



OPERATORS MANUAL

MAKINO A100-5XR-CD

WITH

PROFESSIONAL 3 NC CONTROL



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Power On & Reference Procedure

1. Turn ISOLATOR On
2. Press CONTROL POWER ON button
3. Wait for EMG to go off at the bottom of the screen (takes approx 2 minutes)
4. Press the AUTO ZERO button
5. Press the START button located below the auto zero button
6. Turn the rapid override up after checking the safe movement of the machine
7. Select B axis and jog mode , jog B axis in minus direction
8. Select Reference mode and hold down the plus direction button
9. In Reference mode , select A axis and hold down the minus direction button
10. In Reference mode , select U axis and hold down the plus direction button
11. There should now be six green lights lit

To reference the Pu and Pv axis use the following M-codes in MDI:-

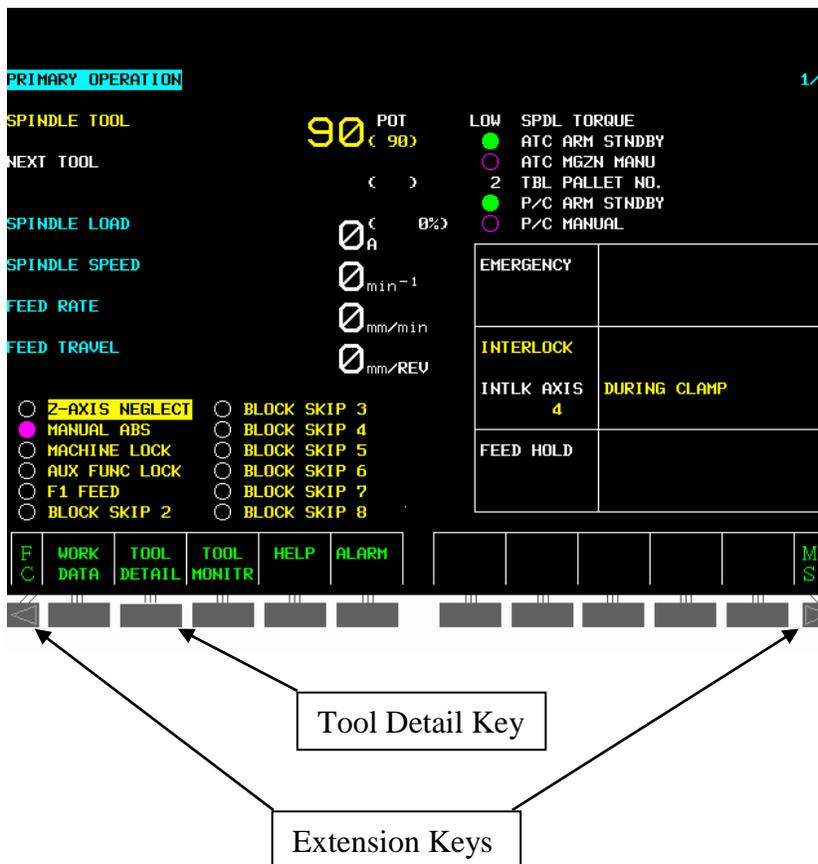
M803 – Pu Axis

M806 – Pv Axis

Registering Tool N^o To Pot N^o

The location of each tool in the magazine must be recorded on the Tool Data Screen.

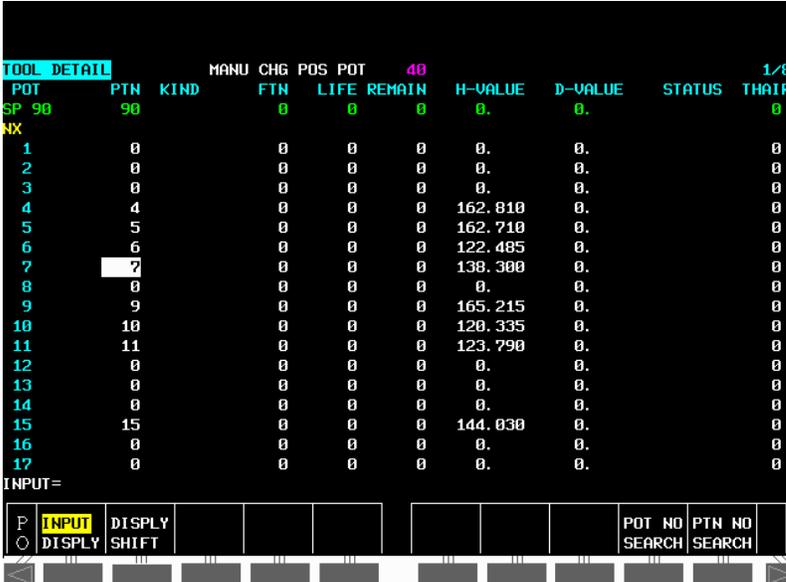
1. Select CUSTOM display button
2. The Primary Operation Screen should be displayed
3. Use extension key (MS, FC, PO) button to find Tool Detail button



4. Press Tool Detail Key
5. Press INPUT/DISPLY to highlight INPUT
6. Cursor to the required Pot Number and enter the Tool number in the PTN column.
7. Press INPUT/DISPLAY to Lock

Entering Tool Length and Tool Radius

1. Select CUSTOM display button.
2. Use extension key (MS, FC, PO) button to find TOOL DETAIL button
3. Press TOOL DETAIL as previous
4. Press INPUT/DISPLY to highlight INPUT



