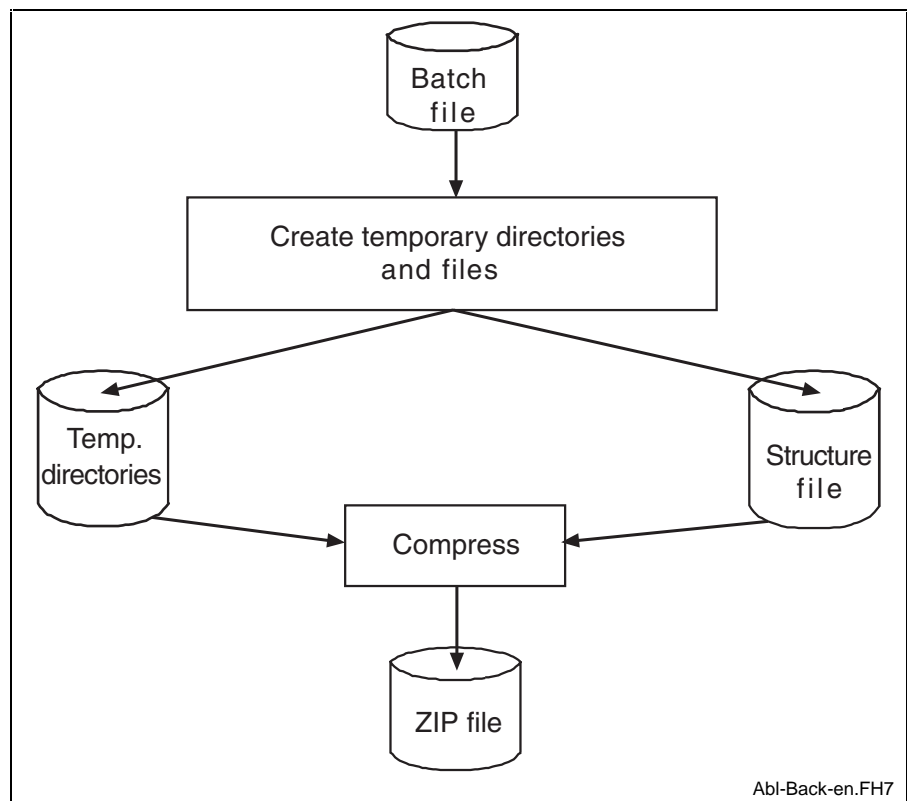


Fig. 6-4: User data backup procedure

Restore

Starting with the selected archive file (ZIP file) the files are decompressed in a temporary directory. The complete content of the archive file is always decompressed. Single files cannot be restored. If all files are decompressed without errors, the files are copied to the destination directories. If the files have been copied successfully, the temporary directory will be deleted.

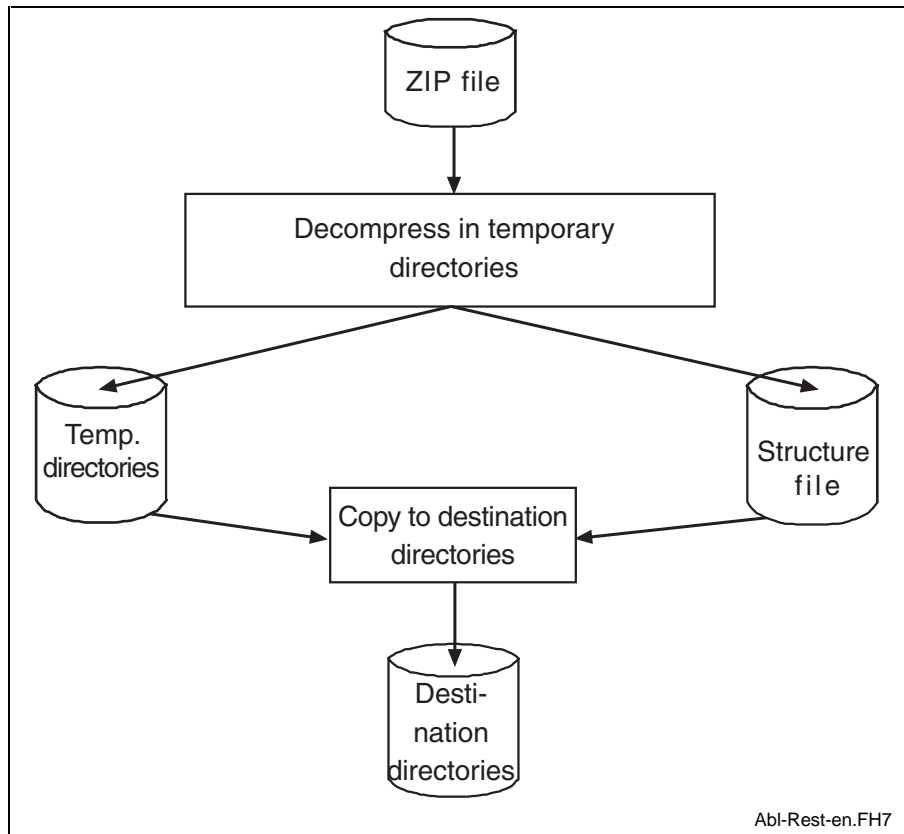


Fig. 6-5: User data restoring procedure

Restore data in the control

After the restore, the changeable data (NC variables, NC events, D corrections, tool lists, zero offset data, machine data, remanent PLC data) must be restored in the control. For this, the corresponding menus are available or the archive function in the GUI can be used. The remanent PLC data is restored with the block commands in the PLC.

6.3 Intelligent security technology IST

Rexroth Indramat CNC control and drive system with integrated intelligent security technology IST

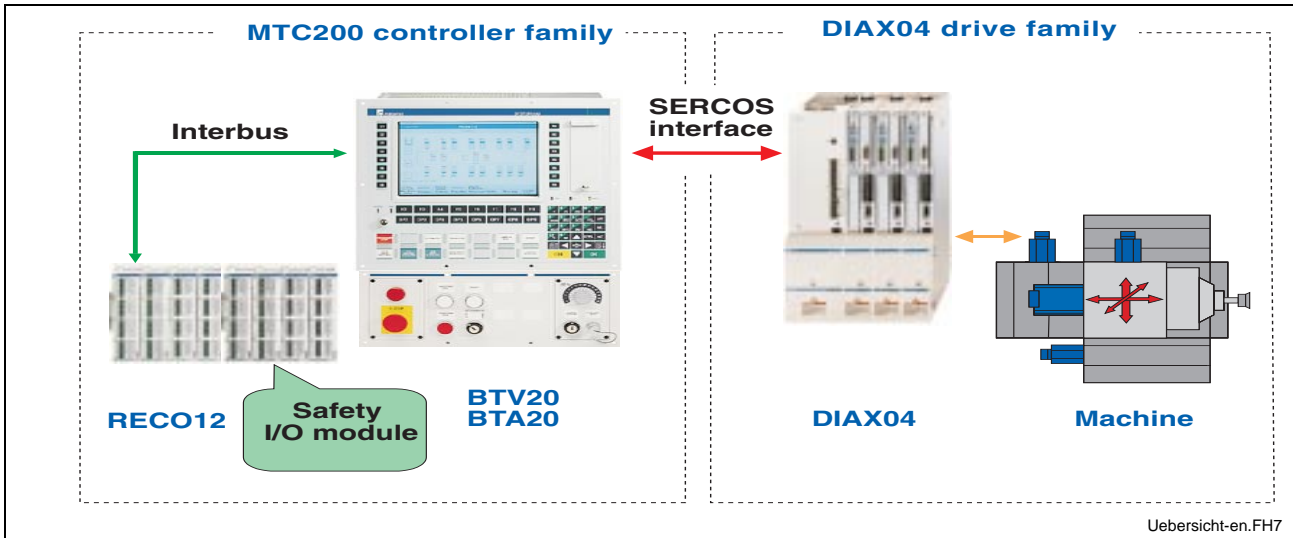


Fig. 6-6: SYSTEM200 with intelligent security technology

SYSTEM200 The Rexroth Indramat control and drive system SYSTEM200 with intelligent security technology basically consists of components of the MTC200 controller family and DIAX04 drive family.

The intelligent security technology is realized by hardware and software components providing the safety functions.

For using IST, an additional hardware component is required for each axis. The RMP safety I/O module based on the RECO12 I/O modules provides mechanically separated safety inputs and potential-free safety outputs.

All other components of the intelligent security technology are software components. These consist of MTC200 and DIAX04 firmware parts and PLC user program parts.

A detailed component list for the intelligent security technology is included in the IST application manual. It is available under the order number

DOK-CONTRL-IST***-AW01-EN-P**

MTC200 controller family The control system MTC200 consists of an industrial PC BTX20 or BTX30 equipped with the CNC module MTC-P and the PLC module MTS-P (ISA bus plug-in cards).

The RECO versions MTC-R and MTS-R can also be used for the intelligent security technology IST.

