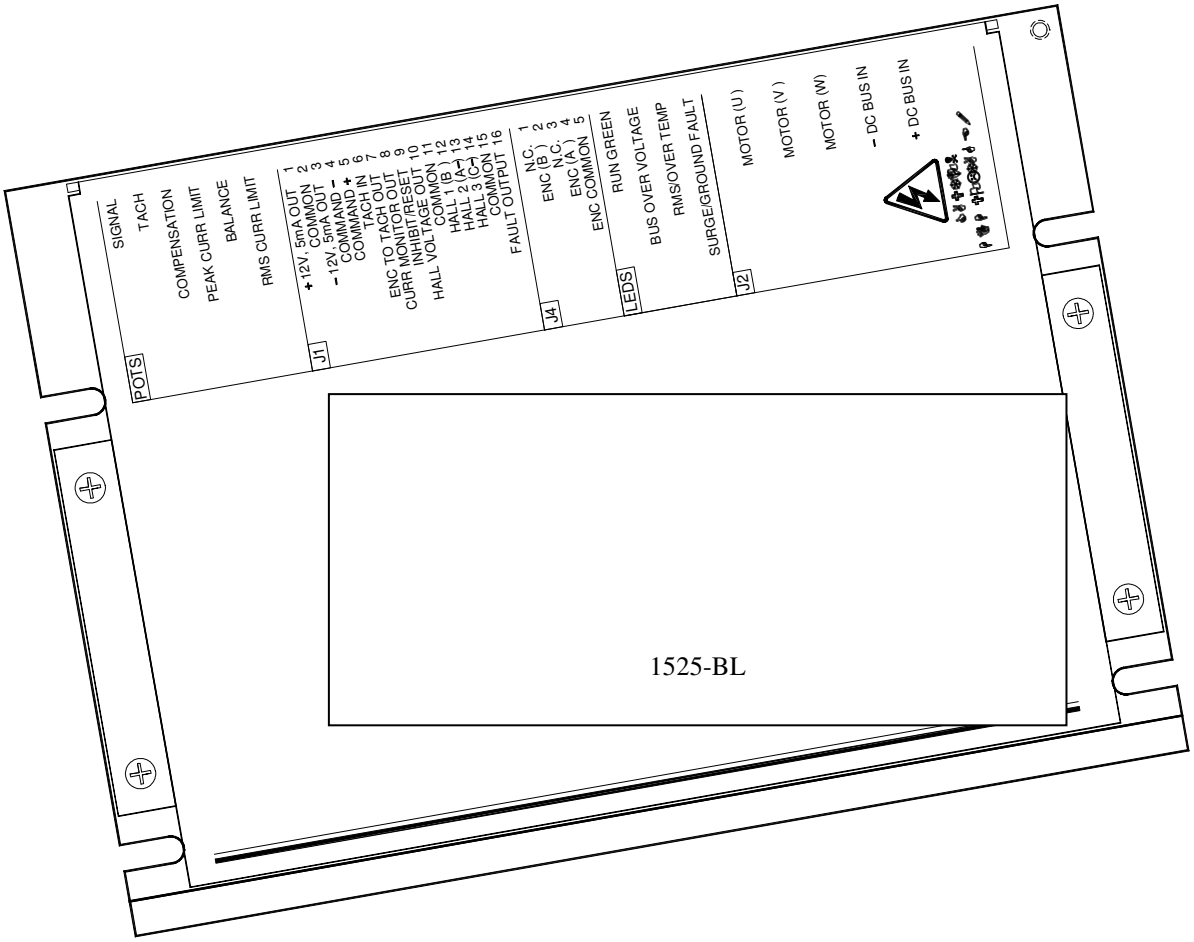
28231 Ave Crocker
Suite 10
Valencia, CA 91355
818-700-8600
Servodynamics.com

INFORMATION MANUAL
1525-BL Rev C



1525-BL, 9/22/2000

INTRODUCTION

This information manual provides the product specifications, wiring diagram, operational modes (torque and velocity) and troubleshooting procedures for the brushless 1525-BL.

