

C H A P T E R 7

Troubleshooting

When a problem occurs in your system, use the following strategy to isolate and identify the problem:

- Check Light Emitting Diodes (LEDs) and the Fault Output for an indication of the cause of the problem.
- Check other possible causes.

When we refer to LEDs,

- **ON** means *illuminated*.
- **OFF** means *not illuminated*.

When we refer to the Fault Output,

- **HIGH** means +5VDC.
- **LOW** means ground, or 0VDC to 0.8VDC.

The next table summarizes LED & Fault Output information. The table after that summarizes other possible sources of problems. Detailed troubleshooting procedures follow the tables.

Check LEDs First!

If you encounter problems, you may be able to quickly identify the problem by looking at the LEDs and the fault output. The next table summarizes possible LED and fault output states.

LEDs and FAULT OUTPUT			
GREEN LED	RED LED	FAULT OUT	CONDITION
OFF	OFF	HI	No Power; or Short on Hall +5VDC or short on Encoder +5VDC
ON	OFF	LO	Normal operating condition
ON	INT	LO	Foldback
ON	ON	LO	Foldback (Red LED turns off within 10 seconds if command input is reduced to 0V)
ON	INT	INT	Normal condition while drive is powering up, or turning off; or, Weak power supply, VDC is too low for operation
ON	ON	HI	Power supply undervoltage; or, No enable
↑		NOT LATCHED	Can recover from above conditions without cycling power.
↓		LATCHED	Cycle power to reset drive, and recover from conditions below.
ON	ON	HI	Overvoltage from regeneration; or, Overtemperature
OFF	ON	HI	Short circuit in load or cables; or bad Hall state (all high or low); or, Power supply fault (typically, a transient undervoltage)
Legend			
			ON = LED is ON (Illuminated); or, HI = Fault Output is HIGH (+5VDC)
			OFF = LED is OFF (Not Illuminated); or, LO = Fault Output is LOW (0VDC, or Ground)
			INT = LED turns ON, then turns OFF; or, INT = Fault Output goes LOW, then goes HIGH

For a detailed description of the various fault conditions, see the basic troubleshooting procedure below.

Other Possible Problems

If the drive is powered up, enabled, and operating properly:

- The green LED is ON
- The red LED is OFF
- The fault output is LOW

These conditions indicate that the OEM770X is probably not the source of the problem. The next table summarizes other possible sources of problems.

TROUBLESHOOTING TABLE	
<i>Possible Source of Problem</i>	<i>SOLUTION</i>
PROGRAM	Verify motion is being commanded.
MOTOR	Check for motor problems. Check motor coils for continuity, shorts, proper resistance. Check Hall and Phase wiring.
MECHANICAL SYS.	Check for jams, binds, increased friction, etc.
WIRING	Check motor wiring: Phases, Hall Effects. Check power supply wiring.
OVERHEATING	Verify that drive's heatplate has good thermal contact with heatsink. Check mounting screws. Provide sufficient ventilation.
POWER SUPPLY	Verify power supply delivers enough power during entire move, without undervoltage, or overvoltage caused by regeneration.
MOVE PROBLEMS	Check speed/torque limitations. Check for excessive friction, regeneration, problems with gravity, transient undervoltage, etc.
RS232 PROBLEMS	Verify proper communications.
ELECTRICAL NOISE	Check for problems caused by electrical noise. Consult Compumotor's <i>EMC Installation Guide</i> for possible solutions.

Details on these problems are discussed after the next section.

