

Section K. Maintenance & Troubleshooting

Section Objectives

This section will help you identify the part of your system (unit) that developed a fault. This should enable you to get the equipment working again with minimal difficulty. The LEDs mounted on some modules indicate the nature of a fault. Using this information, you can find a fault and prevent a recurrence of the problem.

Maintenance

CAUTION

You should never dismantle a suspect motor. If you do, you will demagnetize the permanent magnets. After re-assembly, the motor may still run, but it will not be capable of giving its full performance.

Your system will not normally need any routine maintenance, other than for the few items covered below.

Filters

If you mounted the electronics rack in a cabinet through which filtered cooling air is passed, you will need to inspect and clean the filters at regular intervals. Failure to do this may result in reduced cooling, leading to overheating and possible failure of the electronics.

Cables

If any of your cabling is exposed, you should inspect the cable regularly in inspection to prevent a machine breakdown.

Connectors

Over a period of time, and particularly if subjected to vibration, connectors may come loose. Inspect the connectors regularly to prevent this problem.

Fault Diagnosis

To minimize field failures, all electronic units are fully tested on automatic test equipment and then soak-tested at elevated temperatures before they are shipped. In spite of these precautions, however, occasional failure may still occur.

WARNING

Before you attempt any work on the system, ensure that AC power is disconnected, and that the HV supply is given sufficient time (at least 5 seconds) to reach a safe level.

Problem Isolation

If your system malfunctions, you must identify and isolate the problem. When you accomplish this, you can begin to eradicate and resolve the problem.

The first step is to isolate each system component and ensure that each component functions properly when it is run independently. You may have to dismantle your system and put it back together piece by piece to detect the problem. If you have additional units available, you may want to use them to replace existing components in your system to help identify the source of 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 occurred 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.

Once you isolate 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 Compumotor's Applications Department.

Power Supply and Drive Fault LEDs

The power supply and drive modules of your system are fitted with several LEDs that indicate certain fault conditions. If a fault develops in the system, you should first check these LEDs.

Table K1-1 will help you to identify the causes of common faults related to the power supply and the drive.

PSU LED not illuminated	AC supply not connected. AC fuse failure (fuses located on PSU motherboard)
Drive logic supply LED is not illuminated	If this LED is not illuminated, but the drive still functions, the logic supply may have dropped for a short period and then returned to normal. If you cycle the drive <i>enable</i> signal, the LED should illuminate. If the drive does not function, check that HV is present (the green LED on the PSU should be illuminated). If it is, the problem may be due to excessive load on the external 5V supply. Check that the maximum current rating (0.75A) is not being exceeded.
Drive control fault LED illuminated	This indicates loss of the torque demand signal from the control card. This could be due to a fault either in the control card, the drive, or less likely in the interconnection via the motherboard.
Drive overload LED illuminated	Indicates a short circuit across the motor terminals, or between one terminal and earth. Check the connections to the drive and examine the motor cable. If necessary, check the motor windings with an ohm-meter, after first disconnecting the motor cable from the drive.
Drive HV over-voltage LED illuminated	This will happen if excessive regeneration occurs. To confirm this, check that the fault occurs during deceleration; if so, first check the dump fuse (FS1) on the PSU. If this is intact, it may be necessary to increase the rating of the power dump resistors. Before you do this, contact Compumotor for further advice and fitting instructions.
Drive over-temperature LED illuminated	Over-temperature faults can be caused by a failure within the drive or motor, an elevated ambient temperature, or poor ventilation. Check or replace the motor and check ventilation fans and filters (where fitted) and ambient temperature. If there is no problem in these areas, the drive itself is probably faulty. <i>The LEDs on the Drive Module are latched in the fault condition and the drive is disabled.</i> To reset the latch, you should remove and re-apply the Enable signal.
Poor system high speed performance	Failure of one AC fuse when a 3-phase supply is being used. If one phase of the supply is lost, the system will continue to function, but with a reduced supply voltage under heavy load giving rise to reduced high-speed performance.
Power dump fuse fails on switch on	Failure of power dump circuit. Power dump transistor (Q5 on PSU) short circuit.
Power dump fuse fails during system operation.	Excessive dump current. This is most likely to be caused by excessive regeneration and may be accompanied by an HV over-voltage indication on the drive and overheating of the power dump resistors. If this is the case, a higher wattage power dump resistor may be needed. Before attempting to fit this, you should contact us for further advice and instructions.
Wiring Problems	If all appears to be well, but the system does not operate, you should carefully check all motor and signal connections and wiring (for breakage and loose or incorrect connection). An incorrectly wired limit switch, for example, may prevent motor rotation in one direction while allowing rotation in the other.

