PRICE: $25.00

INSTRUCTIONS
for
SLO-SYN MICRO SERIES
OPEN LOOP
PACKAGED PROGRAMMABLE
INDEXERS

Superior Electric reserves the right to make engineering refinements on all its products. Such refinements may affect information given in instructions. Therefore, **USE ONLY THE INSTRUCTIONS THAT ARE PACKED WITH THE PRODUCT.**

INSPECTION

When unpacking the indexer, examine it carefully for any shipping damage. The "Damage and Shortage" instruction packed with the unit outlines the procedure to follow if any parts are missing or damaged.

FIRST USE

TRY TO DEENERGIZE:

```
echo '<008' >/dev/cua0
echo 'H36' >/dev/cua0
```

ALL LISTEN/ACTIVE

DEENERGIZE

NOTE:

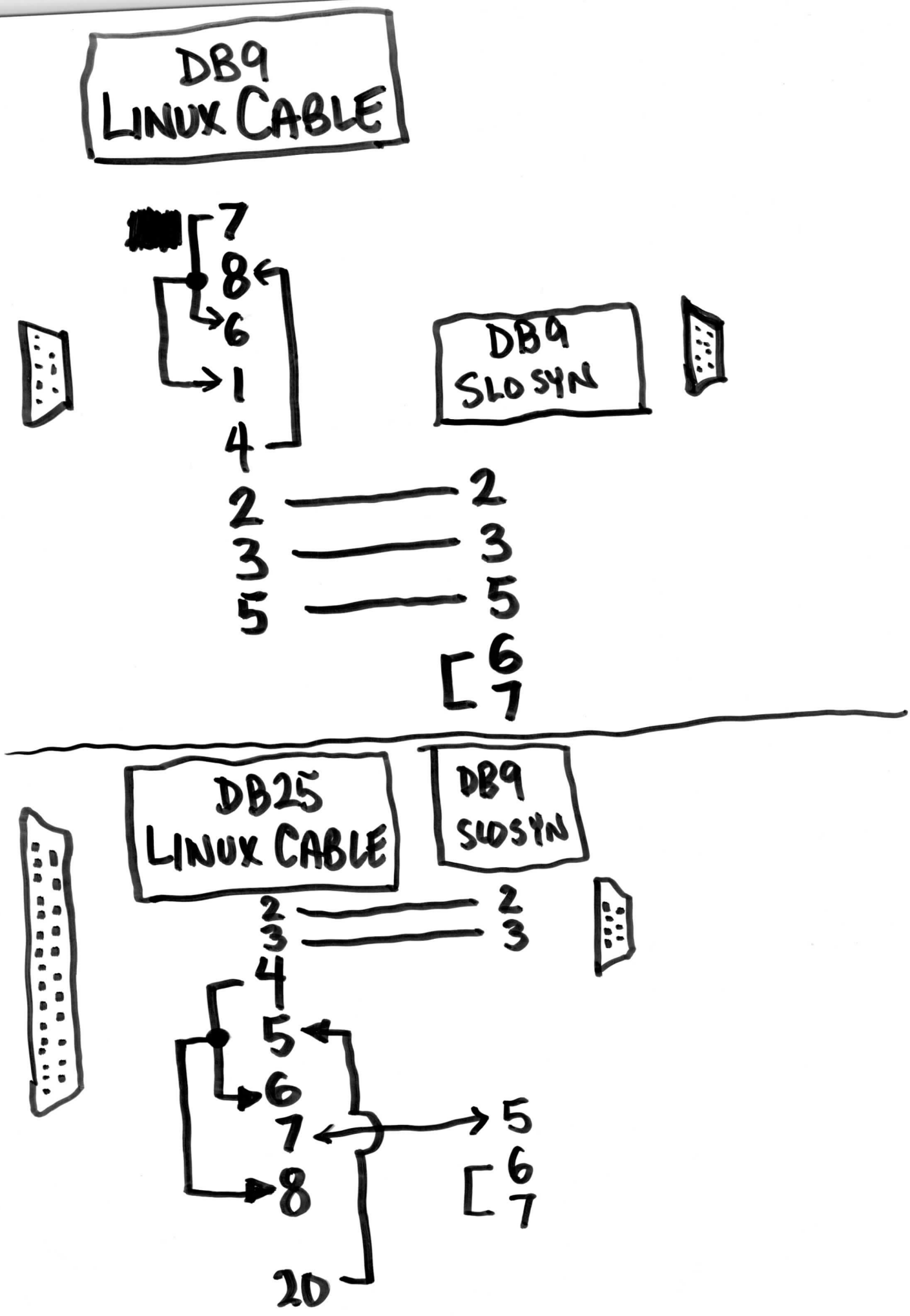
① H35 = ENERGIZE

② IN "ALL LISTEN MODE", NO TRANSMISSIONS FROM SLOSYN. ASSIGN AN ID FIRST!

SUPERIOR ELECTRIC
WARNER ELECTRIC

DANA

EIA RS274-D


DB9
LINUX CABLE
7
8
6
1
4
DB9
SLO SYN
2
3
5
6
7
DB25
LINUX CABLE
DB9
SLOSYN
2
3
4
5
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7
8
20
5
6
7

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LIST OF FIGURES

NOTE: TERMS WHICH APPEAR IN ITALICS IN THIS MANUAL ARE DEFINED IN THE GLOSSARY.

SECTION 1: SCOPE & OBJECTIVES

1.1 USING THIS MANUAL

It is important that you understand how the Programmable Indexer is programmed and operated before you install and use the unit. **We strongly recommend that you read this manual completely before proceeding with the installation of this unit.**

A SLO-SYN Micro Series Programmable Indexer can be operated from a Switch Panel or an SSP-100 Programmer via the 25-pin parallel data port. It can also be operated from a terminal or host computer via the RS232 serial data port, or from the Superior Electric SSP-525 Hand-Held Programmer.

If a Switch Panel or SSP-100 Programmer is to be used, you need to refer to Section 3 for connector locations and pin assignments, to Section 4.2 for I/O specifications, to Section 5 for additional connection information as well as for information on how to operate the Indexer, and to Section 7 for dedicated output information. If RS232 communication is not to be used with the Indexer, it is not necessary to read Section 6.

When the Indexer is to be operated through the RS232 serial port, it is not necessary to read Section 5. You will find connections for the RS232 port listed in Section 3 and specifications for the inputs and outputs listed in Section 4. It is also important that you read Section 6 thoroughly to learn how to program and operate the Indexer. Dedicated outputs are also described in Section 7. An application example and elementary programming information are given in Appendix I.

1.2 PRODUCT FEATURES

SLO-SYN Programmable Indexers are designed to be operated from a simple switch panel which can be easily interfaced with the indexer. If desired, the SSP-100 Programmer can be ordered to accomplish control of a Programmable Indexer. The SSP-100 plugs into the 25-pin parallel data port of the indexer to provide complete control of most programming and operating functions of the units. A Programmable Indexer can also be operated from a terminal or host computer via the RS232 serial data interface port, or it can be controlled from an SSP-525 Hand-Held Programmer.

Note: limited parallel and serial communication may be in operation at the same time. Refer to the Serial/Parallel Input Signal (Section 5.2) for restrictions of simultaneous operation.

Advanced Features Of SLO-SYN Micro Series Programmable Indexers

Micro Series Programmable Indexers have a number of features that can enhance the operation of the system. These features are:

- Choice of absolute or incremental motion

  In the incremental mode, all positioning moves are specified from the present location. In the absolute mode, all positioning information is given relative to a zero, or "home" position.

- Boost or Reduce motor current (3180 and 6180 models only)

  The Boost Current function provides higher current to the motor windings when additional power is needed for accelerating heavy loads. The Reduce Current function allows the motor phase current to be lowered to decrease heating of the motor when maximum power is not necessary.

- Auto Reverse

  When the Auto Reverse feature is active, the Indexer automatically returns the motor to the starting point at the end of each move.

- Auto Repeat

  The operator can program the Repeat Count register with the number of times a program is to be repeated. The indexer will perform the program once, plus the number of times entered in the Repeat Count register. If the number in the register is zero, the indexer will perform the program only once.

- All Windings Off

  H35 - ON
  H36 - OFF

  When holding torque is not needed while the motor is at rest, the All Windings Off function can be activated to shut off current to the windings when the motor comes to a stop, thereby lessening motor heating. This function is only active when the motor is not moving.

  It is important to note that all holding torque is lost when the Windings Off function is active.

- Choice of ramp profiles

  Depending on the type of motion required, the operator can specify that the motion be done using a trapezoidal, "S" or hyperbolic ramp profile.

- *Index* From Run cycle

  Index the commanded distance during a continuous motion upon recognition of the "Home Limit" input.

- Velocity Changing during Motion

  Velocity may be changed during motion via RS232 commands, "!Fnnnnnnn, !H31, !H32, !H4 or !H5", or a transition of the "Low/High" switch input.

- RS232 Operation

  A Micro Series Programmable Indexer can also be directed via the RS232 serial data communications port from a terminal or host computer, or via the SSP-525 Hand-Held Programmer. The command set allows full control of all aspects of Indexer programming and operation.

1.3 Logic And Programming Conventions

All logic is LOW TRUE. This means that a logic signal is **active** when low and inactive when high. **Low true signals are designated by a bar over the signal name, such as $\overline{\text{OUTPUT1}}$.** A signal is brought low by connecting its output terminal to signal common.

If a logic control signal is left open, the function will be clamped in a high or inactive condition.

When a sign is to be used in conjunction with a move distance or an offset direction, + will cause clockwise motion as viewed from the label end of the motor.

Certain commands are designated as MODE commands. Examples include: ABSOLUTE MODE, INCREMENTAL MODE, STEP MODE, JOG MODE, etc. Care should be taken to assure that the correct MODE is operational for each command. Once a mode is set, it remains active until canceled or until an alternate mode is chosen.

Motion performance and the ranges listed for motion parameters are dependent on the translator resolution chosen.

SECTION 2: EXPRESS START UP PROCEDURE

The following instructions describe the minimum steps necessary for the **Indexer** portion of the unit to become operational. Be sure to refer to the Express Start Up Procedure for the Drive section and follow the drive requirements. **FAILURE TO PERFORM THESE STEPS MAY RESULT IN DAMAGE TO THE UNIT.**

This Indexer Manual MUST BE READ IN ITS ENTIRETY to correctly operate the Indexer. This Express Start Up Procedure only highlights the important items necessary to ensure correct Indexer operation.

AC POWER MUST BE OFF

1) Refer to the manual for the Drive portion of your unit and follow the steps listed there for installation of the Drive.

2) Define the primary mode of operation (Serial or Parallel).

   The Indexer can be operated in the Parallel mode from an external user supplied switch panel or from a Superior Electric model SSP-100 Programmer. The switch panel or SSP-100 Programmer connects directly to the 25-pin "D" type connector provided for parallel data entry. Refer to Section 3.2 for further details. See Section 4.2 for voltage and current specifications, to Section 5 for descriptions of the Parallel mode commands and registers and to Section 7 for descriptions of the dedicated outputs.

   No connections are required on the *Parallel I/O* connector to operate the Indexer in the Serial mode. Refer to Section 4.2 for voltage and current specifications and to Section 6 for descriptions of commands for Serial operation. Section 7 describes the dedicated outputs.

TURN THE AC INPUT POWER ON

3) **Set up indexer parameters** starting with the resolution (L70) value. A List of factory *defaults* is listed in APPENDIX A. If the factory *default* values are acceptable proceed to the next step. Otherwise, change the desired parameters.

4) **Define** your **application requirements** (speeds,move distances, delays, etc).

5) Draw a **flowchart or pseudo code application** program flow.
   example:
   N1 X+1000 F1000 (Move +1000 steps @ 1000 pps)
   N2 G04 X1000 (delay 1 second)
   N3 G47 X01 (turn Output 1 On and Output 2 Off)
   N4 G30 (End of Program)

   Note: Refer to APPENDIX I for an Application Example and elementary programming information.

6) **Use** the **Program Worksheets** in **APPENDIX F**.

7) **Program** the **Indexer lines** (1 to 400) to execute the developed flowchart or pseudo code.

SECTION 3: INSTALLATION GUIDELINES

3.1 MOUNTING

The Programmable Indexer is mounted by fastening its mounting brackets to a flat surface. The mounting brackets can be located in either of two positions. Please refer to the manual for the Drive for the proper mounting procedure.

3.2 CONNECTOR LOCATIONS AND PIN ASSIGNMENTS

Connector locations are shown in Figure 3.1.

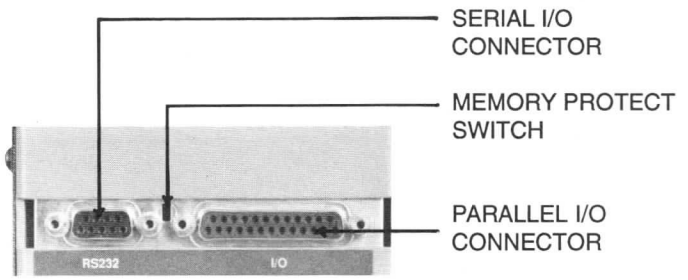


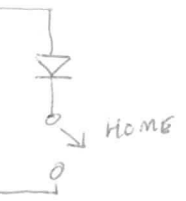
Figure 3.1, Connector Locations

Parallel I/O Connections

Parallel I/O connections are made through a 25-pin "D" type female connector. For maximum noise immunity, a shielded, twisted cable no longer than 20 feet (6.1 m) should be used to connect a parallel device.

The connector pin assignments are as follows:

Pin	Assignment
1	Signal Common (Vo)
2	$\overline{D7}$ Input
3	$\overline{D5}$ Input
4	$\overline{D3}$ Input
5	$\overline{D1}$ Input
6	$\overline{\text{MOTION BUSY}}$ Output *
7	$\overline{\text{STROBE 7}}$
8	$\overline{\text{STROBE 5}}$
9	$\overline{\text{STROBE 3}}$
10	$\overline{\text{STROBE 1}}$
11	$\overline{\text{OUTPUT 2}}$ *
12	$\overline{\text{ALL WINDINGS OFF}}$ Output*
13	CW/$\overline{\text{CCW}}$ Output *
14	Signal Common (Vo)
15	$\overline{D6}$ Input
16	$\overline{D4}$ Input
17	$\overline{D2}$ Input
18	$\overline{D0}$ Input
19	$\overline{\text{POSITION ERROR}}$ Output*
20	$\overline{\text{STROBE 6}}$
21	$\overline{\text{STROBE 4}}$
22	$\overline{\text{STROBE 2}}$
23	$\overline{\text{STROBE 0}}$
24	$\overline{\text{OUTPUT 1}}$*
25	$\overline{\text{PULSE}}$ Output *



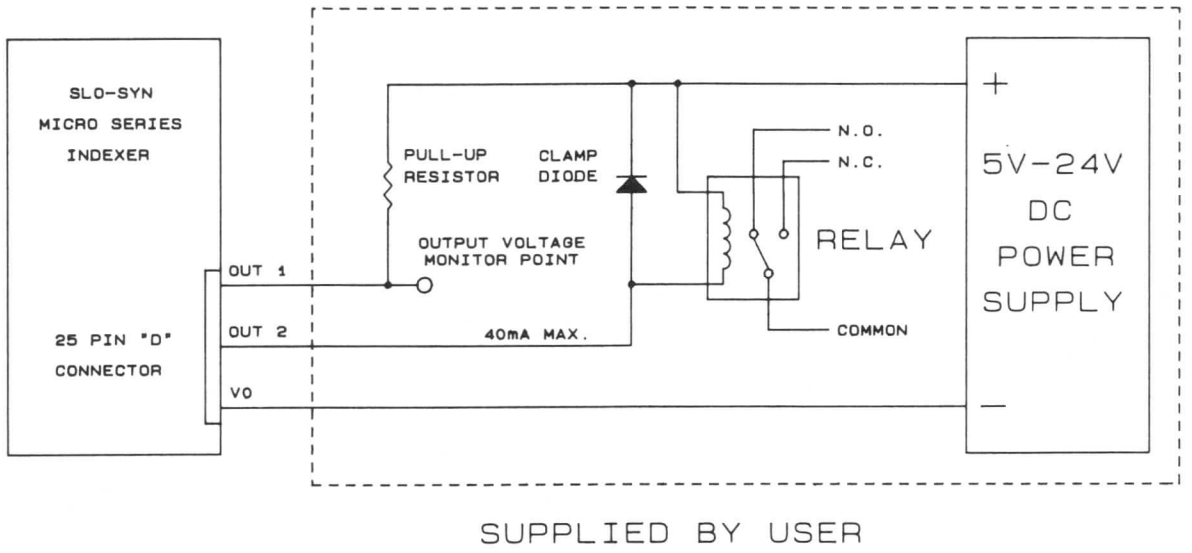
*** These outputs are *open collectors*. If monitored, they must be pulled up to an external voltage source (+24 Vdc maximum) through a series resistor to limit the sink current to a maximum of 40 milliamperes (refer to Figure 3).**

The strobe outputs are also *open collectors*. If they are connected directly to the indexer inputs, pull up resistors are not needed.

When connecting inductive loads such as relays to an output, be sure to use clamp diodes as shown in Figure 3.2.

Signal line filtering has been incorporated to help keep electrical interference from affecting Indexer operation. Because of this, it is not possible to use the $\overline{\text{Pulse}}$ Output signal (pin 25 on the 25-pin connector) when operating in the 1/125 microstep mode.The pulse output on this pin is not affected when operating in the full-step, half-step, 1/5 or 1/10 microstep modes. A maximum pull-up impedance of 3.9k ohms should be used when utilizing the $\overline{\text{Pulse}}$ Output.

Note that the Indexer can still operate in the 1/125 microstep mode. This limitation only affects connection to external drives via the 25-pin connector.



NOTE: Calculate pull-up resister value based on voltage of external dc power supply to limit "sink" current to 40 mA into OUT 1 or OUT 2.

Example: $R = \frac{V}{I} = \frac{24}{0.040}$ **= 600 ohms for Vdc = 24 Vdc**

Figure 3.2, Typical Wiring For Open Collector Output

Serial I/O Connections

Serial I/O connections are made through a 9-pin "D" type female connector.

For maximum noise immunity, a cable with shielded, twisted pairs no longer than 50 feet (15.2 m) should be used.

The wire size should be 24 AWG.

The connector pin assignments are as follows:

Pin	Assignment
1	**Signal Common (Vo)**
2	**RS232 Chain Out (Tx)**
3	**RS232 Receive Data (Rx)**
4	**Signal Common (Vo)**
5	**Signal Common (Vo)**
6	**RS232 Echo**
7	**RS232 Chain In**
8	**+5 Vdc ***
9	**+5 Vdc ***

*** Note that the +5V is brought out to the connector to power the Superior Electric hand-held programmer. These pins should not be populated on a cable to be used to connect the Indexer to another serial device.**

Serial communications can be made with one Indexer as shown in Figure 3.3, or in a *daisy chain* configuration as shown in Figure 3.4.

The following chart shows the maximum number of Indexers which can be daisy chained when communicating at the specified *baud rate*.

BAUD RATE CHART

Baud	Maximum Number Of Daisy Chained Indexers
9600	10
2400	40
1200	80
300	99

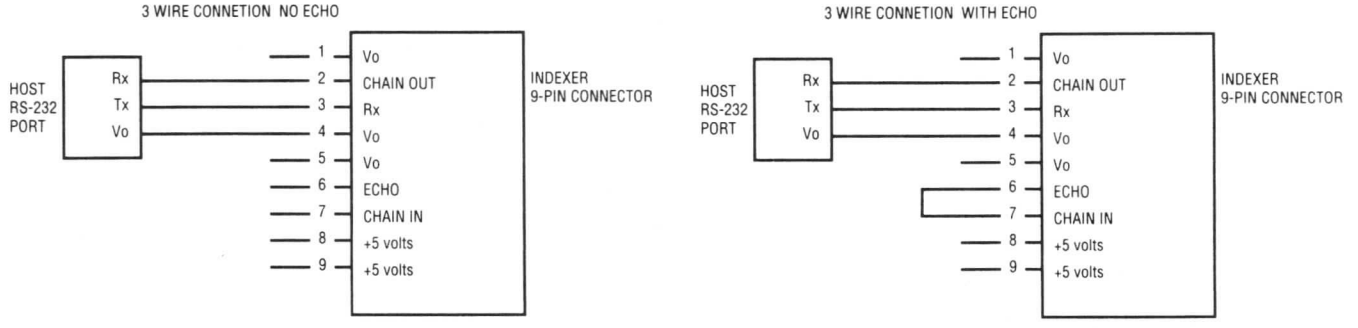


Figure 3.3, Single Indexer Port Connections

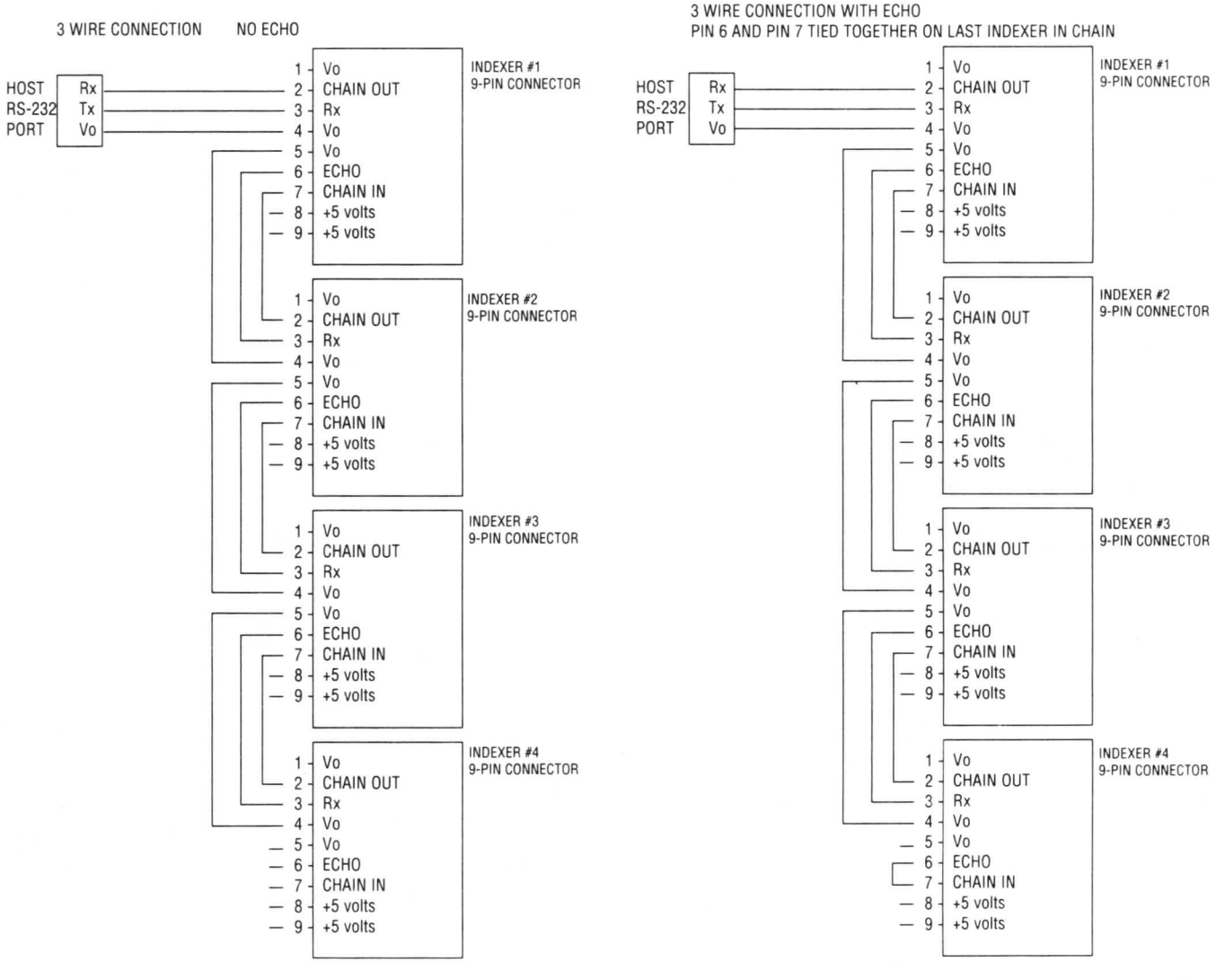


Figure 3.4, Daisy Chain Connections

NOTE: When setting up a *daisy chain* configuration, each Indexer must be given a unique address prior to wiring the system. Refer to Section 6.0, "Device Identification", for programming instructions.

3.3 Memory Protect Switch

All Micro Series Indexers incorporate a hardware Memory Protect Switch to help prevent accidental program or parameter changes. When the switch is in the **"Protect"** position, changes to the program or the parameters will not be allowed. Such changes can be made by placing the switch in the **"Write"** position.

The Memory Protect Switch is located in the grounding strap midway between the 9-pin and the 25-pin filter "D" type connectors (see Figure 3.1). When this switch is positioned toward the 25-pin connector, the Indexer is in the **"Write"** mode. It is in the **"Protect"** mode when the switch is positioned toward the 9-pin connector. The switch is in the **"Write"** mode when the Indexer is shipped from the factory.

In all but the most severe environments, it will not be necessary to use the Memory Protect Switch. However, some users may wish to use the protect feature to prevent unauthorized access to the Indexer program or parameters.

SECTION 4: SPECIFICATIONS

4.1 Inputs and Outputs

NOTE: Failures of the Indexer's I/O circuitry may occur if voltages which are negative with respect to signal common appear on inputs and outputs.

Switch Panel Operation

Output Signal Parameters (*open collector*)
POSITION ERROR, MOTION BUSY, OUTPUT 1, OUTPUT 2, PULSE, CW/CCW, ALL WINDINGS OFF, STROBE 0 Through STROBE 7

High Level Output Voltage:	+24 Vdc max., *open collector*
High Level Leakage Current:	250 microamperes. max.
Low Level Output Voltage:	+0.4 Vdc max @ 16 milliamps sink
	+0.7 Vdc max @ 40 milliamps sink

Input Signal Parameters D0 through D7

High Level Input Voltage:	+8.5 Vdc minimum +15 Vdc maximum
High Level Leakage Current:	1 milliamps maximum
Low Level Input Voltage:	+0.0 Vdc minimum +6.5 Vdc maximum
Low Level Leakage Current:	3.5 milliamps maximum

RS232 Serial Port Operation

RS232 Signal Characteristics:

Output Voltage Swing:	+/-5 Vdc minimum +/-10 Vdc maximum
Input Voltage Range:	-30 Vdc minimum +30 Vdc maximum

4.2 ENVIRONMENTAL SPECIFICATIONS

Operating Temperature:	+32 degrees F to +122 degrees F (0 degrees C to +50 degrees C) free ambient
Storage Temperature:	-40 degrees F to +167 degrees F (-40 degrees C to +75 degrees C)
Humidity:	95% max noncondensing
Altitude:	10,000 feet (3048 m) max.

SECTION 5 PARALLEL PORT OPERATION

5.1 PARALLEL PORT DATA ASSIGNMENTS

SLO-SYN Programmable Indexers are designed to be programmed and directed using external switches. A function is activated by connecting one of the DATA 0 through DATA 7 pins to one of the STROBE 0 through STROBE 7 pins. The chart of Parallel Port I/O Assignments below shows the pin assignments for each indexer function.

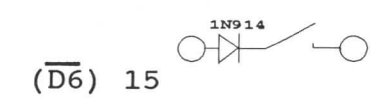
PARALLEL PORT I/O ASSIGNMENTS

INPUT	STROBE 0 (pin 23)	STROBE 1 (pin 10)	STROBE 2 (pin 22)	STROBE 3 (pin 9)	STROBE 4 (pin 21)	STROBE 5 (pin 8)	STROBE 6 (pin 20)	STROBE 7 (pin 7)
D0 (pin 18)	CW Limit	CW Dir	Code 1	Code 100	Data 1M	Data 10K	Data 100	Data 1
D1 (pin 5)	CCW Limit	CCW Dir	Code 2	Code 200	Data 2M	Data 20K	Data 200	Data 2
D2 (pin 17)	Home Limit	Load	Code 4	Code 400	Data 4M	Data 40K	Data 400	Data 4
D3 (pin 4)	Clear Cycle	AWO	Code 8	Code 800	Data 8M	Data 80K	Data 800	Data 8
D4 (pin 16)	Feed Hold	Low/High	Code 10	Sign	Data 10M	Data 100K	Data 1K	Data 10
D5 (pin 3)	IN 1	Step/Jog	Code 20	Sel 1	Data 20M	Data 200K	Data 2K	Data 20
D6 (pin 15)	IN 2	Cycle Start	Code 40	Sel 2	Data 40M	Data 400K	Data 4K	Data 40
D7 (pin 2)	Stop Cycle	Ser/Par	Code 80	Sel 4	Data 80M	Data 800K	Data 8K	Data 80

NOTE: During the strobing of external data, (Strobes 2 - 7), all commands associated with Strobes 0 and 1 are ignored.

