DOOSAN

Operation Manual

Introduction / Precaution / Basic Operation

Vertical Machining Center (Heidenhain NC Controller)

INTRODUCTION

Thank you for choosing the DOOSAN Infracore machine tool. We are proud to have you among our DOOSAN Infracore family of users.

Manuals contain concise information on the installation, setup, operation and maintenance of your machine tool. To make the most of its outstanding performance over a long period, the machine must be properly installed and operating and maintenance procedures must be clearly understood and carefully followed.

We provide the following manuals.

Item	Description	Coverage
Machine manual	Machine instruction manual	Specification, Maintenance data
	Machine operation manual	Basic operation
	Parts list	Machine parts designation
	Electric diagram	Hardware diagram
	Ladder diagram	Software diagram
CNC manual	Instruction manual	NC operation and programming
	Maintenance manual	NC maintenance
Appended data	Extra documents	F.C.F., Parameter sheet, Chuck & Cylinder manual

This manual was considered complete and accurate at the time of publication, however, due to our desire to constantly improve the quality and specification of all our products, it is subject to change or modification.

If you have any questions, please contact the nearest DOOSAN Infracore Technical/Service center.

CONSTRUCTION

SECTION A

PRECAUTION

CONTENTS

This machine is equipped with safety devices which serve to protect personnel and machine itself from hazards arising from unforeseen accidents. However, operators must not rely exclusively on these safety devices : they must also become fully familiar with the safety guidelines presented below to ensure accident-free operation.

This instruction manual and the nameplates attached to the machine cover show only those hazards which DOOSAN Infracore can predicts. Be aware that they do not cover all possible hazards.

The following warning indications in our manuals are used to draw attention to information of particular importance.

⚠ DANGER

1) Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING

2) Indicates potentially hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION

3) Indicates potentially hazardous situation which, if not avoided, may result in minor or moderate injury or damages to the machine.

NOTICE

4) Indicates comments and items for which care should be exercised.

1. General

⚠ WARNING

1) Fully understand the machine specification and function, and perform the work in specified ways.

NOTICE

2) Prepare work process and range before performing work.

⚠ WARNING

3) Indicate clearly the trained staff for each work, and perform the work by indicated one.

NOTICE

4) In more than one staff is necessary absolutely, all involved persons must cooperate and be able to communicate.

⚠ WARNING

5) Always be sure to wear suitable clothes.

⚠ CAUTION

6) Always check that there are no obstacles in and around the machine.

⚠ WARNING

7) Do not handle the electrical equipment with wet hand.

⚠ CAUTION

8) Inspect, adjust and maintain periodically refering to check points described in this manual.

⚠ CAUTION

9) Check the setting value of the machine, and never change that without intention.

⚠ WARNING

10) Never disassemble and adjust the devices and covers for safety without intention

⚠ WARNING

11) Working inside of machine is especially dangerous. In this case, always turn off the main power.

2. Machine installation

NOTICE

1) Fully understand the process in Machine instruction manual.

NOTICE

2) Prepare work process, and perform pre-inspection.

NOTICE

3) In cooperation, all involved persons must be able to communicate..

NOTICE

4) Check that all of necessary implements and tools are prepared.

⚠ CAUTION

5) Use standard devices and tools.

3. Power supply

NOTICE

1) Fully understand the process in Machine operation manual.

⚠ CAUTION

2) Always check that there are no obstacles against operation in and around the machine.

NOTICE

3) Check the electric cabinet doors are closed.

⚠ CAUTION

4) A momentary power stoppage due to a power failure or lightening can cause an accident.

   Therefore, turn off the main power if abnormal fluctuation of power is anticipated.

⚠ CAUTION

5) If the machine stops due to a power failure, turn off the main power immediately.

4.　　Warming up

NOTICE

1) Prepare the extra program for warming up.

⚠CAUTION

2) Perform the warming up before daily operation of machine.

⚠CAUTION

3) Perform checking and inspection of each device's function during warming up.

5.　　Set-up

NOTICE

1) Fully understand the process in operation manual.

⚠CAUTION

2) Check the setting value of all gages and state of moving parts.

⚠WARNING

3) On handling heavy weight, use a crane, hoist or make a teamwork.

⚠CAUTION

4) The work light will be very hot after it has been lit for a long period. Be careful not to touch it.

⚠CAUTION

5) Be careful not to operate the wrong switch.

　　Visually check the switches on the operation panel before operating them.

⚠WARNING

6) When load and unload workpiece, be careful that the machine stops completely.

⚠WARNING

7) Never touch any moving unit while the machine is operating. Be careful that the machine stops completely before touching it.

⚠CAUTION

8) When loosening the bolts on the fixture, be sure to loosen them gradually.

⚠CAUTION

9) Clean thoroughly the chips and foreign matters on workpiece and tools before loading.

⚠ **CAUTION**

10) Clamp the workpiece and cutting tools securely.

⚠ **CAUTION**

11) Depth of cut and cutting feed must be selected with small values.

⚠ **CAUTION**

12) Never put any tools or instruments on the machine operation panel or on any machine part.

⚠ **CAUTION**

13) Check that set-up is finished completely.

⚠ **CAUTION**

14) If set-up is changed, check the process with single block operation to find out any other trouble.

⚠ **CAUTION**

15) On working in new set-up state, be sure to check the set-up state once again before the machine operation.

6.   Automatic operation

NOTICE

1) Fully understand the process in Machine operation manual.

⚠ WARNING

2) Do not lean on the machine while the machine is operating.

⚠ CAUTION

3) Be careful not to operate the wrong switch.

Visually check the switches on the operation panel before operating them.

⚠ WARNING

4) Always close all doors before automatic operation.

⚠ CAUTION

5) Before performing spindle rotation, tool change and axis feed, etc., be careful those operations are safe.

⚠ CAUTION

6) Check that all switches and moving parts are in correct position before automatic operation.

⚠ CAUTION

7) When running a new program for the first time, check the program thoroughly beforehand.

NOTICE

After debugging any bug in program, start the program in single block mode. If no error occurs, start it in automatic mode.

⚠ WARNING

8) Never touch any moving unit while the machine is operating. Be careful that the machine stops completely before touching it.

⚠ WARNING

9) Never open doors and covers in automatic operation.

⚠ CAUTION

10) On automatic operation, be careful not to touch any other switches.

7. Stop operation

⚠ WARNING

1) Stop machine immediately with pushing Emergency stop switch when any trouble occurs.

⚠ CAUTION

2) Fully understand each machine state according to each stop operation.

3) Check that the machine stops completely.

8. End of work and power off

⚠ WARNING

1) Check that the machine stops completely.

⚠ CAUTION

2) Clean the machine inside.

NOTICE

3) Stop the machine to the specified position.

⚠ CAUTION

4) Turn off the main power.

NOTICE

5) Check all switches off.

9. Inspection/adjustment/maintenance

NOTICE

1) Fully understand the process in Machine instruction manual.

NOTICE

2) Clarify the trouble state referring to its operator's advice.

NOTICE

3) Prepare work process and range before performing work.

⚠ CAUTION

4) Indicate clearly the trained staff for each work, and perform the work by indicated one.

NOTICE

5) Share informations with each staff.

NOTICE

6) If teamwork is necessary, discuss enough plan for maintenance with other part and the cooperator.

⚠ WARNING

7) Notify "On maintenance" around the machine while maintenance is performed.

⚠ WARNING

8) Turn off the main power in case that any danger can occur when power on, and attach the warning sign saying "Never power on" around main switch.

⚠ WARNING

9) Always turn off the main power before beginning any work inside of the machine, and attach the warning sign saying "Never power on" around main switch.
If a operator has to be stay inside of machine area for anywork, keep the main door on opening status with locking pin avoid operator trapping.

⚠ DANGER

10) Never touch or operate electrical cables, devices, switches with wet hand.

⚠ WARNING

11) Use a ladder or any safety device to reach high.

⚠ CAUTION

12) Use standard and specified tools.

⚠ CAUTION

13) Do not put the tools or clothes on the moving parts.

⚠ **WARNING**

14) On handling heavy weight, use a crane, hoist or make a teamwork.

⚠ **WARNING**

15) When using a crane, use only specified wires, shackles and gigs.

⚠ **CAUTION**

16) Be sure to use specified parts on changing parts.

SECTION B

GENERAL

CONTENTS

In this section, the kind of operation device according to machine specification and the basic function of them are explained simply.

As the contents in this section are common to all machine tools, it should be observed carefully.

NOTICE

Figure and description in this manual explain general articles in machine operation.

