
REFERENCE
DOCUMENT

**UNIDEX III
(VERSION 2A)**

**ADDENDUM TO
UNIDEX III MANUAL
REV. 0-1A**

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C O N T E N T S
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|                                                |    |
|------------------------------------------------|----|
| INTRODUCTION                                   | 1  |
| SECTION - 1. FEATURES OF UNIDEX-III            | 2  |
| SECTION - 2. GETTING AQUAINTED WITH UNIDEX-III | 3  |
| 2.1 Power Up                                   | 3  |
| 2.2 Front Panel Reset                          | 4  |
| 2.3 Default States at Power Up                 | 4  |
| 2.4 Selecting a Boot_strap Program             | 4  |
| 2.5 Selecting a Set_up Program                 | 5  |
| 2.6 Deselecting Boot_strap & Set_up Programs   | 5  |
| SECTION - 3. SYSTEM PROGRAMMING OF UNIDEX-III  | 6  |
| 3.1 Remote Self Diagnostic Test                | 6  |
| SECTION - 4. MOTION PROGRAMMING OF UNIDEX-III  | 8  |
| 4.1 Independent Feedrate/Vector Feedrate       | 8  |
| 4.2 Unidex-III Reset                           | 9  |
| 4.3 Execution of Program as Subroutine         | 9  |
| 4.4 Pushing a Line Address onto the Stack      | 10 |
| 4.5 Pop Stack and Continue                     | 10 |
| 4.6 Register Operations                        | 12 |
| 4.7 Assigning a Value to a Register            | 12 |
| 4.8 Register Based Move                        | 12 |
| 4.9 Register Comparison & Conditional Skip     | 13 |
| 4.10 Programmable Feed-Hold Interrupt          | 15 |
| 4.11 Programmable Reset Interrupt              | 15 |
| 4.12 Programmable Abort Interrupt              | 16 |
| 4.13 Disabling Interrupts                      | 17 |
| 4.14 Programmable Halt & Service Request       | 17 |
| 4.15 Programmable Halt & Entry into Slew Mode  | 18 |
| 4.16 Programmable Message Display              | 19 |
| 4.17 Handling Limits                           | 21 |
| 4.17.1 Limit at Power Up                       | 21 |
| 4.17.2 Limit in Local Mode                     | 21 |
| 4.17.3 Limit in Remote Mode                    | 22 |
| 4.17.4 Limit during Manual Slew                | 22 |
| 4.17.5 Limit during Programmed Slew            | 23 |
| SECTION - 5. OEM PROGRAMMING CAPABILITIES      | 24 |
| 5.1 Functions of the OEM Jumper                | 24 |

I N T R O D U C T I O N  
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This addendum describes the additional programming features of Unidex-III with Version-2A software. Wherever appropriate, reference is made to the Unidex-III Manual Rev. 0-1A.

SECTION - 1

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FEATURES OF UNIDEX-III. (Refer Section 1-2 of Manual)

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The additional programmable functions of Unidex-III are as follows:

- Vector Feed Rate Mode (Linear Interpolation between two points.)
- Register operations and Register based moves
- Programs executable as subroutines
- Reset System on Interrupt
- Reset System by program statement
- Feed Hold on Interrupt
- Multiple inputs concurrently programmable as interrupt inputs
- Programmable message display

SECTION - 2
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GETTING AQUAINTED WITH UNIDEX-III (Chapter 2 of Manual)
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2.1 POWER UP.

The system initialization at power up also checks the User Memory for any alterations since the previous EDIT session. A validity test is first carried out by verifying a prestored word (16 bytes long). Next, a checksum verification is done on the entire available User Memory. The check sum is stored in the first two bytes of the memory and the prestored word in addresses 3 through 18.

The self testing during power-up is done in the following order:

1. EPROMs: Checksum verification. A failure will cause the message " ROM ERR" to be displayed by the alphanumeric display. The operating system does not proceed further.
2. SYSTYEM RAMs: Write and Read testing. The information in the RAMs is not destroyed during this test. Failure causes message "SRAM ERR" on the display.
3. USER MEMORY:
  - a) Write and Read testing without changing existing information. Failure causes message "URAM ERR"
  - b) Verification of prestored word. Failure causes message "URAM ALT". ( Means User RAM altered). This message is expected when User Memory RAM chips have been powered down for any reason such as installation of new RAM chips or a battery failure.
  - c) Checksum verification. Failure may be due to errors written into the User Memory due to electrical noise.

If the User Memory was cleared prior to powering down Unidex-III, the message "URAM CLR" is displayed at power-up if no failure occurs in the above three tests.

If however, one of the programs in the User Memory has been selected as a Boot-strap program to run at power up, Unidex\_III will execute the appropriate program if the self diagnostic tests are completed without failure.

If alternately, a program (say 47) has been selected as a set-up program, the display will show "RUN - 47" and pressing the [EXEC] key will start the execution of the program.

