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UNIDEX™ 11
MOTION CONTROLLER
INTERACTIVE CONTROL
SOFTWARE (SSP1) MANUAL

PN:EDO103

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ORGANIZATION OF DOCUMENTATION FOR UNIDEX 11:

Up to four manuals may have been shipped with your Unidex 11 Controller, depending on the options ordered. Of the four manuals, two supply basic data regarding programming and hardware support information. These manuals are respectively:

- *Unidex 11 Motion Controller Programming Manual*
- *Unidex 11 Motion Controller Hardware Manual*

Depending on the options supplied with your Unidex 11, one or both of the following documents may have also been supplied:

- *Unidex 11 Motion Controller Options Manual*
- *Unidex 11 Interactive Control Software Manual (SSP1) — which is this manual*

Please review, in detail, *Unidex 11 Motion Controller Programming Manual*, before proceeding to this or any other documentation supplied with your Unidex 11.

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MANUAL CONVENTIONS

Displays:
Most menu and display samples are enclosed in blocks. For example, the communication menu is shown below:

```
1Help 2Immediate 3Run 4Status 5Directory 6Position 7Digitize 8Transfer 9Mn Menu
```

Menu Selections:
The menu selections, such as the one shown above, are made by pressing the appropriate function keys (F1 - F10).

Entering Data:
Within this manual, <Return>, <CR><LF>, or <Enter> all refer to the same function, i.e., that of entering data.

File Names and Program Numbers:
A file name will always refer to a program on the host computer's storage drive, while a program number will always refer to a program in the Unidex 11 memory.

Aborting a Function:
When a softkey function takes you to a point in the program where there are no softkey displays and you want to go back to the previous menu without performing the present function, press <RETURN> in response to the first prompt of that mode. One exception to this is the Interpolation mode. In this mode, select "A" for Abort when the final prompt of the interpolation mode asks "Are all values correct (Y/N/Abort)?"

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CHAPTER 1: INTRODUCTION

The Interactive Control Software Package is a program development aid which enables you to increase the capabilities of your Unidex 11. It increases the Unidex capabilites from those of a point to point motion controller with minimal user memory, to those of a more sophisticated controller with virtually unlimited memory capacity, as well as linear and circular interpolation.

Linear and circular motion program segments for Unidex 11 can be generated in the interpolation mode. They are created after you respond to each of a series of prompts. The software will create incremental motion programs, based on the absolute positions of the program, which can be called as a subroutine or used in a repeat loop. All interpolation functions produce interpolation on two axes with the exception of linear interpolation (Cartesian mode) which can calculate a simultaneous move for all four axes. The interpolation axis pair can be selected by pressing F6, Plane Select. Programming units, English or Metric, can be selected by pressing F8, which toggles between the two choices.

The interpolation mode will append each program segment to the end of the current file, providing a logical means of creating a complete motion sequence. A free editing software package (PC- Write) is included as well.

The communications mode provides functions for motion program transfer, execution and digitizing. The transfer function provides for motion program transfer between the Unidex and the host's disk drive. Several modes of program execution are provided, including immediate mode program execution (runs program from the IBM pc).

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The Interactive Control Software Package features **softkey selections** such as:

- Help
- Setup
- Interpolation/Edit
- Communication (Run, Digitize, Transfer, etc.)
- Directory
- Print

The above selections are from the main menu. Selecting any of these will cause a new set of softkeys to be displayed. Each selection and its subsequent subsections will be covered in this manual.

Other Interactive Control Software features include:

- Interpolation: circles, arcs, vectors
- Help screens (with motion command summary)
- Free editing software package (includes its own help screens)
- Program transfer between Unidex 11 and disk drive
- Auto or Block mode program execution directly from the host's disk drive (i.e., program size virtually unlimited)
- Immediate command execution
- Slew capability from IBM pc keyboard (PC-AT only)
- Status information onscreen (input/output, errors, axis information)
- Digitizing (supports Unidex 11 joystick options—see the *Unidex 11 Motion Controller Hardware Manual*)

Refer to figure 1-1, to see the screen that will be displayed when first you power up.

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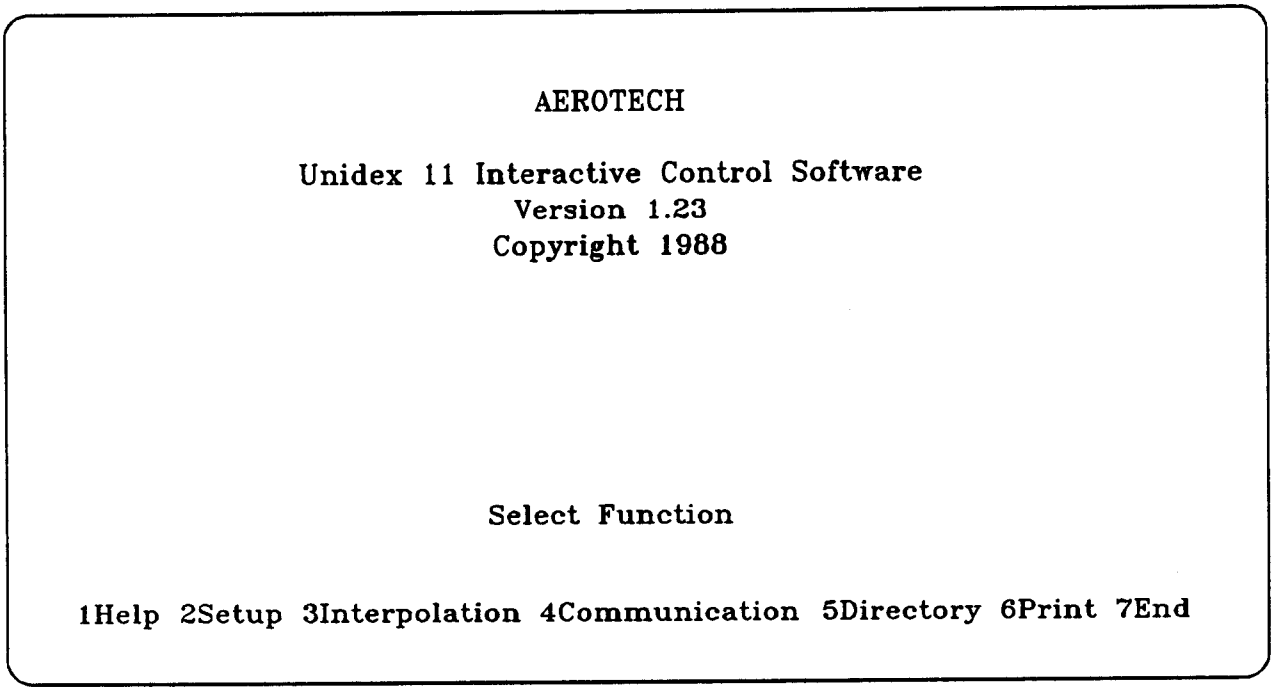


Figure 1-1: Screen Displayed at Power-up (Main Menu)

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CHAPTER 2: INSTALLATION

Unless you wish to install the Unidex Software on your hard disk drive, no installation is necessary. **Remember to make a back-up disk copy, put a write-protect tab on the original, and save the original for archival purposes.** Do not write-protect the copy from which you will be working, since "set-up" parameters, and possibly files (if using a one-drive system), will be written to it.

Boot your system with the back-up Unidex Software disk in drive A.

SECTION 2-1 INSTALLATION FOR HARD DISK USERS

To install the Unidex Software on a hard disk drive, copy the following six files to the same sub-directory:

1. **ED.EXE (editor)**
2. **SETUP**
3. **BRUN30.EXE**
4. **UNIDEX.EXE**
5. **ED.DEF (setup file for editor)**
6. **ED.HLP (editor help file from Source Code disk)**

Also, included on the second disk is the Quickbasic source code listing (Ver 123.BAS), a directory of routines (Director.BAS), and the editors help file (ED.HLP), none of which fits on the main disk. This second disk contains a second copy of the editor ED.EXE and ED.DEF as well.

After installation, you may run the *Unidex* file.

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SECTION 2-2 UNIDEX COMPATIBILITY

Unidex Systems prior to 10/86 with version 2.9 firmware or lower, require the following change to the Setup file for compatibility. This is accomplished by typing ED <SPACE> Setup <RETURN> after the DOS prompt. The editor screen will then be displayed. Press the <ESC> key for "No Back-up" of the file.

The set-up file will then be displayed. Press the <END> key on the numeric keypad. The cursor will then move to the end of the line. Delete the number 3, and type 20000 in its place. Then press F1, followed by F2.

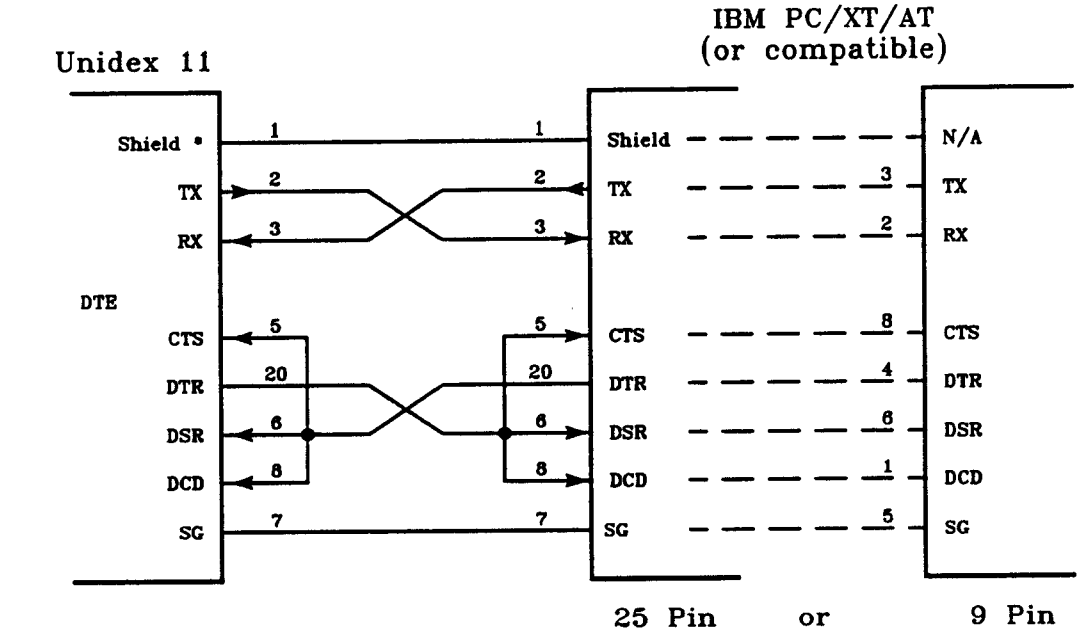
SECTION 2-3 RS-232C CONNECTION

Figure 2-1 illustrates the proper RS-232C connection to make between the Unidex 11 and the IBM pc or compatible.