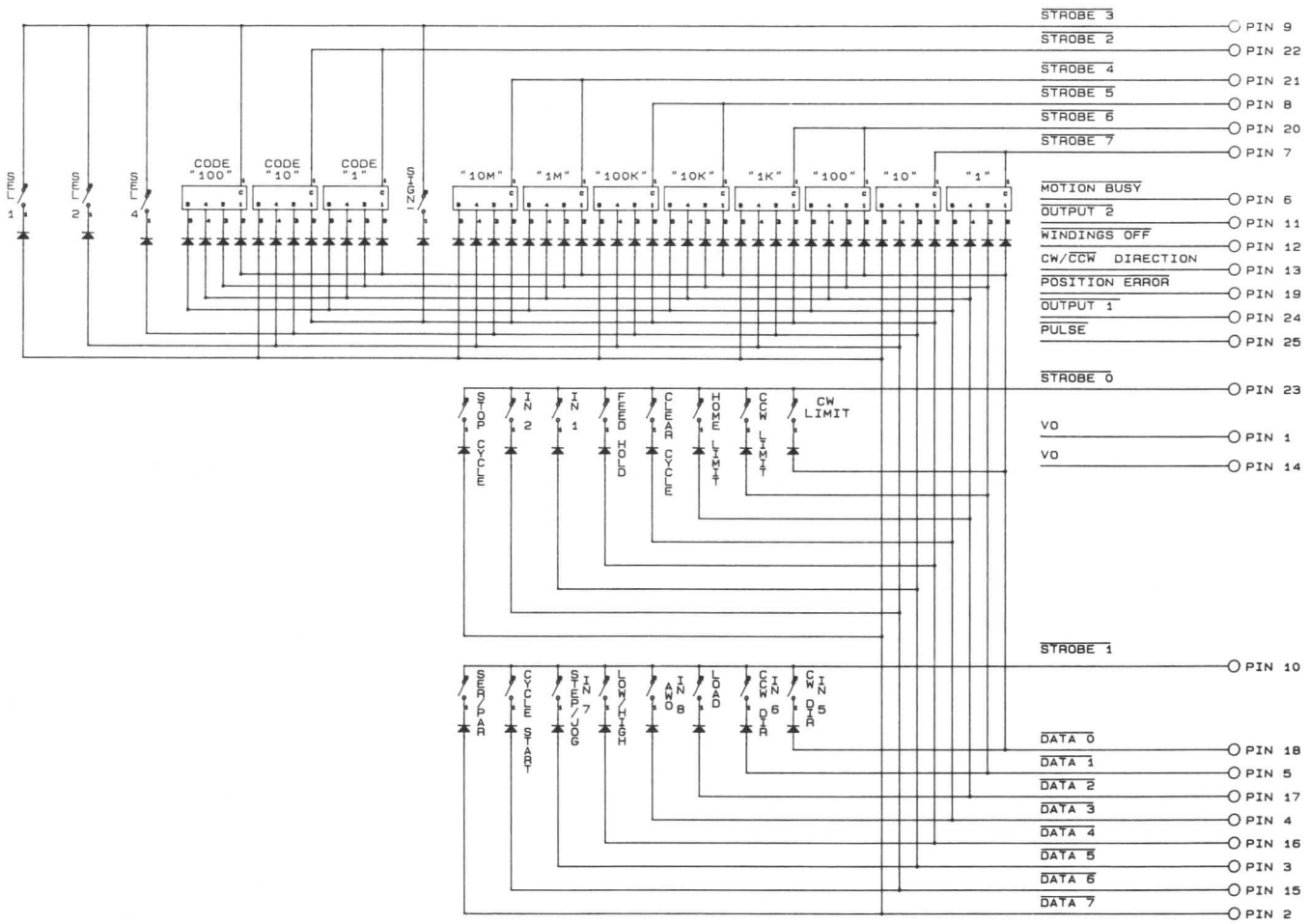
NOTE: All signals are active (connect appropriate data and strobe pins) except LOW, STEP and SER which are active high (e.g., no connection between data and strobe pins).

For example, the CYCLE START function is shown in the Strobe 1 vertical column and in the Data 6 horizontal column. Therefore, the Cycle Start function can be activated by connecting the Data 6 pin (pin 15 on the 25-pin connector) to the Strobe 1 pin (pin 10 on the 25-pin connector) via a user supplied diode. A typical circuit for activating this input is shown.



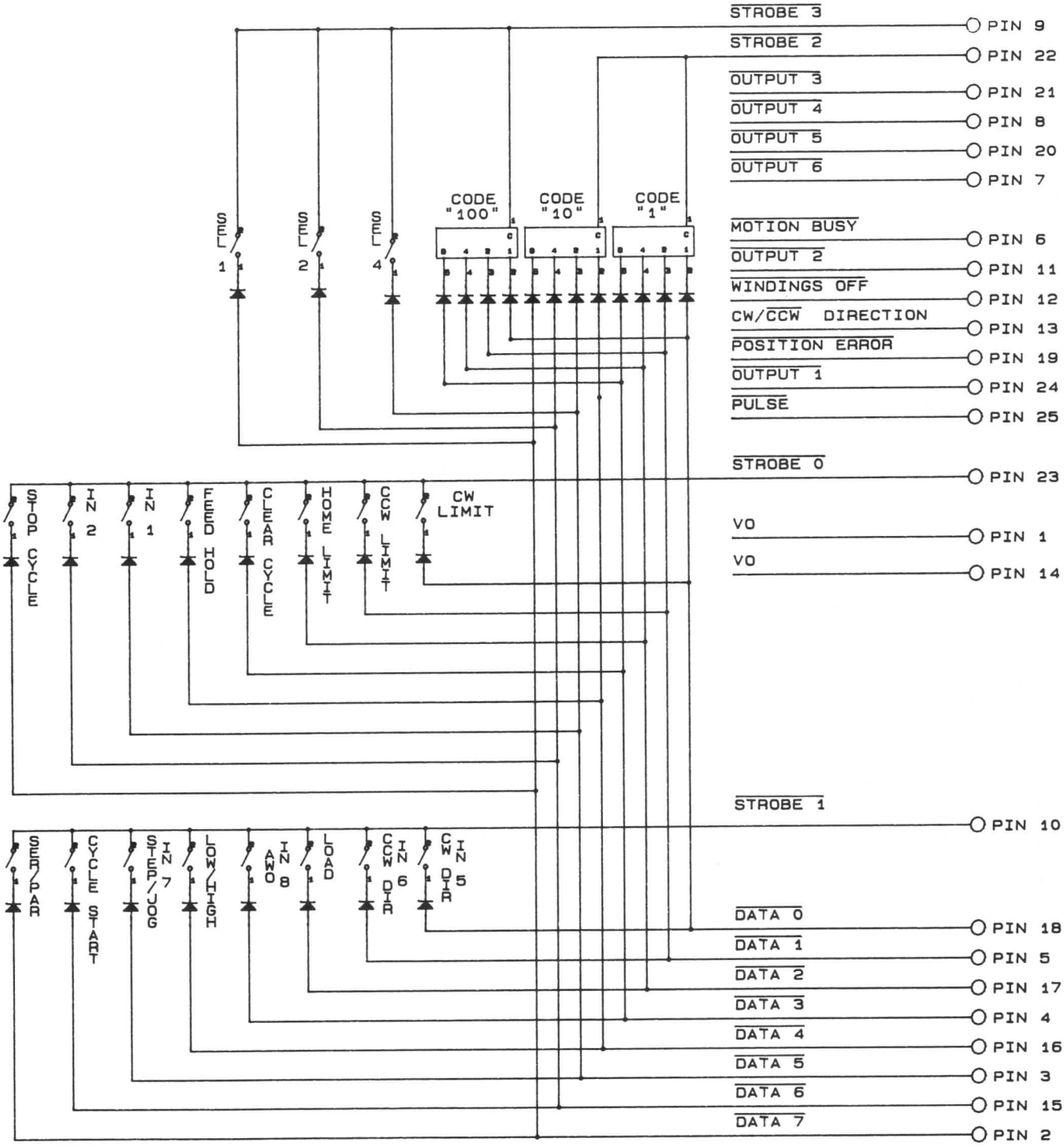
Typical Circuit For Activating CYCLE START Function

All functions which are listed in the Strobe 0 and Strobe 1 columns are available whenever the Load function is not activated. The Indexer repeatedly strobes, in sequence, the inputs connected to Strobe 0 and then Strobe 1. The connection diagram for this strobed input cycle is given in Figure 5.1 and 5.2 and the timing diagram is given in Figure 5.3.



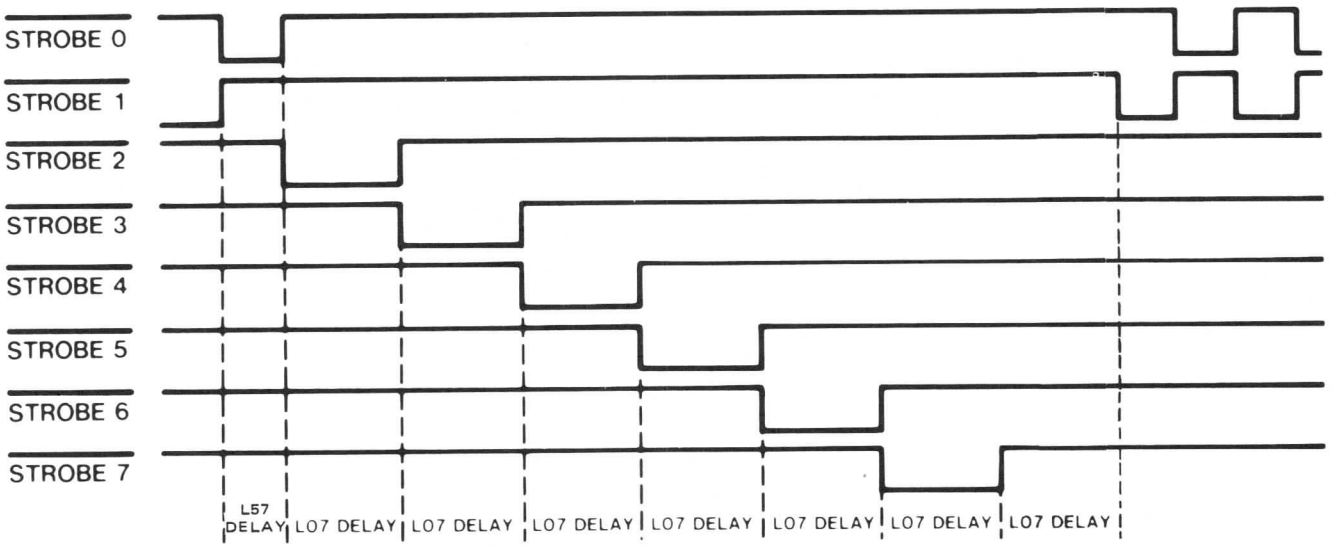
	INPUT ASSIGNMENT			
L51 VALUE	AWO	STEP/JOG	CCW DIR	CW DIR
0	AWO	STEP/JOG	CCW DIR	CW DIR
1	AWO	IN 7	IN 6	IN 5
2	IN 8	STEP/JOG	CCW DIR	CW DIR
3	IN 8	IN 7	IN 6	IN 5

Figure 5.1, Connection Diagram, Strobed Inputs with L51= 0 to 3



	INPUT ASSIGNMENT			
L51 VALUE	AWO	STEP/JOG	CCW DIR	CW DIR
4	AWO	STEP/JOG	CCW DIR	CW DIR
5	AWO	IN 7	IN 6	IN 5
6	IN 8	STEP/JOG	CCW DIR	CW DIR
7	IN 8	IN 7	IN 6	IN 5

Figure 5.2, Connection Diagram, Strobed Inputs with L51= 4 to 7



(Drawing)

Figure 5.3, Strobed Input Timing

Functions in the $\overline{\text{Strobe 2}}$ through $\overline{\text{Strobe 7}}$ columns are only activated during a Load cycle. When the Load command is given, the Indexer disables $\overline{\text{Strobes 0}}$ through $\overline{1}$ and enables $\overline{\text{Strobes 2}}$ through $\overline{7}$. All inputs connected to these strobe pins will then be input into the Indexer in sequence, beginning with those connected to $\overline{\text{Strobe 2}}$.

After inputting the data connected to $\overline{\text{Strobe 7}}$, the Indexer will return to sequencing the $\overline{\text{Strobe 0}}$ and $\overline{\text{Strobe 1}}$ inputs.

Selection of specific registers for entry of data during a Load cycle is done using the Select 1, Select 2 and Select 4 inputs. The data to be entered into a register is selected using the various Code and Field Data inputs. The Register Selection Chart shows how the Select inputs are used to select the available programmable registers.

REGISTER SELECTION CHART

SEL 4	SEL 2	SEL 1	Function Selected	Data
0	0	0	N Line Number	Code nnn
0	0	1	G Code	Code 0nn
0	1	0	X Code (Note 1)	Field snnnnnnnn
0	1	1	F Code (Note 1)	Field nnnnnnn
1	0	0	L Code (Note 1)	Code 0nn,Field snnnnnnnn
1	0	1	H Code	Code 0nn
1	1	0	Initialization	Code 099, Field nnn
1	1	1	Not Used	None

0= input inactive; 1= input active; s= sign input; n= 0 to 9;
Code= Code Data Field; Field= $\overline{\text{Strobe 4}}$ through $\overline{\text{Strobe 7}}$ data inputs.

Note 1: This register will be ignored if L51 = 4 to 7.

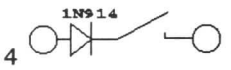
5.2 STROBED INPUT SIGNALS

The following inputs are available whenever the Load input is NOT activated.

NOTE: All inputs must be active for a minimum of 3 times the L57 delay to be recognized by the Indexer as valid input signals.

All Windings Off

Switch Closure:



Function:

If L51=0,1,4,5
When the All Windings Off input is active, motor winding current will be removed when motion ceases.

CAUTION:

The motor has no holding torque when the All Windings Off input is active.

If L51=2,3,6,7
This signal is used as programmable input 8 for a G20 or G22 line command.

Notes:

Whenever the All Windings Off input is active, an additional time delay is introduced during programmed motion cycles. This delay allows winding current to build in the motor prior to the start of motion and to decay after motion has occurred. The delay is approximately 50 milliseconds prior to motion and 50 milliseconds after motion has stopped. Therefore, the shortest time between moves is approximately 100 milliseconds.

Clear

Switch Closure:

Function:

Activating the Clear input will cause an immediate termination of the current operation.

Notes:

When the Clear input is activated, any motion that is taking place will come to an immediate stop. **This may result in an inaccurate absolute position count.**

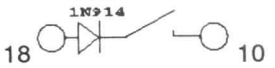
If the Clear input is activated while a program cycle is active, the program cycle will be terminated.

If data is being loaded, the load sequence will be terminated and the register being loaded will retain the previously loaded data.

If a delay is occurring, the delay will be terminated.

Clockwise (CW) Direction

Switch Closure:



Function:

If L51=0,2,4,6
Activating the CW Direction input will start motion in the clockwise direction.

If L51=1,3,5,7
This signal is used as programmable input 5 for a G20 or G22 line command.

Notes:

Serial/Parallel must be active (Parallel mode).

If any motion other than CW manual motion is active or if a Program Cycle is active, the CW Direction Input will not be honored.

The following chart lists the action which will occur with the possible combinations of inputs that affect CW Direction.

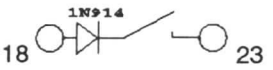
INPUTS THAT AFFECT CW OPERATION			
CW INPUT	**STEP/JOG INPUT**	**LOW/HIGH INPUT**	**FUNCTION**
active	**active**	**active**	**Ramp to Jog Speed rate and Jog**
active	**active**	**inactive**	**Jog at *Low Speed* rate**
active	**inactive**	**active**	**Ramp to Jog Speed rate and Step**
active	**inactive**	**inactive**	**Step at *Low Speed* rate**
active	**active or inactive**	**inactive to active**	**Ramp to Jog Speed rate**
active	**active or inactive**	**active to inactive**	**Ramp to *Low Speed* rate**

Related Inputs:

Step/Jog
Low/High

Clockwise (CW) Limit

Switch Closure:



Function:

If L45=0
The CW Limit input is used to indicate the end of the allowable travel in the CW direction.

If L45=1
This signal is used as programmable input 3 for a G20 or G22 line command.

Notes:

The CW Limit is usually activated by a switch that closes when the system reaches the end of permissible travel in the CW direction.

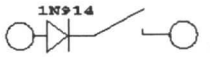
During motion, the Indexer tests this input for the switch closure. If the switch closure occurs, any motion that is taking place in the CW direction will come to an uncontrolled stop. **When this happens, an inaccurate absolute position count may result.**

When the CW Limit input is activated during a program cycle, the program cycle will be terminated.

Motion will only be allowed in the CCW direction as long as the CW Limit input remains active.

COUNTERCLOCKWISE (CCW) DIRECTION

Switch Closure:



Function:

If L51=0,2,4,6
Activating the CCW Direction input will start motion in the counterclockwise direction.

If L51=1,3,5,7
This signal is used as programmable input 6 for a G20 or G22 line command.

Notes:

Serial/Parallel must be active (Parallel mode).

If any motion other than CCW manual motion is active or if a Program Cycle is active, the CCW Direction input will not be honored.

The following chart lists the action which will occur with each possible combination of inputs that affect CCW operation.

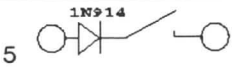
INPUTS THAT AFFECT CCW OPERATION			
CCW INPUT	**STEP/JOG INPUT**	**LOW/HIGH INPUT**	**FUNCTION**
active	**active**	**active**	**Ramp to Jog Speed rate and Jog**
active	**active**	**inactive**	**Jog at *Low Speed* rate**
active	**inactive**	**active**	**Ramp to Jog Speed rate and Step**
active	**inactive**	**inactive**	**Step at *Low Speed* rate**
active	**active or inactive**	**inactive to active**	**Ramp to Jog Speed rate**
active	**active or inactive**	**active to inactive**	**Ramp to *Low Speed* rate**

Related Inputs:

Step/Jog
Low/High

Counterclockwise (CCW) Limit

Switch Closure:



Function:

If L45=0
The CCW Limit input is used to indicate the end of the allowable travel in the CCW direction.

If L45=1
This signal is used as programmable input 4 for a G20 or G22 line command.

Notes:

The CCW Limit is usually activated by a switch that closes when the system reaches the end of permissible travel in the CCW direction.

During motion, the indexer tests this input for the switch closure. If the switch closure occurs, any motion that is taking place in the CCW direction will come to an uncontrolled stop. **When this happens, it may result in an inaccurate absolute position count.**

When the CCW Limit input is activated during an *index* cycle, the *index* will be terminated.

Motion will only be allowed in the CW direction as long as the CCW Limit input remains active.

Cycle Start

Switch Closure:

Function:

The Cycle Start input is used to initiate program execution.

Notes:

When this input is activated, the Indexer will start execution of the program starting from the current line number.

If the Indexer is in the Single Line Execution mode (L06 1), the current line will be executed once.

If the Indexer is in the Automatic Execution mode (L06 2), the program will be executed once plus the number of times entered for the Repeat Count (L47) value.

Activating the Cycle Start while in the Continuous Execution mode (L06 3) causes the program to execute continuously.

When the Continuous Execution mode is selected, the Repeat Count value is ignored.

Feed Hold

Switch Closure:

Function:

Activating the Feed Hold will cause any motion that is occurring to come to a controlled stop. The absolute position count will remain accurate.

Notes:

The rate at which the motor will decelerate to a stop when Feed Hold is activated is determined by the value in the Accel/Decel register.

To continue a motion cycle that was occurring when the Feed Hold input was activated, simply reactivate the input that started that cycle.

If you want to terminate the motion cycle that was occurring, activate the Clear input. If the Clear input is used in this instance, the absolute position count will remain accurate.

Home Limit/Index From Run

Switch Closure:

Function:

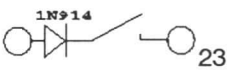
The Home Limit/*Index* From Run input is used to indicate the *mechanical home* position when a Return To *Mechanical Home* cycle is active, or to indicate the *index* starting point when an *Index* From Run cycle is active.

Notes:

This input is tested for a switch closure only when the Indexer is performing a Return To *Mechanical Home* cycle or an *Index* From Run cycle. It is ignored in all other cycles.

Input 1

Switch Closure:



Function:

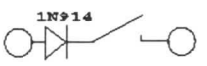
This signal is used as programmable input 1 for line execution of a G20 or a G22 command.

Notes:

During program execution, the Indexer tests this input for a switch closure and compares it with the input 1 condition for a G20 or G22 command.

Input 2

Switch Closure:



Function:

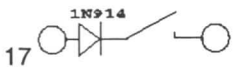
This signal is used as programmable input 2 for line execution of a G20 or a G22 command.

Notes:

During program execution, the Indexer tests this input for a switch closure and compares it with the input 2 condition for a G20 or G22 command.

Load

Switch Closure:



Function:

Activating the Load input will cause the Indexer to load the information which has been entered on the Strobe 2 through Strobe 7 inputs. It is used to load data into the register which has been selected using the Select 1, Select 2 and Select 4 inputs (reference Register Selection Chart Section 5.1).

Notes:

Serial/Parallel must be active (Parallel mode).

To load data into the indexer, first select the desired register by activating the correct combination of Select inputs as noted in the Register Selection Chart in Section 5.1. Then select the information to be entered into the register by activating the correct combination of the Code 1 through Code 400 and the Data 1 through Data 80M inputs. Finally, activate the Load input to enter the data.

When the indexer recognizes the Load input, $\overline{\text{Strobes 0}}$ and $\overline{1}$ are disabled. $\overline{\text{Strobes 2}}$ through $\overline{7}$ are then activated, in sequence. Once the data has been strobed into the register, the Indexer will reactivate $\overline{\text{Strobes 0}}$ through $\overline{1}$.

Example:

To load a move of +98,395 into the X register, first select the correct register by activating the Select 2 input (see chart, Section 5.1). The Select 1 and Select 4 inputs should remain inactive.

Next, select the desired data for that register by activating the Data 80K, Data 10K, Data 8K, Data 200, Data 100, Data 80, Data 10, Data 4 and Data 1 inputs.

Finally, activate the Load input. The indexer will deactivate $\overline{\text{Strobes 0}}$ and $\overline{1}$ and will activate $\overline{\text{Strobes 2}}$ through $\overline{7}$ to strobe the data into the register.

Following the strobing of the data into the register, the indexer will reactivate $\overline{\text{Strobes 0}}$ and $\overline{1}$.

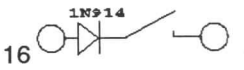
Refer to the Strobe Timing Diagrams in Figure 5.3 for additional information on the load sequence.

Related Inputs:

Sign & Data 1 through Data 80M
Code 1 through Code 400
Select inputs
Serial/Parallel input

Low/High

Switch Closure:



Function:

The Low/High input is used to select the speed at which motion will take place.

Notes:

When the Low/High input is inactive, any motion that occurs will take place at the rate programmed in the *Low Speed* register.

If the Low/High input is active, the motor will ramp from the *Low Speed* rate up to the rate programmed for that motion cycle.

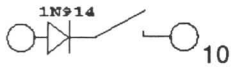
When motion is taking place and the Low/High input is changed from active to inactive, the motor will ramp down to the rate programmed in the *Low Speed* register. If either step or jog motion is occurring and the Low/High input is changed from inactive to active, the motor will ramp up to the rate programmed for that motion cycle.

The following chart further explains the type of motion that will occur for various conditions.

SPEEDS AT WHICH MOTION WILL OCCUR		
Type of Motion Selected	LOW/HIGH INPUT STATUS	
	ACTIVE	INACTIVE
Manual Jog	Jog Speed	*Low Speed*
Manual Step	Jog Speed	*Low Speed*
Index	Feed Rate	*Low Speed*
Backlash	Feed Rate	*Low Speed*
Auto Reverse	Feed Rate	*Low Speed*
Return to *Electrical Home*	Home Speed	*Low Speed*
Return to *Mechanical Home*	Home Speed	*Low Speed*
Index to Home Limit Input	Home Speed	*Low Speed*
Find Home Limit Input	Low Speed	*Low Speed*
Step Off Home Limit Input	Low Speed	*Low Speed*
Back Up to Home Limit Input	Low Speed	*Low Speed*
Mechanical Home Offset Move	Home Speed	*Low Speed*

Serial/Parallel

Switch Closure:



Function:

This input selects the RS232 port (input inactive) or the Parallel port (input active) for data entry or motion control.

Notes:

Serial Mode:
Manual Jog and Step functions are ignored (CW DIR, CCW DIR and STEP/JOG).

The Register Select and Load inputs are ignored (SEL 1, SEL 2, SEL 4 and LOAD).

All other parallel commands are honored.

Parallel Mode:
RS232 Manual Motion and Program Execution commands are ignored (H1, H2, H3, H6, H7, H8, H9, H10, H30).

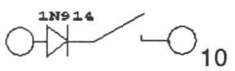
Program Line Data and certain parameters cannot be altered (Nnnn, Gnn, Xsnnnnnnnn, Fnnnnnn, H11, H12, H14, L06, L07, L08, L09, L11, L12, L13, L14, L17, L18, L19, L20, L21, L22, L23, L25, L26, L41, L43, L44, L45, L47, L48, L51, L66, L67, L70, L71, L72, L73, L95).

Mode changes are not allowed (H33, H34, H35, H36, H37, H38, H39, H40).

All other RS232 commands are allowed.

Step/Jog

Switch Closure:



Function:

If L51 = 0, 2, 4 or 6
The Step/Jog input selects the type of motion that will be performed.

If L51 = 1, 3, 5 or 7:
This signal is used as programmable input 7 for Line Execution of a G20 or G22.

Notes:

L51 = 0, 2, 4 or 6:
Serial/Parallel must be active (Parallel mode).

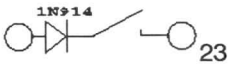
When this input is active, the motor will Jog in the desired direction whenever the CW DIR or the CCW DIR input is active.

When this input is inactive and the CW DIR or CCW DIR input is activated, the motor will Step in the desired direction.

L51 = 1, 3, 5 or 7:
During program execution, the Indexer tests this input for a switch closure and compares it with the input 7 condition for a G20 or G22 command.

Stop Cycle

Switch Closure:



Function: When this input is activated, program execution will be stopped.

Notes: Any motion that is taking place when the Stop Cycle input is activated will be allowed to finish, but a new motion will not be allowed to start.

5.3 LOAD CYCLE INPUT SIGNALS

Code Inputs

Switch Closure: Refer to Figure 5.1 for appropriate connection for each input (Code 800, Code 400, Code 200, Code 100, Code 80, Code 40, Code 20, Code 10, Code 8, Code 4, Code 2, Code 1).

Function: These inputs are used to select the required numerical data for a Line Number, L code, G code or H code.

Refer to Section 5.2 for a complete description of how the Code inputs are used.

Data Inputs

Switch Closure: Refer to Figure 5.1 for appropriate connection for each input (Data 80M, Data 40M, Data 20M, Data 10M, Data 8M, Data 4M, Data 2M, Data 1M, Data 800K, Data 400K, Data 200K, Data 100K, Data 80K, Data 40K, Data 20K, Data 10K, Data 8K, Data 4K, Data 2K, Data 1K, Data 800, Data 400, Data 200, Data 100, Data 80, Data 40, Data 20, Data 10, Data 8, Data 4, Data 2, Data 1).

Function: The Data inputs are used to select the numerical data to be loaded into each register.

