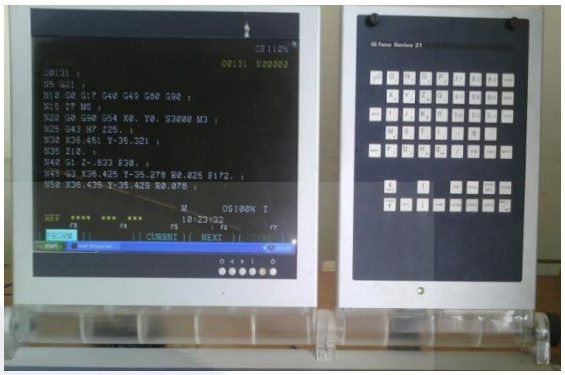
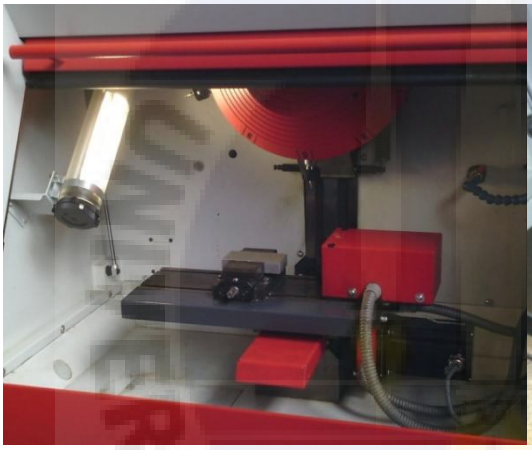
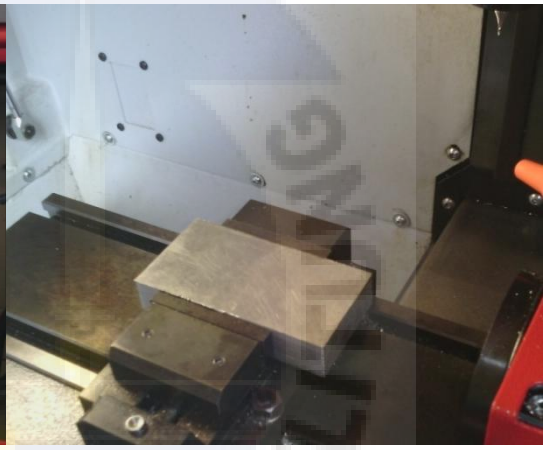
LAMPIRAN

Lampiran 1

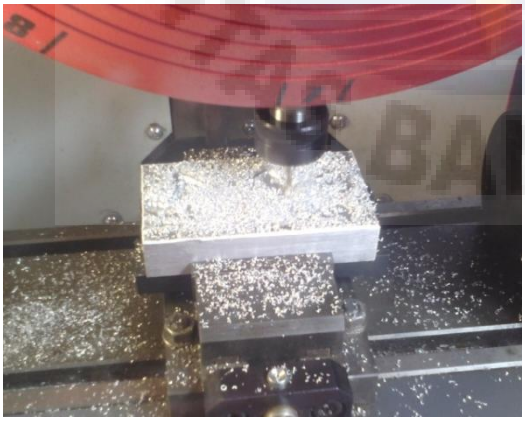
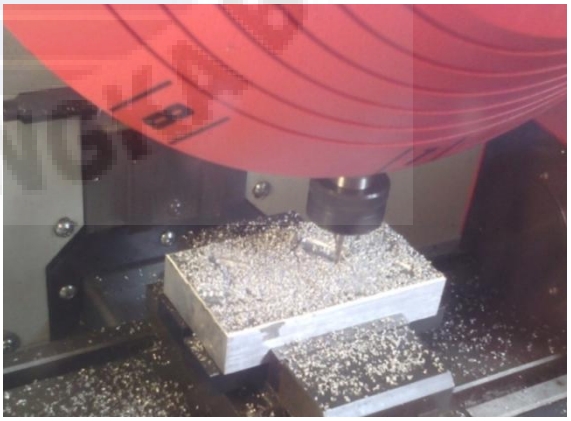
Dokumentasi permesinan CNC

Mesin Milling CNC EMCO Concept Mill 105 dan Pemasukan program

Setting tool dan benda kerja

Proses Permesinan CNC

Lampiran 1 (lanjutan)

