



**Vertical Machining Center**

**Operator's Manual**

**DX32 CNC Control**

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**Rev. A**

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Updated Control Panel (Chapter 1)

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## READ THIS FIRST!

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Like most manufacturers, we go to great lengths to make our products as safe as possible—but operators can still get hurt.

In virtually every case, the injury is the result of:

- Not knowing how to properly operate the machine;
  - Not following proper operating and safety procedures;
  - Carelessness or inattention;
  - Trying to “take a short cut;”
  - Poor maintenance.
- 

For your personal safety, and to get the maximum efficiency out of this precision machine, read and follow operation instructions carefully.

Standard Safety Precautions for operating the **Vertical Machining Center** are:

- NEVER operate machine without safety glasses.
  - DO NOT wear gloves, tie, scarf, ID bracelet, neck chain or other object that could become entangled in the machine or workpiece.
  - ALWAYS wait for the spindle to stop before bringing your hands to the table or workpiece.
  - MAKE CERTAIN workpiece is SECURELY held in place.
  - NEVER attempt to hand hold or hand feed a workpiece.
  - Stop the machine and correct any malfunction immediately (see Maintenance manual or contact your supervisor).
  - Inspect and maintain machine by schedule—not by chance.
  - Keep hands and clothing away from moving parts.
  - If you’re not a qualified electrician, do NOT tamper with electrical connections or wiring. Report any suspected electrical malfunction immediately.
  - Other important safety information is contained in the Installation and Maintenance Manual. Make sure you understand all safety procedures before operating the machine.
- 

### IMPORTANT NOTICE

Although reasonable care has been exercised in the preparation of this manual and the relevant VMC Installation & Maintenance Manual to make them complete and accurate, they do not purport to cover all conceivable problems or applications pertaining to this machine.



## **IMPORTANT SAFETY NOTICE WARNING**

It is the user's responsibility to be acquainted with the legal obligations and requirements in the use and application of the machine, particularly as discussed in the American National Standards Institute Standard Entitled Safety Requirements for the Construction, Care, and Use of Drilling, Milling, and Boring Machines.

### **The Bridgeport Milling Machine**

#### **SAFE INSTALLATION**

The Bridgeport Milling Machine is fitted with safety interlocked table 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 Standard Code of Practice for Safety of Machinery. Guards and interlock shall be kept fully maintained and tested by the customer and shall not be removed.

The guards are made with clear plastic, having high impact resistance to provide operator safety and a clear, unobstructed view of the operations in progress. The opening of any guard door provides access to potential hazard areas. Opening the working area guard doors will automatically stop the spindle, but it is still possible, by means of operator controls, to manually initiate all other machine functions. Extreme care must therefore be used at all times.

#### **SOFTWARE**

Any unauthorized changing of control parameters is not permitted. Bridgeport Machines will not accept any liability whatsoever for the alteration of any set parameters to those programmed at installation.

#### **AUTHORIZED PERSONNEL AND TRAINING**

Operating, service and maintenance engineers shall be authorized by the 'User Company' and properly trained in the use of the machine.

#### **SAFE WORKING PRACTICES**

Workholding devices, crantage, tooling and their use shall be the responsibility of the user. It is the user's responsibility to protect against the hazards caused by chips, 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.

# INTRODUCTION

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## ABOUT THIS MANUAL

This manual provides detailed information and procedures for setting up and operating the Bridgeport DX32 Computerized Numerical Control. The DX32 CNC combines the advanced part-programming ability of the Bridgeport BOSS 9 and BOSS 10 controls with a PC-based user interface, which provides even more sophisticated capabilities. The DX32 is more powerful than ever and its user-friendly screen displays make it easier to learn and use than previous CNC systems.

Updates and enhancements to the BOSS Operating System can be loaded entirely from computer disk. This feature prevents the DX32 from quickly becoming obsolete. The completely reprogrammable DOS-based PC technology provides a springboard into the future, much more so than the Application Specific Design now prevalent in today's CNCs.

## WHAT IS INCLUDED IN THIS MANUAL

- Chapter 1     **Getting Started** provides a brief overview of the parts of the DX32, describes what each part does, and explains how the system hardware and software run together. Also included are instructions on setting up the DX32 for operation.
- Chapter 2     **System Start-Up/Shut-Down** describes the system start-up and shut-down procedures.
- Chapter 3     **BASIC OPERATION** describes the most frequently used commands.
- Chapter 4     **SET-UP** describes how to set-up the part for subsequent machining.
- Chapter 5     **RUN** describes the various Run options.
- Chapter 6     **EDIT/MDI** summarizes the commands available for editing part-program text.
- Chapter 7     **DOS Commands** gives some information on the DOS system software necessary to run the control.
- Appendix A   **Axes and Coordinates** explains the basic principles of axis function within the context of machine tools.
- Appendix B   **Rotary Table** explains how to operate the machine with a fourth axis rotary table option.
- Appendix C   **DX 32 Workshift** describes the "workshift" feature used when multiple setups are required on the machine at the same time.
- Appendix D   **Common Error Messages** lists the error message users commonly get while using the machine, with an explanation of the error causes.



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# CHAPTER 1

## HARDWARE/SOFTWARE

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### Introduction

This chapter describes the hardware and software associated with the DX32 CNC.

Included in this chapter are:

- A brief overview of the parts of the DX32.
- A description of what each part does and how the system hardware and software function together.

### General Description

The DX32 control integrates a PC computer and a BOSS (Bridgeport Operating System Software) CNC control. The PC DOS-based computer combines full-feature capability with ease of use by incorporating VGA color graphics and multiple windows that prompt the user through all control functions. The various machine functions are selected with the numeric keypad and function keys on the keyboard. The keys required to perform the necessary operator functions are linked to a color-coded, on-screen display.

An on-screen Editor incorporates a unique G-code conversational mode that prompts the operator for the information required to execute a machine command. User-selectable HELP screens provide detailed information about the G-code being entered. The editor provides an immediate MDI (Manual Data Input) mode to execute a programmed block of data after it is formatted on the screen. The DX32 features an extensive selection of canned cycles that allow easy execution of frequently used cycles, such as: bolt circles; multi-hole row and frame drilling; slot, frame, and pocket milling, with only a single block of programmed data.

The control includes all the standard high performance features associated with the BOSS 9 and 10 controls:

- 3D Linear, 2D Circular, Helical, and Spiral interpolation.
- XYZ/Polar/Spherical coordinates.
- Cutter compensation with automatic corner-rounding.
- Parametric programming that includes Algebraic and Trigonometric functions, and IF-THEN conditional block execution.
- Repetitive programming using looping techniques and MACROs with call-modifiable variables.
- 256,000 characters (more than 200 ft.) of part-program storage.
- DNC data transfer between the PC based front end and the CNC machine controller which allows programs of unlimited length to be executed from disk.

The control includes a built-in 3.5 inch floppy disk drive and a hard disk drive. The hard-cased 3.5 inch floppy disk has a spring loaded, positive cover over the read area for additional protection in the typical shop environment. Each disk has a 1.44Mbyte capacity (12,000 ft.). A user friendly DOS Shell enables the user to list file directories and to copy, delete, and rename files, as well as format disks. Communications software is provided to link to remote computer systems, such as EZ-CAM, via a provided RS-232 interface.

## **Basic Hardware**

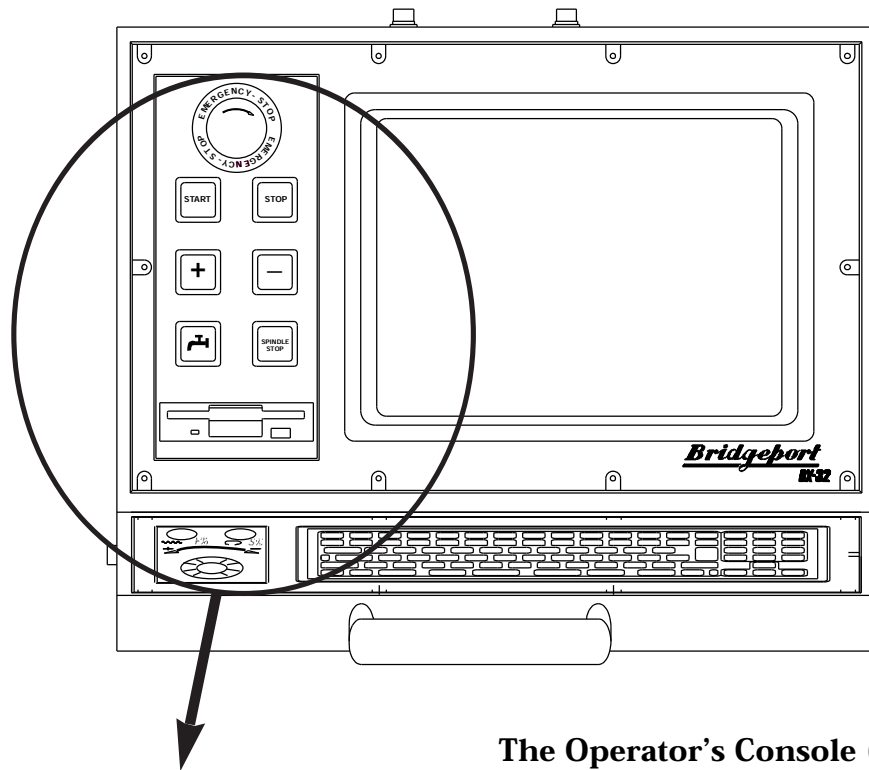
The DX32 consists of three separate and coordinated microprocessor based sub-systems. These are:

**PC:** This is a fully integrated IBM PC compatible computer with hardware controllers for a hard disk, a 3.5 inch 1.44 Mbyte floppy disk drive, a 14" color VGA monitor with 640 x 480 pixel resolution, an alpha-numeric keyboard, and 1 RS-232 serial ports. The primary purpose of the PC is to serve as the user interface for the system. The PC runs under the MS-DOS Operating System.

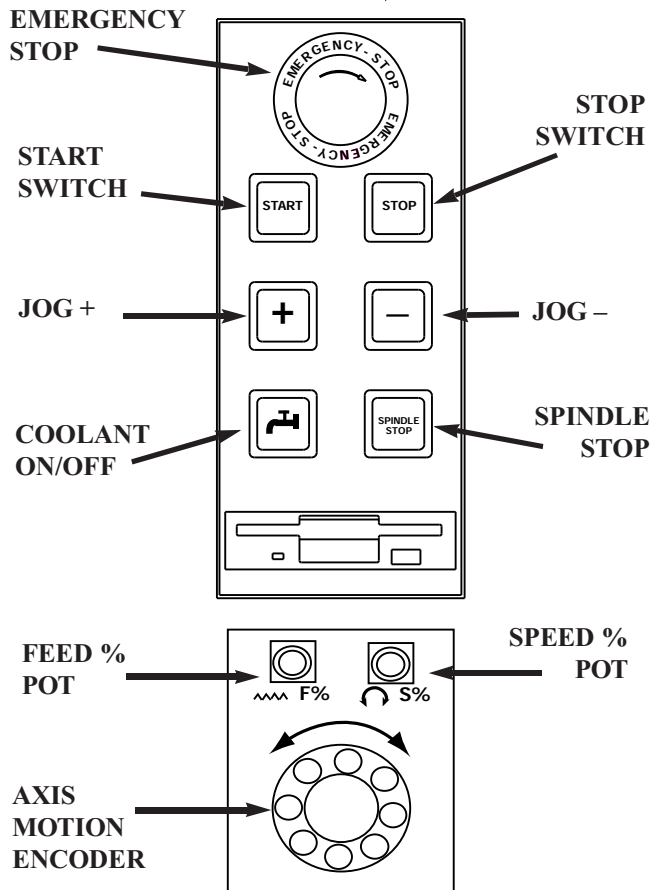
**BMDC:** This is a single board Motorola 68030 microprocessor-based motor drive controller. The BMDC board performs the processing functions that control the positioning of the four servo drives for the X, Y, Z, and C axes. The BMDC board also monitors system status and coordinates all machine tool related processes. The BMDC board runs under the BOSS DX32 Operating System.

**AUF:** This is a single board microprocessor-based auxiliary function controller. The AUF provides the conditioned input/output signals that perform various machine related functions, such as spindle and coolant control, jogging, and spindle speed control. The AUF is connected via internal serial link to the BMDC.

# OPERATOR'S CONSOLE



**Figure 1-1**



## The Operator's Console (Figure 1-1)

consists of a pendant-mounted VGA Color monitor, a keyboard, and control buttons. These controls are used to operate all functions of the CNC.

The VGA Color monitor displays the screen menus from which the operator can select control functions.

The keyboard provides the basic means for communicating with the DX32 control. The keys are organized into five groups, they are:

1. *Main Keyboard* This includes all the keys normally found on a typewriter.

2. *Numeric Keypad* This includes numbers 0-9, decimal point and mathematical function keys. It is used with pop-up menus on the screen to select various control functions.

3. *Function Keys* These enable the operator to select special functions that are assigned to each key.
4. *Screen Control Keys* These enable the operator to select data from different locations on the screen display, particularly in Edit mode.
5. *Special Keys* These keys communicate directly to the operating system.

The control buttons each have a specific function. These functions are used in setting up a part and running a part program.

**START** Pressing the **START** button begins operation of the part program at the current line of the part program text. **START** also resumes execution after an interruption such as PROGRAM STOP or system HOLD.

**STOP** This button stops part program execution and interrupts axis motion without loss of the program position. All axes decelerate to a smooth stop unless a tapping (G84) cycle is in progress. During a tapping or tool change cycle, the machine motion continues until the end of the cycle. The perimeter door guards can be opened at this time, which causes the spindle and coolant to shut off. When the doors are closed, the spindle and coolant will return to their previous conditions.

**NOTE:** In RAPID TRAVERSE (G0) motion may continue up to 0.2 inches after **STOP** is pressed. The active registers are not lost. To continue, use **START**.

## **EMERGENCY**

**STOP** This is a red mushroom button which, when pressed, stops the spindle motor and axes drives. Program execution is terminated and the system is set in the System Start Up mode. When **EMERGENCY STOP** is pressed, the part program and the tool length offsets (TLOs) are not destroyed and axis position is not lost. The **EMERGENCY STOP** button should only be used when an immediate halt of all motion is absolutely necessary or when safety is threatened. In normal use the **HOLD** button should be used to interrupt axis motion.

To recover from **EMERGENCY STOP**, first correct the problem which caused the use of the button. Next, pull out the button and then execute the **AXIS DRIVE ENABLE** sequence. Under certain circumstances the axes drives may need to be re-homed. In this case the machine will prompt the operator to re-home the machine.

**JOG +/-** These are two push-button selector switches. They are used for either jogging an axis continuously, or in 0.0001 steps.

When **9 JOG** is selected from the **BASIC** menu, pressing the push-button causes the axis selected from the screen menu to move. There are two selectable jog motions: FAST and SLOW.

**% SPEED** This potentiometer is used to change the speed of the spindle. The requested spindle speed is adjustable from 50 to 200%.

**% FEED** This potentiometer is used to change the speed of the axis traverse and programmed feed after the override function has been activated. The requested feed or traverse rate is adjustable from 0 to 150%.

**COOLANT  
ON/OFF**

This switch is a normally-open, momentary push-button which acts like a toggle switch. If the flood coolant is off, depressing the switch starts the flow of flood coolant (M8 flood coolant ON). If the flood coolant is on, depressing the switch stops the flow of flood coolant (M9 flood coolant OFF).

**AXIS MOTION**

**ENCODER** This encoder will generate axis motion on the axis selected by the operator. The knob, when rotated, causes 0.1 inches of motion for each revolution when the fast jog is selected, and 0.01 inches of motion when the slow jog is selected. The speed on the axis motion is controlled by the speed of the rotation of the knob.

**Basic BOSS DX32 Software**

**PC** Software used on the PC consists of *System Software*, *Applications Software*, and *User Data*.

**System  
Software**

System software is the essential collection of programs the DX32 needs before you can use it. The operating system used on the PC is **MS-DOS**. MS-DOS (DOS) is a collection of routines that perform basic tasks such as starting (or booting up) the computer, moving data to and from disks and peripheral devices, and managing and allocating memory space in RAM. The most frequently used DOS System commands are described in this manual. For more information on DOS, refer to the *MS-DOS User's Reference Manual*.

DOS is the bottom layer of software used on the PC. In normal operation, it is not necessary to access the DOS level. Upon start-up, a routine called AUTOEXEC.BAT automatically loads the DX32 specific applications software. For advanced users DOS can be accessed via the START-UP menu.

## **Applications**

**Software** The routines that call the front panel screens and perform the commands selected from the screen menus are contained in a program named BXX.EXE. The software driver which controls axis drive functions, and executes machine instructions is called BMDC.BIN. For information on updating the applications software, see Chapter 7.

**NOTE:** The programs BXX.EXE (which runs on the PC) and BMDC.BIN (which runs on the BMDC) are essentially independent of each other. Status and text data are passed between the two programs as required. This enables concurrent use of the systems. For example, the PC can be used to edit a program while the BMDC is machining a part, or the PC can be in the Diagnostic Mode monitoring the servo performance while the BMDC is running diagnostic moves.

There are DOS level errors that can stop execution of BXX.EXE. The most frequent error occurs when no disk or an improper disk is mounted in the disk drive. DOS flags the error and breaks to the DOS system level. To resume operation, type **RUN** when the DOS prompt (**C>**) appears.

**User Data** User Data consists of part programs and tool data. The file extension **.TXT** is appended to part program text. The file extension **.DAT** is appended to tool data.

**BMDC** BOSS DX32 is the Operating System used on the BMDC. Previous Bridgeport CNC systems had BOSS imbedded in ROM. On the DX32, BOSS is loaded into RAM located on the BMDC board.

## **DX32 SYSTEM DISK**

The software described above is stored on the hard disk, as well as a 3.5 inch floppy backup disk. System software and user data may reside on the same disk, however, this does limit the amount of available space for storing user data. It is strongly suggested that backup copies of the system software be kept in a safe place (away from extreme heat, cold, or humidity, magnets, oil and dust).



## CHAPTER 2

# STARTING UP THE DX32

---

### Introduction

The procedure detailed in this chapter is necessary to properly start the DX32 System. Make certain that all set up and pre-start maintenance has been completed before attempting to start the machine.

### Before Starting the DX32

Make a careful check of the following conditions before applying power.

- 1) Check level of lubricating oil, refill if low.
- 2) Check position of all axes with respect to fixtures or other parts left on the table.
- 3) Check air pressure level, adjust to nominal psi.

### **CAUTION!!**

**If there are ANY problems with any of the prestart checks, DO NOT start the machine. Check the Maintenance Manual for proper start up maintenance procedures. Failure to do so may result in machine damage.**

### Turning on the DX32

The DX32-controlled machines boot automatically from the standard hard disk contained within the control cabinet. Before turning on the MAIN DISCONNECT, make sure that the floppy disk drive is empty. To power up the system, move the MAIN DISCONNECT switch, located toward the rear of the machine, to the ON position.

The system will then run through its STARTUP diagnostics and loads the BMDC.BIN software to the BMDC. The system also verifies the integrity of the driver code stored in the BMDC RAM. If the driver code has been corrupted, the system prompts the operator to load a new version of the driver code. This would require inserting the backup software disk and following the update or install instruction found in Chapter 7. If the driver code is okay, the STARTUP routine then automatically loads and executes the DOS-based DX32 System Software. The START-UP SYSTEM Menu then appears on the screen. See Figure 2-1 below.

BOSS DX/32 V4.08/6.41				MON JAN 14 03:15:04 PM				CNC MAN ABS B8&		
Copyright (c) 1988-1995 BRIDGEPORT MACHINES, INC. [C:\ bytes free = 259596288]										
<b>BRIDGEPORT DX/32 CNC</b> <hr/> This software is subject to revision and enhancement. To receive software updates register your system by calling BRIDGEPORT CONTROLS at 215-788-8484. Please give us your NAME/ TITLE/ COMPANY/ ADDRESS/ CITY/ STATE/ ZIP/ PHONE/ FAX/ DEALER/ and CNC SERIAL NO. [FAX 215-788-0734]				7 AXSDRV ENABLE	8 HOME AXES	9 DOS				MODE: SETUP SEQ NO: 0 TOOL NO: 9 TLO: 7.0000 DIA: 0.5000 TIME: 000:00:00 S, ACT 0 75% F, IPM 000.0 F, OVR (OFF) 80% X ABS 12.4214 Y ABS 8.9717 Z ABS 7.1614
				4 LOAD Remote	5 FILES	6 Tool Change				SPINDLE: OFF COOLANT: OFF BAPID, IPM: OPSELSW: OFF OPROTSW: OFF DRYRUN: OFF / DELETE: OFF OPSTOP: OFF
				1 SET PARAMs	2	3 JOGoff LIMITS				
				0 SELECT BASIC MENUS						
F1	F2 N-SEE	F3 WINDOWS	F4 EZ-SPS	F5	F6 dataNET	F7 DIGITIZ	F8 SUProbe	F9 LDmdcSW	F10 Params	

Figure 2-1

To start the system from a floppy disk, (System Disk only), put the disk into the disk drive BEFORE turning the MAIN DISCONNECT on.

**NOTE:** The **SYSTEM MODE** status window (top line in the screen) displays the current version number of the DX-32 software. Always reference this number when calling Bridgeport for technical support.

## Modes of Operation

The DX32 uses any one of four basic modes during machine operation. They are:

**STARTUP      BASIC OPERATION      SETUP      RUN**

The default mode after system initialization is **STARTUP**. The **BASIC OPERATION** menu is automatically displayed after the axis drives are enabled and the axes are homed. The **SETUP** mode is made active by selecting **F3 SETUP** from the **BASIC** menu. The **RUN** mode is made active by selecting **F4 RUN** from the **BASIC** menu.

### STARTUP

This mode is the first active mode after the system is booted up.  
The system commands available from the **STARTUP** screen are:

## **1 SET PARAMs**

Refer to Maintenance Manual.

## **3 JOGoff LIMITS**

This provides the ability to jog-off the axis limit switches. This may be necessary prior to homing if the axis position is such that a limit switch is actuated.

## **4 LOAD Remote**

This provides a communications link to remote devices.

