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PROGRAMMING INFORMATION
for
SLO-SYN® ENHANCED
OPEN-LOOP AND CLOSED-LOOP
PROGRAMMABLE INDEXERS



Superior Electric

DANA

Bristol Connecticut 06010-7488

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INTRODUCTION

SLO-SYN® Programmable Indexers are extremely powerful motion controllers. Their features include:

Programming
- Simple, easy to use format
- Up to 99 Indexers can be daisy chained via serial I/O port
- Nonvolatile, battery-backed memory for program storage
- Serial or parallel port operation

RS232 Communications
- Can be programmed to transmit designated characters over RS232 when certain conditions occur
- Status information can be continuously reported over RS232

Absolute or Incremental Motion Control
- Incremental mode - all moves specified from present location
- Absolute mode - all positioning information given relative to zero, or "Home" position

Index From Run
This feature, also called "Mark Registration", drives the motor until an output is activated to initiate an index of a designated distance

Velocity Change During Motion
Allows velocity to be increased or decreased during motion by a previously selected value or to a specified value

Choice Of Ramp Profile
Choose from Trapezoidal, "S" shaped or hyperbolic ramp profiles

Programmable Backlash Compensation
Allows the operator to compensate for play in the mechanical system

Auto Reverse
Automatically returns to the starting position at the end of each move

I/O Capability
Software parameters can be used to define up to 8 programmable inputs and 6 programmable outputs

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ADDED FEATURES, CLOSED LOOP MODELS

Position Maintenance
The Indexer will automatically correct for any error in final position

Following Error Detection and Correction
The Indexer will detect and report, and can be programmed to correct, any Following Error that occurs during motion

Selectable Encoder Scale Factor
The Indexer can be programmed to function with a variety of encoder resolutions

Dedicated Output for Position Error Detection Status
Indicates: Following Error Condition
Unable To Correct situation
Position Maintenance Error

SLO-SYN Programmable Indexers may be operated by either of two methods:

1. A Programmable Indexer may be operated through its serial RS232 interface from a host computer, a standard ASCII terminal or a Hand-Held Programmer. This is done by issuing various alphanumeric codes to program, and then run, the Indexer.

2. A Programmable Indexer may be operated through its parallel I/O port, via a switch panel such as the SLO-SYN Model SSP-100, or via a Programmable Logic Controller (PLC). In this mode, the Indexer responds to switch closures to activate various functions, and to binary-coded-decimal (BCD) inputs to load move data, such as distance and speed.

Typically, the Indexer is programmed through its serial port. Once programming is completed, the Indexer may be operated through either the serial or the parallel port.

This brochure is intended to give an overview of the two programming methods.

INDEXER COMMANDS

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 Indexer parameters and commands can be grouped into three general categories. Refer to the Programming Worksheets on page 15 for the order in which data are entered.

The three general categories of parameters and commands are:

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

2. **"H Codes"** are used to set Indexer modes, to control manual motion and program execution, and to transmit parameters and Indexer status via the serial communications port.

3. **Line Data Codes** 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.

L CODE LISTING AND DEFAULTS

The following lists show all of the parameters which can be programmed by the user. In addition, all of the factory default values are listed on the following page.

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
L53 nnn	Following Error Exceeded Character
L54 nnn	Unable To Correct 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

Position Verification Parameters

L87 nnnnnn	Following Error
L90 n	Position Verification Enable/Disable
L93 nnnnnn	In Position Bandwidth
L94 n	Invert Encoder Direction
L95 n	Encoder Quadrature Scale Factor
L96 nnnnnn	Number Of Times To Attempt A Position Correction
L97 nnnnnn	Delay Between Correction Attempts

