Operating Manual

Fanuc 0i-MC

GX 300
GX 480
GX 480 APC
GX 710

Fanuc 0i-MC
Fanuc 18i-MB (Option)

GX 510
GX 600
GX 1000
GX 1300
GX 1600

IMPORTANT SAFETY NOTICES

CONTENTS

1.1 INTENDED USE

This machining centre is a numerically controlled machine tool designed to shape cold metal by the application of rotating cutting tools capable of performing two or more machining processes (e.g. boring, drilling, milling, thread tapping) at one set-up of a workpiece and incorporating automatic facilities to:

Select and change tools from a magazine
Change the position of the workpiece relative to the spindle mounted cutter
Select and apply spindle speeds and axis feeds
Control ancillary services (e.g. coolant flow)

1.2 IMPORTANT SAFETY NOTICE WARNING!

It is the user's responsibility to be acquainted with the legal obligations and requirements in the safe use and application of the machine, particularly under the Health and Safety at Work Act 1974 and in the British Standard document PD 5304:2005 Guidance on the Safe Use of Machinery, and other standards and safety codes applicable in the country of use.

SAFE INSTALLATION
It is the customer's responsibility to ensure the machine is installed in a safe operating position, with all service pipes and cables clear of the operation area so as not to cause a hazard. Access must be allowed for safe maintenance, swarf and oil disposal including safe stacking of machined and un-machined components.

MACHINE GUARDING
The Bridgeport Machining Center is fitted with completely enclosed guards as standard. In certain cases and tooling applications additional guarding may have to be provided by the user.

The standard machine guarding has special safety interlocks on the guard doors that comply with the Machinery Directive. Guards and interlocks must be kept fully maintained and tested by the customer and shall not be removed.

The guards are made with clear observation windows having high impact resistance to provide operator safety and a clear unobstructed view of the operations in process. The opening of any guard door provides access to potential hazard areas. Opening of the front working area guard doors is not allowed whilst the spindle is rotating but it is still possible to manually initiate axis movements whilst these doors are open albeit at a reduced traverse rate. Extreme care must therefore be used at all times.

SOFTWARE
Unauthorised changing of machines software or control parameters is hazardous and is not permitted. Hardinge will not accept any liability whatsoever for unauthorized changes in this area.

AUTHORISED PERSONNEL AND TRAINING
Operating, service and maintenance engineers shall be authorised by the 'User Company' and properly trained in the use of the machine.

SAFE WORKING PRACTICE
Workholding devices, lifting equipment, tooling and their use shall be the responsibility of the user. It is the user's responsibility to protect against the hazards caused by swarf, leaking oil or coolant and their use.

Use of proprietary oil or coolant is the responsibility of the user. Special instructions from the suppliers concerning their use should be carefully read and understood before use.

To prevent bodily injury, safe working practices should be employed when operating or servicing the machine.

1.3 SAFETY LISTS ALL COUNTRIES

- It is the user's responsibility to ensure all local regulations and safety instructions are followed.
- Users should consult with their own safety representative to ensure that all such regulations are known and acted upon.
- Additional safety notices may exist for certain specific countries for which Hardinge may be able to advise. Please ask.
- DON'T run the machine until you have made clear to your supervisor that you understand the potential hazard of spindle rotation, the throwing of coolant and the removal of swarf from the cutting process.
- DON'T run the machine until you have read and understood all manuals provided with the machine.
- DON'T run the machine until you have read and understood all the machine and control keys.
- DON'T run the machine for the first time without a qualified instructor. Ask your supervisor for help when you need it.
- PROTECT your eyes. Wear safety glasses with side shields at all times.
- DON'T get caught in moving parts. Remove watches, rings, jewellery, neckties and loose fitting clothes.
- PROTECT your head. Wear a safety helmet when working near overhead hazards.
- KEEP your hair away from moving parts.
- PROTECT your feet. Always wear safety shoes with steel toecaps and oil resistant soles.
- Gloves are easily caught in moving parts. TAKE THEM OFF before you turn on the machine.
- Loose objects can become flying projectiles. REMOVE all loose items (wrenches, chuck keys, rags etc.) from the machine before starting.
- NEVER operate a machine tool after taking strong medication, using non-prescription drugs, prescription drugs or consume alcohol which may impair concentration.
- ALWAYS make sure the working and cutting zone is safeguarded.
- PROTECT your hands. Make sure the spindle is stopped before manually changing a tool or a workpiece.
- PROTECT your hands. Make sure the spindle is stopped before manually clearing away swarf or oil. Use a brush or chip scraper. NEVER use your hands.
- PROTECT your hands. Make sure the spindle is stopped before manually adjusting the work piece or fixture or coolant nozzle.
- PROTECT your hands. Make sure the spindle is stopped before you take measurements.
- PROTECT your hands. Make sure the spindle is stopped before you move a safeguard. Never reach round a safeguard.
- PROTECT your hands. Make sure the machine is switched off and electrically isolated before making any mechanical adjustment.
- PROTECT your hands. Beware sharp edges of cutting tools when changing and handling tools.
- PROTECT your hands. Beware of sharp edges on newly machined components. Wear gloves when unloading.
- PROTECT your eyes and the machine. Never use a compressed air hose to remove swarf or to clean out air vents.
- KEEP the work area well lighted. Ask for additional lighting if needed.
- DON'T slip. Keep your work area clean and dry. Remove swarf, oil and obstacles.
- NEVER lean on the machine. Stand away when machine is running.
- DON'T get trapped. Avoid pinch points caused between other machines and the machine you are working.
- PREVENT objects from flying loose. Securely clamp and locate the workpiece.

SAFETY LISTS ALL COUNTRIES (Cont.)

