Compumotor

Model 150 Indexer User Guide

Compumotor Division
Parker Hannifin Corporation
p/n 88-001384-03 C

User Guide Change Summary

The following is a summary of the primary changes to this user guide since the last version was released. This user guide, version 88-001384-03C, supersedes version 88-001384-03B.

When a user guide is updated, the new or changed text is differentiated with a change bar in the right margin (this paragraph is an example). If an entire chapter is changed, the change bar is located to the right of the chapter title.

The entire user guide has been changed according to the new Compumotor user guide, format, styles, and illustration standards. Also, the chapters have been renumbered and reorganized.

Chapter 1.
Introduction

There were no changes to Chapter 1.

Chapter 2.
Getting Started

There were no changes to Chapter 2.

Chapter 3. Installation

Changes to Chapter 3 are summarized as follows:

- Updated edge connection Pin numbers

Chapter 4.
Application Design

There were no changes to Chapter 4.

Chapter 5.
Hardware Reference

Changes to Chapter 5 are summarized as follows:

- Updated edge connection Pin numbers

Chapter 6.
Troubleshooting

There were no changes to Chapter 6.

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How To Use This User Guide

This user guide is designed to help you install, develop, and maintain your system. Each chapter begins with a list of specific objectives that should be met after you have read the chapter. This section is intended to help you find and use the information in this user guide.

Assumptions

This user guide assumes that you have the skills or fundamental understanding of the following information.

- Basic electronics concepts (voltage, switches, current, etc.)
- Basic motion control concepts (torque, velocity, distance, force, etc.)

With this basic level of understanding, you will be able to effectively use this user guide to install, develop, and maintain your system.

Contents of This User Guide

This user guide contains the following information:

Chapter 1: Introduction

This chapter provides a description of the product and a brief account of its specific features.

Chapter 2: Getting Started

This chapter contains a detailed list of items you should have received with your Model 150 shipment. It will help you become familiar with the system and ensure that each component functions properly. In this chapter, you will perform a preliminary *bench-top* configuration of the system.

Chapter 3: Installation

This chapter provides instructions for you to properly mount the system and make all electrical connections. Upon completion of this chapter, your system should be completely installed and ready to perform basic operations.

Chapter 4: Application Design

This chapter discusses factors that affect your application. Also included are functional descriptions of the optional PROMs available for the Model 150.

Chapter 5: Hardware Reference

This chapter contains information on system specifications (dimensions and performance). Use this chapter to check jumper settings, thumbwheel ranges, and I/O connections.

Chapter 6: Troubleshooting

This chapter describes Compumotor's recommended methods for isolating and resolving hardware problems.

Installation Recommendations

Before you attempt to install this product, you should complete the following steps:

1. Review this entire user guide. Become familiar with the user guide's contents so that you can quickly find the information you need.

2. Develop a basic understanding of all system components, their functions, and interrelationships.

3. Complete the basic system configuration and wiring instructions provided in *Chapter 2, Getting Started.* ***Note that this is a preliminary configuration, not a permanent installation, usually performed in a bench-top environment.***

4. Perform as many functions as you can with the preliminary configuration. You can only do this if you have reviewed the entire user guide. You should simulate the task(s) you expect to perform when you permanently install your application. **However, do not attach a load at this time.** This will give you a realistic preview of what to expect from the complete configuration.

5. After you have tested all of the system's functions and used or become familiar with all of the system's features, carefully read *Chapter 3, Installation.*

6. After you have read Chapter 3 and clearly understand what must be done to properly install the system, you should begin the installation process. **Proceed in a linear manner**; do not deviate from the sequence or installation methods provided.

7. Before you begin to customize your system, check all of the system functions and features to ensure that you have completed the installation process correctly.

The successful completion of these steps will prevent subsequent performance problems and allow you to isolate and resolve any potential system difficulties before they affect your system's operation.

Conventions

To help you understand and use this user guide effectively, the conventions used throughout this user guide are explained in this section.

Warnings & Cautions

Warning and caution notes alert you to possible dangers that may occur if you do not follow instructions correctly. Situations that may cause bodily injury are presented as warnings. Situations that may cause system damage are presented as cautions. These notes will appear in bold face and the word warning or caution will be centered and in all capital letters. Refer to the examples shown below.

WARNING

Do not touch the motor immediately after it has been in use for an extended period of time. The unit will be hot.

CAUTION

System damage will occur if you power up the system improperly.

Change Bars

When a new user guide version is produced, the new or changed text is differentiated with a change bar in the right margin (this paragraph is an example). If the entire chapter is changed, the change bar is located to the right of the chapter title.

Related Publications

The following publications may be helpful resources:

- *Compumotor Programmable Motion Control Catalog*
- Schram, Peter (editor). *The National Electric Code Handbook (Third Edition).* Quincy, MA: National Fire Protection Association

Chapter 1. INTRODUCTION

Chapter Objective

The objective of this chapter is to provide you with information to understand the product's basic functions and features.

Product Description

The Compumotor Model 150 Series indexer is a single-board programmable pulse generator that controls open-loop positioning systems. The Model 150 controls Compumotor motor/drive systems and most stepping motor translators.

The Model 150 indexer is designed to simplify a BCD or programmable logic controller (PLC) interface. Control inputs include a mode selection switch to select preset or continuous operation, and thumbwheel switches for preset programming of acceleration, velocity, and position. As an alternative, all front panel command and data inputs are available in parallel on the main 72-pin edge connector. Only those functions you want to control remotely (and only the specific digits in those functions) need to be interfaced to the edge connector.

The indexer comes with a transformer that delivers 9 - 12VAC at 400mA.

Product Features

Features of the Model 150 Series Indexer are as follows:

- Preset/Continuous mode selector switch
- BCD edge connector enables remote input of thumbwheel data, start/stop, and limit switch inputs
- Start and stop switches
- Thumbwheels provide digital control of acceleration, velocity, direction, and distance
- Jumper-selectable resolution, velocity range, and acceleration range

Chapter 2. GETTING STARTED

Chapter Objectives

The information in this chapter will enable you to do the following:

- Verify that each component of your system has been delivered safely
- Ensure that the Model 150 indexer functions properly

What You Should Have

Inspect your Model 150 indexer shipment upon receipt for damage to its shipping container. Report any damage to the shipping company immediately. Parker Compumotor cannot be held responsible for damage incurred in shipment. The items listed in Table 2-1 should be present and in good condition. Check the serial plate on the back panel to verify which version of the Model 150 you have.

Part/Quantity	Part Number
Possible Versions of the Model 150 Indexer:	
Standard Model 150	150
Model 150-R11	150-R11
Model 150-R4	150-R4
Model 150-R1	150-R1
72-pin Edge Connector	71-001377-01
Drive Connector Cable Assembly	71-004922-10
Model 150 Transformer	47-000604-01
(4) Standoffs, 6-32 x 3/16	52-000621-01
Model 150 User Guide	88-001384-03

Table 2-1. Ship Kit List

Preliminary Configuration

Use the following instructions to establish a temporary bench-top system configuration that you can use to test before you permanently install the Model 150 Indexer. Figure 2-1 illustrates the test configuration.

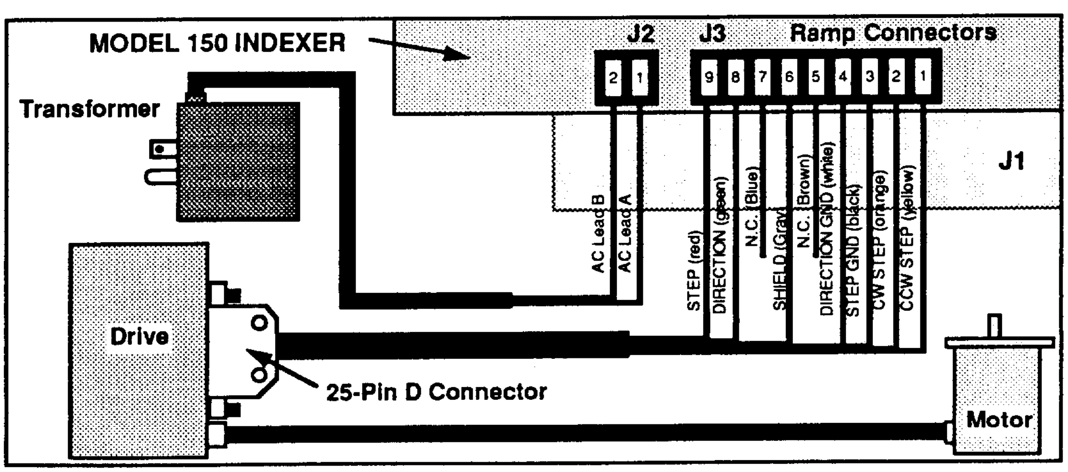


Figure 2-1. Preliminary (Test) Configuration

Drive Connection

> **CAUTION**
>
> **Check that the electrical specifications of the Model 150 and the drive are compatible. Compumotor cannot be responsible for damage due to mismatched components.**

The Model 150 Indexer is shipped with a prewired drive connector cable (compatible with most Compumotor drives). Attach the cable's 9-pin ramp connector to the indexer and the 25-pin D connector to the drive. Refer to Figure 2-1 for pinouts and color codes if the drive's connector is not compatible. Table 2-2 provides pinouts and color codes for the 25-pin connector.

Pin #	Signal	Color
1	STEP	Red
2	DIRECTION	Green
14	GND (Step return)	Black
15	GND (Direction return)	White
---	SHIELD	Shield
3	CW STEP	Orange
4	CCW STEP	Yellow

Table 2-2. 25-Pin D Connector Pinouts and Color Codes

Indexer/Drive Settings

Verify that the drive resolution matches the indexer resolution. ***If the resolutions do not match, the motor will not move at the exact acceleration and velocity specified on the indexer's thumbwheels.***

The Model 150 resolutionis set with jumper JU4, located about 1-1/2 inches above the thumbwheel switches on the right edge of the indexer PCB (see Figure 2-2). The Model 150 is shipped with jumper JU4 not installed; this setting selects the normal resolution for each indexer version as indicated in Table 2-3. To select the high resolution, install jumper JU4. Additional jumpers are included in the ship kit.

If you are using a special-order Model 150 PROM, refer to Table 5-5 in *Chapter 5, Hardware Reference*, for resolution settings.

Model Number	Normal Resolution* (JU4 removed)	High Resolution (JU4 installed)
150	25,000 steps/rev	50,000 steps/rev
150-R1	200 steps/rev	400 steps/rev
150-R4	1,000 steps/rev	-------------- **
150-R5	4,096 steps/rev	16,384 steps/rev
150-R11	25,000 steps/rev	50,000 steps/rev

* Factory Default Setting
** For Model 150-R4, installing JU4 multiplies the acceleration, velocity, and position thumbwheel settings by a factor of 10.