The 1525-BL supplies 15 amps continuous current and 25 amps peak current at 170 VDC for a total of 4250 watts of continuous power. The 1525-BL is a current source type PWM amplifier.

The 1525-BL is a power duplicator of the command signal. A battery, a motion controller, or a signal generator can be the source of the command signal input.

ELECTRICAL CAUTIONS

Ensure that the negative terminal of the bus capacitor is grounded to the earth ground. Improper grounding may cause erratic operation or a safety hazard due to common mode voltages.

Make sure that all voltages and tests are made with battery powered or electrically isolated instruments.

SPECIFICATIONS

1525-BL

Performance Characteristics	
Peak Power	4.2 kW
Peak Output Voltage	± 170 vdc (shut off @ 450 vdc)
Peak Output Current	± 25 amps (1 sec.)
Max. Continuous Current	± 15 amps (50 °C)
Electrical Characteristics	
Input Signal Voltage	± 10 vdc (typ.), ± 35 vdc (max.)
System Gain	0 to 5100 amps/volt – velocity mode 0 to 10.0 amps/volt – torque mode
Input Impedance	40 k Ohms
Typical Input Drift	10 µV/°C
Bandwidth	2 kHz with 2.4 mHy Inductance
Dead Band	Zero
Input Power Requirements	
Input Voltage	80-170 VDC
Adjustments	
Peak Current Limit	0 to 25 amps
RMS Current Limit	0 to 15 amps.
Signal Command Input	Scaling
Balance	Zero velocity/torque offset
Compensation	System response
Tachometer	Scaling
Diagnostics	LED indication
Green	LED 1 - RUN GREEN - AMPLIFIER OPERATIONAL
Red	LED 2 - BUS OVERVOLTAGE
Red	LED 3 – EXCESSIVE RMS CURRENT/ OVER TEMP
Red	LED 4 - SURGE/GROUND FAULT
Physical Characteristics	
Module Dimensions (L x W x H)	7.6 in. x 1.3 in. x 5.4 in.
Weight	1.8 lbs
Ambient Temperature – Operating	0 °C to 50 °C
Shutdown Temperature	80 °C at heat sink
Relative Humidity	5 - 95% non-condensing