POT	PTN	KIND	FTN	LIFE	REMAIN	H-VALUE	D-VALUE	STATUS	THAIR
SP 90	90		0	0	0	0.	0.		0
1	0		0	0	0	0.	0.		0
2	0		0	0	0	0.	0.		0
3	0		0	0	0	0.	0.		0
4	4		0	0	0	162.810	0.		0
5	5		0	0	0	162.710	0.		0
6	6		0	0	0	122.485	0.		0
7	?		0	0	0	138.300	0.		0
8	0		0	0	0	0.	0.		0
9	9		0	0	0	165.215	0.		0
10	10		0	0	0	120.335	0.		0
11	11		0	0	0	123.790	0.		0
12	0		0	0	0	0.	0.		0
13	0		0	0	0	0.	0.		0
14	0		0	0	0	0.	0.		0
15	15		0	0	0	144.030	0.		0
16	0		0	0	0	0.	0.		0
17	0		0	0	0	0.	0.		0

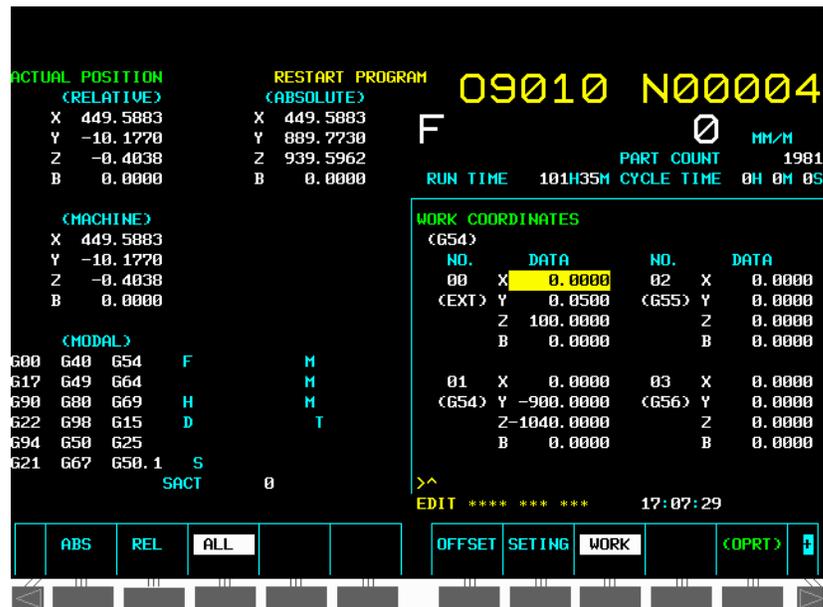
INPUT=

5. Press DISPLAY SHIFT(soft key) to display H-VALUE or D-VALUE
6. Move the cursor to the required tool and column (H = length D=radius)
7. Key in the Data
8. Press the INPUT button on the control panel
9. Press INPUT/DISPLAY to Lock

Entering a known Program Zero

Available In Any Mode.

1. Press OFFSET / SETTING button
2. Press WORK soft key
3. Page and cursor to relevant offset number



4. Highlight relevant axis to be set using cursor keys
5. Key-in data e.g. -603.686
6. Press INPUT button

Setting A Program Zero To a Component Feature

1. Load and clamp a DTI into spindle
2. Using rapid buttons and pulse handle, clock a hole or spigot of known true position
3. Press OFFSET button
4. Press WORK soft key
5. Page and cursor to program zero offset number
6. Key in noted data from the [Machine Position](#)
7. Press INPUT button

Note: If faces of known position are used then insert test bar in spindle instead of DTI, manually, position to the known face and add or subtract the test bar radius of step 6.

The screenshot shows the following data on the control panel:

ACTUAL POSITION (RELATIVE)				RESTART PROGRAM (ABSOLUTE)			
X	449.5883	X	449.5883				
Y	-10.1770	Y	889.7730				
Z	-0.4038	Z	939.5962				
B	0.0000	B	0.0000				

Program ID: 09010 N00004
 F (Feed Rate) 0 (Zero) MM/M
 PART COUNT 1981
 RUN TIME 101H35M CYCLE TIME 0H 0M 0S

MACHINE			
X	449.5883	Y	-10.1770
Z	-0.4038	B	0.0000

Key in this Data

WORK COORDINATES (G54)							
NO.	DATA	NO.	DATA				
00	X 0.0000	02	X 0.0000				
(EXT)	Y 0.0500	(G55)	Y 0.0000				
	Z 100.0000		Z 0.0000				
	B 0.0000	B	0.0000				
01	X 0.0000	03	X 0.0000				
(G54)	Y -900.0000	(G56)	Y 0.0000				
	Z -1040.0000		Z 0.0000				
	B 0.0000	B	0.0000				

MODAL: G00 G40 G54 F M, G17 G49 G64 M, G90 G80 G69 H M, G22 G98 G15 D T, G94 G50 G25, G21 G67 G50.1 S, SACT 0

EDIT **** * * * * 17:07:29

Buttons: ABS, REL, ALL, OFFSET, SETING, WORK, (OPRT)



For Z Axis

1. Manually position end of test bar to a known face.
2. Repeat steps 5 to 7 as previous page, take into account the length of the test bar, i.e. If the Z face is to be at zero and the test bar length is 150mm, the calculation should be:

Z Pos from screen – Test bar length

e.g. $-360.035 - 150 = -510.035$



To Enter Operating Area

1. Press MANUAL RELEASE button when GREEN AVAILABLE light is on
2. Keeping button pressed , open operator door

Note! If the green light is not on it is usually one of the following

- A) The coolant is still on
- B) A spindle is running
- C) The chip conveyor is running

To Enter ATC Magazine

1. Press DOOR LOCK RELEASE button
2. Open ATC MAGAZINE door

Note! Access can only be gained if the machine operator door is closed

To Load a Tool Into Either Spindle

1. Select HANDLE mode
2. Ensure spindles, coolant and chip conveyor are turned off and stationary
3. Ensure SPINDLE ENABLE key switch is in the on position
4. Ensure SPINDLE ENABLE lamp is off for main spindle or on for dresser spindle
5. Open operator door
6. Press TOOL UNCLAMP/CLAMP button to unclamp spindle
6. Put tool into spindle and ensure that the drive dogs are engaged
7. Press TOOL UNCLAMP/CLAMP button to clamp spindle
8. Close operators door



