

Operating Instruction EMCOTRONIC TM 02 Milling

**Edition 91-4
Ref. No. EN7 765**

**Operating Instruction
EMCOTRONIC M2
91-4 EN7 765**

Foreword

1. LITERATURE EMCOTRONIC TM 02 - Milling

The following literature is available for the description of the EMCOTRONIC TM 02 - Milling:

- * Programming instructions - milling Ref. No.: 7766
- * Operating instructions - milling Ref. No.: 7765

2. LITERATURE FOR MACHINES WITH EMCOTRONIC TM 02 CONTROL:

This comprises the above-mentioned brochures and the machine-specific operating instructions, spare parts lists and wiring diagrams.

3. Structure of the EMCOTRONIC TM 02 LITERATURE:

The operating and programming instructions are designed so that they are also suitable for self-study.

The programming instructions contain numerous examples which supplement the summaries and illustrations and describe the control features clearly and comprehensively.

All input routines are described in an easy-to-follow way in the operating instructions.

Note:

The pages in this brochure marked "in preparation" will be completed in the next edition.

Yours sincerely,
EMCO, Maier & Co., Hallein
TECHNICAL DOCUMENTATION

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CHAPTER 1

General preliminary notes

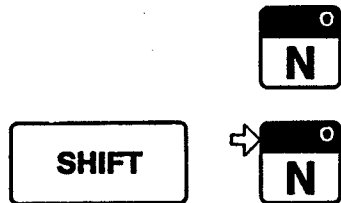
- The SHIFT key 1/1
- The screen 1/2
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- The softkeys 1/4
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- Leading and following zeros 1/5
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The SHIFT Key

SHIFT means here changing over.
If the SHIFT key has been pressed beforehand, the second function of the key in question is selected.

The address keyboard and part of the function keyboard have a dual function.

Example:
N-, 0-key



- When the SHIFT key is not activated, the lower address (N) is selected.
- When the SHIFT key is pressed, the upper address, i.e. 0, is selected.

The Following Representation Rules Apply to the Explanations of the Keys on the Subsequent Pages



No arrow --> lower address

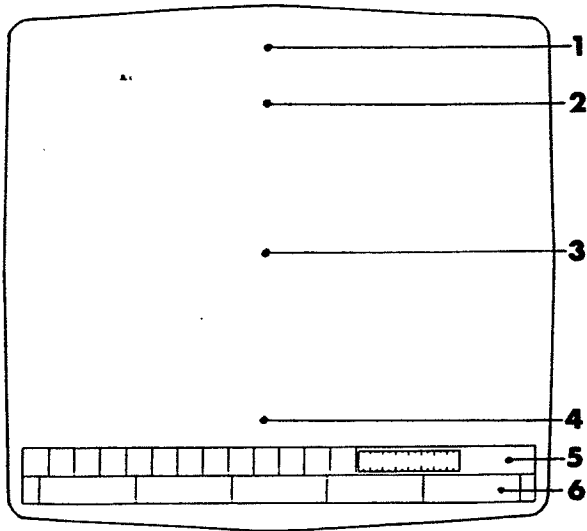


Arrow points to upper address --> upper address
SHIFT has been pressed.

In explanations of the operation modes only the address is described for the sake of clarity.
For further functions of the SHIFT key, refer to key explanation.

The screen

The screen is divided into 6 sections.



1) Information on

- Main mode
- Submodes
- Display in mm or inch
- Program number
- Interface status

2) Alarm displays:

For complete list, see alarm messages.

3) Display and input section

Contents are indicated in the modes.

4) Input field:

- Buffer store in EDIT/EXC.
- Active block in AUTOMATIC mode
- Notes
- COMPLETE
- NEW
- LOADING
- EXISTS
- SAVING
- DELETED

5) Symbol menu

- Display of the active control keys
- SPINDLE OVERRIDE
- Main drive power display

6) Softkeys

Display of the assignment of the unmarked keys below the screen.

The symbol menu

Active key symbols of the machine are shown in the symbol menu on the screen.

