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UNIDEX™ 12
MOTION CONTROLLER
PROGRAMMING MANUAL

PN: EDU111

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ORGANIZATION OF DOCUMENTATION FOR UNIDEX 12:

Up to four manuals may have been shipped with your Unidex 12 Controller, depending on the options ordered. Two of the manuals supply basic data regarding programming and hardware support information, they are:

- *Unidex 12 Motion Controller Programming Manual*—which is this manual
- *Unidex 12 Motion Controller Hardware Manual*

Depending on the options supplied with your Unidex 12, the following documents may have also been supplied:

- *Unidex 12 Motion Controller Options Manual*
- *Unidex 12 Interactive Control Software Manual (SSP3)*

Please review in detail this manual, *The Unidex 12 Motion Controller Programming Manual*, before proceeding to other documentation.

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ORGANIZATION OF THIS MANUAL:

This manual is divided into four distinct parts:

Part I: Introduction to Unidex 12
Part II: Menu-Driven Front Panel Programming of the Unidex 12
Part III: Programmable Acceleration/Deceleration for the Unidex 12
Part IV: RS-232 Serial Interface Programming of the Unidex 12

Information on Service and Repair, as well as Warranty information, is located at the back of the manual.

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PART I

INTRODUCTION TO THE UNIDEX 12

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CHAPTER 1: GENERAL DESCRIPTION

Unidex 12 is a multi-axis (1 through 4 axes) microprocessor-based motion controller. It is available in three packages: a 6U (12" high) one to four axis desktop cabinet (model U12S), a 6U high 19" rack mount chassis (model U12R), and a high power 19" rack mount chassis for heavy duty applications (model U12H). The three configurations are shown in Figure 1-1. All three configurations are capable of one through four axes of motion control, and are capable of DC, Aerodrive and Micro-Step drive control. Any combination of DC, Aerodrive or Micro-Stepping drives may be accommodated.

Table 1-1 lists specifications for various standard DC motor/drive combinations available with Unidex 12.

Table 1-2 lists various standard Stepping motor/drive combinations available with Unidex 12.

Table 1-3 lists various Aerodrive Stepping motors available with Unidex 12.

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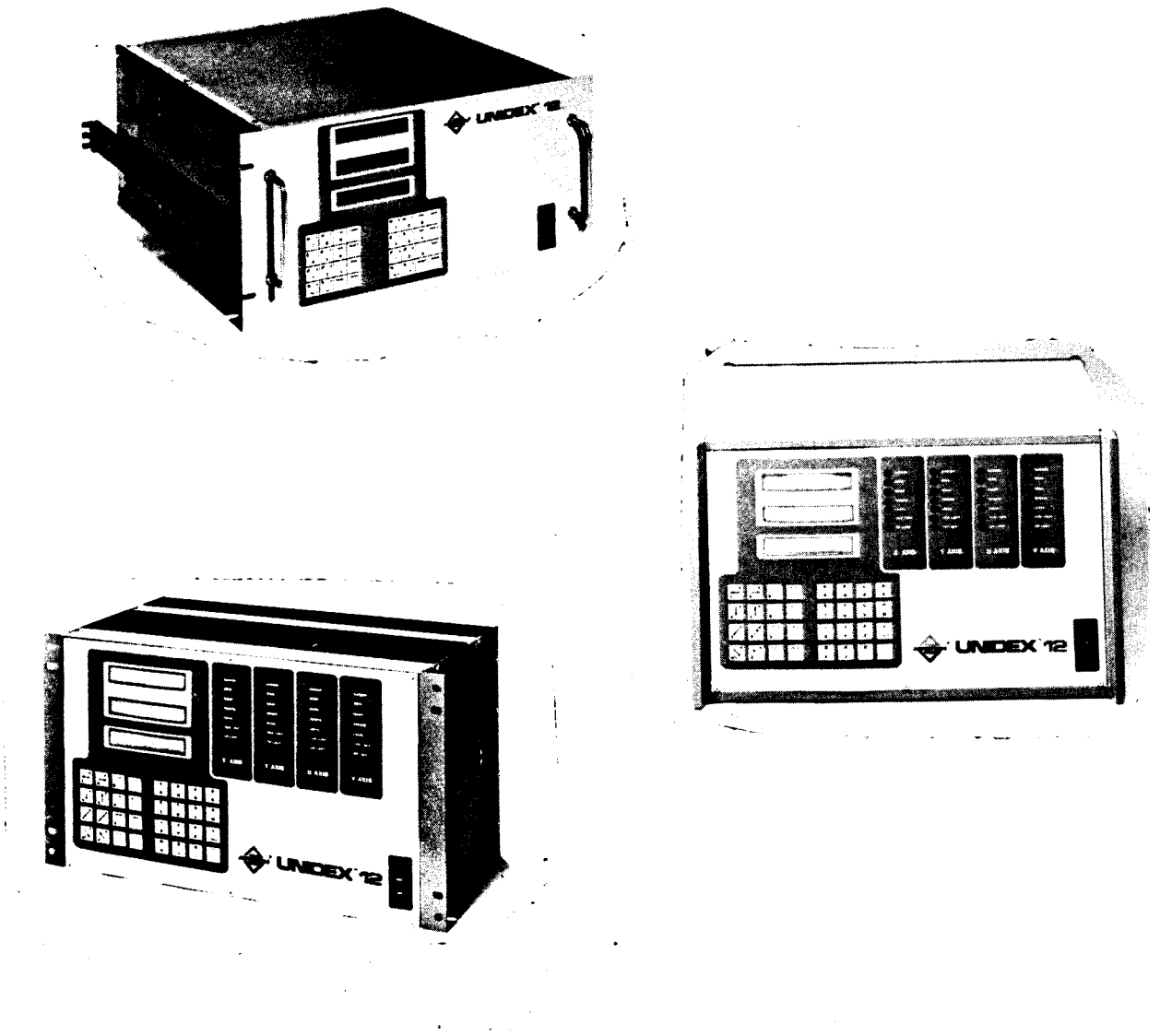


Figure 1-1: Unidex 12 Programmable Multi-Axis Motion Control Family

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UNIDEX 12 SPECIFICATIONS

MEASURES

Resolution	
Stepping Models	0.09° (4,000 steps/rev.)standard;0.9°to 0.00072° (400 to 50,000 steps/rev. optional
Servo & Aerodrive Models	0.18° (2,000 steps/rev.) standard; 1.8° to 0.009°(200 to 4,000 steps/rev.) optional
Accuracy	±5 arc min. typical, unloaded, bidirectional
Repeatability	±5 arc sec. typical, unloaded, unidirectional approach
Hysteresis	3 arc min. or less, unloaded, bidirectional (stepping models only)

MOTIONS

Axes	1 to 4 (designated X, Y, U, V)
Type	Linear Interpolation, four of four axes
Position Range	
Stepping Models	±500,000 rev. with standard resolution
Servo & Aerodrive Models	±1,000,000 rev. with standard resolution
Velocity Range	
Stepping & Aerodrive Models	0.0005 to 50 rev./sec (0.03 to 3000 rpm) with standard resolution
Servo Models	0.0005 to 108 rev./sec (0.03 to 6500 rpm) with standard resolution
Acceleration Ramp	10 to 4,990 msec.
Acceleration Profiles	Linear or parabolic (programmable)
Positioning Modes	Absolute, Incremental (programmable)

PROGRAMMING

Programs Storable	99, randomly accessable
Memory (User)	30KB, battery-backed (5yr.) approximately 3,250 single-axis moves
Modes	SET-UP: Set basic controller operation parameters AUTO: Selected program runs start-to-finish upon entry of execute command

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	BLOCK: Selected program runs one block per execute command
	MANUAL: Command block is executed immediately upon entry
	EDIT: Allows new program entry or existing program alteration
	COMMUNICATIONS: Facilitates control by remote host through communications port
Branching	Unconditional jump
	Hardware conditional skip
	Software conditional skip
Subroutines	Up to 8 level nesting
	Independent program call as subroutine
Scaling	Per-axis divisor from 1 to 999.999 (permits display scaling in metric, english, or rotary units)
Password	Password security to control access to system parameters and program editing functions

INTERFACES

Command	
Serial	RS-232-C with programmable baud, length, parity, stops
Parallel	Optional IEEE-488 (GPIB)
High Speed Binary	Optional high speed interface (HSBC) for a parallel I/O board; data rates to 80,000 bytes/second
Other	Joystick: proportional and scalable analog input for each axis. Optional digitizing (JP4E) version available
Inputs/Outputs	
Discrete	4 inputs, TTL
	4 outputs,TTL
Digital I/O	12 programmable TTL (in groups of4) or optional 2-digit BCD input, or 12-bit binary (or 3-digit BCD) output with strobe. All are PB8, PB16, PB24 (OPTO22) compatible. TDT and HSBC options also use this port. Optional Serial Output Port (SEO) makes available opto-isolated clock and direction commands for external use.

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Displays	3 LCD, 48 (2X24) character each (for menu, position tracking, data entry, message display)
Keyboards	32 key (two 4x4) sealed membrane
Brake Control	Optional output to control electromagnetic brake
DRIVES	
Stepping and Aerodrive	Integral drivers and power supply, torque capability to 1,050 oz-in (7,4 N-m), speed capability to 3,000 rpm
Servo	Integral drivers and power supply (750 watts max. cont.), torque capibility to 6,500 rpm.
ENVIORNMENTAL	
Ambient Temperature	
Operating	0° to 50°C (32° to 132°F)
Storage	-20° to 70°C (-4° to 158°F)
Humidity	0 to 95%, noncondensing
POWER INPUT	
AC Power	115 VAC, 50/60 Hz.(nom.), 1,000 VA (max.), single phase.Optional 230 VAC (nom.),or 100 VAC (nom.), 50 Hz.

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Table 1-1: DC Motor/Drive Specifications for the Unidex 12

DC DRIVE MODEL NO.	—— DSL4020 ——		—— DSL8020 ——			—— DSL16020——		
DC MOTOR MODEL NO.	1035LT	1050LT	1075LT	1135LT	1210LT	1410-02 -1600-99	1580LT	1960LT
Continuous Torque (Max.) Oz-In	35	50	75	135	210	410	580	800
N-m	0,25	0,35	0,53	0,95	1,5	2,9	4,1	5,6
Peak Torque (Max.) Oz-In	170	186	280	490	700	890	1300	2000
N-m	1,20	1,31	2,0	3,46	4,94	6,3	9,2	14,1
Maximum Speed (RPM)	5000	4200	5000	3600	2500	1800	1800	2400
Motor Rotor Inertia Oz-In-Sec^2	0.0054	.008	.023	.052	.18	.37	.26	.37
Kg-M^2	0,038 x 10^{-4}	0,057 x 10^{-4}	0,16 x 10^{-4}	0,36 x 10^{-4}	1,3 x 10^{-4}	2,6 x 10^{-4}	1,8 x 10^{-4}	2,6 x 10^{-4}
DC Drive Amplifier Settings								
DC Bus Voltage	40	40	80	80	80	80	160	160
Max. Peak Current	20	20	20	20	20	20	20	20
Output Fusing, Amps	4	5	5	5	6.25	6.25	8	10
Maximum Input DC Drive Power (Watts)	108	145	170	240	260	395	713	1340
Maximum Output Motor Shaft Power (Watts)	86		140	200	220	325	600	1190
Weights								
Motor (Lbs.)	3.3	3.8	5.8	10.3	10.8	14.3	25.3	38
(Kg)	1,5	1,7	2,6	4,7	4,9	6,5	11,5	17,3
Chassis								
U12S Lbs.			——	50	——			
Kg			——	23	——			
U12R Lbs.			——	42	——			
Kg			——	19	——			
U12H Lbs.			57 (80 with 2P12 dual supply)					
Kg			26 (36 with 2P12 dual supply)					

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STEPPING DRIVE NO.	DM4001	DM4005	DMV8008	DMV16008
STEPPING MOTOR NO.	50SM	101SM	310SM	1010SM
Static Torque (Max.) Oz-In N-m	38 0,27	90 0,64	370 2,61	1050 7,41
Motor Speed (RPM)	1000 17	1875 31	1875 31	1500 25
Motor Rotor Inertia Oz-In-Sec² Kg-M²	1.66 x 10 $^{-3}$ 11,8 x 10 $^{-6}$	5 x 10 $^{-3}$ 35 x 10 $^{-6}$	28.5 x 10 $^{-3}$ 187 x 10 $^{-6}$	114 x 10 $^{-3}$ 805 x 10 $^{-6}$
Motor Type	2 - Phase Hybrid Permanent Magnet, 1.8/Full Step			
Stepping Drive Volts (DC)	40	40	80	160
Amps	1	5	6	8
Type	Unipolar	Unipolar	Bipolar	Bipolar
Maximum Input DC Drive Power (Watts)	25	80	290	460
Maximum Output Motor Shaft Power (Watts)	12	53	250	400
Weights Motor (Lbs.) (Kg)	2.3 1.05	3.6 1.64	8.1 3.68	20 9.09
Chassis U12S Lbs. Kg		____ ____		
U12R Lbs. Kg		____ ____		
U12H Lbs. Kg		____ 57 (80 with 2P12 dual supply) 26 (36 with 2P12 dual supply)		

Table 1-2: Stepping Motor/Drive Specifications for the Unidex 12

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DRIVE MODEL NO.	DAV4008		DAV16008	DAV16008
MOTOR MODEL NO.	50SM	101SM	310SM	1010SM
Continuous Torque (Max.) Oz-In N-m	38 0,27	90 0,64	370 2,61	1050 7,41
Peak Torque (Max.) Oz-In N-m	52 0,4	198 1,4	570 4	1120 7,9
Maximum Speed (RPM)	1500	3000	3000	3000
Motor Rotor Inertia Oz-In-Sec² Kg-M²	1.66×10^{-3} $11,8 \times 10^{-6}$	5×10^{-3} 35×10^{-6}	27×10^{-3} 187×10^{-6}	114×10^{-3} 805×10^{-6}
DC Drive Amplifier Settings DC Bus Voltage Max. Peak Current Output Fusing, Amps	40	40	80	160
Maximum Input DC Drive Power (Watts)				
Maximum Output Motor Shaft Power (Watts)	12	53	250	380
Weights Motor (Lbs.) (Kg)	1.8 0,8	3.3 1,5	8.3 3,8	20.5 9,3
Chassis U12S Lbs. Kg U12R Lbs. Kg U12H Lbs. Kg		—— —— —— —— 57 (80 with 2P12 dual supply) 26 (36 with 2P12 dual supply)	—— —— —— ——	

Table 1-3: Specifications for Unidex 12 with Aerodrive

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CHAPTER 2: UNIDEX 12 PRODUCT SUMMARY

SECTION 2-1 ABOUT THIS MANUAL

The Unidex 12 family of controllers contains many standard and optional features, organized into a highly compact structure. These features constitute both hardware (control board, DC and Stepping drives, and power supply) and a menu driven control interface, all housed in a single, highly rigid chassis.

The hardware and software control structure of Unidex 12 is designed to be highly versatile, and can perform a multitude of applications using the standard configuration.

This section summarizes the standard and optional features of the Unidex 12. References to the main body of this manual are provided to direct the user to more specific information regarding the various programming functions of the Unidex 12.

Hardware specifications (i.e., cable connections for the optional JP4 Joystick, the TDT program selection module, etc.) are contained in a separate manual (see the *Unidex 12 Motion Controller Hardware Manual*). The hardware manual provides specific information regarding the DC servo amplifier module DSL8020, Stepping translator modules D1401, D3001, DM1501, DM4001, DM4005, DMV8008 ,DMV16008, and Aerodrive modules DAV4008, DAV8008 and DAV16008, as well as information regarding the connections of external peripherals.

Information on options for Unidex 12 can be found in two other documents. They are the *Unidex 12 Motion Controller Options Manual* and the *Unidex 12 Interactive Control Software (SSP3) Manual.*

NOTE: These documents are supplied only if the given option is installed in a Unidex 12.

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SECTION 2-2 UNIDEX 12 CONTROL SUMMARY

2-2-1 FRONT PANEL CONTROL & PROGRAMMING

The Unidex 12 provides a menu-driven format to facilitate front panel programming. Every controller operation is available through the menu screens. There are no special codes or key words to remember, the operator simply makes a mode selection from the main menu, steps through the mode menu until the desired function appears, then either enters data or performs the function using the keys indicated on the display. See Part II (*Programming Unidex 12 Through Menu-Driven Front Panel*) of this manual for specific information regarding front panel programming.

2-2-2 EXTERNAL CONTROL AND PROGRAMMING

Programming commands can also be input through one of the remote interfaces to the Unidex 12. The following commands are used to construct motion programs in the Unidex 12 through the remote RS-232 serial interface (standard interface) or the IEEE-488 parallel interface (the optional interface is explained in the *Unidex 12 Motion Controller Options Manual*). Specific information regarding the external programming of the Unidex 12 through the RS-232 Interface is outlined in Part IV of this manual.

NOTE: An italic "*A*" represents any of the axes, X, Y, U, or V. The letters n and f represent decimal numbers, 0 through 9. The symbol * represents an end-of-block.

MOTION COMMANDS

AB*	Absolute mode position tracking
ADnnnn*	Accel./Decel. ramp time to nnnn milliseconds
A*A* *	Enable Velocity Profile for *A* axis
B*A**	Enable - limit for *A* axis
BXYUV*	Enable - limit for all axes

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CC*A*1vddddddddddd *A*2vddddddddddd I vddddddddddd J vddddddddddd*	CCW Circle using any two (2) axes (*A*1,*A*2). *A*1 and *A*2 distances are the incremental distances to their end points. I and J distances are incremental distances to the center.
CO*	Corner rounding mode
CW*A*1vddddddddddd *A*2vddddddddddd I vddddddddddd J vddddddddddd*	CW Circle using any two (2) axes (*A*1, *A*2). *A*1 and *A*2 distances are the incremental distances to their end points. I and J distances are incremental distances to the center.
C*A**	Disable - limit for *A* axis
CXYUV*	Disable - limit for all axes
DT*	Disable tracking display
DWnnn.n*	Dwell nnn.n seconds
ET*	Enable tracking display
E*A**	High run current for *A* axis only
EXYUV*	High run current for all axes
F*A**	Encoder verification for *A* axis
FXYUV*	Encoder verification for all axes
FIi *	Feedhold for Interrupt on line i
H*A**	Home *A* axis
HXYUV*	Home all axes
IFfffffff*	Interpolation Feedrate
IN	Incremental mode

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IXvddddddddd Yvddddddddd Uvddddddddd Vvddddddddd	4 axes linear move
JS*	Call Joystick
J*A**	Enable + limit for *A* axis
JXYUV*	Enable + limit for all axes
K*A**	Disable + limit for *A* axis
KXYUV*	Disable all axes limit
L*A*vddddddddddd*	Load *A* position register
LXvddddddddddd Yvddddddddddd Uvddddddddddd Vvddddddddddd*	Load all position 00000
M*A*vddddddddddd*	- limit for *A* axis
MXvddddddddddd Yvddddddddddd Uvddddddddddd Vvddddddddddd*	- limit for all axes
NC*	Non-corner rounding mode
ORxxxx* OSxxxx*	OUT/RUN State OUT/STOP State
PD(48 CHAR)^* PM(48 CHAR)^* PR(48 CHAR)^*	Print and Display message Display message Print message
P*A*vddddddddddd*	+ limit for *A* axis

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P*A*vddddddddddd*	+ limit for *A* axis
PXvddddddddddd	+ limit for all axes
Yvddddddddddd	
Uvddddddddddd	
Vvddddddddddd*	
RD*	Receive messages
RR	Reset all axes
R*A**	Start *A* axis
RXYUV*	Start all axes
SSn*	Send Service request #n.n
S*A**	Stop *A* axis
SXYUV*	Stop all axes
*A*Ffffffff Dvddddddddddd*	Index for *A* axis
XFffffff Dvddddddddddd	Index for all axes
YFffffff Dvddddddddddd	
UFffffff Dvddddddddddd	
VFffffff Dvddddddddddd*	
*A*Ffffffff R+ *	*A* Freerun
XFffffff R-	All axes Freerun
YFffffff R-	
UFffffff R+	
VFffffff R+ *	
ZS *	Disable velocity profile

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I/O AND PROGRAM FLOW COMMANDS

AInnIi*	Abort move on interrupt (i) and GoSub label nn
BF*	Beep Off
BInnIi*	Go to label nn on interrupt (i)
BN*	Beep On
CInnIi*	Abort move on interrupt (i) and go to label nn.
CPnn*	Call Program #nn
CSnnIvvvv*	Conditional GoSub to label #nn if Inputs = vvvv
CSnnLdd*	Conditional GoSub to label #nn if 1 of 12 line #dd is high
CSnnHdd*	Conditional GoSub to label #nn if 1 of 12 line #dd is high
CSnnM*A**	GoSub to label #nn if *A* is on marker
CSnnMXYUV*	GoSub to label #nn if all axes on marker
CSnnBvvvvvvvvvvv*	GoSub to label #nn for Binary Conditions (vvvvvvvvvvv)
CTnnIvvvv*	Conditional GoTo label #nn if Inputs = vvvv
CTnnLdd*	Conditional GoTo to label #nn if 1 of 12 line #dd is low
CTnnHdd*	Conditional GoTo to label #nn if 1 of 12 line #dd is high
CTnnMA*	GoTo label #nn if *A* is on marker
CTnnMXYUV*	GoTo label #nn if all axes on marker
CTnnBvvvvvvvvvvv*	GoTo label #nn for Binary condition
DBnnn*	BCD Digital Output (nnn)
DDnnnn*	Decimal Digital Output (nnnn)
DG*	GoTo label specified by DIO
DLdd*	Set 1 of 12 digital output lines #dd, low
DHdd*	Set 1 of 12 digital output lines #dd, high
DIvvvv*	Disable interrupt for inputs (vvvv)
DS*	GoSub specified by DIO
GPnn*	GoTo Program #nn

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GSnn*	GoSub Label #nn
GTnn*	GoTo Label #nn
ITvvvv*	Wait till input (vvvv)
LBnn*	Label #nn
LIvvvv*	Enable interrupt for inputs
OTvvvv*	Output (vvvv)
PS*	Program Stop
RCvvvv*	End repeat loop on input conditions (vvvv)
RE*	Repeat loop end
RP*	Repeat Program
RSnnnn*	Repeat loop start nnnn times
SInnIi*	GoSub label #nn for interrupt on input i
SR*	Subroutine return
* or /	End of Block (terminates block)
%	End of edit (downloading)

EDIT COMMANDS (All commands to be terminated with a <CR><LF>)

Enn*	Begin downloading program #nn. Existing program #nn will be deleted automatically
E $ nn	Delete program #nn
E $ 00	Clear program memory (all programs)
%	End edit (downloading)

SYSTEM COMMANDS (All commands to be terminated with a <CR><LF>)

PD	Print directory listing
Pnn	Print program #nn
PS	Print status bytes
P*A*	Print a axis Command position register value
P*a*	Print Encoder position
P00	Print all programs in memory

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Q	Query (serial poll); Unidex 12 returns first Status Byte
	Mode Commands
Ann	Run program #nn in Auto mode
Bnn	Run program #nn in Block mode (subsequent <LF> will execute successive program blocks)
D	Cancel R or S command
H	Put Unidex 12 in HOLD mode(Trigger required to execute program) Hold mode cancelled by O<CR>LF>
I (string)*	Execute Motion Command block (string) in the Immediate mode ("String" is any valid Motion program command; An "I" is required to precede each string)
L	Put Unidex 12 in Local-with-Remote-Enabled mode
O	Cancel Hold mode (default)
R	Enable Remote mode from Host (JP4E only)
S	Enable Joystick mode from Host (JP4E only)
U	Enable Joystick mode from Host, send SRQ on limit (JP4E only)
V	Continue after a programmed pause
W	Complete move with Encoder Verification Error
X	Quit Program under Encoder Verification Error
Z	Load Axis Calibration Table (with Axis Calibration Option only)

INITIALIZATION COMMANDS (All commands to be terminated with a <CR><LF>)

C	Reset Unidex 12 to Power Up conditions
F	Insert block (line) numbers when printing programs (for editing purposes)
G	Cancel block (line) number printing (default)
J	Set up Unidex 12 to send service request after execution
K	Cancel set-up to send service request (default)
M	Set up to transmit status in binary format (default)
N	Set up to transmit status in hex-ASCII format
T	Trigger to start program execution

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SECTION 2-3 APPLICATION PROGRAM EXAMPLE

The following application example illustrates the programming versatility of the Unidex 12 controllers.

For this example, the program is written for transmission through the external RS-232 or IEEE-488 interface. This program example could have just as easily been written in the "menu driven" format (the front panel operation).

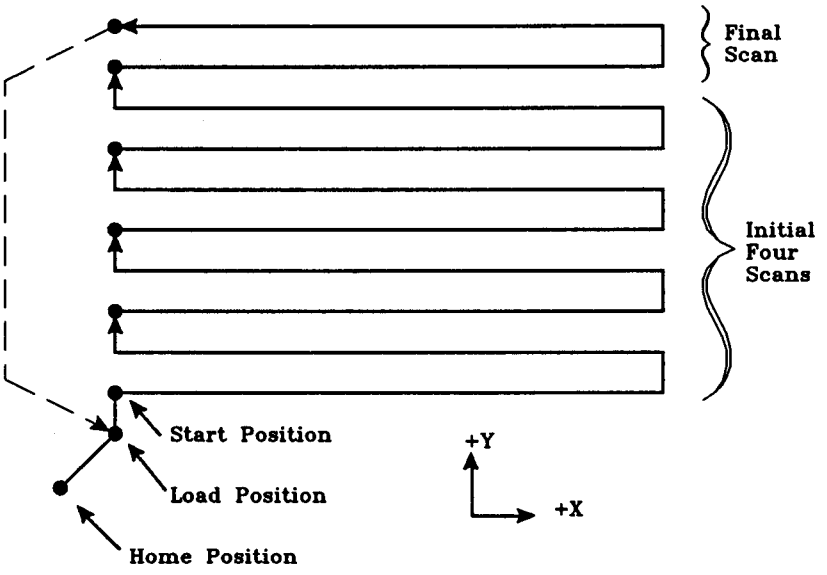
APPLICATION: A product is to be automatically inspected for flaws using an eddy current probe. Flaw parameters are to be sent to and mapped by a host computer.

SOLUTION: A two-axis Unidex 12 controls an X-Y linear stage to produce a raster scan pattern. "On-the-fly" position data is sent to a host computer via an SEO (Serial-Clock Output) option. System resolution is 0.001 in/step.

Command	Description
HXY*	Home axes
IN*	Set incremental mode
NC*	Non-corner-rounding mode
AD200*	Set Accel./Decel. ramp time to 200 mSec.
IF5000	Interpolation Feedrate 5000 steps/sec
IX400	Linear Interpolate to X axis load position
IY400*	Linear Interpolate to Y axis load position
LB10*	Label 10
OT1XXX*	Set output 01 ON to signal operator
CS15I1XXX*	GoSub label 15, if input I1 is ON (run scan)
CT20IX1XX*	GoTo label 20, if input I2 is ON (quit and go home)
GT10*	GoTo label 10
LB20*	Label 20
OTOXXX*	Turn OFF operator signal
HXY*	Home axes
PS*	Program end
LB15*	Label 15 (subroutine)

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IY200 *	Go to Start position
RS4 *	Repeat Loop Start 4 times
XF4000D4000*	
YF6000D200*	Basic scan repeated four times
XD-4000*	
YD200	
RE*	End repeat loop
XD4000*	
YD200*	Final scan
XD-4000*	
OTX0XX*	Deactivate probe
AB*	Set absolute mode
XD400	Return to load position
YD400*	
IN*	Set incremental mode
SR*	End subroutine



NOTE: An additional programming example for Unidex 12 involving menu driven (front panel) input can be found in Appendix 1 of Part II of this manual.

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SECTION 2-4 OPTIONAL ACCESSORIES AND CABLES

The Unidex 12 is available with a number of optional features to enhance its versatility. Descriptions of the major optional accessories follow:

2-4-1 HSBI HIGH SPEED BINARY INTERFACE

The HSBI uses the DIO Interface to provide an 8-bit, high-speed (up to 80KB/sec.) parallel interface that can be used with a host PC that has direct memory access (DMA) capability.

Unlike the RS-232C and IEEE-488 interfaces, motion commands are communicated with HSBI in a binary format that reduces the computational overhead time of the Unidex 12. The result is a very high performance motion controller/host computer combination.

Aerotech has available a cable accessory, model MBI, which is a shielded cable and interface circuitry assembly, specifically designed to interface the Unidex 12 HSBI port to a Metrabyte Corporation PDMA-16 high speed interface board. (See *Unidex 12 Motion Controller Hardware Manual* for more information.)

2-4-2 SEO SERIAL OUTPUT INTERFACE

The SEO (Serial Output) option makes Unidex 12 position information available for external use. CW clock, CCW clock, and Marker (or reset) signals are available with DC drives. Clock, direction, and Marker (or reset) signals are available with Aerodrive and Stepping Motor drives. All signals can be optically isolated.

Each SEO board provides outputs for two axes, so two SEO boards are needed for a three or four axes Unidex 12. The SEO option is applicable for DC Servo and Aerodrive and Stepping motor control. However, it should be noted that for DC control (through the DSL8020 Servo Amplifier module), separate CW and CCW clock signals are provided as standard output connections without the SEO option. However, these outputs are not "opto-isolated" as in the case of the SEO option. (See *Unidex 12 Motion Controller Hardware Manual* for more information.)

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2-4-3 JOYSTICK CONTROLS OPTION (MODELS JP4 and JP4E)

Two joystick options are available: standard, and enhanced. The Unidex 12's joystick options utilize the same joystick actuator featuring two-axis simultaneous control, an axis-pair select button (X and Y/ U and V), a speed change button and a bat-handle button used to execute a program. Joystick features also include:

- Control of up to 4 axes
- High/low speed select button
- Independent, programmable speed scaling of each axis
- Joystick may be activated from user program

The general purpose joystick control (JP4 option) is outlined in Part II of this manual . The JP4E option is similar to JP4, with the added capability of joystick position digitizing (four axes, allowing the host to access position registers on the Unidex 12 through program control) and control of the joystick from a host computer connected to the Unidex 12 (see *Unidex 12 Motion Controller Options Manual* for more information).

Joystick Specifications

Control Features	Direction and proportional velocity for two orthogonal axes
	High/low speed select
	Axis pair (X,Y or U,V) and feedhold select
	Program execute or position digitize select
Scaling	Programmable speed scaling per axis: 250,000:1 ratio
Size	3.9"H x 3.9"W x 4.25"D
	(99mm x 99mm x 108mm)
Weight	0.7 lbs (0,32 kg), including cable
Cable	5 ft. (1,5m) with 15-pin connector

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2-4-4 MODEL SSP-3 SOFTWARE SUPPORT PACKAGE

The SSP-3 Software Support Package is a powerful motion program development aid that harnesses the power and memory capacity of any PC/XT/AT compatible computer for use with the Unidex 12.

Menu-assisted program creation and editing make even complex multi-axis motions easy to develop. Programs can be downloaded to the Unidex 12, or run from a PC with the Unidex 12 in the Immediate mode. Motion status display, program position digitizing and program transfer and print are some of the additional capabilities of this versatile development tool. For more information, see *Unidex 12 Interactive Control Software Manual, SSP-3*.

SSP-3 Specifications

Hardware required	PC/XT/AT or compatible, running PC-DOS or MS-DOS 2.10 (or later)
Memory required	384KB minimum
Program medium	5 1/4" floppy disk
Interface	RS-232C

2-4-5 I488 COMMUNICATION INTERFACE (IEEE-488)

The optional IEEE-488 (GPIB) interface for the Unidex 12 replaces the standard RS-232C serial interface. The Unidex 12 functions as both a listener and a talker, so that interactive control and up-loading of status, data and program information to a host controller is possible. (See *Unidex 12 Motion Controller Options Manual* for more information.)

2-4-6 MODEL TDT PROGRAM SELECTOR MODULE

The TDT Program Selector Module is an inexpensive operator interface for the Unidex 12. Any of up to 99 programs can be selected and started using the TDT. With the TDT there is no risk of inadvertent program loss or alteration by the operator. (See *Unidex 12 Motion Controller Options Manual* for more information.)

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TDT Specifications

Program Selection	Nos. 01 to 99; 00 initializes the TDT
Program Entry	2-digit thumbwheels and execute button
Communication	2-segment BCD
Power	5VDC, 50mA (supplied by Unidex 12)
Size	6.25"H x 3.75"W x 2"D (159mm x 95mm x 551mm)
Weight	1.4 lbs (0,65 kg), including cable
Cable	10 ft. (3m) with connector

2-4-7 PSWD (PASSWORD) SYSTEM SECURITY CONTROL

The PSWD option allows controlled access to program editing and system parameter selections of the Unidex 12. Operator program execution and manual control are unaffected by PSWD. Password system security control is a factory selected option.

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2-4-8 INTERCONNECTING CABLES

Various types of motor to controller interconnect cabling is available with the Unidex 12.

For DC Servo, Aerodrive and Stepping motors using separate cable assemblies (disconnect at both motor side and controller side), the following cable arrangements are available.

SMS-O/	Motor-to-controller, 15 ft. (4,6m), for 50SM through 310SM motors used with U12S and U12R chassis
HP-OB/	Motor-to-controller, 15 ft. (4,6m), for 310SM motor used with U12H chassis
HP-O/	Motor-to-controller, 15 ft. (4,6m), for 1010SM motors used with U12H chassis
DC-MSO/	Motor-to-controller, 15 ft. (4,6m) for 1017 through 1410 motors used with U12S and U12R chassis
MS-O/	Motor-to-controller, 15 ft. (4,6m), for 1050 through 1410 motors used with U12H chassis

For DC Servo, Aerodrive and Stepping motors using integral cable assemblies (cable "married" into motor assembly, no motor connector). The following cable arrangements are available (where "motor" designates 50SM, 101SM, 1050LT, etc.).

(Motor)/C2/	Motor to controller, 15 ft. (4.6m) for 50SM and 101SM motors used with U12S and U12R chassis.
(Motor)/C3/	Motor to controller, 15 ft. (4.6m) for 310SM motors used with U12S and U12R chassis
(Motor)/DC2/	Motor to controller, 15 ft. (4.6m) for 1050LT motors used with U12S and U12R chassis

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(Motor)/DC3/ Motor to controller, 15 ft. (4.6m) for 1075LT and 1135LT motor used with U12S and U12R chassis

Refer to *Unidex 12 Motion Controller Hardware Manual* for information regarding connections of motor, Encoder and other feedback signals for other types of motors not commonly supplied.

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PART II

MENU-DRIVEN FRONT PANEL PROGRAMMING OF THE UNIDEX 12

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CHAPTER 1: INTRODUCTION

SECTION 1-1 GENERAL DESCRIPTION

Unidex 12 is a microprocessor-based motion controller, capable of running up to 4 axes of DC servo, open loop stepping motors, open loop with encoder verification or closed loop servo stepping motors.

This motion controller is totally menu-driven. All menus and the tracking display are shown on three liquid crystal displays (LCDs) located on the front panel. A 4 x 4 keypad is provided for program generation, editing and manual controls. Four sets of LED indicators for axes X, Y, U and V states are also located on the front panel. (See Figure 1-1.)

With the standard 30 kilo-byte battery-backed RAM, the Unidex 12 has the capacity to store approximately:

975 4 - axis moves
1275 3 - axis moves
1850 2 - axis moves
3250 1 - axis moves

This is distributed between 1 and 99 programs. The large memory in conjunction with the following features make Unidex 12 an extremely capable controller:

- Subroutines
- Repeat Loops
- Conditional and Unconditional Jumps
- User programmable Interrupts
- 20 Lines of Input /Output (Opto-22 Compatible)

A choice of Communication Interfaces; RS-232, IEEE-488 or High Speed Binary Parallel Interface, allow for very effective control from a Host Computer.

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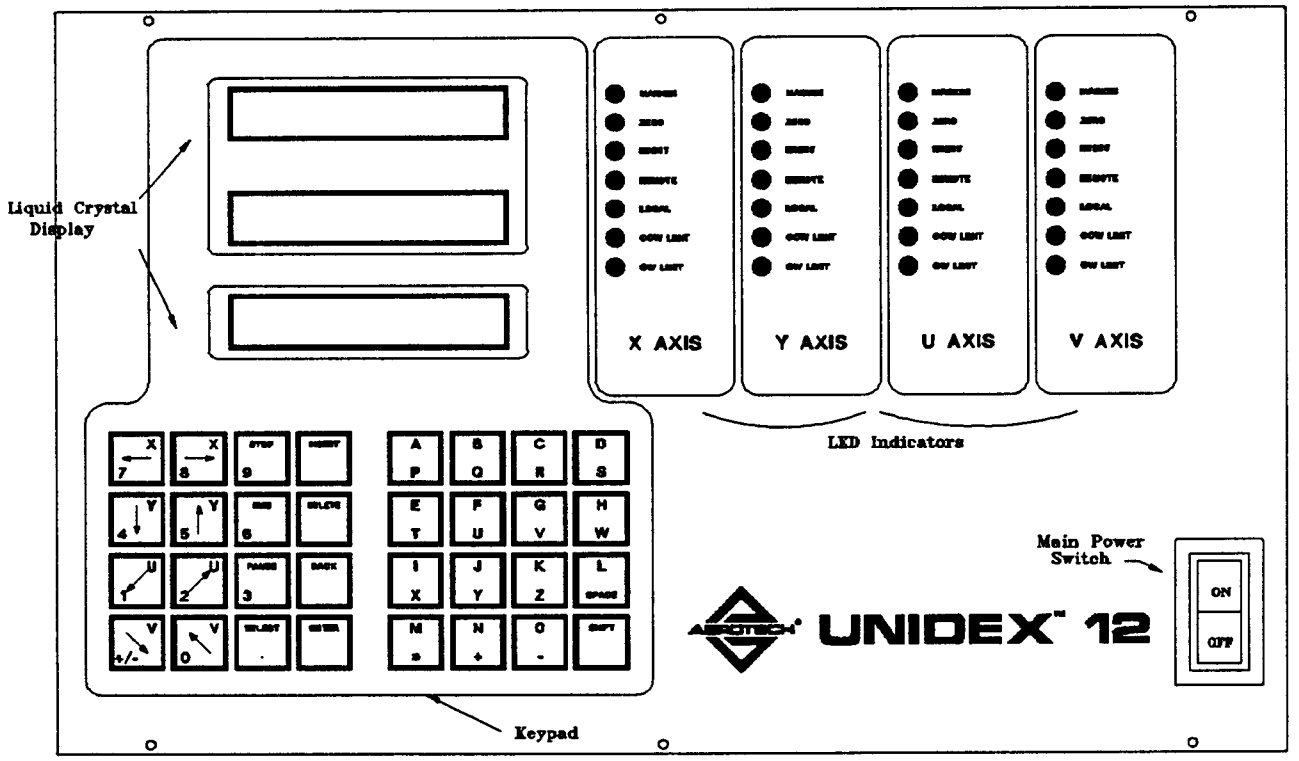


Figure 1-1: Unidex 12 Front Panel - 4 Axis (Models U12R, and U12S)

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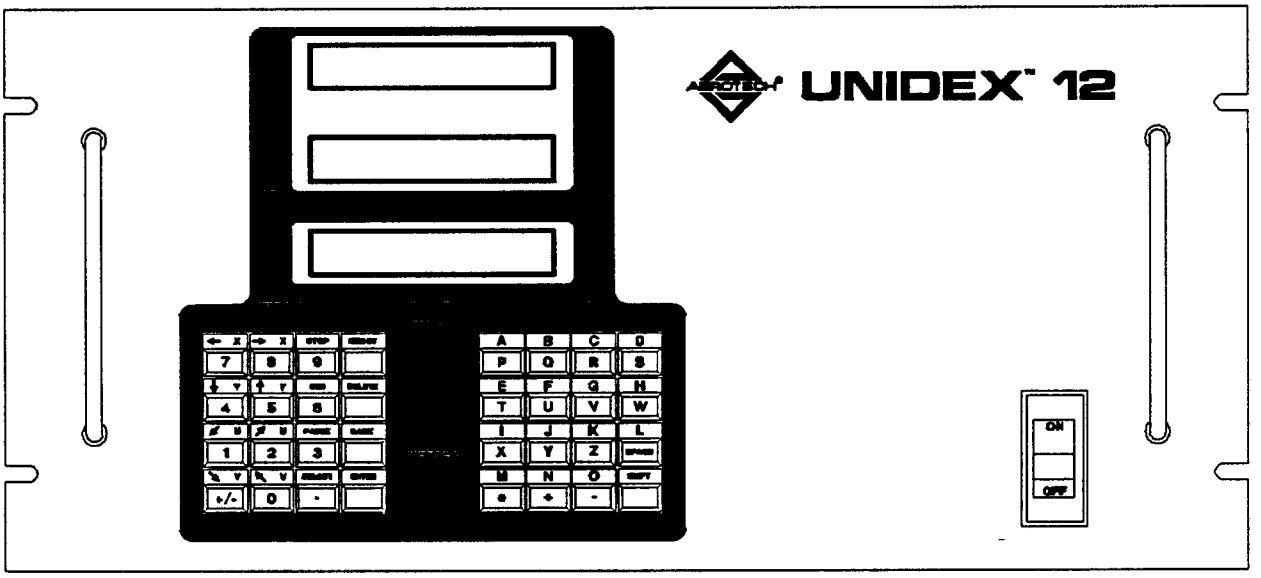


Figure 1-2: : Unidex 12 Front Panel - 4 Axis (Model U12H)

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CHAPTER 2: MODES OF OPERATION

SECTION 2-1: OVERVIEW

The Unidex 12 operates in a menu-driven format when programmed from the front panel. The mode of operation dictates what function a key will perform, i.e., the "context" of the operation determines the function of a key. The concepts involved are SCREEN, CHOICE and SELECT.