## **5 FILES**

This provides the ability to DELETE, RENAME, COPY and APPEND DATA and TEXT files.

## **6 TOOL CHANGER**

This command accesses Tool Changer settings. This command gives the user the ability to load the tool magazine with tools and home the magazine when done. This command is also where the tool change setup is done (refer to the maintenance manual on tool change setup).

## **7 AXSDRV ENABLE**

This command turns on power to all the axis drives.

## **8 HOME AXES**

This command initiates the machine homing sequence.

## **9 DOS**

This command exits to the MS-DOS operating system.

## **0 SELECT BASIC MENUS**

This command selects the BASIC OPERATIONS screen display.

The displayed **STARTUP** commands which can be executed using the Function keys are:

### **F2 N-SEE**

*[Enhanced Performance Option]* This command executes the N-SEE software.

### **F3 WINDOWS**

*[Enhanced Performance Option]* This command exits to the Microsoft Windows environment.

### **F4 EZ-SPS**

*[Option]* This command exits to the Bridgeport Simplified Programming System.

**F6 dataNET**

This command links with a high-speed data network for client-server based communications. This network option is not offered by Bridgeport, it must be installed by the user.

**F7 DIGITIZ**

[*Digitizing Software Option*] This command exits to the Bridgeport Digitizing software.

**F8 SUProbe**

This command enables or disables the Probe.

**F9 LDmdcSW**

This command enables reloading the machine software (BMDC.BIN) into the BMDC.

**F10 Params**

This command enables the operator to configure certain system parameters. (i.e. backlash, rapid and jog rates)

The **[ESC]** key is used to clear the **EVENT STATUS** messages.

**NOTE:** Pressing **[ESC]** does not correct the cause of the ERROR message. The error condition must be corrected before the machine can continue to operate. During an alarm condition, the blinking "ALARM" message needs to be cleared with the "ESC" key BEFORE any other command will be executed, such as spindle off, quill up, etc.

**BASIC OPERATION**

For simplified operation, the BASIC OPERATION menu contains the most frequently used operator commands. In normal operation, all the commands necessary to set up and run the DX32 can be selected from this screen.

Less frequently used DX32 commands can be accessed from the BASIC OPERATION menu by accessing the STARTUP, SETUP, and RUN menus.

This mode is discussed in greater detail in Chapter 3 in this manual.

**SETUP**

The SETUP screens prepare the machine for part making. This includes establishing machine reference points, tool characteristics, initial axis positions, and loading part programs.

The **EDIT** function can be accessed through the SETUP mode. This mode is discussed in greater detail in Chapter 4 in this manual.

## RUN

This mode runs a part program that has been previously loaded into BMDC RAM either in Automatic or Block mode. RUN mode also works with DNC LINK (Direct Numerical Control).

The MDI function can be accessed in the RUN mode. This mode is discussed in greater detail in Chapter 6 in this manual.

## Reading the CRT

The DX32 screen contains the fields shown in Figure 2-2, below.

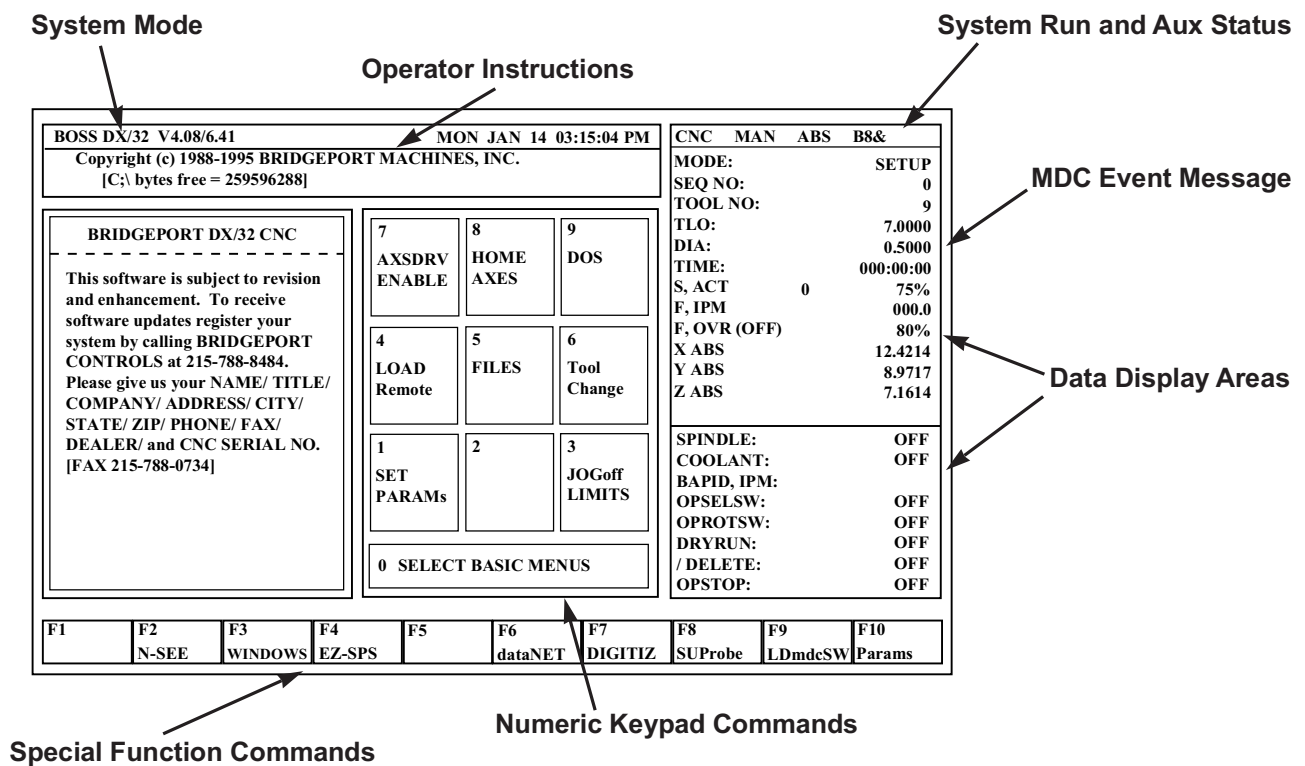


Figure 2-2.

Although the initial reaction to the DX display may be that the screen looks cluttered with data, the screens are actually set up in a consistent, informative manner. The object is to present as much information as possible without requiring the operator to access additional layers of data.

The screen display consists of the following windows:

## **System Mode**

This is a one line status message which displays the System MODE. A real time clock is also displayed on this line.

## **Operator Instructions**

This is a two line message containing information for the operator. A blinking arrow at the top right hand side of the window indicates when operator input is required.

**NOTE:** There are two kinds of input required from the operator:

- 1) A **<NUMERIC KEY>** or **<FUNCTION KEY>** selection may be required to perform the desired command.
- 2) A **DATA** field entry may be required. The only way to complete a **DATA** field is to press the **<ENTER>** key once the data has been satisfactorily entered, or the **<ESC>** key to CANCEL the command.

## **Data Display Areas**

The data display areas are used to show important system information, such as AXIS POSITION, PART PROGRAM TEXT, TOOL TABLES, etc.

## **Numeric Keypad Commands**

These show the available commands which can be selected with individual keys on the keypad.

## **Special Function Commands**

These show the available commands which can be selected with individual function keys on the keyboard.

## **System Run and Aux Status**

These show the state of the MDC controller. All key data registers and mode bit flags are displayed. The TOP line of the RUN STATUS display is particularly important, it shows whether the system is **OFF**, in **MAN**ual mode, in **RUN** mode, or in **HOLD**. It also indicates whether input is **ABS** or **INC** and whether the system is in **B4-7** or **B8&** mode.

## **MDC Event Message**

This is a one line event status message that displays run time dependent messages. For example, it will show fault or error messages.

## Homing the Axes

From the **STARTUP** screen, press **7 AXSDRV ENABLE** to power up the drives. Next, press **8 HOME AXES** twice to initiate the machine homing sequence. This causes the Z axis to move up to the “Home” position and the X and Y axes, and C if installed, to move to their “Home” positions in sequence. The tool changer will also position itself to the current tool position.

**NOTE:** Perimeter guard doors need to be closed to initiate the homing process. Once the tool carousel is finished homing the doors can then be opened. The **SYSTEM STATUS** window shows the **X ABS**, **Y ABS**, and **Z ABS** position, and **C ABS** if installed. Prior to homing, **Not Homed** is displayed. If an Axis LIMIT has been exceeded, the **OPERATOR’S INSTRUCTION** window reads:

—>X AXIS LIMIT — Use JOG KNOB to MOVE OFF LIMIT

Following the directions, use the JOG knob to move the axis off the Limit.

**CAUTION!!** Be sure to select the correct jog direction.

Additionally, the **EVENT STATUS** window may display an ERROR message describing a System Fault.

## Normal Shutdown Procedures

Use the following procedure to shutdown the machine for either overnight or extended periods of time.

- 1) Select BLOCK mode or wait for a tool change block if a program is running.
- 2) Turn spindle OFF.
- 3) Depress EMERGENCY STOP.
- 4) Switch machine Main Disconnect to OFF.

## Power Failure

Loss of power to the machine for more than 1/60 of a second (1 cycle) causes a system shutdown. Use the initial system start up procedure to restart the machine after power failure.

**NOTE:** System RESET may be required if power was off for less than one half second.

## **System Reset**

Pressing the RESET push-button switch sets the DX32 in an initial start up condition. Follow the start up procedure.

## **System Configuration**

Pressing the **F10 XT Params** key allows the operator to set various system parameters. The **UP** and **DOWN** arrow keys are used to select the parameter to be changed. The system parameters that can be set via the **Params** screen are:

### **MAX RATE**

Entering a value here sets the rapid traverse rate (G0).

### **JOG RATE**

Entering a value here sets the jogging traverse rate.

### **BACKLASH COMPENSATION**

Entering a two (2) digit number from 2 – 25 sets the designated backlash value into the system.

The system configuration values are saved in a file named BMD CPRMS.SYS. *It is VERY important that the DX32 BACKUP DISK is matched with the machine that it is to be used with, otherwise, configuration values may not be set properly.*



# Chapter 3

## BASIC OPERATIONS

---

The **BASIC OPERATION** mode contains the commands most frequently used by the operator. The following operations are available from the **BASIC OPERATIONS** menu.

- 1) Axis jog, axis motion and establishment of machine/part program coordinate system.
- 2) Entering, storing, and loading Tool Data.
- 3) Setting of RUN mode – RESET program, AUTO, BLOCK.
- 4) Operation of machine functions – COOLANT, FEEDRATE OVERRIDE.
- 5) Loading part programs.
- 6) Editing part programs.

### Basic Operation Screen

The BASIC OPERATION screen appears as shown in Figure 3-1.

BASIC		MON JAN 14 03:15:04 PM			CNC MAN ABS B8&				
Use <f KEY> or <NUM KEY> to select FUNCTION Cursor Up/Dn for Feed Override (5% increments)									
<b>X</b> <b>12.4214</b>  <b>Y</b> <b>8.9717</b>  <b>Z</b> <b>7.1614</b>	7	8	9						
	SET T//	SET TNO	JOG						
	4	5	6						
	FND :_N_T_	RESET PGM	S_T_M_						
	1	2	3						
	AUTO	BLOCK	FEED OVR						
C: _____ PRV: _____ CUR: _____ NXT: _____	0 EXIT BASIC MENUS								
F1	F2 S_/OFF	F3 SETUP	F4 RUN	F5 PREVIEW	F6 EDIT	F7 LOAD	F8 COOLANT	F9 QU UP	F10

**Figure 3-1**

The key commands available from the **BASIC OPERATIONS** screen are as follows:

**0 EXIT BASIC MENUS** This command will exit the **BASIC OPERATIONS** mode and return the operator to the **STARTUP** screen.

**1 AUTO** This command sets the system in **RUN/AUTO** mode. Hitting the START button begins automatic execution of the part program.

**2 BLOCK** This command sets the system in **RUN/BLOCK** mode. Hitting the START button begins block by block execution of the part program.

**3 FEED OVR** In RUN mode, this enables the use of the feed override potentiometer to override programmed feedrates. When feed override is set to ON, the feed override knob enables the overriding of rapid traverse and feed motion commands from 0% to 150%. When the feed override function is set to OFF, all motion commands return back to executing at 100%, regardless of the feed override knob position.

**NOTE:** Spindle override – Whenever the spindle is rotating, the spindle override knob is active, which enables the override of the programmed RPM from 50% to 200%.

**4 FIND :\_N\_T\_** This command searches the part program for a particular **:**, **N (Sequence Number)**, or **T (Tool Number)** value.

**5 RESET PGM** This command will reset the part program text pointer back to the top of the program. It also initializes the system RUN registers.

**6 S\_T\_M\_** This command allows the input of **S**, **T**, and **M** values. (Spindle Speed, Tool #, or Miscellaneous function)

**7 SET T//** This command allows the direct input of TLO and DIA values.

**9 JOG** This command calls the JOG screen. In addition to Axis JOG and MOTION commands, the JOG screen contains a convenient set of commands for setting the machine up. It will be discussed further in this chapter.

**F2 S\_/OFF** This command shuts off the spindle.

**F3 SETUP** This command will bring up the SETUP screen. It will be discussed further in Chapter 4 of this manual.

**F4 RUN** This command will bring up the RUN screen. It will be discussed further in Chapter 5 of this manual.

**F5 PREVIEW** This command will provide a graphical display of the tool path. It will be discussed further in this chapter.

**F6 EDIT** This command brings up the editor to allow the operator to make changes to the part program. See Chapter 6 in this manual.

**F7 LOAD** This command loads a part program that is stored on disk to the CNC. It also executes a RESET PGM command. It will be discussed further in this chapter.

**F8 COOLNT** This command selects FLOOD or MIST coolant, and turns the coolant either ON or OFF.

**F9 QUILL UP** This command moves the Z axis to the UP (HOME) position.

### Jogging the Axes

After the axes drives have been enabled and the axes have been homed, the **BASIC OPERATION** mode can be used to set up and run the DX32. Pressing the **9 JOG** key from the BASIC OPERATION menu will bring up the screen shown in figure 3-2.

SETUP    JOG				MON JAN 14 03:15:04 PM			CNC MAN ABS B8&																																																																															
Select AXIS/MODE: <+> = MOVE X_Y_Z_ <-> = MOVETO PT [   ]							MODE: SETUP																																																																															
<-> = PROBEPT </> = SAVEPTS							SEQ NO: 0																																																																															
<table border="1"> <tr> <td><b>X</b></td> <td><b>12.4214</b></td> <td>7</td> <td>8</td> <td>9</td> </tr> <tr> <td><b>Y</b></td> <td><b>8.9717</b></td> <td>JOG Z</td> <td></td> <td></td> </tr> <tr> <td><b>Z</b></td> <td><b>7.1614</b></td> <td>4</td> <td>5</td> <td>6</td> </tr> <tr> <td></td> <td></td> <td>JOG Y</td> <td></td> <td></td> </tr> <tr> <td>1</td> <td>-4.2150</td> <td>9.0225</td> <td>-4.3115</td> <td>1</td> <td>2</td> <td>3</td> </tr> <tr> <td>2</td> <td>6.0698</td> <td>-0.5076</td> <td>-4.3115</td> <td>JOG X</td> <td>JOG SLOW</td> <td>JOG FAST</td> </tr> <tr> <td>3</td> <td>6.0698</td> <td>5.3724</td> <td>-4.3115</td> <td colspan="3">0 EXIT JOG MENU</td> </tr> <tr> <td>4</td> <td>-1.5723</td> <td>1.5063</td> <td>-4.3115</td> <td colspan="3"></td> </tr> <tr> <td>5</td> <td>1.8024</td> <td>3.3186</td> <td>-4.3115</td> <td colspan="3"></td> </tr> <tr> <td>6</td> <td>2.1276</td> <td>3.2730</td> <td>-4.3115</td> <td colspan="3"></td> </tr> <tr> <td>7</td> <td>1.9650</td> <td>3.2958</td> <td>-4.3115</td> <td colspan="3"></td> </tr> <tr> <td>8</td> <td>0.0000</td> <td>0.0000</td> <td>0.0000</td> <td colspan="3"></td> </tr> </table>							<b>X</b>	<b>12.4214</b>	7	8	9	<b>Y</b>	<b>8.9717</b>	JOG Z			<b>Z</b>	<b>7.1614</b>	4	5	6			JOG Y			1	-4.2150	9.0225	-4.3115	1	2	3	2	6.0698	-0.5076	-4.3115	JOG X	JOG SLOW	JOG FAST	3	6.0698	5.3724	-4.3115	0 EXIT JOG MENU			4	-1.5723	1.5063	-4.3115				5	1.8024	3.3186	-4.3115				6	2.1276	3.2730	-4.3115				7	1.9650	3.2958	-4.3115				8	0.0000	0.0000	0.0000				TLO: 7.0000			
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							DIA: 0.5000																																																																															
							TIME: 000:00:00																																																																															
							S, ACT 0 75%																																																																															
							F, IPM 000.0																																																																															
							F, OVR (OFF) 80%																																																																															
							X ABS 12.4214																																																																															
							Y ABS 8.9717																																																																															
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							COOLANT: OFF																																																																															
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							OPSELSW: FXAXS																																																																															
							OPROTSW: FXAXS																																																																															
							DRYRUN: OFF																																																																															
							/ DELETE: OFF																																																																															
							OPSTOP: OFF																																																																															
F1	F2	F3	F4	F5	F6	F7	F8	F9	F10																																																																													
	TEACH	Z PTS	GEOM	GoCLRPT	SET X	SET Y	TLO = Z	QU UP	ABS/INC																																																																													

**Figure 3-2**

The commands available from the JOG screen are:

- 1 JOG X**
- 4 JOG Y**
- 7 JOG Z**
- 5 JOG C** (if installed)

These commands are used to select the axis that is to be jogged. A blinking number indicates which axis has been selected.

## 2 JOG SLOW

## 3 JOG FAST

These commands select the resolution for jog motion. Jog is executed by rotating the incremental jog knob or by pressing one of the two jog switches (+,-). In **JOG SLOW** the resolution of the incremental jog knob is 0.01/rev and the selected jog axis is moved 0.0001" each time the jog switch is pressed. In **JOG FAST** the resolution of the incremental job knob is 0.1/rev and continuous motion occurs when the jog switch is pressed.

## F2 TEACH

This command enters the TEACH mode. It allows the operator to create a part once, entering the required points, then having the machine save the moves as a part program. This will be explained in greater detail further in this chapter.

## F3 Z PTS

This command accesses a set of options for positioning the Z-Axis.

**Z Up Point:** This is a Z-axis position usually some safe distance above the workpiece which can be saved for use in the Setup Mode.

**Z Down Point:** This is a Z-axis position usually close to or on the workpiece surface which can be saved for use in the Setup Mode.

**Go to Z Up Pt.**

**Go to Z Down Pt.:**

These commands are used to position the Z-axis to the Z Up Point or Z Down Point location in the Setup Mode.

7 JOG Z	8 SAVE Z UP PT	9 GO TO Z UP PT
4 JOG Y	5 SAVE Z DWN PT	6 GO TO Z DWN PT
1 JOG X	2 JOG SLOW	3 JOG FAST
0 EXIT JOG MENU		

## F4 GEOM

The GEOMETRY mode is used in conjunction with the **SAVE POINTS** coordinates to calculate intersections of lines, centers of rectangles or radii.

While in the **JOG** mode, the OPERATOR INSTRUCTION window displays the following message:

Select AXIS/MODE:	<+>=MOVE X_Y_Z_	<->=MOVETO PT
<.>=PROBEPT	</>=SAVEPTS	

If <+> **MOVE XYZ** is pressed, the OPERATOR INSTRUCTION window will display:

```
—>MOV X_____ <ENTER>  Y_____ <ENTER>  Z_____ <ENTER>
      ABS                               Hit <ESC> to CANCEL
```

ABS indicates the input mode. Press <ENTER> without a value to advance the input pointer past a field. After the X,Y, and Z move values are entered, the OPERATORS INSTRUCTION window displays:

```
—>MOVE X 1.0000 <ENTER>  Y 2.0000 <ENTER>  Z 0.0000 <ENTER>
      <+> to MOVE XYZ   or <ESC> to CANCEL
```

Pressing the <+> key moves the axes to the desired position.

If </> **SAVE PTS** is pressed, the OPERATOR INSTRUCTION window will display:

```
—>SAVE XY PT [1 thru 8] [ ] <ENTER>           <ESC>=CANCEL
      @ X1.0000 Y2.0000 Z0.0000
```

Entering a value from 1 through 8 stores the coordinates of the point in the saved POINT table.

If <-> **MOVE TO PT** is pressed, the axes can be moved to a previously saved point in the POINT table. The OPERATOR INSTRUCTION window displays:

```
—>GOTO XY PT [1 thru 8] <HIT 1-8> or <ESC> to CANCEL
      <+>=GOTO XYZ PT.
```

After the desired saved point has been entered the OPERATOR INSTRUCTION window displays:

```
—>MOVETO PT [1] X1.0000 Y2.0000
      <+> to MOVE XY or <ESC> to CANCEL
```

Hitting the <+> key moves the table to the previously save position.