Examples:

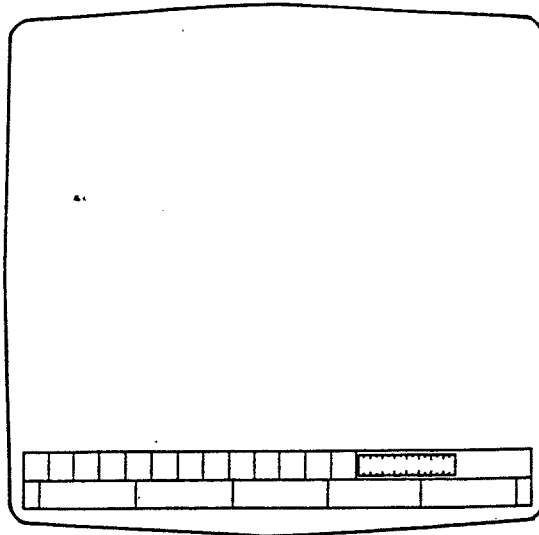


The main spindle is switched on by pressing ON. The symbol for the main spindle in the symbol box on the screen illuminates.



A specific status of the machine is activated by pressing these keys. The relevant symbol in the symbol box illuminates.

The softkeys



5 softkeys are displayed at the bottom edge of the screen.

These softkeys can be selected with the unmarked keys below the screen.

Note:

Key 1: Return to the last softkey level

Key 2: "MORE" function
Display of other softkeys.



Decimal Points:

Decimal points have to be entered, otherwise 1/1000 mm or 1/10000 inch.

Leading Zeros:

Following Zeros:

Leading and following zeros can be entered, but need not be.

Exceptions:

Changing the numbers of programs/blocks (see EDIT 9.6).

Plus/Minus Signs:

Plus signs are not entered.

The minus sign can be entered before or after a number.

Alarms:

You will find a list explaining the alarms in the programming instructions.

CYCLE START cannot be activated as long as an alarm is displayed.

Cancelling an alarm:

Alarms are cancelled with Clear Entry (C.E.) or by switching over to another main mode. Subsequently, the situation which had triggered the alarm must be remedied.

In numerous situations (e.g. when you press CYCLE START with the chip door open) the situation triggering the alarm must be remedied first (close doors); only then can you cancel the alarm.

Representation of the Letter O and the

Digit 0 (Zero):

The letter O is written widely spaced. The digit zero is represented in the texts without a slash but in the screen texts with a slash (Ø).

Chapter 2

Summaries


















- Control panel EMCOTRONIC TM 02 2/1
- Address keyboard 2/2
- Mode keyboard 2/3
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Control panel EMCOTRONIC TM 02

(milling)

in preparation

Address Keyboard

 <p>N-address: for block number</p> <p>EDIT EXC. AUTOM.</p>	 <p>R-address: MON mode (operator monitor) address for parameter R (reference point dimensions).</p> <p>EDIT</p>
 <p>O-address: - for program number - free storage capacity (EDIT)</p> <p>EDIT EXC. AUTOM.</p>	 <p>/ - slash: Designation of a skip block. e.g. N0100/G01.</p> <p>EDIT</p>
 <p>G-address: G-function</p> <p>EDIT EXC.</p>	 <p>F-address: FEED thread lead</p> <p>EDIT EXECUTE MAN</p>
 <p>PSO: Position shift offset Entry into position shift offset register.</p> <p>EDIT</p>	 <p>D-address: 1. Parameter in the case of program cycles. 2. Parameter for MON (operator monitor)</p> <p>EDIT EXC.</p>
 <p>M-address: M-function</p> <p>EDIT EXC.</p>	 <p>S-address: SPEED - spindle speed</p> <p>EDIT EXC. MAN.</p>
 <p>P-address: Parameter in the case of cycles</p> <p>EDIT EXC.</p>	 <p>L-address: 1. Jump address in the case of G25/27 (EDIT) 2. Parameter address in MON mode. 3. Call address for stored programs (EDIT)</p> <p>EDIT EXC.</p>
 <p>X, Y, Z addresses: Addresses for absolute path data.</p> <p>EDIT EXC. REF.</p>	 <p>T-address: TOOL, tool address</p> <p>EDIT EXC.</p>
 <p>I, J, K addresses: Circle centre parameters.</p> <p>EDIT EXC.</p>	 <p>TOOL DATA: Entry into tool data register (EDIT).</p> <p>EDIT MAN</p>
 <p>U, V, W address: Addresses for incremental path data.</p> <p>EDIT EXC.</p>	<p>Direct take-over of the tool data (MAN).</p>

Mode Keyboard**MAN.**

MANUAL mode
Manual operation

EDIT

EDIT mode
Program input with relevant routines,
data input for offsets and tools.
Cassette mode, RS 232C mode, user
monitor.

EXC.

