

The diagram illustrates the power supply circuit for an ECM. A BATTERY is connected to a KEY SWITCH. The KEY SWITCH controls the IGNITION circuit, which passes through an ECM RELAY. The ECM RELAY has terminals labeled 30, 87, 85, and 86. The ECM ELECTRONIC CONTROL MODULE is connected to the BATTERY via a KEEP ALIVE MEMORY circuit and to the IGNITION circuit via the ECM RELAY. The ECM RELAY is also connected to a common ground.

The ECM receives 12 volt operating power with the key ON from the ECM power relay. The ECM also receives 12 volt battery power at all times for the Keep Alive Memory function.

Battery power is applied at all times to support the ECMs keep alive memory. Refer to KEEP ALIVE

The ECM monitors voltage at terminals 37 and 57. If the ECM continuously receives less than 6.5 volts or more that 18 volts a fault code will be set. The fault codes do not cause the Warning light to be turned ON. If the condition is intermittent, the code will be logged as an inactive code.

# ELECTRONIC CONTROL SYSTEM DIAGNOSTICS

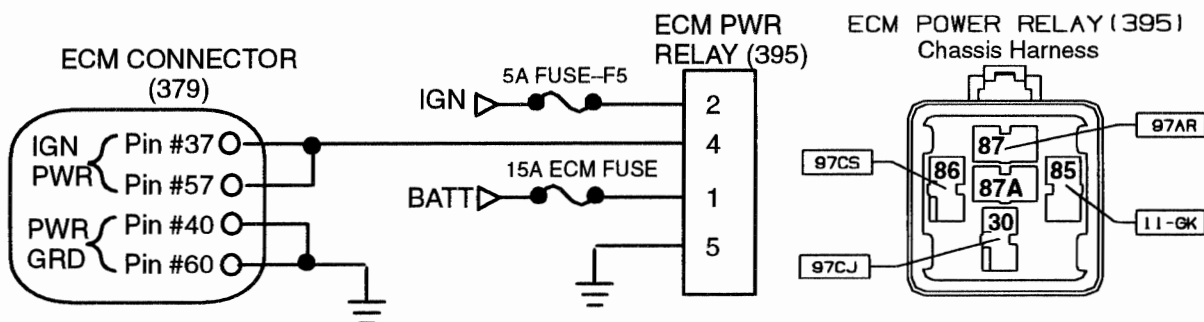
## ELECTRONIC CONTROL MODULE POWER SUPPLY (ECM PWR)

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**Electronic Control Module  
Power Supply  
(ECM-PWR)**

### Fault Codes:

112 Internal power out of range high  
113 Internal power out of range low  
224 KAM Corrupt



**After removing connector always check for damaged pins, corrosion, loose terminals etc.**

**Connector (395) — Check connector (395) with relay removed, ECM connector (379) disconnected and key ON.**

Test Points	Spec.	Comments
#30 to Grd.	$12 \pm 1.5$ volts	< than 10.5 v check connections, 0 v check for open/short to ground or blown fuse
#86 to Grd.	$12 \pm 1.5$ volts	< than 10.5 v check connections, 0 v check for open/short to ground or blown fuse
#86 to #85	$12 \pm 1.5$ volts	< than 10.5 v check grd circuit connections, 0 v check for open ground circuit
#30 to #87	0 volts	Any voltage indicates a short to ground in ECM feed circuit

**Connector (379) – Check with breakout box installed on engine harness only and connector (395) with relay removed and key OFF.**

Test Points	Spec.	Comments
#40 to Grd. #60 to Grd.	< 5 ohms	> 5 ohms indicates open or poor connection in ground circuits.
#37 to Grd. #57 to Grd.	>1000 ohms	< 1000 ohms indicates a short to ground

**Connector (379) to (395) – Check with breakout box installed on engine harness only and connector (395) with relay removed and key OFF**

Test Points	Spec.	Comments
#87 to 37 #87 to 57	<5 ohms	> 5 ohms indicates an open or poor connection. If <5 ohms the ECM power relay is suspect.

### Fault Code Descriptions

112 = Internal power was more than 18 volts.  
113 = Internal power was less than 6.5 volts.  
224 = Keep Alive Memory in ECM lost.

# ELECTRONIC CONTROL SYSTEM DIAGNOSTICS

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## ELECTRONIC CONTROL MODULE POWER SUPPLY (ECM PWR)

### EXTENDED DESCRIPTION

Refer to the Electronic Control Module power supply circuit diagram on page 99 for the following discussion.