A SCREEN is a display. One screen is the Tracking Display. Other screens offer choices from a listed menu. Still other screens allow you to "fill in the blanks" with numbers. These are the three types of screens: Tracking Display, Menu and Data-Entry. Following is a typical example of each type:

TRACKING

```
j m X:0000010000    step
j m Y: 00001.5000   inch
```

MENU

```
1. HOME          2. RUN/SLEW
3. JOG/STP       4. INDEX
```

DATA ENTRY

```
RunSpd  X 0010000      Step/S
RunSpd  Y 00.5000      Inch/S
```


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The various menu screens always appear on the upper two LCDs (models U12S, U12R and U12H). Tracking and data entry screens also appear on the upper LCDs, with X and Y axes on the upper display, U and V on the lower display.

A CHOICE means to depress a number key from the listed menu (for menu screens) or to key in numbers and press ENTER (for data-entry screens). When a selection is made from a menu screen, one of the following may appear; 1) another menu screen, 2) a data-entry screen, or 3) the Tracking display, depending on the context.

In the data entry mode, the variable to be updated is indicated by a blinking character.

When a selection is made in a data-entry screen, the system "steps you along" so that you make all entries. When an item is entered, by pressing the ENTER key in the lower right hand corner, the screen is fully entered. Another screen may or may not appear, depending on the context.

The SELECT button on the keypad is used to step from screen to screen. Two cases may exist; 1) A menu screen is present, but no selection is desired. Pressing the SELECT key will step to the next screen that makes sense in the context. 2) the Tracking display is present and a Menu display is desired, or a particular data- entry screen is present and a consecutive screen is desired. Again, the SELECT key will step you along.

At times it may be desirable to reverse direction for menu selection. Just as the SELECT key allows forward movement, the BACK key allows backward movement. This is a useful function when you have stepped to a sub-mode and wish to go back to the main menu or also for menu selection while editing. When editing, the ENTER, INSERT and DELETE keys are also used as single purpose keys are dedicated to a particular function.

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SECTION 2-2 OPERATION

WARNING: PRIOR TO OPERATING THE UNIDEX 12 MOTION CONTROLLER A THOROUGH UNDERSTANDING OF THE UNIDEX 12 HARDWARE MANUAL IS NECESSARY.

Move the main power switch to the ON position. Unidex 12 will do a system initialization and a self-test. While the bottom display remains blank, the top display will show:

```
**** UNIDEX 12 ****
Version XX : NEW MEMORY
```

NOTE : "XX" represents current software version.

```
VALID AXES : X Y U V
OPTIONS :  /4E /PW /HB /AC
```

```
USER RAM FREE : XXXXX byte
Press SELECT for a MENU
```

If there is battery back-up, the following will appear:

```
**** UNIDEX 12 ****
Version XX : BATT. BACKUP
```

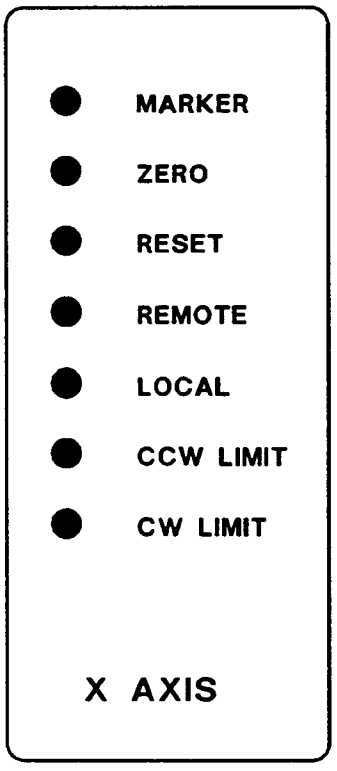
```
VALID AXES : X Y U V
OPTIONS :  /4E /PW /HB /AC
```

```
USER RAM FREE : XXXXX bytes
Press SELECT for a MENU
```


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If any of the previous messages DO NOT appear upon power-up, refer to Part II, Chapter 4 of this manual (Troubleshooting).

The Unidex 12 Motion Controller is equipped with four sets of LED Indicators, (one for each active axis). Upon power-up the LEDs should be energized as follows:



MARKER – ON or OFF, depending on presence of marker input signal (if used). *

(NOTE: This LED will stay energized if a marker is not being used.)

ZERO – ON, indicating axis at rest.

RESET – OFF, indicating axis is enabled for operation.

REMOTE – OFF, indicating external controls (optional) are inhibited.

LOCAL – ON, indicating keypad and/or RS-232C (optional) or IEEE-488 is enabled.

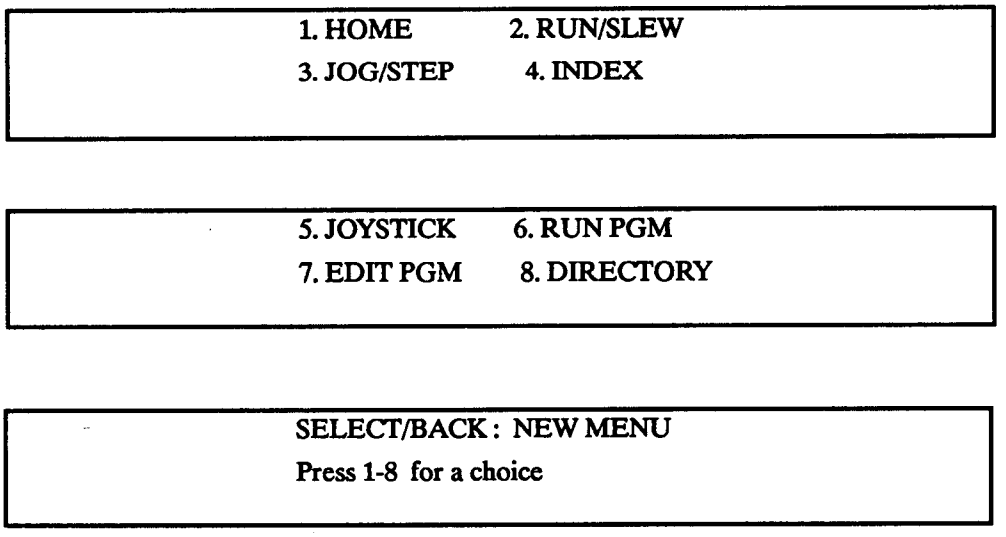
CCW LIMIT – OFF, indicating axis not in CCW limit. *

CW LIMIT – OFF, indicating axis not in CW limit. *

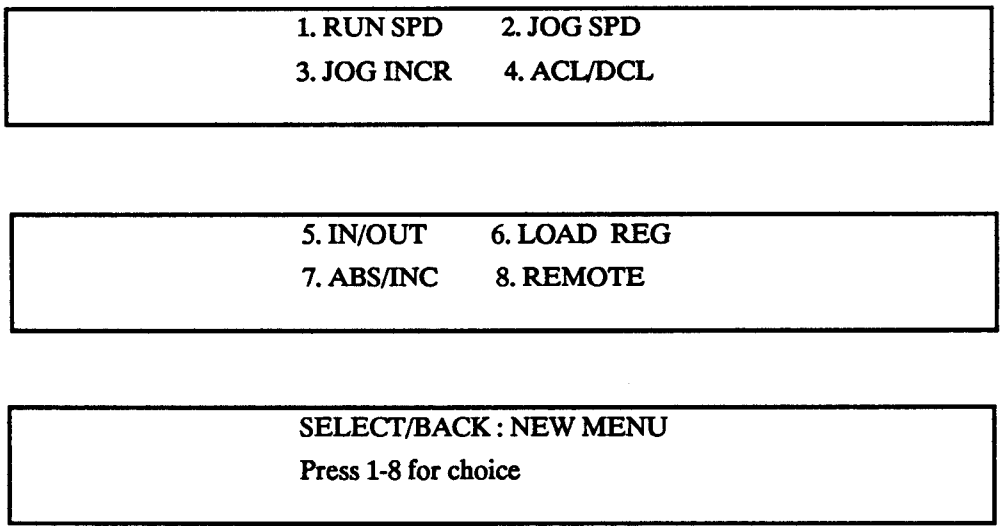
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Press SELECT. Each time you do, you will see one of the four screens of the main menu. They are:

MAIN MENU - FIRST SCREEN

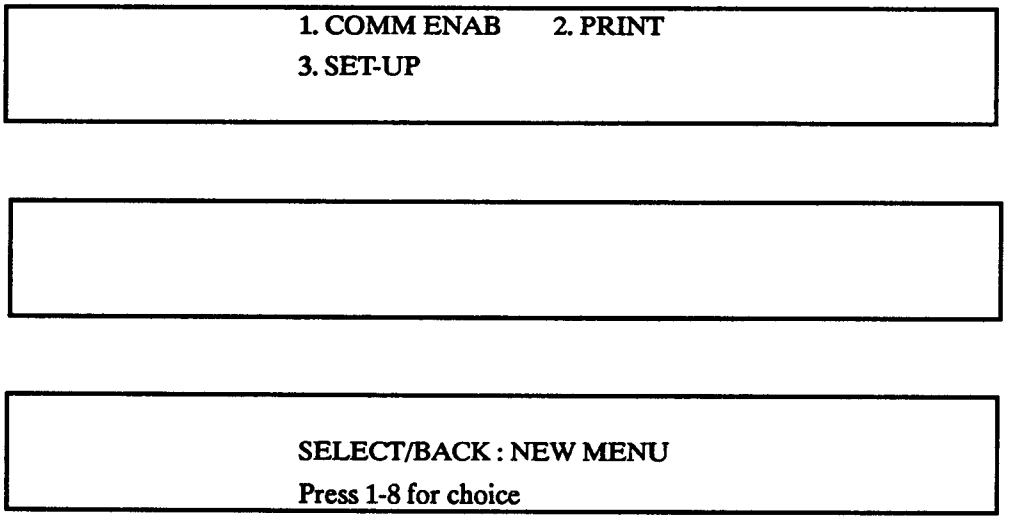


MAIN MENU - SECOND SCREEN



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MAIN MENU - THIRD SCREEN



NOTE: The EDIT Mode (First Screen) is detailed in Part II, Chapter 3 of this manual.

The ACL/DCL function (Second Screen) and RS-232 access are detailed in Parts III and IV manual.

The COMM ENAB and PRINT functions (Third Screen) are detailed Part II: Chapter 2 of this manual.

Before proceeding, note that explanations concerning axis selections will be limited to axis X and axis Y. Manual control and programming of the U and V axis will be similar. Units of distance for the various screens have been selected as millimeters (mm).

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2-2-1 FIRST SCREEN

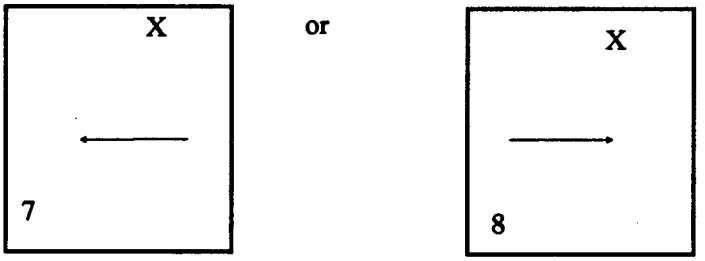
2-2-1-1 HOME

Press key #1 (**First Screen**) to see on Display #3:

"ARROW" Keys: Send Home BACK: exit STOP: abort

NOTE: Generally, displayed information is in upper case letters if denoting a specific key stroke and lower case letters if denoting a function.

The "arrow" keys on the keypad allow you to send each axis home. For instance, if either:



the X axis would be sent home and the display would show:

X AXIS IN HOME CYCLE

When "Home" is reached, the display will show:

X AXIS AT HOME

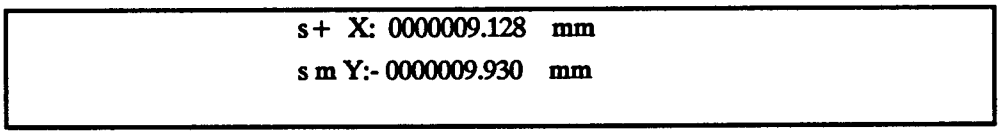
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When all Home cycles are complete, press BACK to go back to the first screen. (NOTE: It is not necessary to send all axes Home before pressing BACK.)

To abort the Home cycle, press STOP. Press SELECT to return to the First Screen.

2-2-1-2 RUN/SLEW

Pressing key #2 (First Screen) will allow you to "slew" the axes, i.e., to move them by pressing the "arrow" keys.



The system defaults to Slew (momentary run) mode indicated by "s" in the left most column of the display. Pressing an arrow key causes the relevant axis to run at a rate programmed in the RUN SPEED mode. The axis stops when the key is released. Run speeds are programmable from 1 to 999,999 steps per second in the non-accel./decel. mode. However, practical system limits dictate that feedrate be limited to a maximum of 250,000 steps/second using accel./decel. mode (see Part III of this manual).

The first +/- sign (after the "s") indicates if the + or - axis key is being depressed. This sign disappears after the axis key is released. The second +/- sign (before the step value) indicates if the axis position is positive or negative with respect to the absolute position of zero.

The "m" is a marker monitor and its presence indicates that a marker is present. (For more information on the marker input connection, see *Unidex 12 Motion Controller Hardware Manual*).

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If the RUN key is pressed once in the slew mode, the system switches to a free-run mode, indicated by "r" in the left most column of the Tracking display. In this mode, an arrow key will start an axis running in the required direction. The "+" or "-" sign will appear next to the "r". The STOP (#9) key will stop all axes motion, and display the position registers. Press SELECT to get back to the first main menu. The keys on the right-most column (INSERT, DELETE, BACK, ENTER) of the keyboard may be used to stop the axes free-run also. Each key stops the corresponding axis within the same row. For example, pressing INSERT will stop the X axis free run. Look at the letter in the left column of the display to see a change in status from "r" to "s". The axis will now be back in the slew mode. Each axis may be in the slew mode or the run mode, regardless of the other axes.

The RUN key will put the system in the free-run mode. When an axis is running, the appropriate arrow key will "bump up" (through the "→" arrow key) or "bump down" (through the "←" arrow key) the run speed by about 6% (depending on resolution) each time it is pressed. The current run speeds may be viewed by pressing the SELECT key. Both the Run and Slew modes allow you to toggle between the Run Speed screen and the Tracking Display screen through the SELECT key, and the Run mode allows you to "bump up" and "bump down" the Run Speed through the +/- arrow keys.

Press the BACK key to return to the Main Menu First screen if no axis is in motion. If all axes are stopped via the STOP key, pressing SELECT will return you to the Main Menu First screen. If all axes are stopped via the keys in the right-hand column, pressing BACK will return you to the Main Menu First screen. To leave one or more axes free-running and return to the first screen, press key #3. When any of the axes is in the free run mode, some of the normal choices within the menu screens are not available. The system indicates this by displaying the following screens whenever these choices are disabled:

```
Axis In Motion
Press BACK To Quit
```


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2-2-1-3 JOG/STEP

Press key #3 (First Screen) to enter the Jog mode. Pressing directional (arrow) keys causes a relevant axis to move a preselected number of steps in the selected direction. The number of steps is programmable from 1 to 1,000,000 in the JOG INCREMENT mode (explained later). The jog speed is programmable in the JOG SPEED mode (explained later), from 1 step/sec to 250,000 steps/sec. with a resolution of 1 microsecond.

The Tracking display is active during any axis motion. A letter "j" on the left column indicates the Jog mode. A sign "+" or "-" indicates the actual direction of motion while the axis is in motion. The system units are displayed on the right portion and may include steps, mils, inches, nanometers, microns, millimeters, centimeters, meters, steps, degrees, arc seconds, and arc minutes.

```
j m X: 000000.000  mm
j m Y: 000000.000  mm
```

Press BACK to return to the first Main Menu.

2-2-1-4 INDEX

INDEX provides an immediate execution of an axis move. Press key #4 (First Screen) to see:

```
1. Point to Point
2. Linear Interpolation
```

```
3. Circular Interpolation
4. Vector Feedrate
```

2-2-1-4-1 POINT TO POINT

Select key #1, Point to Point, to see:

```
X
Y
```


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If one of the axes is already in motion (free-running), the screen instead will be:

```
*WARNING* Axes in Motion
ENTER: continue  BACK: quit
```

If ENTER is pressed, free-run information is displayed. New feedrate data may be entered at this time. NOTE: If this data contains the number 9 (STOP key), the free-run will be aborted and the position registers will be displayed. (Entering data is explained in the following paragraphs.)

If the none of the axes is in motion, the display will be as shown below. Choose an axis by pressing the appropriately labeled key. For example, press X:

```
X
Y
```

The axis chosen will begin to flash on the display. Press ENTER. The X axis feedrate is now displayed and flashes to indicate that you may enter the feedrate data (up to 6 digits).

```
X F 001.000
Y
```

To enter the default data, press ENTER. To enter a new value, enter digits. All feedrates are 6 digits in system units/second. When digits are entered, they will be displayed from right to left. Pressing DELETE will delete the last digit entered. Press BACK to bring back the previous data or press ENTER to enter the new data.

NOTE: The minimum feedrate resolution of Unidex 12 is 1 microsecond. Unidex 12 rounds a feedrate down to the nearest microsecond. Therefore, the feedrate accepted and displayed by Unidex 12 may be slightly different from what was keyed in on the keypad. For example:

30000 steps/sec Keyed In
30303 steps/sec Accepted and Displayed

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After entering feedrate data, press ENTER. You will now see:

```
X F 002.000 D 000000.000
Y
```

D begins to flash, indicating that the distance data may now be entered (in 9 digits). The +/- key may be used to convert distance data to negative or positive numbers.

At this point, an axis free-run may be chosen instead of linear distance, by pressing INSERT. If you press INSERT, you will see:

```
X F 002.000    RUN CW
Y
```

The +/- key may now be used to toggle between CW and CCW . Press +/- to see:

```
X F 002.000    RUN CCW
Y
```

Press ENTER to complete X axis Index entry.

The Y, U and V axes Index information may be entered in the same fashion. After entering all indexing data, press ENTER again to see:

```
Press: RUN to execute
     : BACK to quit
```

NOTE: In any manual mode, the RUN and BACK selection shown above is always available.

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Press RUN to run the axes and show the Tracking display.

Once a manual Index is complete, the Index command information is retained. Pressing key #4 at the first Screen, and then selecting one of the options will display the retained data. Press ENTER and RUN to re-execute or ENTER and BACK to quit.

If an axis is set in the free-run mode external to the manual Index operation, the new status of the axis is reflected when the Index screen is next brought up. The indexing distance information from the previous Index operation is retained and may be recalled when the axis stops the free run.

Press BACK to quit the Index mode and go back to the first sub-screen of the Index Function.

When axes are in motion, press STOP to abort all motion and display the position registers. Pressing STOP aborts Free-Runs, Indexing and Home cycles. Press SELECT to return to the first Main Menu. A Feedhold (explained later) is also available to temporarily halt motion.

Also available is a softkey stop. In Jog, Manual Index and Program Run, pressing PAUSE acts as a Feedhold. It will not, however, stop a Home cycle. It may stop a Free-Run, depending on what has been selected in the Set-up mode.

When motion is stopped via the PAUSE key, pressing RUN will continue motion.

2-2-1-4-2 Linear Interpolation

Select key #2 to see:



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The Unidex 12 computes the Axis component feedrate by applying the following formulas:

$$\text{X Component Feedrate} = \frac{(\text{Interpolation Feedrate}) \times (\text{X Distance})}{\sqrt{(\text{X Distance})^2 + (\text{Y Distance})^2}}$$

$$\text{Y Component Feedrate} = \frac{(\text{Interpolation Feedrate}) \times (\text{Y Distance})}{\sqrt{(\text{X Distance})^2 + (\text{Y Distance})^2}}$$

$$\text{Interpolation Distance} = \sqrt{(\text{X Distance})^2 + (\text{Y Distance})^2}$$

NOTE: See Part II: Appendix 1 Sections B and C for Programming examples.

2-2-1-4-3 Circular Interpolation

The Unidex 12 implements Circular Interpolation by dividing the proposed arc into manageable linear segments. Processing time limitations require that the minimum segment size be executable in 4 mSec and with a minimum distance of 0.3516 degrees (angle subtended at the center).

Example:

An arc is desired having a 1" radius at 1"/second Interpolation Feedrate.

Angular Velocity = 1 rad/ sec = 57.3 deg/sec = $(\frac{360°}{2\pi})$

Angle traveled in 4mSec = 0.229 deg., mi nimum distance permitted is 0.3516 deg. so the minimum axis segment time is 6 mSec.

Press Key#3 to see:

AXIS : 000000000 AXIS : 000000000

I Value J Value

Circular Move: CW [0001]

All Distances Are Incremental

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Press the SELECT key. Press the appropriate axis key. Press ENTER.

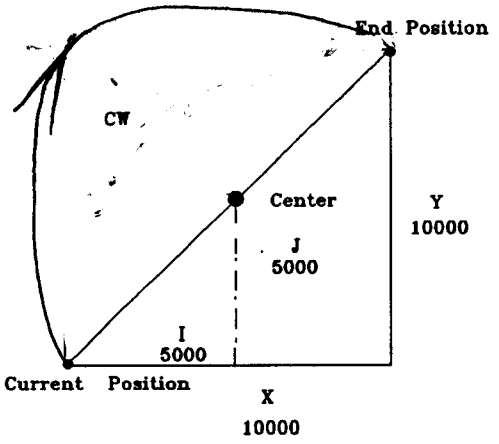
Key in the desired axis values. The axis values are the incremental distances to the end point of the arc. Press ENTER. Repeat the procedures for the second axis. (See illustration below)

Press ENTER to move to I VALUE. The I VALUE is the incremental distance to the center of the arc along the first axis. Key in the desired I VALUE number. Press ENTER to move to the J VALUE. The J VALUE is the incremental distance to the center of the arc along the second axis. (See illustration below)

Press ENTER to move to the Circular Move selection. Use the +/- keys to select either a CW or CCW move, press ENTER to save the block.

This command will move any two axes in a circular path.

NOTE: See Part II: Appendix 1 Sections B and C for Programming examples.



use +/-

I + J is value from starting point to center of the arc

$$R^2 = (I^2 + J^2) = (X-I)^2 + (Y-J)^2$$

2-2-1-4-4 Interpolation Feedrate

The Interpolation Feedrate is the Feedrate desired for travel from the Current Position to the End Position. Interpolation Feedrate may be entered to two decimal places (1% resolution).

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Select key #4 to see

ENTER 000000000FEEDRATE

Press SELECT/BACK to return to the Index sub-menu.

2-2-1-5 JOYSTICK (JP4 OPTION)

Press key #5 JOYSTICK, to see:

1. X/Y axis 3. Divisor 2. U/V axis 4. SEL PGM

5. Digitize

Press #1 to enable the Joystick to move the X and Y axes, the Tracking mode is also enabled at this time. ("jk" indicates the Joystick Tracking display mode.)

Press key #2, U/V axis, to enable the U and V axis.

jk X:000000.145 mm jk Y:000000.000 mm

SELECT: Change axis pair DELETE: zero BACK: exit

Press key #3 DIVISOR, to enter a new joystick frequency Divisor.

The display will be:

Freq.Dvsr. X: 000020 Freq.Dvsr. Y: 000020

Enter Numeric Value Press BACK to exit

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Press key #4, SEL PGM, to enter a program number to be run from Button "C" of the Joystick. If a program number is not entered the default program (program #01) will be executed. The display will be:

JOYSTICK PROGRAM: #01 SELECT: alter BACK: quit

Press SELECT to see:

Input Program #

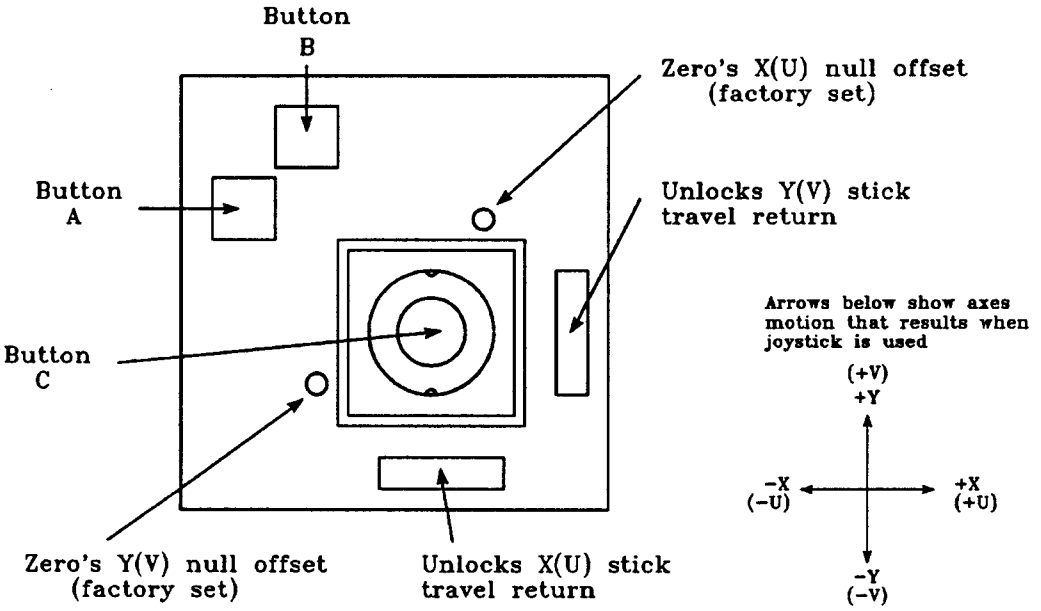


Figure 2-1: Unidex 12 Joystick

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Press BACK to return to the Joystick sub-screen, then BACK again to go to the sub-screen of the Main Menu.

When in the Joystick Tracking display screen, Button "A" allows you to toggle between two axis groups (X:Y or U:V). (One beep indicates X:Y active; two beeps indicate U:V active.) (Feedhold performs the same function as Button "A" during the Joystick mode, i.e., selects an axis group.) During program execution, Button "A" acts as a Feedhold (explained later).

Pressing Button "B" will decrease Joystick speed by a factor of 64 multiplied by the frequency divisor set for the given axis (explained later). Pressing Button "B" again will return the Joystick to the original divisor.

Button "C" executes a program from the Joystick. Button "C" will not allow a program to run until an axis group has been selected by pressing key #1 or key #2. This button is also used for digitizing when using the Joystick Digitizing option (see Digitizing option, JP4E, in the *Unidex 12 Motion Controller Options Manual*).

When in the Joystick screen, press #3, DIVISOR, to see:

```
Freq.Dvsr. X: 000020
Freq.Dvsr. Y: 000020
```

This number may contain up to 6 digits. It is the number by which the Joystick frequency is divided. The default number is 20. (If an odd divisor is entered, Unidex 12 will round it down to an even number.)

To increase the full scale speed of the Joystick, decrease the number (which can be decreased to a low of 2).

To decrease the speed, increase the number (which can be increased to 999,998).

The number entered divides the base (full scale) output frequency of the Joystick (approximately 360 KHz).

Data is entered and deleted as mentioned previously in the RUN SPEED section.

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To increase the Joystick frequency divisor by a factor of 64 times the selected divisor number (which decreases Joystick speed —frequency Divisor screen will show this modification), press Button "B". Since this button toggles, pressing "B" again will reactivate the previous frequency. This function is particularly useful because it enables you to toggle between traverse speed and precision speed.

From within the Joystick screen, press SEL PGM key (#4) to see:

```
JOYSTICK PROGRAM: #01
SELECT: alter  BACK: quit
```

To enter another program number, press SELECT and enter the number. Press BACK to re-enter the Joystick mode. To execute a program from the Joystick mode, select an axis group through key #1 or key #2 and press the button on the top of the Joystick (Button "C").

Once a program is executed, Button "A" may be held down to stop the program (Feedhold). The program will continue once Button "A" is released. This button is always active and will act as a Feedhold even during normal program execution or manual indexing, i.e., that which has been initiated from the front panel. After executing the program, Unidex 12 returns to the Joystick mode. If any axis is in the Free Run mode upon returning to the Joystick mode, those axes will be stopped and the position registers will be updated.

To change the program to be executed, press SELECT to see:

```
Input Program #
00
```

A program number (1-99) may now be entered. If a program number is entered which is not in memory, the display will be:

```
INVALID PROGRAM      #nn
SELECT: alter      BACK: quit
```

Press SELECT to enter a new program number.

Press BACK to go back to the Joystick screen. Press BACK again to return to the Main Menu then SELECT to go on to the third Main Menu screen.

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2-2-1-6 RUN PROGRAM

Press key #6 to select RUN PGM, the display will be:

```
1. AUTO EXECUTE PGM
2. BLOCK EXECUTE PGM
```

2-2-1-6-1 PROGRAM RUN - AUTO RUN MODE

Press key #1 to execute a program in the AUTO mode.

The display will be:

```
Input Program #
00
```

Enter the program number and press ENTER. (A program number must be entered, in order to be able to select RUN or BACK, as shown below. This mode cannot be exited in any other fashion.)

```
RUN: Start exec. Auto
(Press BACK to quit)
```

Press RUN to execute the program from start to end. Once the program run is complete, press BACK to re-enter the first Main Menu screen.

The STOP key, #3, or the PAUSE key may be used to stop or delay program execution. Press BACK to re-enter the first Main Menu screen.

If an axis is free-running when a Program Run (either Block Run or Auto Run) is requested, the following screen will be displayed:

```
**WARNING** Axes in motion
ENTER: continue   BACK: quit
```

Press ENTER to see:

```
Input Program #
nn
```


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If the program title contains the number 9, which makes necessary pressing the #9 (STOP) key, the Free-run will be aborted.

When in the Auto mode and running a program, press SELECT to switch to the Block mode. The program will halt at the end of the current block. RUN may then be pressed to execute the next block.

To return to the Auto mode, press SELECT again and then RUN to start execution.

2-2-1-6-2 PROGRAM RUN - BLOCK RUN MODE

Press key #2 to execute a program in the Block mode. The display will be:

```
Input Program #
00
```

Enter the program number and press ENTER. (A program number must be entered, in order to be able to select RUN or BACK, as shown below. This mode cannot be exited in any other fashion.)

```
RUN: Start exec. Block
(Press BACK to quit)
```

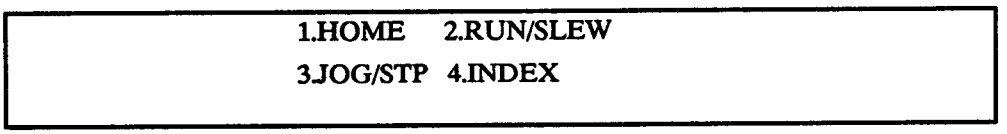
RUN will execute the first block of the program. Successively pressing RUN will execute the program one Block at a time.

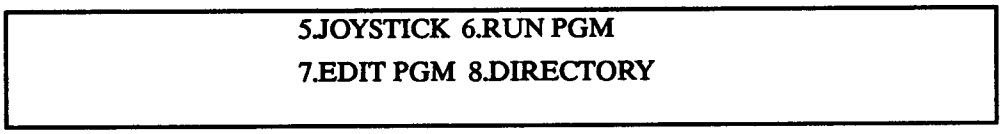
When executing a program in the Block Run Mode, a "b" will appear on the display in the left-hand column beside each axis. This indicates the Block Run Mode. Press RUN to execute the first block of the program. A "c" will appear in the left-hand column, indicating "continue". Press RUN to execute each subsequent block. When the final block has been completed, a "d" will appear in the left-hand column, indicating "done". Press RUN to start the program again. Press BACK to re-enter the first Main Menu screen.

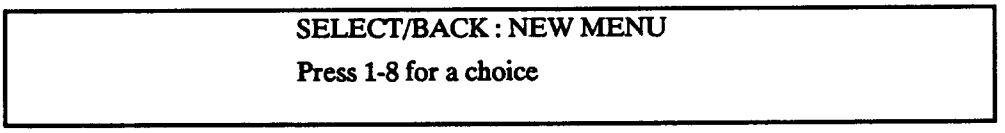
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2-2-1-7 EDIT PROGRAM

The purpose of the EDIT mode is to enter a new program or to edit an existing program. Press SELECT to return to the Main Menu's first sub-screen.





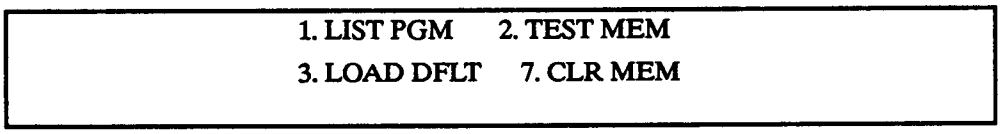


Press key #7, EDIT PGM.

Refer to Part II, Chapter 3 of this manual for a detailed description of the Edit mode.

2-2-1-8 DIRECTORY

From the Main Menu's first sub-screen, press key #8, DIRECTORY, to see:



NOTE: CLR MEM has been given the number 7 purposely to avoid the possibility of the user inadvertently pressing the CLR MEM key and clearing the entire memory.

2-2-1-8-1 LIST PGM

Press key #1, LIST PGM, to see:



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DIRECTORY LISTING SELECT: list BACK: quit

In the example above, the directory contains 3 programs. If there are more than ten (10) programs in memory the display will be:

02, 05, 10, 12, 13, 15, 22, 25, 30, 21, more

Press SELECT to see successive pages. The last page will say "End" instead of "More".

Press BACK to return the DIRECTORY sub-menu.

2-2-1-8-2 TEST MEMORY

Press key #2, TEST MEM, to initiate a memory test. The memory will be tested and the free byte space displayed.

Tested & Saved Memory Free: 30000 BYTES

Press BACK to return to the DIRECTORY sub-menu.

2-2-1-8-3 LOAD DEFAULT

Press key #3, LOAD DFLT, the display will show:

DEFAULT VALUES LOADED Press BACK to quit

Any default values that have been altered are re-entered by this function. The Load Default function re-loads the default values into the Unidex 12 with one function rather than requiring the user to re-enter the values one-at-a-time. The Default values for all axes are listed on the following pages:

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DEFAULT VALUES

Jog Increment	10,000 Units/Second
Run Speed	10,000 Units/Second
Jog Speed	10,000 Units/Second
Joystick Divisor	20
Joystick Program	01
Outputs	Active Low
Free-Run Axis	Will not stop on Feedhold or Limits
Print	No Block #
Accel./Decel.	Linear Profile
Beeper	Enabled
IEEE Parallel Poll Response	1
Baudrate	1200
Stop Bits	1 Bit
Parity	No
Word Length	7 Bits
Start/Stop	500 Steps/Sec
Accel./Decel. Time	250 msec ramp time
Axis Conversion Factor	1
Unit Label Default	Step
Device Address	00
DIO Port Configuration	Input
Boot Program	00
Axis Encoder Ratio	4
Axis Encoder Margin	20

NOTE: Units = mm, microns, etc. (including fractions of units)

If your system is not equipped with a battery-backed memory, Unidex 12 will always revert to default values upon power up.

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Press BACK to return to the DIRECTORY sub-menu.

2-2-1-8-4 CLEAR MEMORY

Press key #7, CLR MEMORY, to see:

DELETE: clear memory BACK: quit

Press BACK to return to the DIRECTORY sub-menu.

Press DELETE to see:

Tested & Cleared Memory Free: 30000 BYTES

Press BACK to return to the Main Menu's sub-menu.

2-2-2 MAIN MENU - SECOND SCREEN

The Main Menu's Second Screen is:

1. RUN SPD	2. JOG SPD
3. JOG INCR	4. ACL/DCL

5. IN/OUT	6. LOAD REG.
7. ABS/INC	8. REMOTE

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2-2-2-1 RUN SPEED

Press key #1, RUN SPEED, to see:

RunSpd X 010.000 mm/s
RunSpd Y 010.000 mm/s

The X is blinking when the screen initially comes up. To enter the Default data, press ENTER. To enter a new value, enter digits. All Feedrates are 6 digits in system units/second. When digits are entered, they will be entered from right to left. Pressing DELETE will delete the last digit entered. Pressing BACK will bring back the previous data. Pressing ENTER will enter the new data.

Press BACK to return to the Main Menu Second screen.

2-2-2-2 JOG SPEED

Press key #2, JOG SPD to see:

JogSpd X 010.000 mm/s
JogSpd Y 010.000 mm/s

See Section 2-2-2-1, for data entry procedures.

2-2-2-3 JOG INCREMENT

Press key #3, JOG INCR, to see:

JogInc X 0010.000 mm
JogInc Y 0010.000 mm

This is the distance the axes will jog when in the Jog mode. The distance may be up to 7 digits in system units.

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The jog distance can only be entered through the respective axes' arrow keys. Each time an arrow key is pressed the distance is incremented (in either a positive or negative direction, depending, on the arrow key pressed). The increments are: 1, 10, 100, 1000, and 100000.

Press BACK to return to the Main Menu's Second screen.

2-2-2-4 ACCEL./DECEL.

Press key #4, ACL/DCL to program the acceleration and deceleration parameters.

See Part II, Chapter 4, of this manual for a detailed description of ACEL./DECEL.

2-2-2-5 INPUT/OUTPUT

Press key #5, IN/OUT, to see:

```
1. Output      2. Input
3. Out: Stop   4. Out: Run
```

```
5. D/O BCD     6. D/O DEC
7. D/O 1-12
```

```
BACK To Main Menu
Press 1-8 for a choice
```


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2-2-2-5-1 OUTPUT

Press key #1, OUTPUT to see,

```
OUTPUT (0,1,x & SELECT)
01:X 02:X 03:X 04:X
```

01 will be flashing, indicating that the output may now be changed. Connections for outputs 02 through 04 are located on the Interface Board located at the back of the unit.

Press SELECT to go to the Output to be changed. Enter 0 for a 0 Output, 1 for a 1 Output and X (key 7 or 8) for a "don't care" output, which leaves the output unchanged.

Press ENTER to see:

```
Press:RUN to execute
   :BACK to quit
```

Press BACK to cancel the new data and return to the INPUT/OUTPUT submenu. Press RUN to enter the new data and return to the INPUT/OUTPUT submenu.

2-2-2-5-2 INPUT

From the IN/OUT sub menu, press key #2, INPUT, to see:

```
INPUTS      OUTPUTS
I4 - I1:1111  04-01: 0000
```

```
DIO PORT LEVELS
(msb) 111111111111    (1sb)
```

```
BACK: To Main Menu
Press 1-8 for a choice
```


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This mode allows the Unidex 12 to monitor inputs in real time and to display a 0 or 1, depending on the status of the inputs (connections for I1 through I4 are located on the Interface board on the back of the unit.) This information is available to you as long as you remain in the Input mode.

NOTE: For information regarding the connections to the I/O (Input/Output)port, refer to the Unidex 12 Motion Controller Hardware Manual.

Press BACK to return to the INPUT/OUTPUT sub-menu.

2-2-2-5-3 OUT/STOP or OUT/RUN

From the I/O sub-menu, press key #3, Out: Stop, to see:

```
OUT/STOP (1,0,X & ENTER)
01:X 02:X 03:X 04:X
```

Press key #4, Out:Run, to see:

```
OUT/RUN (1,0,X & Enter)
01:X 02:X 03:X 04:X
```

Values are entered as they were for the the OUTPUT mode Item 2-2- 2-5-1. The values entered are not output immediately, but will be stored within the system to be output when program motion is stopped through the STOP key (or by activating the Feedhold Input) and when the program motion is continued through the RUN key (or by deactivating the Feedhold Input). These values are modal and will stay in effect until changed by the user or by running a program.

As mentioned in Item 2-2-2-5-1 OUTPUT, once the OUT: STOP or OUT: RUN data is entered, the following menu is displayed:

```
Press: RUN to execute
: BACK to quit
```


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Press BACK to cancel the new data and to return to the I/O sub- menu.

Press RUN to enter the new data and return to the I/O sub-menu.

When in the I/O sub-menu, press BACK to enter the Main Menu's Third Menu.

2-2-2-5-4 DIGITAL/OUTPUT BINARY CODED DECIMAL (D/O BCD)

Press key #5, D/O BCD, to see:

```
BCD DIGITAL OUTPUT #
000
```

Connections for Digital Output (1-12) are located on the Interface Board on the back of the unit.

Key in the BCD number (0-999), then press ENTER to see:

```
Press: RUN to execute
: BACK to quit
```

Press BACK to cancel the new data and return to the I/O sub-menu.

Press RUN to enter the data and return to the I/O sub-menu.