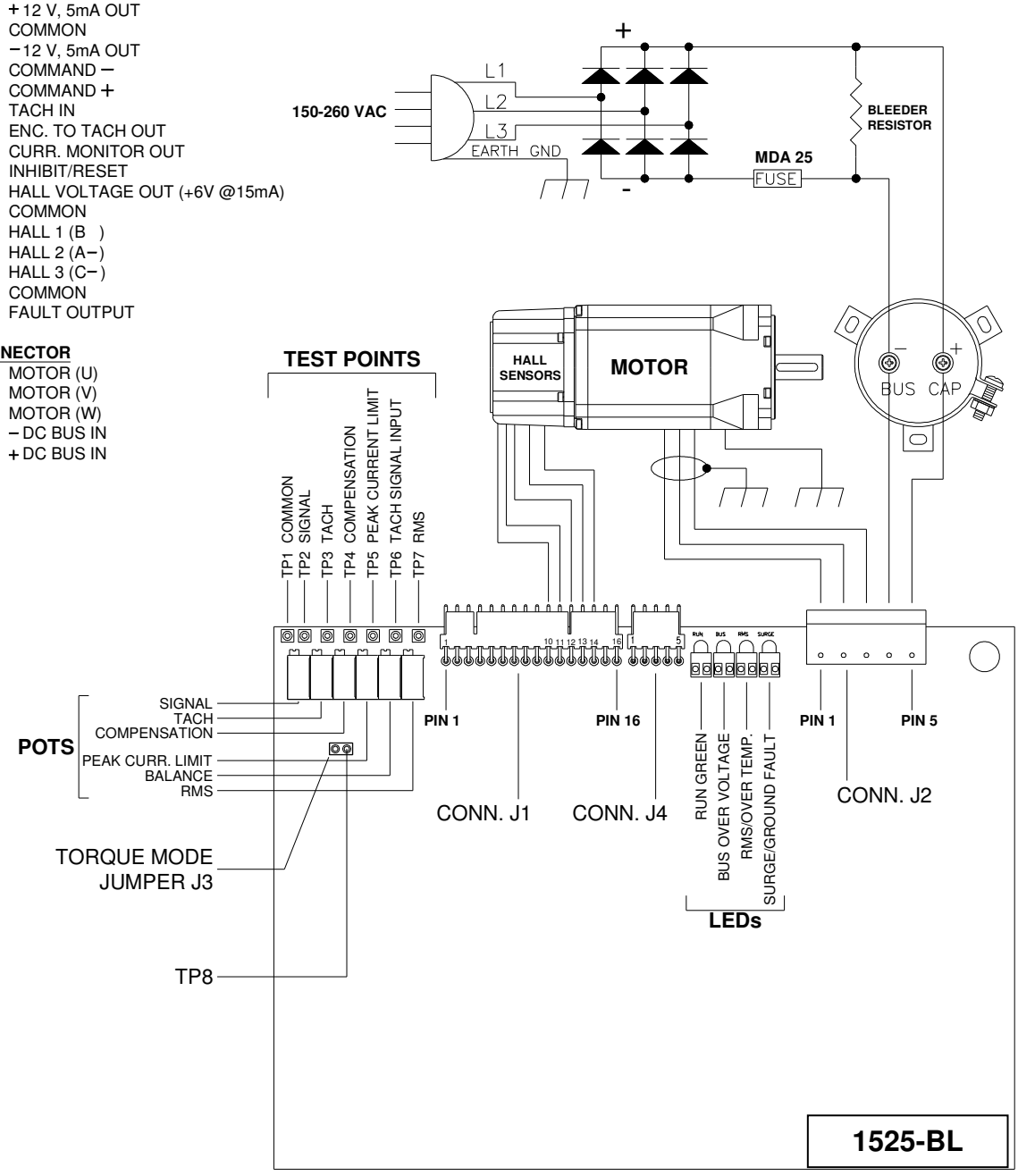
WIRING DIAGRAM
1525-BL
and
Motor with Hall Sensors

J1 CONNECTOR

PIN 1 +12 V, 5mA OUT
PIN 2 COMMON
PIN 3 −12 V, 5mA OUT
PIN 4 COMMAND −
PIN 5 COMMAND +
PIN 6 TACH IN
PIN 7 ENC. TO TACH OUT
PIN 8 CURR. MONITOR OUT
PIN 9 INHIBIT/RESET
PIN 10 HALL VOLTAGE OUT (+6V @15mA)
PIN 11 COMMON
PIN 12 HALL 1 (B)
PIN 13 HALL 2 (A−)
PIN 14 HALL 3 (C−)
PIN 15 COMMON
PIN 16 FAULT OUTPUT