Wheel Dress Routine's

Initial Dressing of Wheels

This must be performed when you replace a worn grinding wheel with a new wheel:

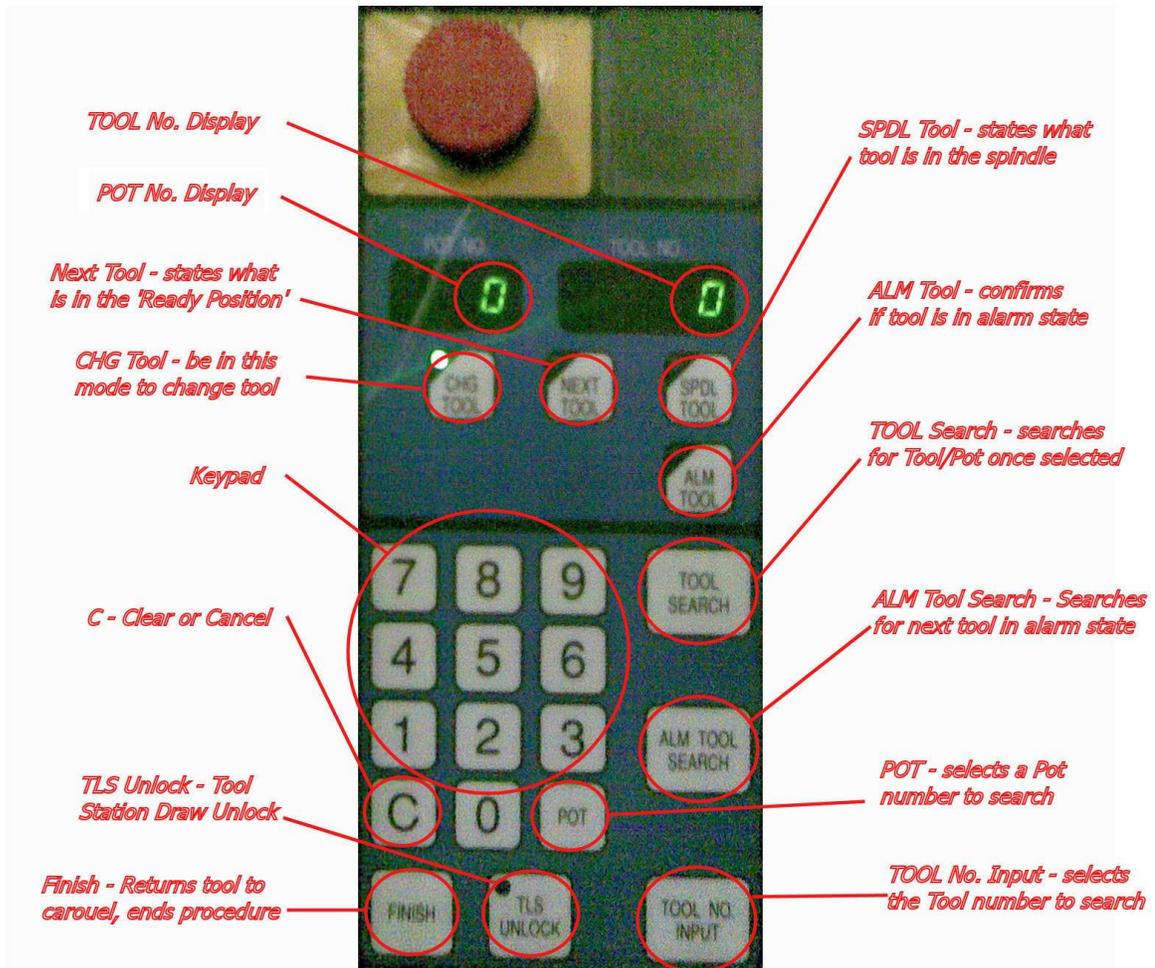
1. Replace the worn wheel with the correct new wheel
2. Select the required program O6*** (e.g. T103 = O6103)
3. Run the program in automatic taking care on first time (e.g. SINGLE BLOCK)
4. Visually check the new wheel

Manual Dressing of Wheels

1. Select the required program O7*** (e.g. T103 = O4103)
2. In the EDIT mode, enter the required dress amount in the A value (e.g. A=0.4)
3. Run the program in automatic taking care on first time (e.g. SINGLE BLOCK)
4. Visually check the dressed wheel



Using The Tool Magazine



NOTE: If the TLS alarms you will see a code flash in the display POT NO. & TOOL NO. It will read A18 000_.
 If at any point you enter the wrong figure press 'C' to reset

alarms

- A18 0006 – operator door not shut
- A18 0009 – tool I.D. not in tool data

To bring a tool into the draw you must be in mode
 To view what tool/pot is in the Ready Position select
 To view what tool/pot is in the Spindle select

'CHG TOOL'
 'NEXT TOOL'
 'SPDL TOOL'



To Call A Pot Number To The Drawer

On the magazine control panel:

1. Press the POT key on the Number Pad
2. Enter the required POT number
3. Press TOOL SEARCH Key
4. (The tool is delivered to the drawer)
5. Press TLS UNLOCK
6. Rotate the drawer handle and open the tooling drawer
7. When loading a dresser ensure 'deep slot is down'
8. Close the drawer and manually lock using the handle
9. Press TLS UNLOCK
10. Press FINISH

To Call A Tool Number To The Drawer

On the magazine control panel:

1. Ensure the display is shown as a tool number
2. Enter the required Tool number
3. Press TOOL SEARCH Key
4. (The tool is delivered to the drawer)
5. Press TLS UNLOCK
6. Rotate the drawer handle and open the tooling drawer
7. When loading a dresser ensure 'deep slot is down'
8. Close the drawer and manually lock using the handle
9. Press TLS UNLOCK
10. Press FINISH

To view tools which are in an alarm state:-

Simply push the 'ALM TOOL SEARCH' and the next alarmed tool will be brought into the carousel. If more than one tool is alarmed the select 'ALM TOOL SEARCH' again and the next alarmed tool comes into the draw, and so on until the tools loop



Main Spindle Tool Change In MDI

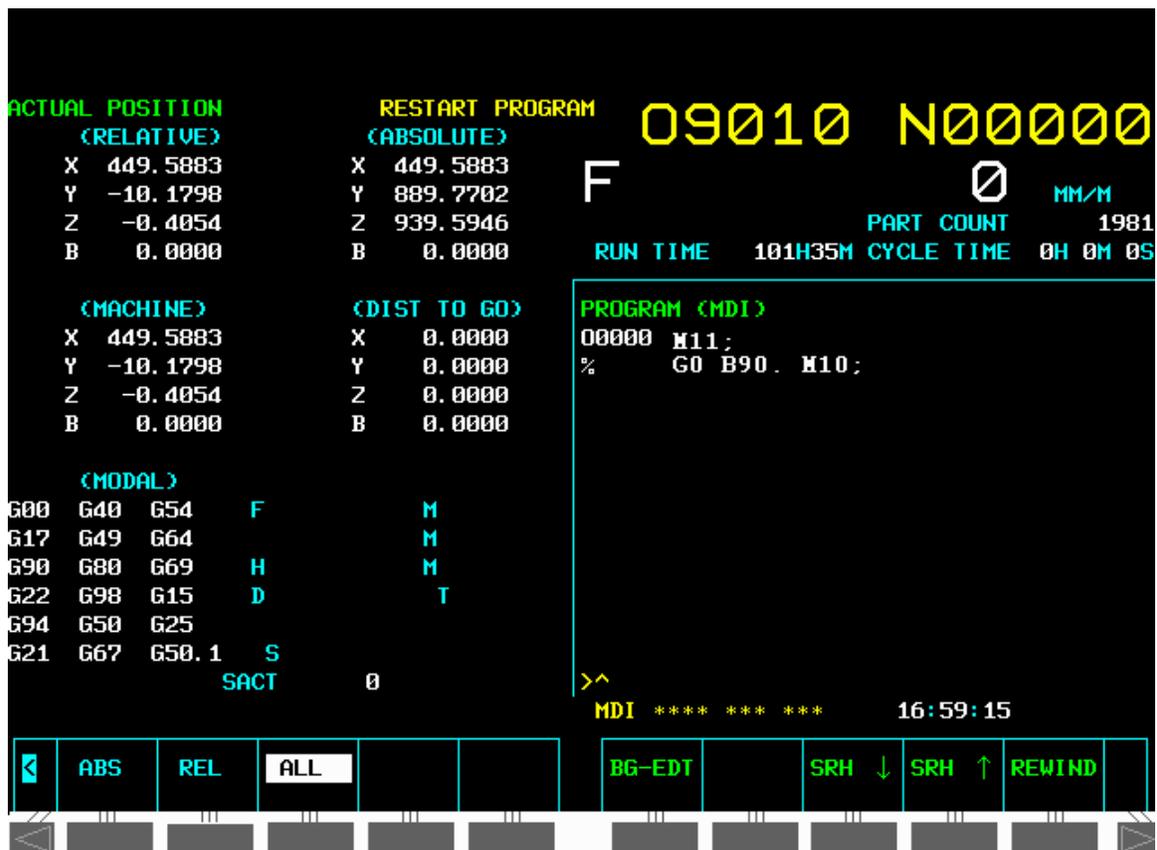
1. Reduce RAPID switch to minimum
2. Reduce FEEDRATE switch to zero
3. Select SINGLE BLOCK
4. Select MDI mode button
5. Press PROGRAM button
6. Key-in the following, G65 P9800 T101 (T101 is the tool we are selecting);
7. Press INSERT button
8. Press CYCLE START
9. Increase RAPID and FEEDRATE switches safely (observing actual axis movement).

Dresser Spindle Tool Change In MDI

1. Reduce RAPID switch to minimum
2. Reduce FEEDRATE switch to zero
3. Select SINGLE BLOCK
4. Select MDI mode button
5. Press PROGRAM button
6. Key-in the following, G65 P9801 T1001 (T1001 is the tool we are selecting);
7. Press INSERT button
8. Press CYCLE START
9. Increase RAPID and FEEDRATE switches safely (observing actual axis movement).

Moving The B Axis In MDI

1. Reduce RAPID switch to minimum
2. Reduce FEEDRATE switch to zero
3. Select SINGLE BLOCK
4. Select MDI mode button
5. Press PROGRAM button
6. Key-in index position i.e. M11; G0 G90 B90. M10;



7. Press INSERT button
8. Press CYCLE START



Manual Change of Erowa Pallet

1. Use JOG and HANDLE modes to move axes to a convenient load/unload position
2. Close operator door
3. Select M.D.I. mode
4. Press PROGRAM button
5. Key in M589;
6. Press INSERT button.
7. Press CYCLE START button
8. Machine is now fixed in handle mode and control box on front of machine is used for the following steps (instead of a robot loader)
9. Turn keyswitch to HAND mode
10. Press DOOR OPEN to open front up/down door
11. Ensure pallet/fixture is supported manually or by crane, hoist etc.
12. Press CHUCK UNCLAMP to release Erowa pallet
13. Present new pallet/fixture to the Erowa system
14. Press CHUCK CLAMP to clamp new Erowa pallet
15. Press DOOR CLOSE to close front up/down door
16. Turn keyswitch to AUTO mode
17. Press RESET to finish loading sequence and return to main machine control panel