The CNC module contains a CNC processor with integrated axis processor and up to 3 additional PC104 axis processors. Each axis processor allows to control up to 8 digital drives via a SERCOS fibre optic loop.

The selection and status signals of the intelligent security technology must be processed in two channels in the complete system. The RMP safety I/O module based on RECO12 is available for the communication between the I/O level and the drive.

- DIAX04 drive family** The DIAX 04 drive system consists of a HVE or HVR power supply unit connected directly to the power supply system and several connected drives.
- Each drive is equipped with a HDS or HDD drive controller and one of the following motor types:
- MKD or MHD synchronous motor or
 - 2AD asynchronous motor or
 - 1MB built-in asynchronous motor or
 - LSF, LAF or LAR built-in linear motor.
- The drive controllers are connected to the axis processors of the CNC module by a SERCOS fibre optic loop.

Comparison with conventional security technology

The difference between a control and drive system with intelligent security technology and systems with conventional, discrete security technology is that in the intelligent drives the safety functions are integrated directly and the control is integrated as hardware and software.

This allows to achieve an increased functionality at maximum security in all operating modes.

The intelligent security technology is primarily not intended for replacing conventional security technology components, such as emergency off, switchgears and protection door controls. However, the following conventional security technology components may not be required:

- Motor zero-speed relay
- Speed monitor
- Power contactors between controllers and motors
- Limit switch or position cams for area detection

At the same time, the available personnel and machine safety is increased since the functionality and the global reaction of the system compared to similar systems with conventional security technology has been considerably improved.

The safety signal transmission takes place via the standard field buses Interbus and the SERCOS interface.

This leads to a considerably easier wiring structure within the machine.

Special control module and drive controller versions are not required for the use of the intelligent security technology IST.

Overview of safety functions for personal protection

Based on the realized monitoring, the intelligent security technology IST provides the following functions:

Safe stop	The safe stop protects the axis against unintentional start. In case of a safe stop, the power supply to the drive system is interrupted.
Safe stop of the machine	Like the safe stop, the safe stop of the machine also protects the axis against unintentional start. The drive system is stopped at a natural point in the production process (stop of the machine). All control functions between the electronic control and the drive motor are maintained. Safety measures prevent the drive from executing dangerous movements in case of errors.
Safely reduced speed	Safety measures in the CNC control and drive system prevent the drive (axis or spindle) from exceeding the specified speed limit.
Safely limited absolute position	Safety measures in the CNC control and drive system prevent the axis from moving out of the admissible travel range.
Safe cams	The safe cams allow a safe division of the axis travel range. They can be used for switching between various safety functions or the safe release of external safety mechanisms.

Design of the intelligent security technology

The intelligent security technology is designed according to DIN EN 60954-1 "Safety-related control parts", part 3, under consideration of the DKE (German commission of electrics) work paper 226.03 "Safety-relevant functions of electric drive systems in machines".

Additional documentation

A detailed description of the intelligent security technology is available under the order number

DOK-CONTRL-IST***-AW01-EN-P**

6.4 Upper spindle speed limit

In addition to the max. spindle speed for main spindle operation defined in the axis parameter 'Cxx.049', it is now possible to limit the max. spindle speed during machine operation by means of further variables.

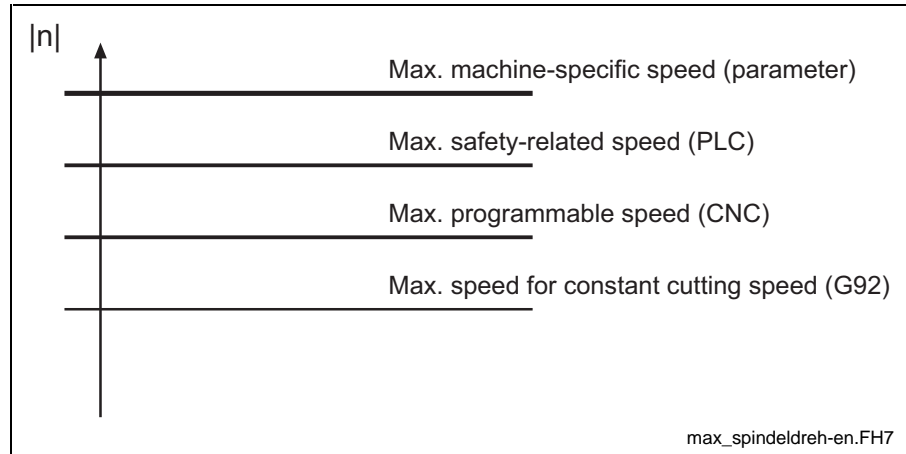


Fig. 6-7: Upper spindle speed limits

Machine data The max. safety-related speed (PLC) and the max. programmable speed (CNC) are set for each axis in machine data page 2.

```

STRUCT 2 Upper spindle speed limit
Safety-related speed limit active   BOOL       NoNC, NoSPS, NoGUI, NoPwGUI
Max. safety-related speed (PLC)    SPEED     NoNC, SPS, NoGUI, NoPwGUI
Max. technol. speed (CNC)         SPEED     NC, SPS, GUI, PwGUI
END_STRUCT
ARRAY [
    Axis no.                        SP_AXIS   1..12
] OF STRUCT
  
```

- PLC interface signal**
- **AxxC.SPEED** The axis control signal is used to activate the safety-related speed limit.
 - **AxxS.SPEED** The axis status signal is set as soon as the speed limit is active.
- Boundary conditions**
- The set-up man can modify the programmable speed limit within the machine data only by entering a special password and if the NC does not execute an NC program at the same time.
 - The speed limits can be modified at any time in the PLC by means of MTD_WR.
 - The speed limit can be programmed for all spindles of a process within an NC block by means of MTD_commands.
 - The PLC can switch the speed limit monitoring on and off by means of the axis-specific control signal 'AxxC.SPEED'.
 - The user can recognize the effectiveness of the speed limits in the machine data by means of the data element 'Safety-related speed limit active' and the control signal 'AxxC.SPEED'.
 - The NC monitors the spindle speed limits in spindle speed mode only if control signal 'AxxC.SPEED' is set. Speed limit modifications as well as activation and deactivation of the monitoring are immediately integrated by the NC.

- When switching on the main spindle synchronization, the NC determines the max. admissible speed of the leading spindle on the basis of all transmission ratios and speed limits. Every time when modifying the speed limit of the leading or synchronous spindles or when activating or deactivating the safety-related speed limit, the NC recalculates the maximum speed of the leading spindle. The NC carries out any possibly required limitation synchronously for all spindles involved in the synchronization.
- If the actual spindle speed exceeds the speed limit when switching on the interface signal 'Activate limit', the NC reduces the speed of the concerned spindle to the smallest maximum limit speed by considering the other speed limits.
- If a coupling (G33, G63, G64, G65, G95) or main spindle synchronization is active when switching on, the NC adjusts the spindle speed and the path velocity of the feed axes or spindles involved in the coupling or synchronization.
- Modifications of the nominal speed value carried out by means of the spindle override are ignored.
- In case of PLC-controlled spindles, the limited speed has to be read at each positive edge of this status signal and transferred to the external spindle.

Safety-related speed limit

The safety-related speed limit allows the machine manufacturer to limit the spindle speed when using a new chuck or opening the protective door.

Programmable speed limit

The programmable speed limit allows the NC programmer to limit the admissible spindle speed under consideration of the technological aspects.

6.5 Feed limit

In addition to the max. axis speed defined in axis parameter 'Cxx.016', it is now possible to limit the axis speed during machine operation by means of a further variable.

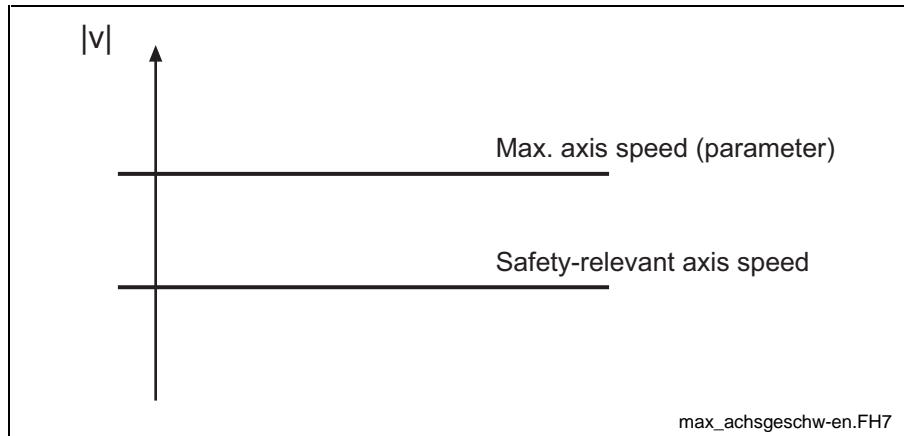


Fig. 6-8: Axis speed limits

The safety-related axis speed allows the machine manufacturer to reduce the maximum admissible axis speed (and thus the path velocity) for machining a heavy workpiece or opening the protective door.