Table 2-3. Indexer Resolution Settings (Jumper JU4)

Power Connection

CAUTION

Before making power connections to the Model 150, make sure the POWER OFF/ON switch is set to OFF.

The transformer (provided) is prewired to the 2-pin ramp connector. Attach the 2-pin connector to connector J2 on the Model 150 (see Figure 2-1) and plug the transformer into a 120VAC power source. **Do not turn on the POWER switch until you are instructed to do so.**

Functional Check

With a test motor and drive, use the following steps to check your indexer and ensure that it is working properly . Refer to Figure 2-2 for indexer thumbwheel and switch illustrations.

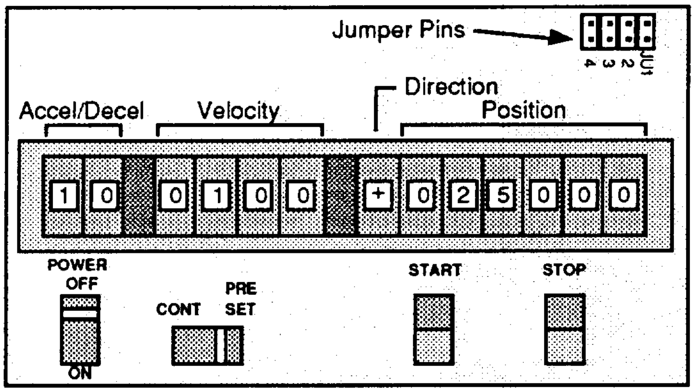


Figure 2-2. Model 150 Thumbwheels, Switches, and Jumper Pins

1. Connect the motor to the drive you are using (refer to the drive/motor user guide for connection instructions).
2. Apply power to the drive (refer to your drive user guide for specific instructions).
3. Move the CONT/PRESET switch to the **PRESET** position.
4. Set ACCEL/DECEL to **10** (equals 10 revs/sec/sec [rps^2])
5. Set VELOCITY to **0100** (equals 1.00 rps for the models 150, 150-R1, and 150-R11, and 10.0 rps for models 150-R4 and 150-R5)
6. Set DIRECTION to **+**
7. Set POSITION to **025000** (1 rev for models 150-R1, 150-R4, and 150-R11, and 25 revs for models 150 and 150-R5)

9. Move the POWER OFF/ON switch to the **ON** position.
10. Press the START switch. The motor should move the specified number of steps and stop at the original starting point.

If the motor does not move, refer to *Chapter 6, Troubleshooting.*

Chapter 3. INSTALLATION

Chapter Objectives

The information in this chapter will enable you to do the following:

- Connect all electrical system inputs and outputs properly
- Mount the indexer properly
- Verify (test) system connections and operability

Before you begin this chapter, you must complete all the steps and instructions discussed in Chapter 2.

Environmental Considerations

The Model 150 Indexer must be stored and operated according to the following specifications:

- Operating Temperature: 32 to 122°F (0 to 50°C)
- Storage Temperature: -22 to 185°F (-30 to 85°C)
- Humidity: 0 to 95% non-condensing

Setting Indexer Functions

Indexer functions are set using jumpers and 2-way switches. **Always turn off the power before adjusting the jumpers.**

Jumper Settings

Use the indexer jumpers to select the acceleration range, velocity range, and resolution. Refer to Table 3-1 for the functions of the pins. Table 3-2 contains the selectable velocity range values and resolutions. Refer to Figure 3-1 to locate the jumperpins. **The Model 150 is shipped to you with no jumpers installed on the pins** (i.e., all OFF). Jumpers are included in the ship kit.

Function	JU1	JU2	JU3	JU4
Normal acceleration, 1 to 99 rps²	OFF	OFF	-----	-----
High acceleration, 10 to 990 rps²	OFF	ON	-----	-----
Low acceleration, 0.1 to 9.9 rps²	ON	OFF	-----	-----
High velocity range	-----	-----	OFF*	-----
Low velocity range	-----	-----	ON*	-----
Normal motor resolution	-----	-----	-----	OFF
High motor resolution	-----	-----	-----	ON

* For 150-R1, the jumper setting is reversed (OFF = high velocity and ON = low).

Table 3-1. Jumper Settings

Model Number	Software P/N	Normal Motor Res. (steps/rev)	High Motor Resolution	High Velocity Range (rps)	Low Velocity Range (rps)	Position Setting for 1 Revolution*	Position Increments
150	92-2476	25K -------	------- 50K	00.01 - 19.99 00.01 - 10.00	0.001 - 1.999 0.001 - 1.999	001000 "	Revs "
150-R1/R2	92-1489	200 -------	------- 400	000.1 - 160.0 000.1 - 080.0	00.01 - 19.99 00.01 - 19.99	000200 000400	Steps "
150-R4	92-3246	1K	-------	000.1 - 100.0	00.01 - 10.00	001000	Revs
150-R5/R8	92-4948	4096 -------	------- 16,384	000.1 - 100.0 000.1 - 025.0	00.01 - 19.99 00.01 - 19.99	001000 "	Revs "
150-R11/R14	92-2477	25K -------	------- 50K	00.01 - 19.99 00.01 - 10.00	0.001 - 1.999 0.001 - 1.999	025000 050000	Steps "

* These position settings are accurate only if the drive and the indexer are at the same resolution.
NOTE: For 150-R4, installing JU4 multiplies the acceleration, velocity, and position thumbwheel settings by 10.
NOTE: The velocity range is dependent on the resolution.

Table 3-2. Velocity Range Values and Resolutions

Additional PROM options, providing different resolutions and velocity ranges, are described in Chapter 4.

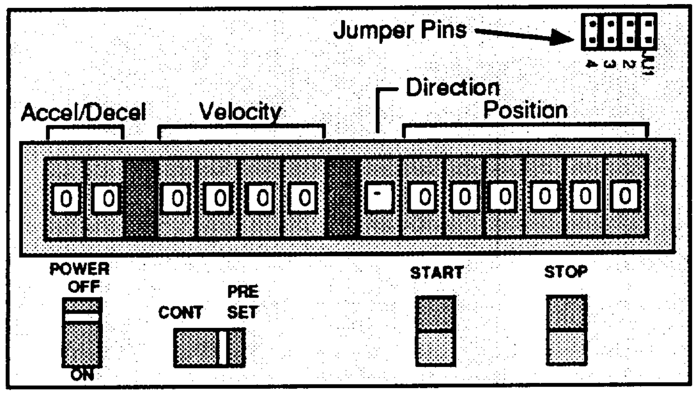


Figure 3-1. Thumbwheels, Switches, and Jumpers

Settings For Using External Controls

You can select Model 150 indexer options and functions using remote switches or a PLC interface (or some other BCD input device).

There are two classes of remote inputs: Control and BCD Data. The Model 150 allows a mixed mode of operation where some functions and/or values are set via the on-board thumbwheels and switches and others are set by remote switches and/or a PLC. Consequently, specific settings are required to allow the PLC to control a particular function.

For remote control and BCD data entry, the following settings must be made (refer to Figure 3-1):

- Set the on-board Preset/Cont switch to **PRESET**.
- Set the on-board Direction thumbwheel to **-**.
- All thumbwheel switches corresponding to the BCD digits and parallel functions that the computer or PLC will control must be set to **0**.

Before proceeding, review the functions you wish to control over the PLC (BCD) interface (see Table 3-3). The 3-1/2 decades of velocity and the 6 decades of position data are probably excessive for many applications. Some of the least or most significant digits may not have to be connected. At four wires per digit, any reductions are helpful in minimizing interface wiring connections.

Standard System Connections

Normally, drive I/O and power input are connected via the designated connectors (J2 for AC input connections, J3 for drive connections). **Refer to *Chapter 2, Getting Started* for connection instructions if you are using connectors J2 and J3.**

If you are making system connections via the 72-pin edge connector (J1), continue to the next section designed for system connections using the edge connector.

System Connections
(Using the Edge Connector)

All command and data inputs are available on the edge connector (J1). You need to interface only those functions you wish to control remotely (*and only the specific bits in those functions*) to your computer or programmable controller.

Typically, acceleration and velocity are set on the thumbwheels, while direction and the significant digits of position are controlled remotely. Most remote applications require start, stop, and end-of- travel limit inputs to be connected. Table 3-3 lists the functions of each edge connector pin. Figure 3-2 illustrates the SAE edge connector and how it connects to the Model 150 indexer.

PCB Pin	SAE Pin	Signal	Input/ output	PCB Pin	SAE Pin	Signal	Input/ output
1	A	GND	I	37	1	GND	I
2	B	Transformer Lead *A*	I	38	2	Transformer Lead *A*	I
3	C	Transformer Lead *B*	I	39	3	Transformer Lead *B*	I
4	D	TTL STEP	O	40	4	STEP GND (STEP Return)	I
5	E	TTL DIRECTION	O	41	5	DIRECTION GND (DIR. Return)	I
6	F	N.C.	---	42	6	$\overline{\text{RESET}}$	I
7	H	Remote $\overline{\text{START}}$	I	43	7	STATUS (MOVING/$\overline{\text{NOT MOVING}}$)	O
8	J	Remote $\overline{\text{STOP}}$	I	44	8	$\overline{\text{CW STEP}}$ (Open Collector)	O
9	K	PRESET/$\overline{\text{CONT}}$ Mode	I	45	9	$\overline{\text{CCW STEP}}$ (Open Collector)	O
10	L	1 Velocity Digit n _ _ _	I	46	10	DIRECTION ($\overline{\text{CW}}$/CCW)	I
11	M	8	I	47	11	8	I
12	N	4 Velocity		48	12	4 Position	
13	P	2 Digit _ n _ _		49	13	2 10^5 Digit	
14	R	1		50	14	1	
15	S	8	I	51	15	8	I
16	T	4 Velocity		52	16	4 Position	
17	U	2 Digit _ _ n _		53	17	2 10^4 Digit	
18	V	1		54	18	1	
19	W	8	I	55	19	8	I
20	X	4 Velocity		56	20	4 Position	
21	Y	2 Digit _ _ _ n		57	21	2 10^3 Digit	
22	Z	1		58	22	1	
23	$\overline{\text{A}}$	8	I	59	23	8	I
24	$\overline{\text{B}}$	4 Accel/Decel		60	24	4 Position	
25	$\overline{\text{C}}$	2 Digit n _		61	25	2 10^2 Digit	
26	$\overline{\text{D}}$	1		62	26	1	
27	$\overline{\text{E}}$	8	I	63	27	8	I
28	$\overline{\text{F}}$	4 Accel/Decel		64	28	4 Position	
29	$\overline{\text{H}}$	2 Digit _ n		65	29	2 10^1 Digit	
30	$\overline{\text{J}}$	1		66	30	1	

