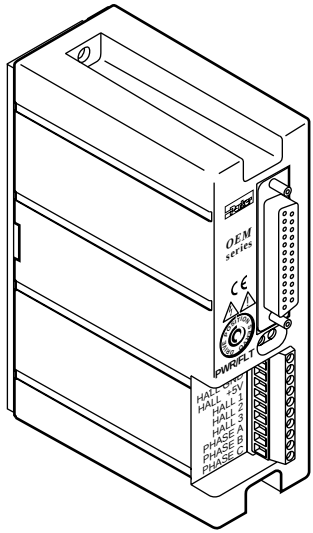
Compumotor

OEM770X
Servo Controller/Drive
User Guide



Compumotor Division
Parker Hannifin Corporation
p/n 88-018468-01 A

Parker

IMPORTANT

User Information

⚠ WARNING ⚠

OEM Series products are used to control electrical and mechanical components of motion control systems. You should test your motion system for safety under all potential conditions. Failure to do so can result in damage to equipment and/or serious injury to personnel.

Technical Assistance ⇨ *Contact your local automation technology center (ATC) or distributor,* ***or ...***

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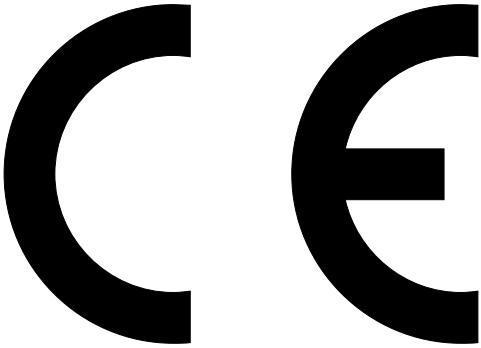

Product Type:
OEM770X Position Servo Controller/Drive

The above product is in compliance with the requirements of directives

- **72/23/EEC Low Voltage Directive**
- **93/68/EEC CE Marking Directive**

The OEM770X, when installed according to the procedures in the main body of this user guide, may not necessarily comply with the Low Voltage Directive (LVD) of the European Community. To install the OEM770X so that it complies with LVD, you must follow the additional procedures described in *Appendix A, LVD Installation Instructions*. If you do not follow these instructions, the LVD protection of the product may be impaired.

OEM770X drives are sold as complex components to professional assemblers. As components, they are not required to be compliant with Electromagnetic Compatibility Directive 89/336/EEC. However, information is offered in Compumotor's *EMC Installation Guide* on how to install the OEM770X in a manner most likely to minimize the effects of drive emissions and to maximize the immunity of drives from externally generated interference.

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C O N T E N T S

P R E F A C E

About This User Guide

You may not need to read this user guide from cover to cover! You can find essential information in the first three chapters—a product description in Chapter 1, installation instructions in Chapter 2, and specifications for the drive and motors in Chapter 3. This may be all you need to use the OEM770X.

Later chapters contain additional information about selected topics. Read them if you need a deeper understanding about these topics.

Special internal circuits, including an extended discussion of the current foldback circuit and the response circuit, are covered in Chapter 4. This chapter may interest you if you want to achieve optimum performance from the drive by adjusting the selectable resistors.

Hall effect sensors, and the way they affect commutation in brushless servo motors, are described in Chapter 5. If you use motors from manufacturers other than Compumotor, you may need this information to determine how to connect your motor to the drive.

Power supply selection is covered in Chapter 6. Read this chapter for information about calculating the power your system requires, how regeneration affects power supplies, and how you can specify a power supply for your system.

Troubleshooting procedures are covered in Chapter 7.

Warnings and Cautions

Warning and caution notes alert you to problems that may occur if you do not follow the instructions correctly. Situations that may cause bodily injury are presented as warnings. Situations that may cause system damage are presented as cautions.

A typical warning note is shown below.

WARNING

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

A typical caution note is shown below.

CAUTION

Do not turn on power unless the motor's Hall effect sensors, Hall +5, and Hall GND are connected to the drive. The motor may be destroyed by over-heating if these connections are not made.