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Symptoms	Possible Causes	Solutions	Useful Commands
No motion	Limits active	Check hard wiring Disable limits	R,RA,LD
	Exceeded maximum distance range	Reset absolute counter with PZ command	PZ, D, MPI, PR
	Position error (red fault light is on)	CPE command too small Check encoder wiring	R,RSE,CPE,DP E
	Already executing a command	Check status commands	R,RB
	Servo gains too small	Increase gains	CPG,CDG,CIL, CIG
	Stop, kill, trigger inputs active	Check wiring to inputs Check input setup	R,RB,IN,IS
	Loop, pause active	Check status commands	R,RB
	Incorrect unit address	Verify unit address Re-issue unit address	R,#
	In absolute mode (already at position)	Issue new or different absolute distance Issue MPI command	R,MPI,MPA
Unit shutdown (red fault light is on)	Enable drive Verify hardwire enable input is shorted	ST, ON R,IS	
No communications	RS-232 miswired	Check wiring for RS-232	
	Wrong RS232 settings	9600 Baud, 8 data bits, 1 stop bit, no parity	
	F command enabled	Issue an E command	E,F
Motor runs away	Encoder miswired	Check encoder wiring Verify power to encoder	
	Controller not receiving encoder pulses	With drive disabled turn shaft clockwise (front of motor) PX should read positive counts	ST0,OFF,ST1, ON,DPA,PX
Fault LED & output active	Position error	Increase allowable position error Decrease moveparameters	CPE,DPE, RSE A,V
	Unit disabled	Enable unit	ST0,ON
Unit not responding to commands	Defined a sequence and didn't close with an XT	Issue an XT at the end of a sequence	XD,XT
	Communications disabled	Enable communications	E,F

RS-232C PROBLEMS

Use the following procedure to troubleshoot communication problems that you may have with the OEM770X.

1. Be sure the host computer's transmit (Tx) wire is wired to the peripheral's receive (Rx) connection, and the host computer's receive (Rx) wire is wired to the peripheral's transmit (Tx) connection. Switch the receive and transmit wires on either the host or peripheral if the problem persists.

CAUTION

OEM770X Rx, Tx, and GND pin outs are not 2, 3, and 7 like most devices.

2. Confirm that the host and peripheral are configured for the same baud rate, 8 data bits, 1 stop bit, and no parity.
3. Use DC common or signal ground as a reference, not earth ground.
4. Cable lengths should not exceed 50 feet (15 m) unless you are using some form of line driver, optical coupler, or shield. As with any control signal, be sure to shield the cable-to-earth ground at one end only.
5. To test the terminal or terminal emulation software and the RS-232C cable for proper three-wire communication, unhook the OEM770X and enter a character. You should not receive an echoed character. If you do, you are in half duplex mode. Connect the host's transmit and receive lines together and send another character. You should receive the echoed character. If not, consult the manufacturer of the host's serial interface for proper pin outs.
6. *The following applies only to firmware 92-016637-01 or higher:*
If the OEM770X echoes back **&** for each byte sent to it, a data communication error has occurred. To re-establish communication, see the **%** command.
7. *The following applies only to firmware 92-016637-01 or higher:*
To extend cable length and/or improve noise immunity, an RS-485 option is available as a custom product. Contact Compumotor's Custom Products Department for details.

SOFTWARE DEBUGGING TIPS

This section offers helpful tips for debugging programs and understanding errors and fault conditions. The OEM770X has several tools that you can use to debug a problem in the system. The software tools are:

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R—Report Status

RA—Limit Switch Status Report

RB—Loop, Pause, Shutdown, Trigger Status report

RSE—Report Servo Errors

IS—Input Status Report

BS—Buffer Status Report

B—Buffer Status Report

The troubleshooting table also offers possible causes for typical symptoms.

ENCODER PROBLEMS

Since the OEM770X relies on feedback information, encoder connections are critical for the unit to operate properly. If you suspect the OEM770X is not receiving good position data, use the following procedure to verify.

1. Disable the drive (**ST1** or **OFF**).
2. Enter a **PZ** command.
3. Rotate the motor CW by hand approximately one revolution.
4. Enter a PX. It should read approximately 4000 (for a 1000 line encoder).
5. Rotate CCW one revolution.
6. Enter PX command. It should read approximately 0.

If your OEM770X did not respond with similar values, it is not receiving encoder information. Either the encoder is miswired or in need of repair. If the green LED is *off*, verify that the Encoder/Hall +5V power is present. If not, repair encoder and Hall wiring and cycle power.

