

CHAPTER FIVE

Troubleshooting

IN THIS CHAPTER

- ❑ The information in this chapter will enable you to isolate and resolve system hardware problems.

TROUBLESHOOTING PROCEDURE

When your system does not function properly (or as you expect it to operate), the first thing that you must do is identify and isolate the problem. When you have accomplished this, you can effectively begin to 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 exchange them with existing components in your system to help identify the source of the problem.

Determine if the problem is mechanical, electrical, or software-related. Can you repeat or recreate 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 occur before the subsequent system problem.

You may be experiencing more than one problem. You must isolate and 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.

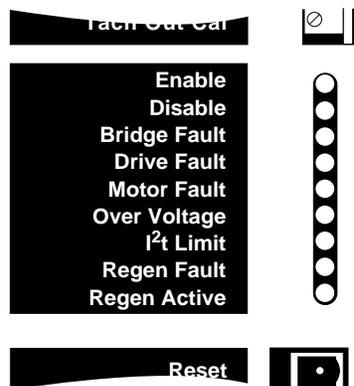
If you are having difficulty isolating a problem be sure to document all occurrences of the problem along with as much specific information, such as time of occurrence, APEX status, and anything else that was happening when the problem occurred.

Once you have isolated a problem, take the necessary steps to resolve it. Refer to the problem solutions contained in this chapter. If your system's problem persists, contact Parker Compumotor's Applications Department at the phone number provided on the inside front cover of this document.

DIAGNOSTIC LEDs

The APEX Drive has a bank of nine light emitting diodes (LEDs) on its front panel. Use these LEDs to isolate and identify problems.

The LED portion of the front panel is shown below. The **Enable** LED, when illuminated, is green. All other LEDs are red when illuminated.



If a problem arises, first check the LEDs for an indication of the problem's origin. The next table explains situations that can illuminate each LED. Also see *Recovering From Faults* in the next section.

LED	Description	Latched (yes/no)	How to reset the fault
Enable	Indicates drive is enabled	no	n/a
Disable	Indicates drive is disabled	no	see Note 1 and Note 2
Bridge Fault	Power stage overtemperature	yes	Note 1
	Power stage overcurrent	yes	Note 1
	Motor short circuit	yes	Note 1
Drive Fault	Control board overtemperature	yes	Note 1
	Undervoltage (brownout)	yes	Note 2
Motor Fault	Resolver not connected	yes	Note 1
	Motor overtemperature	yes	Note 1
	Motor thermostat not connected	yes	Note 1
Over Voltage Fault	Bus voltage exceeded 420VDC	yes	Note 1
I ² T Limit	I ² T limit. Drive is in foldback. Output is limited to continuous current setting.	no	Note 3
Regen Fault	Excessive regeneration (external regeneration resistor may be required)	yes	Note 1
Regen Active	Regeneration circuit active (regeneration resistor is turned on, and dissipating excess power)	no	Note 3

Note 1: Activate **Reset** input on the controller connector (hold the input at a low voltage—less than 1.0V—for at least 20 milliseconds; reset begins upon release of the low voltage); or cycle power on Control L1/L2.

Note 2: When the bus voltage drops below 85VAC the **Drive Fault** LED will latch, indicating an undervoltage condition. When the bus voltage has recovered there are three ways to clear the drive fault: (1) issue a reset via the **RESET** input, (2) cycle power on **Control L1/L2**. (3) toggle the **Enable In** input.

Note 3: These conditions are not latched. Drive will recover on its own when foldback or regen event is over.

RECOVERING FROM FAULTS

Fault conditions will shut down the APEX Drive's current output to the motor. Before trying to restart your system, you should first solve the problem that caused the fault. For example, if a short circuit in a motor cable caused a bridge fault, the same fault will probably occur when you restart the drive—unless you first fix the problem.

Most of the fault conditions are *latched*. This means that after the problem is fixed, the drive will not start up again on its own. You must first reset the drive, or cycle power.

To *reset* the APEX Drive, send a reset signal to the APEX's **Reset** input. A reset signal is a low voltage—less than 1.0V. You can ground the input, or hold it at a low voltage, for at least 20 milliseconds. Reset begins upon release of the low voltage.

