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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:

- IBM (or IBM-compatible) computer experience
- Basic electronics concepts (voltage, switches, current, etc.)
- Working knowledge of at least one computer language Basic, C, Pascal, assembly, etc.)
- Basic motion control concepts (torque, inertia, velocity, acceleration, distance, 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 OEMØ23-AT Indexer shipment. It will help you to become familiar with the system and ensure that each component functions properly. You will learn how to configure the system properly in this chapter.
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 will help you customize the system to meet your application's needs. Important application considerations are discussed. Sample applications are provided.
Chapter ⑤: Hardware Reference	This chapter contains information on system specifications (dimensions and performance). This chapter may be used as a quick-reference tool for proper switch and jumper settings and I/O connections.
Chapter ⑥: Troubleshooting	This chapter describes Compumotor's recommended system maintenance and troubleshooting procedures. It also provides methods for isolating and resolving hardware and software problems.

Installation Process Overview

To ensure trouble-free operation, you should pay special attention to the following:

- The environment in which the OEMØ23-AT will operate
- The system layout and mounting
- The wiring and grounding practices used

These recommendations are intended to help you easily and safely integrate the OEMØ23-AT system into your manufacturing facility. Industrial environments often contain conditions that may adversely affect solid state equipment. Electrical noise or atmospheric contamination may also affect the OEMØ23-AT.

Installation Recommendations

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

- ① Review this entire manual. Become familiar with the manual'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*. This is a bench test intended to be performed in a bench-top environment.
- ④ Perform as many basic moves and functions as you can with the preliminary configuration. You can perform this task only if you have reviewed the entire manual. You should try to simulate the task(s) that you expect to perform when you permanently install your system. **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, 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.

Developing Your Application

Before you attempt to develop and implement your application, you should consider the following:

- Recognize and clarify the requirements of your application. Clearly define what you expect the system to do.
- Assess your resources and limitations. This will help you find the most efficient and effective means of developing and implementing your application.
- Follow the guidelines and instructions outlined in this user guide. **Do not skip any steps or procedures.** Proper installation and implementation can be ensured only if all procedures are completed in the proper sequence.

Related Publications

The following publications may be helpful resources:

- Parker Compumotor Programmable Motion Control Catalog*
- Seyer, Martin. *RS-232C Made Easy: Connecting Computers, Printers, Terminals and Modems*. Englewood Cliffs, New Jersey: Prentice Hall, Inc., 1984
- Operations user guide for the IBM or IBM-compatible computer that you will use with the OEMØ23-AT Indexer
- Schram, Peter (editor). *The National Electric Code Handbook (Third Edition)*. Quincy, MA: National Fire Protection Association

Introduction

Chapter Objective

The information in this chapter will enable you to understand the OEMØ23-AT's basic functions and features.

Product Description

The Compumotor OEMØ23-AT is a microprocessor-based indexer that is designed to be inserted into an IBM Personal Computer (PC, XT, or AT) or compatible. *The OEMØ23-AT is not compatible with PS2 Models 50, 60, or 80.* Manufactured as a single board, the OEMØ23-AT is designed to be inserted into a single open slot in the computer expansion bus or I/O channel. A phoenix connector breakout box (the VM50), can be used to interface to the external motor, drivers, limit switches, trigger inputs, and programmable outputs.

The OEMØ23-AT can control up to three axes of any size Compumotor motor/drive system, most 200/400 step translator and stepper motor combinations, and other drive systems that accept pulsed control signals. The OEMØ23-AT uses a 16-bit processor with custom circuits to simplify the generation of motion profiles.

Product Features

The OEMØ23-AT provides the following features:

