
Varedan Technologies

LA Series



Stand-Alone Linear Amplifiers

Product User Guide

Revision A10

Record of Revisions

Rev	Date	Valid For	Description
A1	07/20/2011	All units	Initial release
A2	10/15/2011	All units	Revise part numbering
A3	11/11/11	All units	Add connection drawing
A4	6/1/2012	All units	Correct mating CPC part numbers
A5	6/18/2012	All units	Add J8 Male pinout
A6	7/27/2012	4016-RC	Add optical isolation for new front panel
A7	10/11/12	All units	Add 800W version
A8	08/11/14	All units	Fix limit - opto input drawing
A9	10/24/14	All units	Revise Appendix A
A10	11/14/14	All units	Add e and f commands, update LA525 settings
A11	11/18/14	All units	Autobalance update, connector updates
A12	12/23/14	All units	Update opto section

Technical changes to improve performance may be made at any time without notice!

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1 Introduction

The LA Series Stand-Alone linear amplifier system is an AC line powered unit based on the LA series current-mode linear amplifiers.

Some of the key features of this system:

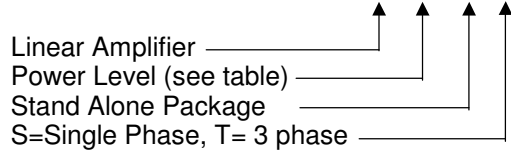
- Available in 4 power levels
- Available in single/two-phase or 3-phase models
- Commonly available front panel connectors for easy wiring
- Single phase 110 or 220 VAC input is only power required for operation
- All required power supplies are contained in the box
- Factory configurable transformer for various bus voltage options
- Front panel status indicator shows amplifier status
- Integrated fans provide sufficient cooling for most applications
- USB or RS-232 communication capability
- Flexible mounting options for bottom or side mounting
- Simple setup and operation

Since the Stand Alone contains a LA amplifier module, we recommend referring to the LA Series Technical Reference manual for the modules as well. That document is available on our website.

Model Numbering

The LA Series Stand-Alone Linear Amplifier System is available in various power options and in either single-phase or 3-phase models.

Model Number Breakdown: LA-415-SA-T



1.1 Specifications 200W, 400W, 500W

Parameter	LA-210-SA-S	LA-210-SA-T	LA-415-SA-S	LA-415-SA-T	LA-525-SA-S	LA-525-SA-T
Output Phases	1 or 2	3	1 or 2	3	1 or 2	3
Peak Output Current	10A		15A		25A	
Continuous Output Current	2.5A		5A		10A	
Peak Output Power (25°C)	400W		1200W		1500W	
Continuous Power Dissipation (25°C)	200W		400W		500W	
Weight	22.0lbs					
Size - Height	7.87 in.					
Size - Length x Width	12.17 in. x 6.28 in.					
Motor Bus Voltage – Bipolar	+/-56VDC (Contact factory for other transformer choices)					
Max. Heat Sink Temperature	70°C					
Current Loop Bandwidth*	up to 10kHz					
Operating Modes	Sinusoidal (w/ external commutation) / Trapezoidal					
Absolute Overcurrent Trip Time	50ms					
Hall Sensor Supply (+5 Ext.)	+5V @ 100mA max.					
Command Signal (A and B inputs)	+/-10V Single-Ended, +/-20V Differential					
Power Requirements	120VAC, 10A or 230VAC, 5A					
Fuse	8A Slow Blow				10A Slow Blow	

Notes: 1 - Single-phase models can drive 2 motor coils using 1/2 the bus voltage by connecting one side of the motor coil to the phase output and the other to ground.



1.2 Specifications 800W

Parameter	LA-830-SA-S	LA-830-SA-T
Output Phases	1 or 2	3
Peak Output Current	30A	
Continuous Output Current	15A	
Peak Output Power (25 °C)	1500W	
Continuous Power Dissipation (25 °C)	800W	
Weight	26.0lbs	
Size - Height	7.93 in.	
Size - Length x Width	17.70 in. x 8.75 in.	
Motor Bus Voltage – Bipolar	+/-56VDC (Contact factory for other transformer choices)	
Max. Heat Sink Temperature	70 °C	
Current Loop Bandwidth*	up to 10kHz	
Operating Modes	Sinusoidal (w/ external commutation) / Trapezoidal	
Absolute Overcurrent Trip Time	50ms	
Hall Sensor Supply (+5 Ext.)	+5V @ 100mA max.	
Command Signal (A and B inputs)	+/-10V Single-Ended, +/-20V Differential	
Power Requirements	120VAC, 15A or 230VAC, 7.5A	

1.3 Safety Information

Read this information before operating this system.

1.3.1 Grounding

The AC power connection to the box must have a connection to ground.



CAUTION



**The LA StandAlone must be plugged into a properly grounded AC outlet.
Failure to provide this ground could result in a fatal electric shock.
Verify ground continuity to all metal pieces on the system.
Metal components bolted only to granite may not be grounded. Black anodized and
painted surfaces are not conductive.**

