



MTC200

The Innovative Force in CNC-Technology

 **SYSTEM200**

MTC200

Connectivity plus motion control expertise

With Rexroth Indramat, you won't compromise performance for connectivity. We pioneered PC-based control. We innovated AC servo technology, digital drives and high-resolution feedback. And we offer you more practical experience with SERCOS communications than any other controls supplier.

Today Rexroth Indramat has over 900.000 installed servo axes worldwide. All this application knowledge is embodied in our MTC200 control and drive technology. The result is faster setup, higher throughput, and increased part quality in applications ranging from complex to cost-sensitive:

- Transfer lines and specialized machines
- High production machining cells
- Machining centers
- Lathes and turning centers
- Milling machines
- Drilling systems
- Grinding machines
- Integrated automation systems

With MTC200, you get a best of breed solution with single source responsibility. But Rexroth Indramat won't lock you in. Our standards-based communications provide connectivity with your choice of vendors:

- SERCOS interface
- INTERBUS
- PROFIBUS-DP
- DeviceNet
- Ethernet





MTC200

The multifunctional multi-axis control

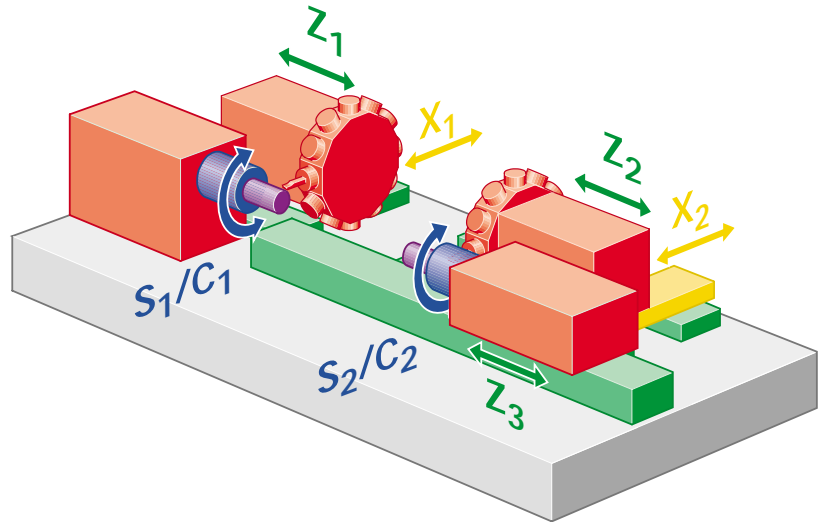
The MTC200 can simultaneously control up to 7 independent CNC processes and 25 PLC mechanisms while communicating diagnostics and operating data. A single MTC200 can control multiple machining operations involving various spindles and slide groups, while coordinating automated handling and measuring systems.

Up to 32 axes can be assigned to 7 CNC processes, including:

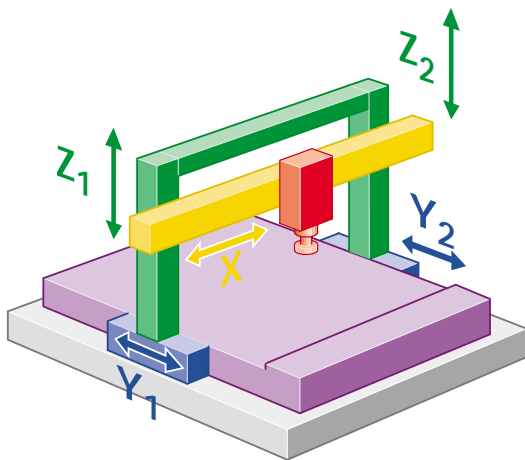
- Main spindle
- Rotary axis-capable main spindle
- Linear axes
- Rotary axes
- Combined spindle/turret axis

The MTC200 performs all functions required for:

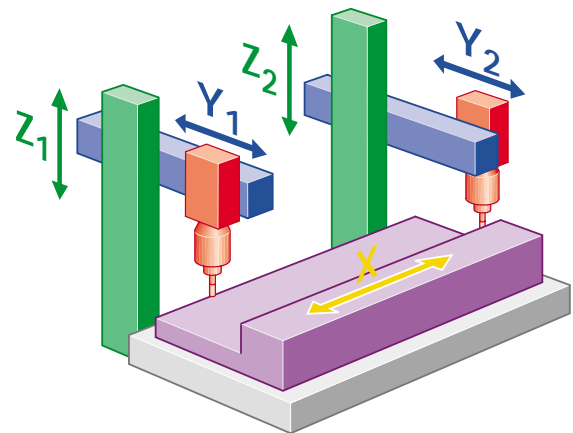
- 3-D linear interpolation
- Circular interpolation
- Helical interpolation
- Polar coordinate transformation
- Main spindle synchronization
- Follower (synchronous) and gantry axes



The MTC200's ability to handle multiple axes and processes with different drive technologies means that three spindle drives can be synchronized in each process.



Even complex machines are easily controlled using the follower and gantry axis functions, with up to four 4-axis synchronous axis groups defined for each process. Axes in a group can be synchronized and de-synchronized using simple PLC control.



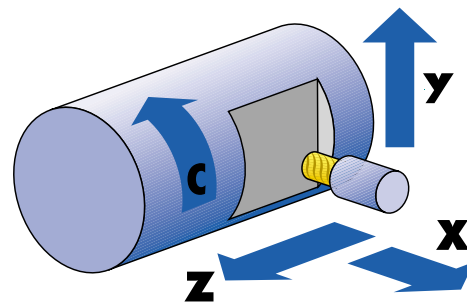
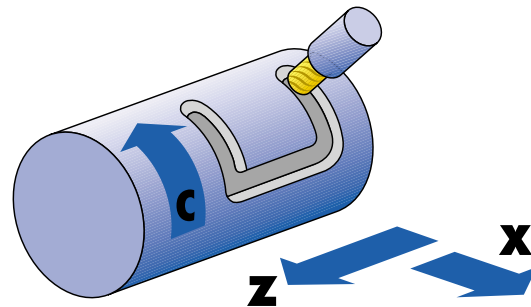
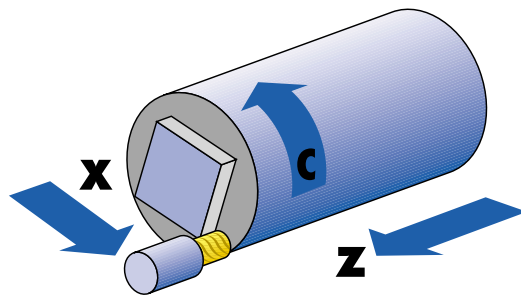
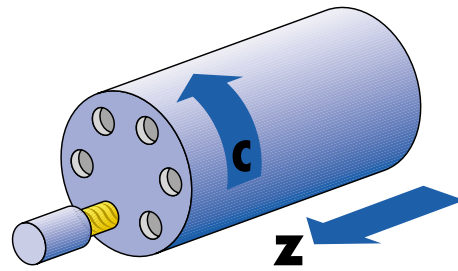
For increased flexibility in machining concepts, individual axes can belong to up to four different processes. Using the Free Axis and Get Axis commands, axis control can be flexibly transferred between processes.

MTC200

Perform complex machining with single clamping

C-axis functionality improves machine efficiency by performing complex turning, milling and drilling operations without the need to re-clamp the workpiece.

Additional time and cost savings are realized simultaneously performing multiple multi-axis functions in one or more CNC processes.