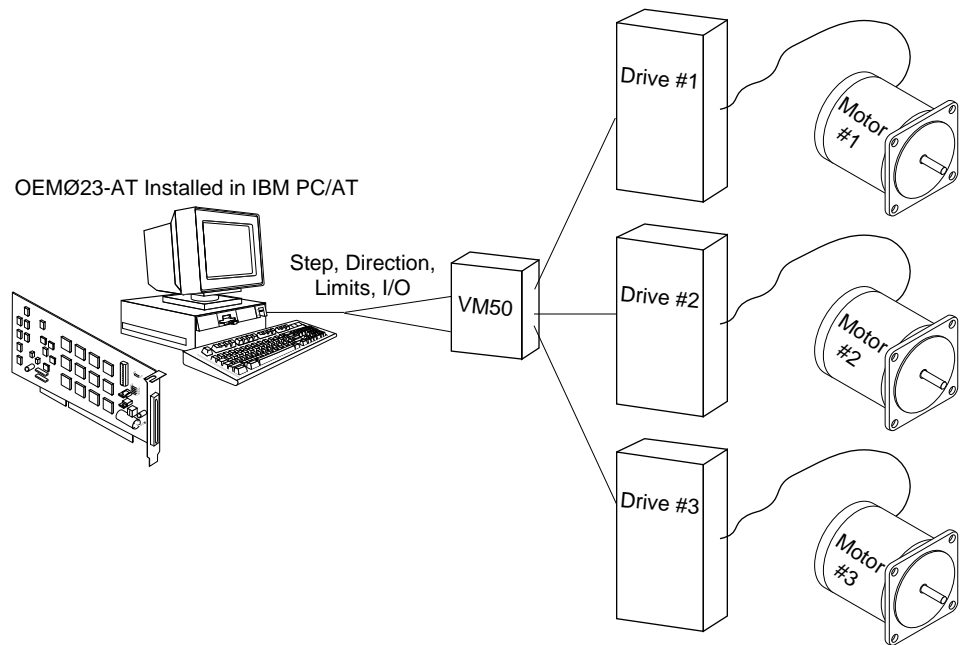
- Three axes of open-loop motion control (open-loop control only)
- Designed for the IBM PC, AT, XT and most IBM PC compatibles, PS2 (Model 30 only)
- Compatible with all Compumotor drives
- May be programmed to interrupt the host processor
- 1,000-character buffer per axis permits downloading of multiple move sequences per axis
- Supplied software support disk provides user utility programs, set-up and test routines, and help information
- Supports motor/drive resolutions up to 1,024,000 steps/rev
- User-defined trigger inputs (6) and outputs (5)
- CW and CCW end-of-travel limits and Home limit provided for all three axes
- User control of pulse source provides for complex move profiles
- Time distance streaming for arbitrary contours

Theory of Operation

The OEMØ23-AT receives acceleration, velocity, and position information (in an ASCII format) from your computer. In turn, the OEMØ23-AT uses that information to generate motion profile command signals for the three axes. Move commands are then sent to the external drive in the form of *step* pulses at a rate of up to 2 MHz. Additional logic provides other necessary functions, such as monitoring limit switches, setting the direction of motor motion, turning outputs on and off, and waiting for trigger inputs. The following figure shows a block diagram illustrating the system's functional processes.

Helpful Hint:
With simple indexer commands, you can move any or all of the three axes as follows:

- Rotate to a precise position and stop
- Rotate at a constant velocity
- Alternate back and forth between two angular positions
- Use a sequential combination of the above moves



Getting Started

Chapter Objectives

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

- Verify that your system arrived without damage
- Become familiar with system components and their interrelationships
- Establish the basic system configuration
- Ensure that each component functions properly

What You Should Have

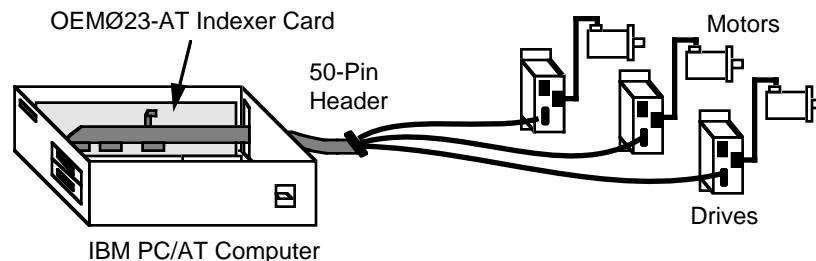
Upon receipt, you should inspect your OEMØ23-AT Indexer shipment for obvious damage to its shipping container. Report any damage to the shipping company as soon as possible. Parker Compumotor cannot be held responsible for damage incurred in shipment. The items listed in the following table should be present and in good condition.