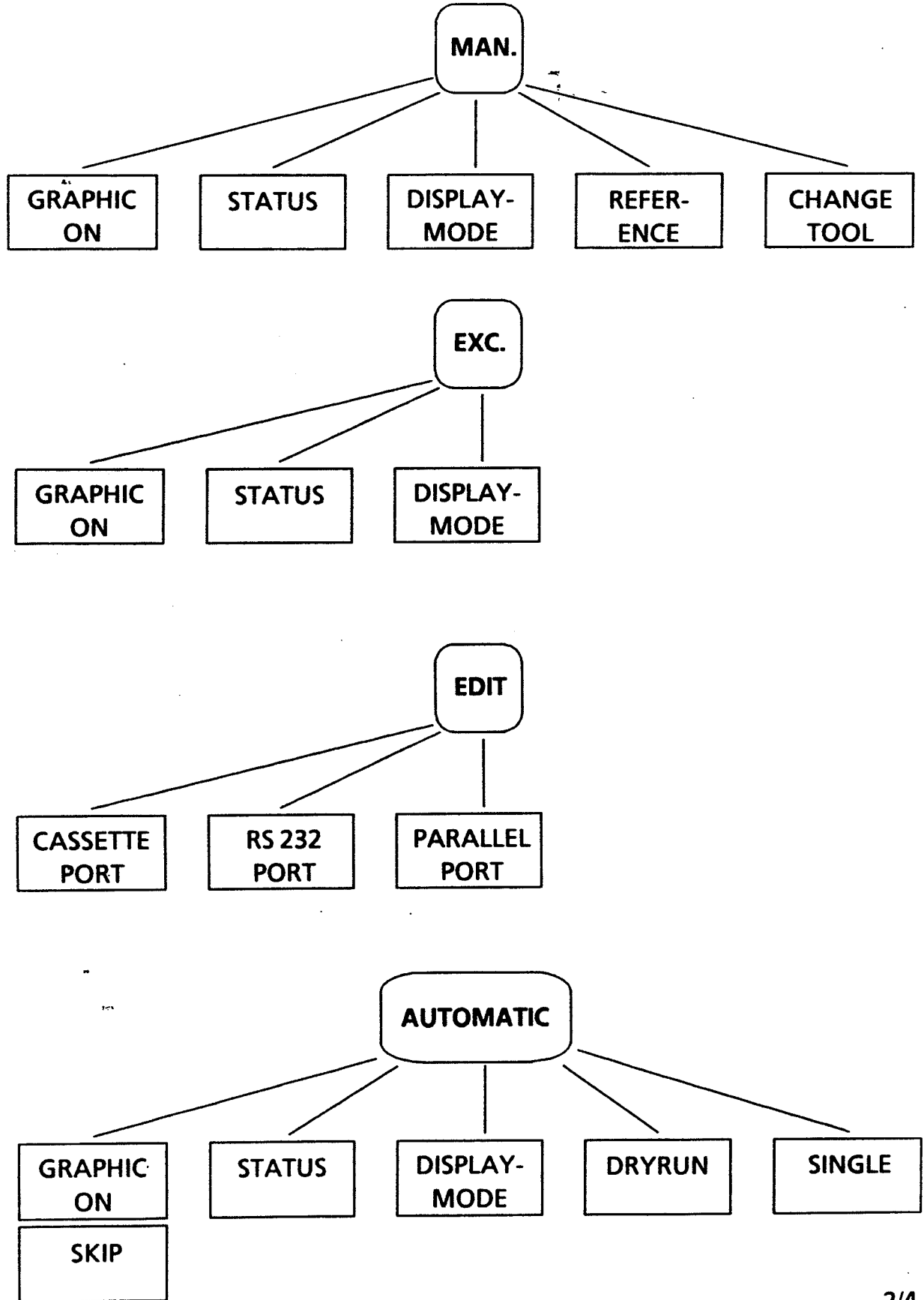
EXECUTE mode
- Processing of block buffer store.
- Call-up of tools and position shift
offsets so that the values are
displayed in the MAN mode.
- Jog mode with any increments desired.

AUTOMATIC

AUTOMATIC mode
- Stored programs can be started from
any block.
- Stored programs run in single block
mode, skip block mode, dry run mode
or test run without any axis movement.