Hasil permesinan CNC

Cetakan 1 mm

Cetakan 1.5 mm

Cetakan 2 mm

Lampiran 2

Dokumentasi pengecoran timah pewter

Proses peleburan timah pewter

Pemanasan cetakan

Proses penuangan

Proses Penuangan

Proses pendinginan hasil pengecoran

Technical Data of the Machine

Working area		
Longitudinal travel (X-axis)	[mm]	200
Cross travel (Y-axis)	[mm]	150
Vertical travel (Z-axis)	[mm]	250
Effective Z-stroke	[mm]	150
Distance spindle nose – table surface	[mm]	95 – 245
Milling table		
Clamping surface (L x W)	[mm]	420 x 125
Maximum table load	[kg]	10
2 T-slots acc. To DIN 650	[mm]	11
T-slots distance	[mm]	90
Milling spindle		
Bearing type		Spindle bearing
Front bearing diameter	[mm]	ø 40
Tool mounting similar DIN 2079		SK30
Draw bolts		Works standard
Tool clamping		automatic
Main drive		
Asynchonous AC motor, power	[kW]	1,1
Speed range (stepless)	[rpm]	150 - 5000
Maximum torque	[Nm]	4,2
Speed per minute with option high speed spindle	[rpm]	20.000
Feed drive		
3-phase step motor in X / Y/ Z axis with a resolution of	[mm]	0,0015-0,001
Feed rate	[m/min]	0 – 5
Rapid traverse in X/Y/Z axis	[m/min]	5
Maximum feed force in X/Y	[N]	2000
Maximum feed force in Z	[N]	2400
Middle positioning variation acc. to VDI 3441 in X / Y	[mm]	0.005
Middle positioning variation acc. to VDI 3441 in Z	[mm]	0.005
Tool system		
Tool magazine	drum with directional logic	
Number of tool stations		10
Entry force	[N]	1100
Maximum tool weight	[kg]	0,7
Maximum tool diameter	[mm]	55
Cut-to-cut time acc. to VDI 2852 T1/T2/T3	[s]	11/10/10
Tool change time (without travel movements) T1/T2/T3	[s]	9/7.5/7.5
Tool clamping		automatic
Lubrication system		
Guideways	oil central lubrication	
Main spindle bearingr	lifetime grease lubrication	

Subject to technical modifications!

Basic pneumatic (standard included in basic machine)		
Pneumatic service unit for tool taper blow-out device (with filter), supply pressure	[bar]	6
Air hose connection	[mm]	ø 10
Compressed air quality		cleanliness class 4 (ISO 8573-1)
Coolant equipment (option)		
Tank volume	[l]	35
Maximum pump capacity	[l/min]	15
Maximum coolant pressure at 50Hz	[bar]	0,5
Pneumatic unit (option)		
Pneumatic unit for the automation accessories: Automatic door, pneumatic machine vice and NC dividing head Supply pressure	[bar]	6
Air hose connection	[mm]	ø 10
Automatic clamping device (option)		
Pneumatic machine vice incl. stroke control and blow out device		
Clamping range	[mm]	70
Jaw width	[mm]	72
Machine base for the machine (option)		
Overall length x depth x height	[mm]	1135x1100x 800
Weight	[kg]	ca. 120
Painting		
light gray	RAL Nr. 7035	
traffic red	RAL Nr. 3020	
graphite gray	RAL Nr. 7024	
Electrical connection		
Voltage supply	[V]	230, 1 1/N/PE
Admissible voltage fluctuation	[%]	+10/-10
Frequency	[Hz]	50/60
Connection value	[kVA]	1,4
Main fuse	[A]	16
Dimensions/weight		
Machine dimensions (L x W x H)	[mm]	1135 x 1100 x 1100
Machine weight (without machine base)	[kg]	400
Machine acceptance		
According to DIN 8615, Part 1		
Safety rules/norms		
Acc. to EEC-rules /acc. to CE EN292 part 1/2, EN60204 part 1 EEC machine guiding rules appendix 1		

Technical Data of PC-Control

Control by PC and control keyboard (option)

Interchangeable control-specific key module
(X9B 000, not included in scope of supply of basic machine)
USB control keyboard does not work without separate PC !

Separate PC with VGA colour monitor is required, but not included in scope of supply of basic machine !