So there are some difference in explanation depend on each model.
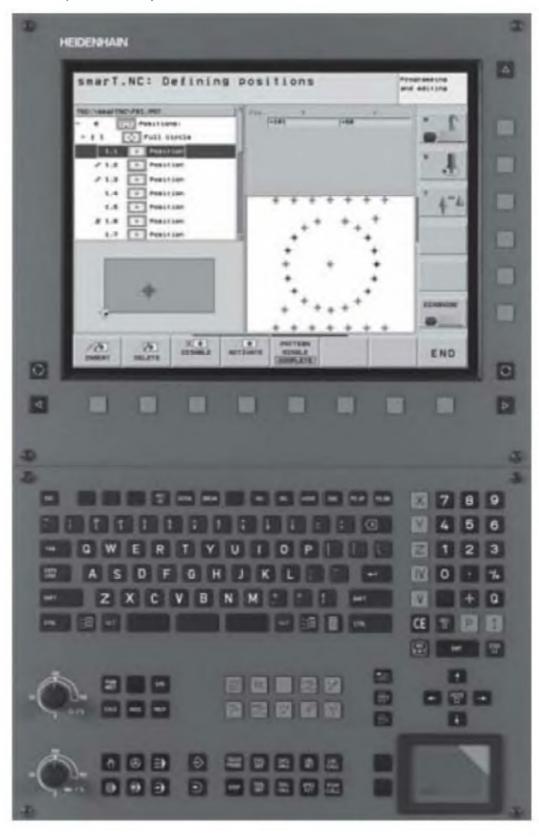
Machine name comparison table

<Contents>

Item	Description	Remark	Page
1	NC variation	- Shape according to NC specification	B-1
2	OP. Panel variation	- English, For CE	B-2
3	Operation symbol	- Explanation of symbol according to ISO standard	B-3

1. NC Variation

iTNC530 (HEIDENHAIN)

2. OP. Panel Variation

MB420

MB520

3. Operation symbol

1) Symbol for device description

Type	Number	Symbol	Description
Keys on visual display unit	1		Split screen layout
	2		Toggle display between machining and programming modes
	3		Soft keys for selecting functions on screen
	4		Shift between soft-key rows
alphanumeric keyboard	5	Q W E R T Y	File names, comments
	6	G F S T M	DIN/ISO programming
Machine operating modes	7		Manual Operation
	8		Electronic Hand wheel
	9		smarT.NC
	10		Positioning with Manual Data Input
	11		Program Run, Single Block
	12		Program Run, Full Sequence
Programming modes	13		Programming and Editing
	14		Test Run
Program/ file management, TNC functions	15	PGM MGT	Select or delete programs and files, external data transfer
	16	PGM CALL	Define program call, select datum and point tables
	17	MOD	Select MOD functions
	18	HELP	Display help text for NC error messages, call TNC guide
	19	ERR	Display all current error messages
	20	CALC	Show pocket calculator

Type	Number	Symbol	Description
Navigation keys	21	↑ ↓ ← →	Move highlight
	22	GOTO	Go directly to blocks, cycles and parameter functions
Programming path movements	23	APPR DEP	Approach/depart contour
	24	FK	FK free contour programming
	25	L	Straight line
	26	CC	Circle center/pole for polar coordinates
	27	C	Circle with center
	28	CR	Circle with radius
	29	CT	Circular arc with tangential connection
	30	CHF	Chamfering
	31	RND	Corner rounding
Tool functions	32	TOOL DEF	Define tool data in the program
	33	TOOL CALL	Call tool data
Cycles, subprograms and program section repeats	34	CYCL DEF CYCL CALL	Define and call cycles
	35	LBL SET LBL CALL	Enter and call labels for sub programming and program section repeats
	36	STOP	Program stop in a program
	37	TOUCH PROBE	Define touch probe cycles
Coordinate axes and numbers: Entering and editing	38	X ... Y	Select coordinate axes or enter them into the program
	39	0 ... 9	Numbers
	40	•	Decimal point
	41	+/−	Reverse algebraic sign
	42	P	Polar coordinate input

Type	Number	Symbol	Description
	43	I	Incremental values
	44	Q	Q parameter programming/Q parameter status
	45		Save actual position or values from calculator
	46	NO ENT	Skip dialog questions, delete words
	47	ENT	Confirm entry and resume dialog
	48	END	Conclude block and exit entry
	49	CE	Clear numerical entry or TNC error message
	50	DEL	Abort dialog, delete program section
Special functions / smarT.NC	51	SPEC FCT	Show special functions
	52		smarT.NC: Select next tab on form
	53		smarT.NC: Select first input field in previous/next frame
About feed speed/spindle speed Roh control [pu]	54		Roh feed speed control [pu]
	55		Roh spindle speed control [pu]

2) Machine operating panel

Number	Symbol	Description
1		Unlock door
2		Coolant
3		Coolant(internal)
4		Coolant(external)
5		Rinse water jet
6		Spot light
7		Chip removal
8		Chip conveyor
9		Tool change
10		Tool changer left
11		Tool changer right
12		Unlock tool
13		Lock tool
14		Retract aixs
15		No symbol
16		NC start
17		NC stop
18		Feed rate
19		Rapid traverse
20		Permissive key
21		

3) Machine operating panel

Number	Symbol	Description
1	**ACTL**	Actual or nominal coordinates of the current position
2	**X Y Z**	Machine axes; the TNC displays auxiliary axes in lower-case letters. The sequence and quantity of displayed axes is determined by the machine tool builder. Refer to your machine manual for more information.
3	**F S M**	The displayed feed rate in inches corresponds to one tenth of the effective value. Spindle speed S, feed rate F and active M functions.
4	✳	Program run started.
5	⊢◀	Axis is locked
6	⊖	Axis can be moved with the handwheel
7		Axes are moving under a basic rotation
8		Axes are moving in a tilted working plane
9		The **M128** function or **TCPM FUNCTION** is active
10		The **Dynamic Collision Monitoring** function (DCM) is active
11		The **Adaptive Feed Function** (AFC) is active (software option)
12		One or more global program settings are active (software option
13		Number of the active presets from the preset table. If the datum was set manually, the TNC displays the text **MAN** behind the symbol.

SECTION C

DESCRIPTIONS

CONTENTS
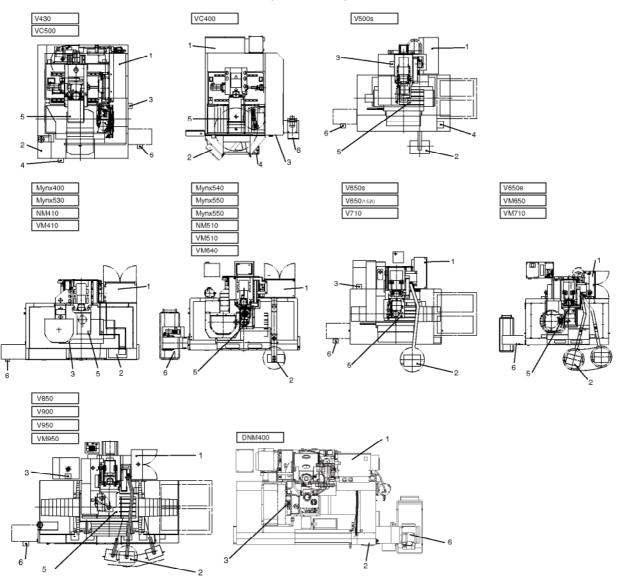
In this chapter, the name and function of each operational device are explained briefly, and the figure below shows the basic arrangement of them for the reference.

NOTICE

Figure and description in this manual explain general articles in machine operation.

So there are some difference in explanation depend on each model.

V430
VC500

VC400

V500s

Mynx400
Mynx530
NM410
VM410

Mynx540
Mynx550
Mynx550
NM510
VM510
VM640

V650s
V650/1520
V710

V650e
VM650
VM710

V850
V900
V950
VM950

DNM400

Item	Description	Remark	Page
1	Electric cabinet		C-1
2	Main OP. Devices		C-2
3	ATC OP. Devices	- Kind/name/function of	C-17
4	APC OP. Devices	attached operational device	
5	Tool Unclamp OP. Panel		
6	Chip Conveyor OP. Devices		

1. Electric cabinet

As built with a viriety of electric device, it has also the function to turn on/off the main power.

Symbol	Description	Remark	Page
1	Main Power N.F.B. Switch	- To turn on/off the main power - Automatic cutting off over voltage	

2. Main OP. devices

As the device for operation the machine and programming, it consists of monitor and operational devices, etc..

Symbol	Description	Remark	Page
1	MDI/CRT Devices	- Refer to B.2.1	
2	Main OP. Panel	- Refer to B.2.2	
3	MPG, Manual Pulse Generator	- Refer to B.2.3	
4	AUX. OP. Panel	- Refer to B.2.4 (Except for some models)	
5	Power Outlet	- Power connection with external Device 220V	
6	Input/Output Device	- Interface with external device	

2.1 Visual display unit

NOTICE

Please refer to NC operation manual for detail descriptions.

Symbol	Description	Remark
1	Header	When the TNC is on, the selected operating modes are shown in the screen header: the machining mode at the left and the programming mode at right.
2	Soft keys	In the footer the TNC indicates additional functions in a soft-key row.
3	Soft-key keys	Soft-key selection keys
4	soft-key rows key	Shift between soft-key rows
5	screen layout key	Sets the screen layout
6	Shift key for mode	Shift key for switchover between machining and programming modes
7	Soft-key for PLC	Soft-key selection keys for machine tool builders
8	Switches soft-key row for PLC	Switches soft-key rows for machine tool builders

2.1.1 Sets the screen layout

You select the screen layout yourself: In the PROGRAMMING AND EDITING mode of operation, for example, you can have the TNC show program blocks in the left window while the right window displays programming graphics. You could also display the program structure in the right window instead, or display only program blocks in one large window. The available screen windows depend on the selected operating mode.

