

Description

The B12A6 PWM servo drive is designed to drive brushless DC motors at a high switching frequency. A single red/green LED indicates operating status. The drive is fully protected against over-voltage, under voltage, over-current, over-heating and short-circuits across motor, ground and power leads. Furthermore, the drive can interface with digital controllers or be used stand-alone, and requires only a single unregulated DC power supply. Loop gain, current limit, input gain and offset can be adjusted using 14-turn potentiometers. The offset adjusting potentiometer can also be used as an on-board input signal for testing purposes.

Power Range

| | |
|--------------------|-------------|
| Peak Current | 12 A |
| Continuous Current | 6 A |
| Supply Voltage | 20 - 60 VDC |



Features

- ▲ Four Quadrant Regenerative Operation
- ▲ DIP Switch Selectable Modes
- ▲ Adjustable Current Limits
- ▲ High Switching Frequency
- ▲ Differential Input Command
- ▲ Digital Fault Output Monitor
- ▲ On-Board Test Potentiometer
- ▲ Offset Adjustment Potentiometer
- ▲ Adjustable Input Gain
- ▲ Selectable 120/60 Hall Commutation Phasing
- ▲ Drive Status LED
- ▲ Current Monitor Output

MODES OF OPERATION

- Current
- Open Loop
- Tachometer Velocity

COMMAND SOURCE

- ±10 V Analog

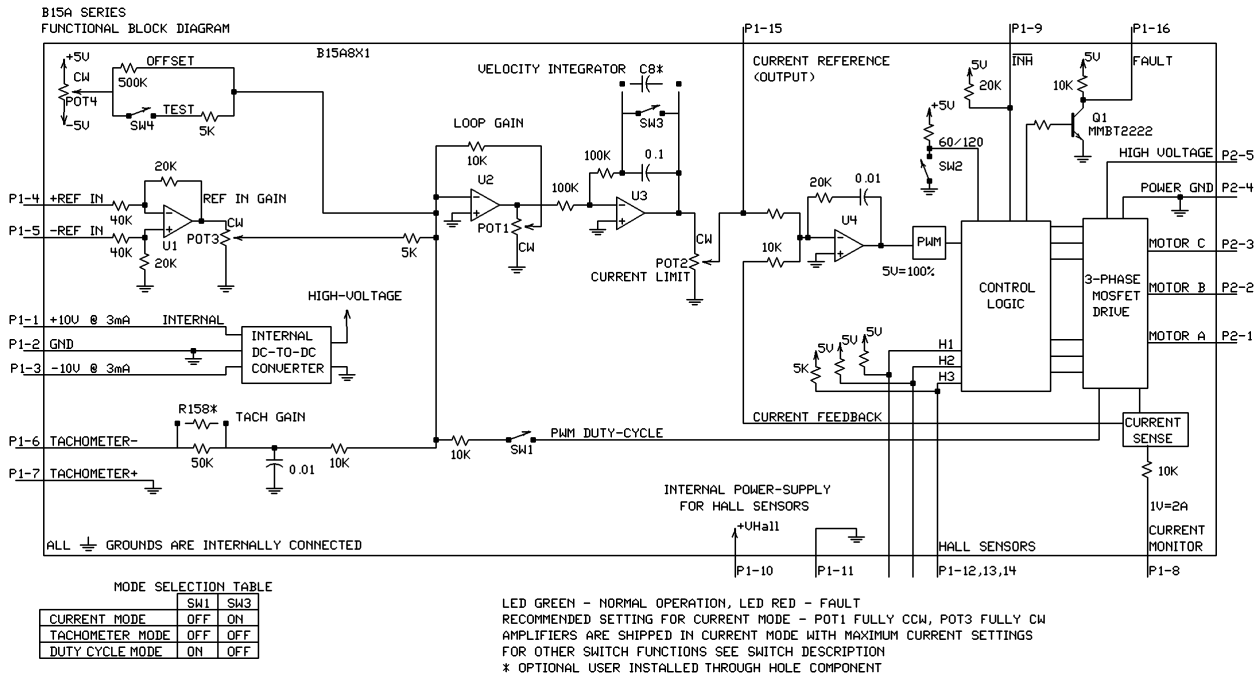
FEEDBACK SUPPORTED

- Halls
- Tachometer

COMPLIANCES & AGENCY APPROVALS

- UL
- cUL
- CE Class A (LVD)
- CE Class A (EMC)
- RoHS

BLOCK DIAGRAM



Information on Approvals and Compliances



US and Canadian safety compliance with UL 508c, the industrial standard for power conversion electronics. UL registered under file number E140173. Note that machine components compliant with UL are considered UL registered as opposed to UL listed as would be the case for commercial products.