CHAPTER 1

Introduction

OEM770X Description

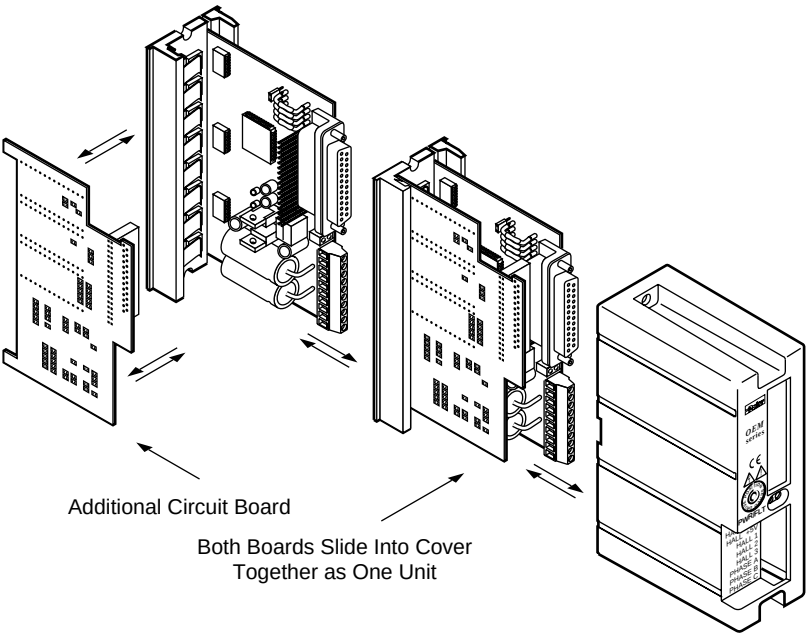
The OEM770X is a torque servo drive designed to operate standard 3 phase brushless DC servo motors equipped with Hall effect sensors, or equivalent feedback signals. It can also operate brushed DC servo motors. It is a high-performance module around which the Original Equipment Manufacturer (OEM) can design a motion control system. The drive offers a basic set of features designed to meet the needs of most customers. It is compatible with standard industry servo controllers, and is intended to be used in positioning applications. It uses three-state current control for efficient drive performance and cooler motor operation.

The OEM770X is small and convenient to use. It installs with only two screws (the screws also provide grounding and captivate the cover). Its right angle screw terminal allows side-by-side mounting, and its small footprint maximizes cabinet space. The snap-on molded cover is removable for drive configuration, and helps provide a barrier against environmental contamination. The drive is the same size as a 3U Eurorack card. Its standard 25 pin D-connector is compatible with universally available connectors.

The drive is designed for manufacturability and reliability. It uses surface mount components and a custom designed ASIC to conserve space, reduce cost, and improve reliability. More than 90% of the components are auto inserted, which reduces assembly time and cost, and further improves reliability.

Operation & Block Diagram

A Compumotor product called the OEM770T Torque Drive is the “building block” in a family of servo drives. It has an internal slot where an additional circuit board can be inserted to make a different product.



Additional Circuit Board Can Mount Internally

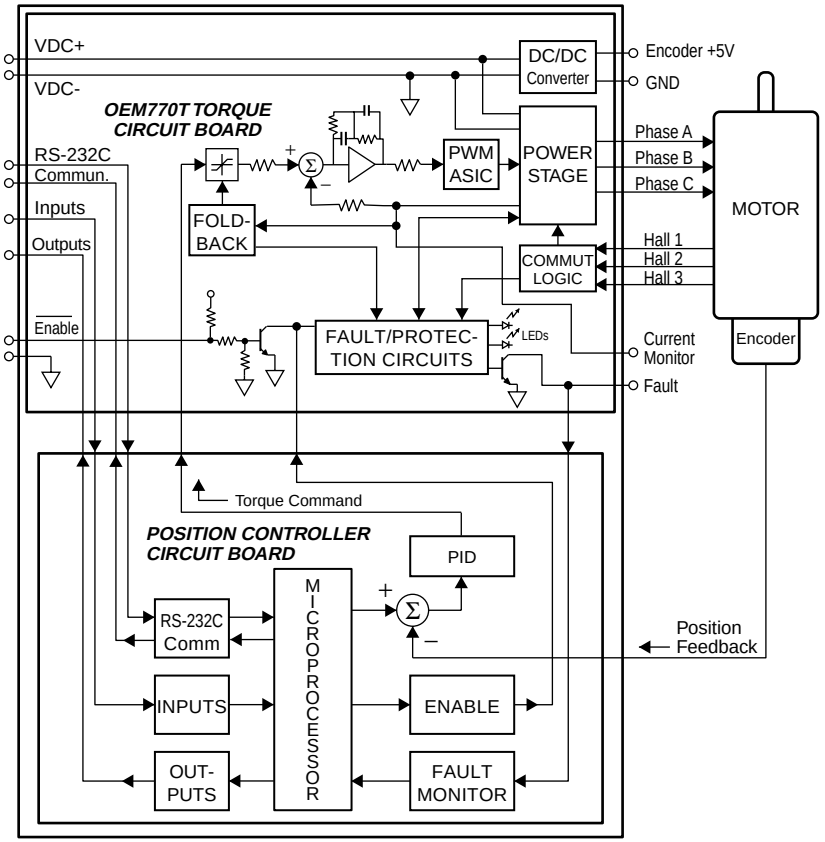
The additional circuit board is inserted at the factory, at the time of manufacture. Externally, the new product looks just like the OEM770T, except that the label is a different color.