2-2-2-5-5 DIGITAL OUTPUT DECIMAL

Press key #6, D/O DEC, to see:

```
DECIMAL DIGITAL OUTPUT #
0000
```

Connections for the Digital Outputs (1-12) are located on the Interface Board at the back of the unit.

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Key in the Decimal number (0-4095) and press ENTER to see:

Press: RUN to execute : BACK to quit

Press BACK to cancel the new data and return to the I/O sub-menu. Press RUN to enter the new data and return to the I/O sub-menu.

2-2-2-5-6 DIGITAL OUTPUT 1 of 12

Press key #7, D/O 1 of 12, to see:

1 of 12 Digital Output Line #00 is L

Connections for the Digital Outputs (1-12) are located on the Interface Board at the back of the unit.

Enter the Digital Output line (1-12) number and using the +/- key, set the Logic Level to Low (L) or High (H).

Press ENTER to see:

Press: RUN to execute : BACK to quit

Press BACK to cancel the new data and return to the I/O sub- menu. Press RUN to enter the new data and go back to the I/O sub-menu.

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2-2-2-6 LOAD REGISTER

Press key #6, LOAD REG, of the Main Menu's Second Screen to see:

Load X:
Load Y:

This mode presets the absolute Position Registers. Press any two arrow keys of a given axis to select the desired register (X,Y) or (X,Y,U or V for a four axis controller). The appropriate axis will start to blink on the display and you may now enter up to 9 digits (positive or negative). The position set through this command may be used to establish a temporary reference point when using the absolute mode.

The default value of the Position Registers is zero. For example; Jog the X axis to a specific point, go into the Load Register mode, press the X axis arrow key and then press ENTER, the value of zero will be automatically loaded into the X axis Position Register. In the Absolute mode, after the Position Registers have been loaded, entering a distance value of zero for the X axis will return it to that point.

Once the Load Register values are entered, press ENTER again. Press BACK to cancel the new data and return to the Main Menu's Second Screen. Press RUN to enter the new data and return to Main Menu's Second Screen.

2-2-2-7 INCREMENTAL/ABSOLUTE

The Incremental mode provides for axis movement in distance increments. Whenever a distance unit is encountered within a program the controller will move the axis the distance specified, referencing from the current position. For example, if a distance is repeated the axis will again travel that amount.

The Absolute mode provides for axis movement relative to the position on the X/Y or U/V coordinates to which the axis must travel. For example, once axis movement has occurred for a specified distance, another distance command of the same value will cause no movement, since it is already at that position.

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Press key #7, INC/ABS to see:

Inc/Abs (+/- & Enter)
INCREMENTAL

Pressing +/- causes the Unidex 12 to toggle between the Absolute and the Incremental modes.

The INC/ABS command is modal, i.e., one that stays in effect until it is changed or the Unidex 12 is powered down. The default command is determined by the Set Up as described in a previous section.

Press ENTER to enter your selection. Once ENTER has been pressed, the "RUN To Enter" or "BACK To Quit" display will return. BACK will cancel the entry and return you to the Main Menu's Second Screen. RUN will enter the selection and return you to the Main Menu's Second Screen.

2-2-2-8 REMOTE

Press key #8, REMOTE, to see:

RUN: Go to Remote Mode
STOP: Reset BACK: quit

The Remote mode allows optional external clock and direction signals to Aerodrive, Stepper Drives or DC Drives. These connections are made at the back of the unit. Refer to the Unidex 12 Motion Controller Hardware Manual for more information.

Press STOP to reset all axes. All axes are held in the Reset mode until BACK is pressed. Reset status is evidenced by the illumination status of the Reset LEDs of each axis.

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Press RUN to see:

```
rtm X: 000000000  mm
rtm Y: 000000000  mm
```

The external clock and direction control connections control the Tracking displays for each axis. (Note that when in this mode, the "Remote" LED indicators for each axis are energized.) The internal position registers of the Unidex 12 are updated this mode (i.e., alternating between Remote and Local mode does not alter position Tracking).

Press BACK to return to the Main Menu's Second Screen.

2-2-3 MAIN MENU - THIRD SCREEN

The Main Menu's Third Screen is:

```
1. COMM. ENAB     2. PRINT
3. SET-UP
```

```
SELECT/BACK : NEW  MENU
Press 1-8 for  a  choice
```

2-2-3-1 COMMUNICATION ENABLED

Selection of Key #1 of the Main Menu Third Screen, COMM. ENAB provides for initialization of the RS-232 Interface/IEEE-488 Interface option.

A detailed functional description is provided in Part IV, Chapter 3.

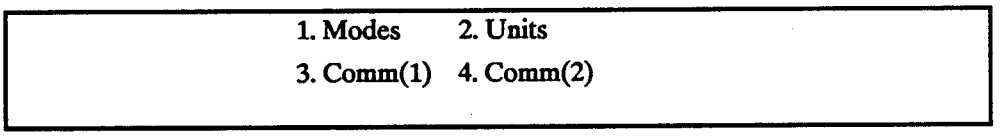
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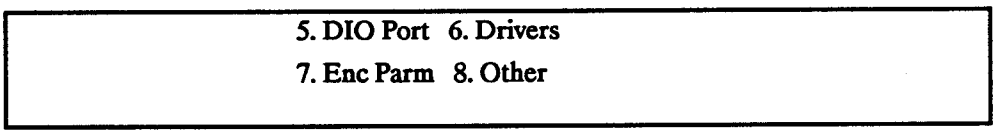
2-2-3-2 PRINT

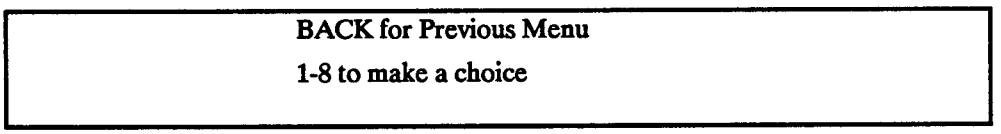
Selection of Key #2 of the Main Menu Third Screen, PRINT, provides various Print related selections available when a output device is connected to the RS-232 Interface option. A detailed functional description is provided in Part IV, Chapter 2.

2-2-3-3 SET-UP

The Set-Up mode provides for the set-up of a variety of system parameters. Press key #3, SET-UP, to see:





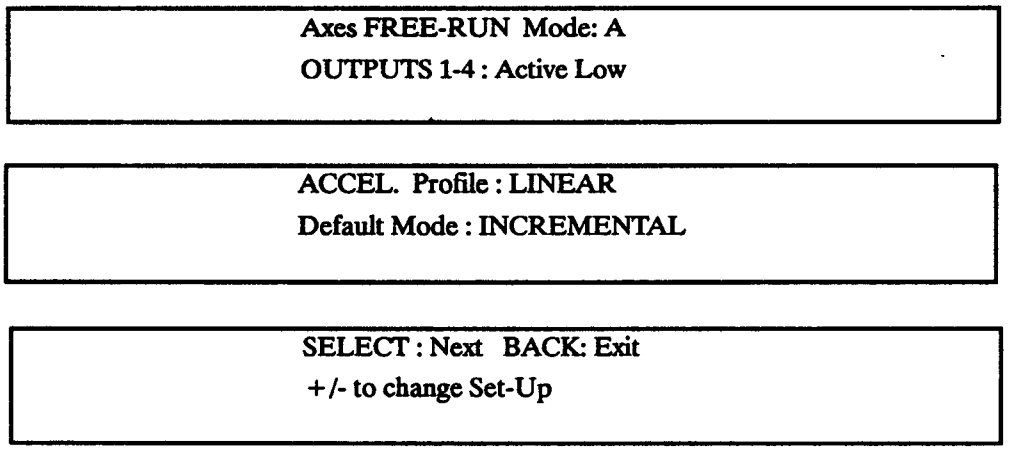


NOTE: If the Unidex 12 is equipped with the Password Option it will be displayed before any of the Set-Up screens.

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2-2-3-3-1 MODES

Press key #1, MODES, to see:



Press the SELECT key to select the first parameter, FREE- RUN, STOP or CONTINUE. Use the +/- key to select either mode "A" or "B". Selection of mode "A" will provide Free-Run motion which will not stop if another axis activates a limit or the PAUSE key is pressed. Selection of mode "B" provides Free-Run motion which will stop if another axis activates a limit or the STOP key is pressed.

Press SELECT for the OUTPUTS (1-4) Active High or Low parameter. Pressing the +/- key will toggle the output connections of the Unidex 12 between the true LOW and true HIGH.

LOW indicates negative logic for Outputs 01-04 (low = 1).
HIGH indicates positive logic for Outputs 01-04 (high = 1).

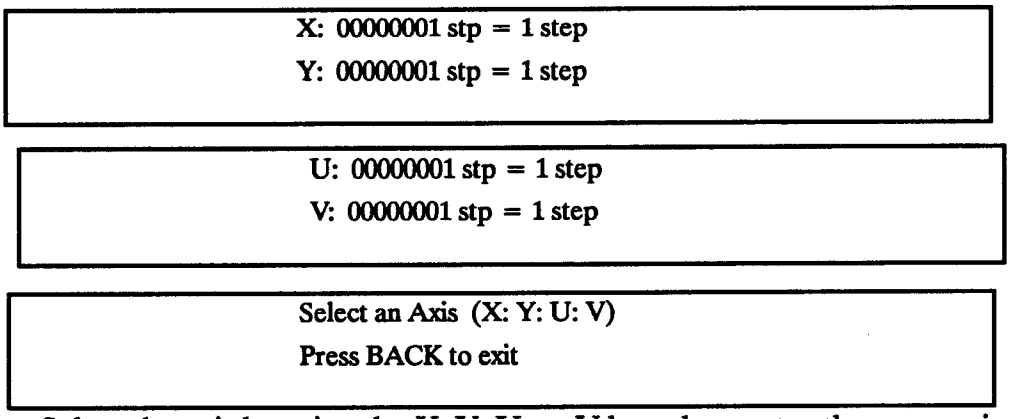
Press SELECT for the ACCEL. Profile. Use the +/- key to choose either a Linear or Parabolic profile.

Press SELECT for the default INCREMENTAL/ABSOLUTE parameter. See Item 2-2-2-7 for an explanation of the INCREMENTAL/ABSOLUTE parameter.

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2-2-3-3-2 UNITS

This SET-UP menu allows set-up of move units by scaling the steps/unit. Press key #2, UNITS, to see:



Select the axis by using the X, Y, U, or V key, then enter the conversion factor for that axis (See examples below). Press the ENTER key and enter the unit's name.

Press the ENTER key to complete this axis. Repeat these procedures for each axis to be changed.

Press the BACK key to return to the Set-Up sub-menu.

Example 1

Motor/Encoder resolution = 4000 steps/rev. Ball Screw Pitch = 4mm

Linear Resolution = 1 micron./step Conversion factor will be 25400 steps = 1 inch

1000 steps = 1 mm

Example 2

Motor/Encoder resolution = 2000 steps/rev. Ball Screw Pitch = 0.2 inch

Linear Resolution = 0.0001 inch

Conversion Factors : 10000 steps = 1 inch

393.70 steps = 1 mm

393700 steps = 1 meter

Example 3

Motor/Encoder resolution = 7200 steps/ rev. Rotary Resolution = 1 Arc Sec.

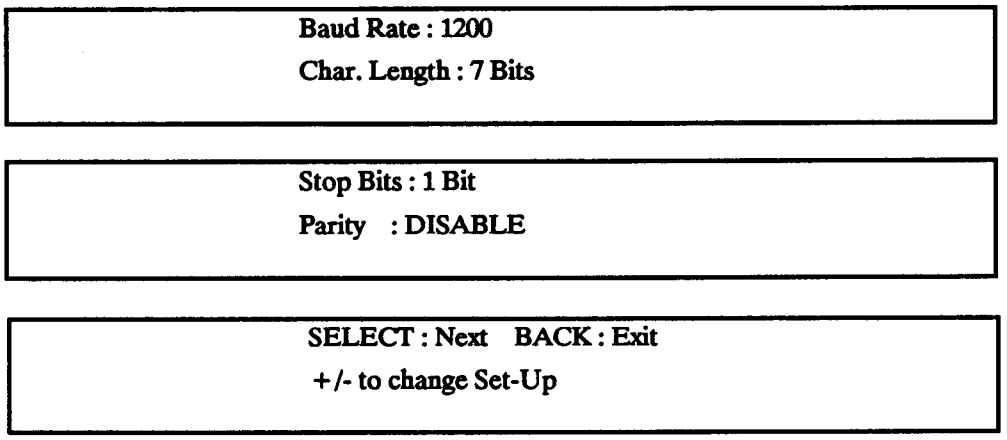
Conversion Factors: 3600 steps = 1 deg.

Gear Ratio = 1:180 1,296,000 steps = 1 rev.

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2-2-3-3-3 COMM (1)

The COMM (1) selection enables the set-up of the Communication Baud Rate, Character Length, Stop Bits and Parity parameters. Press key #3, COMM (1), to see:

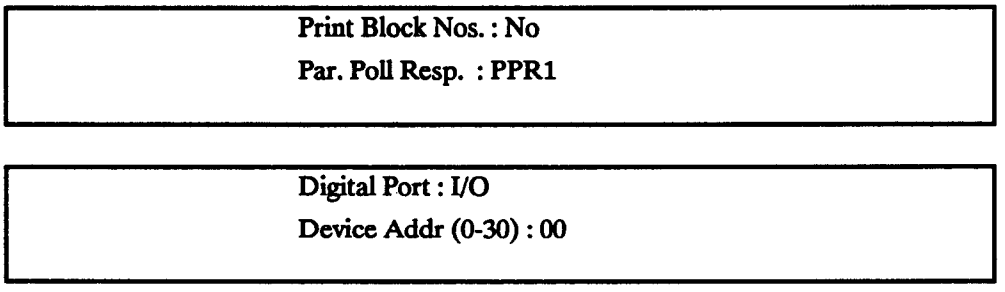


Use the SELECT key to step through these parameters and the +/- key to change them.

Press the BACK key to return to the Set-Up sub-menu.

2-2-3-3-4 COMM (2)

The COMM (2) selection provides for the set-up of Communication parameters not covered by COMM (1). Press key #4, COMM (2), to see:



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Press the SELECT key, the Print Block Nos. may now be enabled (Yes) or disabled (No) with the use of the +/- key.

Press the SELECT key a second time to proceed to the next parameter, Parallel Poll Response. The Parallel Poll Response number may be changed by the +/- key.

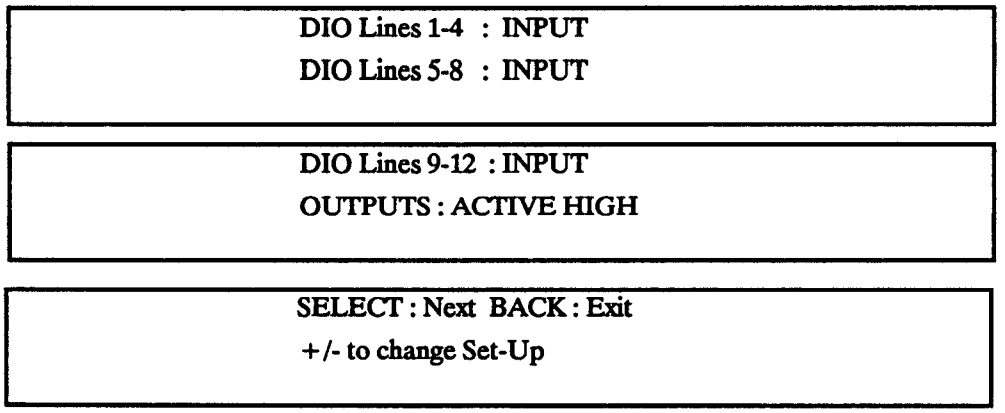
Press the SELECT key to proceed to the next parameter, Digital I/O Port. The Digital I/O Port may be configured for Input/Output, High Speed Binary and Thumbwheel Programmer (TDT). Use the +/- key to select the desired configuration.

Press the SELECT key a second time to proceed to the final parameter, Device Address. This requires the communication identification number for a Unidex 12 when more than one Unidex 12s are connected to a controller. Enter a number from 1 to 30 or press DELETE to set the address to 00.

Press BACK to return to the Set-Up sub-menu.

2-2-3-3-5 DIGITAL INPUT/OUTPUT (DIO) PORT - INTERRUPTS

Press key #5, DIO PORT, to see:



Press SELECT and set the DIO lines 1-4 as INPUTS or OUTPUTS with the use of the +/- key. Repeat this procedure for DIO Lines 5-8 and 9-12. DIO-9 through DIO-12 may be programmed either as INPUTS/OUTPUTS or as INTERRUPTS, I1 through I4. When DIO-9 through DIO-12 are used as Interrupts, use the +/- key to select INPUT.

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These Interrupt Inputs may either be programmed to stop all axis motion and execute the program instuctions or to permit axis motion to continue and execute the Interrupt program instructions simultaneous to axis motion.

NOTE: Interrupts should not be programmed to request a motion of an axis which is currently in motion.

The Interrupt Inputs can be set up to interrupt on either a positive or a negative edge. Upon Interrupt, the program can be either directed to "branch" to a label or to execute a subroutine and return.

While executing an Interrupt subroutine, all four Interrupts are disabled. At the conclusion of the subroutine, the Interrupts are enabled to their previous states. Interrupts are enabled only during a program.

NOTE : See Part II: Chapter 3; Items 3-6-5 for detailed information. See Part II: Appendix 1 Section D, for Programming examples.

Press SELECT to establish the last parameter, OUTPUTS. Using the +/- key, set the Outputs for either ACTIVE HIGH or ACTIVE LOW.

Press the BACK key to return to the Set-Up sub-menu.

2-2-3-3-6 DRIVER

The DRIVER selection provides for Driver configuration. Press key #6, DRIVERS, to see:

```
X axis Drv. : SERVO w ENC
Y axis Drv. : SERVO w ENC

U axis Drv. : SERVO w ENC
V axis Drv. : SERVO w ENC

SELECT : Next  BACK : Exit
+/- to change Set-Up
```


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Press the SELECT key and use the +/- key to configure each of the Drivers to one of the following:

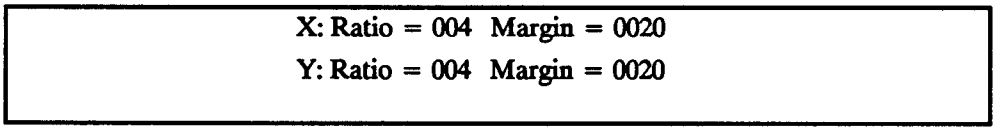
1. SERVO with ENCODER (for DC Motors)
2. OPEN LOOP (Stepping Motors)
3. OPEN LOOP : ENCODER (Stepping Motor with Encoder)
4. CZ : NO ENCODER (Stepping Motor with external Ramping Bd.)

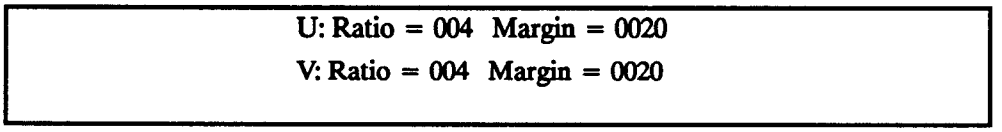
Use the SELECT key to step through each axis.
Press the BACK key to return to the Set-Up sub-menu.

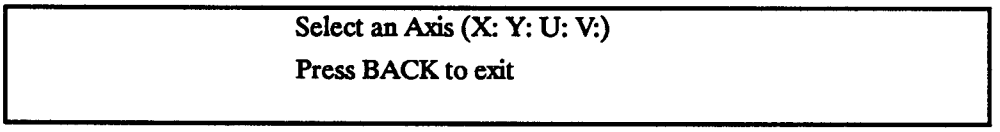
2-2-3-3-7 ENCODER PARAMETERS

The Encoder Parameter selections permit configuration of the Encoders ratio and margin. Press key #7, ENC. PARM. to see:

The Encoder Ratio is determined by the machine steps and Encoder resolution as follows:







$$\text{Encoder Ratio} = \frac{\text{Machine Steps}}{\text{Encoder Cycles}}$$

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The Encoder Margin is the maximum allowable number of Encoder pulses an index may be off before an error message would be displayed.

Using the axis keys, X, Y, U, or V, select the axis that is to be changed. Enter the Ratio number (1-250) and press ENTER. Enter the Margin number (1-9999) and press ENTER. Repeat this procedure for all applicable axes.

Press BACK to return to the Set-Up sub-menu.

Example 1

V Axis has a machine resolution of 2000 steps/rev. The V Axis Ecoder has 500 lines. The Ratio is: $\frac{2000}{500} = 4$

Example 2

V Axis has a machine resolution of 40,000 steps/ rev. The V Axis Encoder has 200 lines. The Ratio is: $\frac{40000}{200} = 200$

NOTE: The Encoder Margin should be a minimum of : $\frac{\text{Ratio}}{4}$

2-3-3-8 OTHER

Press key #8, OTHER, to see:

```
Boot Program  (0-99) : 00
Beeper Sound : ON
```

```
SELECT : Next  BACK : Exit
+/-to change Set-Up
```

Press SELECT and then enter the Boot Program number (0-99). Press DELETE for the program number of 00. After the program number has been entered press ENTER. Boot Program is the program that the Unidex 12 automatically runs upon power up. Program # 00 prevents any power up program execution.

The Beeper can be enabled or disabled by using the +/- key. When the Beeper is disabled the sound will be off.

Press BACK to return to the Set-Up sub-menu.

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CHAPTER 3: THE EDIT MODE

The EDIT mode is used to Enter a new program or reconfigure an existing one.

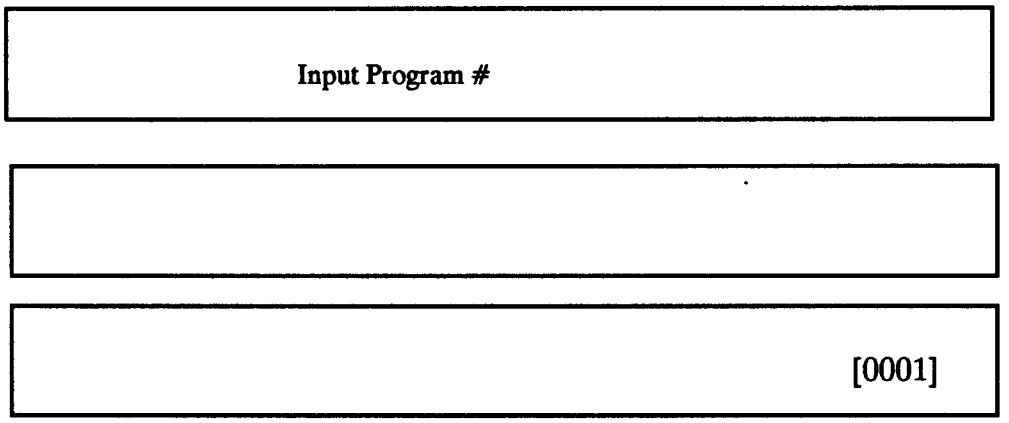
NOTE: **A sample program is provided in Appendix 1 of Part II of this manual. It is recommended that this example be programmed into the Unidex 12 to provide command familiarity prior to an attempt to enter a new program.**

NOTE: When scanning the seven EDIT screens while editing a program, use the SELECT Key to scroll through the screens. The display will scroll up to the seventh screen and then roll-over to the first EDIT screen.

NOTE: Use of the BACK Key will scroll the EDIT screens from the seventh to the first, when the first EDIT screen is displayed, depressing the BACK Key again will bring up the fourth Main Menu Screen and remove you from the EDIT mode.

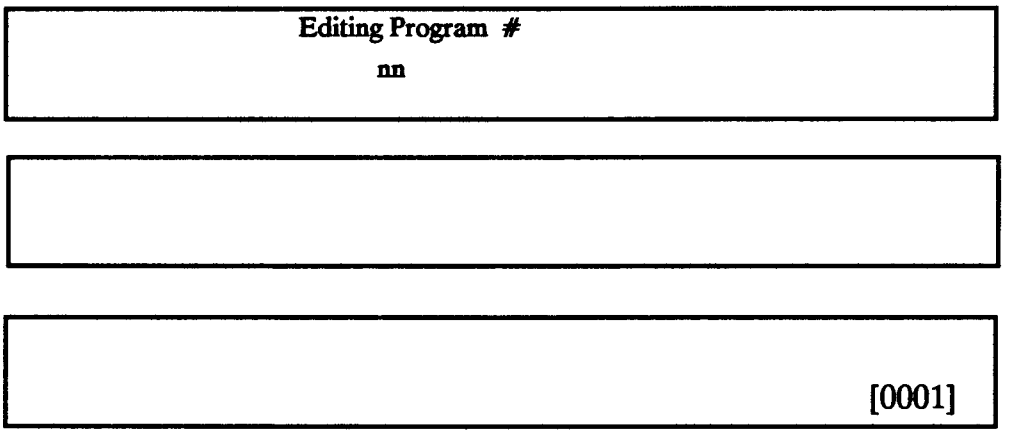
SECTION 3-1 FIRST EDIT SCREEN

In the first Main screen, press key #7, EDIT, to see:



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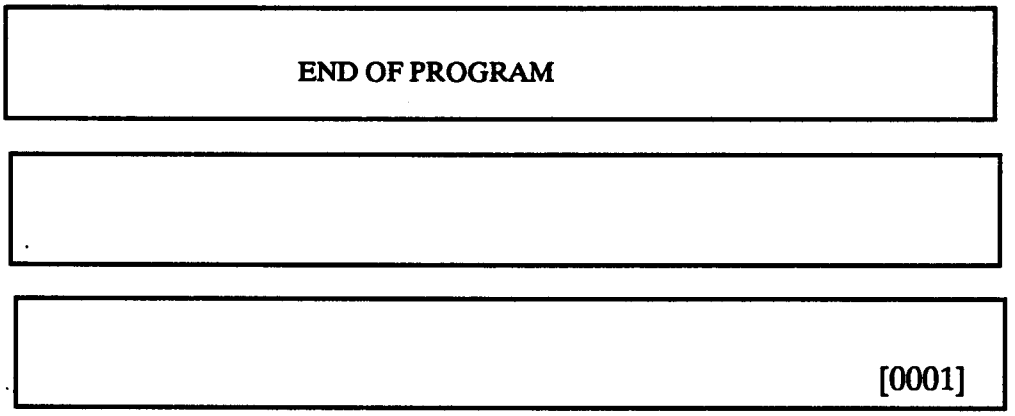
Input a Program Number (01-99), to see:.



If program nn exists in memory, pressing ENTER will bring up the first block of the program.

Upon entering an existing program, a checksum and block verification routine is performed. If statements of a given block are disabled, Unidex 12 will display a MEMORY ALTERED warning message and perform a memory repair routine on the accessed program. (See Section 5-1, "Program Editing Malfunction".)

If program nn does not exist in memory pressing ENTER will display:



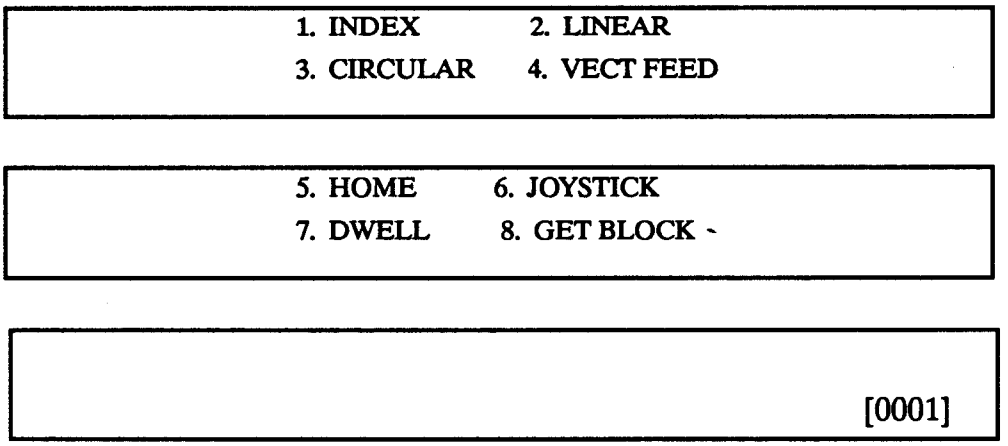
This display indicates that there is presently no data within this program. Press INSERT to view the available choices of blocks. All Edit blocks to be entered into the program are accessed by making selections from within these menus.

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NOTE: To exit the EDIT mode and return to the first Main screen press INSERT and then BACK.

Pressing INSERT will bring up the first Edit screen (shown below). Press SELECT for further Edit screens.

FIRST EDIT SCREEN



NOTE: When editing a program, pressing INSERT brings up the first Edit screen (shown above). Pressing SELECT will display the Edit screens (7 in all) discussed in this chapter. An EDIT function may be selected by pressing the appropriate key number, it is then entered into the program and the next program block is displayed. If, however, it is decided not to enter an EDIT function once INSERT has been pressed, press INSERT again to return to the program block and resume editing.

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3-1-1 INDEX

Press key #1, INDEX, for the following screen:

```
X  F----------------    D ----------------
Y  F----------------    D ----------------
```

Refer to Section 2-2-1-4 for data entry procedures. All data entry is identical to that as listed in that section. If an existing Index block is being edited, and it is desired to delete all data pertaining to an axis within that block, select the axis by pressing any of the two arrow keys relevant to it. When that axis is flashing , press DELETE to erase that entire line, if desired. When the F (feedrate) or D (distance) is flashing, pressing DELETE will erase only the information pertaining to that particular function. Once you begin to enter data, pressing DELETE will delete only the last digit entered.

WARNING: When a new block is displayed, pressing DELETE will delete the entire block from memory and bring up the next block.

After all indexing data is entered in this program block, pressing ENTER will enter the block into the users memory and the display will either show "END OF PROGRAM" or the next block. Press INSERT if another program block is to be inserted. The first Edit sub-screen will be displayed again.

3-1-2 LINEAR

From the first Edit sub-screen, press #2 LINEAR to see:

```
X Distance :
Y Distance :
```


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U Distance : V Distance :

[0001]

Press the appropriate axis key. The selected axis will begin to flash on the display. Linear Move data may be entered at this time. Pressing the DELETE key will erase the previous number, pressing the ENTER key will enter axes values. Press ENTER again when data entry is complete.

Set the Linear Move data for all desired axes.

When executed, this command will move all axes simultaneously such that the move will be in a straight path.

See Part II: Chapter 2; Item 2-2-1-4-2 for a detailed description of Linear movement.

Press INSERT to return to the first EDIT sub-screen.

3-1-3 CIRCULAR

From the first Edit sub-screen press key #3, CIRCULAR, to see:

AXIS : 0000000000 AXIS : 0000000000

I VALUE : J VALUE :

Circular Move : CW [0001]

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Press the SELECT key. The first Axis character will begin to blink. Press the appropriate axis key for the first axis. Press ENTER then key in the axis value. Press ENTER to move to the second axis position. Repeat the preceding procedure to setup the second axis value. The axis values are the incremental distance to the end point of the arc from the current position.

Press the ENTER key to move to I VALUE. Key in the desired I number position. Press ENTER to move to the J VALUE. Key in the desired J VALUE. The I and J values are the incremental distances to the center along the first and second axes respectively. Press ENTER to move to the Circular Move selection. Use the +/- keys to select either a CW or CCW move then press ENTER to save the block.

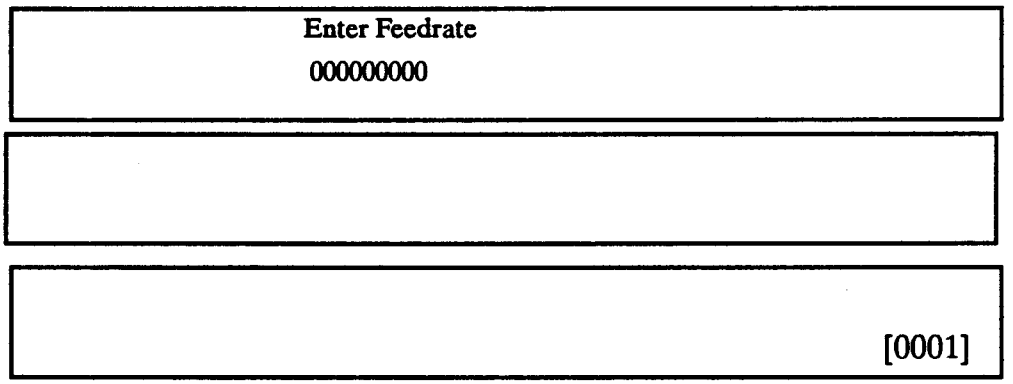
This command block will move any two axes in a circular path.

See Part II:Chapter 2; Item 2-2-1-4-3 for a detailed description of Circular movemet.

Press INSERT to return to the first EDIT screen.

3-1-4 INTERPOLATION FEEDRATE

From the first EDIT screen press key #4, INTERP. FEED, to see:



This function may be used to enter the Interpolation Feedrate into the programs for Linear and Circular moves. Interpolation Feedrates may have two digits after the decimal point.

See Part II: Chapter 2; Item 2-2-1-4-4 for a detailed description of Interpolation Feedrate.

Press INSERT to return to the first EDIT screen.

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3-1-5 HOME

From the first Edit screen, press key #5, HOME, to see:

```
Go Home (+/- & Select)
X:n  Y:n  U:n  V:n
```

The X axis will be flashing. Use the +/- keys to toggle between n (no) and y (yes).

Press the SELECT key to proceed to the next axis. Continue to set the axes until looped back to the X axis. When all Home data has been entered press ENTER then INSERT to return to the first EDIT sub-screen.

3-1-6 JOYSTICK

From the first EDIT screen, press key #6, JOYSTICK, to see:

```
Call Joystick
Press ENTER
```

A user program may initiate Joystick Control through the "Call Joystick" command.

NOTE: The Joystick (JP4) must be connected to the Unidex 12's J3 rear panel connector. If a Joystick is not connected properly to the Unidex 12 at the initiation of this command it will not be possible to return to the program being run.

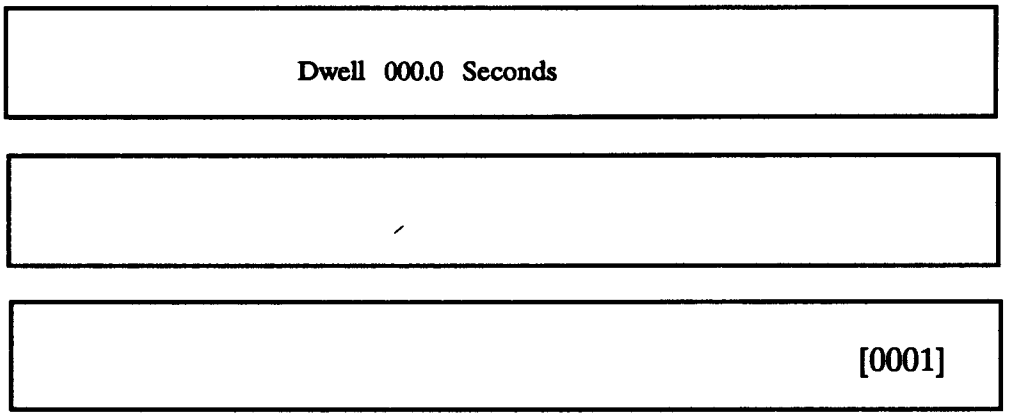
See Part II: Chapter 2; Item 2-2-1-5 for details of Joystick operation.

Press INSERT to return to the first EDIT screen.

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3-1-7 DWELL

From the first Edit sub-screen, press key #2,DWELL, to see:



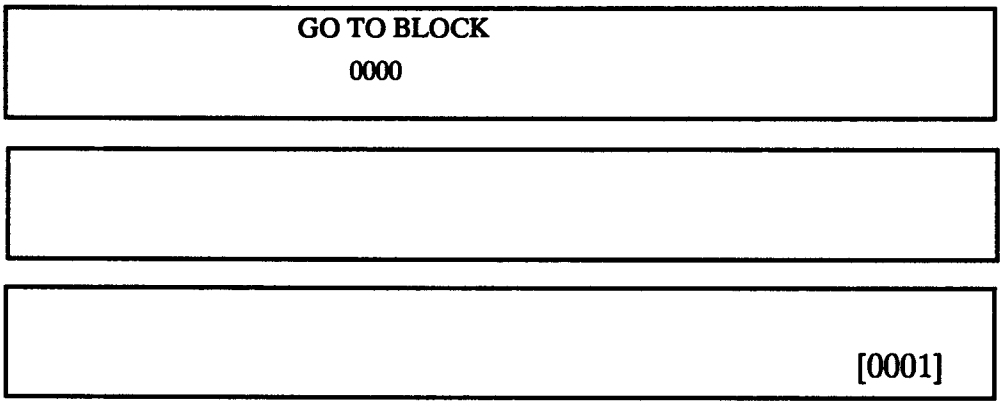
A Dwell time ranging from .1 to 499.9 seconds may be entered. Press ENTER to enter the Dwell time into the program.

The "End of Program" message will be displayed if that was the last block in the program, or the next program block will be displayed if editing an existing program.

Press INSERT to return to the first Edit screen.

3-1-8 GET BLOCK

From the first Edit sub-screen, press key #8, GET BLOCK, to see:



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Entering a number from 1 to 9999 will let the editor jump to the block number specified and display it.

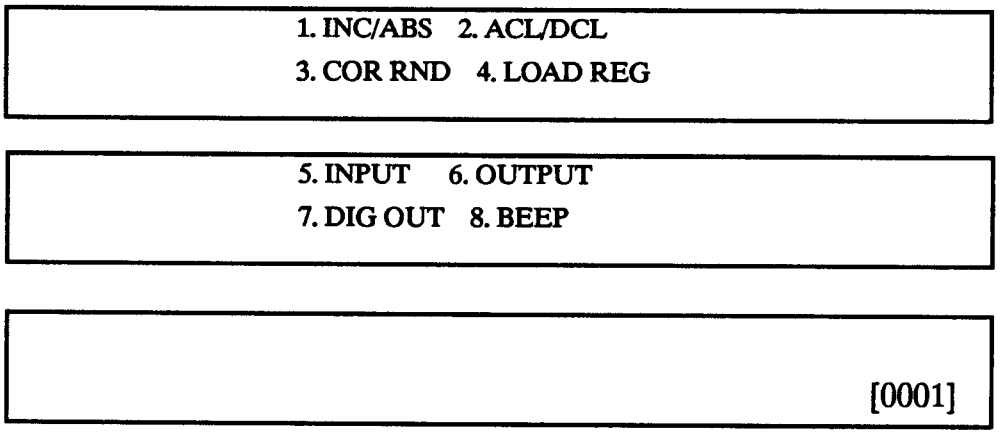
For example, when editing a program, to go directly to 50, the GET BLOCK command may be used instead of pressing the ENTER key 50 times.

The GET BLOCK command is strictly an Edit function and is not intended for program execution purposes.

SECTION 3-2 SECOND EDIT SCREEN

When in the first Edit screen, press SELECT to see the second Edit screen.

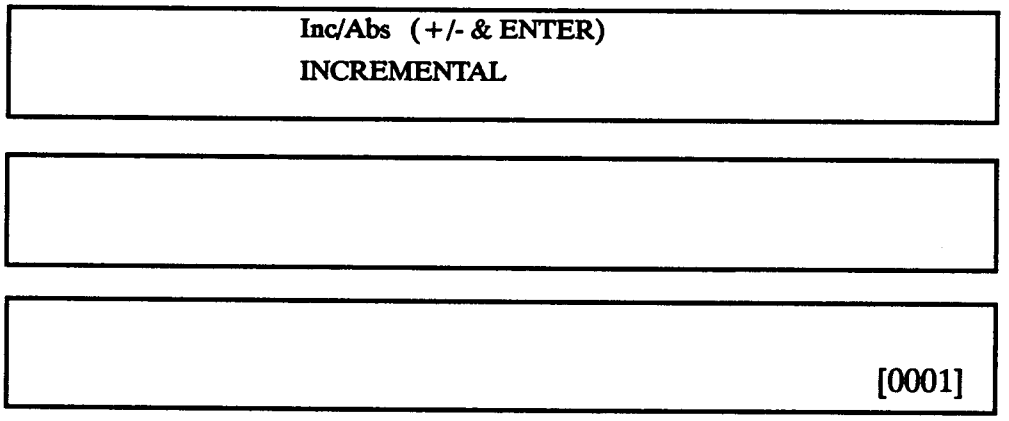
SECOND EDIT SCREEN



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3-2-1 INCREMENTAL/ABSOLUTE

From the second EDIT screen, press key #1, INC/ABS, to see:



The +/- keys toggle between the Incremental and Absolute modes.

The Absolute mode measures an absolute distance, i.e. distance referenced from X0, Y0, U0, and V0 (U0 and V0 apply to a 4- axis chassis).

In the Incremental mode, distance is referenced from the present position of the axes, not from the initial start position.

The Incremental/Absolute commands are modal. Once initiated by a program, they will remain in that mode until it is changed.