J2 CONNECTOR

PIN 1 MOTOR (U)
PIN 2 MOTOR (V)
PIN 3 MOTOR (W)
PIN 4 − DC BUS IN
PIN 5 + DC BUS IN



WIRING DIAGRAM

1525-BL
and
Motor with Encoder with Hall Tracks

J1 CONNECTOR

PIN 1 +12 V, 5mA OUT
PIN 2 COMMON
PIN 3 −12 V, 5mA OUT
PIN 4 COMMAND −
PIN 5 COMMAND +
PIN 6 TACH IN
PIN 7 ENC. TO TACH OUT
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PIN 9 INHIBIT/RESET
PIN 10 HALL VOLTAGE OUT (+6V @15mA)
PIN 11 COMMON
PIN 12 HALL 1 (B)
PIN 13 HALL 2 (A−)
PIN 14 HALL 3 (C−)
PIN 15 COMMON
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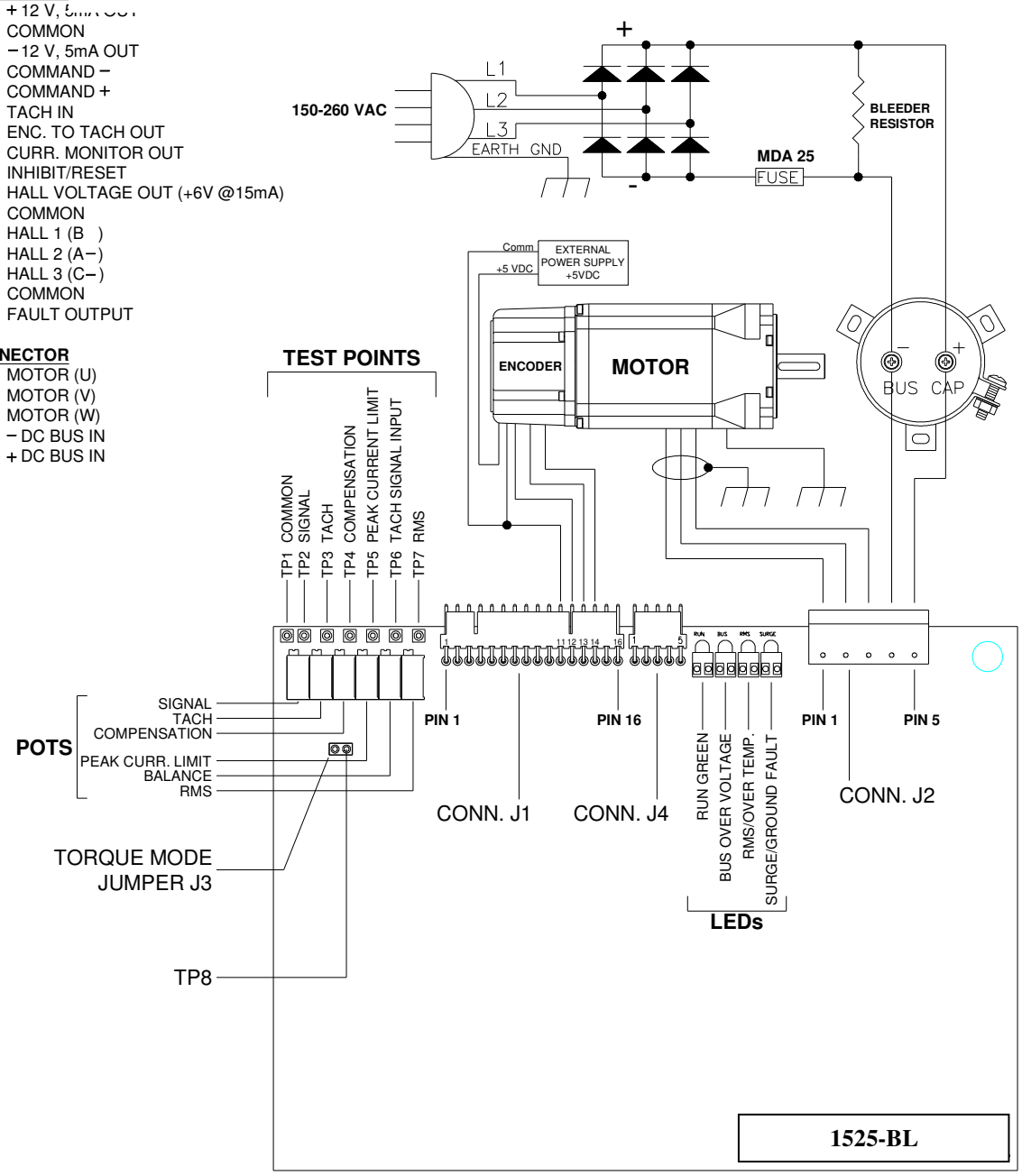
J2 CONNECTOR

PIN 1 MOTOR (U)
PIN 2 MOTOR (V)
PIN 3 MOTOR (W)
PIN 4 − DC BUS IN
PIN 5 + DC BUS IN



OPERATIONAL MODES

The 1525-BL can operate in a Torque or Velocity mode.

In the Torque mode, the 1525-BL only closes the torque loop. The velocity loop is closed in the motion controller.

In the Velocity mode, the 1525-BL itself closes both the torque and velocity loop. Unless otherwise specified, the 1525-BL is preset from the factory in the torque mode.