1.3.2 Hazardous Voltage Information



CAUTION

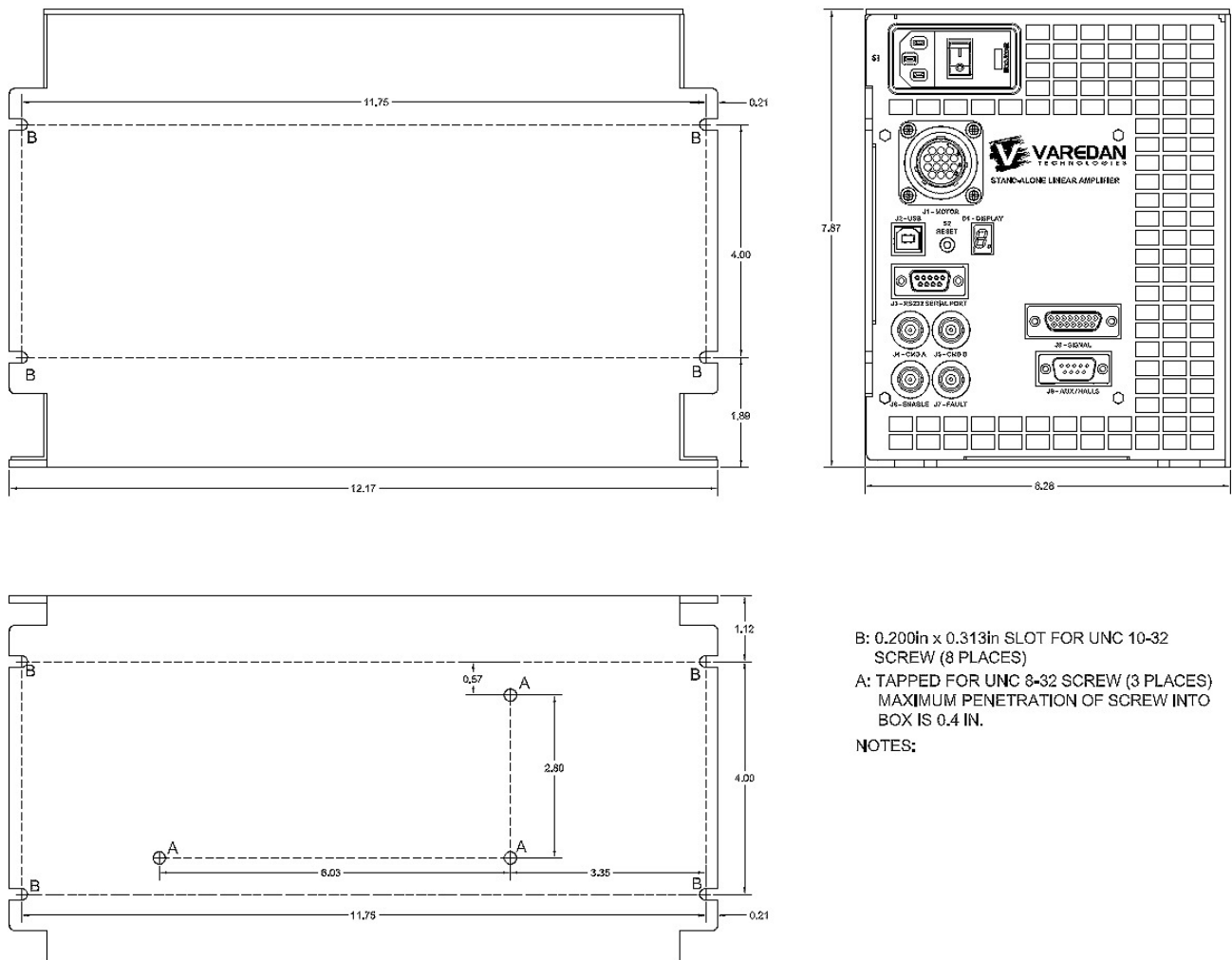


**Hazardous voltages are present at the motor output terminals and within the sheet
metal enclosure. Disconnect the AC power before plugging / unplugging any
connections or before servicing or disassembling the enclosure.**

2 System Installation

2.1 Mechanical Dimensions

2.1.1 200W, 400W, 500W Case Dimensions



B: 0.200in x 0.313in SLOT FOR UNC 10-32 SCREW (8 PLACES)
 A: TAPPED FOR UNC 8-32 SCREW (3 PLACES)
 MAXIMUM PENETRATION OF SCREW INTO BOX IS 0.4 IN.

NOTES:

