MACHINE OPERATION

Bridgeport® **TEXTRON**

Bridgeport Machines Division of Textron Inc.

SPINDLE CONTROL
PANEL

OPERATOR'S MAIN
CONTROL PANEL

LOGIC
CONTROL
CABINET
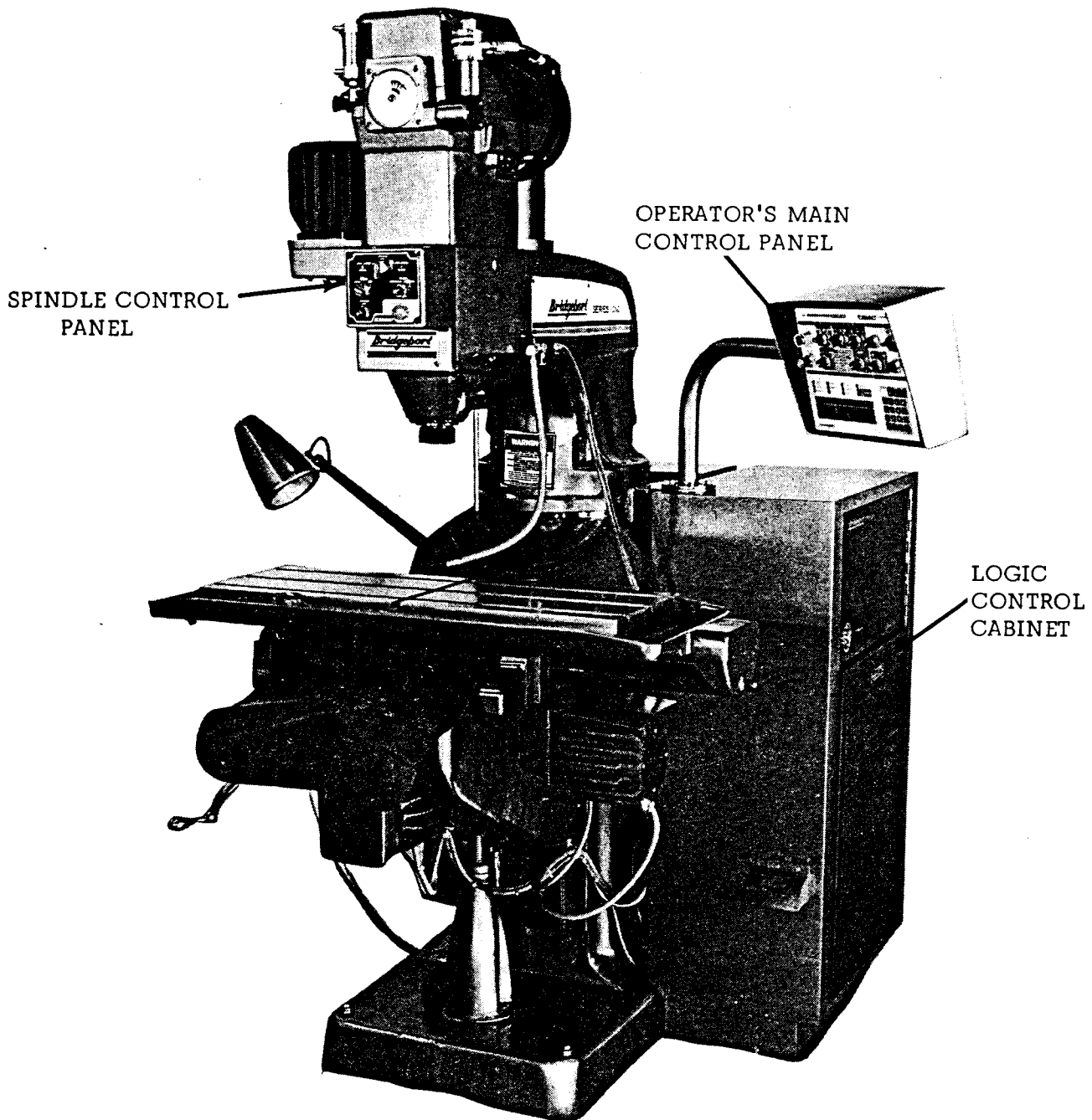
For photographic clarity, machine is shown without point of operation guarding.