The <.> key selects the **PROBEPT** mode. This mode is used with a touch probe to touch off points on the part surface. When the <.> key is pressed, the keypad display reads:

SETUP    JOG				MON JAN 14 03:15:04 PM				CNC MAN ABS B8&																																			
PROBE XYZ    Select PROBE AXIS: or <ESC> = CANCEL								MODE: SETUP																																			
<b>X</b> <b>12.4214</b>  <b>Y</b> <b>8.9717</b>  <b>Z</b> <b>7.1614</b>				7 JOG Z		8		9 PROBE +Y		SEQ NO: 0																																	
<table border="1"> <tr><td>1</td><td>2.5338</td><td>6.2763</td><td>-2.9828</td></tr> <tr><td>2</td><td>6.0698</td><td>-0.5076</td><td>-4.4115</td></tr> <tr><td>3</td><td>6.0698</td><td>5.3724</td><td>-4.3115</td></tr> <tr><td>4</td><td>-1.5723</td><td>1.5063</td><td>-4.3115</td></tr> <tr><td>5</td><td>1.8024</td><td>3.3186</td><td>-4.3115</td></tr> <tr><td>6</td><td>2.1276</td><td>3.2730</td><td>-4.3115</td></tr> <tr><td>7</td><td>1.9650</td><td>3.2958</td><td>-4.3115</td></tr> <tr><td>8</td><td>0.0000</td><td>0.0000</td><td>0.0000</td></tr> </table>				1	2.5338	6.2763	-2.9828	2	6.0698	-0.5076	-4.4115	3	6.0698	5.3724	-4.3115	4	-1.5723	1.5063	-4.3115	5	1.8024	3.3186	-4.3115	6	2.1276	3.2730	-4.3115	7	1.9650	3.2958	-4.3115	8	0.0000	0.0000	0.0000	4 JOG Y		5 PROBE -Z		6 PROBE -Y		TLO: 7.0000	
1	2.5338	6.2763	-2.9828																																								
2	6.0698	-0.5076	-4.4115																																								
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7	1.9650	3.2958	-4.3115																																								
8	0.0000	0.0000	0.0000																																								
				1 JOG Z		2 PROBE -X		3 PROBE +X		PROBE ON																																	
				0 EXIT JOG MENU						TIME: 000:00:00																																	
								S, ACT 0 75%																																			
								F, IPM 000.0																																			
								F, OVR (OFF) 80%																																			
								X ABS 12.4214																																			
								Y ABS 8.9717																																			
								Z ABS 7.1614																																			
								SPINDLE: OFF																																			
								COOLANT: OFF																																			
								BAPID, IPM:																																			
								OPSELSW: FXAXS																																			
								OPROTSW: FXAXS																																			
								DRYRUN: OFF																																			
								/ DELETE: OFF																																			
								OPSTOP: OFF																																			
F1	F2 TEACH	F3 Z PTS	F4 GEOM	F5 GoCLRPT	F6 SET X	F7 SET Y	F8 TLO = Z	F9 QU UP	F10 ABS/INC																																		

Figure 3-3

Use **2 PROBE -X**, **3 PROBE +X**, **5 PROBE -Z**, **6 PROBE -Y**, or **9 PROBE +Y** to move the probe into the part. After the probe hits the part, it automatically prompts the operator to save the touch point and backs off from the part. The OPERATOR INSTRUCTION window displays:

—> SAVE XY PT [1 THRU 8]:	<ENTER>	<ESC>=CANCEL
@X1.0000      Y2.0000		

Entering a value from 1 through 8 stores the saved probe touch point in the stored POINT table.

**NOTE:** The probe keys are situated so as to help the operator determine the direction of the probe motion. If the probe does not come in contact with the part before traveling 1.5”, it will return to its start point.

The **F2 TEACH** key selects the TEACH mode. In this mode, after the axes have been moved using the JOG commands, TEACH commands are available to write the current coordinate values into a file called **TEACH.TXT**.

**WARNING!!** Entering the TEACH mode will overwrite the contents of the previous TEACH file. If another TEACH.TXT file exists, use the **5 FILES** selection in the STARTUP menu (Chapter 2) to rename the existing TEACH file.

When the **F2 TEACH** key is pressed, the display reads:

SETUP    JOG		MON JAN 14 03:15:04 PM			CNC MAN ABS B8&												
Select AXIS/MODE: <+> = MOVE X_Y_Z_ <-> = MOVETO PT [ ]					MODE: SETUP												
ACK ON RAPID <-> = PROBEPT </> = SAVEPTS <*> = [WR] X_Y_Z_PT					SEQ NO: 0												
<table border="1"> <tr> <td>X</td> <td>12.4214</td> </tr> <tr> <td>Y</td> <td>8.9717</td> </tr> <tr> <td>Z</td> <td>7.1614</td> </tr> </table>					X	12.4214	Y	8.9717	Z	7.1614	7			8		9	
					X	12.4214											
					Y	8.9717											
Z	7.1614																
JOG Z																	
4			5		6												
JOG Y																	
1			2		3												
JOG X			JOG SLOW		JOG FAST												
TEACH.TXT					<T> <S> <E> <R> <M> <D> <F> <ALT_I> ACK OFF												
0 EXIT TEACH MENU																	
F1	F2 EDI TCH	F3 Z PTS	F4 GEOM	F5 GoCLRPT	F6 SET X	F7 SET Y	F8 TLO = Z	F9 QU UP	F10 ABS/INC								

**Figure 3-4**

Upon entering the TEACH mode, **NOG0G90** is written as the first block of code in the file TEACH.TXT.

The key functions for the TEACH mode are:

- \* This command enters the current coordinate value as a block of text in TEACH.TXT. If **ACK** is **ON**, the **<ENTER>** key needs to be pressed to enter the data. If **ACK** is **OFF** the data is entered as soon as the \* key is pressed.

**NOTE:** use **<ALT I>** to toggle **ACK OFF/ON**. (**ACK** is the abbreviation for **Acknowledge**.)

- O** This command ends the program. **NG0M22** is written and the TEACH mode is terminated.
- T** This command enables a **T** value to be entered. An **NG0T1M26** block is written.
- S** This command enables a **PROGRAM STOP**. An **NG0M20** block is written.
- E** This command ends the TEACH program.
- R** This command enables the **RAPID** mode. The current coordinates are prefixed with a **G0** code. For example, **NG0X12.Y7.Z10**.

**M** This command enables the **MILL** mode. A prompt requires the feedrate to be entered. The current coordinates are prefixed with a **G1** code. The **F** code will appear at the end of the block. For example: NG1X12.Y7.Z10.F10.

**F** This command enables a quick simplified **FACE** routine. The axes are assumed to be at the extreme left and bottom of the surface to be faced, and the current depth is assumed as the facing depth. A prompt asks for **X**, total X distance; **Y**, total Y distance; **Y**, step Y distance; and **F**, feedrate. A routine to face the surface is automatically generated.

### F2 EDI TCH

This command sets the system in the **EDIT** mode for modifying the TEACH.TXT file. On exiting from the editor, the system returns to the TEACH mode.

### F3 Z PTS

This command accesses a set of screen commands for positioning the Z-Axis. (See Page 3-4.)

The **F4 GEOM** key selects the GEOMETRY mode. This mode is used together with the stored POINT table to construct the Midpoint of a Line, Midpoint of a Parallelogram, Intersection of Two Lines, or the Center of a Circle. When the **F4 GEOM** key is pressed, the keypad display reads:

SETUP    JOG			MON JAN 14 03:15:04 PM			CNC MAN ABS B8&																																																																																		
CALCULATE Geometry    Select FUNCTION or <ESC> = CANCEL						MODE: SETUP																																																																																		
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Figure 3-5



The key functions for the GEOMETRY mode are:

**5 MID PT RECT** This command calculates the midpoint of a rectangle by finding the midpoints of two separate lines of the rectangle. The first two points entered are to construct the first line, and the second two entered are to construct the second line. The OPERATOR INSTRUCTION window displays:

```
—>MIDPT RECT| P [ ] <ENTER> P [ ] <ENTER>  
Y = PT: [ ] <ENTER> PT: [ ] <ENTER> <ESC>=CANCEL
```

For each of the four points, enter the number from 1 through 8 identifying the desired previously stored point. After four points have been entered, the OPERATOR INSTRUCTION window displays:

```
—>SAVE XY PT [1 thru 8] ENTER <1-8> <0>=CANCEL  
CENTER 3 PTS. X5.0820 Y0.4999
```

Entering a value from 1 through 8 stores the coordinates of the calculated midpoint in the saved POINT table.

**6 CENTER 3 PTS** This command calculates the center point of an arc or circle from three points lying on the circumference of the circle. The OPERATOR INSTRUCTION window displays:

```
—>CENTER 3 PTS| PT: [ ] <ENTER> PT: [ ] <ENTER> PT: [ ] <ENTER>  
Probe Dia: [0.0000] <ENTER> In/Out: [ ] <ENTER> <ESC>=CANCEL
```

For each of the three points enter the number 1 through 8 identifying the desired previously stored point. Probe diameter is equal to the diameter used when obtaining the points (probe stylus diameter or edge finder diameter) and In/Out is for whether the Inside or Outside of the Circumference was touched. After the data is entered the OPERATOR INSTRUCTION window displays:

```
—>SAVE XY PT [1 thru 8] ENTER <1-8> <0>=CANCEL  
MID PT RECT| X5.0820 Y0.4999
```

Entering a value from 1 through 8 stores the coordinates of the calculated center point in the saved POINT table.

**8 MID PT 2 PTS** This command calculates the midpoint between two points, and also provides information about the two points. The OPERATOR INSTRUCTION window displays:

```

—>MIDPT 2 PTS| PT: [ ] <ENTER> PT: [ ] <ENTER>
    Probe Dia: [0.0000] <ENTER> In/Out: [ ] <ENTER> <ESC>=CANCEL
  
```

For each of the two points, enter the number from 1 through 8, identifying the desired previously stored point. Probe diameter is equal to the diameter used when obtaining the points (probe stylus diameter or edge finder diameter) and In/Out is for whether the Inside or Outside of the Surface was touched. After two points have been entered, the OPERATOR INSTRUCTION window displays:

```

—>SAVE XY PT [1 thru 8] ENTER <1-8>          <0>=CANCEL
    MIDPT X5.0820 Y0.4999 Z-0.7087 D0.8191 A89.9309
  
```

**D** is the distance between the points. **A** is the angle with respect to the X axis.

Entering a value from 1 through 8 stores the coordinates of the calculated center point in the saved POINT table.

**9 INTOF 2 LNS** This command calculates the intersection of two lines. Each line is determined by two points along the line. Probe diameter is equal to the diameter used when obtaining the points (probe stylus diameter or edge finder diameter) and LEFT/RIGHT is for which side of the surface was touched. The OPERATOR INSTRUCTION window displays:

```

—>INTOF 2 LNS| Probe Dia [0.0000] <ENTER> Left/Right: [ L ] <ENTER>
    LN1 PT: [ ] <ENTER> PT: [ ] <ENTER> LN2 PT: [ ] <ENTER> PT: [ ] <ENTER>
  
```

**NOTE:** The rules for cutter compensation apply to the left/right selection. The lines need to be constructed as a typical cutter path would be described (i.e. pt1 pt2 pt3 pt4 not pt1 pt2 pt4 pt3).

For each of the two lines enter the number from 1 through 8, identifying the desired previously stored points. After four points are entered, the OPERATOR INSTRUCTION window displays:

```

—>SAVE XY PT [1 thru 8] ENTER <1-8>          <0>=CANCEL
    X2LN1 X7.2945 Y-5.3249 Z-0.7087 A89.9301 A-4.6637
  
```

Entering a value from 1 through 8 stores the coordinates of the calculated intersection in the saved POINT table.

Other functions that can be used in JOG mode are:

**F5 GOTO CLR PT** This command moves the table to the clear point position. The point from which the move is made is temporarily stored and is automatically entered as default X and Y values when a **MOVETO XYZ PT** command is selected. The OPERATOR INSTRUCTION window displays:

—>Use <+> = **MOVETO CLRPT** or <anyKEY> to **CANCEL**

Hitting the <+> key moves the table to the clear point.

### **F6 SET X**

**F7 SET Y** These commands enable the operator to set a part program coordinate value to the current position. The OPERATOR INSTRUCTION window displays:

—>**SET X** [        ] <ENTER>  
Hit <ESC> to **CANCEL**

**F8 TLO = Z** This command sets the **TLO** (Tool Length Offset) for the designated tool equal to the current Z coordinate value and provides the ability to enter a cutter diameter. The OPERATOR INSTRUCTION window displays:

—>**TLO=Z**|| **SET TOOLNO:** [ ] <ENTER> <\*>=**SET GAGE HEIGHT**  
**GAGE HEIGHT:** [0.0000]                      <ESC>=**CANCEL**

After a tool number is entered, the OPERATOR INSTRUCTION window displays:

**TNO: 5 TLO: 0.5000 DIA:** [        ] <ENTER> **TIME 00:00:00**  
Hit <ESC> to **CANCEL**

Entering a value sets the DIAMETER for that tool number in the stored TOOL table. The TIME represents the total time that the tool has been used.

<\*> **SET GAGE HEIGHT** When the <\*> is depressed, the control will prompt for a gage height distance. If a 1" gage block is being used to set TLO's, by entering 1.0 the control will automatically add 1" to the current Z axis location for establishing the correct Z datum for that particular tool.

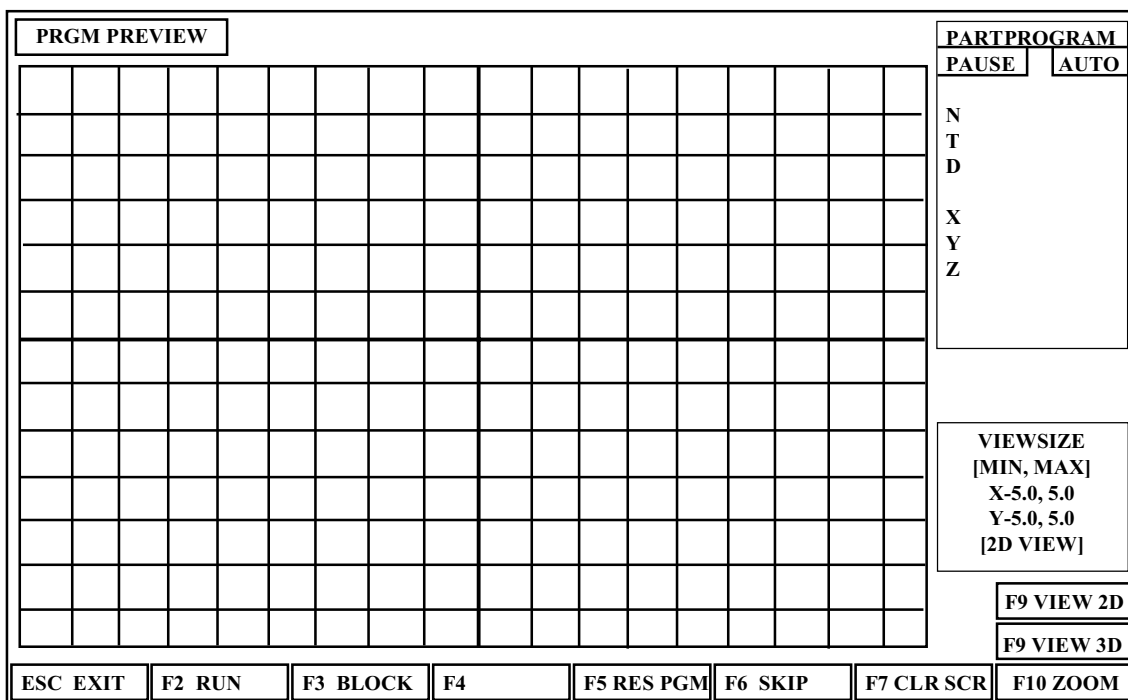
**NOTE:** Gage Height will remain active until it is changed.

**F9 QUILL UP** This command moves the Z axis to the UP (HOME) position.

**F10 ABS/INC** This command toggles the system between the Absolute and Incremental input modes.

### Using the PREVIEW mode

Pressing the **F5 PREVIEW** key changes the screen display from BASIC OPERATIONS SCREEN to the one shown in Figure 3-6.



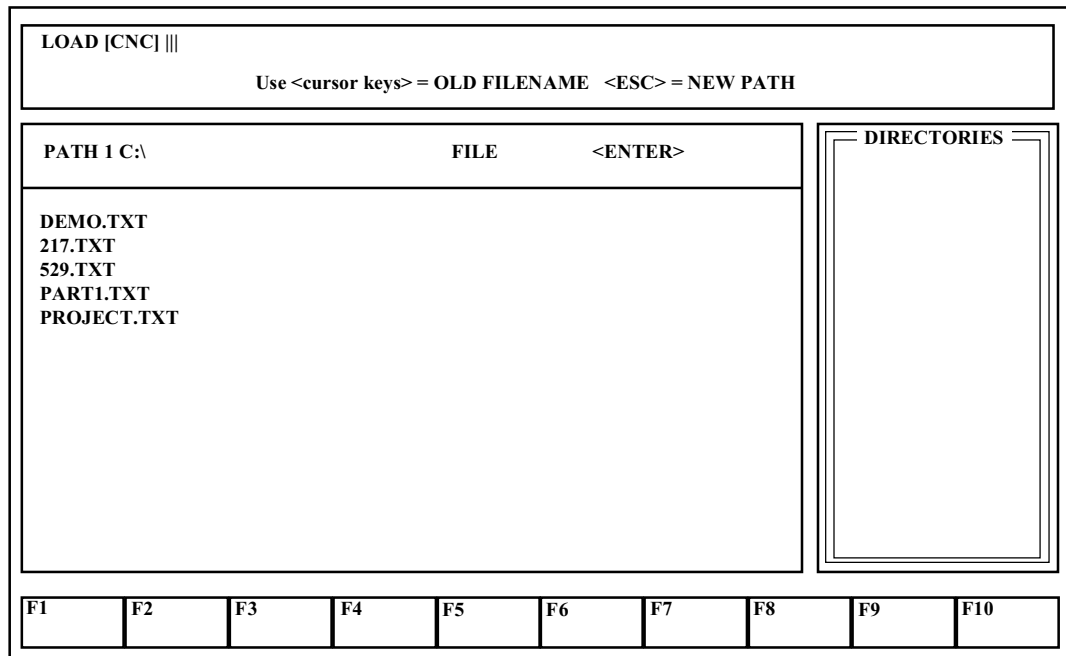
**Figure 3-6**

The PREVIEW mode shows a graphical representation of the part program that is loaded into the CNC. The screen commands available in this mode are:

- ESC** Exits the PREVIEW mode
- F2** Toggle between PAUSE and RUN for pausing or running the file
- F3** Toggle between AUTO/BLOCK for continuous execution or block by block execution of the file
- F4** Block between AUTO/BLOCK for continuous execution or block by block execution of the file
- F5** RESPGM resets the part program to the top of the text

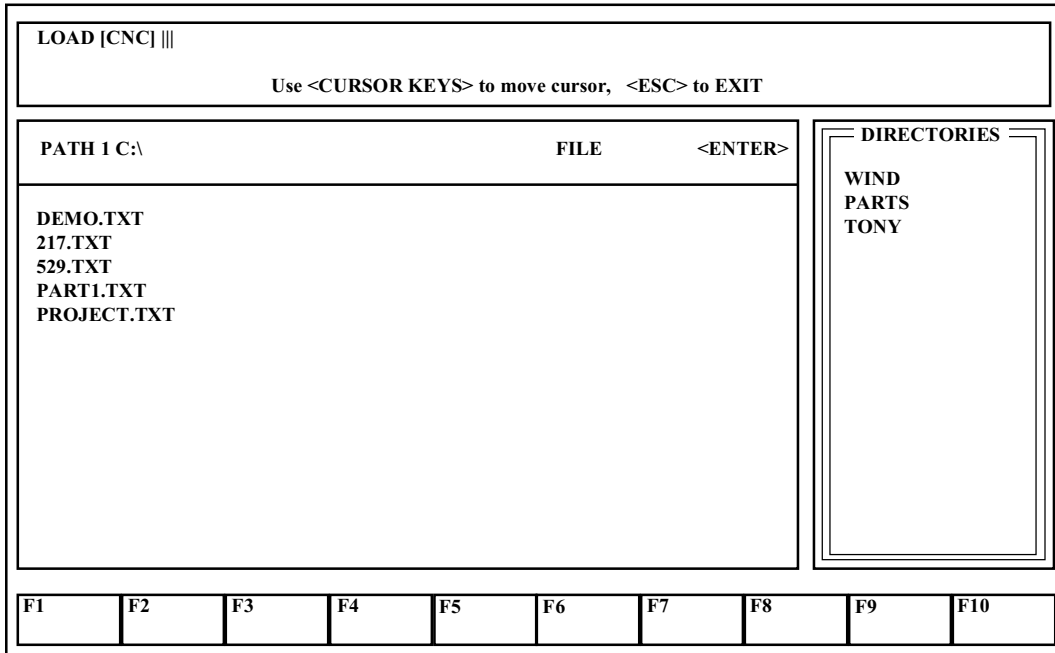
- F6** SKIP allows searching to a (N) sequence or (T) tool number
- F7** CLRSCR clears the screen
- F8** VIEW 2D selects the 2D view mode
- F9** VIEW 3D selects the 3D view mode
- F10** ZOOM allows the user to zoom in on a feature in the 2D mode

**F7 LOAD** from BASIC OPERATIONS SCREEN is used to load a part program from the disk to the CNC. After a part program is loaded it can be run. Pressing the **F7 LOAD** key changes the screen display as shown in Figure 3-7.



**Figure 3-7**

Depress the ESC key twice to select another directory, i.e., A:\ for selecting the floppy disk. Use the cursor keys (arrow keys) to select the file to be loaded for execution. Select the correct path and file name for the part program that is desired. The display will then appear as shown in Figure 3-8 (next page):



**Figure 3-8**

Once the program is selected and the ENTER key is pressed, you will be prompted to load the program which overwrites the previous program that was running.

**NOTE:** Overwriting the existing file only applies to the file being deleted from the part program execution (BMDC) memory and has no effect on the file itself. It will still reside in its original location, i.e.: C:\.

Pressing <Y> will load the program to the CNC. Press **5** to **RESET** the program and to set the system in AUTO mode.

# Chapter 4 SET UP MODE

## Introduction

The SET UP mode is used to prepare the machine for part program execution. The following operations are available:

- 1) Establishment of machine/part program coordinate system
- 2) Axis motion to set up positions
- 3) Axis jog
- 4) Entering, storing and loading Tool Data
- 5) Loading part programs
- 6) Editing part programs

## Set Up screen

To enter the **SET UP** mode, press the **F3 SETUP** key from the BASIC OPERATIONS screen. The **SET UP** screen appears as shown in Figure 4-1.