TORQUE MODE - FACTORY POTENTIOMETER SETTINGS

The 1525-BL is shipped in the torque mode by installing the torque mode jumper at J3 and presetting the potentiometers for the torque mode. The factory potentiometer settings for the torque mode are as follows: (See ADJUSTMENTS section for a more complete description of the potentiometer functions)

Table 1

Potentiometer Description	Potentiometer Setting	Potentiometer Test Point
N/A	N/A	TP1 – COMMON
SIGNAL	4.0 k Ohms	TP2 – SIGNAL
TACH	Full CCW	TP3 – TACH
COMPENSATION	Full CW	TP4 – COMPENSATION
PEAK CURR LIMIT	1.4 k Ohms (25 Amps)	TP5 – PEAK CURR LIMIT
BALANCE	No Preset	None
RMS	10.5 k Ohms (15 Amps)	TP7 – RMS

Note: All Measurements are with respect to TP1 (Common) with J1 removed.

TORQUE MODE - SETUP

The factory preset potentiometer settings are adjusted for the torque mode operation.

To set up and run the 1525-BL in the torque mode, perform the following:

1. Turn power off.
2. Remove J1.
3. Check all wiring connections. Verify that J3 jumper is installed.
4. Set the RMS, PEAK CURRENT LIMIT and SIGNAL pots to match the motor as indicated in Table 2. For preliminary testing under no load, use the factory preset pot settings.
5. Check that the TACHOMETER pot is full counterclockwise (CCW).
6. Check that the COMPENSATION pot is full clockwise (CW).
7. Replace J1.
8. Inhibit the 1525-BL by leaving pin 9 of J1 open or by pulling it to common.
9. Turn power on.
10. Insure that the voltage at COMMAND + and COMMAND – is zero.
11. Enable the 1525-BL by pulling pin 9 of J1 to + 5 VDC.
12. The green LED should be the only LED on. No other LEDs should be on at this point. If any other situation exists, check the TROUBLESHOOTING section of this manual.
13. Adjust the BALANCE pot to give zero volts at CURRENT MONITOR OUT, J1 pin 8.
14. Apply a voltage (0 to +/- 10 Vdc) at COMMAND + and COMMAND -. The motor shaft should turn CW when COMMAND + is positive and should turn CCW when COMMAND + is negative. At low COMMAND voltage, holding the shaft can stall the motor. At higher COMMAND voltage, the torque is much greater and it should be difficult to stall the motor.

MATCHING THE 1525-BL TO THE MOTOR

The factory preset potentiometer settings of the DynaDrive 1525-BL may need to be adjusted to match the continuous current rating of your motor. To accomplish this, find the continuous current rating of the motor to be used and adjust the RMS, PEAK CURR LIMIT and SIGNAL pot per Table 2 below. If the continuous current rating is between the values shown in the table, you may set to the lower value or use linear interpolation for each pot value. The signal pot settings are based on +/- 10 vdc input command signal.

Table 2

Continuous Current Rating of Motor (Amps)	RMS Pot Setting TP7 K Ohms (Amps)	PEAK CURRENT LIMIT Pot Setting TP5 K Ohms (Amps)	SIGNAL Pot Setting TP2 K Ohms
3	.25 k (3.0 Amps)	.38 k (9 Amps)	1.5 k
6	4.6 k (6.0 Amps)	.89 k (18 Amps)	2.8 k
10	8.2 k (9.0 Amps)	1.4 k (25 Amps)	3.8 k
15	10.5 k (15.0 Amps)	1.4 k (25 Amps)	3.8 k

Note: All Measurements are with respect to TP1 (Common) with J1 removed.

VELOCITY MODE – POTENTIOMETER SETTINGS

To set the 1525-BL in the Velocity Mode, remove the cover to expose the Torque Mode Jumper at J3. Remove the Torque Mode Jumper at J3 that is located right behind the Tach pot. The pot settings must be adjusted for Velocity mode per Table 3 below. The Velocity mode requires a tachometer feedback signal from the motor or motion control system.

To match the motor to the 1525-BL, set the RMS and SIGNAL pots per Table 2. Set the PEAK CURR LIMIT pot to full CCW. Set the remaining pots per Table 3 below. Now perform the Velocity Mode Setup procedure on the next page.