L Code 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 Limits	-0	-0	-0	-0	-0
L19	CCW Software Travel Limits	+0	+0	+0	+0	+0
L20	Up/Down Feedrate Override Enable	0	0	0	0	0
L21	Device Identification Number	01	01	01	01	01
L22	RS232 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	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
L53	Following Error Character	0	0	0	0	0
L54	Unable to Correct 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
L87	Following Error	10	20	50	100	1250
L90	Position Verification Enable	0	0	0	0	0
L93	In Position Bandwidth	0	0	0	1	12
L94	Encoder Direction	1	1	1	1	1
L95	Encoder Scale Factor	8	4	2	0	0
L96	Correction Attempts	100	100	100	100	100
L97	Delay between Correction Attempts	100	100	100	100	100
L98	Delay between continuous H Codes	100	100	100	100	100

* L70 programs the Indexer step resolution to match the drive as indicated below:

1 = Full-Step 2 = Half-Step 5 = 1/5 microstep

10 = 1/10 microstep 125 = 1/125 microstep

Indexer defaults are factory programmed according to the type of drive supplied. For example, a 3180-PI10 uses defaults shown in the L70 = 10 column.

H CODE LISTING

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
H22	Transfer Absolute Encoder Position
H23	Transfer Software Revision Level
H24	Program Trace Mode On
H25	Program Trace Mode Off
H26	Transfer Error Count
H27	Transfer Position Verification Status
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

LINE DATA CODE LISTING

Nnnn	Line Number
Xsnnnnnnnn	Program Index Distance or G Code data field
Fnnnnnnnn	Program Feed Rate or G Code Data
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	Disable 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

Notes: "s" is an ASCII sign (+ or -)
"n" is an ASCII number (0 - 9)
The remaining symbols are ASCII characters (decimal value shown)

Line Format: Nnnn Gnn Xsnnnnnnnn Fnnnnnnnn

IMMEDIATE COMMAND LISTING
(Serial Port Only)

Certain commands can be processed as soon as they are issued, even when the Indexer is "busy". These commands, known as "Immediate" commands, include a subset of L codes, H codes and Line Data codes. To indicate that a command should be treated as an immediate command, simply precede it with an exclamation mark (!). A list of immediate commands is given below.

!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
!L53 nnn	Following Error Exceeded
!L54 nnn	Unable To Correct Character
!L55 nnn	Line Done Character
!L56 nnn	Program Done Character
!L57 nnn	Strobe 0, Strobe 1 Delay
!L87 nnnnnn	Following Error
!L93 nnnnnn	In Position Bandwidth
!L96 nnnnnn	Number Of Times To Attempt A Position Correction
!L97 nnnnnn	Delay Between Correction Attempts
!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
!H22	Transfer Encoder Position
!H23	Transfer Software Revision Level
!H24	Program Trace Mode On
!H25	Program Trace Mode Off
!H26	Transfer Error Count
!H27	Transfer Position Verification Status
!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

MISCELLANEOUS COMMAND LISTING
(Serial Port Only)

! (ASCII 33)	Immediate Command
%Hnn	Activate Continuous H Code Transfer Mode
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)

SERIAL PORT OPERATION

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.

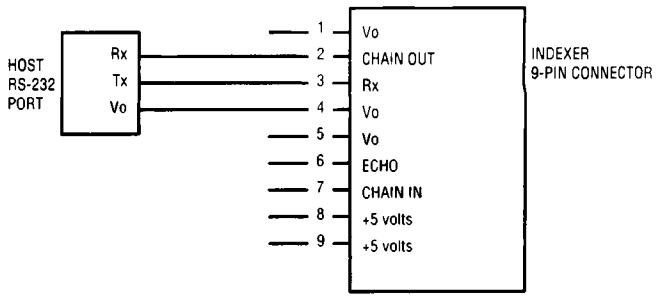
The connector pin assignments are as follows:

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 *

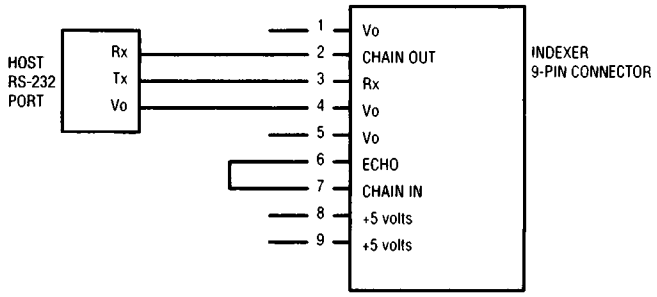
* **Note that the +5 Vdc is brought out to the connector to power the Superior Electric hand-held programmer. These pins should not be populated on a cable to be used to connect the Indexer to another serial device.**

All commands listed in the Indexer Command Section can be used any computer or ASCII terminal via the RS232 port. This allows the user to program all parameters and move profiles through the serial port. A menu-driven Application Generator Software is available for use on an IBM PC. In addition, the SSP-525 Hand-Held Programming Pendant can be used for communication.