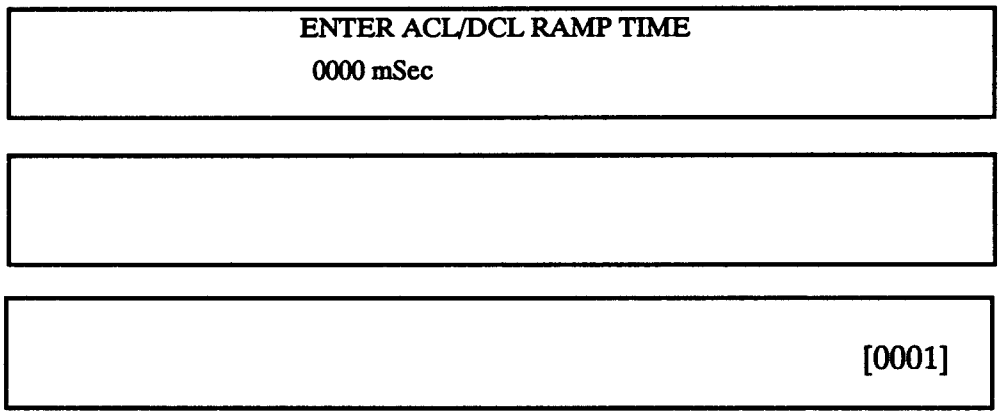
To save the block, press ENTER.

Press the INSERT and the SELECT key to return to the second EDIT screen.

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3-2-2 ACCELERATION/DECELERATION

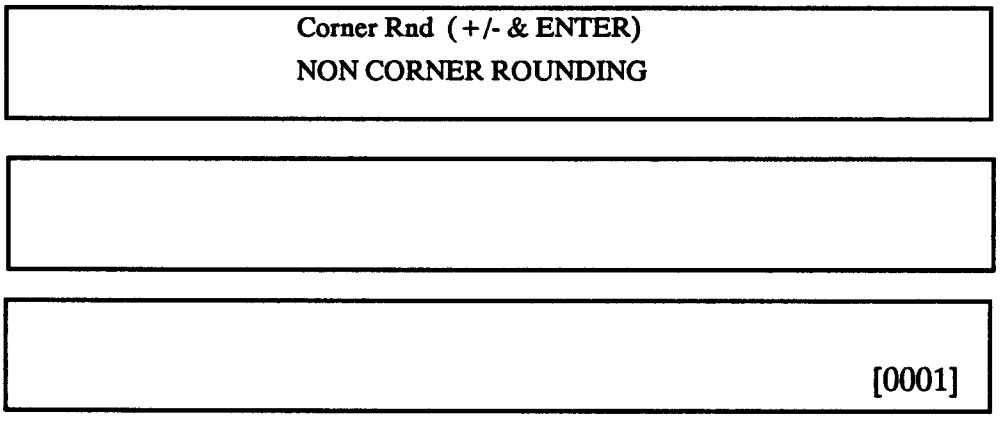
From the second EDIT screen, press key #2, ACL/DCL, to see:



Refer to Part III of this manual for a detailed description of Acceleration/Deceleration.

3-2-3 CORNER ROUNDING

From the second EDIT screen,press key #2, COR RND, to see:



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The +/- keys allow the Unidex 12 to toggle between Corner Rounding and Non-Corner Rounding.

In the Corner Rounding mode, the Unidex 12 does not wait for the "in-position" signal to be received from the amplifier before beginning the next move. When using DC Servo Control, this mode provides smoother motion between blocks.

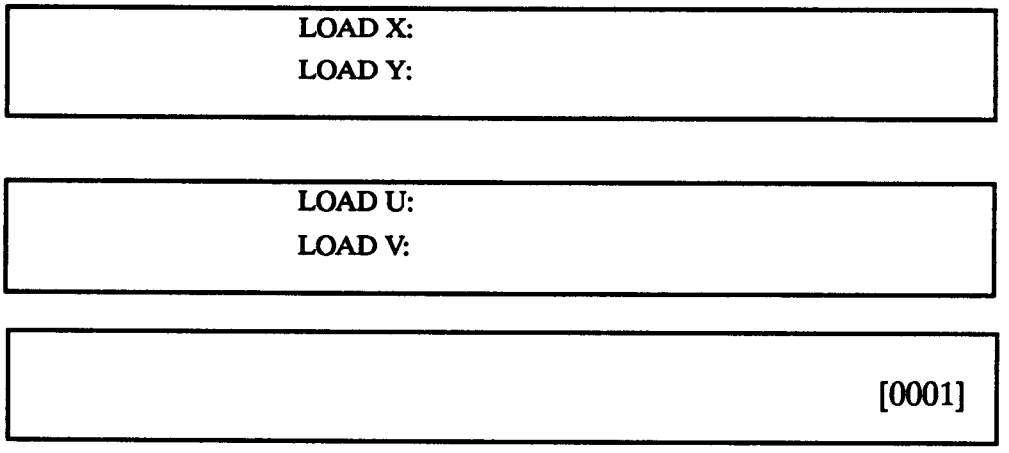
In Non-Corner Rounding the Unidex 12 does wait for the "in- position" signal to come in before continuing with the next move.

Press ENTER to save this block.

Press INSERT and SELECT to return to the second EDIT screen.

3-2-4 LOAD REGISTER

From the second EDIT MENU press key #4, LOAD REG, to see:



Press the appropriate axis key. The axis selected will begin to flash. Key in the Absolute Position Register data. Press DELETE if a number just entered must be erased. Press ENTER to enter axes values, and press ENTER again when data entry is complete.

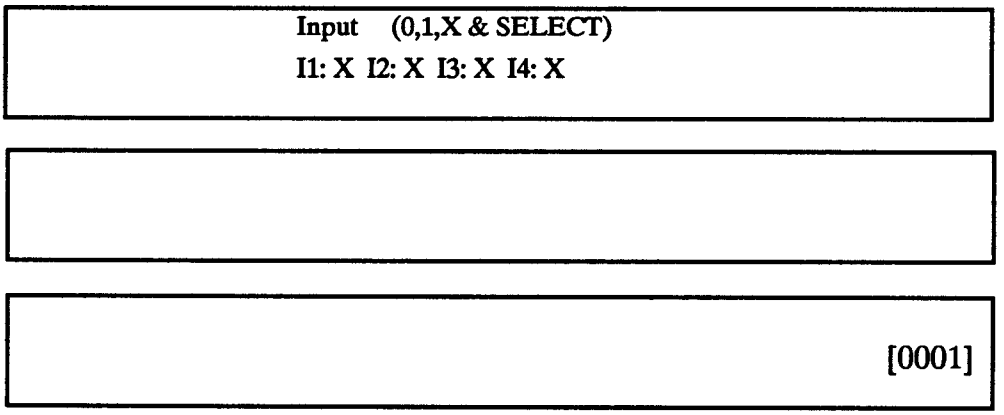
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The position set by this command may be used to establish a temporary reference point, when using the Absolute mode.

Press INSERT and then SELECT to return to the second EDIT screen.

3-2-5 INPUT

From the second EDIT screen, press key #5, INPUT, to see:



The INPUT function permits the program to wait until the input conditions match that which has been programmed. Inputs may be programmed as a 1, 0 or a X (don't care). (For this application "don't care" means that no comparison will be made for this Input.

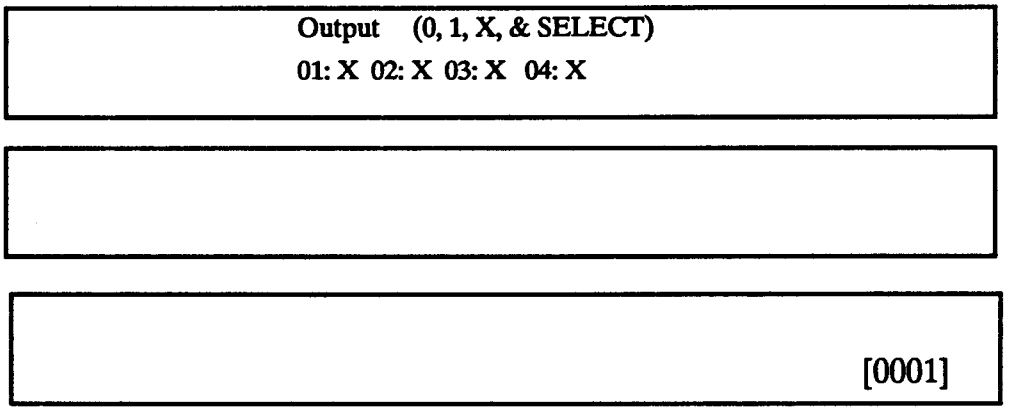
When an Input is flashing on the display, enter 1, 0, or X (key 7 or 8) or proceed to the next Input by pressing SELECT. After all Inputs have been configured, press the ENTER key to save the block.

Press INSERT then SELECT to return to the EDIT screen.

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3-2-6 OUTPUT

From the second EDIT screen, press key #6, OUTPUT, to see:



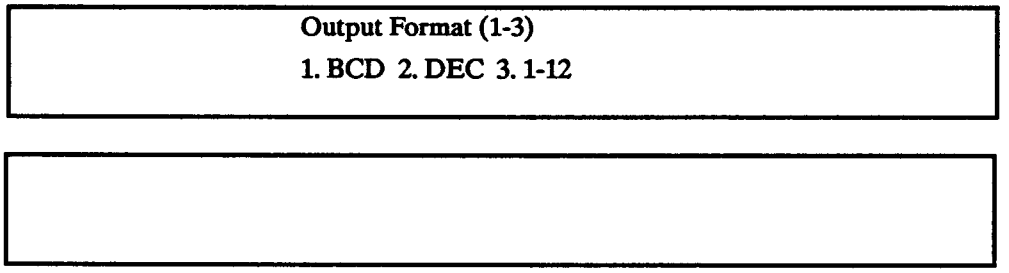
The OUTPUT function permits the Outputs to be programmed as a 1, 0 or a X (don't care). (For this application "don't care" means "don't care" means don't change from the previous set value.

When an Output is flashing on the display, enter 1, 0, or X (key 7 or 8) or proceed to the next Output by pressing SELECT. Press the ENTER key to save the block.

Press INSERT then SELECT to see the second EDIT screen.

3-2-7 DIGITAL OUTPUT

From the second EDIT screen, press key #7, DIG OUT, to see:



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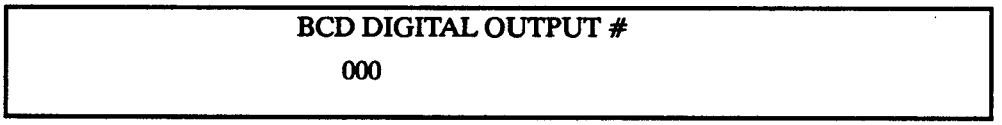


The DIGITAL OUTPUT function permits the selection of one of three formats.

- Press 1 for BCD (Binary Coded Decimal) 000 thru 999
- Press 2 for Decimal (4095 Max).
- Press 3 for one of twelve (1-12)

One of the following screens will be displayed:

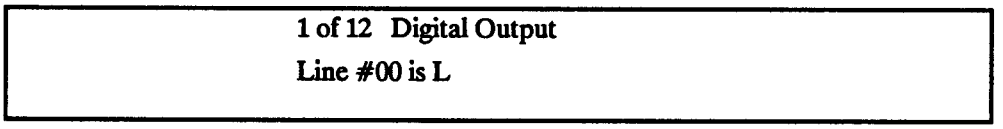
Key #1 - "BCD"



Key #2 - "DEC"



Key #3 - "1-12"



For the BCD and DEC OUTPUTS, enter the Output number then press ENTER to save the Block.

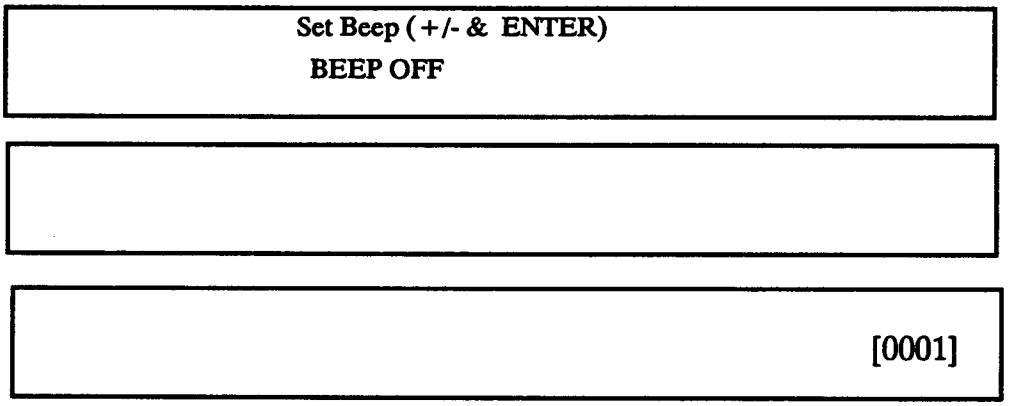
If the 1-12 Digital Output has been selected, enter the Output line (1-12) number and set the level either low (L) or high (H) by using the +/- key. Press ENTER to save the block. Line #1 through 12 refer to DIO-1 through DIO-12.

Press INSERT and then SELECT to return to the second EDIT screen.

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3-2-8 BEEP

From the second EDIT screen, press key #8, BEEP, to see:



Press +/- to toggle between BEEP OFF and BEEP ON. Press ENTER after the selection has been made.

BEEP ON activates the Buzzer in the Unidex 12. Once activated the Buzzer will remain ON until a BEEP OFF block in the program is encountered.

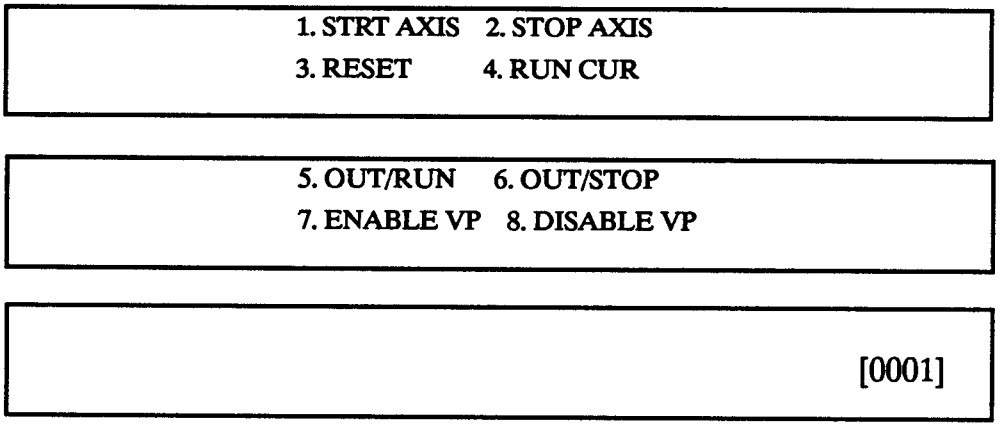
Press INSERT then SELECT to return to the second EDIT screen

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SECTION 3-3 THIRD EDIT SCREEN

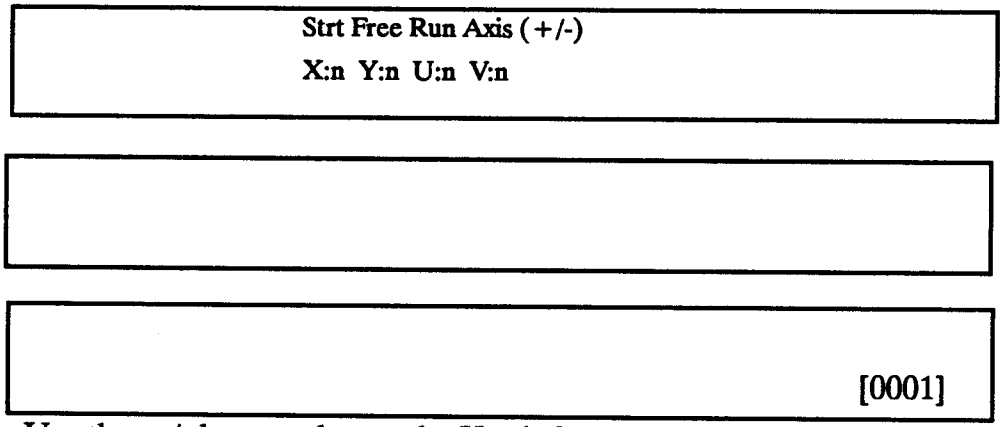
From the second EDIT screen, press SELECT two times to see the third EDIT screen.

THIRD EDIT SCREEN



3-3-1 START AXIS

From the third EDIT screen, press Key #1, STRT AXIS, to see:



Use the +/- keys to change the X axis free-run status (n for no and y for yes). To proceed to the Y axis selection press SELECT and then press ENTER.

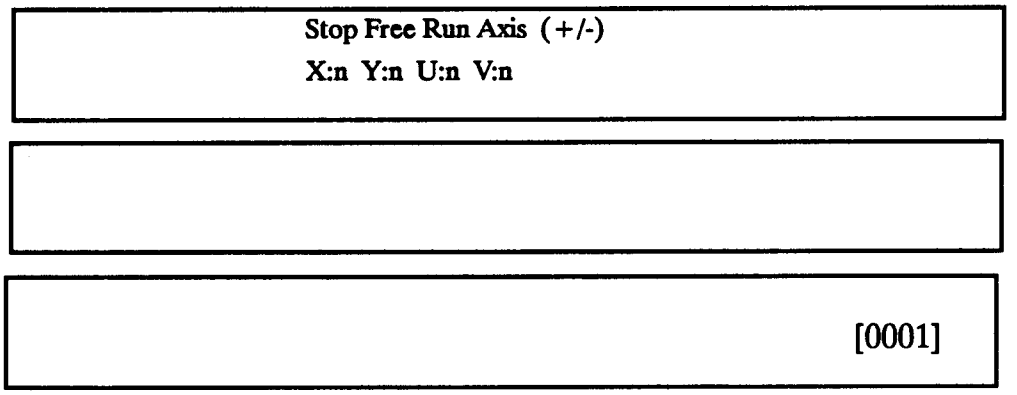
This command restarts a free run axis that has been stopped as well as completes an axis move aborted by an interrupt.

Press INSERT then press SELECT two times to return to the third EDIT screen.

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3-3-2 STOP AXIS

From the third EDIT screen, press Key #2, STOP AXIS, to see:



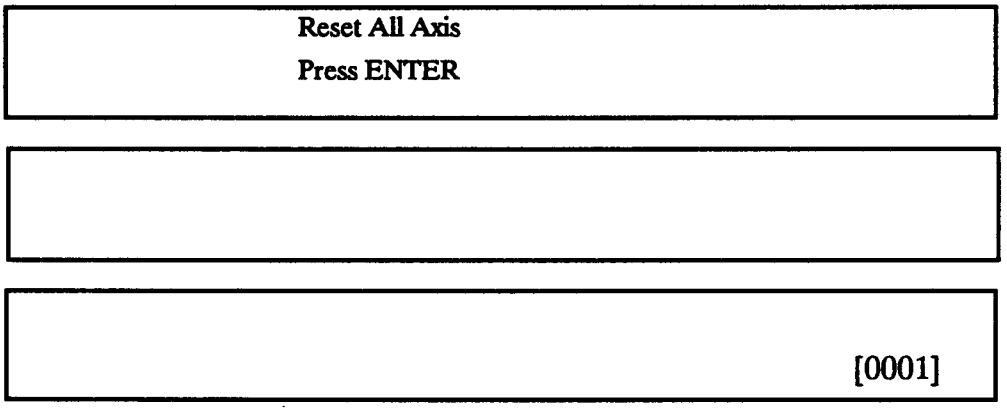
The STOP AXIS function is used to stop a Free-Running axis.

Use the SELECT key to move the cursor to the desired axis and then the +/- key for Y (yes) or N (no). Press ENTER to save this block.

Press INSERT then SELECT two times to return to the third EDIT screen.

3-3-3 RESET

From the third EDIT screen, press Key #3, RESET, to see:

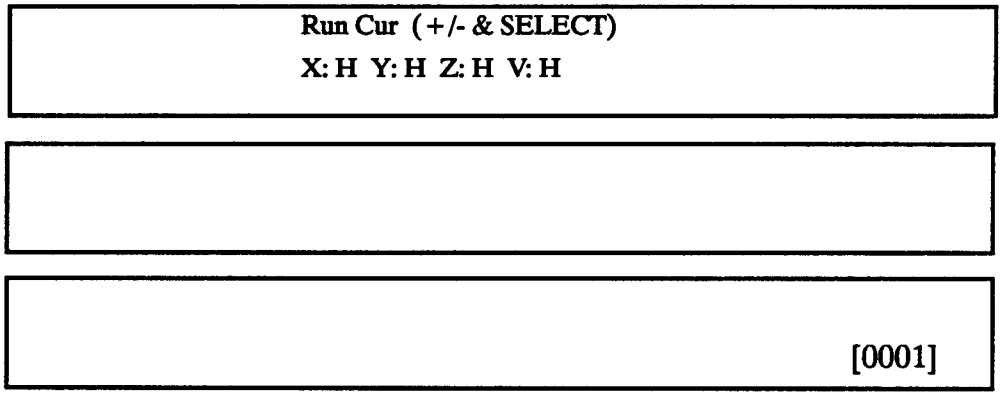


This function serves to Reset all drives. Press ENTER to save this block. Press INSERT and then SELECT twice to return to the THIRD EDIT screen.

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3-3-4 RUN CURRENT

From the third EDIT screen, press Key #4, RUN CURRENT, to see:

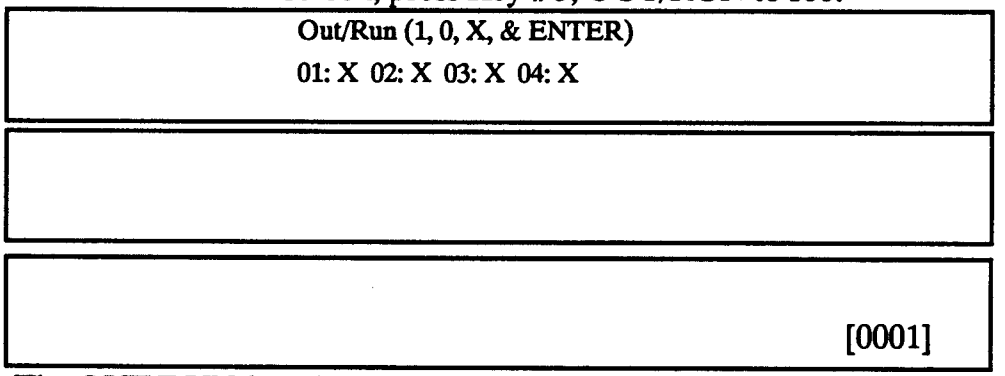


This function provides the ability to set the RUN CURRENT for each axis. Use the SELECT key to select the axis and the +/- key to set either H (High) or L (Low) Run Current. Press ENTER to save block. This command is relevant only to Stepper motors.

Press INSERT and the SELECT twice to return to the third EDIT screen.

3-3-5 OUT/RUN

From the third EDIT screen, press Key #5, OUT/RUN to see:



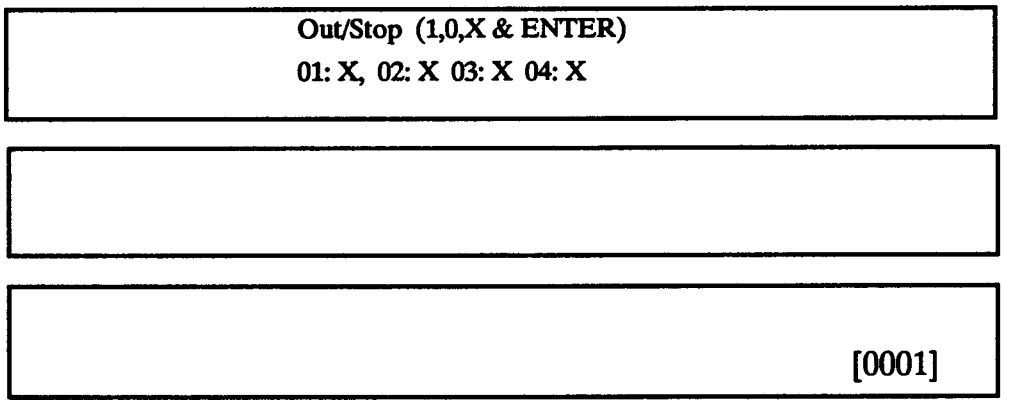
The OUT/RUN function provides the ability to program the output (0, 1, or don't care) when the program is restarted after a stop operation. Restart could exist as a result of the feedhold or pressing the RUN key. Press ENTER to enter Out/Run data.

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Press INSERT then SELECT twice to see the third EDIT screen.

3-3-6 OUT/STOP

From the third EDIT screen, press Key #6, OUT/STOP, to see:

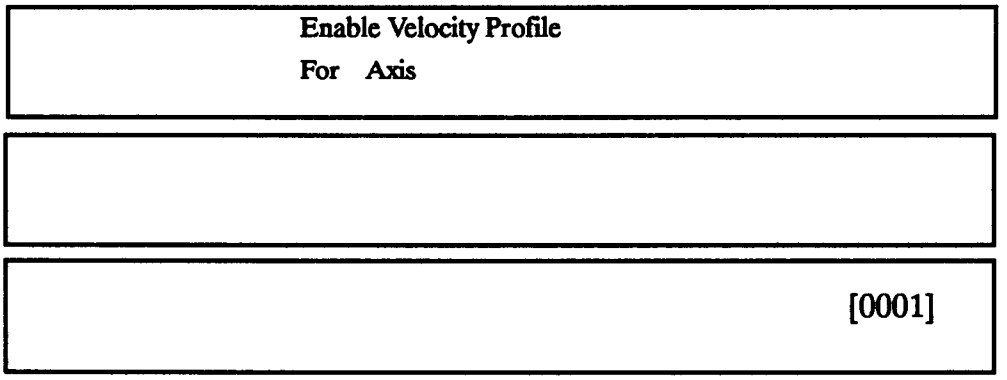


The OUT/STOP function is used to program the condition that will be output (0, 1, or don't care) when the program is stopped by either the STOP key or a Feedhold. Press the ENTER key to save this block.

Press INSERT then SELECT twice to return to the third screen of the EDIT menu.

3-3-7 ENABLE VELOCITY PROFILE

From the third EDIT screen, press Key #7, ENABLE VP, to see:



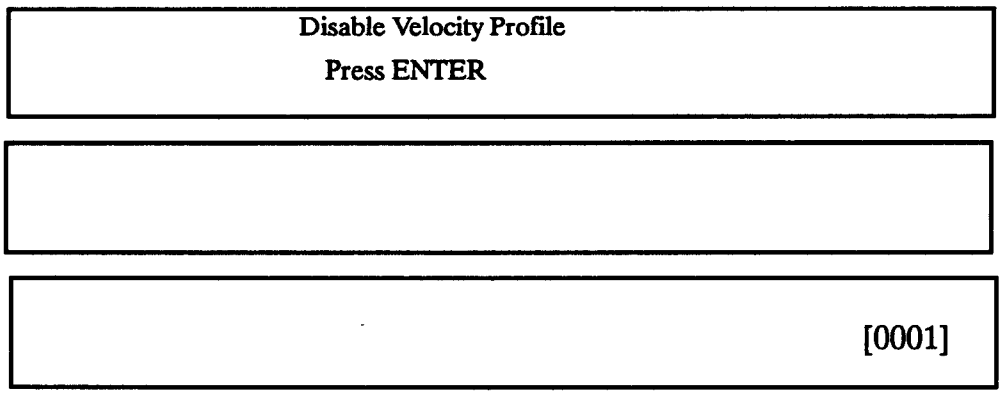
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This function permits the selection and enabling of one of the axes for Velocity Profiling. Press appropriate axis key then press ENTER to save the block.

Press INSERT then SELECT twice to return to the third EDIT screen.

3-3-8 DISABLE VELOCITY PROFILE

From the third EDIT screen, press Key #8, DISABLE VP, to see:



This function is used to disable Velocity Profile. Press ENTER to select and save this block.

Press INSERT and then SELECT twice to see the third EDIT screen.

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SECTION 3-4 FOURTH EDIT SCREEN

Press the SELECT key three times to see the fourth EDIT screen.

FOURTH EDIT SCREEN

1. STRT RPT	2. END RPT
3. COND RPT	4. PROG RPT

5. GOTO PROG	6. GOSUB PROG
7. PROG STOP	8. PROG DEL

[0001]

3-4-1 START REPEAT

From the fourth EDIT screen, press Key #1, STRT RPT, to see:

Repeat Loop Start
Repeat 0000 Times

[0001]

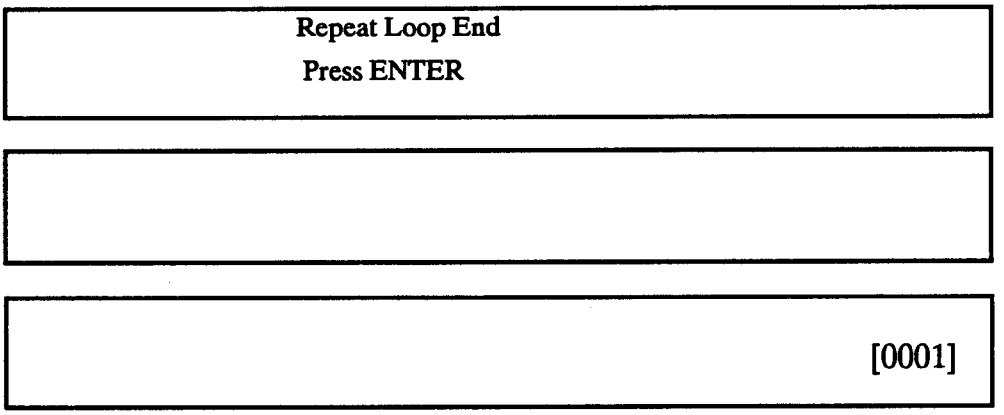
The START REPEAT command provides the ability to enter the number of times that the command blocks within the repeat loop are to be executed. Press ENTER to save this block.

Press INSERT and then SELECT three times to return to the fourth EDIT screen.

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3-4-2 END REPEAT

From the fourth EDIT screen, press key #2, END RPT, to see:

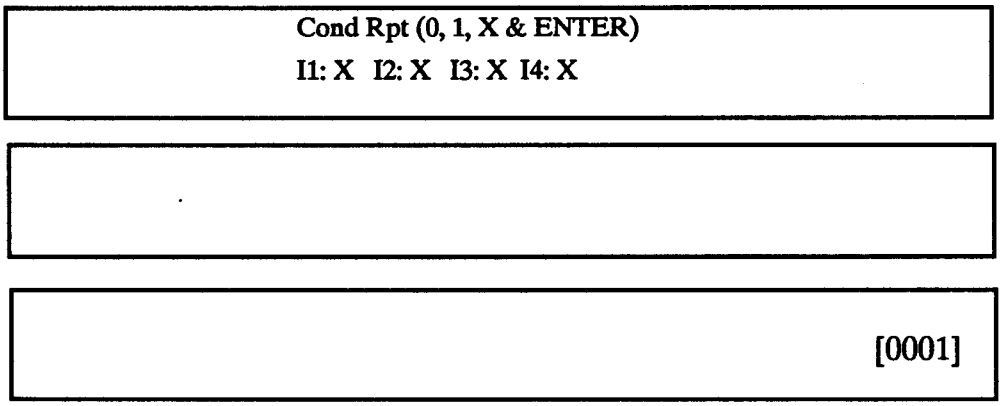


The END REPEAT command is placed at the end of all command blocks to be included in the Repeat Loop. Press ENTER to save this block.

Press INSERT and then SELECT three times to return to the fourth EDIT screen.

3-4-3 CONDITIONAL REPEAT

From the fourth EDIT screen, press Key #3, COND RPT, to see:



The CONDITIONAL REPEAT command may be placed at the end of a Repeat Loop instead of an END REPEAT command.

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When the CONDITIONAL REPEAT command ends the Repeat Loop, the condition of the Inputs dictates whether the commands will be repeated or not. If the conditions specified within the CONDITIONAL REPEAT command are true, the loop will end. If any of the commands are false, the loop will repeat.

The cycle will continue until:

1. The Input conditions are met.

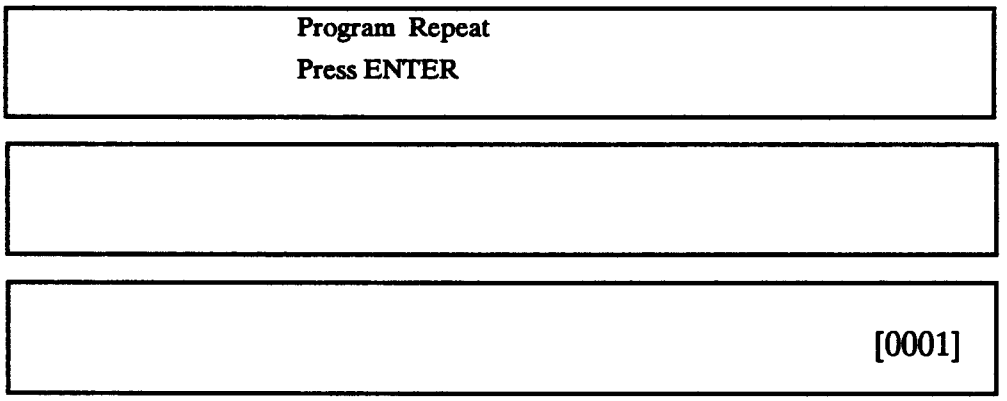
2. The number of loops specified by the STRT RPT command is completed.

The Input conditions of the CONDITIONAL REPEAT command are entered in the same manner as the INPUT command (Section 3-2-5).

Press INSERT and then SELECT three times to return to the fourth EDIT screen.

3-4-4 PROGRAM REPEAT

From the fourth EDIT screen, press Key #4, PGM RPT, to see:



This function will cause the entire program to repeat.

NOTE: Any program blocks entered after the PROGRAM REPEAT command will not be executed unless called through a subroutine.

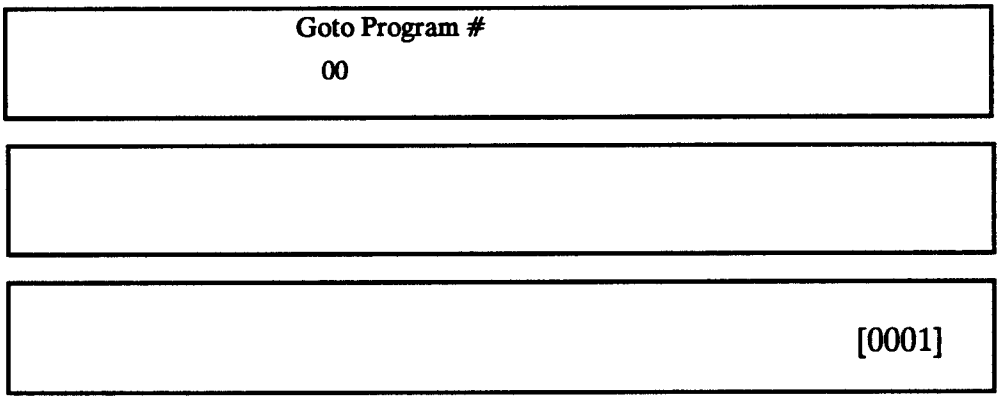
Press ENTER to save this block.

Press INSERT and then SELECT three times to see the fourth EDIT screen.

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3-4-5 GOTO PROGRAM

From the fourth EDIT screen, press Key #5, GOTO PROG, to see:

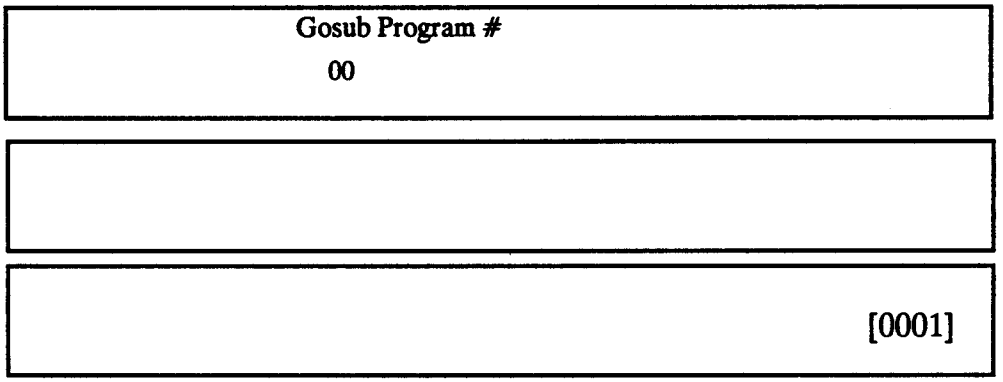


The GOTO PROGRAM command will cause the program to branch to another program. Key in the new program number (1-99) and press ENTER.

Press INSERT and then SELECT three times to return to the fourth EDIT screen.

3-4-6 GOSUB PROGRAM

From the fourth EDIT screen, press Key #6, GOSUB PROG, to see:



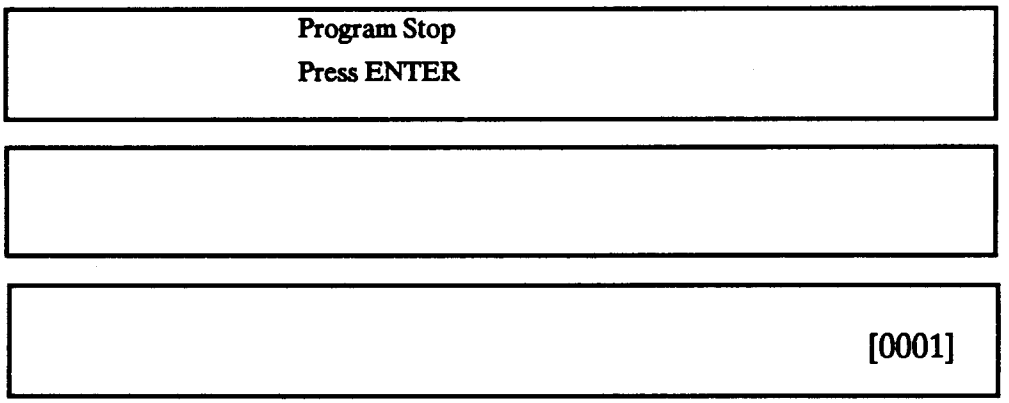
The use of this command permits the program to call up another program as a subroutine. Key in the new program number (1-99) and press ENTER.

Press INSERT and then SELECT three times to return to the fourth EDIT screen.

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3-4-7 PROGRAM STOP

From the fourth EDIT screen, press Key #7, PROG STOP, to see:



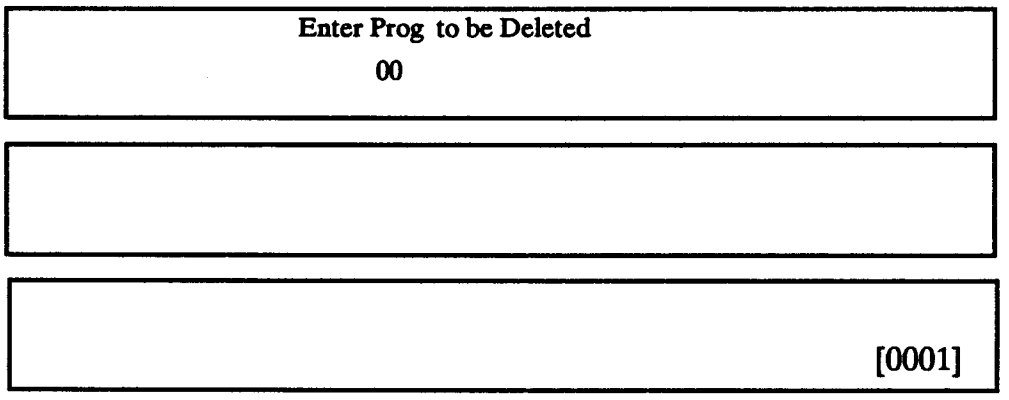
This command causes program execution to stop and returns the control to the Operator keyboard.

Subroutines are generally placed after the PROGRAM STOP command, although it is not necessary to provide a program stop within a program.Press ENTER to save the command.

Press INSERT and then SELECT three times to return to the fourth EDIT screen.

3-4-8 PROGRAM DELETE

From the fourth screen, press Key #8, PROG DEL, to see:



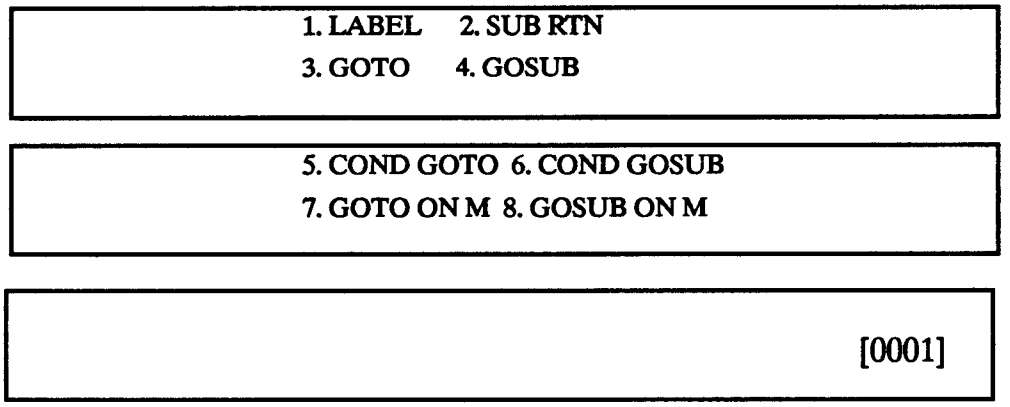
Key in the program number (1-99) to be deleted then press ENTER. The entire program will be deleted and the first Main Menu screen will be displayed.

