

# 1389 Troubleshooting Guide

## Objectives

This document provides information to guide the user in troubleshooting the Bulletin 1389. Included in the document are LED descriptions and fault diagnosis, general system troubleshooting and test point descriptions.

## System Troubleshooting

Most faults are annunciated by the LED diagnostic indicators on the front of the module. Many system malfunctions manifest themselves through a fault. The use of LED indications may aid in identifying servo amplifier, power supply and motor malfunctions.

Tables A and B provide a listing and description of the power supply and servo amplifier LED indicators. In addition, potential causes are listed.

Tables C and D provide a number of common system and servomotor malfunctions and their possible causes.

Tables E and F provide a listing and description of the Bulletin 1389 test points.

---

**WARNING:** This product contains stored energy devices. To avoid hazard of electrical shock, verify that all voltage on the capacitors has been discharged before attempting to service, repair or remove the unit. Voltage at pins 3 (+) and 2 (-) of connector J1 located at the bottom of the Servo Amplifier Module MUST be “0.00” as measured with a standard digital voltmeter or multimeter. Only qualified personnel familiar with solid-state control equipment and safety procedures in publication NFPA 70E should attempt this procedure.

---

**Table A**  
**Power Supply Module LED Descriptions and Fault Diagnosis**

LED	LED Description	Condition/Potential Cause
BUS UV (YELLOW)	If the DC power bus drops below a 145V DC level, a fault occurs and the LED is illuminated.	<p><b>BUS UV LED is illuminated</b></p> <p><u>The power bus voltage has dropped below 145V DC</u></p> <ol style="list-style-type: none"> <li>1. The power contactor (M1) has not energized or has dropped out.</li> <li>2. The power contactor (M1) control fuse is blown.</li> <li>3. The input line voltage is low.</li> <li>4. The shunt regulator circuit has malfunctioned and is placing the shunt resistor across the power bus.</li> <li>5. The power bus capacitor has malfunctioned.</li> <li>6. A power fuse is blown.</li> <li>7. The three-phase input line is open.</li> <li>8. The transformer is providing the incorrect line voltage or has malfunctioned.</li> </ol>

---

**Table A (Continued)**  
**Power Supply Module LED Descriptions and Fault Diagnosis**

<b>LED</b>	<b>LED Descriptions</b>	<b>Condition/Potential Cause</b>
<b>BUS OV</b> (RED)	The DC power bus is continuously monitored. If it exceeds a preset level of 405V DC, a fault is sensed, the power supply is disabled and the LED is illuminated.	<p><b>BUS OV is illuminated</b></p> <p><u>The power bus voltage has exceeded 405V DC</u></p> <ol style="list-style-type: none"> <li>1. The logic or Shunt Regulator Board is malfunctioning and incorrectly sensing the bus voltage.</li> <li>2. A vertical axis with insufficient counterbalancing is overdriving the servomotor and causing excessive energy to be returned to the power supply bus.</li> <li>3. The system inertia is too high causing excessive energy to be returned to the power supply bus.</li> <li>4. The input line voltage exceeds the maximum system input voltage rating.</li> <li>5. The position controller acceleration /deceleration rate is incorrectly set.</li> <li>6. The shunt regulator or Transistor has malfunctioned.</li> <li>7. Shunt regulator fuse has blown.</li> <li>8. External shunt regulator resistor is open or not connected.</li> </ol>
<b>OT</b> (RED)	The Power Supply Module contains a thermal switch on the heat sink which senses the three-phase bridge and shunt regulator temperature. If the temperature is exceeded the LED will illuminate.	<p><b>OT LED is illuminated</b></p> <p><u>The heat sink thermal overload has tripped.</u></p> <p>One or more of the following may have occurred:</p> <ol style="list-style-type: none"> <li>1. The cabinet ambient temperature is exceeding 60°C (140°F)</li> <li>2. The machine duty cycle requires an RMS current exceeding the continuous rating of the power supply.</li> <li>3. The integral fan is not functioning.</li> <li>4. The airflow access to or inside the Chassis Module is limited or blocked.</li> </ol> <p>The shunt regulator resistor thermal overload has tripped.</p> <ol style="list-style-type: none"> <li>1. System inertia is causing excessive energy to be returned to the power supply bus.</li> <li>2. The cabinet ambient temperature is exceeding 60°C (140°F).</li> <li>3. The input line voltage exceeds the maximum system input voltage.</li> <li>4. The Shunt Regulator circuitry has malfunctioned and is inserting the resistor across the power bus at too low of a value of bus voltage.</li> </ol>
<b>±12V</b> (RED)	If the logic supply rises or drops 10% from its nominal value, a fault occurs and the LED is illuminated.	<p><b>±12V LED is illuminated</b></p> <ol style="list-style-type: none"> <li>1. Low voltage bus supply is 10% below rated voltage. Six (6) axes is the maximum load.</li> <li>2. Either the +12 or -12V DC is missing.</li> </ol>
<b>READY</b> (GREEN)	This LED is continuously illuminated until a system or axis fault occurs	<p><b>READY LED is NOT illuminated</b></p> <ol style="list-style-type: none"> <li>1. System fault has occurred.</li> <li>2. Servo amplifier fault has occurred, refer to individual axis for fault indication</li> </ol>