If there are no failures in self testing, the User Memory is not clear and if there are no Boot-strap or Set-up programs selected, the message " SYS RDY" is displayed.

## 2.2 FRONT PANEL RESET.

Performs Self diagnostic tests as above. However, front panel reset does not cause the Boot\_strap program to run.

Resetting of Unidex-III is disabled when editing a program in the User Memory. If the [RES] key is pressed when editing, the message "EDITING!" is displayed. Pressing the [EXEC] key will bring back the display prior to pressing the [RES] key.

## 2.3 DEFAULT STATES AT POWER UP.

The default states that Unidex-III powers up in are as listed below:

- Local with remote enabled
- Incremental mode (G91) [ alternates with G90 ]
- Non Corner-rounding mode (G24)[ alternates with G23 ]
- Independent Feedrate Mode (G00)[ alternates with G01 ]
- Normal Move Mode (G49) [ alternates with G47 & G48 ]

## 2.4 SELECTING A BOOT-STRAP PROGRAM

A program to be run as a Boot\_strap program at power up is selected using the following Key sequence. Any Set-up program selected is cancelled.

Power up

|             |            |                                                                    |
|-------------|------------|--------------------------------------------------------------------|
| [EDIT]      | "PGM -<1>" |                                                                    |
| [SHIFT] [F] | "BOOT 37"  | Program #37 is currently the Boot-strap program.                   |
| [2]         | "BOOT 72"  |                                                                    |
| [5]         | "BOOT 25"  |                                                                    |
| [EXEC]      | "BOOT 25"  | EDIT led is turned off. Program #25 is now the Boot_strap program. |

Power down

Power up                   Executes Program #25

## 2.5 SELECTING A SET-UP PROGRAM

The key sequence is described below:

End of Program Execution " READY "

|             |                       |                                                                                          |
|-------------|-----------------------|------------------------------------------------------------------------------------------|
| [EDIT]      | "EDIT- 41"            | Program #41 just executed.                                                               |
| [SHIFT] [G] | "SETUP 79"            | Current setup program                                                                    |
| [1] [9]     | "SETUP 19"            |                                                                                          |
| [EXEC]      | "SETUP 19"            | EDIT led turns off.<br>Program #19 is now the Setup program. Boot_ Strap pgm. cancelled. |
| [RES]       | "RUN - 19"            |                                                                                          |
| [EXEC]      | Executes Program #19. |                                                                                          |

Boot-Strap and Set-up programs are mutually exclusive. Unidex-III may be programmed to either run a boot-strap program or have a set-up program but not both simultaneously.

## 2.6 DESELECTING BOOT\_STRAP & SET-UP PROGRAMS

The Boot\_strap and Set-up programs may be deselected with the following key sequence.

|             |            |                                                       |
|-------------|------------|-------------------------------------------------------|
| [EDIT]      | "EDIT- 76" |                                                       |
| [SHIFT] [M] | " NOBOOT " |                                                       |
| [EXEC]      | " NOBOOT " | EDIT led turns off.<br>Programs #25 & #19 deselected. |
| [RES]       | " SYS RDY" |                                                       |
| Power down  |            |                                                       |
| Power up    | " SYS RDY" |                                                       |

SECTION - 3  
^^^^^^^^^^

SYSTEM PROGRAMMING OF UNIDEX-III (Section 4-3 of Manual)  
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3.1 REMOTE SELF DIAGNOSTIC TEST.

When operating Unidex-III is in the remote mode of operation, either via the RS232/422 interface or the IEEE-488 interface, the self diagnostic tests described in Section-2 above may be performed and any failure information retrieved by the remote controller.

The character string shown below sent to Unidex-III will initiate the self-test.

"V cr lf" Note: Unidex-III is required to be addressed prior to sending this character string.

As described in Section-2, the test may be prematurely terminated due to a failure. At the end of the testing sequence, Unidex-III will issue a SERVICE REQUEST to the controller. The controller is required to do SERIAL POLL of Unidex-III to retrieve any failure information and enable further communication with Unidex-III.

The status byte obtained as a result of serial polling after self-testing is described below:

	SET	CLEAR
Bit-7	Indicates failure	No failures
Bit-6	Always set. Setting Bit-6 initiates the SRQ	
Bit-5	Not Used	
Bit-4	Not Used	
Bit-3	User Memory Altered	User Memory unchanged
Bit-2	User Memory Write/Read Failure	User Memory Write/Read: No failure
Bit-1	Sytem RAM Write/Read Failure	Sytem RAM Write/Read: No failure
Bit-0	EPROM Checksum Failure	EPROM Checksum verified

Note: Unidex-III will issue a SERVICE REQUEST when the Self-test terminates either due to a failure or upon completion without any failure. Controller must SERIAL POLL Unidex-III to enable further communication with Unidex-III.