Description	Part Number
OEMØ23-AT PCA Card	71-006085-02
OEMØ23-AT User Guide	88-013752-01 A
OEMØ23-AT Software Reference Guide	88-013832-01 A
Software Support Disk	95-013772-01
OEMØ23-AT Card Guide	58-004144-01
PCA Harness Clamp	53-006886-01

Bench Test

The figure below illustrates the temporary bench test configuration. If you do not have a VM50, refer to the pinouts and instruction in step ③. **Use the same computer that you will use in the permanent system configuration discussed in Chapter ③ Installation.**

Helpful Hint:
For test purposes, connection of the auxiliary switches is not required.



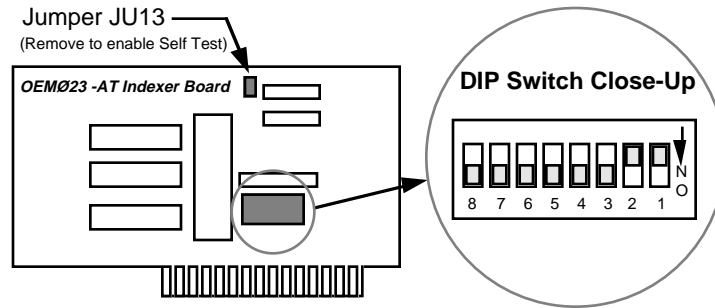
To complete the Bench Test, you will need the following tools and additional items (not provided with the OEMØ23-AT ship kit):

- IBM computer
- Small standard screw driver
- Needle-nose pliers
- Wire (to connect drive to VM50)

① Set the Address

For the computer to control the OEMØ23-AT, it must know where to write instructions and read responses. This requires that the OEMØ23-AT have a unique address.

The address is set using the 8-position DIP switch located on the OEMØ23-AT indexer card. This package consists of eight switches representing a binary number. Only two of the four address locations are significant: one for control and one for data. Input and output operations use the same address. The address may be set to any number that the PC recognizes as valid.



The DIP switches are *negative true* (e.g., any switch in the position marked **ON** has a binary value of zero). Switches that are **OFF** have a non-zero binary value. The sum of the binary values of DIP switches 1 - 8 is the board's *base address*. The binary values assigned to each of the DIP switches are listed in the table below.

Switch #	Address	Binary Value (OFF)		Default Setting
		Decimal	HEX	
1	9	512	200	OFF
2	8	256	100	OFF
3	7	128	80	ON
4	6	64	40	ON
5	5	32	20	ON
6	4	16	10	ON
7	3	8	8	ON
8	2	4	4	ON

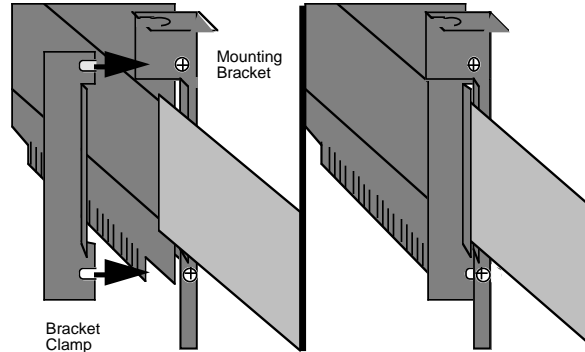
The OEMØ23-AT is shipped from the factory with switches 1 and 2 in the OFF position, all others ON. The board address is $256 + 512 = 768$ (or $100 + 200 = 300$ hex). As such, the OEMØ23-AT is configured to occupy I/O address locations 300 hex through 303 hex. The control and status registers are at the odd address location (301 hex), and data registers are at the even address location (300 hex). The default address is suitable for testing and for general use if no other peripheral devices in the computer are using the same address. This address does not conflict with typical devices that reside on the I/O bus, such as graphics adaptors, disk drives, and serial cards. The OEMØ23-AT occupies four address locations on the I/O bus.

② Enable Self Test

Remove jumper JU13, located above the edge connector and near the top of the OEMØ23-AT PCA card. Removing this jumper enables you to initiate the self test function. The self test will be used later in the system functional test. You must re-install the jumper when testing is complete.

③ Install Indexer OEMØ23-AT PCA Card

- ① Turn off the power to the computer.
- ② Remove the computer's cover to access the internal slots where peripheral PCA cards are added.
- ③ Remove the sheet metal bracket that covers the external access slot. Save the screws. On IBM and IBM-compatible computers, this will be at the rear access panel where all external connections are made. This bracket will be replaced by the bracket on the end of the OEMØ23-AT PCA card.