Table K1-1. Power Supply and Drive Module Fault Conditions

Control Module Fault LED

A single LED, visible through the front panel, functions as a combined fault indicator. If the control module disables the drive when no terminal is connected to the step and direction control module, you can count the number of LED flashes to determine the first reason for the disabling (see Table K2-2). The sequence of flashes continues until the fault is cleared. A one- to two-second delay separates the LED flash sequences.

**RS-232C
Diagnostics and
Problem-Solving**

Via an RS-232C terminal or computer, you can use the System 7 status commands to locate faults. Once you locate the faults you can often resolve the problem by tuning the system with the tuning set-up commands. The most commonly used status command for diagnostics is the Report Servo Error Conditions (RSE) command. This command reports the cause of the fault condition that disabled the drive. Other useful diagnostic status commands are as follows:

- DFX Display interface status flags
- R Status request
- RA Limit switch status request
- RB Miscellaneous status request
- RG Go Home status request
- RS Sequence status request
- XC Report checksum
- XSD Sequence download status request
- XSR Sequence run status request
- XSS Sequence status

Refer to Section J2, *Software Reference*, for status and set-up command descriptions. Refer to Section G1, *Control Module*, for RS-232C connection instructions.

Table K1-2 provides solutions to common parameter set-up problems.

LED off	No fault
LED flashes once	The ST1 or OFF command has been sent. Send the ST0 or ON command to re-enable the drive.
LED flashes three times	The EPROM has been fitted with a different memory map. Check that the EPROM has the correct part number.
LED flashes four times	There has been a following error exceeding the value set by the CPZ command. Reset the value of CPZ if required and re-enable with ST0.
LED flashes five times	The checksum failed at power up.
LED flashes seven times	There has been a prolonged maximum torque demand causing the drive to disable. Investigate the excessive torque requirement.
LED flashes eight times	The ESTOP input has been seen by the indexer. To re-enable the drive, make sure the ESTOP input is connected to +12V.

Table K1-2. Control Module Fault Conditions

Electrical Noise

If the system is affected by electrical noise, it will normally manifest itself as erratic motor movement (the commanded position is not reached), or as movement of a motor which you expect to see at rest. Sources of electrical noise can often be difficult to find. All electrical systems are potential generators of electrical noise.

If you are having problems, refer to Section C1, *Installing the System*, and ensure that you have followed the recommendations. You should also consult the *Technical Data Section* of the Compumotor catalog.

Communications Problems

This section helps you diagnose problems related to RS-232C communications.

- Check the terminal communication parameters set up as follows:
 - 9600 baud
 - 8 data bits
 - no parity
 - 1 start bit
 - 1 stop bit
- Check that the terminal's Tx line is connected to the Control Module's Rx line and vice versa.
- Check that upper case characters are used.
- Send [CTRL] Q if XON/XOFF communications have been used.
- Send Z to ensure that the F command has not been used to disable communication.
- Type <CR> l to set echo back.
- Send nEX1 to set terminal mode if there is no prompt.
- Send SSHØ and then S to clear the command buffer.
- Check the status with the R command. The response should be *R if the controller is ready to accept a command or *B if it is busy.

Drive Control Problems

This section helps you diagnose problems related to drive control. If the communication is working correctly but the drive cannot be enabled, check the following:

- Drive may have to be defined by using the DR command. If the response is that the drive is undefined, use the HSB and HSC commands to configure the drive/motor type.
- The ESTOP input may be active. Current must be sourced to the ESTOP input to allow the drive to be enabled. If a switch is fitted, it should be normally-closed and connected to the +12V supply.
- Send S to clear the command buffer.
- Check the status of the servo error flags using the RSE command and note the number of flashes of the Fault LED on the control module.

Motor Control Problems

This section helps you diagnose problems related to motor control.

