

Description

The BE15A8 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. This drive can use quadrature encoder inputs for velocity control.

See Part Numbering Information on last page of datasheet for additional ordering options.

Power Range

Peak Current	15 A
Continuous Current	7.5 A
Supply Voltage	20 - 80 VDC



Features

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

MODES OF OPERATION

- Current
- Duty Cycle (Open Loop)
- Velocity

COMMAND SOURCE

- ±10 V Analog

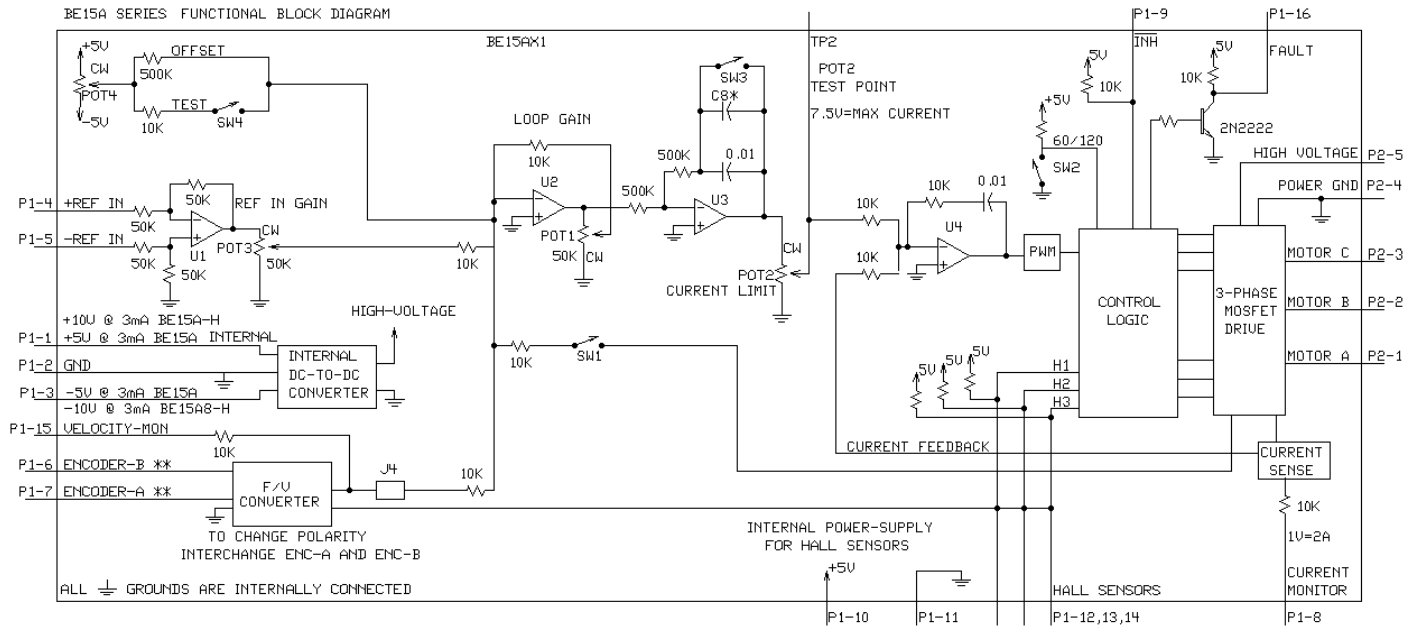
FEEDBACK SUPPORTED

- Halls
- Incremental Encoder

COMPLIANCES & AGENCY APPROVALS

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

BLOCK DIAGRAM



MODE SELECTION TABLE

DUTY CYCLE MODE	SW1	SW3	ENCODER
CURRENT MODE	OFF	ON	NOT CONNECTED
ENCODER MODE	OFF	OFF	CONNECTED
HALL MODE, BE15A8-H	OFF	OFF	NOT CONNECTED
DUTY CYCLE MODE	ON	OFF	NOT CONNECTED

** SEE PIN FUNCTION DESCRIPTION FOR THE BE-H SERIES

LED GREEN - NORMAL OPERATION, LED RED - FAULT
 RECOMMENDED SETTING FOR CURRENT MODE - POT1 FULLY CCW, POT3 FULLY CW
 AMPLIFIERS ARE SHIPPED IN CURRENT MODE WITH MAXIMUM CURRENT SETTINGS
 FOR OTHER SWITCH FUNCTIONS SEE SWITCH DESCRIPTION
 NOTE: TO OPERATE IN DUTY CYCLE MODE WITH THE BE15A8-H, J4 MUST BE REMOVED

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 - 80
DC Bus Over Voltage Limit	VDC	86
Maximum Peak Output Current ¹	A	15
Maximum Continuous Output Current	A	7.5
Maximum Continuous Output Power	W	570
Maximum Power Dissipation at Continuous Current	W	30
Minimum Load Inductance (Line-To-Line) ²	µH	250
Low Voltage Supply Outputs	-	±5 VDC (3 mA), +6 VDC (30 mA)
Switching Frequency	kHz	33
Control Specifications		
Description	Units	Value
Command Sources	-	±10 V Analog
Feedback Supported	-	Halls, Incremental Encoder
Commutation Methods	-	Trapezoidal
Modes of Operation	-	Current, Duty Cycle, Velocity
Motors Supported	-	Three Phase (Brushless)
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	-	Panel Mount
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	+5V 3mA OUT	±5 V @ 3 mA low power supply for customer use. Short circuit protected. Reference ground common with signal ground.	O
2	SIGNAL GND		GND
3	-5V 3mA OUT		O
4	+REF IN	Differential Reference Input (±10 V Operating Range, ±15 V Maximum Input)	I
5	-REF IN		I
6	ENCODER-B IN		I
7	ENCODER-A IN	Single-ended encoder channel A input. +5 V logic level.	I
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	<u>INHIBIT IN</u>	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	VEL MONITOR OUT	Velocity Monitor. Analog output proportional to motor speed. In Encoder Velocity mode, output is proportional to the encoder line frequency. Encoder Velocity scaling is 22 kHz/V.	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	Duty Cycle mode selector. Activates internal PWM feedback.	Duty Cycle 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	Encoder
CURRENT	OFF	ON	Not Connected
DUTY CYCLE	ON	OFF	Not Connected
ENCODER VELOCITY*	OFF	OFF	Connected

*NOTE: Interchange P1-6 and P1-7 to change feedback polarity. This may be required to prevent a run-away condition.

Potentiometer Functions

Potentiometer	Description	Turning CW
1	Loop gain adjustment for duty cycle / 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.

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.

[†]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