SETUP				MON JAN 14 03:15:04 PM				CNC MAN ABS B8&																																
Use <F KEY or Num KEY> to select FUNCTION																																								
<b>X</b> <b>12.4214</b>  <b>Y</b> <b>8.9717</b>  <b>Z</b> <b>7.1614</b>				<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center;">7 SRT T //</td> <td style="text-align: center;">8 SET REFPT</td> <td style="text-align: center;">9 GO TO REFPT</td> </tr> <tr> <td style="text-align: center;">4 SET TNO</td> <td style="text-align: center;">5 SET CLRPT</td> <td style="text-align: center;">6 GO TO CLRPT</td> </tr> <tr> <td style="text-align: center;">1 WORK SHIFTS</td> <td style="text-align: center;">2 MOVETO X_Y_Z_</td> <td style="text-align: center;">3 JOG</td> </tr> </table>			7 SRT T //	8 SET REFPT	9 GO TO REFPT	4 SET TNO	5 SET CLRPT	6 GO TO CLRPT	1 WORK SHIFTS	2 MOVETO X_Y_Z_	3 JOG	MODE:                    SETUP SEQ NO:                 0 TOOL NO:                9 TLO:                      7.0000 DIA:                      0.5000 TIME:                    000:00:00 S, ACT                  0        75% F, IPM                    000.0 F, OVR (OFF)            80% X ABS                    12.4214 Y ABS                    8.9717 Z ABS                    7.1614																								
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01	7.0000	0.5000	000:00:00																																					
02	7.0000	0.2500	000:00:00																																					
03	0.0000	0.0000	000:00:00																																					
04	0.0000	0.0000	000:00:00																																					
05	0.0000	0.0000	000:00:00																																					
0 EXIT SETUP MENU																																								
F1	F2	F3	F4	F5	F6 EDIT	F7 LOAD	F8	F9 QU UP	F10 ABS/INC																															

**Figure 4-1**

The key commands available from the **SET UP** screen are as follows:

- 0 EXIT SETUP MENU** This command returns the screen to the BASIC OPERATIONS menu.
- 1 WORKSHIFT (SET X\_Y\_Z\_)** This command assigns coordinate values to the current position of axis motion. It also gives the ability to set G54-G59 workshift coordinates. Five sets of WORKSHIFT coordinates are available for use in part program execution. They are set with this function in relationship to the original part program coordinate system. These workshifts are commanded as G54-G59 within a part program or the MDI mode. This is discussed in more detail further in this chapter. **(See also APPENDIX C: DX32 WORKSHIFT.)**

**NOTE:** G54 is the default workshift coordinate if no other has been commanded.

- 2 MOVETO X\_Y\_Z\_** This command moves the X, Y, Z axes to the entered position.
- 3 JOG** This command calls up the JOG screen that is described in Chapter 3 of this manual.
- 5 SET CLRPT** This command allows the operator to set the X, Y position as the Clearance Point that will be used to facilitate tool changes (M26) or move to XY Clearance Point and reset Program (M22).
- 6 GO CLRPT** This command moves the axes to the Clearance Point.  
**note:** Clearance Point is a value from machine home which is not affected by the resetting of another XY coordinate in the workshift mode.
- 7 SET T//** This command allows the operator to input the values for TLO and DIA.  
**NOTE:** This command does not set the Active Tool Number. It updates the values stored in the tool table.
- 8 SET REFPT** This command allows the operator to set the X, Y position as a Reference Point to be used to facilitate subsequent fixture set-ups.
- 9 GOTO REFPT** This command moves the axes to the Reference Point.

The functions keys that are available from the SET UP menu are:

- F6 EDIT** This command brings up the editor to allow the operator to make changes to a particular part program.
- F7 LOAD** This command loads part program data that is stored on disk to the CNC.



**F9 QU UP** This command moves the Quill (Z-axis) to the up (HOME) position.

**F10 ABS/INC** This command sets the system in the Absolute or Incremental position mode.

## **DX32 Coordinate Systems**

### **Machine Coordinate System**

The Machine Coordinate System is referenced off the mechanical axis limit switches and the homing marker on the axis motor encoders. When the axes are homed, the X, Y and Z system registers that track axes motion are set to zero. The Operating System handles all motion commands in the Machine Coordinate System. This ensures that all moves are within the axis limits.

### **Part Program Coordinate System**

The operator can set the location of the Part Program Coordinate System with respect to the Machine Coordinate System. This is done by using the **Workshift or SET X, Y Command in the JOG menu**. All user motion commands including **MOVE X\_Y\_Z\_** and Part Program Motion Data are entered with respect to the Part Program Coordinate System. Internally, the Operating System converts the Part Program coordinate values back to Machine coordinates.

#### **Setting the Part Program Coordinate System**

**Workshift or SET X, Y Command** enables the operator to orient the Part Program Coordinate System with respect to the Machine Coordinate System. To do this, the operator enters the values to be set as the Part Program Coordinates for the current machine position.

### **Setting Up the Tool Change Clearance Point**

The Clearance Point can be used during the tool change operation. This is an arbitrary point, established by the operator, which allows adequate clearance for the tool change. Use **F9 QUILL UP** to move the Z axis to the Home position. JOG the X and Y axes to any convenient point away from the work piece where operations such as Program Stop or Tool Change can take place. Then press **5 SET CLR**. Use the + key to set the clearance point, escape to cancel.

## Entering Tool Table Data

Specific tool lengths and diameters can be entered for the tools selected to machine a part. The following tool data information can be stored.

- 1) Tool Length Offset (TLO) values
- 2) Tool Diameter (DIA) values
- 3) Time tool has been used (Tool Life Management)

The data stored in the DX32 BMDC tool buffers is non-volatile, and is retained in memory with power off.

Please note the following when working with Tool Table Data.

- 1) All Tool Data entered into the PC is *immediately* transferred to the BMDC.
- 2) Tool Data from the BMDC is automatically entered into the PC on system start up.
- 3) Because T values can be imbedded in the part program, the actual T value used by the BMDC may not be the same as the T value displayed in the Tool Data window.

Press **7 SET T//** to call up the Tool Table screen, which enables entry of TLO and DIA values. The OPERATOR INSTRUCTION window displays:

→TNO [1 thru 24]: [ ] <ENTER>	Hit <ESC> to EXIT
<-> CLR ALL T//	<R> Read T// from DISK      <W> Write T// to DISK

Key in the tool number associated with the data to be entered. The following functions can be accessed with special (non-numeric) characters entered into the TNO field. The **<ENTER>** key must be pressed after the desired special character is used.

<-> Clears all the T// values

<R> Reads a previously stored TOOL DATA table from disk.

<W> Saves the current TOOL DATA table by writing them to disk.

<ESC> Exits the SET T// screen.

For both Read and Write T//, the Operator Instruction window prompts for the name of the File to be read and a window containing the names of all the TOOL DATA tables previously saved is displayed.

## Tool Length Offsets

Tool Length Offsets can either be entered Manually in the SETUP mode by the following procedure, or by commands embedded in the part program.

**NOTE:** The TOOL Tables retain the last value entered Manually, but the part program can set TLOs only if the previous value of the TLO stored in the TOOL Table is ZERO ( $\emptyset$ ).

The TOOL DATA window displays 5 sets of values starting at the current TOOL number. To display a specific tool number from the 24 stored in the TOOL Table, use the **SET T//** command. To scroll the TOOL Table use the UP or DOWN cursor control arrows.

### Setting TLOs that have not been pre-measured

When the TLO value for a particular tool has not been pre-measured, it is possible to use the machine coordinate system to determine the offset. The current Z ABS value can be entered into the TOOL table by entering a <\*> as the TLO value in the **SET T//** menu. However, the most convenient method of doing this is by using **F8 TLO=Z** in the **JOG** menu.

Press **3 JOG**. Insert the desired tool into the machine and clamp the work piece to the table in the desired location. Using one of the JOG functions, move the Z axis so that the tip of the tool just touches the “Z” zero position, usually the top of the work piece. Press **F8 TLO=Z**. The OPERATOR INSTRUCTION window prompts for the TOOLNO. Key in the desired Tool number and then hit <ENTER>. The Z ABS value is entered into the TOOL table.

Use **6 GoCLRPT** to move the axes to the clear point and insert the next tool in the machine. Repeat the process just described. Continue until all TLO values have been determined for each tool programmed.

### Setting TLOs for pre-measured tools

The SET T// command can be used to input TLO data when tool lengths have been pre-measured. Press 7 SET T//. The OPERATOR INSTRUCTION window displays:

—>TNO [1 thru 24]: [ ] <ENTER>	Hit <ESC> to EXIT
<-> CLR ALL T//	<R> Read T// from DISK      <W> Write T// to DISK

Key in the Tool Number of the TLO to be input and hit **ENTER**. (Or press <-> to CLEAR ALL T// values, <R> or <W> to read or write T// data to or from disk, or <ESC> to exit the SET T// command).

The **SET TLOs** message is displayed in the OPERATOR INSTRUCTION window.

```
—>TNO:01 TLO: [    ] <ENTER> DIA: [    ] <ENTER>  
Enter TLO:  <*> to SET TLO=ZABS      Hit <ESC> to CANCEL
```

The values for the current TLO and DIA are displayed in their respective fields. To retain the current value press ENTER without keying any data into the field.

The TOOL DATA window displays the 5 successive T// values starting from the Tool Number that was just entered.

**NOTE:** Any modification of tool data values made in PC RAM automatically updates the values stored in BMDC RAM.

### Cutter Diameter Compensation

Differences in tool diameter are due to wear during use and to losses during re-grinding. When a tool diameter is less than the one called for in the part program, the operator must compensate for that difference. The DX32 Operating System provides the ability to automatically calculate a new Tool Path based on alterations between the cutter diameter originally programmed for and the actual tool diameter. This compensation value is entered into the TOOL Table.

#### Calculation of compensation value

The compensation value entered is the difference between the programmed diameter and the actual diameter.

For example: if the programmed cutter is a .500" diameter end mill and the actual cutter is a .485" diameter end mill, the compensation value entered is -.15".

If the actual cutter is smaller than the programmed cutter the input value is always negative. If a larger cutter than the programmed cutter is used, the compensation value is always positive.

#### Setting Cutter Diameter Compensation

The **SET T//** command can be used to input DIA compensation data when the values are known. Press **7 SET T//** and follow the procedure described for entering TLO data.

## Moving to Position by Entering X, Y, Z data

Use the **2 MOVETO X\_Y\_Z\_** command when you want to move the axes to a particular position. The X\_Y\_Z\_ data can either be absolute or incremental. To switch from the Absolute Mode to the Incremental Mode use the **F10 ABS/INC** command.

## Moving to Tool Clearance Point

Press **6 GOTO CLRPT**. The display reads:

—>Use <+> = <b>MOVETO CLR PT</b> <ESC> = <b>CANCEL</b>
---

**NOTE:** When moving to Clearance Point the Z axis moves Home before XY motion takes place.

## Filing and Loading Part Programs

Part programs for the DX32 can be located in three separate locations:

- DISK**            Part programs are stored by name on hard disk. Part program file names stored on disk have the extension **.TXT**.
  
- PC RAM**        When EDIT is used, a part program is read off the disk and loaded into PC RAM. At the conclusion of the EDIT session, the modified part program can be filed on disk.
  
- BMDC RAM**     The part program can be loaded from disk into BMDC RAM. This is the part program executed by the DX32 in the RUN mode.

**NOTE:** A part program with the same name may be simultaneously running from BMDC RAM and edited from PC RAM. The changes made in the EDIT mode are not used to cut a part until the revised part program is loaded into BMDC RAM.

## Loading a part program from a file on DISK to the CNC

Press **F7 LOAD** to load a part program to the CNC. The display appears as shown in figure 4-2.

LOAD [CNC]									
Use <CURSOR KEYS> = OLD FILE NAME <ESC> = NEW PATH									
PATH 1 C:\					FILE			<ENTER>	
DEMO.TXT 217.TXT 529.TXT PART1.TXT PROJECT.TXT					DIRECTORIES WIND PARTS TONY				
F1	F2	F3	F4	F5	F6	F7	F8	F9	F10

Figure 4-2

Select the **PATH** and **FILENAME** to be loaded to the CNC. The display will then appear as shown in figure 4-3.

LOAD [CNC]									
Enter PATH    DRIVE:\DIR  <ENTER> <> = WORKDIR									
Use <CURSOR KEYS> to move cursor, <ESC> to EXIT									
PATH 1 C:\					FILE			<ENTER>	
DEMO.TXT 217.TXT 529.TXT PART1.TXT PROJECT.TXT					DIRECTORIES WIND PARTS TONY				
F1	F2	F3	F4	F5	F6	F7	F8	F9	F10

Figure 4-3

When the proper file is selected and ENTER is depressed, the display shows the first 16 lines of the file read from the disk (Fig. 4-4). The OPERATOR INSTRUCTION window displays the message **OVERWRITE Existing PARTPGM in CNC??** This message is displayed to remind the operator that loading a part program into the CNC overwrites the part program that was previously run. Press **<Y>** to continue. A **WAIT** message is displayed on the screen indicating the file is being loaded from the disk to the CNC.

LOAD PARTPGM to CNC						MON JAN 14 03:15:04 PM				CNC	MAN	ABS	B8&		
LOAD PARTPGM from FILE: C: \TAP.TXT to CNC												MODE:	SETUP		
OVERWRITE Existing PARTPGM in CNC?? <Y> or<ESC> = CANCEL												SEQ NO:	0		
												TOOL NO:	9		
												TLO:	7.0000		
												DIA:	0.5000		
												TIME:	000:00:00		
												S, ACT	0	75%	
												F, IPM	000.0		
												F, OVR (OFF)	80%		
												X ABS	12.4214		
												Y ABS	8.9717		
												Z ABS	7.1614		
												SPINDLE:	OFF		
												COOLANT:	OFF		
												BAPID, IPM:			
												OPSELSW:	FXAXS		
												OPROTSW:	FXAXS		
												DRYRUN:	OFF		
												/ DELETE:	OFF		
												OPSTOP:	OFF		
F1	F2	F3	F4	F5	F6	F7	F8	F9	F10						

Figure 4-4





# Chapter 5 RUN

The RUN mode is used to execute the part program and produce actual parts. The RUN mode screen display is as shown in figure 5-1.

RUN    C:\DEMO.TXT		MON JAN 14 03:15:04 PM		CNC CNC ABS B&&					
Use <f KEY> or <Num KEY> to select FUNCTION Cursor Up/Dn for Feed Override (5% increments)									
<b>X</b> <b>12.4214</b>  <b>Y</b> <b>8.9717</b>  <b>Z</b> <b>7.1614</b>	<b>7</b> SET OPTION	<b>8</b>	<b>9</b> CLEAR CNC	MODE:                    A-RDY SEQ NO:                 0 TOOL NO:                9 TLO:                     7.0000 DIA:                    0.5000 TIME:                    000:00:00 S, ACT                  0        75% F, IPM                    000.0 F, OVR (OFF)            80% X DLT                    0.0000 Y DLT                    0.0000 Z DLT                    0.0000					
C: PRV:  CUR:  NXT:	<b>4</b> SET TNO	<b>5</b> RESET PROGRAM	<b>6</b> S R/O = RE / ACT	SPINDLE:                OFF COOLANT:                OFF BAPID, IPM: OPSELSW:                OFF OPROTSW:                OFF DRYRUN:                 OFF / DELETE:                OFF OPSTOP:                 OFF					
	<b>1</b> AUTO	<b>2</b> BLOCK	<b>3</b> FEED OVR						
	<b>0</b> EXIT RUN MENU								
F1	F2 S /OFF	F3	F4 EDT CNC	F5 MDI	F6 CNC :NT	F7	F8 COOLNT	F9 QU UP	F10 SET DNC

**Figure 5-1**

The commands available in the RUN mode are:

- 1 AUTO** This command sets the part program to execute continually.
- 2 BLOCK** This command enables block by block execution of the part program.
- 3 FEED OVR** This command enables using the **FEED OVR** knob to override feed rates embedded in the part program. When Feed override is set to ON, the feed override knob enables the overriding of rapid traverse and feed motion commands from 0% - 150%. When the feed override function is set to OFF, all motion commands return back to executing at 100% regardless of the feed override knob position.
- 5 RESET PROGRAM** This command sets the part program text pointer back to the beginning of the program. It also initializes system **RUN** registers.
- 6 S R/O=PR/ACT** This command toggles the **S,RPM** display between ACTUAL and PROGRAMMED values.

**7 SET OPTION** This command displays the **RUN OPTION** screen.

**9 CLEAR CNC** This command clears out the RUN system registers, part program text or part program macros, which are described later in this chapter.

**0 EXIT RUN MENU** This command returns to the BASIC OPERATIONS screen display and commands.

**F2 S/OFF** This command turns the spindle off.

**F4 EDT CNC** This commands displays the last part program loaded on the screen. This text can be edited and then re-loaded for execution.

**F5 MDI** This command enables Manual Data Input, block by block execution and editing of a part program.

**F6 FND :NT** This command is used to search the part program text for a particular :, N (Sequence Number), or T (Tool Number) value.

**F8 COOLNT** This command selects and turns ON and OFF MIST or FLOOD coolant.

**F9 QU UP** This command moves the Z axis to the HOME or full positive position.

**F10 SET DNC** This command allows the machine to run part programs that are larger than 256 thousand characters.

The **RUN** mode assumes that the part program to be run exists in **BMDC RAM** or that the **DNC LINK** has been established. If the desired program has not been loaded into **BMDC RAM** do so by using the commands described in **Loading and Filing Part Programs** section.

Before the part program is executed for the first time, or after the system mode has been changed, the **RESET PROGRAM** command must be used to initialize the control registers and set the part program text pointer to the beginning of the text buffer.

**NOTE:** The file name is automatically inserted as the first line of text. Reading the file name back from the non-volatile BMDC text buffer when the system is first started up enables the control to know what the name of the last file loaded was, even if power has been turned off.

If the operator does not want to run the part program from the top of the text buffer, **F6 FND :NT** may be used to set the part program text buffer to the beginning of a data block with a particular Sequence Number, or Tool Number.

After either **RESET PROGRAM** or **FIND** has been used to position the part program text pointer, the next step is selecting either **AUTO** or **BLOCK** program run using either **1 AUTO** (continuous operation of the part program) or **2 BLOCK** (block by block) RUN modes.

When using **BLOCK** mode, the **START** switch must be pressed to reactivate the program after each executed block.

If **AUTO** is in effect and **BLOCK** is activated, the control finishes the current block and then stops. Non-motion blocks, such as G91, G90, G71, G4 (dwell), G96, G97, etc., on lines by themselves change status and update axis registers, but the program does not halt at the end of non-motion blocks. For example:

In Block Mode

<b>N50 G0X3.Y2.</b>	Machine stops execution at the end of the Rapid move
<b>N55 G91</b>	Machine changes mode to incremental and executes the next block
<b>N60 G1X2.Y2.F10</b>	Machine stops execution at the end of the feed move

**NOTE:** A loop call or a macro call is considered a motion block. A macro subroutine definition is non-motion. If the operator forgets to turn the spindle on, only rapid traverse (G0) moves are executed. If a block contains a feed rate motion command, operation is stopped and the message SPINDLE NOT ON CANNOT CUT is displayed. The operator must then edit the part program and insert a spindle ON command (i.e. S1000M3) and restart the program.

At the end of a run, a program M2 command resets the part program text pointer to the first programmed block. Press START to re-run the program.

**NOTE:** The program can be interrupted at any time by pressing the **HOLD** key. The program can then be resumed without error by pressing **START**.

### **Resuming Operation After Power to the Drives has been Disabled**

If the **EMERGENCY STOP** button is pushed, or power fails during part program execution or if a motion takes place which causes a travel limit switch to be reached, program execution stops, power to the drives is disabled, and the system is cleared except for the contents of the XYZ offset registers, tool data and part program text.

To resume operation:

- 1) Use AXIS DRIVE ENABLE to restore power to the axes drives. Then use the various JOG options to move off the limit switch, if required.
- 2) Correct the problem and home the machine if necessary.
- 3) Using the FIND command, search for a convenient restart point, preferably a tool change position.

## Modifying Feed Rates

Feed rates may be overridden from 0% to 150% with the **FEED OVERRIDE** knob. Below 1% the system goes into a feed **HOLD** condition.

Press **3 FEED OVR** to toggle **FEED OVR ON/OFF**. The SYSTEM STATUS window indicates **FEED OVR: ON**. Rotating the feed override knob changes the programmed feed rate. The SYSTEM STATUS window indicates **F, OVR %: 80** when the knob has been used to turn the override down to 80% of programmed value. The **F**: value shown in the display is the **ACTUAL** modified value, not the programmed value.

## Run Options

Use **7 SET OPTION** to view the various RUN options available to be used. The display is as shown in figure 5-2.

RUN    OPTIONS		MON JAN 14 03:15:04 PM			CNC	CNC	ABS	B&B	
Use <NUM KEY> for OPTION					MODE:	A-RDY			
X 12.4214		7	8	9	SEQ NO:	0			
Y 8.9717		METRIC	BOSS		TOOL NO:	9			
Z 7.1614			VERS		TLO:	7.0000			
C: PRV: CUR: NXT:		4	5	6	DIA:	0.5000			
		OPSTOP	/ DEL	SET	TIME:	000:00:00			
				BRK PT	S, ACT	0	75%		
		1	2	3	F, IPM	000.0			
		NO Z		MAX FD	F, OVR (OFF)	80%			
		0 EXIT OPTION MENU			X ABS	12.4214			
					Y ABS	8.9717			
					Z ABS	7.1614			
					SPINDLE:	OFF			
					COOLANT:	OFF			
					BAPID, IPM:				
					OPSELSW:	OFF			
					OPROTSW:	OFF			
					DRYRUN:	OFF			
					/ DELETE:	OFF			
					OPSTOP:	OFF			
F1	F2	F3	F4	F5	F6	F7	F8	F9	F10

Figure 5-2

## DRY RUN Options

The **DRY RUN** options enable the part program to be tested without fully running the system.

**1 NO Z** This command allows the part program to be “proven” with no Z axis movement.

**NOTE:** At an M6 (tool change) command the Z axis moves up to the Tool Change position and establishes a new NO Z plane of operation.

**3 MAX FD** This command runs the part program and overrides all programmed feed rates. Complete operation of the part program can be accomplished with maximum feed rate to more quickly detect programming errors.

### **OPERATOR RUN-TIME** Options

These options allow the operator to intervene and modify how the part program is run.