Motor Velocity Incorrect

If the motor does not run at the expected speed, check the following:

- Velocity signal
- HV supply voltage
- Main fuse on the three-phase supply
- Definition of the motor/drive (HSB command)
- Motor resolution (CMR command)
- User resolution (CUR command)
- Servo loop tuning
- Available motor torque
- Condition of the load
- Motor/Encoder connections
- Motor winding resistances (Do not strip the motor or its magnets may be affected.)

**Motor Acceleration/
Deceleration
Incorrect**

If the motor does not accelerate or decelerate as expected, check the following:

- Input acceleration rate demand
- Condition of the load
- Available motor torque
- Servo loop tuning

Returning The System

If you must return your system to effect repairs or upgrades, use the following steps:

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 system to Parker Compumotor, have someone from your organization with a technical understanding of the system 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 # xxxxxxxx

Summary

Using the fault LEDs and the information in this section, you should be able to identify and resolve most of the faults that arise within the system.

Appendices

Warranty

The items described in this document are hereby offered for sale at prices to be established by Parker Hannifin Corporation, its subsidiaries, and its authorized distributors. This offer and its acceptance by any customer (*Buyer*) shall be governed by all of the following Terms and Conditions. Buyer's order for any item described in its document, when communicated to Parker Hannifin Corporation, its subsidiary, or an authorized distributor (*Seller*) verbally or in writing, shall constitute acceptance of this offer.

1. Terms and Conditions of Sale

All descriptions, quotations, proposals, offers, acknowledgements, acceptances, and sales of Seller's products are subject to and shall be governed exclusively by the terms and conditions stated herein. Buyer's acceptance of any offer to sell is limited to these terms and conditions. Any terms or conditions in addition to, or inconsistent with those stated herein, proposed by Buyer in any acceptance of any offer by Seller, are hereby objected to. No such additional, different or inconsistent terms and conditions shall become part of the contract between Buyer and Seller unless expressly accepted in writing by Seller. Seller's acceptance of any offer to purchase by Buyer is expressly conditional upon Buyer's assent to all the terms and conditions stated herein, including any terms in addition to, or inconsistent with those contained in Buyer's offer. Acceptance of Seller's products shall in all events constitute such assent.

2. Payment

Payment shall be made by Buyer net 30 days from the date of delivery of the items purchased hereunder. Amounts not timely paid shall bear interest at the rate of 1.5% for each month or a portion thereof that Buyer is late in making payment. Any claims by Buyer for omissions or shortages in a shipment shall be waived unless Seller receives notice

thereof within 30 days after Buyer's receipt of the shipment.

3. Delivery

Unless otherwise provided on the face hereof, delivery shall be made F.O.B. Seller's plant. Regardless of the method of delivery, however, risk of loss shall pass to Buyer upon Seller's delivery to a carrier. Any delivery dates shown are approximate only and Seller shall have no liability for any delays in delivery.

4. Warranty

Seller warrants that the items sold hereunder shall be free from defects in material or workmanship for a period of 2 years from the date of shipment to Buyer. THIS WARRANTY COMPRISES THE SOLE AND ENTIRE WARRANTY PROVIDED HEREUNDER. SELLER MAKES NO OTHER WARRANTY, GUARANTEE, OR REPRESENTATION OF ANY KIND WHATSOEVER. ALL OTHER WARRANTIES, INCLUDING BUT NOT LIMITED TO, MERCHANTABILITY AND FITNESS FOR PURPOSE, WHETHER EXPRESS, IMPLIED, OR ARISING BY OPERATION OF LAW, TRADE USAGE, OR COURSE OF DEALING ARE HEREBY DISCLAIMED. NOTWITHSTANDING THE FOREGOING, THERE ARE NO WARRANTIES WHATSOEVER ON ITEMS BUILT OR ACQUIRED WHOLLY OR PARTIALLY, TO BUYER'S DESIGNS OR SPECIFICATIONS.