Figure 1: LA StandAlone Dimensions for 200W, 400W and 500W units

2.1.2 800W Case Dimensions

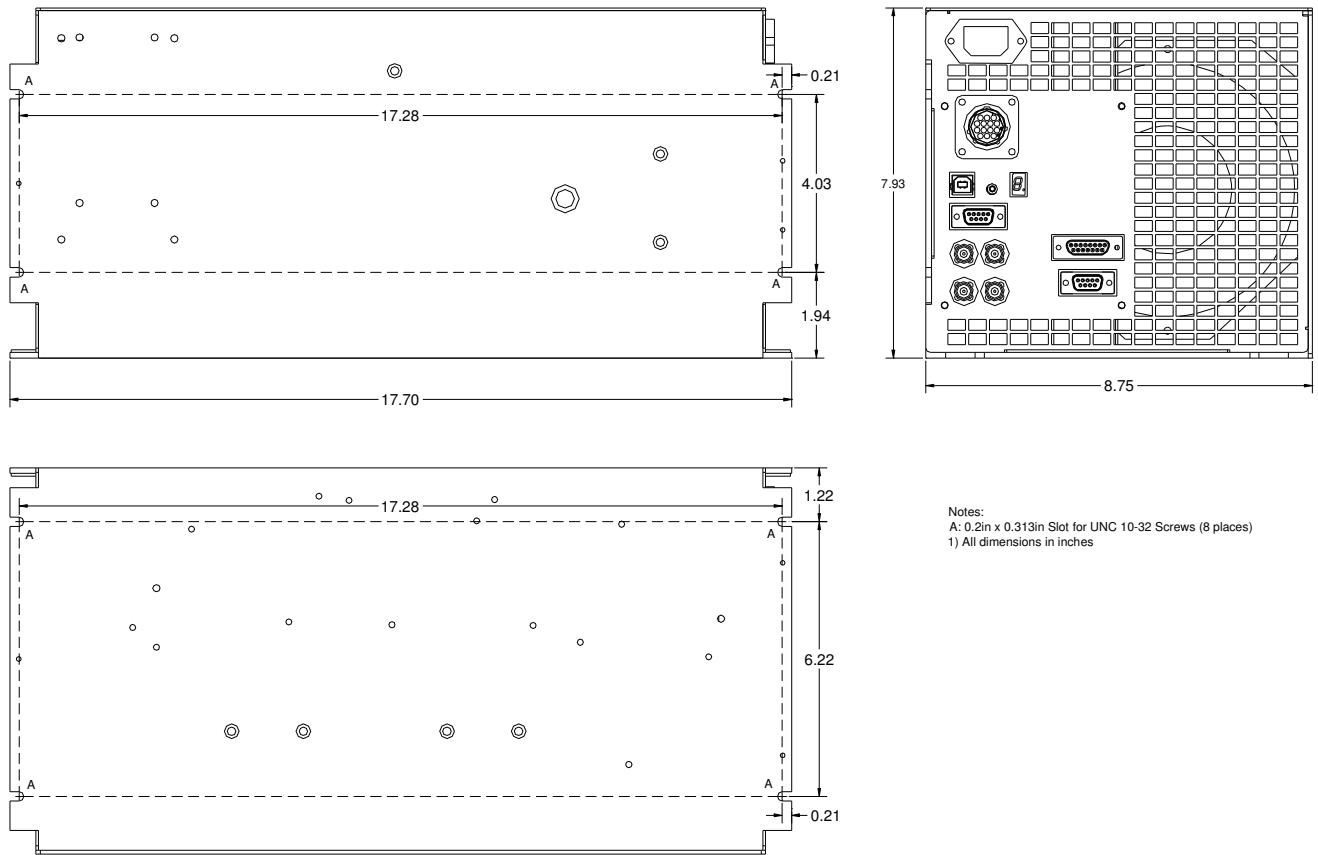


Figure 2: LA StandAlone Dimensions for 800W units

2.2 Selecting a mounting area

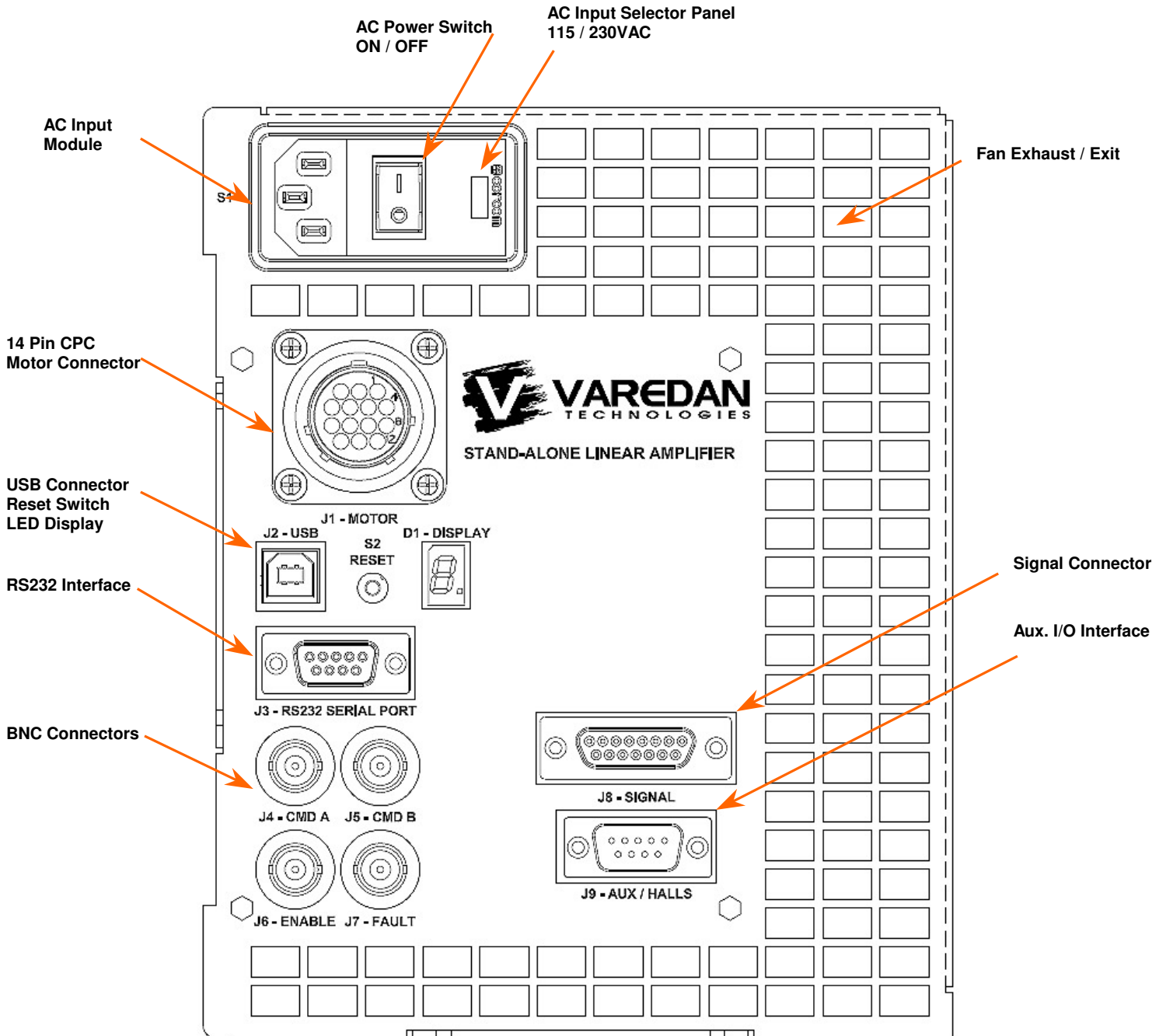
The unit should be mounted in a solid, clean, dry location with adequate ventilation.

Avoid mounting areas that:

- Obstruct the intake or exhaust of the internal forced air cooling.
- Allow dust, debris to enter and contaminate the cooling capability of the drive.
- Have humidity above 80% or are susceptible to moisture or coolant.
- Are prone to corrosive or flammable materials.
- Have an ambient temperature higher than 85°F (30°C).
- Vibrate, are susceptible to vibration or that could transmit the cooling fan vibration to sensitive test equipment.

Note: The StandAlone's allowable power output is limited by the amplifier heatsink temperature. Any reduction in cooling capability will be directly proportional to a reduction in performance.

2.3 Front Panel



2.3.1 AC Input

The LA Stand-Alone amplifier can accept AC input voltages of 100 – 120 and 208 - 240VAC at 47 – 63Hz.

Note that the Stand-Alone amplifier utilizes an unregulated linear power supply. Therefore a higher AC input (for a given range) will provide a higher voltage to the spindle and allow the spindle to reach higher velocities.

The AC Inlet should be configured per the table below.

Fuse / Fuse Block Value in Window		Input AC Voltage Ranges (47-63 Hz)	
Fuse Value	115V / 230V	Input Minimum	Input Maximum
8A	115	100	120
4A	230	208	240

Figure 3: Suggested Fusing for AC Input

2.3.1.1 Changing the AC input configuration

1. Remove power from the AC Inlet
2. Use a flat tipped screwdriver to open the window that covers the red voltage value.
3. Use the screw driver to remove the fuse block.
4. Use the table above to determine the correct fuse value.
5. Reinstall the fuse module such that the correct voltage value will show through the window.
6. Close the window.

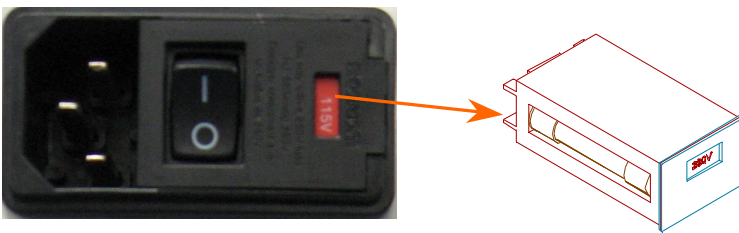
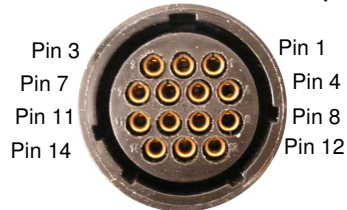


Figure 4: Fuse block removal from the AC inlet

2.4 Interface Connections

2.4.1 Motor Connector (J1) CPC-14



Pin #	Description
1	Motor Phase C or Single-Phase -
6	Motor Phase B or Single-Phase +
8	Motor Phase A (not used for Single-Phase)
14	GND

Mate: Varedan 4006-62
 Includes the following:
 Tyco: 206044-1 Tyco: 66359-2x4 Tyco:206070-1

2.4.2 USB Connector (J2) USB B



Pin #	Description
1	+5vdc
2	USB -
3	USB +
4	GND

2.4.3 Command B+ Input BNC (J4)



Pin #	Description
1	Command B+ Input (Same as J8-3)
Shell	GND

2.4.4 Command A+ Input BNC (J5)



Pin #	Description
1	Command A+ Input (Same as J8-1)
Shell	GND

2.4.5 Enable Input BNC (J6)



Pin #	Description
1	Enable Input (Same as J8-11)
Shell	GND

2.4.6 Fault Output BNC (J7)



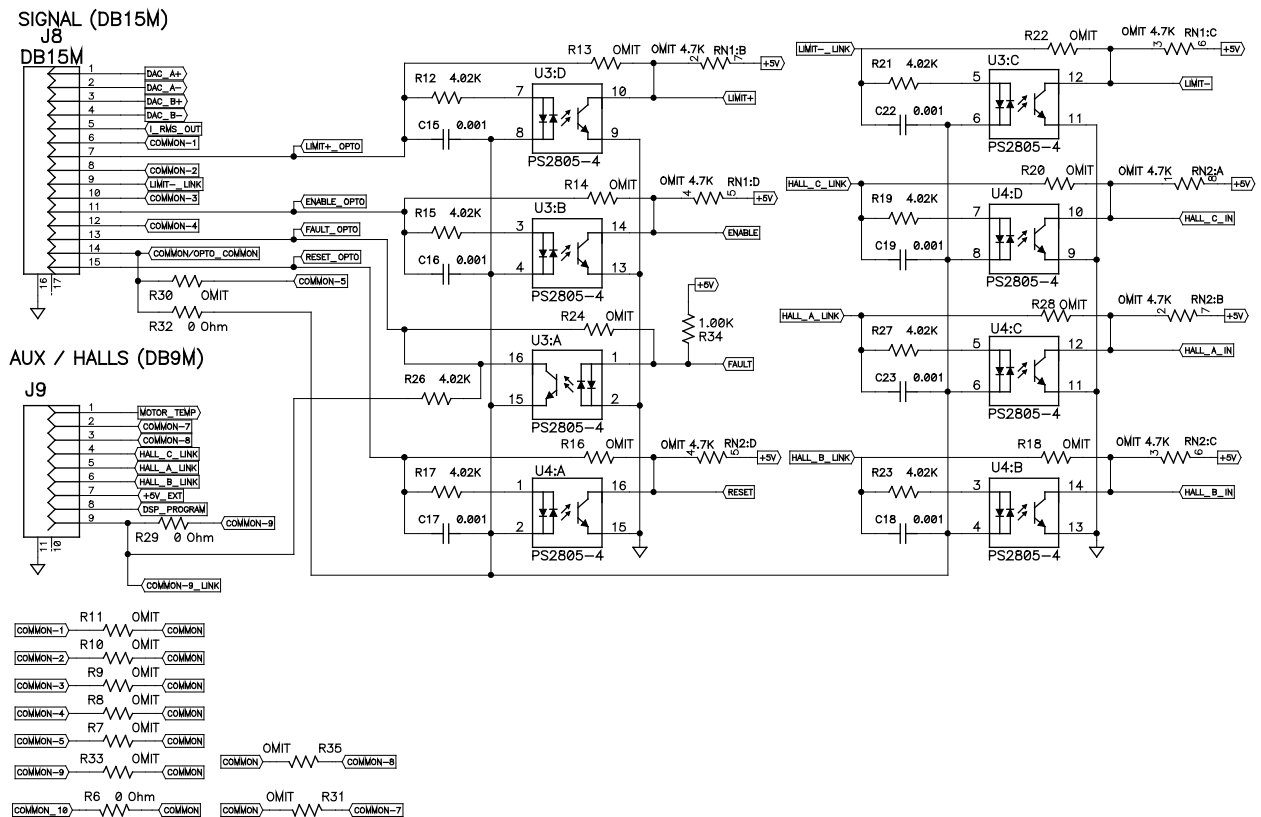
Pin #	Description
1	Fault Output (Same as J8-13)
Shell	GND