31	$\overline{K}$	Current Source (300Ω to +5V)	O
32	$\overline{L}$	Cur Src (300Ω to +5V)	O
33	$\overline{M}$	$\overline{\text{CCW LIMIT}}$	I
34	$\overline{N}$	$\overline{\text{CW LIMIT}}$	I
35	$\overline{P}$	N.C.	----
36	$\overline{R}$	Limit Switch Return	I

67 68 69 70	31 32 33 34	8 4 Position 2 10^0 Digit 1	I
71	35	N.C.	I
72	36	Limit Switch Return (GND)	I

J1 is an SAE 72-Pin (Dual 36) 0.156 PC edge connector with Polarizing Slot (SAE P/N AC 36D/1-2)
N.C. = No Connection, GND = Common DC Ground

Table 3-3. Edge Connector (J1) Pinout List

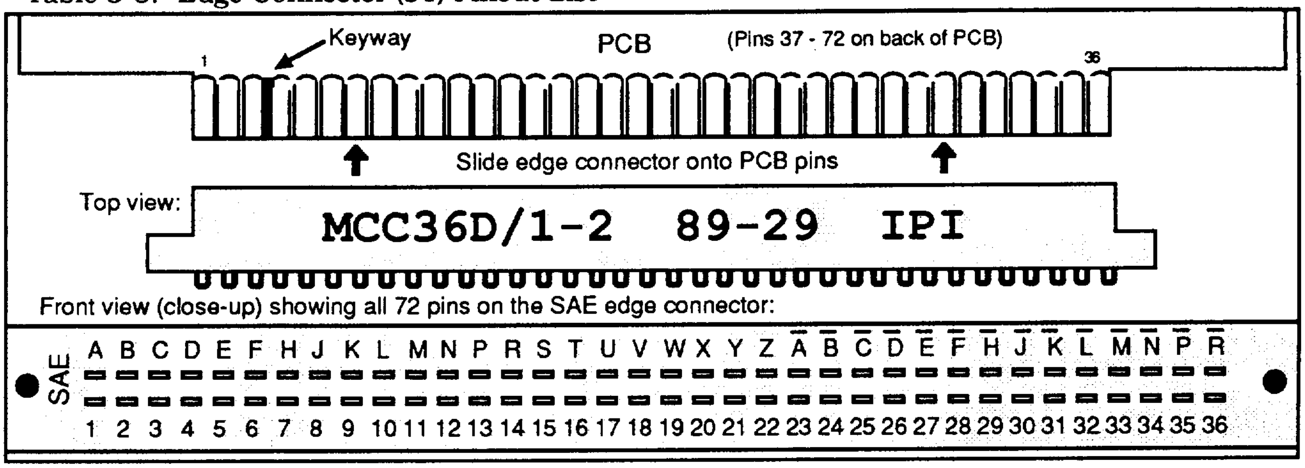


Figure 3-2. 72-Pin SAE Edge Connector

CAUTION

Use the SAE edge connector for all remote connections. Soldering directly to the indexer board voids the warranty.

Drive Signal Connections

Drives are of two general types: those accepting TTL step and direction inputs, and those using an open-collector CW step line and CCW step line.

The step output provides a TTL-level active-high pulse capable of sourcing up to 60mA. The Direction line is a TTL level: ***CW*** = Logic 1 and ***CCW*** = Logic Ø. For both step and direction, Logic 1 sources a maximum of 60mA.

The CW Step and CCW Step outputs are open collectors, capable of sinking up to 300mA at up to 40V (referenced to GND).

> **CAUTION**
>
> **Check that the electrical specifications of the Model 150 and the drive are compatible. Compumotor cannot be responsible for damage due to mismatched components.**

Refer to the information supplied with the drive you intend to use and make the connections outlined in Table 3-4. Refer to Figure 3-3 for edge connections on the Model 150.

Input Type	Signal	J1 Pin #	SAE Pin
TTL Step and Direction Inputs	Step	4	D
	Direction	5	E
	GND (Step Return)	40	4
	GND (Direction Return)	41	5
CW Step and CCW Step (Open-collector)	CW Step	44	8
	CCW Step	45	9

Table 3-4. Edge Connector Pinouts for Drive Connections

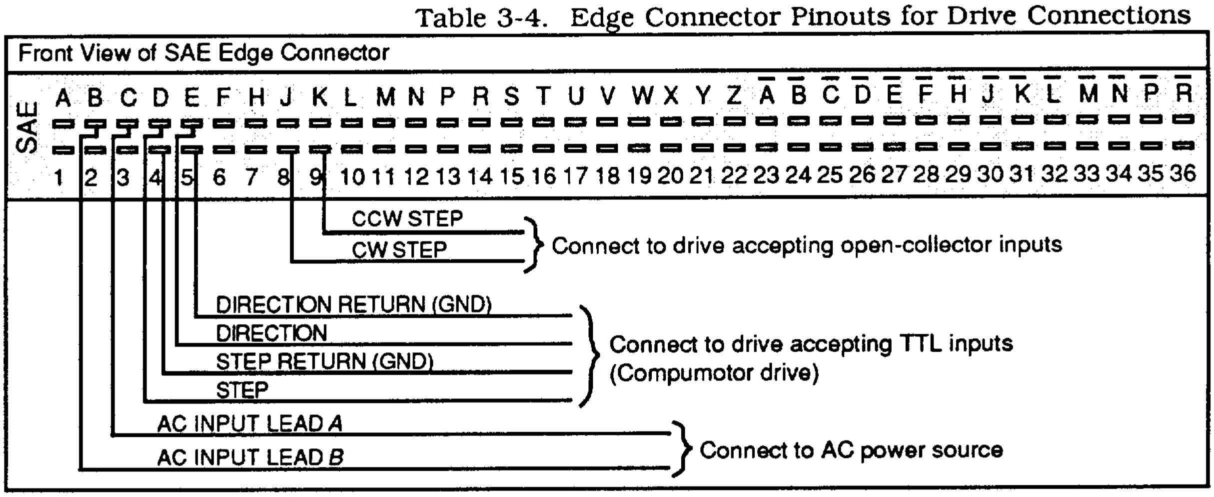


Figure 3-3. Drive and AC Edge Connections

AC Power Connections

As an alternative to using connector J2, you may apply the 9 - 12VAC powerfrom the supplied transformer on J1 Pin #2 (**SAE B**) and J1 Pin #3 (**SAE C**). Refer to Figure 3-3 for edge connections on the Model 150. If you do not use the supplied transformer, you may apply 9 - 12VAC to these pins for on-board regulation referenced to indexer GND, J1 pins #1 and #37 (**SAE A** and **1**).

The Model 150 can be modified to accept DC input voltage. Modification instructions are provided in *Chapter 5, Hardware Reference.*

Remote Command Input Connections

You can perform the following command input functions via the Model 150's edge connector (J1):

- Start
- Stop
- CW and CCW Limits
- Mode (Preset/Continuous)
- Direction
- Reset

All command inputs have *pull-up* resistors (1kΩ) and require grounding to change their status. This may be accomplished with standard TTL outputs, switches, relays, open-collector outputs or open-collector transistors rated at 5mA or more. Refer to Figure 3-4 for edge connections.

Start, stop, reset, and CW and CCW limits inputs require a minimum pulse width of 100 μs for recognition. The CW and CCW limits must be held low for 2 ms to be reliably received. Mode and direction inputs must be stable for 2 ms following a start command.

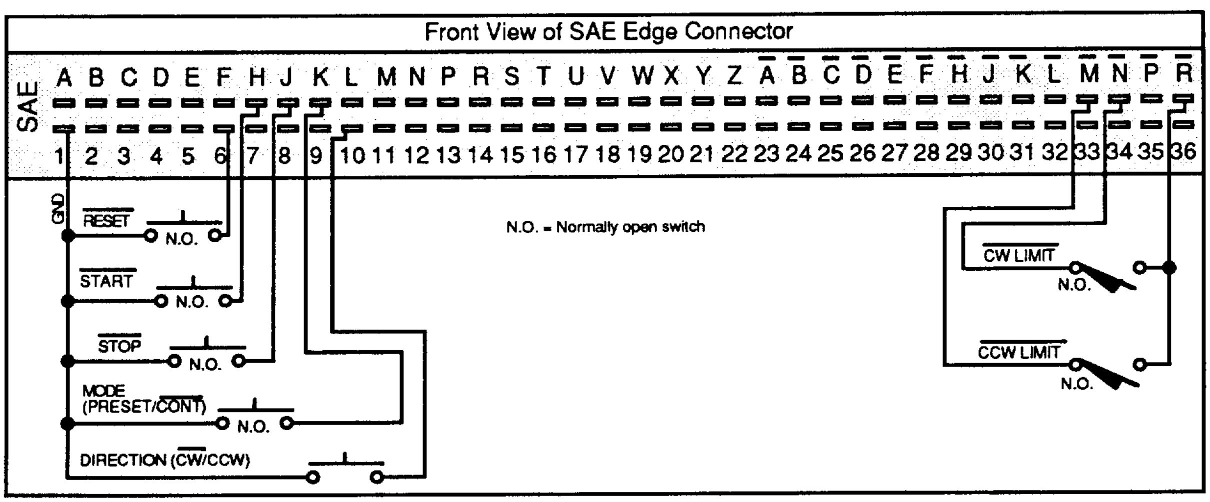


Figure 3-4. Remote Command Input Edge Connections

Start

As an alternative to using the on-board start switch, the start command may be generated by grounding J1 Pin #7 (**SAE H**). Refer to Figure 3-4 for remote connections.

This TTL active-low level input initiates a preprogrammed move on the falling edge. The indexer reads the acceleration, velocity, and position thumbwheels and jumpers within the 2 ms start signal. Depending on the number of changes to the thumbwheels and jumpers, there is a delay of 1 to 40 ms between closing the start switch and motor motion. Delay times are given in *Chapter 5, Hardware Reference*. If the acceleration or velocity thumbwheels are set to zero, no move will occur, either in the preset or continuous mode. If the position thumbwheels are set to zero in the preset Mode, no move will occur.

Stop

As an alternative to using the on-board stop switch, the stop command may be generated by grounding J1 Pin #8 (**SAE J**). Refer to Figure 3-4 for remote connections.

This TTL active-low level input initiates preprogrammed deceleration on the falling edge of the signal. The rate of deceleration is determined exclusively by the acceleration data present when the last start command was received. You can decelerate at a different rate only in the continuous mode by setting the velocity thumbwheels to zero (**0000**), setting the desired deceleration rate with the acceleration thumbwheels (**nn**), and initiating a start (press the **START** switch).