Homing Diagrams

The following diagrams are examples of the many possible homing set-ups. Your parameters may vary and the results may vary slightly depending on your settings.

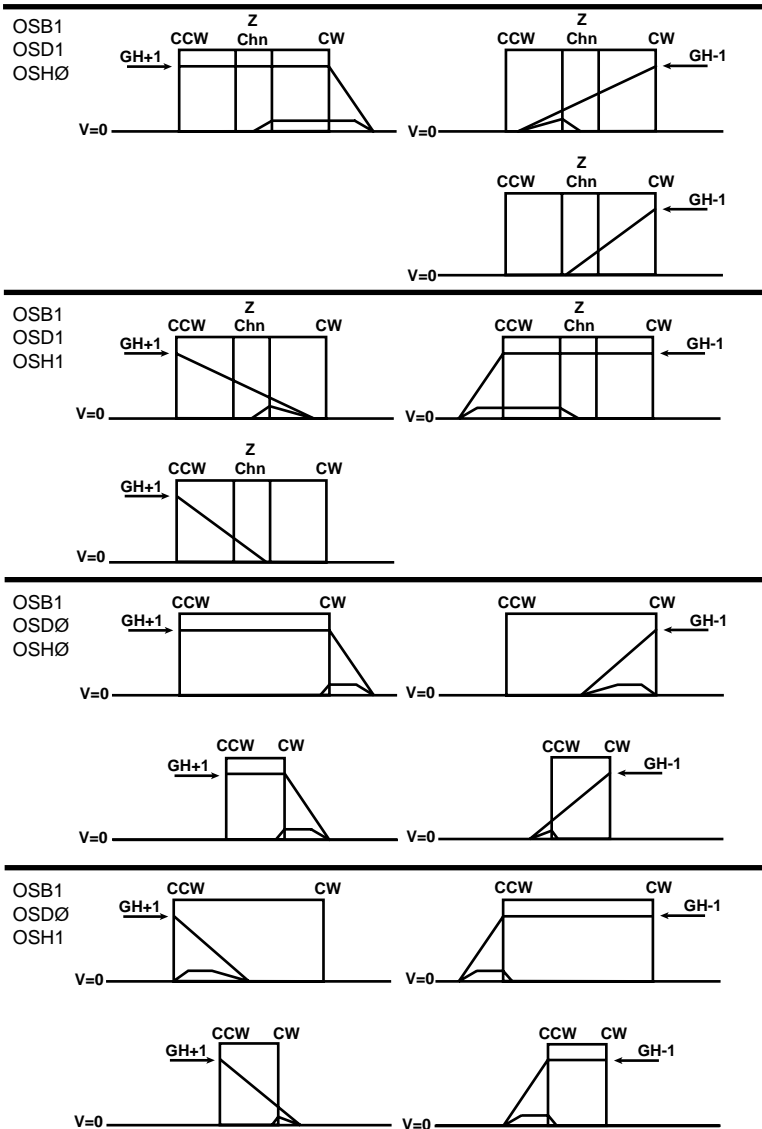
The CW side of the home pulse is the side closest to the CW limit. The CCW side of the home pulse is the side closest to the CCW limit.

The long pulse diagrams are indicative of situations where the motor decelerates while remaining inside the home pulse width due to the rapid homing deceleration or a very wide home pulse. The short pulse diagrams are indicative of situations where the motor decelerates through the home pulse width due to slow deceleration or a very narrow pulse width.

If an end-of-travel limit is hit during the initial homing, refer to the homing diagram for the opposite direction of travel.

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The diagrams are drawn as a general guide. Velocity levels and slopes are drawn to indicate the general move profile the motor will make during the go home move. The vertical axis is velocity and the horizontal axis is position in relation to the home input transitions. Some lines are drawn as closely as possible together to indicate identical velocities, yet remain discernible.