2.4.7 Signal Connector Electrical Interface

The following drawings illustrate the electrical interface for the J8 & J9 signal connectors. Note that there are 2 configurations available from the factory, one with optical isolation and one without. Please be sure to use the correct drawing. Also note that J8 can be either DB15M (male) or DB15F (female).

2.4.7.1 J8 & J9 Electrical Interface, Optically Isolated

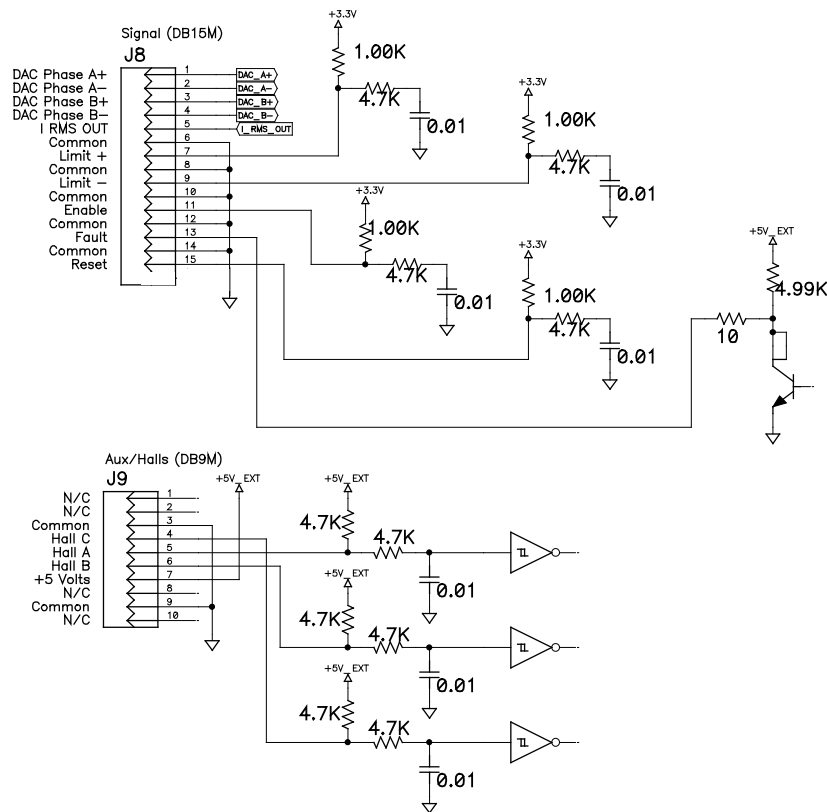
For the optically isolated version of J8, Opto Common is pin 14 and can be any voltage in the range 5-24vdc. Active signal inputs are low referenced to the supply providing the Opto Common voltage. Alternatively a common ground can be provided on pin 14 and 5-24vdc can be used to activate the individual inputs. **Note that the Fault output is open collector with no internal current limiting resistor. The user must provide an external current limiting resistor to limit current to no more than 200mA.**



Note: Pin outs are shown for DB15M connector option. Refer to 2.4.8 or 2.4.9 as appropriate.

2.4.7.2 J8 & J9 Electrical Interface, Non-isolated

The following drawing shows the non-isolated interface for J8 and J9.



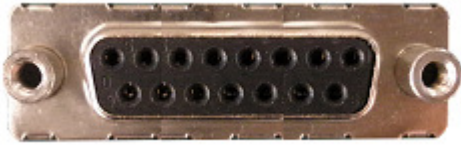
Note: Pin outs are shown for DB15M connector option. Refer to 2.4.8 or 2.4.9 as appropriate

2.4.8 Signal Connector (J8) DB-15 Female

Note: Two different genders of J8 are used. Be sure to use the correct pin out (Male or Female).

Pin 8

Pin 1



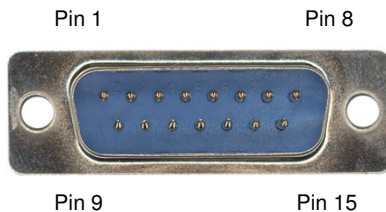
Pin 15

Pin 9

Pin #	Description
1	Common - Signal Ground
2	Limit + Input - Active high input, Internally pulled high (3.3V), set low to enable travel. Not used in Sine Mode. For optically isolated version see section 2.4.7.1
3	Common - Signal Ground
4	Current Monitor IRMS Output - Analog current output 1V=10A (LA-210/LA-415) or 1V=3.3A (LA-525)
5	Command B - Input - +/- 10vdc command input. Only used in Differential mode Note: Command B inputs are also used for single-phase mode
6	Command B+ Input - +/- 10vdc command input. Used in both Single Ended and Differential modes
7	Command A- Input - +/- 10vdc command input. Only used in Differential mode Note: Command A inputs are not used in single-phase mode
8	Command A+ Input - +/- 10vdc command input. Used in both Single Ended and Differential modes
9	Reset Input - Ground to reset amplifier. Internally pulled high (3.3V). For optically isolated version see section 2.4.7.1
10	Common - Signal Ground
11	Fault Output - High output indicates fault, low normally (no fault). Internally pulled high (5V). For optically isolated version see section 2.4.7.1.
12	Common - Signal Ground. Fault Collector for optically isolated version. See section 2.4.7.1.
13	Enable Input - Ground to enable amplifier. Internally pulled high (3.3V). For optically isolated version see section 2.4.7.1
14	Common - Signal Ground
15	Limit - Input - Active high input, Internally pulled high (3.3V), set low to enable travel. For optically isolated version see section 2.4.7.1

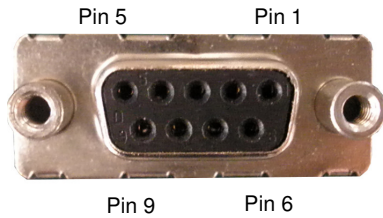
2.4.9 Signal Connector (J8) DB-15 Male

Note: Two different genders of J8 are used. Be sure to use the correct pin out (Male or Female).



