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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 88-007488-02F, supersedes version 88-007488-02E.

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

Chapter ① Introduction

Changes to *Chapter 1, Introduction* are summarized as follows:

- There were no changes to this chapter

Chapter ② Getting Started

Changes to *Chapter 2, Getting Started* are summarized as follows:

- There were no changes to this chapter

Chapter ③ Installation

Changes to *Chapter 3, Installation* are summarized as follows:

- Minor revisions were made for clarity

Chapter ④ Application Design

Changes to *Chapter 4, Application Design* are summarized as follows:

- Minor revisions were made for clarity

Chapter ⑤ Software Reference

Changes to *Chapter 5, Software Reference* are summarized as follows:

- Several commands were added, including:
 - BSP
 - RIFS
 - SP

Chapter ⑥ Hardware Reference

Changes to *Chapter 6, Hardware Reference* are summarized as follows:

- Minor corrections to the I/O Schematic
- Minor changes were made for clarity

Chapter ⑦ Maintenance & Troubleshooting

Changes to *Chapter 7, Maintenance & Troubleshooting* are summarized as follows:

- Minor changes were made for clarity

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O V E R V I E W

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 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, force, etc.)

With this level of understanding, you can effectively use this manual to install, develop, and maintain your system. You can get information about basic motion control concepts by referring to the current Parker Compumotor Motion Control Catalog.

User Guide Contents

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 list of items you should have received with your shipment. It will help you become familiar with the system and ensure that each component functions properly. You will configure the system properly in this chapter.
Chapter ③ Installation	This chapter helps you 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 helps 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 list of all commands, with a syntax and command description for each command is included.

Chapter ⑥
Hardware
Reference

This chapter contains information on system specifications (dimensions and performance). This chapter is as a quick-reference tool for proper 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.

Process Overview

To ensure trouble-free operation, you should pay special attention to the environment in which the Compumotor Plus equipment will operate, the layout and mounting, and the wiring and grounding practices used. These recommendations are intended to help you easily and safely integrate Compumotor Plus equipment into your facility. Industrial environments often contain conditions that may adversely affect solid state equipment. Electrical noise or atmospheric contamination, may also affect the Compumotor Plus System.

Developing Your Application

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

- ❑ 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 only be ensured if all procedures are completed in the proper sequence.

Installation Procedures

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

- ① Review this entire user guide. 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 1, Getting Started*.
- ④ Perform as many basic moves and functions as you can with the preliminary configuration. You can only perform this task if you have reviewed the entire user guide. You should try to simulate the task(s) that 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, Installation* 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.

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. Refer to the examples shown below.

CAUTION

Remember, electrical noise, a poorly designed enclosure, or improper grounding can affect system performance and safety. For more information about these factors, refer to *Chapter 7, Troubleshooting and Maintenance*.

Related Publications

The following publications may be helpful resources.

The current Parker Compumotor Motion Control Catalog. The catalog is available from Parker Compumotor at (800) 358-9068 or (707) 584-7558.

Schram, Peter (editor). *The National Electric Code Handbook (Third Edition)*. Quincy, MA: National Fire Protection Association.

Introduction

Chapter Objectives

The information in this chapter will enable you to:

- ❑ Understand the product's basic functions & features
- ❑ Understand basic motion control concepts and apply them to your application

Product Description

The Compumotor Plus Indexer/Drive is a powerful, *stand-alone*, motion-control device. It provides users with an indexer and driver in one package. A simple RS-232C communications interface allows users to implement Compumotor Plus' powerful command language with minimal setup and preparation. The system's ability to operate up to 16 Compumotor Plus Drives in a daisy chain configuration, from one RS-232C device, further simplifies the Compumotor Plus' implementation in more complex applications.

The Compumotor Plus is equipped with optically isolated CCW and CW end-of-travel limit inputs and a home limit input. The end-of-travel limits can be disabled using the Limit Disable (LD3) command.

In addition, the Compumotor Plus has three trigger inputs for general use with the Wait for Trigger (TR) command. These inputs can also be configured as jog inputs, stop inputs, or sequence select inputs.

