

How To Use This Manual

This manual 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 manual.

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.)
- Basic motion control concepts (torque, velocity, distance, etc.)
- Basic serial communication concepts (specifically RS-232C)

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

Contents of This Manual

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 receive with your AX Drive 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 and non-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: SOFTWARE REFERENCE

This chapter explains Compumotor's X-Series programming language in detail. It describes command syntax and system parameters that affect command usage. An alphabetical listing of all commands, including individual command descriptions, is included.

CHAPTER 6: 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 settings and I/O connections.

**CHAPTER 7:
MAINTENANCE &
TROUBLESHOOTING**

This chapter describes Compumotor's recommended system maintenance 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 AX Drive system will operate
- The system layout and mounting
- The wiring and grounding practices used

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

***Developing Your
Application***

Before you attempt to develop and implement your application, there are several issues that you should consider and address.

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

**Installation
Recommendation**

Before you attempt to install this product, you should 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.
NOTE: This is a preliminary configuration, not a permanent installation, usually 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, you should begin the installation process. 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.

Key Terms

You should read and understand these terms and definitions before reading Chapter 1. Additional terms used in this user guide are defined in the Glossary.

BCD	Binary coded decimal. A system of representing decimal numbers with binary numbers.
Bipolar	The Drive current is bi-directional through each motor phase. There are two motor phases: <i>Phase A (A+/A-)</i> and <i>Phase B (B+/B-)</i> .
Brownout	Low-line voltage at which the device no longer functions properly.

Daisy-chain	A term used to describe linking devices in sequence, such that a single data stream flows through one device and on to the next. Daisy-chained devices are distinguished by device addresses to indicate the desired destination for data in the stream. Up to eight AX Drives may be daisy-chained.
Dead Band	A range of input signals for which there is no system response.
Delimiter	A character (space or carriage return) used to separate fields in a command.
Drive	This is the electronics portion of the system that controls power to the motor. This portion controls the motor to provide micro-stepping.
Indexer	This portion of the system provides communication with the external I/O. It allows you to program sequences and direct motion control.
Micro-stepping	An electronic control technique that proportions the current in a step motor's windings to provide additional intermediate positions between poles. This produces high positional resolution and smoother rotation over a wide speed range.
PLC	Programmable logic controller. An industrial control device that turns on and off outputs based upon responses to inputs.
Quadrature	A type of incremental encoder output in which the two square wave outputs are offset by 90°.
RS-232C	A serial data communications standard that encodes a string of information on a single line in a time sequential format. The standard specifies the proper voltages and timing requirements so that different manufacturers devices are compatible.
Sequence	A series of motion control commands. These commands are created, stored, and executed from the indexer's EEPROM memory.
Short-Circuit	A defect in a winding which causes part of the normal electrical circuit to be bypassed. This frequently results in reducing the resistance or impedance to such an extent (near zero) as to cause overheating of the circuit, and subsequent burnout.

Conventions

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

Highlighted Text

Several methods are used to highlight text. Explanations of special text and the way it is highlighted is presented below.

Commands

The command examples in this user guide are presented vertically to help you read and understand them. When you actually type these commands at your computer keyboard, they will be displayed horizontally on your computer. All commands that you are instructed to enter are displayed in all capital letters, just as they appear on your computer CRT. A one-line explanation of the command is provided next to each example. The command is displayed in boldface. Be sure to add a delimiter (space or carriage return) after each command in a sequence. Refer to the example below:

<u>Command</u>	<u>Description</u>
A 5	Sets acceleration to 5 revs/sec ² (rps ²)
V 5	Sets velocity to 5 rps
D12800	Sets distance to 12,800 steps
G	Executes the move (Go)

Bold face, quotation marks, or other forms of highlighting are not be used for command responses. Responses are set in all capital letters, as they are on the terminal. An example is provided below.

<u>Command</u>	<u>Response</u>
1XU4	A5 V5 D12800 G

The system generally ignores command syntax that is not within the valid range for a specific command (valid ranges are provided in Chapter 5, Software Reference). Compumotor does not guarantee system performance when the system executes commands that contain invalid syntax (outside the valid range).

**Warnings
(Personal Injury)
& Cautions
(System
Damage)**

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.

Italics are used to highlight other important material. Refer to the example below.

Example: Outputs 1 and 2 are user programmable. *Do not use outputs 3 and 4.*

Voltage Levels

In this manual, you will deal with inputs and outputs that you can turn on or off. We will define the terminologies needed for these inputs and outputs.

Inputs	ON (\emptyset , <i>low</i>)	Current flows
	OFF (1, <i>high</i>)	No current flows
	<u>Command</u>	<u>Description</u>
	TR \emptyset 11	Waits for Trigger 1 to turn on and Triggers 2 and 3 to turn off
Outputs	ON (1, <i>high</i>)	Current flows
	OFF (\emptyset , <i>low</i>)	No current flows
	<u>Command</u>	<u>Description</u>
	O \emptyset 1	Turns off Output 1 and turns on Output 2

Related Publications

The following publications may be helpful resources:

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