To change the screen layout:

Press the SPLIT SCREEN key: The soft-key row shows the available layout options

Symbol	Operating Mode	Soft key	Window
1		POSITION	Positions
2		POSITION + STATUS	Left: positions, right: status display
3		POSITION + KINEMATICS	Left: positions, right: active collision objects(FCL4 function).
4	Manual operation and electronic handwheel		
	Positioning with manual data input	PGM	Program
		PROGRAM + STATUS	Left: program blocks, right: status display
		PROGRAM + KINEMATICS	Left: program blocks, right: active collision objects (FCL4 function). If this view is selected, then the TNC indicates a collision with a red frame around the graphics window.
8			
9	Programming and editing	PGM	Program
10		PROGRAM + SECTS	Left: program blocks, right: program structure
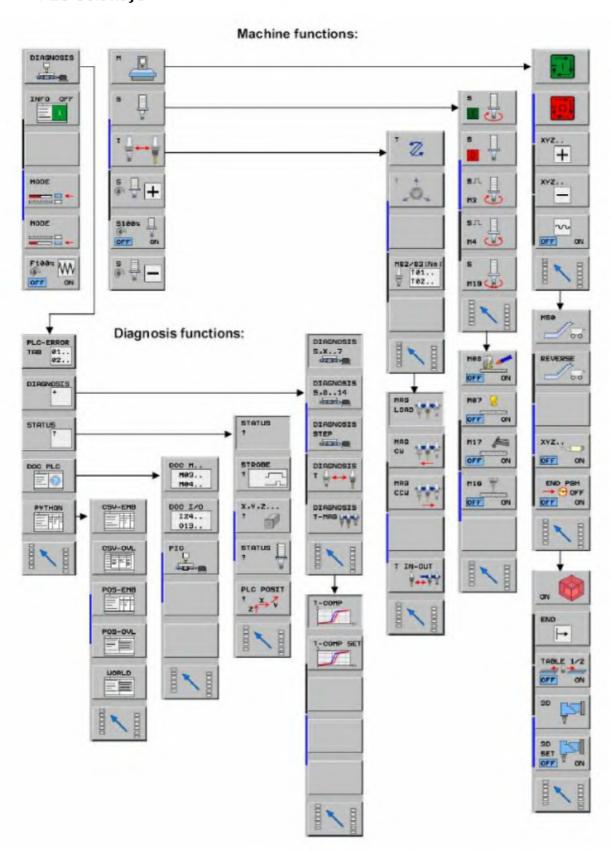
Symbol	Operating Mode	Soft key	Window
11		PROGRAM + GRAPHICS	Left: program blocks, right: graphics
		PROGRAM + 3D LINES	Left: program blocks, right: 3-D line graphics
	Test run		
	Program run, full sequence and program run, single block	PGM	Program
		PROGRAM + SECTS	Left: program, right: program structure
		PROGRAM + STATUS	Left: program, right: status
		PROGRAM + GRAPHICS	Left: program, right: graphics
		GRAPHICS	Graphics
		PROGRAM + KINEMATICS	Left: program blocks, right: active collision objects (FCL4 function). If this view is selected, then the TNC
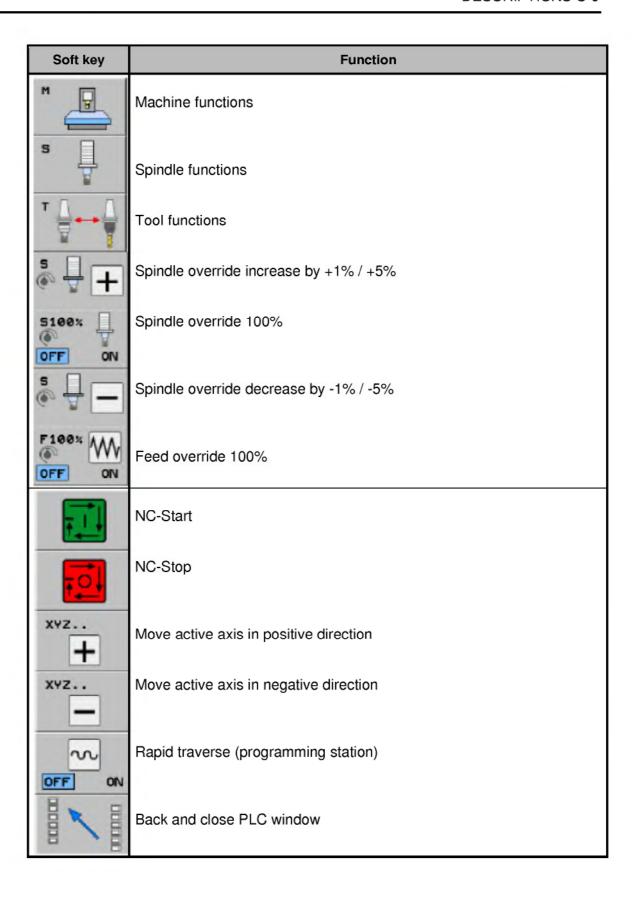
Symbol	Operating Mode	Soft key	Window
			indicates a collision with a red frame around the graphics window.
		KINEMATICS	Active collision objects (FCL4 function) If this view is selected, then the TNC indicates a collision with a red frame around the graphics window.

2.1.2   Path contours - Cartesian Coordinates
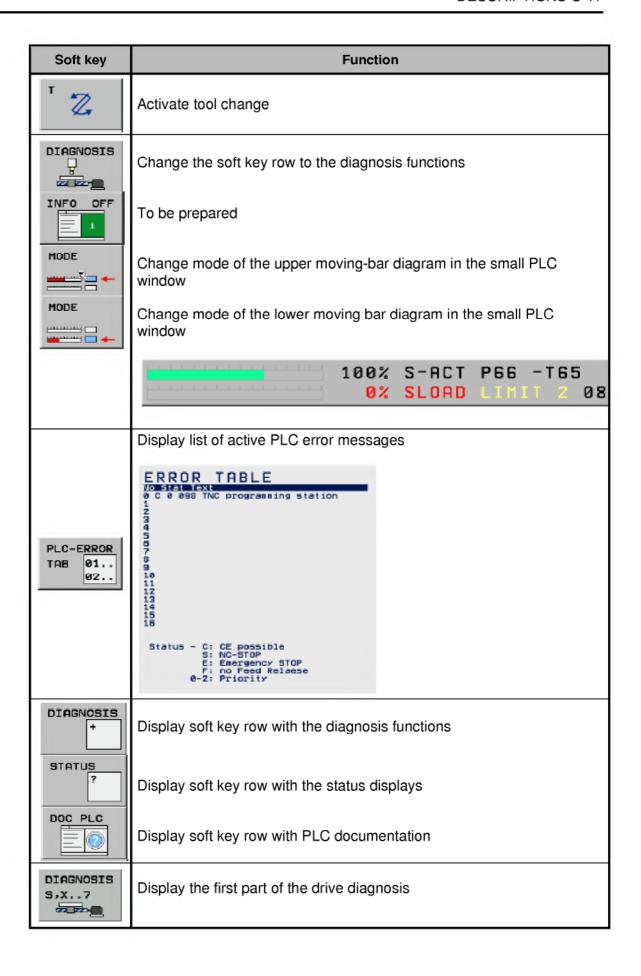
Function	Key	Tool movement	Required input
Line **L**		Straight line	Coordinates of the end points of the straight line
Chamfer **CHF**		Chamfer between two straight lines	Chamfer side length
Circle center **CC**		None	Coordinates of the circle center or pole
Circle **C**		Circular arc around a circle center CC to an arc end point	Coordinates of the arc end point, direction of rotation
Circular arc **CR**		Circular arc with a certain radius	Coordinates of the arc end point, arc radius, direction of rotation
Circular arc **CT**		Circular arc with tangential connection to the preceding and subsequent contour elements	Coordinates of the arc end point
Corner rounding **RND**		Circular arc with tangential connection to the preceding and subsequent contour elements	Rounding radius R
FK free contour programming	FK	Straight line or circular path with any connection to the preceding contour element	Path Contours - FK free contour programming

2.2 PLC Soft keys

Soft key	Function
M	Machine functions
S	Spindle functions
T	Tool functions
S +	Spindle override increase by +1% / +5%
S100% OFF ON	Spindle override 100%
S −	Spindle override decrease by -1% / -5%
F100% OFF ON	Feed override 100%
	NC-Start
	NC-Stop
XYZ.. +	Move active axis in positive direction
XYZ.. −	Move active axis in negative direction
OFF ON	Rapid traverse (programming station)
	Back and close PLC window

Soft key	Function
M50	Chip conveyor on/off M50/M51
REVERSE	Chip conveyor reverse
XYZ.. OFF ON	Lubrication on
END PGM → OFF OFF ON	Automatic switch after the end of the NC program
ON	Monitoring working area
END	Axis motion from end position
TABLE 1/2 OFF ON	Alternating table operation on/off
S	Spindle Start M03
S 0	Spindle Stop M05
S M3	Jog mode spindle direction M3
S M4	Jog mode spindle direction M4
S M19	Spindle orientation M19
M08 OFF ON	Coolant outside on/off M08/M09
M07 OFF ON	Coolant inside on/off M07/M09
M17 OFF ON	Coolant additional on/off M17/M09
M16 OFF ON	Touch probe TSxxx blow off M16 (timer)