**4 OPSTOP** Enabling this function causes the program to **STOP** after executing any data block that contains an **MØ1** command.

**5 / DEL** When **/ DEL** in **ON**, the system will ignore any part program block that starts with a slash (/).

**6 SET BREAK PT** The **BRKPT** feature is used to allow the operator to stop at a convenient point in the program. The program stops before the designated sequence number is executed. When the **BREAKPOINT** is reached, the system status message indicates a Program **STOP**. Press **START** to resume program execution.

### **Other RUN** Options

**7 METRIC** This option sets the system to accept all input dimensions as metric values during the operation of the part program.

**NOTE:** This does not convert inch programs to metric or metric to inch.

**8 BOSS VERS** This option provides compatibility with part programs written for previous Bridgeport CNC machines using BOSS level 4 through 7 software.



# Chapter 6

## EDIT/ MDI MODE

---

The on screen editor provides the ability to enter and edit text. The editor also includes a G-code help mode that assists the operator in entering part program data.

There are three different methods of accessing the editor. Each of these methods calls up the same basic functions, the differences are noted below.

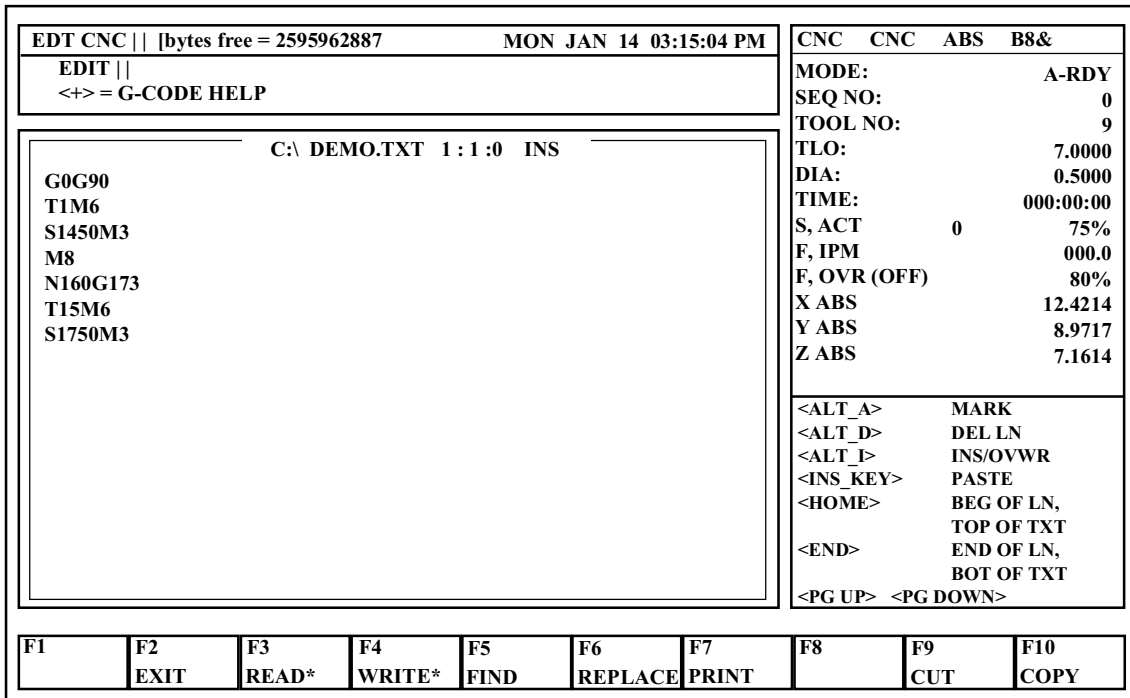
**EDIT** When **F6** is selected from the **SETUP** or **BASIC MENU** screen, the operator is prompted for the file to be created or edited. The display shows the directory of all the previous files created.

**EDT CNC** When **F4 EDT CNC** is selected from the **RUN** screen, the last file loaded for execution is loaded into the edit buffer.

**MDI** When **F5 MDI** is selected from the **RUN** screen, the file MDI.TXT is automatically created. As each data block is created, the operator is given the choice of executing the block. At the end of the MDI session the operator can choose to store the MDI.TXT file, rename the file, or exit without storing the file.

### Commands for Editing Text

After entering the EDIT/MDI mode, the display is as shown in figure 6-1.



**Figure 6-1**

The editing commands available are:

**F2 EXIT** This command is used to EXIT the EDIT session. The operator is given the choice of exiting with or without saving the text, or saving the text in a file with another name or saving and loading the file.

**F3 READ\*** This command provides the ability to INSERT a previously saved file into the text at the current cursor location.

**F4 WRITE\*** This command provides the ability to CUT a portion of the edited text and save it in a new file or appending an existing file.

**F5 FIND** This command prompts the operator for a Target text. The operator enters the text to be searched for into the Target field. The cursor is then positioned at the start of the text designated as a Target.

**NOTE:** To find the next occurrence, shift the cursor one character to the right before using FIND.

**F6 REPLACE** This command prompts the operator for a Target text and a Replacement text. The operator enters the text to be changed into the Target field. The new text is entered into the Replacement field. The operator is then asked if ALL instances of the Target text are to be changed, if just the NEXT instance is to be changed, or if the operator wants to scan through all instances of the targeted text and choose which ones to replace.

**F7 PRINT** This command prints the screen. The operator is given the choice of <1> printing marked text; or <2> making a screen dump.

**F9 CUT** This command cuts the marked block to the hidden text buffer. The text that was cut is erased.

**F10 COPY** This command copies the marked block to the hidden text buffer. The text that was copied is retained.

<ALT A> **MARK** This command begins marking a portion of the text for use by the CUT or COPY commands. The cursor control keys are used to mark the rest of the block.

<ALT D> **DEL LN** This command deletes the current line which the cursor is on. The cursor need not be at the beginning of the line.

<ALT I> **INSERT** This command toggles between the INSERT and OVERWRITE character input modes.

<INS KEY> **PASTE** This command pastes the text that was written to the hidden text buffer at the current cursor location. PASTE can be used any number of times – each time it is used, the contents of the hidden text buffer is pasted at the current cursor position.



**<HOME>** Pressing HOME the first time sets the cursor at the start of the line. Pressing HOME again sets the cursor at the top of the text.

**<END>** Pressing the END key the first time sets the cursor at the end of the line. Pressing END again sets the cursor at the end of the text.

**<PGUP>** This command displays the previous page of text.

**<PGDN>** This command displays the next page of text.

**UP/DOWN/LEFT/RIGHT ARROW** These keys move the cursor up/down a line or left/right a space.

### Direct MDI Input

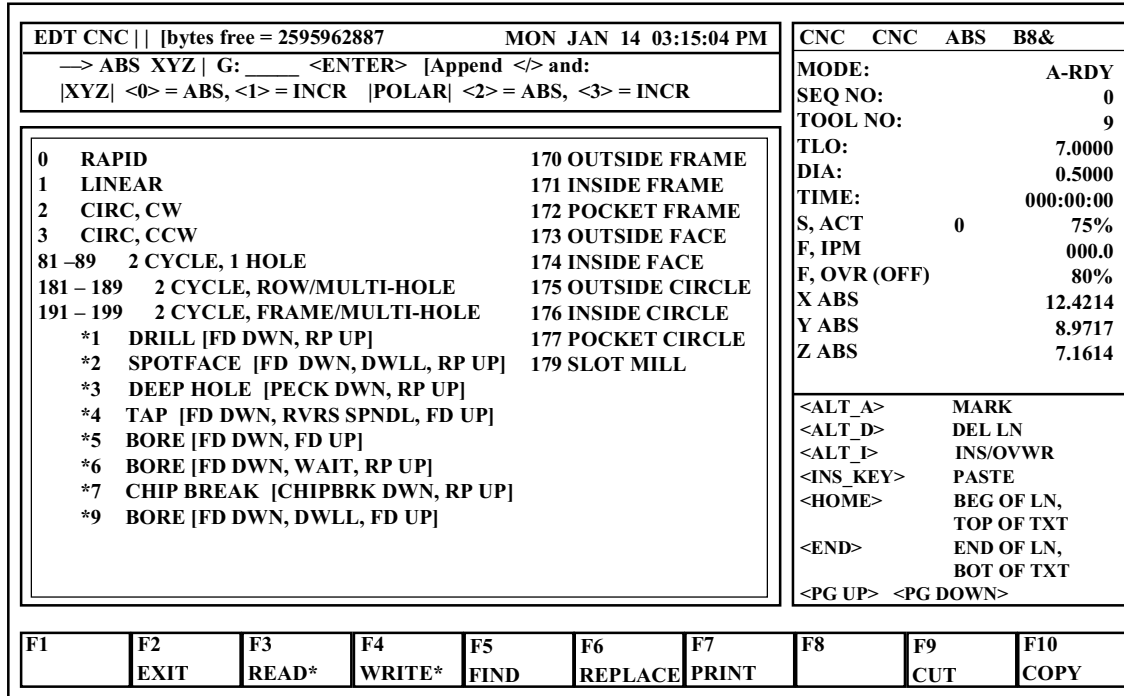
In EDT/MDI, entering a **<\*>** as the first character in a line sets the system in the MDI Input mode. The display will read:

—>ENTER G CODE	<RET>= EXEC	<ESC>=CANCEL	

A line of G-code can then be entered and executed.

### Using the G-code Help Mode

In the EDIT mode, entering **<+>** as the first character in a line brings up the G-code Help Mode. The display appears as shown in figure 6-2 (next page).



**Figure 6-2**

The G-code motion commands are displayed on the screen. Enter a valid G motion code in the **G:** field. To select Rectilinear [XYZ] or Polar motion, either using ABS or INCR coordinates, append </> and <0> for XYZ ABS, <1> for XYZ INCR, <2> for POLAR ABS, or <3> for POLAR INCR. Once entered, both the G-code and motion type commands are Modal. See the DX32 Programming Manual for more information.

The left portion of the EDIT screen now displays a table of data entry fields. Prompts give the work addresses and field descriptors for the data required for a particular G-code. The default value in the input field is the data from the previous field entered with the same G-code. Entering any new data in the field blanks the field. The cursor control keys can be used to position the cursor to any field to change previously entered data. <ENTER> can be used to skip over any field except the last entry in the table. Pressing <ENTER> after the last field causes the data to be put in the program and closes the table.

If **F1 HELP** is pressed while a data entry table is displayed, the system will display text messages that explain the G-code being used. The screen appears as shown in figure 6-2.

To exit the HELP screen, press <ESC>.

After the data is entered in a G-code table, it is displayed in the OPERATOR INSTRUCTION window as a line of G-code text. In the MDI mode, entering <1> executes the data block. Using any other key inserts the line of text in the EDIT buffer at the current position of the cursor.

# Chapter 7

## DOS COMMANDS

---

### DOS System Commands

Typically, it is not necessary to access the DOS command level. Some frequently used DOS commands are listed here in case it is necessary to work from the DOS level. Note that the commands listed below are all typed in at the DOS prompt, **C:\>**. The DOS level may be accessed by pressing **<9> DOS** at the Start-Up menu.

#### Execute Program

To execute an application program, simply type the name of the program at the DOS prompt. Application programs are easily identified by the **.EXE** or **.BAT** file extension in a disk directory. Do not type the file extension when executing a program.

The most frequently used Executable Program command loads and executes the DX32 system software. The command is:

**C>RUN**

#### List Directory

This command lists all the files on the chosen disk. To list the root directory on drive A, type:

**A>DIR A:/P**

The modifier **/P** causes one screen page at a time to be displayed. To list the root directory on drive C, the hard disk drive, type:

**C>DIR C:/P**

MS-DOS allows the user to organize the files on any disk into directories and sub-directories. This is called a multi-level directory structure. This allows the user to sub-divide the disk into convenient groups of data.

#### Format Disk

**WARNING!!** Formatting a disk destroys all the information previously stored on the disk. A back-up, read-only System disk is provided in case the primary system disk is damaged.

Before information can be loaded onto a disk, the disk needs to be initialized into a format that can store the data. Always format new disks, even if they have been purchased as “pre-formatted”. This will insure that the machine will be able to read from and write to the disk.

To format a disk, type:

**C> FORMAT A:**

The screen displays the message:

**Insert new diskette for drive A:  
and press ENTER when ready. . .**

Follow these instructions. The system then formats the disk. At the conclusion of the process, the system displays the message:

**Format complete  
1457664 bytes total disk space  
1457664 bytes available on disk  
Format another (Y/N)?**

Enter <N> to exit the FORMAT command.

A 3.5 inch disk can hold 1.44 Mbytes. Some space on each disk is used to keep track of the disk’s contents. The space used for this directory depends on how much data is on the disk.

## **Copy Files**

This command copies a file from one disk to another. for example, to copy a file called T20.TXT from the system disk, type:

**C:\COPY T20.TXT A:**

The system displays the message:

**Insert diskette for drive B: and strike  
any key when ready**

Insert the target disk (the disk the file is being copied to) into the disk drive and strike any key. After the system finishes copying the file, the screen displays the message:

**1 File(s) copied**

## Disk Copy

This command copies an entire disk. This command can be used to create a backup disk that may be used if the original backup disk is accidentally damaged. To use this command, type:

**A> DISKCOPY**

The screen displays the message:

**Insert SOURCE diskette in drive A:  
Press any key when ready. . .**

Insert the source disk in drive A:. Strike any key. The screen then displays the message:

**Copying 80 Tracks**

After the source disk is copied, the display reads:

**Copying 18 Sectors/Track, 2 sides  
Insert TARGET diskette in drive A:  
Press any key when ready. . .**

Follow the instructions by putting the target disk in the disk drive.

It is necessary to swap the source and target disks into the drive several more times to complete the diskcopy process. At the completion of DISKCOPY, the screen reads:

**Copy another diskette (Y/N)?**

Enter <N> to exit the command.

## Re-Booting DOS

Sometimes it may be necessary to re-boot the PC front end without resetting the entire system. This is useful if the PC locks up. To re-boot, simultaneously press the three keys Control <CTRL>, Alternate <ALT>, and Delete <DEL>.

The system continues through the boot process until the START-UP SYSTEM menu appears.

## Setting up the PC System Configuration

Do not confuse setting up the PC system configuration with setting up the DX32 system configuration.

The PC set-up parameters are configured at the factory. To check or alter the set-up parameters, simultaneously press the <CTRL>, <ALT>, <DEL> keys. This re-boots the PC. While the PC is restarting, press the <DEL> key to execute the **Setup** utility.

### Setting the Time and Date

The Time and Date settings can be reset via DOS. Exit the DX32 software, and type the command **TIME** at the DOS prompt. Enter the correct time.

To reset the Date setting, type **DATE** at the DOS prompt. Enter the correct date.

# Appendix A

## Axes and Coordinates

---

### Some Background Information

When we talk about a machine tool cutting a part, we say that the cutter moves in three axes. These are the three directions in which the tool moves in order to cut the material of the part. These directions are left and right (the X axis), forward and backward (the Y axis), and up and down (the Z axis). If you watch the machine tool in motion though, it is the worktable, and the part itself that move (forward and backward, and left and right) not the cutting tool, or cutter.

It is easier to think of the tool moving, so that the motion makes more sense. This way the tool does all of the movement. It also makes sense when you think about the directions and the values they represent on the screen. When the X coordinate is increasing in value, the motion of the tool is to the operator's right. When the Y coordinate is increasing in value, the tool is moving towards the back of the machine.

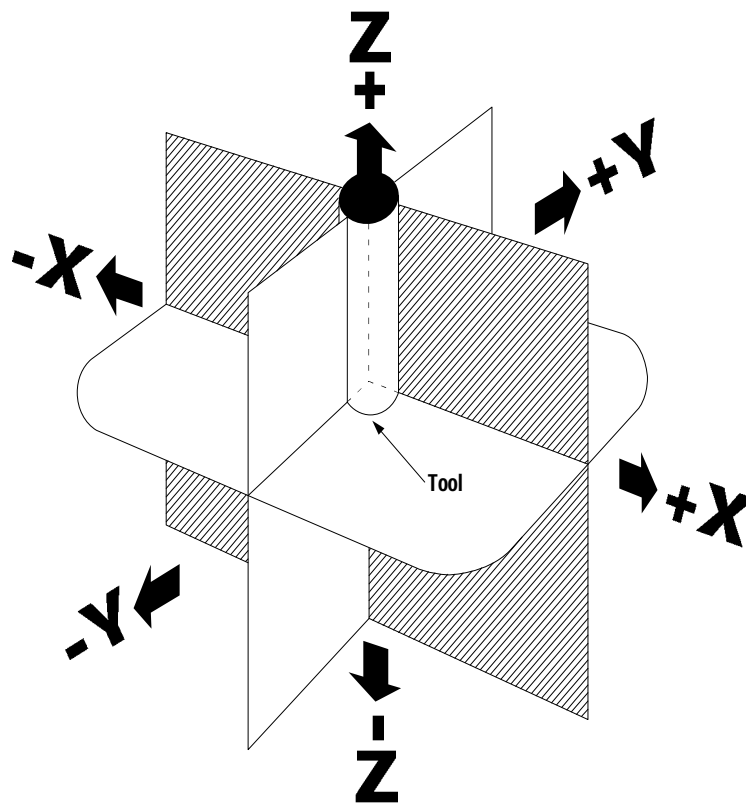


Figure A-1

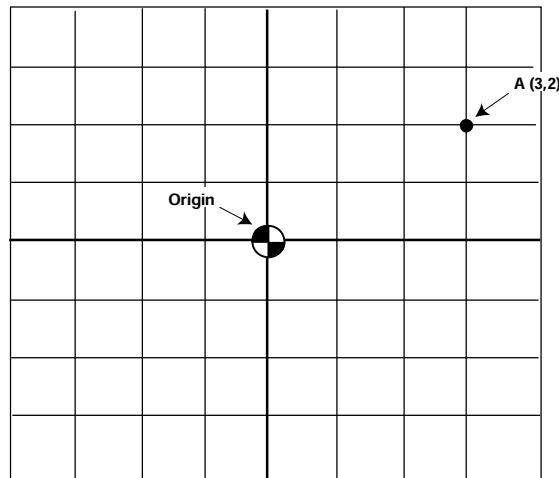
## Axes and Coordinates

We've already mentioned the terms **axis**, and **coordinate**, but what do they have to do with the VMC?

The VMC (and all CNC machine tools) use a **coordinate system** to identify where the tool is at any one moment, and to define where the tool is moving to when it is cutting chips. This coordinate system is called a **Rectangular Coordinate System**.

A Rectangular Coordinate System is based on a grid of lines which have set distances from one central point called the **origin**. Every point on the grid is given both an X and a Y coordinate which show how far to move to get to that point from the origin. Coordinates are usually shown in parentheses ( ) with a comma separating them. They are always given in the same order, X first, and then Y. A Z coordinate is added when the point can move along a third axis, called the Z axis. The Z coordinate determines how deep the tool is cutting into the part. The Z coordinate is always listed last when the coordinates are shown in parentheses.

The origin is given the coordinates (0,0) to make things simple. This means that to move to a point we'll call **A** that has the coordinates (3,2), you would start at the origin and move 3 grid lines (usually inches) along the X axis, and then 2 grid lines along the Y axis. Or you could move 2 inches along the Y axis and then 3 inches along the X axis. You still end up at point **A**, but the path you took to get there is different.

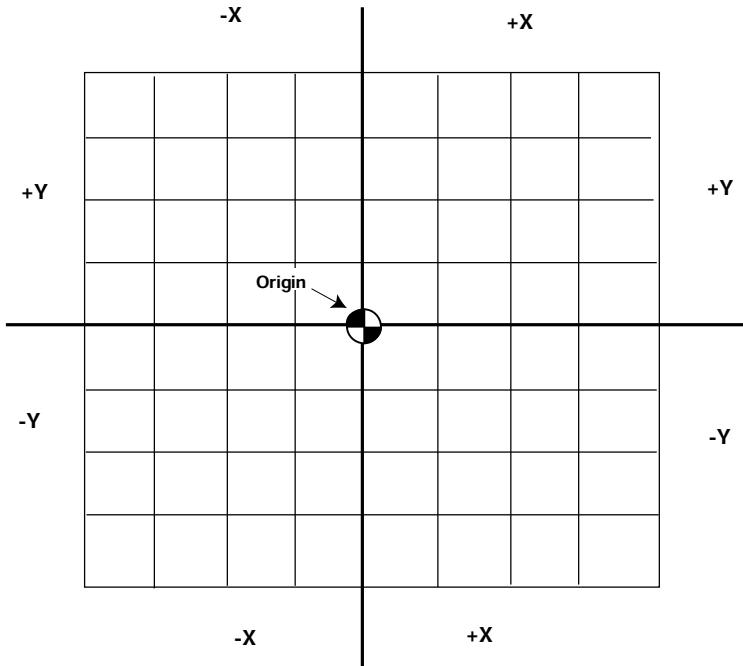


**Figure A-2**



When you move from one point to another on the grid, you count up or down depending on the direction you're moving to get to the desired point. If you move to the right, you count up, or add to the X coordinate. If you move left, you count down, or subtract one for each grid line you cross as you move to get to the target point. If you move towards the top of the grid you add to the Y coordinate, and if you move towards the bottom of the grid, you subtract one for each line that you cross.

If you cross to the left side of the origin, or below the origin, you reach zero and then go beyond it. These are negative numbers and are shown with a minus sign, like -1. The minus in -1 shows that you are one line to the left or below the origin, depending on whether the -1 is the X coordinate or the Y coordinate.

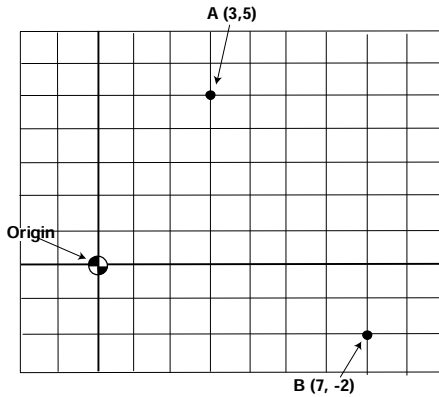


**Figure A-3**

As you move on the grid the number of lines that you cross in each direction is the distance that you moved along each axis to get to the new point. This gives two distances for each move, one along the X axis, and one along the Y axis. It is easy to calculate the distances necessary to move from one point to another.