Basic Troubleshooting Method

To identify the cause of a problem, find the condition below that matches your situation. Then follow the detailed procedure listed under that condition.

ARE BOTH LEDs OFF?

Possible Problems:

- No power from power supply

Procedure

1. Remove power. Disconnect all wiring except VDC+ and VDC-. Reapply power. Verify that power supply voltage is in the 24VDC–75VDC range. Is the green LED now on?
2. If the green LED is still off, return the drive to Compumotor.

IS THE GREEN LED OFF, AND RED LED ON?

Possible problem:

- Short circuit in motor or cabling

Procedure

1. Remove power.
2. Disconnect all wiring except VDC+ and VDC-.
3. Reapply power.
4. Green LED should now be on, and red LED should be off. This indicates the problem is a short circuit in the cabling or motor.
5. Fix the short, and cycle power.

Possible problem:

- Bad Hall state (all three HIGH or all three LOW)

Procedure

1. Remove power.
2. Disconnect all wiring except VDC+ and VDC-.
3. Connect a jumper wire from any Hall input to HALL GND.
4. Apply power. The green LED should now be *on*.

5. Next, remove power again. Connect Hall wires to motor (Hall 1, Hall 2, Hall 3, Hall GND, Hall +5). *Do not connect motor phase wires.*
6. Apply power.
7. If green LED is off, and red LED is ON, then problem is a bad Hall state (all three HIGH or all three LOW). Possible causes are Hall miswiring, a damaged motor, or a short in Hall or encoder power wiring. Check Hall wiring, and voltage levels at Hall terminals. Check motor for faulty Hall sensors.
8. Measure HALL +5V with respect to HALL GND. If there is no HALL +5V, disconnect Encoder +5V and cycle power. If HALL +5V returns after you cycle power, then the encoder power wiring is bad (possibly a short on Encoder +5 wiring).

Possible problem:

- Power supply undervoltage during move

Procedure

1. Cycle power. Green LED should now be on, red LED off.
2. Make the move.
3. If the move causes a fault, the problem is probably a power supply undervoltage during the move. Try a larger power supply.

IS GREEN LED ON, RED LED OFF—BUT NO MOTION?

These conditions indicate that the OEM770X is powered up, enabled, and operating properly. It is probably not the source of the problem. Look for the cause of the problem elsewhere in your system.

Possible problems:

- Wrong motor phase wiring
- Wrong motor Hall effect wiring
- Mechanical jam
- Program is not commanding motion

Procedure

1. Verify program is commanding motion.
2. Try to rotate the shaft manually. If you can, then the motor phases are probably miswired. Or, the motor may be damaged—check its phases for proper resistance, continuity, shorts, shorts to the case, etc.

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3. If you cannot rotate the shaft, disable the drive. Try to rotate the shaft manually.
4. If you can rotate the shaft, then Hall wires are probably miswired. Check them, and check the motor temperature. (Without proper Hall inputs, the drive may command maximum current and overheat the motor—but no motion will result.)
5. If you cannot rotate the shaft, the machine is mechanically jammed.

ARE GREEN AND RED LEDs BOTH ON?

Possible problems:

- Not Enabled
- Foldback
- Power Supply problem
- Overvoltage
- Overtemperature

Procedure

1. Check the enable input to see if it is low (grounded). If not, then the drive is not enabled.
2. With the drive enabled, reduce command input to 0VDC. If the red LED goes out within 10 seconds, then foldback was the problem. Check motor temperature. Check for a mechanical jam in your system.

(**NOTE:** The fault output stays LOW during foldback. Foldback is the only condition that turns the red LED ON, but keeps the fault output LOW)

3. If red LED is still on (with a 0VDC command input), measure power supply voltage at the drive terminals, VDC+ and VDC-. It should be in the 24VDC – 75VDC range. If not, there is a power supply or power cabling problem.
4. With proper power supply voltage at the drive, measure the temperature of the drive's heatplate. Is it hot? If so, the problem could be an overtemperature shutdown. Wait 30 minutes for the drive to cool. Check for proper drive mounting and heatsinking. Check for a mechanical jam. When the drive has cooled, cycle power to resume operations. If overheating persistently causes shutdowns, you can try several remedies: change move profile or duty cycle; improve drive

mounting or heatsinking; reduce drive ambient temperature; add forced air cooling.