3 WIRE CONNECTION NO ECHO



3 WIRE CONNECTION WITH ECHO



PARALLEL PORT OPERATION

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

* **These output 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.**

I/O SIGNAL SPECIFICATIONS

Output Signal Parameters

High Level Output Voltage	+24 Vdc max., open collector
High Level Leakage Current	250 μA max.
High Level Output Voltage	+0.4 Vdc max. @ 16 mA sink
	+0.7 Vdc max. @ 40 mA sink
Maximum Sink Current	40 mA max.

Input Signal Parameters

High Level Input Voltage	+8.5 Vdc min.
	+15 Vdc max.
High Level Leakage Current	1 mA max.
Low Level Input Voltage	+0.0 Vdc min.
	+6.5 Vdc max.
Low Level Leakage Current	3.5 mA max.

Figure 1 shows the internal circuitry for using the inputs and outputs. The drawing in Figure 2 gives typical wiring for using an open collector output.

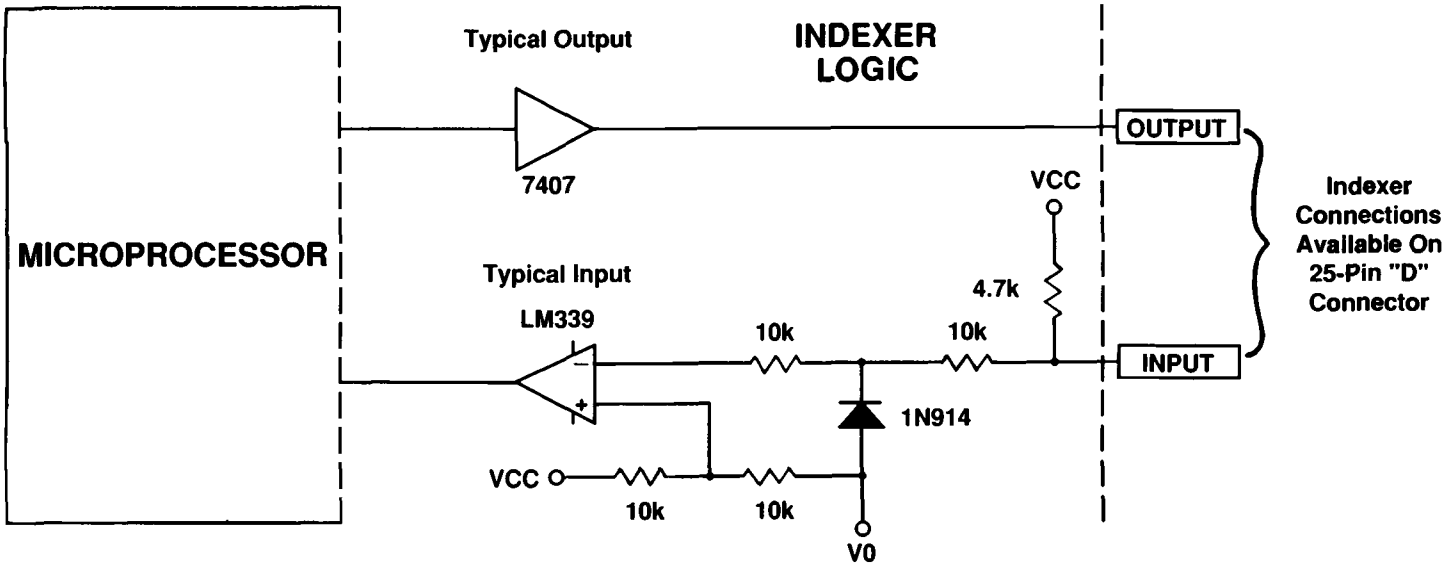
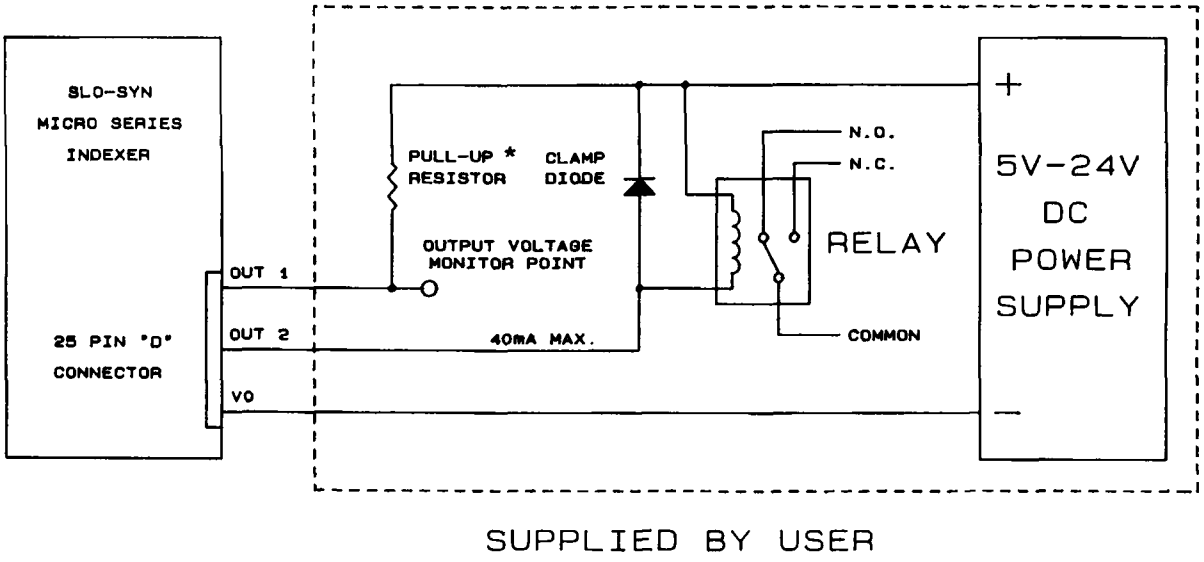