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SELLER'S LIABILITY ARISING FROM OR IN ANY WAY CONNECTED WITH THE ITEMS SOLD OR THIS CONTRACT SHALL BE LIMITED EXCLUSIVELY TO REPAIR OR REPLACEMENT OF THE ITEMS SOLD OR REFUND OF THE PURCHASE PRICE PAID BY BUYER, AT SELLER'S SOLE OPTION. IN NO EVENT SHALL SELLER BE LIABLE FOR ANY INCIDENTAL, CONSEQUENTIAL, OR SPECIAL DAMAGES OF ANY KIND OR NATURE WHATSOEVER, INCLUDING BUT NOT LIMITED TO LOST PROFITS

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6. Changes, Reschedules and Cancellations

Buyer may request to modify the designs or specifications from the items sold hereunder as well as the quantities and delivery dates thereof, or may request to cancel all or part of this order. However, no such requested modification or cancellation shall become part of the contract between Buyer and Seller unless accepted by Seller in a written amendment to this Agreement. Acceptance of any such requested modification or cancellation shall be at Seller's discretion, and shall be upon such items and conditions as Seller may require.

7. Special Tooling

A tooling charge may be imposed for any special tooling, including without limitation, dies, fixtures, molds and patterns, acquired to manufacture items sold pursuant to this contract. Such special tooling shall be and remain Seller's property notwithstanding payment of any charges therefor by Buyer. In no event will Buyer acquire any interest in apparatus belonging to Seller which is utilized in the manufacture of the items sold hereunder, even if such apparatus has been specially converted or adapted for such manufacture and notwithstanding any charges paid by Buyer therefor. Unless otherwise agreed, Seller shall have the right to alter, discard or otherwise dispose of any special tooling or other property in its sole discretion at any time.

8. Buyer's Property

Any designs, tools, patterns, materials, drawings, confidential information, or equipment furnished by Buyer or any other

items that become Buyer's property, may be considered obsolete and may be destroyed by Seller after two (2) consecutive years have elapsed without Buyer placing an order for the items that are manufactured using such property. Seller shall not be responsible for any loss or damage to such property while it is in Seller's possession or control.

9. Taxes

Unless otherwise indicated on the face hereof, all prices and changes are exclusive of excise, sales, use, property, occupational or like taxes which may be imposed by any taxing authority upon the manufacture, sale, or delivery of the terms sold hereunder. If any such taxes must be paid by Seller or if Seller is liable for the collection of such tax, the amount thereof shall be in addition to the amount for the items sold. Buyer agrees to pay all such taxes or to reimburse Seller therefore upon receipt of its invoice. If Buyer claims exemption from any sales, use, or other tax imposed by any taxing authority, Buyer shall save Seller harmless from and against any such tax, together with any interest or penalties thereon which may be assessed if the items are held to be taxable.

10. Indemnity for Infringement of Intellectual Property Rights

Seller shall have no liability for infringement of any patents, trademarks, copyrights, trade dress, trade secrets, or similar rights except as provided in this Part 10. Seller will defend and indemnify Buyer against allegations of infringement of U.S. patents, U.S. trademarks, copyrights, trade dress, and trade secrets (hereinafter 'Intellectual Property Rights'). Seller will defend at its expense and will pay the cost of any settlement or damages awarded in any action brought against Buyer based on an allegation that an item sold pursuant to this contract infringes the Intellectual Property Rights of a third party. Seller's obligation to defend and indemnify Buyer is contingent on Buyer notifying Seller within ten (10) days after Buyer becomes aware of such allegations of infringement, and Seller having sole control over the defense of any allegations or actions including all negotiations

for settlement or compromise. If an item sold hereunder is subject to a claim that it infringes the Intellectual Property Rights of a third party, Seller may, at his sole expense and option, procure for Buyer the right to continue using said item, replace or modify said item so as to make it non-infringing, or offer to accept return of said item and return the purchase price less a reasonable allowance for depreciation. Notwithstanding the foregoing, Seller shall have no liability for claims of infringement based on information provided by Buyer, or directed to items delivered hereunder for which the designs are specified in whole or part by Buyer, or infringements resulting from the modification, combination, or use in a system of any item sold hereunder. The foregoing provisions of this Part 10 shall constitute Seller's sole and exclusive liability and Buyer's sole and exclusive remedy for infringement of Intellectual Property Rights.

If a claim is based on information provided by Buyer or if the design for an item delivered hereunder is specified in whole or in part by Buyer, Buyer shall defend and indemnify Seller for all costs, expenses, or judgments resulting from any claim that such item infringes any patent, trademark, copyright, trade dress, trade secret, or any similar right.