OEM770X Position Controller/Drive

The OEM770X Controller/Drive consists of the OEM770T with a position controller circuit board.

The OEM770X requires a single external power supply. The drive accepts 24VDC to 75VDC for its power input. Its internal DC-to-DC converter produces +5V to power Hall effect sensors and encoder electronics, and all internal voltages used for the drive's circuits.

The block diagram for the OEM770X is shown in the next drawing.

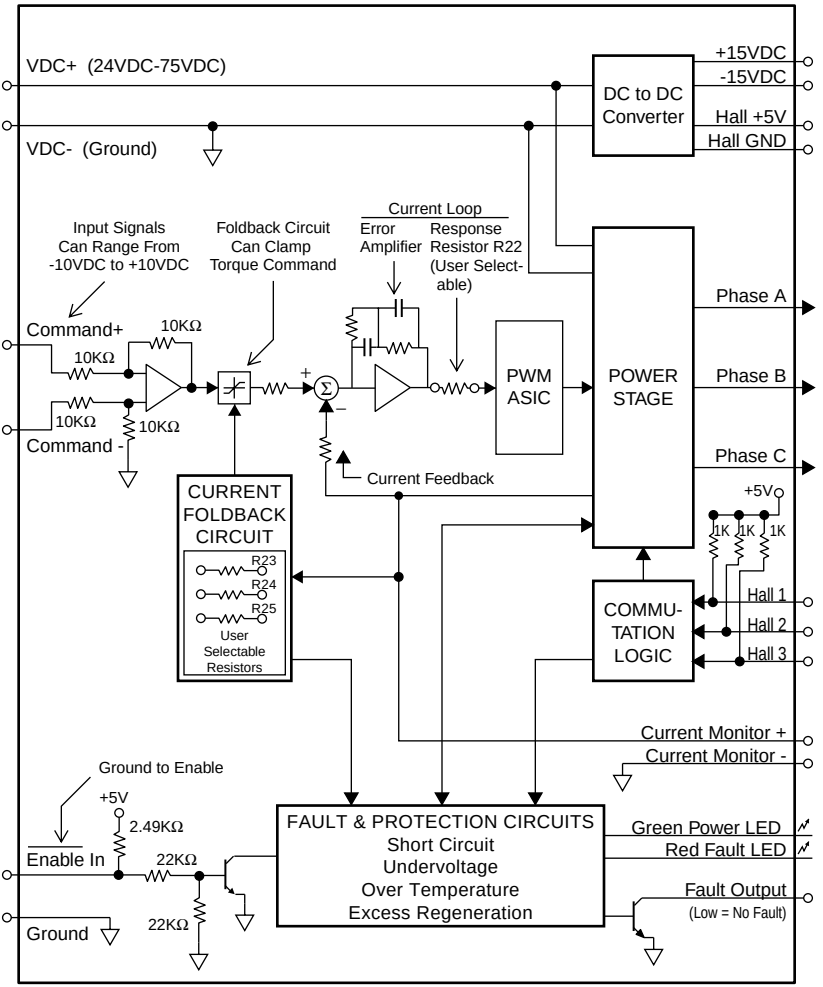


OEM770X Position Controller/Drive — Block Diagram

Inputs, outputs, and RS-232C communications are internally routed to the position controller board, where they interface with a microprocessor. The microprocessor generates a position command. It can also enable or disable the torque board.