Figure 1, Equivalent Internal Circuits For The Indexer Inputs And Outputs



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

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

Figure 2, Typical Wiring For An Open Collector Output

PARALLEL PORT DATA ASSIGNMENTS

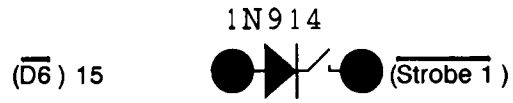
The following chart shows the pin assignments for the indexer functions available via the parallel port. A function is activated by connecting one of the DATA 0 through DATA 7 pins to one of the STROBE 0 through STROBE 7 pins.

PARALLEL PORT I/O ASSIGNMENTS

INPUT	STROBE 0	STROBE 1	STROBE 2	STROBE 3	STROBE4	STROBE 5	STROBE 6	STROBE 7
D0	CW Limit	CW Dir	Code 1	Code 100	Data 1M	Data 10K	Data 100	Data 1
D1	CCW Limit	CCW Dir	Code 2	Code 200	Data 2M	Data 20K	Data 200	Data 2
D2	Home Limit	Load	Code 4	Code 400	Data 4M	Data 40K	Data 400	Data 4
D3	Clear Cycle	AWO	Code 8	Code 800	Data 8M	Data 80K	Data 800	Data 8
D4	Feed Hold	Low/High	Code 10	Sign	Data 10M	Data 100K	Data 1K	Data 10
D5	IN 1	Step/Jog	Code 20	Sel 1	Data 20M	Data 200K	Data 2K	Data 20
D6	IN 2	Cycle Start	Code 40	Sel 2	Data 40M	Data 400K	Data 4K	Data 40
D7	Stop Cycle	Ser/Par	Code 80	Sel 4	Data 80M	Data 800K	Data 8K	Data 80