<u>Pin #</u>	<u>Description</u>
1	Command A+ Input - +/- 10vdc command input. Used in both Single Ended and Differential modes
2	Command A- Input - +/- 10vdc command input. Only used in Differential mode Note: Command A inputs are not used in single-phase mode
3	Command B+ Input - +/- 10vdc command input. Used in both Single Ended and Differential modes
4	Command B - Input - +/- 10vdc command input. Only used in Differential mode Note: Command B inputs are also used for single-phase mode
5	Current Monitor IRMS Output - Analog current output 1V=10A (LA-210/LA-415) or 1V=3.3A (LA-525)
6	Common - Signal Ground
7	Limit + Input - Active high input, Internally pulled high (3.3V), set low to enable travel. Not used in Sine Mode. For optically isolated version see section 2.4.7.1.
8	Common - Signal Ground
9	Limit - Input - Active high input, Internally pulled high (3.3V), set low to enable travel. For optically isolated version see section 2.4.7.1.
10	Common - Signal Ground
11	Enable Input - Ground to enable amplifier. Internally pulled high (3.3V). For optically isolated version see section 2.4.7.1.
12	Common - Signal Ground. Fault Collector for optically isolated version. See section 2.4.7.1.
13	Fault Output - High output indicates fault, low normally (no fault). Internally pulled high (5V). Fault Emitter for optically isolated version see section 2.4.7.1.
14	Common - Signal Ground
15	Reset Input - Ground to reset amplifier. Internally pulled high (3.3V). For optically isolated version see section 2.4.7.1.

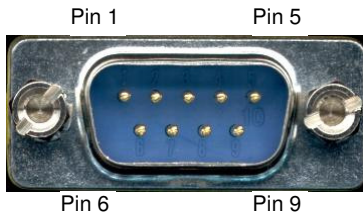
2.4.10 RS232 Connector (J3) DB-9F



<u>Pin #</u>	<u>Description</u>
1	No Connection
2	RS232 Receive - Data into amplifier
3	RS232 Transmit - Data from amplifier
4	No Connection
5	Ground
6	No Connection
7	No Connection
8	No Connection
9	No Connection

Note: Receive and Transmit pins are disabled if J2 (USB) is used for communication.

2.4.11 Auxiliary I/O Connector (J9) DB-9M



<u>Pin #</u>	<u>Description</u>
1	Motor Temperature Switch Input - Ground to enable amplifier (switch closed). Pulled up to +5vdc.
2	Common - Use as return for Motor Temperature Switch.
3	Common - Ground
4	Hall C Input. For optically isolated version see section 2.4.7.1
5	Hall A Input. For optically isolated version see section 2.4.7.1
6	Hall B Input. For optically isolated version see section 2.4.7.1
7	+5VDC Output
8	DSP Program Input - Contact Factory for Programming Instructions.
9	Common - Ground

Note: +5VDC Output is limited to 300mA

2.4.12 7-Segment Display

The 7 segment LED display on the front panel shows the status of the controller in real-time. The following table lists the front panel LED display codes and their meaning. If multiple errors are present, the display will cycle through all the error codes, displaying each for ½ second. Most errors can be reset by either pressing the front panel pushbutton switch or cycling power to the unit, although some errors cannot be fixed in the field. Please contact the factor for assistance with any errors that do not clear after a reset.

0	Ok, motor current enabled. This is the “normal” display when enabled.
1	DSP Fault – Set when the internal DSP checksum fails following reset
2	NVM Fault – Set when NVM checksum fails following reset. Parameter defaults are set.
3	Internal +5vdc – Set when the internal +5vdc supply is out of range
4	Autobalance Fault – Set when autobalance can’t balance amplifier outputs.
5	ABS Overcurrent – Set when instantaneous overcurrent condition is detected
6	SOA – Set when Safe Operating Area protection detects an over power condition.
A	Internal +5 vdc Reference error – Set when internal +5 reference supply is out of range
b	Bus Over Voltage – Set when the internal motor bus voltage is greater than +/-75 vdc.
[Ok, not enabled (Output is Clamped off). This is the normal display when not enabled.
C	Internal +2.5 vdc Reference error – Set when internal 2.5vdc supply is out of range.
F	Fatal Error – Set if the DSP encounters an unidentified problem.

- H** Heatsink Over Temp – Set when the heat sink temperature is above 70 C. Remove power and allow the unit to cool before attempting to run again.

- L** Overcurrent – Set when amplifier detects an overcurrent condition. (“L”ow speed circuit breaker).

- U** Bus Under Voltage – Set when the internal motor bus voltage is less than +/-10 Vdc.

- Bias error – Set when the internal bias voltage input is outside the allowable range.

- .** (Decimal point on) Indicates an Overcurrent (“L”) trip pending

3 Establishing Communications

The LA StandAlone amplifier communicates via a RS232 port or USB port at 19200 baud.

A serial communication program such as HyperTerminal can be used for communications. The standard settings are **8** data bits, **1** stop bit, **no** parity and **no** hardware or software handshaking.

Settings → Emulation = ANSIW. **ASCII Setup** → No boxes checked, 100msec delay,

HyperTerminal Note: When changing baud rates or establishing communication for the first time use the call\disconnect and then call\call tab prior to cycling power to the controller.

3.1 RS232 Serial Interface

The controller can communicate with a host via RS-232 using a standard three wire DTE to DTE cross over serial cable as shown below. Note that the J3 RS-232 interface pins (2 & 3) are disabled if the USB port is being used, but the signal pins remain active.

NOTE: Do not attempt to use RS-232 and USB at the same time. Remove the USB connector when using RS-232.

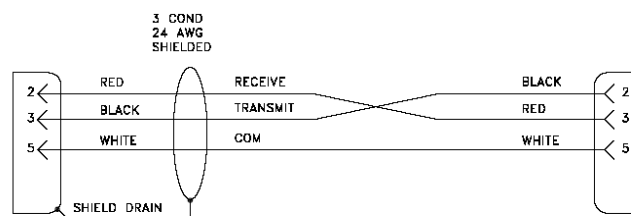


Figure 8: Serial Data Cable Diagram

3.2 USB Interface

As an alternative to RS-232, USB can be used for communication. The connection is a standard USB Type B connector. The easiest way to use the USB interface is to establish a virtual com port (VCP) using the driver provided by Future Technology Devices, Inc. which can be found at

<http://www.ftdichip.com/Drivers/VCP.htm>

This driver allows the USB port to be configured as a COM port by the operating system. Application software can access the USB device in the same way as it would access a standard COM port with of the same settings.

Be sure to set the baud rate for the VCP to 19200. When an active USB cable is plugged into the USB port, the RS-232 communication on J3 is disabled.

NOTE: Do not attempt to use RS-232 and the USB at the same time. Remove the RS-232 connector when using USB.

3.3 Serial Commands

The following commands are supported over the serial port communications interface.

3.3.1 A – Alarm Reset

This command allows viewing or resetting the alarm status. “A” with no parameter is used to read the alarm status. “A 1” is used to reset the alarm status. Note: When an alarm is detected by the system, the drive is immediately disabled.

3.3.2 B – AutoBalance

This command is used to invoke the autobalance algorithm. During autobalance the display will indicate “-“ (middle bar).

3.3.3 E – Enable Status

This command is used to set/view the enable state of the drive. Note: When an alarm is detected by the system, the drive is immediately disabled.

There are two modes of Enable operation, Software and Hardware. In Hardware mode, the drive enable is controlled by the hardware Enable input. A low on this input Enables the drive. A high or open on this input disables the drive. The E command only allows viewing the enable state when in “hardware” enable mode.

Software enable mode is configured following a reset and BEFORE the hardware input is used. The drive will come up disabled and the E command can be used to enable (E1) or disable (E0) the drive. If at any time during software mode operation, the hardware input goes low, the drive reverts to hardware mode as described above.

3.3.4 e - Enable Level

This command sets or views the active level for the hardware enable input. Entering e 0 sets the level to active low. Entering e 1 sets the level to active high. Entering e without any value returns the present setting. The factory default level is 0 (active low) to enable.