Machine data The safety-related axis speed is set for each axis in machine data page 11.

```
STRUCT 11 Feed limit
Safety-related speed limit active   BOOL      NoNC, NoSPS, NoGUI, NoPwGUI
Max. safety-related speed          VELO      NC, SPS, GUI, PwGUI
END_STRUCT
ARRAY [
    Axis no.                        IP_AXIS   1..12
] OF STRUCT
```

The machine data element 'Max. safety-related speed (PLC)' can be modified by the user in the machine data menu, the NC program and the PLC.

The element 'Safety-related speed limit active' used for visualization of the PLC interface signal only allows read access.

PLC interface signal

- AxxC.SPEED The axis control signal is used to activate the safety-related speed limit.
- AxxS.SPEED The axis status signal is set as soon as the safety-related speed limit is active.

Boundary conditions

- The set-up man can modify the safety-related axis speed in the machine data only by entering a special password and if the NC does not execute an NC program at the same time.
- The safety-related axis speed can be modified at any time in the PLC by means of MTD_WR.

- The safety-related axis speed can be programmed for all axes of a process within an NC block by means of MTD_commands.
- The PLC can switch the monitoring of the safety-related axis speed on and off by means of the axis-specific control signal 'AxxC.SPEED'.
- The user can recognize the effectiveness of the safety-related axis speed in the machine data by means of the data element 'Safety-related speed limit active'.
- After having set the PLC interface signal, the safety-related axis speed only becomes effective in the next NC block or after an immediate stop.
- A modified safety-related axis speed only becomes effective in the next NC block or after an immediate stop.
- Modifications of the nominal value caused by the spindle override are ignored by the NC.

6.6 Travel range limits

In addition to the travel range limits defined in the axis parameters 'Cxx.011' and 'Cxx.012', further travel range limits can be programmed in the changeable software limits.

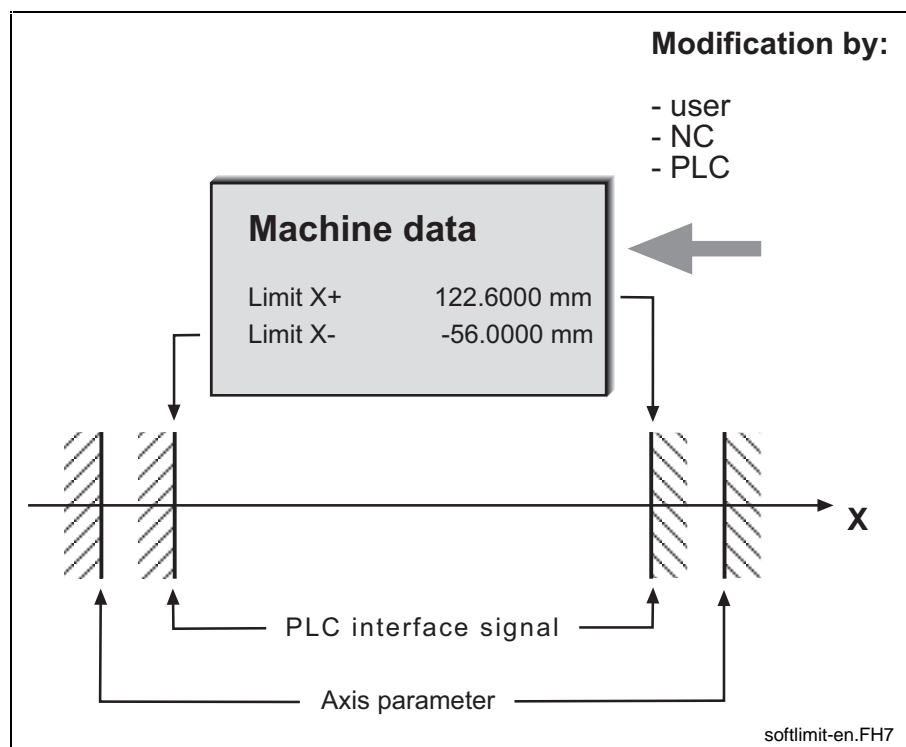


Fig. 6-9: Changeable software limits

Note: The position values are indicated as machine coordinates.

Machine data The changeable software limits are set for each axis in machine data page 12.

```

STRUCT 12 Programmable travel range limits
Prog. travel range limits active    BOOL    NoNC, NoSPS, NoGUI, NoPwGUI
Prog. travel range limit positive   POS     NC, SPS, GUI, PwGUI
Prog. travel range limit negative   POS     NC, SPS, GUI, PwGUI
END_STRUCT
ARRAY [
    Axis no.                IP_AXIS    1..12
] OF STRUCT

```

The machine data elements 'Prog. travel range limit positive' and 'Prog. travel range limit negative' can be modified by the user in the machine data menu, the NC program and the PLC.

The element 'Prog. travel range limit active' used for visualization of the PLC interface signal only allows read access.

- | | |
|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PLC interface signal | <ul style="list-style-type: none"> • AxxC.LIMIT The axis control signal is used to activate the changeable software limits. • AxxC.LIMIT The axis status signal is set as soon as the control signal has reached the NC. |
| Boundary conditions | <ul style="list-style-type: none"> • The changeable software limits are not effective in NC blocks which have already been calculated by the block preparation when setting the control signal 'AxxC.LIMIT'. • The changeable software limits must be smaller than the travel range limits set in the axis parameters. • If, during activation, the axis is out of the changeable software limits, the limits only become effective in the next axis movement block. |

Example ...
G1 X250 F1500
X100
MTD(12,1,,2)=122.6
X200
...

The positive travel range limit is reduced to 122.6 mm by the programmable positive travel range limit (the limit set in the axis parameters is higher). When travelling to X200 after having set the programmable travel range limit to 122.6, an error is indicated.

6.7 Quick stop upon probe detection

The previously existing probe function was enhanced by the function "Quick stop upon probe detection". The drives are stopped immediately when approaching the probe to the measuring point. After completion of the measuring process, the drives are switched on again.

Condition This function is only possible for DIAX04 drives with firmware SSE03 or higher.

Functional description In addition to the previous probe functionality, the function 'Quick stop upon probe detection' can be selected as of version SSE03.

If the value "5" is set for *position value 1/2 with quick stop at positive edge* in **P-0-0200, signal selection probe 1**, the drive automatically switches to "zeroing of nominal speed value" when the positive edge is detected. This drive state is maintained until the probe-1 enable in parameter **S-0-0405, probe 1 enable** is deleted by the control. Then, the drive uses again the nominal control values.

7 CNC functions

7.1 Feed to positive stop

With "Feed to positive stop G75", it is now possible to set the stop detection torque and the holding torque separately. The parameterization takes place via AXD commands.

Programmable torque In addition to the axis parameter 'Cxx.044 reduced torque at positive stop', the torque for feed to positive stop can be set depending on the machining process in the NC or PLC program via AXD parameters

65017 (P-7-3577)	Reduced torque of the digital drive in percentage for feed to positive stop. The positive stop is detected at this torque.
65018 (P-7-3578)	Reduced torque of the digital drive in percentage at the positive stop. The value becomes only effective if it is smaller than the value programmed in axis parameter 'Reduced torque at positive stop' and less than 100%. The positive stop is held with this torque.

NC program example

```

@101=AXD(X:P-7-3577)      ; save preset values
@102=AXD(X:P-7-3578)
AXD(X:P-7-3577)=200      ; values required for the machining
                          ; process
AXD(X:P-7-3578)=120     ; write (multiplication factor = 40)
G75 X200 F500           ; feed to positive stop
...
G76                     ; cancel torque pretension
AXD(X:P-7-3577)=@101   ; restore saved
AXD(X:P-7-3578)=@102   ; preset values

```

The AXD parameter '65017 (P-7-3577)' is used to set the torque for positive stop detection. After detecting the positive stop, the axis is held at the positive stop with the torque set in the AXD parameter '65018 (P-7-3578)' until the torque pretension is cancelled by means of G76.

