

## Features

- ❑ Specially designed for control of brushless motors without encoder
- ❑ Hall-Servo and Encoder-Servo control modes
- ❑ Motors supported:
  - Brushless 60/120° commutated (AC)
  - Brush-commutated (DC)
- ❑ Up to 20A peak, 12A continuous output current
- ❑ 12 to 90V DC single power supply
- ❑ 32-bit position, velocity, acceleration, 16-bit PID filter gain values
- ❑ Comprehensive motor output short-circuit protection:
  - Output to output
  - Output to ground
  - Output to power
- ❑ Adjustable motor current limit
- ❑ Over/under voltage shutdown
- ❑ Overheating protection
- ❑ Emergency stop input
- ❑ Communication speed 19.2 - 115.2 KBps
- ❑ Servo rate 2 kHz
- ❑ Command rate up to 1000/sec
- ❑ Small footprint (5" x 3.3" x 0.85")



## Description

**LS-173U** is a single-axis motion controller with integrated servo amplifier designed for applications using **Hall-Servo** or **Encoder-Servo** modes for controlling of brushless (AC) motors up to 1 HP. In Encoder-Servo mode it can be used with brush-commutated (DC) motors. Trapezoidal brushless motor commutation is performed automatically if hall sensors are connected to the unit.

Up to 31 intelligent servo drives can be controlled over a multi-drop full duplex RS-485 network in a distributed motion control environment. Standard RJ-45 connectors and commercially available cables are used for daisy chaining of the modules.

LS-173U is equipped with various safety features such as short circuit protection for the motor and amplifier, emergency stop input, over and under voltage shutdown. The maximum motor output current can be limited by setting of dipswitches.

# Logosol Intelligent Hall-Servo Drive LS-173U

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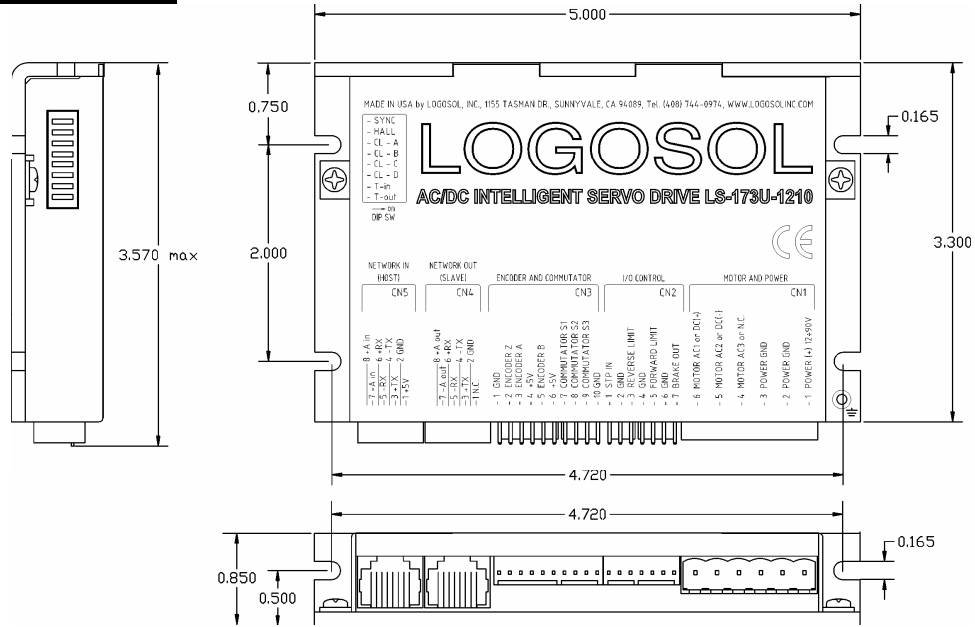
## **TECHNICAL SPECIFICATIONS** rated at 25°C ambient, POWER (+)=60VDC, Load=250μH motor