SECTION 2-4 SYSTEM REQUIREMENTS

The Unidex Software requires an IBM PC/XT/AT or compatible microcomputer, 384K of RAM, a single 5 1/4" drive and PC-DOS/MS-DOS 2.10 or higher. (It also supports a hard-disk.)

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* Frame Ground

Figure 2-1: RS-232C Connection

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CHAPTER 3: SETUP

The main menu consists of the following selections:

```
1Help 2Setup 3Interpolation 4Communication 5Directory 6Print 7End
```

Press the **F2** key to enter the Setup Mode.

SECTION 3-1 PARAMETERS

The first group of prompts relate to the valid axes in your system, as well as their resolutions. If the X axis is in your system, you will first see:

```
Set-up Menu
Enter X axis label (Default INCHES) ?
```

Enter the appropriate **label** (unit of measurement) for the X axis (i.e., steps, inches, mils, millimeters, microns, etc.).

NOTE: You may press <RETURN> to enter the default value if one is displayed. If no default value is displayed, pressing <RETURN> will skip that axis and go on to the next one.

The letters D E L may be entered to delete an axis and its associated prompts, and move on to the next axis. This would be the case if a particular axis is not available in your system.

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After responding to the first prompt, press <RETURN> for the next one, which is:

```
Enter system setup - Metric, English (Default )?
```

This allows you to select the unit of measurement for your system. The next question is worded according to the previous answer:

```
Enter step size in millimeters - (Default .001)?
```

or

```
Enter step size in inches - (Default .001)?
```

This parameter is required to convert inches (or millimeters) to steps for Unidex 11.

These same questions will be asked for each axis (Y, U, and V), unless D E L is entered for that axis, as noted previously. The next prompt defines the default programming units for the interpolation mode:

```
Enter programming units mode? (Default English)?
```

and on which drive your programs are to be stored:

```
Enter program storage drive letter (Default A)?
```

SECTION 3-2 COMMUNICATION PARAMETERS

The questions immediately following the Axes Information are:

```
Enter IBM Com. port number (Default 1)?
```


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Enter baud rate - 9600 max. (Default 9600)?
Enter parity - odd, even, none (Default N)?
Enter number of data bits - 7,8 (Default 7)?
Enter number of stop bits - 1,2 (Default 1)?

The first of the prompts is requesting the communications port number of the host computer, through which Unidex 11 will communicate.

Obviously, the communications parameters must be set the same in the Unidex 11 for proper communication. If necessary, select "setup" from the Unidex 11 (local keyboard) and set the communications parameters. After doing so, be sure to re-enable the Unidex 11 communications port by selecting "Comm. Enable", then "RS-232 port".

NOTE: **The baud rates from which you may select are: 300, 600, 1200, 1800, 2400, 4800, and 9600.**

When these prompts are answered, the main menu is displayed again. If you would like to alter any of your responses, select Setup and answer the prompts again.

(For an explanation of the Communication Parameters, refer to the *Unidex 11 Motion Controller Programming Manual* (Part IV).

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CHAPTER 4: INTERPOLATION AND EDIT MODES

Unidex 11 is a point to point linear motion controller that does not have vectoring or contouring capabilities. The Interpolation software in this package allows the user to generate vectorial and contouring motions in a Unidex 11, in response to prompts by the user. (Section 4-10 gives a detailed example of an interpolation program.)

The user may specify a vectorial move or a circular move, and the software will generate a program segment for Unidex 11 that, when executed in a program, will achieve the desired motion by making a set of linear moves.

The motion program segment generated by the software is compiled into a file named at the start of an Interpolation session. One of the function keys also permits editing of the file being compiled so that corrections may be made as a Unidex 11 program is being created. A command input mode provides a means of adding actual Unidex 11 commands to the file without entering the edit mode. These commands may be used to add to the file such commands as: Go Home, labels, conditional commands, subroutine definitions and calls, repeat loops, input/output commands, etc.

Press **F3** to see:

Enter new or existing file name?

(A filename will always refer to a program storage drive within the host computer. A program number always refers to a program in the Unidex memory.)

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NOTE: **Any of the main functions may be aborted by just pressing <ENTER>. This will take you back to the previous menu. All of the interpolation sub-functions will prompt for A (Abort).**

Enter the file name of a new or existing file. If an existing file is specified, all program segments will be appended to the end of the current file. The file name is limited to eight letters and/or numbers.

If you enter a name with more than eight characters, a decimal point will automatically be added. Three additional characters may follow the decimal point. Enter a file name to see:

```
1Help 2Circle 3Arc 4Linear 5Cmd.Input 6Plane Select 7Edit 8English 9Main Menu
```

Each of the interpolation modes will be discussed after this brief explanation.

In the interpolation mode you may directly enter Unidex 11 motion commands (listed in section 4-2) by pressing **F5**, Command Input.

You may program circles, arcs or linear vectors, selecting angles, dimensions and planes with **F2, F3, F4 and F6.**

You may also call up the editor by pressing **F7**, but before doing any of the above, please press **F1** and review the Help information.

SECTION 4-1 HELP

The Help Menu explains:

- Dimensions
- Program comments
- Vectorial moves

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- Degree increments
- Circular interpolation
- Tool up/down commands
- Arcs (using polar or cartesian coordinates)
- Linear interpolation (polar or cartesian)
- Command input

It also contains a motion command summary.

You may step through the help screens using the function keys F1 (next page), F2 (previous page) and F3 (end). F3 will allow you to exit the help mode.

SECTION 4-2 COMMAND INPUT

Press **F5**, Command Input, to see:

```
                Motion command input
Enter Unidex command to merge into file?
```

The motion commands that may be entered are described in detail in the *Unidex 11 Motion Controller Programming Manual*, Part IV. The following list is a summary of these commands.

A. UNIDEX 11 RS-232 MOTION COMMAND SUMMARY

*	; end of program block (automatically entered)
; comment <CR><LF>	; program comment
X F ffffff D-ddddddddd *	; X axis move at f-f steps/sec., distance of d-d steps CCW (-).

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Y F ffffff R + *	; Y axis free run CW (+), at f-f steps/sec.
DW nnn.n *	; Dwell nnn.n seconds
H XU *	; X and U axis go home
OT 10XX *	; Output to O1, O2, O3, O4 where : 1: true 0: false X: don't care
IT X001	; Wait until input I1, I2, I3, I4 matches X001
OS 0011 *	; Set output to O1, O2, O3, O4 during Feedhold or Soft Stop.
OR 1100 *	; Set output to O1, O2, O3, O4 when program execution begins
RS nnnn *	; Repeat loop start, repeat nnnn times
RE *	; Repeat loop end
RC 10X0 *	; End repeat loop on input I1, I2, I3, I4
R X *	; Restart free run X axis after stop (S X *)
R YUV *	; Start Y, U, V axes free running at last feedrate specified
S YUV *	; Stop free run axes Y, U, V
RP *	; Repeat program
L X-ddddddddd U ddddddddd *	; Load position register with (+/-) ddddddddd
IN *	; Set incremental programming mode
AB *	; Set absolute programming mode
BN *	; Set beeper ON
BF *	; Set beeper OFF
LB nn *	; Define label "nn" in program
GT nn *	; Goto label "nn"
GS nn *	; Call subroutine at label "nn"
SR *	; Return from subroutine
PS *	; Define end of program
CT nn I 10X0	; Goto label "nn" if input state is 10X0, else continue
CS nn I 1XXX	; Gosub label "nn" if input state is 1XXX, else continue
CO *	; Set corner rounding mode
NC *	; Set non-corner rounding mode
AD nnnn * (option)	; Accel/decel ramp time in milliseconds
DD nnnn * (option)	; Binary digital output where "nnnn" < = 4095
DB nnn * (option)	; BCD digital output where "nnn" < = 999

Enter a command such as "H XY" (send XY axes home), and press <RETURN>. You will again see the Interpolation Menu.

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B. PROGRAM COMMENTS

Each of the Interpolation modes (Circle, Arc, Linear) allows a program comment to be placed at the start of the program segment. If you do not enter one, a default comment defining that Interpolation Mode will be inserted. A similar default comment will define the end of each of these program segments. Commas are not allowed within program comments.

Comments are highly recommended for future editing or modifications of motion programs. For example, let us assume you have created a program which contains program segments for three circles. You would now like to modify one of them. Program comments can simplify editing by helping you to differentiate one circle from another. Once you have identified it you may delete it, create a new circular motion program segment, and merge it into the proper place in the file, all using the edit mode.

SECTION 4-3 CIRCULAR INTERPOLATION

The circular interpolation function produces a circular movement, with the current point as the center of the circle. Therefore, a circular interpolation command will cause a move to be generated in the positive direction of the "Plane 1" axis from the current point to the circumference. At this point, the "Tool Down" command will be inserted into the file, if specified. At the completion of the circle, the "Tool Up" command will be inserted, and a move will be generated back to the center of the circle.

(If a circular move greater than 360 degrees is desired, then generate it with the arc interpolation mode rather than the circular interpolation mode.)

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To generate a circular motion program segment with the current position as center, press **F2**. You will see:

```
Aerotech Circular Interpolation
Tool function command at start of circle (CMD/CRLF) ?
```

This question allows the user to enter a Unidex 11 tool function command into the file before the start of the circle.

Press <RETURN> to bypass this function. To enter Tool Up and Tool Down commands, enter any valid motion command, such as the motion command "OT" for output. You might enter "OT nnnn", where:

"n" = 1: true
"n" = 0: false
"n" = X: no change

The next question is:

```
Tool function command at end of circle (CMD/CRLF)?
```

You may now enter a Unidex 11 command to cancel the previously entered tool function.