SEL 1, SEL 2, SEL 4

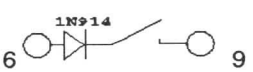
Switch Closure: Refer to Figure 5.1 for appropriate connection for each input (SEL 4, SEL 2, SEL 1).

Function: The Select inputs (SEL 1, SEL 2, SEL 4) are used to select the register which is to be loaded.

Notes: Refer to the Register Selection Chart in Section 5.1 for additional information on the use of the Select inputs.

+ Sign/- Sign

Switch Closure:



Function: This input is used to specify direction when loading information into a register.

Notes: The input should be active if motion in the minus (CCW) direction is required and inactive if motion is to be in the plus (CW) direction.

5.4 PROGRAMMABLE REGISTERS

Line Number Loading

Function: This value sets the current line number.

Units: none

Range: 0 through 400

Default: none

Load Sequence:
SEL 1 input to inactive
SEL 2 input to inactive
SEL 4 input to inactive
Select the desired Code Data value (line number)
Activate the Load input

Notes: The Serial/Parallel input must be active (Parallel mode selected).

This value will transfer the Strobed Code Data value to the current line number if the Code Data is in range. If the Code Data value is out of range, the previous line number will be retained.

Related inputs: Serial/Parallel

Example:
Setting the current line number to 2
- SEL 1 input to inactive
- SEL 2 input to inactive
- SEL 4 input to inactive
- Set Code Data inputs
  - Code 2 active
  - Code 1, Code 4, Code 8, Code 10, Code 20, Code 40, Code 80, Code 100, Code 200, Code 400 and Code 800 inactive
- Activate Load input

G Codes

Function: Loads the G code register specified by the current line number.

Units: none

Range: See APPENDIX E for listing of G Codes.

Default: none

Load Sequence:

SEL 1 input to active
SEL 2 input to inactive
SEL 3 input to inactive
Select the Code Data value (G code)
Activate the Load input

Notes:

If the Code Data value is not a valid G code, the previous G Code Data will be retained.

During program execution, the G code is tested to see if additional data fields are required. If the additional fields are in range, the G code command will be executed. If the additional fields are out of range, the program will be terminated and the line designated by the L41 command will become the current line.

The Serial/Parallel input must be active (Parallel mode active)

Related Inputs: Serial/Parallel

Example:

Loading a G04 on the current line.

- SEL 1 input to active
- SEL 2 input to inactive
- SEL 4 input to inactive
- Set Code Data inputs
  - Code 4 active
  - Code 1, Code 2, Code 8, Code 10, Code 20, Code 40, Code 80, Code 100, Code 200, Code 400 and Code 800 inactive
- Activate Load input

X Code

Function:

This is used to specify the move distance and direction. It transfers the Sign and Field Data value to the X register specified by the current line number.

Units:

steps
G code field data

Default:

none

Load Sequence:

SEL 1 input to inactive
SEL 2 input to active
SEL 4 input to inactive
Select the sign and the Field Data values
Activate the Load input

Notes:

The Serial/Parallel input must be active (Parallel mode selected).

During program execution, the X register value may be treated as a move or as an extension of a G code.

When it is a move value, the Indexer will *index* the direction and distance programmed in this register. When the Incremental mode has been selected, the direction and distance will be relative to the position at the start of the motion. If the Indexer is in the Absolute mode, the direction and distance are relative to the *Electrical Home* position.

When the Auto Reverse feature has been selected, the Indexer will automatically reverse at the end of the motion and will then *index* the distance programmed in this register.

If L51 = 4 to 7, this function cannot be achieved.

F Code

Function:

This value is used to specify the Feed Rate or G code field data.

During Program Execution, the F register value may be treated as a High Speed value or as an extension of a G code.

Units:

steps per second or
G code field data

Range:

Full Step Mode	0 to 115,000 steps per second
Half Step Mode	0 to 115,000 steps per second
1/5 Step Mode	0 to 115,000 steps per second
1/10 Step Mode	0 to 115,000 steps per second
1/125 Step Mode	0 to 1,875,000 steps per second

Default:

none

Load Sequence:

SEL 1 input to active
SEL 2 input to active
SEL 4 input to inactive
Select the Field Data value (F value)
Activate the Load input

Notes:

The field data value will be loaded into the F register for the current line number. If the data value is out of range, the previously loaded data will be retained.

If the value in the Feed Rate register is equal to or less than the *Low Speed* rate, the Feed Rate register will be used as the *Low Speed* rate during an index.

If the value in the *Low Speed* register is zero, the Indexer will ramp from standstill directly up to the Feed Rate register value at the start of motion and from this value directly down to zero at the end of the motion.

The value in the Feed Rate register is ignored when the Indexer is in the Low Speed mode.

If the data exceeds the rate programmed in the Ramp Limit register, the Ramp Limit register value will be used as the default value.

If L51 = 4 to 7, this function cannot be achieved.

Related Inputs:

Low/High

Related L Codes:

Low Speed (L12)
Ramp Frequency Limit (L71)

L Codes

Function: Loads the selected L code register (code data) with the field data.

Units: none

Range: See APPENDIX A for listing of L Codes.

Default: none

Notes: The Serial/Parallel input must be active (Parallel mode selected).

A L51 value of 0, 1, 2 or 3 must be programmed to enable this function.

Load Sequence:

SEL 1 input to inactive
SEL 2 input to inactive
SEL 4 input to active
Select the Code Data for the desired L Code
Select the Field Data for the desired L code
Activate the Load input

Example:

Setting L71 = 10000
- SEL 1 input to inactive
- SEL 2 input to inactive
- SEL 4 input to active
- Set Code Data inputs
  - Code 1, Code 10, Code 20 and Code 40 active
  - Code 2, Code 4, Code 8, Code 80, Code 100, Code 200, Code 400, Code 800 inactive
- Set Field Data inputs
  - Data 10K active
  - Data 1, Data 2, Data 4, Data 8, Data 10, Data 20, Data 40, Data 80, Data 100, Data 200, Data 400, Data 800, Data 1K, Data 2K, Data 4K, Data 8K, Data 20K, Data 40K, Data 80K, Data 100K, Data 200K, Data 400K, Data 800K, Data 1M, Data 2M, Data 4M, Data 8M, Data 10M, Data 20M, Data 40M and Data 80M inactive
- Activate Load input

H Codes

Function: Executes the Designated H Code Command.

Units: none

Range: See APPENDIX B for listing of H Codes.

Default: none

Load Sequence:
SEL 1 input to active
SEL 2 input to inactive
SEL 4 input to active
Select the desired H code (Code data)
Activate the Load input

Notes: The Serial/Parallel input must be active (Parallel mode selected)

If the Code Data matches the one of the H codes, that H code will be executed if no motion is taking place.

H6, H7, H31, H32 cannot be executed while in Parallel mode.

Refer to Section 6.2, H Code Descriptions, for further information on specific H codes.

Related Inputs: Serial/Parallel

Example: Starting an *Index* From Run Cycle (H30) using the values from the current line.

SEL 1 input to active
SEL 2 input to inactive
SEL 4 input to active
Set Code inputs
Code 10 and Code 20 active
Code 1, Code 2, Code 4, Code 8, Code 40, Code 80, Code 100, Code 200, Code 400 and Code 800 inactive
Activate Load input

Initialization

Function: Initializes the Indexer to the *default* values of the selected resolution. Also clears all program lines (0 through 400).

Units: none

Default: none

Notes: The Serial/Parallel input must be active (Parallel mode selected).

If a Field Data value other than 1, 2, 5, 10 or 125 is selected, the full step *default* values will be set.

Example 1: Setting the Indexer to Full Step *default* values

- SEL 1 input to inactive
- SEL 2 input to active
- SEL 4 input to active
- Set Code Data values
  - Code 1, Code 8, Code 10 and Code 80 active
  - Code 2, Code 4, Code 20, Code 40, Code 100, Code 200, Code 400 and Code 800 active
- Set Field Data inputs
  - Data 1 active
  - Data 2, Data 4, Data 8, Data 10, Data 20, Data 40, Data 80, Data 100, Data 200, Data 400, Data 800, Data 1K, Data 2K, Data 4K, Data 8K, Data 10K, Data 20K, Data 40K, Data 80K, Data 100K, Data 200K, Data 400K, Data 800K, Data 1M, Data 2M, Data 4M, Data 8M, Data 10M, Data 20M, Data 40M and Data 80M inactive
- Activate Load input

Example 2: Setting Indexer to Half Step *default* values

- SEL 1 input to inactive
- SEL 2 input to active
- SEL 4 input to active
- Set Code Data inputs
  - Code 1, Code 8, Code 10 and Code 80 active
  - Code 2, Code 4, Code 20, Code 40, Code 100, Code 200, Code 400 and Code 800 inactive
- Set Field Data inputs
  - Data 2 active
  - Data 1, Data 4, Data 8, Data 10, Data 20, Data 40, Data 80, Data 100, Data 200, Data 400, Data 800, Data 1K, Data 2K, Data 4K, Data 8K, Data 10K, Data 20K, Data 40K, Data 80K, Data 100K, Data 200K, Data 200K, Data 400K, Data 800K, Data 1M, Data 2M, Data 4M, Data 8M, Data 10M, Data 20M, Data 40M and Data 80M inactive
- Activate Load input

Initialization examples continued

Example 3:

Setting Indexer to 1/5 step *default* values
- SEL 1 input to inactive
- SEL 2 input to active
- SEL 4 input to active
- Set Code Data inputs
  - Code 1, Code 8, Code 10 and Code 80 active
  - Code 2, Code 4, Code 20, Code 40, Code 100, Code 200, Code 400 and Code 800 inactive
- Set Field Data inputs
  - Data 1 and Data 4 active
  - Data 2, Data 8, Data 10, Data 20, Data 40, Data 80, Data 100, Data 200, Data 400, Data 800, Data 1K, Data 2K, Data 4K, Data 8K, Data 10K, Data 20K, Data 40K, Data 80K, Data 100K, Data 200K, Data 400K, Data 800K, Data 1M, Data 2M, Data 4M, Data 8M, Data 10M, Data 20M, Data 40M and Data 80M inactive
- Activate Load input

Example 4:

Setting Indexer to 1/10 step *default* values
- SEL 1 input to inactive
- SEL 2 input to active
- SEL 4 input to active
- Set Code Data inputs
  - Code 1, Code 8, Code 10 and Code 80 active
  - Code 2, Code 4, Code 20, Code 40, Code 100, Code 200, Code 400 and Code 800 inactive
- Set Field Data inputs
  - Data 10 active
  - Data 1, Data 2, Data 4, Data 8, Data 20, Data 40, Data 80, Data 100, Data 200, Data 400, Data 800, Data 1K, Data 2K, Data 4K, Data 8K, Data 10K, Data 20K, Data 40K, Data 80K, Data 100K, Data 200K, Data 400K, Data 800K, Data 1M, Data 2M, Data 4M, Data 8M, Data 10M, Data 20M, Data 40M and Data 80M inactive.
- Activate Load input

Example 5:

Setting Indexer to 1/125 step *default* values
- SEL 1 input to inactive
- SEL 2 input to active
- SEL 4 input to active
- Set Code Data inputs
  - Code 1, Code 8, Code 10 and Code 80 active
  - Code 2, Code 4, Code 20, Code 40, Code 100, Code 200, Code 400 and Code 800 inactive
- Set Field Data inputs
  - Data 1, Data 4, Data 20 and Data 100 active
  - Data 2, Data 8, Data 10, Data 40, Data 80, Data 200, Data 400, Data 800, Data 1K, Data 2K, Data 4K, Data 8K, Data 10K, Data 20K, Data 40K, Data 80K, Data 100K, Data 200K, Data 400K, Data 800K, Data 1M, Data 2M, Data 4M, Data 8M, Data 10M, Data 20M, Data 40M and Data 80M inactive
- Activate Load input

SECTION 6: RS232 COMMANDS

6.0 General Programming Information

EIA (Electronic Industries Association) Standard RS274-D, the programming guide for numerically controlled machines, has been used as the basis for the Micro Series Indexer command structure. Although it was not technically feasible to conform to this standard in complete detail, it proved beneficial in the program structure to permit complex and varied operations to be performed using a simple format. The RS232 parameters and commands can be grouped into three general categories:

1. **"L Codes"** (described in Section 6.1) are used to set parameters for each Indexer. These commands do not cause motion, but simply establish the motion parameters.

2. **"H Codes"** (described in Section 6.2) are used to set Indexer modes, to control manual and program execution and to transmit parameters and Indexer status via the serial communications port.

3. **Line Data Codes** (described in Section 6.3), are the codes that define the motion that will be made (X Code), the speed at which it will be done (F Code) and G Code which can control program execution and modify the way it operates.

Buffering Of Commands

A Micro Series Programmable Indexer has two buffers dedicated to RS232 communications. Each buffer holds 255 characters. One buffer holds commands which will be processed only when the Indexer is not "Busy" (when a cycle is in process or when previously transmitted commands are being processed). These commands are referred to as "Standard" commands and include all L codes, H codes and Line Data codes. They are processed in the order in which they are received, and each command must be completed before the next command is processed.

The second buffer holds commands which will be processed as soon as they are issued, even when the Indexer is "Busy". These commands are known as "Immediate" commands and include only a subset of the L codes, H codes and Line Data codes. To indicate that a command should be treated as an immediate command, simply precede the command with an exclamation mark (!). A list of immediate commands is given in Appendix C. Immediate commands are processed in the order in which they are received, as are standard commands.

Multiple commands can be transmitted to the Indexer at the same time. The Carriage Return (ASCII 13) and/or Line Feed (ASCII 10) will terminate a string of commands. If a string of immediate commands is to be sent, the "!" character need only be used in front of the first command. The Immediate Buffer selection is canceled when the Carriage Return or Line Feed is received.

The "Backspace And Delete" command, Control H (^H) can be used to delete a character in a buffer when data is being entered. In addition, the "Delete RS232 Buffer" command, Control X (^X), can be used to delete the last line entered in the active buffer.

The number of characters remaining in either the standard or the immediate character buffer may be requested at any time. To request the status of the standard buffer, send the "/" character (ASCII 47). Send the "\" character (ASCII 92) to request the status of the immediate buffer. Neither character is actually stored in the buffer. The response format from the Indexer is:

nnn CRLF

where nnn is the character count remaining.

Xon/Xoff Protocol

Xon/Xoff is a serial communications protocol, executed in software, that allows communications between two devices without the need for additional hardware control. This method of controlling data flow requires only a three-wire connection between the devices. The protocol is used for controlling the flow of data between the Indexer and another device. **It should NOT be used to determine the status of the Indexer.**

The Xoff character (ASCII 19) is used to stop the transmission of RS232 characters. When one device sends an Xoff to the other device, it is telling the other to stop transmitting characters. The transmitting device should comply with the request.

The Xon character (ASCII 17) is used to resume transmission of the RS232 characters. When one device sends an Xon character to the other, it is signifying that it is ready to receive more data. If there is more data to be sent, the transmitting device may now resume transmission.

When the Indexer sends an Xoff command to the host, all activation commands (see below) and immediate H codes can still be processed.

Note: The Xon/Xoff protocol is only used when the L26 value is 0-3.

Device Identification

In order to daisy chain multiple Indexers to communicate with a single host, each Indexer must be given a unique identification. The L21 value defines the identification number of the Indexer. **Each Indexer must be given a unique identification before the system is wired**. The device addresses need not be consecutive, and the Indexers can be placed in any positions in the chain regardless of their addresses.

Refer to the *Baud Rate* chart in Section 3.2 for information concerning the maximum baud rate which can be achieved for a given number of Indexers in a system.

Device Activation

In order to accept commands from a host device, an Indexer must be set to the active mode. To do this, the host must send the device attention command (<) followed by the device identification number and, as always, a carriage return/line feed. For example, to activate device 01 send <01CRLF. The Indexer which has been activated will respond with an = if it is not busy, or with a : if it is busy. If you wish the Indexer to identify itself in the response, include a ? in the request (<01?CRLF). The response will be 01= if the Indexer is not busy, or 01: if it is busy.

Note: If L26= 0 thru 3, an Xon will be transmitted following the =. If L26= 4 thru 7, no Xon will be transmitted.

All Indexers can be activated at the same time by issuing a <00CRLF from the host. Any information requested from the Indexers while all units are active will cause all Indexers to transmit at once, resulting in garbled data. Therefore, transfer commands should be avoided and any characters received by the host should be ignored when all Indexers are active.

If the host wishes to identify the active Indexer, the Device Acknowledgement command (?) can be issued. If the active device is not busy , it will respond with a nn=Xon, where nn is the device ID. If the active device is busy, it will respond with a nn:. If no device is active, no response will be received. (Xon will not be transmitted if the protocol is disabled.)

Refer to Figure 6.1 for a Communications flowchart.

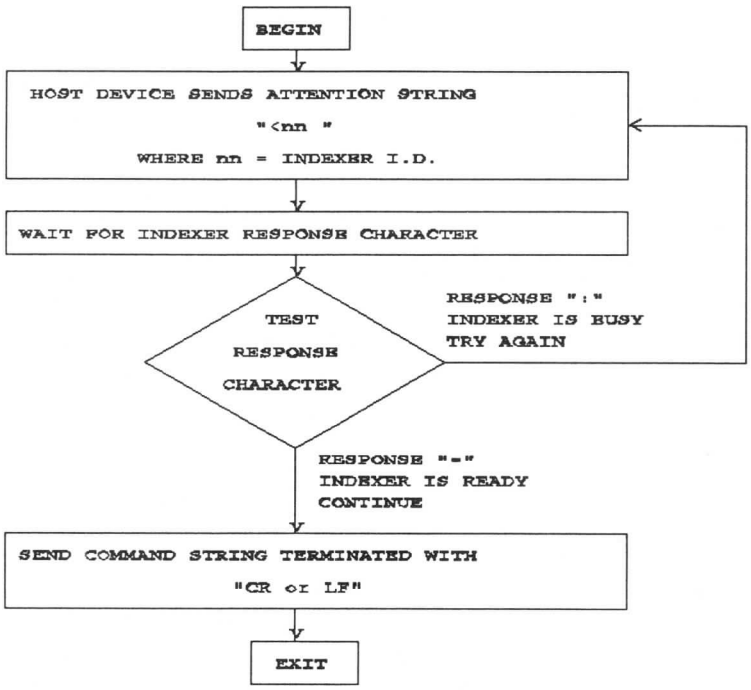
Listen Mode

In addition to the active mode, an Indexer can also be placed in the listen mode. To do this, the host must send the device attention command (<), followed by the device identification number, followed by an ampersand (&). For example, to place device 01 in the listen mode, send <01&CRLF. In response to the listen command, the Indexer will send a 01=Xon if it is not busy, or a 01: if it is busy. (Again, Xon will not be transmitted if the protocol is disabled.)

While in the listen mode, an Indexer will execute commands issued by the host. However, it will transfer data only in response to its device attention command for busy polling. All other transfer commands will be ignored while in the listen mode.

To cancel the listen mode, the host must transmit the device attention command (<), followed by the device attention character, followed by an @. For example, to cancel the listen mode for device 01, send <01@. This device will now become the active device.

All Indexers can be placed in the listen mode by issuing a <00&CRLF from the host. To cancel this mode for all Indexers, a <00@ can be sent from the host. When this is done, all Indexers become active.



NOTES: "Busy" means that the Indexer cannot accept or process any new commands via RS232 because a program is executing and/or motion is occurring.

"Ready" means that motion has ceased and/or program execution is completed. The Indexer can now accept further information.

Immediate commands can be processed anytime.

Figure 6.1, PC Program Flow Chart For Indexer Communications

General Programming Comments

1. The first task that faces an operator is that of setting "L codes", the parameters of each indexer.

2. It is important to note the **factory default values** that have been set for each parameter. These default values allow entry steps to be eliminated for those parameters where the factory default value is acceptable.

3. If invalid data is entered for any parameter or field, the previous data will not be replaced.

4. If the number of characters entered for a parameter exceeds the number of characters required, the data is truncated to the correct length by eliminating the first characters sent. For example, if a parameter requires eight characters and ten are sent, only the last eight will be used.

5. In the command descriptions which follow, the field descriptions for each command use an "n" to designate a number and an "s" to designate a sign (+ or -). For example, the field designation "snnnnnnnn" designates that the field consists of a + or - sign followed by eight numbers

6. Some functions which can be executed through the parallel port may be activated at any time. This allows the user to perform system set up through RS232 and operation through the parallel port. Refer to Section 5.2 Serial/Parallel for the restrictions. Note that if a parameter is changed over the serial port, it will override the switch setting on the panel. For example, if the High Speed is selected on the panel and then the RS232 command for Low Speed mode is sent followed by a request for a CCW move from the panel, the move will be executed at Low Speed even though the panel switch is set at the High Speed mode.

7. Note that defaults which are dependent on the L70 value are set when the L70 is programmed at the factory. If the L70 value is changed, these values will not change automatically.

8. When using any of the L, H and G codes, preceding zeros can be omitted. For example, H1CRLF will perform the same as H01CRLF.

9. If it is necessary to know when an *index* motion is complete, the Line Done Character (L55) parameter can be used. Note that if a Program Line Delay is programmed, the character will not be transmitted until the delay has expired. The Immediate Transfer Mode Status (!H19) can also be monitored. The second most significant character will be set (1) if motion is active and Clear (0) if motion is inactive.

10. Appendix I shows how to develop the Indexer program for a typical application.

6.1 L CODE DESCRIPTIONS

L06 Execution Format

Function: The L06 Code is used to define the way in which the program executes.

Units: none

Range:
1 = Single-Line Execution
2 = Automatic Program Execution
3 = Continuous Program Execution

Default: 2 = Automatic Program Execution

Command Format: L06 nCRLF

Notes: In the Single-Line Execution mode (1), the line will be executed once when a Cycle Start command is given.

In the Automatic Execution mode (2), the program will be executed once plus the number of times programmed in the Repeat Count register.

In the Continuous Execution mode (3), the program will be executed continuously.

The Repeat Count register value will be ignored if the Indexer is in the Single Cycle or the Continuous Cycle mode.

Related RS232 Commands:
"H1" (Cycle Start) start program execution
"$" (Feed Hold) pause motion
"*" (Clear) uncontrolled motion stop or cancel program execution
"#" (Program Stop) stop program after current line is executed

L07 Strobe Delay

Function: This code is used to define the active low time of the Strobe 2 through 7 outputs. Each Strobe output will be active for the selected time as the Strobes are activated in succession.

Units: milliseconds

Range: 0 to 9,999

Default: 0

Command format: L07 nnnnCRLF

Example: L07 1000 CRLF sets the strobe delay to 1000 milliseconds.

L08 Mechanical Home Direction

Function: This code defines the direction to be used when a Return to *Mechanical Home* command is issued.

Units: none

Range: + (CW direction)
- (CCW direction)

Default: + (CW direction)

Command format: L08 sCRLF

Related RS232 commands: "H10" (Return To *Mechanical Home* Start).
"$" (Feed Hold) pause motion
"*" (Clear) uncontrolled motion stop

Related G Code command: "G78" (Program line Return to *Mechanical Home*)

Example: L08 + CRLF sets a clockwise *Mechanical Home* direction.

L09 Jog Speed

Function:

The L09 command defines the speed to be used when the Indexer is in the High Speed mode and a Jog or a Step command is given.

Units:

pulses per second

Range:

1 to 115,000 for L70=1
1 to 115,000 for L70=2
1 to 115,000 for L70=5
1 to 115,000 for L70=10
1 to 1,875,000 for L70=125

Default:

1,000 for L70=1
2,000 for L70=2
5,000 for L70=5
10,000 for L70=10
125,000 for L70=125

Command format:

L09 nnnnnnnCRLF

Notes:

If the selected Jog Speed is equal to or less than the *Low Speed* rate, the Jog Speed rate will be used as the *Low Speed* rate during a manual jog.

If the *Low Speed* rate is zero, the Indexer will ramp from standstill directly up to the Jog Speed rate at the start of motion and from the Jog Speed rate directly down to standstill at the end of the motion.

The Jog Speed rate is ignored if the Indexer is in the *Low Speed* mode.

The Ramp Frequency Limit (L71) value determines the maximum *High Speed* which will be allowed.

Related RS232 Commands:

H02 (Select *Step Mode*)
H03 (Select *Jog Mode*)
H04 (Select *High Speed* Mode)
H05 (Select *Low Speed* Mode)
H06 (Start CW Motion)
H07 (Start CCW Motion)
$ (Feed Hold) pause motion
* (Clear) uncontrolled motion stop

Related L Codes:

L11 (Accel/Decel)
L12 *(Low Speed)*

Example:

L09 2000CRLF sets the Jog *High Speed* to 2000 pulses per second.

L11 Acceleration/Deceleration

Function: This command defines the maximum acceleration/deceleration value allowed for the selected ramp profile (L72).

Units: pulses per second^2

Range: 1 to 99,999,999

Default:
1,000 for L70 = 1
2,000 for L70 = 2
5,000 for L70 = 5
10,000 for L70 = 10
125,000 for L70 = 125

Command Format: L11 nnnnnnnCRLF

Notes: When motion begins, the Indexer will go directly from standstill to the *Low Speed* rate without acceleration and will then ramp up to the appropriate speed rate at the acceleration rate programmed for this parameter.

At the end of the motion, the Indexer will ramp down to the *Low Speed* rate at the deceleration value programmed in this register and will then stop.

Related L Codes: L72 (Ramp Profile Select)

Example: L11 2000 CRLF sets the acceleration/deceleration rate to 2,000 pulses per second^2.

L12 Low Speed

Function:

The L12 command defines the speed to be used as the *Low Speed* rate when the Indexer is in the *Low Speed* mode. This rate is also used as the instantaneous starting rate when the Indexer is in the *High Speed* mode.

Units:

pulses per second

Range:

0 to 115,000 for L70=1
0 to 115,000 for L70=2
0 to 115,000 for L70=5
0 to 115,000 for L70=10
0 to 1,875,000 for L70=125

Default:

300 for L70=1
600 for L70=2
1,500 for L70=5
3,000 for L70=10
37,500 for L70=125

Command Format:

L12 nnnnnnn CRLF

Notes:

When motion begins, the Indexer will go directly from standstill to the *Low Speed* rate without acceleration. At the end of the motion, the Indexer will go directly from the *Low Speed* rate to standstill without deceleration.

When *Low Speed* operation has been selected, motion is performed at the Low Speed rate and all other programmed speeds are ignored.

If the *Low Speed* rate has been selected and the programmed *Low Speed* rate is zero, no motion will occur and the motion command will be terminated.

If the *High Speed* rate has been selected and the programmed speed rate is equal to or less than the *Low Speed* rate, the programmed speed will be used as the *Low Speed* rate. If the *High Speed* has been selected and the programmed Low Speed rate is zero, the Indexer will ramp from standstill up to the programmed speed at the start of motion and from the programmed speed down to standstill at the end of the motion.

The Ramp Frequency Limit (L71) value sets the maximum *High Speed* allowed.

Related L Codes:

L09 (Jog Speed)
L11 (Accel/Decel)
L14 (Home Speed)
L71 (Ramp Frequency Limit)

Related RS232 Commands:

H2 (Select *Step Mode*)
H3 (Select *Jog Mode*)
H4 (*High Speed* Mode)
H5 (*Low Speed* Mode)
H6 (Start CW Motion)
H7 (Start CCW Motion)
$ (Feed Hold) pause motion
* (Clear) uncontrolled motion stop

Example:

L12 320 CRLF sets the *Low Speed* value to 320 pulses per second.

L13 Step Increment

Function: The L13 parameter defines the number of steps to be indexed when the Indexer is in the *Step mode* and a CW or CCW command is given.

Units: pulses

Range: 1 to 99,999,999

Default:
1 pulse for L70=1
2 pulses for L70=2
5 pulses for L70=5
10 pulses for L70=10
125 pulses for L70=125

Command Format: L13 nnnnnnnn CRLF

Notes: If the CW and/or CCW software limits are enabled and the move distance programmed here will cause a limit to be exceeded, the move will not be allowed.

Related RS232 Commands:
H02 (Select *Step Mode*)
H03 (Select *Jog Mode*)
H06 (Start CW Motion)
H07 (Start CCW Motion)
$ (Feed Hold) pause motion
* (Clear) uncontrolled motion stop

Example: L13 200 CRLF sets the Step Size value at 200 pulses.