The Electronic Control Module (ECM) Power Relay (395) has battery power supplied directly from the batteries to terminal 30. This circuit is protected by the 15A ECM #1 PWR fuse that is part of the battery cable assembly.

When the key switch is turned ON, the ECM Power Relay (395) is energized by ignition power from 5A fuse F5 (5A fuse C1 with FBC) at the relay control coil terminal 86. With the ECM Power Relay (395) energized, power flows through the normally open (N.O.) relay contacts (30 to 87) then on circuit 97AR to ECM connector (379), terminals 37 and 57.

The ground side of the ECM Power Relay control coil (terminal 85) is grounded by circuit 11-GK at the Electronic Ground Stud located at the cab. The Diode Assy (415) prevents the electronic components from voltage spikes created by the relay opening and closing.

The ECM power ground terminals 40 and 60 are grounded through ECM connector (379) at the negative battery terminal.

### ECM DIAGNOSTICS

If the ECM continuously receives less than 6.5 volts or more than 18 volts at terminals 37 and 57, it will cause Flash Code 112 or 113 to be set.

#### FLASH CODE 112

**ATA CODE PID 168 FMI 3**

**ECM: INTERNAL VOLTAGE POWER OUT OF RANGE HIGH**

Code 112 can be caused by either of two conditions:

1. Vehicle voltage supply to the ECM is continuously more than 18 volts. Excessive voltage can be caused by a defective alternator.
2. The ECM has an internal fault.

If the condition causing code 112 is intermittent, the code will change from active to inactive status.

Code 112 does not cause the Engine Warning light to turn ON.

#### FLASH CODE 113

**ATA CODE PID 168 FMI 4**

**ECM: INTERNAL VOLTAGE POWER OUT OF RANGE LOW**

Code 113 can be caused by consistently less than 6.5 volts being applied to ECM terminals 37 and 57. This can be caused by a defective alternator, low batteries, and/or increased resistance in the battery feed circuits. Code 113 does not turn the Engine Warning Light ON. If the condition causing Code 113 to set is an intermittent condition, when the condition is no longer present, the code status will change from active to inactive.

#### FLASH CODE 224

**ATA CODE SID 254 FMI 2**

**ECM: KAM CORRUPT**

Flash code 224 can be caused by high or low battery power supply to ECM terminal 1 OR an internal ECM error.

### TROUBLESHOOTING

If Flash Code 112 is active, refer to CTS- 5000 Master Service Manual, GROUP 08 – ALTERNATORS and troubleshoot the charging system.

If Flash Code 113 is active or NO voltage is present to the ECM, perform TESTING ECM POWER SUPPLY CIRCUITS on page 100. If the power supply to the ECM checks good, replace the ECM.

If a vehicle no-start condition is present and there is no power to the ECM, perform TESTING ECM POWER SUPPLY CIRCUITS on page 100.

### BEFORE PERFORMING ANY TESTS

Inspect ECM power relay circuit connectors for pushed back, damaged, corroded or dirty terminals as well as making sure the terminals and wires are properly crimped. Make sure connectors are properly joined together. Also check for damaged wiring, and clean, tight battery and ground connections.