With a User Memory of 32K bytes the self-test may take upto 4 seconds to complete. (Therefore the SRQ to indicate the termination of the test)

It is also important to note that a EPROM error may cause a bus hang up if the error in the EPROM is in the remote interface software. A bus hang up situation is detectable by the remote controller.

SECTION -4

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MOTION PROGRAMMING OF UNIDEX-III (Chapter 5 of Manual)

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4.1 INDEPENDENT FEEDRATE/VECTOR FEEDRATE [G00/G01]

Unidex-III powers up in the Independent Feedrate Mode. In this mode, the feed rates for the X and Y axes are entered separately following the axis move commands. An "F" command has to be preceded by an axis move command.

EX: G00 * X3000 F600 Y4000 F800 *

In the Vector Feedrate mode, the Feedrate Command is an individual command and stands alone.

EX: G01 * F1000 X3000 Y4000 *

The feedrate of 1000 steps/sec. will be vectored into an X-axis feedrate of 600 steps/sec. and a Y-axis feedrate of 800 steps/sec. in order that the move between the start and end points is in a straight line.

When changing from "G00" mode to "G01" mode, Unidex-III expects a vector feedrate to be available either from an earlier vector move or from a new feed command. But when changing from "G01" to G00", the X and Y components of the feedrate from the most recent vector move will be effective unless new independent feedrates are entered.

EX: G00 * X100 F100 Y100 F100 * G01 * X200 Y300 *

Unidex-III will display "-F-ERROR" after making the first move of X100 Y100.

EX: G01 * F1000 X3000 Y4000 * G00 * X100 Y100 *

The first vector move of X3000 Y4000 will be made with an X-feedrate of 600 and a Y-feedrate of 800. These feedrates will be effective during the second move of X100 Y100.

The accuracy of the component feedrates in a vector move is +/- 3.5% with a minimum resolution of 1 micro-second period between steps. This accuracy is maintained only when the X-axis and Y-axis moves are of the same order of magnitude. When the ratio of the value of the moves is very large, the component feedrates are not accurate enough for simultaneous completion.

4.2 UNIDEX-III RESET

[G99]

The command G99 resets Unidex-III. All the initialization procedures are performed except the self diagnostic tests and execution of the Boot-strap program.

```
EX: G91 G00 * X100 F100 Y100 F100 * G99 *
```

Unidex-III will make the move of X100 Y100 and when the move is complete, reset itself.

4.3 EXECUTION OF A PROGRAM AS SUBROUTINE

[N < dd]

A program may be called to run as a subroutine of the currently running program. When the subroutine program ends, control is automatically returned to the main program. The subroutine programs may also be executed independently like any program. Subroutine programs are executed as independent subroutines; the following statuses of the main program are preserved:

1. Incremental mode / Absolute mode
2. Non-corner rounding mode / Corner rounding mode
3. Independent feedrate mode / Vector feedrate mode
4. Normal move mode / Register operations mode
5. The values of axis feedrates.

The command that initiates a subroutine program call is.

```
N < dd
```

where "dd" is the two digit program number to be executed as a subroutine

Subroutines may be nested 16 levels deep. Unidex-III maintains a stack space that can store upto 16 return addresses. All types of subroutine calls are included:

```
Program subroutines      - N < dd
Independent Subroutines  - N = ddddd
Ordinary Subroutines     - N - ddddd
```

If a subroutine call is made when the stack is full, or if a return from a subroutine is executed when the stack is empty, Unidex-III flags a Stack Overflow Error and displays the message "STK OVFL"

A program that is called as a subroutine must be entered into the User Memory before the main program that is the

calling program. If down loading programs from a remote controller, the subroutine program must be downloaded before the calling program. Unidex-III performs a precompilation when quitting EDIT mode whereby the jump addresses for the "N > dddd" command and the subroutine addresses for all the three types of subroutines are computed and stored within each program. If a subroutine is not available corresponding to a call, a Compile Error is generated. Unidex-III then displays the message "C-ERR dd" where "dd" is the number of the program which generated the error.

4.4 PUSHING A LINE ADDRESS ONTO THE STACK [N + dddd]

The address of a line (number "dddd") may be put on the same stack used for storing subroutine return addresses.

EX: N + 2500 * Stack the address of line number 2500

If the above command was the most recent stacking operation, then executing a "M99" command will unstack the address of line number 2500 and program will execute that line.

4.5 POP STACK AND CONTINUE [M89]

This command is used to decrement the stack pointer so that the next unstacking will result NOT in the most recently stacked address being unstacked but the one prior to that.

Use of this command may be convenient if say, we want to jump out of a subroutine without going through the normal procedure of a return (M99). Jumping out of a program subroutine is not possible.

Pushing and Popping the stack are very sensitive and tricky operations and great caution has to be exercised when incorporating these commands.

The sample programs in page 11 illustrates the use of the above commands.