Start with the X coordinate of each point. Take the higher number of the two X coordinates and subtract the lower number. Remember that subtracting a negative number is the same as adding a positive number (e.g.  $3 - -2 = 5$ ). The answer is the distance between the X coordinates of the two numbers. Repeat this for the Y coordinates.

For example, if we take two points (7,-2) and (3, 5) (shown in Figure A-4). Take the higher of the two X coordinates and subtract the lower number ( $7 - 3 = 4$ ). Repeat for the Y coordinates ( $5 - -2 = 7$ ). The distances are 4 in the X and 7 in the Y.



**Figure A-4**

This doesn't tell you how to move to get to the new point though. If you were at the point (7,-2) and wanted to move to the point (3,5) you would need to know more than just how far to move. You need to know **what direction** to move.

Compare the X coordinates again. You are starting at a point whose X coordinate is 7, and you want to go to a point whose X coordinate is 3. 7 is greater than 3 so the movement direction is towards the lower numbers on the left. This gives the direction along the X axis. The same method is used to find the Y direction. You are starting at a point whose Y coordinate is -2. You are moving to a point whose Y coordinate is 5. Since -2 is less than 5, the movement direction is towards the greater numbers at the top of the grid. This gives the direction along the Y axis.

### **Absolute vs. Incremental Programming**

There are two ways to program a machine tool to move from one point to another. You can instruct the machine to move from the current location to the point whose coordinates are  $(X_1, Y_1)$ . This is called **absolute** programming because the coordinates you give the machine are based on a known origin (0,0) location.

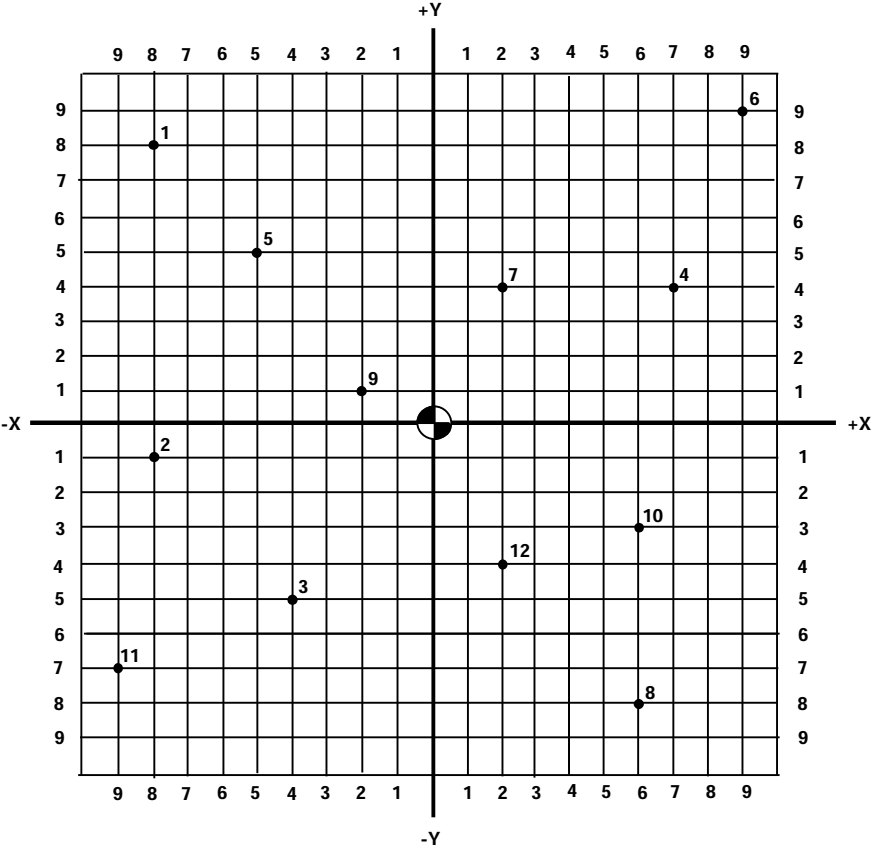
The second way to program this same move, is to tell the machine tool how far to move in each axis. This means that the point is given as two distances from the current location, one along the X-axis, the other along the Y-axis. Each distance is accepted as a direction and distance. For instance, giving **-2** as the X distance moves the tool to the left where giving **2** would move the tool to the right. Each of these would move the tool the same distance from the current location, but in opposite directions. This is called **incremental** programming, and it does not matter where the origin is located.

In programming the VMC, you may use either **absolute** or **incremental** programming. Sometimes it is easier to use one or the other. The program mode is shown in the programmed instructions for the VMC as **ABS** or **INC**. This is usually the third item seen in the instruction line. For example:

```
0000 LINE INC X4.000 Y0.000 Z0.000 F10.
```

This instruction tells the VMC to mill a line from the current position, four inches in the positive X direction, zero inches in the Y direction, and with the Z set at zero, at a feed rate of 10 inches per minute.

Below is a grid with some points marked on it. The origin is at the center of the grid. Starting at the first point given, move to the next point, and write down the absolute and incremental values of the move. Remember when you move to the right or towards the top of the grid, your movement is positive, when you move left or down, it is negative.



**ABSOLUTE**

example:  
 7 to 11    X -9    Y -7

**INCREMENTAL**

7 to 11    X -11    Y -11

- 6 to 1    X \_\_\_\_\_    Y \_\_\_\_\_
- 5 to 4    X \_\_\_\_\_    Y \_\_\_\_\_
- 8 to 3    X \_\_\_\_\_    Y \_\_\_\_\_
- 2 to 4    X \_\_\_\_\_    Y \_\_\_\_\_
- 4 to 5    X \_\_\_\_\_    Y \_\_\_\_\_
- 5 to 6    X \_\_\_\_\_    Y \_\_\_\_\_
- 12 to 7    X \_\_\_\_\_    Y \_\_\_\_\_
- 10 to 8    X \_\_\_\_\_    Y \_\_\_\_\_
- 4 to 9    X \_\_\_\_\_    Y \_\_\_\_\_

- 6 to 1    X \_\_\_\_\_    Y \_\_\_\_\_
- 5 to 4    X \_\_\_\_\_    Y \_\_\_\_\_
- 8 to 3    X \_\_\_\_\_    Y \_\_\_\_\_
- 2 to 4    X \_\_\_\_\_    Y \_\_\_\_\_
- 4 to 5    X \_\_\_\_\_    Y \_\_\_\_\_
- 5 to 6    X \_\_\_\_\_    Y \_\_\_\_\_
- 12 to 7    X \_\_\_\_\_    Y \_\_\_\_\_
- 10 to 8    X \_\_\_\_\_    Y \_\_\_\_\_
- 4 to 9    X \_\_\_\_\_    Y \_\_\_\_\_

## ANSWERS TO EXERCISES

### ABSOLUTE

example:

$$7 \text{ to } 11 \quad X \underline{-9} \quad Y \underline{-7}$$

$$6 \text{ to } 1 \quad X \underline{-8} \quad Y \underline{8}$$

$$5 \text{ to } 4 \quad X \underline{7} \quad Y \underline{4}$$

$$8 \text{ to } 3 \quad X \underline{-4} \quad Y \underline{-5}$$

$$2 \text{ to } 4 \quad X \underline{7} \quad Y \underline{4}$$

$$4 \text{ to } 5 \quad X \underline{-5} \quad Y \underline{5}$$

$$5 \text{ to } 6 \quad X \underline{9} \quad Y \underline{9}$$

$$12 \text{ to } 7 \quad X \underline{2} \quad Y \underline{4}$$

$$10 \text{ to } 8 \quad X \underline{6} \quad Y \underline{-8}$$

$$4 \text{ to } 9 \quad X \underline{-2} \quad Y \underline{1}$$

### INCREMENTAL

$$7 \text{ to } 11 \quad X \underline{-11} \quad Y \underline{-11}$$

$$6 \text{ to } 1 \quad X \underline{-17} \quad Y \underline{-1}$$

$$5 \text{ to } 4 \quad X \underline{12} \quad Y \underline{-1}$$

$$8 \text{ to } 3 \quad X \underline{-10} \quad Y \underline{3}$$

$$2 \text{ to } 4 \quad X \underline{15} \quad Y \underline{5}$$

$$4 \text{ to } 5 \quad X \underline{-12} \quad Y \underline{1}$$

$$5 \text{ to } 6 \quad X \underline{14} \quad Y \underline{4}$$

$$12 \text{ to } 7 \quad X \underline{0} \quad Y \underline{8}$$

$$10 \text{ to } 8 \quad X \underline{0} \quad Y \underline{-5}$$

$$4 \text{ to } 9 \quad X \underline{-9} \quad Y \underline{-3}$$

# Appendix B

## 4<sup>TH</sup> ROTARY AXIS

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### Enabling the Rotary Axis

The 4th rotary axis is enabled during machine power up. If the rotary axis cable is properly connected **BEFORE** powering up the machine, the status display to the right of the control will display **X, Y, Z, C**. Upon enabling the axis drives, when the “HOME AXIS” key is selected, all four axes will travel to their “HOME” positions.

### Coordinate System

The 4th rotary axis is designated by the letter C. The axis travel limit is as follows:

C-Axis (rotary) +/- 8,500 degrees

During start up, the C axis is moved to the “HOME” position, which is defined as the machine coordinate zero point.

**NOTE:** The “Home Position” for the C axis is mechanically set by the position of the “Home” switch and a zero reference mark on the axis feedback encoder.

### Rotary Axis Set Up

The rotary axis zero position is established in any of the JOG menus found in the BASIC and SETUP operating screens. The JOG function has the ability to jog the rotary axis using the continuous jog button or the jog handwheel, for finer adjustments. The jogging of the rotary axis is very similar to the jogging of the other three axes (X, Y, Z), limited to the maximum travel in both the positive and negative direction.

### Establishing the Part Program Coordinate System

When programming a part, the coordinate system must be established. Additionally, since the workpiece may be located at an arbitrary position on the rotary axis, the relationship between the machine coordinate system and the part program coordinate system must be established. This relationship is entered into the system during the setup mode.

The C axis coordinate system is set in the same manner as any other axis on the machine. In the SETUP menu, the C axis coordinate can be set by selecting the “SET X\_Y\_Z\_” function. This function will allow the user to enter a coordinate in degrees for establishing the rotary axis position. When the fourth axis is enabled, this function (SET X\_Y\_Z\_) will

prompt for a C axis coordinate in addition to the other 3 axis coordinates. When the C axis is disabled, this function will NOT prompt for the C axis coordinate. This also holds true for the “C AXIS” jog prompt in the JOG mode. The “MOVE X\_Y\_Z\_” will also prompt for the C axis coordinate when the rotary axis is enabled, allowing the user to position the axis to a coordinate in relation with the part program coordinate system.

## Addressing the Rotary (C) Axis

The rotary axis is addressed by the axis designation C. The minimum input value for the C axis is .001 degrees. The proper format for motion commands are as follows:

N\_G\_(X,Y,Z,C)F\_M\_

### G0 – Rapid Traverse Positioning

N10G0X0.Y0.C0.

This command in the Rapid Traverse Mode (G0) will position all three axes (X, Y, C) simultaneously to their respective coordinates. If the Z axis were programmed in the same line, the same rules would apply in respect to the Z axis moving before or after the other three axes are positioned.

- \* If a Z POSITIVE move is commanded in relationship to the current Z coordinate, the Z axis will move BEFORE all the other axes. If a Z NEGATIVE move is commanded in relationship to the current Z coordinate, the Z axis will position AFTER all other axes.

### G1 – Linear Interpolation

N10G1X0.Y0.C0.F100.

This command in the Linear Interpolation Mode (G1) will position all three axes (X, Y, C) simultaneously to their respective coordinates at the specified feedrate. If the Z axis were programmed in the same line, all four axes would feed to their coordinates simultaneously.

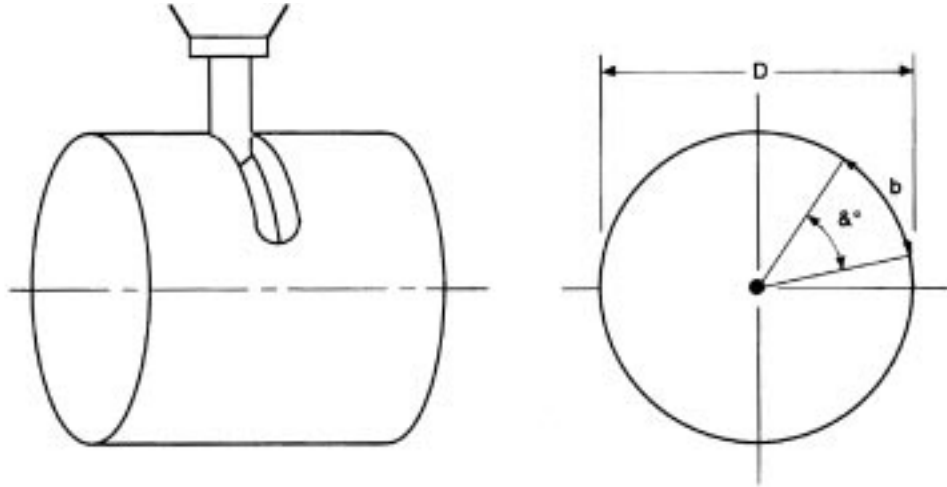
The following formula is used for calculating the feed for any linear interpolation command containing the C axis coordinate word. All linear interpolation with the C axis is defined in Degrees Per Minute.

$$\text{Feedrate} \times (360^\circ / (\text{diameter} \times 3.1416))$$

Therefore, if the desired Feedrate = 10 IPM and the part diameter = 4.00” the feedrate in degrees per minute would be F286.468.

**NOTES:**

- 1) The rotary axis (C) cannot be programmed with Cutter Diameter compensation.
- 2) The rapid traverse rate and maximum programmable feedrate for the rotary axis (C) is 3,600 degrees per minute.









# Appendix C

## DX32 Workshift

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The following is information regarding the workshift function on the DX32 control. This function is found in the SETUP menu (F3 from the BASIC menu). The workshift feature is generally used when multiple setups are required on the machine at the same time.

### Workshift Coordinate Systems

There are 6 different work coordinate systems available on the DX32. These coordinate systems are G54-G59. The default or BASE coordinate system after powering up the machine is the G54 coordinate system. The G54 coordinate system operate operates identical to the SET X, Y or Z commands found in the JOG or SETUP menus. The G54 coordinate system is in effect until another coordinate system is commanded during automatic operation of a part program. When not in the RUN mode i.e., SETUP, JOG, etc., the G54 coordinate system is active. All other work coordinate systems are the absolute distance from machine zero. This means that when the G54 or BASE coordinate system is changed by resetting X, Y, Z or changing the G54 coordinates, this does not affect the locations of the G55-G59 workshifts.

### Setting the Workshift Coordinate Systems

In the SETUP menu the number 1 WKSHFT command allows setting of the various work coordinate systems. When this is selected a prompt will appear at the top of the screen requiring the input of the coordinate system being established. Follow the steps below for enetering the proper data for the coordinate system. The system should be in the absolute (ABS) positioning mode while setting the coordinate systems.

**NOTE:** For the following example, we will be using the G55 work coordinate system. The following example is for a two (2) station setup. The first station or BASE coordinate system (original X, Y zero) is on the left of the table and the second is to the right. The same procedure would apply for all the available work coordinate systems (G55-G59).

- 1) Establish the BASE coordinates (set X, Y zero on left part).
- 2) Position the spindle to the desired datum of the second station.
- 3) In SETUP select 1 WRKSHFT
- 4) Enter the desired coordinate system at the prompt (G55).

5) Enter the current position in relation to the second stations Datum (if you are at the zero position for station two enter zero for the X and Y).

**NOTE:** If Z is not changing, leave that field blank.

The coordinate system for the second station has now been established. You will notice the coordinates on the display have not changed. This is because the Base coordinate system is ALWAYS active in the SETUP mode. To verify the coordinate system is correct, use the following procedure.

### **Activating the Work Coordinate Systems**

The work coordinate system can be activated in two ways. The most common is during part program operation commanding a G54-G59 which will make the new coordinate system active. The new coordinate system will remain active until another coordinate system is commanded or part program operation is terminated in which case G54 or the BASE coordinate system will be reinstated. A new coordinate system can also be activated by commanding the desired coordinate system in the MDI mode found in the F4 RUN screen. Use the following procedure to verify the desired coordinate system has been set properly.

- 1) Position machine at the datum or X, Y zero position for station #2.
- 2) Select F5 MDI from the run mode.
- 3) Depress the asteric (\*) key which will now prompt for a G mode.
- 4) Enter the desired work coordinate system (G55).
- 5) When the enter key is pressed the new coordinate system will be activated updating the X, Y Z display to the position in relation to the coordinate system. If you had been over the datum of the second station, the display should be X, Y zero.

All moves now commanded will be in relation to the new coordinate system commanded. The Base coordinate system (G54) will be restored when the MDI mode is terminated.

### **Clearing the Work Coordinate Systems**

The following is the procedure for restoring any of the work coordinate systems.

- 1) Position the machine to the original (BASE COORDINATE SYSTEM) X, Y zero.
- 2) At zero select the 1 WRKSHFT command from the SETUP menu.

3) Enter the desired WORKSHIFT to be cleared.

4) Enter ZERO for all three axes.

Refer back to “SETTING THE WORKSHIFT COORDINAT SYSTEM” for setting additional workshifts.



# Appendix D

## Common Error Messages

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### MESSAGES

### MEANING

\*\*\*\* ALARM \*\*\*\*

This text is displayed in blinking white on a red background in the machine status window between DIA: and S,ACT (green window in the upper right corner of the display) when the machine is in an alarm state. To reset an alarm, hit the Escape key. If the alarm does not reset, call a service man.

All Parameters Set

The operator receives this message after he has finished re-loading the binary executive by selecting F9 in Startup. This message informs the operator that all machine parameters in the BMDC card have been set to the values in BMDCPRMS.SYS.

Attempt to write to a write-protected disk

An attempt was made to write a part program to a write-protected floppy disk. Check that the button on the back of the disk is set to the write position.

auxFuncs: Low Air Pressure

This message applies only to machines with electronic (automatic) and air-motor spindles. The operator receives this message when the air pressure is low.

auxFuncs: Low Lube Level

This message only applies to machines with air-motor and electronic (automatic) spindles. The operator receives this message when the lubrication level is low.

auxFuncs: Spindle Orient Failed

This message applies to machines with auto tool changers only. The spindle is oriented during a tool change operation, immediately after Z is moved to tool change height and immediately before the carousel is extended (arm out). If the spindle did not orient, this message is displayed and the spindle and axis drives are shut down.

auxFuncs: Spindle Time-Out

This message only applies to machines with electronic (automatic) spindles. The operator receives this message because it took too long for a spindle command to be processed because the spindle control module is busy. If tapping was being done, the spindle and axis drive are turned off immediately after posting the message. If another operation was being performed, no action is taken after posting the message.

AXES must be HOMED to  
enable MENUS [ - ]!!  
Hit <any KEY> to CONTINUE

This message is displayed if the operator attempted to select BASIC menus from the Start Up Menu before homing the axes.

Axis Drive Fault

The operator receives this message whenever the axis drive fault bit has been set. The spindle and axis drives are turned off and the system is shut down.

Axis Drives OFF

This message appears whenever the machine starts to execute a commanded move and the axis drive system is off.

Bounds Fault

This message is displayed when a commanded (move would exceed limits) move exceeds the limits set by the maximum travel parameters.

Canceled by operator

This message is displayed when the operator presses the escape key in "4 Load Remote" from Startup Menus while attempting to send or receive a part program from a remote terminal.

Canceled by remote device

The operator receives this message in "4 Load Remote" from Startup Menus while attempting to send or receive a part program from a remote terminal. The link was canceled by the remote terminal.

Cannot Open Param File

The operator receives this message while attempting to re-load the binary executive (BMDC.BIN) file by selecting "F9 LDmdcSW" from the Startup Menu. This message is displayed while attempting to load the machine parameters from BMDCPRMS.SYS to the BMDC board. Check to make sure that the BMDCPRMS.SYS file exists and

<p>Can't CLEAR when in RUN Hit &lt;any KEY&gt; to CONTINUE</p>	<p>is in the bootup directory (i.e. the directory containing the CNC software).</p> <p>This message is displayed if the operator tries to "9 CLEAR CNC" in "F4 RUN" from Basic Menus while the axes are in motion.</p>
<p>Can't EDT CNC when in DNC Hit &lt;any KEY&gt; to CONTINUE</p>	<p>This message is displayed when, during DNC mode, the operator tries to "F2 EDT CNC" in "F4 RUN" from Basic Menus while the axes are in motion.</p>
<p>Can't FIND when in RUN</p>	<p>This message is displayed if the operator tries to "4 FIND : _N_T_" from Basic Menus while the axes are in motion.</p>
<p>Can't FIND when in RUN Hit &lt;any KEY&gt; to CONTINUE</p>	<p>This message is displayed if the operator tries to "F6 FND :NT" in "F4 RUN" from Basic Menus while the axes are in motion.</p>
<p>Can't HOLD now will HOLD when done</p>	<p>This message appears when the HOLD button is pressed during a critical section of a tool change or plug reverse tapping cycle. It informs the user that it can only place the machine in a HOLD state after the cycle completes.</p>
<p>Can't JOG when in RUN Hit any key to continue</p>	<p>This message is displayed if the operator tries to "9 JOG" from Basic Menus while the axes are in motion.</p>
<p>Can't LOAD when in RUN Hit &lt;any KEY&gt; to CONTINUE</p>	<p>This message is displayed while attempting to load a part program into the BMDC card after selecting "F4 EDT CNC" in "F4 RUN" from Basic Menus while the axes are in motion.</p>
<p>Can't LOAD when in RUN Hit &lt;any KEY&gt; to CONTINUE</p>	<p>This message is displayed if the operator tries to "F7 LOAD" from Basic Menus while the axes are in motion.</p>
<p>Can't LOAD when in RUN Hit &lt;any KEY&gt; to CONTINUE</p>	<p>This message is displayed if the operator tries to load a part program from "F5 MDI" in "F4 RUN" from Basic Menus while the axes are in motion.</p>



!!! Can't LOAD when in RUN  
Hit <any KEY> to CONTINUE

This message is displayed when attempting to select "F7 LOAD" in "F3 SETUP" while the axes are in motion.