MACHINE CONTROL EQUIPMENT

OPERATOR'S MAIN CONTROL PANEL

INITIAL CONDITIONS AT POWER ON

Power is applied to the entire system by throwing the machine Disconnect Switch to the ON position. The switch is located on the Power Control Cabinet. When this occurs, the "red" travel limit light will go on, indicating that the limit detection electrics must be enabled before the system can be used. Proceed by depressing the travel limit override pushbutton. With power on, BOSS (Bridgeport Operation System Software) will come up fully operational and with all registers cleared.

A self-test diagnostic routine is incorporated in the system with the object of checking all the components in the BOSS to validate their operational status. This will be done automatically every time the system is booted up by depressing the RESET switch (total time approximately 5 seconds). If a component has failed, the ERR lamp on the front panel will be lit and the bank in which the component has failed will be indicated by number in the display (see Maintenance Manual). The routine will stop and no further operation is possible. If a local data terminal is connected, depressing the P key will enable the user to check the rest of the BOSS for the possibility of errors.

Since all program text storage is volatile (i.e. lost when power was disconnected), it is necessary to reload the old program if more parts of the previous day's operation are to be manufactured. If the TLO's are not on the tape, it will also be necessary to reload the old tool length offset if the existing cutting tools are to be reused in the existing holders. If, however, power has been left ON, a review of subsequent paragraphs in the order in which they are presented will provide the operator with the quickest means of restoring production.

CAUTION: Since the lubrication system is inoperative until the spindle is turned on, the operator is well advised to lift the plunger of the auto lube pump a few times before attempting to move the axis in JOG or by other means.

NOTE: If lubricating oil level is low, the spindle will not rotate when the switch is ON.

POSITIONING ALONG AN AXIS

In SETUP

1. Select the desired axis (X,Y,Z).

2. Select JOG, 1. , .1, .01, or STEP.

3. Select the desired direction (+ or -).

4. Depress the axis direction Pushbutton (Move Button).
   Each time the button is depressed, the axis will move
   1. , .1, .01, or STEP as selected, or if in JOG, axis
   motion will continue until the pushbutton is released.
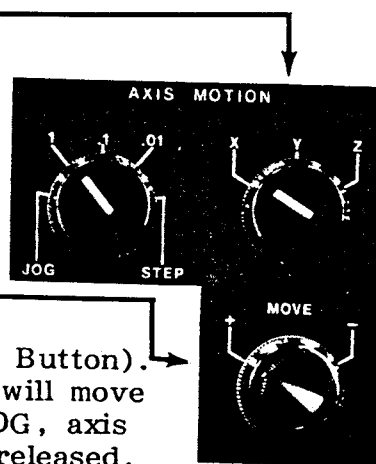
NOTE: All pulses that go to the axis step motor drives enter the
X,Y,Z axis absolute registers. After the axes are in
position, the operator should rezero the registers (or pre-
set them to their proper values). This method of jogging
the axes to a position without the spindle turning is use-
ful when using a dial indicator in the spindle, or when
setting the slides to specific coordinates utilizing the
digital axis displays on the control panel, or the mechani-
cal counters on the machine.

SETTING THE XY ABSOLUTE ZERO LOCATION

In SETUP

1. a. Using the AXIS MOTION Controls,
      move the slides to the XY Zero point of the part co-
      ordinate system. An example of this method of setup
      might be indicating a bore diameter or boss on a part.

   b. Set upper ABS/TLO Switch to ZERO. →

   c. Set lower Switch to XY/T1 position and
      depress.
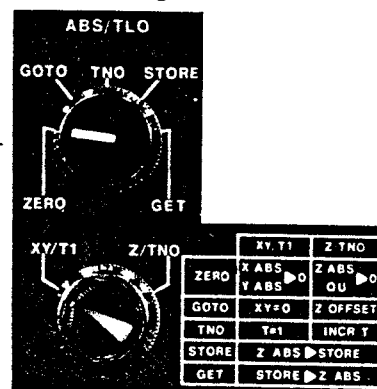
This will set the XY absolute registers to ZERO.

To verify: On the MDI Keyboard, push "5" key (X), then the
"6" key (Y). This will alternately display the absolute location
of the X and Y axis. They should both display Zeros.