Compliant with European CE for both the Class A EMC Directive 2004/108/EC on Electromagnetic Compatibility (specifically EN 61000-6-4:2001, EN 61000-6-2:2001, EN 61000-3-2:2000, and EN 61000-3-3:1995/A1:2001) and LVD requirements of directive 2006/95/EC (specifically EN 60204-1), a low voltage directive to protect users from electrical shock.



RoHS (Reduction of Hazardous Substances) is intended to prevent hazardous substances such as lead from being manufactured in electrical and electronic equipment.

SPECIFICATIONS

| Power Specifications | | |
|---|---------|--|
| Description | Units | Value |
| DC Supply Voltage Range | VDC | 20 - 60 |
| DC Bus Over Voltage Limit | VDC | 67 |
| Maximum Peak Output Current ¹ | A | 12 |
| Maximum Continuous Output Current | A | 6 |
| Maximum Continuous Output Power at Continuous Current | W | 342 |
| Maximum Power Dissipation at Continuous Current | W | 18 |
| Minimum Load Inductance (Line-To-Line) ² | µH | 200 |
| Switching Frequency | kHz | 33 |
| Control Specifications | | |
| Description | Units | Value |
| Command Sources | - | ±10 V Analog |
| Feedback Supported | - | Halls, Tachometer |
| Commutation Methods | - | Trapezoidal |
| Modes of Operation | - | Current, Open Loop, Tachometer Velocity |
| Motors Supported | - | Three Phase (Brushless), Single Phase (Brushed, Voice Coil, Inductive Load) |
| Hardware Protection | - | Invalid Commutation Feedback, Over Current, Over Temperature, Over Voltage, Short Circuit (Phase-Phase & Phase-Ground) |
| Mechanical Specifications | | |
| Description | Units | Value |
| Agency Approvals | - | CE Class A (EMC), CE Class A (LVD), cUL, RoHS, UL |
| Size (H x W x D) | mm (in) | 129.3 x 75.8 x 25.1 (5.1 x 3 x 1) |
| Weight | g (oz) | 280 (9.9) |
| Heatsink (Base) Temperature Range ³ | °C (°F) | 0 - 65 (32 - 149) |
| Storage Temperature Range | °C (°F) | -40 - 85 (-40 - 185) |
| Form Factor | - | Stand Alone |
| P1 Connector | - | 16-pin, 2.54 mm spaced, friction lock header |
| P2 Connector | - | 5-port, 5.08 mm spaced, screw terminal |

Notes

1. Maximum duration of peak current is ~2 seconds.
2. Lower inductance is acceptable for bus voltages well below maximum. Use external inductance to meet requirements.
3. Additional cooling and/or heatsink may be required to achieve rated performance.

PIN FUNCTIONS

| P1 - Signal Connector | | | |
|-----------------------|------------------|--|-----|
| Pin | Name | Description / Notes | I/O |
| 1 | +10V 3mA OUT | ±10 V @ 3 mA low power supply for customer use. Short circuit protected. Reference ground common with signal ground. | O |
| 2 | SIGNAL GND | | GND |
| 3 | -10V 3mA OUT | | O |
| 4 | +REF IN | Differential Reference Input (±10 V Operating Range, ±15 V Maximum Input) | I |
| 5 | -REF IN | | I |
| 6 | -TACH IN | Negative Tachometer Input (Maximum ±60 V). Use signal ground for positive input. | I |
| 7 | +TACH / GND | Positive Tachometer Input and Signal Ground | GND |
| 8 | CURRENT MONITOR | Current Monitor. Analog output signal proportional to the actual current output. Scaling is 2 A/V. Measure relative to signal ground. | O |
| 9 | INHIBIT IN | TTL level (+5 V) inhibit/enable input. Leave open to enable drive. Pull to ground to inhibit drive. Inhibit turns off all power devices. | I |
| 10 | +V HALL 30mA OUT | Low Power Supply For Hall Sensors (+6 V @ 30 mA). Referenced to signal ground. Short circuit protected. | O |
| 11 | GND | Signal Ground | GND |
| 12 | HALL 1 | Single-ended Hall/Commutation Sensor Inputs (+5 V logic level) | I |
| 13 | HALL 2 | | I |
| 14 | HALL 3 | | I |
| 15 | CURR REF OUT | Measures the command signal to the internal current-loop. This pin has a maximum output of ±7.2 V when the drive outputs maximum peak current. Measure relative to signal ground. | O |
| 16 | FAULT OUT | TTL level (+5 V) output becomes high when power devices are disabled due to at least one of the following conditions: inhibit, invalid Hall state, output short circuit, over voltage, over temperature, power-up reset. | O |

| P2 - Power Connector | | | |
|----------------------|--------------|--|-----|
| Pin | Name | Description / Notes | I/O |
| 1 | MOTOR A | Motor Phase A | O |
| 2 | MOTOR B | Motor Phase B | O |
| 3 | MOTOR C | Motor Phase C | O |
| 4 | POWER GND | Power Ground (Common With Signal Ground) | GND |
| 5 | HIGH VOLTAGE | DC Power Input | I |