Softkeys

Diagram



Function Keyboard

ENTER	In the CNC field ENTER means: - store in a memory - acknowledge - control function - call of T/PSO register, N,O,INT, tool data direct take-over.
EDIT EXC. MAN. AUTOM.**	
EDIT EXC.	<u>Examples:</u> 1) Words must be acknowledged with ENTER when being input. You enter a word, e.g. G01. G01 appears on the screen but it is not stored until ENTER is pressed.
MAN	2) Input of F,S values must be acknowledged with ENTER.
EDIT EXC.	3) Jump forwards in the block wordwise.
EDIT EXC.	4) SHIFT ENTER Jump back to block start.
EDIT	5) Call of a tool or a position shift offset register.

SHIFT	SHIFT here means switching over
EDIT EXC. MAN. AUTOM.	
EDIT EXC. AUTOM.	<u>Functions</u> 1) An upper address is selected. <u>Example:</u> SHIFT R U R-address is selected.
EDIT EXC.	2) SHIFT ENTER When the cursor stands on a program word, it jumps back to the block start with SHIFT ENTER.
MAN	3) Manual mode SHIFT ON Spindle turns counterclockwise

C. BL. C. E.	C.E. = Clear Entry - which means delete entry.
EDIT EXC.	<u>Functions:</u> - Delete the last entry (digit)
EDIT EXC. MAN. AUTOM. REF.	- Cancellation of alarm messages.

C. BL. C. E.	C.Bl. = Clear Block - which means delete block
EDIT EXC.	
EDIT	<u>Function:</u> Deletion of blocks in the program memory and block buffer store.
EXC.	Deletion of blocks in the block buffer store.

C. PR. C. W.	C.W. = Clear Word - which means delete word. Word must be selected.
EDIT EXC. MAN.	

C. PR. C. W.	C.Pr. = Clear Program - which means delete program. program number must be selected, screen must display "found".
EDIT	

Funktion Keyboard

<div style="border: 1px solid black; padding: 2px; display: inline-block; text-align: center;">STORE NEXT</div> EDIT EXC. AUTOM.	
EDIT	<u>Functions:</u> 1. Storing of a block from the block buffer store into the main memory. The block is concluded with STORE NEXT 2. At the same time a jump is made to the next block. <u>Please note:</u> STORE NEXT has to be pressed even after corrections in a block as otherwise the corrected value is not taken over into the main memory.
EDIT AUTOM. EXC.	- Turning pages of a called program (blockwise).
<div style="border: 1px solid black; padding: 2px; display: inline-block; text-align: center;">PREV.</div> EDIT AUTOM. EXC.	- PREV = previous. <u>Function:</u> Working backwards blockwise in the program.

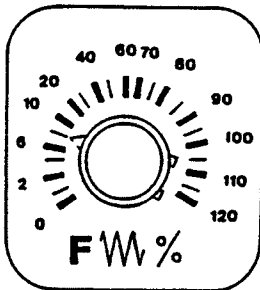
Control Keyboard



MAN
EXC.
AUTOMATIC

Speed override:

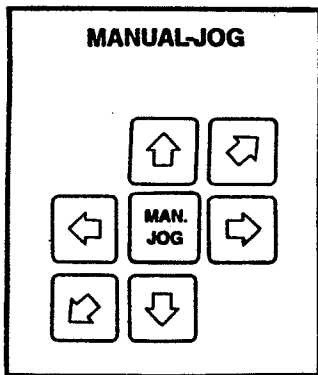
Increase speed
Decrease speed



AUTOMATIC
EXC.
MAN.

Feed override:

0% - 120% of the active F-value
(exception: thread-cutting!)



MAN

Manual traversing keys for slides MAN

The MAN.JOG key must also be pressed with the direction keys. The F-value must be entered.

STATUS submode
Scrolling

Control keyboard

Main spindle ON.



Main spindle OFF.

MAN.
EXC.
AUTOM.

MANUAL mode

Main spindle ON in clockwise direction.



Main spindle ON in counterclockwise direction.

AUTOMATIC, EXECUTE modes

If, after FEED HOLD, the main spindle is switched off with the OFF key and ON is then pressed, the spindle runs in the original direction of rotation, i.e. before it was switched off.

Control KeyboardSingle piece key

Single workpiece mode can be set with this key.

"1x" in the symbol menu illuminates:
Single piece mode active

"1x" in the symbol menu goes off:
The program is run several times according to the preselected number of workpieces

Central lubrication key

The lubrication pump is switched on and off by pressing this key.

The flashing of the relevant symbol in the symbol menu indicates that the machine has to be lubricated manually. The flashing is cancelled by pressing the key.

AUXILIARY ON key

The auxiliary drives of the machine are switched on with this key.