You can preload a move and begin motion without the 40-ms delay by using the **LOAD & GO** function. To initiate this function, you must perform the following steps:

1. All of the parameters should already be set on the thumbwheels or via BCD inputs.

2. Press the **START** and **STOP** switches simultaneously.

No move will be made, but subsequent start signals with unchanged data will initiate the moves with less than a 1-ms delay.

CW and CCW Limits

These two TTL active-low inputs function as extreme travel limits. A low-going edge on either of these inputs will immediately stop pulse generation and terminate the move that is in progress. If either line remains low, the indexer will only accept moves in the direction opposite to the original direction of travel. This remains true until the limit is cleared (i.e., until the limit input goes high). The CW Limit is J1 Pin #34 (**SAE $\overline{N}$**) and the CCW Limit is J1 Pin #33 (**SAE $\overline{M}$**). Use either J1 Pin #36 (**SAE $\overline{R}$**) or J1 Pin #72 (**SAE 36**) as the limit return.

These limit switches should be located ***before*** the physical end-of-travel to allow for the deceleration time of the motor and load. Figure 3-5 illustrates two types of limit switches (mechanical and proximity) that may be installed.

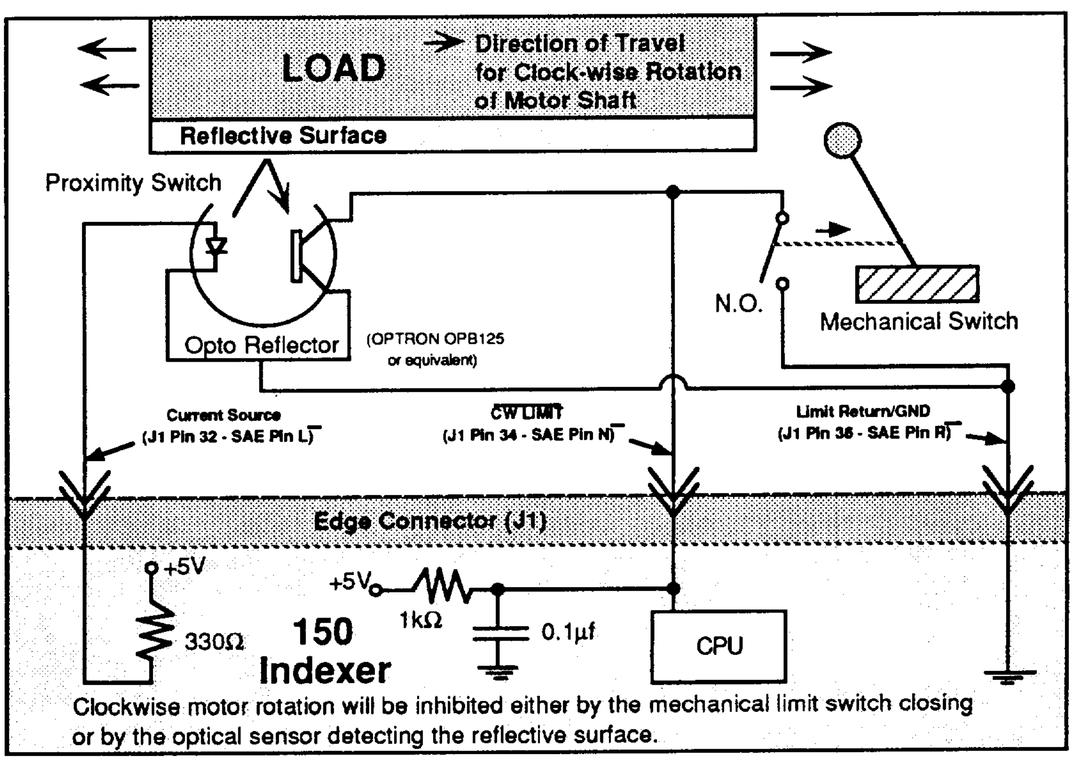


Figure 3-5. Mechanical and Proximity Limit Switches

Mode Selection

As an alternative to using the on-board **PRESET/CONT** switch, you can wire a remote switch using J1 Pin #9 (**SAE K**). This input is paralleled by the **PRESET/CONT** switch and selects moves that are either *preset* (move a distance X and stop) or *continuous* (accelerate to a constant velocity and continue until stopped). ***The PRESET/CONT switch must be set to PRESET for external control.*** This input is read by the indexer only when the start command is received and only if the motor is stopped at the time. In continuous mode, the position data lines are ignored, and a stop signal is required to initiate deceleration. The mode will be **PRESET** unless this line is grounded or the mode switch is set to **CONT**. Refer to Figure 3-4 for edge connections.

Direction

This input determines the direction of rotation of the motor shaft. It is acknowledged only if the motor is stationary when the start command is received. It is read by the indexer as a data input, although it is electrically configured like other command inputs. The indexer will ignore changes on the direction input line before motor movement has stopped. If the activation of a limit input has caused a stop, the direction input must be reversed to back away from the limit. When J1 Pin #46 (**SAE #10**) is low, CW rotation (+) is commanded. Holding this line high commands a CCW rotation (-). **The direction thumbwheel must be set to CCW rotation (-) for external control.** Refer to Figure 3-4 for edge connections.

Reset

This TTL active-low level input will immediately discontinue the step output signal going to the drive. All counters are reset and the position data is lost. Reset is on J1 Pin #42 (**SAE #6**). **Do not use this function to stop the motor because no controlled deceleration of the load is provided. At high speeds and inertias, the momentum of the load may force the motor to *freewheel*, even after the step pulses have ceased.** Refer to Figure 3-4 for edge connections.

Remote BCD Data Input Connections

Each of the thumbwheel switches are connected in parallel with the edge connector (J1). Refer to Table 3-3 for pinouts. External data input signals may conflict with thumbwheel data. Therefore, you should set the BCD-associated thumbwheels to zero to avoid conflicts. The codes of digits 0 - 9 are shown in Table 3-5. Refer to Figure 3-6 for edge connections.

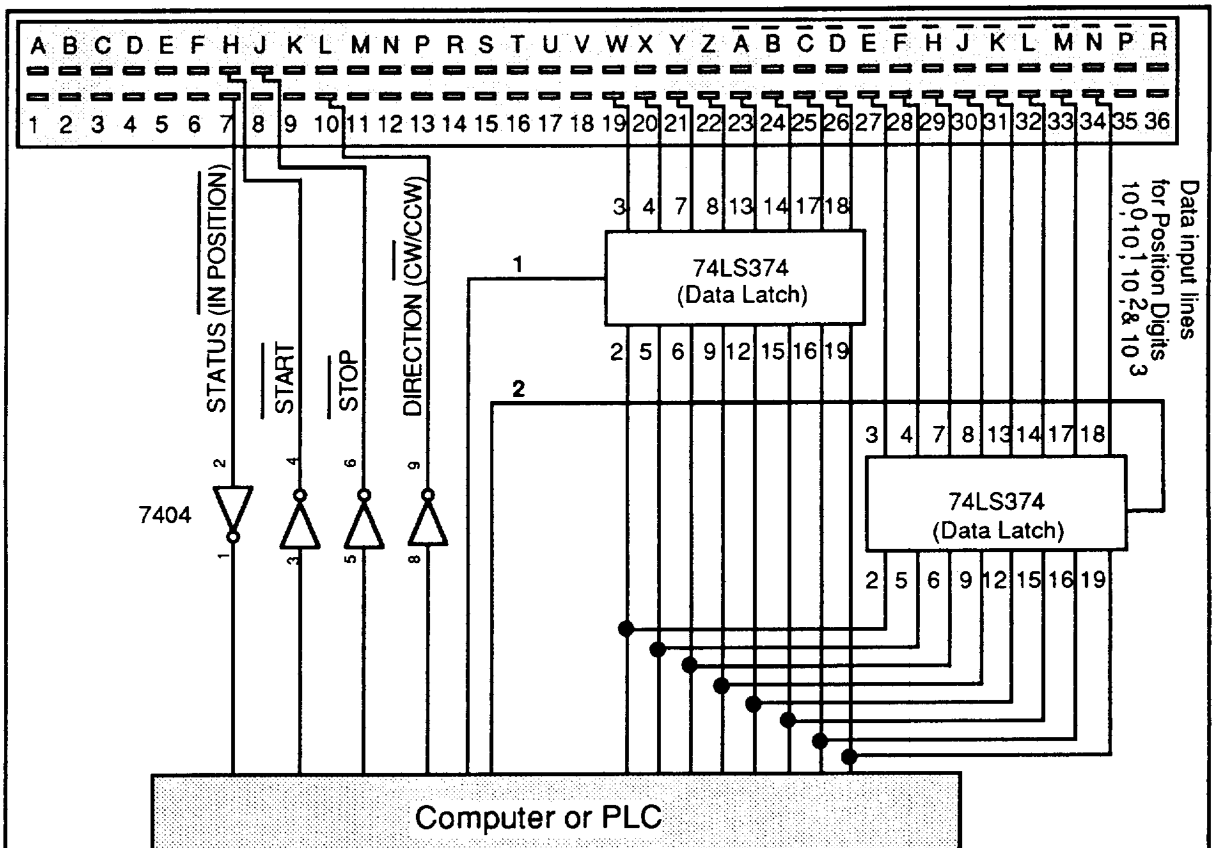
	BCD Data Lines			
Digit	8	4	2	1
0	Low	Low	Low	Low
1	Low	Low	Low	High
2	Low	Low	High	Low
3	Low	Low	High	High
4	Low	High	Low	Low
5	Low	High	Low	High
6	Low	High	High	Low
7	Low	High	High	High
8	High	Low	Low	Low
9	High	Low	Low	High

Other combinations of 1, 2, 4, and 8 (above digit 9) are undefined in the BCD format.

Table 3-5. BCD Data Pinouts

All data inputs have *pull-down* resistors (4.7kΩ) and require switch closures to +5VDC (nominal 1mA) to yield Logic 1. These inputs may be driven by buffered TTL outputs, switches, relays, or open emitter transistors. In practice, standard TTL outputs will drive the inputs. However, for reliable signal transmission over moderate to long cable lengths, buffered outputs using the 74LS367 or similar data latching devices are recommended (see example in Figure 3-6).

Data inputs must be held constant for 2 ms following a start command. If the source computer cannot hold this data for that period, you may need to add data-latching circuitry to the interface (refer to Figure 3-6).



Computer I/O Lines 1 and 2 are used to clock position data from the Data Bus into the Data Latches. This particular configuration provides 1-step resolution with a range of 1 to 9999 steps.

