1391B Troubleshooting Guide

Objectives

This document provides information to guide the user in troubleshooting the Bulletin 1391. Included in the document are LED descriptions and fault diagnosis, general system troubleshooting and test point descriptions.

System Troubleshooting

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

Table A provides a listing and description of the LED indicators. In addition, potential causes are listed.

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

Table D provides a listing and descriptions of the Bulletin 1391 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 this unit.
Voltage at terminals 9(+) and 7(-) of TB5 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
LED Descriptions and Fault Diagnosis

LED	LED Description	Condition/Potential Cause
OVER-TEMPERATURE	The controller contains a thermal switch on the heat sink which senses the power transistor. If the temperature is exceeded the LED will illuminate.	**OVERTEMPERATURE LED is illuminated** The logic supply (±12V DC, +5V DC) circuits have malfunctioned (fuse blown etc.) or the AC input at TB4-19, 20, 21 is incorrectly wired. The heat sink thermal overload has tripped. One or more of the following may have occurred: 1. The cabinet ambient temperature is too high. 2. The machine duty cycle requires an RMS current exceeding the continuous rating of the controller. 3. The integral fan is not functioning. 4. The airflow access to the controller is limited or blocked.
POWER FAULT (RED)	The current through the power output transistors is monitored. If the current exceeds a fixed level (greater than 300% of controller rating) the LED will illuminate.	**POWER FAULT LED is illuminated** 1. The current through any one of the power transistors has exceeded 300% of the controller's current rating. 2. Malfunctioning power transistor. 3. Shorted load. 4. Excessive winding to case motor capacitance.

Table A (Continued)
LED Descriptions and Fault Diagnosis

LED	LED Description	Condition/Potential Cause
CONTROL POWER (RED)	If the power supply rises or drops 10% from its nominal value, a fault occurs and the LED is illuminated.	**CONTROL POWER LED is illuminated** 1. The input line voltage is low. 2. The transformer auxiliary logic supply winding is open. 3. The logic supply(±12V DC, +5V DC) circuits have malfunctioned (fuse blown etc.) or the AC input at TB4-19, 20, 21 is incorrectly wired.
OVERVOLTAGE (RED)	The DC Power Bus is continuously monitored. If is exceeds a present level a fault is sensed, the power supply is disabled and the LED is illuminated.	**OVERVOLTAGE LED is illuminated** The logic supply (±12V DC, +5V DC) circuits have malfunctioned (fuse blown etc.) or the AC input at TB4-19, 20, 21 is incorrectly wired. <u>The power bus voltage has exceeded 405V DC</u> 1. The Logic Board is malfunctioning and incorrectly sensing the bus voltage. 2. A vertical axis with insufficient counterbalancing is overdriving the servomotor and causing excessive energy to be returned to the power supply bus. 3. The system inertia is too high causing excessive energy to be returned to the power supply bus. 4. The input line voltage exceeds the maximum controller input voltage rating. 5. The position controller acceleration/deceleration rate is incorrectly set. 6. The shunt regulator or transistor has malfunctioned. 7. Shunt regulator fuse has blown. 8. Shunt regulator resistor not connected to controller. 9. Shunt regulator switch SW1 is set too low.
UNDERVOLTAGE (YELLOW)	If the DC Power Bus drops below a present level, a fault occurs and the LED is illuminated.	**UNDERVOLTAGE LED is illuminated** <u>The power bus voltage has dropped below a preset DC value</u> 1. The power contactor (M) has not energized or has dropped out. 2. The input line voltage is low. 3. The shunt regulator circuit has malfunctioned and is placing the shunt resistor across the power bus. 4. The power bus capacitor has malfunctioned. 5. The circuit breaker (MCB) has tripped. 6. The three-phase input line is open. 7. The transformer is providing the incorrect line voltage or has malfunctioned. <u>The logic supplies have dropped 10% below their nominal value</u> 1. The input line voltage is too low. 2. The transformer auxiliary logic supply winding is open. 3. The logic supply (±12V DC, +5V DC) circuits have malfunctioned (fuse blown etc.) or the AC input at TB4-19, 20 21 is incorrectly wired.
CURRENT FOLDBACK (YELLOW)	The CURRENT FOLDBACK LED illuminates when the Current Foldback circuitry is operating.	**CURRENT FOLDBACK LED is illuminated** The logic supply (±12V DC) circuits have malfunctioned (fuse blown etc.) or the AC input at TB4-19, 20 21 is incorrectly wired. <u>The output current is exceeding its time-current rating.</u> 1. The acceleration/deceleration command from the position controller is requiring peak current for an excessive amount of time. 2. The gain pot is set too high causing excessive peak currents. 3. The machine friction, inertial load and/or viscous loading is excessive. 4. The servomotor has been improperly sized. 5. A short circuit exists across the controller output terminals.