- PREVENT cutter breakage. Use correct cutter speed and axis feed rate for the job. Make manual over ride adjustments of axis feed rate or spindle speed if you notice unusual noise or vibration. Ask your supervisor for help if you need it.
- PREVENT cutter breakage. Rotate the spindle in a clockwise direction for right handed tools, counter clockwise for left handed tools. Use the correct tool for the job.
- PREVENT work piece and cutter damage. Never start the machine when the cutter is in contact with the work piece.
- Dull and damaged tools break easily. Inspect tools and tool holders. Keep tools sharp. Keep overhang short.
- KEEP all lubrication reservoirs maintained at the correct level. Always keep to the maintenance schedule.
- Certain materials such as magnesium are highly flammable in dust and chip form. See your supervisor before working these materials.
- PREVENT fire. Keep flammable liquids and materials away from the work area and from hot swarf.
- PREVENT the machine from moving unexpectedly. When leaving the machine unattended, not producing, leave switched in the MANUAL mode, with the EMERGENCY STOP button depressed.
- DON'T use the machine in a volatile atmosphere. Electrical devices fitted to the machine are for normal factory use and are not explosion proof.
- ALWAYS keep the machine clean and do not let swarf collect.
- ALWAYS keep the area around the machine clean and tidy. Opening the guards creates the potential for residual coolant and swarf to fall to the swarf tray and possibly to the floor. Good housekeeping minimizes the potential for trips, slip or fall of all personnel.
- DON'T reach into any control or power case, unless electrical power is OFF.
- DON'T touch electrical equipment when hands are wet or when standing on a wet surface.
- ASCERTAIN AND CORRECT the cause of a shutdown caused by overload heaters before restarting the machine.
- This machine tool is a machining center, and is intended for the use in machining materials with the work piece fixed to the table, and the cutting tool rotating in the spindle. The machine should not be used for any other purpose.
- INFORM all other personnel who approach the machine about the hazards described in this safety list.
- When making adjustments with spanners, always ensure that the required leverage is safely applied. Always avoid slippage. Always apply the leverage by pulling, never by pushing. Always use the correct size spanner. Ensure the spanner is not damaged.
- Do not use organic chemical solvents to clean the machine guards or compressed air services equipment.
- This machine is intended for use in an industrial environment and must not be used in the residential, commercial and light industrial environment.
- The windows fitted to Bridgeport Machining Centers are manufactured from bulletproof polycarbonate sheet. This material does deteriorate with age, and should be exchanged within the time period described later in this manual.
- Any workholding device used in conjunction with this machining center must fit within the working envelope available. Under no circumstances must any such workholding device be used when it would require the need to override/defeat the safety interlocks fitted as standard to this machine.

1.4 GUARD WINDOW SAFETY

The majority of windows fitted to Bridgeport Machining Centers are manufactured from the GE Plastics LEXAN® range of polycarbonate sheet, with a hardened surface coating called Margard®. The hard coating gives protection against minor scratching. Testing over the past few years has resulted in confirmation that the impact resistance of polycarbonate degrades over time after exposure to the metalworking fluids and lubricants used in the metalworking process. Although the Margard® coating provides some protection against the cutting fluids, the polycarbonate still degrades. Guidance on the replacement of windows is given in the Operators Safety Manual, section 1.7.

1.5 BEFORE SWITCHING ON

Training on all aspects of this machine tool is available from Hardinge. Please contact your Hardinge representative for further details.

Cables, cords or electric wires of which insulation is damaged can produce current leaks and electric shocks. Check their condition before connecting.

A qualified electrician should only carry out connection of the power cable to the machine.

Ensure the power cable to the machine main isolator has sufficient current carrying capacity to handle the electric power used.

Cables which must be laid on the floor, must be protected against chips, oil and coolants penetration, which might cause damage.

In the event of power failure, turn off the main circuit breaker immediately.

Fuses and circuit breakers should be replaced only with suitably rated alternatives. Safety devices should be replaced only with the machine manufacturers recommended parts.

Protect the CNC unit, operating panel, and electric cabinet etc from shocks which could cause a failure of malfunction.

Check the condition of the warning labels. If they are missing or become illegible, order replacements from Hardinge according to the part number on the label plate. Do not remove warning labels.

After unpacking the machine clean all rust preventative from the machine with a non-volatile cleaning fluid. Lightly lubricate each sliding part before trying to operate the machine.

Use recommended oil brands and appropriate levels for all lubricating systems. See the instruction plate at the rear of the machine.

The coolant system comprises a separate tank at the front of the machine and a coolant pump located beneath the electrical cabinet.

1.6 WARRANTY INFORMATION

Hardinge warrants to the original purchaser only that all products manufactured by it will be free from defects in materials or workmanship, such warranty to remain in effect if and only if such products are used in accordance with all instructions as to maintenance and operations set forth in manuals and instruction sheets furnished by Hardinge.

The machine manufacturer is not responsible for any danger or damage arising from improper operation of the machine. Some examples of improper use are listed below.

1. Adding to or modifying the machine without consulting Hardinge.
2. Operating the machine outside the machining range.
3. Improper use of a workpiece holding or peripheral device.
4. Using the machine with interlocks or protection covers removed.
5. Carrying out machine operation, programming or maintenance and inspection work without thoroughly understanding the caution information, i.e. without having read the instruction manuals carefully.

1.7 ROUTINE INSPECTION

The schedules below are based on single shift operations using coolant at all times.

Daily
1. Check pressure gauge reading.
    Air pressure 5.5bar (80psi)
2. Check that there is sufficient oil in the air lubricator.
3. Check motors and other parts for abnormal noises.
4. Check the lubrication of sliding parts for evidence of proper lubrication.
5. Check safety covers and safety devices for proper operation.
6. Check coolant level and fill as necessary.
7. Clean dirt and chips from the axes and empty the swarf trays.

Weekly (In addition to daily routine)
1. Clean chips and dirt from the entire machine and wipe down.
2. Check the air filter at the rear of the electrical cabinet. Replace the filter element if it is contaminated.
3. Check all polycarbonate vision panels for signs of damage – crazing, cracking etc. or reduced visibility and replace if necessary. Contact your Hardinge representative for details.

1.8   MACHINE WARM UP

WARNING ⚠	If the machine is used to produce components immediately after being started, following a long idle period, sliding parts may be worn due to lack of oil and thermal expansion of the machine can jeopardize machining accuracy. To prevent this condition, always warm the machine up.

We recommend that the machine is 'Warmed up' prior to first operation by running all axes for 10 to 20 minutes at about half or one third the maximum speed in the automatic operation mode before actual cutting.

This automatic operation program should cause each machine component to operate. During this cycle check the correct function of these operations.

Be particularly careful to warm up the spindle.

SPINDLE WARM UP
It is essential that the spindle in the machine is correctly warmed up before use.