Figure 3-6. BCD Data Line Connection Example (Including Data Latching Circuitry)

System Mounting

To mount the Model 150, replace the four existing plastic PCB standoffs with your own 4-40 screws. The screws must be at least 1/2" long to reach the mounting surface. **Be sure to use the standoffs from the ship kit to separate the PCB from the protective back plate** (see Figure 3-7). Compumotor recommends that you mount the Model 150 indexer in a NEMA enclosure to protect it from electrical noise.

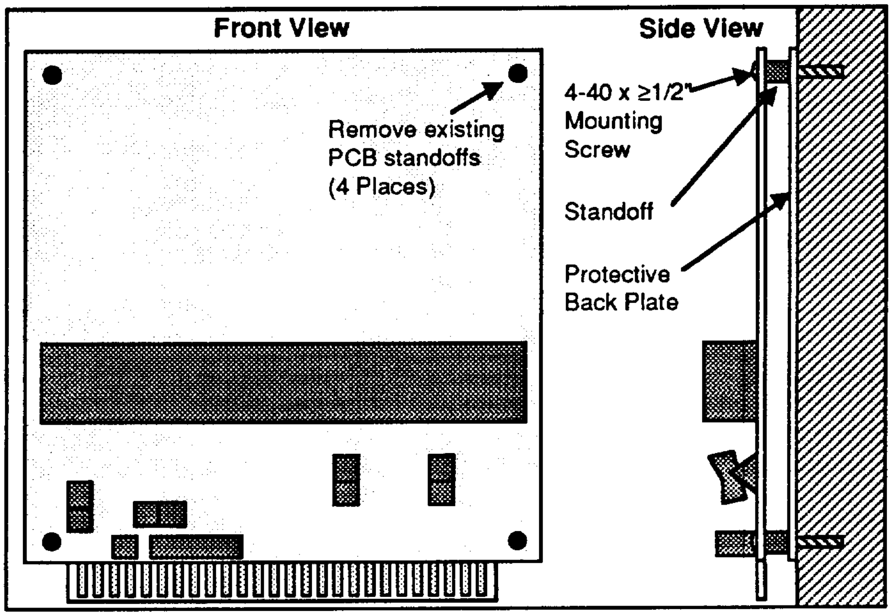


Figure 3-7. Indexer Mounting Diagram

Testing For Proper Installation and Operation

This section will help you test your system to confirm proper connection and operation of the indexer, limits, translator, motor, and associated mechanism. If the motor used for testing is connected to a limited-travel mechanism, be sure to connect both CW and CCW limit switches before initiating any tests. The following test procedure assumes the use of limit switches.

1. Set the thumbwheel switches to the following parameters (see Figure 3-8 for thumbwheel illustration):
   - Move the PRESET/CONT switch to **PRESET**
   - ACCEL/DECEL to **10**
   - VELOCITY to **0010**
   - DIRECTION to **+**
   - POSITION to **012500** (or a value equal to 1/2 of a complete motor revolution)

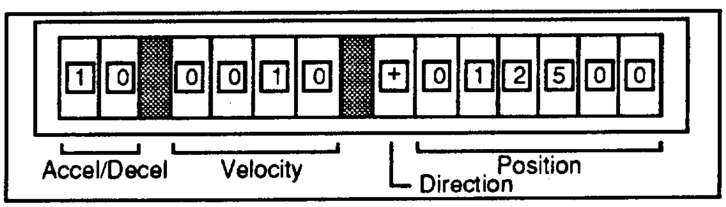


Figure 3-8. Thumbwheel Switches

2. Press **START**.
3. The motor shaft should move CW when viewed from the flange end of the motor. Note the direction in which the mechanism moves. If the mechanism is of the limited travel variety, check that the load moves toward the CW limit. The definition of (+) and (-) direction is arbitrary. You may want to rewire the indexer/translator connections to obtain the proper direction sense for your application. **It is very important that the limit switches be changed accordingly.**
4. Change DIRECTION to -. Press **START** again and confirm that the motor and mechanism actually reverse direction and that the proper limit switch is being approached.
5. Change PRESET/CONT to **CONT**. Press **START** and let the mechanism **slowly** approach one of the limit switches. Press **STOP** if the limit switch fails to stop the move.
6. Confirm proper operation of the opposite limit switch by changing direction and pressing **START**.

After you complete these tests, perform a variety of acceleration, velocity, and position commands. At the end of each preset move, the Status Output on J1 Pin #43 (**SAE 7**) should go low. When the motor reaches constant velocity in the Continuous mode, the Status Output should go low. This indicates that you can program a new acceleration and velocity.

Chapter 4. APPLICATION DESIGN

Chapter Objectives

The information in this chapter will enable you to the following:

- Recognize and understand important considerations that must be addressed before you implement your application
- Understand the features of the optional software PROMs

Application Considerations

Successful application of a rotary indexer system requires careful consideration of the following important factors:

- Move profiles
- Mechanical resonance
- Ringing or overshoot
- Move times (calculated vs. actual)
- Positional accuracy and repeatability

Move Profiles

A move or motion profile represents the velocity of the motor during a period of time in which the motor changes position. The type of motion profile that you need depends upon the motion control requirement that you specify. The basic types of motion profiles are described below.

Triangular and Trapezoidal Profiles

For constant acceleration indexing systems, velocity, acceleration, and distance parameters are defined before the system can execute a preset move. The value of these parameters determines the type of motion profile as either triangular or trapezoidal. A triangular profile results when the velocity and acceleration are set such that the defined velocity is not attained before the motor travels half of the specified distance. This results from either a relatively low acceleration, a relatively high velocity, or both. For example, if the acceleration is set to 1 revs/sec/sec (rps^2), velocity is set to 18 revs/sec (rps), and distance is set to 2,500 steps (with a resolution of 25,000 steps/rev), a triangular motion profile is the result. By the time the motor travels half of the defined distance based on the acceleration setting of 1 rps^2, the motor begins decelerating to complete the move. The motion profile for this move is shown in Figure 4-1.

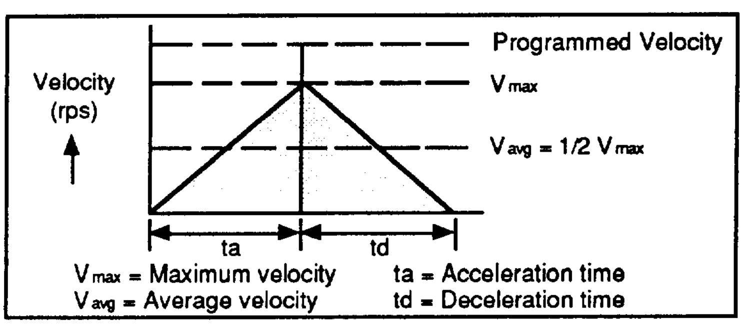


Figure 4-1. Triangular Profile

A trapezoidal move profile results when the defined velocity is attained before the motor has moved half of the specified distance. A trapezoidal move may occur if you specify a low velocity with a high acceleration or a long distance. The resulting motion profile will resemble the profile shown in Figure 4-2.

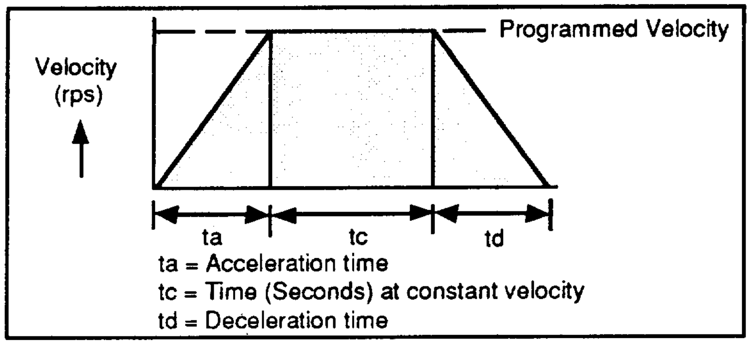


Figure 4-2. Trapezoidal Profile

Mechanical Resonance

Resonance, a characteristic of all stepper motors, can cause the motor to stall at low speeds. Resonance occurs at speeds that approach the natural frequency of the motor's rotor and the first and second harmonics of those speeds. It causes the motor to vibrate at these speeds. The speed at which fundamental resonance occurs is typically between 0.3 and 1.0 revs per second with small motors having higher resonance frequencies than large motors.

Most full-step motor controllers jump the motor to a set minimum starting speed to avoid this resonance region. This causes poor performance below one rev per second. In nearly all cases, using a micro-stepping drive will overcome these problems.

Motors that will not accelerate past one rev per second may be stalling due to resonance. The resonance point may be lowered to some extent by adding inertia to the motor shaft. This may be accomplished by putting a drill chuck on the back shaft. *This technique is applicable only to double-shaft motors with the shaft extending from both ends of the motor.* In extreme cases, you may also need a viscous damper to balance the load. One of the manufacturers of viscous dampers is listed below:

Ferrofluidics Corporation
40 Simon Street
Nashua, NH 03061
(603) 883-9800

Changing the velocity setting and acceleration setting may also help a resonance problem.

Ringing or Overshoot

The motor's springiness, along with its mass, form an underdamped resonant system that *rings* in response to acceleration transients (such as at the end of a move). Ringing at the end of a move prolongs settling time. *Overshoot* occurs when the motor rotates beyond the actual final position. The actual settling time of a system depends on the motor's stiffness, the mass of the load, and any frictional forces that may be present. By adding a little friction, you can decrease the motor's settling time.

Move Times: Calculated vs. Actual

You can calculate the time required to complete a move by using the acceleration, velocity, and distance values that you define with the thumbwheel settings. However, you should not assume that the values that you use will constitute the actual move time.

You should expect some time to elapse for the motor and the load to settle. Also, when you change the thumbwheel or jumper settings, there will be a slightly increased delay time between pressing the **START** switch and motor movement. Refer to Table 4-1 for the delay times.

Changed Thumbwheels and Jumpers	Delay
No New Data	1 ms
New Position Only	2 - 8 ms
New Acceleration Only	10 - 20 ms
New Velocity Only	20 - 30 ms
New Velocity and Acceleration	20 - 30 ms
All New Data	30 - 40 ms

Table 4-1. Move Delay Times

Positional Accuracy vs. Repeatability

In positioning systems, some applications require high absolute accuracy. Others require repeatability. You should clearly define and distinguish these two concepts when you address the issue of system performance.

If the positioning system is taken to a fixed place and the coordinates of that point are recorded, the only concern is how well the system repeats when you command it to go back to the same point. For many systems, what is meant by accuracy is really repeatability. Repeatability measures how accurately you can repeat moves to the same position.