HARDWARE SETTINGS

Switch Functions

| Switch | Description | Setting | |
|--------|---|----------------|-------------|
| | | On | Off |
| 1 | Open-loop mode selector. Activates internal PWM feedback. | Open-loop mode | Other modes |
| 2 | 60/120 degree commutation phasing setting | 120 degrees | 60 degrees |
| 3 | Outer loop integration. Activates or deactivates integration. ON, by default, for current mode and OFF for other modes. | Inactive | Active |
| 4 | Test/Offset. Switches the function of the Test/Offset pot between an on-board command input for testing or a command offset adjustment. OFF by default. | Test | Offset |

Mode Selection Table

| | SW1 | SW3 | Tachometer |
|---------------------|-----|-----|---------------|
| CURRENT | OFF | ON | Not Connected |
| OPEN LOOP | ON | OFF | Not Connected |
| TACHOMETER VELOCITY | OFF | OFF | Connected |

Potentiometer Functions

| Potentiometer | Description | Turning CW |
|---------------|--|--------------------------------------|
| 1 | Loop gain adjustment for open loop / velocity modes. Turn this pot fully CCW in current mode. | Increases gain |
| 2 | Current limit. It adjusts both continuous and peak current limit while maintaining their ratio. | Increases limit |
| 3 | Reference gain. Adjusts the ratio between input signal and output variables (voltage, current, or velocity). | Increases gain |
| 4 | Offset / Test. Used to adjust any imbalance in the input signal or in the amplifier. Can also be used as an on-board signal source for testing purposes. | Adjusts offset in negative direction |

Note: Potentiometers are approximately linear and have 12 active turns with 1 inactive turn on each end.

Through-hole Components[†]

| Location | Description |
|----------|--|
| C8* | Velocity Loop Integrator. Through-hole capacitor that can be added for more precise velocity loop tuning. See section below on Tuning with Through-hole components for more details. |
| R158* | Tachometer Input Scaling. Through-hole resistor that can be added to change the gain of the tachometer input. See section below on Tachometer Gain for more details. |

Tuning With Through-hole Components

In general, the drive will not need to be further tuned with through-hole components. However, for applications requiring more precise tuning than what is offered by the potentiometers and dipswitches, the drive can be manually modified with through-hole resistors and capacitors as denoted in the above table. By default, the through-hole locations are not populated when the drive is shipped. Before attempting to add through-hole components to the board, consult the section on loop tuning in the installation notes on the manufacturer's website. Some general rules of thumb to follow when adding through-hole components are:

- A larger resistor value will increase the proportional gain, and therefore create a faster response time.
- A larger capacitor value will increase the integration time, and therefore create a slower response time.

Proper tuning using the through-hole components will require careful observation of the loop response on a digital oscilloscope to find the optimal through-hole component values for the specific application.

Tachometer Gain

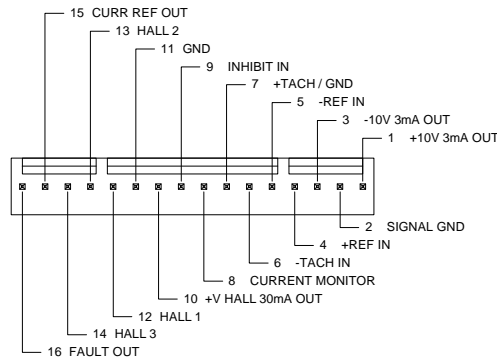
Some applications may require an increase in the gain of the tachometer input signal. This occurrence will be most common in designs where the tachometer input has a low voltage to RPM scaling ratio. The drive offers a through-hole location listed in the above table where a resistor can be added to increase the tachometer gain. Use the drive's block diagram to determine an appropriate resistor value.

[†]Note: Damage done to the drive while performing these modifications will void the warranty.

MECHANICAL INFORMATION

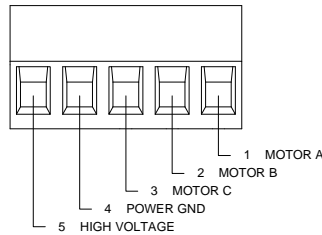
P1 - Signal Connector

| | | |
|-----------------------|---------------------|---|
| Connector Information | | 16-pin, 2.54 mm spaced, friction lock header |
| Mating Connector | Details | Molex: P/N 22-01-3167 (connector) and P/N 08-50-0114 (insert terminals) |
| | Included with Drive | Yes |



P2 - Power Connector

| | | |
|-----------------------|---------------------|--|
| Connector Information | | 5-port, 5.08 mm spaced, screw terminal |
| Mating Connector | Details | Not applicable |
| | Included with Drive | Not applicable |



MOUNTING DIMENSIONS