**Table A (Continued)**  
**Power Supply Module LED Descriptions and Fault Diagnosis**

<b>LED</b>	<b>LED Descriptions</b>	<b>Condition/Potential Cause</b>
<b>ENABLE</b> (GREEN)	The application of an Enable signal by the machine position controller will cause the ENABLE LED to illuminate.	<p><b>ENABLE LED is NOT illuminated</b></p> <ol style="list-style-type: none"> <li>1. The position controller has not enabled the system.</li> <li>2. The Enable wiring to the system is open.</li> <li>3. The position controller Enable relay/switch has malfunctioned.</li> <li>4. The position controller has detected a machine system malfunction that will not allow the system to be Enabled.</li> <li>5. Power has not been applied to input isolation transformer.</li> <li>6. The logic supply circuits have malfunctioned (fuse blown etc.) or the AC input at TB1-7,8 on the Power Supply Module is incorrectly wired.</li> </ol> <p><b>ENABLE LED is illuminated, but System does not Enable</b></p> <ol style="list-style-type: none"> <li>1. A system malfunction has occurred but is not annunciated by the LED indicators. (check the status of the System OK contact, then check the individual Drive OK outputs at TB1-14, 15)</li> <li>2. A component malfunction exists in the Enable circuit.</li> <li>3. A power line fuse has blown.</li> <li>4. The power contactor has not been energized or has malfunctioned.</li> </ol> <p><u>The system logic supplies are not operational</u></p> <ol style="list-style-type: none"> <li>1. The logic supply fuses are blown</li> <li>2. Logic supply AC voltage is missing</li> <li>3. A system malfunction has occurred but is not annunciated by the LED indicators. (check the status of the System OK relay contact, then check individual Drive OK outputs at TB1-14,15).</li> </ol>

**Table B**  
**Servo Amplifier Module LED Descriptions and Fault Diagnosis**

<b>LED</b>	<b>LED Descriptions</b>	<b>Condition/Potential Cause</b>
<b>OT</b> (RED)	The Servo Amplifier Module contains a thermal switch on the heat sink which senses the power transistor temperature is exceeded the LED will illuminate.	<p><b>OT LED is illuminated</b></p> <ol style="list-style-type: none"> <li>1. The temperature of the power transistor heat sink has exceeded the rated temperature. Due to: <ul style="list-style-type: none"> <li>- Machine duty cycle requirements.</li> <li>- Overload on motor.</li> <li>- Cabinet temperature is exceeding 60°C (140°F).</li> <li>- Loss of fan cooling the servo amplifiers.</li> </ul> </li> </ol>
<b>P FAULT</b> (RED)	The current through the power output transistors is monitored. If the current through any one of the transistors exceeds a fixed level (greater than 300% of axis rating) the LED will illuminate.	<p><b>P FAULT is illuminated</b></p> <ol style="list-style-type: none"> <li>1. The current through any one of the power transistors has exceeded 300% of the amplifier current rating.</li> <li>2. Malfunction power transistor.</li> <li>3. Shorted load.</li> <li>4. Excessive winding to case motor capacitance.</li> </ol> <p><b>IMPORTANT: On early units, the 100% 1 LIMIT setting may cause intermittent power fault trips. If this occurs, reduce 1 LIMIT setting to approximately 80% (this will still yield maximum torque (100%).</b></p>
<b>READY</b> (GREEN)	This LED is continuously illuminated until an axis fault occurs.	<p><b>READY LED is NOT illuminated</b></p> <ol style="list-style-type: none"> <li>1. Servo amplifier fault has occurred.</li> </ol>