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SECTION 3-5 FIFTH EDIT SCREEN

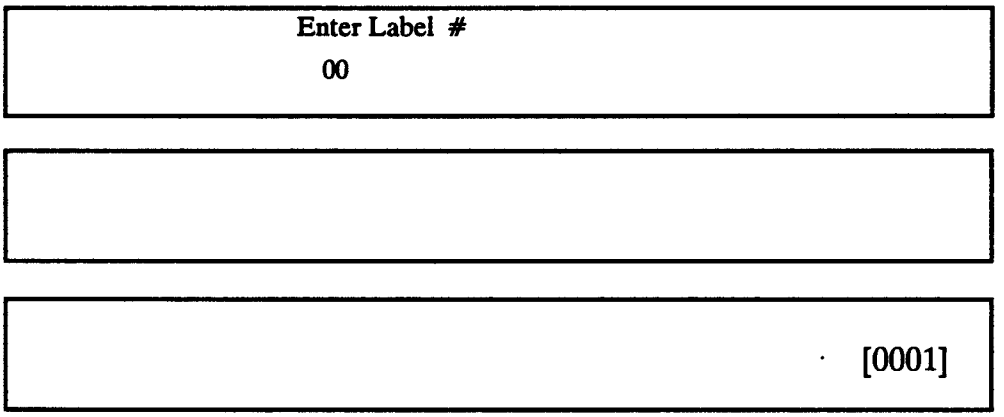
Press SELECT four times to display the fifth EDIT screen.

FIFTH EDIT SCREEN



3-5-1 LABEL

From the fifth EDIT screen, press Key #1, LABEL, to see:



The LABEL command permits the entry of label (1-99) into the program. The label then serves as a subroutine name for a GOSUB command or as an entry point for a GOTO command.

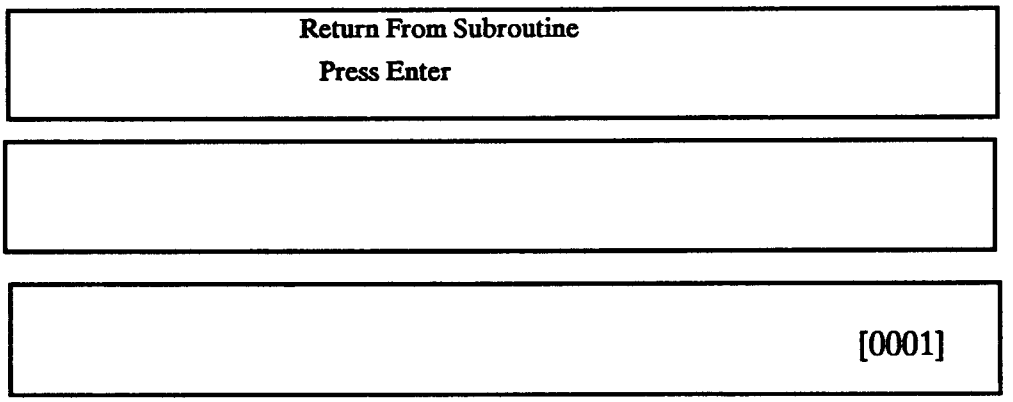
Key in the LABEL number and then press ENTER to save the command.

Press INSERT and then SELECT four times to see the fifth EDIT screen.

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3-5-2 SUBROUTINE RETURN

From the fifth EDIT screen, press Key #2, SUB RTN, to see:

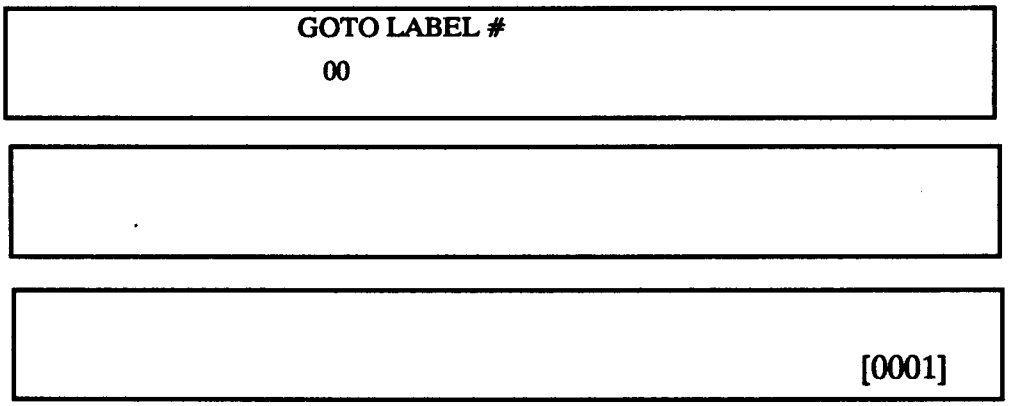


This command is placed at the end of a Subroutine to cause the program flow to return to the block immediately following the GOSUB block that called the Subroutine. Press ENTER to enter this program block into the program.

Press INSERT and then SELECT four times to see the fifth EDIT screen.

3-5-3 GOTO

From the fifth EDIT screen, press Key #3, GOTO, to see:



The GOTO command sends the program to the entry point which has been previously identified by a corresponding label.

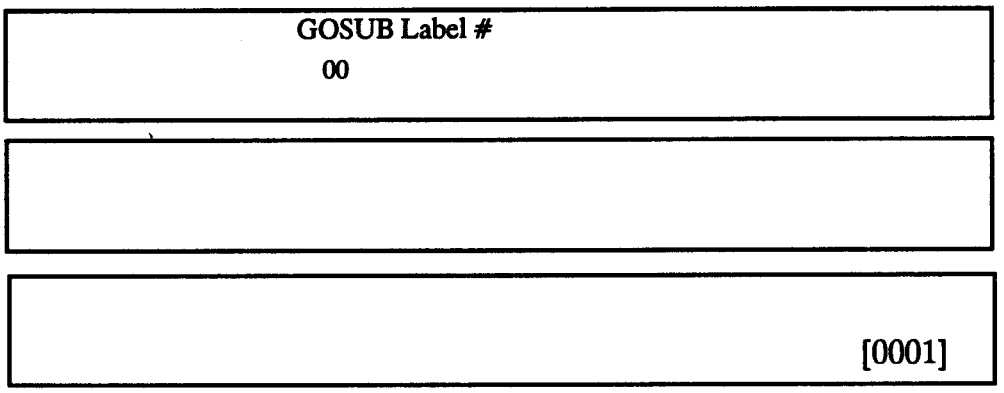
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Key in the Label number then press ENTER to save this command.

Press INSERT and then SELECT four times to return to the fifth EDIT screen.

3-5-4 GOSUB

From the fifth EDIT screen, press Key #4, GOSUB, to see:



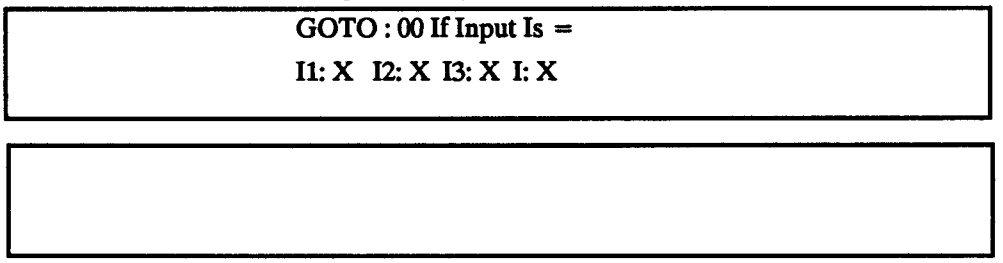
This command directs program flow to the Subroutine identified by the corresponding Label. A Subroutine may be entered after a PROGRAM STOP command. Every Subroutine should be followed by a SUB RTN.

Enter the Label number and then press ENTER to save this command.

Press INSERT and then SELECT four times to return the fifth EDIT screen.

3-5-5 CONDITIONAL GOTO

From the fifth EDIT screen, press Key #5, COND GOTO, to see:



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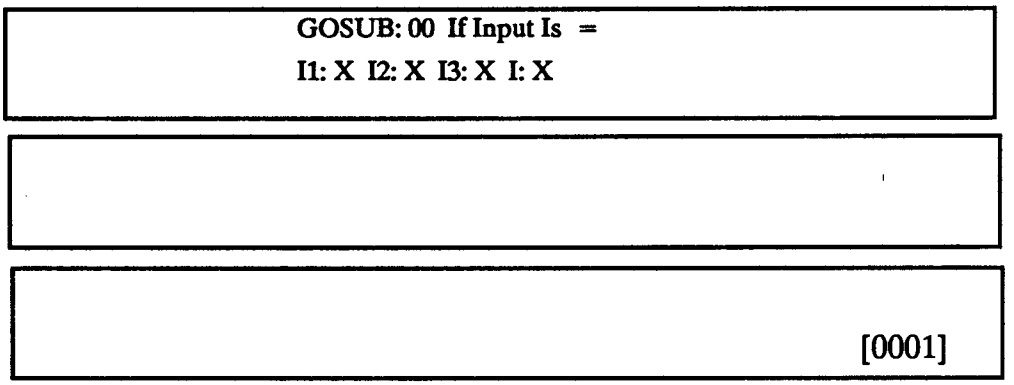
The CONDITIONAL GOTO is the same as the previously described GOTO in that "nn" identifies the entry point to which the program must jump. In the case of the CONDITIONAL GOTO, however, the jump occurs only if the conditions of the inputs, set in the above command, are satisfied. Otherwise, the program continues with the next block.

Key in the block number of the entry point and then press SELECT. Enter the Input condition (I1 through I4), then press ENTER to save this command.

Press INSERT and then SELECT four times to see the fifth EDIT screen.

3-5-6 CONDITIONAL GO SUB

From the fifth screen, press Key #4, COND.GOSUB, to see:



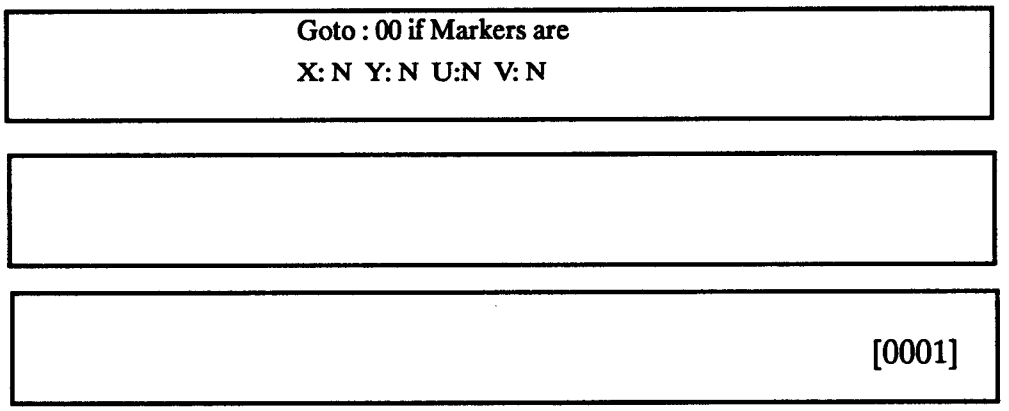
This command functions in the same fashion as the Conditional GO TO, above. The label nn identifies the subroutine of the same name. The program can only go to the subroutine labeled "nn" if the Input conditions specified in the above command are satisfied. Press ENTER to save this command.

After entering data, press INSERT and then SELECT four times to return to the fifth EDIT screen.

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3-5-7 GOTO ON MARKER

From the fifth EDIT screen, press Key #7, GOTO ON M, to see:



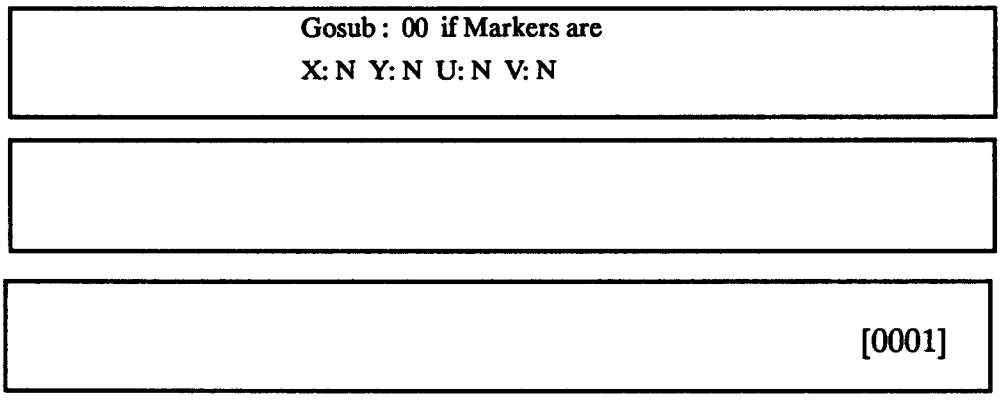
The GOTO ON MARKER command will direct the program flow to the block number label specified, when the selected axes are at their Marker positions.

Key in the block number label, then press SELECT. Using the SELECT and the +/- keys, configure the Marker condition comparison line. Press ENTER to save this command.

Press INSERT and then SELECT four times to return to the fifth EDIT screen.

3-5-8 GOSUB ON MARKER

From the fifth EDIT screen, press Key #8, GOSUB ON M, to see:



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The GOSUB ON MARKER command functions essentially the same as the GOTO command. Marker Status is to initiate the jump to the delineated Sub-routine.

Enter the block number label and press the SELECT key. Using the SELECT and the +/- Keys configure the Markers. Press ENTER to save this command.

Press INSERT and then SELECT four times to return to the fifth EDIT screen.

SECTION 3-6 SIXTH EDIT SCREEN

Press SELECT five times to see the sixth EDIT screen.

SIXTH EDIT SCREEN

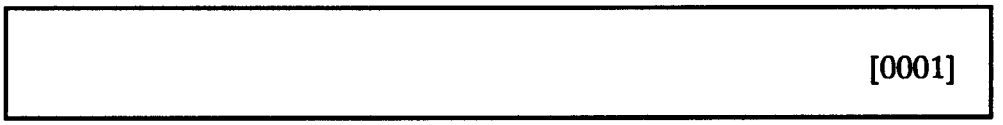
1. FEEDHOLD 2. SET SRQ 3. DIG GOTO 4. DIG GOSUB
5. GOTO ON I 6. GOSUB ON I 7. ENABLE I 8. DISABLE I
[0001]

3-6-1 FEEDHOLD

From the sixth EDIT screen, press Key #1, FEEDHOLD, to see:

Feedhold for Interrupt # (1-4)

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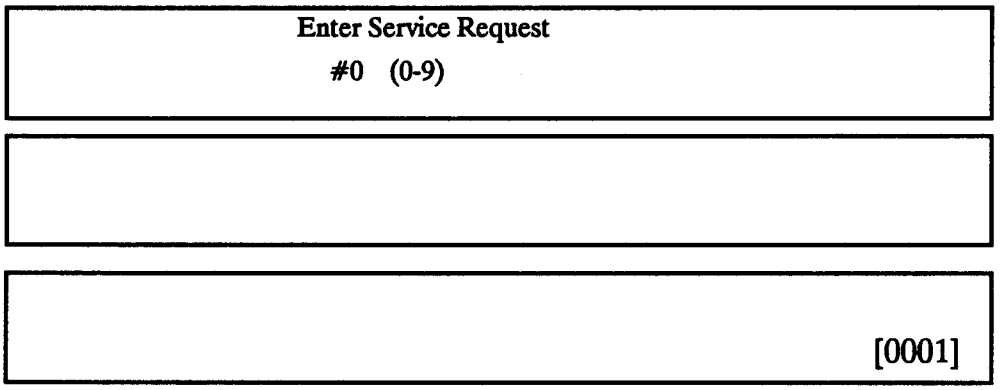
This command enables the FEEDHOLD for a given interrupt.

Key in an Input (1-4), then press ENTER to save this block.

Press INSERT and then SELECT five times to return to the sixth EDIT screen.

3-6-2 SET SERVICE REQUEST

From the sixth EDIT screen, press Key #2, SET SRQ, to see:



This command initiates a programmed pause in the program.The number entered is the ID for the PAUSE. When executed the program halts and waits for the BACK key.

When operating via the Communication Port, Unidex 12 halts the program and sets the Service Request. The controller then Serial Polls the Unidex 12 and sends "V" <CR><LF> to continue.

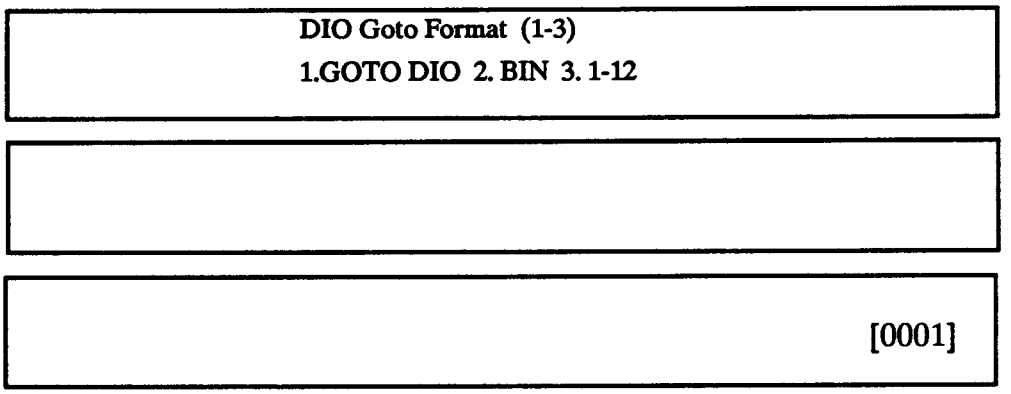
Key in the SERVICE REQUEST number and then press ENTER to save this command.

Press INSERT and then SELECT five times to return to the sixth EDIT screen.

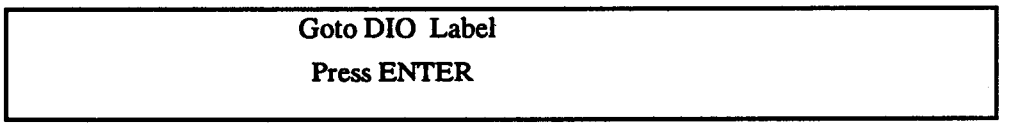
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3-6-3 DIGITAL GOTO

From the sixth EDIT screen, press Key #3, DIG GOTO, to see:

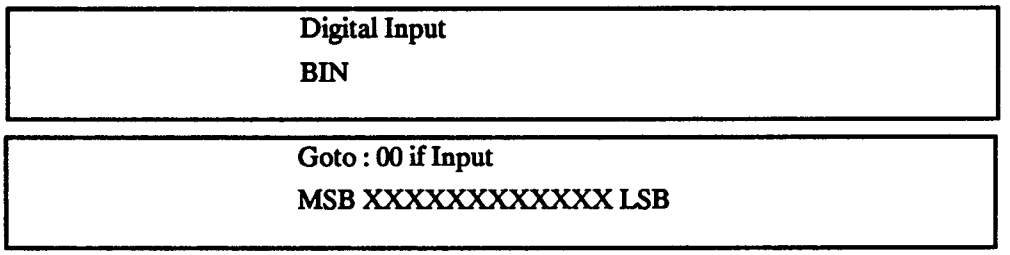


Press Keys 1-3 for selection. One of the following DIGITAL GOTO screens will appear:



This command will cause the program to go to the label specified by the DIO Inputs 1-8.

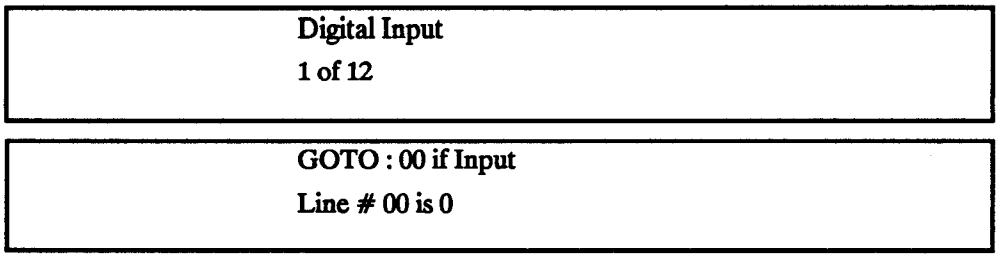
Press ENTER to save this block.



This command causes the program to go to a specified label if the 12 bit digital input condition is met.

Key in the block number label and then press SELECT. Using SELECT, 0, 1, and X configure the Digital Input conditions. Press the ENTER key to save this block.

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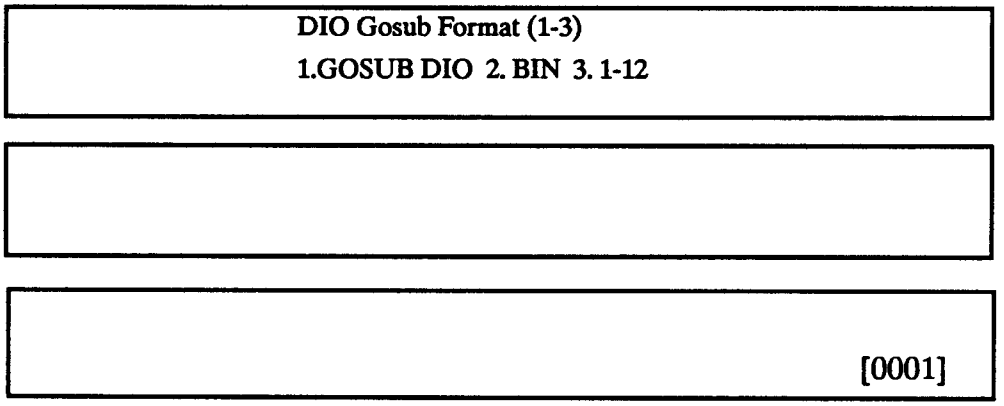
This command selection will cause the program to go to the specified block number label if the selected line is the proper logic level.

Enter the label number and press SELECT. Enter the Digital Input Line number. Use the +/- keys to set the Logic Level. Press the ENTER key to save this command.

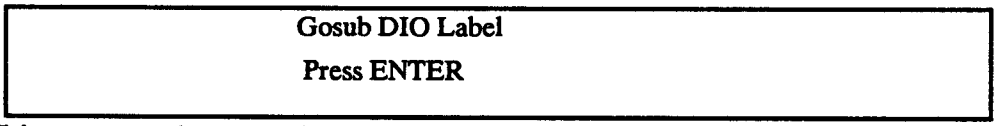
Press INSERT and then SELECT five times to return to the sixth EDIT screen.

3-6-4 DIGITAL GOSUB

From the sixth EDIT screen, press Key #4, DIG GOSUB, to see:

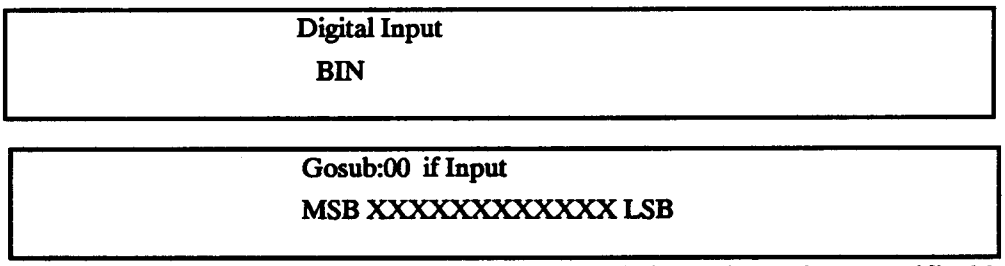


Select one of the DIO GOSUB options (1-3). One of the following screens will appear:



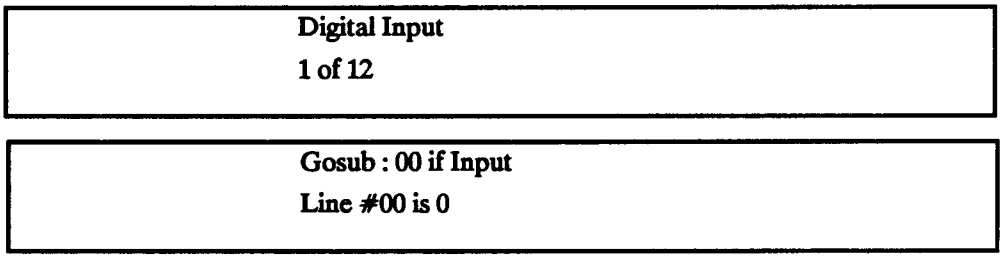
This command causes the program to call the Subroutine which is specified by the DIO Inputs 1-8. Press ENTER to save this block.

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This command will cause the program to call the Subroutine specified by the Label if the 12 bit Input condition is met.

Key in the Label number and press SELECT. Use the SELECT, 0, 1, and X Keys to configure the Digital Input conditions. Press the ENTER key to save this block.



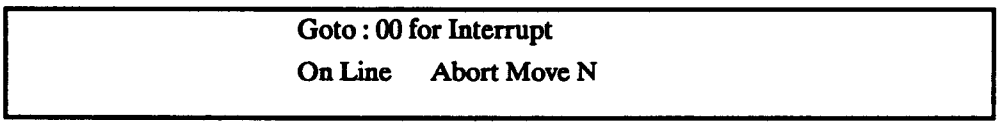
This command causes the program to call the Subroutine specified by the Label if the selected line is the proper logic level.

Key in the Label number and press SELECT. Key in the Digital Input line number. Use the +/- keys to configure the Logic Level. Press ENTER to save this block.

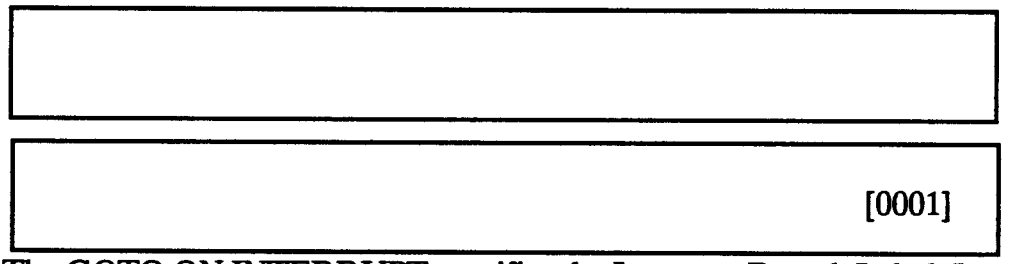
Press INSERT and then SELECT five times to return to the sixth EDIT screen.

3-6-5 GOTO ON INTERRUPT

From the sixth EDIT screen, press Key #5, GOTO ON I, to see:



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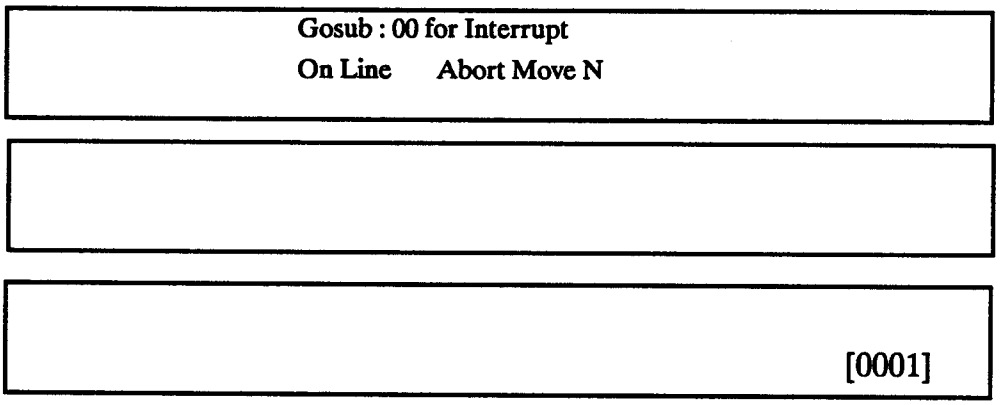
The GOTO ON INTERRUPT specifies the Interrupt Branch Label, Input Line and whether the move will be stopped.

Key in the Label number, then press SELECT. Key in the Line numbers 1-4. Use the +/-Keys to Abort the move (Y) or not to Abort the move (N). Press ENTER to save this block. Lines numbers 1-4 corresponds to inputs DIO-9 through DIO-12.

Press INSERT and then SELECT five times to return to the SIXTH EDIT screen.

3-6-6 GOSUB INTERRUPT

From the sixth EDIT screen, press Key #6, GOSUB ON I, to see:



This command specifies the Interrupt Subroutine Label, the Input Line and if the move will be stopped.

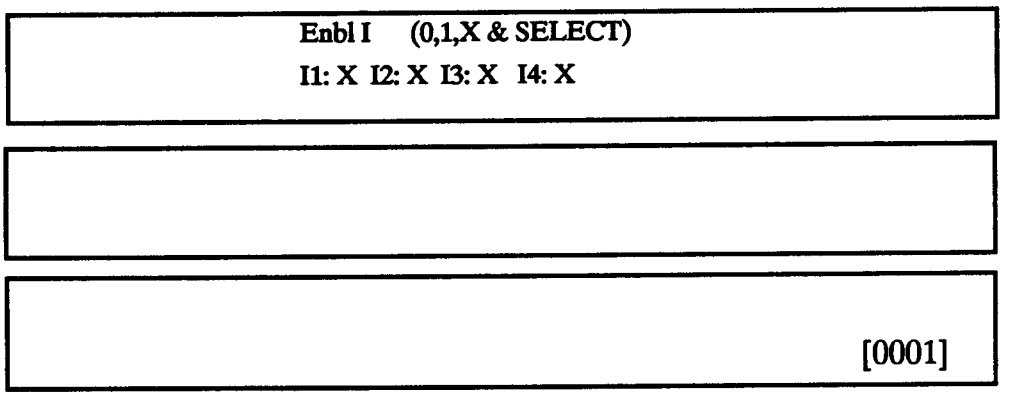
Key in the block number Label, then press SELECT. Enter the Line number. Use the +/- Keys to Abort the Move (Y) or to not Abort the Move (N). Press ENTER to save this block.

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Press INSERT and then SELECT five times to return to the sixth EDIT screen.

3-6-7 ENABLE INTERRUPT

From the sixth EDIT screen, press key #7, ENABLE I, to see:



This command allows the selection of the Inputs to be used as Interrupts as well as the polarity of the Interrupts.

Use the SELECT, 1 or 0 Keys to configure the interrupts. These Interrupt Inputs may either be programmed to stop all axis motion and execute the program instuctions or to permit axis motion to continue and execute the Interrupt program instructions simultaneous to axis motion.

NOTE: Interrupts should not be programmed to request a motion of an axis which is currently in motion.

The Interrupt Inputs can be set up to interrupt on either a positive or a negative edge. Upon Interrupt, the program can be either directed to "branch" to a label or to execute a subroutine and return.

While executing an Interrupt subroutine, all four Interrupts are disabled. At the conclusion of the subroutine, the Interrupts are enabled to their previous states. Interrupts are enabled only during a program.

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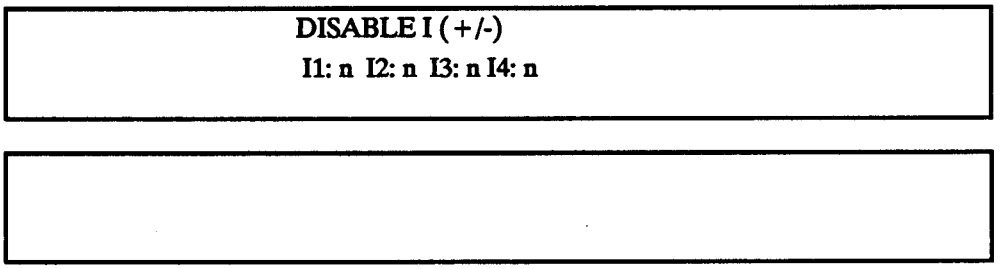
NOTE : See Part II: Appendix 1 Section D, for Programming examples.

Press the ENTER Key to save this block. A "1" sets up the interrupt for a low to high edge. A "0" sets up the interrupt for a high to low edge.

Press INSERT and then SELECT five times to return to the sixth screen of the EDIT screen.

3-6-8 DISABLE INTERRUPTS

From the sixth EDIT screen, press Key #8, DISABLE I, to see:



This command permits selective disabling of some or all of the Interrupts.

Use the +/- and SELECT Keys to configure the DISABLE INTERRUPTS. Press ENTER to save this block.

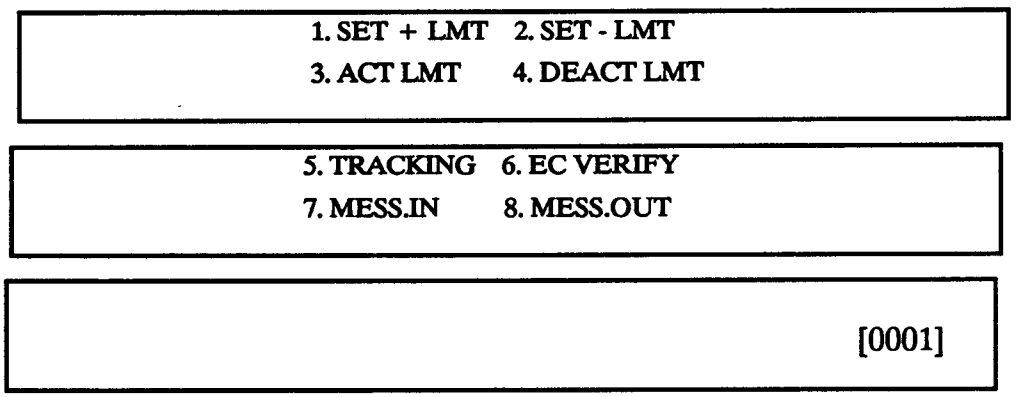
Press INSERT and then SELECT five times to return to the sixth EDIT screen.

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SECTION 3-7 SEVENTH EDIT SCREEN

Press SELECT six times to see the seventh EDIT screen.

SEVENTH EDIT SCREEN



3-7-1 SOFTWARE TRAVEL LIMITS

A user program in Unidex 12 may be used to set Travel Limits for each of the axes in each direction. These Limits establish position boundaries that are not to be crossed during program execution.

Plus (+) Limit represesnts the boundary established in the Positive or CW direction.

Minus (-)Limit represents the boundary established in the Negative or CCW direction.

After a Limit has been programmed and enabled, a motion command block requesting an axis to move across a boundary will cause a "SOFT LIMIT ERROR" message to be displayed and the program will be terminated .

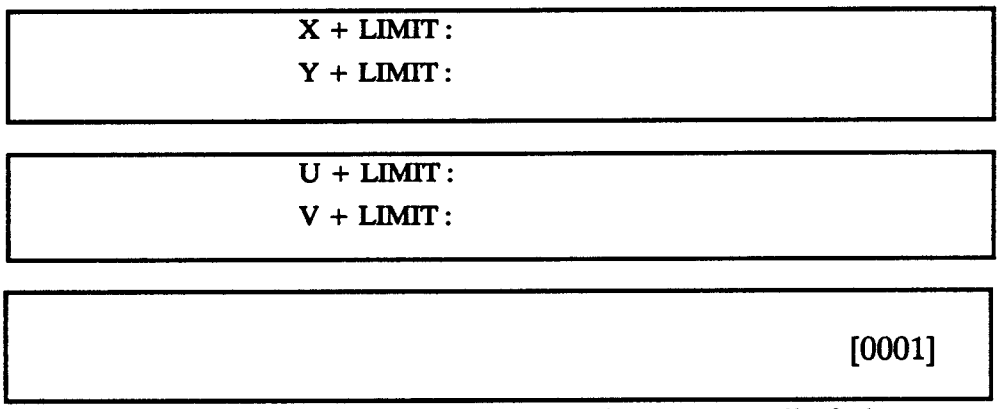
When the Unidex 12 is under Joystick control the axes are monitored for Plus and Minus Limits every 200 milliseconds. Upon the detection of a Limit violation the "Soft Li mit Error" message is displayed and the program is terminated.

See Part II: Appendix 1 Section E, for programming example.

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3-7-1-1 SET +LIMIT

From the seventh EDIT screen, press Key #1, SET + LMT, to see:



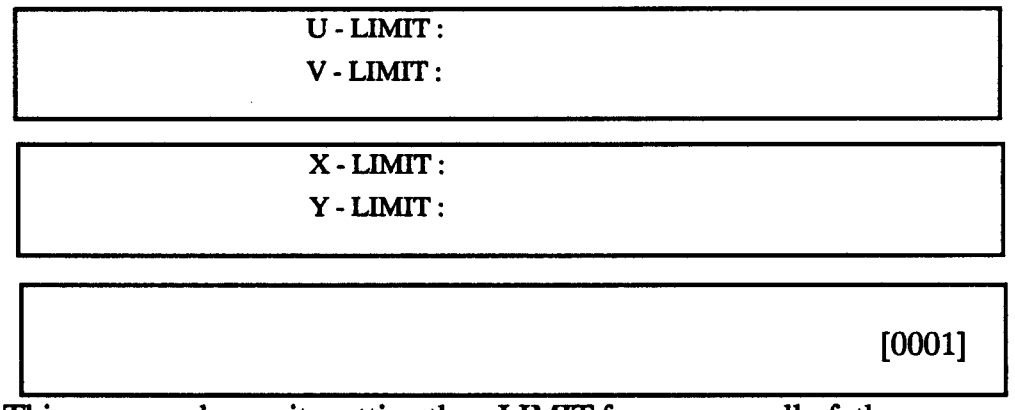
This command permits setting the +LIMIT for some or all of the axes.

Press the appropriate axis key, the axis will begin to flash. The + LIMIT data may now be entered. Press DELETE if the previously entered number is to be erased. Press ENTER and then key in axes values. Press ENTER again when data is complete.

Press INSERT and then SELECT six times to return to the seventh EDIT screen.

3-7-1-2 SET - LIMIT

From the seventh EDIT screen, press Key #2, SET - LMT, to see:



This command permits setting the - LIMIT for some or all of the axes.

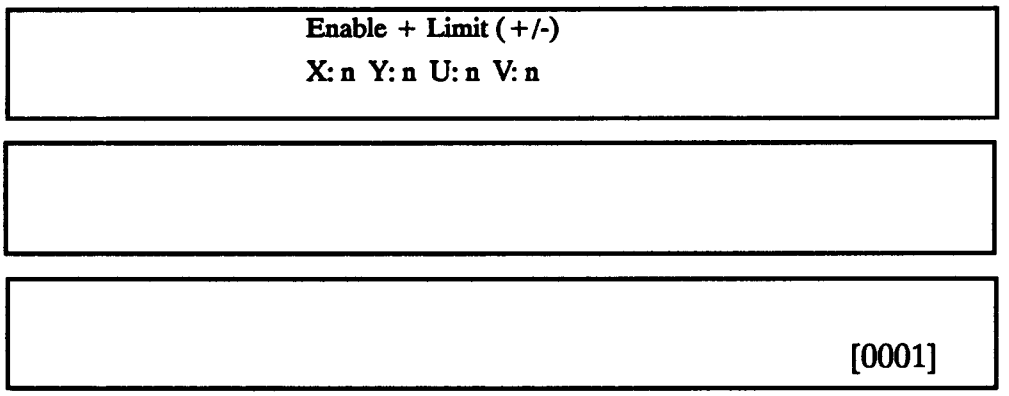
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Press the appropriate axis key, the axis will begin to flash. The - LIMIT data may now be entered. Press DELETE if the previously entered number is to be erased. Press ENTER and then key in axes values. Press ENTER again when data is complete.

Press INSERT and then SELECT six times to return to the seventh EDIT screen.

3-7-1-3 ACTIVATE LIMIT

From the seventh EDIT screen, press Key #3, ACT LMT, to see:



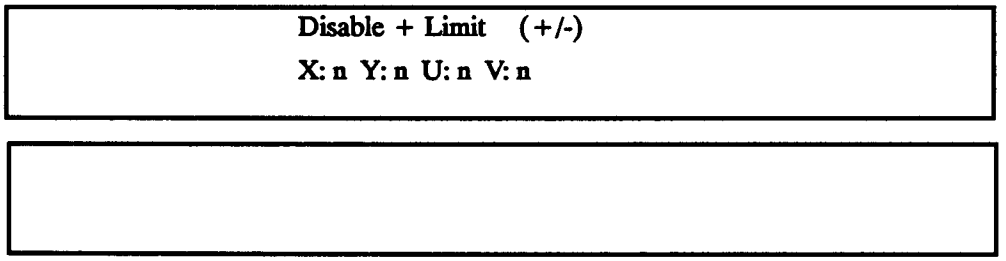
The ACTIVATE LIMIT command may be used to enable any or all of the software limits.