5. With proper power supply voltage at the drive, and if the drive is not hot, the problem could be an overvoltage fault. Regeneration during deceleration could have caused the overvoltage fault. Cycle power to resume operations. If regeneration repeatedly causes overvoltage faults, you can try several remedies to solve the problem: reduce deceleration rate; reduce bus voltage; add bus capacitance; add power dump circuitry.

NOTE: Overvoltage and overtemperature faults both have identical indicators: red and green LEDs both ON; fault output HIGH; fault condition is *latched*. To distinguish between the two faults, monitor conditions while the drive runs. Monitor heatplate temperature to see if it gets too high, which could cause an overtemperature fault. Monitor power bus voltage, to see if it gets too high, particularly during deceleration. This could cause an overvoltage fault.

Miscellaneous Problems

The basic troubleshooting procedure, presented above, will identify most problems, particularly those that affect the LEDs or the fault output. Some problems, however, occur transiently during a move, or do not affect the LEDs. Others may be due to wiring mistakes, or failure of other components in the system (encoder, motor, etc.). The sections below will help you identify such problems.

PROBLEMS DURING MOVE

Speed/Torque Limitations

Make sure that you are not commanding a move that requires the motor to go faster than it can, or use more torque than it can produce. Check the motor's speed/torque curve for your operating voltage.

Weak Power Supply

A weak power supply may not produce sufficient power during all parts of the move. It can cause an undervoltage problem. Undervoltage can affect the drive in two ways:

- Temporary Fault – the red LED will turn ON and the fault output will go HIGH during the undervoltage condition. The fault is *not latched*, and will disappear when the voltage goes above approximately 24VDC.
- Latched Fault—The undervoltage trips the short circuit protection. The green LED is turned off, the Red LED is turned ON, and the fault output goes HIGH. This is a *latched* condition.

For a full description of faults caused by a weak power supply, see the section on *Undervoltage*, and the section on *Short Circuit Protection*, in *Chapter 4 Special Internal Circuits*.

Excessive Friction

Too much friction in your system might cause move problems. Excessive friction can cause trouble when mechanical components in a system age. As friction increases, problems may occur in a system that had previously been working well.

MECHANICAL PROBLEMS

Check for binds, jams, increased friction, or other problems in the mechanical system. If a system was working properly, but then suddenly develops new problems, check for changes in the mechanical system that could be causing the problems.

ELECTRICAL NOISE PROBLEMS

Electrical noise can cause problems, depending on the application and the sensitivity of equipment in the system. For more information on identifying problems caused by electrical noise, and solutions to those problems, consult the technical section in Compumotor's *EMC Installation Guide*.

Product Return Procedure

If you must return the OEM770X for repairs, 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 to be out of warranty.
2. In the USA, call your Automation Technology Center (ATC) for a Return Material Authorization (RMA) number. Returned products cannot be accepted without an RMA number. If you cannot obtain an RMA number from your ATC, call Parker Compumotor's Customer Service Department at (800) 722-2282.

Ship the unit to:

Parker Hannifin Corporation
Compumotor Division
5500 Business Park Drive, Suite D
Rohnert Park, CA 94928
Attn: RMA # xxxxxxxxx

3. In the UK, call Parker Digiplan for a GRA (Goods Returned Authorization) number. Returned products cannot be accepted without a GRA number. The phone number for Parker Digiplan Repair Department is 0202-690911. The phone number for Parker Digiplan Service/Applications Department is 0202-699000.

Ship the unit to:

Parker Digiplan Ltd.
21, Balena Close,
Poole, Dorset,
England. BH17 7DX

4. Elsewhere: Contact the distributor who supplied the equipment.