**Table C**  
**General System Troubleshooting**

<b>Condition</b>	<b>Possible Cause</b>
Axis or System runs uncontrollably	<ol style="list-style-type: none"> <li>1. The velocity feedback, position feedback device or velocity command signal wiring is incorrect or open.</li> <li>2. An internal system malfunction exists.</li> <li>3. Shorted power transistor module(s) exist.</li> <li>4. JP1 on the servo amplifier is set incorrect.</li> </ol>
Axis or System is unstable.	<ol style="list-style-type: none"> <li>1. Velocity Loop Compensation or GAIN potentiometer is incorrectly set.</li> <li>2. Position loop gain or position controller accel/decel rate is improperly set.</li> <li>3. Improper grounding or shielding techniques are causing noise to be transmitted into the position feedback or velocity command lines, causing erratic axis movement.</li> <li>4. Incorrect jumper placement.</li> </ol>
Desired motor acceleration/deceleration cannot be obtained	<ol style="list-style-type: none"> <li>1. The I LIMIT pot is incorrectly set.</li> <li>2. The system inertia is beyond motor/amplifier capabilities.</li> <li>3. The system friction torque is excessive.</li> <li>4. Servo amplifier current rating is insufficient to supply the sufficient torque.</li> <li>5. The Current Feedback Scaling is incorrect.</li> <li>6. External I limit incorrect.</li> </ol>
Motor does not respond to a Velocity Command	<ol style="list-style-type: none"> <li>1. The system has a malfunction.</li> <li>2. The system is not enabled.</li> <li>3. The power contactor is not energized.</li> <li>4. Isolation transformer is supplying the incorrect voltage or none at all.</li> <li>5. The motor wiring is open.</li> <li>6. The motor or transformer thermal overload has tripped.</li> <li>7. The motor has malfunctioned.</li> </ol>
Presence of noise on Command or Tach signal wires	<ol style="list-style-type: none"> <li>1. 60 Hz line frequency may be present.</li> <li>2. Incorrect wiring or grounding practice.</li> </ol>

