

## SE25A SERIES BRUSHLESS SERVO AMPLIFIERS

Model: SE25A40

### FEATURES:

- \* Surface-mount technology
- \* Small size, low cost, ease of use
- \* Optical isolation, see block diagram
- \* DIP switch selectable modes:  
current, encoder velocity
- \* Four quadrant regenerative operation
- \* Sinusoidal commutation





	<b>MODEL</b>
<b>POWER STAGE SPECIFICATIONS</b>	<b>SE25A40</b>
DC SUPPLY VOLTAGE	120 - 400 V
PEAK CURRENT (2 sec. max., internally limited) *	± 25 A
MAX. CONT. CURRENT (internally limited) *	± 12.5 A
MINIMUM LOAD INDUCTANCE**	600 µH
SWITCHING FREQUENCY	20 KHz
HEATSINK (BASE) TEMPERATURE RANGE	-25° to +65° C, disables if > 65° C
POWER DISSIPATION AT CONT. CURRENT	115 W
OVER-VOLTAGE SHUT-DOWN (self reset)	420 V
BANDWIDTH	2.5 KHz

<b>MECHANICAL SPECIFICATIONS</b>	
POWER CONNECTOR: P3	Screw terminals
SIGNAL CONNECTORS: P1, P2	P1 is a 25 pin D-sub connector and P2 is a 15 pin D-sub connector.
SIZE	9.12 x 6.43 x 1.36 inches 231.7 x 163.4 x 34.6 mm
WEIGHT	3 lb. 1.4 kg

\* This amplifier is available in a 40/20 Amp (Peak/Continuous) output for OEM production quantities. Please contact factory for more details.

\*\* Low inductance motors require external inductors.

## PIN FUNCTIONS

CONNECTOR	PIN	NAME	DESCRIPTION / NOTES	I/O
P1	1	+10 V 5 mA	For customer use	O
	2	SIGNAL GND	Reference ground	GND
	3	-10 V 5 mA	For customer use	O
	4	+REF	Differential reference input, maximum $\pm 15$ V, 50K input resistance	I
	5	-REF		
	6	Velocity Input	Single ended reference input, external velocity signal, maximum $\pm 15$ V, 10K input resistance	I
	7	VELOCITY MONITOR	1 V = 25 KHz Encoder frequency	O
	8	CURRENT MONITOR	This signal is proportional to the RMS current in the motor leads; 1 V = 5 A.	O
	9	Current Reference	This monitors the input signal connected directly to the internal current amplifier; 7.5 V = maximum peak current. SW3=ON, 7.5V=25A; SW3=OFF, 7.5V=12.5A.	O
	10	PHASE	TTL level output: The phase out is low when commutating in trapezoidal mode and will be high when the amplifier is commutating sinusoidally.	O
	11	INHIBIT / ENABLE	SW7 = ON Pull to ground to inhibit SW7 = OFF Pull to ground to enable	I
	12	+INHIBIT / +ENABLE	If SW7 = ON, pull P1 - 12 to ground to inhibit (+) motor rotation and P1 - 13 to inhibit (-) motor rotation. If SW7 = OFF, pull P1 - 12 to ground to enable (+) motor rotation and P1 - 13 to inhibit (-) motor rotation.	I
	13	-INHIBIT / -ENABLE		I
	14	FAULT (LED red)	This TTL level output becomes high during output short circuit, over voltage, under voltage, inhibit, and during power-on reset. A fault condition is also indicated by a red LED.	O
	15	+ 5 V @ 300 mA OUT	For Customer Use	O
	16	SIGNAL GND	Reference ground	GND
	17	Controller Power*	Connected to P2-15 For customer use	I
	18	Controller Line 1*	Connected to P2-10 For customer use	I
	19	Controller Line 2*	Connected to P2-11 For customer use	I
	20	Encoder Channel A	Differential encoder input	O
	21	Encoder Channel A		
	22	Encoder Channel B	Differential encoder input	O
	23	Encoder Channel B		
	24	Index	Differential encoder input	O
	25	Index		

Notes: All circuits on connectors P1 and P2 are optically isolated from all circuits on connector P3.

\* No connection internal to the amplifier. See block diagram.

## PIN FUNCTIONS

CONNECTOR	PIN	NAME	DESCRIPTION / NOTES	I/O
P2	1	Phase A	Phase sensor inputs, logic levels, internal 2K $\Omega$ pull-up. The maximum low level input is 1.5 V and the minimum high level input is 3.5 V.	I
	2	Phase B		
	3	Phase C		
	4	Encoder Channel A	Differential encoder output	I
	5	Encoder Channel A		
	6	Encoder Channel B	Differential encoder output	I
	7	Encoder Channel B		
	8	Index	Differential encoder output	I
	9	Index		
	10	Controller Line 1*	Connected to P1-18 For customer use	O
	11	Controller Line 2*	Connected to P1-19 For customer use	O
	12	GND	Reference ground	GND
	13	+ 5V, 300 mA OUT	For Customer Use	O
	14	TACH	Tachometer input, 10 K $\Omega$ input resistance, $\pm 60$ V MAX	I
	15	Controller Power*	Connected to P1-17 For customer use	O
P3	1	MOTOR A	Motor phase A connection	O
	2	MOTOR B	Motor phase B connection	O
	3	MOTOR C	Motor phase C connection	O
	4	POWER GND	Power ground	GND
	5	HIGH VOLTAGE	DC power input	I

Notes: All circuits on connectors P1 and P2 are optically isolated from all circuits on connector P3.