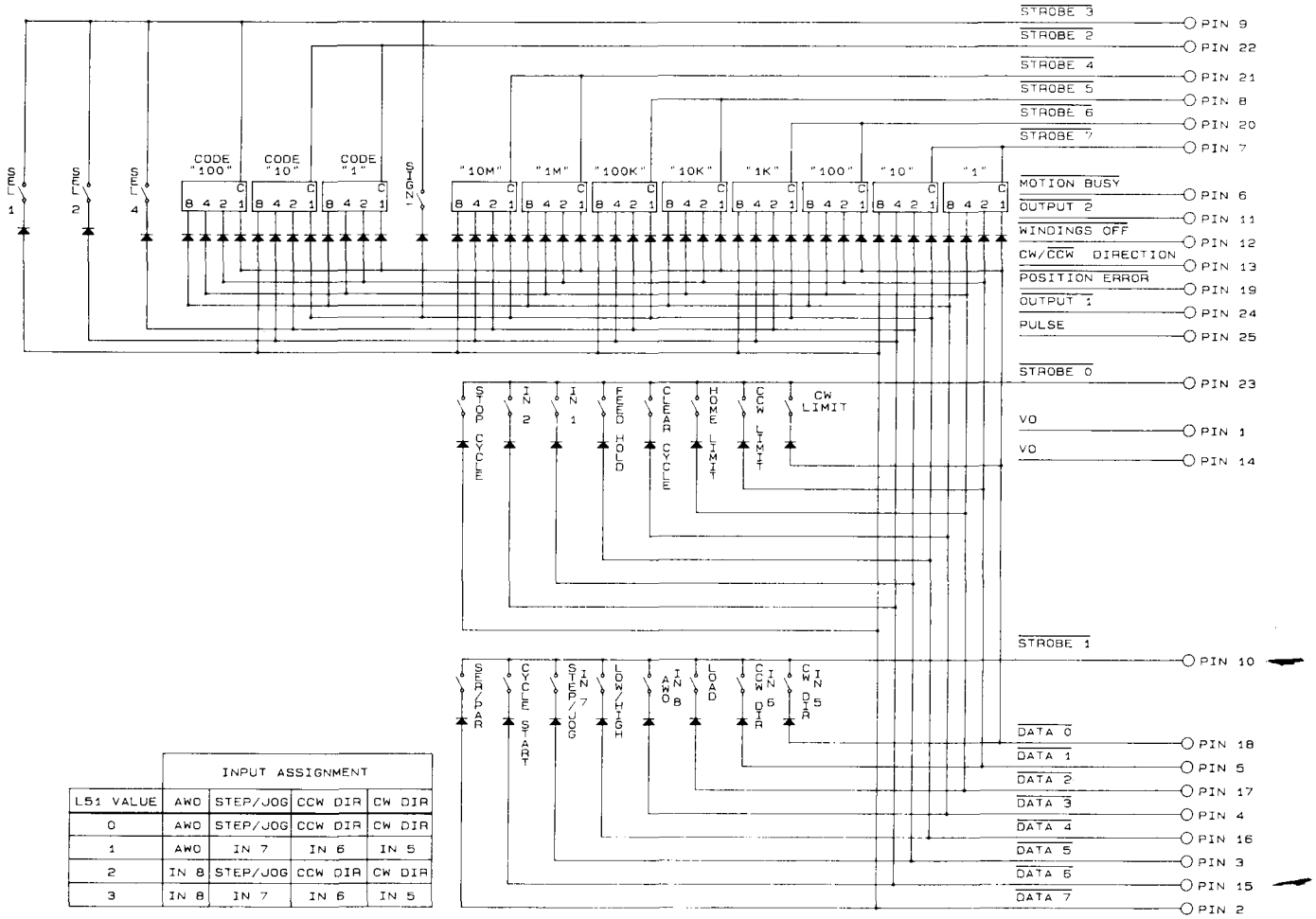
NOTE: All functions are active low (connect appropriate data and strobe pins) except LOW, STEP and SER, which are active high (e. g., no connection between data and strobe pins).