PC-Minimum configuration

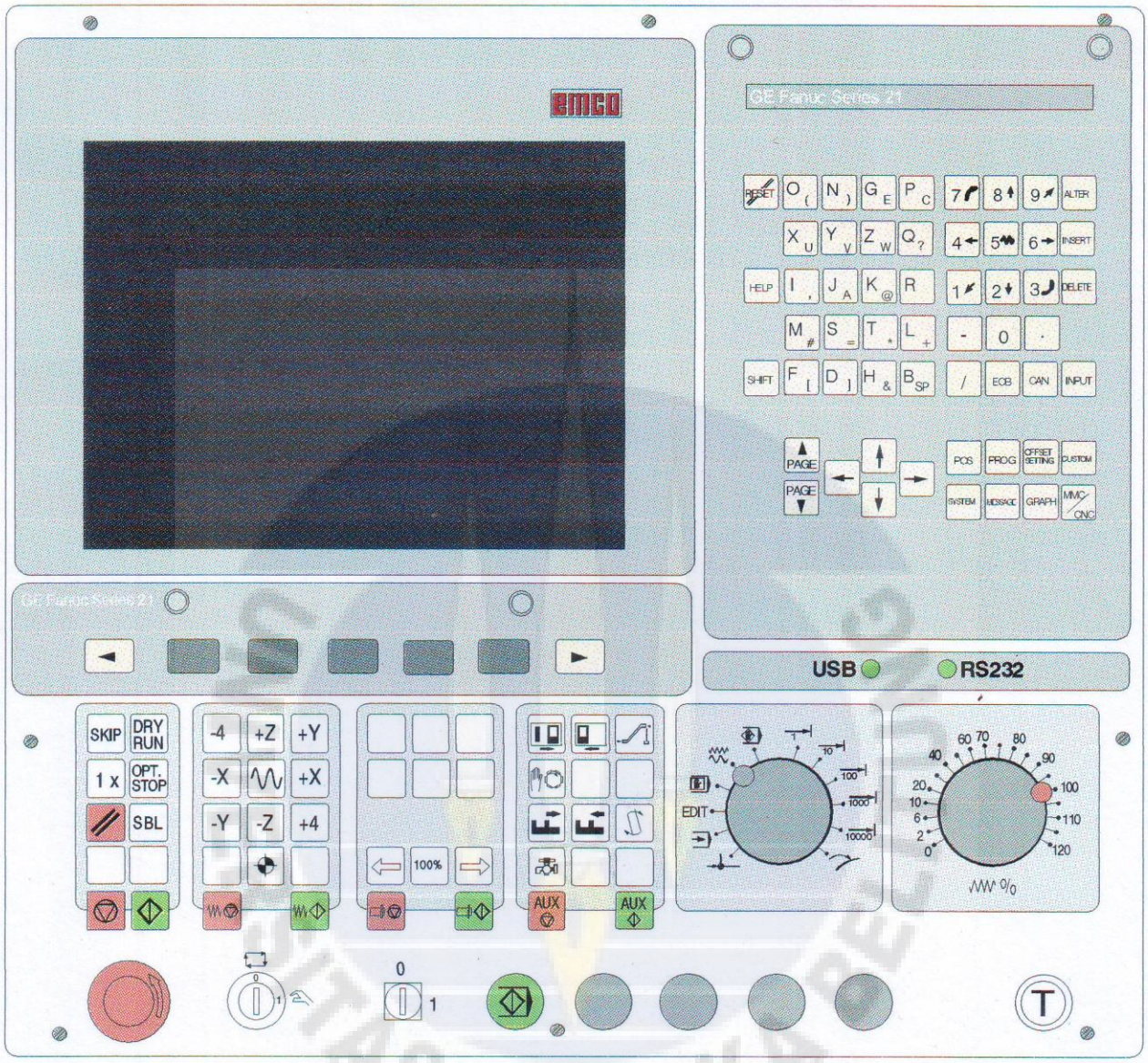
Processor	PC 1000 MHz
Operating system 32 bit / 64 bit	Windows XP-SP3/Vista/7
Random memory	256 MB RAM
Graphic card	min. 8MB VGA
Free Hard drive memory, ROM	400 MB
Hardware for programming stations	CD-ROM disc drive USB Interface
additional Hardware for machine license	USB Interface / Network card (TCP/IP able)

Machine license:

Does the direct control of the CONCEPT Machines and includes machine specific datas.
For every CONCEPT Machine a new machine license is to be produced.
Technical Data