Example:

Program # 25

```

1   G90 G01 * F1000 X100 Y200 * ; Do a Move.
2   G273 N+3000 * ; If C-3 high stack line
; address 3000.
3   N + 2000 * ; Else stack 2000
4   N < 37 * ; Pgm # 37 as subroutine
5   M99 ; Unstack and jump to line
6   N3000 * ; address 2000 or 3000
7   M=167 X2000 Y5674 * ; Do a move
8   N - 300 * ; Subroutine call
9   More Moves ; Sub. 300 returns to these
; Moves
10  N2000 X4563 Y1342 M=34 * ; More moves
11  More Moves
12  M2 * ; End of main program #25

13  N300 ; Subroutine 300
14  M=1 D200 M=0 D200 ; M functions
15  G271 M89 N>2000 * ; Test input C1 and if low
; skip to End-of-block. If
; high, pop stack and jump to
; line address 2000.

16  G272 N>300 * ; If input C2 is high go back
; to line 300 (start of sub)

17  M99 * ; If low return from sub.

```

Program # 37

```

G91 G00 * ; Initialize modes
G661 = 10 * N10 ; Repeat loop counter
X10 F10 M=8 Y10 F10 * ; These moves trace a square
X-10 * Y-10 M=0 ; of side equal to ten steps
G671 N>10 * ; End of repeat loop.
M2 * ; End of Program # 37

```

In LINE 2 of the main program, either line address 2000 or line address 3000 is stacked based on the state of the input C-3. In LINE 5, after executing program #37, "M99" causes a jump to either line address 3000 or 2000

So why not test C-3 input at LINE 5 and jump to wherever required. We do not care whether the state of input C-3 has been changed by program #37 or not. The destination of the jump has been decided prior to executing program #37.

4.6 REGISTER OPERATIONS

[G45,G46,G47,G48,G49]

Unidex-III has eight registers X1,X2,X3,X4, Y1,Y2,Y3 and Y4 that may be used by a motion program in addition to the X and Y position registers. These registers as well as the X and Y registers are used in register operations described in the following paragraphs.

Unidex-III is in the Register Mode when handling registers. Normal mode is the default at power up and return to normal mode from register mode is effected by the modal command - "G49"

Simple register arithmetic may be performed using the plus, minus and equal-to signs. A register may be added to or subtracted from a number or a register to arrive at a value required for a specific operation. There are certain restrictions on the syntax when using these signs as described below.

4.7 ASSIGNING A VALUE TO A REGISTER

[G47]

Any of the registers may be assigned a value not greater than +/- 2,000,000,000. This value may be a number or the value of an arithmetic expression including registers numbers and the "+" and "-" signs.

EX: G47 * X1 = 2500 * X = 5000 Y = 3000 * G49 *

The above line assigns the value 2500 to register X1 and value 5000 to X position register and 3000 to Y position register.

G47 * Y3 = X1 + X - Y -350 *

This line assigns the value of the expression to the right of the "=" sign (4150) to register Y3.

When using "G47" it is illegal to use a "+" or "-" sign on the left side of the "=" sign. Unidex-III will flag an error and if in local mode, will display "ILL.CHAR"

4.8 REGISTER BASED MOVE

[G48]

An X-axis move or a Y-axis move or a combined two axis move may be performed based on register values. In the incremental mode, the number of steps for the move is realized by evaluating an expression containing registers

and numbers. In the absolute mode, the value of the expression is used as the destination position for the axis.

```
EX: G91 G01 * F10000 * G48 * X = 5000 Y = X + 1000 *
```

The above line makes for a two axis move at a vector feedrate of 10000 steps/sec. X axis moves 5000 steps and Y axis moves 6000 steps.

```
EX: G90 G00* G47 X3 =100 * G48 X=X3+10 F100 Y=200 F50 *
```

Register X3 is assigned a value of 100. X axis moves to position 110 at 100 steps/sec. and Y axis moves to position 200 at 50 steps/sec., in a two axis move.

4.9 REGISTER COMPARISON & CONDITIONAL SKIP [G45,G46]

Just as conditional skip to end-of-block is made based on the level of a C-input, or a repeat counter decrementing to zero, skip to end-of-block can be performed based on comparisons between registers and/or numbers.

Command "G45" allows a skip to end-of-block if the condition specified is TRUE

Command "G46" allows a skip to end-of-block if the condition specified is FALSE.

The end-of-block automatically cancels the register comparison mode

```
EX: G90 G00 * G45 X >= 3000 X3000 F1000 *
```

If the value of X position register is greater than or equal to 3000, skip to end-of-block, or else move X axis to position 3000 at 1000 steps/sec.

```
EX: G90 G00 * G46 X < 3000 G48 X=3000 F1000 *
```

This line performs exactly the same function.

```
EX: G45 X1 + 200 <> Y - X3 +500 M=1 N=20 * M=2 *
```

Here if $[X1+200]$ is equal to $[Y-X3+500]$, M output no.1 is turned on and program execution moves to line number 20. If the two expressions are not equal, output no.2 is turned on.