Use the +/- Keys to choose either a + or - Limit then press SELECT. Use the +/- and SELECT Keys, to enable the Limits by setting the corresponding axis to Y using the +/- and SELECT Keys. Press ENTER to save this command.

Press INSERT and then SELECT six times to return to the seventh EDIT screen.

3-7-1-4 DEACTIVATE LIMIT

From the seventh EDIT screen, press Key #4, DEACT LMT, to see:



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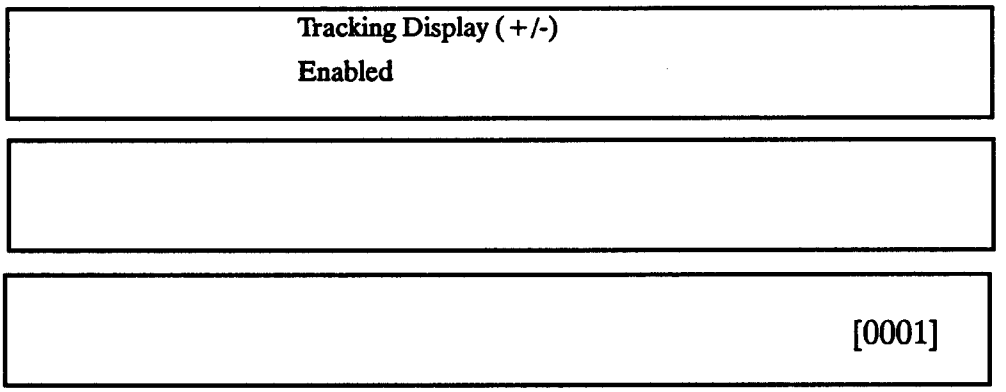
The DEACTIVATE LIMIT command is used to disable any or all software limit checks.

Use the +/- Keys to select either the + or - Limit then press SELECT. Use the +/- and SELECT Keys, to disable the Limits by setting the corresponding axis to Y. Press ENTER to save block.

Press INSERT and then SELECT six times to return to the seventh EDIT screen.

3-7-1-5 TRACKING DISPLAY

From the seventh Edit screen, press Key #5, TRACKING to see:



This command is used to enable or disable the TRACKING DISPLAY.

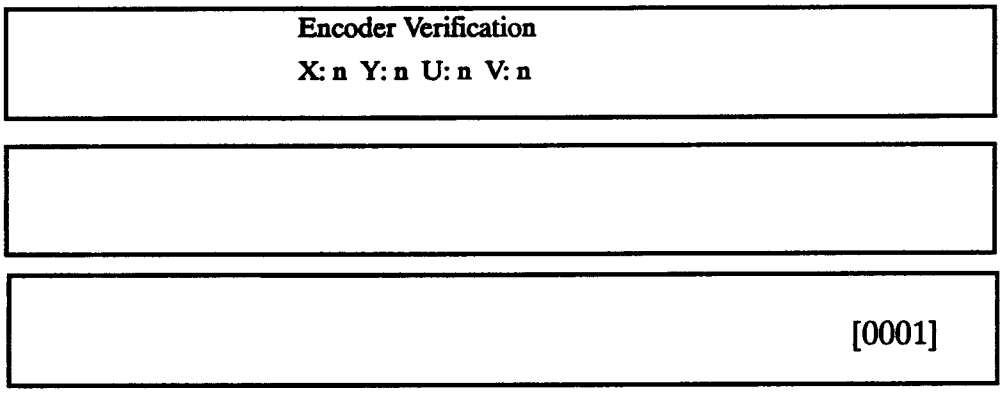
Use the +/- Keys to select either Enable or Disable TRACKING DISPLAY. Press ENTER to save this command.

Press INSERT and then SELECT six times to return to the seventh EDIT screen.

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3-7-1-6 ENCODER VERIFICATION

From the seventh EDIT screen, press Key #6, ENC VERIFY, to see:



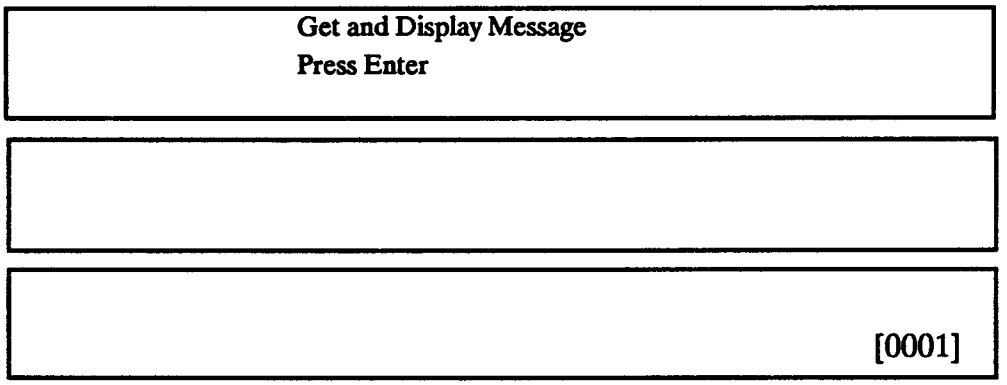
This command is used to enable or disable ENCODER VERIFICATION.

Use the SELECT Key to choose the appropriate axis, then use the +/- Keys to either enable (Y) or disable (N). Press ENTER to save this command.

Press INSERT and then SELECT six times to see the seventh EDIT screen.

3-7-1-7 MESSAGE IN

From the seventh EDIT screen, press Key #7, MESS.I, to see:



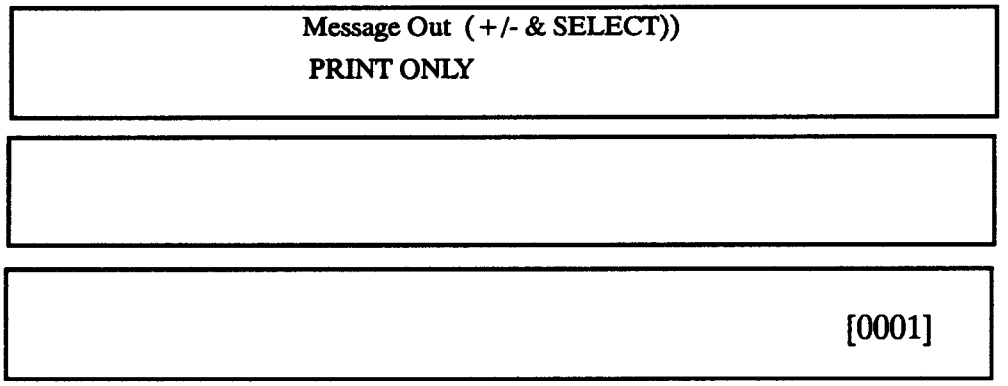
This command will receive Input via the Communication Port and display a message of up to eight characters. Press ENTER to save this block.

Press INSERT and then SELECT six times to return to the seventh EDIT screen.

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3-7-1-8 MESSAGE OUT

From the seventh EDIT screen, press Key #8, MESS. OUT, to see:



This command is used to print and/or display a 48 character message through the RS-232 port. This command is executed only when Unidex 12 is running in the Local mode.

Use the +/- Keys to toggle between, PRINT ONLY, DISPLAY ONLY or PRINT AND DISPLAY. Press the SELECT Key, a 48 character message may now be entered. Press ENTER to save this block.

Press INSERT and then SELECT six times to return to the seventh EDIT screen.

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CHAPTER 4: TROUBLESHOOTING

Chapter 4 provides an explanation of some of the common software problems encountered during Power-Up, Program Editing and Manual program run modes.

SECTION 4-1 POWER UP: SYSTEM CHECK

MESSAGE	POSSIBLE CAUSE AND SOLUTION
System Fail RAM Rd/Wrt Error	A system RAM READ/WRITE error is caused by a memory byte failure somewhere within the 32K RAM chip M3 on the control board (CB5). Upon power-up, Unidex 12 checks all byte locations of the RAM by writing a value back for verification. For the battery back-up option, only the area dedicated to system RAM is checked in this manner. The user area (program area) is not tested. The user can, however, test the program area even with battery back-up (refer to Item 2-2-1- 8-2 of Part II; Chapter 2.). For this test, Unidex 12 will temporarily store each program byte of the program area in a register, check the given program memory byte, and return the original information from the register to the memory byte again. Refer to *Unidex 12 Motion Controller Hardware Manual* for information on replacing RAM chips M3 or M11.
User Memory Check Sum Error	A check sum verification is performed on the RAM upon power-up. *This is performed only on the battery back-up memory option.* At the end of program editing or manual mode parameter changes (i.e., Joystick Divisor, Slew Speed parameters, etc.) Unidex 12 modifies the Check Sum register. When Unidex 12

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is powered up again, a sum of all bytes in the RAM (M3 on the CB4 Control Board or M11 on the OP4 Option Board) is made (see *Unidex 12 Motion Controller Hardware Manual*). This sum is then compared to the Check Sum Register. If they do not match, one or more bytes in RAM has been altered.

Note that a Check Sum error may not necessarily mean a damaged RAM. In some instances, battery backed RAM may be altered by a system software malfunction or a power failure during editing.

SECTION 4-2 PROGRAM EDITING

MESSAGE	POSSIBLE CAUSE AND SOLUTION
WARNING: AT END Of MEM Press ENTER to Continue	An End of Memory warning statement alerts the user that the next block of instruction(s) to be entered may not be stored, because available program memory space is almost depleted. If this situation occurs, the programmer should either reevaluate the program being written for better coding efficiency, or go back to the program delete mode (Item 3-4-8, Part II; Chapter 3.) to delete the existing programs, allowing more space for the new program being written.

NOTE: If the RS-232 option exists, before being deleted, programs can be downloaded into a storage device. (See Part IV of this manual, *RS-232 SERIAL INTERFACE PROGRAMMING OF THE UNIDEX 12,* for more information.)

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BLK NOT SAVED, MEM FULL Press ENTER to Continue

If an attempt to enter an additional block of statement(s) is made after an End of Memory warning (described above) is encountered, and the block size is larger than the available remaining memory space, a "Block Not Saved" statement will appear. Note some block sizes are larger than others, depending on the statement(s) being entered. So it is possible that small blocks (such as "Go To", "Go Sub", etc.) may be entered without being truncated.

If the Memory Full warning is encountered after entering a block which exceeds the amount of memory available, the block will be ignored.

MEMORY ALTERED Press SELECT to Continue

When an existing program is accessed in the EDIT mode, Unidex 12 performs a Check Sum on the entire contents of that program.

Unidex 12 also evaluates the statements of each program block as they are pulled for editing purposes. Each statement is analyzed for the proper format.

If in either of the two cases above, a MEMORY ALTERED statement appears. Unidex 12 automatically performs a MEMORY REPAIR on the program which has been accessed. If undefined statements of a given block of the program are encountered, the entire block containing the statement(s) is deleted. What is left is a program with missing blocks. The user need only scan this program and replace the missing blocks.

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MEMORY REPAIR is a very important feature because it eliminates the possibility of Unidex 12 "locking up" if a faulty program is executed. Since Unidex 12 is menu driven, the possibility of entering improper data is next to impossible. A MEMORY ALTERED warning can only exist due to faulty RAM or some unrecoverable transient power glitch on the input power supply. In both cases the occurrence is rare.

SECTION 4-3 MANUAL/AUTO RUN

MESSAGE	POSSIBLE CAUSE
ILLEGAL BYTE IN MEMORY Press BACK to quit	If during manual or program execution, a user memory byte cannot be identified by Unidex 12, an ILLEGAL BYTE IN MEMORY statement will appear. This detection mechanism monitors on a block by block basis, unlike the Check Sum and block verification mechanisms described in the previous Sections on the Power Up and the Editing Mode. These mechanisms "scanned" the entire user memory before execution took place. For this error detection mode, "BACK" functions as an escape, allowing the Unidex 12 to return to the main menu screens.
Exceeded 8 Repeat Loops	Unidex 12 Programming mode allows only a maximum of eight "nested" repeat loops. (i.e., a loop within a loop, eight times). A possible user-stack overload condition exists if the level of loop nesting exceeds eight levels. An unlimited amount of unnested repeat loops are allowed. The "EXCEEDED 8 REPEAT LOOPS" error is detected during program execution.
Invalid Repeat-Loop End	This statement declares that a repeat loop "End Repeat" statement was encountered without a preceding "Start Repeat" statement. This error is detected during program execution.

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Incompleted Repeat Loops

This statement declares that a "Start Repeat" statement was encountered without a following "End Repeat" statement. This error is detected at the end of program execution.

Incomplete Subroutines

This error statement is similar to a "Incomplete Repeat Loop" error statement in that a "Go Sub" statement was detected without a following "Return-from-Sub" statement. This error is detected at the end of program execution.

Missing Label

This statement declares that a program label does not exist for a label number specified in a given "GoTo", "GoSub", "Cond. GoTo" or "Cond.GoSub" statement. This error is detected during program execution.

Exceeded 8 Subroutines

This error statement is similar to an "Exceeded 8 Repeat Loops" error statement in that a maximum number of 8 "nested" subroutines has been exceeded.

A possible user stack overload exists if the level of subroutine nesting exceeds eight levels. Up to 99 unnested subroutines are allowed (i.e., up to 99 available program labels). This problem is detected during program execution.

Invalid Return-from-Sub

This statement declares that a "Subroutine Return" statement exists without a corresponding "GoSub" statement. This error is detected during program execution.

Memory Check Sum Error

Unidex 12 evokes a Check Sum test on user program memory when an auto or block program run is activated by the RUN key (see Item 2-2-1-6 of Part II; Chapter 2).

Check Sum errors are attributed to causes discussed in the "Power Up" and "Program Editing" error statements discussed in a previous part of this Chapter (Sections 4-1 and 4-2).

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No Programs In Memory	This statement declares that no programs exist in user memory as dictated by the Directory command (Item 2-2-1-8 of Part II; Chapter 2).
Invalid Program #nn Press BACK to Quit	This statement declares that the program number (specified by "nn") does not exist in user memory (as specified by Item 2-2- 1-6, Part II; Chapter 2) or if program number "nn" called as a Subroutine a program that does not exist.
X Axis In Limit, Y Axis In Limit, U Axis In Limit, V Axis In Limit	If an X, Y, U and/or V axis CW or CCW limit is encountered during manual, block or auto run modes, an "AXIS IN LIMIT" warning statement will appear. If this occurs in the manual mode, the user need only press the "arrow" key to move the axis out of the given limit. In the block or auto run modes, the user must go to the manual mode (Slew or Jog) and move the given axis out of the limit.
X Axis Out of Position, Y Axis Out of Position, U Axis Out of Position, V Axis Out of Position	If the Axis Encoder position is differant than the command position by the Encoder Margin. (See Item 2-2-3- 3-7)
***WARNING* Axis In Motion ENTER: Continue BACK: Quit**	See Item 2-2-1-6-1, Part II; Chapter 2 for information regarding this Warning statement.
X Soft Limit Error Y SoftLimit Error U Soft Limit Error V Soft Limit Error	A Command in the User program would have taken an axis beyond a programmed limit.

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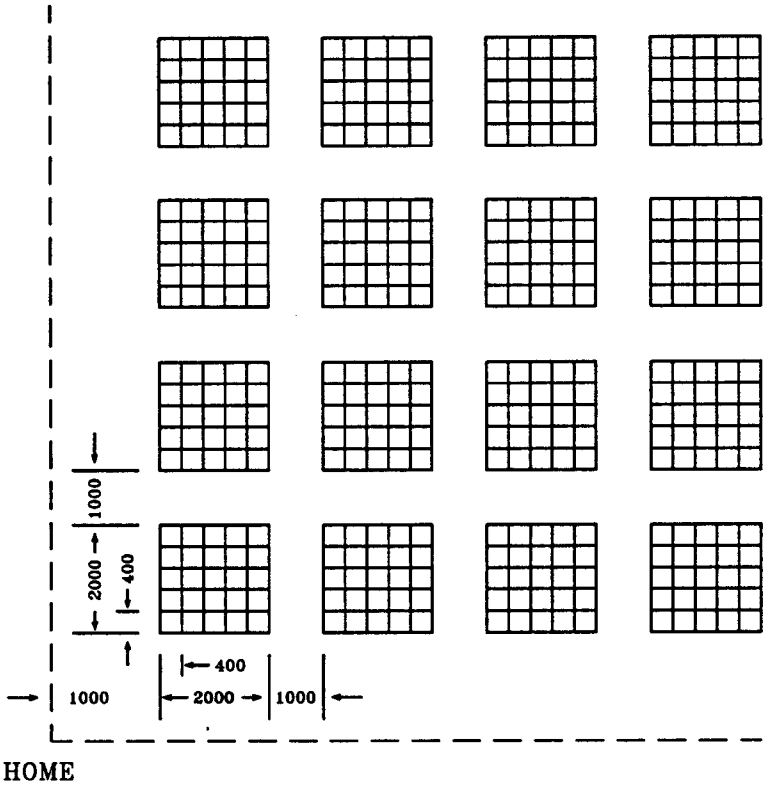
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APPENDIX 1: SAMPLE PROGRAMS FOR UNIDEX 12

A. X/Y SCANNER

The sample given is a simple X/Y scan type program, where X and Y axes are moved to form a scan running parallel to the X axis, and then an overlapping scan running parallel to the Y axis. The above pattern is then repeated three more times along a row. Now the entire row is repeated 3 more times to form a 4 x 4 matrix of the patterns. Output O1 drives a pen down to draw required parts of the pattern. After each pattern the beeper is turned on for one second. The pen operation as well as beeper is in subroutine form. The basic moves of the scan also are in sub-routine. The axes are first sent home at the start of the program.

The program should draw the following pattern:



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The program logic may be described as follows:

```
1. Go Home  X:Y                          ; send axis home
2. Incremental mode                      ; set incremental mode
3. Non Corner Rounding Mode              ; set non-corner rounding mode
4. Index  X F1000 D1000                  ; offset to start scan
        Y F1000 D1000                    ; Y move
5. Start Repeat Loop : 4 times           ; pattern column repeat
6. Start Repeat Loop : 4 times           ; pattern row repeat
7. GOSUB Label #10                       ; scan pattern subroutine
8. End Repeat Loop                       ; End of row repeat
9. Index  X F1000 D-12000                ; offset to start next
    Y F1000 D 03000                      ; pattern
10. End Repeat Loop                      ; end of column repeat
11. Program stop                         ; end of program execution
12. Label #10                            ; main subroutine start
13. Start Repeat Loop : 3 times          ; X parallel scan start
14. GOSUB Label #20                      ; X parallel scan moves
15. End Repeat Loop                      ; end of repeat
16. Index X                              ; no X move
    Y F1000 D-0400                       ; position for Y scan
17. Start Repeat Loop : 3 times          ; Y parallel scan start
18. GOSUB Label #30                      ; moves
19. End Repeat Loop                      ; end of loop
20.  Index  X F1000  D 0600              ; position for next pattern (X move)
        Y F1000  D-2000                  ; Y move
21. GOSUB Label #15                      ; BEEP ON for 1 sec.
22. Return from Subroutine               ; return from Sub #10
23. Label #20                            ; X scan moves
24. GOSUB Label #51                      ; pen down
25. Index  X F1000 D02000                ; X move
        Y                                ; No Y move
26. GOSUB Label #52                      ; pen up
27. Index X                              ; No X move
        Y F1000 D00400                   ; Y move
```


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```
28. GOSUB Label #51                    ; pen down
29. Index X F1000 D-2000               ; move X
        Y                              ; no Y move
30. GOSUB Label #52                    ; pen up
31. Index X                            ; no X move
        Y F1000 D00400                 ; Y move
32. Return from Subroutine             ; ends X scan moves
33. Label #30                          ; Y scan moves
34. GOSUB Label #51                    ; pen down
35. Index X
        Y F1000 D-02000                ; Y move
36. GOSUB Label #52                    ; pen up
37. Index  X F1000 D00400
        Y
38. GOSUB Label #51                    ; pen down
39. Index X
        Y F1000 D02000
40. GOSUB Label #52                    ; pen up
41. Index  X F1000 D00400
        Y
42. Return from subroutine             ; ends Y scan move
43. Label #15                          ; 1 second beeper
44. Beep ON                ;
45. Dwell 001.0 seconds
46. Beep OFF
47. Return from subroutine
48. Label #51                          ; pen down
49. OUTPUT  O1:1  O2:X  O3:X  O4:X     ; activate relay
50. Dwell 000.1 seconds                ; delay for relay
51. Return from Subroutine
52. Label #52                          ; pen up
53. OUTPUT  O1:0  O2:X  O3:X O4:X      ; deactivate relay
54. Dwell 000.1 seconds                ; delay for relay
55. Return from subroutine
```


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The actual key strokes for part of the program are presented on the following pages.

Power up Unidex 12. Press SELECT 1 times

The FIRST SCREEN is now displayed. Press #8. to see:

1. LIST PGM 2. TEST MEM 3LOAD DFLT 7. CLR MEM

Press #7 to see:

DELETE: clear memory BACK: quit

Press DELETE and then press BACK to return to the FOURTH SCREEN.

Press #1. Unidex 12 now requires a program number, for example 25. Press #2, #5, ENTER.

The display will be:

End of Program

Press INSERT. The FIRST EDIT SCREEN will be displayed.

Press #3. The GO HOME screen will be displayed.

Press +/- to program X axis to go home. Press SELECT to see Y flashing. Press +/- to program Y axis go home.

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Press ENTER to enter this block in memory. You now see:

End of Program

Press INSERT. Press SELECT 1 times. You now see the SECOND EDIT SCREEN. Press #1. Press ENTER to enter the Incremental mode command block into memory.

Press INSERT. Press SELECT 1 times. Press #3. Press ENTER to program non corner rounding.

Press INSERT. Press #1 for the INDEX SCREEN.

Press any X key, press ENTER. The F next to X is flashing . Enter the required Feedrate: #1, #0, #0, #0, ENTER. Enter a Distance Offset from Home #1, #0, #0, #0, ENTER.

Press any Y key, press ENTER. Enter same Feedrate and Distance for Y in the same manner as for X.

Press ENTER to enter the block into memory. Press INSERT. Press SELECT 3 times. Press #1. Press #4, ENTER. The first repeat loop is now initiated.

The rest of the program may be similarly entered, referring to the logic described previously.

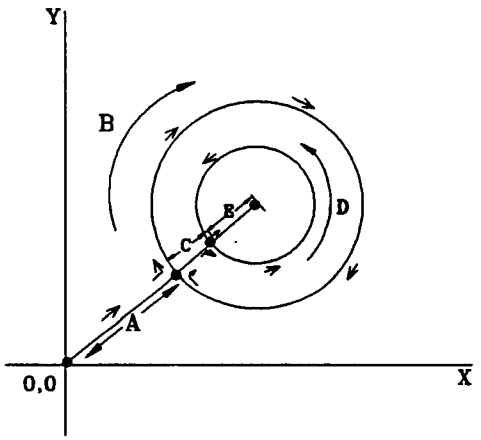
After entering the entire program, press INSERT, BACK to quit the editor and to return to the FIRST SCREEN.

Press #6 (RUN PROG). Press #1 for AUTO RUN and then press #2, #5 to enter program number you want to run. Press ENTER. Press RUN to start program execution.

While the program is running, the STOP key may be pressed to stop program execution. Press PAUSE to pause program execution. Press RUN to continue.

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B. SAMPLE PROGRAMMING LINEAR AND CIRCULAR INTERPOLATION (FRONT PANEL PROGRAMMING)



SYSTEM RESOLUTION:

10,000 Steps = 1 inch

HOME: X,Y

INTERPOLATION FEEDRATE: 5.00

(A)

LINEAR INTERPOLATION

X Distance: 0.5000
Y Distance: 0.5000

(B)

CIRCULAR INTERPOLATION

X Distance: 0.0000
Y Distance: 0.0000
I Value: 0.5000
J Value: 0.5000
CW

(C)

LINEAR INTERPOLATION

X Distance: 0.2500
Y Distance: 0.2500

(D)

CIRCULAR INTERPOLATION

X Distance: 0.0000
Y Distance: 0.0000
I Value: 0.2500
J Value: 0.2500
CCW

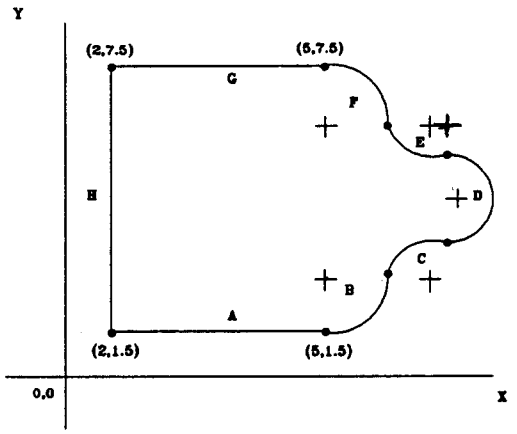
(E)

LINEAR INTERPOLATION

X Distance: 0.2500
Y Distance: 0.2500

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C. LINEAR AND CIRCULAR INTERPOLATION (RS232/IEEE-4888 COMMAND LANGUAGE)



SYSTEM RESOLUTION
1000 Steps = 1 inch

```
HXY                                    ;Home

I F 10.00 *                            ;Interpolation
                                        Feedrate

I X 2.000                              ; Go To (2,1.5)
  Y 1.500
                    (A)
X  F  10.000 D 3.000 *                 ; Move X to (5,1.5)

                    (B)
CC X 1.000                             ; CCW Arc
   Y 1.000
   I 0.000
   J 1.000 *
                    (C)
   CW X 1.000                          ; CW  Arc
     Y 1.000
     I 1.000
     J 0.000 *
```


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(D)

```
CC X 0.000                                  ; CCW Semi-Circle
   Y 2.000
   I 0.000
   J 1.000 *
```

(E)

```
CW X-1.000                                  ; CW Arc
   Y+1.000
   I 0.000
   J 1.000 *
```

(F)

```
   CC X-1.000                               ; CC Arc
   Y+1.000
      I-1.000
      J-0.000 *
```

(G)

```
X F 10.000 D -3.000 *                       ; Move to (2,7.5)
```

(H)

```
Y F 10.000 D -6.000 *                       ; Back to Start
```


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D. INTERRUPT PROGRAMMING EXAMPLES

1) INTERRUPT SUBROUTINE WITHOUT STOPPING MOTION

```
SI 20 I1*          ;Go Sub Label 20 on Interrupt 1
LI0XXX*            ;Enable Interrupt 1 on Low Edge
XF2000 D100000*    ;Move X 100,000 steps
PS*                ;Program Stop
LB20*              ; Subroutine Label #20
OT1XXX*            ; Output 1 ON
SR*                ; Subroutine Return
```

2) INTERRUPT SUBROUTINE ABORTING MOTION

```
AI 20 I1*          ;Abort move and GoSub 20
LI 1XXX*           ;Enable Interrupt 1 on High Edge
XF2000 D200000*    ;Move X 200,000 steps
PS*                ;Program Stop
LB20*              ;Subroutine Label #20
OT1XXX             ;Output 1 ON
SR*                ;Subroutine Return
```

3) BRANCH ON INTERRUPT AND RESTART MOTION

```
BI 20 I1*          ;GoTo Label 20 on Interrupt
LI 1XXX*           ;Enable Interrupt on High Edge
XF2000 D200000     ;Move X 200,000 steps
PS*                ;Program Stop
LB20*              Subroutine Label 20
SX*                ;Stop Axis (Decel. to Stop if Acel. programmed)
OT1XXX*            ;Output 1 is ON
RX*                ;Restart Axis
CONTINUE PROGRAM
```


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E. SOFTWARE TRAVEL LIMITS

```
IN*                          ;Incremental Mode
PX 2,000,000*                ;Plus Limit for X Axis
MX0*                         ;Minus Limit for X Axis
JX *                         ;Enable Plus Limit
BX *                         ;Enable Minus Limit
XF10000 D 1,000,000 *        ;Move to 1,000,000
DW 1.0*                      ;Dwell (wait) 1 sec
XF10000 D600,000*            ;Move to 1,600,000
XF10000 D500,000*            ;Move to 2,100,000
```

"X SOFT LIMIT ERROR"

(This Motion Command block will not be executed, the program will be terminated at X position 1,600,000.)

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PART III

PROGRAMMABLE

ACCELERATION /DECELERATION

FOR THE UNIDEX 12

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CHAPTER 1: PROGRAMMABLE ACCEL./DECEL.

Programmable Acceleration/Deceleration increases the performance of the motion control system by providing the ability to achieve higher motor speeds. The ramp time (the time to attain programmed feedrate) is programmable from 10 milliseconds to 4999 milliseconds. The Acceleration/Deceleration profile may be set up to be linear or parabolic. Also programmable is the individual start/stop feedrate for each axis. (The start/stop setting is used as a default speed for very short moves where Accel./Decel. cannot be used, and also as the starting and ending speed when implementing Accel./Decel.)

Once the user has set (Set Up mode) the desired ramp time, start/stop feedrate and the profile for Acceleration/Deceleration, the values are stored in the battery backed up memory. The system default values for these parameters are:

ACCEL/DECEL RAMP TIME:	250 MILLISECONDS
START/STOP FEEDRATE:	500 STEPS/SECOND
ACCEL/DECEL PROFILE:	LINEAR

These parameters are modal. That is, they stay in effect in both the programmed (indexed) and immediate modes of Unidex 12. However, Unidex 12 may be programmed (in the Edit mode) to change the Accel./Decel. ramp time during program execution. (Start/Stop feedrate and Accel./Decel. profile can only be changed in the Set Up mode.) If the Accel./Decel. ramp time is changed during program control, the last value set becomes the new modal Accel./Decel. parameter.

Before proceeding with the discussion of the Accel./Decel. option, it is assumed that the user has reviewed Part II (*Menu-drive Front Panel Programming*) of this manual.

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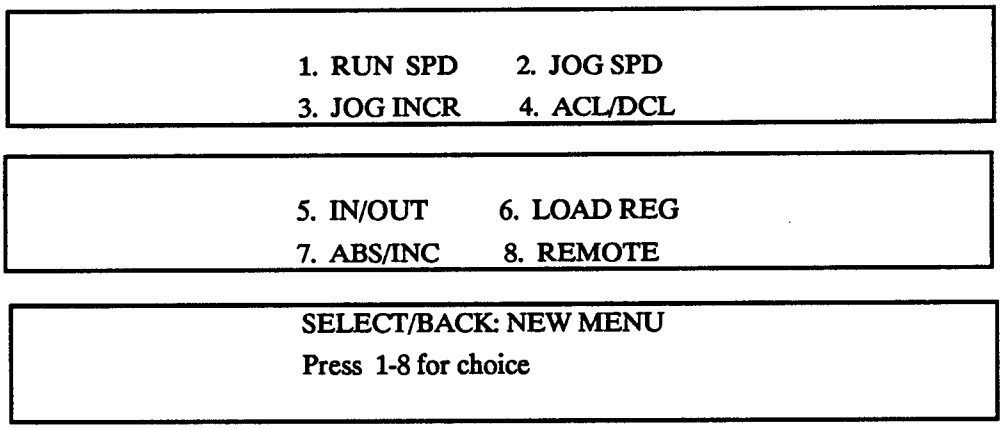
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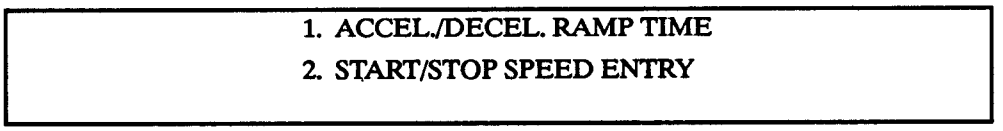
CHAPTER 2: PROGRAMMING ACCEL./DECEL.

SECTION 2-1 MANUAL PROGRAMMING OF RAMP TIME

To program the parameters related to Acceleration and Deceleration, bring up the Second screen of the Main Menu:



Press key #4 to see:



Press key #1 to select Ramp Time programming:



The screen shows the current active value of Ramp Time.

The required Ramp Time may now be programmed. This value may be from 10 to 4999 mSec. Any value below 10 will be entered in the system as zero and this will turn Acceleration and Deceleration OFF. After entering the ramp time, press "ENTER". Unidex 12 now gives the option to execute the command by pressing

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RUN or to quit by pressing BACK (as described in the command description in Part II, Chapter 2 of this manual).

User memory (battery back up) will be updated as a result of manually programming the ramp time.

SECTION 2-2 PROGRAMMING START/STOP FEEDRATE

The Start/Stop Speed entry is similar to Run Speed entry. Press key #2 to select Start/Stop Speed programming.

```
SS-Spd X 0000500 step/s
SS-Spd Y 0000500 step/s
```

Feedrate values from 2 to 250,000 machine steps/sec may be entered here (in this case, 2 to 250,000 machine steps/sec). Start/Stop speed is the speed the axis defaults to when a programmed move is too short to implement Acceleration and Deceleration. If the time for the move is less than 10 milliseconds, Acceleration/Deceleration is turned off for the move and the move is executed at the Start/Stop Feedrate.

SECTION 2-3 ACCEL./DECEL. PROFILE SETUP

The Accel./Decel. Profile is set up as linear or parabolic using the Set Up screens (see Item 2-2-3-3 of Part II; Chapter 2 of this manual).

Press Key #1, MODES, to see:

```
Axes FREE-RUN MODE: A
OUTPUTS 1-4 : Active Low
```

```
ACCEL Profile : LINEAR
Default Mode  : INCREMENTAL
```


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```
SELECT : Next   BACK : Exit
+/- to change Set Up
```

Press SELECT until ACCEL Profile is reached, then use the +/- keys to select either Linear or Parabolic.

SECTION 2-4 RAMP TIME PROGRAMMING

The second EDIT screen (see Part II of this manual) allows Acceleration/Deceleration Ramp Time programming.

```
1. INC/ABS      2. ACL / DCL
3. COR RND      4. LOAD REG
```

```
5. INPUT        6. OUTPUT
7. DIG OUT      7. BEEP
```

```
                                    [0001]
```

Press key #2 for:

```
ENTER ACL/DCL RAMP TIME
0000   mSec
```

Enter the desired value and press ENTER to enter the block in memory. The Accel./Decel. block, if called up again, will show the most recently entered ramp time.

To turn off Acceleration/Deceleration, program 0 milliseconds.

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The motion command for entering the ramp time when downloading a program via a Communication Port (i.e., RS-232C or IEEE-488) is:

AD nnnn *

where "nnnn" is the ramp time in milliseconds. (See Part IV of this manual for information on RS-232 and the *Unidex 12 Motion Controller Options Manual* for information on IEEE- 488.)

The Ramp Time may be programmed as many times as required within a program. At the end of program execution, the value of the Ramp Time will remain as the last programmed value. If programmed manually before running a program, this value will be effective at the start of the program. The last Ramp Time block executed from a program becomes modal to the system, but is *not* retained in the battery backed user memory after power down.

SECTION 2-5 ACCEL./DECEL. NOT IMPLEMENTED

The conditions under which Accel./Decel. is not implemented are:

- Ramp time programmed is less than 10 mSec.
- Feedrate for the move is less than 16 units/second.
- Total time for the move is less than 10 mSecs.

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CHAPTER 3: OPERATION OF ACCEL./DECEL.

SECTION 3-1 ACCEL./DECEL. IN OPERATION

Acceleration and Deceleration velocity profiles in Unidex 12 are achieved by updating the clock rate from the indexer at fixed intervals, pre-computed from the programmed ramp time. The minimum clock-rate-update interval is 1 mSec. and the maximum number of updates is 250. If the ramp time programmed is 250 mSecs., the controller increments the clock rate from 0 to the programmed feedrate in 250 steps of a 1 mSec interval. For ramp times less than 250 mSecs. but greater than 125 mSecs., the number of updates is 125 and the interval is accordingly computed. For ramp times between 125 and 50 mSecs., the number of updates is 50. The following table illustrates this:

Ramptime	Number Of Updates	Update Interval (mS)
5000	250	20.0
400	250	1.6
200	125	1.6
80	50	1.6
30	25	1.2
10	10	1.0

In LINEAR Accel./Decel. mode, the clock-rate is updated linearly. In PARABOLIC mode, the clock-rate-update is a parabolic function of time. In the following description, N stands for the number of updates computed from the programmed Ramp Time as explained above, Fn represents Feedrate at interval number n and Fp represents programmed Feedrate.

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The Feedrate as a function of an update interval number during Acceleration is shown below.

LINEAR

$Fn = (Fp/N) * n$	$n < N$	3.1
$Fn = Fp$	$n = N$	

PARABOLIC

$Fn = (Fp/N) * n(2 - n/N)$	$n < N$	3.2
$Fn = Fp$	$n = N$	

In the linear Accel./Decel. mode, when the programmed move is longer than the Ramp Time, a trapezoidal velocity profile is achieved. When the move is shorter, (but greater than 10 mSec.), a triangular velocity profile results and the axis does not attain the programmed Feedrate. Parabolic profile is truncated when the programmed move is not long enough to attain programmed Feedrate.

Figures 3-1 and 3-2 illustrate examples of linear and parabolic ramping in both full and truncated profiling modes.

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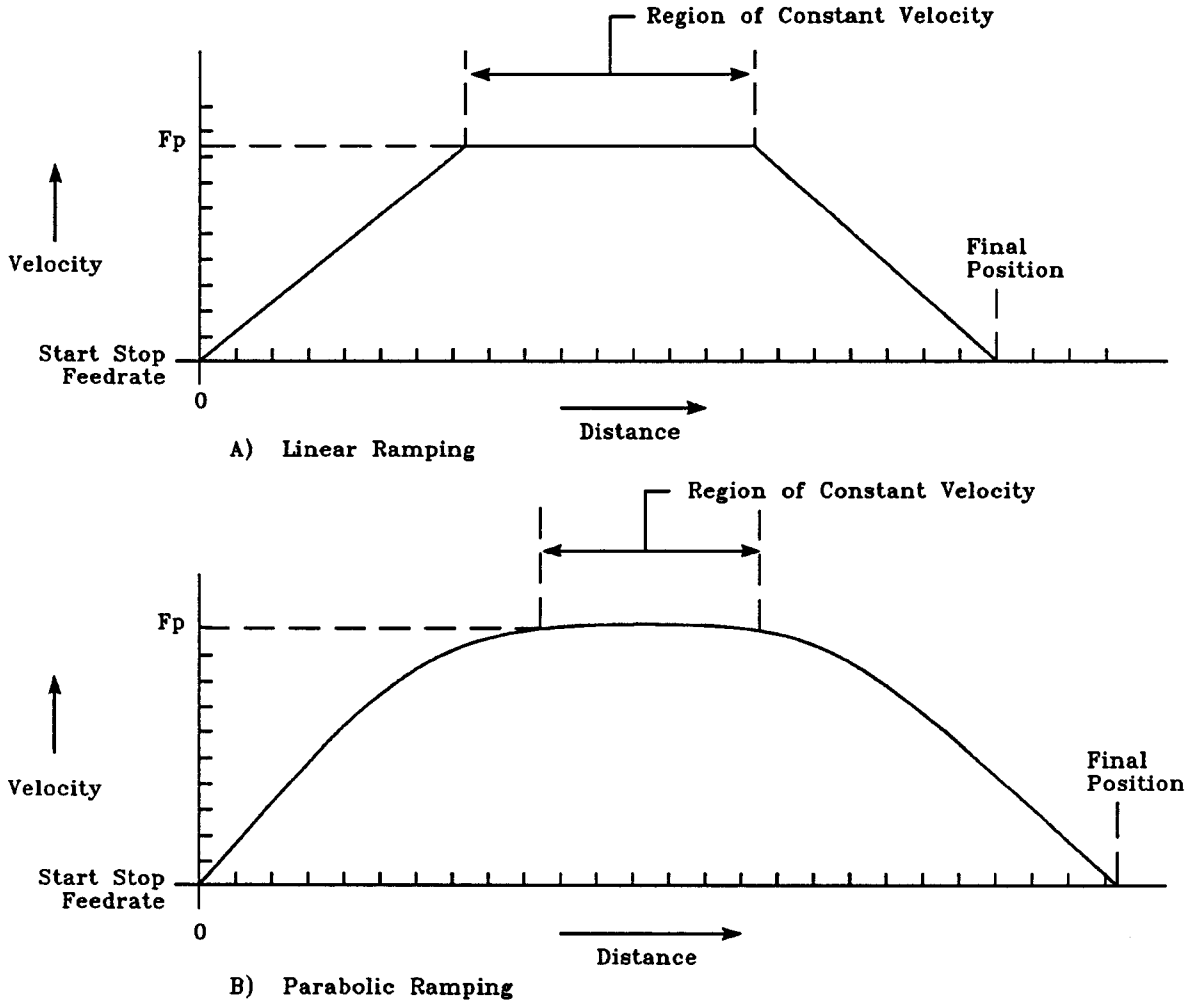


Figure 3-1: Full Ramp Profiles For Linear And Parabolic Ramping

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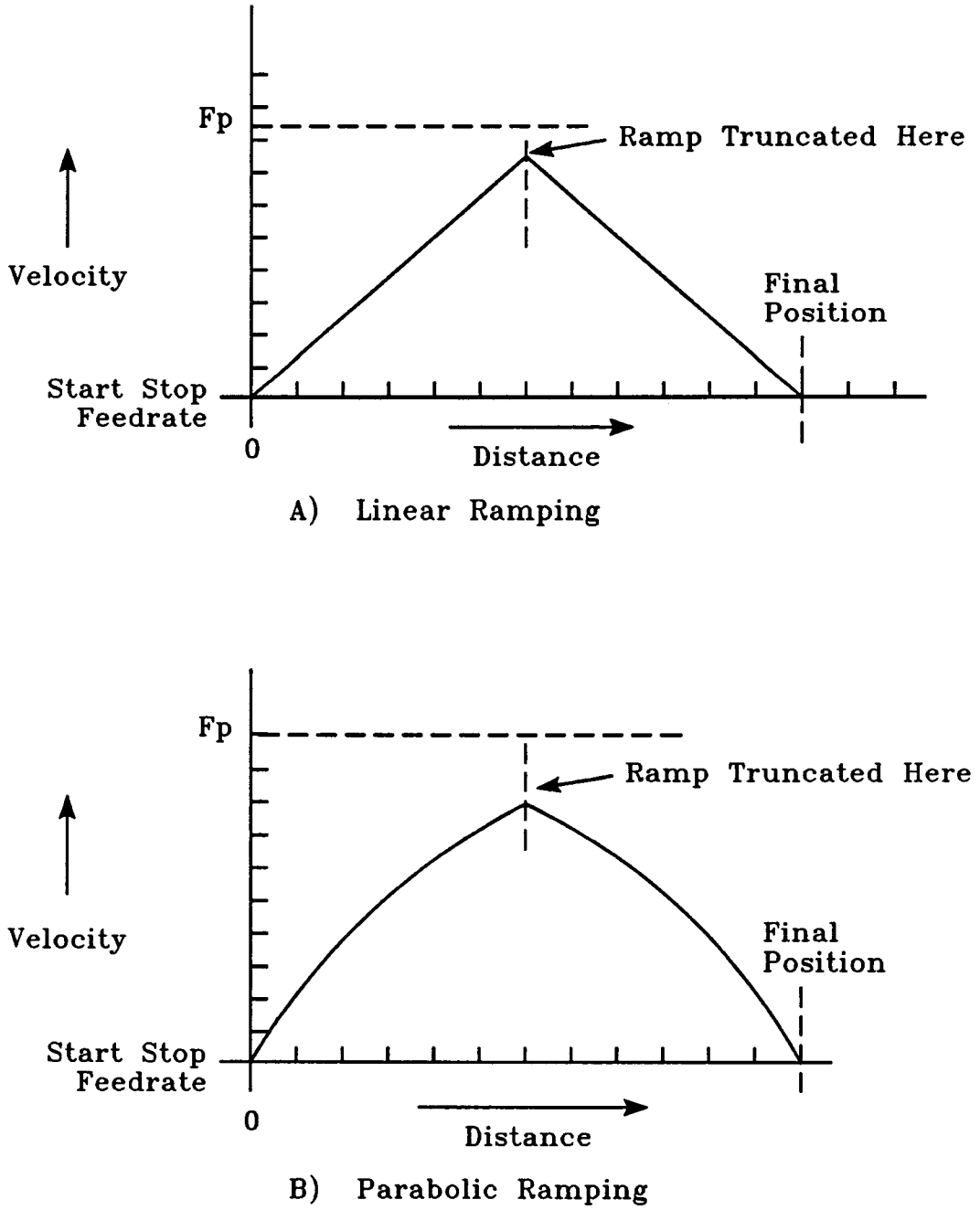


Figure 3-2: Truncated Ramp Profiles For Linear And Parabolic Ramping

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SECTION 3-2 RAMPING LIMITATIONS

Accel./Decel control in Unidex 12 is implemented with individual hardware VCO (Voltage Control Oscillator) circuitry. Hardware VCOs are used because of the need for feeding back electronic damping control signals from the Aerotech stepping translators when the Unidex 12 is used to control stepping motor systems. Since these VCOs are analog drivers, and operate asynchronously with respect to the indexing circuitry of Unidex 12, user calculated vector motion for any two sets of axes may yield inaccuracies in the trajectory between two given points.