A: Key Description

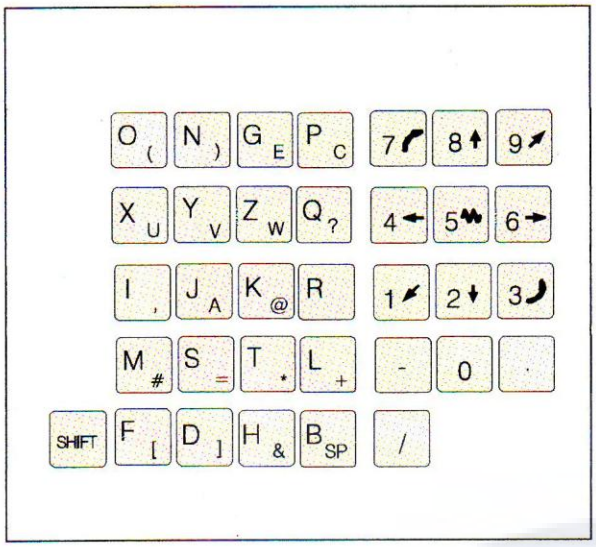
Control Keyboard, Digitizer Overlay



Key Functions

RESET ..... Cancel an alarm, reset the CNC (e.g. interrupt a program), etc.
HELP ..... Helping menue
CURSOR ..... Search function, line up/down
PAGE ..... Page up/down
ALTER ..... Alter word (replace)
INSERT ..... Insert word, create new program
DELETE ..... Delete (program, block, word)
EOB ..... **E**nd **O**f **B**lock

CAN ..... Delete input
INPUT ..... Word input, data input
POS ..... Indicates the current position
PROG ..... Program functions
OFSET SETTING. Setting and display of offset values, tool and wear data, variables
SYSTEM ..... Setting and display of parameter and display of diagnostic data
MESSAGES ..... Alarm and message display
GRAPH ..... Graphic display

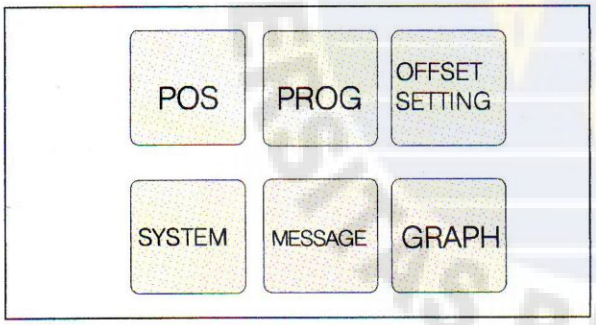


Data input keys

Data Input Keys

Note for the Data Input Keys

Each data input key runs several functions (numbers, address character(s)). Repeated pressing of the key switches to the next function automatically.



Function keys

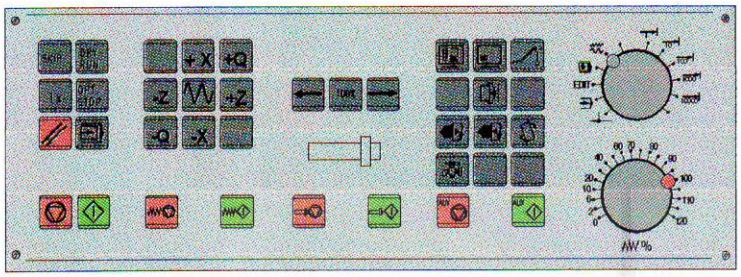
Function Keys

Note for Function Keys

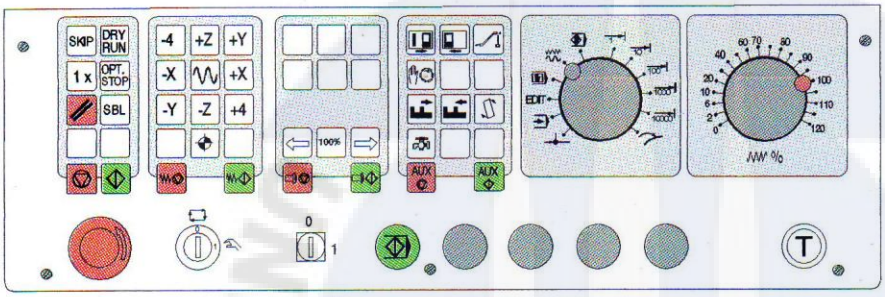
With the PC keyboard the function keys can be displayed as softkeys by pressing the key F12.

Machine Control Keys

The machine control keys are in the lower block of the control keyboard resp. the digitizer overlay.
Depending on the used machine and the used accessories not all functions may be active.