Accuracy, on the other hand, is the error in finding a random position. For example, suppose the job is to measure the size of an object. The size of the object is determined by moving the positioning system to a point on the object and using the move distance required to get there as the measurement value. In this situation, basic system accuracy is important. The system accuracy must be better than the tolerance on the measurement that is desired.

For more information on accuracy and repeatability, consult the technical data section of the *Compumotor Programmable Motion Control Catalog.*

Using Optional PROMs

There are several special functionPROMs available for the Model 150. Acceleration, velocity, and resolution ranges and positioning increments for all optional PROMs are provided in Table 4-2. Some of the optional PROMs listed in Table 4-2 are not discussed below because the only feature they offer is different acceleration, velocity, and resolution ranges and/or different positioning increments (steps vs. revolutions).

To order an optional PROM, contact an Applications Engineer at (800) 358-9070.

Model Number	Software P/N	Normal Motor Res. (steps/rev)	High Motor Resolution	High Velocity Range (rps)	Low Velocity Range (rps)	Position Setting to move 1 Rev***	Position Increments
150-R17	92-3083*	25K -------	------- 50K	00.01 - 19.99** 00.01 - 10.00**	0.001 - 1.999** 0.001 - 1.999**	025000 050000	Steps "
--------	92-3622*	25K -------	------- 50K	00.01 - 19.99 00.01 - 10.00	0.001 - 1.999 0.001 - 1.999	001000 "	Revs "
--------	92-3623*	25K -------	------- 50K	00.01 - 19.99 00.01 - 10.00	0.001 - 1.999 0.001 - 1.999	025000 050000	Steps "
150-REG	92-3651*$	25K	-------	00.01 - 19.99	0.001 - 1.999	001000	Revs
150-R16	92-4950	10K -------	------- 20K	000.1 - 050.0 000.1 - 025.0	0.001 - 1.999 0.001 - 1.999	010000 020000	Steps "
150-R6/R9	92-4952	10K -------	------- 20K	000.1 - 050.0 000.1 - 025.0	0.001 - 1.999 0.001 - 1.999	001000 "	Revs "
150-R15	92-4954	12.5K -------	------- 25K	000.1 - 040.0 00.01 - 19.99	0.001 - 1.999 0.001 - 1.999	012500 025000	Steps "
150-R7	92-4956	12.5K -------	------- 25K	000.1 - 040.0 00.01 - 19.99	0.001 - 1.999 0.001 - 1.999	001000 "	Revs "

* A functional description of this PROM is provided in this chapter.
** Velocity settings for the Low Speed PROM (150-R17) are in increments of revs/hour.
*** These position settings are accurate only if the drive resolution matches the indexer resolution.
$ The Registration PROM (150-REG) is available at an additional cost.

Table 4-2. Velocity, Resolution, and Positioning Parameters for Optional PROMs

Registration Option
(MODEL 150-REG)

The registration software PROM allows you to run a motor continuously, stopping when the motor shaft or attached mechanism encounters a registration mark. *This PROM is available at an additional cost.*

The Model 150 functions as a normal Model 150 if the mode switch is to the **PRESET** position. To enable the special registration function, switch the mode switch to **CONT** and press the start switch. The indexer will run at the thumbwheel velocity until the registration trigger signal is received on the CCW limit input. The indexer then uses the thumbwheel position setting to stop at the set distance from the registration mark.

Since the CCW limit is used as the registration trigger, you must use the CW limit for both CCW and CW limit structures. Therefore, if a limit is reached, the load must be manually positioned away from the limit to resume motion.

During the constant velocity portion of the move, all start, stop, and limit inputs are ignored.

After encountering the registration mark, the indexer response time ranges from 500 μs to 1 ms.

If jumper JU4 is not installed, the move after encountering the registration mark continues at the thumbwheel velocity until it decelerates to a stop. If JU4 is installed, the indexer increases the velocity to finish the move in the shortest possible time span.

Low Speed Option
(MODEL 150-R17)

For all other PROMs, the lowest possible acceleration is 0.1 revs/sec^2 (jumper JU2 installed). The low speed PROM allows you to **accelerate as low as 0.1 revs/hour/sec**.

For all other PROMs, the lowest possible velocity is 0.001 revs/sec. The low speed PROM allows you to run the motor at a **velocity as low as 0.001 revs/hour**.

Multiplexed Data Option
(p/n 92-003622 & 92-003623)

The function is this software is to disable the thumbwheels and allow data to be input via a *pseudo* 16-bit data bus. Data input via this data bus is acceleration, velocity, position, direction, and mode. The thumbwheels are no longer used and must be set to zero (direction to minus) for proper operation. The jumper functions and acceleration, velocity, and resolution ranges are the same as for the standard Model 150.

The 16-bit data bus is an input bus only (with respect to the indexer). The indexer writes no data to the bus, it only reads data written to the bus by an external device. That device in this case is intended to be a TI-550 Programmable Controller.

There are four strobes associated with the data bus to identify the dat being transmitted. These strobes are named STRBØ STRB1, STRB2, and STRB3. A strobe is active high and inactive low. For BCD digits, 1 = TTL high and Ø = TTL low. Strobes are expected to be approximately 800 μs in length. If more than one strobe is active at the same time, the lower number strobe will be used as the identifier. On the average, the indexer samples for a strobe every 275 μs. The longest time between samples for the strobes is approximately 470 μs.

The only time you cannot enter data into the Model 150 is immediately following the start signal. The worst-case wait period is 33 ms. This delay is determined by the size of the move parameters and whether or not the parameters have changed since the last move.

The only difference between the two multiplexed data PROMs is that PROM 92-003622 positions the moves in increments of revolutions, and PROM 92-003623 positions the moves in increments of steps.

Chapter 5. HARDWARE REFERENCE

Chapter Objectives

This chapter is designed to function as a quick-reference tool for the following information:

- System specifications (dimensions and performance)
- Jumper settings
- I/O connections and specifications

Specifications

Parameter	Value
Performance	
Stepping Accuracy	±0 steps from preset total
Velocity Accuracy	±0.02% of maximum rate above 0.01 revs/sec
Velocity Repeatability	±0.02% of maximum rate
Power Input	
AC Wall Transformer (supplied)	9 - 12VAC, 400mA (with 115VAC, 60 Hz input from wall outlet)
User-supplied to SAE Connector	9 - 12VAC, 50 - 400 Hz, 400mA (can be modified for 5VDC input - see page 30)
Inputs	
Control Inputs:	
Start, Stop, CW Limit, CCW Limit, & Reset	TTL-compatible Active Low pulse inputs with 1kΩ pull-up active low requiring nominal 5mA closure to ground. Minimum Logic 0 input current = 4.25mA Maximum Logic 0 input voltage = +0.75VDC Minimum pulse width: 100 µs for Start, Stop, and Reset 2 ms for CW limit and CCW limit
Direction & Preset/Cont. Mode	TTL-compatible DC inputs have the electrical specifications shown above. Minimum DC signal duration is 10 ms following **START**. Direction is CW (+) for Logic 0, CCW (-) for Logic 1. Mode is continuous for Logic 0, preset for Logic 1.
BCD Data Inputs:	45 lines parallel BCD data have 4.7kΩ input impedance. Each requires nominal 1mA in at 5VDC for Logic 1. Minimum Logic 1 input current = 1mA Minimum Logic 1 input voltage = 2VDC Minimum data duration = 10 ms following **START**
Position	6 BCD decades (24 lines) Range: 0.001 to 999.999 revolutions or 1 to 999999 steps (152)
Velocity	3-1/2 decades; 0.01 to 19.99 rps
Acceleration	2 BCD decades (8 lines) Range: 1 to 99 rps^2 (No Jumpers installed) 0.1 to 9.9 rps^2 (Jumper JU1 installed) 10 to 990 rps^2 (Jumper JU2 installed)
Outputs	
Step	Nominal 1 ms wide pulses at 5VDC. Frequency range = 250 Hz to 499.75 kHz for 25,000 steps/rev resolution
Direction	Nominal 5VDC out for CW rotation (CW = Logic 1) ØV for CCW (CCW = Logic 0)
CW and CCW Step	Maximum Logic 1 (CW)output current = 120mA Maximum Logic 0 (CCW) output current = -0.90mA
Status	Maximum Logic 1 output current = 2mA (indicates busy) Minimum Logic 1 output voltage = 2.4VDC Maximum Logic 0 output current = 1.7mA (indicates ready for command)
Environmental	
Operating	Temperature: 32°F to 122°F (0°C to 50°C); Humidity: 10 to 95% (non-condensing)
Storage	-22°F to 185°F (-30°C to 85°C)

Table 5-1. Model 150 Specifications

Connector Summary and Pinouts

Figures 5-1 is a pinout drawing of connectors J2 and J3. Figure 5-2 illustrates the SAE edge connector and how it attaches to the edge connector (J1) on the Model 150 (see Table 5-3 for pinouts).