Short Term Spindle Warm up
If the machine has been idle for less than two weeks, run the spindle at 25% of the maximum spindle speed for 15 minutes. Once this has been completed, the machine is ready for operation

Long Term Spindle Warm up
If the machine has been idle for two weeks or more, run the spindle at 25% of the maximum spindle speed for 20 minutes, then at 50% of the maximum speed for 30 minutes. Once this has been completed, the machine is ready for operation.

1.9   SPINDLE MAINTENANCE

Daily Maintenance.
Clean the front nose of the spindle but do not use compressed air.
Check the taper for dirt. If necessary, use a cleaning arbor.
Check coolant level in spindle cooler and top up if necessary.
Check air supply.

Monthly Maintenance.
Test tool change function.
Check the spindle knock out distance. Activate the tool un-clamp pushbutton to check that the knock out distance is as specified in the maintenance manual.
Note: prior to inserting a tool holder, ensure that the spindle taper is clean.

Spindle Tooling
Tooling with a balance level of G2.5 or better should always be used. Failure to do so will reduce spindle life and surface finish and may void the machine warranty.
For safe operation, refer to the informative tag and make sure the tool holder and pull stud combination meet the standard.

1.10   INTERRUPTING MACHINING

WARNING!

When leaving the machine temporarily after completing a job, turn off the power on the operator panel with the Emergency Stop button and turn off the main isolator. Never turn off power during automatic operation or with the spindle or axes running unless an emergency occurs. It is better to interrupt the program by pressing the "Cycle Stop" push button.

1.11   COMPLETING A JOB.

Always clean the machine and supporting equipment down after use. Remove and dispose of chips and clean the covers and windows etc. Return each machine component to its initial condition. Check wipers for damage and replace if necessary. Check coolants, hydraulic oils and lubricants for level & contamination. Change them if you suspect they are contaminated. Clean the filter on the top of the coolant tank. Turn off the power first on the control panel with the emergency stop button and then at the main isolator before leaving the machine at end of the shift.

1.12   SAFETY DEVICES

Make yourself aware of the locations of the emergency stop push buttons, which should be well known so that they can be operated at any time without the need to look for them. Test the push buttons periodically for their correct operation.

Further safety devices are located at the following points around the machine:

The front door, APC front folding door and the toolchanger load station door have safety interlock switches with guard door locking. (Note that only the GX 480 APC has a toolchanger load station door.)

Over travel limit switches are present at each end of each axis stroke.
Stored stroke limit (Parameter setting): The control system will recognize when a move is requested that will take the motion beyond the end of the machine stroke. This move will not be allowed to start.

Functional Explanation

Emergency Stop Circuit
A safety circuit is fitted in the machine through which the Emergency Stop Buttons are wired. In addition to this, hard wired over travel switches are located on both ends of all 3 axes to check whether the axis has travelled beyond the allowed boundary. If any one of the Emergency Stop buttons is pressed, the machine will stop immediately and go into an Emergency Stop condition.

CAUTION!
Once the emergency condition has been safely resolved and the emergency stop buttons are released, the "RESET" button should be pressed to clear any error messages within the control system.

Servo & Spindle Power Disconnect
Once the Emergency Stop button is pressed or any of the over travel limit switches have been operated, the machine will stop and the power supply to the drives is removed.

Door Safety Circuit
The machine has interlocked doors, the main access door at the front of the machine and the toolchanger load station door at the left hand side of the machine. Both doors are shot bolted shut and can only be opened once the spindle is stationary and there is no program running. (Note that only the GX 480 APC has a toolchanger load station door.)

Power On Safety Circuit (Allows the operator to execute certain tasks whilst either door is open)
Limited machine functionality is available to the operator whilst either door is open. The handwheel and jog keys are able to move the machine axes at feed rates of 2m/min and less. Spindle operation is prohibited whilst either door is open as the spindle contactor is hard wired through the door interlock safety relay. Selection of automatic program running is prohibited until the doors are shut. Rotation of the tool magazine is also prohibited until the doors are shut.

Door Interlock of Electrical Cabinet Safety Circuit
When door interlock switch is on the position "0" and the cabinet doors are open, the machine power will be kept ON. When door interlock switch is on the position "1" and the cabinet doors are open, the machine power will be turned OFF.

2.1 OPERATOR PANEL

GX 480 & GX 710
Operator Panel

GX 480 APC
Operator Panel

GX 300 & GX 510
Operator Panel

GX 510 with Fanuc 18i-MB
Operator Panel

GX 600 & GX 1000
Operator Panel

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GX 1000 with Fanuc 18i-MB
Operator Panel

GX 1300 & GX 1600
Operator Panel (18i-MB)

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2.2 MACHINE FUNCTIONS

Emergency Stop
When depressed, the mushroom cap Emergency Stop buttons stop all machine and chip conveyor motions. Pull the Emergency Stop push button UP to release.

Rapid Override Switch
The switch can modify the machine rapid traverse rate on the X, Y, and Z axes in steps from 0% ~ 100%. It is active in Positioning Mode (G00). It is also active during return passes for machining cycles.

Feedrate / Jog Override Switch
The switch can modify programmed feedrates from 0% ~ 150% when In Automatic or Manual Data Input mode. A setting of "0" will stop G01, G02, & G03 motion.
When in Jog mode, the switch establishes the rate of axis motion. A setting of "0" will inhibit axis motion. When the Override switch is set to 100%, the rate of motion is:
Inch mode: 0 ~ 787 inches/minute
Metric mode: 0 ~ 2000 millimeters/minute
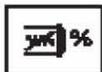
Spindle Override Switch
The switch can modify programmed spindle speeds from 50% ~ 120%.

Edit Mode
When pressed, Edit mode allows the operator or programmer to enter a new program or edit a stored program. To deactivate Edit mode, select another operating mode.

Automatic Mode
When pressed, Automatic mode allows execution of a part program stored in control memory and modification of part programs using the Background Edit function.

Manual Data Input Mode
When pressed, Manual Data Input mode allows manual input of a temporary program block.

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MACHINE FUNCTIONS (cont.)

Direct Numerical Control (DNC) Mode
When pressed, Direct Numerical Control mode allows execution of a part program read directly from an input device connected to the machine control.

Jog Mode
When pressed, Jog mode allows non-programmed movement of the axes through the use of the axis direction push buttons.

Handwheel (Manual Pulse Generator) Mode
This switch setting activates Handwheel mode.

Zero Return Mode
When pressed, Zero Return mode allows the selected axis to be moved to the "Home" position. This mode is activated automatically at Power-Up.