Soft key	Function
T	Activate tool change
DIAGNOSIS	Change the soft key row to the diagnosis functions
INFO OFF	To be prepared
MODE	Change mode of the upper moving-bar diagram in the small PLC window
MODE	Change mode of the lower moving bar diagram in the small PLC window
	100% S-ACT P66 -T65 0% SLOAD LIMIT 2 08
PLC-ERROR TAB 01.. 02..	Display list of active PLC error messages
	ERROR TABLE
DIAGNOSIS +	Display soft key row with the diagnosis functions
STATUS ?	Display soft key row with the status displays
DOC PLC	Display soft key row with PLC documentation
DIAGNOSIS S,X..7	Display the first part of the drive diagnosis

Soft key	Function

	DIAG AXES/SPINDLE
	1-X 2-Y 3-Z 4-a 5-A 6-B 7-C
	S
	
	Motor Temperature [Degree]
	23 25 27 28 23 254 254
	254
	Motor Utilization [%]
	0 0 1 0 0 0 0
	0
	Motor rpm [1/min]
	+0 +0 +0 +0 +0 +0 +0
	+0
	
	      1 2 3 4 5 6 7
	      S X Y Z a A B C
	I2T Warning : 0 0 0 0 0 0 0 0
	I2T Limitation: - 0 0 0 0 0 0 0
	Inverter Tmax : 0 0 0 0 0 0 0 0
	Drives ready : 0 1 1 1 0 0 0 0
	no Reference : 0 0 0 0 0 0 0 0
	Axes Release : - 1 1 1 0 0 0 0
	in Motion : 0 0 0 0 0 0 0 0

DIAGNOSIS
S,8..14
	Display the second part of the drive diagnosis
	
	DIAG AXES/SPINDLE
	8== 9== 10== 11== 12== 13== 14==
	S
	
	Motor Temperature [Degree]
	0 0 0 0 0 0 0
	254
	Motor Utilization [%]
	0 0 0 0 0 0 0
	0
	Motor rpm [1/min]
	+0 +0 +0 +0 +0 +0 +0
	+0
	
	      8 9 10 11 12 13 14
	      S - - - - - - -
	I2T Warning : 0 0 0 0 0 0 0 0
	I2T Limitation: - 0 0 0 0 0 0 0
	Inverter Tmax : 0 0 0 0 0 0 0 0
	Drives ready : 0 0 0 0 0 0 0 0
	no Reference : 0 0 0 0 0 0 0 0
	Axes Release : - 0 0 0 0 0 0 0
	in Motion : 0 0 0 0 0 0 0 0

DIAGNOSIS
Step
	Display the third part of the drive diagnosis
	
	DIAG AXES/SPINDLE
	    1 2 3 4 5 6 7
	Axis X Y Z a A B C
	Step 5 5 5 1 1 1 1
	
	    8 9 10 11 12 13 14
	Axis - - - - - - -
	Step 0 0 0 0 0 0 0
	
	Legend
	0 = Initialization
	1 = Wait in position
	2 = Current/speed control on
	3 = Close positioning loop
	4 = Unclamping
	5 = Positioning
	6 = Clamping
	7 = Open positioning loop
	8 = Current/speed control off
	9 = Step end

DIAGNOSIS T	Display tool change diagnosis

Soft key	Function
	DIAG TOOL CHANGE (-1) : * TC auto - Double arm * CASE(0): 00 TC auto start (+1) : 00 TC auto start Standby Pocket : 5 TOOL Pocket W262 : 0 TOOL Number W264 : 0 T Strobe M4073: 0 TZ M4520: 0 T0 M4521: 1 T W Pocket M4522: 0 T W/o Pocket M4523: 0 X Y Z 4 5 6 7 8 9 PLC-Positioning : 0 0 0 0 0 0 0 0 0
DIAGNOSIS **T-MAG**	Display axes status **DIAG TC MAGAZINE** (-1) : * TC magazine - PLC axis * CASE(0): 00 Magazine start (+1) : 01 Tool def quit TC magazine active : off T CALL strobe M4073 : 0 T DEF strobe M4074 : 0 TOOL pocket W262 : 0 TOOL number W264 : 0 TOOL magazine W268 : 0 Standby pocket : 5 Nominal position : 500000
X,Y,Z... **?**	Display tool magazine diagnosis **STATUS AXES** Axes released : 0007 in position : ffffffff in motion : 0000 not pass over ref : 0000 End position + : 0000 End position - : 0000 activate open loop: 0078 open loop : 0078 no axes monitoring: 0000 Actl/noml transfer: 0000 Ref end position : 0000 Feed released : 007f Manual motion + : 0000 Manual motion - : 0000
STATUS **?**	Display spindle status

Soft key	Function
	STATUS SPINDLE Drive release : 0 Drive ready : 0 Orientation : 0 Loop open : 1 in position : 0 no reference : 0 not in ramp : 1 nominal value 0: 1 Rotation left : 0 Rotation right : 0 Speed MP3520 : 0 Thread CYCL 2 : 0 Thread CYCL 17 : 0 nominal rpm : 0 actual rpm : 0 End speed : 0 Programmed rpm : 100
PLC POSIT ? X Z Y	Display status of PLC positioning **PLCPOS PLC->NC** Achse activ Target Feedrate Status 1 X +0.000 0 0 2 Y +0.000 0 0 3 Z +0.000 X 0 0 4 - +0.000 0 0 5 A +0.000 0 0 6 B +0.000 0 0 7 C +0.000 0 0 8 - +0.000 0 0 9 - +0.000 0 0 10 - +0.000 0 0 11 - +0.000 0 0 12 - +0.000 0 0 13 - +0.000 0 0 14 - +0.000 0 0 Status 0: No PLC positioning was started 1: Target position reached 2: PLC positioning was started 3: Target position not reached 4: Target position outside limit 5: Posit impossible (free rotation) 6: Posit temp stopped (NC stop)
DOC M.. M03.. M04..	Display documentation of the M-functions **M Function** machinespecific M00 - programmed stop M01 - conditional stop M02 - END program M03 - spindle right CW on M04 - spindle left CCW on M05 - spindle off M07 - coolant inside on M08 - coolant on M09 - coolant off M10 - clamping axes M11 - unclamping axes M13 - spindle right coolant on M14 - spindle left coolant on M19 - spindle orientation 0 degree M20 - spindle orientation CYCL 13 M21 - start index table M30 - END program M31 - working without M3/M4 M32 - working area monitoring off M44 - clamping mode off axis 4 M45 - clamping mode off axis 5 M46 - clamping mode off axis 6 Page down (Page 1/2)
DOC I/O I24.. O13..	Display documentation of the inputs and outputs

Soft key	Function
	PLC Output/Input

```
PLC Output/Input
                              Value Addr
I_key_NC_start            :  0 - I146
I_key_NC_stop             :  1 - I147
I_key_rapid_traverse      :  0 - I148
O_lamp_NC_start           :  0 - O0
O_lamp_NC_stop            :  1 - O1
I_key_spindle_M3          :  0 - I143
I_key_spindle_M4          :  0 - M8777
I_key_spindle_M5          :  0 - I144
O_lamp_spindle_M3         :  0 - O3
O_lamp_spindle_M4         :  0 - M9001
O_lamp_spindle_M5         :  1 - O2

O_HR410_lamp_NC_start     :  0 - O110
O_HR410_lamp_NC_stop      :  0 - O111
O_HR410_lamp_spindle_M3   :  0 - O109
O_HR410_lamp_spindle_M4   :  0 - M8901
O_HR410_lamp_spindle_M5   :  0 - M8902
I_HR410_key_NC_start      :  0 - I174
I_HR410_key_NC_stop       :  0 - I175
I_HR410_key_spindle_M3    :  0 - I173
I_HR410_key_spindle_M4    :  0 - M8758
I_HR410_key_spindle_M5    :  0 - M8759

Page down                 (Page 1 of 11)
```

2.3   Handwheel (HR410)

Select the Electronic Handwheel operating mode.
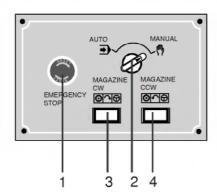
Press and hold a permissive button.
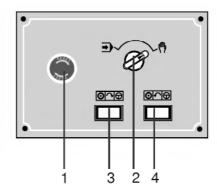
Symbol	Description	Function
1	EMERGENCY STOP button	
2	Handwheel	
3	Axis address keys	
4	Actual-position-capture key	
5	Actual-position-capture key	
6	Keys for defining the feed rate (slow, medium, fast; the feed rates are set by the machine tool builder)	
7	Direction in which the TNC moves the selected axis	
8	Machine function (set by the machine tool builder)	

3. ATC OP. devices

3.1 CAM ATC OP. devices*)

<div style="text-align:center"><English></div>

<div style="text-align:center"><For CE></div>

Symbol	Description	Function
1	Emergency stop switch	- Refer to 2.2.2.4
2	Manual/Auto. Selection Toggle switch	- To select ATC OP. devices' manual operation mode possible/ impossible
3	TOOL/MAG. CW Rotation Button	- To turn the tool magazine in CW
4	TOOL/MAG. CCW Rotation Button	- To turn the tool magazine in CCW
5	Tool Pull-Outer	- To unload the tool into magazine

*) Applied machines

SECTION D

OPERATION

CONTENTS

In this chapter, the method are explained with the process and the devices, which are necessary for each step from power ON to power OFF after end of work.