Answer this prompt as described above and press <RETURN>. Then the following questions pertaining to your circular contour will be asked (metric mode used in example):

```
Enter radius in millimeters?
```

before the question:

```
Enter vector feedrate in mm/sec. (Default 1)?
```


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(Any vectorial feedrates with components greater than 10,000 steps/sec. will have decreasing accuracy due to the 2μS resolution of Unidex 11.)

Degree increments?

The degree increments specify the number of angular degrees between the start of each point to point move of a particular program segment. The user of Unidex 11 with standard 6 kilobytes of user memory must be conscious of the degree increments specified, due to the fact that a circle consisting of .20 degree increments will fill memory. Typically, a 4" circle with a resolution of 5 degree increments will provide sufficient resolution, and only fill about 1250 bytes of memory. Of course, this can be overcome by executing the program in the immediate mode (ie., run from the IBM pc).

Enter direction of travel (CW/CCW)?
Enter comment for program segment?
Are all values correct (Y/N/Abort)?

NOTE: **Comments may not contain commas.**

If the answer to the final question is "N", you will be given the opportunity to answer the above prompts again.

If you wish to abort the Circle routine, enter an A for "Abort".

Answer "Y" and the circular contouring segment of your program will scroll on the screen. It will begin with the comment you entered (as in the following example) or with the default comment, ";Aerotech Circular Interpolation Routine", and will end with the comment, ";Circle Interp. End".

Press the appropriate function key to continue with the program or go back to the main menu.

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Following is a sample Circular Interpolation program segment.

```
                Aerotech Circular Interpolation
Tool function command at start of circle (CMD/CRLF)? OT 10XX
Tool function commannd at end of circle (CMD/CRLF)? OT OOXX
Enter radius in inches? 5
Enter vector feedrate in inches/sec. (Default 1)? 1
Degree increments? 20
Enter direction of travel (CW/CCW)? CW
Enter comment for program segment? CIRCLE 1
Are all values correct? (Y/N/Abort)
```

```
; CIRCLE 1
   IN *
   X F 25400 D 5000 *      ; Move To Circum.
   OT 10XX *               ; Tool Down Cmd.
   X F 174 D-302
   Y F 25014 D-43437 *
   X F 500 D-868
   Y F 21997 D-38197 *
   X F 766 D-1330
   Y F 16327 D-28351 *
   X F 940 D-1632
   Y F 8687 D-155086 *
   X F 1000 D-1736
   Y F 0 D 0 *
   X F 940 D-1632
   Y F 8687 D 15086 *
   X F 766 D-1330
   Y F 16327 D  28351 *
   X F 500 D-868
   Y F 21997  D 38197 *
   X F 174 D-302
   Y F 25014 D 43437 *
   X F 174 D 302
   Y F 25014 D 43437 *
   X F 500 D 868
   Y F 21997 D 38197 *
   X F 766 D 1330
   Y F 16327 D 28351 *
```


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```
X F 940 D 1632
Y F 8687 D 15086 *
X F 1000 D 1736
Y F 0 D 0 *
X F 940 D 1632
Y F 8687 D-15086 *
X F 766 D 1330
Y F 16327 D-28351 *
X F 500 D 868
Y F 21997 D-38197 *
X F 174 D 302
Y F 25014 D-43437 *
OT 00XX *              ; Tool Up Cmd.
X F 25400 D-5000 *     ; Move Back To Center

; CIRCLE INTERP. END
```

SECTION 4-4 ARC INTERPOLATION

Use the Arc Interpolation Mode to create any portion of a circle, or a circular contour that exceeds 360 degrees when in the polar mode. In either case, the motion will begin from the current point, which is understood to be on the arc. The polar mode allows negative angles as well as angles larger than 360 degrees to be specified.

To generate an arc, press F3. The screen will display:

```
Aerotech Arc Interpolation Program
1Polar Mode  2Cartesian Mode  3Interp. Menu
```

Press F3, Interpolation Menu, of the Arc Interpolation screen, to return the program to the Interpolation Menu.

Press F1, Polar Mode, to generate an arc using polar coordinates. You will see:

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```
                    Polar Mode
Enter radius in inches (Y/N)?
```

The remaining questions concerning an arc interpolation are:

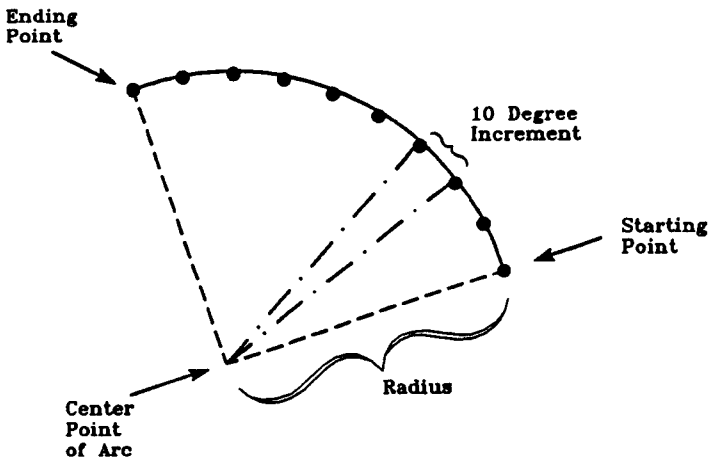
```
                    Polar Arc Mode
Enter radius in inches?
Enter angular starting point of the arc?
Enter angular ending point of the arc?
Enter degree increment of arc?
Enter direction of travel (CW/CCW)?
Enter vector feedrate in inches/sec. (Default 1)?
Enter comment for program segment?
Are all values correct? (Y/N/Abort)
```

If all values are correct, enter "Y" and press <RETURN>. (Enter "N" to re-answer and "A" to abort.) You will see the arc routine scroll, beginning with the comment you have entered. When the routine has finished scrolling, it will end with the comment, ";Arc Interp. End" and the Interpolation Menu will be displayed.

The following illustration shows the relationship between the angles entered and the arc generated.

```
                    Polar Arc Mode
Enter radius in inches? 3
Enter angular starting point of the arc? 30
Enter angular ending point of the arc? 120
Enter degree increment of arc? 10
Enter direction of travel (CW/CCW)? CCW
Enter vector feedrate in inches/sec. (Default 1)? 1
Enter comment for program segment? ARC START
Are all values correct?  (Y/N/Abort)
```


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Press **F3** for arc interpolation again. The Arc Menu will be displayed:

1Polar Mode 2Cartesian Mode 3Interp. Menu

Press **F2**, Cartesian Mode. You will see:

Cartesian Mode
Enter ending coordinates in inches; Axis 1 = ?

(If the system programming units selected are metric, the following questions will say "millimeters" instead of "inches".) The remaining questions are:

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```
                    Cartesian Arc Mode
Enter ending coordinates in inches ; Axis 1 = ? 2
                                   ; Axis 2 = ? 2
Enter center coordinates in inches ; Axis 1 = ? 1
                                   ; Axis 2 =1 ? 1
Enter direction of travel (CW/CCW)? CW
Enter vector feedrate in inches/sec. (Default 1)? 1
Degree increments? 20
Enter comment of program segment?
Are all values correct? (Y/N/Abort)
```

NOTE: The coordinates for center and end points are relative to the current position.

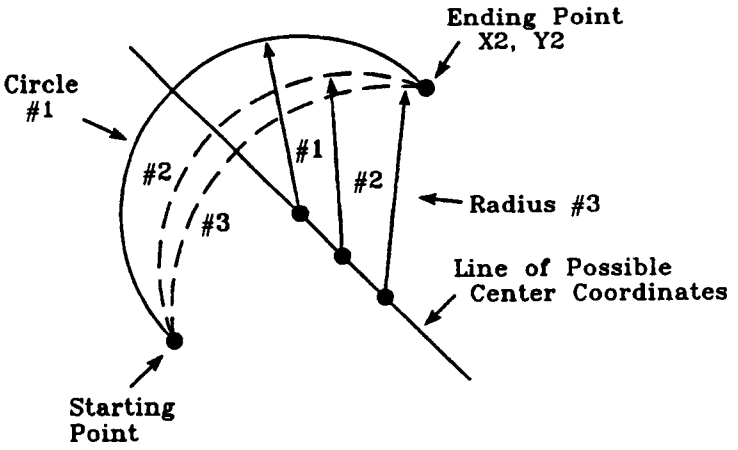
The Arc routine will scroll. When it is done, you will see the ";Arc Interp. End" comment and the Interpolation Menu will be displayed again.

If you enter invalid points, however, you will see the message:

```
The radius of the two sets of points differ by n%!
Would you like to re-enter the points?
```

If you select "N" , a new set of center points will be calculated for you, and you will be prompted for the vector feedrate, unless you have made a major error. In that case, you will again be informed of the % error, indicating that the center point is not an equal distance from the starting point (current position) and the ending point that has been specified. This means the center point specified is not on the line of possible center coordinates. See the following diagram, where axis 1 = X axis and axis 2 = Y axis:

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SECTION 4-5 LINEAR INTERPOLATION

When in the Interpolation Mode, press **F4**, Linear,for linear interpolation. You will see:

```
Linear Interpolation
1Polar mode  2Cartesian mode  3Interp. Menu
```

Pressing **F3**, Interp. Menu, will return you to the Interpolation Menu. Instead, press **F1**, Polar mode, to program a linear contour using polar coordinates. The following questions will be asked:

```
Enter angular direction of travel?
```


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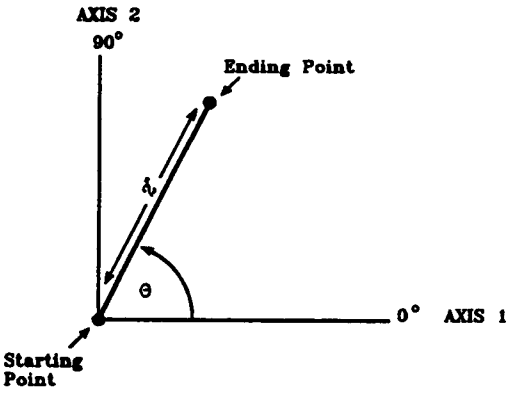
Answer the previous prompt in degrees.

If the programming units selected had been metric, the following prompts would ask for vector distance in millimeters.