- ④ Mount the supplied card guide in the computer to support the opposite end of the PCA card. This guide snaps into the holes in the computer's chassis.

CAUTION

While handling the PCA card, be sure to observe proper grounding techniques to prevent electro-static discharge (ESD).

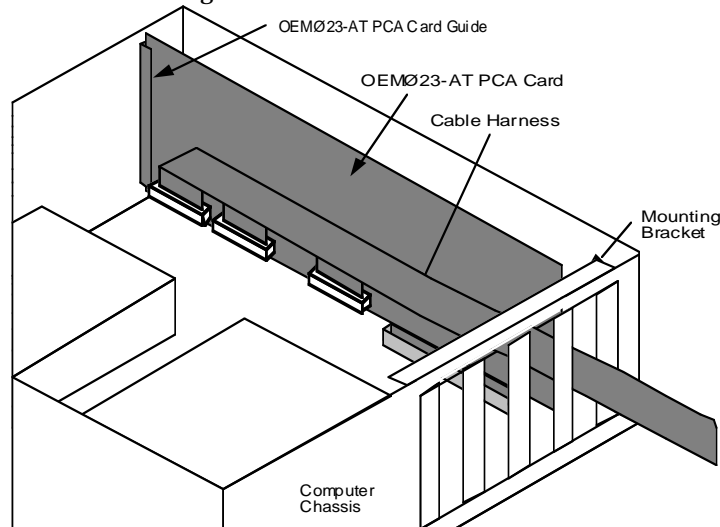
- ⑤ Run the cable harness through the slot in the computer's access panel and plug its 3 flat cables into the PCA card connectors.

CAUTION

Be sure to align the adaptor connectors properly over the pins on the PCA card connectors. Any misalignment can damage the cables and the PCA card connectors.

- ⑥ Insert the bottom corner of the OEMØ23-AT board into the PCA card guide slot. Ease the card and the bracket-end simultaneously down into the computer until the PCA card edge connector reaches the mating connector at the bottom. Adjust the PCA card until the edge connectors align and press it down into the mating connector.
- ⑦ Using the screw that secured the access slot cover bracket, fasten the OEMØ23-AT mounting bracket.

Helpful Hint:
If you have a VM50, connect the 50-pin connector into the VM50

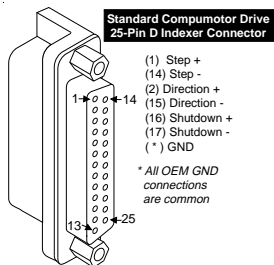


④ Connect Drive

The OEMØ23-AT is designed for use as a single-ended step and direction indexer. To use the OEMØ23-AT's single-ended outputs with a differential input drive (i.e., Compumotor stepper drives), connect each axis as shown in the table and diagram below.

OEMØ23-AT (50-Pin Header)	Pin #	Axis ①	Pin #	Compumotor Drive (25-Pin)
STEP	13	Connect to	1	STEP +
DIRECTION	14	Connect to	2	DIRECTION +
GND*	4	Connect to	14 & 15	STEP- (14) & DIRECTION- (15)
SHUTDOWN -	10	Connect to	17	SHUTDOWN -
SHUTDOWN +	9	Connect to	16	SHUTDOWN +
Axis ②				
STEP	15	Connect to	1	STEP +
DIRECTION	16	Connect to	2	DIRECTION +
GND*	23	Connect to	14 & 15	STEP- (14) & DIRECTION- (15)
SHUTDOWN -	20	Connect to	17	SHUTDOWN -
SHUTDOWN +	19	Connect to	16	SHUTDOWN +
Axis ③				
STEP	39	Connect to	1	STEP +
DIRECTION	40	Connect to	2	DIRECTION +
GND*	45	Connect to	14 & 15	STEP- (14) & DIRECTION- (15)
SHUTDOWN -	42	Connect to	17	SHUTDOWN-
SHUTDOWN +	41	Connect to	16	SHUTDOWN+