AUXILIARY OFF key

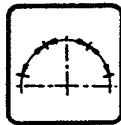
The auxiliary drives of the machine are switched off with this key.

Chip conveyor key

This key function is activated in a subsequent software version.

Control KeyboardChip guard door key

This key function is activated in a subsequent software version.

Dividing attachment key

This key function is activated in a subsequent software version.

Tool magazine key

The tool magazine can be indexed by pressing the MAN.JOG and tool magazine keys at the same time.

Tool magazine rotates in counter-clockwise direction:



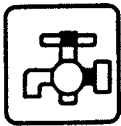
Tool magazine rotates in clockwise direction:

Coolant key

The coolant can be switched on and off with this key.

"Coolant" in the symbol menu illuminates:
Coolant on.

"Coolant" in the symbol menu goes off:
Coolant off.

Clamping fixture keys

These key functions are activated in a subsequent software version.

CHAPTER 3

Modes

- MANUAL
- EXECUTE
- EDIT
- AUTOMATIC

MANUAL mode

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6.4 Path display from the workpiece zero point to the cutting tip (W - P)	MAN 11

Mode - MANUAL

1. Summary - Possibilities

- o Traversing slides by hand
- o Spindle on, off, clockwise, counterclockwise
- o Coolant on, off
- o Index tool magazine

Overrides:

FEED OVERRIDE
SPINDLE OVERRIDE

Other applications:

Collecting tool data

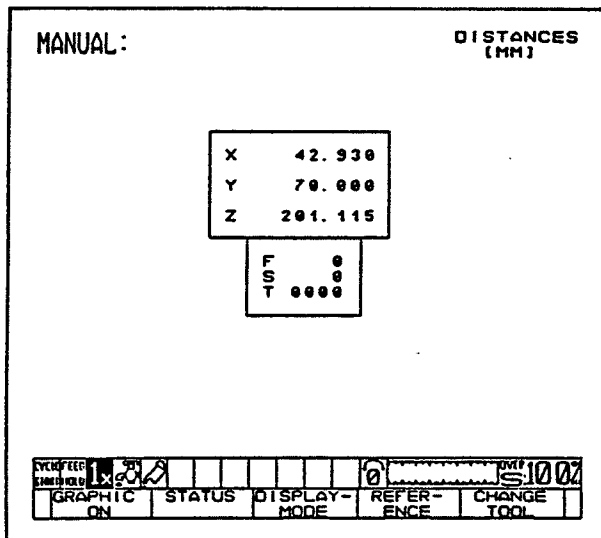
Submodes:

STATUS: Display of the active functions

REFERENCE: Approaching the reference point

CHANGE TOOL: Manual changing of the tools

2. Displays on the screen



- Path display X, Y, Z values
- Feed rate F
- Current speed S
- Tool number and correction number (T.. ..)
- PSO active or inactive

XYZ-values:

- * values M to N (machine zero point - tool holding fixture reference point)
- * value M to cutting tip of tool
- * values W to N (workpiece zero point - tool holding fixture reference point)
- * values W to cutting tip of the actual tool.

3. The softkeys and their meaning in the MANUAL mode

GRAPHIC
ON

GRAPHIC ON softkey:

The softkey function GRAPHIC ON is activated in a subsequent software version.

STATUS

STATUS softkey:

This softkey function switches the machine into the STATUS submode (display of the active functions). You will find a detailed description of this softkey and its function under "The submodes of the MANUAL mode".

DISPLAY-
MODE

DISPLAY MODE softkey:

2 letter sizes of the path display (X,Y,Z) can be selected with the DISPLAY MODE softkey function.

REFER-
ENCE

REFERENCE softkey:

The activation of this softkey switches the machine into the REFERENCE submode (approach reference point). You will find a detailed description of this softkey and its function under "The submodes of the MANUAL mode".

CHANGE
TOOL

CHANGE TOOL softkey:

This softkey function switches the machine into the CHANGE TOOL mode. You will find a detailed description of this softkey and its function under "The submodes of the MANUAL mode".

4. Operation

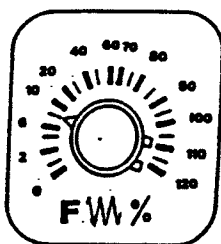
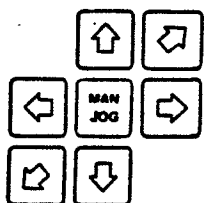
4.1 Traversing the Slides

4.1.1 Entry of the feed rate:

e.g. F = 500 mm/min



The maximum feed rate is limited. Alarm is given in the event of excessive values.