Example

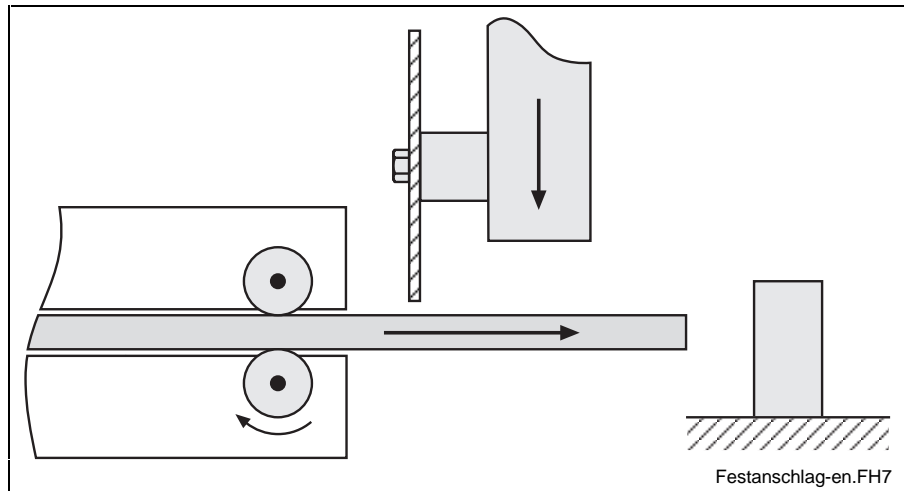


Fig. 7-1: Feed to positive stop

7.2 Enhanced NC syntax (NC control structures)

Overview

The following control structures were added to the NC syntax in version 19 and higher:

- IF-ELSE
- FOR
- WHILE
- REPEAT-UNTIL
- SWITCH-CASE
- CONTINUE
- BREAK

One of these instructions can be programmed for each NC block line. A control structure may contain an instruction or a block of instructions. A block of instructions is indicated between '{' and '}' An NC block according to DIN 66025 is considered as an instruction.

Example:

```

N0001 IF(@10>X)      ; control instruction
N0002 Y100 F100     ; instruction if the condition is met
N0003 ELSE
N0004 {              ;instruction block if the condition
N0005 Y=@10         ;is not met
N0006 G04 F100
N0007 }

```

An NC program may consist of an instruction or a list of instructions. The line feed separates the instructions.

Control instructions can be preceded by the elements: block number, extended block number, block skip, label and main block detection.

Note: Notation in the syntax description.

The character string '\n' in the syntax description means that a line break has to be inserted at this position. The characters must not be entered.

Conditions in control structures

The control instructions are controlled by conditions. A condition is composed of a logic expression.

Example:

```
N0001 FOR(@10=0,@10<100,@11*0.1 )
```

```
N0002 X=@10 F100
```

```
N0003 ...
```

The X axis travels from @10=0 to 100 at an increment of @11*0.1. The cancel condition is indicated in the middle of the FOR instruction. „@10<100“

Mathematical expressions may be followed by the relations:

- < (smaller)
- <= (smaller of equal)
- > (larger)
- >= (larger or equal)
- != (unequal)
- == (equal)

The result of a relation is either TRUE or FALSE.

The relations may be followed by the logic operands:

- || (or)
- && (and)
- ! (not)
- == (equal)
- != (unequal)

Examples of valid conditions:

```
(@10 < @11*10 && @100 != G(1) )
```

```
(TLD(,0,1,2,0,5,)==1)
```

```
(!(@10<@1 && @12>100))
```

Note: Make sure that there is no space in front of the character '(', otherwise the bracketed expression is evaluated as comment.

The priority of the operands is defined by the order in the syntax rule and increases from top to bottom, i. e. the operation '!' is more binding than operation '||'.

Block instructions

The block instruction combines a list of instructions in one instruction.

Example:

```
N0001 IF(@10<100) ;variable value smaller than 100
N0002 {           ; block start
N0003 Y=-3       ; axis movements
N0004 X=@10 Z=@11
N0005 Y=20
N0006 }         ;block end and end of IF instruction
N0007 G0 X=@100 Z=@101
```

Syntax description:

Block instruction = '{ 'n' {instruction} }' 'n'.

IF instruction

The following instruction is only carried out if the condition is met. The optional ELSE branch is executed alternatively if the condition is not met. Nested IF instructions are executed from inside to outside.

Note: The max. nesting depth of IF instructions must not exceed 15.

Example:

```
N0001 IF(@10<100) ;1st IF instruction
N0002 IF(@11>10) ;2nd IF instruction
N0003 Y=100
N0004 ELSE       ;ELSE of second IF instruction
N0005 IF(@11<100) ;3rd IF instruction
N0006 Y=200
N0007 ELSE       ;ELSE of 3rd IF instruction
N0008 Y=300     ;end of 3rd, 2nd and 1st IF instruction
N0009 X100 Z200
```

Syntax description:

IF instruction = 'IF' '(' condition ')' 'n'
 instruction
 ['ELSE' 'n'
 instruction].

FOR instruction

The FOR loop allows to repeat an instruction until the cancel condition is met. The loop variable is initialized at the beginning of the instruction and increased with each run according to the increment.

Example:

```
N0001 FOR(@10=0,@10<=100,0.1)
```

```
N0002 X=@10 Z=@10*0.25
```

The positions X 0.0 Z 0.0, X 0.1 Z 0.025, ... ,X 100 Z 25 are approached successively.

Syntax description:

FOR instruction = 'FOR' '(' variable ',' condition ',' increment ')' '\n'
instruction.

WHILE instruction

The WHILE instruction repeats the following instruction as long as the condition is met.

Example:

```
N0001 WHILE( @10>0 )
```

```
N0002 {
```

```
N0003 @12=@12+@10 X@12 Y@10
```

```
N0004 @10=@10-1
```

```
N0005 }
```

The blocks N0003 and N0004 are repeated until @10=0.

Syntax description:

WHILE instruction = 'WHILE' '(' condition ')' '\n'
instruction.

REPEAT UNTIL instruction

The REPEAT UNTIL instruction repeats the instructions between REPEAT and UNTIL until the UNTIL condition is met.

Example:

```
N0001 REPEAT
```

```
N0002 ....
```

```
N0011 UNTIL(@10>100 || @12==@11 )
```

The block between REPEAT and UNTIL is executed at least once and is repeated until @10>100 or @12=@11.

Syntax description:

REPEAT instruction = 'REPEAT' '\n'
{ instruction }
'UNTIL' '(' condition ')' '\n'.

CONTINUE instruction

The CONTINUE instruction continues the machining process with the next loop run. The loop counter is increased and the condition is checked within the FOR instruction. The WHILE and UNTIL instructions continue the checking of the condition.

Example:

```

N0000 @100=10
N0001 WHILE( @100 > 0 ) ;repeat as long as @100>0
N0002 { ; block start
N0003 @100=@100-1 ; decrease loop counter
N0004 IF( OTD(,,@100,4,0) == 0 ) ; offset in zero offset table =
0?
N0007 CONTINUE ; yes, address next memory
N0010 BSR .KONTUR ; contouring
N0011 } ; end of While instruction

```

Syntax description:

CONTINUE instruction = 'CONTINUE' '\n'

BREAK instruction

The BREAK instruction interrupts a loop.

Example:

```

N0001 FOR(@1=0,@1<10,1) ; repeat from @1=0 to @1=9
N0002 {
N0003 BSR .TSTPOS ; subroutine
N0004 IF(@0==0) ; interruption of loop
N0005 BREAK ; if @0=0
N0006 BSR .KONTUR
N0007 } ; end of FOR instruction

```

Syntax description:

BREAK instruction = 'BREAK' '\n'

SWITCH instruction

The SWITCH instruction allows the programming of a jump distributor. Depending on the value of the SWITCH expression, a CASE label is addressed. An instruction block may be preceded by several CASE labels. Branching to the end of the SWITCH instruction takes place after an instruction block. The DEFAULT label is addressed if no CASE label applies. If, in this case, the DEFAULT label is not available, branching to the end of the SWITCH instruction takes place.

Example:

```
N0001 SWITCH(G(17))           ; active transformation?
N0002 {
N0003 CASE 30:                ;G30
N0004 G31 X1 10 Y2 10 F100   ; activate Transmit
N0005 CASE 31:                ;G31
N0006 BSR .KONTUR            ; contouring
N0007 DEFAULT:                ;G32
N0008 G30 C0 F200            ; switch off transformation
N0009 }
```

Syntax description:

```
SWITCH instruction = 'SWITCH' '(' math. expression ')' '\n'
                    '{' '\n'
                    '{{ 'CASE integer ':' '\n' }
                    { instruction }}
                    [ 'DEFAULT' ':' '\n'
                    instruction ]
                    ')' '\n'
```

Indexable NC variables

In order to use the NC variables as fields in conjunction with the loop instructions "while", "for" and "until", indirect addressing is introduced in addition.

Syntax description:

```
NC-Var = @0..255
        | @0..6:0..255
        | @[ math. expression ]                ; new
        | @[ math. expression ]:[ math. expression ]. ; new
```

Example:

```
N0000 G01 F1000
N0001 FOR(@1=0,@1<10,1)
N0002 X=@[ 2 ]:[ @1 ] Y=@[ 3 ]:[ @1 ]
The polygon points (X,Y)=@2:i ,@3:i are approached.
```

7.3 Adaptive feed control (G26)

The adaptive feed control allows to modify the feedrate of an axis or the path velocity of the interpolating axes depending on the motor current/torque of a spindle or feed axis so that the machining capacity or machining volume (during milling, turning or grinding) remains constant. Thus, it is possible to obtain

- an improved surface quality,
- shorter machining times and
- to protect the tool, workpiece and machine against overload.

The function is activated by parameter B00.062. The feed control parameters are available in machine page 30.