Can't MDI when in DNC  
Hit <any KEY> to CONTINUE

This message is displayed in DNC mode if the operator tries to "F5 MDI" in "F4 RUN" from Basic Menus while the axes are in motion.

Can't MDI when in HOLD  
Hit any key to continue\

This message is displayed if the operator tries to "F5 MDI" in "F4 RUN" from Basic Menus while the HOLD button is pushed in.

Can't MDI when in RUN  
Hit any key to continue

This message is displayed if the operator tries to "F5 MDI" in "F4 RUN" from Basic Menus while the axes are in motion.

Can't MDI when in RUN or HOLD  
Hit any key to continue

This message is displayed if the operator tries to "6 S\_T\_M\_" from Basic Menus while the axes are in motion.

Can't PREVIEW when in RUN

This message is displayed if the operator tries to "F5 PREVIEW" from Basic Menus while the axes are in motion.

Can't QUILL UP when in RUN  
Hit any key to continue

This message is displayed if the operator tries to "F9 QU UP" in "F4 RUN" from Basic Menus while the axes are in motion.

Can't QUILL UP when in RUN  
Hit any key to continue

This message is displayed if the operator tries to "F9 QUILL UP" from Basic Menus while the axes are in motion.

Can't RESET when in RUN  
Hit <any KEY> to CONTINUE

This message is displayed if the operator tries to "5 RESET PGM" from Basic Menus while the axes are in motion.

Can't RESET while in RUN  
Hit any key to continue

This message is displayed if the operator tries to "5 RESET PGM" in "F4 RUN" from Basic Menus while the axes are in motion.

Can't SET DNC while in RUN  
Hit <any KEY> to CONTINUE

This message is displayed if the operator tries to "F10 SET DNC" in "F4 RUN" from Basic Menus while the axes are in motion.

Can't SET OPTIONS when in RUN  
Hit any key to continue

This message is displayed if the operator tries to "7 SET OPTION" in "F4 RUN" from Basic Menu while the axes are in motion.

Can't set params in HOLD!!

This message is displayed if the operator attempts to select "1 SET PARAMS" from startup while the HOLD button is pressed in.

Can't SET TNO when in RUN  
Hit any key to continue

This message is displayed if the operator tries to "8 SET TNO" from Basic Menu while the axes are in motion.

Can't SET TNO when in RUN  
Hit any key to continue

This message is displayed if the operator tries to "4 SET TNO" in "F4 RUN" from Basic Menu while the axes are in motion.

Can't SET TOOLS when in RUN  
Hit any key to continue

This message is displayed if the operator tries to "7 SET T\\"" from Basic Menu while the axes are in motion.

Can't SETUP when in RUN  
Hit any key to continue

This message is displayed if the operator tries to "F3 SETUP" from Basic Menu while the axes are in motion.

!!! Can't SETUP when in RUN  
Hit any key to continue

This message is displayed if the operator tries to "F3 SETUP" from Basic Menu while the axes are in motion.

Can't SPINDLE/OFF when in RUN  
Hit any key to continue

This message is displayed if the operator tries to "F2 S\_/OFF" from Basic Menu while the axes are in motion.

Can't SPINDLE/OFF when in RUN  
Hit any key to continue

This message is displayed if the operator tries to "F2 S\_/OFF" in "F4 RUN" from Basic Menu while the axes are in motion.

!!! Can't STARTUP when in RUN

This message is displayed if the operator attempted to make a startup menu selection while the axes are in motion.

CENTER 3 PTS | ERROR !!

This message appears when "6 CNTR 3 PTS" was selected in "F4 GEOM" from "9 JOG" in Basic Menu. Two or more of the points on the arc are the same point.

CENTER 3 PTS | ERROR !!  
[X, Y, or R > 999.]  
Hit <any KEY> to CONTINUE

This message appears when “6 CNTR 3 PTS” was selected in “F4 GEOM” from “9 JOG” in Basic Menus. One or more of the X or Y coordinate values of a point is too large.

CENTER 3 PTS | ERROR !!  
Select I (inside) or O (outside)  
Hit <any KEY> to CONTINUE

This message appears when “6 CNTR 3 PTS” was selected in “F4 GEOM” from “9 JOG” in Basic Menus. “I” for inside circle or “O” for outside circle must be inputted so that the cutter radius can be subtracted or added, respectively, to the circle radius value.

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This message informs the user that this software is copyrighted. It appears immediately following boot-up or a reset command (i.e. whenever the binary executive is loaded into the BMDC card).

Cutter-Comp: Dummy Radius Won't Fit

This message occurs when the compensated offset from the cutting surface is less than the radius of the tool.

Cutter-Comp: Negative Radius

This message appears if a negative radius was specified within a cutter compensation block.

Disable Spindle prior to Enabling

The operator receives this message if he tries to Axis Drives turn on the axis drive system with the spindle running.

DNC file error – ABORTED

This message is displayed if a block of data could not be successfully read from the DNC part program file. Check media and make sure DNC file is not read protected.

DNC file error – ABORTED

The format of the DNC file is not compatible with the IBM PC file format.

DNC internal error – ABORTED

This message is displayed while running under DNC mode. DNC mode is used when the size of the part program to run is larger than 256K bytes. The operator receives this message because there was an error detected while writing a portion of the DNC file to the BMDC. Check the BMDC board.

DNC internal error – ABORTED

The operator receives this message if the DNC part program file could not be loaded into the BMDC card. Check that the format of the DNC part program file is IBM PC compatible and check the BMDC card.

DNC OFF? <Y>  
or <ESC>= CANCEL

The operator receives this message while running under DNC mode when “F10 DNC OFF” is selected from “F4 RUN” in Basic Menus. This message prompts the operator for confirmation before turning off DNC mode. DNC mode is unaffected if the <ESC> key is pressed.

dpCom: ADC Failure

An ADC test is performed immediately following power up. The axis command inputs to the ADC are examined. The inputs should be near ground because of the hardware reset. This message is displayed if the values are outside the +-6.25% allowable tolerance.

dpCom: Commanded X Axis Move  
Too Far Minus

This message is displayed when a commanded X move is less than the X axis negative limit of travel (parameter 17). The interpolator caught the error meaning that the machine has moved as far as it can in the negative X direction.

dpCom: Commanded X Axis Move  
Too Far Positive

This message is displayed when a commanded X move is greater than the X axis positive limit of travel (parameter 18). The interpolator caught the error, meaning that the machine has moved as far as it can in the positive X direction.

dpCom: Commanded W Axis Move Too  
Far Minus

dpCom: Commanded W Axis Move Too  
Far Positive

dpCom: Commanded S Axis Move Too  
Far Minus

dpCom: Commanded S Axis Move Too  
Far Positive

dpCom: Commanded Y Axis Move Too Far Minus

dpCom: Commanded Y Axis Move Too Far Positive

dpCom: Commanded Z Axis Move Too Far Minus

dpCom: Commanded Z Axis Move Too Far Positive

dpCom: Invalid Command

This message appears because the front end user interface submitted an invalid command to the BMDC card. Some of the valid commands are: "home axes", "move command", "set param values", "set axis Jog command", etc.

dpCom: Low Air Pressure

This message applies only to machines with electronic (automatic) and air-motor spindles. The operator receives this message when the air pressure is low.

dpCom: Low Lube Level

This message only applies to machines with air-motor and electronic (automatic) spindles. The operator receives this message when the lubrication level is low.

dpCom: Must HOME AXES first

An axis move was attempted before the axes were homed.

dpCom: No Feedrate Specified

This message occurs when a GCODE block requires a feedrate and none was specified. Example: G1X2.Y3. will generate this message (G1 requires a feedrate).

dpCom: Program Buffer Overflow

This message appears because the size of the part program has exceeded 256K bytes.

dpCom: QDAC Failure

QDAC tests are performed immediately following power up. Each DAC (one for each axis) is loaded with 3 values. The DAC input register is then read to verify that the data was written. If the data in the DAC input register differs from the values

written, then this message is displayed and the axis drive system is disabled. The output voltage is then read by the ADC. The expected values are (FF, 00, and 80 hex). The allowable absolute tolerance is (F8 – D0), (70 – 90), and (08 – 30) for the X, Y, Z, W axis DACs respectively. This message is generated when the output value read by the ADC is outside these tolerances.

dpCom: SDAC Failure

SDAC tests are performed immediately following power up. The SDAC is used to output analog command voltages to the spindle drive. The SDAC is loaded with 5 values. The SDAC input register is then read to verify that the data was written properly. This message is displayed when the data in the DAC input register differs from the values written. Test Failure also causes the axis drive system to be disabled.

dpCom: Tool Changer Not Ready

This message is generated because an axis move was attempted while a tool change is in progress.

dpCom: Tool-Changer Not Safe

The operator receives this message when the tool-changer height (parameter 93) plus the tool holder height (parameter 104 – height above tool-changer) is too low to allow the tool-changer carousel to jog safely.

Drill Hole Here  
hit START when ready

This message is displayed on a 2-axis machine during a drilling cycle upon reaching the drill point.

Drive not ready

A floppy disk could not be found in drive A:\. Check that there is a floppy disk in the disk drive, that the disk is pressed in, and that the drive door is closed all the way.

\*\* DRIVES OFF \*\*

This message informs the operator that the axis drive system is off. The operator receives this message just after boot up, after a fatal error, or after a soft reset or after reloading the binary executive.

Emergency Stop Activated

This message is displayed whenever the emergency stop button is pushed in or whenever the user presses the emergency stop button. The user cannot clear the message when in E-STOP. He must first pull out the E-STOP button and then clear the message by hitting the escape key.

Enable Spindle FWD

This message applies only to machines that have manual spindles. It appears whenever the spindle has been commanded to rotate in the forward direction. It prompts the operator to set the spindle direction switch to forward and then turn the spindle on.

Enable Spindle HI

This message is displayed only on a lathe machine when spindle gear 2 (HI) (M12) is selected. The message prompts the operator to turn the spindle on.

Enable Spindle HI-CW

This message is used with machines that have air-motor (semi-automatic) spindles only. It appears when the commanded spindle RPM is in the HI gear range and the commanded spindle direction is clockwise. It informs the operator of the current switch settings and prompts him to turn the spindle on.

Enable Spindle HI-CCW

This message is used with machines that have air-motor (semi-automatic) spindles only. It appears when the commanded spindle RPM is in the HI gear range and the commanded spindle direction is counter clockwise. It displays the current spindle settings and prompts the operator to turn the spindle on.

Enable Spindle LO

This message is displayed only on a lathe machine when spindle gear 1 (LO) (M11) is selected. The message informs the user of his selection and prompts him to turn the spindle on.

Enable Spindle LO-CW

This message is used with machines that have air-motor (semi-automatic) spindles only. It appears when the commanded spindle RPM is in the LO gear range and the commanded spindle direction is clockwise. It displays the current switch settings and prompts the operator to turn the spindle on.

Enable Spindle LO-CCW	This message is used with machines that have air-motor (semi-automatic) spindles only. It appears when the commanded spindle RPM is in the LO gear range and the commanded spindle direction is counter clockwise. It displays the current spindle settings and prompts the operator to turn the spindle on.
Enable Spindle REV	This message applies only to machines that have manual spindles. It appears whenever the spindle has been commanded to rotate in the reverse direction. It prompts the operator to set the spindle direction switch to reverse and then turn the spindle on.
ERR: Failed to open	The operator receives this message while attempting to load a part program from a remote terminal (EZLINK) or from a remote terminal (XON/OFF) in "4 Load Remote" from Startup Menus. This message is displayed if the part program failed to open on the destination machine (machine operator is using). Check that the disk or diskette is not write protected (make sure that the button on the back of the diskette is set to the write position).
ERR -- Illegal Baudrate	This is displayed if the baud rate to send/receive file in "4 Load Remote" from Startup Menus is not one of the following values (110, 300, 600, 1200, 2400, 4800, 19200, 38400).
ERR -- link error -- aborted	This message is displayed in "4 Load Remote" from Startup Menus while attempting to link up with a remote terminal. The operator receives this message if the MODEM could not establish a link with the remote terminal.
ERR -- reading file -- aborted	This message is displayed while attempting to send/receive a part program from a remote terminal. This message applies to the operator's end if we are sending a file and to the remote end if we are receiving. Check that the file exists.



ERR -- writing file -- aborted

This message is displayed while attempting to send/receive a part program from a remote terminal. EZLINK or XON/OFF could not send/receive the entire file. Check disk space or disk write protection.

ERROR: Enter numeric data only !!  
Hit <any KEY>

This message is displayed when the operator selects "F5 GOCLRPT" from "9 JOG" in Basic Menus and then enters invalid characters for the X, Y, Z, C coordinates of the clearance point.

ERROR: Enter numeric data only !!  
Hit <any KEY>

This message is displayed when "SET X" is selected from "9 JOG" in Basic Menus and invalid characters are entered for the X coordinate value.

ERROR: Enter numeric data only !!  
Hit <any KEY>

This message is displayed when "SET Y" is selected from "9 JOG" in Basic Menus and invalid characters are entered for the Y coordinate value.

ERROR in LOAD CNC!!  
Hit <any KEY>

This message is displayed when exiting teach mode (teach mode is selected from "9 JOG" in Basic Menus). When the operator selects "<+> ENTER/EXIT/REVIEW" (Enter to enter the last GCODE block into TEACH.TXT, EXIT to exit teach mode and load the teach program into the BMDC board, and REVIEW to edit TEACH.TXT). Reasons for this message include: (1) Teach program is too large (> 256K bytes), (2) Bad BMDC board, (3) Bad file format.

ERROR in Reading DISK!!  
Hit <any KEY>

This message is displayed when exiting teach mode (teach mode is selected from "9 JOG" in Basic Menus). When the operator selects "<+> ENTER/EXIT/REVIEW" (Enter to enter the last GCODE block into TEACH.TXT, EXIT to exit teach mode and load the teach program into the BMDC board, and REVIEW to edit TEACH.TXT). Check for room on the hard disk.

ERROR in Reading DISK!!  
Hit <any KEY>

This message is displayed while attempting to load the DNC part program file during "F10 SET DNC" from "F4 RUN". It could not open the DNC part program file. Check that the DNC part program file exists.

ERROR in Reading DISK!!  
Hit <any KEY>  
Use START switch to validate MACROs,  
then Hit <any KEY> to continue

This message is displayed while attempting to load in the DNC macros file during “F10 SET DNC” from “F4 RUN”. The operator receives this message if the DNC macros file could not be opened. The operator receives this message if the DNC part program file could not be opened. Check that the DNC macros file exists.

ERROR in Reading TEACH.TXT !!  
Hit <any KEY> to CONTINUE

This message is displayed when the operator selects “EDIT TEACH” while in teach mode from “9 JOG”. The front end software could not open the file TEACH.TXT. Make sure that TEACH.TXT exists and is located in the root directory.

Error Reading Param File

This message occurs while reading the machine parameter file values for downloading to the BMDC card. The operator receives this message if the Parameter file revision number could not be found or the parameter file contains too many parameters for the current version of the software to handle.

Error: Spindle Not On

This message appears if the Spindle is off when a move is in progress that requires the spindle to be on.

Error while reading.  
File may be corrupt

This message is displayed when configuration file information could not be found. Check media and check the format of the configuration file (see “Unexpected EOF. File may be corrupt” message).

Executive Load...  
FAILED to open file \  
hit any key

The operator receives this message while attempting to re-load the binary executive (BMDC.BIN file) by selecting “F9 LDmdcSW” from the Startup Menu. Make sure BMDC.BIN is in your bootup directory (i.e. C:\BMDC.BIN or A:\BMDC.BIN).

EXIT || ERROR in writing FILE !!  
Hit <any KEY> to continue

This message is displayed while attempting to write a part program to disk or diskette after exiting the editor. Possible reasons for this message could be disk or diskette full.

FAILED – BMDC did not start	The front end software waits 20 seconds for the binary executive to load and for the BMDC card to come on line. This message is displayed if the BMDC card takes longer than 20 seconds. Check the BMDC card.
FAILED – Error reading binary image file!	An error was detected while reading in the “BMDC.BIN” file. The contents of the file may be corrupt or the boot disk may be bad.
FAILED – Error reading file!	The operator receives this message while attempting to load the binary executive (BMDC.BIN file) into the BMDC card. Check the boot drive.
FAILED – File too large!	This message is displayed if the size in bytes of the BMDC.BIN file has exceeded 256K.
FAILED to open file	Just after boot-up the information in the binary executive file is read and then loaded into the BMDC card. This message is displayed if the binary executive file “BMDC.BIN” could not be located. Check that the BMDC.BIN file exists.
Guards Not In Place	The user gets this message if guarding is enabled and the doors are not closed. This message can happen during axes homing, executing a GCODE block, when the START button has been pressed to enable a cycle start, or during a critical section of a tool change or plug reverse tapping cycle.
hit START when ready	This message only applies to Discovery class machines with automatic tool changers. It appears immediately following a tool change operation. It informs the user that the tool change operation has completed and that the machine is ready to execute the next GCODE block.
Illegal M-Code	This message is displayed when an unknown M-Code has been encountered.

INCOMPATIBLE SOFTWARE  
VERSIONS DETECTED  
You MUST RE-LOAD the executive  
software by selecting <F9>, LDmdcSW  
from the initial menu.  
HIT ANY KEY to clear this message  
-- Hit Any Key to return to DOS --  
[%s bytes free = %ld]

The operator receives this message when the  
version of the binary executive software is not  
supported by the hardware or front end software.

INCOMPATIBLE SOFTWARE  
VERSIONS DETECTED  
You MUST RE-LOAD the executive  
software by selecting <F9>,  
LDmdcSW from the initial menu.  
HIT ANY KEY to clear this message

The operator receives this message while  
attempting to re-load the binary executive  
(BMDC.BIN file) by selecting "F9 LDmdcSW"  
from the Startup Menu. Software versions of the  
binary executive below 2.27 are not compatible  
with the current front end software and BMDC  
board. Try re-loading the executive software.  
If the message persists, contact BMI  
applications and get an update disk  
containing the latest software.

[INSERT NEW DISK !!]  
Hit <anyKEY> to continue

This message is displayed while attempting  
to write a part program to disk or diskette  
after exiting the editor. Possible reasons  
for this message could be disk or diskette  
full.

INTOF 2LNS| ERROR !! 2 points  
are same for a line  
Hit <any KEY> to CONTINUE

The operator receives this message when he  
selects "9 INTOF 2 LN" in "F4 GEOM" from  
"9 JOG" of Basic Menus. Check that the  
starting and ending points for line 1 or  
line 2 are different.

Insufficient Lube Pressure

This message only applies to machines that  
have electronic (automatic) or air-motor  
spindles. It appears when the lube  
pressure is low.

\*\*LIMIT\*\*

This message is displayed in the machine  
status window (green window in the upper  
right corner of the display across from  
the XABS, YABS, ZABS labels) when the X,  
Y, Z, W coordinate positions have exceeded  
the max. travel limits (params 31, 32,  
33).

Low Air Pressure – Cannot Set Speed

This message only applies to machines with  
air-motor spindles. It appears when the  
spindle speed has been changed via  
encountering an "S" command in a part  
program or by "6 STM" from

Basic menus. It occurs because the air pressure generated by the air motor solenoid is too low to change the spindle speed.

MIDPT 2PTS | ERROR !!  
Select I (inside),  
O (outside) or N (none)  
Hit <any KEY> to CONTINUE

This message appears when “8MID PT 2 PTS” was selected in “F4 GEOM” from “9 JOG” in Basic Menus. “I” for inside circle or “O” for outside circle or “N” for no offset must be inputted so that the cutter radius can be added or subtracted, respectively, from the mid point.

No Feedrate Specified

This message is displayed when a GCODE block (or rate of zero) requires a feedrate and none was specified. Example: G1X2.Y3. will generate this message (G1 requires a feedrate).

NO FILES in DIRECTORY !!  
<F2>= EXIT, or <ENTER>= NEW PATH

This message appears during a file selection operation (in F7 Make New Directory or F8 Change Working Directory from 5 FILES in Startup Menus) when the current working directory (usually the directory containing the startup software) has no part program files (files with extension “.TXT”). It gives the user the option of changing the current working directory. Once the path has been changed, all part program files in the new working directory will be displayed.

NO FILES in DIRECTORY !!  
<F2>= EXIT, <ESC>= CANCEL  
or <ENTER>= NEW FILE

This message appears during a file selection operation (from “5 FILES” of Startup Menus, “EDIT CNC” in “F4 RUN”, or “F6 EDIT” in Basic Menus) when the current working directory (usually the directory containing the startup software) has no part program files (files with extension “.TXT”). It gives the operator the option of exiting file selection or typing in a file specification to select from.

NOT HOMED

This message is displayed in the machine status window (green window in the upper right corner of the display across from the XABS, YABS, ZABS labels) before the axes have been homed. Once “8 Home Axes” has been invoked, these values will display the user offset values of the current spindle position.

NOT RUNNING	This message is displayed just after bootup or when re-entering by typing run at the DOS prompt if the BMDC is not currently up and running.
Orient Tool, Hit AUTO/BLOCK, START	This message applies to machines with manual (non-orientable) spindles only. It occurs when processing an M19 "Spindle Orient" command. It prompts the user to manually move the tool to the desired orient position. Note: Check parameter 92 – Tool Change #1 Orient Position (milidegrees).
OPTIONS can not be set when in RUN Hit any key to continue	This message is displayed if the operator tries to "7 SET OPTIONS" in "F4 RUN" from Basic Menus while the axes are in motion.
Parser: #1 Internal Addressing Error	This message is displayed when the number of nesting levels in a user macro has exceeded 4. Example of nesting: When macro B is called from within macro A, macro A has a nesting level of 0 and macro B has a nesting level of 1. If B calls C which in turn calls D which in turn calls E, then C, D, E have nesting levels of 2, 3, 4 respectively.
Parser: #2 Internal Addressing Error	This message is displayed when the number of user macro definitions has exceeded 99.
Parser: #3 Internal Addressing Error	This message is displayed when the number of nesting levels in a user macro has exceeded 4.
Parser: #4 Internal Addressing Error	This message is displayed when trying to jump to an invalid canned cycle label. Valid canned cycle labels are numbered 0 – 11.
Parser: #5 Internal Addressing Error	This message is displayed when the label number in an "L" label command is not in the range 1 – 9. An "L" label command occurs when the first character in a GCODE block is an "L" and the second character is a digit (1 – 9).
Parser: #6 Internal Addressing Error	This message is displayed when calling an invalid canned cycle. Valid canned cycles are in the range G81 – G89, G170 – G176, G181 – G189, G191 – G199. This message occurs when the specified name is outside this range.