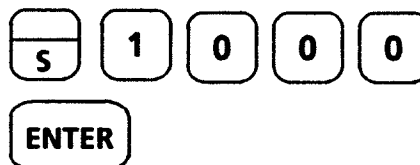
4.1.2 Traversing:

The key MAN JOG must be pressed at the same time as the direction key. Control with FEED OVERRIDE of 0 - 120%.

4.2 Switching the main spindle on and off

4.2.1 Entry of the main spindle speed:

e.g.: S = 1000 rpm



4.2.2 Entry of the direction of spindle rotation:

Spindle runs clockwise



Spindle runs counterclockwise



Spindle off



Further possibilities of switching off the main spindle:

- RESET
- EMERGENCY OFF

Note:

Please also observe the direction of rotation symbol in the symbol menu on the screen.



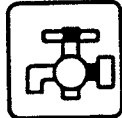
4.2.3 Overriding the main spindle speed

You can override the programmed spindle speed (50%-120%) using these keys.

Note:

Please observe the percentage display of the main spindle speed in the symbol menu on the screen.

4.3 Coolant on, off



"Coolant" in the symbol menu illuminates:

- Coolant on

"Coolant" in the symbol menu off:

- Coolant off

Switch over by pressing the key again.

4.4 Central lubrication

The lubrication pump is switched on and off by pressing the key.

The flashing of the relevant symbol in the symbol menu indicates that the machine has to be lubricated manually. The flashing is cancelled by pressing the key.



4.5 Indexing the tool magazine4.5.1 Indexing the tool magazine
in counterclockwise direction

By pressing the MAN.JOG keys and the tool magazine key at the same time, the magazine can be indexed in counterclockwise direction.

4.5.2 Indexing the tool magazine in
clockwise direction

When the SHIFT key is active (corresponding symbol in the symbol menu illuminates) and the MAN.JOG and tool magazine keys are pressed at the same time, the tool magazine is indexed in clockwise direction.

Reduced safety function:

If G₀₈ bit 0 is set in the user monitor, the tool magazine can only be indexed with the tool magazine key.

4.6 Switching on the auxiliary drives

The auxiliary drives are switched on by pressing the AUXILIARY ON key.

4.7 Switching off the auxiliary drives

Through pressing the AUXILIARY OFF key, all auxiliary drives will be stopping and switched off.



5. The submodes of the MANUAL mode

MANUAL :			STATUS			DISTANCES (MM)		
GROUP	G	M	GROUP	G	M	GROUP	G	M
00	:	05	:	08	:	08	:	40
01	:	33	:	09	:	09	:	17
02	:	94	:	10	:	10	:	30
03	:	53	:	11	:	11	:	98
04	:	:	:	12	:	12	:	:
05	:	56	:	13	:	13	:	:
06	:	:	:	14	:	14	:	:
07	:	71	:	15	:	15	:	:
ACTUAL F 5000			OVER F 0%					
ACTUAL S 0			OVER S 100%					
ACTUAL T 0000								
GRAPHIC ON	STATUS	DISPLAY-MODE	REFER-ENCE	CHANGE	TOOL			

5.1 STATUS submode

By switching over to the STATUS submode, you can see which functions are active.

Display in the STATUS submode:

- * G-functions
- * M-functions
- * Programmed F-value
- * Programmed S-value
- * Actual T-value
- * Percentage of the FEED OVERRIDE
- * Percentage of the SPINDLE OVERRIDE

MANUAL:		REFERENCE	DISTANCES (MM)
X	42.938		
Y	70.000		
Z	201.115		
F	0		
S	0		
T	0000		
VERSION: AC04.01/DC04.00/GC04.06/IC01.00			
CYCLE START	GRAPHIC ON	STATUS	DISPLAY- MODE
			REFER- ENCE
			CHANGE TOOL

REFER-
ENCE

CYCLE
START

5.2 REFERENCE submode

The internal measuring system of the machine is synchronised by approaching the reference point.

5.2.1. Approaching the reference point

- After the machine has been switched on
- After ALARM 150 (loss of synchronisation)

5.2.2. Procedure

- o Switch on control with key-operated switch. The control reports in the MANUAL mode.
- o Switch on the auxiliary drives with the AUX ON key.
- o Press REFERENCE softkey. The REFERENCE submode is selected.
- o All three slides traverse automatically to the reference point when the CYCLE START key is pressed.