MTC200

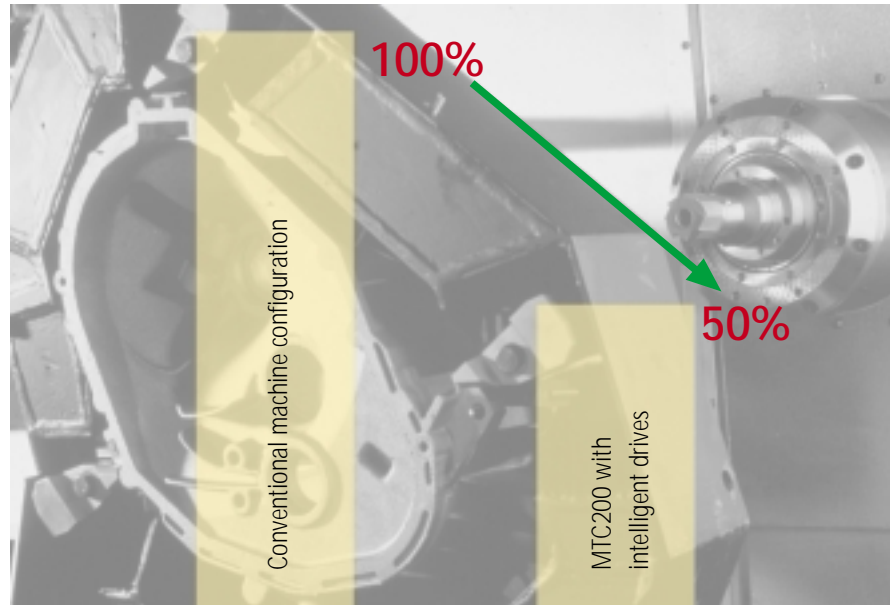
High precision, high speed cutting

Using SERCOS digital communications, Rexroth Indramat takes full advantage of digital drive performance. Velocity and position loops are closed in the drives, independent of the network data rate. Servo response of 250 μ s without following error assures high precision at the fastest machining rates and chip to chip times.

Advantages of Rexroth Indramat's intelligent digital drive technology include:

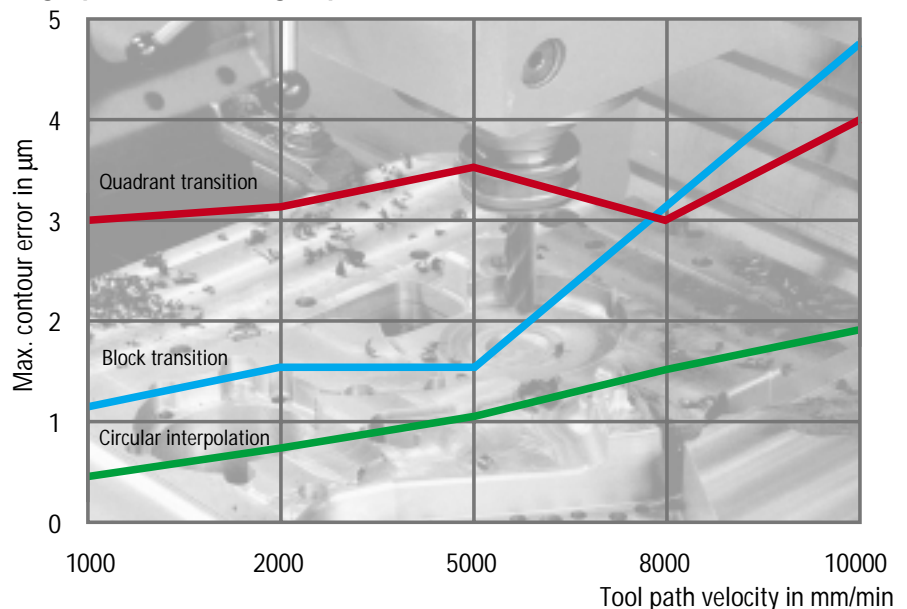
- High speed, deterministic SERCOS drive interface
- Fiber optic communications eliminate electrical noise between drives and control
- Drive homing function
- Feed to positive stop function
- Oscilloscope function for recording (down to 250ms)
- Actual position
- Actual velocity
- Torque command value
- Position lag
- High-resolution/precision feedback options
- EnDAT, square wave or voltage/current sinusoidal feedback interfaces
- Multiturn absolute value interface
- Motor and external feedback value monitoring
- Two high-speed probe inputs
- Home switch – marker pulse monitoring
- Hardware overtravel power control
- Automatic motor holding brake control and monitoring
- Operation of synchronous/asynchronous, servo/spindle/linear motor technology
- Precision lead screw error compensation
- Backlash/reversal compensation
- Position temperature compensation

Reduced primary and secondary manufacturing times



The MTC200 with Rexroth Indramat intelligent drives reduces primary and secondary manufacturing times of clutch cases by approximately 50 percent, compared to conventionally equipped machining centers.

High precision at high speeds



Rexroth Indramat intelligent digital drives with SERCOS communications increase performance by a factor of 10 over conventional controllers and drives. The maximum contour deviation is less than 5 mm with a circle diameter of 40 mm.

Look-ahead NC block processing

Excellent contour accuracy at high path velocities is achieved through fast NC block processing times, dead time-free NC block switching and look-ahead NC block preparation. This means excellent surface finish and extended tool life.

Notch Filter

Filtering of resonance frequencies protects machine mechanics and improves the surface quality of your workpiece.

Acceleration feed forward

For higher accuracy at contour transitions, we added the acceleration feed forward function to the velocity feed forward function.

Friction value compensation

Modern machine elements have reduced friction values to a minimum. The still remaining friction values can be compensated with this function to eliminate errors at very small speeds (reversal).

Precision axis error compensation

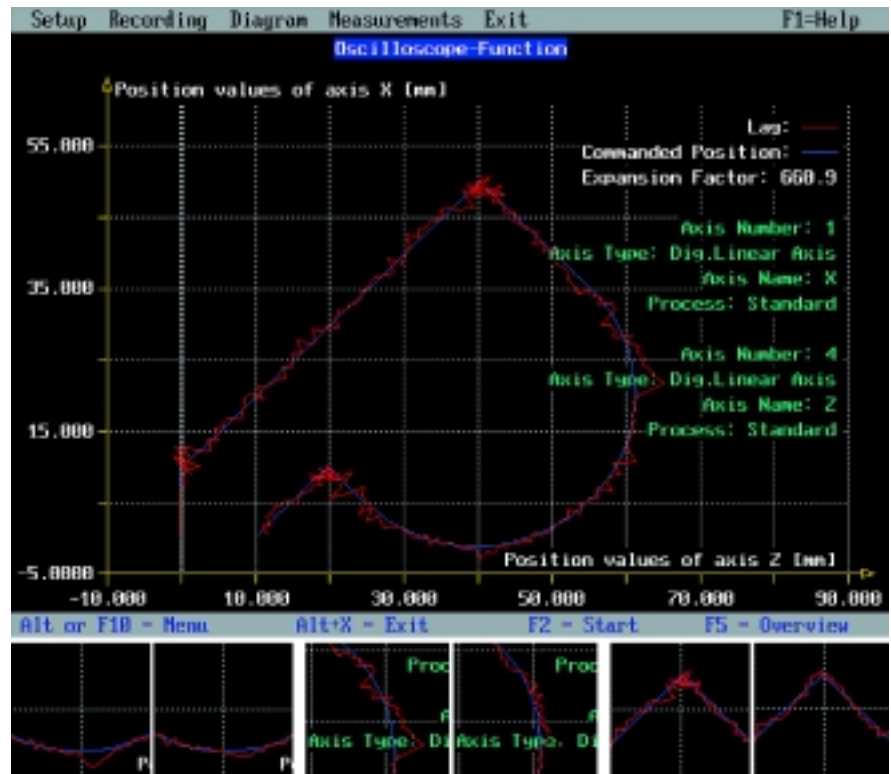
This correction can be used to eliminate inaccuracies in the drive kinematics as well as reversal errors.