```
Enter vector distance in inches?
Enter vector feedrate in inches/sec. (Default 1)?
Enter comment for program segment?
Are all values correct (Y/N/Abort)?
```

The above routine ends with the comment, ";Vector Interp. End".

Angular Direction And Distance



For Angular Direction of 60 Degrees and Vector Distance of 2 inches.

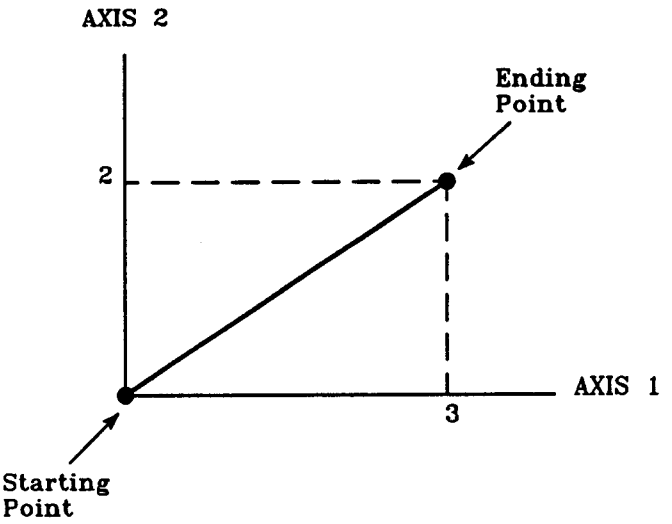
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Now press **F2**, Cartesian Mode. You will be prompted for a distance for each valid axis based upon the setup information, independent of the interpolation planes selected.

```
Linear Cartesian Interpolation
Enter incremental distance for X axis in inches ? 2
Enter incremental distance for Y axis in inches ? 2
Enter vector feedrate in inches/sec. (Default 1)? 1
Enter comment for program segment?
Are all values correct (Y/N/Abort)?
```

The program segment will scroll when you press <RETURN> and end with ";Vector Interp. End".

Linear Vector, Cartesian Coordinates



For an Axis-1 Distance of 3 Inches.
For an Axis-2 Distance of 2 Inches.

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SECTION 4-6 PLANE SELECT

Press **F6**, Plane Select, to select the two axes to be involved in a circle, arc or linear vector. The default values are X and Y, but any two axes within your system may be specified.

You may *not* enter as a plane selection, any axis which had not been given a label and resolution in the Setup Mode.

SECTION 4-7 EDIT MODE

Press **F7**, Edit. The editor (PC Write) will appear on the screen. It will explain to you what you must do to edit your file. When the first editor screen appears, the top line of the display prompts you to press F9 if you desire a back-up copy of your file, or the <ESC> key for no back-up copy.

You may edit your file at any time when in the Interpolation Mode. It allows you to make changes in a file as you create it, or go back and edit an existing file.

Read the Editor Help Screens before making changes to your program. To enter the editor help menus, press F1 twice. To exit the help menus, press <ESC>.

To return to the interpolation menu while editing your file, press **F1**, then **F2**.

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SECTION 4-8 ENGLISH AND METRIC UNITS

Press F8, Programming Units mode. The softkey label for F8 shows the active programming units mode. Selecting F8 will change the active mode and update the menu line. Following this action, all prompts will be in the new system units. The power up default state will not be altered.

SECTION 4-9 MAIN MENU

Press **F9**, Main Menu, and the following screen will again be displayed:

1Help 2Setup 3Interpolation 4Communication 5Directory 6Print 7End

SECTION 4-10 INTERPOLATION EXAMPLE

Refer to figure 4-1 to see contour that results from the following program. The actual program is located in appendix 1.

PROGRAMMING UNITS:

From the main menu, select F3, Interpolation. Enter a name for the file you are about to create, and press <ENTER>. If F8 does not indicate that you are in the English programming units mode, select F8 and the label for F8 will change to English.

PLANE SELECT:

Now select F6, Plane Select. Pressing <ENTER> twice will select the default interpolation axes. The default axes will produce a motion program for the X and Y axis.

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HOME:

To begin our motion program, we must first initialize our drives to a known starting position. This is accomplished by sending each axis to its home position (CCW std.). Select F5, Cmd. Input, and enter the Unidex motion command "H XY" and press <ENTER>.

HOME OFFSET:

Now move from home to an offset position. To accomplish this, select F4, Linear, for a linear move. A sub-menu will then be displayed, prompting you to select the polar or cartesian coordinate mode. For our example, select F2, Cartesian, and you will be prompted for the X distance. Looking at our example in figure 4-1, and noting the polarity of the desired move in relation to the X and Y scale, you will see that both axes must move positive. Now enter 1 inch for the X distance, and 1 inch for the Y distance. If you have more than a two axis system, enter 0 for the distance for all other axes. Following this, you will be prompted for a feedrate. Enter ".5" for 1/2 inch per second. Now enter a comment such as "Home offset". If you have entered all values correctly, enter "Y" to the last prompt.

RIGHT SIDE:

Now we're ready to begin our actual pattern. Begin by drawing the right side of the box. This requires a linear move. Select F4, Linear, then F2, Cartesian. We require only a Y axis move of +2 inches. So enter 0 for the X distance, and 2 for the Y distance. Press <ENTER> for the feedrate, and the previous .5 inches/sec. value will be used. Once again for comment, enter a label such as "Right Side". Then "Y" when all values are correct.

LOWER RIGHT ARC:

To program an arc, select F3, Arc, then F2, Cartesian. You will then be prompted for the ending coordinates of the arc for axis 1, which we selected as the X axis in the plane select mode. The arc will begin from the current point, which is the reference point, and is assumed to be point 0,0. Specify the distance to the ending coordinates from point 0,0. From figure 1, you will see that axis 1 and axis 2 must both move +.25 inches to the end of the arc. Enter that now and you

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will be prompted for the distance to the center coordinates from the starting point. They are axis 1 (X axis) = +.25 inches and axis 2 (Y axis) = 0 inches.

The direction must be specified next. In this example, the direction is CW, or clockwise rotation. Following that is the feedrate prompt which also displays a default value, so <ENTER> may be pressed to select that value. Following this, a degree increment is requested. For our example, enter "5", which will cause the arc to be comprised of eighteen discrete point to point moves. For the comment enter "Lower right arc", then "Y" when all values are correct.

BOTTOM:

Once again a linear move is required. Select F4, Linear, then F2, Cartesian. Enter +1.5 for the X distance, and 0 for the Y distance. Select the default feedrate, and enter "Bottom of Box" for the comment. Then enter "Y" when all values are correct.

LOWER LEFT ARC:

Our second arc will have the same dimensions as the first, except the directions will be different. For example, axis 1 will end at +.25 inches, and axis 2 will end at -.25 inches. The center coordinates will now be axis 1 = 0 and axis 2 = -.25 inches. The direction is still CW. Enter these now, along with the default feedrate, a 5 degree increment and the comment "Lower left arc", then "Y" when all values are correct.

LEFT SIDE:

For the left side we require a linear move comprised of Y traveling -2 inches, and X0. Enter these dimensions and the comment "Left side".

UPPER LEFT ARC:

The third arc requires axis 1 to end at -.25 inches and axis 2 to end at -.25 inches. Enter these and then the center coordinates referenced from the start of the arc, which are axis 1 = -.25" and axis 2 = 0. Enter CW for the direction, press <ENTER> for the default

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feedrate shown and 5 for the degree increments. For the comment enter "Upper left arc". Enter these now.

TOP:

This will be a linear move. Axis 1 = 1.5" and axis 2 = 0. Enter these and the comment "Top".

UPPER RIGHT ARC:

The last move is an arc and will return you to your home offset point. To do this, you must specify axis 1 to move -.25" and axis 2 to move +.25" to the end of the arc. The center must be specified as axis 1 = 0 and axis 2 = +.25". Answer the following prompts the same as for the previous arcs, and enter the comment "Upper right arc".

MOVE TO CENTER :

Now move to the center of where the circle is to be. This will be a linear move. Refer to figure 4-1 to see that the X axis must move +1 inch and the Y axis must move +1 inch also. Enter these dimensions and the comment "Move to center".

CIRCLE:

To complete the pattern shown in figure 4-1, select F2, Circle. Since you must move to the circumference of the circle, a tool function command is provided, which will be executed upon reaching the circumference of the circle. Any valid Unidex motion command may be entered here, or press <ENTER> and no command will be inserted into the program. The following prompt provides for a tool function command at the end of the circle before returning to the center.

After this, specify the radius of the circle which, for this example, is .75". Enter this now, answering the rest of the prompts as previously discussed.

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RUN:

The program is finished. It may now be transferred to the memory of the Unidex and run with the functions provided in the communications mode.

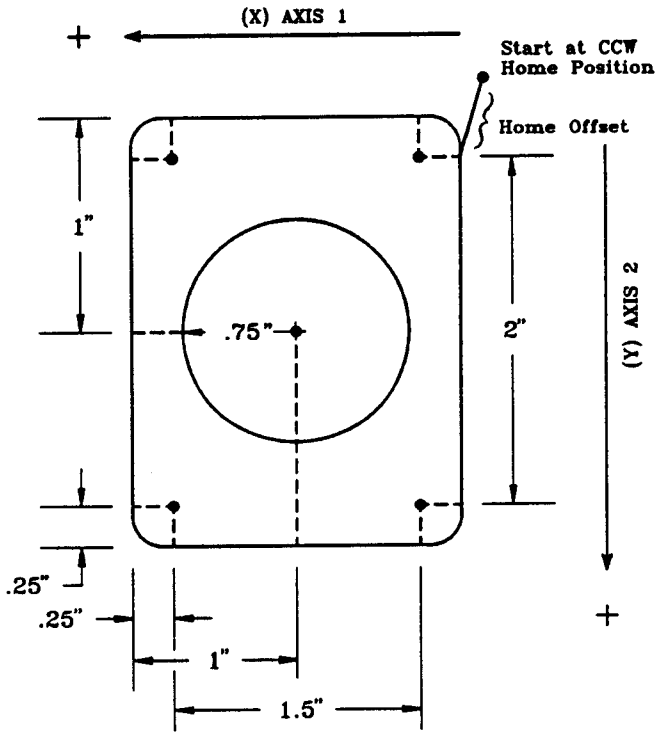


Figure 4-1: Interpolation Example

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SECTION 4-11 PROGRAMMING HINTS

There are ways to contour shapes other than those on the Interpolation Menu. For example:

A. PROGRAMMING AN ELLIPSE

To produce an elliptical move, vary the resolution of one axis and then program a circle. To achieve only an elliptical segment, vary the resolution of one axis and program an arc.

B. TRIANGLES, OCTAGONS, PENTAGONS, ETC.

To contour a triangle, octagon, pentagon, etc., vary the Degree Increment in the Circular Interpolation Mode to create the desired shape. For example:

ANGLE INCREMENT	INTERPOLATION
45 Degrees	Octagon
60 Degrees	Hexagon
72 Degrees	Pentagon
90 Degrees	Square
120 Degrees	Triangle

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CHAPTER 5: COMMUNICATION MODE

From the main menu, select function **F4** (Communication), to enter the Communication Mode. In this mode, you will see:

```
1Help 2Immediate 3Run 4Status 5Directory 6Position 7Digitize 8Transfer 9Mn Menu
```

The Communication Mode enables the transfer of information between Unidex 11 and the controller. This information may include:

- Files (Programs)
- Axes positions
- Statuses
- Motion commands
- System commands
- Digitizing information

SECTION 5-1 HELP MODE

Press **F1**, Help, for the Communication Help Mode. It contains a paragraph of information on each of the communication modes.

Please review this mode before continuing with Communication.

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SECTION 5-2 IMMEDIATE MODE

The Immediate Mode allows for a command to be sent to Unidex 11 from the controller and executed immediately, without the need for an entire program to be sent and/or retained in memory. Upon entering the immediate command mode, you will be prompted for a Unidex motion command. After entering a command and pressing <RETURN>, your host computer will then wait for a service request from the Unidex, indicating that the command has been executed. Upon receiving this acknowledgment, the command prompt will again be displayed. While the Unidex is executing the command, the <ESC> key may be pressed to reset the Unidex, aborting the command.

In this mode, the function keys are treated as direct commands, and should therefore only be selected at the command (?) prompt.

Press F2, Immediate, to enter the Immediate Mode, in which motion commands may be executed immediately by Unidex 11. You will see:

```
                X Position = 0000000000 MICRONS
                Y Position = 0000000000 MICRONS
                U Position = 0000000000 MICRONS
                V Position = 0000000000 MICRONS

                        Immediate Command Mode
Command?


1Help 6Position 7Slew 9Communication Menu ESC - Abort Command
```


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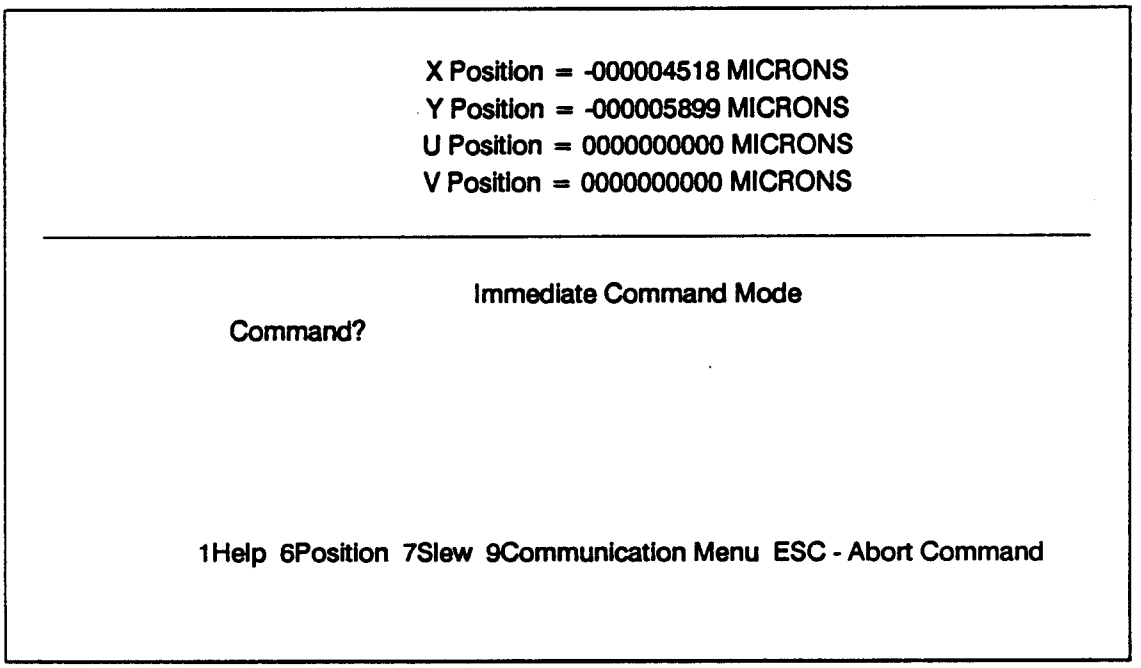
Again, pressing **F1** will display Help. Help consists of a command summary when in the Immediate Mode.

The command summary consists of several screens of motion commands that may be sent to Unidex 11 in the Immediate mode. Selecting **F3** (End) will return you to the immediate mode menu.

While in the immediate mode, you may enter motion commands, such as:

H XY <RETURN> (X,Y axes go home)
X F5000 D-4518 <RETURN> (X axis move)
Y F5000 D-5899 <RETURN> (Y axis move)

Once those commands have been entered, press **F6**, Position. You will see a screen similar to:

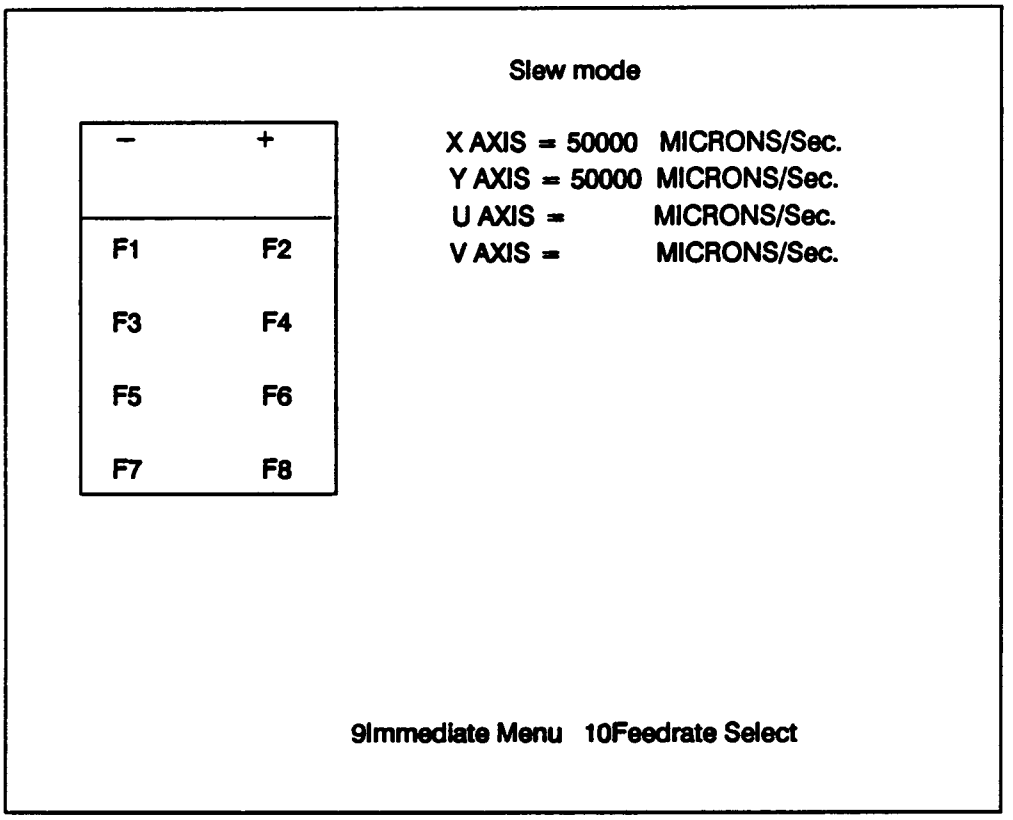


The absolute positions will be displayed.

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NOTE: **If you want to reset the Unidex once a move has begun, press <ESC>.**

Slew, **F7**, allows you to slew the axes via the function keys F1 through F8, however, this is a hardware specific function and is only available to IBM PC-AT users. The display will show:

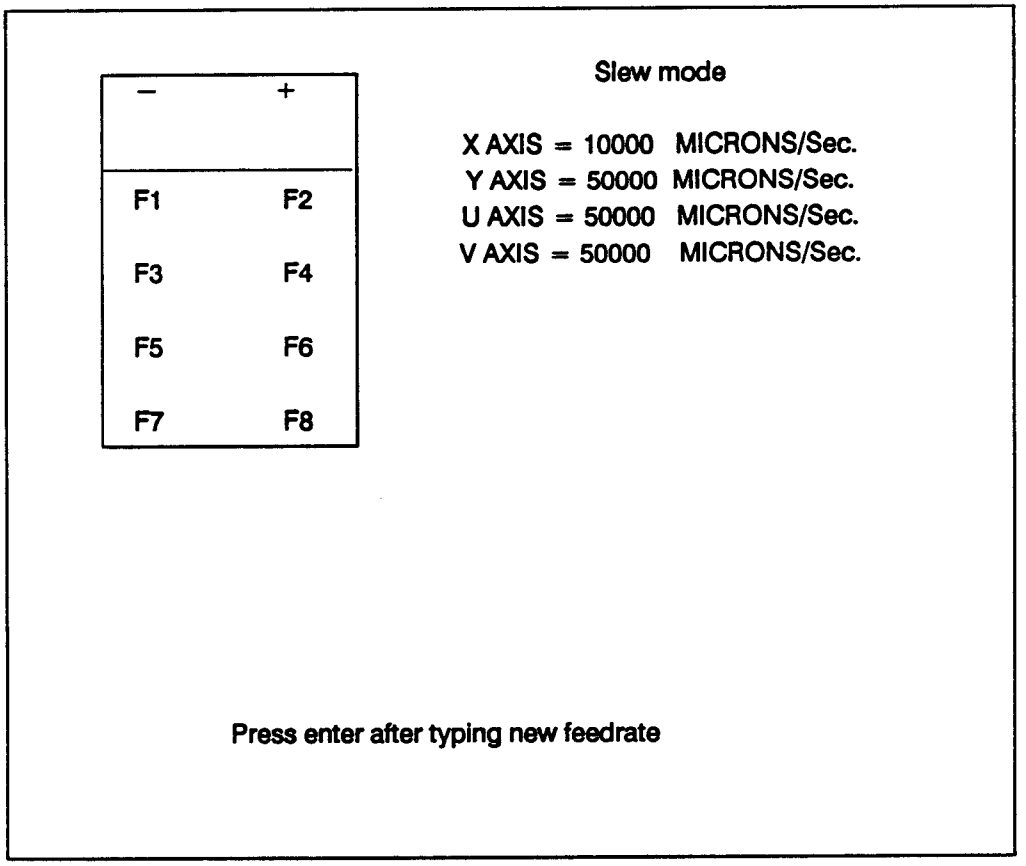


Press **F9**, Immediate Menu, to go back to the Immediate mode menu, shown previously, or begin to slew any axis in a positive or negative direction (according to the screen as shown above), if the feedrates displayed are the required values.

NOTE: **The axes displayed in the Slew Mode are the labels established in the Setup Mode. If what you see on the display is not correct, return to the Setup Mode and re-enter the information.**

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While in the slew mode, press **F10**, Feedrate Select, to select new feedrates for the axes. You will see:



Be sure to press <ENTER> after each feedrate, whether it is one you have changed or not, before you begin to slew.

Once you begin to slew, you will see the prior slew screen. Press **F9**, Immediate Menu, to go back to the Immediate mode.

Once in the Immediate Mode, press **F9**, Communication Menu, to return to the communication menu.

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SECTION 5-3 RUN MODE

The run mode allows you to run a program from the program storage drive, from Unidex 11, (in Auto or Block Mode), or in the Immediate program mode. Press F3, Run, to see:

1From Disk 2From Unidex 3From IBM pc 4Com. Menu

(Of course, pressing F4 returns you to the Communication Menu.)

Press F1, From Disk, to transfer a file from the disk drive to the Unidex and run it in the auto or block mode. This function is a combination of two modes and serves as a shortcut. First you will be prompted to enter the file name you wish to download from the program storage drive to Unidex. You will be asked:

Enter file name you wish to download from disk?
Enter program number you wish to download it to?
Auto or block run mode (A/B)?

If you press "A" for auto and press <RETURN>, the program will scroll on the screen as it downloads. It will then begin to run as the screen shows the following display.

Program execution has begun Waiting for program completion 00:00:10

When the program is complete, the message "Program execution complete" will appear directly under the time it took the program to complete. (Time shown above as 10 seconds into program execution).

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After a particular program has been transferred to the Unidex's memory, it will reside there. In the future it may be run directly "From Unidex" (discussed next). However, if you edit the program from the host and wish to transfer the updated version, do a "From Disk" function again, or you may download the program without execution via the "Transfer" function described later.

If you select "B" for block and press <RETURN>, the program will scroll as it is downloaded. Each block will execute individually and the display will show:

```
Block is executing
```

When each block is complete, you will see:

```
Block is complete.
Press any key to execute next block.
```

The message "Program complete" will appear when the program execution is complete.

Press **F3**, Run, to see the Run Menu again.

```
1From Disk  2From Unidex  3From IBM pc  4Com. Menu
```

Press **F2**, From Unidex. You will be asked the following questions:

```
Enter program number you would like to run?
Auto or block run mode (A/B)?
```

If you ask for a program in Unidex 11 memory, you will see a display similar to:

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```
Enter program number you would like to run? 20
 Auto or block run mode (A/B)? A
                    Waiting for program completion
                          00:00:10
```

When the program execution is complete:

```
Enter program number you would like to run? 20
Auto or block run mode (A/B)? A
                    Waiting for program completion
                          00:03:09
                    Program execution complete.
```

If you enter "B" for block and press <RETURN>, you will see:

```
                    Block executing
```

When the block is done:

```
                    Block complete
          Press any key to execute the next program block.
```

The final run mode is "From IBM pc". In this mode a lengthy program stored in the host's disk drive may be executed as a series of immediate commands. For this reason, only programs containing valid immediate commands may be executed in this mode. Motion program commands for Repeat Loops, Subroutines and GOTO labels are therefore invalid. The block processing time in this mode is approximately 22-30 mS. for a two-axis move. This is in comparison to approximately 6 mS. for a similar move from a program. The additional processing time is required for conversion from ASCII to binary (numeric). (This is normally accomplished as a program is entered into memory.)

Unidex 11 has a 256 character RS-232 buffer. When it fills, it will signal the host to halt transmission (XON/XOFF Protocol). After ex-

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ecuting all of these commands, the host will be signaled to send more. It is at this time, when the RS-232 buffer is refilling, that there may be a delay of up to approximately 300 mS (at 9600 baud).

Press F3, Run, again. The display shows:

1From Disk 2From Unidex 3From IBM pc 4Communication Menu

Press F3, From IBM pc. You will be asked:

Enter file name you wish to execute in the immediate mode?

The screen will fill up with the first portion of program commands from the program you have requested. All of the commands will now be preceded by an "I" for Immediate.

For optimum speed, Unidex 11 should be made to operate in the non-service request mode. In this mode, however, Unidex does not signal the host at the completion of each move. Therefore the host computer cannot detect errors such as limits, bad commands, etc. For this reason the <ESC> key is enabled when the host's display screen is paused, and may be used by the operator to reset the Unidex 11.

In this circumstance, following the transmission of the last command in the user's program, a system command will be sent to the Unidex controller, placing it in the service request mode. Following this a .1 second dwell command will be sent. After execution of this command, the Unidex will signal completion of the command (and the user's program). This sequence is intended to delay user commands until program completion.

When program execution is completed, the communication menu will be displayed.

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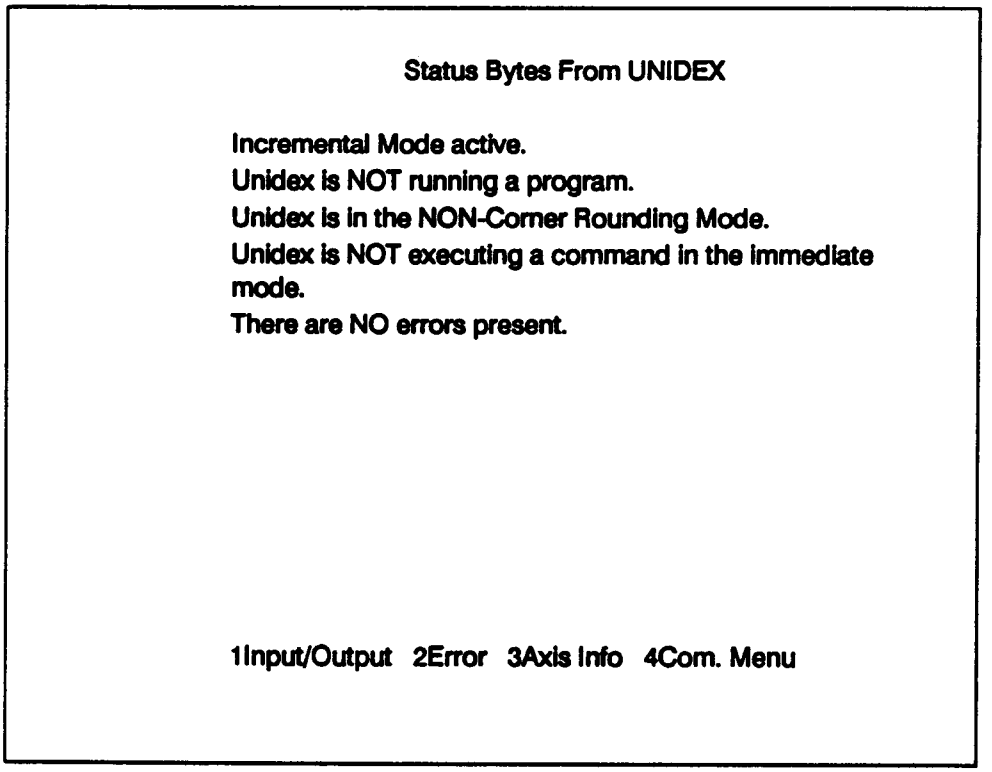
SECTION 5-4 STATUS BYTES FROM UNIDEX 11

The first status byte of Unidex 11 is displayed on the screen when you press F4, as well as a sub-menu of the other status information grouped into three categories. They are:

Input/Output states
Errors
Axis information

Each time the status mode is selected from the communications menu, this information will be updated with the current data from the Unidex controller.

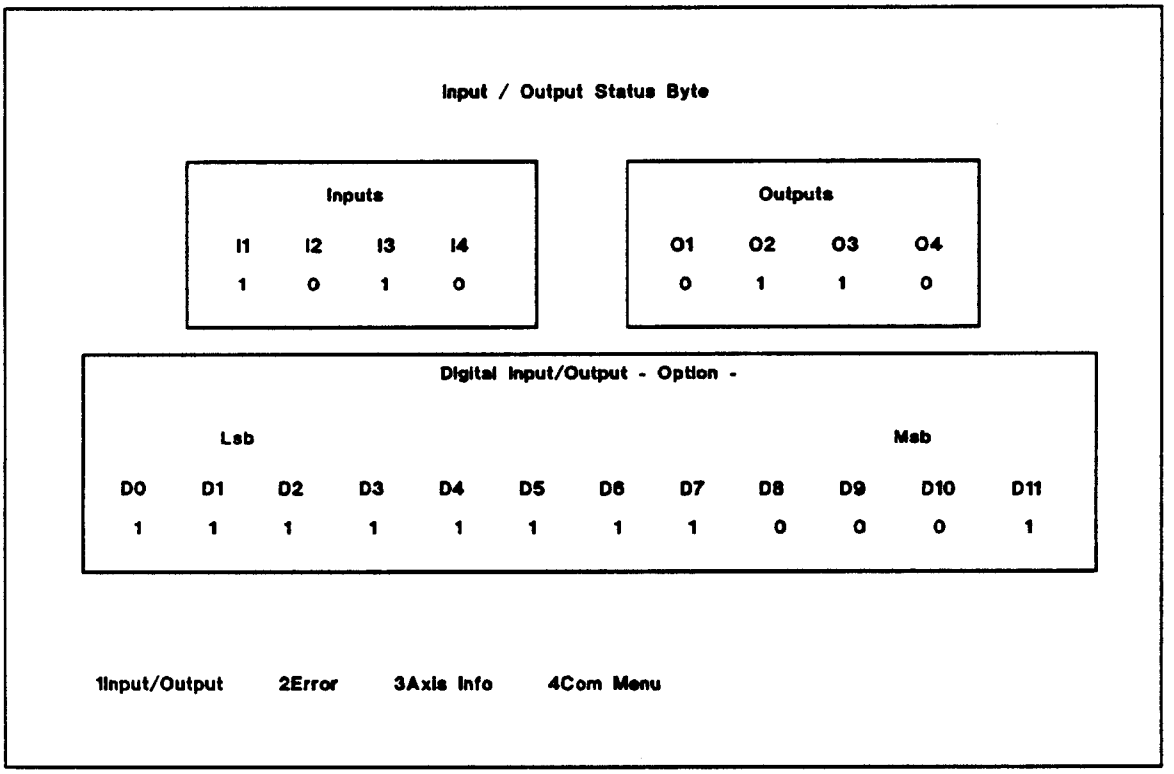
Press F4, Status, to see:



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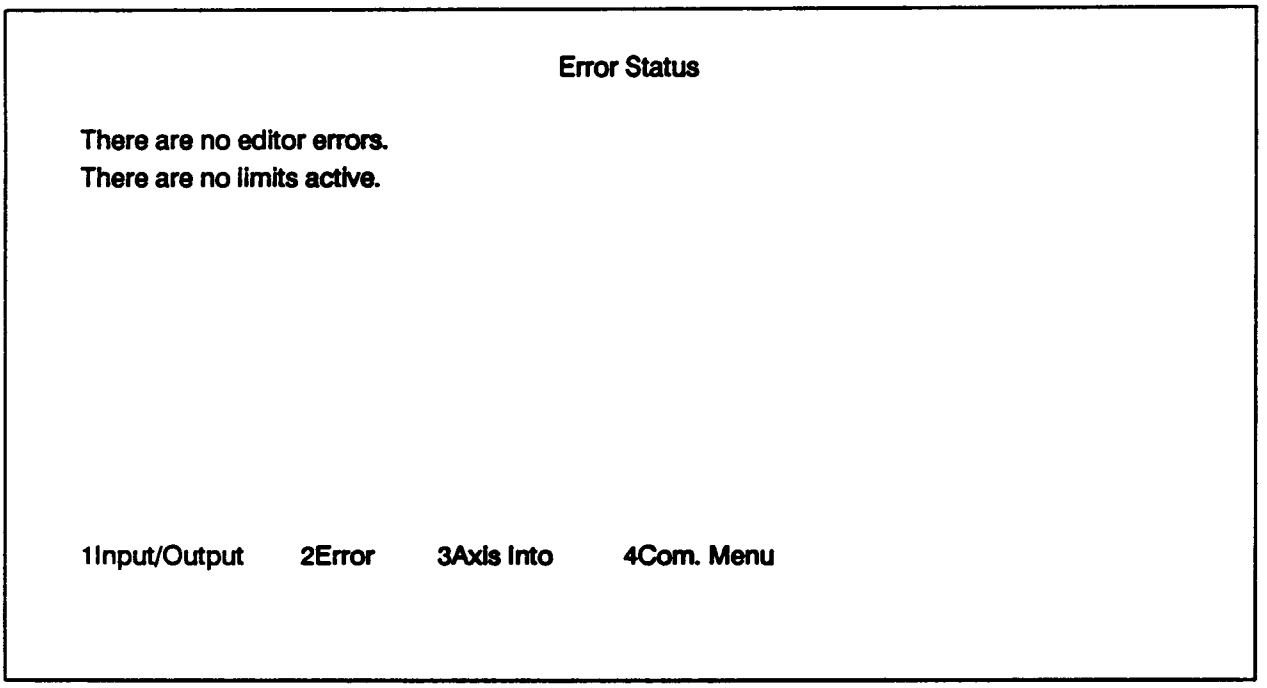
(F4 of the status menu will take you back to the Communication Menu.)

F1, Input/Output, will display the status of the system's inputs and outputs, where a "1" indicates a logic high state (+5 volts) on that input or output, and a 0 indicates a logic low state. These states are independent of the active state programmed into the setup mode of Unidex 11 (local mode). The following illustration is an example.

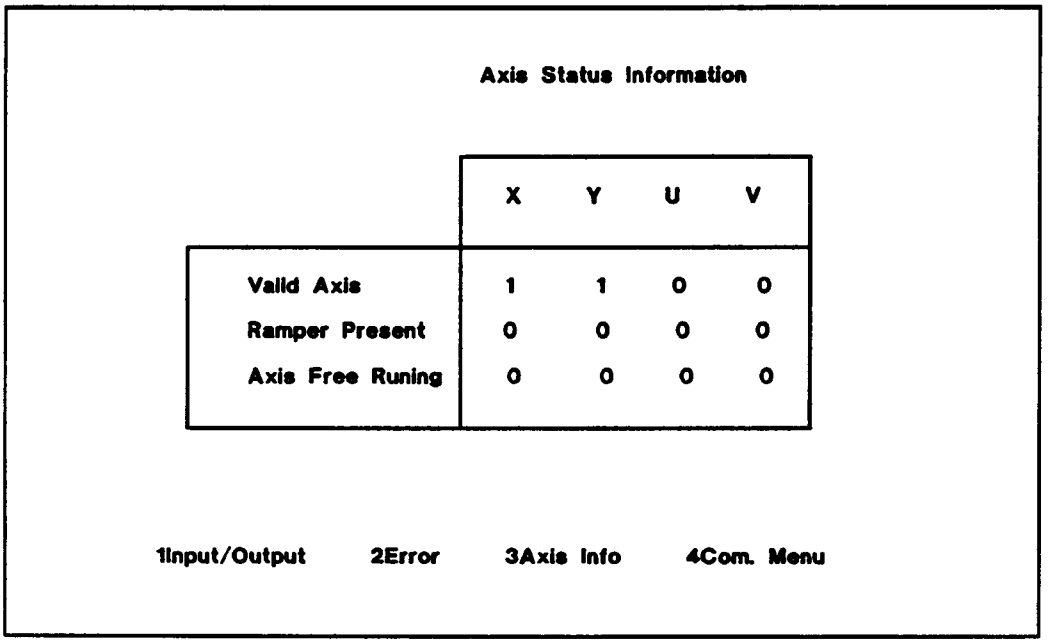


Press **F2**, Error, to see the Error statuses. You will typically see no indication of any errors. However, all of the Unidex error status bytes are fully interpreted, and will be displayed when valid. Errors may be reported when transferring a program to the Unidex, sending immediate commands, or executing a program (except as mentioned previously).

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Press F3, Axis Information, to see:



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In the above illustration, a 1 indicates that the label is true for that axis. In the above example, the information indicates that it is a two axis system (X and Y), that the system contains no 1MR rampers or that there is no DC servo axis, and that no axis is currently free running.

Press **F4**, Communication Menu, to go back to that menu.

SECTION 5-5 DIRECTORY

The directory menu allows you to view the directory of the specified program storage drive or the Unidex memory. You may also delete a program from either of the directories.

Press **F5**, Directory, to see:

```
1Disk Dir  2Unidex Dir  3Program Delete  4Com. Menu
```

Press **F1**, Disk Directory, for the directory of the host's program storage drive. You will see a listing of all files and the amount of memory remaining on the disk. Example:

```
                    Disk Directory : C

FILE1          FILE2          FILE3          FILE4
FILE5

24795136 Bytes free




1Help 2Immediate 3Run 4Status 5Directory 6Position 7Digitize 8Transfer 9Mn Menu
```


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Press **F5** for the directory menu again. Now press **F2**, Unidex Directory. You will see the Unidex 11 directory, which will show each of the programs in memory, their length, and the amount of user memory remaining. Example:

```
                    Unidex Program Directory

PROGRAM #33  LENGTH : 00003 BYTES
PROGRAM #01  LENGTH : 00023 BYTES
PROGRAM #02  LENGTH : 02585 BYTES
PROGRAM #45  LENGTH : 00032 BYTES
PROGRAM #46  LENGTH : 00032 BYTES

FREE : 03357 BYTES

1Help 2Immediate 3Run 4Status 5Directory 6Position 7Digitize 8Transfer 9Mn Menu
```

Press **F5**, Directory. Now press **F3**, Program Delete. You will see:

```
1Disk Program  2Unidex Program  3Com. Menu
```

Press **F1**, Disk Program. You will see:

```
Enter file name that you wish to delete?
```


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When you enter a file name and press <RETURN>, the file will be deleted and the Communication Menu will be displayed again.

If you decide not to delete a file once F1 (or F2) has been pressed, just hit <RETURN>. The message "File not found" will be displayed, just as it is if you enter the name of a file not in the directory.

Press F2, Unidex Program, to delete a file in the Unidex 11 memory. You will see:

```
Enter 100 to delete all programs in memory.
Enter program number that you wish to delete?
```

Enter the program number. Press <RETURN> and the Communication Menu will be displayed.

SECTION 5-6 POSITION

The position function will display the absolute position of each axis in your system. (The axes which are displayed and the labels assigned to them, are defined in the Setup Mode.) Example:

```
                    Unidex axis positions

X Position = -0000002518 MICRONS
Y Position = -0000003899 MICRONS
U Position = 0000000000 MICRONS
V Position = 0000000000 MICRONS




1Help 2Immediate 3Run 4Status 5Directory 6Position 7Digitize 8Transfer 9Mn Menu
```


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SECTION 5-7 DIGITIZING

The digitizing mode allows the operator to create a motion control program in conjunction with the Unidex Joystick Options (JP-4C or JP-4D). Either option allows the operator to move into position with the joystick, and press the fire button to place into a motion program the commands required to move to that position. The JP-4D (Local Joystick Digitizing) mode allows an absolute or incremental program to be created. Digitizing with the JP-4C option (Computer Enabled Joystick) will calculate the vectorial feedrate between digitized points. The joystick feedrate may be changed by depressing the Hi/Lo Feedrate Select Button on the joystick. The Hi/Lo feedrates are determined by the joystick divisor (in the local mode).