Boundary conditions

- The adaptive feed control can be used in conjunction with digital spindles/feed axes with SERCOS interface.
- All axes and spindles involved in the adaptive feed control must be part of a process. This means that the reference axis must be part of the process of which the feedrate is to be controlled.
- All axes and spindles (including the feed axes involved in the interpolation) involved in the adaptive feed control must be connected to an axis processor. (The CPU informs the APR to which axes the internal override is to be distributed.)
- The adaptive feed control **cannot** be used for the following functions:
 - axis homing cycle (G74),
 - feed to positive stop (G75).
- Furthermore, the adaptive feed control is only available in the operating modes automatic, semi-automatic and MDI.
- The NC deactivates the adaptive feed control automatically (and sets G25) upon control reset and end of program.

Syntax

- G25 Switch off adaptive feed control (switch-on state)
G26 Switch on adaptive feed control

Parameters

If the manufacturer answers the process parameter "adaptive feed control" with "Yes", further process parameters follow

- Bxx.063 Reference axis for adaptive feed control
- Bxx.064 Nominal machining torque
- Bxx.065 Minimum machining torque
- Bxx.066 Maximum idling torque
- Bxx.067 Maximum feed reduction
- Bxx.068 Amplification
- Bxx.069 Measuring period

Machine parameters

The process-specific page "adaptive feed control" (page 30) is structured as follows:



Fig. 7-2: Structure of machine data page 30

PLC interface signals

With the "adaptive feed control" function, two new PLC interface signals were introduced. These signals are used for measuring result analysis.

- PxxS.THMISS „Thrust Missing“ depending on process parameter Bxx.065 and
- PxxS.EXCTH „Excessive Thrust“ depending on process parameter Bxx.064.

Thrust Missing

Type	Process status signal
Designation	PxxS.THMISS (THrust MISSing)
Meaning	PxxS.THMISS = 1:

The machining torque did **not exceed** the specified minimum machining torque Bxx.065 during the machining process.

PxxS.THMISS = 0:

The machining torque **exceeded** the specified minimum machining torque Bxx.065 during the machining process.

Update	The NC updates the interface signal after switching the adaptive feed control on (G26) and off (G25). The NC resets this signal upon program end and control reset.
Method of operation	If the machining torque does not exceed the minimum machining torque Bxx.065 during machining with activated adaptive feed control, the NC indicates this by setting the interface signal "Thrust Missing" (PxxS.THMISS) when switching off the adaptive feed control.

Excessive Thrust

Type	Process status signal
Designation	PxxS.EXCTH (EXCessive THrust)
Meaning	<p>PxxS.EXCTH=1:</p> <p>The current feed reduction exceeds the maximum feed reduction Bxx.067.</p> <p>PxxS.EXCTH=0:</p> <p>The current feed reduction does not exceed the maximum feed reduction Bxx.067.</p>
Update	The NC updates the interface signal when switching the adaptive feed control on (G26) and off (G25). The NC resets this signal upon program end and control reset.
Method of operation	If the current feed reduction exceeds the maximum feed reduction Bxx.067 during machining with activated adaptive feed control, the NC indicates this by setting the interface signal "Excessive thrust" (PxxS.EXCTH).

Note: The NC continues the machining process regardless of whether or not the current feed reduction exceeds the maximum feed reduction. Only if the current feed reduction reaches 100% (i. e. feedrate = 0 mm/min) and the set maximum feed reduction Bxx.067 or machine data variable 013 is less than 100%, the NC stops the machining and generates the error message .510 "100% feed reduction @ axis".

Problem of „inclined axis“

In case of "inclined axis without counter force", a torque for holding the axis in position is required. This holding torque is added as offset to all indicated torques. The torques required for the adaptive feed control are distorted.

Note: The adaptive feed control is not possible when an inclined axis is used as reference axis.

Solution:

The torque offset (stall torque) required for holding the axis must be eliminated for the adaptive feed control.

To do so, a command for recording the stall torque is required.

Stall torque recording is possible with the commands

- ITM or
- AXD.

The reference axis indicated in the parameters or machine data is referred to. The stall torque is included in the torque generation during the adaptive feed control.

The stall torque is generated during the dwell time indicated in the machine data.

The **machine data** has to be extended:

adaptive feed control active
reference axis
amplification

New *measuring period stall torque*

New *stall torque*

measuring period idling torque
idling torque
maximum idling torque
current machining torque
peak machining torque
minimum machining torque
limiting machining torque
current feed reduction
peak feed reduction
maximum feed reduction

The parameters for measuring period stall torque and stall torque have the same unit and priorities as the parameters for measuring period idling torque and idling torque.

The torque generated by STM is saved in the stall torque parameter.

Parameterization

The feed adaptation function is controlled by machine data page 30 "adaptive feed control". If no reference axis (=0) was entered in the machine data page, the following parameter data is stored:

<u><Machine data element></u>	= <Process parameter>
002 Reference axis	= B0x.062 Reference axis for adaptive feed control
003 Amplification	= B0x.068 Amplification

004 Measuring period	= B0x.069 Measuring period
006 Max. idling torque	= B0x.066 Max. idling torque
009 Min. machining torque	= B0x.065 Min. machining torque
010 Limiting machining torque	= B0x.064 Limiting machining torque
013 Max. feed reduction	= B0x.067 Max. feed reduction

Additional documentation

A detailed description of the function is available under the order number
DOK-MTC200-AD*FEED*V19-FK01-EN-P

7.4 Switchover to second encoder system (Adaptive Depth)

Adaptive Depth supports a second encoder system which is, for example, used for the compensation of workpiece clamping errors (surface probe). The second encoder is parameterized in the axis parameters Cxx.087, Cxx.088, Cxx.089, Cxx.090 and Cxx.091. The switchover is carried out with the G code G69 while the probe is deflected. Switching back to the encoder system 1 takes place with G68 while the probe is still deflected.

Application

Application 1

Adaptive positioning with linear probe. The switchover takes place during movement.

Application 2

Switchover from motor encoder to external measuring system. The external measuring system may be a linear probe, rotary encoder in case of circular axes or a linear probe. Switchover takes place when stopped but with power on and controller enabled.

New axis parameters

If motor encoder was selected in the axis parameter "position transmitter arrangement", further axis parameters are available for switching over to a second encoder system.

- Cxx.087 Adaptive control
- Cxx.088 Reference value of 2nd encoder system
- Cxx.089 Positive travel range limit of 2nd encoder system
- Cxx.090 Negative travel range limit of 2nd encoder system
- Cxx.091 Admissible predeflection of probe in 1st encoder system

G codes for switchover to second encoder system

Two new G codes are available for switching between two encoder systems.

- G69 switches over to the second encoder.
- G68 switches back to the motor encoder.

The G codes are effective in the operating modes.

If the G code G69 is executed when preselecting G09, switchover to the second encoder takes place when stopped. When preselecting G08, the axis coordinate value is approached as target position in the second encoder system.

Examples:

G69 G09 X0 ; switchover when stopped
 G69 G08 X200 ; approach target position in encoder system 2

7.5 Test mode

Purpose

In addition to the existing functions such as single block mode, semi-automatic mode, spindle override, rapid feed override, block skip, conditional and unconditional stop, as well as virtual NC including (offline) simulation, the new functions such as

- help function output,
- locking of movements,
- test feed,
- rapid program execution and
- graphical online simulation

allow the user faster commissioning.

The new functions – in the following called “test mode” – allow the user to concentrate directly on the geometry, process synchronization and collision protection. By means of these functions, the complete process and especially the parallel sequences of a run can be viewed separately and repeated at any speed as often as required. This is possible with and without I/O level activation and with and without axis movements.

Suppressing the help function output

The function “suppress help function output” allows the machine operator to switch off special help functions (e. g. coolant) or all help functions (M, Q, S and T/E functions) during the test mode.

The operator can activate the function “suppress help function” by pressing an M key.

Locking axes and spindles

Application

The function “lock axes and spindles” allows the operator to switch on and off certain axes and spindles and to test the program step-by-step.

Examples

- | | |
|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Simple milling machine | The test mode on a milling machine allows the operator to lock the feed axis (Z axis) by pressing an M key and to select a higher speed (test feed) for program execution.

During the subsequent test mode, the tool change is carried out like in normal program mode. |
| Simple lathe | The test mode of a lathe is similar. By pressing an M key, all axes (X, Z and W (tool turret)) and the spindle are locked and the test feed is activated. |
| Complex machine | From the creation of the NC program to the production of the part, the following steps (test stages) are carried out for example:

1. The operator can activate the following functions by means of M keys: <ul style="list-style-type: none"> - lock all main axes (X, Z), turret and spindle (S), - lock secondary axes (U (steady), V (tailstock), - activate test feed and |

- suppress help function output.

The operator switches on the online graphics before starting the program.

2. After successful program execution, the operator cancels the locking of the main axes, tool turret and spindle by pressing an M key and runs the NC program again (without part). The user checks the correction data (zero offsets, tool offsets,...) by means of the traversed path.
3. Then, the operator switches on the secondary axes (U, V) and checks their movements with regard to collision.
4. After this stage has been completed successfully, the operator deactivates the function "suppress help function output" and checks the help functions displayed while the run is repeated.