The contents below is showing overall process and main work.

⚠ CAUTION

1. Before operation, fully understand the machine specifications in machine instruction manual.

⚠ CAUTION

2. Programmer must understand fully the contents in NC instruction manual.

1.　　Power ON

As the process preparing to operate the machine, there can be some differences in the actual action by operating devices.

1) Main power on

Step	Operation	Location	Remark
1	Check the machine state and interference	Machine	- Refer to precautions/ instruction manual
2	Main N.F.B. switch ON	Electric cabinet	- Spindle fan ON - Work light available

2) NC power on

Step	Display	Operation
1	POWER INTERRUPTED	Switch on the power supply for control and machine. The TNC starts the operating system. This process may take several minutes. Then the TNC will display the message "Power interruption."
2	COMPILE PLC PROGRAM	**CE** Press the CE key: The TNC converts the PLC program
3	RELY EXT. DC VOLTAGE MISSING	**I** Switch on the control voltage: The TNC checks operation of the emergency stop circuit and goes into the reference run mode
4	MANUAL OPERATION TRAVERSE REFERENCE POINTS	**I** Cross the reference points manually in the displayed sequence: For each axis press the machine START button, or **X** **Y** Cross the reference points in any sequence: Press and hold the machine axis direction button for each axis until the reference point has been traversed.

2. Power OFF
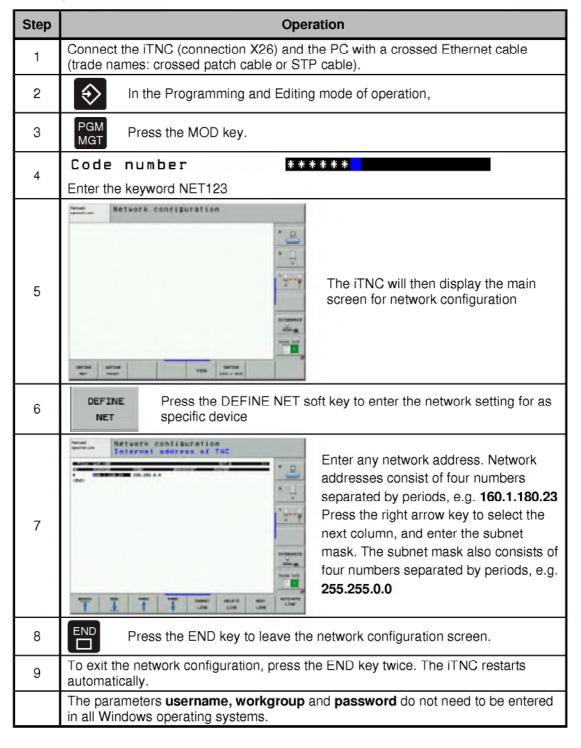
To prevent data from being lost at switch-off, you need to shut down the operating system of the TNC as follows:

Step	Operation
1	Select the Manual Operation mode
2	Select the function for shutting down, confirm again with the YES soft key
3	When the TNC displays the message **Now you can switch off the TNC** in a pop-up window, you may cut off the power supply to the TNC
4	Remember that pressing the END key after the control has been shut down restarts the control. Switch-off during a restart can also result in data loss!
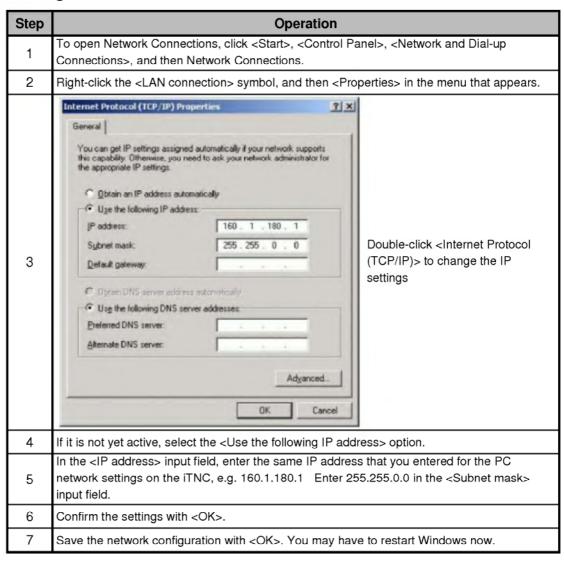
3. Ethernet Interface

The TNC is shipped with a standard Ethernet card to connect the control as a client in your network. The TNC transmits data via the Ethernet card with the **smb** protocol (**s**erver **m**essage **b**lock) for Windows operating systems, or the **TCP/IP** protocol family (Transmission Control Protocol/Internet Protocol) and with support from the NFS (Network File System). The TNC also supports the NFS V3 protocol, which permits higher data transfer rates.

3.1 Settings on the iTNC

Step	Operation
1	Connect the iTNC (connection X26) and the PC with a crossed Ethernet cable (trade names: crossed patch cable or STP cable).
2	In the Programming and Editing mode of operation,
3	Press the MOD key.
4	**Code number** ＊＊＊＊＊＊ Enter the keyword NET123
5	The iTNC will then display the main screen for network configuration
6	Press the DEFINE NET soft key to enter the network setting for as specific device
7	Enter any network address. Network addresses consist of four numbers separated by periods, e.g. **160.1.180.23** Press the right arrow key to select the next column, and enter the subnet mask. The subnet mask also consists of four numbers separated by periods, e.g. **255.255.0.0**
8	Press the END key to leave the network configuration screen.
9	To exit the network configuration, press the END key twice. The iTNC restarts automatically.
	The parameters **username, workgroup** and **password** do not need to be entered in all Windows operating systems.

3.2 Settings on a PC with Windows XP

Step	Operation
1	To open Network Connections, click <Start>, <Control Panel>, <Network and Dial-up Connections>, and then Network Connections.
2	Right-click the <LAN connection> symbol, and then <Properties> in the menu that appears.
3	Double-click <Internet Protocol (TCP/IP)> to change the IP settings
4	If it is not yet active, select the <Use the following IP address> option.
5	In the <IP address> input field, enter the same IP address that you entered for the PC network settings on the iTNC, e.g. 160.1.180.1 Enter 255.255.0.0 in the <Subnet mask> input field.
6	Confirm the settings with <OK>.
7	Save the network configuration with <OK>. You may have to restart Windows now.

In Step 3, the dialog shows:

Internet Protocol (TCP/IP) Properties

General

You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.

○ Obtain an IP address automatically
● Use the following IP address:

IP address: 160 . 1 . 180 . 1
Subnet mask: 255 . 255 . 0 . 0
Default gateway:

○ Obtain DNS server address automatically
● Use the following DNS server addresses:

Preferred DNS server:
Alternate DNS server:

Advanced...

OK   Cancel

3.3 Data transfer between the TNC and TNCremoNT

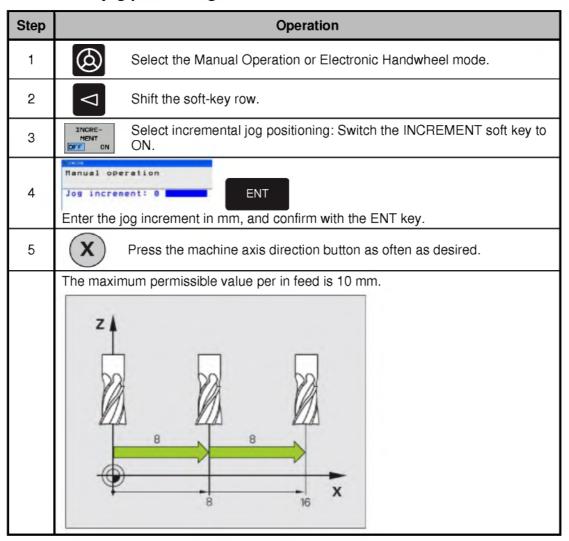| Step	Operation
1	Once you have started TNCremoNT, you will see a list of all files that are stored in the active directory in the upper section of the main window **1**. Using the menu items <File> and <Change directory>, you can change the active directory or select another directory on your PC.
2	Select <File>, <Setup connection>. TNCremoNT now receives the file and directory structure from the TNC and displays this at the bottom left of the main window **2**.
3	To transfer a file from the TNC to the PC, select the file in the TNC window with a mouse click and drag and drop the highlighted file into the PC window **1**.
4	To transfer a file from the PC to the TNC, select the file in the PC window with a mouse click and drag and drop the highlighted file into the TNC window **2**.