**Table D**  
**General Servomotor Troubleshooting**

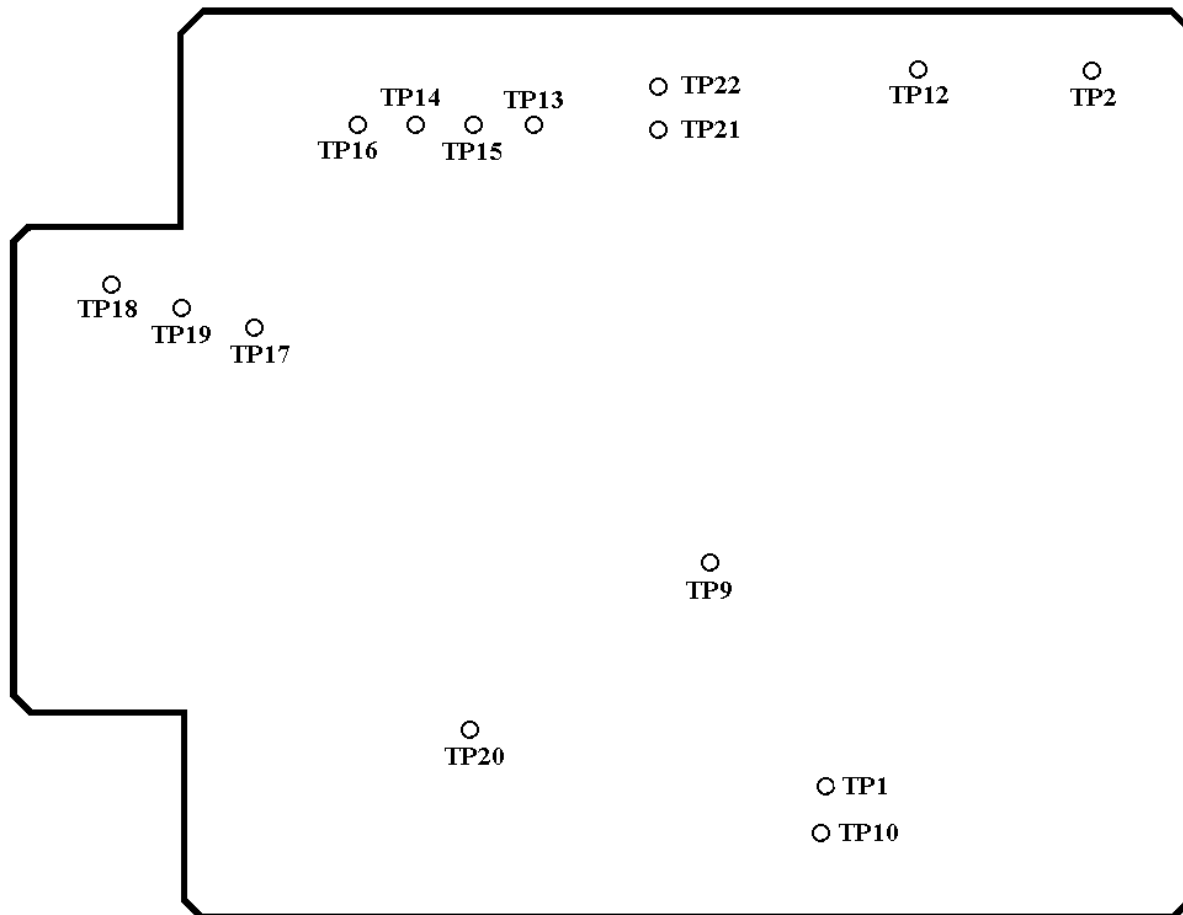
<b>Condition</b>	<b>Possible Cause</b>
No Rotation	<ol style="list-style-type: none"> <li>1. The motor connections are loose or open.</li> <li>2. Foreign matter is lodged in the motor.</li> <li>3. The motor load is excessive.</li> <li>4. The bearings are worn.</li> </ol>
Overheating	<ol style="list-style-type: none"> <li>1. The rotor is partially demagnetizing causing excessive motor current.</li> <li>2. Motor voltage is exceeding the maximum value.</li> <li>3. The duty cycle is excessive.</li> </ol>
Abnormal Noise	<ol style="list-style-type: none"> <li>1. Loose parts are present in the motor.</li> <li>2. Through bolts are loose.</li> <li>3. The bearings are worn.</li> <li>4. GAIN setting is too high.</li> </ol>
Erratic Operation - Motor locks into position, runs without control or with reduced torque.	<ol style="list-style-type: none"> <li>1. Phases A &amp; B, A &amp; C or B &amp; C reversed</li> <li>2. Sine, Cosine or Rotor leads reversed</li> <li>3. Sine, Cosine, Rotor lead sets reversed</li> <li>4. Combinations of 1, 2, 3</li> </ol>

## Test Point Descriptions

Tables E, F, and G list and describe the various test points found in the Bulletin 1389 Servo Amplifier System. Refer to figures 1, 2, and 3 for test point locations.