3D temperature compensation

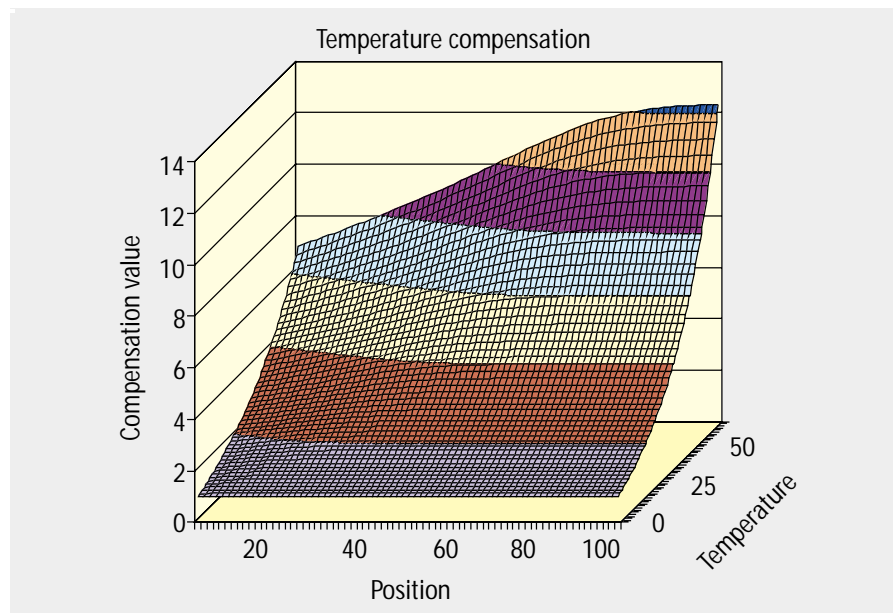
Inaccuracies caused by thermal effects can be compensated with this function that is available in most digital intelligent Rexroth Indramat drives.

Axis droop compensation

Machine elements do not have infinite stiffness. This is the reason why droop (or straightness) compensation was developed. You can compensate mechanical tension and miss-alignment in the machine by defining the position correction of one axis depending on the position of another axis.



Compensation functions improve workpiece quality and shorten machining times.



Temperature compensation improves the stability of machining processes.

MTC200

NC-Editor simplifies programming

The MTC200's NC programming environment is EIA RS 274D (DIN 66025) compliant with application oriented extensions. This language standard is familiar to CNC operators, reducing the learning curve.

An integrated line editor, ASCII editor and optional graphical NC editor provide a wide range of programming tools for all levels of expertise. Externally created or post-processed CNC programs can be imported and exported from serial interface ports, local or net-work disk drives. Because the MTC200 supports technologies such as turning, milling, drilling and probing, complete precision machining can be accomplished with a single workpiece clamping operation.

Graphical NC editor

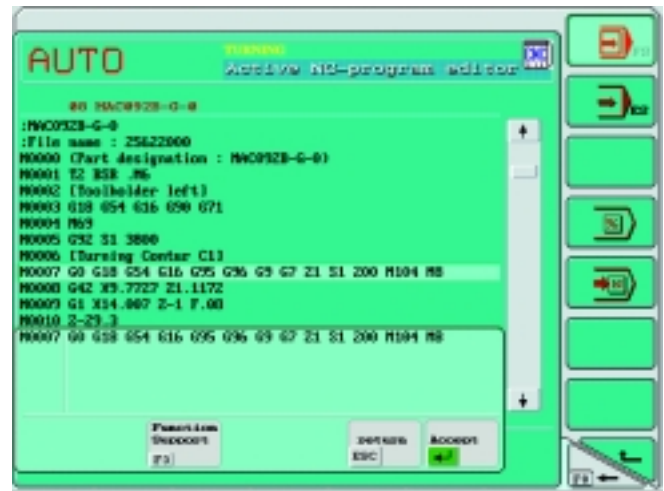
The optional graphical NC editor (GNE) provides graphical dialog programming for turning and milling. The editor can be operated via keyboard and pointing devices at any time during CNC programming. Functions can be selected from menu tables with clear text guidance to graphically define geometry elements and machining cycles. In addition, the editor provides the graphical definition of machining windows, intersection point calculations and tolerance selections.



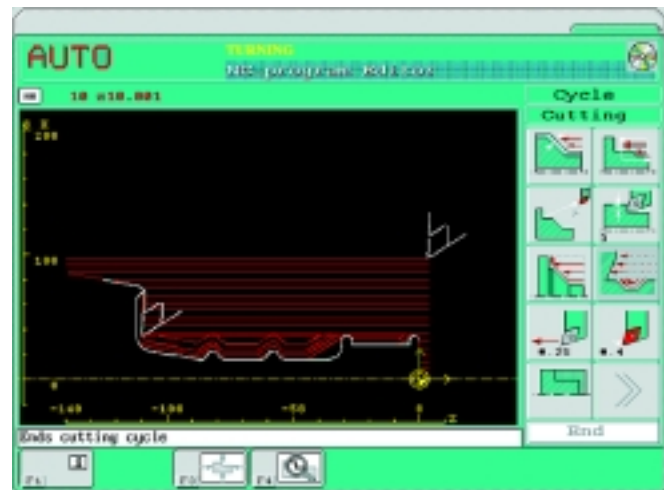
Turning menu



Milling menu



Various on-line and off-line tools can be used to quickly edit NC programs or implement NC cycles via graphical dialogs.



With the graphical NC editor (GNE) you program faster and more effective:

- Remaining/finishing stock
- Tool approach and retract method
- Feedrates for rapid traverse, cutting and tool change
- Rough part definition
- Partial cutting window
- Chip thickness
- Cutting variations
- Tool orientation
- Tool edge definition
- Automatic cycle generation for cutting remaining stock

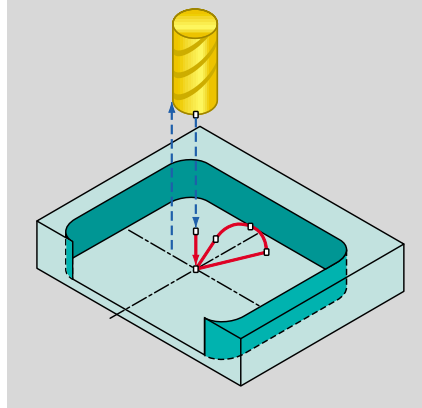
...and integrated NC cycles

Integrated NC cycles

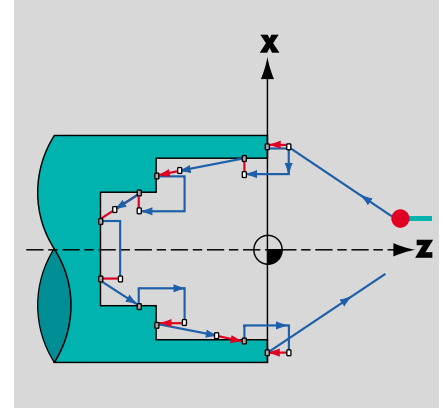
The MTC200 offers numerous turning, milling, drilling and probing cycles to simplify the programming of repetitive machining tasks.

Peck drilling, rigid and floating tapping, inside thread milling, thread cutting, taper thread cutting, point patterns, facing, rough cutting and grooving are just some of the many cycles available. You can also create your own cycles and supply them with your own graphical dialog.