Table 3

Potentiometer Description	Potentiometer Setting	Potentiometer Test Point
N/A	N/A	TP1 – Common
SIGNAL	See Table 2	TP2 – SIGNAL
TACH	2.4 k Ohms	TP3 – TACH
COMPENSATION	Full CCW	TP4 – COMPENSATION
PEAK CURR LIMIT	Full CCW	TP5 – PEAK CURR LIMIT
BALANCE	No Preset	None
RMS	See Table 2	TP7 – RMS

Note: All Measurements are with respect to TP1 (Common) with J1 removed.

VELOCITY MODE - SETUP

To set up and run the 1525-BL in the Velocity mode, perform the following:

1. Turn power off.
2. Remove J1.
3. Check all wiring connections. Verify that J3 jumper is removed.
4. Check that the pots are set per Table 3.
5. Inhibit the DynaDrive by leaving pin 9 of J1 open or by pulling it to common.
6. Replace J1.
7. Turn power on.
8. Insure that the voltage at COMMAND + and COMMAND – is zero.
9. Enable the DynaDrive by pulling pin 9 of J1 to + 5 VDC.
10. The green LED should be the only LED on. No other LEDs should be on at this point. If any other situation exists, check the TROUBLESHOOTING section of this manual.
11. Slowly turn the PEAK CURR LIMIT pot CW. If the motor runs away, turn the power off, reverse the velocity feedback leads and repeat above. If the motor does not run away, turn power off and wait for the green LED to go out, disconnect J1. Set the PEAK CURR LIMIT pot to the value given in Table 2. Re-install J1, turn power on and continue.
12. Turn the COMPENSATION pot CW until the motor starts buzzing. Now turn the pot CCW until the motor stops buzzing and then turn another 1 ½ turns CCW.
13. The motor shaft should not be rotating at this point. If it is slowly rotating, adjust the BALANCE pot until rotation is stopped.
14. With zero voltage at COMMAND + and COMMAND –, the motor shaft should be stiff and difficult to turn. A low voltage at COMMAND + will cause the motor to turn at a slow speed with high torque and the motor should be difficult to stall. The motor speed should be proportional to the COMMAND voltage.

CONNECTOR INFORMATION

1525-BL

J1

Pin	Label	Description
1	+ 12V, 5mA OUT	Auxiliary voltage that has 1K ohm resistor in series with this output.
2	COMMON	Connected to other commons and connected to the metalwork of the amplifier mounting plate.
3	- 12V, 5mA OUT	Auxiliary voltage that has 1K ohm resistor in series with this output,
4	COMMAND -	Differential input. This pin can also be used as a single ended input. Use J1, pin 2 as common.
5	COMMAND +	Differential input
6	TACH IN	Single ended input that has additional tach filtering and conditioning.
7	ENCODER to TACH OUT (option)	Jumper to Pin 6 if Encoder to tach option is being used.
8	CURR MONITOR OUT	Current monitor output. +/- 10 Vdc out equals approx. +/- 25 amps.
9	INHIBIT/RESET	Connect to + 5Vdc to enable amplifier. Remove +5Vdc to inhibit and reset amplifier.
10	HALL VOLTAGE OUT	+ 5Vdc to hall sensors (120 mA max)
11	COMMON	Common connection for hall sensors. See pin 2 above.
12	HALL 1	Internally pulled up to + 5 Vdc.
13	HALL 2	Internally pulled up to + 5 Vdc.
14	HALL 3	Internally pulled up to + 5 Vdc.
15	COMMON	See pin 2 above.
16	FAULT OUTPUT	Uncommitted collector output that is low (On) during normal operation and high (off) if a fault occurs. Note: Use an external pull up resistor to 5 - 24 Vdc at 10 mA max.

J2

Pin	Label	Description
1	MOTOR (U)	Output power to motor
2	MOTOR (V)	Output power to motor
3	MOTOR (W)	Output power to motor
4	- DC BUS IN	DC Bus Return
5	+ DC BUS IN	DC Bus High Side

ADJUSTMENTS

The following is a description of the function of each pot. The pot settings can be measured at test points TP1 thru TP7.