The digitize option will prompt you for the digitizing option purchased with your system. The choices are JP-4D and JP-4C. If digitizing is required at a later date, JP-4C is recommended over JP-4D, due to the fact that the digitzing mode will calculate vector feedrates between digitized points with the JP-4C option.

A. LOCAL JOYSTICK MODE (JP-4D)

Press F7, Digitize, to see:

```
Digitize Input Mode
Enter file name for program to be digitized?
```

Enter a file name and you will see:

```
Digitize Input Mode
Enter file name for program to be digitized?
You may now begin digitizing from Unidex in the local mode.
When finished be sure to re-enable the RS-232C port!
```


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The Unidex controller will now be placed into the local mode, and you may begin digitizing by selecting digitizing from the joystick menu. In this mode you must select "Transfer via RS- 232" from the digitizing menu. After digitizing, you must enable the RS-232C port from Unidex 11, by selecting "Com. Enable" from the menu screens, and then selecting "RS-232 Enable". The host computer will then prompt you to press any key to regain remote operation.

B. COMPUTER ENABLED JOYSTICK (JP-4C)

Press F7, Digitize. There will be a one second delay while the Unidex is polled to determine if the computer enabled joystick firmware is present.

```
Digitize Input Mode

Enter new or existing file name for program to be digitized?
```

A digitized file may be appended to the end of a file created in the interpolation mode (or vice versa), so an existing file name may be specified. Therefore, enter a new or existing file name, or just press <ENTER> to go back to the communication menu.

```
Digitize Input Mode

Enter new or existing file name for program to be digitized?
Enter vector feedrate in inches/sec. (Default 1) ?

You may now begin digitizing from Unidex.


8Motion Command Input 9End
```


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You may now begin to digitize. As you use the joystick to move from point to point, keep in mind that you may change the joystick feedrate by toggling the Lo/HI Feedrate Select button on the joystick. The maximum speed is determined by the joystick divisor in the Unidex joystick menu. While you are digitizing, you may also directly enter motion commands or comments (;comment.....) into the file by pressing **F8** (motion command input), typing the command, and pressing <RETURN>. An end-of- block terminator is not required, it will be inserted after you press <RETURN>.

Press **F9**, End, to go back to the communication menu.

See *Unidex 11 Motion Controller Options Manual* for more information.

SECTION 5-8 TRANSFER

The Transfer function will send a file:

From Disk to Unidex
From Unidex to Disk

Press **F1**, From disk to Unidex. You will see:

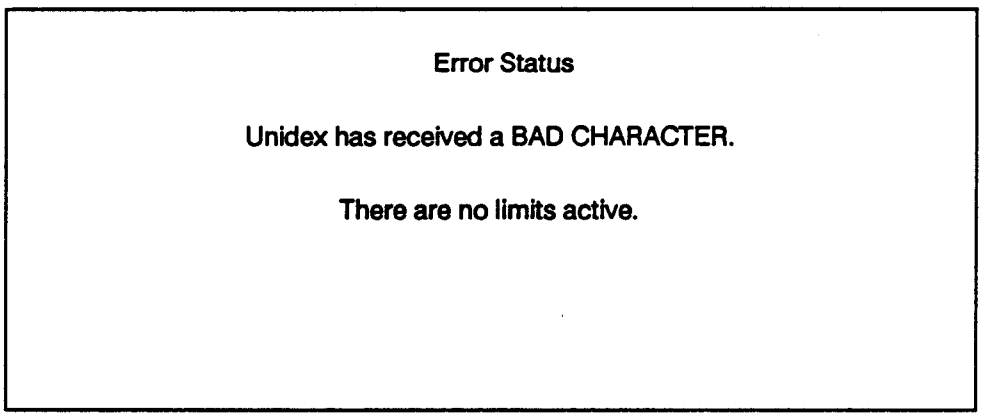
Enter file name you wish to download from disk?

Enter the file name, or press <RETURN> to abort. You will be asked:

Enter program number you wish to download it to?

The program will scroll. If errors are found, it will display the error status, such as:

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If a Bad Character message appears, there has either been a transmission error, or your program has a motion command syntax error.

Press **F2**, From Unidex to Disk. You will see:



Enter the program number. You will see:



Enter the file name and press <ENTER>. The program will scroll as it uploads. When it is done, the Communication Menu will be displayed again.

SECTION 5-9 MAIN MENU

Press **F9**, Mn Menu, to go back to the Main Menu. You will see:



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CHAPTER 6: DIRECTORY

Press **F5** of the menu for the Directory function. (The Directory is also accessible through the Communication Menu.) It allows you to see the directory listing of the disk or the Unidex memory. You may delete a program from either of the directories.

When you press **F5**, Directory, you will see:

1Disk Dir	2Unidex Dir	3Program Delete	4Main Menu

Press **F1**, Disk Directory, for the disk directory. You will see a listing of all files and the amount of memory remaining on the disk. Example:

```
                    Disk Directory C:

TEST          CIRCLE          ARC          LINEAR
DIGIT         GRAPHICS        SCAN         DEMO
GASKET

24795136 Bytes free



1Help 2Setup 3Interpolation 4Communication 5Directory 6Print 7End
```


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Press **F5** for the Directory Menu again. Now press **F2**, Unidex Directory. You will see the Unidex 11 directory, which will list files and remaining memory. Example:

```
                    Unidex Program Directory

PROGRAM # 33  LENGTH : 00003 BYTES
PROGRAM #01   LENGTH : 00023 BYTES
PROGRAM #02   LENGTH : 00032 BYTES
PROGRAM #46   LENGTH : 02585 BYTES
PROGRAM #47   LENGTH : 00184 BYTES
PROGRAM #45   LENGTH : 00184 BYTES
   FREE : 03021 BYTES

1Help 2Setup 3Interpolation 4Communication 5Directory 6Print 7End
```

Now press **F5**, Directory, and **F3**, Program Delete. You will see:

```
1Disk Program  2Unidex Program  3Main Menu
```

Press **F1**, Disk Program. You will see:

```
Enter file name that you wish to delete?
```

When you enter a file name and press <RETURN>, the file will be deleted and the Main Menu will be displayed again.

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If you decide not to delete a file once F1 or F2 has been pressed, just hit <RETURN> to abort that function.

Press **F2, Unidex Program,** to delete a file in the Unidex 11 memory. You will see:

```
Enter 100 to delete all programs in memory.
Enter program number that you wish to delete?
```

Enter the program number. Press <RETURN> and the Main Menu will be displayed:

```
1Help  2Setup  3Interpolation  4Communication  5Directory  6Print  7End
```


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CHAPTER 7: PRINT

Print Function will produce a hard copy of programs on the line printer (LPT1:). (Be sure your printer is ON LINE before using the print function.)

The Unidex controller and the host computer each store programs differently. For example, program comments are not stored in the Unidex memory, so a program containing comments must be printed from the program storage disk.

Program block numbers may be used in conjunction with the "get block" function of the Unidex internal menu-driven editor. These block numbers are not contained within files on the program storage disk. If block numbers are desired in the listing, the program should be printed from the Unidex memory.

Press **F6** of the Main Menu for the Print function. You will see:

1From Unidex	2From Disk Drive	3Main Menu

Now press **F1**, From Unidex, and you will see:

1Unidex Dir	2Unidex Pgm	3Current Position

You may select **F1**, Unidex Directory, and the Unidex directory listing of programs and free memory remaining will be output to the line printer. For example:

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```
                    * UNIDEX 11 DIRECTORY LISTING *

PROGRAM # 33   LENGTH : 00003 BYTES
PROGRAM # 01   LENGTH : 00023 BYTES
PROGRAM # 02   LENGTH : 02585 BYTES
PROGRAM # 46   LENGTH : 00032 BYTES
PROGRAM # 47   LENGTH : 00184 BYTES
PROGRAM # 45   LENGTH : 00184 BYTES
   FREE : 03021 BYTES
```

Or press **F2**, Unidex Program, to be asked:

```
Enter 100 to print all programs.

Enter program number you would like to print ? 45
Would you like the block numbers printed (Y/N)? Y
```

The program requested will be printed. For example:

```
E45*
                0001 IN *
                0002  X F 0012195 D 0000023405
                      Y F 0022727 D 0000043558 *
                0003 X F 0017241 D -0000016580
                      Y F 0019231 D 0000018269 *
                0004 X F 0002703 D 0000000797
                      Y F 0025000 D 0000007465 *
```


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Or you may choose **F3**, Current Position, to see the axes' current positions (absolute position registers). For instance:

```
X Position = 00000000000 MICRONS
Y Position = 0000000000 MICRONS
U Position = 0000000000 MICRONS
V Position = 0000000000 MICRONS
```

After any of the above information has been printed out, the Main Menu will again be displayed:

```
1Help  2Setup  3Interpolation  4Communication  5Directory  6Print  7End
```

Now press **F6**, Print, and **F2**, From Disk Drive. You will see:

```
1Disk Pgm   2Disk Dir   3Main Menu
```

Press **F1**, Disk Program, and you will be asked to enter the file name to be printed:

```
Enter file name you would like to print?
```

Enter the file name and that program will be printed. For example:

```
HXY *                          ; GO HOME
X F10000 D50000
Y F10000 D50000 *              ; MOVE TO CENTER OF TABLE
OT 1XXX *                      ; PEN DOWN
```


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The Main Menu will again be displayed, once the program has been printed. Press **F6** for Print, and then press **F2**, Disk Directory. A standard DOS directory, listing programs and remaining memory, will be printed. For example:

```
Volume in drive C is DISKC
Directory of C:

TEST            18      9-03-88    3:25p
CIRCLE        3742      10-01-88   3:50p
ARC            559      12-16-87   9:39a
LINEAR        2867      10-02-88   9:52a
DIGIT          118      9-05-88    2:38p
DEMO          6031      11-01-87   1:15p
    6 File(s)  26797184 bytes free
```

Once the directory has been printed, the Main Menu will be displayed.

NOTE: **When you select the Print function, either from Unidex or disk, and then change your mind, press <RETURN>. This will take you back to the Main Menu, without requiring that you print a program first.**

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CHAPTER 8: END

The final function of the Main Menu is End. Press F7 to leave the Main Menu and return to DOS.

If you should wish to return to the Unidex 11 Interactive Control Software from DOS, either enter the name "UNIDEX" and press <RETURN>, or reboot the system by pressing <CTRL>, <ALT> and <DEL> (simultaneously).

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