3.3.5 F – Factory Defaults

This command is used to set all the parameters to the factory defaults. Use the “S” command to save the settings to NVM following the F command. By not automatically saving the defaults, the user can choose to go back to the original settings (that were in the drive before the F command was used) by resetting the drive.

3.3.6 f - Fault Output Level

This command sets or views the active level for the Fault output. Entering f 0 sets the active Fault output to low for a fault condition. Entering f 1 sets the active Fault output high for a fault condition. Entering f without any value returns the present setting. The factory default level is 1 (active high) for a fault condition.

3.3.7 H – Help

This command lists a summary of commands and their function.

3.3.8 L – List all parameters

This command lists all the user settable parameters and system readings to the display. The enable and alarm status are also shown.

3.3.9 M – Mode

This command is used to view or set the commutation mode of the drive. M0 sets trapezoidal commutation, M1 sets Sinusoidal 2 phase input commutation. The “M command can only be used to view the commutation setting if jumpers are installed.

3.3.10 R – Reset

This command causes the drive to perform a power on reset.

3.3.11 S – Save Parameters

This command saves the user selectable parameters to NVM.

3.3.12 Y – Display Fault History

The last 8 errors from the fault history buffer are displayed. If a fault occurs while the drive is enabled, the fault is saved into the fault history buffer. The last 8 errors are saved in NVM and recalled for display when this command is issued. Only errors that occur while the drive is enabled are stored. This prevents nuisance errors that commonly occur during startup/shutdown to be ignored.

3.3.13 YC – Clear Fault History

This command clears the fault history buffer in NVM. This command is useful after setting up a new system in production to be sure any setup errors are cleared.

3.3.14 YS – Display SOA Fault History

This command displays the last saved SOA trip information from NVM. In the event of an SOA trip, all the system parameters related to the trip are stored. This information is useful to the factory for troubleshooting SOA events.

4 Serial Parameter Settings

The user parameter settings are configured either by jumpers or via the serial interface. When jumpers are used, the serial interface can only be used to read the jumper settings. If no jumpers are installed, the software settings are used. If the configuration when using jumpers results in no jumpers being installed (Sine Mode with all minimum values), place a jumper on JP1-G. This will force the drive to read and use the jumper settings. The use of this jumper in Sine mode will not affect operation.

When no jumpers are installed, the settings are controlled from software using P values as shown below. To use the serial interface to configure the settings, remove all jumpers and use the values as described below for the Pn locations. Note that if any jumper is installed, all jumper settings will be read and used for setting the parameters.

4.1 P – Parameter Command

This command is used to view or set the user parameters and RAM locations in the drive. The following list shows software variables and their corresponding “P” access number. Be VERY careful when changing these values, as the software does not provide for protection from improper settings. Adverse settings may cause “undesirable” effects on the system.

The values for P0-P6 reflect the jumper settings as described above when jumpers are installed and cannot be changed from the serial interface. When no jumpers are installed, these values can be modified using the serial interface by changing the appropriate Pn value to configure the drive as if jumpers were present.

- P0 Transconductance setting
- P1 Absolute Overcurrent Trip setting
- P2 Overcurrent Trip setting
- P3 Overcurrent Trip Time setting
- P4 Input Filter setting
- P5 Sine/ Hall mode setting
- P6 Current Loop Bandwidth setting
- P7 Motor Reverse setting

Note: P8-P255 are system values that should not be changed by the user.

To set a parameter value, type P followed by the address (0-6) followed by a space followed by the value followed by <Enter> (Cr Lf). Refer to the next page for the P values and their settings.

Example: Set P1 Absolute Overcurrent Trip to 15.0 Amps.

Type: P1 1<Enter>

Drive response: 1

To view a parameter setting, type P followed by the address (0-6) followed by Enter.

Example: View the Overcurrent Trip setting:

Type: P2 <Enter>

Drive response: 1 (or whatever the present value is)

4.2 Software Parameter Setting Table Summary

P0 – Transconductance value

<u>P0 Value</u>	<u>LA-210</u>	<u>LA-415</u>	<u>LA-525</u>	<u>DAC Single End/Differential</u>
0	0.25	0.8	1.0	Differential (Bipolar)
1	0.5	1.0	1.5	Differential (Bipolar)
2	0.75	1.2	2.0	Differential (Bipolar)
3	1.0	1.5	2.5	Differential (Bipolar)
4	0.25	0.8	1.0	Single Ended (Unipolar)
5	0.5	1.0	1.5	Single Ended (Unipolar)
6	0.75	1.2	2.0	Single Ended (Unipolar)
7	1.0	1.5	2.5	Single Ended (Unipolar)

P1 – Absolute Overcurrent Level

<u>P1 Value</u>	<u>LA210/LA415 Trip Level</u>	<u>LA525 Trip Level</u>
0	12 Amps	15 Amps
1	15Amps	20 Amps
2	18Amps	25 Amps
3	20Amps	30 Amps

P2 – Overcurrent Trip Level

<u>P2 Value</u>	<u>LA210/LA415 Trip Level</u>	<u>LA525 Trip Level</u>
0	2.0 Amps	4 Amps
1	3.0 Amps	6 Amps
2	4.0 Amps	8 Amps
3	5.0 Amps	10 Amps

P3 – Overcurrent Trip Time

<u>P3 Value</u>	<u>Trip Time</u>
0	1.25 Sec
1	2.5 Sec
2	5.0 Sec
3	10.0 Sec

P4 – Input Filter Setting

<u>P4 Value</u>	<u>LA210/LA415 Input Filter Setting</u>	<u>LA525 Input Filter Setting</u>
0	500 Hz	500 Hz
1	800 Hz	2,500 Hz
2	15 kHz	10,000 Hz
3	32 kHz	20,000 Hz

P5 – Sine Hall Mode Setting

<u>P5 Value</u>	<u>Sine Hall Setting</u>
0	Sine
1	Hall

P6 – Open Loop Gain Setting (fixed configuration in some versions)

<u>P6 Value</u>	<u>Current Loop Bandwidth</u>
0	Contact
1	Factory
2	For
3	Settings

P7 – Motor Reverse Setting

<u>Value</u>	<u>Motor Reverse Setting</u>
0	Normal Halls Direction
1	Reverse direction