**Table E**  
**Power Supply Module Test Point Descriptions**

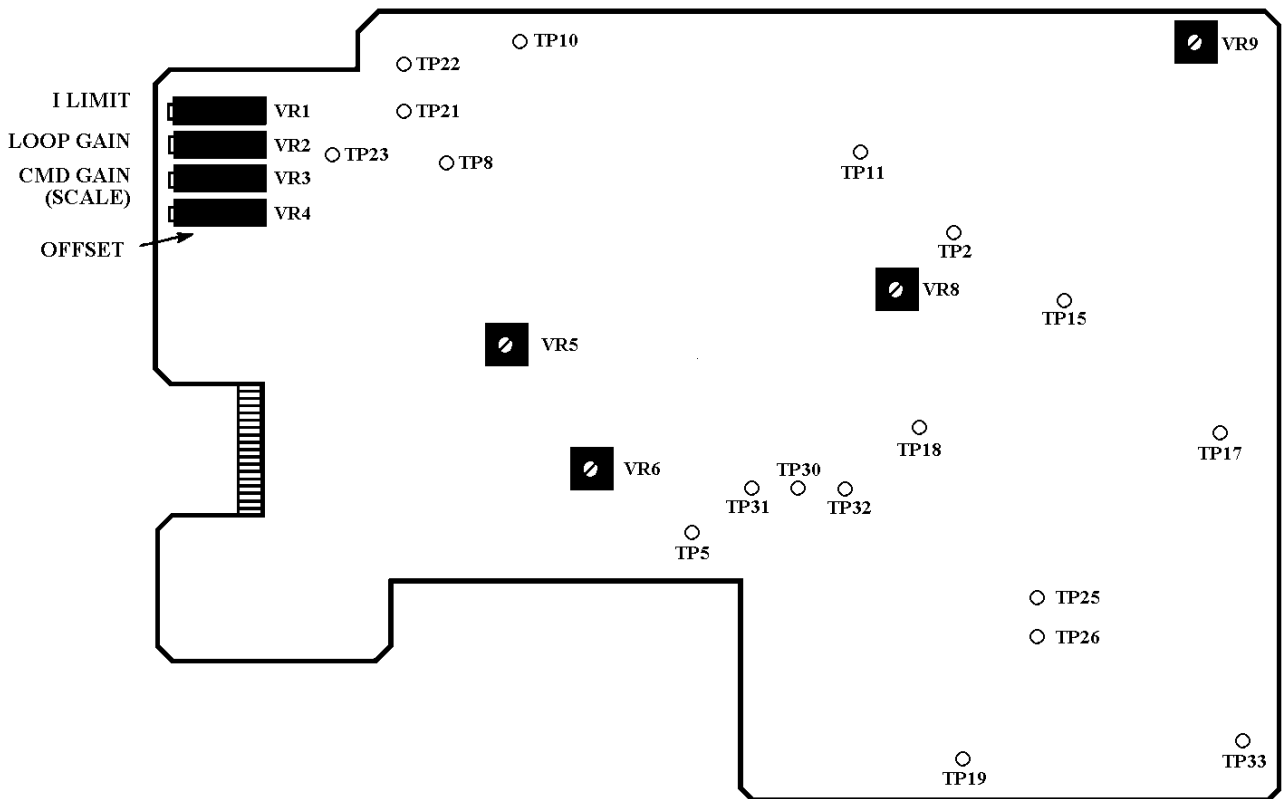
Test Point	Description
TP1	Shunt TR Emitter
TP2	+ DC Bus
TP9	Bus Overvoltage
TP10	Shunt Regulator "ON" = 1
TP12	Bus UV
TP13	Signal Common
TP14	+ 12V DC
TP15	- 12V DC
TP16	Bus UV
TP17	Bus Overvoltage
TP18	Overtemperature
TP19	Supply
TP20	System OK = 0
TP21	System Enable
TP22	NOT System PUR