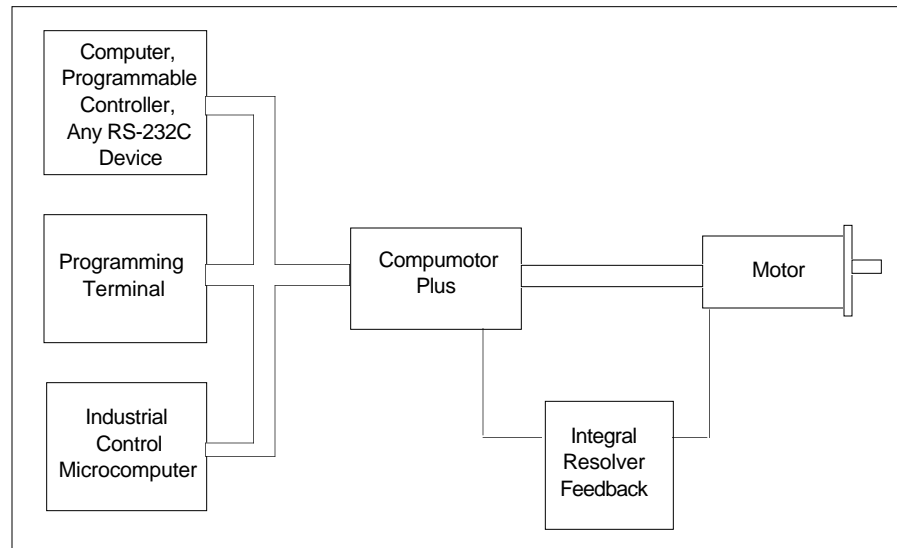
The Compumotor Plus system provides high accelerations (up to 10 times higher than open-loop stepper systems) and high torque's in each frame size. The torque profiles have been chosen to provide high torque's at low to moderate speeds. This makes the Compumotor Plus system ideal for point-to-point positioning applications where increased throughput is important.

Since the Compumotor Plus system runs closed loop, current is only produced when torque demands require it. Consequently, the Compumotor Plus system runs much cooler than comparable open-loop steppers. This can be important in applications where motor heating is a factor (such as stage drives).

The Compumotor Plus system runs as a servo (i.e., the motor cannot stall in the same way that conventional open-loop steppers can). If torque demands exceed the capability of the system, the motor just slows down and tries to keep moving. If the load absolutely prohibits the motor from

moving, the drive can be programmed to abort the program or move, indicate a fault to the operator or control system, and display an error code on the LED.

Elements of the System



Interface Options

The Compumotor Plus system is offered with three different standard interfaces. All three versions have push-button and RS-232C tuning, Velocity Monitor and Fault outputs, and Hardware Enable input. The system also offers CW/CCW limit inputs, and a display that indicates set-up and fault information. The exact nature of any fault (e.g., excess average current, excess following error, loss of resolver signal, etc.) is displayed as a unique two-digit number.

The X version of the Compumotor Plus system contains the servo controller and a complete, RS-232C-based indexer that executes the Compumotor X programming language. Motion control parameters such as distance, velocity, and acceleration can be combined into sequences along with time delays, loops, and programmable outputs. These sequences can be controlled via RS-232C or via external inputs that can control and time program execution. Trigger inputs can be used to coordinate program execution with external events. Multiple motion-control programs can be stored in non-volatile memory and executed automatically or according to external sequence and trigger controls.

The X language is based on simple, readable commands that use ordinary decimal numbers. Any CRT, hand-held terminal, computer, or programmable controller with an RS-232C interface can be used to program the system.

Part Number Designation

	Low Power	High Power
X version	CPLX	CPHX

Product Features

The Compumotor Plus servo system is a brushless, digital, closed loop positioning system based on motor and drive technology developed by Compumotor. It offers many innovative features, including:

- Motor with integral brushless resolver

- ❑ Industry standard 23, 34, and 42 stepper compatible frame sizes
- ❑ Digital velocity and position loops with simple PID tuning
- ❑ Front panel push-button tuning with LED diagnostic display
- ❑ Standard RS-232C interface provides on-line setup assistance
- ❑ Velocity monitor output provides real-time performance data
- ❑ Three interface options
 - Built-in RS-232C indexer executes Compumotor X language and offers non-volatile program memory and program sequence control
 - Step & Direction interface compatible with all Compumotor Indexer
- ❑ Integrated controller/amplifier has built-in power supply, low EMI filtered amplifier outputs, full optical isolation on all user connections, 2 digit diagnostic LED display

Theory of Operation

Compumotor has joined each motor with a new digital control system designed specifically to take advantage of the performance characteristics of the motor. Each drive is fully packaged with integral power supply, filtered power amplifier (for low EMI and low motor heating), and controller card. The controller is based on a 68,000 16-bit microprocessor and digitally closes the position and velocity loop. Loop gains (specified as proportional, integral, derivative, and velocity gains) are factory preset for stability with moderate frictional and inertial loads. These gains may be adjusted with either hidden front panel push-buttons (assisted by a 2 digit LED display) or with the unit's standard RS-232C interface. With the RS-232C interface the user can query the servo system about performance data such as following error, average and peak currents, set points, and gains. Each drive also has a Velocity Monitor output which provides a synthesized tachometer signal that can be used in conjunction with an oscilloscope to visually monitor system performance.

A brushless resolver made of the same rotor and stator components used in the motor was developed. This resolver is magnetically similar to the motor itself, and is manufactured as an integral part of the motor. The result is a sensor with the same number of poles as the motor (which makes control straightforward) that is always properly aligned with the motor and can be operated in high noise, high temperature environments.