Machine control keyboard



Machine control keyboard of the EMCO PC- Mill Serie

SKIP (skip blocks will not be executed)

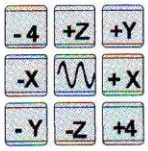
DRY RUN (test run of programs)

OPT STOP (program stop at M01)

RESET

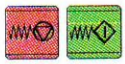
Single block machining

Program stop / program start



manual axis movement

Approaching the reference point in all axes



Feed stop / feed start

Spindle override lower / 100% / higher

Spindel stop / spindle start; spindle start in JOG and INC1...INC10000 mode:

Clockwise: perss key short, Counterclockwise: press min. 1 sec.

Open / close door

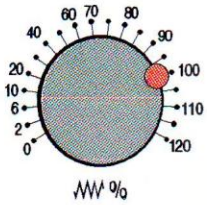
Swivel dividing head

Open / close clamping device

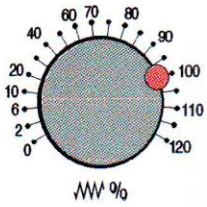
Swivel tool turret

Coolant on/off

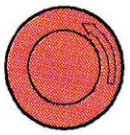
AUX OFF / AUX ON (auxiliary drives off / on)



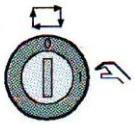
Vorschub- / Eilgangkorrekturschalter



Feed / rapid feed override switch



EMERGENCY OFF (Unlock: pull out button)



Key switch for special operations (siehe Maschinenbeschreibung)

Additional NC start key

Additional key clamping device

Consent key

No function

PC Keyboard

$4 = 4 ⇧ $4 = $ Strg $4 = Alt $4 = INC 1 000

Some alarms will be acknowledged with the key ESC.

By pressing the key F1 the modes (MEM, EDIT, MDI,...) will be displayed in the softkey line.
The assignement of the accessory functions is described int the chapter "Accessory Functions".

The meaning of the key combination ctrl 2 depends on the machine:
EMCO PC MILL 50/55: Puff blowing ON/OFF
EMCO PC MILL 100/125/155: coolant ON/OFF

* With F12 the function keys POS, PROG, OFFSET SAETTING, SYSTEM, MESSAGES and GRAPH will be displayed in the softkey line.

The machine functions in the numeric key block are active only with active NUM lock.

D: Programming

Program Structure

CNC programming for machine tools according to DIN 66025 is used.
The CNC program is a sequence of program blocks which are stored in the control.
With machining of workpieces these blocks will be read and checked by the computer in the programmed order.
The corresponding control signals will be sent to the machine.

The CNC program consists of:
- Program number
- CNC blocks
- Words
- Addresses
- number combinations (for axis addresses partly with sign)

Used Addresses

C ..... chamfer
F ..... feed rate, thread pitch
G ..... path function
H ..... number of the correction value address in the offset register (OFFSET)
I, J, K .... circle parameter, scale factor, K also number of repetitions of a cycle, mirror axes
M ..... miscellaneous function
N ..... block number 1 to 9999
O ..... Program number 1 to 9499
P ..... dwell, subprogram call
Q ..... cutting depth or shift value in cycle
R ..... radius, retraction height with cycle
S ..... spindle speed
T ..... tool call
X, Y, Z .. position data (X also dwell)
; ..... block end

Survey of G Commands

G00[1] ..... Positioning (Rapid Traverse)
G01 ..... Linear Interpolation
G02 ..... Circular Interpolation Clockwise
G03 ..... Circular Interpolation Counterclockwise
G04[2] ..... Dwell
G09[2] ..... Exact Stop
G10 ..... Data Setting
G11 ..... Data Setting Off
G15[1] ..... End Polar Coordinate Interpolation
G16 ..... Begin Polar Coordinate Interpolation
G17[1] ..... Plane Selection XY
G18 ..... Plane Selection ZX
G19 ..... Plane Selection YZ
G20 ..... Measuring in Inches
G21 ..... Measuring in Millimeter
G28[2] ..... Approach Reference Point
G40[1] ..... Cancel Cutter Radius Compensation
G41 ..... Cutter Radius Compensation left
G42 ..... Cutter Radius Compensation right
G43 ..... Tool Length Compensation positive
G44 ..... Tool Length Compensation negative
G49[1] ..... Cancel Tool Length Compensation
G50[1] ..... Cancel Scale Factor
G51 ..... Scale Factor
G52[2] ..... Local Coordinate System
G53[2] ..... Machine Coordinate System
G54[1] ..... Zero Offset 1
G55 ..... Zero Offset 2
G56 ..... Zero Offset 3
G57 ..... Zero Offset 4
G58 ..... Zero Offset 5
G59 ..... Zero Offset 6
G61 ..... Exact Stop Mode
G62 ..... Automatic Corner Override
G63 ..... Thread Cuting Mode On
G64[1] ..... Cutting mode
G68 ..... Coordinate System Rotation ON
G69 ..... Coordinate System Rotation OFF
G73 ..... Chip Break Drilling Cycle
G74 ..... Left Tapping Cycle
G76 ..... Fine Drilling Cycle
G80[1] ..... Cancel Drilling Cycles (G83 bis G85)
G81 ..... Drilling Cycle
G82 ..... Drilling Cycle with Dwell
G83 ..... Withdrawal Drilling Cycle
G84 ..... Tapping Cycle
G85 ..... Reaming Cycle
G86 ..... Drilling Cycle with Spindle Stop
G87 ..... Back Pocket Drilling Cycle
G88 ..... Drilling Cycle with Program Stop
G89 ..... Reaming Cycle with Dwell
G90[1] ..... Absolute Programming
G91 ..... Incremental Programming
G92[2] ..... Coordinate System Setting
G94[1] ..... Feed per Minute
G95 ..... Feed per Revolution
G97[1] ..... Revolutions per Minute
G98[1] ..... Retraction to Starting Plane (Drilling Cycles)
G99 ..... Retraction to Withdrawal Plane