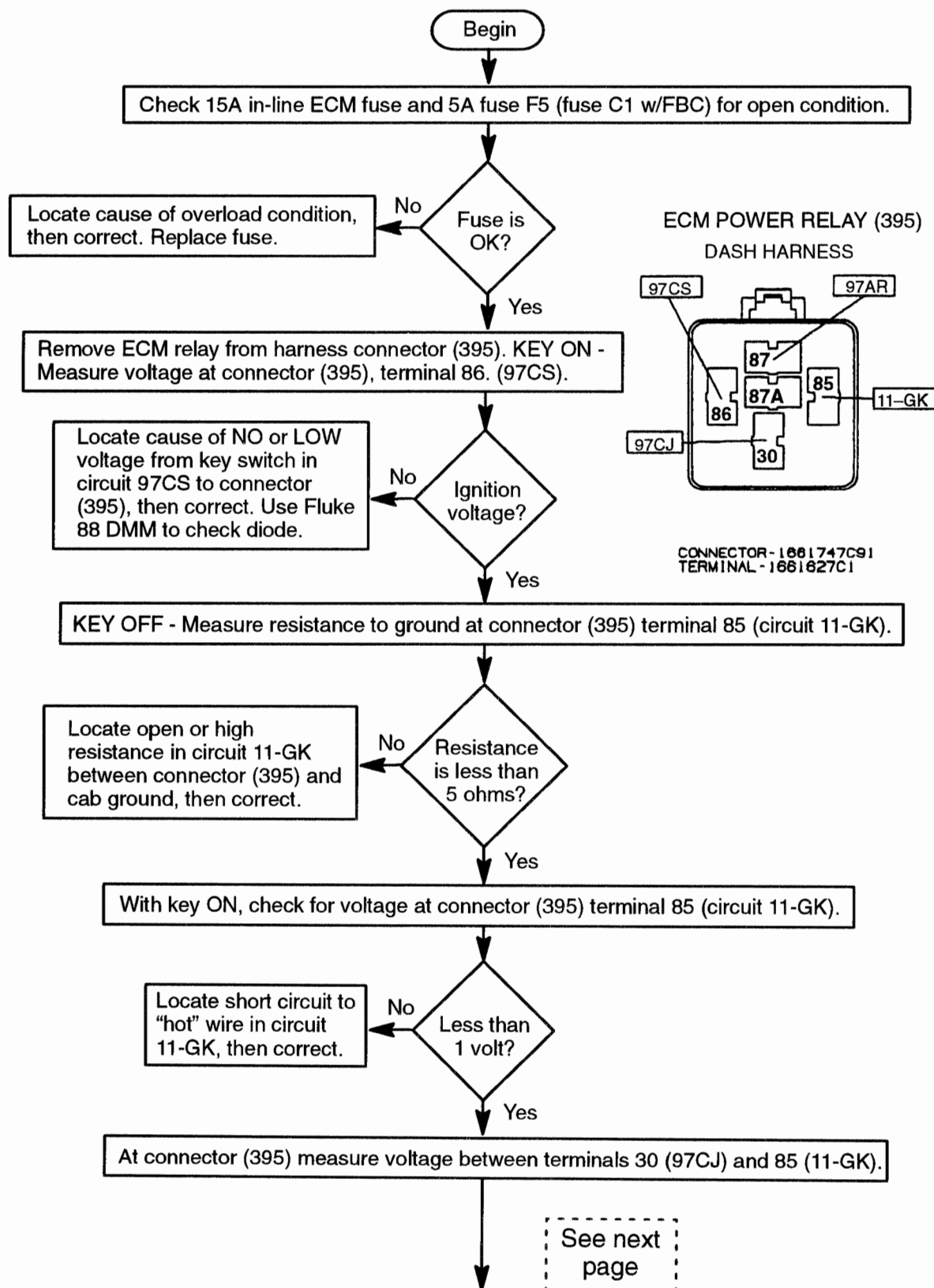
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## ELECTRONIC CONTROL SYSTEM DIAGNOSTICS