Then, the part is machined.

Further application The axis/spindle lock is not only used for test purposes but also for other purposes. It is for example also used for dual lathes or milling machines, which are operated as a dual machine or as two individual machines.

Test feed

Application The test feed allows a fast NC program run. This is especially favorable if axes and spindles are locked. Furthermore, smooth execution of the machining processes as well as smooth approaching and moving away are possible.

Method of operation The test feed is used for program execution instead of the programmed feed when selection the function "test feed" in the operating modes automatic and semi-automatic.

With the function "test feed" activated, the NC moves the axes programmed in connection with G01, G02, G03, G33, G63, G64, G65, G74, G75 and G77 at the test feed. This feed value is also used for G95 (feed per revolution) regardless of the respective spindle speed.

In case of G00, the NC moves the axes at a second test feed (rapid test feed) with the function "test feed" activated.

The function "test feed" is always available for the user during the test mode, regardless of whether the axes or spindles are locked or not.

With the test feed activated, feed and rapid feed override have the same effect as during normal operation. As in normal operation, the NC avoids that the maximum axis speeds defined in the machine parameters and the maximum path velocity are exceeded.

Selection of the test feed The machine operator selects the test feed via the user interface by using an M key.

Upon selection, the interface signal PxxCDRYRN (DRY RuN) is transferred to the NC and the machine data element "test feed" is set if it has not been set before.

Note: During the configuration of the function within the GUI, assure that "test mode" is displayed as sub-mode on the GUI screens.

Entry of test feed The values for the test feedrates "test feed" and "rapid test feed" are to be entered by the machine manufacturer in machine data page "test mode" and may be overwritten by the end-user directly in the machine data or indirectly via the PLC. The machine manufacturer may, for example, propose values for test feed and rapid test feed via the M keys thus enabling the end-user to make his selection.

Rapid program execution

- Application** The rapid program execution is the fastest way to check an NC program. It can be carried out by using the block scan whereby the operator does not need to select a start or target block. As in normal operation, the NC starts with the first NC block and stops as soon as the program end is reached. The axes and spindles are not moved during this process and only the help functions defined in the machine parameters (Bxx.058 - Bxx.061) are output.
- This function allows to quickly check tool offsets, zero offsets and D corrections with regard to travel range limits or variable calculations, etc.

Online simulation

- Application** The online simulation can be switched on and off in all operating modes and sub-modes and gives the user reliable information about the travelled path of the (moved or locked) axes within the machine.

Note: In case of very short NC blocks (e. g. transition radiuses) and very high path velocities, the online simulation may possibly not cover all NC blocks. These are not shown within the graphics or marked by arrows or points.

Suppressing tool transfer and tool movements

- Application** The function “suppress tool transfer and tool movement” constitutes an important partial function of an NC program test during the execution of which the tool storage axis is locked and the help functions are not output. It allows the machine manufacturer to freeze or to use the tool list during the test mode, if required. The freezing of the tool list is especially required if, during the test mode, the appropriate tool storage axis is locked and the tool-change-specific help functions are not processed in the PLC.

Note: During commissioning, ensure that when locking the tool storage axis the tool-change-specific help functions are not processed in the PLC and the tool list is frozen!

8 PLC functions

8.1 Switching from PEA external to PEA internal

The enhancement of PC board MTS-P01.1 to MTS-P01.2/2.2 allowed to integrate the PEA in the board. The additional PC104 board is no longer required. This, however, requires an I/O configuration modification in programs developed for MTS-P01.1 with PEA (BTV20 with BTA20).

- Procedure:**
1. Save PLC program in ASCII format, menu **File – ASCII store**.
 2. Switch to the clipboard by pressing <Alt>+ and search the following entry within the section IO:

```
LOOP AT (**): 16#E000 'PEA3/4'
  MASTER
  (*) AT 1: 16#0001 'input core image storage'
    MODULE
      AT 0..2: 16#0001 'IB'
    END_MODULE
  (*) AT 2: 16#0002 'output core image storage'
    MODULE
      AT 0..2: 16#0002 'QB'
    END_MODULE
  END_MASTER
END_LOOP
```

3. Modify entry LOOP AT (**): 16#..... in LOOP_INTERN AT 4: 16#.... and remove the keywords MASTER and END_MASTER. Then, the entry must read as follows:

```
LOOP_INTERN AT 4: 16#E000 'PEA3/4'

  (*) AT 1: 16#0001 'input core image storage'
    MODULE
      AT 0..2: 16#0001 'IB'
    END_MODULE
  (*) AT 2: 16#0002 'output core image storage'
    MODULE
      AT 0..2: 16#0002 'QB'
    END_MODULE

END_LOOP
```

(**) corresponds to the slot number according to the current configuration (1...4)

(*) corresponds to the unchanged logic user numbers of the original configuration (1...999)

4. Mark the complete clipboard.
5. Load the ASCII file by means of menu **File – ASCII load**.

Script control The conversion can be carried out automatically by means of the script control:

SCRIPT PEA1_DE pea external -> internal German		SCRIPT PEA2_EN pea external -> internal English	
KEY Alta	KEY del	KEY Altf	KEY del
KEYS I	KEY del	KEYS I	KEY del
DELAY 250	KEY del	DELAY 250	KEY del
KEY Enter	KEY del	KEY Enter	KEY del
KEY AltB	KEY del	KEY AltB	KEY del
KEY CtrlQ	KEY down	KEY CtrlQ	KEY down
KEYS F	KEY down	KEYS F	KEY down
KEYS PEA	KEY down	KEYS PEA	KEY down
DELAY 200	KEY down	DELAY 200	KEY down
KEY Enter	KEY down	KEY Enter	KEY down
KEY Home	KEY down	KEY Home	KEY down
DELAY 200	KEY down	DELAY 200	KEY down
KEY right	KEY down	KEY right	KEY down
KEY right	KEY down	KEY right	KEY down
KEY right	KEY del	KEY right	KEY del
KEY right	KEY del	KEY right	KEY del
KEY right	KEY del	KEY right	KEY del
KEY right	KEY del	KEY right	KEY del
KEY right	KEY del	KEY right	KEY del
KEY right	KEY del	KEY right	KEY del
DELAY 200	KEY del	DELAY 200	KEY del
KEYS _INTERN	KEY del	KEYS _INTERN	KEY del
KEY right	KEY del	KEY right	KEY del
KEY right	KEY del	KEY right	KEY del
KEY right	KEY del	KEY right	KEY del
KEY right	KEY del	KEY right	KEY del
KEYS 4	KEY del	KEYS 4	KEY del
KEY DEL	KEY del	KEY DEL	KEY del
KEY down	KEY del	KEY down	KEY del
KEY Home	KEY del	KEY Home	KEY del
KEY Del	KEY AltA	KEY Del	KEY Altf
KEY del	KEYS c	KEY del	KEYS c
KEY del	DELAY 250	KEY del	DELAY 250
KEY del	KEY Enter	KEY del	KEY Enter
KEY del	KEY F2	KEY del	KEY F2
KEY del	KEY Alti	KEY del	KEY Alti
KEY del	DELAY 250	KEY del	DELAY 250
	EXIT		EXIT

Fig. 8-1: Script control for automatic adaptation

8.2 BT bus as I/O page

The BT bus can be used to connect up to four operator panels of type BTM15/16 or BTA20. The maximum length of the BT bus may be up to **50 m** (from the connection point to the last user). This applies to the connection of only one device and the permissible maximum number of 4 devices. It is not possible to directly access the I/O data of the operator panels from the PLC (e.g. %IBP*.*). Data is exclusively exchanged via the core image storage. A wide transmission speed range can be adjusted, a default value of 19200 baud makes sense. An increase to 38400 baud is possible but increases the cycle time considerably.

The address assignments required for programming can be found in the concerning documents of the devices to be connected.

Addressing

The BT bus is addressed by assigning a logic user number in the I/O editor of the PLC programming interface. Each input core image storage as well as each output core image storage is assigned its own logic address.

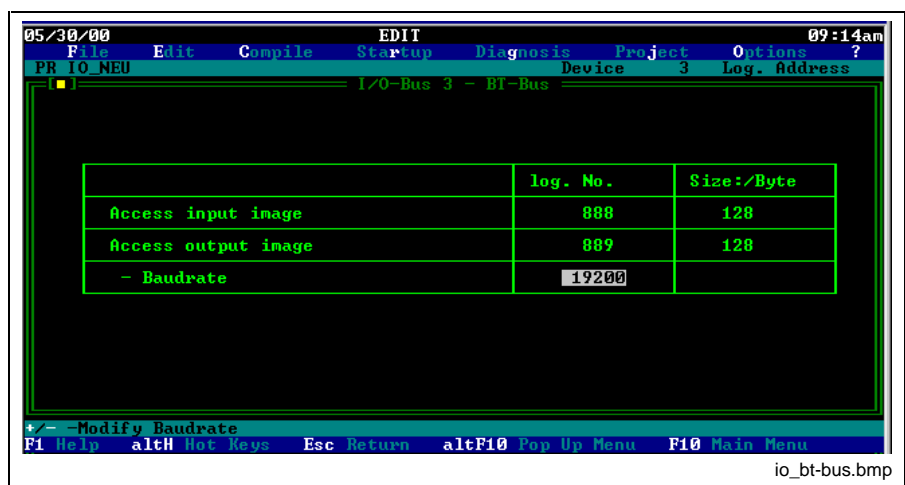


Fig. 8-2: BT storage page

Each of the two core image storages has a size of 128 bytes, which are available for the connected operating devices. The number of bytes assigned in the core image storage depends on the operating device.