Note: M589 is linked with subprogram O9022, upon sending M589 the machine will launch program O9022, at the end of O9022 is the second M589. When the control reads the second M589 is when Work Change Request is activated. To avoid any machine movement delete all content within sub-program O9022 except the M589, or add into the sub-program aa jump which avoids all data except the M589



Axis Move In MDI

1. Reduce RAPID switch to minimum
2. Reduce FEEDRATE switch to zero
3. Select MDI mode button
4. Select SINGLE BLOCK
5. Press PROGRAM button
6. Key-in axis movement i.e.G0 G90 G54 X 100. Y100.;
7. Press INSERT button
8. Press CYCLE START
9. Increase RAPID and FEEDRATE OVERRIDES' switch safely (observing actual axis movements).

Nozzle Change In MDI

1. Reduce RAPID switch to minimum
2. Reduce FEEDRATE switch to zero
3. Select MDI mode button
4. Select SINGLE BLOCK
5. Press PROGRAM button
6. Key-in G65 P9821 A3. (A is the number of the required nozzle)
7. Press INSERT button
8. Press CYCLE START
9. Increase RAPID and FEEDRATE OVERRIDES' switch safely (observing actual axis movements).
10. Current nozzle will be replaced with the requested one



Mid Auto Manual Interruption

1. Press FEED HOLD
2. Press COOLANT ON/OFF to turn off coolant
3. Turn off dresser coolant (angle plate coolant) if in use
4. Ensure SPIDLE ENABLE light is off
5. Press SPINDLE STOP to stop main spindle
6. Press SPINDLE ENABLE to illuminate light
7. Press SPINDLE STOP to stop dresser spindle
8. Select HANDLE MODE
9. Press MANUAL RELEASE button and pull open door (green lamp must be on)
10. Carry out manual operation i.e. wheel inspection
11. Close door
12. Select MEMORY MODE
13. Press SPINDLE START to start dresser spindle
14. Press SPINDLE ENABLE to turn lamp off
15. Press SPINDLE START to start main spindle
16. Press COOLANT ON/OFF to turn on coolant
17. Turn on dresser coolant (angle plate coolant) if required
18. Press SINGLE BLOCK
19. Reduce RAPID switch to minimum
20. Reduce FEEDRATE switch to zero
21. Press CYCLE START
22. Increase RAPID OVERRIDE and/or FEEDRATE switches safely

21. CONTINUE IN SINGLE BLOCK UNTIL IT IS SAFE FOR FULL AUTO

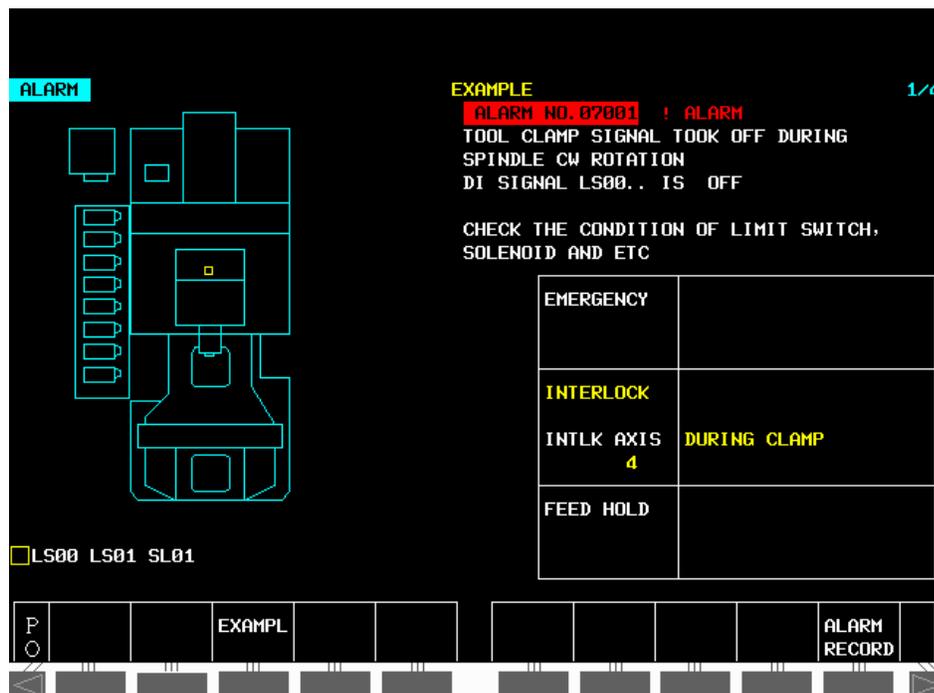
Note: if at any point you have pushed the reset button you must not continue as you will have lost your place in the program and all non-modal information.

Alarm Recovery Procedure

1. Remedy problem
2. Press RESET on main panel for NC alarm
3. Press ALARM RESET M/C button for machine alarm
4. Select JOG or RAPID mode
5. Select Z axis button
6. Press '+' button to retract spindle
7. Increase rapid on JOG OVERRIDE switch if necessary

Makino M/C Alarms

Alarm number will be displayed, with a description of the alarm
 Press NEXT ALARM soft key if next alarm exists
 Recovery procedure can mean pressing alarm reset soft key or if it is displayed the retry soft key.