POWER SUPPLY VOLTAGE	12 to 90 V DC, 100V Absolute Maximum
MAX MOTOR OUTPUT CURRENT LS-173U-1210, LS-173U4-1210 Peak/Continuous	8A/12A
LS-173U-2010, LS-173U4-2010 Peak/Continuous	12A/20A
MAX MOTOR OUTPUT VOLTAGE	$V_{out} = 0.96(\text{POWER (+)}) - 0.17(I_{out})$
MIN LOAD INDUCTANCE	200μH
PWM SWITCHING FREQUENCY LS-173U-1210, LS-173U-2010	19,512 KHz
LS-173U4-1210, LS-173U4-2010	39,024 KHz
SERVO RATE	0.512 msec
SERIAL BAUD RATE	19.2 – 115.2 Kbps (faster communication rates are possible at lower servo rates)
OPEN COLLECTOR BRAKE OUTPUT Max voltage applied to output Max current load	48V 0.3A
INPUTS Encoder & Commutation Digital Inputs	TTL with 2K2 pull-up to 5V LOmin=-0.5V, HImax=48V
ENCODER	Hall sensors or Quadrature with index
COMMUTATION	Hall sensors 60/120°
LEDS ORANGE GREEN or RED with two intensity levels	Power 'ok' (ORANGE and GREEN leds are ON when the Power Servo 'on' is 'OK' and the device is not initialized)  Power 'ok' – low intensity / Servo 'on' – high intensity
PROTECTION Short circuit	Motor output to motor output Motor output to POWER GND Motor output to POWER (+) Activated at 80°C
Overheating shut off	
FIRE-SAFETY Internal fuse LS-173U-1210, LS-173U4-1210 LS-173U-2010, LS-173U4-2010	10A Quick blow 15A
POWER DISSIPATION (max)	30W
THERMAL REQUIREMENTS Storage temperature range Operating temperature range	-30 to +85 °C 0 to 45 °C
MECHANICAL Size Weight	L=5.00", H=3.30", D=0.85" 0.55lb. (250gr.)
MATING CONNECTORS Power & Motor Inputs & Outputs Encoder & Commutator Communication	Magnum EM2565-06-VL or Phoenix MSTB 2.5/6-ST-5.08 Molex 22-01-3077 housing with 08-50-0114 pins (7 pcs.) Molex 22-01-3107 housing with 08-50-0114 pins (10 pcs.) 8 pin RJ-45

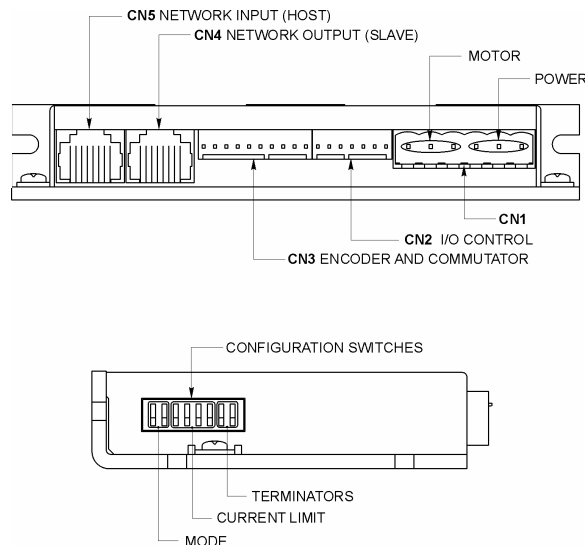
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## DIMENSIONAL DRAWING