L14 Home Speed

Function:

The L14 parameter defines the value to be used as the step rate when the Indexer is in the *High Speed* mode and a Return To *Electrical Home* or a Return To *Mechanical Home* command is issued.

Units:

pulses per second

Range:

1 to 115,000 for L70=1
1 to 115,000 for L70=2
1 to 115,000 for L70=5
1 to 115,000 for L70=10
1 to 1,875,000 for L70=125

Default:

1,000 for L70=1
2,000 for L70=2
5,000 for L70=5
10,000 for L70=10
125,000 for L70=125

Command Format:

L14 nnnnnnn CRLF

Notes:

If the Home Speed rate is equal to or less than the *Low Speed* rate, the Home Speed rate will be used as the *Low Speed* rate during a homing cycle.

If the *Low Speed* rate is zero, the Indexer will ramp from standstill directly up to the Home Speed rate at the start of motion and will ramp from this rate directly down to standstill at the end of the motion.

The Home Speed rate will be ignored if the Indexer is in the *Low Speed* mode.

The Ramp Frequency Limit (L71) value sets the maximum speed that will be allowed.

Related L Codes:

L12 (*Low Speed*)

Related RS232 Commands:

H04 *(High Speed* Mode)
H05 (*Low Speed* Mode)
H08 (Return To *Electrical Home*)
H10 (Return To *Mechanical Home*)
$ (Feed Hold) pause motion
* (Clear) uncontrolled motion stop

Related G Code commands:

G76 (Return To *Electrical Home*)
G78 (Return To *Mechanical Home*)

Example:

L14 3000 CRLF sets the Home *High Speed* at 3000 pulses per second.

L16 Index From Run Travel Limit

Function: This parameter defines the maximum *Index* From Run distance allowed before the cycle comes to a controlled stop.

Units: pulses

Range: 0 to 99,999,999

Default: 0 (disabled)

Command Format: L16 nnnnnnnn CRLF

Notes: If a value other than zero is placed in L16, this value will be the maximum number of pulses to be allowed during an *Index* From Run cycle. If this number is exceeded, motion will cease, the Position Error output will be activated and a status bit will be set in the Motion Error status.

The L16 value should be slightly larger than the distance between the *Index* markers **plus** the *Index* move distance.

Related RS232 Commands:
H30 *(Index* From Run)
$ (Feed Hold) Pause Motion
* (Clear) Uncontrolled Motion Stop

Related G Code Command: G10 *(Index* From Run)

Example: L16 2000 CRLF sets the *Index* From Run Travel Limit at 2000 pulses.

L17 Offset From Mechanical Home

Function: This parameter defines the offset distance and direction to be indexed once the Indexer has reached the Home Limit switch.

Units: pulses

Range: -99,999,999 to +99,999,999

Default: +0

Command Format: L17 snnnnnnnnCRLF

Notes: Once the Indexer has offset from the Home Limit switch, the new position will be established as *Electrical Home*.

The Home Offset register value is only used during a Return To *Mechanical Home* cycle. It is not used during a Return To *Electrical Home* cycle.

Related RS232 Commands:
H10 (Return To *Mechanical Home*)
$ (Feed Hold) pause motion
* (Clear) uncontrolled motion stop

Related G Code Command: G78 (Return To *Mechanical Home*)

Example: L17 +1000 CRLF sets the *Electrical Home* Offset at +1000 pulses from Mechanical Home.

L18 Clockwise Software Travel Limit

Function: This value represents the maximum distance that the Indexer will be allowed to travel in the CW direction.

Units: pulses

Range: +0 to +99,999,999 (-0 disables this function)

Default: -0 (function disabled)

Command Format: L18 snnnnnnnnCRLF

Notes: If the limit is exceeded during a Jog cycle, motion will come to a controlled stop. No further motion will be allowed in the CW direction until the Absolute Position count is less than the L18 value.

The Indexer will not perform a clockwise *index* cycle (step or program execution) if the resulting position will be equal to or greater than the L18 value.

Examples: L18 -0 CRLF disables the Clockwise Software Travel Limit.

L18 +100000 CRLF enables the Clockwise Software Travel Limit and sets it at +100000 pulses.

L19 Counterclockwise Software Travel Limit

Function: This value represents the maximum distance that the Indexer will be allowed to travel in the CCW direction.

Units: pulses

Range: -0 to -99,999,999 (+0 disables this function)

Default: +0 (function disabled)

Command Format: L19 snnnnnnnnCRLF

Notes: If the limit is exceeded during a Jog cycle, motion will come to a controlled stop. No further motion will be allowed in the CCW direction until the Absolute Position count is less than the L19 value.

The Indexer will not perform a counterclockwise *index* cycle (step or program execution) if the resulting position will be equal to or greater than the L19 value.

Examples: L19 +0 CRLF disables the Counterclockwise Software Travel Limit.

L19 -100000 CRLF enables the Counterclockwise Software Travel Limit and sets it at -100000 pulses.

L20 Up/Down Feed Rate Override

Function: Specifies how the Up (!H31) and Down (!H32) commands are treated when motion is completed.

Units: none

Range: 0
Forget commanded Up/Down velocity after completing motion.

1
Remember the commanded Up/Down velocity if it occurs during *Index* motion. This velocity will be forgotten if a program line Feed Rate (Nnnn Fnnnnnnn) or Feed Rate Override (!Fnnnnnn) is encountered.

Default: none

Command Format: L20 n CRLF

Notes: This parameter relates to programmed moves only.

If enabled this velocity becomes the programmed *index* move velocity and will be remembered even if the indexer is powered down.

L21 Device Identification Number

Function: Defines the ID of the Indexer.

Units: none

Range: 1 to 99

Default: 1

Command Format: L21 nnCRLF

Notes: When multiple indexers have been daisy chained, a unique ID must be assigned to each indexer. This ID number will be used with the "<nn" "Device Attention" command to activate a specific indexer.

Example: L21 5 CRLF sets the Indexer ID to 5.

L22 Baud Rate

Function: Sets the RS232 baud rate.

Units: bits per second

Range: 300, 1200, 2400 or 9600

Default: 9600

Command Format: L22 nnnnCRLF

Example: L22 2400 CRLF sets the RS232 baud rate at 2400 bits per second.

L23 Character Length

Function: Sets the number of data bits in each character sent via the RS232 serial port.

Units: bits

Range: 7 or 8

Default: 8

Command Format: L23 nCRLF

Example: L23 7 CRLF sets the RS232 character length to 7 bits.

L25 RS232 Parity

Function: Sets the parity protocol for characters sent via the RS232 serial port.

Units: none

Range:
1 = parity disabled
2 = odd parity enabled
3 = even parity enabled

Default: 1 (parity disabled)

Command Format: L25 nCRLF

Notes: When parity is disabled, two stop bits will be sent regardless of the character length.

If odd or even parity is selected, one stop bit will be sent if the L23 character length is 8 and two stop bits will be sent if the L23 character length is 7.

Example: L25 3 CRLF sets the RS232 character parity to even.

L26 Command Acknowledgement

Function: Selects the transmission protocol the Indexer will use when responding to input commands.

Units: none

Range: 0 to 7 (see below)

Default: 0

Command Format: L26 n CRLF

Notes:

Xon/Xoff Protocol Enabled	
n=0	normal transmission mode (no "EOT" or "=" characters)
n=1	"EOT" follows each complete data transmission
n=2	"=" is transmitted when the indexer is ready for more commands
n=3	"EOT" follows each complete data transmission and "=" is transmitted when the indexer is ready for more commands
Xon/Xoff Protocol Disabled	
n=4	normal transmission mode (no "EOT" or "=" characters)
n=5	"EOT" follows each complete data transmission
n=6	"=" is transmitted when the indexer is ready for more commands
n=7	"EOT" follows each complete data transmission and "=" is transmitted when the indexer is ready for more commands

EOT: ASCII 04 decimal.

Examples: Indexer with device ID1 and Parameter L26 set to 3.

Command: <01CRLF
Response: =Xon

Command: H15CRLF
Response: Xoff NnnnCRLF EOT Xon=

Command: H18H19CRLF
Response: Xoff nnnnnnnnCRLF EOT
nnnnnnnnCRLF EOT Xon

L41 Auto Start Line Number

Function: Selects the line number to which the program line pointer will automatically be set during any of the following conditions:
- Upon power up
- During invalid program execution
- Upon encountering an End Of Program command
- After a Clear command

Units: none

Range: 0 to 400

Default: 1

Command Format: L41 nnn CRLF

Example: L41 100 CRLF sets the auto start line number to 100.

L43 Delay Between Index And Backlash

Function: Selects the delay that will occur between an *index* motion and a *backlash* cycle.

Units: milliseconds

Range: 0 to 9,999

Default: 50

Command Format: L43 nnnn CRLF

Example: L43 100 CRLF sets a delay of 100 milliseconds between an *index* and a *backlash* cycle.

L44 Program Line Delay

Function: Selects the delay that will occur between line executions.

Units: milliseconds

Range: 0 to 9,999

Default: 50

Command Format: L44 nnnn CRLF

Notes: The delay should be of sufficient length to allow the motor to settle before the next *index* begins.

A delay is necessary whenever the Continuous Cycle mode is selected, the Auto Reverse feature is enabled or the Auto Repeat feature is used.

Example: L44 100 CRLF selects a delay of 100 milliseconds between line executions.

L45 Limit Switch Enable

Function: Permits the CW Limit and CCW Limit inputs to be used as limit switch inputs (0) or as additional Programmable inputs (1) for the Branch On Input (G20) and Wait For Input Condition commands (G22).

Units: none

Range: 0 = Limit Switches Enabled
1 = Programmable Inputs Enabled

Default: 0

Command Format: L45 n CRLF

Notes: If activated when used as a limit switch input, the CW Limit or CCW Limit input will terminate motion in the CW or CCW direction and will prevent further motion in that direction until the limit is inactive again. If a limit is activated during program execution, motion will come to an uncontrolled stop and program execution will be terminated.

When used as additional programmable inputs, CW Limit functions as Input 3 and CCW Limit functions as Input 4 for the Branch On Input Condition (G20) and Wait For Input Condition (G22) commands.

Example: L45 1CRLF selects use of the Limit inputs as programmable inputs.

L47 Repeat Count

Function: This parameter sets the number of times a program will be repeated when the Indexer is in the Auto Execution (L06 2) mode.

Units: none

Range: 0 to 99,999,999

Default: 0

Command Format: L47 nnnnnnnn CRLF
!L47 nnnnnnnn CRLF

Notes: The number of program cycles that will be performed is the L47 value plus one.

If the Repeat Count value is changed during execution, and the new value has already been exceeded, the cycle will be terminated. If the new value has not been reached, execution will continue until it is reached.

The Repeat Count value is ignored when in the Continuous Execution mode (L06 3) or the Single Execution mode (L06 1).

Example: L47 50CRLF sets the Repeat Count value at 50 when motion has stopped.

!L47 30CRLF sets the repeat count to 30 during motion.

L48 Program Line Count Designator

Function: Selects the Line Count Designator in response to a Clear Program or a Transfer Program Lines command.

Units: none

Range: 0 to 400

Default: 20

Command Format:
L48 nnnCRLF
!L48 nnnCRLF

Notes: If the L48 value is 0, all lines will be cleared in response to a Clear Program Lines command (H12) and all lines will be transferred in response to a Transfer Program Lines command (H14).

If the L48 value is 1 through 400, the Indexer will start at the current line and use the L48 value as a line count when responding to a Clear Program Lines or Transfer Program Lines command.

Examples: L48 0 H14CRLF will cause all lines to be transferred.

L48 0 H12CRLF will cause all lines to be cleared.

Related RS232 Commands:
H12 (Clear Program Lines using L48)
H14 (Transfer Program Lines using L48)

L49 Parameter Transfer Designator

Function: Selects the Parameters which will be returned in response to a transfer parameter request.

Units: none

Range: 0 to 99

Default: 0 (all parameters)

Command Format:
L49 nn CRLF
!L49 nnCRLF

Notes:
nn = 00 results in the transfer of all parameters in response to a parameter transfer request.

nn = 01 to 99 results in the transfer of the designated parameter in response to a parameter transfer request.

If nn is an invalid parameter, only a CRLF is returned.

Related L Codes: L50 (Parameter Transfer Count)

Related H Codes: H16 (Transfer Parameters)

Examples:
!L49 0 H16CRLF will cause all parameters to be transferred immediately.

!L49 0 L50 0 H16CRLF will cause all parameters to be transferred immediately in three column format.

!L50 4 L49 21 H16CRLF will result in four parameters being transferred starting at L21.
Response:
L21 nnCRLF
L22 nnnnCRLF
L23 nCRLF
L25 nCRLF

L50 Parameter Transfer Count

Function: Defines the number of parameters to be transferred in response to a Transfer Parameters (H16) request.

Units: none

Range: 0 to 99

Default: 0

Command Format:
L50 nnCRLF
!L50 nnCRLF

Notes: The parameter count starts at the parameter specified by the L49 value.

If L49 = 0, all parameters will be transferred.

If L50 = 0 also, then a three L code per line transfer will occur.

Related L Codes: L49 (Parameter Transfer Designator)

Related H Codes: H16 (Transfer Parameters)

Example: !L50 4 L49 21 H16CRLF will result in four parameters being transferred starting at L21.
Response:
L21 nnCRLF
L22 nnnnCRLF
L23 nCRLF
L25 nCRLF

L51 Input/Output Mode Select

Function: This command allows additional inputs and outputs to be used in conjunction with the G20 (Condition Branch), G22 (Wait For Input) and G47 (Set Output Condition) commands.

Units: none

Range: 0 to 7

Default: 0

Command Format: L51 nCRLF

Notes:

L51 Value	Inputs				Outputs
	AWO	Step/Jog	CCW Direction	CW Direction	$\overline{\text{Strobes 4}}$ thru $\overline{\text{7}}$
0	Normal	Normal	Normal	Normal	Normal
1	Normal	Input 7	Input 6	Input 5	Normal
2	Input 8	Normal	Normal	Normal	Normal
3	Input 8	Input 7	Input 6	Input 5	Normal
4	Normal	Normal	Normal	Normal	$\overline{\text{Outputs 3}}$ thru $\overline{\text{6}}$
5	Normal	Input 7	Input 6	Input 5	$\overline{\text{Outputs 3}}$ thru $\overline{\text{6}}$
6	Input 8	Normal	Normal	Normal	$\overline{\text{Outputs 3}}$ thru $\overline{\text{6}}$
7	Input 8	Input 7	Input 6	Input 5	$\overline{\text{Outputs 3}}$ thru $\overline{\text{6}}$

If L51=4 Through 7
$\overline{\text{Strobe 4}}$ is $\overline{\text{Output 3}}$, $\overline{\text{Strobe 5}}$ is $\overline{\text{Output 4}}$, $\overline{\text{Strobe 6}}$ is $\overline{\text{Output 5}}$ and $\overline{\text{Strobe 7}}$ is $\overline{\text{Output 6}}$. These outputs are used in conjunction with the G47 command.

```
G47 XOOnnnnnn
     OOn-----  Strobe 7 (L51= 4 thru 7)
     OO-n----  Strobe 6 (L51= 4 thru 7)
     OO--n---  Strobe 5 (L51= 4 thru 7)
     OO---n--  Strobe 4 (L51= 4 thru 7)
     OO----n-  Output 2 (L51= 0 thru 7)
     OO-----n  Output 1 (L51= 0 thru 7)
```

The AWO, Step/Jog, CCW Dir and CW Dir inputs can be reassigned as conditional inputs for the G20 and G22 commands.

```
G20 Xnnnnnnnn
G22 Xnnnnnnnn
     n------- AWO       (L51= 2,3,6 or 7)
     -n------ Step/Jog  (L51= 1,3,5 or 7)
     --n----- CCW Dir   (L51= 1,3,5 or 7)
     ---n---- CW Dir    (L51= 1,3,5 or 7)
     ----n--- CCW Limit (L45= 1)
     -----n-- CW Limit  (L45= 1)
     ------n- In 2      (L51= 0 thru 7)
     -------n In 1      (L51= 0 thru 7)
```

L51 continued

If L51 = 4 thru 7, the following functions are lost:
G36 (Strobe X) ignored
G38 (Strobe F) ignored
parallel data for the L, X and F codes are disabled

If L51 = 1, 3, 5 or 7, the parallel Jog and Step functions are lost

If L51 = 2, 3, 6 or 7, the parallel Windings On/Off function is lost

L52 Buffer Warning Character

Function: Defines the character to be sent when either buffer has ten characters or less remaining before it will overflow.

Units: none

Range: 0 to 127 (0 = disabled)

Default: 0 (disabled)

Command Format:
L52 nnnCRLF
!L52 nnnCRLF

Notes: L52 value of 1 to 127 defines the ASCII code to be sent when ten characters or less remain before an overflow condition will occur.

The character is sent only if the indexer ID is active.

The character is only sent once, regardless of the Xoff status.

Example: L52 66 CRLF sets "066" (B) as the character to be sent as a buffer overflow warning.

L55 Line Done Character

Function: Defines the character to be sent when a program line is completed.

Units: none

Range: 0 to 127 (0 = disabled)

Default: 0 (disabled)

Command Format:
L55 nnnCRLF
!L55 nnnCRLF

Notes: An L55 value from 1 to 127 determines the ASCII character to be sent upon completion of a program line (line 1 thru 400).

The character is only sent if the indexer ID is active.

The character will be sent once regardless of the Xoff status.

Example: L55 69 CRLF sets "069" (E) as the character to be sent when a Line Done condition occurs.

L56 Program Done Character

Function: Defines the character to be sent when the program is completed.

Units: none

Range: 0 to 127 (0 = disabled)

Default: 0 (disabled)

Command Format:
L56 nnnCRLF
!L56 nnnCRLF

Notes: An L56 value from 1 to 127 designates the ASCII code to be sent upon completion of the program.

The character is sent only if the indexer ID is active.

The character will be sent regardless of the Xoff status.

Example: L56 70 CRLF sets "070" (F) as the character to be sent when the program has been executed.

L57 $\overline{\text{Strobe 0}}$, $\overline{\text{Strobe 1}}$ Delay

Function: Sets the $\overline{\text{Strobe 0}}$ and $\overline{\text{Strobe 1}}$ delay time for fetching switch input commands.

Units: milliseconds per strobe

Range: 4 to 98 (even numbers only)

Default: 4

Command Format:
L57 nnnCRLF
!L57 nnnCRLF

Example: L57 8 CRLF sets the delay time for $\overline{\text{Strobe 0}}$ and $\overline{\text{Strobe 1}}$ to 8 milliseconds.

L66 Backlash Compensation

Function: The L66 parameter selects the number of steps to be used as *backlash* compensation.

Units: pulses

Range: -99,999,999 to +99,999,999

Default: +0 (disabled)

Command Format: L66 snnnnnnnn CRLF

Notes: *Backlash* Compensation will only be performed when the *index* direction matches the direction programmed for this parameter and the *index* is not a Step Index.

When performing *Backlash* Compensation, the Indexer adds the L66 value to the *index* motion. Following the motion, the Indexer delays for the time programmed in the *Backlash* Delay register (L43), reverses direction and indexes the distance programmed for the L66 parameter.

Examples: L66 +100CRLF sets up a clockwise direction *backlash* compensation of 100 pulses.

L66 -100 sets up a counterclockwise direction *backlash* compensation of 100 pulses.

L67 Auto Reverse

Function: The L67 command enables or disables the Auto Reverse cycle.

Units: none

Range: 0 = Auto Reverse cycle disabled
1 = Auto Reverse cycle enabled

Default: 0

Command Format: L67 nCRLF

Description: When the L67 function is enabled, a Reverse *Index* move will be performed after an incremental *index* move and delay have been executed. The delay between moves is the Program Line Delay (L44) value.

A *Backlash* cycle may be performed, if enabled.

Auto Reverse is disabled when in the Absolute Position mode.

Example: L67 1CRLF enables the Auto Reverse function.

L70 Resolution

Function:

Program the L70 parameter with the correct value for the desired positioning resolution.

Units:

none

Default:

1 = full-step drive (200 pulses per revolution)
2 = half-step drive (400 pulses per revolution)
5 = 1/5 step drive (1,000 pulses per revolution)
10 = 1/10 step drive (2,000 pulses per revolution)
125 = 1/125 step drive (25,000 pulses per revolution)

Command Format:

L70 nnnCRLF

Notes:

This code should be programmed first.

The following chart shows the values that can be used with the various Programmable Indexer models.

RESOLUTION REGISTER VALUES					
DRIVE MODEL	Resolution Register Value				
	1	2	5	10	125
3180-EPI	Full	Half	-	-	-
3180-EPI10	-	-	-	1/10	-
3180-EPI125	-	-	-	-	1/125
6180-EPI	Full	Half	-	-	-
6180-EPI10	-	-	-	1/10	-
6180-EPI125	-	-	-	-	1/125

The value entered for the L70 parameter determines the input limits for the L09, L12, L14, L71 and L73 values. These limits are:

1 115,000 pulses maximum
2 115,000 pulses maximum
5 115,000 pulses maximum
10 115,000 pulses maximum
125 1,875,000 pulses maximum

L70 nnn will be processed when motion has stopped unless a Feed Hold *index* pause is active.

Example:

L70 125CRLF sets the motor drive translator to the 1/125 microstep mode.

L71 Ramp Frequency Limit

Function: This parameter sets the maximum speed that any motion will be allowed to achieve.

Units: pulses per second

Range:
1 to 115,000 for L70=1
1 to 115,000 for L70=2
1 to 115,000 for L70=5
1 to 115,000 for L70=10
1 to 1,875,000 for L70=125

Default:
115,000 for L70=1
115,000 for L70=2
115,000 for L70=5
115,000 for L70=10
1,875,000 for L70=125

Command Format: L71 nnnnnnnCRLF

Notes: If the value in any speed register exceeds the L71 value, the L71 value will be used as the default value for that register.

Example: L71 20000 CRLF sets the maximum motion velocity limit to 20000 pulses per second.

L72 Ramp Profile Select

Function: This command selects the ramp profile that will be used during any motion that requires acceleration and deceleration.

Units: none

Range:
0 = trapezoidal ramp profile
1 = hyperbolic ramp profile
2 = "S" shaped ramp profile

Default: 0

Command Format: L72 nCRLF

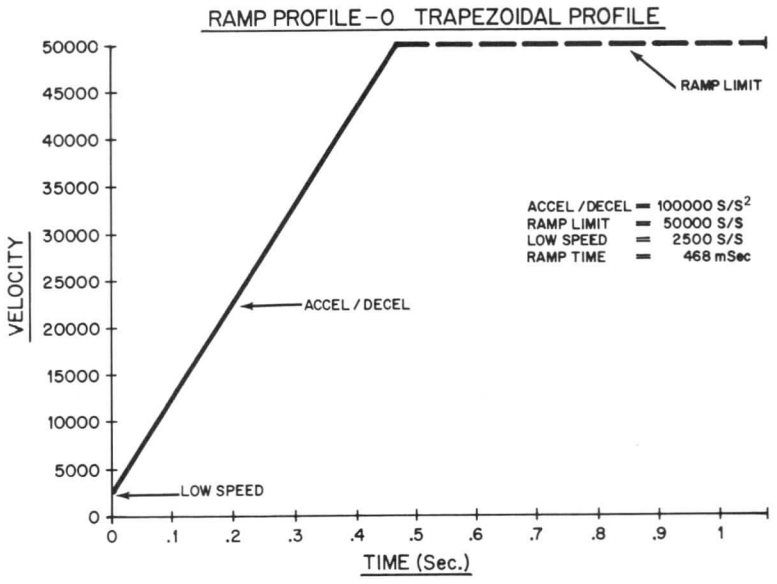
Notes: The three Diagrams show the available ramp profiles (trapezoidal, "S" and hyperbolic).

With some combinations of motor and load, a nonlinear ramp profile ("S" or Hyperbolic) will allow ramping to and from higher speeds than would be possible using a linear profile.

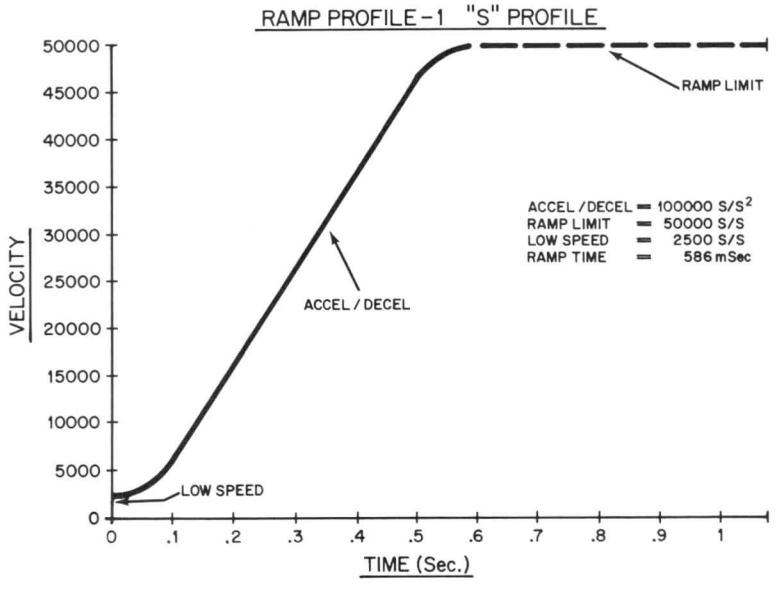
Selecting a ramp profile other than Trapezoidal will result in longer acceleration and deceleration times for a given Accel/Decel register value.

Related L Codes:
L11 (Acceleration/Deceleration)
L12 (*Low Speed*)
L71 (Ramp Frequency Limit)

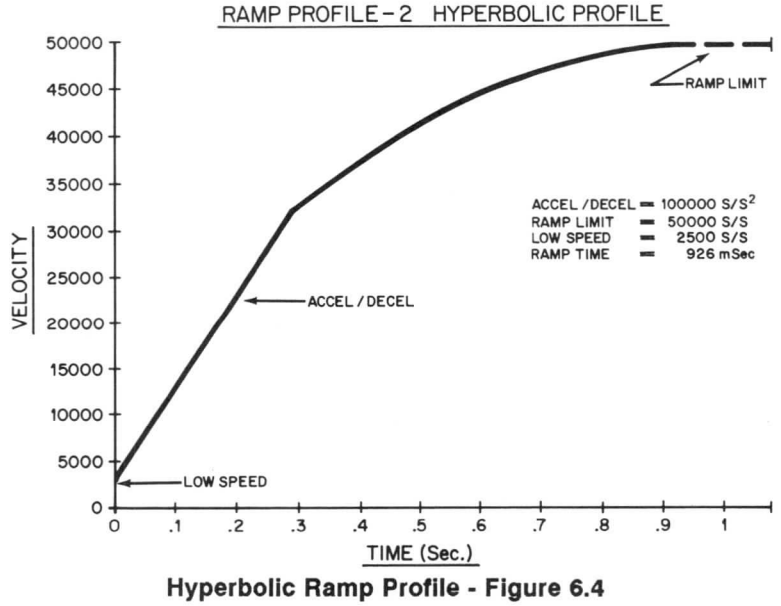
Example: L72 2CRLF selects an "S" shaped ramp profile.



Trapezoidal Ramp Profile - Figure 6.2



"S" Ramp Profile - Figure 6.3



Hyperbolic Ramp Profile - Figure 6.4

L73 Deviation Frequency

Function:

The L73 parameter selects the change in motor speed that will occur each time a Target Velocity Increase (H31) or Target Velocity Decrease (H32) command is given.

Units:

pulses per second

Range:

1 to 115,000 for L70=1
1 to 115,000 for L70=2
1 to 115,000 for L70=5
1 to 115,000 for L70=10
1 to 1,875,000 for L70=125

Default:

10 for L70=1
20 for L70=2
50 for L70=5
100 for L70=10
1,250 for L70=125

Command Format:

L73 nnnnnnnCRLF

Notes:

The rate at which the motor speed will change is determined by value set for the Acceleration/Deceleration (L11) parameter.

The Deviation Frequency function is available during all modes of operation, including *Low Speed*.

If the speed rate is increased to the point where it exceeds the Ramp Limit (L71) value, the L71 value will be used as the default speed rate.

Related H Codes:

H31 (Target Velocity Increase)
H32 (Target Velocity Decrease)

Example:

L73 100CRLF sets the deviation frequency at 100 pulses per second.