Device type	Storage assignment in the input/output core image
BTM15	Depending on the configuration 2 bytes for digital I/Os (always assigned) 2 additional bytes for each module (except handwheel) 4 additional bytes for handwheel module
BTM16	14 bytes
BTM20	6 bytes

Fig. 8-3: Storage requirements of operating devices

Depending on the physical order of the operating devices connected to the BT bus, the device addresses are assigned in the input and output core image storage without any gaps, according to the storage requirements of the operating devices. The example BT-Bus.bmp shows the principle of the BT bus storage assignment.

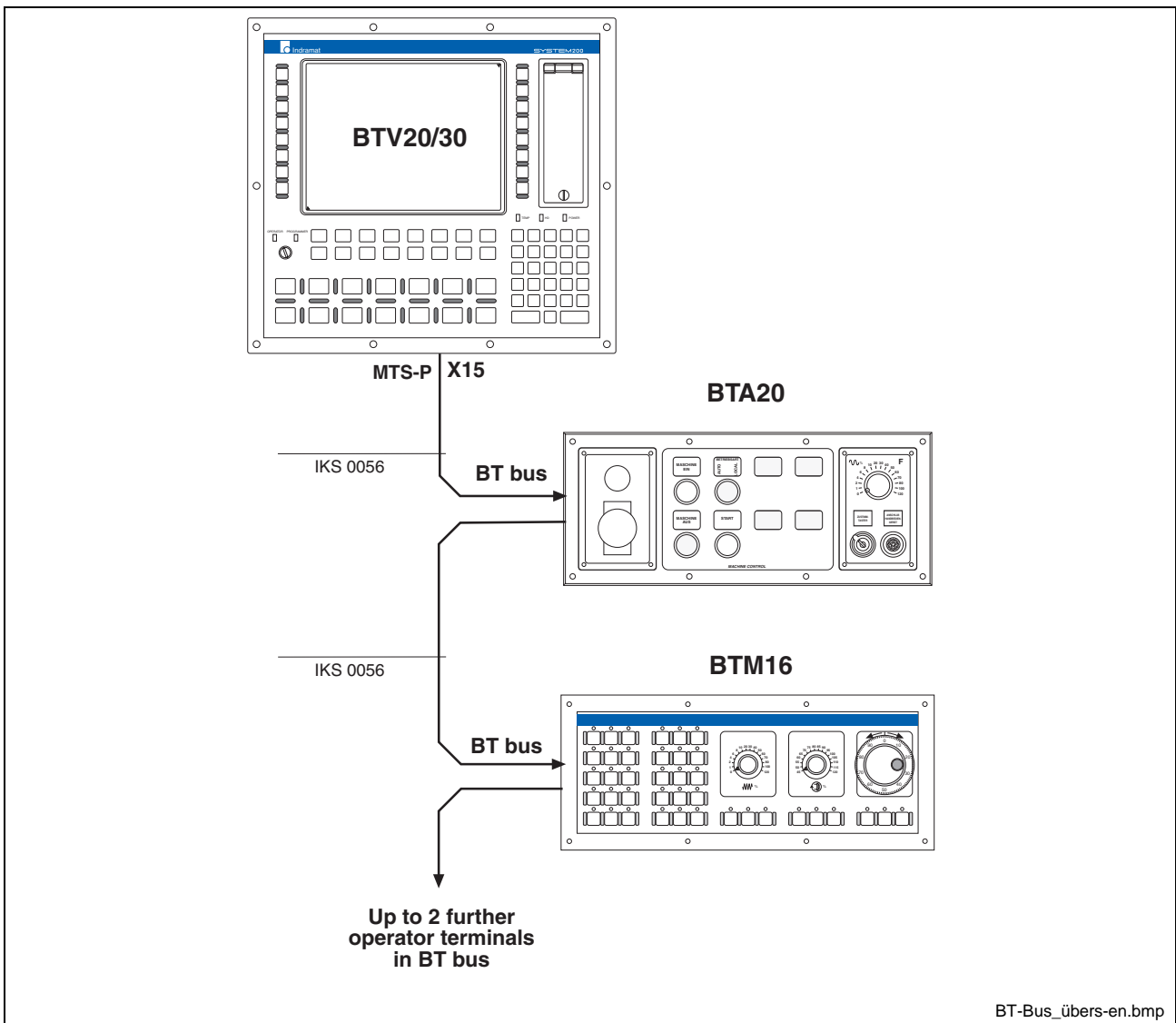


Fig. 8-4: Addressing example BT bus

8.3 Parameters for setting the data consistency at the Interbus

In the past (Interbus), the data exchange between the PLC and the field bus interface was carried out freely and asynchronously.

Data consistency could therefore only be guaranteed for one word (16 bits) (quickest method to exchange data between two systems).

Since more and more modules are required for which the data consistency per word is not sufficient, a consistent access to a larger range should be possible. Since the PLC has a higher cycle time than the field bus, the consistency must be controlled by the PLC.

For this reason, a buffered and PLC-controlled version guaranteeing the consistency for the complete field bus is offered. This version controlled by certain handshake bits is slower and should therefore only be used as an option.

An access mechanism for this option was implemented via the pop-up menu (<Alt>+<F10>) of the I/O editor (see also Fig. 8-5: Switch data consistency in Interbus parameter

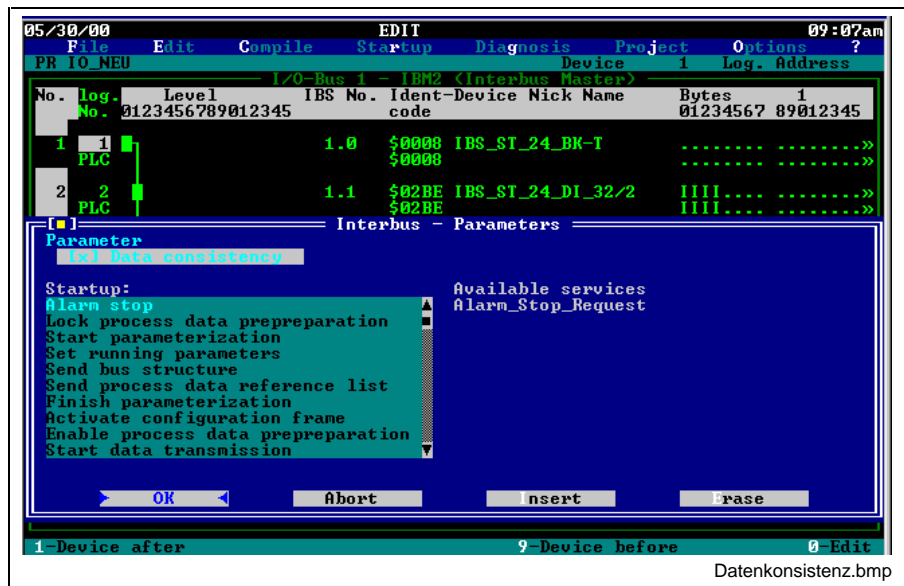


Fig. 8-5: Switch data consistency in Interbus parameter

8.4 Control of the Interbus system (IBM2, G4)

The following user function blocks are available in the PLC programming interface for the control of the Interbus system (IBM2, G4).

CLR_DIAG: clear diagnosis parameter register

SEG_OFF: switch off segment

SEG_ON: switch on segment

STOP_D: stop data transfer

START_D: start data transfer

These blocks allow to exchange Interbus modules during bus operation or to switch Interbus sections on and off independently. Furthermore, the diagnosis parameter registers can be cleared in order to be able to react to active messages (failing peripheral units, etc.).

Conditions

Before using the function blocks, the following actions have to be carried out:

- Enter the standard registers of the Interbus interface in the I/O editor of the Interbus master interface by assigning a logic user number. Please observe that these registers can only be entered after the last bus node.
 - Diagnosis status register (designation in the IBS list: DiagnosisStatusReg)
 - Diagnosis parameter register (designation in the IBS list: DiagnosisParameterReg)
 - Function status register (designation in the IBS list: FunctionStatusReg)
 - Function parameter register (designation in the IBS list: FunctionParameterReg)
 - Function start register (designation in the IBS list: FunctionStartReg)

The blocks are to be imported into the programming interface by means of the menu **Project – Archive - Fetch**.