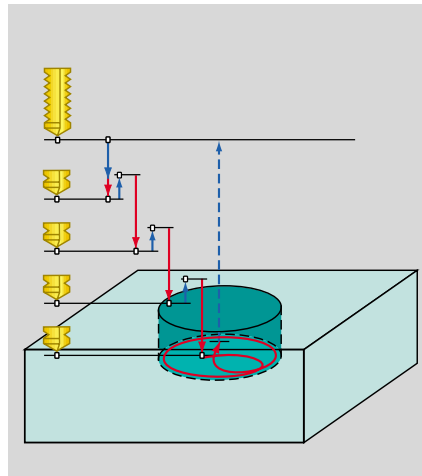
Pocket milling



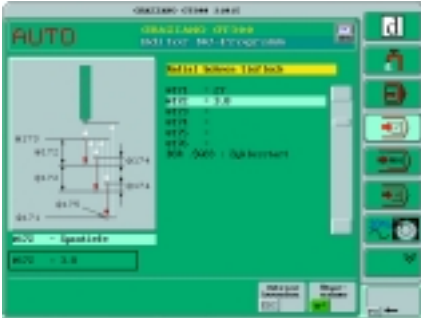
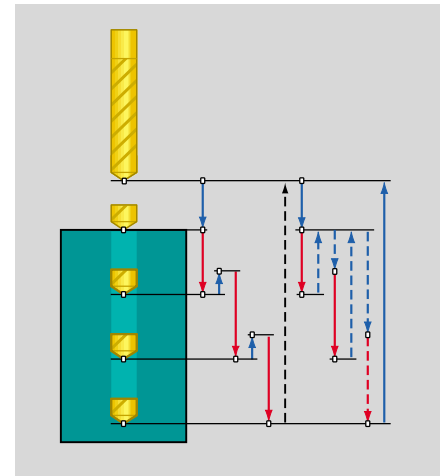
Fast probing



Tapping and thread milling

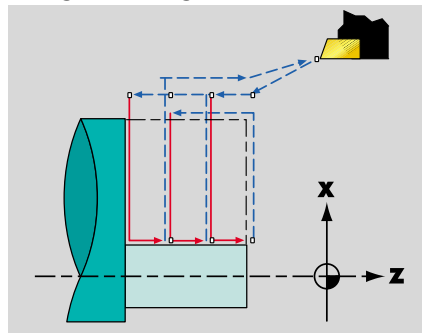


Peck drilling

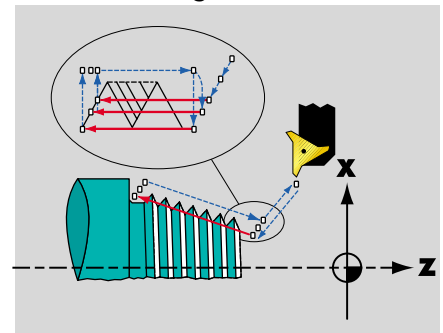


NC cycle call: peck drilling

Rough cutting



Thread cutting



MTC200

Job master simulates machine operation

With the job master functions you can simulate NC program execution and optimize the machining prior to cutting metal on the machine.

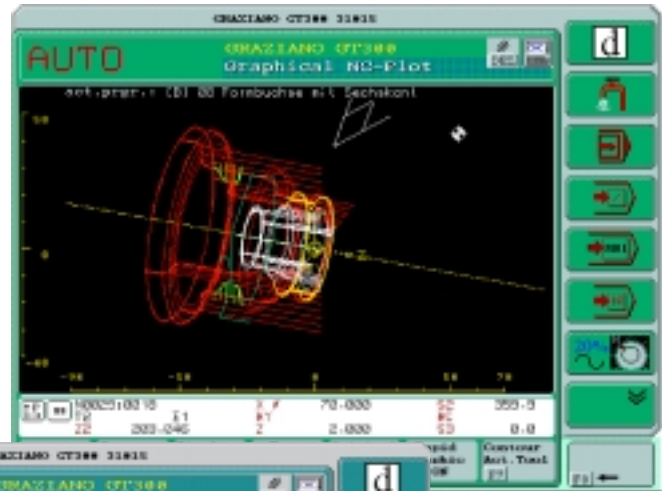
The simulation

The CNC Simulation function generates a graphical contour of the tool tip in up to two screen windows while the NC program is executed. A simultaneous 2D and 3D view can be displayed on a dual window for optimum path analysis. Different functions such as tools, feeds and rapid traverse are displayed clearly with different colors. Details can be examined via zoom function. The actual NC data and NC block being processed are displayed below or to the right of the windows.

The virtual NC Option

The virtual NC with the NC Program Optimizer (NCPO) allows you to analyze the NC program on a PC running Windows NT:

- CNC operator panel via software for realistic operation
- Real NC program execution in software
- Graphical 2D and 3D tool path display
- Display of machining and non-machining times reduce NC program optimization time on the machine to a minimum.



3D view



Horizontally-split screen



2D and 3D representation



MTC200

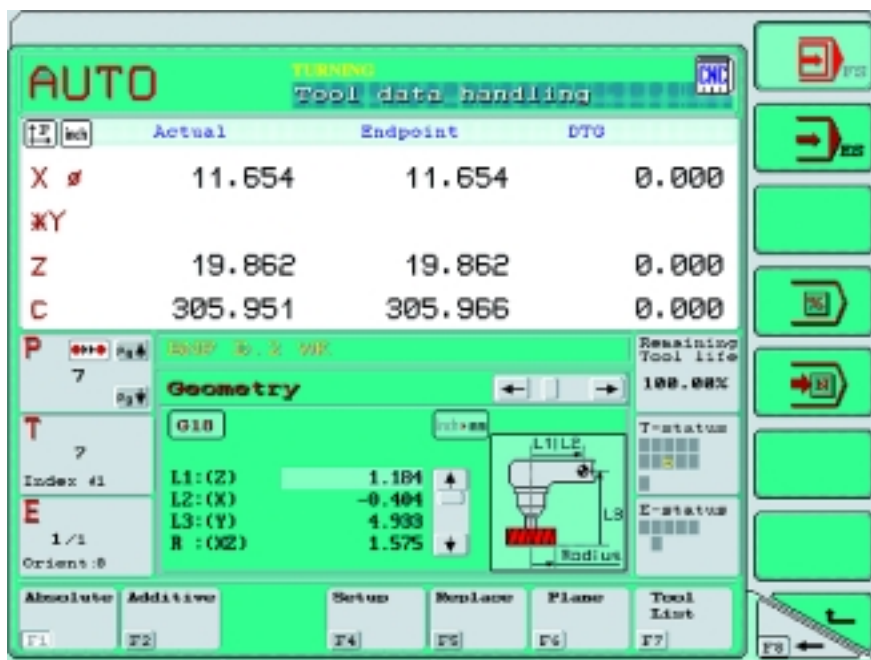
Prevent errors with integrated tool management

At the beginning of each machining process, the MTC200's tool management system can compare the actual data with tool setup data specified for the CNC process or program. This provides maximum protection for operator, machine and work-piece.

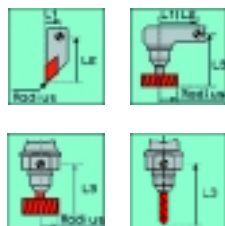
Tool management can be adapted to any machine with just a few parameter definitions and PLC interlocks. Tool data can be created, edited, saved and copied for each process, either on-line or off-line. Tool data also can be entered via PLC and external devices to accommodate post gage and background tool storage processing. Tool data can be archived, exported and imported from serial interface ports and local or network disk storage drives.

Other standard tool management functions include:

- Tool corrections for different types of tools
- Tool life monitoring – minutes or cycles
- Tool family management – automatic selection of suitable replacement tools
- Tool and edge status monitoring
- Synchronous/Asynchronous tool changer – turret or magazine
- Tool user data – for needs beyond standard applications



Edit tool data on-line during machining, or prepare data off-line.



Tool corrections for different types of tools



Full tooling support, including stationary and powered tooling.

MTC200

Open human-machine interface is readily customized

The MTC200 lets you quickly create application-specific screens for machine operation and diagnostics using existing graphical images. In these screens, you can read and partially write all PLC and most CNC data.

The display visually organizes all programming, operating and diagnostic information.

Key arrangement can be customized, simplifying program entry and machine operation. The ASCII keyboard allows for alphanumeric entry in all menus and dialog boxes. Menus for program handling and service functions can be activated by the function keys. Entry and display of zero offsets, variables, tool data and other information can also be called via these keys.

The vertical machine operation keys can be user-configured to control any PLC function specific to the application.