4. Position Display Types

Step	Operation
1	✋ Select the Manual Operation mode
2	MOD Select the MOD Key
3	Select the Position display 1 or Position display 2 Select Split screen layout key POSITION + STATUS Select Position + Status Softkey With the MOD function Position display 1, you can select the position display in the status display. With Position display 2, you can select the position display in the additional status display.

| Display	Function
NOML	Nominal position: the value presently commanded by the TNC
ACTL	Actual position; current tool position
REF	Reference position; the actual position relative to the machine datum
DIST	Distance remaining to the programmed position; difference between actual and target positions
LAG	Servo lag; difference between nominal and actual positions (following error)
DEFL	Deflection of the measuring touch probe
M118	Traverses that were carried out with handwheel super positioning (M118) (only Position display 2)

5. Moving the Machine Axes
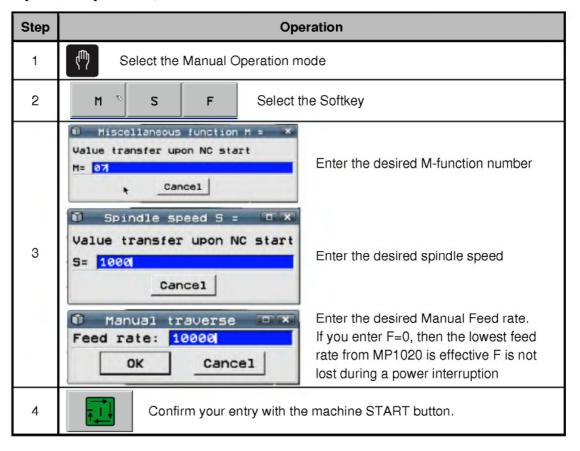
5.1 To traverse with the machine axis direction buttons

Step	Operation
1	(hand icon) Select the Manual Operation mode
2	(X button) Press the machine axis direction button and hold it as long as you wish the axis to move, or
	(X button) (I button) Move the axis continuously: Press and hold the machine axis direction button, then press the machine START button.
3	(0 button) To stop the axis, press the machine STOP button.
4	You can move several axes at a time with these two methods. You can change the feed rate at which the axes are traversed with the F soft key

5.2 Incremental jog positioning

Step	Operation
1	(handwheel icon) Select the Manual Operation or Electronic Handwheel mode.
2	(arrow icon) Shift the soft-key row.
3	(INCREMENT OFF/ON soft key) Select incremental jog positioning: Switch the INCREMENT soft key to ON.
4	Manual operation / Jog increment: 0 (ENT) Enter the jog increment in mm, and confirm with the ENT key.
5	(X button) Press the machine axis direction button as often as desired.
	The maximum permissible value per in feed is 10 mm.

6.   Spindle speed S, Feed Rate F and Miscellaneous Functions M

Step	Operation	
1	✋	Select the Manual Operation mode
2	M S F	Select the Softkey
3	**Miscellaneous function M =** Value transfer upon NC start M= 07 Cancel	Enter the desired M-function number
	Spindle speed S = Value transfer upon NC start S= 1000 Cancel	Enter the desired spindle speed
	Manual traverse Feed rate: 10000 OK Cancel	Enter the desired Manual Feed rate. If you enter F=0, then the lowest feed rate from MP1020 is effective F is not lost during a power interruption
4	⬛	Confirm your entry with the machine START button.

7.   Datum setting

You fix a datum by setting the TNC position display to the coordinates of a known position on the workpiece.
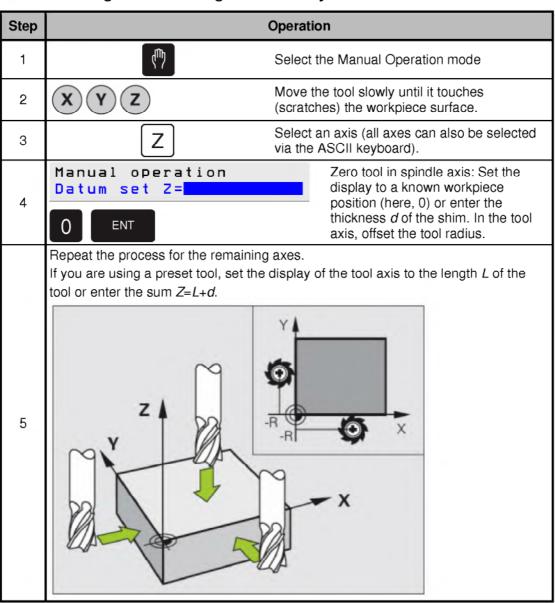
Preparation

Clamp and align the workpiece.

Insert the zero tool with known radius into the spindle.

Ensure that the TNC is showing the actual position values.

7.1   Datum Setting Datum setting with axis keys

Step	Operation	
1	✋	Select the Manual Operation mode
2	X Y Z	Move the tool slowly until it touches (scratches) the workpiece surface.
3	Z	Select an axis (all axes can also be selected via the ASCII keyboard).
4	Manual operation Datum set Z=▮ 0 ENT	Zero tool in spindle axis: Set the display to a known workpiece position (here, 0) or enter the thickness *d* of the shim. In the tool axis, offset the tool radius.
5	Repeat the process for the remaining axes. If you are using a preset tool, set the display of the tool axis to the length *L* of the tool or enter the sum *Z=L+d*. 	

7.2 Datum management with the preset table

Saving the datums in the preset table

The preset table has the name **PRESET.PR,** and is saved in the directory

TNC:\. PRESET.PR is editable only in the **Manual Operation** and **Electronic Handwheel**

modes. In the Programming and Editing mode you can only read the table, not edit it.

It is permitted to copy the preset table into another directory (for data backup). Lines that

were written by your machine tool builder are also always write-protected in the copied

tables. You therefore cannot edit them.

Never change the number of lines in the copied tables! That could cause problems when

you want to reactivate the table.

To activate a preset table copied to another directory you have to copy it back to the

directory **TNC:\.**

7.3 Manually saving the datums in the preset table

Step		Operation
1		Select the Manual Operation mode
2	X Y Z	Move the tool slowly until it touches (scratches) the workpiece surface, or position the measuring dial correspondingly.
3	PRESET TABLE	Displaying the preset table: The TNC opens the preset table and sets the cursor to the active table row.
4	CHANGE PRESET	Select functions for entering the presets: The TNC displays the available possibilities for entry in the softkey row. See the table below for a description of the entry possibilities.
5	↓	Select the line in the preset table that you want to change (the line number is the preset number).
6	→	If needed, select the column (axis) in the preset table that you want to change.
7	CORRECT THE PRESET	Use the soft keys to select one of the available entry possibilities (see the following table).

Soft key	Function
⊣⊢	Directly transfer the actual position of the tool (the measuring dial) as the new datum: This function only saves the datum in the axis which is currently highlighted.
ENTER NEW PRESET	Assign any value to the actual position of the tool (the measuring dial): This function only saves the datum in the axis which is currently highlighted. Enter the desired value in the pop-up window.
CORRECT THE PRESET	Incrementally shift a datum already stored in the table: This function only saves the datum in the axis which is currently highlighted. Enter the desired corrective value with the correct sign in the pop-up window. If inch display is active: enter the value in inches, and the TNC will internally convert the entered values to mm.
EDIT CURRENT FIELD	Directly enter the new datum without calculation of the kinematics (axis-specific). Only use this function if your machine has a rotary table, and you want to set the datum to the center of the rotary table by entering 0. This function only saves the datum in the axis which is currently highlighted. Enter the desired value in the pop-up window. If inch display is active: enter the value in inches, and the TNC will internally convert the entered values to mm.
SAVE PRESET	Write the currently active datum to a selectable line in the table: This function saves the datum in all axes, and then activates the appropriate row in the table automatically. If inch display is active: enter the value in inches, and the TNC will internally convert the entered values to mm.

Editing the preset table

Soft key	Editing function in table mode
BEGIN ↑	Select beginning of table
END ↓	Select end of table
PAGE ↑	Select previous page in table
PAGE ↓	Select next page in table
CHANGE PRESET	Select the functions for preset entry
ACTIVATE PRESET	Activate the datum of the selected line of the preset table
APPEND N LINES	Add the entered number of lines to the end of the table (2nd soft-key row)
COPY FIELD	Copy the highlighted field (2nd soft-key row)
PASTE FIELD	Insert the copied field (2nd soft-key row)
RESET LINE	Reset the selected line: The TNC enters – in all columns (2nd soft-key row)
INSERT LINE	Insert a single line at the end of the table (2nd soft-key row)
DELETE LINE	Delete a single line at the end of the table (2nd soft-key row)

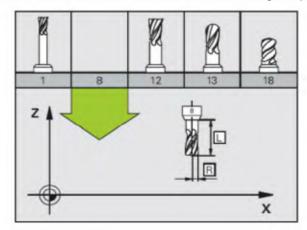## 7.4   Activating a datum from the preset table in the Manual Operation mode

Step		Operation
1	🖐	Select the Manual Operation mode
2	PRESET TABLE	Display the preset table.
3	↑	Select the datum number that you want to activate, or
	GOTO 4 ENT	With the GOTO key, select the datum number that you want to activate. Confirm with the ENT key.
4	ACTIVATE PRESET	Activate the preset.
5	EXECUTE	Confirm activation of the datum. The TNC sets the display and if defined the basic rotation.
6	END	Leave the preset table.
	Activating a datum from the preset table in an NC program To activate datums from the preset table during program run, use Cycle 247. In Cycle 247 you define the number of the datum that you want to activate	

8. Tool

8.1 Tool data

Requirements for tool compensation

You usually program the coordinates of path contours as they are dimensioned in the workpiece drawing. To allow the TNC to calculate the tool center path i.e. the tool compensation you must also enter the length and radius of each tool you are using.