Notes:

If the machine has not been switched on for over 3 months, it can happen that the MSD data (machine status data) are no longer in the buffer store. In this case the screen displays ALARM 150 after being switched on. The values in the position shift offset and the data in the tool data memory show nonsensical values, the program memory is empty.

Measures:

Reload machine data from cassette or punched tape.

5.3 CHANGE TOOL submode

This submode serves to change tools by hand on the tool magazine.

Procedure:

- o Select the CHANGE TOOL submode.
- o Press tool magazine key and MAN.JOG key.
- o The Z-slide traverse upwards into a defined position. This tool can now be changed.

You will find a detailed description of this submode in the operating instructions of the machine in question.

6. The Path Displays in MANUAL mode

Knowledge of the various types of display in the manual mode is important for the setting-up mode and the various types of tool measurement.

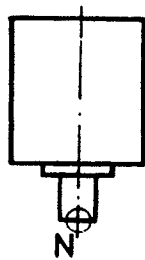
The same path displays are given in the AUTOMATIC and EXECUTE modes as well, depending on whether position shift offsets (PSO) and tool length data (TO) are called or not.

Please note that positive position offsets (tool offsets) are not cancelled by a change in the mode!

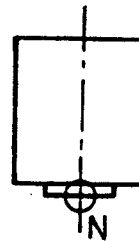
Tools and PSO data are called in the EXECUTE mode; using CYCLE START the display jumps over, followed by switch-over to MAN.

Preliminary explanations

The position of the tool holding reference point N is different on the machines VMC-100 and VMC-200 (see diagrams).



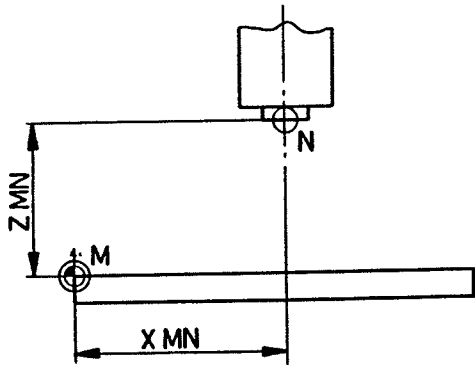
VMC-100



VMC-200

On the following pages the tool holding reference point N of the VMC-200 is used for the explanatory diagrams.

6.1 Path display from the machine zero point to the tool holding reference point (M-N)



- No tool active (T00 00) or one tool without correction value (e.g.: T03 00).
- POSITION SHIFT OFFSET INACTIVE (no G54, G55, G57, G58, G59 active)

The distances

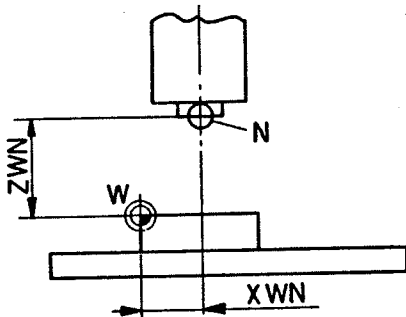
X_{MN}
Y_{MN}
Z_{MN}

are displayed.

When:

- When the machine is switched on and the reference point approached.
- With EMERGENCY OFF.
- When the machine is switched over from other modes and neither a tool nor PS0 are active.

6.2 Path display from the workpiece zero point to the tool holding reference point (W-N)



- No tool active (T00 00) or one tool without correction value (e.g.: T03 00).
- POSITION SHIFT OFFSET ACTIVE (G54, G55, G57, G58, G59 active)

The distances

X_{WN}
Y_{WN}
Z_{WN}

are displayed.

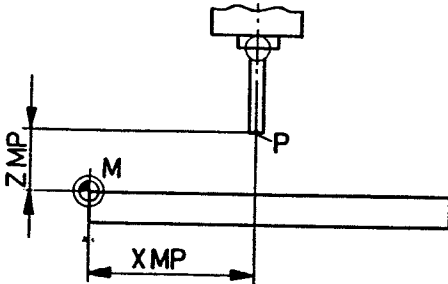
Activation of a PS0: e.g. G 54

EXECUTE mode



Switch-over to MANUAL mode:
W-N values are displayed.

6.3. Path display from the machine zero point to the cutting tip (M-P)



- One tool with correction value active.
- POSITION SHIFT OFFSET INACTIVE
(no G54, G55, G57, G58, G59 active)

The distances

X_{MP}
Y_{MP}
Z_{MP}

are displayed.