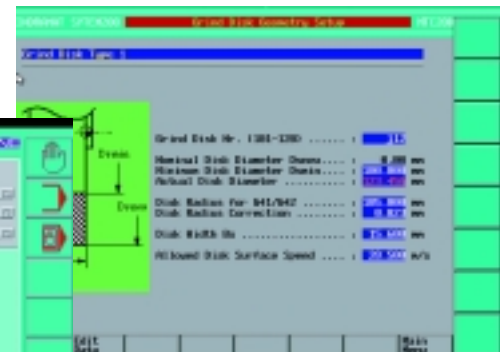
Example of a user-defined screen for startup, operation, status and error messages.



The open interface makes it easy to customize displays with foreign languages and symbols.



An overview screen providing diagnostic and machine layout.



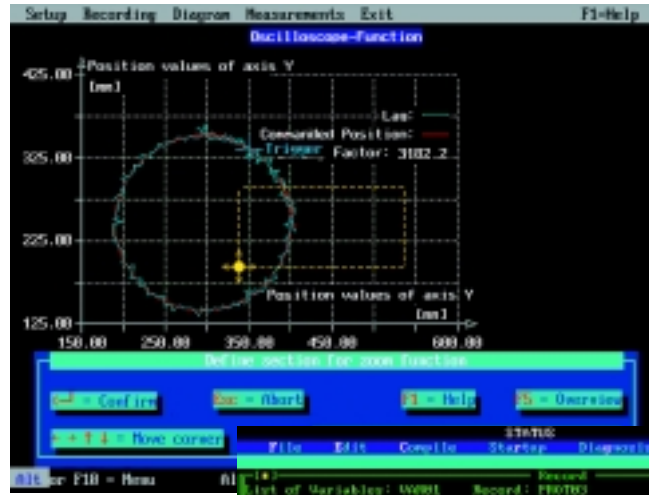
Lower and upper limits can be assigned to each embedded data element, minimizing the need for error checking in the program, because the data is checked at the time and point of entry.

MTC200

Extensive diagnostic tools increase the machine uptime

Quick, high resolution diagnostic using the axis oscilloscope

The oscilloscope function lets you record and evaluate contour, time and frequency diagrams of different axis data. Recorded data can be stored for later comparison with other recordings, to assist in making maintenance decisions.



Analysis of path accuracy at circular interpolation with intelligent digital drives and SERCOS interface.

Quick logic troubleshooting with the PLC logic analyzer

The PLC logic analyzer makes it easier to determine sporadic errors. Data can be simultaneously recorded and displayed as signal diagrams in eight channels. This function can also record data in the background while other interfaces are in use, to isolate intermittent problems.



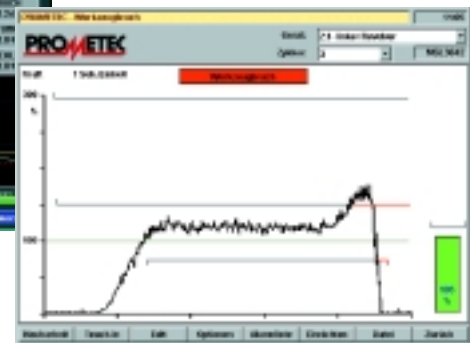
PLC logic timing analysis using the PLC logic analyzer

Open for third party applications

The open control structure allows you to implement business specific such as third party software for tool monitoring.



Artis screenshot



Prometec screenshot

MTC200 – Standardize your production systems with system solutions using standard components

Whether you plan to control a typical stand-alone machine tool or a complex manufacturing system, the MTC200 can be scaled in performance to your specific requirements.

BTV – the proven industrial-grade PC-based HMI terminal

For a complete machine control solution, Rexroth Indramat integrates CNC and PLC functions in a high performance industrial PC. The BTV30 integrates an ASCII keyboard. The BTV20 is optimized for automated high production lines.



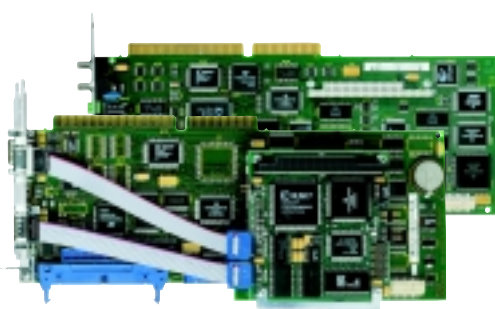
BTV20



BTV30

MTC-P – CNC on the PC backplane

The MTC-P is a fully featured CNC on a single ISA bus card. The basic version, which coordinates up to 8 digital drives and 7 CNC processes, can be upgraded to handle up to 32 axes using PC/104 axis processor cards. Each card controls up to 8 digital drives via a SERCOS fiber optic link. For industrial PC implementations, the MTS-P provides a high-performance PLC controlling thousands of inputs and outputs per master interface. The PLC can also operate independent of the CNC. Programming conforms to IEC 61131-3 (DIN EN 61131).



MTS-P MTC-P

MTC-R – CNC in a compact rack format

The MTC-R and the MTS-R are the compact rack versions of the MTC-P and MTS-P, featuring the same functionalities. They seamlessly fit into the modular RECO I/O system. With this system you can monitor multiple controllers via a single operator interface.



MTS-R MTC-R

RECO – modular I/O system

The RECO is a modular I/O system for fast I/O exchange with the PLC. Rack units for 2 or 4 I/O modules are easily installed on standard mounting rails. Analog and also digital inputs and outputs are available.



RECO

SMx – space-saving distributed I/O modules

Compact SMx I/O units bring your I/O modules closer to the sensor level and reduces cable runs and wiring needs due to quick connections. IP65 rated modules include input, output and combination modules with fieldbus interface.



SMx

BTC – the portable handheld terminal

For portable machine operation, the BTC06 offers a standard programmable LCD display, keyboard with LED display, E-stop and live man PB. The BC06 is also available with an optional override potentiometer and hand wheel (MPG).



BTC06

BTA and BTM –flexible machine operator panels

Machine operator panels are available in configurable and standard versions connected to standard fieldbus interfaces to minimize installation cost and maximize flexibility.



BTA20



BTM16

DIAX and ECODRIVE – digital intelligent drives

Intelligent digital drives offer excellent performance for all power ranges, where production processes up to 93 kW must be automated precisely and economically. A wide range of synchronous and asynchronous motors for servo and spindle applications completes the system.

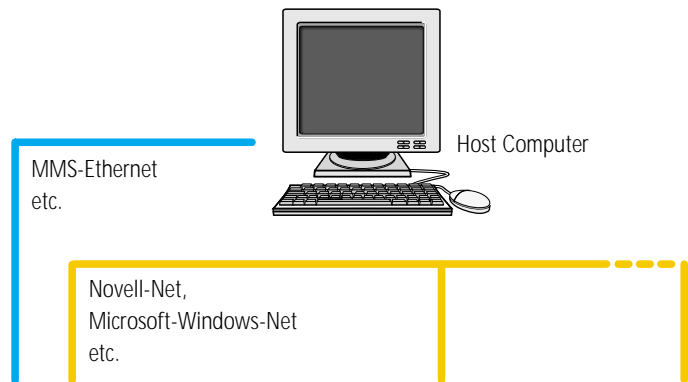


MTC200

Reliable communication at all levels

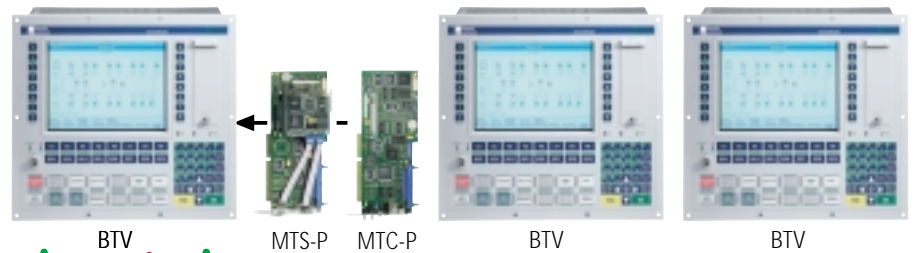
Enterprise host computer level

The PC-based control can efficiently communicate with enterprise and host computers applications via Profibus-FMS, MMS Ethernet, FIPway, DDE and Windows NT. Production data collection and application data archiving can be accomplished via low cost but fast Ethernet connectivity.