Tool data can be entered either directly in the part program with **TOOL DEF** or separately in a tool table. In a tool table, you can also enter additional data for the specific tool. The TNC will consider all the data entered for the tool when executing the part program.
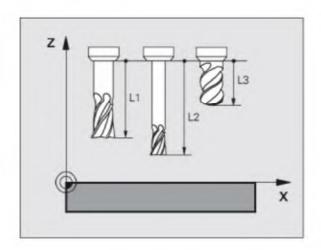

Tool numbers and tool names

Each tool is identified by a number between 0 and 32767. If you are working with tool tables, you can also enter a tool name for each tool. Tool names can have up to 16 characters. The tool number 0 is automatically defined as the zero tool with the length L=0 and the radius R=0. In tool tables, tool T0 should also be defined with L=0 and R=0.

Tool length L

You should always enter the tool length L as an absolute value based on the tool reference point. The entire tool length is essential for the TNC in order to perform numerous functions involving multi-axis machining.
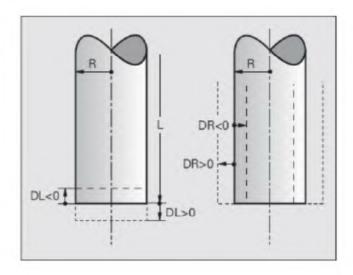
Tool radius R

You can enter the tool radius R directly.

Delta values for lengths and radii

Delta values are offsets in the length and radius of a tool. A positive delta value describes a tool oversize (**DL, DR, DR2**>0). If you are programming the machining data with an allowance, enter the oversize value in the **TOOL CALL** block of the part program. A negative delta value describes a tool undersize (**DL, DR, DR2**<0). An undersize is entered in the tool table for wear. Delta values are usually entered as numerical values. In a **TOOL CALL** block, you can also assign the values to Q parameters. Input range: You can enter a delta value with up to ± 99.999 mm.
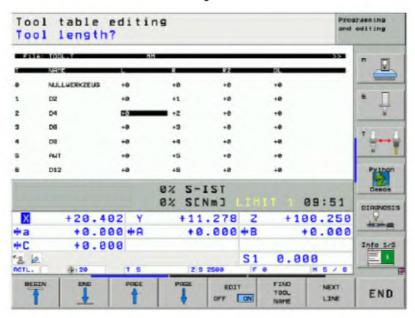
8.2   Entering tool data in the table

Abbr	Operation	Diglog
T	Number by which the tool is called in the program	-
NAME	Name by which the tool is called in the program (no more than 12 characters, all capitals, no spaces)	**Tool name?**
L	Compensation value for tool length L	**Tool length?**
R	Compensation value for the tool radius R	**Tool radius R?**
R2	Tool radius R2 for toroid cutters (only for 3-D radius compensation or graphical representation of a machining operation with spherical or toroid cutters)	**Tool radius R2?**
DL	Delta value for tool length L	**Tool length oversize?**
DR	Delta value for tool radius R	**Tool radius oversize?**
DR2	Delta value for tool radius R2	**Tool radius oversize R2?**
LCUTS	Tooth length of the tool for Cycle 22	**Tooth length in the tool axis?**
ANGLE	Maximum plunge angle of the tool for reciprocating plunge-cut in Cycles 22 and 208	**Maximum plunge angle?**
TL	Set tool lock (**TL:** for Tool Locked)	**Tool locked?** **Yes = ENT / No = NO ENT**
RT	Number of a replacement tool, if available (**RT:** for Replacement Tool; see also **TIME2**)	**Replacement tool?**
TIME1	Maximum tool life in minutes. This function can vary depending on the individual machine tool. Your machine manual provides more information on TIME1.	**Maximum tool age?**
PLC	Information on this tool that is to be sent to the PLC	**PLC status?**

8.3   Editing tool tables

The tool table that is active during execution of the part program is designated as TOOL.T.

You can only edit TOOL.T in one of the machine operating modes. Other tool tables that are to be archived or used for test runs are given different file names with the extension .T.

Step		Operation
1		Select the Manual Operation mode
2		Press the TOOL TABLE soft key to select the tool table.
3		Set the EDIT soft key to ON
4		Select the line in the tool table
5		If needed, select the column.
6		When you have opened the tool table, you can edit the tool data by moving the cursor to the desired position in the table with the arrow keys or the soft keys. You can overwrite the stored values, or enter new values at any position. The available editing functions are illustrated in the table below.

Soft key	Editing function in table mode
BEGIN ↑	Select beginning of table
END ↓	Select end of table
PAGE ↑	Select previous page in table
PAGE ↓	Select next page in table
FIND TOOL NAME	Look for the tool name in the table
LIST FORM	Show tool information in columns or show all information on one tool on one screen page
BEGIN LINE ←	Move to beginning of line
END LINE →	Move to end of line
COPY FIELD	Copy highlighted field
PASTE FIELD	Insert copied field
APPEND N LINES	Add the entered number of lines (tools) at the end of the table.
INSERT LINE	Insert a line for the indexed tool number after the active line. The function is only active if you are permitted to store multiple compensation data for a tool (MP7262 not equal to 0). The TNC inserts a copy of the tool data after the last available index and increases the index by 1. Application: e.g. stepped drill with more than one length compensation value.
DELETE LINE	Delete current line (tool).
POCKET # DISPLAY HIDE	Display / Do not display pocket numbers.
TOOLS DISPLAY HIDE	Display all tools / only those tools that are stored in the pocket table.

8.4   Pocket table for tool changer

For automatic tool changing you need the pocket table TOOL_P.TCH. The TNC can manage several pocket tables with any file names. To activate a specific pocket table for program run you must select it in the file management of a Program Run mode of operation (status M).

In order to be able to manage various magazines in a tool-pocket table (indexing the pocket number), Machine Parameters 7261.0 to 7261.3 must not be equal to 0.

Step	Operation
1	Press the TOOL TABLE soft key to select the tool table.
2	Press the POCKET TABLE soft key to select the pocket table.
3	Set the EDIT soft key to ON. On your machine this might not be necessary or even possible. Refer to your machine manual.

8.5   Entering Pocket data in the table

Abbr	Operation	Diglog
P	Pocket number of the tool in the tool magazine	
T	Tool number	**Tool number?**
ST	Special tool with a large radius requiring several pockets in the tool magazine. If your special tool takes up pockets in front of and behind its actual pocket, these additional pockets need to be locked in column L (status L).	**Special tool?**
F	Fixed tool number. The tool is always returned to the same pocket in the tool magazine	**Fixed pocket?** **Yes = ENT / No = NO ENT**
L	Locked pocket (see also column ST)	**Pocket locked Yes = ENT** **/ No = NO ENT**
PLC	Information on this tool pocket that is to be sent to the PLC	**PLC status?**
TNAME	Display of the tool name from TOOL.T	

Soft key	Editing function in table mode
BEGIN ↑	Select beginning of table
END ↓	Select end of table
PAGE ↑	Select previous page in table
PAGE ↓	Select next page in table
RESET POCKET TABLE	Reset pocket table
RESET COLUMN T	Reset tool number column T
NEXT LINE	Go to beginning of next line
RESET COLUMN	Reset column to original state. Only applies to the columns **RSV**, **LOCKED_ABOVE, LOCKED_BELOW, LOCKED_LEFT** and **LOCKED_RIGHT**

9. ATC Operation

9.1 Manual ATC Operation

Step	Operation
1	✋ Select the Manual Operation mode
2	MOD Select the MOD Key
3	HELP Select the Softkey
4	Select the command line #301 ~ #313
5	Confirm your entry with the machine START button.

Number	Function
#301	S to tool change position
#302	Z to tool change position
#303	Tool pocket Down
#304	Tool pocket up
#305	Tool changer one cycle
#306	Tool changer setup CW
#307	Tool changer setup CCW
#308	Magazine turn CW
#309	Magazine turn CCW
#310	Magazine reference
#311	Delete spindle status
#312	Tool unclamping
#313	Tool calmping

10. Manual Data Input (MDI)

The Positioning with Manual Data Input mode of operation is particularly convenient for simple machining operations or prepositioning of the tool. It enables you to write a short program in HEIDENHAIN conversational programming or in ISO format, and execute it immediately. You can also call TNC cycles. The program is stored in the file $MDI. In the Positioning with MDI operating mode, the additional status displays can also be activated.

Step	Operation
1	Select operating mode: Positioning with MDI.
2	Select the axis of the rotary table, enter the rotation angle you wrote down previously and set the feed rate. For example: **L C+2.561 F50**
3	Conclude entry.
4	Press the machine START button: The rotation of the table corrects the misalignment.

11. Program Run

Program Run, Full Sequence

Start the part program with the machine START button.
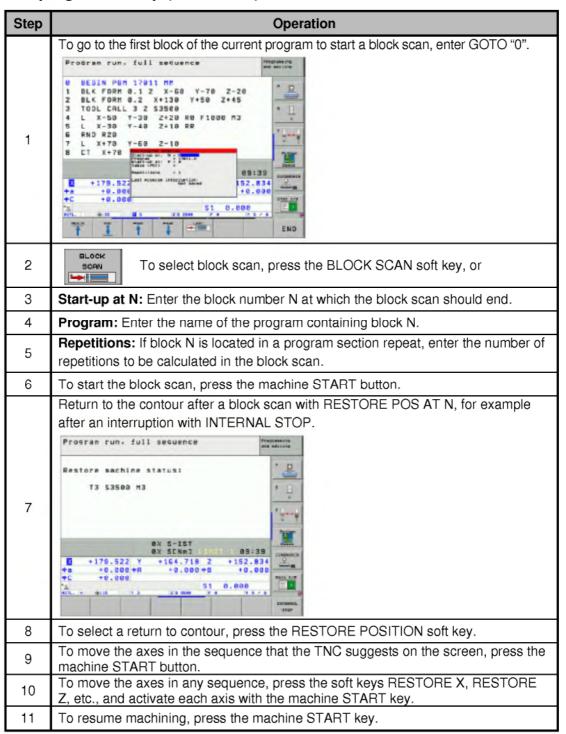
Program Run, Single Block

Start each block of the part program individually with the machine START button.