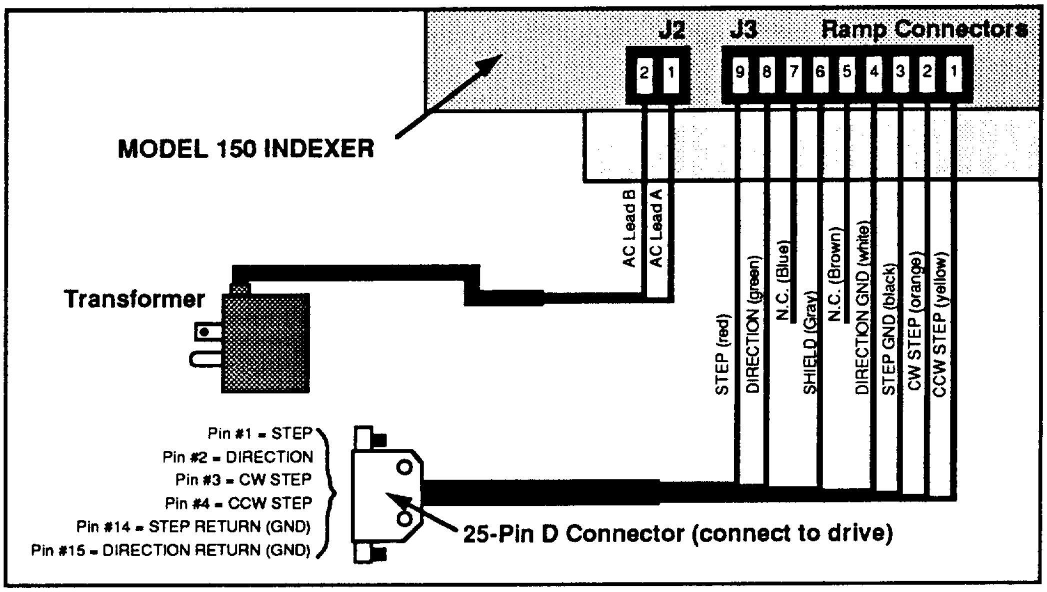


Figure 5-1. Power Connector (J2) and Drive Connector (J3) Pinouts

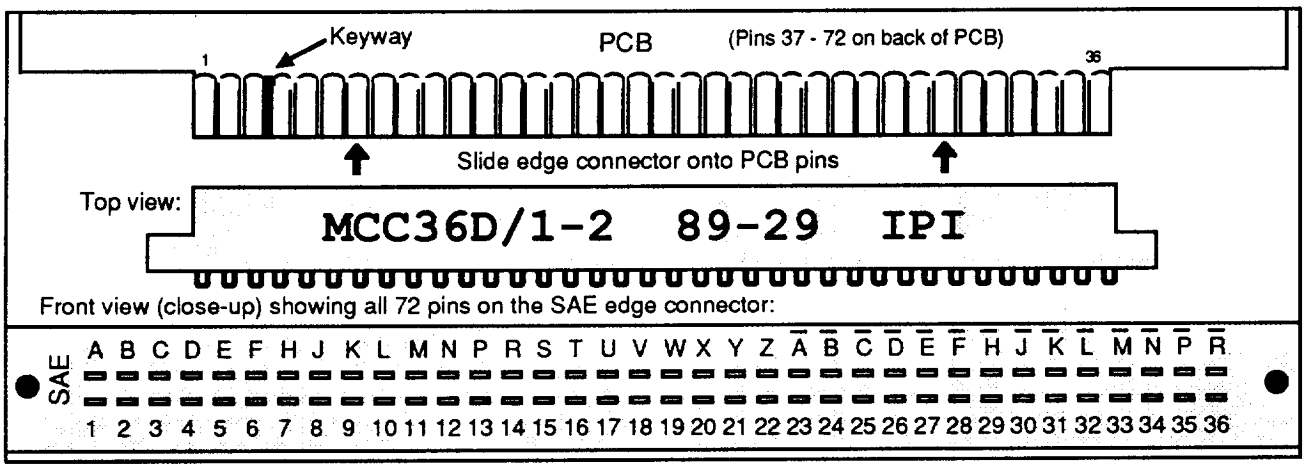


Figure 5-2. SAE Edge Connector

PCB Pin	SAE Pin	Signal	Input/ Output	PCB Pin	SAE Pin	Signal	Input/ Output
1	A	GND	I	37	1	GND	I
2	B	Transformer Lead *A*	I	38	2	Transformer Lead *A*	I
3	C	Transformer Lead *B*	I	39	3	Transformer Lead *B*	I
4	D	TTL STEP	O	40	4	STEP GND (STEP Return)	I
5	E	TTL DIRECTION	O	41	5	DIRECTION GND (DIR. Return)	I
6	F	N.C.	----	42	6	$\overline{\text{RESET}}$	I
7	H	Remote $\overline{\text{START}}$	I	43	7	STATUS (MOVING/$\overline{\text{NOT MOVING}}$)	O
8	J	Remote $\overline{\text{STOP}}$	I	44	8	$\overline{\text{CW STEP}}$ (Open Collector)	O
9	K	PRESET/$\overline{\text{CONT}}$ Mode	I	45	9	$\overline{\text{CCW STEP}}$ (Open Collector)	O
10	L	1 Velocity Digit n _ _ _	I	46	10	DIRECTION ($\overline{\text{CW}}$/CCW)	I
11	M	8	I	47	11	8	I
12	N	4 Velocity		48	12	4 Position	
13	P	2 Digit _ n _ _		49	13	2 10^5 Digit	
14	R	1		50	14	1	
15	S	8	I	51	15	8	I
16	T	4 Velocity		52	16	4 Position	
17	U	2 Digit _ _ n _		53	17	2 10^4 Digit	
18	V	1		54	18	1	
19	W	8	I	55	19	8	I
20	X	4 Velocity		56	20	4 Position	
21	Y	2 Digit _ _ _ n		57	21	2 10^3 Digit	
22	Z	1		58	22	1	
23	$\overline{\text{A}}$	8	I	59	23	8	I
24	$\overline{\text{B}}$	4 Accel/Decel		60	24	4 Position	
25	$\overline{\text{C}}$	2 Digit n _		61	25	2 10^2 Digit	
26	$\overline{\text{D}}$	1		62	26	1	
27	$\overline{\text{E}}$	8	I	63	27	8	I
28	$\overline{\text{F}}$	4 Accel/Decel		64	28	4 Position	
29	$\overline{\text{H}}$	2 Digit _ n		65	29	2 10^1 Digit	
30	$\overline{\text{J}}$	1		66	30	1	
31	$\overline{\text{K}}$	Current Source (300Ω to +5V)	O	67	31	8	I
				68	32	4 Position	
				69	33	2 10^0 Digit	
				70	34	1	
32	$\overline{\text{L}}$	Cur Src (300Ω to +5V)	O	71	35	N.C.	I
33	$\overline{\text{M}}$	$\overline{\text{CCW LIMIT}}$	I	72	36	Limit Switch Return (GND)	I
34	$\overline{\text{N}}$	$\overline{\text{CW LIMIT}}$	I				
35	$\overline{\text{P}}$	N.C.	----				
36	$\overline{\text{R}}$	Limit Switch Return	I				

The SAE connector is a 72-Pin (Dual 36) 0.156 PC edge connector with Polarizing Slot (SAE P/N AC 36D/1-2)
N.C. = No Connection; GND = Common DC Ground

Table 5-2. SAE Edge Connector (J1) Pinout List

Jumper Settings

Use the indexer jumpers to select the acceleration range, velocity range, and resolution. Refer to Table 5-3 for the functions of the pins. Table 5-4 contains the selectable velocity range values and resolutions. The jumper pins are located about 1-1/2 inches above the thumbwheel switches on the right edge of the indexer PCB (see Figure 5-3). The Model 150 is shipped to you with no jumpers installed on the pins (i.e., all the pins are OFF). *To recognize a change in the JU4 configuration, you must cycle power to the 150.*

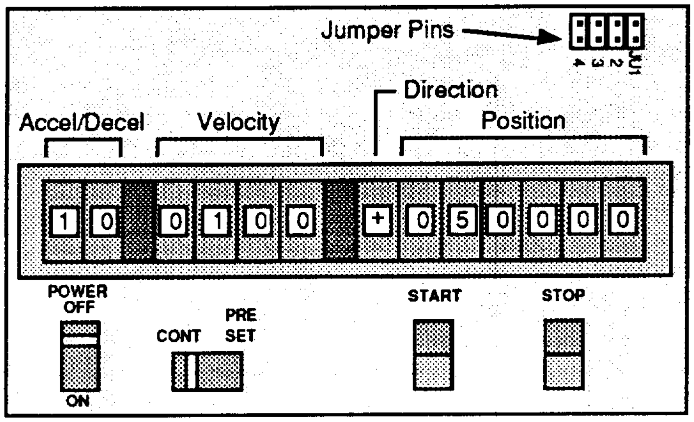


Figure 5-3. Thumbwheels, Switches, and Jumpers

Function	JU1	JU2	JU3	JU4
Normal acceleration, 1 to 99 rps^2	OFF	OFF	-----	-----
High acceleration, 10 to 990 rps^2	OFF	ON	-----	-----
Low acceleration, 0.1 to 9.9 rps^2	ON	OFF	-----	-----
High velocity range	-----	-----	OFF*	-----
Low velocity range	-----	-----	ON*	-----
Normal motor resolution	-----	-----	-----	OFF
High motor resolution	-----	-----	-----	ON

* For 150-R1, the jumper setting is reversed (OFF = high range, ON = low).

Table 5-3. Jumper Settings

Model Number	Software P/N	Normal Motor Res. (steps/rev)	High Motor Resolution	High Velocity Range (rps)	Low Velocity Range (rps)	Position Setting for 1 Revolution*	Position Increments
150	92-2476	25K -------	------- 50K	00.01 - 19.99 00.01 - 10.00	0.001 - 1.999 0.001 - 1.999	001000 "	Revs "
150-R1/R2	92-1489	200 -------	------- 400	000.1 - 160.0 000.1 - 080.0	00.01 - 19.99 00.01 - 19.99	000200 000400	Steps "
150-R4	92-3246	1K	-------	000.1 - 100.0	00.01 - 10.00	001000	Revs
150-R5/R8	92-4948	4096 -------	------- 16,384	000.1 - 100.0 000.1 - 025.0	00.01 - 19.99 00.01 - 19.99	001000 "	Revs "
150-R11/R14	92-2477	25K -------	------- 50K	00.01 - 19.99 00.01 - 10.00	0.001 - 1.999 0.001 - 1.999	025000 050000	Steps "

* These position settings are accurate only if the drive and the indexer are at the same resolution.
NOTE: For 150-R4, installing JU4 multiplies the acceleration, velocity, and position thumbwheel settings by 10.
NOTE: The velocity range is dependent on the resolution.

Table 5-4. Velocity Range Values and Resolutions

Settings for Optional PROMs

Table 5-5 provides the resolutions and velocity ranges of the optional PROMs available for the Model 150.

Model Number	Software P/N	Normal Motor Res. (steps/rev)	High Motor Resolution	High Velocity Range (rps)	Low Velocity Range (rps)	Position Setting to move 1 Rev***	Position Increments
150-R17	92-3083*	25K -------	------- 50K	00.01 - 19.99** 00.01 - 10.00**	0.001 - 1.999** 0.001 - 1.999**	025000 050000	Steps "
--------	92-3622*	25K -------	------- 50K	00.01 - 19.99 00.01 - 10.00	0.001 - 1.999 0.001 - 1.999	001000 "	Revs "
--------	92-3623*	25K -------	------- 50K	00.01 - 19.99 00.01 - 10.00	0.001 - 1.999 0.001 - 1.999	025000 050000	Steps "
150-REG	92-3651*$	25K	-------	00.01 - 19.99	0.001 - 1.999	001000	Revs
150-R16	92-4950	10K -------	------- 20K	000.1 - 050.0 000.1 - 025.0	0.001 - 1.999 0.001 - 1.999	010000 020000	Steps "
150-R6/R9	92-4952	10K -------	------- 20K	000.1 - 050.0 000.1 - 025.0	0.001 - 1.999 0.001 - 1.999	001000 "	Revs "
150-R15	92-4954	12.5K -------	------- 25K	000.1 - 040.0 00.01 - 19.99	0.001 - 1.999 0.001 - 1.999	012500 025000	Steps "
150-R7	92-4956	12.5K -------	------- 25K	000.1 - 040.0 00.01 - 19.99	0.001 - 1.999 0.001 - 1.999	001000 "	Revs "

* Detailed descriptions of these PROMs are provided in Chapter 4, Application Design.
** Velocity settings for the Low Speed PROM (150-R17) are in increments of revs/hour.
*** These position settings are accurate only if the drive resolution matches the indexer resolution.
$ The Registration PROM (150-REG) is available at an additional cost.