L98 Delay Between Continuous H Code Transmissions

Function:

Defines the delay between continuous H codes (%). See Section 6.2 for details on the Continuous H Code Transmission mode.

Units:

milliseconds

Range:

0 to 499

Default:

100

Command Format:

L98 nnnCRLF
!L98 nnnCRLF

6.2 H CODE DESCRIPTIONS

H01 Cycle Start

Function: This command starts program execution or restarts motion from a Feed Hold ($) condition.

Default Mode: none

Command Format: H01CRLF

Notes: A program consists of a series of program lines. Each line is made up of a **Line Number** (Nnnn), **G Code** (Gnn), **Move Distance or G code data** (Xsnnnnnnnn), and **Feed Rate or G code data** (Fnnnnnnnn). All of these fields need not be programmed on each line. The execution time of a program line includes the Program Line Delay (L44) value.

Related L Codes: L06 (Line Execution Format)

H02 Step Mode

Function: This command selects the *Step mode* and deselects the *Jog mode* for manual motion operation.

Default Mode: *step mode* (on power turn-on)

Command Format: H02CRLF

Notes: The H02 command does not cause motion to occur.

When the Indexer is in the *Step mode* and an H06 (CW) or an H07 (CCW) command is given, the Indexer will step the motor in the desired direction. The step distance for this move is the value entered for the L13 (Step Increment) parameter.

H02 will not be processed during a Feed Hold condition.

Related L Codes: L09 (Jog Speed)
L13 (Step Increment)

Related H Codes: H04 (*High Speed* Mode)
H05 (*Low Speed* Mode)
H06 (CW Direction)
H07 (CCW Direction)
H19 (Transfer Mode Status)

H03 Jog Mode

Function:

The H03 command selects the *Jog mode* and deselects the *Step mode* for manual motion operation.

Default Mode:

Step Mode (on power turn-on)

Command Format:

H03CRLF

Notes:

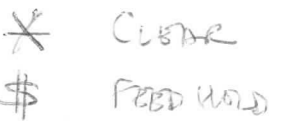
The H03 command does not cause motion to occur.

When the Indexer is in the *Jog mode* and an H06 (CW) or an H07 (CCW) command is given, the motor will Jog in the desired direction. The motor will jog until a Feed Hold or a Clear command is issued or until a limit is exceeded.

H03 will not be processed during a Feed Hold condition.

Related H Codes:

H04 *(High Speed* Mode)
H05 (*Low Speed* Mode)
H06 (CW Direction)
H07 (CCW Direction)
H19 (Transfer Mode Status)



H04 High Speed Mode

Function:

The H04 command selects the *High Speed* mode and deselects the *Low Speed* mode.

Default Mode:

High Speed mode (on power turn-on)

Command Format:

H04CRLF
!H04CRLF

Notes:

The H04 command selects the L09 value as the *High Speed* rate for the Jog cycle or Step execution and the F value as the *High Speed* rate for Program Execution.

When a motion command is given, the motor will ramp from the *Low Speed* rate up to the rate programmed for the motion cycle that is occurring.

If !H04 is issued during *Low Speed* motion, the appropriate *High Speed* value will become the target velocity for the motion in progress.

Related L Codes:

L09 (Jog Speed)

Related H Codes:

H05 (*Low Speed* Mode)
H19 (Transfer Mode Status)

H05 Low Speed Mode

Function:

The H05 command selects the *Low Speed* mode and deselects the *High Speed* mode.

Default Mode:

High Speed mode (on power turn-on)

Command Format:

H05CRLF
!H05CRLF

Notes:

This command selects the L12 (*Low Speed*) parameter value as the velocity for a Jog cycle, Program Execution or Step Execution.

If an !H05 command is issued during *High Speed* motion, the L12 (*Low Speed*) value becomes the target velocity for the motion in progress. The motor will be ramped down to the L12 (*Low Speed*) parameter value.

Related H Codes:

H04 *(High Speed* Mode)
H19 (Transfer Mode Status)

Related L Codes:

L12 (*Low Speed*)

H06 CW Direction

Function: This command is used to start a Jog or Step motion in the CW direction.

Default Mode: none

Command Format: H06CRLF

Notes: **If any motion other than CW manual motion is active or if a Program Cycle is active, The CW command will not be honored.**

The following chart lists the action which will occur with the possible combinations of inputs that affect CW Direction.

INPUTS THAT AFFECT CW DIRECTION			
CW MOTION	**STEP/JOG**	**SPEED**	**FUNCTION**
active	**Jog (H03)**	**High (H04)**	**Ramp to Jog Speed rate and Jog**
active	**Jog (H03)**	**Low (H05)**	**Jog at Low Speed rate**
active	**Step (H02)**	**High (H04)**	**Ramp to Jog Speed rate and Step**
active	**Jog (H03)**	**Low (H05)**	**Step at Low Speed rate**
active	**Jog or Step**	**Low to High**	**Ramp to Jog Speed rate**
active	**Jog or Step**	**High to Low**	**Ramp to Low Speed rate**

Related L Codes:
L09 (Jog Speed)
L12 (*Low Speed*)
L13 (Step Increment)

Related H Codes:
H02 (*Step Mode*)
H03 (*Jog Mode*)
H04 (*High Speed* Mode)
H05 (*Low Speed* Mode)

H07 CCW Direction

Function: This command is used to start a Jog or Step motion in the CCW direction.

Default Mode: none

Command Format: H07CRLF

Notes: **If any motion other than CCW manual motion is active or if a Program Cycle is active, The CCW command will not be honored.**

The following chart lists the action which will occur with the possible combinations of inputs that affect CCW Direction.

INPUTS THAT AFFECT CCW DIRECTION			
CW MOTION	**STEP/JOG**	**SPEED**	**FUNCTION**
active	**Jog (H03)**	**High (H04)**	**Ramp to Jog Speed rate and Jog**
active	**Jog (H03)**	**Low (H05)**	**Jog at Low Speed rate**
active	**Step (H02)**	**High (H04)**	**Ramp to Jog Speed rate and Step**
active	**Jog (H03)**	**Low (H05)**	**Step at Low Speed rate**
active	**Jog or Step**	**Low to High**	**Ramp to Jog Speed rate**
active	**Jog or Step**	**High to Low**	**Ramp to Low Speed rate**

Related L Codes: L09 (Jog Speed)
L12 (*Low Speed*)
L13 (Step Increment)

Related H Codes: H02 (*Step Mode*)
H03 (*Jog Mode*)
H04 (*High Speed* Mode)
H05 (*Low Speed* Mode)

H08 Return To Electrical Home

Function: The H08 command will cause the Indexer to perform an *index* move to return to the location which has been designated *Electrical Home*. This is an Absolute position of zero.

Default Mode: none

Command Format: H08CRLF

Notes: The direction for a Return To *Electrical Home index* move will be the reverse of the direction of the present Absolute position and the distance will be that of the present Absolute electrical position.

Related H Codes: H04 (*High Speed* Mode)
H05 (*Low Speed* Mode)
H09 (Set *Electrical Home*)

Related L Codes: L14 (Home Speed)

H09 Set Electrical Home

Function: The H09 commands the Indexer to establish the present mechanical position as *Electrical Home* and Encoder Home Position.

Default Mode: none

Command Format: H09CRLF

Notes: All Absolute positions are referenced to the *Electrical Home* position.

Upon power up, the present mechanical position will be established as *Electrical Home*. This home position will continue to be the *Electrical Home* position until a new Set *Electrical Home* command is given, a Return to *Mechanical Home* cycle is executed or until the Indexer is de-energized.

H09 will not be processed while a Feed Hold condition is active.

H10 Return To Mechanical Home

Function: This code commands the Indexer to perform a Return To *Mechanical Home* cycle.

Default Mode: none

Command Format: H10CRLF

Notes: When an H10 command is issued, the Indexer begins the cycle by Jogging in the direction selected by the L08 (*Mechanical Home* Direction) parameter.

The Indexer will Jog until the Home Limit Switch input is activated and will then ramp to a halt. The point at which the Home Limit Switch input was activated will be registered as the temporary Home position.

When motion ceases, the Indexer will *index* to the temporary Home position and will Jog at Low Speed (L12 value) until the Home Limit switch input becomes active and then inactive.

The Indexer then reverses direction and Jogs at Low Speed (L12 value) until the Home Limit Switch input becomes active again. This position is then established as the Absolute Electrical Home Position.

If a value other than 0 is entered for the *Mechanical Home* Offset (L17) parameter, the Indexer will now *index* this direction and distance. This position is then established as the Absolute *Electrical Home* Position.

Related L Codes:
L08 (*Mechanical Home* Direction)
L12 (*Low Speed*)
L14 (Home Speed)

See also p5-10

Related RS232 Commands:
H04 (*High Speed* Mode)
H05 (*Low Speed* Mode)

H11 Clear Program Line

Function: The H11 commands the Indexer to clear the present program line.

Default Mode: none

Command Format: H11CRLF

H12 Clear Program Lines Using L48

Function: This command, together with L48 = 0, will clear the entire program. The lines will be irretrievably erased and the line pointer will be reset to the line selected by L41.

Default Mode: none

Command Format: H12CRLF

Notes: If L48 = nnn and the H12 command is issued, nnn lines will be cleared starting from the current line.

Examples: L48 0 H12CRLF will clear lines 1 through 400.

N1 L48 10 H12CRLF will clear lines 1 through 10.

H13 Transfer Program Line

Function: Requests the transfer of the current program line.

Default Mode: none

Command Format: H13CRLF
!H13CRLF

Notes: The data will be transferred in the following format:
Nnnn Gnn Xsnnnnnnnn FnnnnnnnnCRLF

H14 Transfer Program Lines Using L48

Function: This command, together with L48, will send program lines.

Default Mode: none

Command Format: H14CRLF

Notes: If L48 = nnn and this command is given, nnn lines will be sent, starting from the current line.

The line data will be transferred in the following format:
Nnnn Gnn Xsnnnnnnnn FnnnnnnnnCRLF

If no value has been programmed for a program field, spaces will be sent in its place:
Nnnn Xsnnnnnnnn CRLF

Examples: L48 0 H14CRLF will send lines 1 through 400.

N1 L48 10 H14CRLF will send lines 1 through 10.

H15 Transfer Current Line Number

Function: This command requests the transfer of the current line number.

Default Mode: none

Command Format:
H15CRLF
!H15CRLF

Notes: The data will be transferred in the following format:
NnnnCRLF

H16 Transfer Parameters

Function: The H16 command requests the transfer of all parameters (L codes) or of a designated parameter.

Default Mode: none

Command Format:
H16CRLF
!H16CRLF

Notes: When L49 = 0, all parameters will be transferred. If L50 = 0 also, a three L code per line transfer will occur.

If the L49 value is a legal parameter number, see L Code Listing APPENDIX A, only the contents of that parameter will be transferred.

If the L49 value is not a legal parameter, only a CRLF will be returned.

Example:
command:!L49 dd H16 CR or L49 dd H16 CR
where: "dd" is a legal code listed in APPENDIX A

response:Ldd (data) CRLF
where: "dd" consists of two ASCII characters from 0 to 9
(data) is field data for this parameter
CR is a Carriage Return
LF is a Line Feed

H17 Transfer Absolute Electrical Position

Function: This code requests the transfer of the Absolute Electrical Position.

Default Mode: none

Units: pulses

Command Format:
H17CRLF
!H17CRLF

Notes: The data will be transferred in the following format:
snnnnnnnnnnCRLF

H18 Transfer Motion Status

Function:

The H18 code requests the transfer of the status of motion related inputs and functions.

Default Mode:

none

Command Format:

H18CRLF
!H18CRLF

Notes:

The data will be transferred in the following format:

nnnnnnnnCRLF

```
n------- Stop Execution    0=inactive   1=active
-n------ CCW Direction     0=inactive   1=active
--n----- CW Direction      0=inactive   1=active
---n---- Feed Hold         0=inactive   1=active
----n--- Clear             0=inactive   1=active
-----n-- Home Limit        0=inactive   1=active
------n- CCW Limit         0=inactive   1=active
-------n CW Limit          0=inactive   1=active
```

The limits will only appear active if the last motion was in the designated direction and the limit sensor is active.

Example:

!H18CRLF sent. The data transfer results might be as follows:
00001001CRLF
This transfer indicates that the "Clear" and the "CW Limit" are active. All others are inactive.

H19 Transfer Mode Status

Function:

The H19 code requests the transfer of the status of the Indexer modes.

Default Mode:

none

Command Format:

H19CRLF
!H19CRLF

Notes:

The data will be transferred in the following format:

nnnnnnnnCRLF

```
n------- Program Execution     0=inactive        1=active
-n------ Motion                0=inactive        1=active
--n----- 0=Incremental Mode    1=Absolute Mode
---n---- All Windings Off      0=inactive        1=active
----n--- Boost Current         0=inactive        1=active
-----n-- Reduced Current       0=inactive        1=active
------n- 0=Low Speed Mode      1=High Speed Mode
-------n 0=Step Mode           1=Jog Mode
```

Example:

!H19CRLF sent. The following data transfer may result:
00100011CRLF

This data transfer indicates that the Absolute Mode, *Jog Mode* and *High Speed* mode are active. All others are inactive.

H20 Transfer Output Status

Function: Transfers the status of the Indexer outputs.

Default Mode: none

Command Format:
H20CRLF
!H20CRLF

Notes: The data will be transferred as follows:

```
OOnnnnnnCRLF
OOn----- Output 6 (L51 = 4 thru 7)  0= inactive  1= active
OO-n---- Output 5 (L51 = 4 thru 7)  0= inactive  1= active
OO--n--- Output 4 (L51 = 4 thru 7)  0= inactive  1= active
OO---n-- Output 3 (L51 = 4 thru 7)  0= inactive  1= active
OO----n- Output 2                   0= inactive  1= active
OO-----n Output 1                   0= inactive  1= active
```

Example: !H20CRLF sent. The following data transfer may result:
00000010CRLF

This data transfer indicates that Output 2 is active. All others are inactive.

H21 Transfer Conditional Input Status

Function: Transfers the status of the Indexer inputs.

Default Mode: none

Command Format:
H21CRLF
!H21CRLF

Notes: The data will be transferred as follows:

```
nnnnnnnnCRLF
n------- Input 8 (L51 = 2,3,6 or 7) 0= inactive  1= active
-n------ Input 7 (L51 = 1,3,5 or 7) 0= inactive  1= active
--n----- Input 6 (L51 = 1,3,5 or 7) 0= inactive  1= active
---n---- Input 5 (L51 = 1,3,5 or 7) 0= inactive  1= active
----n--- Input 4 (L45 = 1)          0= inactive  1= active
-----n-- Input 3 (L45 = 1)          0= inactive  1= active
------n- Input 2                    0= inactive  1= active
-------n Input 1                    0= inactive  1= active
```

Example: !H21CRLF sent. The following data transfer may result:
10000010CRLF

This data transfer indicates that Input 8 and Input 2 are active. All others are inactive.

H23 Transfer Software Revision Level

Function: The H23 and !H23 codes request the transfer of the Software Revision Level.

Default Mode: none

Command Format:
H23CRLF
!H23CRLF

Notes: The data will be transferred in the following format:
EPI mm/yy/xCRLF
where:
EPI = Enhanced Indexer
mm = Month
yy = Year
x = Revision Level

H24 Program Trace Mode On

Function: This command causes the Indexer to transmit the contents of each line as it is executed during program execution.

Default Mode: Off

Command Format:
H24CRLF
!H24CRLF

Notes: The data will be transmitted in the following format:
Nnnn Gnn Xsnnnnnnnn FnnnnnnnCRLF

If a value has not been programmed for a program field, spaces will be sent in its place.
Nnnn Xsnnnnnnnn CRLF

An unprogrammed line will not be sent.

H25 Program Trace Mode Off

Function: This command will cancel the Program Trace Mode.

Default Mode: Off

Command Format:
H25CRLF
!H25CRLF

H28 Transfer Switch Input Status

Function: This command transfers the status of the Indexer switch inputs.

Default Mode: none

Command Format: H28CRLF
!H28CRLF

Notes: The data will be transferred as follows:

```
nnnnnnnnCRLF
n------- 0=Serial Position          1=Parallel Position
-n------ Home Limit                 0=inactive   1=active
--n----- Clear                      0=inactive   1=active
---n---- Feed Hold                  0=inactive   1=active
----n--- Cycle Stop                 0=inactive   1=active
-----n-- Cycle Start                0=inactive   1=active
------n- 0=Low Speed Position       1=High Speed Position
-------n Load                       0=inactive   1=active
```

Example: !H28CRLF sent. The following data transfer may result:
11000010CRLF

This data transfer indicates that the Serial/Parallel, Home Limit and Low/High inputs are active. All others are inactive.

H29 Transfer Program Execution Time

Function: This command transfers the program execution time, in milliseconds.

Units: milliseconds

Default Mode: none

Command Format: H29CRLF
!H29CRLF

Notes: A Cycle Start command restarts the timing from zero (except when restarting from a Feed Hold condition). Timing is stopped by a Feed Hold, Clear, Program Line Error, Program Stop or Program Execution Complete.

Individual line execution times can be monitored in the Single Execution mode.

Times for executing entire programs can be monitored in the Automatic Execution mode.

Elapsed time from Program Start can be obtained in any mode using the immediate command (!H29).

Accuracy of the timing is +/-2 milliseconds.

The data will be transferred as follows:
nnnnnnnnnnCRLF

H30 Start Index From Run Cycle

Function:

This code requests the start of an *Index* From Run cycle using the present program line X and F values. If no X field is programmed, the distance and direction will be obtained from the external field data inputs.

Default Mode:

none

Command Format:

H30CRLF

Notes:

The cycle begins with the Indexer starting a Jog cycle. During the Jog portion, Strobe 0 becomes the only active strobe. When the Home Limit/*Index* From Run input is recognized, the *index* value becomes active and the *index* portion of the cycle begins.

The maximum distance travelled during an *Index* From Run cycle may be limited using the *Index* From Run Travel Limit (L16) parameter. This parameter limits the move in case the *Index* marker is missed.

Index From Run is not allowed in the Absolute mode.

The maximum velocity allowed may be limited by the "X" value or by the Ramp Frequency Limit (L71).

The repeatability of the *Index* From Run can be calculated as follows:
Maximum Velocity/250 = Maximum error, in pulses

For example, the repeatability of an *Index* From Run with an "F" value of 1000 is calculated as follows:
1000/250 = 4 pulses

Related L Codes:

L12 (*Low Speed*)

Related H Codes:

H04 *(High Speed* Mode)
H05 (*Low Speed* Mode)

Related Line Data Codes:

X (*Index* Distance)
F (Program *High Speed* Rate)

H31 Target Velocity Increase

Function:

This command requests that the target velocity be increased by the Deviation Frequency (L73) value.

Default Mode:

none

Command Format:

!H31CRLF

Notes:

If the !H31 command is given while the motor is moving, the motor speed will increase by the Deviation Frequency (L73) value.

Related L Codes:

L20 (Up/Down Feed Rate Override)
L73 (Deviation Frequency)

H32 Target Velocity Decrease

Function: The H32 command requests that the target velocity be decreased by the Deviation Frequency (L73) value.

Default Mode: none

Command Format: !H32CRLF

Notes: If the !H32 command is given while the motor is moving, the motor speed will decrease by the Deviation Frequency (L73) value.

Related L Codes: L20 (Up/Down Feed Rate Override)
L73 (Deviation Frequency)

H33 Incremental Position Mode

Function: This command selects the Incremental Position mode. All moves will be made in the plus or minus direction from the **present position.**

Default Mode: Incremental mode (H33)

Command Format: H33CRLF

Notes: **H33 will be ignored if a Feed Hold ($) is active.**

H34 Absolute Position Mode

Function: This command selects the Absolute Position mode. All moves in this mode are referenced from the *electrical home* position.

Default Mode: Incremental mode (H33)

Command Format: H34CRLF

Notes: **The Auto Reverse feature will be disabled when operating in the Absolute positioning mode.**

H34 will be ignored if a Feed Hold ($) is active.

H35 Motor Windings On

Function: The H35 code causes current to be applied to the motor windings at all times.

Default Mode: Windings On (H35)

Command Format: H35CRLF

Notes: **Use the H35 command when holding torque is required at standstill.**

H36 Motor Windings Off

Function: This command causes current to be removed from the motor windings when motion ceases.

Default Mode: Windings On (H35)

Command Format: H36CRLF

Notes: Without winding current, the motor will have no holding torque. Therefore, **the H36 command should only be used when holding torque at standstill is not needed.**

Whenever the Motor Windings Off function is active, an additional time delay is introduced during programmed motion cycles to allow winding current to build in the motor prior to the start of motion and to decay after motion has occurred. This delay is approximately 50 milliseconds prior to motion and 50 milliseconds after motion has stopped. Therefore, the shortest possible time between moves is approximately 100 milliseconds.

When the Indexer is in the Windings Off mode, the Reduce Current feature will be ignored.

H37 Enable Boost Current

This command applies only to 3180 and 6180 Series models.

Function: When the H37 command is issued, motor winding current will be increased during acceleration and deceleration by 50% of the value set by the dip switches on the drive.

Default Mode: Disable Boost Current (H38)

Command Format: H37CRLF

Notes: When accelerating, boost current will be applied for the first 5 seconds, or until the motor has reached the programmed speed.

When decelerating, boost current will be applied for the first 5 seconds, or until the motor has stopped.

An additional time delay is introduced when the Boost Current feature is active to allow time for the motor winding current to build prior to motion and to decay after motion. This delay is approximately 50 milliseconds before the motion and 50 milliseconds after motion has stopped.

The Boost feature should be used when additional torque is needed for starting or stopping.

H38 Disable Boost Current

This command applies only to 3180 and 6180 Series models.

Function: This command cancels Boost current during acceleration and deceleration.

Default Mode: Disable Boost Current (H38)

Command Format: H38CRLF

H39 Enable Reduce Current

This command applies only to 3180 and 6180 Series models.

Function: This command will cause the motor current to be reduced at standstill by 50% of the value which has been selected on the drive. This condition lowers heating of the motor and also reduces holding torque at standstill.

Default Mode: Disable Reduce Current (H40)

Command Format: H39CRLF

Notes: An additional time delay is introduced during programmed motion cycles whenever the Reduce feature is active. This delay allows winding current to build in the motor prior to motion and to decay after motion has stopped. The delay is approximately 50 milliseconds prior to motion and 50 milliseconds after motion has stopped.

Activate the Reduce feature only when maximum holding torque at standstill is not needed.

The Reduce command will be ignored when the Windings Off feature is active.

H40 Disable Reduce Current

This command applies only to 3180 and 6180 Series models.

Function: This command cancels the Reduce Current mode.

Default Mode: Disable Reduce Current (H40)

Command Format: H40CRLF

H41 Transfer Remaining Repeat Value

Function: This command sends the remaining Repeat Count value.

Default Mode: none

Command Format: H41CRLF
!H41CRLF

Notes: If the present Repeat Count is zero and a Cycle Start command is given, the L47 (Repeat Count) value is transferred to the Repeat Count. The count remaining can be interrogated using this command.

The Repeat Count is decremented each time a Program End or line 400 is encountered during program execution.

The Repeat Count is zero when the Indexer is in the Continuous Execution or the Single Execution mode.

The data will be transferred in the following format:
nnnnnnnnCRLF

H60 Transfer Present Velocity

Function: The H60 command requests that the present velocity be transferred.

Default Mode: none

Units: pulses per second

Command Format:
H60CRLF
!H60CRLF

Notes: The data will be transferred in the following format:
nnnnnnnnnCRLF

H85 Transfer Motion Error Status

Function: The H85 command requests the transfer of the Motion Error status of the Indexer.

Default Mode: none

Command Format:
H85CRLF
!H85CRLF

Notes: The data will be transferred in the following format:
OnnnnnnnCRLF

```
On------ Index From Run Limit Exceeded  0=inactive  1=active
0-n----- 0=Index ok    1=Index will be => CCW software limit
0--n---- 0=Index ok    1=Index will be => CW software limit
0---n--- CCW Software Limit              0=inactive  1=active
0----n-- CW Software Limit               0=inactive  1=active
0-----n- CCW Hard Limit                  0=inactive  1=active
0------n CW Hard Limit                   0=inactive  1=active
```

H86 Transfer Data Error Status

Function:

The H86 code is used to request the transfer of the Indexer's Data Error Status.

Default Mode:

none

Command Format:

H86CRLF
!H86CRLF

Notes:

The format of the transferred data will be as follows:

```
nnnnnnnnCRLF
n------- Illegal L Code or Illegal G Code during a
          Jog cycle (G48)          0=inactive  1=active
-n------ L Code data out of range   0=inactive  1=active
--n----- Subroutine or Loop nesting 0=inactive  1=active
---n---- F data out of range        0=inactive  1=active
----n--- X data out of range        0=inactive  1=active
-----n-- N data out of range        0=inactive  1=active
------n- Line requires F data       0=inactive  1=active
-------n Line requires X data       0=inactive  1=active
```

The Status bit assignments are:

Illegal L Code or Illegal G code during a Jog cycle (G48)
- Set whenever an unassigned L Code data change is attempted or an illegal G code was executed during a Jog cycle (G48).
- Reset when an assigned L Code is changed or when program execution begins.

L Code data out of range
- Set when the data field for an L code is outside the legal range.
- Reset when L Code data is in range or when program execution begins.

Subroutine or Loop Nesting
- Set only during program execution if Subroutine or Loop nesting is detected.
- Reset when program execution begins.

F data out of range
- Set when a program line F value, !F value, Strobed F data (G38) or G20 F data is outside the legal range.
- Reset when F data is in range or program execution begins.

X data out of range
- Set during program execution if the X value is outside the legal range (1 to 400) for a G11 or G12 code.
- Reset when program execution begins.

N data out of range
- Set when an addressed line number is out of range (0 to 400) or during program execution if the Strobe N (G37) value is out of range (1 to 400).
- Reset when an addressed line is in range or when program execution begins.

Line requires F data
- Set during program execution if the F field is omitted on the following G Code commands: G11, G20 and G29.
- Reset when program execution begins.

Line requires X data
- Set during program execution if the X field is omitted on the following G Code commands: G10, G11, G12, G20, G22, G25, G47, G48 and G79.
- Reset when program execution begins.

If a data error occurs during program execution, the line it occurred on can be interrogated using the H87 command.

H87 Transfer Program Error Line Number

Function: This command requests the transfer of the program line number with an error detected during program execution.

Default Mode: none

Command Format:
H87CRLF
!H87CRLF

Notes: The data will be transferred in the following format:
NnnnCRLF (if program was terminated on a programming error)
CRLF (if no program error was detected)

H88 Transfer Active Cycle

Function: This command requests the transfer of the present active cycle.

Default Mode: none

Command Format:
H88CRLF
!H88CRLF

Notes: The data will be transferred in the following format:

nnnnnnnnCRLF

```
n------- Program Execution          0= inactive  1= active
-n------ Return To Electrical Home  0= inactive  1= active
--n----- Return To Mechanical Home  0= inactive  1= active
---n---- Index From Run              0= inactive  1= active
----n--- Step CW                     0= inactive  1= active
-----n-- Step CCW                    0= inactive  1= active
------n- Jog CW                      0= inactive  1= active
-------n Jog CCW                     0= inactive  1= active
```

When a Feed Hold has been executed, the pending cycle will still be active.

H99 Transfer Unit Type

Function: This command transfers the Factory established Unit designation.

Default Mode: none

Command Format: H99CRLF

Notes: Up to 32 characters and a CRLF will be sent in response to this command.

% Activate Continuous H Code Transfer Mode

Function:

This command will set the active Indexer into the Continuous Transfer mode for designated H codes. When active the data requested by the designated H Code will be transferred continuously until the mode is canceled. This mode will be canceled by receipt of a code that is not one designated for continuous transfer.

Command Format:

%HnnCRLF
%!HnnCRLF

Notes:

Nondesignated codes:

Lnn
Hnn
Xsnnnnnnnn
Fnnnnnnn
!Fnnnnnnn
<
*
<nn& (Listen Mode)

Designated H Codes:

H13	Transfer Program Line
H15	Transfer Current Line Number
H17	Transfer Absolute Electrical Position
H18	Transfer Motion Status
H19	Transfer Mode Status
H20	Transfer I/O Status
H60	Transfer Present Velocity
H85	Transfer Motion Error Status
H86	Transfer Data Error Status

% is ignored if the Listen mode is active (&).