Rapid
Activating manual rapid traverse mode with Jog mode active and pressing one of the axis directional push buttons move the selected axis at the rapid jog rate. The Rapid Override switch can be used to adjust the rapid traverse rate.

M01 (Option Stop)
The push button can activate and deactivate Option Stop alternately. The indicator light is illuminated when Option Stop is active. The function causes the control to stop execution of the part program AFTER executing an active block that contains an M01 code. The M01 code is ignored when Option Stop is not active.

The function may be activated before or during execution of the block containing the M01 code.

To resume program execution, press the Cycle Start push button. The Feed Hold push button light will turn OFF. Program M03, M04, M13, or M14 to restart the spindle and coolant

BDT (Block Skip)
The push button can activate and deactivate Block Skip alternately. The indicator light is illuminated when Block Skip is active. The function ignores any program data block preceded by a slash (/) code.

MACHINE FUNCTIONS (cont.)

SBK (Single Block)
The indicator light is illuminated when Single Block is active. Single Block allows the operator to execute one block of data each time the Cycle Start push button is pressed.

MLK (Machine Lock)
The mode must be OFF for normal machine operation.

The push button can activate and deactivate Machine Lock mode alternately. The indicator light is illuminated when Machine Lock is active. The function inhibits all axis and spindle motions. M, S, and T functions are also inhibited.

ZMLK (Z Axis Machine Lock)
The push button disables all Z axis motion. When a part program is executed, all other machine activity will occur as programmed. This push button is illuminated when Z Axis Machine Lock is active.

DRN (Dry Run)
The mode must be OFF for normal machine operation.

The push button can activate and deactivate Dry Run mode alternately. When the mode is active, programmed feedrates are ignored and cutting moves are performed at a Jog feedrate of 50 inches [1260 millimeters] per minute. The indicator light is illuminated when Dry Run is active.

Coolant ON
The push button turns the coolant pump ON, regardless of the programmed M codes for coolant control. Coolant ON deactivates Coolant Automatic and Coolant OFF.

Coolant OFF
The push button turns the coolant pump OFF, regardless of the programmed M codes for coolant control. Coolant OFF deactivates Coolant Automatic and Coolant ON.

Coolant Automatic
Coolant is turned ON when an M08, M13, or M14 is read from the part program by the control. Coolant is turned OFF when an M00, M01, M02, M05, M09, or M30 is read from the part program. Coolant Automatic deactivates Coolant OFF and Coolant ON.

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MACHINE FUNCTIONS (cont.)

Chip Conveyor ON/OFF
The push button can turn the chip conveyor ON or OFF. The push button is illuminated when the chip conveyor is ON.

Chip Conveyor Reverse
The push button reverses the direction of the chip conveyor motion. The push button is illuminated when the chip conveyor is running in the reverse direction.

Chip Flush
The push button can activate and deactivate the optional coolant chip flush alternately. The push button flush chips from the machine table into the chip pans or chip conveyor. Chip flush is an optional feature on standard machining centers.

Spindle Jog Speed Control
The variable switch adjusts the spindle speed while jogging the machine spindle.

Clockwise Rotation
The push button jogs the machine spindle in the clockwise direction (as viewed from the top of the machine)

Spindle Stop
This push button cancels the spindle jog.

Counterclockwise Rotation
The push button jogs the machine spindle in the counterclockwise direction (as viewed from the top of the machine)

Work Light
Turns the work light ON or OFF.

Alarm Cancel
The push button cancels the audible alarm.

MACHINE FUNCTIONS (cont.)

Emergency Stop Reset

When pressed and held, the Emergency Stop Reset push button jogs the axes out of an over travel condition. Using the push button to reset the control once the Emergency Stop push button has been released and the problematic condition has been corrected.

Cycle Start

The push button is a latching type switch that initiates program execution when the control is in Automatic mode or Manual mode. An additional function of this switch is to execute Manual Data Input commands.

Feed Hold

The Feed Hold push button stops all programmed slide motion. However, the active spindle speed is not affected. Feed Hold can be activated when in Automatic, Single Block, Dry Run, or Machine Lock modes.

Press Cycle Start to resume normal operation after a feed hold. The push button is illuminated when Feed Hold is active.

Electrical Cabinet Door Interlocks

When the electrical cabinet door interlock is position at "0" (only allowed for the qualified and competent engineers with door-key), power can be turn ON while the electrical cabinet door is open. When the electrical cabinet door interlock is position at "1" (normal operating condition), power cannot be turn ON while the electrical cabinet door is open.

Work Set Finish

When job setup is finished. The APC associated push button activates changeover each time the Cycle Start is pressed. The push button is illuminated when Work Set Finish is active.

APC Hinge Arm Open

When spindle is stopped, folding door is closed and pallets are clamped by the APC, the push button allows the operator to open the APC Hinge Arm for tool loading in Handwheel mode. The push button is illuminated when APC Hinge Arm Open is active.

Lift up and move the locking handle to the right to open the APC Hinge Arm. Open until the safety linkage is fully extended. To return, pull the olive-shaped knob out, engage the locking handle and deactivate the push button to resume machine operation.

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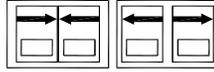
Manual Door Open/Close Button

When spindle is stopped, press "Door Open" button to open front door manually which is available in GX 480 series and equipped with auto-door facility.

Under manual/auto mode, manual door close operating is only available to press "Door Close" button and "Feed Hold" simultaneously. (In auto mode, M48 is only for door open. For safety reason there is no M code for door close.)

Axis Direction Push Buttons and Indicator Lights

The X, Y, Z, and 4th axis push buttons allows manual axis movement in Jog mode. The X, Y, and Z axis push buttons are also used in conjunction with the Jog Feedrate switch.

2.3   INDICATOR LIGHTS

DISPLAY INDICATOR LIGHTS

COL. (Coolant) - Indicates that the coolant pump is ON.

M19 - Indicates that the spindle is oriented to the tool change position.

ATC (Automatic Tool Changer) - Indicates that Tool Change mode is active.

TCL (Tool Clamp) - Indicates that a tool is clamped in the spindle.

ALARM INDICATOR LIGHTS

EM (Emergency Stop) - Indicates that an Emergency stop condition exists.

ATC (Automatic Tool Changer) - Indicates that an alarm associated with the tool magazine has occurred.