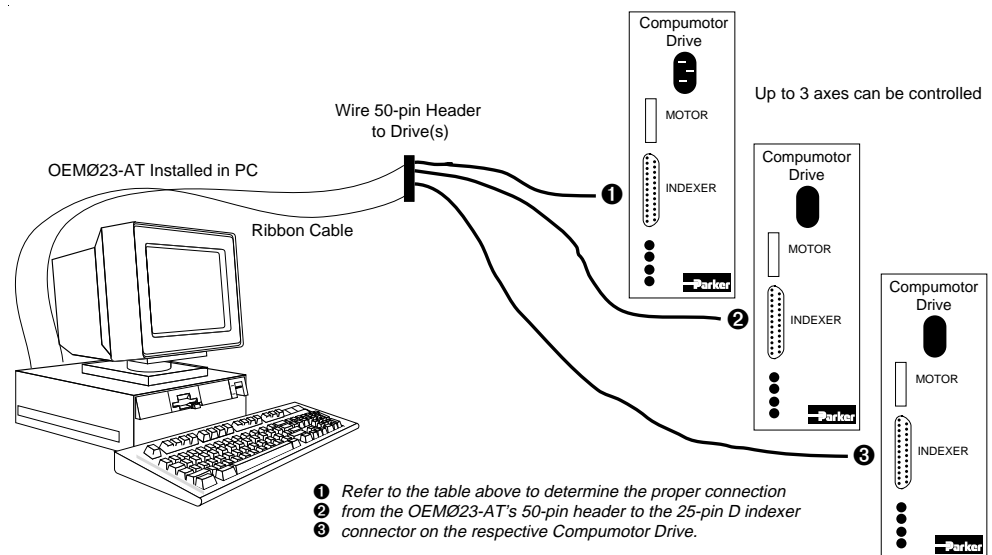
* All OEMØ23 GND connections are common.



If a differential step and direction signal is required, a new cable can be constructed using the pinouts for the main board provided in [Chapter ⑤ Hardware Reference](#).

Helpful Hint:

The mating connector for the 50-pin header is not provided in the OEMØ23-AT ship kit. Users must provide the mating connector and solder the connections as shown in this section.



If you are using an optional **VM50 Adaptor Board**, refer to the wiring instructions (Step② Make Auxiliary Connections) provided in [Chapter ③ Installation](#).

⑤ System Test

The successful completion of the steps in this test will verify that your system connections are correct and that the system operates properly. *The OEM023-AT's default resolution is 25,000 steps/rev (1.0 μs step pulse width). If you are using a full or half-step drive (e.g., PK3), the self test may not work.*

- ① Verify that the drive and motor connections are secure.
- ② Verify that you have removed jumper JU13 on the indexer card.
- ③ If the drive you are using is equipped with limits (e.g., Compumotor Plus), disable them for this test.
- ④ Apply power to the drive(s) in accordance with the drive user guide. The motor(s) must be free to rotate in either direction.
- ⑤ Apply power to the computer to initiate the self test. Immediately after applying power, the motor(s) will rotate CW and then CCW. The distance and rate of rotation depends on the motor's resolution. Standard Compumotor 25,000 step/rev motors will rotate 1 revolution at a rate of 0.2 revs/sec (25,000 steps at 5,000 steps/sec).
- ⑥ **Turn off power to the computer** and replace jumper JU13 on the OEM023-AT indexer card. This disables the self-test routine.
- ⑦ Insert the OEM023-AT support diskette into the computer disk drive. Type **INSTALL** at the DOS prompt. This will create an OEM23 subdirectory on the hard drive and install all the support programs.
- ⑧ Type **OEM23TRM** and enter the device address (**768**).
- ⑨ Enter the command sequence below. **If you make a mistake while entering the commands, do not backspace—re-type the command sequence.**

☞ *Helpful Hint:*

After the test move, the fault LED should illuminate. The OEM023-AT will not function until you cycle power to the computer.

☞ *Helpful Hint:*

The motor should rotate one CW revolution and stop.

Command	Description
1LD3	Disables limits for axis #1
1A10	Sets acceleration to 10 rps ²
1V1	Sets velocity to 1 rps
1D25000	Sets distance to 25,000 steps (1 rev @ 25,000 steps/rev)
1G	Go (execute the move)

- ⑩ Press the **<F10>** key to exit the program. After successfully completing the system test, remove power from all components (including the computer) and disconnect the motor driver from the VM50.

Proceed to *Chapter ③ Installation*. In *Chapter ③*, you will configure your system for permanent operation.