As can be seen in the examples above, multiple symbols may be concatenated to test for the following conditions:

- | | |
|-----------------------------|-------------------|
| 1. Less Than | < |
| 2. Greater Than | > |
| 3. Equal to | = |
| 4. Less Than or Equal to | <= |
| 5. Greater Than or Equal to | >= |
| 6. Not Equal to | <> or >< |
| 7. Unconditional | <=> or <>= or =<> |

Example:

The following is a program that calls a subroutine to do a rectangle 10 times. The size of the rectangle is passed to the subroutine in X1 and Y1 registers and the number of repeat loops to be performed is passed in register X2. This enables different rectangles to be described and the repeat loop to be executed different number of times using the same subroutine.

```
G90 G01 G24 *           ;Initialize
G47 X1=100 Y1=50 *      ;Rectangle size
X2 = 10                 ;Loop count
N=200 *                 ;Subroutine call
...
...
M2 *                   ;End of program

N200 * G00 *           ; Subroutine begins
N40 G48 *              ; Reg.based moves. Loop begins
X=X1 F100 * Y=Y1 F50 * ; Two sides of rectangle
X=-X1 * Y=-Y1 *       ; Two more sides
G47 X2 = X2-1 *        ; Decrement counter
G45 X2 = 0 N>40 *      ; If counter zero quit loop
M99 *                  ; Return
```

It can be seen that the repeat loop in the subroutine was realized using a register operation rather than the usual G661 = 10 and G671 combination. The count of 10 may be passed to the subroutine via repeat counter by statement G661 = 10 prior to calling the subroutine. The difference is that G671 always decrements by ONE and quits the loop only when ZERO. The Register operation provides for more flexibility

4.10 PROGRAMMABLE FEED-HOLD INTERRUPT [G201 - G204]
[G211 - G214]

The C-inputs may be programmed to interrupt and halt program execution and stop clock output from the axis indexers on a high to low or a low to high transition on the input programmed. A transition in the opposite direction releases the hold and allows clock output and resumes program execution.

G201 arms input C-1 to interrupt on a -VE (high to low) transition. Similarly G202, G203 and G204 arm C-2, C-3 and C-4.

G211, G212, G213 and G214 arm the respective inputs to interrupt on the +VE (low to high) transition.

EX: G201 * X1000 F1000 M-27 D1000 Y2000 F2000 *

Input C-1 is armed to interrupt on the high to low (-ve) transition which may occur at any time. If the interrupt occurs during the dwell, the duration of the dwell will be extended by the feed hold. The amount of extension will be time C-1 input remains low.

A command arming an input to interrupt invalidates all previous interrupt arming commands relating to that input

More than one input may be concurrently programmed to interrupt. In such a case, the inputs behave in a manner similar to switches connected in series. Any one input may halt the program. All inputs must release hold before program can resume

EX: G211 G212 * X100000 F10000 Y200000 F10000 *

The following sequence will hold true:

- C-1 goes high - Indexer clock outputs stopped
- C-2 goes high - No change
- C-1 goes low - No change
- C-2 goes low - Clock outputs resume

4.11 PROGRAMMABLE RESET INTERRUPT [G401 - G404]
[G411 - G414]

The same C-1, C-2, C-3 and C-4 inputs may be programmed to interrupt and reset Unidex-III. The reset effected is the same as the "Clear Device" operation from a remote controller or the reset executed by the program statement "G99". System initialization is performed without the self test function. Boot_strap program does not execute.

G401 through G404 arm inputs C-1 through C-4 to interrupt on the -VE transition. G411 - G414 causes interrupts on the +VE transition.

4.12 PROGRAMMABLE ABORT INTERRUPT [G301 - G304]
[G311 - G314]

The interrupts can be programmed such that the following actions are taken:

1. Halt program execution
2. Stop clock outputs from indexer
3. Update position registers based on clock pulses actually put out by the indexer
4. Set a User Flag to indicate the occurrence of the interrupt
5. Skip to end-of-block and continue program execution

Example:

```
1  G90 G01 G24 G49 * F1000 * ;Initilize & Feedrate
2  G7 * ;Go Home
3  G313 ;Arm Input C-3 to interrupt
   ;on +VE transition
4  N200 X15000 Y25000 * ;Move command
5  G533 N>300 * ;If Flag-3 is CLEAR,
   ;end program.
6  N=100 * ;If SET do subroutine
7  N>200 ;Go back and complete
   ;interrupted move
8  N300 M2 * ;End

9  N100 * G91 G00 * ;Subroutine begins
10 G503 * ;Clear Flag
11 G47 X1=X Y1=Y * ;Store position of interrupt
12 G49 * X10 F10 Y10 F10 ;Moves
13 Moves
14 G90 G48 X=X1 Y=Y1 ;Get back to position of
   ;interrupt
15 G49 * M99 * ;Return
```