2. If the setup point has a value other than X0, Y0, for
    example, if you are using an edgefinder or fixture locating
    hole, then the following method may be used for setting Zero.

    a. Using the AXIS Motion Controls
        move the slides to the setup point.

    b. Set Mode switch to MDI position.
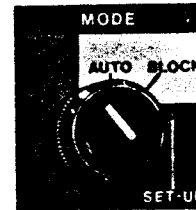
    c. Using MDI Keyboard, input G92 X(value), Y(value),
        then (EOB) black key. This will set the absolute Zero
        position, and the X,Y display will verify the current
   spindle location in reference to that absolute Zero.

TOOL LENGTH OFFSET

1. Tool Length Offset is a multi-functional
    device used to: Simplify "Z" axis pro-
    gramming; reduce tooling set-up proce-
    dures; and control minor discrepancies
    in depth for tight tolerance parts.

2. Tool Length Offset Value is the length from
    the tip of the tool, with the spindle in the
    home position, to the "Z" Zero plane; where-
    ever it may be located by the programmer.

3. The Tool Length Offset Value is automatic-
    ally specified with the coded tool select
    number (e.g. T3), however, it is initiated
    only after the Control has read the M6
    (Tool Change).

4. The tool length offset logic consists of a 24-position read/write
    memory into which data can be input or retrieved. This
    memory is volatile, i.e., the information it contains is destroyed
    when power is removed from the system.
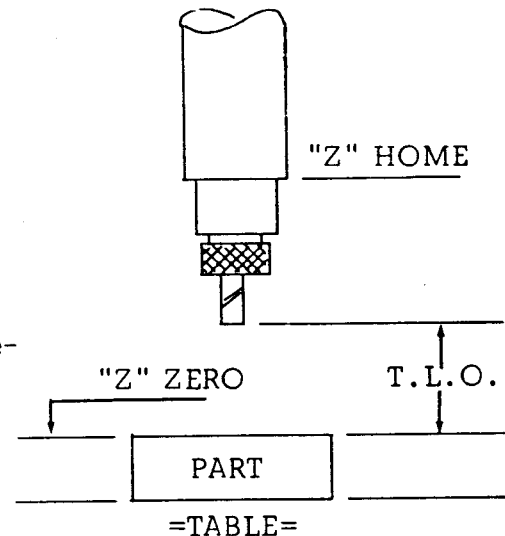
NOTE: The Z axis absolute register is set to the tool length offset
       value (always positive).

TOOL LENGTH OFFSET STORAGE

1. Machine POWER/ON and RESET: TLO values utilized by the
    machine are set to "Z" Zero and a value to be stored can be
    entered from any source.

2. TLO value stored from Program Entry: Only when the stored
    value of TLO is Zero, can a part program input value of
    TLO be entered and become effective in the machine. This

value of Zero is obtained by (a) above or by inputting a value of "Z" Zero through the MDI panel in the SETUP mode using "T" and "TLO" buttons.

3. TLO value stored from Front Panel Entry: In SETUP the TLO value input will be stored and will be utilized by the machine whether the existing stored value in zero or not.
Further, this value input in SETUP will override the value input by any means except those embedded within a program.

Setting The Tool Length Offset

There are three methods of setting tool length offset as follows:

1. Utilizing the machine.
2. Inserting thru the MDI Keyboard.
3. Programming on a tape.

Note: It is highly recommended that the longest tool be selected and a minimum TLO value of .5 inches be assigned by any of the above methods.

When using the machine, the longest tool's TLO should be set first. The knee should then be positioned for the job in relation to this tool. All remaining TLO's may now be set by the following procedure:

a. Set the upper ABS/TLO switch on TNO; set lower switch on Z/TNO position. Depressing the lower switch will increment the 3 digit tool number display until the desired tool number is reached.
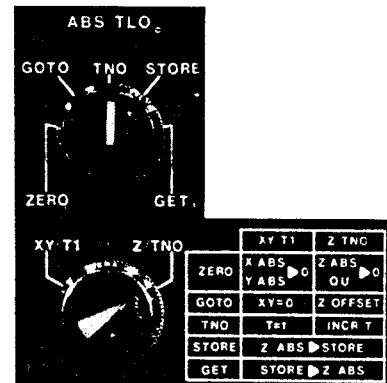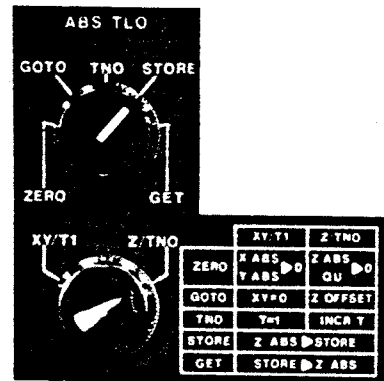