**Figure 1 - Power Supply Module Test Point Locations**

**Table F**  
**4.5 and 9A Servo Amplifier Module Test Point Descriptions**

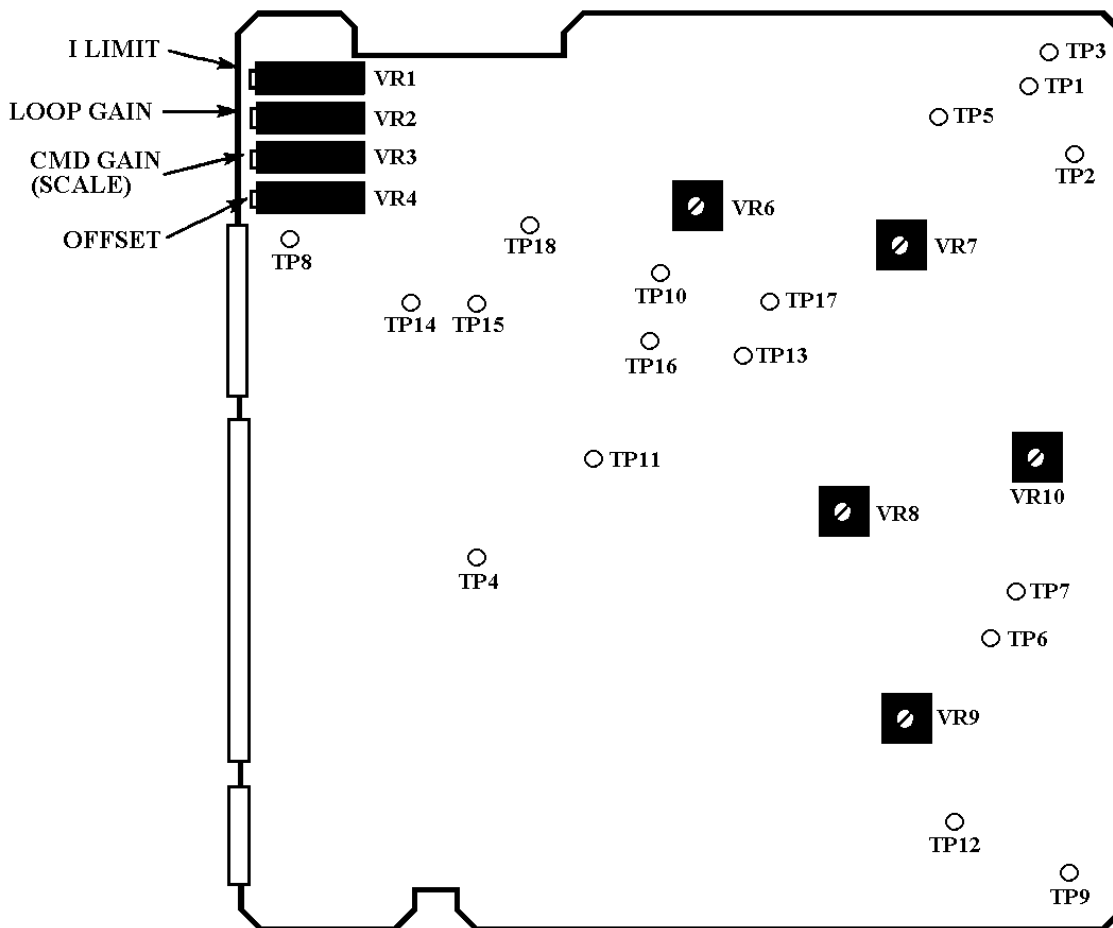
Test Point	Description
TP2	Rotor Amplitude Calibrate (13.5-14V p-p)
TP5	Tach Feedback
TP8	Command In
TP10	I Command
TP11	I Limit (3V = 100 % Rated Motor Current)
TP15	Demod Sine
TP17	I <sub>A</sub> Reference (2.5V <sub>p</sub> = 100% Motor Current)
TP18	I <sub>B</sub> Reference (2.5V <sub>p</sub> = 100% Motor Current)
TP19	ABSI
TP21	Signal Common
TP22	+12V DC
TP23	-12V DC
TP25	I <sub>A</sub>
TP26	I <sub>B</sub>
TP30	PWM A
TP31	PWM B
TP32	PWM C
TP33	2.5kHz Triangle (11V p-p)



**Figure 2 - 4.5 and 9A Servo Amplifier Module Test Point Locations**

**Table G**  
**17A Servo Amplifier Module Test Point Descriptions**

<b>Test Point</b>	<b>Description</b>
TP1	Signal Common
TP2	+12V DC
TP3	-12V DC
TP4	+5V DC
TP5	Rotor Amplitude Calibrate - 13.5-14V p-p
TP6	Tach Output
TP7	Demod Sine - 7.5V pk
TP8	Velocity Command
TP9	Absolute Value of Current Feedback Signal - ABSI
TP10	Io - I Command
TP11	I Limit
TP12	Power Fault
TP13	Buffered Rotor Signal - 1.5V RMS
TP14	Roll Off Capacitors/Velocity Error - Across Velocity Error
TP15	Roll Off Capacitors/Velocity Error - Feedback PI
TP16	Velocity Command Filtering
TP17	Signal Common
TP18	Tach Filtering



**Figure 3 - 17A Servo Amplifier Module Test Point Locations**