Table A (Continued)
Led Descriptions and Fault Diagnosis

LED	LED Description	Condition/Potential Cause
RUN ENABLE (GREEN)	The application of an Enable signal by the machine position controller will cause the RUN ENABLE LED to illuminate.	**ENABLE LED is NOT illuminated** 1. The position controller has not enabled the controller. 2. The Enable wiring to the controller is open. 3. The position controller Enable relay/ switch has malfunctioned. 4. The position controller has detected a machine system malfunction that will not allow the controllers to be enabled. 5. Power has not been applied to input transformer. 6. The logic supply (±12V DC) circuits have malfunctioned (fuse blown etc.) or the AC input at TB4-19, 20, 21 is incorrectly wired. **ENABLE LED is illuminated, but controller does not enable** 1. A controller malfunction has occurred but is not annunciated by the LED indicators. Check the status of the Drive OK output (DROK) relay. 2. A component malfunction exists in the Enable circuit. 3. The circuit breaker (MCB) is tripped. 4. The power contactor has not been energized or has malfunctioned. <u>The controller logic supplies are not operational</u> 1. The logic supply fuses are blown 2. Logic supply AC voltage is missing 3. A controller malfunction has occurred but is not annunciated by the LED indicators (check the status of the Drive OK contacts).
DRIVE READY (GREEN)	This LED is continuously illuminated until a system fault occurs.	**DRIVE READY LED is NOT illuminated** 1. System fault has occurred.

Table B
General System Troubleshooting

Condition	Possible Cause
Axis or System run uncontrollably	1. The velocity feedback, position feedback device or velocity command signal wiring is incorrect or open. 2. An internal controller malfunction exists.
Axis or System is unstable	1. Velocity Loop Compensation or Gain potentiometer is incorrectly set. 2. Position Loop Gain or Position Controller accel/decel rate is improperly set. 3. Improper grounding or shielding techniques are causing noise to be transmitted into the position feedback or velocity command lines, causing erratic axis movement.
Desired motor acceleration/deceleration cannot be obtained	1. The Current Limit pot is incorrectly set. 2. The Current Feedback Scaling is incorrect. 3. The system inertia is excessive. 4. The system friction torque is excessive. 5. Available controller current is insufficient to supply the correct accel/decel rate.
Motor does not respond to a Velocity Command	1. The controller has a malfunction. 2. The controller is not enabled. 3. The power contactor is not energized. 4. Power transformer is supplying the incorrect voltage or none at all. 5. The motor wiring is open. 6. The motor or transformer thermal overload has tripped. 7. The motor has malfunctioned. 8. The motor coupling has malfunctioned. 9. The feedback circuit (motor to controller) is open.
Presence of noise on Command or Tach signal wires	1. 60 Hz line frequency may be present. 2. 120 Hz from a single phase logic supply may be present. 3. 180 or 360 Hz from other adjustable speed drives may be present. 4. Variable frequency (varies with motor speed) may be velocity feedback ripple or a disturbance caused by gear teeth or ballscrew speeds. 5. Recommended grounding per Appendix B (Publication 1391-5.1) has not been followed.

Table C
General Servomotor Troubleshooting

Condition	Possible Cause
No Rotation	1. The motor connections are loose or open. 2. Foreign matter is lodged in the motor. 3. The motor load is excessive. 4. The bearings are worn. 5. The brake is set (when equipped).
Overheating	1. The rotor is partially demagnetized causing excessive motor current. 2. Motor voltage is exceeding the maximum value. 3. The duty cycle is excessive.
Abnormal Noise	1. Loose parts are present in the motor. 2. Through bolts are loose. 3. The bearings are worn. 4. GAIN setting is too high.
Erratic Operation - Motor locks into position, runs without control or with reduced torque.	1. Phases A & B, A & C or B & C reversed 2. Sine, Cosine or Rotor leads reversed 3. Sine, Cosine, Rotor lead sets reversed 4. Combinations of 1, 2, 3

Test Point Descriptions

Table D describes the various test points found in the Bulletin 1391 controller. Refer to Figure 1 for test point locations.