Parser: #7 Internal Addressing Error	This message is displayed when the number of nesting levels for a canned cycle has exceeded 4.
Parser: #8 Internal Addressing Error	This message is displayed when the number of loop nesting levels has exceeded 4.
Parser: #9 Internal Addressing Error	This message is displayed when the label number on a =Ln (jump to Ln) statement is not a single digit in the range 1 – 9.
Parser: #10 Internal Addressing Error	This message is displayed when the label number in an “L” label command is not in the range 1 – 9. An “L” label command occurs when the first character in a GCODE block is an “L” and the second character is a digit (1 – 9).
Parser: #11 Internal Addressing Error	This message is displayed when the number of nesting levels in a user macro has exceeded 4. Example of nesting: when macro B is called from within macro A, macro A has a nesting level of 0 and macro B has a nesting level of 1. If B calls C which in turn calls D which in turn calls E, then C, D, E have nesting levels of 2, 3, 4 respectively.
Parser: #12 Internal Addressing Error	This is displayed when the macro number is less than zero or greater than 99 following the pound (#) sign in a user macro definition.
Parser: #13 Internal Addressing Error	This message is displayed when the number of nesting levels for system macros has exceeded 4.
Parser: #14 Internal Addressing Error	This message is displayed when the number of loop nesting levels has exceeded 4.
Parser: #15 Internal Addressing Error	Specified tool number is invalid. Valid tool numbers are in the range 1 – 24.
Parser: #16 Internal Addressing Error	An invalid variable index has been encountered. A variable name consists of a letter, A – Z, followed by a variable index, 1 – 9. A valid variable index must be a positive single digit number without a decimal point.

Parser: Bad Arc Radius Or Endpoint	This message is displayed when a negative radius is specified in a GCODE block.
Parser: Call Of Undefined Loop Or Macro	A sequence number was referenced in an =N loop call that does not exist or a label was referenced in an =L label call that does not exist or a macro number was referenced in an =# or =% that does not exist.
Parser: Cannot Comp "C" Axis	This message occurs when a C axis move or cut command appears between a G41 or G42 and a G40.
Parser: Commanded S Axis Move Too Far Minus	This message is displayed when a commanded S move is less than the S axis negative limit of travel (parameter 24).
Parser: Commanded S Axis Move Too Far Positive	This message is displayed when a commanded S move is greater than the S axis positive limit of travel (parameter 25).
Parser: Commanded W Axis Move Too Far Minus W	This message is displayed when a commanded move is less than the W axis negative limit of travel (parameter 22).
Parser: Commanded W Axis Move Too Far Positive W	This message is displayed when a commanded move is greater than the W axis positive limit of travel (parameter 23).
Parser: Commanded X Axis Move Too Far Minus X	This message is displayed when a commanded move is less than the X axis negative limit of travel (parameter 17). The parser caught the error before the commanded move started.
Parser: Commanded X Axis Move Too Far Positive X	This message is displayed when a commanded move is greater than the X axis positive limit of travel (parameter 18). The parser caught the error before the commanded move started.
Parser: Commanded Y Axis Move Too Far Minus	This message is displayed when a commanded Y move is less than the Y axis negative limit of travel (parameter 19). The parser caught the error before the commanded move started.



Parser: Commanded Y Axis Move Too Far Positive	This message is displayed when a commanded Y move is greater than the Y axis positive limit of travel (parameter 19). the parser caught the error before the commanded move started.
Parser: Commanded Z Axis Move Too Far Minus Z	This message is displayed when a commanded move is less than the Z axis negative limit of travel (parameter 20). The parser caught the error before the commanded move started.
Parser: Commanded Z Axis Move Too Far Positive	This message is displayed when a commanded Z move is greater than the Z axis positive limit of travel (parameter 21).
Parser: Illegal Condition Code	This message is displayed when the relational operator in a conditional test data block is unknown or invalid. Valid relational operators are: <GE>, <GT>, <LE>, <LT>, <EQ>, <NE>. The format of a conditional test data block is: ?A_<rel. op.> B_ where A_ is the variable to be tested against B_.
Parser: Illegal G-Code	This message is displayed when an unknown GCODE has been encountered.
Parser: Loops And Macros Illegal in DNC	This message is displayed during DNC mode when a macro definition block is encountered. Macro definitions are illegal in DNC mode.
Parser: No Feedrate Specified	This message occurs when a GCODE block requires a feedrate and none was specified. Example: G1X2.Y3. will generate this message (G1 requires a feedrate).
Parser: Syntax Error: Too Many Digits	A numeric string in a Parser line has exceeded the maximum number of digits allowed (17 digits). A numeric string can have the following symbols: "+ - . 0 1 2 3 4 5 6 7 8 9".
Position Z-Axis	This message is displayed on a 2 axis machine hit START when ready when a commanded move causes the value of Z to change.
PPPL: Bad destination variable index	This message is posted when the first character in a PPPL assignment statement was an alphabetic

character (variable name encountered) and the second character is not a numeric character (The first character of a variable name must be an alphabetic character and the second character of the name must be a numeric character).

PPPL: Bad destination variable letter

This message is generated when a PPPL assignment statement does not begin with an alphabetic character (PPPL assignment statements must begin with a variable name and the name must start with an alphabetic character).

PPPL: Bad PI

This message appears because PI was not found following a #.

PPPL: Cannot find equals sign

This message is generated if the first character in a PPPL statement is a letter and the second character is a digit (0 – 9) ( indicating a variable name) but the third character in a PPPL statement is not an Equal sign (must be a PPPL assignment statement). PPPL assignment statements must begin with a variable name followed by an equal sign).

PPPL: Expected Operator

This message appears when a missing operator is encountered or an invalid operator was specified in an assignment statement. An operator can appear between two variable names, a variable name and a constant, or 2 constants. Valid operators are “+” for addition, “-” for subtraction, “\*” for multiplication, and “/” for division.

PPPL: Improper Function call

This message is displayed when a variable name or function call was expected but invalid PPPL characters for a variable name or subroutine call were found.

PPPL: Syntax Error-Parsed  
past End of Line

This message occurs when parsing a part program line. A character was expected but the end of the line was encountered. In other words, a premature end of line occurred.

PPPL: Syntax Error: Missing Value

This message occurs when parsing a part program line. More information was expected but the end of the line was encountered. In other words, a premature end of line occurred.

PPPL: Syntax Error: Too Many Digits	A numeric string in a PPPL line has exceeded the maximum number of digits allowed (17 digits). A numeric string can have the following symbols: "+ - . 0 1 2 3 4 5 6 7 8 9".
PPPL: 2-Argument Functions Require Parentheses	This message is displayed if a parenthesis is missing around the arguments of a two-argument trig function.
PPPL: User IO but User AUF not operating	This message is displayed if the user AUF is not installed or operating properly.
Probe Fault (unexpected touch)	This message only applies to a machine with a probe in the spindle. It appears when an unexpected probe hit was encountered. It occurs when the probe is moving but not probing and the probe senses a touch. Upon sensing the touch, the probe will stop moving immediately (a safety feature).
Probe Installed – Spindle Denied	This message appears when a commanded M3 or M4 is encountered in a part program or the user tries to turn the spindle on via "6 STM" from Basic menus. It informs the user that spindle commands are not allowed when a touch probe has been installed.
Put TOOL #1 in SPINDLE	This message occurs during the loading of the Leave SLOT #1 EMPTY tool changer magazine. It appears when there is no tool in the spindle or if the number of the tool in the spindle is unknown. It prompts the user to put tool #1 in the spindle and to leave slot #1 in the magazine empty.
rdParamFile ( ) returned return-code Internal Error	This message is displayed if the rdParamFile ( ) function has been modified and the function that calls the rdParamFile ( ) function has not been updated to reflect the change. This is an internal software problem. Contact BMI applications.
Read fault	An error was detected while reading from a floppy or hard drive. Run a diagnostic test on the floppy or hard disk.

Re-Load Tools

This message is displayed on machines with automatic tool changers when the tool changer becomes disoriented. A typical example of this is when the guard doors are opened during a tool change operation. When this message is displayed the operator must: (1) Re-Home the machine by selecting "8 HOME AXES" from the Startup Menu, (2) Home the tool changer magazine by selecting "6 TOOL CHANGE" in the Startup Menu and then selecting "2 HOME MAGAZINE".

REMOVE SYSTEM DISK and INSERT  
BLANK DISK BEFORE FORMATTING  
Hit <any KEY> to continue  
or <ESC> to exit

This message reminds the operator to remove the system disk from the floppy drive and insert the blank disk to be formatted.

Remove Tool From Spindle

This message applies only to Discovery class machines with automatic tool changers. The operator receives this message during an M6 command when the tool number of the desired tool is in the carousel but the tool number of the current tool in the spindle is not in the carousel. The message prompts him to remove the current tool from the spindle so that the desired tool can be retrieved from the carousel.

rev version-number required!  
Wrong Param File Version

This message is displayed when the machine parameter file is not compatible with the current front end software. Run the update program to make the parameter file current.

Rigid Tap Clamped to 3,00 RPM

The user receives this message when the current spindle speed is too high to perform rigid tapping. It informs the user that the maximum spindle RPM when performing rigid tapping is 3600. The current spindle speed is then set to 3600 RPM and the cycle starts.

SAVE AS || ERROR in naming FILE !!  
SAVE TO OLD FILENAME? Y/N

This message is displayed when the operator selects "<S> = SAVE AS NEW FILE" to exit "F6 EDIT" from Basic Menus or to exit "F4 EDIT CNC" in "F4 RUN" from Basic Menus or to exit "F2 EDIT TEACH" program from "9 JOG" in Basic Menus and then hits the escape key to cancel instead of

selecting a file name or typing in a new file name. This message gives the user the option of saving to the old file name or exiting without saving.

Servo: S DAC Underflow

An S underflow condition exists that causes the S DAC to become saturated, meaning control of that axis has been lost. When this discrepancy is detected and then persists for 150ms, an alarm condition is generated, this message is displayed, and the axis drive system is shut down.

Servo: S DAC Overflow

An S overflow condition exists that causes the S DAC to become saturated, meaning control of that axis has been lost. When this discrepancy is detected and then persists for 150ms, an alarm condition is generated, this message is displayed, and the axis drive system is shut down.

Servo: W DAC Underflow

A W underflow condition exists that causes the W DAC to become saturated, meaning control of that axis has been lost. When this discrepancy is detected and then persists for 150ms, an alarm condition is generated, this message is displayed, and the axis drive system is shut down.

Servo: W DAC Overflow

A W DAC overflow condition exists that causes the W DAC to become saturated, meaning control of that axis has been lost. When this discrepancy is detected and then persists for 150ms, an alarm condition is generated, this message is displayed, and the axis drive system is shut down.

Servo: X DAC Underflow

An X underflow condition exists that causes the X DAC (Digital to Analog Converter) to become saturated, meaning control of that axis has been lost. When this discrepancy is detected and then persists for 150ms, an alarm condition is generated, this message is displayed, and the axis drive system is shut down.

Servo: X DAC Overflow

An X overflow condition exists that causes the X DAC to become saturated, meaning control of that axis has been lost. When this discrepancy is detected and then persists for 150ms, an alarm

condition is generated, this message is displayed, and the axis drive system is shut down.

Servo: Y DAC Underflow

A Y underflow condition exists that causes the Y DAC to become saturated, meaning that control of that axis has been lost. When this discrepancy is detected and then persists for 150ms, an alarm condition is generated, this message is displayed, and the axis drive system is shut down.

Servo: Y DAC Overflow

A Y overflow condition exists that causes the Y DAC to become saturated, meaning control of that axis has been lost. When this discrepancy is detected and then persists for 150ms, an alarm condition is generated, this message is displayed, and the axis drive system is shut down.

Servo: Z DAC Underflow

A Z underflow condition exists that causes the Z DAC to become saturated, meaning control of that axis has been lost. When this discrepancy is detected and then persists for 150ms, an alarm condition is generated, this message is displayed, and the axis drive system is shut down.

Servo: Z DAC Overflow

A Z overflow condition exists that causes the Z DAC to become saturated, meaning control of that axis has been lost. When this discrepancy is detected and then persists for 150ms, an alarm condition is generated, this message is displayed, and the axis drive system is shut down.

setParameter (parameter  
-number) FAILED!  
Error Setting Parameter

This message is displayed if the front end software failed to set a machine parameter in the BMDC to a specific value or the BMDC got hung up. Check the BMDC board.

Speed not valid in ANY gear

This message occurs on machines with air-motor or electronic spindles when the commanded spindle speed is too high or low for the spindle motor or belt to handle.

Spindle Motor Over-Heated

This message is displayed when the spindle load has caused the motor to overheat.

Spindle Motor Overload	This message occurs when the load on the spindle is too large for the spindle motor to handle.
Spindle Not On – Cannot Cut	This message appears on machines with air-motor or electronic spindles during RUN (AUTO or BLOCK) because the user did not put a spindle on “S” command before a command milling or drilling operation in a part program or because the user tried to MDI (DO EVENT) a milling or drilling operation before turning the spindle on.
Spindle Speed Too High	This message applies only to machines that have air-motor (semi-automatic) spindles. It appears when the commanded spindle speed is too low for even the low gear to handle. It displays the current spindle settings and prompts the operator to turn the spindle on.
Spindle Speed Too Low	This message applies only to machines that have air-motor (semi-automatic) spindles. It appears when the commanded spindle speed is too low for even the low gear to handle. It displays the current spindle settings and prompts the operator to turn the spindle on.
Spindle: Spindle Error	Spindle time out. The software waits 450 milliseconds for the spindle drive to enable. This message is displayed if the spindle did not turn on during the wait interval.
Spindle Stalled	This message appears when the actual spindle slip percentage is greater than the max Limit (parameter 53).
System: C-Axis Run-Away	If the C encoder or DAC fails, a large discrepancy between the Commanded and actual velocities will develop. When this discrepancy persists for a pre-determined period of time, this message is posted, an alarm condition is generated, and the axis drive system is shut down.
System Communication Error from AUF	This message occurs when the number of errors on packets from the AUF has exceeded the MAX.

System Communication Error from TLAUF	This message is displayed when the number of errors on packets from tool changer #1 AUF or tool changer #2 AUF has exceeded the maximum.
System Communication Error to AUF	This message occurs when the number of errors on packets to the AUF has exceeded the MAX.
System Communication Error to TLAUF	This message is displayed when the number of errors on packets to tool changer #1 AUF or tool changer #2 AUF has exceeded the maximum.
System: S-Axis Run-Away	If the S encoder or DAC fails, a large discrepancy between the Commanded and actual velocities will develop. When this discrepancy persists for a pre-determined period of time, this message is posted, an alarm condition is generated, and the axis drive system is shut down.
System: X-Axis Run-Away	If the X encoder or DAC fails, a large discrepancy between the Commanded and actual velocities will develop. When this discrepancy persists for a pre-determined period of time, this message is posted, an alarm condition is generated, and the axis drive system is shut down.
System: Y-Axis Run-Away	If the Y encoder or DAC fails, a large discrepancy between the Commanded and actual velocities will develop. When this discrepancy persists for a pre-determined period of time, this message is posted, an alarm condition is generated, and the axis drive system is shut down.
System: Z-Axis Run-Away	If the Z encoder or DAC fails, a large discrepancy between the Commanded and actual velocities will develop. When this discrepancy persists for a pre-determined period of time, this message is posted, an alarm condition is generated, and the axis drive system is shut down.
TiChg: Carousel Timeout	The operator receives this message when the carousel failed to rotate to the desired pocket or while putting away a tool or getting a tool from the spindle. It can also occur if the carousel failed to jog to the next or previous pocket. (Note: Can



use the jog knob to jog the carousel to the next pocket if the jog knob is set to “+” and previous pocket if the jog knob is set to “-”.)

TlChg: Drawbar Timeout

The operator receives this message when the tool-in-spindle did not unclamp or when the carousel did not clamp over the old tool during the “put-away” portion of a tool change operation or when the tool in the carousel did not unclamp or when the spindle did not clamp over a new tool during the “get” portion of a tool change operation.

TlChg: Invalid Switch States

Applies to machines with automatic tool changers only. This message will be displayed during a tool change operation while getting a tool from the carousel. It is displayed when a carousel or draw bar sensor failure occurs.

TlChg: Invalid Tool-In-Spindle

The operator receives this message when the tool number of the tool in the spindle is greater than the maximum pocket number in the carousel or less than 1; or if the spindle is not empty when loading a tool from the carousel.

TlChg: MUST RE-HOME CAROUSEL

This message informs the operator that the carousel must be re-homed before proceeding with the next operation. It is displayed whenever the carousel is in an unsafe position (the carousel did not either fully extend or retract). This message will also be displayed when enabling the drives after a failed event, such as an E-stop, has been cleared.

TlChg: MUST RE-LOAD CAROUSEL

The operator receives this message when the TLAUF board has an invalid tool number for the current tool in the spindle during the start of a tool change operation or immediately after homing the carousel. The operator must re-load the carousel.

TlChg: NVRAM write error

This message is displayed when the non-volatile RAM on a TLAUF board is faulty.

TlChg: Tool-Arm Timeout

This message is displayed when the carousel did not extend to the spindle while putting away the

old tool or inserting the new tool. It also appears when the carousel did not retract after putting the new tool in the spindle, after putting away the old tool or when the carousel did not home successfully.

TLAUF abort FAILED!

Whenever a failed event, such as an E-stop, occurs, the control sends an abort signal to the TLAUF (even if the TLAUF is not busy). The control then waits 100 milliseconds for the TLAUF to indicate that the abort command has been executed. This message is displayed if the TLAUF did not respond with an abort status within the 100 millisecond period.

Turn Off Spindle

This message appears only on a lathe when an M5 “Spindle Off” command is issued.

Turn On Spindle to Enable Run

The operator receives this message on a lathe or a milling machine with a manual spindle during RUN (AUTO or BLOCK) because a spindle on “S” command did not appear before a commanded cutting operation in a part program or because the part programmer tried to MDI (DO EVENT) a cutting operation before turning the spindle on.

Turn Spindle On In 1st Gear  
hit START when ready

This message applies only to machines with air-motor (semi-automatic) spindles. It appears when the commanded spindle speed is in the range of gear 1 (low gear) (less than the Spindle-Range #1 Max (param. 74)). It prompts the user to set the knob to low gear and then to turn the spindle on.

Turn Spindle On In 2nd Gear  
hit START when ready

This message applies only to machines with air-motor (semi-automatic) spindles. It appears when the commanded spindle speed is in the range of gear 2 (high gear) (less than the Spindle-Range #1 Max (param. 74)). It prompts the user to set the knob to high gear and then to turn the spindle on.

Unexpected EOF. File may be corrupt

This message is displayed just after booting up while reading the configuration file (cfgprms.sys) contents. The operator receives this message when there is data missing from the configuration file.

<p>USE &lt;JOG SELECTOR SW&gt; OR &lt;JOG KNOB&gt; TO MOVE AXES OFF UNEXPECTED POSITION</p>	<p>If there is a problem loading the configuration file, a default will be created. This means that all TLOs and offsets will need to be re-established.</p>
<p>WAIT -- AXIS HOMING!! AXIS DRIVES NOT ENABLED !!!</p>	<p>The operator receives this message if he selected "3 JOG OFF Limits" from the Startup Menu. This message informs the operator to turn the +- Jog Select Switch on the front panel to select the direction to jog then push the +- Jog Select Switch to jog the selected axis and to use the rotary switch to move in finer increments.</p>
<p>WAIT -- ORIENTING S-AXIS</p>	<p>This message is displayed if the operator selects "8 HOME AXES" before selecting "7 AXIS DRV ENABLE" from the startup menu.</p>
<p>WAIT -- POSITIONING Z-AXIS</p>	<p>This message is displayed if the operator attempts to enter a command while the spindle is orienting during a tool change magazine homing operation. Orienting the spindle occurs just after moving the Z axis to the tool change height.</p>
<p>WAIT -- TOOL-CHANGER HOMING</p>	<p>The operator receives this message if he attempts to enter a command while moving the Z axis to the tool change height after homing the tool change magazine.</p>
<p>waiting for BMDC</p>	<p>This message is displayed if the operator attempts to enter a command while the tool changer is homing. This message informs the operator to wait until the tool changer homing process has completed before it is safe to enter a command.</p>
<p>WARNING !!! FILE DID NOT WRITE: CHECK ROOM ON DISK. Loading... FAILED -- File too large!</p>	<p>This message is displayed while attempting to load the binary executive into the BMDC card. This message informs the user to wait for the binary executive to finish loading and for the BMDC to come on line.</p>
<p>WARNING !!! FILE DID NOT WRITE: CHECK ROOM ON DISK. Loading... FAILED -- File too large!</p>	<p>The operator receives this message while attempting to load the binary executive (BMDC.BIN file) into the BMDC card. This message is displayed if the size of the BMDC.BIN file exceeds 256K bytes (262,144 bytes).</p>

Write fault

An error was detected while writing to a floppy or hard drive. Run a diagnostic test on the floppy or hard disk.

[WRITE PROTECT] SOURCE DISK  
BEFORE COPYING

NOTE: diskcopy will require  
swapping SOURCE and TARGET disks  
several times

Hit <any KEY> to continue  
or <ESC> to exit

This message informs the operator to slide the latch on the diskette to the write protect position so that the information on the source disk will not get corrupted.

Z-Move: Tool-Changer Not Safe

Applies to machines with automatic tool changers only. Occurs during a tool change operation when the Z axis has moved to the tool change height but the tool in the spindle did not unclamp.