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.



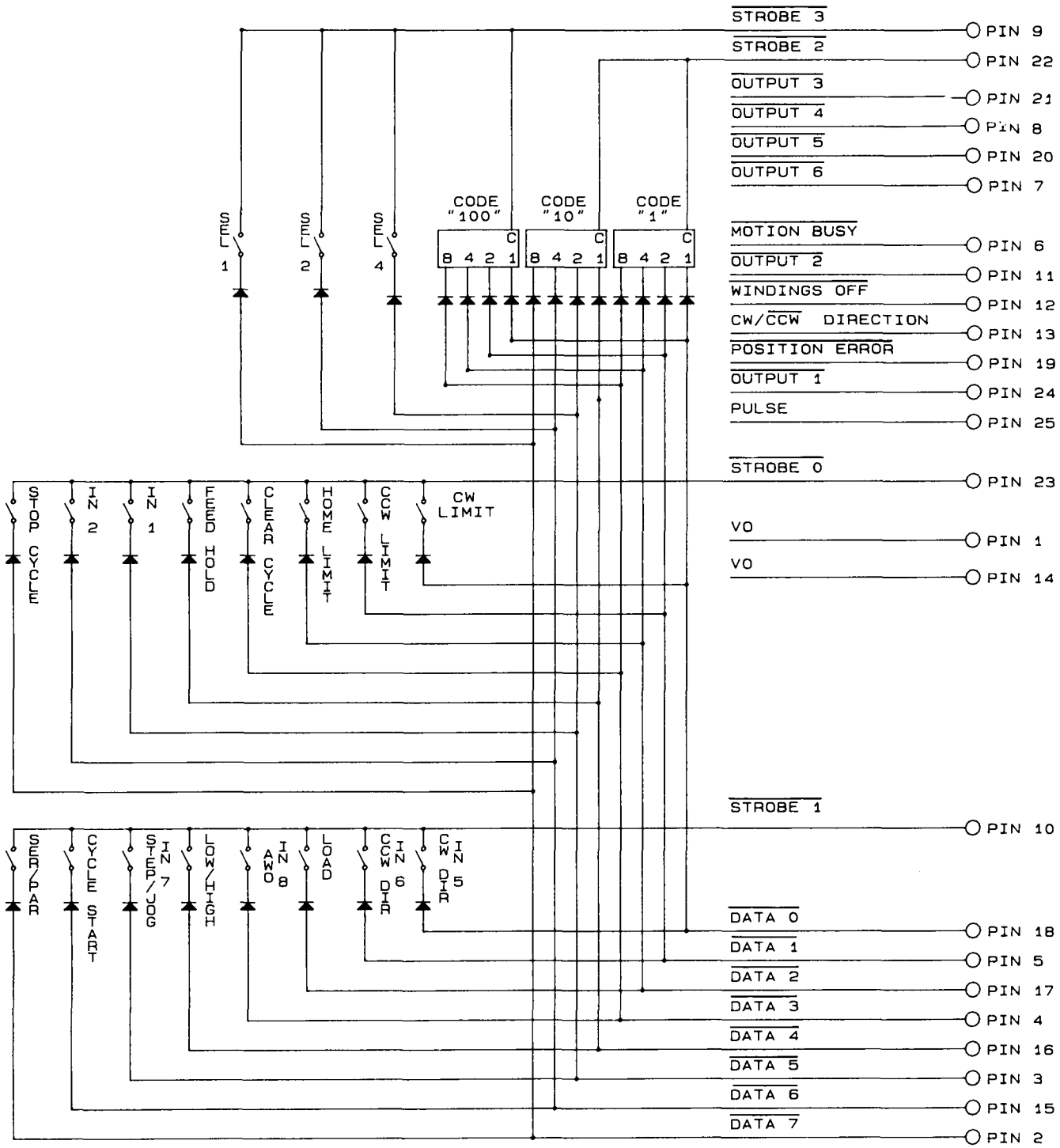
Typical Circuit For Activating CYCLE START Function

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 Figures 3 and 4 and the timing diagram is given in Figure 5.