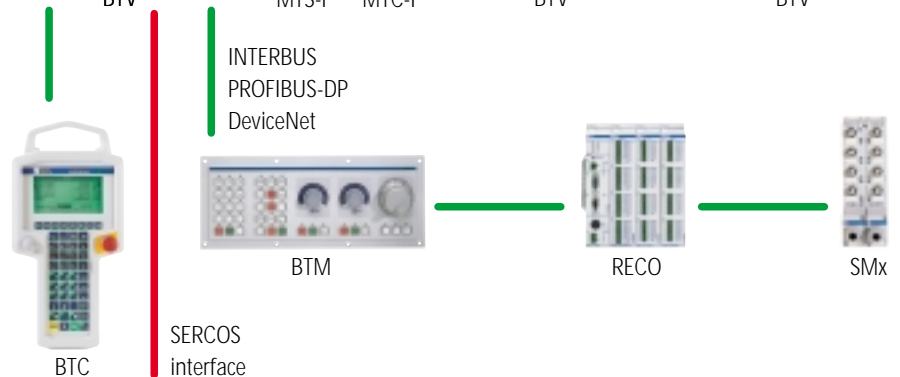
HMI level

The use of PC-based controls with standard operating systems applies proven data exchange between different controls via common networks such as the Novell-Net or the Microsoft-Windows-Network.



I/O level

For device level communications, Rexroth Indramat supports popular fieldbus interfaces, including InterBus, Profibus-DP and soon DeviceNet.



Drive level

The control exchanges cyclical and non-cyclical data with the drives via the international interface standard SERCOS. Drive synchronization is accurate within microseconds to assure fast cycle rates. Additionally the SERCOS interface allows the entry and the display of all drive internal data and diagnostics via the PC.



Intelligent digital drives

MTC200 solves all processing tasks in CNC-technology with maximum dynamism and precision as a result of the modular system concept, open control structure and international standard interfaces.

1.	Cutting Technologies	MTC200-P	MTC200-R
1.1	Turning	●	●
1.2	Milling	●	●
1.3	Drilling	●	●
1.4	Automation	●	●
1.5	Handling	●	●
1.6	Special Purpose	●	●

2.	Axis Control	MTC200-P	MTC200-R
2.1	Max. No. of Controlled Axes	32 ○	32 ○
2.2	Standard No. of Axes	8 ●	8 ●
2.3	Max. No. Axes/Spindles per process	9/3 ●	9/3 ●
2.4	No. of Independent processes	7 ●	7 ●
2.5	Max. No. of Interpolating Axes per process	9 ●	9 ●
2.6	Max. No. of Controlled Spindles per process	3 ●	3 ●
2.7	Max. No. of Simulated Axes per process	12 ●	12 ●
2.8	PLC Controlled Spindles per process	3 ▲	3 ▲
2.9	Axis Names per process (index with or w/o 1,2,3)	X, Y, Z, U, V, W A, B, C ●	X, Y, Z, U, V, W A, B, C ●
2.10	Max. No. of Synchronized Spindles per process	3 ●	3 ●
2.11	Axis Synchronization Groups per process	4 ●	4 ●
2.12	No. of Axis per Synchronization Group (Gantry and Follower Axes)	4 Max. ●	4 Max. ●
2.13	Programmable Stroke Limits	●	●
2.14	Axis Switching Between Processes	4 ●	4 ●
2.15	Smallest Programming Increment	0.00001 mm/inch ●	0.00001 mm/inch ●
2.16	Smallest Detection Increment	0.00001 mm/inch ●	0.00001 mm/inch ●
2.17	Smallest Programmable Increment	0.00001 mm/inch ●	0.00001 mm/inch ●
2.18	Multi Position Feedback System	□	□
2.19	Inch / Metric Conversion	G70/G71 ●	G70/G71 ●
2.20	Stroke Check in Control and Drive	●	●
2.21	Backlash/Reversal Error Compensation	± 10 mm ■	± 10 mm ■
2.22	Axis Error Compensation – Bi-directional	512 points ■	512 points ■
2.23	Position Dependent Temperature Compensation	■	■
2.24	Position Independent Temperature Compens.	■	■
2.25	Position Correction	■	■
2.26	Axis Homing with Switch/Marker Check	■	■
2.27	Droop/Straightness Compensation	512 points ●	512 points ●
2.28	Acceleration Feed Forward	■	■
2.29	Two Fast Probe Inputs per Axis Drive	■	■
2.30	Registration Speed for Probe Inputs	1 μs ●	1 μs ●
2.31	Position Switches (Way Points) in PLC per axis	8 ●	8 ●
2.32	Axis Torque Status in PLC	●	●
2.33	Axis Position Status in PLC	●	●
2.34	Mirroring of Double Turret	▲	▲

Legend:

- Standard Control Feature
 - Optional Control Feature
 - Standard drive function with SERCOS interface (per axis)
 - Optional drive function with SERCOS interface (per axis)
 - ▲ Special PLC support or programming required/Special consultation
- 1) with Rexroth Indramat BTV20 or BTV30 industrial PC

3.	Interpolation Functions	MTC200-P		MTC200-R	
3.1	Smallest Interpolation	0.0001 mm 0.00001 inch	●	0.0001 mm 0.00001 inch	●
3.2	Rapid Traverse	G0	●	G0	●
3.3	Linear Interpolation	G1	●	G1	●
3.4	With/Without Exact Stop	G61/G62	●	G61/G62	●
3.5	Circular Interpolation (full circle) I,J,K,R	G2/G3	●	G2/G3	●
3.6	Center Point Programming I,J,K		●		●
3.7	Radius Programming R		●		●
3.8	Helical Interpolation (Coord. System Axes)	G2/G3	●	G2/G3	●
3.9	Minimized Lag Interpolation	G6/G7	●	G6/G7	●
3.10	Dwell time	G4	●	G4	●
3.11	Cartesian-Polar Coordinate Transformation	G31	●	G31	●
3.12	Transformation for Cylindrical Interpolation	G32	●	G32	●
3.13	Thread Cutting	G33	●	G33	●
3.14	Multi-thread Cutting	G33	●	G33	●
3.15	Continuous Thread Cutting	G33	●	G33	●
3.16	Circular (Face) Thread Cutting	G33	●	G33	●
3.17	Floating Tapping	G65	●	G65	●
3.18	Rigid Tapping	G63/G64	●	G63/G64	●
3.19	Rigid Tapping 3D	G63/G64	●	G63/G64	●
3.20	Polygon Turning		▲		▲
3.21	Continuous Dressing		▲		▲
3.22	Index Table Clamping		●		●
3.23	NC Block Look Ahead	4	●	4	●
3.24	Extended NC Block Look Ahead (NC Compiler, Tool Radius Compensation)	10	●	10	●
3.25	Extended NC Block Velocity Look Ahead Over Complete Program (NC compiler)	100	●	100	●
3.26	Interpolation Cycle Time	2 ms	●	2 ms	●

4.	Feed Functions	MTC200-P		MTC200-R	
4.1	Rapid Traverse Rate 0.0001 – 800 m/min	(0.1 μm)	●	(0.1 μm)	●
4.2	Rapid Traverse Override	0 - 255%	●	0 - 255%	●
4.3	Path Feedrate for Cutting 0.0001 – 800 m/min	(0.1 μm)	●	(0.1 μm)	●
4.4	Jog Rapid Feedrate	0 - 100 m/min	●	0 - 100 m/min	●
4.5	Jog Feedrate	0 - 100 m/min	●	0 - 100 m/min	●
4.6	Cutting/Jog Feedrate Override	0 - 255%	●	0 - 255%	●
4.7	Feed Per Minute	G94	●	G94	●
4.8	Feed Per Revolution	G95	●	G95	●
4.9	Inverse Time Feed	G93	●	G93	●
4.10	Contouring Mode Feed Acc/Dec	G8/G9	●	G8/G9	●
4.11	Bell-shaped Acc/Dec		■		■
4.12	Feed Hold		●		●
4.13	Acceleration Ramp for Rapid Traverse		●		●
4.14	Constant Wheel Circumference Speed	G66	●	G66	●
4.15	Constant Surface Speed	G96	●	G96	●
4.16	Constant Feedrate on Tool Center Path/Contour	G98/G99	●	G98/G99	●