b. Set the upper switch to Zero; leave the lower switch on the Z/TNO position and depress. This will retract the quill to the "home" position and set the "Z" absolute register to Zero.
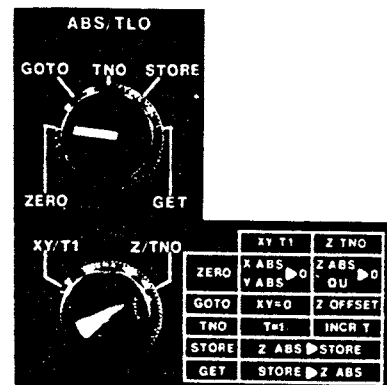

c. Using the Axis Motion switches move the tool to the reference plane previously set when the knee was cranked into position. (e.g. usually the top of the work surface)

d. Set the upper selector switch to STORE, set lower switch to Z/TNO and depress. This will transfer the contents of the absolute register (which has tracked the quill from the uppermost home position to the reference surface) into TLO storage.
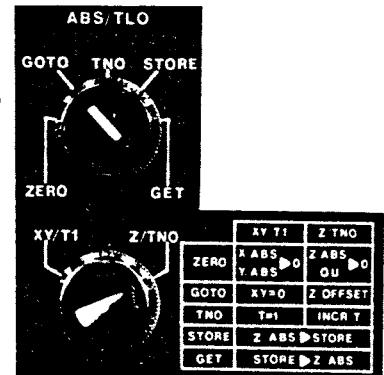
e. Set the upper selector switch to ZERO, set lower switch to Z/TNO and depress. This will drive the quill home.
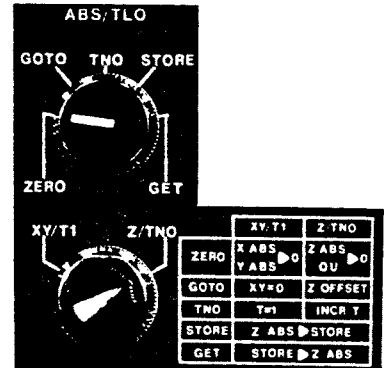
To verify TLO value:

NOTE: Before the following procedure can be used, be sure: 1. Tool Number is correct (Refer to previous step a. if a change is required).
2. Quill must be in home position, refer to step e. above.

a. Set upper switch to GOTO and set lower switch to Z/TNO then depress. This will send the quill to the previously set TLO point. Recheck!

b. Set the upper selector switch to ZERO, set lower switch to Z/TNO and depress. This will drive the quill home.
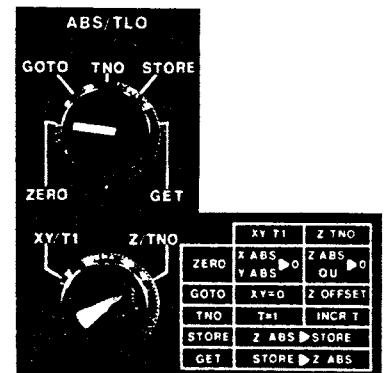
Repeat steps a-e and verify for all remaining tools.

NOTE: GOTO will not work unless the quill is home when the lower Z/TNO pushbutton is depressed.

The values should be recorded for each tool after all tool length offsets have been set in the manner described.
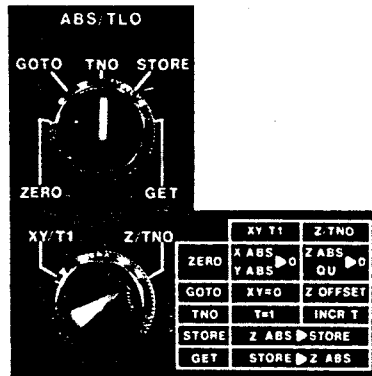
Initiating Tool Length Offset

TLO may be initiated by the control in three modes of operation, Set-up, MDI, or AUTO.