### ELECTRONIC CONTROL MODULE POWER SUPPLY (ECM PWR)

#### TESTING ECM POWER SUPPLY CIRCUITS

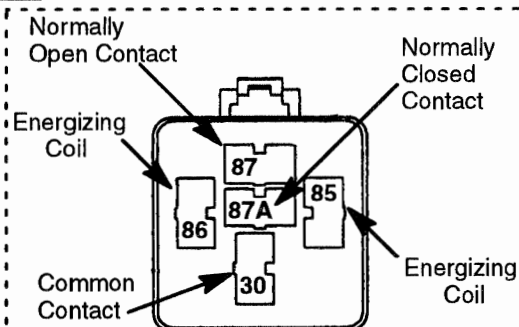
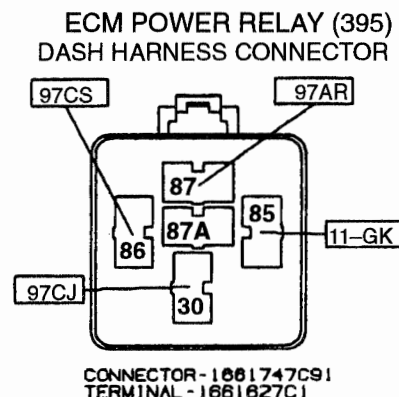
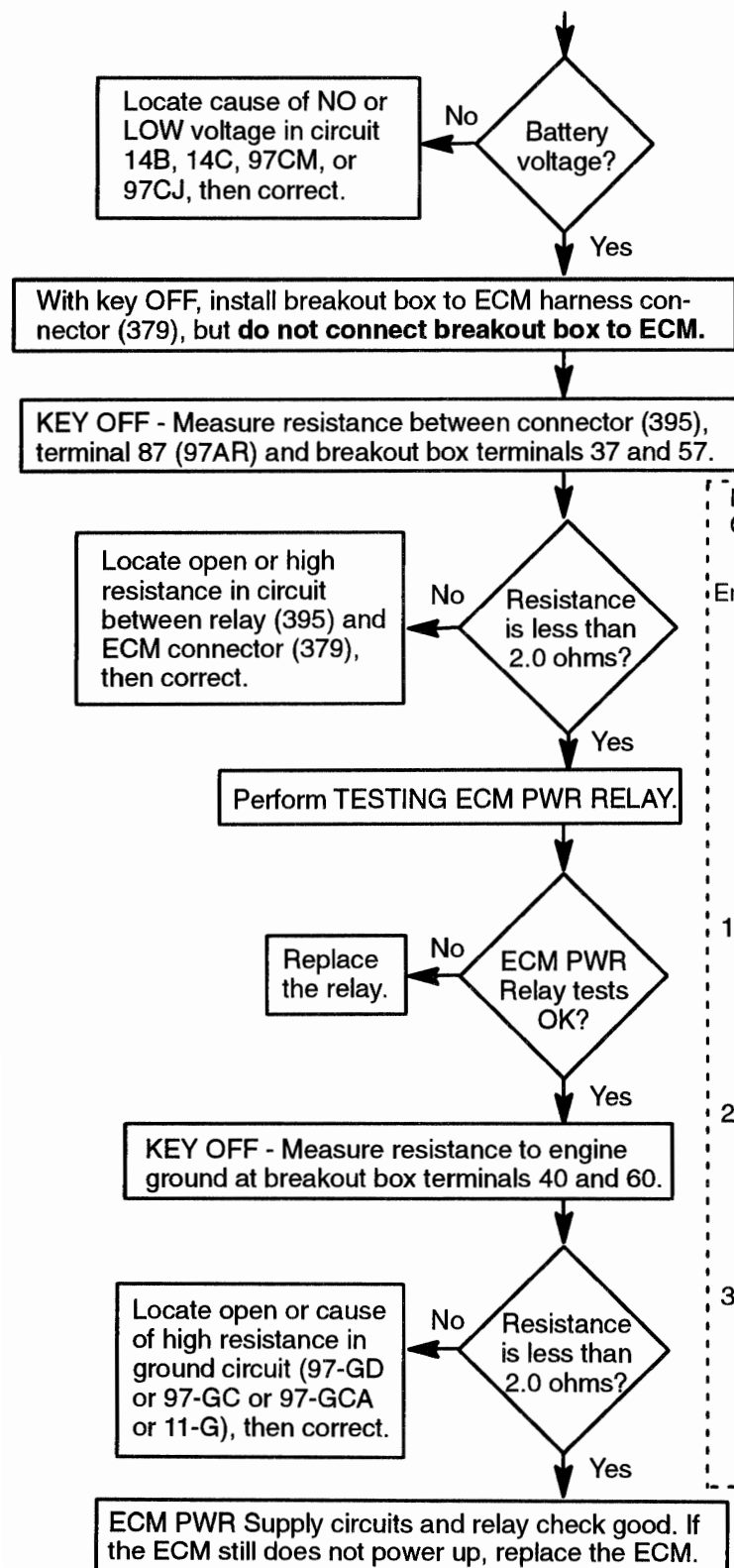


# ELECTRONIC CONTROL SYSTEM DIAGNOSTICS

## ELECTRONIC CONTROL MODULE POWER SUPPLY (ECM PWR)

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### TESTING ECM POWER SUPPLY CIRCUITS (Continued)



#### TESTING HELLA RELAY

With relay removed:

1. Connect (+) battery lead to terminal 85 and (-) lead to terminal 86.
  - A. If relay energizes making an audible click sound, go to step 2. Otherwise replace the relay.
2. With relay energized, measure resistance between terminals 30 and 87.
  - A. If resistance is less than 2 ohms, go to step 3. Otherwise replace the relay.
3. Disconnect battery leads from relay and measure resistance between terminals 30 and 87.
  - A. If resistance is 100K ohms or more, the relay is good. Otherwise replace the relay.