5.	Program Input	MTC200-P		MTC200-R	
5.1	Block Skip (/)		●		●
5.2	No. of Programs in NC Memory per process	0 - 99	●	0 - 99	●
5.3	NC-memory A/B (Background Editing)		●		●
5.4	Automatic NC Block Sequence Number	Nxxxx	●	Nxxxx	●
5.5	Radius / Diameter Programming	G15/G16	●	G15/G16	●
5.6	Interpolation Plane XY, ZX, YZ	G17/G18/G19	●	G17/G18/G19	●
5.7	Free Plane Selection	G20	●	G20	●
5.8	Rotary Axis Mode	G36/G37/G38	●	G36/G37/G38	●
5.9	Rotary Axis Roll-Over (Modulo)		●		●
5.10	Machine Coordinate System per process	G53	●	G53	●
5.11	Coordinate System Setting per process	G52	●	G52	●
5.12	Workpiece Coordinate System per process	G54 - G59	●	G54 - G59	●
5.13	Additional Work Coordinate Systems per process	10 Tables G54 - G59	●	10 Tables G54 - G59	●
5.14	Work Coordinate Offset Tables per process	00 - 09	●	00 - 09	●
5.15	Programmed Work Coordinate System (Absolute / Incremental) per process	G50, G51	●	G50, G51	●
5.16	Coordinate System Plane Rotation		●		●
5.17	External Work Coordinate Input	OTD	▲	OTD	▲
5.18	Direct Input of Zero Offset Input per process		●		●
5.19	Manual Override of Zero Offsets in Automatic per process		▲		▲

Legend:

- Standard Control Feature
 - Optional Control Feature
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 - Optional drive function with SERCOS interface (per axis)
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5.	Chamfer/Rounding Insertion	MTC200-P	MTC200-R
5.20	Chamfer/Rounding Insertion	CF/RD ●	CF/RD ●
5.21	Programmable Data Input (Offsets, Drive Parameters, Machine Data, Tool Data)	OTD/AXD/MTD/TLD ●	OTD/AXD/MTD/TLD ●
5.22	Number of NC Variables per process	256 ●	256 ●
5.23	Number of NC Events per process	32 ●	32 ●
5.24	Waiting for NC Events per process	WES, WER ●	WES, WER ●
5.25	Sub-Program Call	●	●
5.26	Sub-Program Nesting Depth	10 levels ●	10 levels ●
5.27	User Macro Definitions	●	●
5.28	Event controlled Sub-Program Control per process	NC event 0 - 7 ●	NC event 0 - 7 ●
5.29	Canned Cycles for Drilling	. *G81 - . *G89 ●	. *G81 - . *G89 ●
5.30	Canned Cycles for Milling	. *G81 - . *G89 ○	. *G81 - . *G89 ○
5.31	Point Pattern – Bolt Hole Pattern	. *G50 - . *G54 ○ . *G531 - . *G532 . *G541 - . *G542	. *G50 - . *G54 ○ . *G531 - . *G532 . *G541 - . *G542
5.32	Canned Cycles for Turning	. *G81 - . *G89 ○	. *G81 - . *G89 ○
5.33	Canned Cycles for Probing	○	○
5.34	Canned Cycles for Grinding	▲	▲
5.35	Circular Interpolation with Radius Programming	●	●
5.36	Scaling	G78/G79 ●	G78/G79 ●
5.37	Mirroring	G72/G73 ●	G72/G73 ●
5.38	Absolute/Incremental Positioning	G90/G91 ●	G90/G91 ●
5.39	Machine Time Calculation	○	○
5.40	Further NC Functions: Math Expressions, Math (double precision), Trigonometry functions, Flow Control, NC Event Control	x=(.) ● *, -, *, /, %, SQRT ABS, INT, E^, 10^, 2^, LN, LG, LD, ● SIN, ASIN, COS, ACOS, TAN, ATAN, DEG, RAD, ● DP, AP, RP, LP, ● BEO, BMI, BPL, ● BES, BER, ● SE, RE ●	x=(.) ● *, -, *, /, %, SQRT ABS, INT, E^, 10^, 2^, LN, LG, LD, ● SIN, ASIN, COS, ACOS, TAN, ATAN, DEG, RAD, ● DP, AP, RP, LP, ● BEO, BMI, BPL, ● BES, BER, ● SE, RE ●
5.41	Time Measurement Function	TIME ●	TIME ●

6.	Operation	MTC200-P	MTC200-R
6.1	Dynamic Graphic Function (Online)	○	○
6.2	Graphical Simulation (Online/Offline)	○	○
6.3	CNC Memory Operation	A/B ●	A/B ●
6.4	MDI Operation per process	●	●
6.5	Program Number / Name Search	●	●
6.6	NC Block Search per process	●	●
6.7	NC Program Restart	●	●
6.8	NC Program Restart/Repositioning	●	●
6.9	Rückpositionieren und Wiederanfahren	G79 ●	G79 ●
6.10	Reverse Vector Programming	●	●
6.11	Axis homing	G74 ●	G74 ●
6.12	Single Block Mode	●	●
6.13	Jog Feed Functions	●	●
6.14	Manual Reference Return	●	●
6.15	Absolute Position Detection	■	■
6.16	Reference Position Shift	■	■
6.17	Handwheel (MPG) Override per Process	1 ●	1 ●
6.18	Handwheel (MPG) Override per Axis	1 ●	1 ●
6.19	Handwheel (MPG) Feedrate X1, x10, x100, x1000, x10000, x Parameter	●	●
6.20	Handwheel (MPG) interruption	●	●
6.21	Incremental Feed X1, x10, x100, x1000, x10000, x Parameter	●	●
6.22	Master/Slave Process Programming	●	●
6.23	Test Mode (Dry Run)	in preparation	in preparation

7.	CNC Editing Operation	MTC200-P	MTC200-R
7.1	Graphical NC Editor – Milling/Turning per process	○	○
7.2	Graphical Shop-Floor Programming	○	○
7.3	NC Program Storage 675 kByte	●	●
7.4	NC Program Storage 1675 kByte	○	○
7.5	No. of NC Programs in NC Memory A/B per process	99/99 Max. ●	99/99 Max. ●
7.6	NC Program Editing	●	●
7.7	NC Program Protect Via Password	●	●
7.8	Background Editing	●	●
7.9	NC Program Copy Across Processes	●	●
7.10	NC-Programm stationsübergreifend kopieren	●	●
7.11	Online/Offline Program Editing	●	●
7.12	Data Archive to HDD, Floppy, Network	●	●