Table D
Test Point Descriptions

Test Point	Description
TP1	Buffered Resolver Rotor Signal
TP3	Tachometer Output (2.5V/kRPM)
TP4	Demodulated Sine Wave
TP5	Demodulated Cosine Wave
TP6	I_D
TP7	PWM Triangle (2.5 kHz, 11Vp-p)
TP8	PWM B
TP9	PWM A
TP10	PWM C
TP11	PWM Multiplier Triangle (22.5 kHz. 15V p-p)
TP12	Signal Common
TP13	+12V DC
TP14	-12V DC
TP15	I_B Reference
TP16	I_A Reference
TP17	$\lvert I \rvert$ Absolute Value
TP18	Velocity Gain Calibration
TP19	Buffered Velocity Command
TP20	Velocity Error
TP21	Current Limit Calibration (adjust with R148, 3V= Rated Motor Current)
TP22	Current Command
TP23-TP24	Velocity Loop Response Calibration
TP26-TP27	Velocity Loop Response Calibration
TP28	Signal Common
TP29	Current Feedback (Phase B, 2.5Vp-p= Rated Motor Current)
TP30	Current Feedback (Phase A, 2.5Vp-p= Rated Motor Current)
TP31	Signal Common

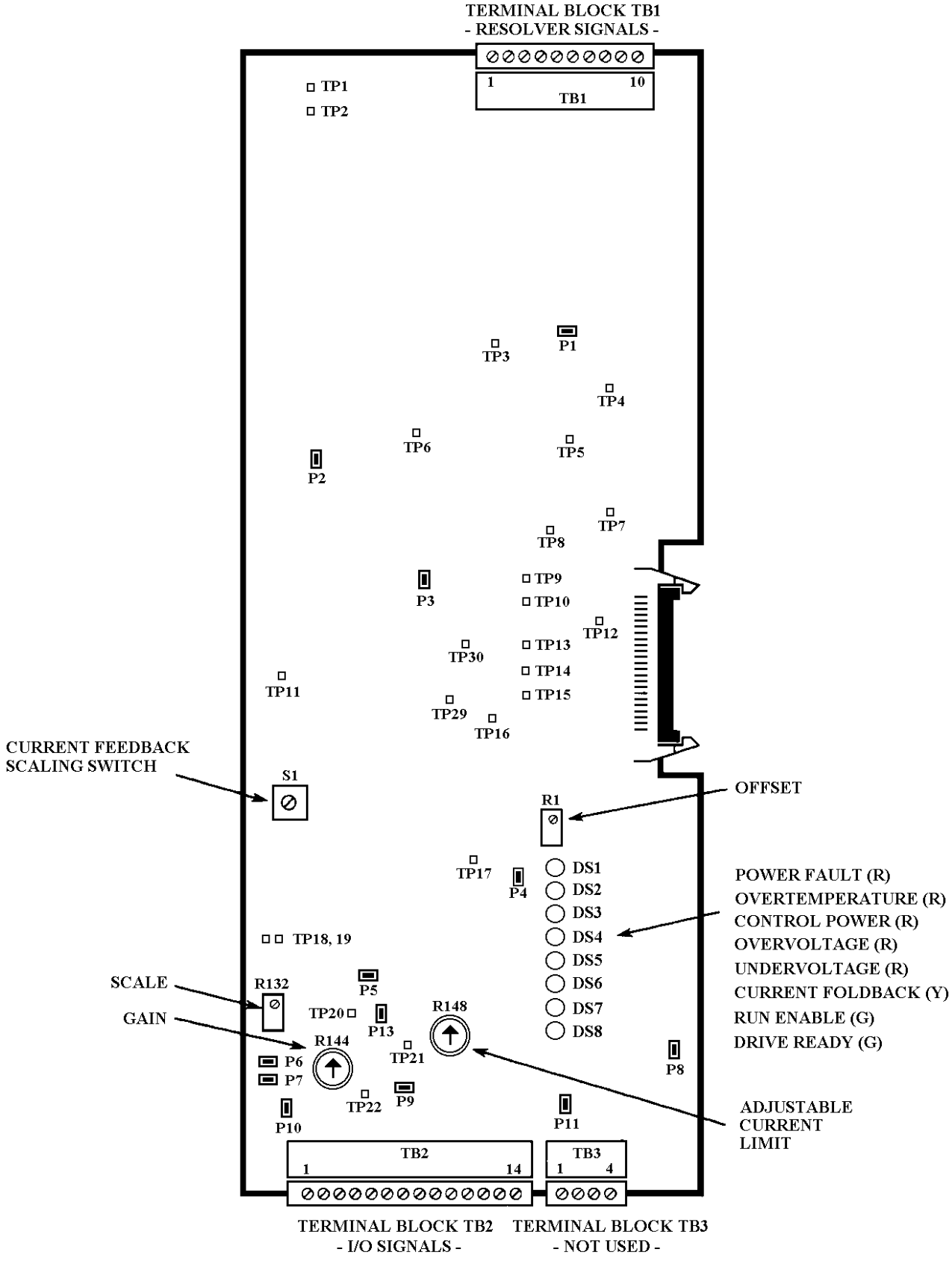

Figure 1 - Bulletin 1391 Logic Control Board Test Point Locations