## SERVO DRIVE LAYOUT



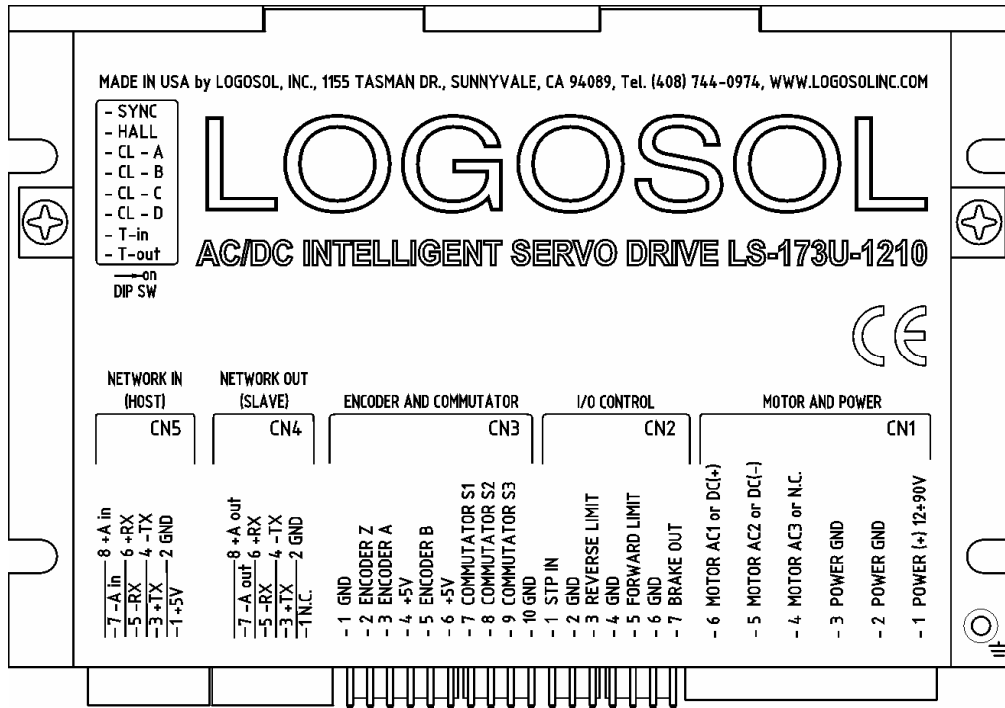
## ORDERING GUIDE

PART NUMBER	MODEL	DESCRIPTION
912173030	LS-173U-1210	Intelligent Hall-Servo drive 8A/12A 100V 20KHZ PWM
912173031	LS-173U-2010	Intelligent Hall-Servo drive 12A/20A 100V 20KHZ PWM
912173032	LS-173U4-1210	Intelligent Hall-Servo drive 8A/12A 100V 40KHZ PWM
912173033	LS-173U4-2010	Intelligent Hall-Servo drive 12A/20A 100V 40KHZ PWM

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## CONNECTORS AND PINOUT



### DIP SW – DIP SWITCH

SW	SIGNAL	DESCRIPTION	FACTORY SETTING
1	T-out	Transmit line terminator	OFF
2	T-in	Receive line terminator	OFF
3	CL-D	Current limit switch	OFF
4	CL-C	Current limit switch	ON
5	CL-B	Current limit switch	ON
6	CL-A	Current limit switch	ON
7	HALL	ON=hall mode OFF=encoder mode	ON
8	SYNC	Only in Hall mode – reverse count direction.	ON

### CN1 – POWER AND MOTOR CONNECTOR

PIN	SIGNAL	DESCRIPTION
1	POWER (+) 12 ÷ 90V	12 to 90V power supply, positive terminal
2	POWER GND*	Power supply ground
3	POWER GND*	Power supply ground
4	MOTOR AC3 or NC	Output to motor Phase 3 terminal for brushless motor Not connected for brush motor
5	MOTOR AC2 or DC (-)	Output to motor Phase 2 terminal for brushless motor Negative terminal for brush motor
6	MOTOR AC1 or DC (+)	Output to motor Phase 1 terminal for brushless motor Positive terminal for brush motor

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## CN2 – I/O CONTROL

PIN	SIGNAL	DESCRIPTION
1	STP IN	Stop input (disable servo amplifier)
2	GND*	Signal ground
3	REVERSE LIMIT	Over travel input
4	GND*	Signal ground
5	FORWARD LIMIT	Over travel input.
6	GND*	Signal ground
7	BRAKE OUT	Brake output. Open collector output 48V/0.3A.

## CN3 – ENCODER AND COMMUTATOR

PIN	SIGNAL	DESCRIPTION
1	GND*	Encoder ground
2	ENCODER Z	Encoder index
3	ENCODER A	Encoder phase A
4	+5V**	Encoder power supply
5	ENCODER B	Encoder phase B
6	+5V**	Commutator power supply
7	COMMUTATOR S1	Hall sensor #1
8	COMMUTATOR S2	Hall sensor #2
9	COMMUTATOR S3	Hall sensor #3
10	GND*	Commutator ground

## CN4 – NETWORK OUT (SLAVE)

PIN	SIGNAL	DESCRIPTION
1	N.C.	Not connected
2	GND*	Interface ground
3	+TX	(+) Transmit data
4	-TX	(-) Transmit data
5	-RX	(-) Receive data
6	+RX	(+) Receive data
7	-A out	(-) Address output
8	+A out	(+) Address output

## CN5 – NETWORK IN (HOST)

PIN	SIGNAL	DESCRIPTION
1	+5V	RS-232 adapter power supply
2	GND	Interface ground
3	+TX	(+) Transmit data
4	-TX	(-) Transmit data
5	-RX	(-) Receive data
6	+RX	(+) Receive data
7	-A in	(-) Address input
8	+A in	(+) Address input

## DESCRIPTION

LS-173U Hall-Servo drive is designed to control brushless motors without incremental encoder. Hall sensors transitions are used for generating of feedback pulses necessary for servo control.

In Hall-Servo mode the equivalent encoder resolution ( $N$ ) is:

$$N = (\text{pole pairs}) \times 6 \text{ cnt/rev.}$$

The operation in this mode is smoother for motors with higher number of pole pairs.

\* POWER GND and GND are electrically connected. Drive Case is isolated from drive circuitry and can be grounded externally.

\*\* 200mA Max current for all three outputs combined.

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## Phasing of Brushless motor

Often, phasing the brushless motor phases is difficult because of the different terms and signal names, which different manufactures are using. Here is a simple procedure that may be used.

Connect the motor commutation sensors to LS-173U "ENCODER AND COMMUTATOR" connector according to the next table with most common manufacture signal names.