To Clear Makino M/C Alarms Press ALARM RESET M/C button



Alarm History

1. Press CUSTOM button

ALARM RECORD-1 1/10

ALARM NO.	KIND	DATE	TIME
1. 13033	! ALARM	18. DEC. 2001	10:27
NC ALARM IS GENERATED BMI SIGNAL AL... IS ON			
2. 21015	! ALARM	13. DEC. 2001	13:16
SL MONITOR ALARM IS GENERATED			
3. 13003	! ALARM	13. DEC. 2001	12:35
THERMAL RELAY IS TRIPPED DI SIGNAL THA... WENT OFF			
4. 13003	! ALARM	13. DEC. 2001	12:35
THERMAL RELAY IS TRIPPED DI SIGNAL THA... WENT OFF			
5. 13003	! ALARM	13. DEC. 2001	12:35
THERMAL RELAY IS TRIPPED DI SIGNAL THA... WENT OFF			
6. 13033	! ALARM	13. DEC. 2001	12:31
NC ALARM IS GENERATED BMI SIGNAL AL... IS ON			

Control Panel: P O, CLEAR, RECORD NO. 2, ALARM

2. Use (MS, FC or PO) soft key to find ALARM soft key
3. Press ALARM soft key
4. Press ALARM RECORD soft key

The last 20 alarms are displayed, number one being the last one.



Program Editing

Main Program Number is preceded by the letter O. Program ends M30.
Sub Program Number is preceded by the letter O. Program ends M99.

TO LOAD PROGRAM

1. EDIT mode
2. PRGRM button
3. Key-in program number e.g.O1234
4. READ button
5. EXECUTE button

TO PUNCH PROGRAM FROM MEMORY

1. EDIT mode
2. PROGRAM button
3. Key-in program number e.g.O1234
4. PUNCH button
5. EXECUTE button

TO CHANGE A STORED PROGRAM NUMBER

1. EDIT
2. PROGRAM button
3. Cursor to program number
4. Key-in new program number
5. Press the HOME (ALTER) button



TO SEE DIRECTORY

1. EDIT mode
2. PROGRAM button
3. DIR soft key
4. Use arrow soft keys to page through directory

TO PROGRAM SEARCH

1. MEM or EDIT
2. PROGRAM button
3. Key-in program number
4. Cursor down

TO ADDRESS SEARCH

1. EDIT or MEM
2. PROGRAM button
3. Key-in address to be search for e.g. N67
4. Cursor down

TO DELETE A PROGRAM

1. EDIT mode
2. PROGRAM button
3. Key-in program number to be deleted
4. DELETE button.

TO MODIFY ADDRESS DATA

1. EDIT mode
2. PROGRAM button
3. Cursor to relevant address
4. Key-in new data
5. HOME (ALTER) button



Spindle Load Monitoring

The cutting load can be monitored and an alarm generated if the load exceeds the maximum expected load.

The Makino can *learn* the loads exerted during normal cutting and automatically set the maximum allowed load to a percentage higher.

The maximum load is normally set at 125% of the maximum cutting load

To set SL values automatically:

1. Select CUSTOM display button.
2. Use extension key (MS, FC, PO) button to find TOOL MONITR button
3. Press TOOL MONITR button
4. Press the STUDY MODE soft key to colour the circle next to the STUDY display.
5. Run the program under normal condition (speed and feed at 100%)
6. When program is complete turn SUDY MODE off on TOOL MONITOR page
7. SL values are load into TOOL DATA page at the end of each tool.

SL values can be edited on the TOOL DATA page.

To Apply Spindle Load Monitoring:

1. Select CUSTOM display button.
2. Use extension key (MS, FC, PO) button to find TOOL MONITR button
3. Press TOOL MONITR button
4. Press the SL MODE soft key to colour the circle next to the SL display.
5. An alarm will be generated if the load on a tool exceeds the SL value

NOTE: SL monitoring and STUDY MODE must be activated before the program is started.



G Codes

G00	RAPID
G01	FEED (LINEAR)
G02	CW FEED
G03	CCW FEED
G04	DWELL
G09	EXACT STOP
G10	DATA SETTING
G11	DATA SETTING CANCEL
G15	POLAR CO-ORDINATE COMMAND: CANCEL
G16	POLAR CO-ORDINATE COMMAND
G17	PLANE SELECTION: XY
G18	PLANE SELECTION: ZX
G19	PLANE SELECTION: YZ
G20	IMPERIAL INPUT
G21	METRIC
G22	STORED STROKE CHECK FUNCTION: ON
G23	STORED STROKE CHECK FUNCTION: OFF
G27	REFERENCE POINT RETURN CHECK
G28	RETURN TO REFERENCE POINT
G29	RETURN FROM REFERENCE POINT
G30	REFERENCE POINT RETURN (SECOND, THIRD, FOURTH)
G31	SKIP FUNCTION
G33	THREAD CUTTING
G39	CORNER OFFSET CIRCULAR INTERPOLATION
G40	CUTTER RADIUS COMPENSATION: CANCEL
G41	CUTTER RADIUS COMPENSATION: LEFT
G42	CUTTER RADIUS COMPENSATION: RIGHT
G43	TOOL LENGTH COMPENSATION: +
G44	TOOL LENGTH COMPENSATION: -
G49	TOOL LENGTH COMPENSATION: CANCEL
G50	SCALING: CANCEL
G51	SCALING: ON
G52	LOCAL CO-ORDINATE SYSTEM SETTING
G53	MACHINE CO-ORDINATE SYSTEM SELECTION
G54	WORK CO-ORDINATE SYSTEM SELECTION 1
G55	WORK CO-ORDINATE SYSTEM SELECTION 2
G56	WORK CO-ORDINATE SYSTEM SELECTION 3