It is now possible to remember the X and Y positions when the interrupt occurs (LINE 11) and after executing a subroutine go back to the position of interrupt (LINE 14) and complete the move (LINE 7)

4.13 DISABLING INTERRUPTS [G321 - G325]

All the interrupt arming commands described in the preceding paragraphs give the programmed input the capability to interrupt at any time during program execution. To disable an input from interrupting, the following commands may be used:

- G321 - Disable C-1 input from interrupting
- G322,G323,G324 - Disable C-2,C-3,C-4 inputs
- G325 - Disable all four inputs from interrupting

4.14 PROGRAMMABLE HALT & SERVICE REQUEST [G25]
[G25 = ddd]

The command "G25" causes the motion program to halt and display a message "G25 = " if in local mode. To resume the motion program, [EXEC] key may be pressed once.

In the remote mode, Unidex-III issues a SERVICE REQUEST to the remote controller. The controller is required to do a SERIAL POLL. The status byte returned indicates that the SRQ was generated by a "G25" by virtue of Bit-1 being set. The remote controller may read the position registers and status bytes and resume the motion program by sending to Unidex-III the character string: "B cr lf".

The command "G25 = ddd" assigns a number (up to 255) to the programmed HALT. In local mode the message display is "G25 =ddd". The number is to identify the HALT within a motion program. The program may be halted at different times in order to perform different operations external to the program.

When in the remote mode, the remote controller may access the G25 number by sending to Unidex-III the string, "P N cr lf". Unidex-III returns the number in binary form as a single byte followed by <cr lf>.

If a plain "G25" comes after a "G25=ddd" in a motion program, the number "ddd" remains assigned to G25. The number changes only when a new number is assigned.

When in the G25 state, X and Y position and the status bytes may also be accessed by the controller.

Both in Local as well as Remote mode, a command to print the directory ["PD"] or to print a program ["Pdd"] will cancel th G25 state and inhibit continuation of the program. Pressing the Mode Keys [AUT], [SGL], [EDT] or [IMD] will also cancel the G25 state.

A Manual Slew operation may be performed while in the G25 state. Quitting the SLEW mode by the key sequence [CE] [EXEC] will continue program execution with the position registers updated during the slew. However if any of the axes encounters a limit, the G25 state is cancelled.

In the Remote Mode, after doing a SERIAL POLL to exit the SRQ state a GO-TO-LOCAL command may be executed by the controller to put Unidex-III in the Local with Remote Enabled state and give control to the keyboard. After a Manual Slew operation, the [RMT] key may be pressed to put Unidex-III back into the Remote Enabled state. The controller may now send a second GO-TO-LOCAL command and then address Unidex-III to resume the Remote mode of operation.

4.15 PROGRAMMABLE HALT & ENTRY INTO SLEW MODE [G78*,G79]
[G78 = ddd*, G79 = ddd]

The command "G78*" halts the motion program and puts Unidex-III in the SLEW mode. The keyboard or the joystick may be used to slew the X and Y axes. When using the keyboard to slew, the key sequence

[CE] [EXEC]

may be pressed to exit the slew mode and resume the motion program. If instead the joystick is used to slew, and the front panel is inaccessible, the Joystick Button may be pressed to exit slew mode and resume program execution. Pressing the Joystick Button will not clear the position registers in this case (as in the normal Manual Slew which is initiated from the front panel). If a position register is to be cleared, that may be done by a "G92" command in the program immediately following the "G78*" or "G79" command.

Assigning a number to G78 makes for a message display "SLEW=ddd". The number "ddd" identifies the SLEW operation and may be any value up to "255".

The axis slew feedrates or the joystick slew rate division factor may be programmed along with the "G78" or the "G78=ddd" command. If these values are not programmed Unidex-III assumes the previously programmed values (the default values if they were never programmed).

EX: G78 = 57 X F1000 Y F2000 *

Unidex-III halts and displays "SLEW= 57". Keyboard slew will move X axis at 1000 steps/sec and Y axis at 2000 steps/sec. Joystick division factor is the previous value.

EX: G78 F - 10 *

Unidex-III halts and displays "SLEW= 57". Joystick clock rates will now be divided by a factor of 10. Keyboard slew rates will remain at 1000 and 2000 steps/sec.

The "*" is essential after a "G78" to indicate to the program interpreter the extent of the command. Without it the interpreter looks for feedrates or joystick division factor following the "G78". In cases where the "*" is inconvenient, "G79" or "G79=ddd" may be used. No slew feedrates or joystick division factor may be entered in the case of "G79" or "G79=ddd".

The X and Y position registers will be updated as a result of the slewing operation. When the motion program resumes, these new values will be effective.

4.16 PROGRAMMABLE MESSAGE DISPLAY ['mmmm']

Arbitrary messages of up to eight characters in length may be displayed on the alphanumeric display as a part of a motion program. Any of the valid ASCII codes is permissible as a character. Some of the codes may not be displayable as characters.