To *cycle power*, turn off AC power to the APEX Drive, then turn the power back on. If **L1/L2/(L3)** has a separate power input from **Control L1/L2**, you can cycle power by doing either of the following:

- Turn off AC power *only* to **Control L1/L2**
- Turn off AC power to *both* **Control L1/L2 and L1/L2/(L3)**

Turning off AC power only to **L1/L2/(L3)** will not clear all fault conditions. Even if you corrected the original fault, cycling power on **L1/L2/(L3)** will result in a latched undervoltage fault. You would then need to cycle power on **Control L1/L2** to clear the undervoltage fault.

Recovery procedures for each fault condition are listed below.

BRIDGE FAULT

DRIVE FAULT

MOTOR FAULT

OVER VOLTAGE

REGEN FAULT

For each of these faults, the APEX Drive's output current to the motor will be *latched off*.

To recover from these fault conditions, do either of the following:

- Reset the APEX Drive; or
- Cycle Power

To recover from a **Drive Fault** caused by an undervoltage, you can use either of the above methods; or, you can toggle the enable input after the voltage has recovered.

I²T LIMIT

This condition is *not latched*. It indicates that the APEX Drive is in current foldback, with its output current limited to the continuous current level. The drive may recover on its own, if the level of continuous current is low enough to permit the motor to cool.

Under some conditions, the drive may not recover on its own—it may stay in current foldback. To recover, turn off AC power to the drive, then wait for the motor to cool before you resume operations.

Do not use the **Reset** input to clear the fault. If you do so, the protective circuit loses all information about motor temperature. It assumes the motor operates from a cold start, and it may not protect the motor from overheating if the motor is hot when you reset the drive.

When an **I²T Limit** occurs, it indicates that something is wrong with your system—a mechanical jam, the motor is undersized, the move is too aggressive for the motor, etc. You should solve the problem that caused the **I²T Limit**.

The motor has less torque during an **I²T Limit**. If you configure your controller to detect position errors, then an **I²T Limit** will probably cause a position error fault in your controller.

REGEN ACTIVE

This is not a fault condition. When the LED turns on, it indicates that the internal regeneration resistor is dissipating excess regenerated power. The LED will turn off when the resistor stops dissipating power.

COMMUTATION TEST MODE

You can operate the APEX Drive in *commutation test mode* to help identify and isolate problems. When it runs in commutation test mode, the APEX Drive does not use any motor feedback information for commutation. It ignores the resolver or the Hall effect sensor input, and commutates the motor in an open loop fashion at one revolution per second. The current it sends to the motor will be proportional to the command input voltage.

You can use commutation test mode to verify that your APEX Drive is commutating properly, and that the motor phases are wired correctly.

To operate in commutation test mode:

- ① Turn off AC power to the APEX Drive.
- ② Turn DIP Switch#3, Position#3, ON.
- ③ Turn on AC power to the APEX Drive.
- ④ Slowly increase the command input voltage until the motor starts to turn.
- ⑤ The APEX Drive should begin commutating the motor clockwise at the following speeds:
 - 1 rps (for 2-pole motors)
 - 2/3 rps (for 3-pole motors)
- ⑥ Depending upon your application, you may need to remove the load from the motor, or adjust command input to get adequate motor current. (Current will be scaled as set with DIP Switch#3, positions 6 & 7.)

RETURNING THE APEX DRIVE

If you must return your APEX system for 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 to be out of warranty.
- ② Before you return the unit, have someone from your organization with a technical understanding of the APEX Drive and its application include answers to the following questions:
 - What is the extent of the failure/reason for return?
 - How long did it operate?
 - Did any other items fail at the same time?
 - What was happening when the unit failed (e.g., 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 environment (temperature, enclosure, spacing, unit orientation, contaminants, etc.)?
 - What upgrades, if any, are required (hardware, cables, user guide)?
- ③ 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 # xxxxxxxx

- ④ 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

- ⑤ Elsewhere: Contact the distributor who supplied the equipment.