Figure 9. Typical Three-Phase Mode Connections

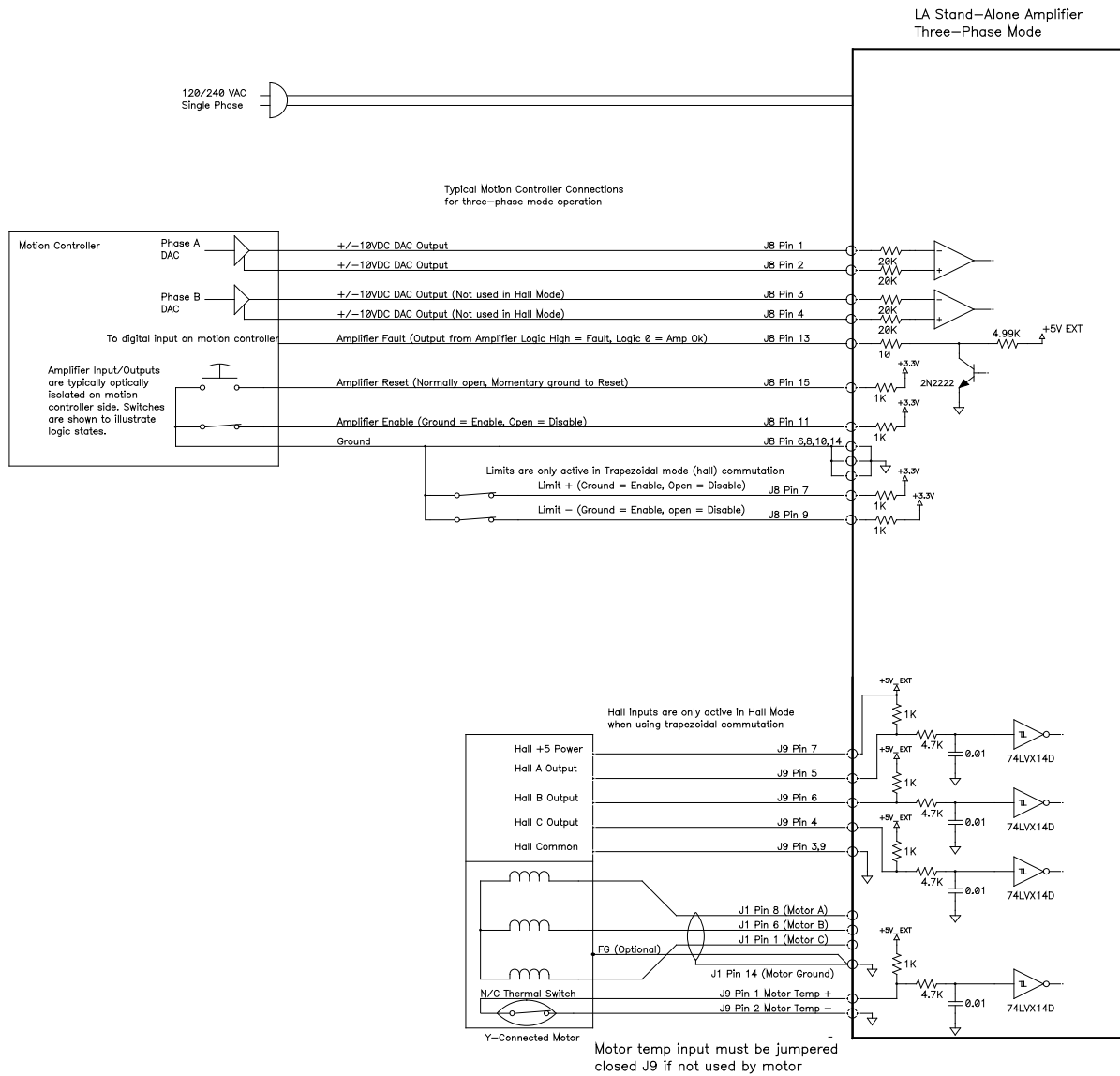
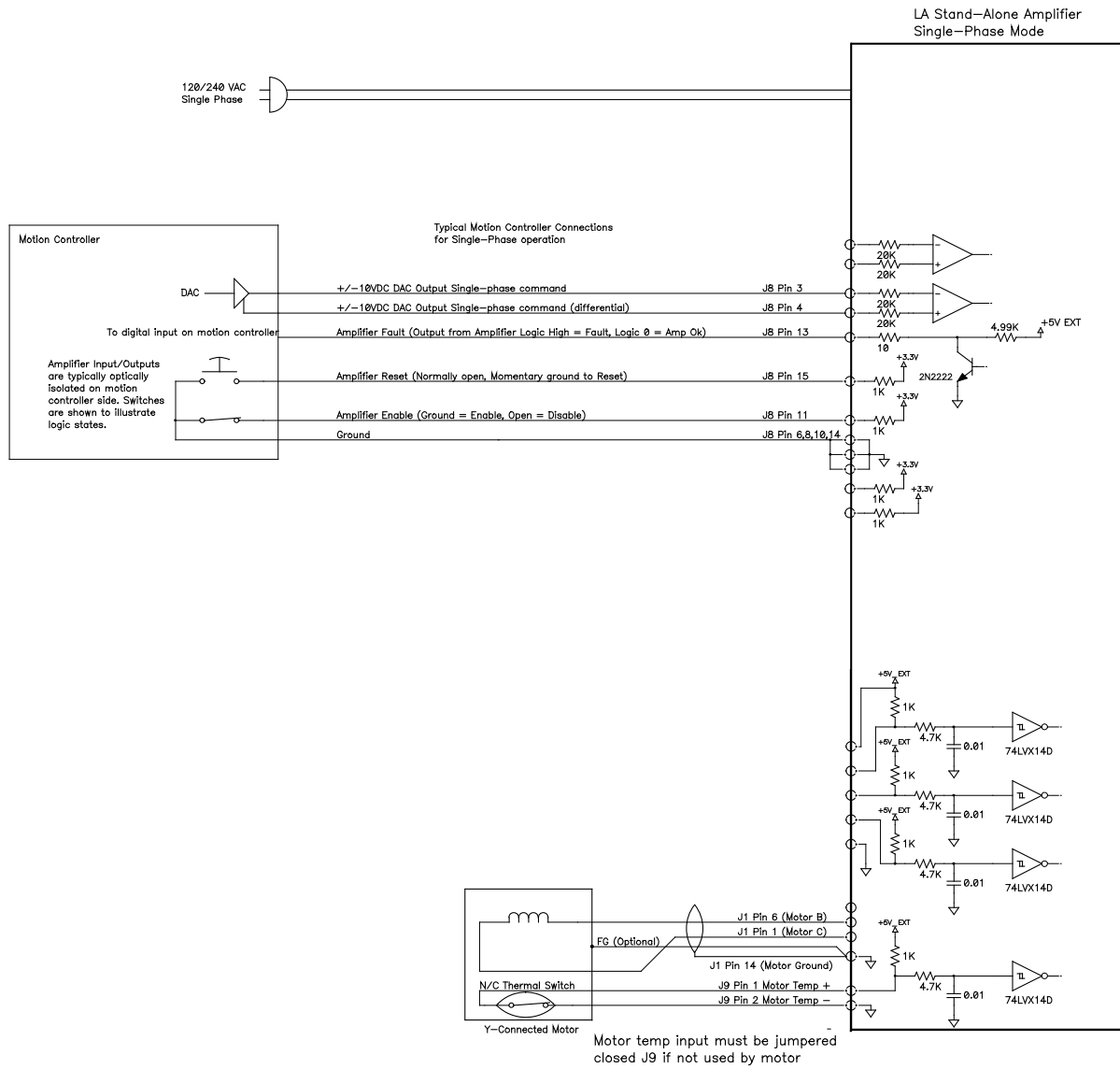


Figure 10. Typical Single-Phase Mode Connections



5 Troubleshooting

5.1 Autobalance

The amplifier has a built-in algorithm for balancing the linear amplifier power stage. Normally it is not necessary to perform this procedure as the amplifier stage is balanced at the factory. Due to the inherent offsets of the analog circuitry in the power stage, offsets may occur in the system over time that cause unwanted torque ripple. Offsets can be detected in open loop mode by commanding 0 current and rotating the motor by hand and feeling for “detents”. If any significant detents are found, balancing may be necessary.

To Autobalance the system, the following procedure is used:

- 1) Run the system to operating temperature.
- 2) Lock the motor such that no motion can be commanded by the controller when current is applied.
- 3) Issue a "B" command over the serial interface. Alternatively the procedure can be started by accessing the amplifier module under the top cover and pressing the S1 reset switch for greater than 1 second. Note: The reset switch on the front panel will not initiate Autobalance.
The middle bar on the LED display will illuminate indicating Autobalance is in progress.
- 4) Autobalance is now running and may take up to 1 minute to complete.
- 5) When the Autobalance algorithm completes successfully ("C" or "0" on display), issue a "S" command to save the final settings in the amplifier. If this save is not performed, a power on reset will return the balance to the pre-autobalance settings.
- 6) If Autobalance cannot complete, a "4" error code will be on the display. This indicates the controller is unable to balance the motor. Reset the system and try again to Autobalance. Autobalance errors can be due to motor movement, very low resistance (<1 ohm), severely out of range balance in the amplifier, or other internal problems. Please contact the factory for assistance if repeated attempts to Autobalance fail.