In other words, a calculated vectorial move between two given points of an X/Y plane using Accel./Decel. may produce a slight curvature on the line connecting the two points. For this reason, it is recommended that the Accel./Decel. mode not be used in those cases where precise vectorial motion is required.

This limitation is not considered a flaw in Unidex 12 performance since the basic design criteria for Unidex 12 is two or four axis point to point motion.

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PART IV

RS-232 SERIAL INTERFACE

PROGRAMMING

OF THE UNIDEX 12

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CHAPTER 1: RS-232 - INTRODUCTION

The RS-232 option for the Unidex 12 makes it possible to control Unidex 12 from a host device (CRT terminal, PC, etc.) via the Serial Port. A simple command sequence through the RS-232 interface gains control of the device. The host may, from this point on, perform different tasks using Unidex 12. These tasks include executing command block(s) in the immediate mode, downloading a program into the user memory, running a program from the memory in auto-run or block-run mode, and reading the axis position, system statuses, directory, program or entire memory.

Unidex 12 may also be set up for interactive control. In this mode, Unidex 12 sends a service request after executing a program or a command block, or if there is an error condition. Subsequently, the host device is required to poll Unidex 12 before proceeding further.

The RS-232 port also allows connecting a passive device (printer, paper tape punch, cassette tape, etc.) to the Unidex 12 so that programs, directory and axis positions may be printed using the front panel.

Before proceeding, review Part II (*Menu-Driven Front Panel Programming*) of this manual.

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SECTION 1-1 REQUIRED HARDWARE

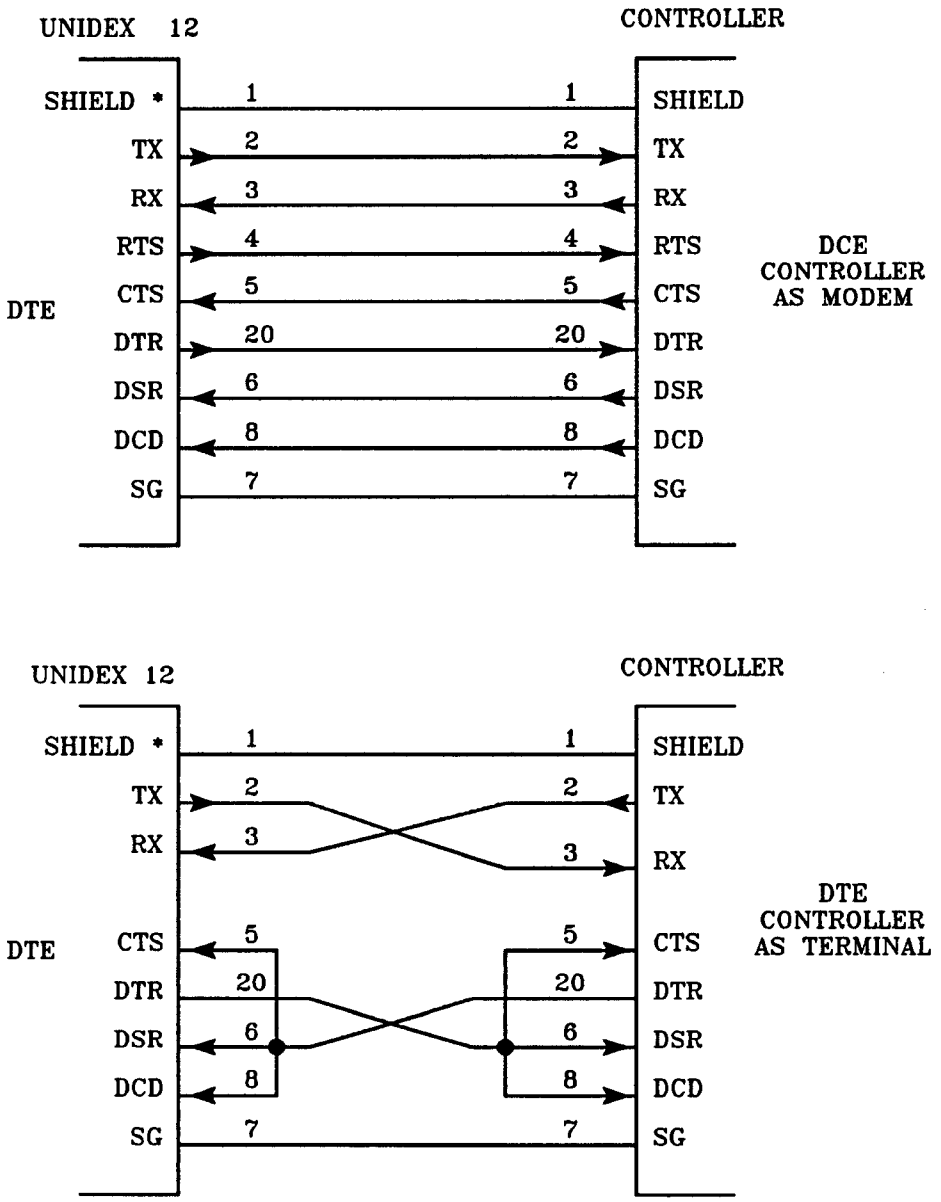
The RS-232 port is a standard DB25P connector implementing the following signal lines:

Pin 1	Shield
Pin 2	Transmit Data (TXD)
Pin 3	Receive Data (RXD)
Pin 4	Request To Send (RTS)
Pin 5	Clear To Send (CTS)
Pin 6	Data Set Ready (DSR)
Pin 7	Signal Common
Pin 8	Data Carrier Detect (DCD)
Pin 20	Data Terminal Ready (DTR)

For more information on the RS-232 port, refer to the *Unidex 12 Motion Controller Hardware Manual.*

The interface is configured as a DTE and therefore the cabling diagrams shown in Figure 1-1 may be of aid in selecting the right configuration for your application.

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* FRAME GROUND

Figure 1-1: RS-232 Connections

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CHAPTER 2: RS-232 UNIDEX 12 OPERATION

SECTION 2-1 SETTING UP THE RS-232 FORMAT

It is required that certain communication parameters of the sending device match those of the receiving device to enable data to be transferred. These parameters determine the format for communication. There are four parameters that must be set up in Unidex 12. They are:

Baud Rate - This relates to the rate of transfer of data. The value represents the "number of bits per second" of transfer. Unidex 12 may be set up for a baud rate of from 45.5 to 19200. (Settings include 45.5, 50, 75, 110, 134.5, 150, 300, 600, 1200, 1800, 2000, 2400, 4800, 9600, and 19200.)

Character Length - Each byte of data is encoded in either 7 or 8 bit length.

No. Of Stop Bits - The end of each byte is indicated by the stop bit sequence. This is also the minimum time required by the receiver to start looking for the next byte after the 7 or 8 bits of the current byte are received. Number of stop bits may be 1 or 2.

Parity - The parity bit is an extra bit added to the character (in addition to the 7 or 8 bits described above) so as to make the number of "1" bits either even or odd, thus adding an extra check for accuracy of data. Parity may also be disabled so that no parity bit is added. Unidex 12 may be set up for ODD or EVEN or DISABLED parity.

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Unidex defaults to the following values upon power-up if there is no battery backed user memory or if the "Load Default" operation is performed.

Baud Rate	**: 1200**
Character Length	**: 7 Bits**
No. Of Stop Bits	**: 1**
Parity	**: disabled**

To change the above values, Unidex 12 must be put into the Set up mode as described in Item 2-2-3-3, Part II; Chapter 2 of this manual.

Press SELECT until the following Set Up screens are displayed. The display will show:

```
Print Block Nos: No
Par. Poll Resp.: PPR1
```

```
Digital Port: I/O
Device Addr (0-30): 00
```

Press the SELECT key for Print Block Nos. and use the +/- key to toggle between "YES" and "No". This feature lets you select whether programs printed on a printer connected to Unidex 12's RS-232 port should contain block numbers. (Printing block numbers may aid in editing a program.)

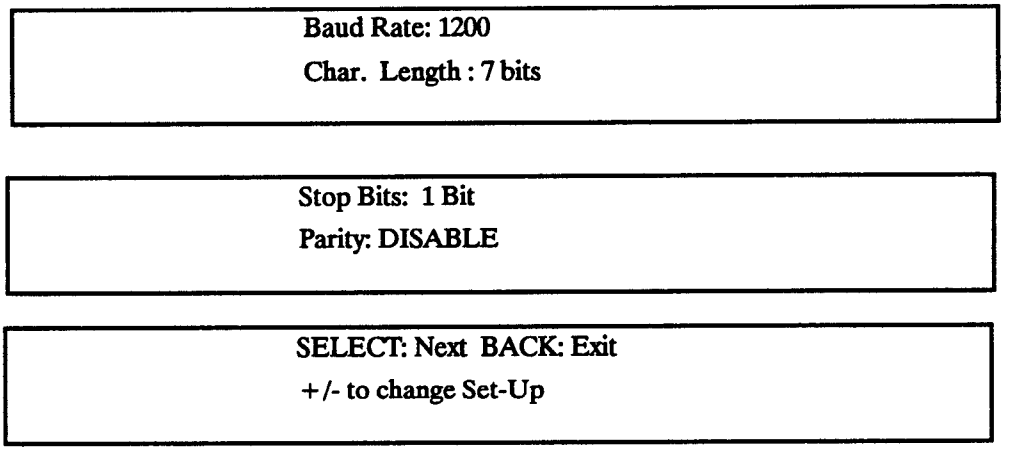
The Par. Poll Resp. and Digital Port entries are not used with the RS-232 Interface.

Press the SELECT key to proceed to the Device Address parameter. This requires the communication identification number for a Unidex 12 when more than one Unidex 12s are connected to one controller.

Press BACK to return to the Set-Up sub menu.

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Press key #3, COMM(1) to see:



Press the SELECT key. The Baud rate may be changed to the value required by successively pressing the +/- key. Unidex 12 can be set up for any one of the 16 different Baud rates mentioned previously. These range from 45.5 to 38400.

Press SELECT again to change Character Length. Press +/- to change to 8 bits if required.

Press SELECT to change Stop Bits. The number of Stop Bits may be changed to 2 bits by pressing +/- key.

Press SELECT to proceed to Parity. Press +/- to change parity to ODD. Press +/- again to disable ODD parity and to select EVEN parity.

After selecting the correct RS-232 formats for Unidex 12, press BACK to return to the Third Main Menu screen.

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SECTION 2-2 PRINT OPERATION FROM UNIDEX 12

To print from the Unidex 12 Front Panel Interface, press key #2, PRINT, of the Third Main Menu screen. You will see:

1. POSN	2. DIR
3. PRGM	4. MEMORY

2-2-1 PRINT POSITION

Pressing key #1, POSN, sends the position values through the RS-232 interface. For example:

X:AXIS = 0000000000 step
Y:AXIS = 0000000000 step
U:AXIS = 0000000000 step
V:AXIS = 0000000000 step

2-2-2 PRINT DIRECTORY

Pressing key #2, DIR, sends a directory listing of programs through the RS-232 interface. For example:

*** UNIDEX-12 DIRECTORY LISTING ***
PROGRAM # 25 LENGTH : 00039 BYTES
FREE :29961 BYTES

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2-2-3 PRINT PROGRAM

Pressing key #3, PROGM, sends a Unidex 12 program through the RS-232 interface. Press key #3 to see:

```
Input Program #
00
```

Input a program number and press ENTER. If the program is not in memory, you will see:

```
INVALID PROGRAM     #nn
Press BACK to Quit
```

If program #nn is in memory, you will see:

```
1. To Printer
2. To Tape
```

Press #1, To Printer, to send program "nn" in printer format (i.e., title, margins and optional block numbers). An example (without block numbers) would be:

```
PROGRAM #25  LENGTH : 00039
H XU *
AB *
X F 0001000 D  0000010000
Y F 0002000 R  +
U F 0000500 D -0000002000
V F 0000001 R - *
```


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An example, containing block numbers, would be:

```
PROGRAM #25  LENGTH : 00039
0001 H XU *
0002 AB *
0003 X F 0001000 D  0000010000
     Y F 0002000 R  +
     U F 0000500 D -0000002000
     V F 0000001 R - *
```

Press #2, To Tape, to send program #nn in a tape format (i.e., *no* title, margins or block numbers). This function is mainly for off-line storage on paper tape or cassette tape. Each program is preceded by a string "## Enn * <CR><LF>" and followed by a string "% L <10 nulls> <CR><LF>" so that the program can readily be downloaded from the tape to Unidex 12. For example:

```
##E25*
H XU *
AB *
X F 0001000 D  0000010000
Y F 0002000 R  +
U F 0000500 D -0000002000
V F 0000001 R - *
% L
```

2-2-4 PRINT MEMORY

Press key #4, MEMORY, to send the entire contents of memory to the printer. The display will be:

```
1. To Printer
2. To Tape
```


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All of the programs in memory will be sent in a printer format (key #1) or a tape format (key #2). For example (using a TO PRINTER format):

```
PROGRAM # 25  LENGTH : 00039 BYTES
H XU *
AB *
X F 0001000 D  0000010000
Y F 0002000 R  +
U F 0000500 D -0000002000
V F 0000001 R - *
FREE : 05993 BYTES
```

NOTE: When in the Print mode, Unidex 12 responds to the Xon/Xoff protocol from the device connected to Unidex 12 through the RS-232 interface.

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CHAPTER 3: PROGRAMMING WITH RS-232

SECTION 3-1 COMMUNICATING WITH RS-232

Unidex 12 is ready for communication at power up if the RS-232 format has been correctly set up and the system has a battery back up, or if the default values are already the required format. The host needs only to send an "Attention" command (discussed at the end of this Section) at this point.

If any of the Unidex 12 keys are pressed, the communication interface is disabled and Unidex 12 will not respond to commands on the RS-232 line until the interface is enabled from the keyboard. To manually enable RS-232 interface, bring up the third screen of the Main Menu:

```
1. COMM.ENAB    3. PRINT
2. SET-UP
```

Press key #1 to see:

```
1. RS-232/IEEE-488
2. TDT/HSB
```

Press key #1, RS-232/IEEE-488, and Unidex 12 is ready to communicate with RS-232. You will see:

```
RS-232 INTERFACE
COMMUNICATION ENABLED
```


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The host device must now send the "attention" command to Unidex 12. This consists of the character string "##" or the character string ">>". The two "#" or ">" signs must be consecutive. Unidex 12, upon receiving the "attention" command, will display:

```
RS-232 INTERFACE
COMMUNICATION ACTIVE
```

SECTION 3-2 TYPES OF COMMANDS

Commands sent to Unidex 12 with the RS-232 interface may be classified into two types:

System Commands: These commands interact with Unidex 12 as a device and perform operations such as resetting the unit, printing a program, printing position values, running a program, downloading a program, transferring status byte information from Unidex 12, etc. Each system command establishes a mode of operation once it is received by Unidex 12.

Program (Motion) Comands: These are the user program blocks in a motion program that Unidex 12 executes when running a program in the Auto or Block mode. Program commands are valid only if entered in the Immediate or Edit mode.

SECTION 3-3 SERVICE REQUEST AND SERIAL POLL

Service Request is an important concept in device control when there is a controller (host computer) as the master and the controlled device (such as a printer or Unidex 12) as the slave. The purpose of Service Request is for the slave device to catch the attention of the master controller. Typically a controller has more than one device being controlled by it and it would be very inefficient for the master controller to continually read the statuses of all the devices to check for error states.

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The controlled (slave) device therefore has the capacity to send a signal (Service Request) to the master controller whenever it requires the attention of the master. The reason for requesting service may be an error condition or to signal the completion of a task.

Unidex 12 implements a Service Request by sending a predetermined byte of data followed by a <CR><LF>. The controller (master) may be set up to be interrupted by this data byte whereupon it must take a necessary action.

The minimum necessary action that the controller must take once Unidex 12 has sent the Service Request signal is to poll Unidex 12 by sending the query (Serial Poll) command Q <CR><LF>. Unidex 12 waits until the Query command is received, and will not respond to any other system command until this is done. The purpose of the Query command Q <CR><LF> is to transfer a status byte from Unidex 12 to the controller. The 8 bits of this status byte represent different internal states of Unidex 12. Serial Polling may be done any time the RS-232 interface is active, not necessarily only after a Service Request.

The status byte may be analyzed by the controller to determine the cause of the Service Request. Each of the bits in the status byte is described as follows:

	ZERO	ONE
BIT 0	Incremental mode	Absolute mode
BIT 1	Not running a program	Running a program
BIT 2	Block run mode	Auto run mode
BIT 3	Non-corner rounding mode	Corner rounding mode
BIT 4	Communication disabled	Communication enabled
BIT 5	Inactive - Not executing a command in immediate mode	Active - Executing command in immediate mode
BIT 6	No service request signal sent	Service request signal sent - waiting for "Q"
BIT 7	No errors detected	Error detected

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Unidex 12 may be put into the Service Request Mode by the system command J <CR> <LF>. The default Service Request data byte sent by Unidex 12 defaults to "%". Unidex 12 sends:

% <CR> <LF>

as a Service Request signal. This byte may also be programmed by the user by entering a character immediately after J. This entry becomes the new Service Request character. For example, if

J# <CR> <LF>

were entered, the Service Request character would become "#" and Unidex 12 would send "#" <CR> <LF> as the Service Request signal.

The Service Request mode may be canceled by sending the system command K <CR> <LF>. In this mode, Unidex 12 will not send a Service Request signal for any reason. This is the default mode. In this mode, to determine if an immediate command or a program has been completed, a Serial Poll (Query) may be done as explained on the previous page and the status byte analyzed (bit 1 and bit 5). When these bits are clear (zero), Unidex 12 is ready to take the next command.

When in the Service Request mode, Unidex 12 sends a Service Request (SRQ) character under the following conditions:

- When an Immediate command execution is complete.
- When a program is completely executed in the Auto Run mode.
- When a block is executed in the Block Run mode.
- When a run time error condition is generated and the program is aborted.
- When an axis limit is activated.
- When a program or immediate move is stopped by pressing the STOP key on the front panel keypad.

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- At the end of a program download operation if an error was generated while downloading. (The SRQ character is sent by Unidex 12 after the "%" that ends the downloading of the program.)
- When it is requested that a non-existent program be printed. (If "Pnn <CR><LF>" is sent to Unidex 12 and program #nn does not exist, Unidex 12 will send the SRQ character.)

NOTE: For more information on error bytes, see Part IV: Chapter 4 of this manual.

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CHAPTER 4: ERROR CODES

The host computer may detect an error condition by checking the most significant bit (bit 7) of the Serial Poll status byte (Section 3-3 of Part IV: Chapter 3 of this manual). If this bit is set to "1", an error has occurred.

To further determine the type of error, the system status may be read by the host by sending the command "PS <CR><LF>". Unidex 12 will send back 13 bytes followed by <CR><LF>. (Refer to Chapter 5 of Part IV of this manual for details on printing status byes.) These 13 bytes represent a complete status report of Unidex 12, and are described as follows:

BYTE 1 Same as Serial Poll status byte in Section 3-3 of Part IV: Chapter 3 of this manual.

BYTE 2 **EDITOR ERROR STATUS:**

	Zero	**One**
Bit 0	No illegal character during download	Illegal character during download (illegal command code)
Bit 1	Memory not full during download	Memory full during download
Bit 2	No user memory checksum error	Checksum error during download of program
Bit 3	No illegal command	Illegal command during download (illegal command code)

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Bit 4
||
Bit 7 Not used

NOTE: If one of these errors is generated during download operation, Unidex 12 will send an SRQ (Service Request) character if you are in the Service Request mode. It is recommended that the user then edit and correct that program.

BYTE 3 RUNTIME ERROR STATUS 1:

	Zero	One
Bit 0 *	X axis not in limit	X axis in limit
Bit 1 *	Y axis not in limit	Y axis in limit
Bit 2 *	U axis is not in limit	U axis in limit
Bit 3 *	V axis not in limit	V axis in limit
Bit 4 *	No illegal byte in memory	Illegal byte in memory
Bit 5 *	Program number valid	Invalid program number called for run
Bit 6 *	Memory not clear	No programs in memory (Memory clear)
Bit 7 *	No user memory checksum error	User memory checksum error

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BYTE 4 **RUNTIME ERROR STATUS 2**

	Zero	One
Bit 0	Stop key not pressed	Stop key pressed to stop motion/program
Bit 1 *	No "Repeat Loop End Invalid" error	"Repeat Loop End Invalid" error
Bit 2 *	No "Repeat Loop Incomplete" error	"Repeat Loop Incomplete" Error
Bit 3 *	Eight repeat loops not exceeded	Eight repeat loops exceeded
Bit 4 *	No "Return From Subroutine Invalid" error	"Return From Subroutine Invalid" error
Bit 5 *	No "Incomplete Subroutine" error	"Incomplete subroutine" error
Bit 6 *	Eight subroutines not exceeded	Eight subroutines exceeded
Bit 7 *	No "Missing Label" error	"Missing Label" error

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BYTE 5 **COMMUNICATION STATUS 1**

	Zero	One
Bit 0	No RS-232 hardware on OP4 board	RS-232 hardware on OP4 board
Bit 1	No IEEE-488 hardware on OP4 board	IEEE-488 hardware on OP4 board
Bit 2	RS-232 communication not active	RS-232 communication active
Bit 3	IEEE-488 communication not active	IEEE-488 communication active
Bit 4	">" or "#" not received	">" or "#" received
Bit 5	No serial poll initiated	Serial poll initiated by sending "Q". Waiting for <CR><LF>
Bit 6	Not in SRQ mode	In SRQ mode
Bit 7	Not in Hold mode	In Hold mode

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BYTE 6 COMMUNICATION STATUS 2

	Zero	One
Bit 0	LCD Display s present system	LCD Display 1 not included in system
Bit 1	Not Used	
Bit 2	In Hold mode, but no trigger command received	In Hold mode, and trigger command received
Bit 3	Unidex 12 "receive buffer" not full	Unidex 12 "receive buffer" full
Bit 4	Xon received during transmit	Xoff received during transmit
Bit 5	Not in program download mode	In program download mode
Bit 6	Status bytes printed in binary format	Status bytes printed in hex-ASCII format
Bit 7	Not in TDT mode	In TDT mode

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BYTE 7 **AXIS VALIDITY STATUS**

	Zero	One
Bit 0	X axis not in system	X axis in system
Bit 1	Y axis not in system	Y axis in system
Bit 2	U axis not in system	U axis in system
Bit 3	V axis not in system	V axis in system
Bit 4	X axis no Encoder Verification Error	X axis Encoder Verification Error
Bit 5	Y axis no Encoder Verification Error	Y axis Encoder Verification Error
Bit 6	U axis no Encoder Verification Error	U axis Encoder Verification Error
Bit 7	V axis no Encoder Verification Error	V axis Encoder Verification Error

BYTE 8 **RAMPER BOARD STATUS**

	Zero	One
Bit 0	X axis does not have in-position signal	X axis has in-position signal
Bit 1	Y axis does not have in-position signal	Y axis has in-position signal
Bit 2	U axis does not have in-position signal	U axis has in-position signal
Bit 3	V axis does not have in-position signal	V axis has in-position signal
Bit 4	X axis no Soft Limit Error	X axis Soft Limit Error
Bit 5	Y axis no Soft Limit Error	Y axis Soft Limit Error
Bit 6	U axis no Soft Limit Error	U axis Soft Limit Error
Bit 7	V axis no Soft Limit Error	V axis Soft Limit Error

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BYTE 9 **AXIS MOTION STATUS**

	Zero	**One**
Bit 0	X axis not moving	X axis moving
Bit 1	Y axis not moving	Y axis moving
Bit 2	U axis not moving	U axis moving
Bit 3	V axis not moving	V axis moving
Bit 4		
| |	Not used	
Bit 7		

BYTE 10 **FREE RUN MODE STATUS**

	Zero	**One**
Bit 0	X axis not in free run mode	X axis in free run mode
Bit 1	Y axis not in free run mode	Y axis in free run mode
Bit 2	U axis not in free run mode	U axis in free run mode
Bit 3	V axis not in free run mode	V axis in free run mode
Bit 4		
| |	Not used	
Bit 7		

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BYTE 12 I/O STATUS

	Zero	One
Bit 0	Input 1 is a 0 (I1)	Input 1 is a 1 (I1)
Bit 1	Input 2 is a 0 (I2)	Input 2 is a 1 (I2)
Bit 2	Input 3 is a 0 (I3)	Input 3 is a 1 (I3)
Bit 3	Input 4 is a 0 (I4)	Input 4 is a 1 (I4)
Bit 4	Output 1 is a 0 (O1)	Output 1 is a 1 (O1)
Bit 5	Output 2 is a 0 (O2)	Output 2 is a 1 (O2)
Bit 6	Output 3 is a 0 (O3)	Output 3 is a 1 (O3)
Bit 7	Output 4 is a 0 (O4)	Output 4 is a 1 (O4)

BYTE 12 AND BYTE 13 DIGITAL OUTPUT STATUS

Bit 0
||
Bit 11 - 12 bit value of digital output

Bit 12
||
Bit 15 - Not used

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CHAPTER 5: TYPES OF COMMANDS

SECTION 5-1 SYSTEM COMMANDS

System commands interact with Unidex 12 as a device and perform operations such as resetting Unidex 12, printing a program, printing position values, running a program, downloading a program, transferring status byte information from Unidex 12, etc. Each system command establishes a mode of operation once it is received by Unidex 12. Each system command must be entered as a capital letter.

5-1-1 GETTING UNIDEX 12'S ATTENTION

The system command required from the host device to get Unidex 12's attention is two consecutive "#" or ">". These commands put the Unidex 12 into the RS-232 mode, once the communication interface is enabled. The host must send

```
##
or
>>
```

to activate the RS-232 interface.

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5-1-2 AUTO MODE

Executing a program in the Auto mode enables the program to run automatically, and execute the motion commands of the program with no need of further user intervention.

To run a program in the Auto mode, send "A", the program number ("nn") and <CR><LF>. Example:

A 10 <CR><LF>

If the Unidex 12 has been put into the Service Request mode prior to executing a program in the Auto Mode (see Section 3-3 of Part IV: Chapter 4 of this manual), at the completion of program execution the Unidex 12 will send the Service Request character (SRQ) and wait for a Serial Poll. After the Serial Poll, you may execute the same program again by sending another <CR><LF>. To run a different program, send "A nn <CR><LF>".

5-1-3 BLOCK MODE

A motion program can be run one block at a time, instead of automatically, as discussed in the above subsection. To run a program in the block mode, send "B" for block, the program number ("nn") and a <CR><LF>. Example:

B 10 <CR><LF>

If the Unidex 12 has been put into the Service Request mode, prior to executing a program block, the Unidex 12 will send the SRQ character after each block has been executed. The host must then Serial Poll (see Section 3-3 of Part IV: Chapter 3 of this manual) Unidex 12 after the execution of each block.

After the execution of the first Command Block and the Serial Poll, send a <CR><LF> to execute the next block. Bit 1 of the Status Byte (see Section 3-3 of Part IV: Chapter 3 of this manual) may be checked to detect completion of the program. This bit is cleared after the last block in the program.

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5-1-4 REMOTE RESET

Sending the command "C" followed by <CR> <LF> resets Unidex 12 after a system command is executed. This returns it to power up conditions. Example:

C <CR> <LF>

5-1-5 DISABLING JOYSTICK MODE OR REMOTE MODE

This command is available with the Unidex 12 Joystick (JP4C) option only. For more information on this option, see the *Unidex 12 Motion Controller Options Manual.*

The system command:

D <CR> <LF>

will do one of the following:

1. Disable the Computer Enabled Joystick Mode and return control to the host controller. (The position registers will be updated with the absolute position values before returning control.)

2. Disable the Remote Mode and return control to the host. (The position registers are updated with the absolute position values before returning control.)

When in the Computer Enabled Joystick Mode, Unidex 12 will respond only to the Print Position commands or "D" commands. When in the Remote Mode , response will only be to the "D" commands.

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5-1-6 DOWNLOADING PROGRAM TO UNIDEX FROM HOST

The "E" command, followed by a program number ("nn") and an end- of-block character (* or /), will put Unidex 12 into the Edit mode and set it up to enter the program commands into program "nn" in the user memory. If an existing program with the same number already resides in Unidex 12, it will be deleted automatically when the new program "nn" is downloaded. Example:

E10 * HXY * XF100D1000YF1000D-2000 * %

In the above example, the commands following "E10*" will be downloaded into the Unidex 12 user memory and stored in program #10. The motion commands that may be included in this program will be discussed in Section 5-2, Program Commands.

5-1-7 DELETING A PROGRAM

In order to delete a program from the Unidex 12 user memory, send the command "E", followed by the character "$", the program number "nn" and an end-of-block character, either "*" or "/". Example:

E $ 10 / (or *)

Program 10 will be erased.

5-1-8 DELETING ALL PROGRAMS (FROM USER MEMORY)

To delete all programs from the Unidex 12 user memory, send the command "E", followed by the character "$", two zeros ("00") and an end-of-block character, either "*" or "/". Example:

E $ 00 /

All programs will be erased.

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5-1-9 BLOCK NUMBERING

If programs are to be printed with block numbers, send the "F" command and a <CR> <LF>. Block numbering may make editing the program easier. Example:

F <CR> <LF>

After this command is sent to Unidex 12, all programs will be printed with block numbers.

5-1-10 BLOCK NUMBERING CANCEL

To cancel block numbering when a program is printed, send the command "G" along with <CR> <LF>. Example:

G <CR> <LF>

After this command has been sent to Unidex 12, programs will be printed without block numbering.

The system commands F and G do not change the system set up feature stored in the battery backed memory.

5-1-11 HOLD

The command to "hold" the execution of a command string or an entire program is established by the "H" command and <CR> <LF>. Example:

H <CR> <LF>

The above command will cause Unidex 12 to suspend execution of any Immediate, Auto or Block commands which may follow it. This is useful if synchronization of axis motion with some other action is necessary. Unidex 12 will only execute the

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commands when it receives a "T" (for Trigger) command (discussed in a following subsection). Example:

```
H <CR> <LF>
A 20 <CR> <LF>  Program #20 not executed (held)
T <CR> <LF>     Program #20 executes
```

5-1-12 CANCEL HOLD

"O" cancels the Hold ("H") command and allows Unidex 12 to execute the Auto, Immediate or Block command:

```
O <CR> <LF>
```

5-1-13 IMMEDIATE MODE

The "I" command, followed by motion program commands, an end-of-block character (* or /) and a <CR> <LF>, allows a block of motion commands to be executed immediately instead of being entered as a motion program. Each block of Immediate commands must begin with an I. For example:

```
I X F10000 D20000 * <CR> <LF>
```

The above Immediate commands will send the X axis 20000 steps at a feedrate of 10000 steps per second (or whatever units might be set in the system). If in Service Request mode, Unidex 12 will send a SRQ character and wait for a Serial Poll after the command is executed. After being polled, Unidex 12 is ready to execute another block of commands.

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All motion commands that make up a Unidex 12 motion program are listed in Section 5-2 of this chapter. Although all motion commands are valid in the Edit mode, not all are valid in the Immediate mode. Following is a list of motion commands that are valid in the Immediate mode (for a full explanation of each, see Section 5-2 of this chapter):

AB*	**HX***	**OT***	**CCA1vddddd**
AD*	**IN***	**RX***	**A2vddddd**
BF*	**IT***	**SX***	**I vddddd**
BN*	**LX***	**X F D***	**J vddddd**
CO*	**NC***	**Y F D***	**CWA1vddddd**
DB*	**OR***	**U F D***	**A2vddddd**
DD*	**OS***	**V F D***	**I vddddd**
DW*	**EA**	**FA**	**J vddddd**
IFffff	**JS**	**PD^**	**IXvdddd**
PM^	**PR^**	**RD^**	**Yvdddd**
RR	**DLdd**	**DHdd**	**Uvdddd**
			Vvdddd

5-1-14 SERVICE REQUEST SET UP

In order to establish the Service Request mode, send the "J" command, followed by <CR><LF>. After the SRQ mode has been established through the J command, Unidex 12 will send the SRQ signal under conditions described in Section 3-3 of Part IV: Chapter 3 of this manual. It then waits until it receives a Serial Poll from the host device before executing any further commands.

5-1-15 SERVICE REQUEST CANCEL

To cancel the Service Request (SRQ) mode established by the J command, send a K command, followed by <CR><LF>. Example:

K <CR><LF>

(SRQ canceled is the default status.)

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5-1-16 LOCAL WITH COMMUNICATION ENABLED MODE

The command "L" followed by <CR> <LF> puts Unidex 12 into the Local with Communication enabled mode. Example:

L<CR> <LF>

This is the state that was originally enabled upon power-up, when key #3, COMM ENAB, of the fifth Main Menu and the subsequent key #1, RS-232/IEEE-488 were pressed, in order to enable the RS-232 interface.

5-1-17 STATUS BYTE IN BINARY FORMAT

To establish the format of the Status Bytes as binary upon transmission, send command "M", followed by <CR> <LF>. Example:

M <CR> <LF>

Status Bytes will be sent as 13 binary bytes followed by <CR> <LF>. Binary format is the default status.

5-1-18 STATUS BYTE IN HEX-ASCII FORMAT

To establish the Status Bytes in the Hex-ASCII format upon transmission, send the command "N", followed by <CR> <LF>. Example:

N <CR> <LF>

Status bytes will be sent as 13 sets of 3 bytex (2Hex - ASCII + space) ended by <CR> <LF>.

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5-1-19 PRINT AXIS POSITION

1. Print X Axis Position (PX)
   In order to print the X axis position register, send:

   PX <CR> <LF>

   The axis position is sent in the following format:

   <space> or <negative sign> <10 digits> <CR> <LF>

2. Print Y Axis Position (PY)
   In order to print the Y axis position register, send:

   PY <CR> <LF>

3. Print U Axis Position (PU)
   In order to print the U axis position register, send:

   PU <CR> <LF>

4. Print V Axis Position (PV)
   In order to print the V axis position register, send:

   PV <CR> <LF>

5-1-20 PRINTING DIRECTORY LISTING

To get a listing of the programs in the Unidex 12 directory, send:

PD <CR> <LF>

Bytes of memory remaining in Unidex 12 will be printed as well. Transmission of data will be terminated by character <ETX>.

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5-1-21 PRINTING A PROGRAM

To print one program, send the command "P", the program number ("nn") and <CR><LF>. Example:

P10 <CR><LF>

The above command will cause program #10 to be printed. Transmission of data will be terminated by character <ETX>.

5-1-22 PRINTING ALL PROGRAMS

To print all programs, send the command "P", two zeros (00) and <CR><LF>. Example:

P00 <CR><LF>

The above command will cause all programs in memory to be printed. Transmission of data will be terminated by character <ETX>.

5-1-23 PRINTING STATUS BYTES

To have the status bytes listed in Chapter 4 of Part IV of this manual, printed, send:

PS <CR><LF>

Depending on "M" or "N" command, the status will be sent as 13 binary bytes followed by <CR><LF> or 13 sets of 3 bytes (2 hex - ASCII + space) ended by <CR><LF>.

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5-1-24 QUERY (SERIAL POLL)

The host device may Serial Poll (Query) Unidex 12 by sending:

Q <CR> <LF>

In response to a Query, Unidex 12 returns it's Status Byte (see Section 3-3 of Part IV: Chapter 3 of this manual) followed by <CR> <LF>. The Status Byte may be one binary byte or 2 hex - ASCII + space, ended by <CR> <LF>.

5-1-25 REMOTE MODE

The system command

R <CR> <LF>

enables Unidex 12 with the "JP4C" option to be driven through the auxiliary controls.

The display shows the Remote mode tracking screen:

The host controller may now signal an external device to take control of Unidex 12. Unidex 12 keeps track of the axes' positions during external control.

```
rtm   X: 0000023456  step
 rt   Y:-0002345.12  mm
```

5-1-26 ENABLING JOYSTICK "S"

This command is available with the Unidex 12 Joystick (JP4C) option only. For more information refer to the *Unidex 12 Motion Controller Options Manual.*

The system command:

S <CR> <LF>

puts Unidex 12 into the "computer-enabled" Joystick mode. The display changes to the Joystick mode Tracking display (see Item 2-2-1-5 of Part II: Chapter 2 of this manual).

In a system with more than 2 axes, the initially active axes will be X and Y. The Joystick may now be operated to move the axes.

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5-1-27 TRIGGER

To execute the program that is suspended with a Hold command (H), send:

T <CR> <LF>

5-1-28 ENABLING JOYSTICK "U"

This command :

U <CR> <LF>

enables the Joystick in much the same manner as Item 5-1-26 , however, upon an axis encountering a Limit, the Unidex 12 sends the Service Request character to the Host computer.

For more information refer to the *Unidex 12 Motion Controller Options Manual*.

5-1-29 RESUME PROGRAM EXECUTION AFTER PROGRAMMED SRQ

To resume program execution after a programmed Service Request is generated by the Unidex 12, send:

V <CR> <LF>

(See Item 5-2-33 for further information concerning a programmed Service Request.)