OL (Overload) - Indicates that a servo drive or electrical overload has occurred.

AL (Alarm) - Indicates that a general machine alarm has occurred. Refer to the control display screen for the specific alarm message.

MAIN POWER ON INDICATOR LIGHT
The light turns ON when the main disconnect switch is turned ON.

SPINDLE SPEED RANGE INDICATOR LIGHTS
NOTE – Available only on High Torque machining centers.

The spindle speed range is selected through the use of M codes.

H-GEAR (High Gear) - Indicates that the spindle drive is in high gear, which provides more speed and less torque to the spindle.

L-GEAR (Low Gear) - Indicates that the spindle drive is in low gear, which provides less speed and more torque to the spindle.

2.4 MACHINE POWER ON/ZERO RETURN

POWER ON MACHINE
1. Be sure the coolant guard door is closed.
2. Turn main isolator on the power case ON.
3. Press the Control ON push button and wait until the control display screen is ON.
4. Pull the Emergency Stop push button OUT to release.
5. If necessary, release the Emergency Stop push button(s) located next to the manual index push buttons for the tool magazine(s).
6. The machine is now ready for the Zero Return (Reference Home) procedure.

AXIS ZERO RETURN
1. Select Zero Return mode.
2. Press the +Z push button. The Z axis will move to the Home position.
3. Press the -X push button. The X axis will move to the Home position.
4. Press the +Y push button. The Y axis will move to the Home position.
5. If the machine is equipped with an optional rotary table, press the +4 push button to index the rotary table to the Home position.
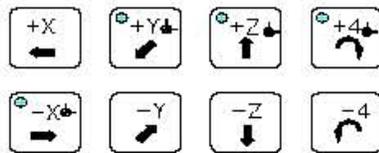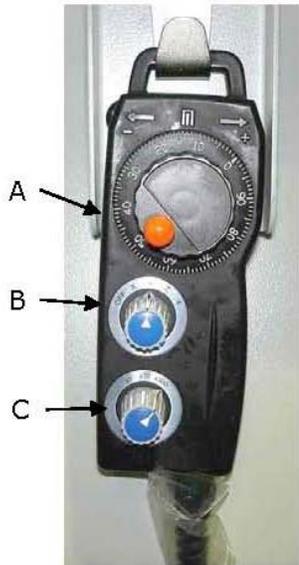
2.5 MANUAL AXIS JOG

Select

In Jog mode, the following buttons can be used to manually move an axis:
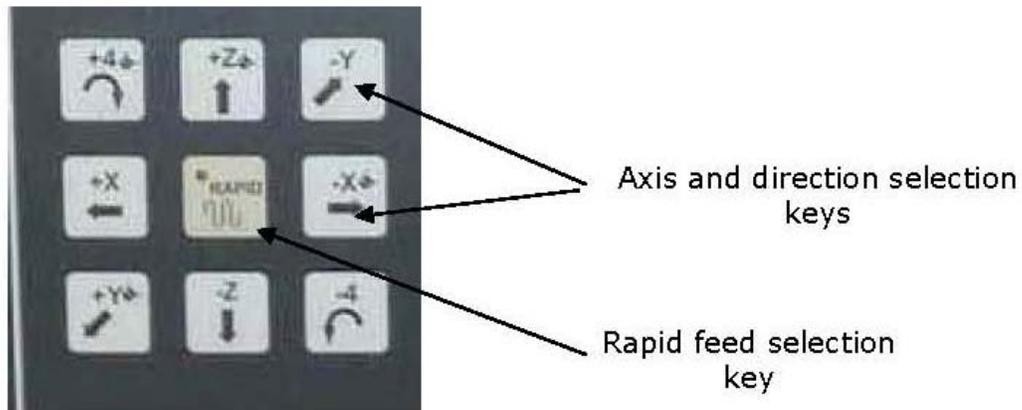
The feedrate can be controlled using the feed override dial.
For rapid feed press the rapid feed selection key

2.6 MPG OPERATION

Select

AXIS SELECT SWITCH
Axis selector switch "B" determines which machine axis will move.

INCREMENT SELECT SWITCH ("C")
X1   The incremental jog rate per division on the dial is .0001 inches in English mode
         or .001 mm in Metric mode.
X10   The incremental jog rate per division on the dial is .001 inches in English mode
         or .01 mm in Metric mode.
X100   The incremental jog rate per division on the dial is .01 inches in English mode
         or .1 mm in Metric mode.

MANUAL PULSE GENERATOR DIAL ("A")
Clockwise: Positive Axis Motion
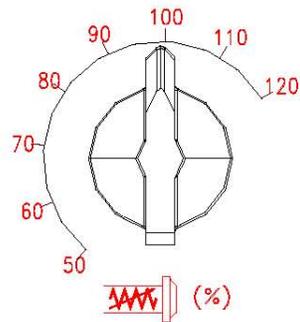Counter-clockwise: Negative Axis Motion

2.7 SPINDLE OPERATION

Spindle Control Buttons:

Spindle Jog   Spindle Stop   Spindle Jog
     CW   CCW
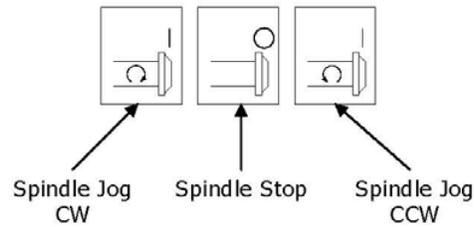
The above buttons allow spindle operation in MPG or Jog mode.

Spindle Speed Override Dial:

In all modes, the override dial allows the programmed spindle rpm to be manually adjusted from 50 - 120%. When adjusting the spindle rpm during program run, there may be a slight feed hold to allow the machine to achieve the new spindle speed before continuing.