G57	WORK CO-ORDINATE SYSTEM SELECTION 4
G58	WORK CO-ORDINATE SYSTEM SELECTION 5
G59	WORK CO-ORDINATE SYSTEM SELECTION 6
G60	ONE DIRECTIONAL POSITIONING
G61	EXACT STOP MODE
G62	AUTOMATIC CORNER OVERRIDE MODE
G63	TAPPING MODE
G64	CUTTING MODE
G68	CO-ORDINATE SYSTEM ROTATION
G69	CO-ORDINATE SYSTEM ROTATION: CANCEL
G73	FIXED CYCLE: HIGH SPEED DRILLING
G74	FIXED CYCLE: REVERSE TAPPING
G76	FIXED CYCLE: FINE BORING
G80	FIXED CYCLE: CANCEL
G81	FIXED CYCLE: DRILL/SPOT BORING
G82	FIXED CYCLE: DRILL/COUNTER BORING
G83	FIXED CYCLE: DEEP-HOLE DRILLING CYCLE
G84	FIXED CYCLE: TAPPING
G85	FIXED CYCLE: BORING (BACK)
G86	FIXED CYCLE: BORING (STD)
G87	FIXED CYCLE: BACK BORING (RAPID IN/FEED BACK)
G88	FIXED CYCLE: BORING CYCLE
G89	FIXED CYCLE: BORING
G90	ABSOLUTE
G91	INCREMENTAL
G92	SETTING OF WORK CO-ORD SYSTEM
G94	FEED PER MIN
G95	FEED PER REV
G98	RETURN TO INITIAL POINT IN CANNED CYCLE
G99	RETURN TO POINT R IN CANNED CYCLE



M CODES

M00	PROGRAM STOP
M01	OPTIONAL STOP
M02	END OF PROGRAM
M03	SPINDLE START IN CW DIRECTION
M04	SPINDLE START IN CCW DIRECTION
M05	SPINDLE STOP
M06	AUTOMATIC TOOL CHANGE
M07	MIST COOLANT OR AIR BLOW ON
M08	NOZZLE COOLANT ON
M09	COOLANT OFF
M10	4TH AXIS CLAMP
M11	4TH AXIS UNCLAMP
M12	5TH AXIS CLAMP
M13	5TH AXIS UNCLAMP
M14	BTS ARM ADVANCE (MOVABLE BTS)
M15	INDEX TABLE CCW
M16	4TH-AXIS MIRROR IMAGE ON
M18	BTS ARM RETRACT (MOVABLE BTS)
M19	SPINDLE ORIENTATION
M20	BTS (BROKEN TOOL DETECTION) CHECK
M21	X-AXIS MIRROR IMAGE ON
M22	Y-AXIS MIRROR IMAGE ON
M23	MIRROR IMAGE OFF
M26	THROUGH SPINDLE COOLANT ON
M27	TAP OIL (MIST, JET) ON
M28	THROUGH TOOL AIR ON
M29	UNCONDITIONAL POWER CUT
M30	END OF PROGRAM & REWIND
M31	WORK AUTOMATIC MEASURING MODE
M32	TOOL LENGTH AUTO MEASURING MODE
M33	TOOL LENGTH CIRCUIT CHECK



M34 WORK AUTO MEASURING, SPARE TOOL CALL
M35 WORK AUTO MEASURING, PALLET UNLOAD
M36 PRIOR TOOL CHECK MODE
M37 TOOL DATA REGISTER MODE OFF
M38 AC. SL VALUE TEMPORARY ALTER MODE ON
M39 AC. SL VALUE TEMPORARY ALTERATION
M40 TL REMAIN. DATA REGISTER MODE ON
M41 SL COEFFICIENT SETTING 125%
M42 SL COEFFICIENT SETTING 150%
M43 SL COEFFICIENT SETTING 200%
M44 SL AC COEFFICIENT 0%
M46 SL DATA REGISTER MODE ON
M47 AC DATA REGISTER MODE ON
M48 M49 MODE CANCEL
M49 FEEDRATE OVERRIDE CANCEL

M50 AC COEFFICI 100% SL COEFFIC 200%
M51 M52 MODE CANCEL
M52 AUTO. UNLOAD INHIBIT MODE AT ALM.
M53 TOOL OFFSET DATA REGISTER MODE
M54 TOOL OFFSET MINUS REGIST. MODE
M56 TOOL OFFSET DATA TRANSF. COMMAND
M57 TOOL NUMBER REGISTERING MODE ON
M58 M59 MODE CANCEL
M59 SPINDLE SPEED OVERRIDE CANCEL

M60 PALLET CHANGE
M68 NO. 2 M-CODE DESIGNATION

M70 QTY. VECTOR TAKE-IN
M71 QTY. VECTOR PROCESS INCREMENT
M72 QTY. VECTOR QTY DECREMENT
M76 BUZZER 1 ON (WITHOUT READY)
M77 THROUGH SPINDLE AIR ON



M78 REVOLV LIGHT 1 ON NO READY PALLET
M79 REVOLV LIGHT 2 ON NO READY PALLET

M84 PALLET 1 LOAD CHECK
M85 AUTO. MEASURING APPROACH MODE
M86 AUTO. MEASURING FAST FEED MODE
M93 SPARE TOOL REGISTER MODE ON
M94 TOOL DATA DELETE MODE ON
M95 PALLET 2 LOAD CHECK
M96 THROUGH TOOL COOLANT ON
M97 SHOWER COOLANT ON
M98 SUB-PROGRAM ACCESS
M99 RETURN TO MAIN PROGRAM

M135 RIGID TAP MODE ON

M140 FIRST BLOCK SKIP ON
M141 FIRST BLOCK SKIP OFF
M142 FIRST BLOCK SKIP RETURN
M146 ODEC SURFACE READY CONTROL
M147 90 DEC SURFACE READY CONTROL
M148 180 DEC SURFACE READY CONTROL
M149 270 DEC SURFACE READY CONTROL