The message to be displayed is enclosed within quotation marks. Unidex-III completes execution of all moves up to the message and then displays the message. If there are more than eight characters within the quotes, only the first eight are displayed. If there are less than eight, they are displayed starting from the left end of the display. A maximum of fourteen characters may be entered within the quotes. All characters after the fourteenth merely replace the previous one and will eventually be replaced by the closing quote.

EX: G91 G00 "X-AXIS"X100F100 "Y-AXIS-MOVE" Y100f100 *

Unidex-III will display "X-AXIS " and make the X move of 100 steps. Then Unidex-III will display "Y-AXIS-M" and make the Y move.

Display updates by Unidex-III such as " READY " or "G25 =126" will override any programmed messages. In order that a message may stay on display for a length of time it may be required to program a dwell after the message.

EX: "KARUMBA" D10000 *

The message stays on for 10 seconds before Unidex-III displays " READY "

The legends on the keyboard have been modified to accommodate this new feature in the local mode of operation. All the possible ASCII characters are not available due to the small number of keys. However, all the numerals, the entire alphabet and a useful set of symbols are provided.

When editing a program in the local mode, pressing the keys [SHIFT] ["] does the following:

1. Enters the quotation mark (") on the display.
2. Starts the EDIT LED blinking on and off to indicate that we are now in the Message Entry Mode.
3. The keys on the front panel have new character assignment. These characters are printed on the right hand bottom corner of the upper and lower sections of the keycap. Where there are no such characters, the key retains the normal character assignment.
4. The [CE] and [SHIFT] keys do not change their function.

The key sequence [SHIFT] ["] will exit the Message Entry Mode and turn the EDIT LED continuously ON.

When editing a program from the keyboard, "STP" and "BST" will align the closing quote with the right most position of the alphanumeric display. The entire message including the quotes is treated as a single command for the edit functions. STEP, BACKSTEP and CLEAR-COMMAND. In the SEARCH mode, if the character string searched for is part of a message, the cursor (right most position of display) is aligned with the closing quote.

The [CE] key will put Unidex-III in the Message Entry Mode if the character cleared is the closing quote. The EDIT LED will start to blink on and off. If the entire message is cleared including the opening quote, Unidex-III exits the Message Entry Mode.

If for some reason, Unidex-III is powered down while re-editing a message (in the Message Entry Mode), the program being edited will neither compile nor execute correctly because the closing quote is missing from the program. The program should be cleared from the user memory and re-entered.

4.17 HANDLING LIMITS.

It is conceivable that Unidex-III may get into a LIMIT situation by running into one of the axis limits. In such a case there are a number of protection features built into the system.

The hardware that drives the axes motors (the stepper translators, the servo amplifiers) prevents the motors from running further into a limit by inhibiting the clock pulses put out by Unidex-III. Clock pulses in the opposite direction are allowed to pass through permitting a retreat from the limit.

Unidex-III itself inhibits the indexers from putting out any more clock pulses when a limit is detected in either axis. Unidex-III also updates the position registers with the number of clock pulses actually put out by the indexers. The alphanumeric display indicates which axis is in limit with either "-X-LIMIT" or "-Y-LIMIT"

4.17.1 LIMIT AT POWER UP

If one of the limits is active at power up Unidex-III detects it after initialization and self diagnostic tests are completed. Unidex-III will then default to the LOCAL mode and indicate the axis in limit. The procedure to exit from a limit is described in the following paragraphs.

4.17.2 LIMIT IN LOCAL MODE

When operating in the LOCAL Mode, the front panel keys may be used to back out of a limit. The [SLEW] key may be pressed to enter the manual slew mode and the appropriate "arrow" key used to slew out of a limit. Alternately one can execute an IMMEDIATE command or execute a program from the User Memory in the AUTO or SNGL Mode to come out of the limit.

It has to be noted that any move commanded by Unidex-III to go further into the limit will be executed by Unidex-III but will be inhibited by the subsequent hardware as described above. This will result in the axis position registers having incorrect information and therefore not matching the tracking displays.

It is also important to expect the limit switches to

exhibit contact bounce and create a second limit situation when backing out of limit. The limit switches are not debounced because ignoring a noisy or a faulty limit switch compromises the protection features built into the system.

4.17.3 LIMIT IN REMOTE MODE OF OPERATION

When operating in the REMOTE mode, Unidex-III may be set up to do one of the following when a limit is encountered.

1. Jumper 37 removed:

REMAIN IN REMOTE STATE and issue a SERVICE REQUEST to the controller. The controller has to SERIAL POLL Unidex-III to continue communication with it.

The controller may then proceed to send appropriate commands to back out of the limit.