AUTO   In the AUTO or Block Mode, programming, e.g. T1M6, on on tape, will first retrieve the offset value stored for the tool number specified, and then set the Z absolute register to that value (always positive).

MDI   Similarly, in the MDI Mode, entering e.g., T2M6 EOB through the MDI keyboard will also initiate the TLO for tool number two.

SET-UP   1. In the Set-up Mode using ABS/TLO switches, set upper switch on TNO and lower switch on Z/TNO. Depress lower Z/TNO Button to increment the tool number display to the desired tool number

2. Next, set upper switch to GET, leave lower switch in Z/TNO position and depress. This will "get" the TLO value for the tool number selected, i.e. set the absolute Z register to the TLO value.
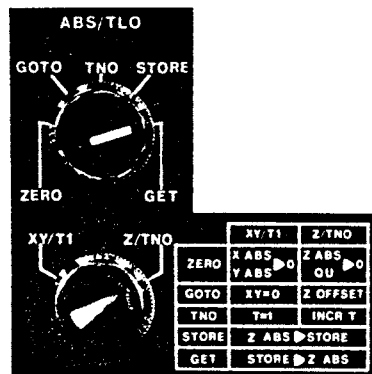
Checking The Value of the Tool Length Offset Storage and/or the Cutter Diameter Compensation Storage Registers.
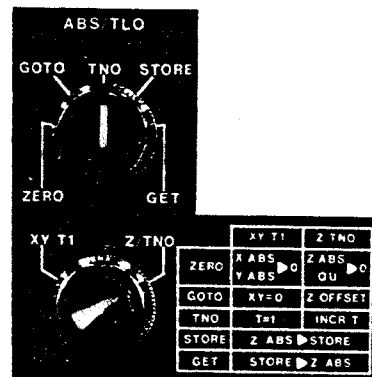
Using MDI Keyboard:

1. In any mode of operation (SETUP, MDI or AUTO), depress the 4 key (T) and the 8 key (TLO) on the MDI keyboard. This will cause a tool number to be displayed in the 3 digit display and the tool length offset value to be displayed in the 5 digit display. For diameter, depress the 4 key (T) and the 9 key (DIA).

2. Setting the desired tool number:

   a. In SETUP Mode:
   Set upper ABS/TLO switch in TNO position. Set lower switch in Z/TNO position. Depressing this lower switch will increment thru the 24 tool numbers and display their associated Tool Offset Value in the five digit display window.

   b. Also in the SETUP Mode, the MDI Keyboard may be used:

   Operating the N(T) key followed by the tool number desired; then the EOB (black key).

Input Value of Cutter Diameter Compensation

The Compensation value to be entered is the algebraic difference:
ACTUAL CUTTER DIAMETER minus PROGRAMMED CUTTER DIAMETER.

E.G.

Programmed Cutter   =   1/2 (.500) Dia. End Mill
Actual Cutter Used   =   .485 Dia. End Mill
The Compensation Value to be input would be:

$$
\begin{array}{rl}
.485 & \text{Actual} \\
-.500 & \text{Programmed} \\
\hline
-.015 & \text{Dia. (Algebraic Difference)}
\end{array}
$$

Enter: -.015 as a Compensation Value.

An alternate way of remembering this signed value might be:

If the actual cutter used is smaller than that programmed, the input value is always negative.
Conversely, using a larger cutter than was programmed, will always produce a positive compensation value.

Cutter Diameter Compensation Storage

The tool diameter storage consists of a 24-position read/write memory into which data can be input or retrieved. This memory is volatile, i.e., the information it contains is destroyed when power is removed from the system. Operation is as follows:

a. Machine POWER/ON and RESET: Diameter values are set to zero and a value to be stored can be entered from any source.

b. Diameter value stored from Program Entry: Diameter values for various tool numbers may be coded in the program at the beginning of the text or they may be embedded in the program. If coded at the beginning, the value can be changed by MDI; however, if they are embedded in the program, and a change is required, it must be done through the EDITOR.

c. Diameter value stored from Front Panel Entry: In SETUP the diameter value input will override any old value and become stored under all circumstances except when the diameter value is embedded in the coded part of the program text.