11.1 Program start
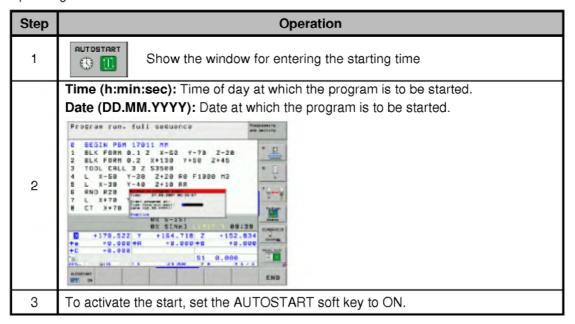
Step	Operation
1	▣▶ or ▶▶ Select operating mode: Program Run, Single Block or Program Run, Full Sequence
2	PGM MGT Select PGM MGT button
3	Call the file manager with the PGM MGT key and select the file
4	Go to the program beginning: Select line 0 with the GOTO key and confirm your entry with the ENT key.
5	**I** Press the machine START button:

11.2   Mid-program startup (block scan)

Step	Operation
1	To go to the first block of the current program to start a block scan, enter GOTO "0".
2	**BLOCK SCAN** (soft key) To select block scan, press the BLOCK SCAN soft key, or
3	**Start-up at N:** Enter the block number N at which the block scan should end.
4	**Program:** Enter the name of the program containing block N.
5	**Repetitions:** If block N is located in a program section repeat, enter the number of repetitions to be calculated in the block scan.
6	To start the block scan, press the machine START button.
7	Return to the contour after a block scan with RESTORE POS AT N, for example after an interruption with INTERNAL STOP.
8	To select a return to contour, press the RESTORE POSITION soft key.
9	To move the axes in the sequence that the TNC suggests on the screen, press the machine START button.
10	To move the axes in any sequence, press the soft keys RESTORE X, RESTORE Z, etc., and activate each axis with the machine START key.
11	To resume machining, press the machine START key.

11.3 Automatic Program Start

In a Program Run operating mode, you can use the AUTOSTART soft key (see figure at upper right) to define a specific time at which the program that is currently active in this operating mode is to be started:

Step	Operation
1	Show the window for entering the starting time
2	**Time (h:min:sec):** Time of day at which the program is to be started. **Date (DD.MM.YYYY):** Date at which the program is to be started.
3	To activate the start, set the AUTOSTART soft key to ON.

11.4 Optional Block Skip

In a test run or program run, the TNC can skip over blocks that begin with a slash "/":

Step	Operation
1	To run or test the program without the blocks preceded by a slash, set the soft key to ON.
2	To run or test the program with the blocks preceded y a slash, set the soft key to OFF.
3	**Erasing the "/" character** In the **Programming and Editing** mode you select the block in which the character is to be erased.

11.5 Optional Program-Run Interruption

Step	Operation
1	Do not interrupt Program Run or Test Run at blocks containing M1: Set soft key to OFF.
2	Interrupt Program Run or Test Run at blocks containing M1: Set soft key to ON.

12. File Management

NOTICE

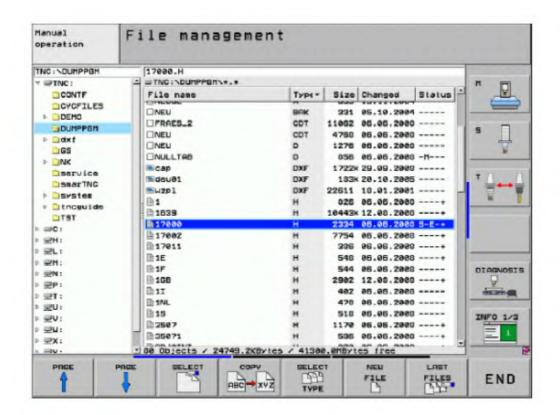Please refer to NC handling manual for detail information.

12.1 Fundamentals

Files in the TNC	Type	Description
Programs	.H	HEIDENHAIN format
	.I	DIN/ISO format
smarT.NC files	.HU	Structured unit program
	.HC	Contour descriptions
	.HP	Point tables for machining positions
Tables	.T	Tools
	.TCH	Tool changers
	.P	Pallets
	.D	Datums
	.PNT	Points
	.PR	Presets
	.CDT	Cutting data
	.TAB	Cutting materials, workpiece materials
	.DEP	Dependent data (such as structure items)
Texts	.A	ASCII files
	.CHM	Help files
Drawing data	.DXF	
Other files	.CFT	Fixture templates
	.CFX	Parameterized fixtures
	.DEP	Dependent data (such as structure items)

12.2   Calling the file manager

Press the PGM MGT key: The TNC displays the file management window (see figure for default setting. If the TNC displays a different screen layout, press the WINDOW soft key.)

Display	Meaning
File name	Name with max. 25 characters
Type	File type
Size	File size in bytes
Changed	Date and time that the file was last changed. The date format can be set.
Status	File properties: **E:** Program is selected in the Programming and Editing mode of operation. **S:** Program is selected in the Test Run mode of operation. **M:** Program is selected in a Program Run mode of operation. **P:** File is protected against deletion and editing. **+:** Dependent files exist (structure file, tool usage file)

12.3 Functions of the file manager

Soft key	Function
	Copy (and convert) individual files
	Select target directory
	Display a specific file type
	Create new file
	Display the last 10 files that were selected
	Delete a file or directory
	Tag a file
	Rename a file
	Protect a file against editing and erasure
	Cancel file protection
	Open a smarT.NC program
	Manage network drives
	Copy a directory
	Display all the directories of a particular drive

12.4   Selecting drives, directories and files

Step	Operation
1	**PGM MGT** Select PGM MGT button
2	With the arrow keys or the soft keys, you can move the highlight to the desired position on the screen: ← → Moves the highlight from the left to the right window, and vice versa. ↓ ↑ Moves the highlight up and down within a window. PAGE↑ PAGE↓ Moves the highlight one page up or down within a window.
	Step 1: Select drive
3	Move the highlight to the desired drive in the left window:
4	**SELECT** To select a drive, press the SELECT soft key, or **ENT** Press the ENT key.
	Step 2: Select a directory
5	Move the highlight to the desired directory in the left-hand window—the right-hand window automatically shows all files stored in the highlighted directory.
6	**SELECT TYPE** Press the SELECT TYPE soft key.
7	**SELECT .H** Press the soft key for the desired file type, or **SHOW ALL** Press the SHOW ALL soft key to display all files, or **4*.H** **ENT** Use wild card characters, e.g. to show all files of the file type .H that begin with 4.
8	Move the highlight to the desired file in the right window
9	**SELECT** Press the SELECT soft key, or **ENT** Press the ENT key.
10	The TNC opens the selected file in the operating mode from which you called the file manager.

12.5 Creating a new part program

Step		Operation
1		Select the **Programming and Editing** operating mode.
2	PGM MGT	Press the PGM MGT key to call the file manager.
3		Select the directory in which you wish to store the new program:
4	NEW FILE	Select the NEW FILE softkey
5	New file — File name: OLD.H — Yes No — ENT	Enter the new program name and confirm your entry with the ENT key.
6	M M	To select the unit of measure, press the MM or INCH soft key. The TNC switches the screen layout and initiates the dialog for defining the **BLK FORM** (workpiece blank).
7	WORKING SPINDLE AXIS X/Y/Z? — Z	Enter spindle axis, e.g. Z
6	DEF BLK FORM: MIN CORNER? — ENT	Enter in sequence the X, Y and Z coordinates of the MIN point and confirm each of your entries with the ENT key.
7	DEF BLK FORM: MAX CORNER? — ENT	Enter in sequence the X, Y and Z coordinates of the MAX point and confirm each of your entries with the ENT key.
8		

12.6 Programming tool movements in conversational format

Step	Operation
1	Dialog initiation
2	**COORDINATES?** **X** 10 Enter the target coordinate for the X axis.
3	**Y** 20 **ENT** Enter the target coordinate for the Y axis, and go to the next question with ENT
4	**RADIUS COMP. RL/RR/NO COMP. ?** **ENT** Enter "No radius compensation" and go to the next question with ENT.
5	**FEED RATE F=? / F MAX = ENT** 100 **ENT** Enter a feed rate of 100 mm/min for this path contour; go to the next question with ENT.
6	**MISCELLANEOUS FUNCTION M?** 3 **ENT** Enter the miscellaneous function **M3** "spindle ON." Pressing the ENT key terminates this dialog.
7	**3 L X+10 Y+5 R0 F100 M3** The program-block window displays the following line:
8	

Key	Function
NO ENT	Ignore the dialog question
END	End the dialog immediately
DEL	Abort the dialog and erase the block