The position controller board receives feedback about actual position from an encoder, and compares commanded position with actual position. It generates a torque command to correct any position errors. The torque command (which is an analog voltage) then goes to the torque board as a *command input* signal, passes through the foldback circuit, and proceeds through the remainder of the torque board's circuits.

The detailed block diagram for the torque board is shown in the next drawing.



Block Diagram — OEM770T Torque Servo Drive

Input to the torque board is a voltage signal called *command input.* It can range from -10VDC to +10VDC. Output current is scaled so that each volt of command input corresponds to 1.2A of output current. For example, a command input of 5V results in a 6A output current. The maximum command input of 10V results in the full 12A output current.

When the command input signal enters the board, it is amplified, sent through a foldback circuit (which may or may not be active) and an inverter,

and summed with a current feedback signal that is proportional to the actual output current.

An error signal—the difference between commanded and actual output current—goes through an error amplifier. The amplifier's output controls a pulse width modulation (PWM) circuit. If actual current is too low, the PWM circuit will send longer pulses to the power stage. These pulses keep the stage turned on longer, which results in more output current. If actual current is too high, the PWM circuit sends shorter pulses, resulting in less current.

A *response resistor* affects the signal level that goes into the PWM circuit. The user can choose a value for this resistor that produces the best current loop gain and system dynamics for a particular motor.

The power stage has three outputs—each connects to a particular motor coil. The drive gets inputs from the motor's Hall effect sensors, and determines which of six possible positions the rotor is in. It then uses a six-state commutation technique to send current into one coil and out of another (the third coil receives no current). The current creates a torque on the rotor, and the rotor turns to the next position. The drive reads the new position from the Hall sensors, and switches current to a different combination of coils. The rotor turns further, and the process repeats. (The drive can also be configured to commutate brushed servo motors.)

The drive has several fault and protection circuits. These monitor temperature, regeneration, undervoltage, and short circuits. They can shut down the drive if limits are exceeded. LEDs indicate power and fault status.

A foldback circuit monitors motor current, and protects the motor from overheating due to prolonged high currents. The user can install resistors to set levels for peak current, foldback current, and time constant. When the circuit invokes foldback, it clamps the command input signal at a voltage that reduces motor current to the preset level. After a period of time, the circuit may release its clamp on the command input signal, and normal operations can continue.

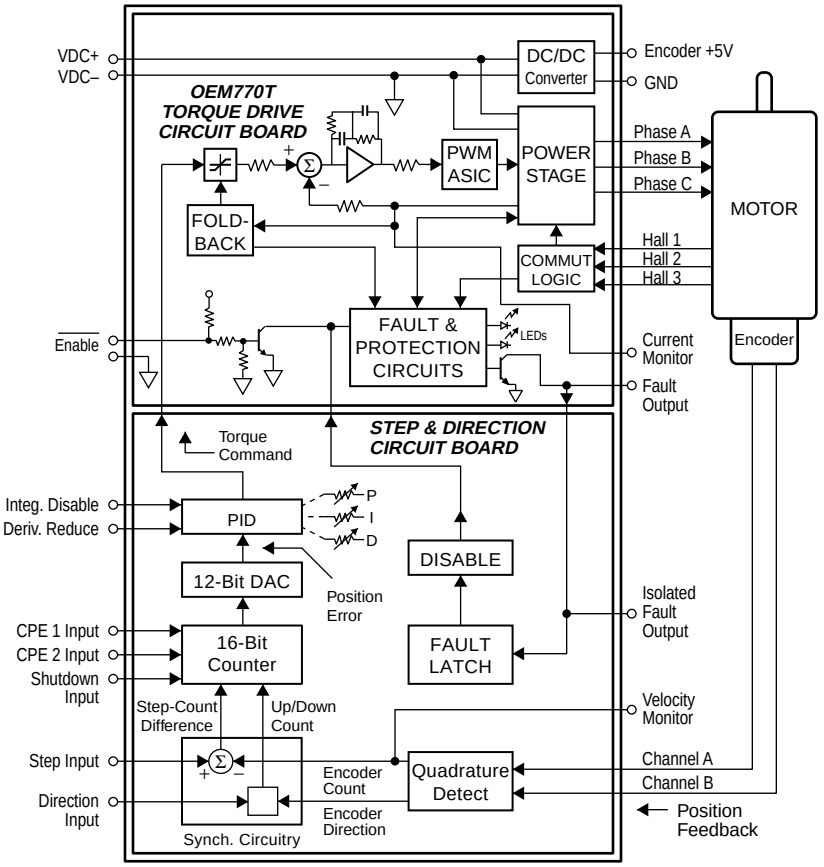
The drive has several other inputs and outputs. An enable input must be grounded to enable the drive. A fault output is held low if there are no faults. A current monitor output provides a voltage scaled to represent the actual output current. It can range from -10V to +10V, with one volt corresponding to 1.2 amps of output current.