2.8 M-FUNCTION CODES

M Word	Definition	Standard /Option
M00	Program Stop	S
M01	Optional Stop	S
M02	End of Program	S
M03	Spindle Forward	S
M04	Spindle Reverse	S
M05	Spindle Stop	S
M06	Automatic Tool Change	S
M08	Coolant Pump ON	S
M09	Coolant Pump OFF	S
M10	Rotary Table Brake ON	O
M11	Rotary Table Brake OFF	O
M13	Spindle Forward / Coolant Pump ON	S
M14	Spindle Reverse / Coolant Pump ON	S
M15	Spindle Stop / Coolant OFF	S
M16	Spindle Air Blast OFF	S
M17	Spindle Air Blast ON	S
M19	Spindle Orient	S
M20	Spindle Orient Cancel	S
M21	X Axis Mirror Image ON	S
M22	Y Axis Mirror Image ON	S
M23	Mirror Image Cancel	S
M24	Work Light ON	S
M25	Work Light OFF	S
M26	Tool probe interface select	O
M27	Tool probe interface select	O
M29	Rigid Tapping Mode ON	S
M30	End of Program	S
M34	Spare M-code 1 ON	O

M-FUNCTION CODES (cont.)

M Word	Definition	Standard /Option
M35	Spare M-code 1 OFF	O
M36	Spare M-code 2 ON	O
M37	Spare M-code 2 OFF	O
M38	Spare M-code 3 ON	O
M39	Spare M-code 3 OFF	O
M41	Spindle Low Gear (High Torque Machine only)	S
M42	Spindle High Gear (High Torque Machine only)	S
M46	Free time ON	S
M47	Free time OFF	S
M48	Door Open in Auto Mode (Auto Door)	O
M51	Chip Coolant ON	S
M52	Chip Coolant OFF	S
M53	Thru-Spindle Coolant ON	O
M54	Thru-Spindle Coolant OFF	O
M68	Chip Conveyor ON	O
M60	APC Pallet Change	O
M69	Chip Conveyor OFF	O
M80	Auto Power OFF	O
M90	Spare M-code 4 ON	O
M91	Spare M-code 4 OFF	O
M92	Spare M-code 5 ON	O
M93	Spare M-code 5 OFF	O
M98	Subprogram Call	S
M99	Subprogram End	S
M101	Pallet A change (APC only)	O
M102	Pallet B change (APC only)	O

2.9   LOADING A TOOL INTO THE SPINDLE

WARNING

Ensure adequate protection is used to prevent injury from sharp cutting tools.

Select or or to load the correct tool number into the Spindle.

Open front guard door of machine.

While holding the tool, press and hold the clamp/unclamp button "A" on the machine head to release the tool (See illustration). Replace tool and release the button to clamp.

Close guard door of machine.

Note: Not all models have a tool release button. Without this button, tools have to be loaded directly into the carousel.

2.10 TOOL MAGAZINE DATA TABLES

The tool location table monitors the position of the tool magazine and the location of the tools installed on the machine. Diagnostic registers are used to store the tool number data.

The tools are loaded into the tool magazine such that the tool number matches the pocket number of the tool magazine. The valid ranges of programmable tool numbers are:

GX 300 & GX 510 (40 Taper)	Swing Arm Magazine [Standard]: 1 to 20
GX 480 & GX 710 (40 Taper)	Drum Magazine 1 [Standard]: 1 to 16 Swing Arm Magazine [Option]: 1 to 20
GX 480 APC (40 Taper)	Swing Arm Magazine [Standard]: 1 to 20
GX 600, GX 800 & GX 1000 (40 Taper)	Drum Magazine 1 [Standard]: 1 to 20 Drum Magazine 2 [Option]: 21 to 40 Swing Arm Magazine [Option]: 1 to 24
GX 1300 (40 Taper) GX 1600 (40 Taper)	Swing Arm Magazine [Standard]: 1 to 30 Swing Arm Magazine [Option]: 1 to 40

TOOL CHANGE POSITION

The tool change position for **drum tool magazines** is the position aligned with the machine spindle, as illustrated below:
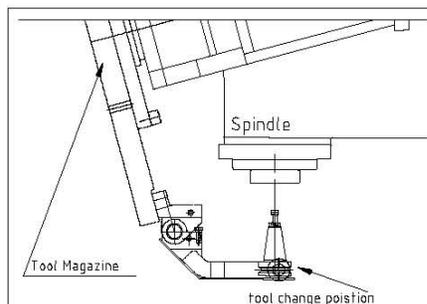
The tool change position for the **swing arm tool magazines** is the lowest tool position in the magazine, as illustrated below:

The tool change position for **turret tool magazines** is the lowest tool position in the magazine, as illustrated in below:
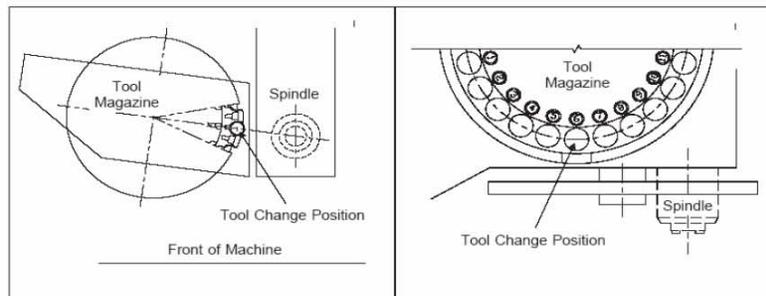
Top View of Drum Tool Magazine and
Spindle (Tool Magazine 1)

Left End View of Swing
Arm Tool Magazine and Spindle

Right END View of Turret Tool Magazine
and Spindle

TOOL MAGAZINE DATA TABLES (cont.)

DIAGNOSTIC ADDRESSES
Sample Tool Data for Drum Magazine (Standard)
Address D0000 contains the number of the tool currently in the spindle.
Address D0001 contains the number of the tool located at the tool change position.
Address D0002 contains the number of the tool pocket located at the tool change position.

Addresses D0010 through D0029 contain the tool numbers and do not change.

Location	Diagnostic Address Number	Tool Number
Tool in Spindle	D0000	14
Tool Number in Change Position	D0001	3
Tool Pocket in Change Position	D0002	3
Position 01	D0010	1
Position 02	D0011	2
Position 03	D0012	3
Position 04	D0013	4
Position 05	D0014	5
Position 06	D0015	6
Position 07	D0016	7
Position 08	D0017	8
Position 09	D0018	9
Position 10	D0019	10
Position 11	D0020	11
Position 12	D0021	12
Position 13	D0022	13
Position 14	D0023	14
Position 15	D0024	15
Position 16	D0025	16
Position 17	D0026	17
Position 18	D0027	18
Position 19	D0028	19
Position 20	D0029	20

TOOL MAGAZINE DATA TABLES (cont.)