6 Appendix A – Serial Interface Details

This section describes the details of the serial communication messages. The only white space character used in this protocol is the Space (ASCII 0x20). All lines are terminated with a Carriage Return and Line Feed (cr/lf) followed by a ">" prompt (ASCII 0x3E). The prompt is sent following any message by the amplifier. The prompt line has no termination in order to allow a dumb terminal cursor to remain on the prompt line. This provides a clear indication for the user when the amplifier is ready for a new command when using a dump terminal interface.

Some common characters used in this section are:

cr = Carriage Return, ASCII 0x0D

lf = Line Feed, ASCII 0x0A

> = Greater Sign (used as the prompt), ASCII 0x3E

When the amplifier is first powered up, the user must wait until the sign on message and the prompt are sent before normal communication can begin. The sending of the first prompt from the amplifier means it is ready for operation. If a fault alarm is present on power up, the fault message will be shown followed by a prompt.

All command sent to the unit must be in upper-case characters. Messages that the amplifier sends for a particular command or condition are a fixed length. Messages are padded with the space (ASCII 0x20) to achieve the desired length. As an example, all alarm messages are 14 characters in length.

All messages from the amplifier are shown in quotes to allow the programmer to determine the character count for each message. The quotes are not part of the message. Any blank lines sent by the amplifier are shown by the cr/lf sequence in the text shown below.

6.1 Sign on Message

Upon power up or following a reset, the amplifier sends the following message.

```
"Varedan Technologies, (c) 2007 Ver 4002-11-2.3.0-2"  
>
```

In addition, if any faults are present, the fault status is show following the above message.

```
"Alarm = BUS UV"  
>
```


6.2 Alarm Messages

Sent in response to "A" command or upon detection of alarm condition. 16 possible responses, 14 characters in length.

```
"Alarm = DSP  "
"Alarm = NVM  "
"Alarm = HALLS "
"Alarm = AMP OT"
"Alarm = MOT OT"
"Alarm = ABS OC"
"Alarm = RMS OC"
"Alarm = BUS OV"
"Alarm = BUS UV"
"Alarm = 5V REF"
"Alarm = 15VREF"
"Alarm = 2.5REF"
"Alarm = 5V EXT"
"Alarm = AUTOBL"
"Alarm = SOA  "
"Alarm = FATAL "
">"
```

6.3 Autobalance Messages

In response to the "B" command:

If Autobalance can't run:

```
"Drive Must Be Enabled to use this command"
```

```
">"
```

While Autobalance is active:

```
"_"
```

(Prompt is sent upon completion of Autobalance)

```
">"
```

6.4 Enable Status Messages

In response to the "E" command:

If disabled with alarm:

```
"DISABLED"
```

```
cr/lf
```

```
"Alarm = BUS UV"
```

```
">"
```

If disabled without alarm:

```
"DISABLED"
```

```
">"
```

If enabled:

```
"ENABLED"
```

```
">"
```

6.5 Factory Default Message

In response to the "F" command:

```
"Loading Default Parameters"  
">"
```

6.6 Help Messages

In response to the "H" command:

```
"Command List"  
"A<n> = Show/Reset Alarm Status"  
"E<n>= Set/View Enable Status Enable=1 Disable=0"  
"F = Load Factory Defaults"  
"H = Help"  
"L = List Parameters"  
"M = View Mode"  
"P Addr <data> = Set/View Parameter"  
"R = Reset Drive"  
"S = Save setting to NVM"  
"T = SOA Trip Data"  
"Y = Show Alarm History"  
"YC = Clear Alarm History"  
"YS = Show Saved SOA Fault Data"  
cr/lf  
">"
```

6.7 List Messages

In response to the "L" command:

```

"Bus+= 0 V"
"Bus--=0 V"
"Vpha= 0 V"
"Vphb= 0 V"
"Vphc= 0 V"
"Ipha= 0.0 A"
"Iphb= 0.0 A"
"Iphc= 0.0 A"
"+15 = 15.2 V"
"-15 =-15.2 V"
"+5 = 4.9 V"
"+5Ex= 4.9 V"
"+2.5= 2.50 V"
"-2.5=-2.50 V"
"Temp= 23 C"
cr/lf
"RMS Overcurrent, JP1-A,B (Amps): Off Off"
"RMS Trip Time, JP1-C,D (Sec): On Off "
"Absolute Overcurrent, JP1-E,F (Amps): Off On "
"Motor Direction Setting, JP1-H: Normal"
"Sine or Hall Mode, JP2-A: Sine"
"Input Filter Setting, JP2-B,C (kHz): On On "
"Transconductance Ratio, JP2-D,E: Off Off"
"Input Differential or Single Ended, JP2-F : Diff"
cr/lf
"DISABLED"
cr/lf
"Alarm = BUS UV"
">"

```

Note that this is an example message. The actual message data depends on the values and status of the amplifier. If the amplifier is enabled, "ENABLED" is shown instead of "DISABLED". The alarm message follows the alarm message formats as described earlier.

6.8 Mode Command Messages

In response to the "M" command, the amplifier responds with the following, depending on the jumper settings or the user setting for mode:

```

"Sine Current Mode"
">"

"Trap Current Mode"
">"

```

6.9 Save Parameters Message

In response to the "S" command:

```

"Saving Parameter"
">"

```

6.10 Fault History Messages

In response to the "Y" command:

```
cr/lf
"Alarm History (Last to First)"
cr/lf
"Alarm = BUS UV"
cr/lf
"Alarm = 15VREF"
cr/lf
"Alarm = 15VREF"
cr/lf
"Alarm = BUS UV"
cr/lf
"Alarm = 15VREF"
cr/lf
"Alarm = ABS OC"
cr/lf
"Alarm = BUS UV"
cr/lf
"Alarm = BUS UV"
cr/lf
">"
```

Note that this is just an example fault history. Actual results may vary, but all messages follow the format for the Alarm messages described earlier. If no history is stored, the amplifier responds with just a prompt.

6.11 Clear Fault History Message

In response to the "YC" command:

```
cr/lf
Alarm History Cleared
cr/lf
">"
```

6.12 SOA Fault History Messages

In response to the "YS" command:

```
cr/lf
"Saved SOA History"
cr/lf
"Cnts= 0"
"MaxP= 0 W"
"ActP= 0 W"
"Bus+= 0.0 V"
"Bus--=0.0 V"
"Vpha= 0.0 V"
"Vphb= 0.0 V"
"Vphc= 0.0 V"
"Ipha= 0.0 A"
"Iphb= 0.0 A"
"Iphc= 0.0 A"
"Temp= 0 C"
cr/lf
">"
```

Note that this is an example message. Actual results will be displayed in the event of an actual SOA trip.

7 Appendix B – Firmware Updates

It may become necessary to update the firmware in the controller if a new release of code becomes available, or if additional features are added. Updates are easily done in the field using a personal computer with a USB or RS-232 serial interface port and a small application program that sends the updated code to the controller from the host PC. The controller contains a built-in boot loader that updates the firmware via the RS-232 or USB interface. This boot loader becomes active when the DSP detects J9 pin 8 (DSP Program) is grounded on power up or reset. In this mode the normal serial interface is disabled and a special programming interface is activated. Please contact the factory for more detailed programming instructions.

8 Sales and Service

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