	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 3, 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 4, Connection Diagram, Strobed Inputs With L51 = 4 To 7

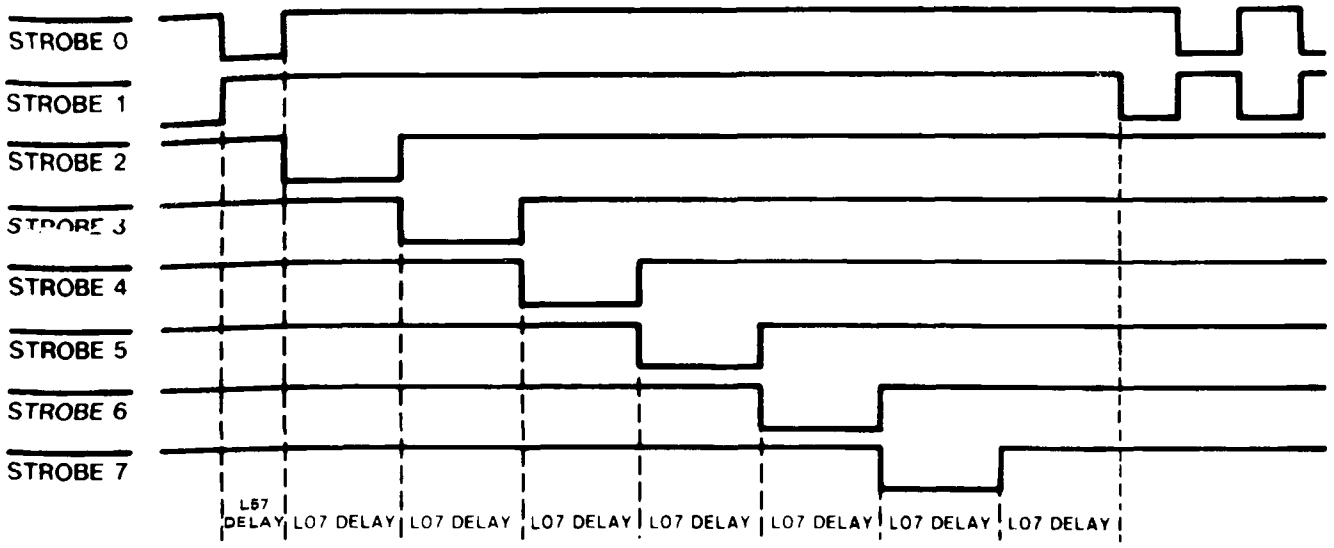


Figure 5, Strobed Input Timing

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

After inputing the data connected to Strobe 7, the Indexer will return to sequencing the Strobe 0 and 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 (Notes 1 & 2)	Field snnnnnnnn
0	1	1	F Code (Notes 1 & 2)	Field nnnnnnn
1	0	0	L Code (Notes 1 & 2)	Code 0nn, Field snnnnnnnn
1	0	1	H Code (Note 2)	Code 0nn
1	1	0	Initialization	Code 099, Field nnn
1	1	1	Not Used	None

0= input inactive; 1= input active; a= sign input; n= 0 to 9;
Code= Code Data Field; Field= Strobe 4 through Strobe 7 data inputs.

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

Note 2: See Indexer Command Section for description of these commands.

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. Figures 6 and 7 show how the typical switch panel connection can be translated to a PLC connection.