SIGNAL	The signal potentiometer is used for scaling the command signal. Turning the potentiometer CW increases the amount of command signal to the front end of the amplifier.
TACH	The tachometer potentiometer is used for scaling the various tachometer voltage gradients. This input has to be used because of special signal conditioning. Turning the pot CW increases the amount of tach-feedback into the amplifier.
COMPENSATION	The Compensation potentiometer is used to increase or decrease the response (bandwidth) of the amplifier. Turning the potentiometer CW increases the response of the amplifier.
PEAK CURR LIMIT	The peak current limit potentiometer is used to increase or decrease the peak output current of the amplifier. Turning the potentiometer CW increases the output current of the amplifier from zero amps to maximum peak amps.
BALANCE	The balance potentiometer is used to stop motor rotation when no input signal exists. The function of this pot is such that for zero input volts the output current should be at zero amps.
RMS	The RMS potentiometer is for changing the level of the RMS current. The amplifier is capable of providing maximum RMS current when fully CW. The minimum current is approximately 0 amps when fully CCW.

TEST POINTS INFORMATION

1525-BL

TP1 - COMMON
TP2 - SIGNAL input pot wiper
TP3 - TACH input pot wiper
TP4 - COMPENSATION pot wiper
TP5 - PEAK CURR LIMIT pot wiper
TP6 - TACH IN signal directly connected to J1, pin 6 thru a 10K resistor
TP7 - RMS current setting pot wiper
TP8 - Front-end opamp output (J3, pin 2)

TROUBLESHOOTING

The 1525-BL has four diagnostic LEDs:

1) RUN GREEN
2) BUS OVER VOLTAGE
3) RMS/ OVER TEMP
4) SURGE/ GROUND FAULT

GREEN LED:

RUN GREEN - Indicates the amplifier is working properly. When the green LED goes off and there are no red LEDs on, the following may have occurred:

1. Loss of power to the amplifier.
2. Bus Voltage less than 80 VDC.
3. Amplifier has been inhibited by J1, Pin 9.

RED LEDs:

Note: When a red LED is on, the amplifier has been inhibited and remains inhibited until reset. To reset, toggle J1 pin 9 momentarily to Common.

BUS OVER VOLTAGE - Indicates that the bus voltage has exceeded 210 VDC. This condition may be caused by rapid deceleration or back driving of the motor. A shunt regulator is required to dissipate the motor energy. If a shunt regulator is present in the system check its fuses.

RMS/OVER TEMP
Excess RMS - The amplifier delivered current beyond its continuous capability. This condition can exist if a machine is asked to perform a task greater than its design capabilities. This would include a motor that is mechanically stalled or binding or a motor with shorted stator (armature) wires.
Over temperature - The heat sink has exceeded 80 °C. An over temperature condition may exist for the following reasons:

a) Insufficient airflow across the heat sink.
b) Ambient cabinet temperature too high.

SURGE/GROUND FAULT
Surge - Indicates an excessive amount of current through the power transistors in the output power bridge. This condition may be due to a damaged output power device or shorted output leads to the motor.
Ground fault - One of the output wires to the motor is shorted to ground. This condition may be due to faulty or pinched wiring or the motor is arcing to the case ground.

OTHER CONDITIONS:

MOTOR OR MACHINE RUNS AWAY:

1.Check the tachometer voltage to the amplifier by testing TP3 with respect to TP1. Then look at TP6 with respect to TP1 with a voltmeter.

2.Ensure the tachometer signal is phased correctly.

3.Check to see if the position loop phasing (CNC command) is correct relative to the position encoder feedback device.

MOTOR RUNS ERRATIC OR PRODUCES VERY LOW TORQUE IN VARIOUS SHAFT POSITIONS:

1.Check the phase relationship of the motor commutator (Hall) sensors wires (J1, Pins 12, 13, and 14) relative to the motor power wires at the motor terminals of the amplifier chassis.

2.Check the wires from the motor commutator sensors and make sure the motor commutator signals are making connection in J1, Pins 12, 13 and 14 on the connector on the amplifier module.

MOUNTING DIMENSIONS

1525-BL