11. Force Majeure

Seller does not assume the risk of and shall not be liable for delay or failure to perform any of Seller's obligations by reason of circumstances beyond the reasonable control of Seller (hereinafter 'Events of Force Majeure'). Events of Force Majeure shall include without limitation, accidents, acts of God, strikes or labor disputes, acts, laws, rules or regulations of any government or government agency, fires, floods, delays or failures in delivery of carriers or suppliers, shortages of materials, and any other cause beyond Seller's control.

12. Entire Agreement/ Governing Law

The terms and conditions set forth herein, together with any amendments, modifications, and any different terms or conditions expressly accepted by Seller in writing, shall constitute the entire

Agreement concerning the items sold, and there are no oral or other representations or agreements which pertain thereto. This Agreement shall be governed in all respects by the law of the State of Ohio. No actions arising out of the sale of the items sold hereunder of this Agreement may be brought by either party more than two (2) years after the cause of action accrues.

Index

- 7-signal link A1-4
- Absolute mode H1-5
- Absolute zero J1-67
- Accessibility C1-2
- Address settings H1-22
- Asynchronous mode H1-7
- Bench test configuration B1-1
- Buffered commands J1-1
- Buffers H1-10, J1-1
- Command buffer J1-1
- Communications problems K1-5
- Computer Host mode J1-1
- Continuous moves H1-5
- Control module (RS-232C) A1-4
 - address settings H1-22
 - fault conditions K1-3
 - LED H1-2
 - specifications H1-2
- Daisy-chaining H1-21
- Dimensions A1-1
- Dither H1-10
- Drive module F1-1
 - control problems K1-5
 - current limit levels F1-5
 - fault conditions K1-3
 - functional block diagram F1-2
 - HV fuse F1-4
 - LEDs F1-6
 - specifications F1-3
- Encoder
 - connections B1-2, G1-4
 - couplings G1-5
- Encoder backup supply G1-5, H1-15
- Encoder following H1-9
- ESTOP input H1-13
- Fault LED diagnostics K1-2
- Following H1-9
- Functional block diagram A1-3
- Handshaking H1-19
- HELP11 H1-25
- Hold off distance H1-7
- Immediate commands J1-2
- Incremental mode H1-4
- Initialization H1-10
 - normal H1-10
 - reduced movement H1-10
- Installation
 - cables C1-4
 - drive F1-4
 - heat sinking C1-3
 - motors C1-3
 - precautions C1-1
 - shielding C1-4
 - transformer C1-4
- Interactive mode J1-1
- Limit inputs H1-16
 - end-of-travel H1-16
 - home H1-17
- Linear interpolation H1-7
- Module removal C1-2
- Motor G1-1
 - cabling G1-4
 - connections B1-2, G1-4
 - control problems K1-5
 - dimensions G1-2
 - specifications G1-1
 - motor/encoder couplings G1-6
- Parameter settings H1-25
- Position error H1-27
- Position monitoring H1-14
- Power supply module A1-5, E-1
 - AC input E-3
 - DC output E-3
 - fault conditions K1-3
 - fuses E-2
 - specifications E-1
- Preset moves H1-4
- Pulse width modulated signal A1-2
- Rack Dimensions C1-1
 - HP vs. U A1-2
- Reduced movement initialization H1-10
- Registration H1-6
- Return Material Authorization (RMA) number K1-6
- RS232C
 - communication parameters B1-3, H1-19
 - diagnostics K1-4
 - front-panel access H1-20
 - motherboard connections H1-20
 - permanent or temporary connection H1-20
- Safety precautions H1-24
- Self-tuning H1-23, H1-30
- Sequence buffer J1-1
- Sequence execution via command input J1-11
- Sequence execution via hardware input J1-11
- Servo control loop H1-23
- Simultaneous start H1-7
- Software scaling H1-10
- Speed relationship H1-7
- Synchronous mode H1-7
- Test (functional) B1-4
- Transformers A1-5, D-1
 - fuse D-3
 - single-phase D-1
 - three-phase D-3
- Tuning
 - parameters H1-23, H1-24
 - procedure H1-27
- User memory H1-10
- Velocity monitoring H1-15
- Ventilation C1-2
- Warranty APP-1
- Z channel C1-5
- ZDDC H1-21