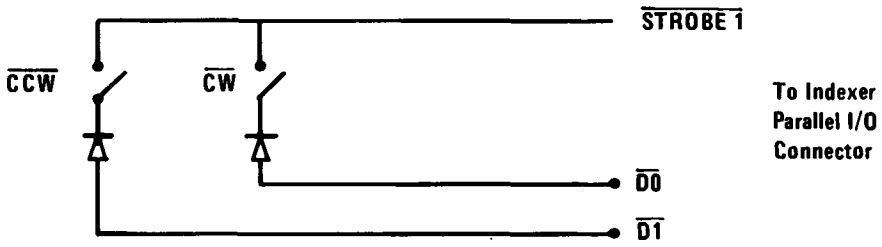


Figure 6, Typical Switch Panel Connection

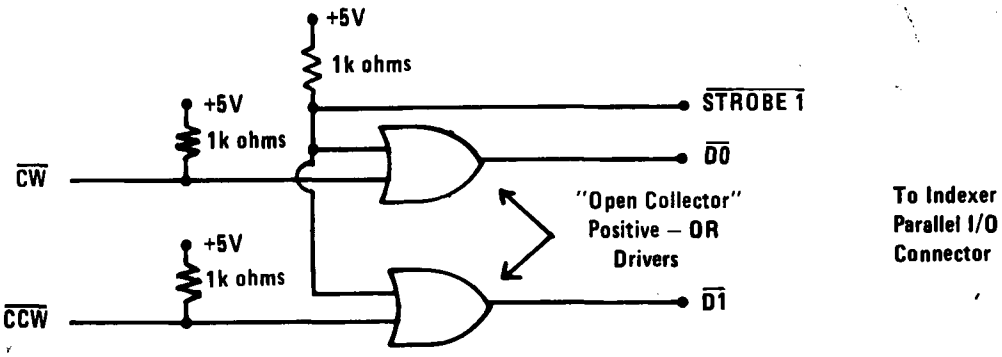


Figure 7, Corresponding PLC Interface

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.**

PROGRAM WORKSHEETS

Indexer Parameters					
L Code data	Function		L Code data	Function
L06 _	Execution Format		L48 _ _ _	Program Line Count Designator
L07 _ _ _ _	Strobe Delay		L49 _ _	Parameter Transfer Designator
L08 _	Mechanical Home Direction		L50 _ _	Parameter Transfer Count
L09 _ _ _ _	Jog Speed		L51 _	Input/Output Mode Select
L11 _ _ _ _ _ _ _	Acceleration/Deceleration		L52 _ _ _	Buffer Warning Character
L12 _ _ _ _ _ _ _	Low Speed		L53 _ _ _	Following Error Character
L13 _ _ _ _ _ _ _ _	Step Increment		L54 _ _ _	Unable to Correct Character
L14 _ _ _ _ _ _	Home Speed		L55 _ _ _	Line Done Character
L16 _ _ _ _ _ _ _	Index From Run Travel Limit		L56 _ _ _	Program Done Character
L17 _ _ _ _ _ _ _	Offset From Mechanical Home		L57 _ _ _	Strobe 0 and Strobe 1 Delay
L18 _ _ _ _ _ _ _	CW Software Travel Limit		L66 _ _ _ _ _ _ _ _	Backlash Compensation
L19 _ _ _ _ _ _ _	CCW Software Travel Limit		L67 _	Auto Reverse
L20 _	Up/Dn Feed Rate Override		L70 _ _	Resolution
L21 _	Device Identification Number		L71 _ _ _ _ _	Ramp Frequency Limit
L22 _ _ _	Baud Rate		L72 _	Ramp Profile Select
L23 _	Character Length		L73 _ _ _ _ _	Deviation Frequency
L25 _	RS232 Parity		L87 _ _ _ _ _	Following Error
L26 _	Command Acknowledgement		L90 _	Position Verification Enable
L41 _ _	Auto Start Line Number		L93 _ _ _ _ _	In Position Bandwidth
L43 _ _ _	Delay Between Index And Backlash		L94 _	Invert Encoder Detected Direction
L44 _ _ _	Program Line Delay		L95 _	Encoder Quadrature Scale Factor
L45 _	Limit Switch Enable		L96 _ _ _ _	Number of Correction Attempts
L47 _ _ _ _ _ _	Repeat Count		L97 _ _ _ _	Delay Between Corrections
L48 _ _ _	Program Line Count Designator		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 _ _ _ _ _ _

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