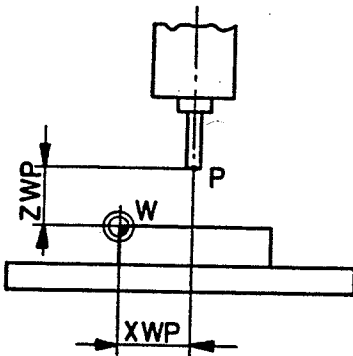
Activation of a tool: e.g. T 0303

EXECUTE mode



Switch-over to MANUAL mode:
M-P values are displayed.

6.4. Path display from the workpiece zero point to the cutting tip (W-P)



- One tool with correction value active.
- POSITION SHIFT OFFSET ACTIVE
(G54, G55, G57, G58, G59 active)

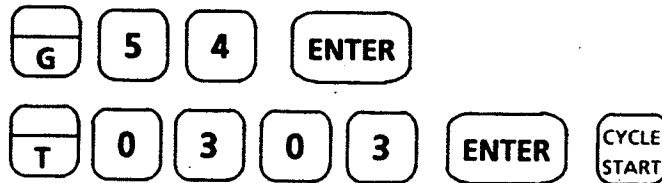
The distances

X_{WP}
Y_{WP}
Z_{WP}

are displayed.

Activation: e.g. G 54 T 0303

EXECUTE mode



Switch-over to MANUAL mode:
W-P values are displayed.

EXECUTE mode

- | | |
|---|---------------|
| 1. Summary, possibilities | EXE 1 |
| 2. Displays on the screen | EXE 1 |
| 3. The softkeys and their meaning in the EXECUTE mode | EXE 2 |
| 4. Possibilities in the EXECUTE mode | EXE 3 - EXE 4 |
| 4.1 Activation of the displays M-N, W-N, M-P, W-P | EXE 3 |
| 4.2 Entry of NC blocks | EXE 4 |
| 4.3 Call-up of NC blocks from the main memory | EXE 4 |
| 5. The submode of the EXECUTE mode | EXE 5 |
| 5.1 STATUS submode | EXE 5 |

EXECUTE mode

1. Summary, possibilities

- o Travērsing of any increments
- o Entry and processing of single blocks
- o Call and processing of single blocks from the program memory
- o Selection of machine statuses (e.g.: G70/G71, M38/M39)

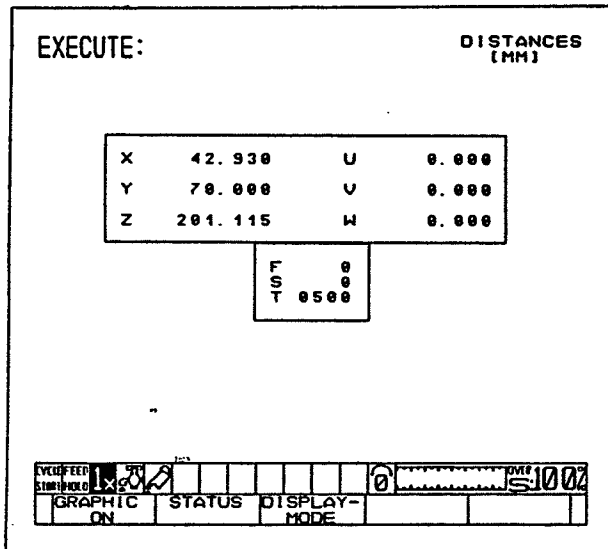
Overrides:
 FEED OVERRIDE
 SPINDLE OVERRIDE

- Other applications:
- * Activation of the tool length compensation in the path display
 → see MANUAL
 - * Activation of the zero point offset in the path display
 → see MANUAL.

Submode:
 STATUS: Display of the active functions.

2. Displays on the screen

- Path display X, Y, Z values
- Feed rate F
- Actual speed S
- Tool number and correction number (T.. ..)
- NC block in buffer store.



3. The softkeys and their meaning in the
EXECUTE mode

GRAPHIC
ON

GRAPHIC ON softkey:

The softkey function GRAPHIC ON is activated in a subsequent software version.

STATUS

STATUS softkey:

This softkey function switches the machine into the STATUS submode (display of the active functions). You will find a detailed description of this softkey and its function under "The submode of the EXECUTE mode".

DISPLAY-
MODE

DISPLAY MODE softkey:

2 letter sizes of the path display (X,Y,Z,U,V,W) can be selected with the softkey function DISPLAY MODE.