8.	Spindle and Auxiliary Functions	MTC200-P	MTC200-R
8.1	M-Functions M0 – M9999 per process	●	●
8.2	Q-Functions Q0 – Q9999 per process	●	●
8.3	Configurable Quick Output M/S/T Functions per process	●	●
8.4	Max. No. of Aux. Functions per NC Block	6 ●	6 ●
8.5	Auxiliary Function Groups per process	3S,1Q, 16M 1T, 1E ●	3S, 1Q, 16M, 1T, 1E ●
8.6	Digital Spindle Control Sx0.0 – Sx 99999.9 per process	(x ∈ 1, 2, 3) ●	(x ∈ 1, 2, 3) ●
8.7	Constant Surface Speed per process	G96 ●	G96 ●
8.8	Constant Wheel Speed per process	G66 ●	G66 ●
8.9	Spindle Speed Limit per process	G92 ●	G92 ●
8.10	Constant Spindle Speed per process RPM	G97 ●	G97 ●
8.11	Spindle Override 0 - 255% per process	●	●
8.12	Actual Spindle Speed Output per process	●	●
8.13	Spindle Speed Monitoring per process	▲	▲
8.14	Spindle Orientation Mx19 per process	(x ∈ 1, 2, 3) ●	(x ∈ 1, 2, 3) ●
8.15	Spindle Synchronous Control per process	●	●
8.16	Multi Spindle Control per process	3 Max. ●	3 Max. ●
8.17	Spindle Interpolation (C-Axis Control)	●	●
8.18	Digital Spindle Control	●	●
8.19	S-Coded BCD Output 5-Digit	●	●
8.20	External Interface Spindle Encoder	■	■
8.21	Manual Mode for Spindle Indexing/Logging	●	●

9.	Tool Functions	MTC200-P	MTC200-R
9.1	Managed Tool Locations per process	1 - 999 ●	1 - 999 ●
9.2	Managed Tool Locations per process	●	●
9.3	Tool Edges per Tool (Command E)	E1 - E9 ●	E1 - E9 ●
9.4	Tool Wear Register per Tool Edge	●	●
9.5	Tool Offsets per Tool Edge	L1, L2, L3, R ●	L1, L2, L3, R ●
9.6	Tool Length Correction	G47 - G49 ●	G47 - G49 ●
9.7	Cutter/Tool Nose Radius Compensation	G40 - G42 ●	G40 - G42 ●
9.8	Transition Element Chamfer/Rounding	G43/G44 ●	G43/G44 ●
9.9	Tool Life Monitoring per Tool Edge	min/cycles ●	min/cycles ●
9.10	Spare Tool Management	●	●
9.11	Tool Measurement	▲	▲
9.12	Automatic Tool Measurement	▲	▲
9.13	External Tool Data Input (PLC)	TLD ▲	TLD ▲
9.14	Programmable Tool Data	TLD ●	TLD ●
9.15	Direct Input of Tool Data	●	●
9.16	Wheel Wear Compensation	●	●
9.17	Tool Retract/Recovery via Reverse Vectors	●	●
9.18	Tool Setup List with Tool Data Check	Prg./Process ●	Prg./Process ●

10.	Display and Settings	MTC200-P	MTC200-R
10.1	Real Time Clock Function	●	●
10.2	Status Display per process	●	●
10.3	Current Position Display	●	●
10.4	NC Program Name Display (24 char.)	●	●
10.5	Parameter Entry and Display	●	●
10.6	Operation Data Collection	▲	▲
10.7	Actual Cutting Feedrate Display	●	●
10.8	Display of Spindle Speed and T-Numbers	●	●
10.9	Digital Drive Parameter Settings	●	●
10.10	Configurable Machine Function Keys	●	●
10.11	Password Administration (99 Users/32 Levels)	●	●
10.12	Language Selection English/German	●	●
10.13	Further Language Support	○	○

Legend:

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 - Optional Control Feature
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 - Optional drive function with SERCOS interface (per axis)
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11.	Integrated PLC	MTC200-P	MTC200-R
11.1	Interbus – Max. No. of Devices	255 ●	255 ○
11.2	Interbus – Max. No of I/O	8192/8192 ●	8192/8192 ●
11.3	Profibus – Max. No of Devices	126 ○	126 ○
11.4	Profibus – Max. No of I/O	4096/4096 ●	4096/4096 ●
11.5	Serial Interfaces to PLC (RS232)	1 ●	1 ●
11.6	Optional Serial Interfaces to PLC (RS232/RS422)	2/2 ○	2/2 ○
11.7	Modbus – PLC Interface	Serial ○	Serial ○
11.8	Hand Terminal – PLC Interface	Serial ○	Serial ○
11.9	Data Tags (Balluff) – PLC Interface	Serial ○	Serial ○
11.10	Analog Inputs (Interbus)	○	○
11.11	Analog Outputs (Interbus)	○	○
11.12	No. of Counters (as needed)	●	●
11.13	Flags – Absolute Address	2048 Byte ●	2048 Byte ●
11.14	Flags Retentive – Absolute Address	2048 Byte ●	2048 Byte ●
11.15	Flags – Symbolic Address	4096 Byte ●	4096 Byte ●
11.16	Flags Retentive – Symbolic Address	4096 Byte ●	4096 Byte ●
11.17	Byte Marker – Symbolic Address	32768 Byte ●	32768 Byte ●
11.18	Byte Marker Retentive – Symbolic Address	32768 Byte ●	32768 Byte ●
11.19	PLC Scan Time per 1000 Instructions	typ. 1,6 ms ●	typ. 1,6 ms ●

11.	Integrated PLC	MTC200-P	MTC200-R
11.20	PLC Data Memory	2 MB ●	2 MB ●
11.21	SPS Programming Language (EN 611131)	SFC, LD, FBD, IL ●	SFC, LD, FBD, IL ●
11.22	Program Organization Units (POU)	●	●
11.23	POU Password Protection	●	●
11.24	Multi-Lingual PLC Program Comments	●	●
11.25	Online/Offline Programming	●	●
11.26	Store Source Program in Control	●	●
11.27	Complete Documentation Generation	●	●
11.28	Complete Archiving	●	●
11.29	External Messages	▲	▲

12.	Maintenance	MTC200-P	MTC200-R
12.1	Data Access to All Spindles and Axes	● ¹⁾	●
12.2	Machine Data Access	● ¹⁾	●
12.3	CNC Program Status	● ¹⁾	●
12.4	No of User Messages in PLC per process	600 ●	600 ¹⁾ ●
12.5	Further Information per User Message	● ¹⁾	●
12.6	Online Help System	● ¹⁾	●
12.7	PLC Diagnostic System	● ¹⁾	●
12.8	Drive Diagnostic System	● ¹⁾	●
12.9	Error Logbook on HDD	● ¹⁾	●
12.10	Screen Hard Copy	Printer/File ●	Printer/File ●
12.11	Self-Diagnosis Function	●	●
12.12	Alarm Display	●	●
12.13	Alarm History Display	●	●
12.14	Display of Hardware/Software Configuration	●	●

13.	OEM Development Tools	MTC200-P	MTC200-R
13.1	Custom Screen Development (BVS-PRO)	○	○
13.2	Custom Screen Run-Time (BVS-RUN)	○	○
13.3	NC User Compiler (NUC)	○	○
13.4	Function Interface Driver for Windows NT (VB and C++; Read/Write of all PLC data and most CNC and Axis Data, Diagnostics)	○ 1)	○
13.5	DDE Server for Windows NT (Read/Write of all PLC data and most CNC and Axis Data, Diagnostics)	○ 1)	○
13.6	Ethernet	PC ▲	PC ▲
13.7	DNC File Server (if PC has Ethernet installed)	●	●
13.8	Machine Data Definitions	●	●
13.9	Application Builder Development for Windows Custom Screens	○	○

14.	Software and Hardware	MTC200-P	MTC200-R
14.1	Operating System MS-DOS 6.22	● 1)	●
14.2	Operating System Windows NT 4.0	● 1)	●
14.3	PC Unit Depth	BTV30/20 200 mm	Rack 180 mm
14.4	PC 10 Slot Passive Backplane	●	
14.5	Pentium 200 MHz Processor	●	
14.6	Main Memory Standard	64 MB	64 MB
14.7	Hard Disk Drive	> 1 GB	> 1 GB
14.8	Display 10.4" (Color TFT 640x480, keyboard, Floppy)	●	●
14.9	3.5" Floppy Drive	BTV-PC	●
14.10	Ports (ASCII keyboard, 2 serial, 1 LPT)	●	●
14.11	ISA Extension Specification	5	9
14.12	Local I/O Level (max. 16 * 32 points)	-	○
14.13	Interface Between PC and Control Cards	DPR	RS232C/485

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