- Entry of the required blocks in the import list.
- Declaration of function blocks in the declaration editor.

8.5 Possible faults during the start-up of IBS G4 and their elimination

Values entered in the IBS interface are valid until they are overwritten by the same service or the interface is reset. If, now, two programs with different start-up services are successively transferred to the control, addresses can be relocated.

Example Program 1 is a new program of version V19 with the required start-up sequence (Set_Value – Load_Configuration – Load_Process_Data_Reference_List)

Program 2 is an older program with physical addressing containing only the simple start-up (Load_Configuration);

If now the start-up services of program 1 are transferred to the IBS interface, the IBS interface takes the base addresses for the process data from the service 0x750 – "Set_Value". These base addresses remain also valid after the start-up services of program 2 have been transferred; since they do not contain the service 0.750 – Set_Value and the interface has not been reset in the meantime, the value transferred first remains valid. The automatic parameterization of the process data channel, carried out by the interface after service 0.308, is based on the base addresses of the start-up services of program 1. The PLC GUI, however, does not include these base addresses in the calculation of the individual user addresses.

Error elimination This error can only be eliminated by a control reset (possibly by a software reset if an error is active).

9 Tool management functions

9.1 Flexible equipment check

The process signal PccC.MGWTC (magazine without tool check) - formerly PxxC.F62 - allows to suppress the automatic equipment check (tool list vs. set-up list) at the beginning of the forward program start. It can be started at a later time from the NC program.

TID Tool Identification

An equipment check can be carried out during an NC program by using the NC command TID.

This function is especially required in connection with background magazines.

The equipment check function and the individual actions carried out after releasing the check are described in the document "Tool management".

No equipment check upon reverse start

No equipment check is carried out in version 19 upon a reverse start. Thus, starting the reverse program is always possible. If, however, an equipment check should be carried out in the reverse program, the NC command 'TID' has to be programmed in the reverse program.

9.2 Movement indication PLC turret

The tool management always indicates a movement for PLC-controlled turrets. In case of NC-controlled turrets, however, a movement is only indicated if a turret movement is necessary (nominal position \neq actual position).

From version 19 and higher, the automatic suppression of unnecessary tool axis movements will only be possible for NC-controlled tool drives. If required, a corresponding logic must be provided in the PLC user program for PLC-controlled tool drives. This allows cutting with a complete revolution of the tool drive by selecting the same tool repeatedly.

9.3 Modifications

Remaining tool life

The value range of the remaining tool life has been extended:

previously: 0,00 to 100,00

now: -99,99 to 100,00

By means of the extended value range of the remaining tool life, it is possible to find out whether a worn tool was still used and if yes, for how long.

10 Parameters/interface signals

10.1 Maintaining the reference system upon control reset

Purpose	This parameter allows to determine whether, upon a control reset, the active zero offset and the active tool length offset are initialized according to the switch-on state or whether the currently active state is maintained.
Parameter designation	Maintain reference system upon control reset
Parameter number	Bxx.070
Value range	YES/NO
Default setting	NO
Unit	---
From version:	>= 04.19

If the parameter is set to **NO**, the following initializations are carried out upon a control reset:

- The active zero offset is deactivated and the zero offset (G53 G59) entered in process parameter Bxx.039 (stored zero offset) is activated.
- The active zero point memory is set to ,0'.
- The active tool length offset is deactivated and the tool length offset (G47 G49) entered in process parameter Bxx.038 (stored tool length offset) is activated.
- The active D correction is set to ,0', i. e. it is deactivated.

If the parameter is set to **YES**, the following states are maintained upon a control reset:

- The active zero offset (G53..G59)
- The active zero point memory
- The active tool length offset (G47..G49)
- The active D correction (0..99)

Note: Upon program end with return (RET) and back with stop (BST), the default state stored in the process parameters is activated, i. e. parameter Bxx.070 has the same effect as if the parameter was set to NO.

10.2 Axis transfer for all processes possible

Up to now, it was possible to transfer axes to a maximum of 4 different processes. By entering an asterisk (*) in axis parameter Cxx.000 "assigned process" as alternative process (e. g. 1,*), axes can be transferred between all available processes.

10.3 New interface signals

AxxS.HOLD

With AxxS.HOLD an acknowledge signal is available for each axis to process the movement hold. This signal indicates that the movement hold (AxxC.MHOLD) is active in the PLC program. This signal allows to switch off the controller enable only if the movement hold is active and to thus avoid the error message "inactive axis programmed".

PxxS.RVACT

PxxS.RVACT is used to check in the PLC program whether a reverse vector (REV command) is active in a process. This information is maintained after switching off the control.

10.4 Modifications

Increasing the path velocity

The maximum path velocity has been increased from 800 m/min to 999.9 m/min.

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<p>USA Hauptniederlassung - Headquarters</p> <p>Bosch Rexroth Corporation Rexroth Indramat Division 5150 Prairie Stone Parkway Hoffman Estates, IL 60192-3707</p> <p>Tel.: +1 847 6 45 36 00 Fax: +1 847 6 45 62 01 service@indramat.com</p>	<p>USA Central Region - Mitte</p> <p>Bosch Rexroth Corporation Rexroth Indramat Division Central Region Technical Center 1701 Harmon Road Auburn Hills, MI 48326</p> <p>Tel.: +1 248 3 93 33 30 Fax: +1 248 3 93 29 06</p>	<p>USA Southeast Region - Südwest</p> <p>Bosch Rexroth Corporation Rexroth Indramat Division Southeastern Technical Center 3625 Swiftwater Park Drive Suwanee, Georgia 30124</p> <p>Tel.: +1 770 9 32 32 00 Fax: +1 770 9 32 19 03</p>	<p>USA SERVICE-HOTLINE</p> <p>- 7 days x 24hrs -</p> <p>+1-800-860-1055</p>
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<p>Canada East - Kanada Ost</p> <p>Bosch Rexroth Canada Corporation Burlington Division 3426 Mainway Drive Burlington, Ontario Canada L7M 1A8</p> <p>Tel.: +1 905 335 55 11 Fax: +1 905 335-41 84 michael.moro@boschrexroth.ca</p>	<p>Canada West - Kanada West</p> <p>Bosch Rexroth Canada Corporation 5345 Goring St. Burnaby, British Columbia Canada V7J 1R1</p> <p>Tel. +1 604 205-5777 Fax +1 604 205-6944 david.gunby@boschrexroth.ca</p>	<p>Mexico</p> <p>Bosch Rexroth S.A. de C.V. Calle Neptuno 72 Unidad Ind. Vallejo 07700 Mexico, D.F.</p> <p>Tel.: +52 5 754 17 11 +52 5 754 36 84 +52 5 754 12 60 Fax: +52 5 754 50 73 +52 5 752 59 43</p>	<p>Mexico</p> <p>Bosch Rexroth S.A. de C.V. Calle Argentina No 3913 Fracc. las Torres 64930 Monterey, N.L.</p> <p>Tel.: +52 8 333 88 34...36 +52 8 349 80 91...93 Fax: +52 8 346 78 71 mario.quiroga@boschrexroth.com.mx</p>

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<p>Argentina - Argentinien</p> <p>Bosch Rexroth S.A.I.C. "The Drive & Control Company" Acaassuso 48 41/47 1605 Munro Prov. Buenos Aires</p> <p>Tel.: +54 (0)11 4756 01 40 Fax: +54 (0)11 4756 01 36 mannesmann@mannesmannsaic.com.ar</p>	<p>Argentina - Argentinien</p> <p>NAKASE Servicio Tecnico CNC Calle 49, No. 5764/66 1653 Villa Balester Prov. - Buenos Aires</p> <p>Tel.: +54 (0) 11 4768 36 43 Fax: +54 (0) 11 4768 24 13 nakase@usa.net nakase.com</p>	<p>Brazil - Brasilien</p> <p>Bosch Rexroth Ltda. Av. Tégula, 888 Ponte Alta, Atibaia SP CEP 12942-440</p> <p>Tel.: +55 (0)11 4414 56 92 +55 (0)11 4414 56 84 Fax sales: +55 (0)11 4414 57 07 Fax serv.: +55 (0)11 4414 56 86 alexandre.wittwer@rexroth.com.br</p>	<p>Brazil - Brasilien</p> <p>Bosch Rexroth Ltda. R. Dr.Humberto Pinheiro Vieira, 100 Distrito Industrial [Caixa Postal 1273] 89220-390 Joinville - SC</p> <p>Tel./Fax: +55 (0)47 473 58 33 Mobil: +55 (0)47 9974 6645 prochnow@zaz.com.br</p>
<p>Columbia - Kolumbien</p> <p>Reflutec de Colombia Ltda. Calle 37 No. 22-31 Santafé de Bogotá, D.C. Colombia</p> <p>Tel.: +57 1 368 82 67 +57 1 368 02 59 Fax: +57 1 268 97 37 reflutec@inter.net.co</p>			

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