2. Jumper 37 installed.

GO TO "LOCAL with REMOTE ENABLED" state and issue a SERVICE REQUEST. The controller has to SERIAL POLL Unidex-III. The status byte returned will reflect the Remote Enabled state. Unidex-III may now be accessed from the keyboard or via one of the remote interfaces.

If a limit is encountered while in the Remote Enabled state, Unidex-III goes to the LOCAL state. Thus if the limit switch has contact bounce and generates a -VE transition more than once, Unidex-III will be in the LOCAL state and will not be accessible via the remote interfaces.

4.17.4 LIMIT DURING MANUAL SLEW OPERATION

If Unidex-III detects a limit during a manual slew from the keyboard, the indexers are inhibited and a message indicating the axis in limit is displayed. The [SLEW] key has to be pressed to re-enter the manual slew mode and back out of limit.

If the Joystick is used for slewing, backing out of a limit may be accomplished without going to the front panel. Detecting a limit disables the joystick, but a change in the direction of any one of the axes (from the joystick) reenables it and allows the use of the joystick to back out

from a limit. That is, if a limit is encountered when slewing X-axis in a CW direction, moving the joystick in the opposite direction automatically re-enables it and slews the X-axis out of the limit in the CCW direction.

4.17.5 LIMIT DURING PROGRAMMED SLEW (G78,G79)

If the slew operation is initiated by a "G78" or "G79" in a motion program, and a limit is encountered while slewing, it is possible to back out of the limit and resume program execution.

The message "-X-LIMIT" or "-Y-LIMIT" will be displayed when the limit is detected. The [SLEW] key must be pressed to re-enter the slew mode and the appropriate arrow key pressed to back out of limit and slew the axis to the desired position. The key sequence [CE] [EXEC] will then exit the slew mode and resume execution of the program.

If the joystick is being used, changing the direction re-enables it and after backing out of the limit, program execution may be resumed by pressing the joystick button.

If Unidex-III is being operated in the REMOTE mode, a SERVICE REQUEST is issued when the limit is detected. The controller MUST do a SERIAL POLL to release control to the keyboard and joystick so that one of the arrow keys or the joystick may be used to back out of limit. The program execution may be resumed as described above after the serial poll.

SECTION - 5

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OEM PROGRAMMING CAPABILITIES OF UNIDEX-III
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For OEM customers, the RS232 Serial Comm. board (690D1268) is modified to include a jumper (the OEM jumper). The function of the jumper is described in the following paragraphs.

For Standard customers, it is required that the Switch No. 5 of SW1 on the Interface Board (rear panel) be permanently "ON".

The character length for serial communication for both the OEM customer as well as the standard customer is now,

7 bits - SW1 : Switch 6 -ON or  
8 bits - SW1 : Switch 6 -OFF

The options of 5 bits and 6 bits are not available.

5.1 FUNCTIONS OF THE OEM JUMPER

The status of the OEM jumper (IN or OUT) determines whether programs 50 thru 99 in the user memory may be accessed for editing and printing. The M-function outputs M:5 thru M:8 are not accessible to programs 1 thru 49 when the jumper is out.

When the OEM jumper is IN, Unidex-III allows normal operation. All programs are accessible for editing or printing. Any M-fuction output may be controlled by any program.

When the OEM jumper is OUT, (or SW1 : switch 5 is in the "OFF" position), Unidex-III will do the following.

1. Programs 50 thru 99 will not be accessible for EDITing or PRINTing. They may be run in the AUT or SGL modes or as a subroutine of another program. Unidex-III will display the message " WHAT ? " and turn off all modes if attempt is made to access these programs. In the Remote mode, UNidex-III will issue a SERVICE REQUEST to the controller instead of the message.

EX: [EDT] [6] [5] [EXC] " WHAT ? "  
[PRT] [0] [0] [EXC] " WHAT ? "

Remote: "P 87 cr lf" Unidex-III requests service.

The Directory may be printed out listing all programs.

2. Clear Memory operation will not be carried out.

EX: [EDT] [CC] [0] [0] [EXC] " WHAT ? "

Remote: "E \$ 0 0 or lf" Unidex-III requests service.

3. Programs 1 thru 49 or the Immediate mode may only modify M-fuction-outputs M:1 thru M:4. The outputs M:5 thru M:8 are accessable only to programs 50 thru 99. These outputs (M:5 thru M:8) will remain unchanged unless a program numbered 50 thru 99 changes them.

For an M-function command in a program numbered 1 thru 49, or in an Immediate mode operation, the four outputs M:5 thru M:8 will not be affected.

4. The program selected as the Boot-strap program with the OEM jumper IN (OEM Boot-Strap) will be executed before the Boot-strap program selected with the jumper OUT (USER Boot-Strap)
5. The OEM Boot\_Strap program or the OEM Set-up program can be deselected only with the OEM jumper IN.
6. The USER Boot-Strap or Set-up program is deselected when the OEM Boot-Strap or Set-up program is deselected. They have to be re-selected after removing the jumper.