The L98 (Delay Between Continuous H Codes) sets the delay between continuous H code transfers.

The L26 value should be 4, 5, 6 or 7 if the Xon/Xoff protocol is to be ignored during the transfers.

The restrictions for designated H codes will be honored. For example, !HnnCRLF will be honored during motion while HnnCRLF will not be honored until motion has stopped.

Transfer Format:

(data)CRLF

6.3 G CODES, PREPARATORY COMMANDS

G codes are preparatory commands that are stored and executed within a program. Several G codes are modal commands which retain their state until canceled or superseded by a subsequent command.

Attempting to execute a G code without the required additional data fields will cause program execution to halt and the line number to be loaded with the L41 value.

The following G codes require additional data fields:

G04	Xnnnnnn	(Delay X Value)
G10	Xsnnnnnnnn	(*Index* From Run)
G11	Xnnn Fnnnn	(Call Subroutine Line X And Repeat F Times)
G12	Xnnn	(Go To Line X)
G20	Xnnnnnnnn Fnnn	(Branch On Input Condition X To Line F)
G22	Xnnnnnnnn	(Wait For Input Condition X)
G25	Xnnn	(Loop Start, repeat X times)
G29	Xnnnnnnnn Fnn	(Preload designated parameter)
G47	Xnnnnnn	(Output Condition X)
G48	Xs	(Start Jog Cycle)
G79	Xsnnnnnnnn	(Preload Electrical Absolute Position)

The following G codes are modal commands and require no additional data fields:

G27	(*High Speed* Mode)
G28	(*Low Speed* Mode)
G64	(Enable Reduced Current Mode)
G65	(Disable Reduced Current Mode)
G66	(Enable Boost Current Mode)
G67	(Disable Boost Current Mode)
G68	(Windings Off Mode)
G69	(Windings On Mode)
G90	(Absolute Mode)
G91	(Incremental Mode)

The following G codes do not require additional data fields:

G23	(Increment Jog Cycle Frequency)
G24	(Decrement Jog Cycle Frequency)
G26	(Loop End)
G30	(End Of Program)
G31	(Program Stop)
G32	(Return From Subroutine)
G36	(Strobe X Code Data)
G37	(Strobe N Code Data)
G38	(Strobe F Code Data)
G49	(Stop Jog Cycle)
G76	(Return To *Electrical Home*)
G77	(Set *Electrical Home*)
G78	(Return To *Mechanical Home*)

G04 Dwell Time

Function: This command allows a delay to be entered into the program.

Units: milliseconds (X field)

Range: 0 to 99,999

Default Mode: none

Command Format: G04 XnnnnnCRLF

Notes: If the value entered is greater than 99,999, it will default to the 99,999 limit.

If no X value is entered, this command will be ignored.

The F field, if programmed, will become the new *High Speed* rate.

The G04 XnnnnnnCRLF command will be entered on the present program line.

The G04 command can be used during a Program Jog Cycle (a cycle started by a G48 command).

Examples: N001 G04 X1000CRLF calls for a delay of 1 second.

N001 G04 X1000 F2000CRLF calls for a delay of 1 second and changes the *High Speed* rate to 2000 pulses per second.

G10 Start Index From Run

Function: This command requests the start of an *Index* From Run cycle.

Units: pulses

Range: -99,999,999 to +99,999,999 (X field)

Default Mode: none

Command Format: G10 Xsnnnnnnnn CRLF

Notes:

The distance and direction of an *Index* From Run is defined by the X field or the external field data inputs. If no X field is programmed, the distance and direction will be obtained from the external field data inputs.

The maximum distance travelled during an *Index* From Run cycle may be limited using the *Index* From Run Travel Limit (L16) parameter. This parameter limits the move in case the *Index* marker is missed.

If an F field is programmed, that value will become the *High Speed* rate for the cycle. Otherwise, the previously programmed rate becomes the *High Speed* rate.

The cycle begins with the Indexer starting a Jog cycle. During the Jog portion, Strobe 0 becomes the only active strobe. When the Home Limit/*Index* From Run input is recognized, the *index* value becomes active and the *index* portion of the cycle begins. If an *Index* From Run cycle is halted by a Feed Hold, it can be resumed by issuing a Cycle Start command.

The maximum velocity may be limited by the X value or by the Ramp Frequency Limit (L71).

The repeatability of the *Index* From Run can be calculated as follows:
Maximum Velocity/250 = Maximum Error, in pulses

For Example, The repeatability of an *Index* From Run cycle
(Nnnn G10 Xsnnnnnnnn F1000) command is:
1000/250 = 4 pulses

Related L Codes: L12 (*Low Speed*)

Related RS232 Commands: H04 *(High Speed* Mode)
H05 (*Low Speed* Mode)

G11 Call A Subroutine

Function: This command calls a subroutine line (X) and repeats this subroutine call (F) times.

Units: line number (X field); repeat count (F field)

Range: 1 through 400 for X field; 0 through 9,999 for F field

Default Mode: none

Command Format: G11 Xnnn FnnnnCRLF

Notes: The X field is the subroutine line number. If this field is missing or out of range, program execution will stop and the line number will be loaded with the L41 value.

The F field is the subroutine repeat count. The number of times the subroutine will be repeated is the F field value plus one. If this field is missing, program execution will stop and the line number will be loaded with the L41 value.

Subroutine nesting (calling a subroutine within a subroutine) is not allowed. If subroutine nesting is attempted, program execution will stop and the line number will be loaded with the L41 value.

When a Return From Subroutine (G32) command is encountered during a subroutine, the Indexer returns to the line calling the subroutine and begins the subroutine again. This cycle is repeated F + 1 times. The Indexer will then go on to the next program line.

Related G Codes: G32 (Return From Subroutine)

Example: The following program executes ten moves of 200 pulses each, and then stops. The L06 value is 2. The execution command is "N1H1CRLF".

```
N001 G11 X10 F9      (call line 10 and repeat 9 times)
N002 G30             (end of program)
N10 G91 X200 F500    (index 200 pulses at 500 pulses per second)
N11 G32              (return from subroutine)
```

G12 Go To Line Number

Function: This command tells the Indexer to go to the line specified by the X field.

Units: line number (X field)

Range: 1 through 400 (X field)

Default Mode: none

Command Format: G12 XnnnCRLF

Notes: The X field is the line number. If this field is missing or is out of range, program execution will stop and the line number will be loaded with the L41 value.

The G12 command causes the X value to be loaded as the line number.

Example: The execution of N010 G12 X2 sets the line number to 2.

G20 Conditional Branch

Function:

This command tells the Indexer to go to line Fnnn if the input condition specified by the X field occurs. If the specified condition does not occur, the Indexer goes on to the next line.

Units:

line number (F field)

Range:

1 through 400 (F field)

Default Mode:

none

Command Format:

G20 Xnnnnnnnn FnnnCRLF

Notes:

The X field specifies the input condition for the branch. If this field is missing, program execution will stop and the line number will be loaded with the L41 value.

The X field input assignments are as follows:

```
Xnnnnnnnn
n------- Input 8          if L51= 2,3,6,7
-n------ Input 7          if L51= 1,3,5,7
--n----- Input 6          if L51= 1,3,5,7
---n---- Input 5          if L51= 1,3,5,7
----n--- Input 4          if L45= 1
-----n-- Input 3          if L45= 1
------n- Input 2
-------n Input 1
```

If the L51 or L45 value is not met, that bit will be ignored.

The programmable input condition for each bit is a value from 0 to 9. A value of 0 requires the input to be inactive. A value of 1 requires the input to be active. A value from 2 to 9 indicates a "don't care" condition.

The F field represents the line number the Indexer will branch to. If this value is missing or out of range, program execution will stop and the line number will be loaded with the L41 value.

Examples:

Example 1

L51= 1, L45= 0, and the following line is executed:

N10 G20 X11201101 F20

```
1------- ignored (only used if L51= 2,3,6,7)
-1------ Input 7 active
--2----- Input 6 don't care
---0---- Input 5 inactive
----1--- ignored (only used if L45= 1)
-----1-- ignored (only used if L45= 1)
------0- Input 2 inactive
-------1 Input 1 active
```

If the above condition is met, go to line 20. Otherwise, go to line 11.

Example 2
L51= 2, L45= 0 and the following line is executed:

```
N10 G20 X11201101 F20

1------- Input 8 inactive
-1------ ignored (only used if L51= 1,3,5,7)
--2----- ignored (only used if L51= 1,3,5,7)
---0---- ignored (only used if L51= 1,3,5,7)
----1--- ignored (only used if L45= 1)
-----1-- ignored (only used if L45= 1)
------0- Input 2 inactive
-------1 Input 1 active
```

If the above condition is met, go to line 20. Otherwise, go to line 11.

Example 3
L51= 3, L45= 1 and the following line is executed:

```
N10 G20 X11001101 F20

1------- Input 8 active
-1------ Input 7 active
--0----- Input 6 inactive
---0---- Input 5 inactive
----1--- Input 4 active
-----1-- Input 3 active
------0- Input 2 inactive
-------1 Input 1 active
```

If the above condition is met, go to line 20. Otherwise, go to line 11.

G22 Wait For Input

Function:

This command causes the program to wait until the states of the inputs match the X field values.

Units:

none

Range:

0 to 99999999 (X field)

Default Mode:

none

Command Format:

G22 XnnnnnnnnCRLF

Notes:

The X field specifies the input conditions for the "wait". If this field is missing, program execution will stop and the line number will be loaded with the L41 value.

The X field input assignments are as follows:

```
Xnnnnnnnn
n------- Input 8          if L51= 2,3,6,7
-n------ Input 7          if L51= 1,3,5,7
--n----- Input 6          if L51= 1,3,5,7
---n---- Input 5          if L51= 1,3,5,7,
----n--- Input 4          if L45= 1
-----n-- Input 3          if L45= 1
------n- Input 2
-------n Input 1
```

If the L51 or L45 value is not met, that bit will be ignored.

The programmable input condition for each bit is a value from 0 to 9. A value of 0 requires the input to be inactive and a value of 1 requires the input to be active. Values from 2 to 9 indicate a "don't care" condition.

The F field value, if programmed, will become the new *High Speed* rate.

Examples:

Example 1

L51= 1, L45= 0 and the following line is executed.

```
N10 G22 X11201101

1------- ignored (only used if L51= 2,3,5,7)
-1------ Input 7 active
--2----- Input 6 don't care
---0---- Input 5 inactive
----1--- ignored (only used if L45= 1)
-----1-- ignored (only used if L45= 1)
------0- Input 2 inactive
-------1 Input 1 active
```

When the above condition is met, the line number is advanced to 11.

Example 2
L51= 2, L45= 0 and the following line is executed:

```
N10 G22 X11201101

1------- Input 8 active
-1------ ignored (only used if L51= 1,3,5,7)
--2----- ignored (only used if L51= 1,3,5,7)
---0---- ignored (only used if L51= 1,3,5,7)
----1--- ignored (only used if L45= 1
-----1-- ignored (only used if L45= 1)
------0- Input 2 inactive
-------1 Input 1 active
```

When the above condition is met the line number is advanced to 11.

Example 3
L51= 3, L45= 1 and the following line is executed:

```
N10 G22 X11001101

1------- Input 8 active
-1------ Input 7 active
--0----- Input 6 inactive
---0---- Input 5 inactive
----1--- Input 4 active
-----1-- Input 3 active
------0- Input 2 inactive
-------1 Input 1 active
```

When the above condition is met, the line number is advanced to 11.

G23 Increment Jog Cycle Frequency

Function: This command causes the velocity to be incremented by the L73 value.

Units: none

Range: none

Default Mode: none

Command Format: G23CRLF

Notes: This command is only active if a programmed Jog (G48) cycle is taking place. The program will pause until the commanded velocity is attained.

The maximum velocity which can be achieved is limited by the Ramp Frequency Limit parameter (L71).

The X and F fields should not be programmed.

The G23 command will be ignored if a programmed Jog cycle is not taking place.

Example: Ramp from *Low Speed* to 500 pulses per second. Delay one second and increment the velocity by 100 pulses per second. Repeat this sequence nine times. The velocity is now 1500 pulses per second.

Delay one second and decrement the velocity by 100 pulses per second. Repeat this sequence nine times. The velocity is now 500 pulses per second. Delay one second and then stop.

L73= 100, L41= 1, L06= 2 and the following program is executed.

N1 G48 X+ F500	start Jog cycle *High Speed* 500 pps
N2 G11 X10 F9	go to subroutine line 10 and repeat 9 times
N3 G11 X13 F9	go to subroutine line 13 and repeat 9 times
N4 G04 X1000	delay 1 second
N5 G49	stop Jog cycle
N6 G30	end of program
N10 G04 X1000	delay 1 second
N11 G23	increment velocity by 100
N12 G32	return from subroutine
N13 G04 X1000	delay 1 second
N14 G24	decrement velocity by 100
N15 G32	return from subroutine

G24 Decrement Jog Cycle Frequency

Function: This command causes the velocity to be decremented by the L73 value.

Units: none

Range: none

Default Mode: none

Command Format: G24CRLF

Notes: This command is only active if a programmed Jog (G48) cycle is taking place. The program will pause until the commanded velocity is attained.

The X and F fields should not be programmed.

The G24 command will be ignored if a programmed Jog cycle is not taking place.

Example: Ramp from *Low Speed* to 500 pulses per second. Delay one second and increment the velocity by 100 pulses per second. Repeat this sequence nine times. The velocity is now 1500 pulses per second.

Delay one second and decrement the velocity by 100 pulses per second. Repeat this sequence nine times. The velocity is now 500 pulses per second. Delay one second and then stop.

L73= 100, L41= 1, L06= 2 and the following program is executed.

N1 G48 X+ F500	start Jog cycle *High Speed* 500 pps
N2 G11 X10 F9	go to subroutine line 10 and repeat 9 times
N3 G11 X13 F9	go to subroutine line 13 and repeat 9 times
N4 G04 X1000	delay 1 second
N5 G49	stop Jog cycle
N6 G30	end of program
N10 G04 X1000	delay 1 second
N11 G23	increment velocity by 100
N12 G32	return from subroutine
N13 G04 X1000	delay 1 second
N14 G24	decrement velocity by 100
N15 G32	return from subroutine

G25 Loop Start

Function: Defines the start of a Loop and repeats this loop X times.

Units: repeat count (X field)

Range: 0 to 9999 (X field)

Command Format: G25 XnnnnCRLF

Notes: The Execution Loop are lines executed from the loop start (G25) to the loop end (G26) command. When the loop is completed the line following the loop end (G26) will be executed.

The X field is the loop repeat count. The number of loop executions is the X value + 1. If this field is missing program execution will halt and the line number is loaded with the L41 value.

Loop nesting, calling another loop in a loop, is not allowed. If loop nesting occurs the program execution will halt and the line number is loaded with the L41 value.

A Loop can exist inside a Subroutine.

Related G codes: G26 (loop end)

Example: The following program executes 10 moves of 1000 pulses each and stops. The L06 value is 2. The execution command is "N1H1CRLF".

```
N1 G25 X9          (Loop start; repeat 9 times)
N2 G91 X1000       (index 1000 pulses)
N3 G26             (Loop end)
N4 G30             (End of Program)
```

G26 Loop End

Function: Defines the Loop End.

Units: none

Range: none

Command Format: G26CRLF

Notes: When encountered during a Loop (G25) restores the loop start line number.

Continues on with the next line when the Loop Start repeat count becomes 0.

Related G codes: G25 (loop start)

G27 High Speed Mode

Function: Sets the *High Speed* Mode of Operation.

Units: none

Range: none

Command Format: G27CRLF

Notes: The X field value, if programmed, will become the *index* distance and direction.

The F field value, if programmed, will become the new *High Speed* value.

Related H Codes: H4 (*High Speed* Mode)
H5 (*Low Speed* Mode)

Related G Codes: G28 (*Low Speed* Mode)

Example: Select the *High Speed* Mode of Operation during Program Execution.
N001 G27CRLF

G28 Low Speed Mode

Function: Sets the *Low Speed* Mode of Operation.

Units: none

Range: none

Command Format: G28CRLF

Notes: The X field value, if programmed, will become the *index* distance and direction.

The F field value, if programmed, will become the new *High Speed* value.

Related H codes: H4 (*High Speed* Mode)
H5 (*Low Speed* Mode)

Related G Codes: G27 (*High Speed* Mode)

Example: Select the *Low Speed* Mode of Operation during Program Execution.
N002 G28CRLF

G29 Preload Designated Parameter

Function: Preloads the designated Parameter (F field) with the X field data.

Units: Parameter (F field); Data (X field)

Range: designated L Codes listed below (F field)

L Code	parameter range (X field)
L07	Strobe delay (0 to 9999)
L08	*Mechanical Home* Direction (+ or -)
L09	Jog Speed (L70 dependent)
L11	Acc/Dcc (1 to 99999999)
L12	*Low Speed* (L70 dependent)
L13	Step Size (1 to 99999999)
L14	Home Speed (L70 dependent)
L16	*Index* From Run Limit (0 to 99999999)
L17	*Mechanical Home* Offset (-99999999 to +99999999)
L18	CW Software Travel Limit (-99999999 to +99999999)
L19	CCW Software Travel Limit (-99999999 to +99999999)
L20	Up/Down Feedrate Override (0 or 1)
L41	Auto Start Line Number (1 to 400)
L43	Delay between *Index* and *Backlash* cycle (0 to 9999)
L44	Program Line Delay (0 to 9999)
L45	Limit Enable/ Disable (0 or 1)
L47	Repeat Count (0 to 99999999)
L51	Input/Output Mode Select (0 to 7)
L52	Buffer Overflow Tx character (0 to 127)
L55	Line Done Tx character (0 to 127)
L56	Program Done Tx character (0 to 127)
L57	Strobe 0 & 1 delay (4 to 98)
L66	*Backlash* Compensation (-99999999 to +99999999)
L67	Auto Reverse (0 or 1)
L71	Ramp Frequency Limit (L70 dependent)
L72	Ramp Profile Select (0 to 2)
L73	Deviation Frequency for Up/Down command (L70 dependent)

Command Format: G29 Xsnnnnnnnn Fnn CRLF

Notes: If the F field is not one of the above parameters the cycle will be terminated and the line number will become the L41 value.

If the X field data is outside the designated parameter range the cycle will be terminated and the line number will become the L41 value.

If the X field is omitted the external field data will be strobed in.

Example: Change the ramp profile during program execution to the following:
L12= 300; L11= 15000; L71= 15000; L72= 2.

```
N001 G29 X300 F12      (L12 300)
N002 G29 X15000 F11    (L11 15000)
N003 G29 X15000 F71    (L71 15000)
N004 G29 X2 F72        (L72 2)
```

G30 End Of Program

Function: This command denotes the end of the program and resets the line pointer to the line designated by the L41 parameter.

Units: none

Range: none

Default Mode: none

Command Format: G30CRLF

Notes: In the Automatic Execution mode, the number of times the program will repeat is the L47 parameter plus one. The line pointer will be reset to the line designated by the L41 parameter each time the G30 command is encountered.

In the Continuous Execution mode, the program will execute continuously until a Program Stop command or a Clear command is encountered. The line pointer will be reset to the line designated by the L41 parameter each time the G30 command is encountered.

The X and F fields are ignored.

If no G30 command is incorporated, program line 400 becomes the End Of Program.

G31 Program Stop

Function: This command causes the program to stop executing and the line pointer to reset to the next program line.

Units: none

Range: none

Default Mode: none

Command Format: G31CRLF

Notes: Program execution can be resumed after a Program Stop command by issuing a Cycle Start command.

The X and F fields are ignored.

G32 Return From Subroutine

Function: This command, used in conjunction with a G11, indicates the end of a subroutine.

Units: none

Range: none

Default Mode: none

Command Format: G32CRLF

Notes: If this command is encountered with no subroutine call pending, program execution will stop and the line number will be loaded with the L41 value.

When this command is encountered during a subroutine call, the line pointer will be restored to the G11 line number.

The X and F fields are ignored.

Related G Codes: G11 (Call a Subroutine)

G36 Strobe X Code Data

Function: During program execution, the G36 command will cause the Indexer to load the parallel data inputs. The field data entry becomes the X field for the program line.

Units: none

Range: none

Default Mode: none

Command Format: G36CRLF

Notes: If an X field is programmed for the line containing a G36 command, it will be ignored.

The F field, if programmed, will become the new *High Speed* rate.

If L51= 4,5,6 or 7, this command will be ignored.

Example: Nnnn G36 F1000CRLF will load the parallel data distance and direction and will execute that motion using a *High Speed* rate of 1000 pulses per second.

G37 Strobe N Code Data

Function: During program execution, the G37 command will cause the Indexer to load the parallel data inputs. The Code data entry becomes the active program line number.

Units: none

Range: 1 through 400 (External Code Data)

Default Mode: none

Command Format: G37CRLF

Notes: The Code data entry becomes the line number. If this value is out of the permissible range of 1 through 400, program execution will stop and the line number will be loaded with the L41 parameter.

The X and F fields are ignored.

G38 Strobe F Code Data

Function: During program execution, the G38 command will cause the Indexer to load the parallel data inputs. The fields data entry becomes the F field for the program line.

Units: none

Range: External Field Data
1 thru 115,000 pulses per second for L70 = 1
1 thru 115,000 pulses per second for L70 = 2
1 thru 115,000 pulses per second for L70 = 5
1 thru 115,000 pulses per second for L70 = 10
1 thru 1,875,000 pulses per second for L70 = 125

Default Mode: none

Command Format: G38CRLF

Notes: When this command is issued, the parallel data input becomes the new program feed rate. If this data is out of the permissible range, program execution will stop and the line number will be loaded with the L41 value.

The X field value, if programmed, will become the *index* distance and direction.

If the G38 command is encountered during a program Jog cycle, the parallel data input value becomes the new target velocity.

If programmed, the F field for the line will be ignored.

If L51= 4,5,6 or 7, this command will be ignored.

Examples: Nnnn G38 X-1000 will execute an *index* of -1000 at the *High Speed* rate selected by the parallel data input value.

G47 Set Output Condition

Function:

During program execution, the G47 command sets the programmable output states to the value of the X field.

Units:

none

Range:

0 to 999,999 (X field)

Default Mode:

none

Command Format:

G47 XnnnnnnCRLF

Notes:

The programmable output condition for each bit is a value from 0 through 9. A value of 0 sets the output to the inactive state and a value of 1 sets the output to the active state. Values from 2 through 9 indicate no change to the output state.

The X field is the output condition. If this field is missing, program execution will stop and the line number will be loaded with the L41 value.

The X field output assignments are as follows:

```
Xnnnnnn
n----- Output 6      (L51= 4,5,6,7)
-n---- Output 5      (L51= 4,5,6,7)
--n--- Output 4      (L51= 4,5,6,7)
---n-- Output 3      (L51= 4,5,6,7)
----n- Output 2
-----n Output 1
```

If the L51 value condition is not met, that bit will be ignored.

The F field value, if programmed, will become the *High Speed* rate value.

Examples:

Example 1

L51= 0 and the following line is executed.

```
Nnnn G47 X111101
1----- ignored  (used only if L51= 4,5,6,7)
-1---- ignored  (used only if L51= 4,5,6,7)
--1--- ignored  (used only if L51= 4,5,6,7)
---1-- ignored  (used only if L51= 4,5,6,7)
----0- Output 2 inactive
-----1 Output 1 active
```

Example 2

L51 = 4 and the following line is executed.

```
Nnnn G47 X101020
1----- Output 6 active
-0---- Output 5 inactive
--1--- Output 4 active
---0-- Output 3 inactive
----2- Output 2 no change
-----0 Output 1 inactive
```

G48 Start Jog Cycle

Function:

During program execution, a G48 command starts a Jog cycle in the X direction. The feed rate will be the Jog Speed parameter unless an F field is part of the program line.

Units:

none

Range:

none

Default Mode:

none

Command Format:

G48 Xs CRLF

Notes:

In the Single Line execution mode, a G48 command will start a Continuous Line Execution condition until a Stop Jog Cycle (G49) command is encountered.

The following line commands will be honored once a Jog cycle is started.

Nnnn Fnnnnnn	(ramp to velocity F)
Nnnn G04 Xnnnnnn	(delay X milliseconds)
Nnnn G04 Xnnnnnn Fnnnnnnn	(delay X milliseconds, then ramp to velocity F)
Nnnn G11 Xnnn Fnnnn	(call subroutine line X and repeat F times)
Nnnn G12 Xnnn	(go to line X)
Nnnn G20 Xnnnnnnnn Fnnn	(branch on input condition X to line F)
Nnnn G22 Xnnnnnnnn	(wait for input condition X)
Nnnn G22 Xnnnnnnnn Fnnnnnn	(wait for input condition X, then ramp to velocity F)
Nnnn G23	(increment present velocity by L73 value)
Nnnn G24	(decrement present velocity by L73 value)
Nnnn G25 Xnnnn	(Loop Start; Repeat X times)
Nnnn G26	(Loop End)
Nnnn G27	(*High Speed* Mode)
Nnnn G28	(*Low Speed* Mode)
Nnnn G32	(return from subroutine)
Nnnn G37	(strobe N value and go to this line)
Nnnn G38	(ramp to the strobed F value)
Nnnn G47 Xnnnnnn	(output condition X)
Nnnn G47 Xnnnnnn Fnnnnnnn	(output condition X, then ramp to velocity F)
Nnnn G49	(stop Jog cycle)

The X field sign designates the Jog cycle direction. If this field is missing, program execution will stop and the line number will be loaded with the L41 value.

The F field value, if programmed, will become the feed rate override value. Therefore, the target velocity will become the F field value.

The program cycle will be terminated by any of the following:

execution of a G code other than those listed above
a Clear (*) request
a Feed Hold ($) request
execution of line 400
index motion called for before G49 encountered

Related G Codes:

G49 (Stop Jog Cycle)

Example:

Start a Jog Cycle. If the CCW LIMIT input is active strobe the external field data and make it the *High Speed* target value. Set Output 2 inactive and Output 1 active. Delay 100 milliseconds and then increment the velocity 200 pulses/sec. Repeat this 9 times. Delay 100 milliseconds and then decrement the velocity 200 pulses/sec. Repeat this 9 times. Set Output 2 active and Output 1 inactive. Stop the Jog Cycle. Wait for CW LIMIT input to be inactive. If INPUT 2 is active end the program. If INPUT 1 is active delay 1 second. Set Output 2 inactive and Output 1 inactive. Repeat program starting at line 1.

L06= 2, L41= 1, L45= 1, L47= 0, L51= 0, L73= 200

```
N001 G48 X- F300          (start CCW Jog, ramp to 300 pps)
N002 G20 X0222 F4         (if CCW Limit inactive, go to line 4)
N003 G38                  (ramp to Strobe F velocity)
N004 G47 X01              (Output 2 inactive, Output 1 active)
N005 G11 X17 F9           (go to subroutine line 17 and repeat 9 times)
N006 G11 X20 F9           (go to subroutine line 20 and repeat 9 times)
N007 G47 X10              (Output 2 active, Output 1 inactive)
N008 G49                  (stop Jog cycle)
N009 G22 X2022            (If CCW Limit active, wait for inactive condition)
N010 G20 X2212 F23        (if Input 2 active, end program)
N011 G20 X2220 F13        (if Input 1 active, delay 1 second)
N012 G04 X1000            (delay 1 second)
N013 G47 X00              (Output 2 inactive, Output 1 inactive)
N014 G12 X1               (go to line 1)
N017 G04 X100             (delay 100 milliseconds)
N018 G23                  (increment velocity by 200 pps)
N019 G32                  (return from subroutine)
N020 G04 X100             (delay 100 milliseconds)
N021 G24                  (decrement velocity by 200 pps)
N022 G32                  (return from subroutine)
N023 G30                  (end of program)
```

G49 Stop Jog Cycle

Function: This command will cause a Jog cycle to come to a controlled stop.

Units: none

Range: none

Default Mode: none

Command Format: G49CRLF

Notes: When this command is issued, a programmed Jog cycle will come to a controlled stop and program execution will pause until motion has stopped.

The G49 command will be ignored if a programmed Jog cycle is not in process.

The X and F fields will be ignored.