Related Products

In addition to the OEM770X and OEM770T, the other products described below comprise the family of Compumotor OEM Servo Products.

OEM770SD Step & Direction Servo Drive

The OEM770SD Step & Direction Servo Drive consists of the OEM770T with a position controller circuit board added.



Block Diagram – OEM770SD Step & Direction Servo Drive

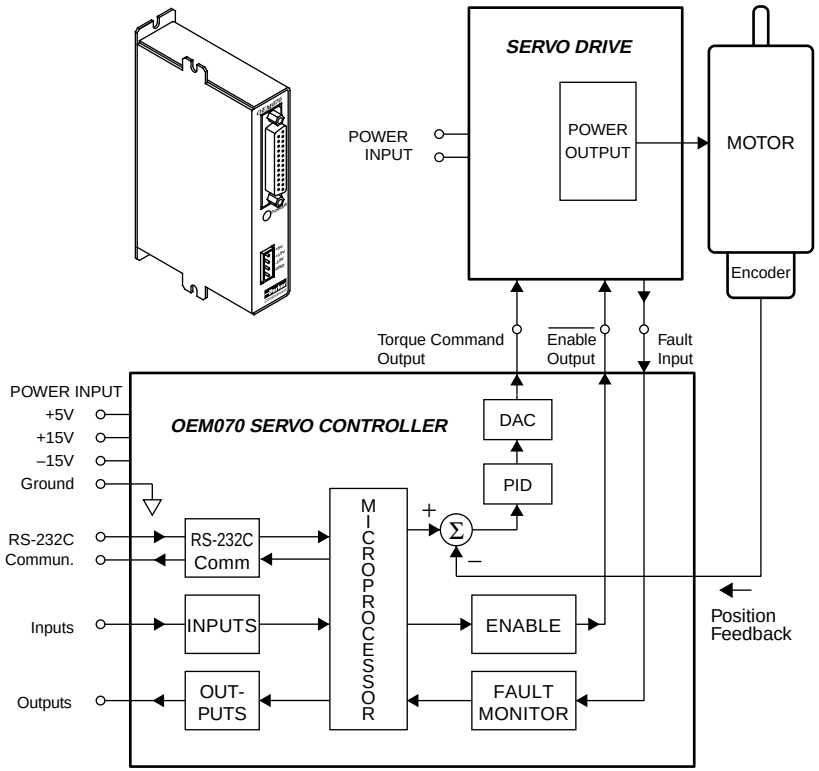
The controller accepts step and direction position commands from an indexer. It uses encoder signals for feedback. Its internal PID position control loop generates an analog command output voltage that is sent to the torque board.

Indexers intended for use with step motor systems can operate the OEM770SD. It emulates a stepper drive, but can achieve servo system levels of high speed performance and thermal efficiency.

OEM070 Servo Controller

The OEM070 Servo Controller is a compact, stand-alone controller designed to operate with analog servo drives.

The OEM070 contains the same position controller board used in the OEM770X. The board is packaged by itself in a minimum depth, small footprint housing. It controls motor torque or velocity with a ±10V command output signal. Through its I/O and RS-232C ports, the OEM070 can interface with external devices such as incremental encoders, switches, computers, and programmable control units.



OEM070 Servo Controller – Block Diagram

SM and NeoMetric Series Servo Motors

Compumotor offers SM Series and NeoMetric Series servo motors designed to operate with OEM Series servo drives. Each motor is equipped with Hall effect outputs and an encoder.