Table 5-5. Velocity, Resolution, and Positioning Parameters for Optional PROMs

Dimensional Drawing

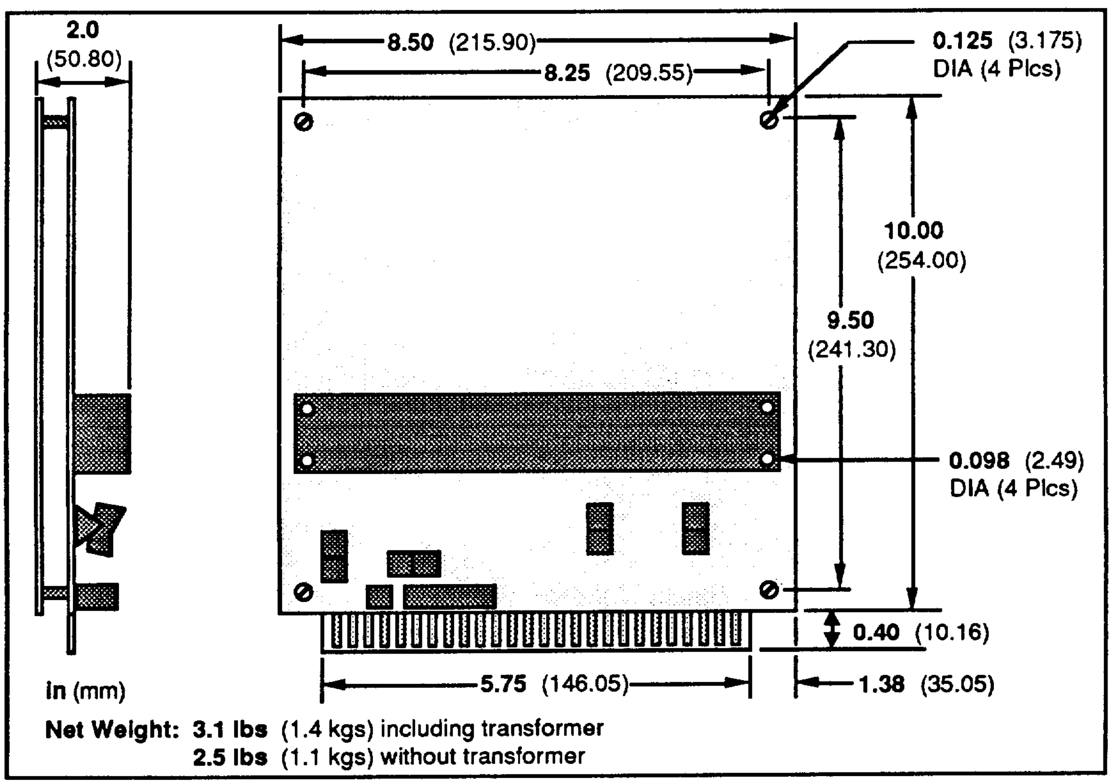


Figure 5-4. Model 150 Dimensional Drawing and Weight Specifications

Modification for 5VDC Input Power

Locate the two voltage regulators (Q1 and Q2) mounted to the heatsinks in the upper left-hand corner of the circuit board (see Figure 5-5). De-solder all three links to both Q1 and Q2 and remove the regulators. Prepare short, insulated jumpers and solder them in place between the two outside holes for each regulator.

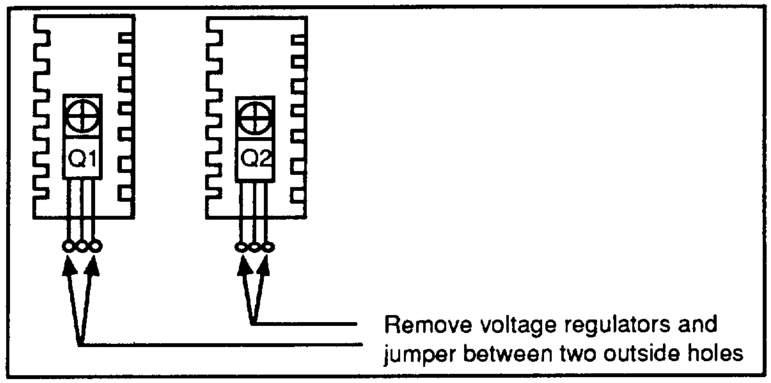


Figure 5-5. Location of Voltage Regulators

Remove the top and bottom diodes (CR1 and CR4) in the lower left-hand corner of the circuit board and replace them with insulated jumpers (see Figure 5-6). Connect the external 5VDC power supply's positive terminal to J1 pin #2 (**SAE B**) and connect the negative terminal (GND) to J1 pin #1 (**SAE A**).

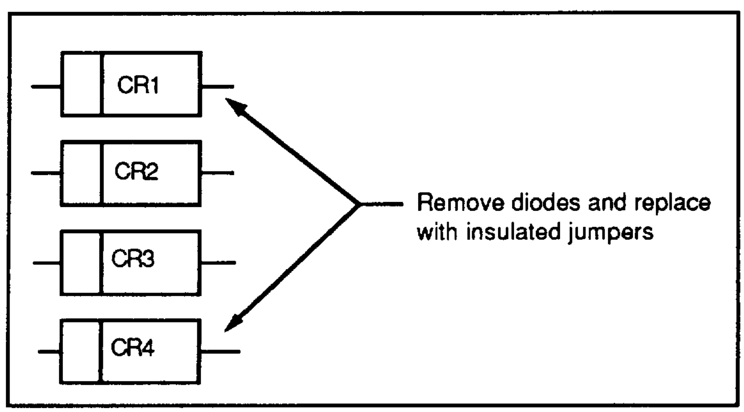


Figure 5-6. Location of diodes

Chapter 6. TROUBLESHOOTING

Chapter Objective

The information in this chapter is provided to help you to isolate and resolve system hardware problems .

Troubleshooting

This section discusses methods to identify, isolate, and resolve indexer-related problems that may occur.

Problem Isolation

When your system does not function properly (or as you expect it to operate), the first thing that you must do is identify and isolate the problem. When you accomplish this, you can effectively begin to resolve the problem.

Try to determine if the problem is mechanical, electrical, or software-related. *Can you repeat or re-create the problem?* Do not attempt to make quick rationalizations about problems. Random events may appear to be related, but they are not necessarily contributing factors to your problem. You must carefully investigate and decipher the events that occur before the subsequent system problem.

You may be experiencing more than one problem. You must solve one problem at a time. Log (document) all testing and problem isolation procedures. You may need to review and consult these notes later. This will also prevent you from duplicating your testing efforts.

Isolate each system component and ensure that each component functions properly when it is run independently. You may have to remove your system components and re-install them component-by-component to detect the problem. If you have additional components available, you may want to use them to replace existing components in your system to help identify the source of the problem.

WARNING

Make sure to remove power before disconnecting system components or changing wiring.

Once you have isolated the problem, take the necessary steps to resolve it. Refer to the problem solutions contained in this chapter. If your system's problem persists, contact Parker Compumotor's Applications Department at (800) 358-9070.

Motor Fails to Move

Test the motor to see if it has holding torque. If there is no holding torque, there are bad connections or bad cables. Power-down, disconnect the indexer-to-drive cable (at both ends), and use an ohm meter to monitor continuity between the connectors (refer to Chapter 5 for connector pinouts).

If the motor has holding torque and the shaft still fails to move, here are some probable causes:

- The indexer's limit switches have been tripped or are faulty. Make sure that your limit switches are open.
- The load is jammed. You should *hear* the drive attempting to move the motor. Remove power from the drive and verify that you can move the load manually away from the point of the jam.
- If you are using a Compumotor Plus drive, make sure its limit switches are disabled.

Motor Stalls

A motor stall during acceleration may be caused by one or more of the following factors:

- The torque requirements may be excessive
- The acceleration ramp may be too steep
- The motor supply is too low
- The load inertia and rotor inertia may be grossly mismatched. *The load inertia can be too high or too low*.

Lower acceleration may be required.

Motor Fails to Run at High Speeds

If the motor fails to run at high speeds, it is possible that the motor may not produce enough torque to move a given load at these velocities. Check the motor's torque/speed curves and make sure you are trying to run the motor in the proper range.

Another factor may be that the resolution is incorrect. **Remember: In order for the Model 150 to recognize that you have changed the motor resolution (by either installing or removing jumper JU14), you must cycle power.**

Reducing Electrical Noise

If you operate the Model 150 in an environment in which there is an excessive amount of electrical noise, try to eliminate sources of possible noise interference. Potential sources of electrical noise include inductive devices such as solenoids, relays, motors, and motor starters when they are operated by a hard contact. Compumotor recommends that you mount the Model 150 indexer in a NEMA enclosure to protect it from electrical noise.

For more information on identifying and suppressing electrical noise, refer to the Technical Data section of the *Compumotor Programmable Motion Control Catalog*.

Returning The System

If you must return your 150 Series Indexer to effect repairs or upgrades, use the following procedure:

1. Get the serial number and the model number of the defective unit, and a purchase order number to cover repair costs in the event the unit is determined by Parker Compumotor to be out of warranty.

2. Before you ship the indexer to Parker Compumotor, have someone from your organization with a technical understanding of the 150 Series Indexer and its application include answers to the following questions:

   - What is the extent of the failure/reason for return?
   - How long did it operate?
   - How many units are still working?
   - How many units failed?
   - What was happening when the unit failed (i.e., installing the unit, cycling power, starting other equipment, etc)?
   - How was the product configured (in detail)?
   - What, if any, cables were modified and how?
   - With what equipment is the unit interfaced?
   - What was the application?
   - What was the system sizing (speed, acceleration, duty cycle, inertia, torque, friction, etc.)?
   - What was the system environment (temperature, enclosure, spacing, unit orientation, contaminants, etc.)?
   - What upgrades, if any, are required (hardware, software, user guide)?

3. Call Parker Compumotor for a Return Material Authorization (RMA) number. Returned products cannot be accepted without an RMA number. The phone number for Parker Compumotor Applications Department is (800) 358-9070.

4. Ship the unit to: Parker Compumotor Corporation
   5500 Business Park Drive
   Rohnert Park, CA 94928
   Attn: RMA # xxxxxxx

APPENDICES

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