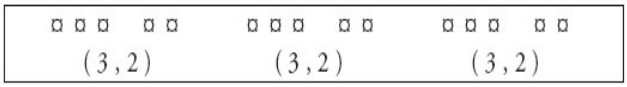
5 DIAGNOSTICS AND TROUBLESHOOTING

The 1207/1207A controllers provide diagnostics information to assist technicians in troubleshooting drive system problems. The diagnostics information can be obtained in two ways: reading the appropriate display on the programmer or observing the fault codes issued by the Status LED. The Status LED is located on top of the controller. On 1207 models, it is under the sliding protective cover.

LED DIAGNOSTICS

During normal operation, with no faults present, the Status LED flashes a single flash at approximately 1 flash/second. If the controller detects a fault, a 2-digit fault identification code is flashed continuously until the fault is corrected. For example, code "3,2"—welded direction contactor—appears as:



The codes are listed in Table 1. For suggestions about possible causes of the various faults, refer to the troubleshooting chart (Table 2).

Table 1 LED CODES

LED CODE		EXPLANATION
LED off	▬	no power or defective controller
solid on	▭	defective controller
single flash	▫	controller operational; no faults
1,2	▫ ▫▫	hardware fail-safe error
1,3	▫ ▫▫▫	M- fault or motor output short
1,4	▫ ▫▫▫▫	sequencing fault (SRO)
2,1	▫▫ ▫	5kΩ–0 or throttle wiper input fault
2,2	▫▫ ▫▫	emerg. rev. circuit check fault (BB wiring)
2,3	▫▫ ▫▫▫	high-pedal-disable fault (HPD)
2,4	▫▫ ▫▫▫▫	throttle pot low open or shorted to B+ or B-
3,1	▫▫▫ ▫	contactor or shunt driver overcurrent
3,2	▫▫▫ ▫▫	welded direction contactor
3,3	▫▫▫ ▫▫▫	[reserved for future use]
3,4	▫▫▫ ▫▫▫▫	missing contactor or shunt
4,1	▫▫▫▫ ▫	low battery voltage
4,2	▫▫▫▫ ▫▫	overvoltage
4,3	▫▫▫▫ ▫▫▫	thermal cutback
4,4	▫▫▫▫ ▫▫▫▫	[reserved for future use]

NOTE: Only one fault is indicated at a time, and faults are not queued up.

Table 2 TROUBLESHOOTING CHART

LED CODE	PROGRAMMER LCD DISPLAY	EXPLANATION	POSSIBLE CAUSE
1,2	HW FAILSAFE	hardware fail-safe error	1. Controller defective.
1,3	M- SHORTED	M- output shorted	1. M- output shorted to ground. 2. Direction contactor not closing. 3. Direction contactor not closing fast enough. 4. Internal motor short to ground.
1,4	SRO	SRO fault	1. Improper sequence of KSI, brake, and direction inputs. 2. Wrong SRO type selected. 3. Brake or direction switch circuit open. 4. Sequencing delay too short.
2,1	THROTTLE FAULT 1	5kΩ–0 or wiper fault	1. Throttle input wire open. 2. Throttle input wire shorted to ground or B+. 3. Throttle pot defective. 4. Wrong throttle type selected.
2,2	BB WIRING CHECK	emerg. reverse wiring fault	1. BB wire open. 2. BB check wire open.
2,3	HPD	HPD sequencing fault	1. Improper seq. of KSI, brake, throttle inputs. 2. Wrong HPD type selected. 3. Misadjusted throttle pot.
2,4	THROTTLE FAULT 2	Pot Low broken or shorted	1. Pot Low wire open. 2. Pot Low wire shorted. 3. Wrong throttle type selected.
3,1	CONT DRVR OC	driver output overcurrent	1. Direction contactor coil shorted. 2. Shunt field shorted.
3,2	DIR CONT WELDED	welded direction contactor	1. Direction contactor stuck closed.
3,4	MISSING CONTACTOR	missing contactor or shunt	1. Direction contactor coil open. 2. Direction contactor missing. 3. Shunt field open. 4. Wire to shunt or direction contactor open.
4,1	LOW BATTERY VOLTAGE	low battery voltage	1. Battery voltage <16 volts. 2. Corroded battery terminal. 3. Loose battery or controller terminal.
4,2	OVERVOLTAGE	overvoltage	1. Battery voltage >48V (1207); >33V (1207A). 2. Vehicle operating with charger attached.
4,3	THERMAL CUTBACK	over-/under-temp. cutback	1. Temperature >85°C or <-25°C. 2. Excessive load on vehicle. 3. Improper mounting of controller. 4. Operation in extreme environments.

Operational faults—such as overtemperature—are cleared as soon as operation is brought within range. Non-operational faults—such as a throttle fault—usually require the brake or keyswitch to be cycled after the problem is remedied.

PROGRAMMER DIAGNOSTICS

With a programmer, diagnostics and troubleshooting is more direct than with the LED alone. The programmer presents complete diagnostic information in plain language—no codes to decipher. Faults are displayed in the Diagnostic Menu, and the status of the controller inputs/outputs is displayed in the Test Menu.

The following 4-step process is generally used for diagnosing and troubleshooting an inoperative vehicle: (1) visually inspect the vehicle for obvious problems; (2) diagnose the problem, using the programmer; (3) test the circuitry with the programmer; and (4) correct the problem. Repeat the last three steps as necessary until the vehicle is operational.

> **Example**: A vehicle that does not operate in "forward" is brought in for repair.
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> STEP 1: Examine the vehicle and its wiring for any obvious problems, such as broken wires or loose connections.
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> STEP 2: Connect the programmer, put it in diagnostic mode, and read the displayed fault information. In this example, the display shows "No Faults Present," indicating that the controller has not detected anything out of the norm.
>
> STEP 3: Put the programmer in test mode, and observe the status of the inputs and outputs in the forward direction. In this example, the display shows that the forward switch did not close when "forward" was selected, which means the problem is either in the forward switch or the switch wiring.
>
> STEP 4: Check or replace the forward switch and wiring and repeat the test. If the programmer shows the forward switch closing and the vehicle now drives normally, the problem has been corrected.

Refer to the troubleshooting chart (Table 2) for suggestions covering a wide range of possible faults.