LS-173U Encoder & Sensor Connector signal	Motor manufacture signal name			
S1	R	U	A	S1
S2	S	V	B	S2
S3	T	W	C	S3

Connect the commutator power leads to GND and +5V. Connect the encoder and its power lines to the same connector. Connect the three motor leads to "MOTOR AC1 (U) or DC+", "MOTOR AC2 (V) or DC-", "MOTOR AC3 (W) or NC" of LS-173P "MOTOR AND POWER" connector using the same order as for the commutation sensors. Power and initialize the controller. Set the Drive in PWM mode. Start the motor with PWM for example 5 (this value might be enough or not depending on motor used) Set PWM to -5. If the phasing is correct the motor shaft should rotate CW (CCW) smoothly without any jerks. Otherwise try different motor leads connection. There are only six combinations and it is recommended to try all of them. Usually only one works fine. If you find more than one, try to run the motor at higher speed.

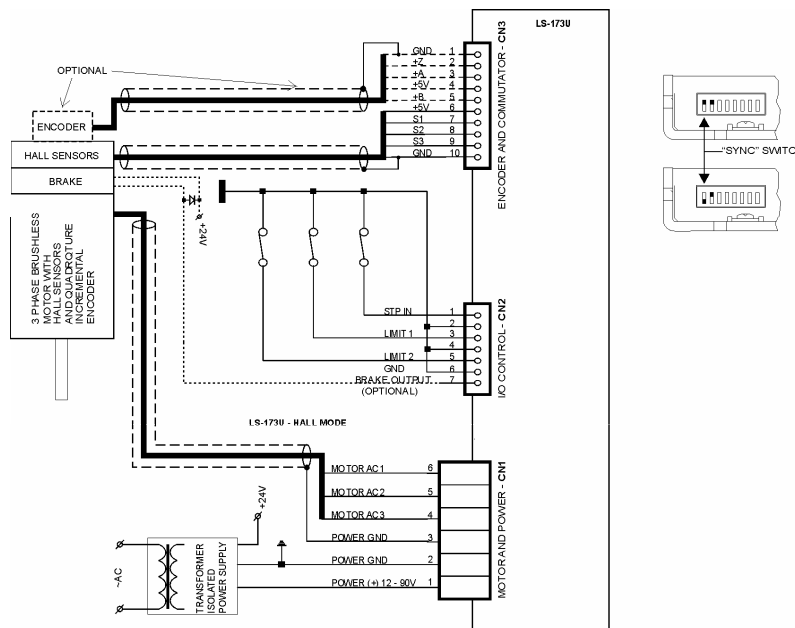
After the motor is phased the direction of the rotation can be reversed exchanging S1 with S3 and AC1 with AC2.

## Hall-Servo mode feedback synchronization:

Set the Drive in Velocity mode and start the motor in CW direction.

If the motor runs away **SYNC** switch should be **flipped**.

## Hall-Servo wiring example:

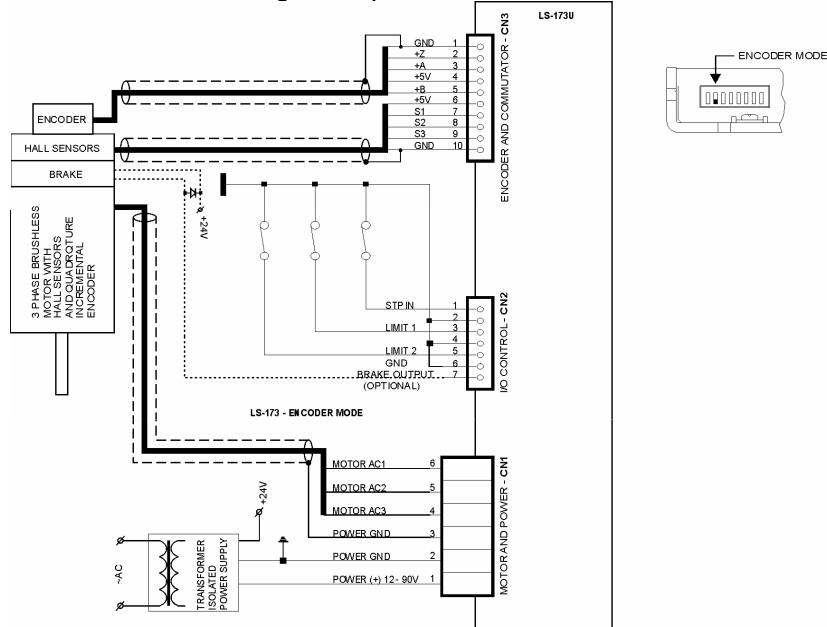


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**Encoder-Servo** mode feedback synchronization:  
Set the Drive in velocity mode and start the motor in CW direction.  
If the motor runs away, **exchange A and B** phase wires.

## Encoder-Servo wiring example:



### NOTE:

**LS-173U is a modification of LS-173E**

For all additional data see: <http://logosolinc.com/download/ls-173e.pdf>