Related G Codes: G48 (Start Jog Cycle)

G64 Enable Reduce Current

This command applies only to 3180 and 6180 Series models.

Function: This command causes the motor current to be reduced at standstill to 50% of the value selected on the drive. Reducing the motor current lowers motor heating and also reduces holding torque at standstill.

Units: none

Range: none

Default Mode: disable Reduce Current

Command Format: G64CRLF

Notes: When the Reduce Current feature is active, an additional time delay is introduced during programmed motion cycles. This delay allows winding current to build in the motor prior to motion and to decay after motion has stopped. The delay is approximately 50 milliseconds prior to motion and 50 milliseconds after motion has stopped. Therefore, the shortest possible time between moves is approximately 100 milliseconds.

The Reduce Current feature should only be used when maximum holding torque at standstill is not needed.

The X field, if programmed, will define the *index* distance and direction.

The F field, if programmed, becomes the *High Speed* velocity

The Reduce Current command will be ignored when the Windings Off feature is active.

Related G Codes: G65 (disable Reduce Current)

G65 Disable Reduce Current

This command applies only to 3180 and 6180 Series models.

Function: This command cancels the Reduce Current mode.

Units: none

Range: none

Default Mode: Disable Reduce Current

Command Format: G65CRLF

Notes: Canceling a Reduce Current condition with the G65 command will provide maximum holding torque at standstill and will also permit slightly shorter cycle times.

The X field, if programmed, defines the *index* distance and direction.

The F field, if programmed, becomes the *High Speed* velocity.

Related G Codes: G65 (disable Reduce Current)

G66 Enable Boost Current

This command applies only to 3180 and 6180 Series models.

Function: The G66 command will cause the motor current to be increased during acceleration and deceleration by 50% of the value set on the drive.

Units: none

Range: none

Default Mode: Disable Boost Current

Command Format: G66CRLF

Notes: When accelerating Boost Current will be applied for the first 5 seconds, or until the motor has reached the programmed speed.

When decelerating, Boost Current will be applied for the first 5 seconds, or until the motor has stopped.

When the Boost Current feature is active, an additional time delay is introduced to allow time for motor winding current to build prior to motion and to decay after motion has stopped. This delay is approximately 50 milliseconds prior to motion and 50 milliseconds after motion has stopped.

The X field, if programmed, defines the *index* distance and direction.

The F field, if programmed, becomes the *High Speed* velocity.

The Boost Current feature should be used when additional torque is needed for starting or stopping.

Related G Codes: G67 (Disable Boost Current)

G67 Disable Boost Current

This command applies only to 3180 and 6180 Series models.

Function: The G67 command cancels the Boost Current mode.

Units: none

Range: none

Default Mode: Disable Boost Current

Command Format: G67CRLF

Notes: Cancelling the Boost Current feature allows slightly shorter cycle times.

The X field, if programmed, defines the *index* distance and direction.

The F field, if programmed, becomes the *High Speed* velocity.

Related G Codes: G66 (Enable Reduce Current)

G68 Motor Windings Off

Function: The G68 command selects an average motor winding current level of zero at standstill.

Units: none

Range: none

Default Mode: Windings On

Command Format: G68CRLF

Notes: **The G68 command should only be used when no holding torque is required at standstill.**

When the Motor Windings Off function is active, an additional time delay is introduced during programmed motion cycles to allow winding current to build in the motor prior to motion and to decay after motion has stopped. This delay is approximately 50 milliseconds prior to motion and 50 milliseconds after motion has stopped. Therefore, the shortest possible time between moves is approximately 100 milliseconds.

The X field, if programmed, defines the *index* distance and direction.

The F field, if programmed, becomes the *High Speed* velocity.

Related G Codes: G69 (Motor Windings On)

G69 Motor Windings On

Function: The G69 command cancels the Motor Windings Off condition, causing current to be applied to the motor windings.

Units: none

Range: none

Default Mode: Windings On

Command Format: G69CRLF

Notes: When the Windings Off mode is inactive, motor winding current is applied at all times, providing holding torque at standstill and allowing slightly shorter cycle times.

The X field, if programmed, defines the *index* distance and direction.

The F field, if programmed, becomes the *High Speed* velocity.

Related G Codes: G68 (Motor Windings Off)

G76 Return To Electrical Home

Function: This command will cause the Indexer to return to the location which has been designated as *Electrical Home* by performing an *index* move. This is an Absolute position of zero.

Units: none

Range: none

Default Mode: none

Command Format: G76CRLF

Notes: The direction for a Return To *Electrical Home* move is the reverse of the direction of the present Absolute position and the distance will be the present Absolute position value.

The X field, if programmed, defines an *index* distance and direction.

The F field, if programmed, becomes the *High Speed* velocity.

Related RS232 Commands: H04 (*High Speed* Mode)
H05 (*Low Speed* Mode)
H08 (Return to *Electrical Home*)
H09 (Set *Electrical Home*)

G77 Set Electrical Home

Function: This command causes the Indexer to establish the present mechanical position as *Electrical Home*.

Units: none

Range: none

Default Mode: none

Command Format: G77CRLF

Notes: The X field, if programmed, defines an *index* direction and distance.

The F field, if programmed, becomes the *High Speed* velocity.

Related RS232 Commands: H09 (Set *Electrical Home*)

G78 Return To Mechanical Home

Function:

This command tells the Indexer to perform a Return To *Mechanical Home* cycle.

Units:

none

Range:

none

Default Mode:

none

Command Format

G78CRLF

Notes:

The Indexer begins a Return To *Mechanical Home* cycle by jogging at the rate programmed for the Home Speed parameter (L14). The direction of the motion is determined by the *Mechanical Home* Direction parameter (L08).

The Indexer will Jog until the Home Limit switch is activated, and will then ramp to a halt. The point at which the Home Limit switch was activated will be registered as the temporary Home position.

When motion ceases, the Indexer will *index* to the temporary Home position and will Jog at Low Speed (L12 value) until the Home Limit switch input becomes active and then inactive.

The Indexer then reverses direction and Jogs at Low Speed (L12 value) until the Home Limit switch becomes active again. This position is then established as the Absolute *Electrical Home* Position.

If a value other than 0 is programmed for the *Mechanical Home* Offset (L17) parameter, the Indexer will now *index* this direction and distance. This position is then established as the Absolute *Electrical Home* Position.

The X field, if programmed, defines an *index* distance and direction.

The F field, if programmed, becomes the *High Speed* velocity.

Related RS232 Commands:

H04 (*High Speed* Mode)
H05 (*Low Speed* Mode)
H09 (Set *Electrical Home*)
H10 (Return to *Mechanical Home*)

G79 Preload Absolute Position

Function: Preloads the Electrical Absolute Position to the X value.

Units: none

Range: none

Default Mode: none

Command Format: G79 Xsnnnnnnnn CRLF

Notes: If no X value is programmed, the Absolute value will be derived from the external field data inputs.

G90 Absolute Position Mode

Function: This command selects the Absolute Position mode.

Units: none

Range: none

Default Mode: Incremental mode

Command Format: G90CRLF

Notes: When the Indexer is in the Absolute Position mode, any programmed move will be treated as an absolute distance from *electrical home*.

The X field, if programmed, defines an *index* distance and direction.

The F field, if programmed, becomes the *High Speed* velocity.

The Auto Reverse feature will be disabled when operating in the Absolute Position mode.

G91 Incremental Position Mode

Function: This command selects the Incremental Position mode.

Units: none

Range: none

Default Mode: Incremental mode

Command Format: G91CRLF

Notes: When operating in the *Incremental Positioning* mode, each programmed move will be treated as an incremental distance from the present mechanical position.

The X field, if programmed, defines an *index* distance and direction.

The F field, if programmed, becomes the *High Speed* velocity.

6.4 LINE DATA CODES

The data on a program line consists of a line number, a G code, a move distance or G code data (see Section 6.3), and a feed rate value or G code data.

The line data format is as follows:
Nnnn Gnn Xsnnnnnnnn FnnnnnnnCRLF

The fields can be loaded in any order or one at a time.

Once a line number has been addressed, it will remain addressed until one of the following occurs:
1) A different line is addressed (Nnnn).
2) Program execution is started (H1).
3) A Clear command is issued (*).
4) A Transfer Program Lines command is issued (H14).
5) A Clear Program Lines command is issued (H12).

When a program is started, the line which has been addressed will be the first line to be executed.

N Line Number

Function: This command will set the line pointer to the line specified by the "nnn" entry.

Units: none

Range: 0 through 400

Default: L41 value (at power up)

Command Format: NnnnCRLF

Notes: All program lines (0 to 400) are stored in nonvolatile, battery-backed RAM.

If the Line Number is 0, the Manual Data Interface mode will be selected. If this line is executed, the line pointer will remain at 0 upon completion of the line. If execution of the line is terminated by a Clear command or by detection of a line error, the line pointer will be set to the L41 value.

The commands allowed on this line 0 are:

Motion

N000 Xsnnnnnnnn Fnnnnnnn	(Index)
N000 G10 Xsnnnnnnnn Fnnnnnnn	(*Index* From Run)
N000 G36 Fnnnnnnn	(Strobe X Data)
N000 G38 Xsnnnnnnn	(Strobe F And Index)
N000 G76	(Return To *Electrical Home*)
N000 G78	(Return To *Mechanical Home*)

Auxiliary Functions

N000 G04 Xnnnnnn	(Delay X Value)
N000 G29 Xsnnnnnnnn Fnn	(Preload Designated Parameter)
N000 G47 Xnnnnnn	(Output Condition X)
N000 G77	(Set *Electrical Home*)
N000 G79 Xsnnnnnnnn	(Preload Absolute Position)

Line Number continued

Mode Selection

N000 G27	(*High Speed* Mode)
N000 G28	(*Low Speed* Mode)
N000 G64	(Enable Reduced Current Mode)
N000 G65	(Cancel Reduced Current Mode)
N000 G66	(Enable Boost Current Mode)
N000 G67	(Cancel Boost Current Mode)
N000 G68	(Windings Off Mode)
N000 G69	(Windings On Mode)
N000 G90	(Absolute Mode)
N000 G91	(Incremental Mode)

Example:

Executing line 0 from a host computer.
The following is sent as one line (37 characters).

N0 G91 H1 X+1000 F2000 H1 X-1000 H1CRLF

Description:

N0 G91 H1	(set Incremental mode)
X+1000 F2000 H1	(execute a 1000 pulse move CW at 2000 pps)
X-1000 H1	(execute a 100 pulse move CCW at 2000 pps)

X Program Move And Direction

Function: This command defines the direction and distance of a move, or is the data field for a G codes.

Units: pulses or G code data

Range: -99,999,999 to +99,999,999 pulses

Default: none

Command Format: XsnnnnnnnnCRLF

Notes: G Codes which require an X data field are listed below:

G04 Xnnnnnn	(delay X milliseconds)
G11 Xnnn Fnnnn	(subroutine call to line X, repeat F times)
G12 Xnnn	(go to line X)
G20 Xnnnnnnnn Fnnn	(branch to line F on input condition X)
G22 Xnnnnnnnn	(wait for condition X)
G25 Xnnnn	(Loop Start)
G29 Xsnnnnnnn Fnn	(Preload Designated Parameter)
G47 Xnnnnnn	(output condition X)
G48 Xs	(start Jog cycle in X direction)
G79 Xsnnnnnnnn	(Preload Absolute Position)

When an X field that is not a data field for a G code is encountered during program execution, the Indexer will *index* the distance and direction programmed.

If the Incremental mode has been selected, the distance and direction will be relative to the position at the start of the motion.

If the Absolute mode has been selected, the direction and distance will be relative to the *Electrical Home* position.

If the Auto Reverse feature has been activated, the Indexer will automatically reverse direction at the end of the motion and will *index* the distance programmed for this parameter.

Example: X+1000CRLF sets the move for the program line to 1000 pulses in the plus direction.

L11 [accel PPS] → 40000 = SLOW, 60000 = MED, 80000 = FAST

See L12 [START SPEED]

F [PPS VELOCITY] → 5000 = SLOW..., 15000 = NORM, 20000 = FAST

GOOD EXAMPLE RUN

```
<01                    ; TALK TO UNIT #01
L11 40000              ; ACCEL
L12 1000               ; START VEL
N0 H12                 ; clear
N0 H1 G91 X 20000 F15000
```

(H1 = SET; H1 = RUN!; INC MODE; dist IN PULSES; SPEED (PPS))

GOOD EXAMPLE

N0 H12 (clear program)

N0

TO REPEAT, JUST TYPE "H1"2. TO CHG DIST, TYPE (X2000 H12)

F Program High Speed Feed Rate

Function:

This command selects the rate to be used as the step rate when the Indexer is in the *High Speed* mode. It may also be used as the data field for a G codes.

Units:

pulses per second or G Code field data

Range:

1 to 115,000 for L70=1
1 to 115,000 for L70=2
1 to 115,000 for L70=5
1 to 115,000 for L70=10
1 to 1,875,000 for L70=125

Default:

none

Command Format:

FnnnnnnnCRLF

Notes:

G Codes which require an F data field are listed below:

G11 Xnnn Fnnnn	(subroutine call to line X, repeat F times)
G20 Xnnnnnnnn Fnnn	(branch to line F on input condition X)
G29 Xsnnnnnnnn Fnn	(Preload Designated Parameter)

When an F field that is not a data field for a G code is encountered during program execution, the Indexer will use this value as the *High Speed* value for the motion.

If the value programmed for this parameter exceeds the value entered for the Ramp Frequency Limit (L71) parameter, the Ramp Frequency Limit (L71) parameter will be used as the default value for the F code.

Example:

F10000 CRLF sets the program feed rate to 10,000 pulses per second.

6.5 MISCELLANEOUS COMMANDS

Clear

Function:

Activating the Clear command will cause an immediate termination of the current operation.

Command Format:

* (ASCII 42) (no terminator required)

Notes:

The * command will stop motion immediately, terminate program execution, cancel any paused motion and clear the RS232 buffer.

Since the Clear command causes an immediate termination of motion, it may result in an inaccurate Absolute position count.

If data is being loaded, the load sequence will be terminated and the previously loaded value will be retained.

If a delay is occurring, the delay will be terminated.

Feed Hold

Function:

Activating the Feed Hold function will cause any motion that is occurring to come to a controlled stop. The absolute position count will remain accurate.

Command Format:

$ (ASCII 36) (no terminator required)

Notes:

The rate at which the motor will decelerate to a stop when a Feed Hold is issued is determined by the value programmed for the Acceleration/Deceleration Limit (L11) parameter.

To continue a motion cycle that was halted by a Feed Hold command, simply reactivate the Command that started the motion cycle.

If you want to terminate the motion cycle that was in process, activate the Clear (*) function. If the Clear command is used in this instance, the absolute position count will remain accurate.

Program Stop

Function:

This command will terminate program execution. Any motion or delay that is taking place will be allowed to finish. However, a new motion cycle will not be allowed to start.

Command Format:

(ASCII 35) (no terminator required)

Notes:

If the Single Cycle mode of operation has been selected and a Repeat Count value has been programmed, the next Cycle Start (H01) command will cause the Indexer to use the remaining repeat count (rather than the repeat count plus 1 value).

If you wish to execute the total Repeat Count Cycle, you must execute a Clear Command prior to the cycle start.

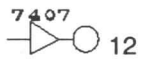
Related L Codes:

L06 (Execution Format)
L47 (Repeat Count)

SECTION 7: DEDICATED SIGNAL OUTPUTS

NOTE: See section 3.2 for guidelines on using these open-collector outputs.

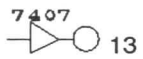
All Windings Off (AWO)

Pin Number: 

Function: The All Windings Off is an *open collector* output that permits monitoring of the state of the motor windings.

Notes: The output is inactive when current is applied to the motor and active when no current is applied.

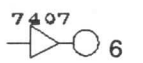
CW/CCW

Pin Number: 

Function: This *open collector* output permits monitoring of the direction of indexer motion.

Notes: The output is active when motion is in the CCW direction and inactive when motion is in the CW direction.

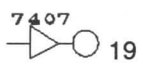
Motion Busy

Pin Number: 

Function: Motion Busy is an *open collector* output that can be used to monitor indexer motion.

Notes: The output will be active when motion is taking place, and inactive when no motion is occurring.

Position Error

Pin Number: 

Function: This *open collector* output permits monitoring of an *Index* From Run Travel Limit Error.

Notes: This output will become active if an *Index* From Run Travel Limit (L16) was exceeded.

A new motion command will deactivate this output.

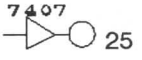
Power Supply Common (V0)

Pin Number: 1 and 14

Function: These pins will connect the power supply common of the indexer to the common of the external power supply.

Notes: Use this connection point when providing a source voltage for $\overline{\text{Position Error}}$, $\overline{\text{Motion Busy}}$, $\overline{\text{All Windings Off}}$, CW/$\overline{\text{CCW}}$ and $\overline{\text{Pulse}}$ outputs.

$\overline{\text{Pulse}}$

Pin Number: 

Function: This *open collector* output can be used to monitor the pulse train that the indexer generates during motion.

Notes: When a resolution of 1,2,5 or 10 is selected, the pulse train will be square waves. **This signal should not be used if the selected resolution is 1/125.**

The pulse train count is based on the rising edge of the pulses.

APPENDIX A L CODE LISTING AND DEFAULTS

L Code Listing

Indexer Parameters

L07 nnnn	Strobe Delay
L13 nnnnnnnn	Step Increment
L16 nnnnnnnn	Index From Run Travel Limit
L18 snnnnnnnn	CW Software Travel Limit
L19 snnnnnnnn	CCW Software Travel Limit
L20 n	Up/Down Feed Rate Override
L41 nnn	Auto Start Line Number
L45 n	Limit Switch Enable
L57 nnn	Strobe 0, Strobe 1 Delay
L67 n	Auto Reverse
L70 nnn	Resolution

RS232 Parameters

L21 nn	Device Identification Number
L22 nnnn	Baud Rate
L23 n	Character Length
L25 n	RS232 Parity
L26 n	Command Acknowledgement
L48 nnn	Program Line Count Designator
L49 nn	Parameter Transfer Designator
L50 nn	Parameter Transfer Count
L52 nnn	Buffer Warning Character
L55 nnn	Line Done Character
L56 nnn	Program Done Character
L98 nnn	Delay Between Continuous H Code Transmissions

Program Parameters

L06 n	Execution Format
L44 nnnn	Program Line Delay
L47 nnnnnnnn	Repeat Count
L51 n	Input/Output Mode Select

Feed Rate Parameters

L09 nnnnnnn	Jog Speed
L12 nnnnnnn	Low Speed
L14 nnnnnnn	Home Speed
L73 nnnnnnnn	Deviation Frequency

Ramp (Accel/Decel) Parameters

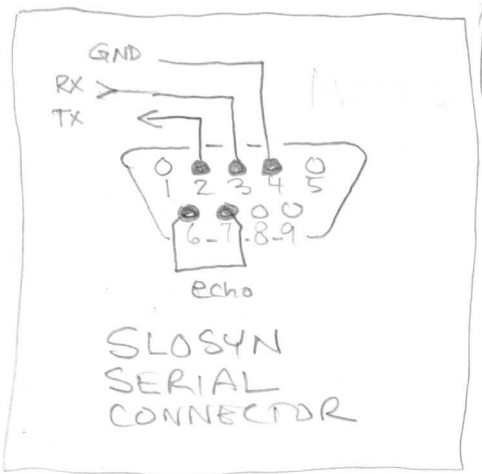
L11 nnnnnnnn	Acceleration/Deceleration
L71 nnnnnnnn	Ramp Frequency Limit
L72 n	Ramp Profile Select

Mechanical Home Parameters

L08 s	Mechanical Home Direction
L17 snnnnnnnn	Offset From Mechanical Home

Backlash Compensation Parameters

L43 nnnn	Delay Between Index And Backlash
L66 snnnnnnnn	Backlash Compensation



SLOSYN SERIAL CONNECTOR

WIRING

NOTES ON RUNNING MOTORS

<Ø1 ; TALK TO UNIT Ø1

SELECTING THE UNIT

9600, N, 8, 1

DEFAULT BAUD/PARITY

= ; response "OK"

RESPONSE

<008 ; Talk to ALL UNITS

Factory Defaults Summary

Code	Function	L70=1	L70=2	L70=5	L70=10	L70=125
L06	Execution Format	2	2	2	2	2
L07	Strobe Delay	0	0	0	0	0
L08	Mechanical Home Direction	+	+	+	+	+
L09	Jog Speed	1000	2000	5000	10000	125000
L11	Acceleration/Deceleration	1000	2000	5000	10000	125000
L12	Low Speed	300	600	1500	3000	37500
L13	Step Increment	1	2	5	10	125
L14	Home Speed	1000	2000	5000	10000	125000
L16	Index From Run Travel Limit	0	0	0	0	0
L17	Offset From Mechanical Home	+0	+0	+0	+0	+0
L18	CW Software Travel Limit	-0	-0	-0	-0	-0
L19	CCW Software Travel Limit	+0	+0	+0	+0	+0
L20	Up/Down Feedrate Override	0	0	0	0	0
L21	Device Identification Number	01	01	01	01	01
L22	Baud Rate	9600	9600	9600	9600	9600
L23	Character Length	8	8	8	8	8
L25	RS232 Parity	1	1	1	1	1
L26	Command Acknowledgement	0	0	0	0	0
L41	Auto Start Line Number	1	1	1	1	1
L43	Delay Between Index and Backlash	50	50	50	50	50
L44	Program Line Delay	50	50	50	50	50
L45	Limit Switch Enable	0	0	0	0	0
L47	Repeat Count	0	0	0	0	0
L48	Program Line Count Designator	20	20	20	20	20
L49	Parameter Transfer Designator	0	0	0	0	0
L50	Parameter Transfer Count	0	0	0	0	0
L51	Input/Output Mode Select	0	0	0	0	0
L52	Buffer Warning Character	0	0	0	0	0
L55	Line Done Character	0	0	0	0	0
L56	Program Done Character	0	0	0	0	0
L57	Strobe 0 and Strobe 1 Delay	4	4	4	4	4
L66	Backlash Compensation	+0	+0	+0	+0	+0
L67	Auto Reverse	0	0	0	0	0
L71	Ramp Frequency Limit	115000	115000	115000	115000	1875000
L72	Ramp Profile Select	0	0	0	0	0
L73	Deviation Frequency	10	20	50	100	1250
L98	Delay between continuous H Codes	100	100	100	100	100

APPENDIX B H CODES

H01	**Cycle Start**
H02	**Step Mode**
H03	**Jog Mode**
H04	**High Speed Mode**
H05	**Low Speed Mode**
H06	**CW Direction**
H07	**CCW Direction**
H08	**Return To Electrical Home**
H09	**Set Electrical Home**
H10	**Return To Mechanical Home**
H11	**Clear Program Line**
H12	**Clear Program Lines Using L48**
H13	**Transfer Program Line**
H14	**Transfer Program Lines Using L48**
H15	**Transfer Current Line Number**
H16	**Transfer Parameters**
H17	**Transfer Absolute Electrical Position**
H18	**Transfer Motion Status**
H19	**Transfer Mode Status**
H20	**Transfer Output Status**
H21	**Transfer Conditional Input Status**
H23	**Transfer Software Revision Level**
H24	**Program Trace Mode On**
H25	**Program Trace Mode Off**
H28	**Transfer Switch Input Status**
H29	**Transfer Program Execution Time**
H30	**Start Index From Run Cycle**
H31	**Target Velocity Increase**
H32	**Target Velocity Decrease**
H33	**Incremental Position Mode**
H34	**Absolute Position Mode**
H35	**Motor Windings On**
H36	**Motor Windings Off**
H37	**Enable Boost Current**
H38	**Disable Boost Current**
H39	**Enable Reduce Current**
H40	**Disable Reduce Current**
H41	**Transfer Remaining Repeat Value**
H60	**Transfer Present Velocity**
H85	**Transfer Motion Error Status**
H86	**Transfer Data Error Status**
H87	**Transfer Program Error Line Number**
H88	**Transfer Active Cycle**
H99	**Transfer Unit Type**

APPENDIX C IMMEDIATE COMMANDS

!Fnnnnnnn	Feed Rate Override
!L47 nnnnnnnn	Repeat Count
!L48 nnn	Program Line Count Designator
!L49 nn	Parameter Transfer Designator
!L50 nn	Parameter Transfer Count
!L52 nnn	Buffer Warning Character
!L55 nnn	Line Done Character
!L56 nnn	Program Done Character
!L57 nnn	$\overline{\text{Strobe 0}}$, $\overline{\text{Strobe 1}}$ Delay
!L98 nnn	Delay Between Continuous H Code Transmissions
!H04	High Speed Mode
!H05	Low Speed Mode
!H13	Transfer Program Line
!H15	Transfer Current Line Number
!H16	Transfer Parameters
!H17	Transfer Absolute Electrical Position
!H18	Transfer Motion Status
!H19	Transfer Mode Status
!H20	Transfer Output Status
!H21	Transfer Conditional Input Status
!H23	Transfer Software Revision Level
!H24	Program Trace Mode On
!H25	Program Trace Mode Off
!H28	Transfer Switch Input Status
!H29	Transfer Program Execution Time
!H31	Target Velocity Increase
!H32	Target Velocity Decrease
!H41	Transfer Remaining Repeat Value
!H60	Transfer Present Velocity
!H85	Transfer Motion Error Status
!H86	Transfer Data Error Status
!H87	Transfer Program Error Line Number
!H88	Transfer Active Cycle

APPENDIX D MISCELLANEOUS COMMANDS

! (ASCII 33)	Immediate Command
%Hnn	Activate Continuous H Code Transfer Mode
Nnnn	Line Number
Gnn	Preparatory Command
Xsnnnnnnnn	Program Index Distance or G Code data field
Fnnnnnnn	Program Feed Rate or G Code data field
Xoff (ASCII 19)	Stop Transmission
Xon (ASCII 17)	Resume Transmission
^H (ASCII 8)	Backspace And Delete
^X (ASCII 24)	Delete RS232 Buffer
<00CR	All Devices Active Mode
<00&	All Devices Listen Mode
<00@	Cancel Listen Mode For All Devices
<nnCR	Device Active
<nn?	Device Active And Acknowledge ID
nn&	Device Listen Mode
nn@	Device Cancel Listen Mode And Become Active
? (ASCII 63)	Device Acknowledge ID
* (ASCII 42)	Clear
$ (ASCII 36)	Feed Hold
# (ASCII 35)	Program Stop
/ (ASCII 47)	Transfer Normal Buffer Character Count Remaining
\ (ASCII 92)	Transfer Immediate Buffer Character Count Remaining

Notes:

"s" is an ASCII sign (+ or -)
"n" is an ASCII number (0 to 9)
The remaining symbols are ASCII characters (decimal value shown)

APPENDIX E G CODE LISTING

G04 Xnnnnnn	Dwell Time
G10 Xsnnnnnnn	Start Index From Run
G11 Xnnn Fnnnn	Call a Subroutine
G12 Xnnn	Go To Line Number
G20 Xnnnnnnnn Fnnn	Conditional Branch
G22 Xnnnnnnnn	Wait For Input
G23	Increment Jog Cycle Frequency
G24	Decrement Jog Cycle Frequency
G25 Xnnnn	Loop Start
G26	Loop End
G27	High Speed Mode
G28	Low Speed Mode
G29 Xsnnnnnnnn Fnn	Preload Designated Parameter
G30	End Of Program
G31	Program Stop
G32	Return From Subroutine
G36	Strobe X Code Data
G37	Strobe N Code Data
G38	Strobe F Code Data
G47 Xnnnnnn	Set Output Condition
G48 Xs	Start Jog Cycle
G49	Stop Jog cycle
G64	Enable Reduce Current
G65	Disable Reduce Current
G66	Enable Boost Current
G67	Enable Boost Current
G68	Motor Windings Off
G69	Motor Windings On
G76	Return To Electrical Home
G77	Set Electrical Home
G78	Return To Mechanical Home
G79 Xsnnnnnnnn	Preload Absolute Position
G90	Absolute Position Mode
G91	Incremental Position Mode