Sample Tool Data for Drum Magazine 2 [Option]
Address D0000 contains the number of the tool currently in the spindle.
Address D0001 contains the number of the tool located at the tool change position.
Address D0002 contains the number of the tool pocket located at the tool change position.

Addresses D0030 through D0049 contain the tool numbers and do not change.

Location	Diagnostic Address Number	Tool Number
Tool in Spindle	D0000	34
Tool Number in Active Position	D0001	23
Tool Pocket in Active Position	D0002	23
Position 01	D0030	21
Position 02	D0031	22
Position 03	D0032	23
Position 04	D0033	24
Position 05	D0034	25
Position 06	D0035	26
Position 07	D0036	27
Position 08	D0037	28
Position 09	D0038	29
Position 10	D0039	30
Position 11	D0040	31
Position 12	D0041	32
Position 13	D0042	33
Position 14	D0043	34
Position 15	D0044	35
Position 16	D0045	36
Position 17	D0046	37
Position 18	D0047	38
Position 19	D0048	39
Position 20	D0049	40

TOOL MAGAZINE DATA TABLES (cont.)

Sample Tool Data for Swing Arm Magazine [Option]
Address D0000 contains the number of the tool currently in the spindle.
Address D0001 contains the number of the tool located at the tool change position.
Address D0002 contains the number of the tool pocket located at the tool change position.

Addresses D0010 through D0033 contain the tool numbers and do not change.

| Location	Diagnostic Address Number	Tool Number
Tool in Spindle	D0000	14
Tool Number in Change Position	D0001	3
Tool Pocket in Change Position	D0002	3
Position 01	D0010	1
Position 02	D0011	2
Position 03	D0012	3
Position 04	D0013	4
Position 05	D0014	5
Position 06	D0015	6
Position 07	D0016	7
Position 08	D0017	8
Position 09	D0018	9
Position 10	D0019	10
Position 11	D0020	11
Position 12	D0021	12
Position 13	D0022	13
Position 14	D0023	14
Position 15	D0024	15
Position 16	D0025	16
Position 17	D0026	17
Position 18	D0027	18
Position 19	D0028	19
Position 20	D0029	20
Position 21	D0030	21
Position 22	D0031	22
Position 23	D0032	23
Position 24	D0033	24

2.11   MANUALLY CONTROLING THE TOOL MAGAZINE

INDEXING DRUM TOOL MAGAZINE

Select [icon] or [icon] or [icon] for application in indexing tool magazine clockwise or counter-clockwise, as viewed from the top of the machine.
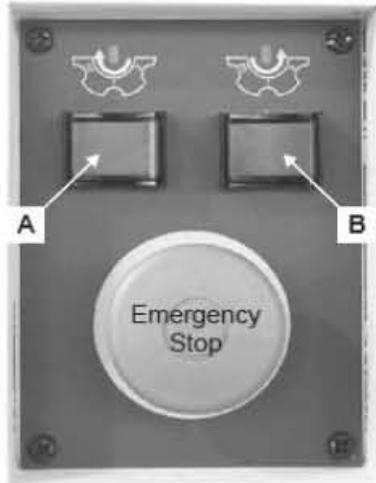
Push buttons for indexing
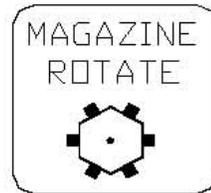
Push buttons for indexing
GX 480 & GX 710

SWING ARM TOOL MAGAZINE (OPTION)

Select [icon] or [icon] or [icon]
Set dial "C" to the desired setting.
Press bush button "D" to initiate the selected action.

Controls for Swing
Arm Tool Magazine

Index the tool magazine clockwise or counter-clockwise, as viewed form the control panel

Lower or raise the tool pocket

Exchange the tool in the spindle and the active station of the magazine

OFF   Disable magazine push button

2.12   APC ALARM MESSAGES

2024   APC HYDRAULIC MOTOR OVERLOAD
  Cause: APC hydraulic motor was drawing excess current.
Solution: Check the motor and related equipment, and then RESET the overload MC7.

2025   APC IN ADJUST MODE
  Cause: APC Adjustment Mode is for the machine builder only.
Solution: Exit the mode and press the RESET key.

2026   APC IN PALLET RECOVERY MODE
  Cause: Pallet changer has stopped with an incomplete pallet change.
Solution: (1) With Handwheel mode active, press ALARM, SBK, and FEEDHOLD
             simultaneously to return pallets to position.
         (2) Press RESET key.

2027   WORK SET FINISH NOT CONFIRMED OR
      APC FRONT FOLDING DOOR NOT CLOSED
  Cause: (1) APC front folding door not fully closed.
         (2) WORK SET FINISH not active before CYCLE START.
Solution: (1) Close the APC folding door.
         (2) Press WORK SET FINISH and then CYCLE START buttons.

2028   PALLET CALL ERROR
  Cause: Wrong code, M101 or M102 used to call the pallet into working zone.
Solution: Press RESET key

2029   APC ACTION TIME OUT
  Cause: Pallet change not completed within the time allowed.
Solution: (1) Check the pallet changer and machine for faults.
         (2) Check timer No33.
         (3) Press RESET key.

2030   APC HYDRAULIC PRESSURE LOW
  Cause: APC hydraulic pressure is low.
Solution: Check the Hydraulic pump and pipe work.

2032   APC UNIT SEPARATION ERROR
  Cause: (1) The APC hinge door out of position.
         (2) The APC front folding door not completely closed.
Solution: (1) Check the APC hinge door.
         (2) Close the APC front folding door.
         (3) Press RESET key.

2033   APC SELF DETECTION DIAGNOSTIC
  Cause: SENSOR error during self-diagnostic test.
Solution: (1) Check for machine faults.
         (2) Press RESET key.

2034   APC NOT IN POSITION
  Cause: Pallet not in position.
Solution: (1) Check the position of the pallet. (2) Press RESET key.