\* No connection internal to the amplifier. See block diagram.

## SWITCH FUNCTIONS

SWITCH	FUNCTION DESCRIPTION	SETTING	
		ON	OFF
1	Test / Offset controls the sensitivity of the "offset" pot. This is used as an on-board reference signal in test mode.	Test	Offset
2	Current loop gain	Decrease	Increase
3	Current scaling. When OFF, this increases the sensitivity of the current sense thus reducing both peak and continuous current limit by 50%.	100%	50%
4	Loop integrator. This capacitor normally ensures "error-free" operation in velocity mode by reducing the error signal (output of summing amplifier) to zero.	Shorts out the velocity / voltage loop integrator capacitor	Velocity / voltage loop integrator operating
5	Commutation mode	See page D-28	
6	Velocity feedback. This connects the internally generated velocity signal from the encoder.	On	Off
7	INHIBIT / ENABLE	P1-11, 12, 13: INHIBIT	P1-11, 12, 13: ENABLE
8	Continuous current reduction	Continuous / peak current limit ratio is 50%	Continuous / peak current limit ratio is 25%
9	Integrator capacitor. This adjusts the value of the integrator capacitor in velocity mode.	Increase	Decrease
10	Commutation mode	See page D-28	

## POTENTIOMETER FUNCTIONS

POTENTIOMETER	DESCRIPTION	TURNING CW
Pot 1	This potentiometer is the loop gain adjustment in velocity mode and the voltage to current scaling factor adjustment in current mode.	Increases loop gain
Pot 2	Current limit. This potentiometer adjusts both the continuous and peak current limit while maintaining a selected ratio.	Increases current limit
Pot 3	Reference in gain. This potentiometer adjusts the ratio between input signal and output variables (voltage, current, velocity).	Increases reference input gain
Pot 4	Test / Offset. Used to adjust any imbalance in the input signal or in the amplifier. When SW1 (DIP switch) is ON, the sensitivity of this pot is greatly increased allowing it to be used as an on-board signal source for testing purposes.	N/A

## TEST POINTS FOR POTENTIOMETERS

See section "G".

## OPERATING MODE SELECTION

### FEEDBACK MODE

The following operating modes can be selected by setting the DIP switches according to the following chart:

- \* Current mode
- \* Encoder velocity mode

MODE	SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8	SW9	SW10
Current Mode	X	ON	X	ON	X	OFF	X	X	X	X
Encoder Velocity Mode	X	ON	X	OFF	X	ON	X	X	X	X

X does not affect mode.

### COMMUTATION MODE

The following operating mode can be selected.

MODE	SW 1	SW 2	SW3	SW4	SW5	SW6	SW7	SW8	SW9	SW10
120° Phase sensor Start Up-Sinusoidal	X	X	X	X	ON	X	X	X	X	ON
60° Phase sensor Start Up-Sinusoidal	X	X	X	X	ON	X	X	X	X	OFF
Reserved	X	X	X	X	OFF	X	X	X	X	ON
Reserved	X	X	X	X	OFF	X	X	X	X	OFF

X does not affect mode.

### 120°/60° Phase Sensor Start Up

In sinusoidal mode, the motor will be commutated using the phase sensors for a minimum of one torque cycle and a maximum of two torque cycles to synchronize the motor phase with the encoder. Once the phase is synchronized the amplifier will commutate the motor sinusoidally. The In-phase indicator will indicate when the amplifier is commutating sinusoidally. If the encoder signals are lost the amplifier will commutate the motor using the phase sensors and then attempt to re-synchronize the motor phase with the encoder. The In-phase output will deactivate when the amplifier is commutating using phase sensors.

**APPLICATION NOTE:** For proper operation, P1-6 and P2-14 must be connected to the signal ground if they are not being used.

## SET-UP

See section "G" for engineering and installation notes.

## CURRENT LIMIT ADJUSTMENTS

These amplifiers feature separate peak and continuous current limit adjustments. The current limit adjustment Pot 2 adjusts both peak and continuous current limit at the same time. It has 14 turns and is approximately linear. Thus, to adjust the current limit turn the potentiometer counter-clockwise to zero, then turn clockwise to the appropriate value. In many applications it is sufficient to use only the DIP switches for current limit adjustments. SW3 reduces both peak and continuous current limit by 50% when OFF. SW8 reduces only the continuous current limit by 50% when it is OFF:

SW8	CONTINUOUS / PEAK CURRENT LIMIT RATIO
ON	50%
OFF	25%

P1-9 is the input to the internal current amplifier stage. Since the output current is proportional to P1-9, the adjusted current can be observed at this pin without connecting the motor. The maximum peak current value equals 7.5 V at this pin. Note that a command signal must be applied to the reference inputs to obtain a reading on P1-9.

The actual output current can be monitored at pin P1-8.

## ORDERING INFORMATION

Models: SE25A40X

X indicates the current revision letter.

**TYPICAL SYSTEM WIRING:** See section "G".

## CONNECTOR CABLES

CBL-D15-D25 cable assembly sets are available. *ADVANCED MOTION CONTROL'S* cable assemblies are strongly recommended to ensure proper operation. See section "F" for more information.