APPENDIX F PROGRAM WORKSHEETS

Indexer Parameters					
L Code data	Function		L Code data	Function
L06 _	Execution Format		L43 _ _ _ _	Delay Between Index And Backlash
L07 _ _ _ _	Strobe Delay		L44 _ _ _ _	Program Line Delay
L08 _	Mechanical Home Direction		L45 _	Limit Switch Enable
L09 _ _ _ _ _ _ _	Jog Speed		L47 _ _ _ _ _ _ _ _	Repeat Count
L11 _ _ _ _ _ _ _ _	Acceleration/Deceleration		L48 _ _ _	Program Line Count Designator
L12 _ _ _ _ _ _ _	Low Speed		L49 _ _	Parameter Transfer Designator
L13 _ _ _ _ _ _ _ _	Step Increment		L50 _ _	Parameter Transfer Count
L14 _ _ _ _ _ _ _	Home Speed		L51 _	Input/Output Mode Select
L16 _ _ _ _ _ _ _ _	Index From Run Travel Limit		L52 _ _ _	Buffer Warning Character
L17 _ _ _ _ _ _ _ _ _	Offset from Mechanical Home		L55 _ _ _	Line Done Character
L18 _ _ _ _ _ _ _ _ _	CW Software Travel Limit		L56 _ _ _	Program Done Character
L19 _ _ _ _ _ _ _ _ _	CCW Software Travel Limit		L57 _ _	Strobe 0 and Strobe 1 Delay
L20 _	Up/Dn Feed Rate Override		L66 _ _ _ _ _ _ _ _ _	Backlash Compensation
L21 _ _	Device Identification Number		L67 _	Auto Reverse
L22 _ _ _ _	Baud Rate		L70 _ _ _	Resolution
L23 _	Character Length		L71 _ _ _ _ _ _ _	Ramp Frequency Limit
L25 _	RS232 Parity		L72 _	Ramp Profile Select
L26 _	Command Acknowledgement		L73 _ _ _ _ _ _ _	Deviation Frequency
L41 _ _ _	Auto Start Line Number		L98 _ _ _	Delay Between Continuous H Code Transmissions

Program							
Line Number	G Code	Move Distance or Data	Feed Rate or Data	Line Number	G Code	Move Distance or Data	Feed Rate or Data
N _ _ _	G _ _	X _ _ _ _ _ _ _ _ _	F _ _ _ _ _ _ _	N _ _ _	G _ _	X _ _ _ _ _ _ _ _ _	F _ _ _ _ _ _ _
N _ _ _	G _ _	X _ _ _ _ _ _ _ _ _	F _ _ _ _ _ _ _	N _ _ _	G _ _	X _ _ _ _ _ _ _ _ _	F _ _ _ _ _ _ _
N _ _ _	G _ _	X _ _ _ _ _ _ _ _ _	F _ _ _ _ _ _ _	N _ _ _	G _ _	X _ _ _ _ _ _ _ _ _	F _ _ _ _ _ _ _
N _ _ _	G _ _	X _ _ _ _ _ _ _ _ _	F _ _ _ _ _ _ _	N _ _ _	G _ _	X _ _ _ _ _ _ _ _ _	F _ _ _ _ _ _ _
N _ _ _	G _ _	X _ _ _ _ _ _ _ _ _	F _ _ _ _ _ _ _	N _ _ _	G _ _	X _ _ _ _ _ _ _ _ _	F _ _ _ _ _ _ _
N _ _ _	G _ _	X _ _ _ _ _ _ _ _ _	F _ _ _ _ _ _ _	N _ _ _	G _ _	X _ _ _ _ _ _ _ _ _	F _ _ _ _ _ _ _
N _ _ _	G _ _	X _ _ _ _ _ _ _ _ _	F _ _ _ _ _ _ _	N _ _ _	G _ _	X _ _ _ _ _ _ _ _ _	F _ _ _ _ _ _ _
N _ _ _	G _ _	X _ _ _ _ _ _ _ _ _	F _ _ _ _ _ _ _	N _ _ _	G _ _	X _ _ _ _ _ _ _ _ _	F _ _ _ _ _ _ _
N _ _ _	G _ _	X _ _ _ _ _ _ _ _ _	F _ _ _ _ _ _ _	N _ _ _	G _ _	X _ _ _ _ _ _ _ _ _	F _ _ _ _ _ _ _
N _ _ _	G _ _	X _ _ _ _ _ _ _ _ _	F _ _ _ _ _ _ _	N _ _ _	G _ _	X _ _ _ _ _ _ _ _ _	F _ _ _ _ _ _ _
N _ _ _	G _ _	X _ _ _ _ _ _ _ _ _	F _ _ _ _ _ _ _	N _ _ _	G _ _	X _ _ _ _ _ _ _ _ _	F _ _ _ _ _ _ _
N _ _ _	G _ _	X _ _ _ _ _ _ _ _ _	F _ _ _ _ _ _ _	N _ _ _	G _ _	X _ _ _ _ _ _ _ _ _	F _ _ _ _ _ _ _
N _ _ _	G _ _	X _ _ _ _ _ _ _ _ _	F _ _ _ _ _ _ _	N _ _ _	G _ _	X _ _ _ _ _ _ _ _ _	F _ _ _ _ _ _ _
N _ _ _	G _ _	X _ _ _ _ _ _ _ _ _	F _ _ _ _ _ _ _	N _ _ _	G _ _	X _ _ _ _ _ _ _ _ _	F _ _ _ _ _ _ _
N _ _ _	G _ _	X _ _ _ _ _ _ _ _ _	F _ _ _ _ _ _ _	N _ _ _	G _ _	X _ _ _ _ _ _ _ _ _	F _ _ _ _ _ _ _
N _ _ _	G _ _	X _ _ _ _ _ _ _ _ _	F _ _ _ _ _ _ _	N _ _ _	G _ _	X _ _ _ _ _ _ _ _ _	F _ _ _ _ _ _ _
N _ _ _	G _ _	X _ _ _ _ _ _ _ _ _	F _ _ _ _ _ _ _	N _ _ _	G _ _	X _ _ _ _ _ _ _ _ _	F _ _ _ _ _ _ _
N _ _ _	G _ _	X _ _ _ _ _ _ _ _ _	F _ _ _ _ _ _ _	N _ _ _	G _ _	X _ _ _ _ _ _ _ _ _	F _ _ _ _ _ _ _
N _ _ _	G _ _	X _ _ _ _ _ _ _ _ _	F _ _ _ _ _ _ _	N _ _ _	G _ _	X _ _ _ _ _ _ _ _ _	F _ _ _ _ _ _ _
N _ _ _	G _ _	X _ _ _ _ _ _ _ _ _	F _ _ _ _ _ _ _	N _ _ _	G _ _	X _ _ _ _ _ _ _ _ _	F _ _ _ _ _ _ _
N _ _ _	G _ _	X _ _ _ _ _ _ _ _ _	F _ _ _ _ _ _ _	N _ _ _	G _ _	X _ _ _ _ _ _ _ _ _	F _ _ _ _ _ _ _
N _ _ _	G _ _	X _ _ _ _ _ _ _ _ _	F _ _ _ _ _ _ _	N _ _ _	G _ _	X _ _ _ _ _ _ _ _ _	F _ _ _ _ _ _ _
N _ _ _	G _ _	X _ _ _ _ _ _ _ _ _	F _ _ _ _ _ _ _	N _ _ _	G _ _	X _ _ _ _ _ _ _ _ _	F _ _ _ _ _ _ _
N _ _ _	G _ _	X _ _ _ _ _ _ _ _ _	F _ _ _ _ _ _ _	N _ _ _	G _ _	X _ _ _ _ _ _ _ _ _	F _ _ _ _ _ _ _
N _ _ _	G _ _	X _ _ _ _ _ _ _ _ _	F _ _ _ _ _ _ _	N _ _ _	G _ _	X _ _ _ _ _ _ _ _ _	F _ _ _ _ _ _ _
N _ _ _	G _ _	X _ _ _ _ _ _ _ _ _	F _ _ _ _ _ _ _	N _ _ _	G _ _	X _ _ _ _ _ _ _ _ _	F _ _ _ _ _ _ _
N _ _ _	G _ _	X _ _ _ _ _ _ _ _ _	F _ _ _ _ _ _ _	N _ _ _	G _ _	X _ _ _ _ _ _ _ _ _	F _ _ _ _ _ _ _
N _ _ _	G _ _	X _ _ _ _ _ _ _ _ _	F _ _ _ _ _ _ _	N _ _ _	G _ _	X _ _ _ _ _ _ _ _ _	F _ _ _ _ _ _ _
N _ _ _	G _ _	X _ _ _ _ _ _ _ _ _	F _ _ _ _ _ _ _	N _ _ _	G _ _	X _ _ _ _ _ _ _ _ _	F _ _ _ _ _ _ _
N _ _ _	G _ _	X _ _ _ _ _ _ _ _ _	F _ _ _ _ _ _ _	N _ _ _	G _ _	X _ _ _ _ _ _ _ _ _	F _ _ _ _ _ _ _
N _ _ _	G _ _	X _ _ _ _ _ _ _ _ _	F _ _ _ _ _ _ _	N _ _ _	G _ _	X _ _ _ _ _ _ _ _ _	F _ _ _ _ _ _ _

APPENDIX G CABLE INFORMATION

Cables For Serial I/O Connections

The following cables are available from Superior Electric for *serial I/O* connections:
(25-pin male "D" connector on one end, 9-pin female "D" connector on other)

Length	Part Number
5 feet (1.5m)	B216059-001
10 feet (3m)	B216059-002

Cables For Parallel I/O Connections

The following cables are available from Superior Electric for *parallel I/O* connections:
(25-pin male "D" connector on each end)

Length	Part Number
5 feet (1.5m)	C215851-007
10 feet (3m)	C215851-008

APPENDIX H TYPICAL PLC INTERFACE

A PLC can be used to provide the inputs required to run a SLO-SYN Indexer through the *Parallel I/O* interface. Figure H1 shows how the typical switch panel connection can be translated to a PLC connection. Please refer 5.1 through 5.3 for all connection information and timing.

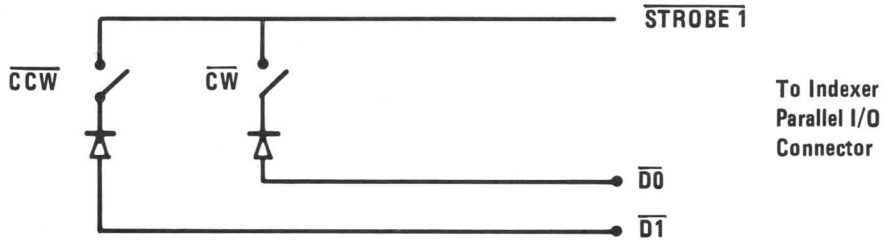


Figure H1A, Typical Switch Panel Connection

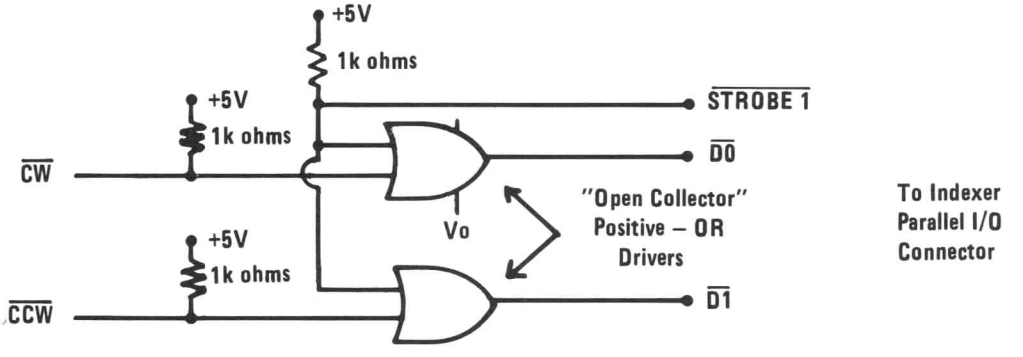


Figure H1B, Corresponding PLC Interface

Note: An External +5Vdc is required for the Corresponding PLC Interface. The Common on this Supply (-) must be connected to pin 1 or 14 on the Parallel I/O connector.

APPENDIX I APPLICATION PROGRAM EXAMPLE

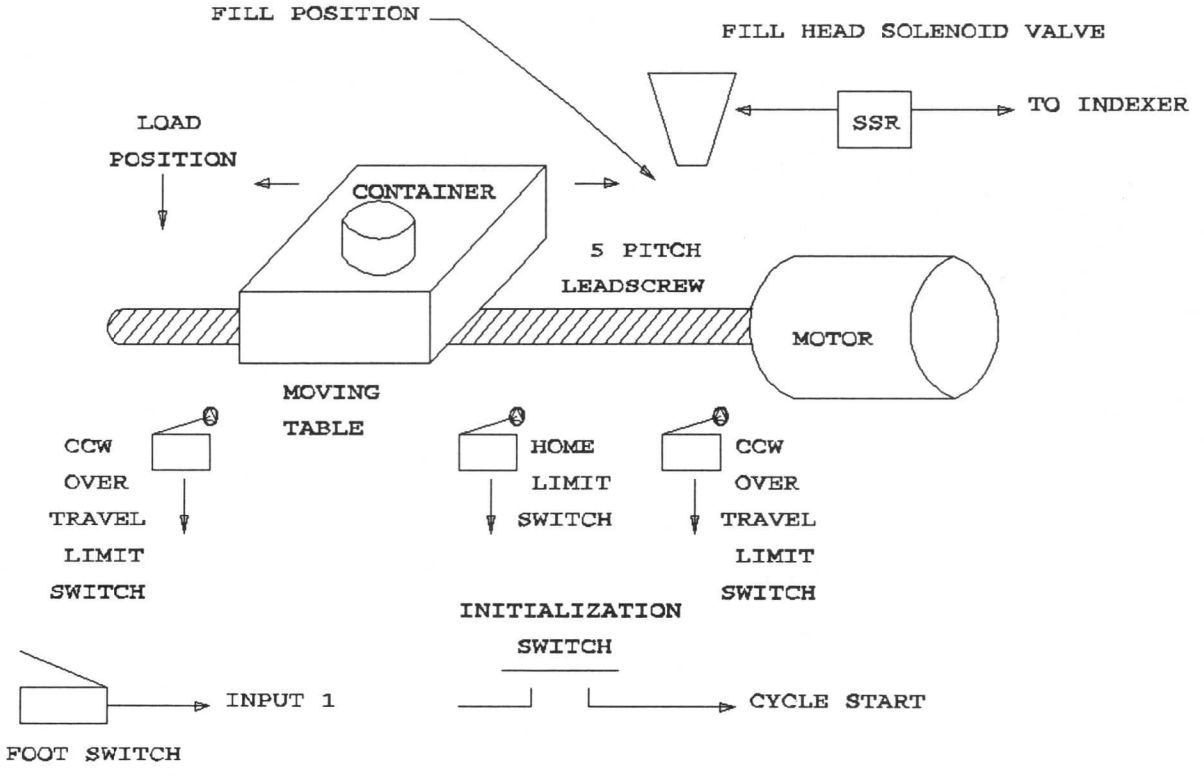


Figure I-1

Application

- A Single Axis Table With a 5-pitch leadscrew, 5 revolutions of a 200 step/rev motor to move a table 1.000 inch (each motor step= 0.001 inch movement). A Stepping motor Drives the leadscrew.

- Five Inputs to the Indexer are required (see Figure I-2).
  - CW Overtravel Limit (CW Limit) and CCW Overtravel Limit (CCW Limit)
    - Prevents mechanical damage to the table.
  - Home Limit Switch (Home Limit)
    - Indicates the *Mechanical Home* Position.
  - Foot Switch (Input 1)
    - Initiates a material fill cycle.
  - Initialize Switch, Power Turn On (Cycle Start)
    - Initiates a *Mechanical Home* cycle and moves to the "Load" Position.

- One Output from the Indexer is required (see Figure I-2).
  - Output 1
    - Used to control the Fill Head through a Solid State Relay.

- The CW & CCW "soft" Limits are set for 1" inside the Overtravel limit switches.

Writing Your Own Program

1. Thoroughly familiarize yourself with the Operator Manual, where the information is, what it is, how it is presented, before you start.

2. Define your objectives. Write it down and keep it simple.
   Do a *Mechanical Home* Cycle.
   Move table to "Load" Position (-5" from Home Position).
   Wait for closure of foot switch (Input 1).
   Move table to "Fill" Position (+5" from Home Position).
   Delay 1/10 of a second.
   Enable Output to open valve (Output 1).
   Delay 5 seconds while container fills.
   Disable Output to close valve (Output 1).
   Move table to "Load" Position (-5" from Home Position).
   Wait foot switch release (Input 1).

3. List out the system parameters (L Code) of the Indexer. See APPENDIX A for a complete L Code Listing and Section 5.1 for detailed information about the L Code.

4. Decide on Your parameter settings and write them down. The Indexer *default* values should be used if possible. A complete listing of Indexer *Default* Values is given in APPENDIX A of this manual.

L06 2	(Automatic Execution Format)
L08 +	(*Mechanical Home* Direction)
L17 -5000	(*Mechanical Home* Offset) (Distance to "Load" Position from *Mechanical Home*)
L18 +7000	(CW Travel Limit) (1" from CW Limit Switch)
L19 -7000	(CCW Travel Limit) (1" from CCW Limit Switch)
L41 001	(Auto Start Line Number)
L70 001	(Resolution)
L72 0	(Trapezoidal Ramp Profile)

5. Break the objective down into G codes and discrete moves and velocity. Refer to Sections 6.3 and 6.4 of this manual for detailed descriptions of G code operation and Line Data Codes. A sample "Programming Worksheet" has been provided in APPENDIX F. Now Proceed as follows:
   a) Write down the G Codes you will be programming next to the objective.
      G78 Do a *Mechanical Home* Cycle and Move table to "Load" Position (-5" from Home Position).
      G22 X21 Wait for closure of foot switch (Input 1).
      G04 X100 Delay 1/10 of a second.
      G47 X01 Enable Output to open valve (Output 1).
      G04 X5000 Delay 5 seconds while container fills.
      G47 X00 Disable Output to close valve (Output 1).
      G22 X20 Wait foot switch release (Input 1).
   b) Write Down the Move value (X) and Velocity (F) next to the objective.
      G90 X+5000 F1000 Move table to "Fill" Position (+5" from Home Position).
      X-5000 Move table to "Load" Position (-5" from Home Position).
   c) Decide if Subroutines, Loops or Branches will be useful.
   d) Now assemble all these sections into the desired sequence.

G78	(*Mechanical Home* Cycle with offset to "Load" Position)
G22 X21	(Wait for Foot Switch closure)
G90 X+5000 F1000	(set *Absolute Position* Mode and move to "Fill" Position +5000)
G04 X100	(Delay 1/10 of a second)
G47 X01	(Output 1 active, open valve)
G04 X5000	(Delay 5 seconds)
G47 X00	(Output 1 inactive, close valve)
X-5000	(Move to "Load" Position, *Absolute Position* -5000)
G22 X20	(Wait for Foot Switch opening)

e) Assign line numbers (N values)

N001 G78	(*Mechanical Home* Cycle with offset to "Load" Position)
N002 G22 X21	(Wait for Foot Switch closure)
N003 G90 X+5000 F1000	(set *Absolute Position* Mode and move to "Fill" Position +5000)
N004 G04 X100	(Delay 1/10 of a second)
N005 G47 X01	(Output 1 active, open valve)
N006 G04 X5000	(Delay 5 seconds)
N007 G47 X00	(Output 1 inactive, close valve)
N008 X-5000	(Move to "Load" Position, *Absolute Position* -5000)
N009 G22 X20	(Wait for Foot Switch opening)
N010 G12 X2	(Continue at Line 2)

6. Be patient. Plan on going through several iterations and having to make changes before your program works as you envision it would work.

If you have difficulty, the following ideas may help:

a) Double check your program and L Codes (transfer them from the Indexer) to be sure they were entered correctly.

b) Use the "Trace Mode" (H24 page 6-45) to check each step of the program operation.

c) Use the fault code transfer commands (H85, H86 and H87) and Status Transfer commands (H18, H19, H20, H21, H27 and H28) to check system operation.

d) Double check system wiring, especially any connections between components.

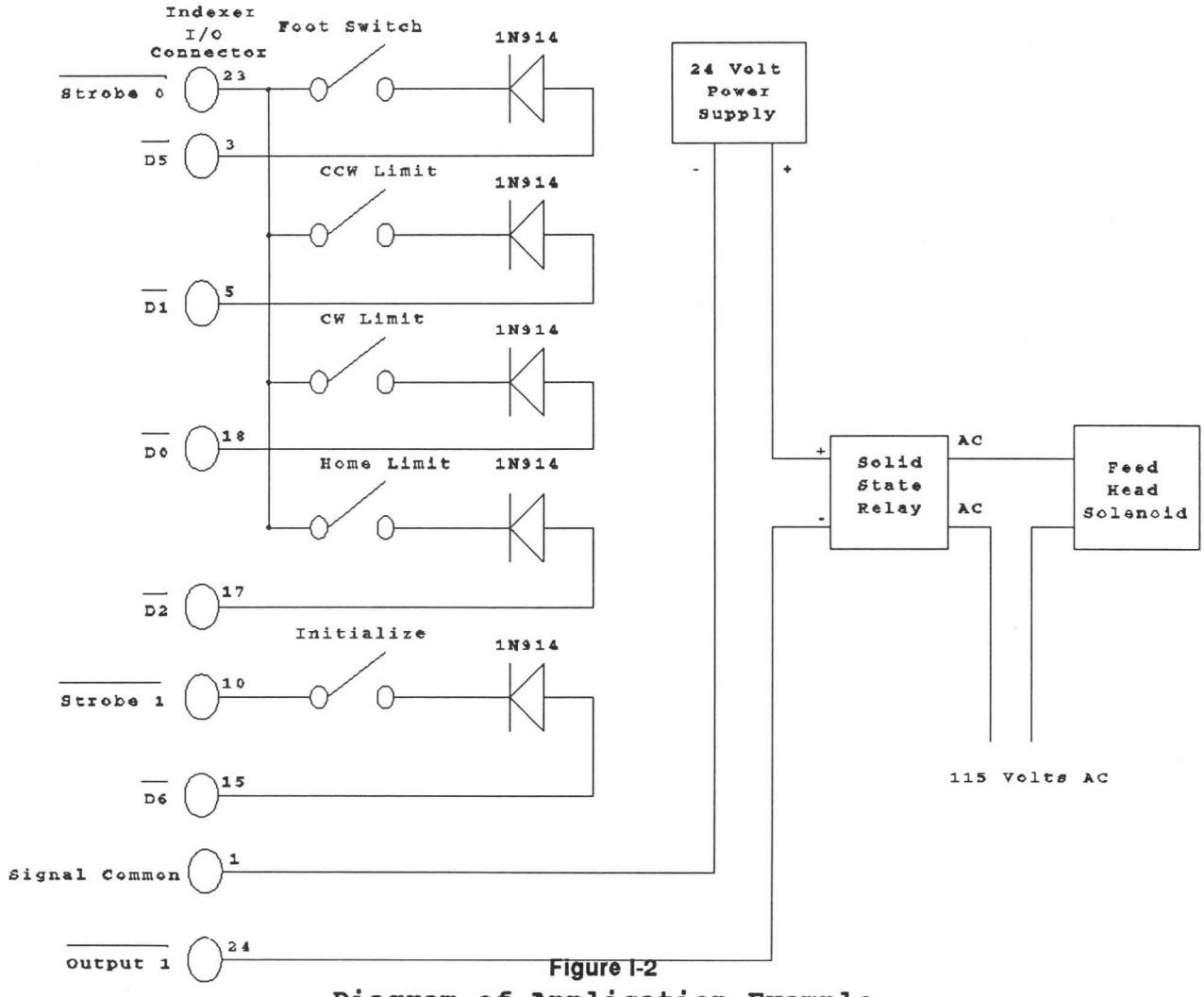


Figure I-2
Diagram of Application Example

GLOSSARY

Absolute Positioning

In the Absolute Positioning mode, all positioning commands are expressed as with respect to the absolute zero position. For example, if the motor is +100 steps from zero and the next motion command is +75, the motor will be driven 25 steps in the minus direction so that it will then be located at the +75 position.

Backlash

When a load is driven through a mechanical device such as a gear train, play or "lash" in the mechanical system may cause the motor to make several steps before the load actually begins to move. The SLO-Syn Indexer has a backlash Compensation feature to help prevent the position errors which can be caused by "lash" in the mechanical system. Using the L66 parameter, the operator selects the direction and the number of pulses to be used for backlash compensation. Whenever a move is made in the selected direction, the Indexer adds the selected number of pulses to the move. It then reverses direction and moves the selected number of pulses again, thereby compensating for play in the system.

Baud Rate

The number of binary bits that will be transmitted in serial fashion over a communications interface such as RS232.

BCD (Binary Coded Decimal)

A system in which the individual digits expressing a number in decimal notation are represented by a four-bit binary numeral. For example, the number twenty-three is represented by 0010 0011 in the 8-4-2-1 type of binary codes decimal notation.

Daisy Chain

An arrangement whereby up to 99 Indexers can communicate with a single host using only one serial port. Each Indexer in the chain must be assigned a unique device address to allow the host to communicate with each indexer individually. The host can also communicate with all indexers simultaneously, if necessary.

Default

Each Indexer parameter is assigned a default value at time of manufacture. The default value will be used for a parameter unless the user programs it with a different value.

Drive Resolution

The Drive Resolution is used to establish the number of pulses the drive must provide to the motor to accomplish one full motor step. A drive with a resolution of 1 requires one pulse to complete one full step, or 200 pulses to complete a full revolution of the motor shaft.

Electrical Home

Electrical Home is the position where the absolute position count is zero. All Absolute positioning moves are made with respect to this location.

High Speed

The High Speed rate is the speed used when rapid motion is needed and maximum torque is not required. The Indexer starts at the Low Speed rate and then ramps up to the High Speed at the programmed acceleration rate. The Indexer ramps down to the Low Speed rate and then stops at the end of the motion.

Incremental Positioning

In this positioning mode, the motor will move the programmed distance in the chosen direction each time an index command is given. Each positioning command represents the distance which the motor is to move from the present position.

Index

An Index motion is one in which the motor is driven a specific number of steps when the Index motion command is given. In the case of the SLO-SYN Indexer, the X field represent the number of steps to be taken when an Index command is issued.

Jog Mode

The Jog Mode provides continuous motor motion when a CW (H06) or CCW (H07) command is given. The motor will operate in the selected direction until a Feed Hold ($) or a Clear (*) command is issued.

Low Speed

The Low Speed is a rate to which the motor will start without acceleration or deceleration. When motion is to be done at the High Speed rate, the motor will be started at the Low Speed rate and then accelerated to the High Speed rate. When stopping at the end of motion, the motor will be decelerated to the Low Speed and then to a stop.

When setting the Low Speed rate, be sure to select a rate to which the motor can be started without acceleration.

Mechanical Home

The Mechanical Home position is used to establish a physical location as home. Using the Return To Mechanical Home cycle, the user can reference all electrical information to this physical location. The Return To Mechanical Home cycle establishes Electrical Home as well as Mechanical Home.

Open Collector

An output device that uses a transistor to simulate a switch. One end of the switch is at ground (V0) and the other end is accessible for connection to the device which must be controlled.

Parallel I/O

A Parallel I/O interface is one in which all of the bits of a command are processed simultaneously. The SLO-SYN Indexer uses a Parallel I/O interface for operation from a switch panel or the SSP-100 Programmer.

Pull-Up Resistor

A resistor that is connected to the accessible end of an open collector output to permit monitoring of the output when it is in the off state.

Serial I/O

A Serial I/O interface is a type of information transfer performed by a digital computer or other device in which all bits of a word or command are handled sequentially.

Step Mode

When operating in the Step mode, the Indexer will drive the motor the Step distance each time a motion command is given.

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ASSIGN AN ID TO SINGLE DEVICE, AND THEN MAKE IT ACTIVE

```
1  <00[redacted]2      ; ALL ACTIVE
2  L21,12              ; SETS DEVICE ID = 1
3  <012                ; DEVICE #1 ACTIVE
4  <01@                ; DISABLE "LISTEN" MODE SO WE CAN RECEIVE RESPONSES
```

PREP CONFIG

L70,102 2000 HR

→ SEE PP 6-78 FOR EXAMPLE RUN ←

SEE PP AP-12 FOR HOME PROGRAMS, ETC

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