2035   PALLET UNIT DEPARTURE
  Cause: The APC hinge door fault during pallet change
Solution: (1) Check the APC hinge door. (2) Press RESET key

2.13 TOOL CHANGER FAULT RECOVERY

DRUM TOOL CHANGER 1
1.   Press the Reset key.
2.   Select Manual Data Input mode.
3.   Press the Program key.
4.   Cancel tool change mode:
     a) Key in M77.
     b) Press the EOB key.
     c) Press the Insert key.
     d) Press the Cycle Start push button.
5.   Activate tool change mode:
     a) Key in M76.
     b) Press the EOB key.
     c) Press the Insert key.
     d) Press the Cycle Start push button.
6.   Clamp the tool:
     a) Key in M73.
     b) Press the EOB key.
     c) Press the Insert key.
     d) Press the Cycle Start push button.
7.   Move the tool magazine to the home position:
     a) Key in M71.
     b) Press the EOB key.
     c) Press the Insert key.
     d) Press the Cycle Start push button.
8.   Cancel tool change mode:
     a) Key in M77.
     b) Press the EOB key.
     c) Press the Insert key.
     d) Press the Cycle Start push button.
9.   Press the Reset key.
10. Press the Offset Setting key.
11. Press the Setting soft key.
12. Change Parameter Write Enable to 1.
13. Press the Input key. The control is placed in alarm No. 100.
14. Press the System key.
15. Press the PMC soft key.
16. Press the PMCPRM soft key.
17. Press the Data soft key.
18. Press the G.Data soft key.
19. Check the value of D00 and D01.
     D00 is the number of the tool in the spindle.
     D01 is the number of the pocket in the tool change position.
20. Verify that D00 and D01 are both equal to the number of the tool pocket at the
     tool change position. Modify D00 and D01, if necessary.
21. Press the far left soft key.
22. Press the Counter soft key.
23. Check the values of C00 and C04 Preset and Current.
     C00 and C04 Preset should be 20.
     C00 Current and C04 Current should equal to the number of the tool pocket at the
     tool change position.
     Modify C00 Current and C04 Current if necessary.
24. Press the Offset Setting key.
25. Change Parameter Write Enable to 0.
26. Press the Input key.
27. Press the Reset key.

TOOL CHANGER FAULT RECOVERY (cont.)

DRUM TOOL CHANGER 2 [Option]
1.   Press the Reset key.
2.   Select Manual Data Input mode.
3.   Press the Program key.
4.   Cancel tool change mode:
    a) Key in M77.
    b) Press the EOB key.
    c) Press the Insert key.
    d) Press the Cycle Start push button.
5.   Activate tool change mode:
    a) Key in M76.
    b) Press the EOB key.
    c) Press the Insert key.
    d) Press the Cycle Start push button.
6.   Clamp the tool:
    a) Key in M73.
    b) Press the EOB key.
    c) Press the Insert key.
    d) Press the Cycle Start push button.
7.   Move the tool magazine to the home position:
    a) Key in M81.
    b) Press the EOB key.
    c) Press the Insert key.
    d) Press the Cycle Start push button.
8.   Cancel tool change mode:
    a) Key in M77.
    b) Press the EOB key.
    c) Press the Insert key.
    d) Press the Cycle Start push button.
9.   Press the Reset key.
10.   Press the Offset Setting key.
11.   Press the Setting soft key.
12.   Change Parameter Write Enable to 1.
13.   Press the Input key. The control is placed in alarm No. 100.
14.   Press the System key.
15.   Press the PMC soft key.
16.   Press the PMCPRM soft key.
17.   Press the Data soft key.
18.   Press the G.Data soft key.
19.   Check the value of D00, D01, and D02.
    D00 is the number of the tool in the spindle.
    D01 is the number of the pocket in the tool change position for magazine 1.
    D02 is the number of the pocket in the tool change position for magazine 2.
20.   Verify that D01 matches the tool pocket at the tool change position for magazine1.
    Verify that D02 matches the tool pocket at the tool change position for magazine2.
    Modify D01 or D02, if necessary.
21.   Press the far left soft key.
22.   Press the Counter soft key.

DRUM TOOL CHANGER 2 [Option] (continued)
23. Check the values of C00 and C04 Preset and Current.
    C00, C04, C08, and C12 Preset should be 20.
    C00 Current and C04 Current should equal to the number of the tool pocket at the tool change position for magazine 1.
    C08 Current and C12 Current should equal to the number of the tool pocket at the tool change position for magazine 2. (1 = T21, 2 = T22, …)
    Modify C00 Current, C04 Current, C08 Current, and C12 Current, if necessary.
24. Press the Offset Setting key.
25. Change Parameter Write Enable to 0.
26. Press the Input key.
27. Press the Reset key.

SWING-ARM TOOL CHANGER [Option]
1. Correct the condition that caused the fault.
2. Press the Reset key to clear condition alarms.
                      -.NOTE –
    After resetting the condition alarm, the "ATC Arm Not In Position" alarm will remain active. The Cycle Start and Feed Hold lights will be flashing.
3. Select Jog or Handwheel or Zero Return mode.
4. Check the TCL indicator light, located on the operator control panel. If the light is not ON, proceed to step 5a. If the indicator light is ON, proceed to step 5b.
5a. Press and hold the Coolant OFF push button until the tool change sequence is completed and the ATC arm and tool pocket return to their correct positions.
5b. Press and hold the +X jog key until the tool change sequence is completed and the ATC arm and tool pocket return to their correct positions.
6. Select Manual Data Input mode.
7. Press the tool data table button, located on the operator control panel.
8. Note the values of D0000, D0001 and D0002.
    D0000 = Tool in spindle
    D0001 = Tool number in change position
    D0002 = Tool pocket in change position
9. Press the far left soft key.
10. Press the Counter soft key.
11. Check the values of C00 and C04 Preset and Current.
    C00 and C04 Preset should be 23 (GX 600/800/1000 Machining Centres)
    C00 and C04 Current should be 1 less than the tool pocket in the tool change position.

TOOL CHANGER FAULT RECOVERY (cont.)

SWING-ARM TOOL CHANGER [Option] (continued)
Example: Tool pocket 11 is in tool change position.

Preset Current
C00 23 10
C04 23 10

> **NOTE**
> If the values in the Current column needs to be altered,
> you must first turn on the parameter write enable.
> If changes are not required, the recovery procedure is
> finished. DO NOT Proceed to step 12.

12. If necessary, select Manual Data Input mode.
13. Press Offset Setting key.
14. Press Setting soft key.
15. Change the value of PWE to a 1.
16. Press the Input key. Alarm 100 will appear. Disregard this alarm.
17. Repeat steps 7 through 11 and make necessary corrections.
18. When finished, repeat steps 13 through 16 to change PWE back to 0.
19. Press the Reset key.