Group	Command	Function
0	G04	Dwell
	G09	Exact stop
	G10	Data Setting
	G11	Data Setting Off
	G28	Approach Reference Point
	G52	Local Coordinate System
	G53	Machine Coordinat System
	G92	Coordinate Sytem Setting
1	G00	Positioning (Rapid Traverse)
	G01	Linear Interpolation
	G02	Circular Interpolation Clockwise
	G03	Circular Interpolation Counterclockwise
2	G17	Plane Selection XY
	G18	Plane Selection ZX
	G19	Plane Selection YZ
3	G90	Apsolute Programming
	G91	Incremental Programming
5	G94	Feed per Minute
	G95	Feed per Revolution
6	G20	Measuring in Inches
	G21	Measuring in Millimeter
7	G40	Cancel Cutter Radius Compensation
	G41	Cutter Radius Compensation left
	G42	Cutter Radius Compensation Right
8	G43	Tool Lenght Compensation positive
	G44	Tool lenght Compensation negative
	G49	Cancel Tool Lenght Compensation
9	G73	Chip Break Drilling Cycle
	G74	Left Tapping Cycle
	G76	Fine Drilling Cycle
	G80	Cancel Drilling Cycles
	G81	Drilling Cycle
	G82	Drilling Cycle with Dwell
	G83	Withdrawing Drilling Cycle
	G84	Tapping Cycle
	G85	Reaming Cycle
	G86	Drilling Cycle with Spindle Stop
	G87	Back Pocket Drilling Cycle
	G88	Drilling Cycle with Program Stop
	G89	Reaming Cycle with Dwell
10	G98	Retraction to Starting Plane
	G99	Retracion to Withdrawal Plane
11	G50	Cancel Scale Factor
	G51	Scale Factor
13	G97	Revolutions per Minute
14	G54	Zero Offset 1
	G55	Zero Offset 2
	G56	Zero Offset 3
	G57	Zero Offset 4
	G58	Zero Offset 5
	G59	Zero Offset 6
15	G61	Exact Stop Mode
	G63	Thread Cutting Mode ON
	G64	Cutting Mode
16	G68	Coordinate System Rotation ON
	G69	Coordinate System Rotation OFF
17	G15	End Polar Coordinate Interpolation
	G16	Begin Polar Coordinate Interpolation

[1] ..... Einschaltzustand
[2] ..... Nur satzweise wirksam

Survey of M Commands

M00 ..... Programmed Stop
M01 ..... Programmed Stop, Conditional
M02 ..... Program End
M03 ..... Main Spindle ON Clockwise
M04 ..... Main Spindle ON Counterclockwise
M05[1] ..... Main Spindle OFF
M06 ..... Tool Change
M08 ..... Coolant ON
M09[1] ..... Coolant OFF
M10 ..... Lock dividing head
M11 ..... Unlock dividing head
M19 ..... Oriented Spindle Stop
M25 ..... Release Clamping Device
M26 ..... Close Clamping Device
M30 ..... Program End
M71 ..... Puff blowing ON
M72[1] ..... Puff blowing OFF
M98 ..... Subprogram Call
M99 ..... Subprogram End

[1] ..... Initial status