5-1-30 RESUME AND COMPLETE MOVE AFTER A ENCODER VERIFICATION ERROR

When one or more Axes in motion has an Encoder Verification Error at the end of an indexed move, the Unidex 12 will display an "OUT OF POSITION " error. The Program is halted and control is returned to the Host computer. If the Unidex 12 is in the SRQ mode, a Service Request is set. The Host must now do a Serial Poll("Q") and the status received will show an Error condition. Byte 7 of

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the detailed status (See PartIV: Chapter 4) provides information regarding the Axis containing the Encoder Verification Error. The Print Position commands may be used at this time if needed.

To resume Program execution the Host must send:

W<CR><LF>

To terminate the Program Command the Host must send :

X<CR><LF>

5-1-31 AXIS CALIBRATION TABLE LOAD COMMAND

The command "Z" followed by an Axis designation is to load an Axis Calibration Table into Unidex 12.

See the *Unidex 12 Motion Controller Option Manual* for further information.

5-1-32 RESETTING UNIDEX 12

To reset Unidex 12, send the hexadecimal number 7F or FF. Either is the ASCII code for <DEL>.

SECTION 5-2 MOTION PROGRAM COMMANDS

The motion program commands make up the program that Unidex 12 executes while running in the auto or block mode. While all of the program commands are valid in the Edit mode, only some are valid in the Immediate mode. A list of the motion program commands that will operate in the Immediate mode is given in Section 5-1-11 (*Immediate Mode*) of this Chapter.

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5-2-1 END OF BLOCK

An end-of-block terminates a block of a program. It may be one of two characters:

* or /

If two or more axes are to run simultaneously, keep those axes commands within one block, i.e., place an end-of-block character after the axes moves have been entered. For example:

X F10000 D150000
Y F10000 D150000
V F500 D10000 * (or /)

5-2-2 AXIS MOTION COMMANDS

The axis to move must be specified by an axis command (X, Y, U or V).
The speed with which it travels must be specified by a feedrate command (F).

The distance which it is to travel (or the position it is to attain if in the Absolute Mode) is specified with a distance command (D).

The following is an example of a program block utilizing the above commands:

X F10000 D150000 *

The above command block would send the X axis a distance of 150000 system units at a feedrate of 10000 system units/second.

NOTE: When programming through RS-232 communication, the feedrate need only be entered with the first index block. After that the feedrate need only be entered if it is to be changed.

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1. Axis Free-Run

The axes are commanded to free-run by the command R and a "+" or "-" sign to signify CW (+) or CCW (-). Example:

Y F10000 R+ *

The above command tells the Y axis to free-run in the CW direction at a speed of 10000 system units/second.

5-2-3 INCREMENTAL MODE/ABSOLUTE MODE

The Incremental mode uses a distance command to tell Unidex 12 how much further to move the axes. For example:

X F10000 D1000 *

This command would move the X axis 1000 steps in the CW direction each time it was executed.

Program "IN", followed by an end-of-block, to establish the Incremental mode. Example:

IN *

The Absolute mode uses distance command as an absolute position. For example:

X F10000 D1000 *

When in the Absolute mode, the above example instructs the Unidex 12 to send the X axis to the position 1000. Once there, the re-execution of the above command will not move the axis any further since it is already at the position commanded. To establish the Absolute mode of programming, enter:

AB *

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5-2-4 ACCELERATION/DECELERATION RAMP TIME

The Accel./Decel. ramp time can be programmed in milliseconds by the command "AD" followed by the desired time and an end-of-block character. Example:

AD 10 *

In the above example, the Acceleration ramp time as well as the Deceleration ramp time will be 10 milliseconds. The maximum value is 4999.

5-2-5 ENABLE VELOCITY PROFILE

Velocity Profile may be enabled by sending an "A" followed by the axis designation to be profiled. Example:

AX *
or
AV *

The first command enables the X axis for Velocity Profiling, the second example will enable the V axis.

5-2-6 ENABLE COUNTERCLOCKWISE (CCW) (MINUS) SOFT LIMIT

CCW Limit may be enabled by sending a "B" followed by the axis designation to be enabled. Example:

BY *
or
BXYUV *

The first example enables the Y axis CCW Limit. The second example enables the CCW Limit for all axes.

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5-2-7 CIRCULAR MOVES

A Circular move may be sent by entering the character "C" and then following it with a "W" for a clockwise circle, or a "C" for a counterclockwise circle. This is then followed with the first axis character (X,Y,U, or V) and it's incremental end point distance. Following this should be the "I" and "J" characters with their incremental distances. Example:

CW X 20000 Y 15000 I 25000 J-2000 *

or

CC V 33000 U-25000 I 30000 J 3000 *

The first example is a clockwise circle with the first axis X and the second axis Y. Following the axes are the "I" and "J" values. The second example is a counterclockwise circle using V as the first axis and U as the second.

Refer to PartII:Chapter 2; Item 2-2-1-4-3 for more information.

5-2-8 CORNER ROUNDING/NON-CORNER ROUNDING

The command to implement corner rounding is "CO" followed by an end-of-block. Example:

CO *

The above example would enable corner rounding for all four axes. In the corner rounding mode, a new mode is started without waiting for the Servo Lag from the previous move to be completed (In-Position signal). This feature serves to smooth the motion between blocks.

The command to go back to non-corner rounding is "NC" followed by an end-of-block. Example:

NC *

The above command would take all four axes out of the corner rounding mode.

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5-2-9 DISABLE COUNTERCLOCKWISE (CCW) (MINUS) SOFT LIMIT

The CCW Limit may be disabled by the command "C" followed by the axis or axes to be disabled. Example:

```
CX
 or
CXYUV
```

The first example will disable the X axis CCW Limit only. The second example disables the CCW Limit for all axes.

5-2-10 DISABLE TRACKING DISPLAY

The Tracking display may be disabled by the command "DT" followed by an end-of-block. Example:

```
DT*
```

Disabling the Tracking Dislay eliminates the time necessary to compute position every 200 ms. Overhead time between blocks becomes more consistent.

5-2-11 DWELL

A program Dwell can be entered into a program with a DW command, followed by the duration of the Dwell in of seconds. Example:

```
DW 10 *
or
DW 1.0 *
```

The examples above would enter a Dwell (programmed wait) of 10 seconds and 1 second respectively within the program.

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5-2-12 ENABLE TRACKING DISPLAY

Tracking Display is enabled by sending the command ET. Example:

ET*

This command causes the display to be updated and enables the display if it is disabled.

5-2-13 HIGH RUN CURRENT

This command applies only to Stepper Motors that are run in the Opern Loop mode. It sets the Run current for all axes. Enter a E, followed by the axes which are to run in high current. Example:

EY*
or
EXYUV *

The first example will cause the Y axis to run in high current and the remaining axes to run in low current. The second example causes all of the axes to run in high current.

5-2-14 ENCODER VERIFICATION

This command selects which axes are to be Encoder verified. Enter a F character followed by the axis or axes to be verified. Example:

FX *
or
FXYUV *

The first example will enable only the X axis for Encoder verification. The second example will enable all axes for Encoder verification.

Those axes having Encoder verification, compare the commanded position to the Encoder position at the end of each move block. An Error message will be dis-

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played if these positions differ by more than the programmed margin (Refer to Part II: Chapter; Item 2-2-3-3-7 for more information) and the program will be halted..

When in the "Local" mode of operation the RUN key may be depressed to continue motion and complete the move and resume program execution. Pressing the BACK key will terminate the program.

When using a Host compute, the Unidex 12 will halt the program and return to system level. If in the SRQ mode, a Service Request is set. Following a Serial Poll, the Host computer may be used to send :

W<CR><LF> : Resumes Program
X<CR><LF> : Terminates Program

5-2-15 FEEDHOLD ON INTERRUPT

The command Feedhold on Interrupt is entered by FI followed by the Input line number (1-4). Example:

FI2 *

This example will provide a Feedhold if an Interrupt occurs on Line # 2.

5-2-16 HOME

Send an axis home with command H followed by the axis or axes to be sent home and an end-of-block character. Example:

H X *
or
H XYUV *

The first example will send the X axis home. The second command will send all axes home.

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5-2-17 INTERPOLATION FEEDRATE

The Interpolation Feedrate characters, IF, followed by the Feedrate will load the Interpolation Feedrate. Example:

IF 10000 *

This Feedrate value is used in the Linear and Circular Interpolation calculations. (See Part II: Chapter 2; Item 2-2-1-4-4)

5-2-18 LINEAR MOVE

A Linear Move may be sent by first sending the character "I" followed by the axis code and move value for that axis. Repeat the axis code and move value for each axis to be moved. Example:

I X 10000 U 25000 *
or
I X 5000 Y 8000 U 11000 V 975 *

The first example moves the X and U axes together in a Linear Move. The second example moves all axes in a Linear Move.

Refer to Part II: Chapter 2; Item 2-2-1-4-2.

5-2-19 CALL JOYSTICK

The command "JS" may be used to initiate Joystic control. Example:

JS *

The Joystick will return control to the program when Button C is pressed.

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5-2-20 ENABLE CLOCKWISE (CW) LIMIT

The CW Limit is enabled by entering a "J" followed by the axis or axes to be enabled. Example:

JU *
or
JXYUV *

The first example enables the U axis CW Limit, the second example enables the CW Limit for all of the axes.

5-2-21 DISABLE CLOCKWISE (CW) (PLUS) SOFT LIMIT

To disable the CW Limit, send a "K" followed by the axis or axes to be disabled. Example:

KV *
or
KXYUV *

The first example will disable the V axis CW Limit. The second example will disable the CW Limit for all of the axes.

5-2-22 LOAD POSITION REGISTERS

Any of the axes Position Registers may be loaded with an "L" command, followed by a distance and an end-of-block. The value, which is in system units, may be a positive or negative number or may be a zero. Example:

LX0Y0 *

In the above example, the X and Y Position Registers are loaded with zeros. This command may be used to establish an absolute reference position. The axes may be moved to this reference position by programming, in the Absolute mode, an Index block with distance values equal to the reference position.

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5-2-23 COUNTERCLOCKWISE (CCW)(MINUS) SOFT LIMIT

One or more of the axes may be loaded with a positive or negative CCW Limit position by sending the CCW Limit code "M" followed by the axes limits. Example:

MX 20000 Y -30000 V 15000 *

In the above example, the X, Y, and V CCW Limit positions are loaded. A limit will now occur if a CCW commanded move takes the axis beyond one of the loaded limit positions.

5-2-24 OUT/RUN STATE

Permits output values to be sent to the Outputs when the program is instructed to run again by pressing RUN or releasing the Feedhold (after the STOP key, key #3, or Feedhold has been pressed), program "OR" followed by the desired values and an end- of-block. Example:

OR XXXX *

In the above example, when the program run is allowed to continue, the outputs will remain unchanged (all have been programmed as "don't cares").

5-2-25 OUT/STOP STATE

Permits output values to be sent to the Outputs when the program is stopped (through the STOP key, a Feedhold, or pressing key #3 on the front panel), enter the command "OS" followed by the desired values and an end-of-block character. Example:

OS 0011 *

When the program is stopped, a zero will be output on O1 and O2, a one will be output on O3 and O4.

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5-2-26 PRINT AND DISPLAY MESSAGE

The Print and Display message command "PD" may be followed by a maximum of 48 characters of message. The character "^" must be entered following the last message character. Example:

PD UNIDEX 12 ^ *

The previous example will print and display via the RS 232 (when in the Local Mode) the message "UNIDEX 12". Characters or codes which are used for control purposes should not be used within Print or Display messages or problems with the Unidex 12 could result. Some such characters are:

>, <, ## and 7F (Hex)

5-2-27 DISPLAY MESSAGE

The Display Message command "PM" may be followed by a maximum of 48 characters of message. The character " ^" must be entered following the last message character. Example:

PM UNIDEX 12 ^ *

The above example will display the message "UNIDEX 12". Characters or codes which are used for control purposes should not be used within Display messages or problems with the Unidex 12 could result. Some such characters are:

>, <, ## and 7F (Hex)

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5-2-28 PRINT MESSAGE

The Print Message command "PR" may be followed by a maximum of 48 characters of message. The character "^" must be entered following the last message character. Example:

PR UNIDEX 12 ^ *

The above example will print the message "UNIDEX 12" when in the Local mode. Characters or codes which are used for control purposes should not be used within Display messages or problems with the Unidex 12 could result. Some such characters are:

>, <, ## and 7F(Hex)

5-2-29 CLOCKWISE (CW) (PLUS) SOFT LIMIT

One or more of the axes may be loaded with a CW Limit position. This Limit position may be positive or negative. The command is entered by typing the character "P" followed by the designated axis then the limit. Example:

P X 1723 Y 2650 U -3400 *

In the above example, the X, Y, and U CW Limit positions are loaded. A limit will now occur if a CW commanded move reaches one of the loaded limit positions.

Refer to Part II: Appendix 2; Section E for a program illustrating a CW Soft Limit.

5-2-30 RECEIVE MESSAGE

To receive a message enter "RD" followed by an end-of-block. Example:

RD *

This command will display a message on the screen as it is received. Message reception is terminated with <CR><LF> or when 48 characters are received.

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5-2-31 RESET ALL AXIS

All axes may be reset by entering "RR" followed by an end-of- block. Example:

RR *

This example will cause a reset to be sent to all axes drives.

5-2-32 STARTING FREE RUN AFTER A STOP FREE RUN OR RE-STARTING AN INTERRUPTED MOVE

After a Free Run has been stopped (see Item 5-2-34), programming an "R" followed by the axis or axes to be restarted, will start the axis or axes again. Example:

R X * (or)
R XYUV *

The first example restarts the X axis. The second example restarts all axes if they have been stopped..

5-2-33 SEND SERVICE REQUEST NUMBER

Unidex 12 may be programmed to serve a Service Request command by entering "SS" followed by it's identification number (0-9). Example:

SS5 *

The above example sends a Service Request number (5). When Unidex 12 executes this command during a user program, it sends a SRQ signal to the Host Con-

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troller. The Host Controller must now perform a Serial Poll. The status sent back by Unidex 12 under this condition is unique.

Bit 7	-0	
Bit 6	-1	(SRQ Sent)
Bit 5	-1	(Immediate Mode Active)
Bit 4	-0	
Bit 3		(The ID Number of the SRQ)
Bit 2		" " " "
Bit 1		" " " "
Bit 0		" " " "

The Host may now resume program execution by sending the command <CR><LF>. The ID Number will identify the Service Request if there are multiple program SRQs.

5-2-34 STOP AXES FREE RUN

To stop an axis or axes' Free Run, program an "S" command, followed by those axes that are to be stopped, and an end-of-block character. Example:

```
S X *   (or)
S XY *  (or)
S XYUV *
```

The first example stops an X axis Free Run. The second stops an X and Y axes Free Run. The third stops an all-axes Free Run.

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5-2-35 DISABLE VELOCITY PROFILE

Velocity Profiling may be disabled by sending "ZS". Example:

```
ZS *
```

The above example disables velocity profiling.

SECTION 5-3 : I/O AND PROGRAM FLOW COMMANDS

5-3-1 ABORT MOVE AND GOSUB ON INTERRUPT

To initiate the Abort Move and GoSub on Interrupt command, send the characters "AI" followed by the GoSub Label number. Then send "I" followed by the Interrupt line number (1-4). Example:

```
AI10I2 *
```

The above example will Abort the move and GoSub Label # 10 for Interrupt on Input line #2.

5-3-2 BEEPER (ON/OFF)

To turn the beeper ON, program "BN" followed by end-of-block. To turn it OFF, program "BF" followed by end-of-block. Example:

```
BN *
DW .5 *
BF *
```

The above example turns ON the beeper for 1/2 of a second and then turns it off.

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5-3-3 GOTO LABEL ON INTERRUPT

This command directs the program to a specified Label if a Interrupt should occur. Send the GoTo command "BI" followed by the Label number. Then send the Input Line code "I" followed by the Line number (1-4). Example:

BI 15 I3 *

The above example will cause the program to GoTo Label number 15 if an interrupt on Input Line 3 occurs.

5-3-4 ABORT MOVE AND GOTO ON INTERRUPT

The Abort a Move and GoTo command is initiated by sending the characters "CI" followed by the GoTo Label number. Then send an "I" followed by the Interrupt line number (1-4). Example:

CI 27 I3 *

5-3-5 CALL PROGRAM

For a Call Program command, send the characters "CP" followed by the desired program number. Example:

CP35 *

The above example calls program #35 and will execute it as if it was a subroutine and then return.

NOTE: A Program used with the Call Program command as a subroutine, does not require a Subroutine Return "SR" command at it's end, control will return to the calling program.

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5-3-6 CONDITIONAL GOSUB ON INPUTS

The command to send the program to a subroutine if the input status matches specified values is "CS". It must be followed by the label number, an "I" (for input) and the desired input values. For example:

```
CS 33  I 110X
```

The above command tells Unidex 12 to go to the subroutine labeled "33" when the value of I1 is 1, I2 is 1, I3 is 0. If these input conditions do not exist, continue with the next program block.

Conditional subroutines may be nested in combination with regular subroutines to 8 levels deep.

5-3-7 CONDITIONAL GOSUB ON DIO (1 of 12)

A program may be sent to a subroutine if the DIO 1 of 12 line matches a specified value. Enter the characters "CS", followed by the Label number, the Logic level (L or H) and the DIO Line number. Example:

```
CS 24 L7 *
  or
CS 59 H11 *
```

The first example is a conditional GoSub to Label #24 if the DIO line #7 is Low. The second example is a conditional GoSub to Label #59 if the DIO line #11 is High.

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5-3-8 CONDITIONAL GOSUB ON MARKER

The command which will send the program to a Subroutine if the Markers for a specified axis is present, is entered by typing "CS", followed by the Label number, an "M" (for Marker) and the desired axes. Example:

CS 24 M Y *
or
CS 37 M XYUV *

The first example will cause the subroutine number 24 to be called if axis Y is on the Marker. The second example will cause the subroutine number 37 to be called if all of the axes are on their respective markers.

5-3-9 CONDITIONAL GOSUB ON DIO (BINARY)

For a Conditional GoSub on DIO (Binary) send the character "CS", followed by the Label number, a "B" (for Binary) and the DIO Input conditions (0,1,X). Example:

CS 41 B 10XXXXXXXXXX *

The above example will call subroutine Label number 41 if the binary Input conditions MSB equals 1 and the next bit is equal to 0. The remaining bits are don't care (X).

5-3-10 CONDITIONAL GOTO

The command "CT", followed by a label number, an "I" and four input values, gives instruction that the program should go to a specific block if the input statuses match the specified values. For example:

CT 22 I 10X0 *

The above command tells Unidex 12 to go to the program block labeled "22" when I1 is 1, I2 is 0, and I4 is 0. If the inputs are not these values, continue with the next program block.

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5-3-11 CONDITIONAL GOTO ON DIO (1 of 12)

The Conditional GoTo on DIO permits branching to a Label if the DIO (1 of 12) line matches the specified value. Enter "CT" followed by the Label number, the Logic level (L or H) and the DIO Line number. Example:

CT 366 L4 *
or
CT 75 H 9 *

The first example is Conditional GoTo to Label #36 if the DIO Line #4 is Low. The second example is a Conditional GoTo Label #75 if the DIO Line #9 High.

5-3-12 CONDITIONAL GOTO ON MARKER

Conditional GoTo on Marker is enabled by typing "CT". It must be followed by the Label number, "M" (for Marker) and the desired axis. Example:

CT 17 MV *
or
CT 26 MXYUV

The first example will branch to Label #17 if axis V is on Marker. The second example will branch to Label #26 if all of the axes are on Marker.

5-3-13 CONDITIONAL GOTO ON DIO (BINARY)

Conditional GoTo on DIO (Binary) is enabled by typing "CT", followed by the Label umber, a "B" (for Binary) and the DIO Input conditions (0,1,X). Example:

CT 34 BXXXXXXXXXX10 *

The above example will GoTo Label #34 if the LSB of the Binary Input conditions is equal to 0 and the next bit is equal to 1. The remaining bits are don't care (X).

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5-3-14 BINARY DIGITAL OUTPUT/BCD DIGITAL OUTPUT

To program the Digital Output to be a binary number, enter command "DD" followed by the number ("nnnn") to be output and an end-of- block. Note: (nnnn < = 4095). The binary equivalent of the number you enter will be the output. Example:

DD 22 *

In the above example the binary equivalent of the number 22 will be output on the 12 output lines as: 000000010110

To program the Digital Output to be a BCD number, enter command "DB", followed by number ("nnn") to be output and an end-of- block. Note: (nnn < = 999). Example:

DB 22 *

The number 22 will be output in BCD format as 0000 0010 0010. A mSec strobe will be output on the strobe line after the 12 bit value settles.

5-3-15 GOTO DIO LABEL

The command to execute GoTo DIO Label is "DG" followed by an end- of-block. Example:

DG *

This command will read the DIO port and retrieve the Label number, to which it will branch.

The Label Number is formed by taking the DIO:8 - through DIO:1 (8 Bits) as a two digit Binary Coded number.

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5-3-16 DIO OUTPUT (1 of 12)

To program the DIO 1 of 12 Output, enter a "D" followed by the Logic Level (L OR H) and the Output Line number # (1-12). Example:

DL 10 *
or
DH 7 *

The first example sets the DIO Output line # 10, Low. The second example sets the DIO Output line # 7 High.

5-3-17 DISABLE INTERRUPT

Disable Interrupt is initiated by entering "DI" followed by a Y to disable or a N to retain as enabled, for each Input (I1-I4). Example:

DI YNNN *

This example disables Input #1 as a interrupt. The remaining Interrupts will remain enabled if previously enabled.

5-3-18 GOSUB

This command tells Unidex 12 to execute a subroutine at label #nn. It is initiated by typing "GS", followed by the block label number and an end-of-block. Example:

GS 15 *

The Subroutine to be executed is located at label #15.

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5-3-19 GOTO

This command directs program flow to a label. Enter "GT" and a label number, followed by an end-of-block. Example:

GT 20 *

The above command tells Unidex 12 to continue program execution at label 20.

5-3-20 INPUT STATE

To set up the conditions that the inputs should attain prior to the program continuing, program an "IT" command, followed by the desired conditions and an end-of-block character. Example:

IT X001 *

The above command states that the program should wait until I2 is a 0, I3 is a 0 and I4 is a 1. State of Input I1 does not matter since it is programmed as a "don't care".

5-3-21 LABEL

A label (0 to 99) labels a block of program as the place to which the program goes when a GOSUB (go to subroutine) or a GOTO command is encountered. It is programmed with a "LB" command, followed by the number and an end-of-block. Example:

LB55 *

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5-3-22 ENABLE INTERRUPT

Enable Interrupt is initiated by typing "LI" followed by the interrupt conditions (0,1,X) for I1 to I4. Example:

LI 01XX *

The above example Interrupt I1 is a 0, I2 is a 1 and I3 and I4 are don't care.

5-3-23 OUTPUT STATE

To establish the output as a 1 (true), a 0 (false) or an X (don't care), send the command "OT" followed by a 1, 0 or X. Example:

OT 10XX *

In the above example, O1 is to be programmed to a 1, O2 to a 0, O3 is a "don't care" and O4 is also a "don't care". "Don't care" leaves the state of an output unchanged.

5-3-24 PROGRAM STOP

Program Stop marks the place in the program at which program execution ends. To initiate a Program Stop, type in "PS". Example:

PS *

Subroutines should be placed after this block.

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5-3-25 CONDITIONAL REPEAT LOOP END

To end the Repeat Loop based on input conditions, program "RC" followed by the required input state and an end-of-block. Example:

RC 10XX *

The above example states that the Repeat Loop will end when the inputs are as follows: I1 is a 1, I2 is a 0. I3 and I4 have no control over the above program block.

The Repeat Loop ends when the programmed number of iterations are completed, if the input conditions have not been satisfied until that time.

5-3-26 REPEAT LOOP END

To mark the end of the Repeat Loop (discussed in the above subsection), enter the program command "RE" followed by an end-of-block. Example:

RE *

Repeat loops may be nested to eight levels deep.

5-3-27 REPEAT PROGRAM

To repeat the entire program from the start, enter command "RP" and an end-of-block. Example:

RP *

NOTE: Remember, any commands following this command within the program will not be executed.

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5-3-28 REPEAT LOOP START

The command to start a repeat loop in your program and the number of times the loop executes is established with a "RS" command, followed by the number of times to repeat and an end-of-block. Example:

RS 8 *

The repeat loop beginning has been marked, and the loop is to be repeated 8 times. (The section of the program that is repeated 8 times, is delineated by the first RE* command that follows this command)

5-3-29 GOSUB LABEL ON INTERRUPT

The GoSub Label on Interrupt will call a specified subroutine if an Interrupt should occur. Enter the characters "SI", followed by the Label number, the Input Line code "I" then the Input line number (1-4). Example:

SI 27 I Y *

The above example will call the Subroutine with label #27 if the Interrupt on Input line 4 occurs.

5-3-30 SUBROUTINE RETURN

This command causes Unidex 12 to return from the Subroutine to the Program Block that immediately follows the "GS nn" block. Every subroutine should end with a Subroutine Return.

SR *

Subroutines may be nested to 8 levels deep.

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SECTION 5-4 SAMPLE RS-232 COMMANDS

A few brief samples may help demonstrate the commands discussed in the last section.

SAMPLE IMMEDIATE COMMANDS

```
##                                          ; Interface active
I H XY * <CR> <LF>                          ; Send home X and Y
I X F10000 D10000 * <CR> <LF>               ; Move X axis
I Y F10000 D10000 * <CR> <LF>               ; Move Y axis
I BN * <CR> <LF>                            ; Beeper ON
I BF * <CR> <LF>                            ; Beeper OFF
I X F100 D1000 Y F100 D1000 * <CR> <LF>     ; X and Y axes move
```

SAMPLE MOTION PROGRAM

```
##                                          ; Interface active
E 01 *                                      ; Edit program 1
H XY *                                      ; Send X and Y axes home
X F10000 D10000 *                           ; Move X axis
Y F10000 D10000 *                           ; Move Y axis
BN *                                        ; Beeper ON
DW .2 *                                     ; Dwell for 2/10 second
BF *                                        ; Beeper OFF
%                                           ; End edit mode
```

Send F <CR> <LF> to set Unidex 12 to the block number printing mode.

P01 <CR> <LF>

The above command will cause program #1 to be printed with block numbers.

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Cancel numbering with a G command.

Program #1 may be run block by block by sending:

B01 <CR> <LF>

and successive <CR> <LF> for successive blocks. To run this same program in the Auto Mode, send:

A01 <CR> <LF>

It may be deleted by sending:

E $ 01 *

Check your directory with a PD command to verify that program #1 has been deleted.

The X position register may be read by sending:

PX <CR> <LF>

The Y position register may be read by sending:

PY <CR> <LF>

Send J <CR> <LF> to put Unidex 12 in the Service Request Mode. (You may enter a character of your own choosing or use the default Service Request character, %.) When this character is sent by Unidex 12, acknowledge it with a Q <CR> <LF> (query) before continuing. If running the program in the Auto mode, the Service Request will come after the program execution. If running a program block by block, it will follow each block.

Send command K <CR> <LF> to cancel the Service Request mode.

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APPENDIX 1: RS-232 COMMAND SUMMARY FOR UNIDEX 12

The following is a list of commands for the Unidex 12 when operating via the RS-232 communication bus in the System Command mode.

NOTE: System Commands must be entered as upper case letters. An italic "A" or "a" represents any of the axes X,Y,U,and V. The letters "n", and "f " represent decimal numbers , 0 through 9. The symbol * represents an end-of-block.

SYSTEM COMMANDS

## or > >	: Activate RS-232 interface
A nn <CR><LF>	: Run program # nn in AUTO mode (nn = 0 to 99).
B nn <CR><LF>	:Run program # nn in BLOCK mode (subsequent <CR><LF> will execute successive program blocks).
C <CR><LF>	: Reset Unidex 12 after previous system command is executed.
D <CR><LF>	: Cancel S or R command
E nn *	: Begin downloading program #nn. Existing program #nn will get deleted automatically.
E $ nn *	: Delete program # nn.
E $ 00 *	: Clear program memory (all programs).
F <CR><LF>	: Insert block numbers when printing programs.

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G <CR> <LF>	:Cancel block number printing (default state)
H <CR> <LF>	: Put Unidex 12 in HOLD mode (Trigger required to execute programs). Hold mode cancelled by O <CR> <LF>.
I (string) * <CR> <LF>	: Execute program block (string) in the immediate mode.
J <CR> <LF>	: Set up Unidex 12 to send Service Request after execution.
K <CR> <LF>	: Cancel set up to send SRQ (default state)
L <CR> <LF>	: Go to Local with Remote enabled.
M <CR> <LF>	: Set up to transmit status in binary format (default state)
N <CR> <LF>	: Set up to transmit status in Hex-ASCII format
O <CR> <LF>	: Cancel HOLD mode (default state)
P*A* <CR> <LF>	: Print *A* axis position register value
PD <CR> <LF>	: Print Directory listing
P*a* <CR> <LF>	: Print *a* Encoder Position value
Pnn <CR> <LF>	: Print program #nn
P00 <CR> <LF>	: Print all programs in memory

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PS <CR> <LF>	: Print Status bytes
Q <CR> <LF>	: Query (serial poll); Unidex 12 returns a byte
R <CR> <LF>	: Enable Remote Mode from host controller
S <CR> <LF>	: Enable Joystick Mode from host controller
T <CR> <LF>	: Trigger to start program execution
U <CR> <LF>	: Enable Joystick mode from Host , send RSQ on Limit
V <CR> <LF>	: Continued after programmed pause
W <CR> <LF>	: Complete move with Encoder Verification Error
X <CR> <LF>	: Quit program with Encoder Verification Error
Z <CR> <LF>	: Load Axis Calibration Table (with Axis Calibration option only)
<DEL> (hex 7F)	: Reset Unidex 12

MOTION PROGRAM COMMANDS

AB *	: Absolute Mode
AD nnn *	: Accel./Decel. ramp time in milliseconds

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A*A* *	: Enable velocity profile for *A* axis
B*A* *	: Enable - limit for *A* axis
BXYUV *	: Enable - limit for all axes
CCA1vddddddddddd A2vddddddddddd I vddddddddddd J vddddddddddd *	: CCW circle using any two axes (A1, A2). A1 and A2 distances are the incremental distances to thier end points. I and J distances are incremental distances to the center.
CO *	: Corner rounding mode
CWA1vddddddddddd A2vddddddddddd I vddddddddddd J vddddddddddd *	: CW circle using any two axes (A1, A2). A1 and A2 distances are the incremental distances to thier end points. I and J distances are incremental distances to the center.
C*A* *	: Disable -limit for *A* axis
CXYUV *	: Disable -limit for all axes
DT *	: Disable tracking display
DWnnn.n *	: Dwell nn.n seconds
ET *	: Enable Tracking Display
E*A* *	: High run current for *A* axis
EXYUV *	: High run current for all axes
F*A* *	: Encoder verification for *A* axis
FXYUV *	: Encoder verification for all axes
FIi *	: Feedhold for Interrupt on line i
H*A* *	: Home *A* axis
HXYUV *	: Home all axes
IF ffffff *	: Interpolation Feedrate
IN *	: Incremental Mode

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IX vddddddddd	: 4 axis Linear move
Y vddddddddd	
U vddddddddd	
V vddddddddd *	
JS *	: Call Joystick
J*A* *	: Enable + limit for *A* axis
JXYUV *	: Enable + limit for all axes
K*A* *	: Disable + limit for *A* axis
KXYUV *	: Disable all axes + limit
L*A*vddddddddd *	: Load *A* position
LX vddddddddd *	: Load all axes position register
Y vddddddddd	
U vddddddddd	
V vddddddddd *	
M*A* vddddddddd*	: - limit for *A* axis
MX vddddddddd	: - limit for all axes
Y vddddddddd	
U vddddddddd	
V vddddddddd *	
NC *	: Non-Corner rounding mode
OR xxxx *	: Out/Run State
OS xxxx *	: Out/Stop State
PD (48 char) ^ *	: Print and Display message
PM (48 char) ^ *	: Display Message
PR (48 char) ^ *	: Print message

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P*A* vddddddddd*	: + limit for *A* axis
PX vddddddddd	: + limit for all axes
Y vddddddddd	
U vddddddddd	
V vddddddddd *	
RD *	: Receive Message
RR *	: Reset all axes
R*A* *	: Start *A* axis
RXYUV *	: Start all axes
SSn *	: Send Service Request #n
S*A* *	: Stop *A* axis
SXYUV *	: Stop all axes
*A*F ffffff Dvddddddddddd *	: Index for *A* axis
XF ffffff Dvddddddddddd *	: Index for all axes
YF ffffff Dvddddddddd	
UF ffffff Dvddddddddd	
VF ffffff Dvddddddddd *	
*A*F ffffff R + *	: *A* Freerun
XF ffffff R -	: All axes Freerun
YF ffffff R -	
UF ffffff R -	
VF ffffff R +	
ZS *	: Disable velocity profile

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I/O AND PROGRAM FLOW COMMANDS

AI nn I1 *	: Abort move on interrupt (i) and GoSub Label nn
BF *	: Beeper Off *
BI nn Ii *	: GoTo Label nn on interrupt (i)
BN *	: Beeper On
CI nn Ii *	: Abort move on interrupt (i) and GoTo Label nn
CP nn *	: Call Program #nn
CS nn Ivvvv *	: Conditional GoSub to Label #nn if Inputs = vvvv
CS nn Ldd *	: Conditional GoSub to Label #nn if 1 of 12 line #dd is Low
CS nn Hdd *	: Conditional GoSub to label #nn if 1 of 12 line #dd is High
CS nn Mx *	: GoSub to Label #nn if X is on Marker
CS nn MXYUV *	: GoSub to Label #nn if all axes on Marker
CS nn Bvvvvvvvvvvv *	: GoSub to Label #nn for Binary condition (vvvvvvvvvvv)
CT nn I vvvv *	: Conditional GoTo to Label #nn if Inputs = vvvv
CT nn L dd *	: Conditional GoTo Label #nn if 1 of 12 line #dd is Low
CT nn H dd *	: Conditional GoTo to Label #nn if 1 of 12 line #dd is High
CT nn Mx *	: GoTo Label #nn if X is on Marker
CT nn MXYUV *	: GoTo Label #nn if all axes on Marker
CT nn Bvvvvvvvvvvv *	: GoTo to Label #n for Binary condition (vvvvvvvvvvv)

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DB nnn *	: BCD Digital Output (nnn)
DD nnnn *	: Decimal Digital Output (nnnn)
DG *	: GoTo Label specified by DIO
DL dd *	: Set 1 of 12 Digital Output line #dd, Low
DH dd *	: Set 1 of 12 Digital Output line #dd, High
DI vvvv *	: Disable Interrupt for Inputs vvvv
DS *	: GoSub specified by DIO
GP nn *	: GoTo Program #nn
GS nn *	: GoSub Label #nn
GT nn *	: GoTo Label #nn
IT vvvv *	: Wait till Input vvvv
LB nn *	: Label #nn
LI vvvv *	: Enable Interrupt for Inputs
OT vvvv *	: Output vvvv
PS *	: Program Stop
RC vvvv *	: End Repeat Loop on Input conditions (vvvv)
RE *	: Repeat Loop End
RP *	: Repeat Program
RS nnnn *	: Repeat Loop Start nnnn times
SI nn Ii *	: GoSub Label #nn for Interrupt on Input i
SR *	: Subroutine Return
* or /	: End of Block (terminates Block)
%	: End of Edit (Downloading)

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PART V

UNIDEX 12

SERVICE AND WARRANTY

INFORMATION

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CHAPTER 1 : SERVICE AND REPAIR

Customer repair of the equipment is limited to the items listed in Part II: Chapter 4; Troubleshooting. Translator and/or Control Board(s) may be removed and replaced if necessary, however, component level repair must not be attempted..

WARNING: DURING THE WARRANTY PERIOD, REPAIR OF ANY SUSPECTED DEFECTIVE ELECTRICAL COMPONENTS ON THE CONTROL OR TRANSLATOR BOARDS MUST NOT BE ATTEMPTED BY THE CUSTOMER ANY ATTEMPT AT TRANSLATOR OR CONTOL BOARD COMPONENT REPLACEMENT OR REPAIR WILL VOID THE WARRANTY.

On-site service should be performed by an experienced electronic technician, preferably one trained by Aerotech.

SECTION 1-1: SHIPMENT

The procedure for shipping equipment to Aerotech, described below, pertains to warranty as well as non-warranty repairs.

1. Before returning any equipment a "Return Authorization Number" must be obtained from Aerotech. (Be prepared to give the serial number of the equipment being returned.)

2. The equipment being returned must be encased in a proper cushioning material and enclosed in a cardboard box.

Call for a "Return Authorization Number" if it is necessary to ship any equipment to the factory.

WARNING: DAMAGE TO THE EQUIPMENT DUE TO IMPROPER PACKAGING MAY VOID WARRANTY!

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Aerotech Sales and Service offices are listed below. For service and information, contact the office servicing your area.

AEROTECH, INC. SALES OFFICES

WORLD HEADQUARTERS

AEROTECH ,INC.
101 Zeta Drive
Pittsburgh, Pa. 15238

Phone (412) 963-7470
FAX (412) 963-7459
TWX (710) 795-3125

AEROTECH LTD.
3 Jupiter House, Calleva Park
Aldermaston
Berkshire RG7 4QW England

Phone (07356) 77274
TLX 847228
FAX (07356) 5022

AEROTECH GMBH
Neumeyerstrasse 90
8500 Nuernberg 10
West Germany

Phone (0911) 521031
TLX 622474
FAX (0911) 521235

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Warranty and Field Service Policy

Aerotech, Inc. warrants its products to be free from defects caused by faulty materials or poor workmanship for a minimum period of one year from date of shipment from Aerotech. Aerotech's liability is limited to replacing, repairing or issuing credit, at its option, for any products which are returned by the original purchaser during the warranty period. Aerotech makes no warranty that its products are fit for the use or purpose to which they may be put by the buyer, whether or not such use or purpose has been disclosed to Aerotech in specifications or drawings previously or subsequently provided, or whether or not Aerotech's products are specifically designed and/or manufactured for buyer's use or purpose. Aerotech's liability on any claim for loss or damage arising out of the sale, resale or use of any of its products shall in no event exceed the selling price of the unit.

Laser Product Warranty

Aerotech, Inc. warrants its laser products to the original purchaser for a minimum period of one year from date of shipment. This warranty covers defects in workmanship and material and is voided for all laser power supplies, plasma tubes and laser systems subject to electrical or physical abuse, tampering (such as opening the housing or removal of the serial tag) or improper operation as determined by Aerotech. This warranty is also voided for failure to comply with Aerotech's return procedures.

Return Products Procedure

Claims for shipment damage (evident or concealed) must be filed with the carrier by the buyer. Aerotech must be notified within (30) days of shipment of incorrect materials. No product may be returned, whether in warranty or out of warranty, without first obtaining approval from Aerotech. No credit will be given nor repairs made for products returned without such approval. Any returned product(s) must be accompanied by a return authorization number. The return authorization number may be obtained by calling an Aerotech service center. Products must be returned, prepaid, to an Aerotech service center (no C.O.D. or Collect Freight accepted). The status of any product returned later than (30) days after the issuance of a return authorization number will be subject to review.

Returned Product Warranty Determination

After Aerotech's examination, warranty or out-of-warranty status will be determined. If upon Aerotech's examination a warrantied defect exists, then the product(s) will be repaired at no charge and shipped, prepaid, back to the buyer. If the buyer desires an air freight return, the product(s) will be shipped collect. Warranty repairs do not extend the original warranty period.

Returned Product Non-Warranty Determination

After Aerotech's examination, the buyer shall be notified of the repair cost. At such time the buyer must issue a valid purchase order to cover the cost of the repair and freight, or authorize the product(s) to be shipped back as is, at the buyer's expense. Failure to obtain a purchase order number or approval within (30) days of notification will result in the product(s) being returned as is, at the buyer's expense. Repair work is warranted for (90) days from date of shipment. Replacement components are warranted for one year from date of shipment.

Rush Service

At times, the buyer may desire to expedite a repair. Regardless of warranty or out-of-warranty status, the buyer must issue a valid purchase order to cover the added rush service cost. Rush service is subject to Aerotech's approval.

On-Site Warranty Repair

If an Aerotech product cannot be made functional by telephone assistance or by sending and having the customer install replacement parts, and cannot be returned to the Aerotech service center for repair, and if Aerotech determines the problem could be warranty- related, then the following policy applies.

Aerotech will provide an on-site field service representative in a reasonable amount of time, provided that the customer issues a valid purchase order to Aerotech covering all transportation and subsistence costs. For warranty field repairs, the customer will not be charged for the cost of labor and material. If service is rendered at times other than normal work periods, then special service rates apply.

If during the on-site repair it is determined the problem is not warranty related, then the terms and conditions stated in the following "On-Site Non-Warranty Repair" section apply.

On-Site Non-Warranty Repair

If an Aerotech product cannot be made functional by telephone assistance or purchased replacement parts, and cannot be returned to the Aerotech service center for repair, then the following field service policy applies.

Aerotech will provide an on-site field service representative in a reasonable amount of time, provided that the customer issues a valid purchase order to Aerotech covering all transportation and subsistence costs and the prevailing labor cost, including travel time, necessary to complete the repair.

AEROTECH, Inc., 101 Zeta Drive, Pittsburgh, Pennsylvania 15238

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