M150 BLOCK SKIP (2 TO 9) OFF
M152 BLOCK SKIP 2 ON
M153 BLOCK SKIP 3 ON
M154 BLOCK SKIP 4 ON
M155 BLOCK SKIP 5 ON
M156 BLOCK SKIP 6 ON
M157 BLOCK SKIP 7 ON
M158 BLOCK SKIP 8 ON
M159 BLOCK SKIP 9 ON



M302 FIN CHECK FOR M303 OR M304
M303 SPINDLE CW WITHOUT WAITING FIN
M304 SPINDLE CCW WITHOUT WAITING FIN
M307 COOLANT AND SPDL PAUSE AND STORE
M308 COOLANT AND SPINDLE RECOVER

M312 COOLANT STOP AND STORE
M313 COOLANT RECOVER
M315 OILMATIC OFF
M316 OILMATIC ON
M319 PRE-ORIENTATION
M325 CS-AXIS CONTOURING MODE OFF
M326 CS-AXIS CONTOURING MODE ON

M390 SPINDLE TOOL CLAMP
M391 SPINDLE TOOL UNCLAMP
M392 SPINDLE TOOL UNCLAMP PREPARE

M433 BTS LS300 OFF CHECK

M462 SEND OUT PALLET NO
M463 PRINT OUT MODE OUTPUT
M464 COMMANDED SPINDLE TOOL OUTPUT
M465 SPINDLE TOOL NO '0' OUTPUT
M466 LOAD PALLET NO. DESIGNATION
M469 TL ALARM SUSPENSION MODE ON

M478 RECORD MACHINING FINISH TIME
M479 RECORD MACHINING START TIME
M480 MACRO VARIABLE (100-149) UPLOAD

M580 USER I/O M-CODE
M581 USER I/O M-CODE
M582 USER I/O M-CODE



M583 USER I/O M-CODE
M584 USER I/O M-CODE
M585 USER I/O M-CODE
M586 USER I/O M-CODE
M587 USER I/O M-CODE

M600 PALLET CHANGE SUB M CODE (09810, 09820)
M601 B AXIS INDEX PROGRAM END (09811 - 09814)
M602 DNC PROG END (ONE-TOUCH FUNCTION)
M608 LOAD ONLY
M609 UNLOAD ONLY

M661 ATC & B AXIS SIMUL-MOTION
M662 ATC & B AXIS SIMUL-MOTION FIN CHECK

M700 COOLANT OILMATIC +0.5 DEG
M701 COOLANT OILMATIC 0 DEG
M702 COOLANT OILMATIC -0.5 DEG
M703 COOLANT OILMATIC -1.0 DEG
M704 COOLANT OILMATIC -1.5 DEG
M705 COOLANT OILMATIC -2.0 DEG
M709 COOLANT STOP WITHOUT WAITING DEN

M710 MIST COLLECTOR OFF
M711 MIST COLLECTOR ON

M736 MACHINE LIGHT ON
M737 MACHINE LIGHT OFF
M740 SPIRAL CHIP CONVEYOR OFF
M741 SPIRAL CHIP CONVEYOR ON
M742 OIL SKIMMER OFF
M743 OIL SKIMMER ON
M747 MEASURING HEAD CLEANING AIR ON
M748 IMM CLEANING UNCONDITINALLY ON
M749 IMM CLEANING UNCONDITIONALLY OFF



M750	IMM CLEANING AIR ON
M751	IMM CLEANING AIR OFF
M752	MIST COOLANT ON
M753	WORK CLEAN COOL OR CLEAN AIR ON
M754	BASE COOLANT ON
M755	TELESCOPIC COVER COOLANT ON
M756	AIR BLOW ON
M757	TELESCOPIC COVER COOLANT OFF
M758	WORK CLEAN COOL OR CLEAN AIR OFF



M910 WORK AUTO.MEASUR. M31 MODE CANCEL
M911 MEASURING HEAD ALARM CHECK
M913 RENISHAW RECEIVER COVER CLOSE
M914 RENISHAW RECEIVER COVER OPEN
M920 TOOL LENGTH MEASUR REGISTRATION
M921 TOOL DIAMETER MEASUR REGISTRATION
M922 M920, M921 ADDITION MODE
M925 M926 MODE CANCEL
M926 LC LING SENSOR OBSERVATION MODE
M927 FIRST USED TOOL FLAG SET
M928 FIRST UESD TOOL FLAG OFF
M929 FIRST USED TOOL FLAG RESULT N.G.

M930 TOOL LIFE DATA REGISTER MODE ON
M931 TOOL REMAIN. DATA REGIST MODE ON
M934 TOOL ALARM DATA REGISTER MODE ON

M940 AUTO END DUE TO WORK MEASURING ABNORMAL



ADDRESS	FUNCTION	FORMAT
O	PROGRAM NUMBER. USED AS START OR ENTRY POINT OF PROGRAMS OR SUB PROGRAMS	O----
N	SEQUENCE OR NUMBER BLOCK IDENTIFICATION	N----
G	PREPARATORY FUNCTION MODE SELECTION	G-- 3 DIGIT
X, Y Z, B	AXIS COORDINATE WORDS	*-----"----
I, J, K R	INCREMENTAL ARC CENTRE FOR X, Y & Z ARC RADIUS	*-----"----
R	CUT STARTING LEVEL (FIXED CYCLE)	R-----"----
S	SPINDLE SPEED (RPM) S----	
T	TOOL NUMBER	T1 to T9999
F	FEEDRATE	F-----
F	DWELL	F-----"----
M	ON/OFF MODAL OR 1 SHOT FUNCTION	M--
M	SIMPLE SUB-PROGRAM CALL	M--
H, D	OFFSET NUMBER	*----
P	DWELL (FIXED CYCLE) P-----"----	
Q	CUT DEPTH OR SHIFT IN FIXED CYCLE	Q-----"----
L	REPEAT FIXED CYCLE OR SUB PROGCALL	L--