Using the MDI Keyboard to Enter Tool Diameter Compensation Values

a. Set the mode select switch to SETUP

b. Depress the N Key (T)

c. Enter the tool number

d. Depress the F Key (DIA)

e. Enter the Tool Diameter Compensation

f. Depress the black key (EOB)
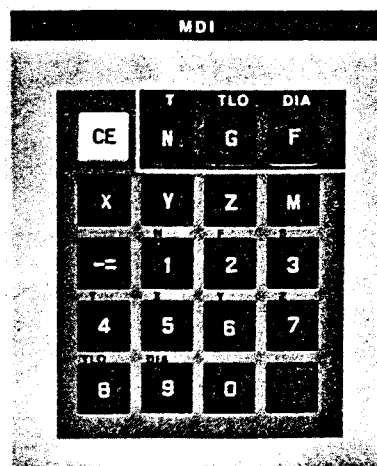
TURNING POWER OFF

The main disconnect switch on the back of the machine is the only means of removing power anywhere in the system. When power is turned off, the stored TLO and program text data in storage is lost. BOSS is non-volatile and will control the machine when power is turned ON again.

REMINDER

Record all:

TLO Values
CDC Values
Zero Locations

LOADING PROGRAM INTO STORAGE

<u>Tape Reader Entry</u> *

a. Place the MODE switch in SETUP.

b. Mount paper tape into reader. (Reference Figure 2-6)
    If tape is between spools, place switch to spool position.
    If tape is short, place switch in loop position.

c. Using Slew control at reader (< >) run tape until read
    head is over the leader before the data portion of the
    tape.

d. Operate the CLEAR switch if MDI data may be in the
    active registers.

e. Operate the LOAD switch (located in the Special Opera-
    tions Panel, Figure 2-4). The tape will be driven
    forward loading the program into storage.

f. If a second tape has to be added to the existing stored
    program, proceed as above. After operating the LOAD
    switch, the second tape will be driven forward appending
    the new program into storage at the end of the previously
    stored data. (This is typical of having your TLO's on a
    separate tape; loading them first, then loading your Part
    program.)

<u>NOTE</u>: For a tape to load and rewind properly, a % must be
         at the very beginning of the TEXT (See recommended
         format in <u>NOTE</u> under Paragraph 4.2.2) and an E(cr)
         must be the last line of the program. If the above two
         conditions are met, the tape will load up to the E
         (Rewind Code) then rewind to the % (Rewind Stop
         Code).

<u>Program Entry Through Editor ("Local" Data Entry Port)</u>

This method of input is valid for most peripheral input devices, for
example, teleprinter, CRT, etc.

a. In the SETUP mode, depress the EDIT pushbutton (the
    editor will come up in one of the two modes INPUT or
    EDIT). The system must be in the INPUT mode. To
    enter the INPUT mode from the EDIT mode, type K(cr).

b. Type CTRL Q. This will prepare the system for receiving
    the tape input.

c. Start peripheral device; for example using teleprinter: load
    tape in reader associated with the teleprinter and move
    switch to start position. (At this time the tape will be loaded
    into the machine.

d. If at the end of loading the editor does not prompt with an
    *, hit (cr) until an * is seen.

e. EXIT editor by typing CTRL Z.

3-11

SEARCHING FOR A PARTICULAR PART PROGRAM BLOCK

GUIDELINES

Do not search for a sequence number within a macro definition
Do not search for a sequence number within a loop range
Do not search for a sequence number 0

CAUTION: Search operation sets the system in the RESTART condition
(i.e. G0, G90, G70, G74) and clears all active registers.

It is recommended that the search block be a tool change
data block, the most useful block when restarting. See
special provisions in the Programming Manual under
"Definition Block". (M-129 Section 5.1).

If two data blocks contain the same sequence number, the
system can only find the first block.

Search will end at the end of the data block prior to the
block being searched.

The sequence number displayed will be that of the last
sequence number read into the system. If a sequence num-
ber is not available, the search will stop at the end of the
program text displaying the last available sequence number.

OPERATION:

a. Set the MODE switch to AUTO.

b. Depress the N key, followed by the sequence number of the
desired block.

c. Depress the BLACK key. The system will automatically REWind,
then search for the required block starting at the top of the
part program storage.

d. Set the FUNCTION switch to START/CONTINUE. Depress that
pushbutton to begin operation. The system will execute the
block containing the sequence number that had been searched
and found.

NOTE: Spindle must be running with the correct tool and its TLO.