

# High Performance Spindle Drive LS-2315

Doc # 712231501 / Rev.4, 14-Aug-2006

## Features

- ❑ HF spindle motors supported:  
0.1KW to 1KW
- ❑ Inverter frequency range:  
83.3Hz to 1666.6Hz
- ❑ Dry contact “Spindle Stopped” output
- ❑ CNC-SK-2310 compatible Safety Bus  
and Spindle control interface
- ❑ Automated and Manual control modes
- ❑ Two selectable Speed command inputs  
(0..10V)
- ❑ Two adjustable reference voltage  
outputs (0..10V)
- ❑ Spindle Load monitor output (0..10V)
- ❑ Spindle Speed monitor output (0..10V)
- ❑ Thermal protection sensor input (PTC)
- ❑ Three status/diagnostic LEDs
- ❑ 30 to 180VDC DC-Bus voltage range



## Description

LS-2315 is a high performance Spindle motor drive designed for control of HF Spindle motors up to 1KW and 100 000 rpm. Drive's controls allow applications under CNC-SK-2310 control or standalone mode. Dual analog input interface can be used for flexible implementation of fixed and variable speed control.

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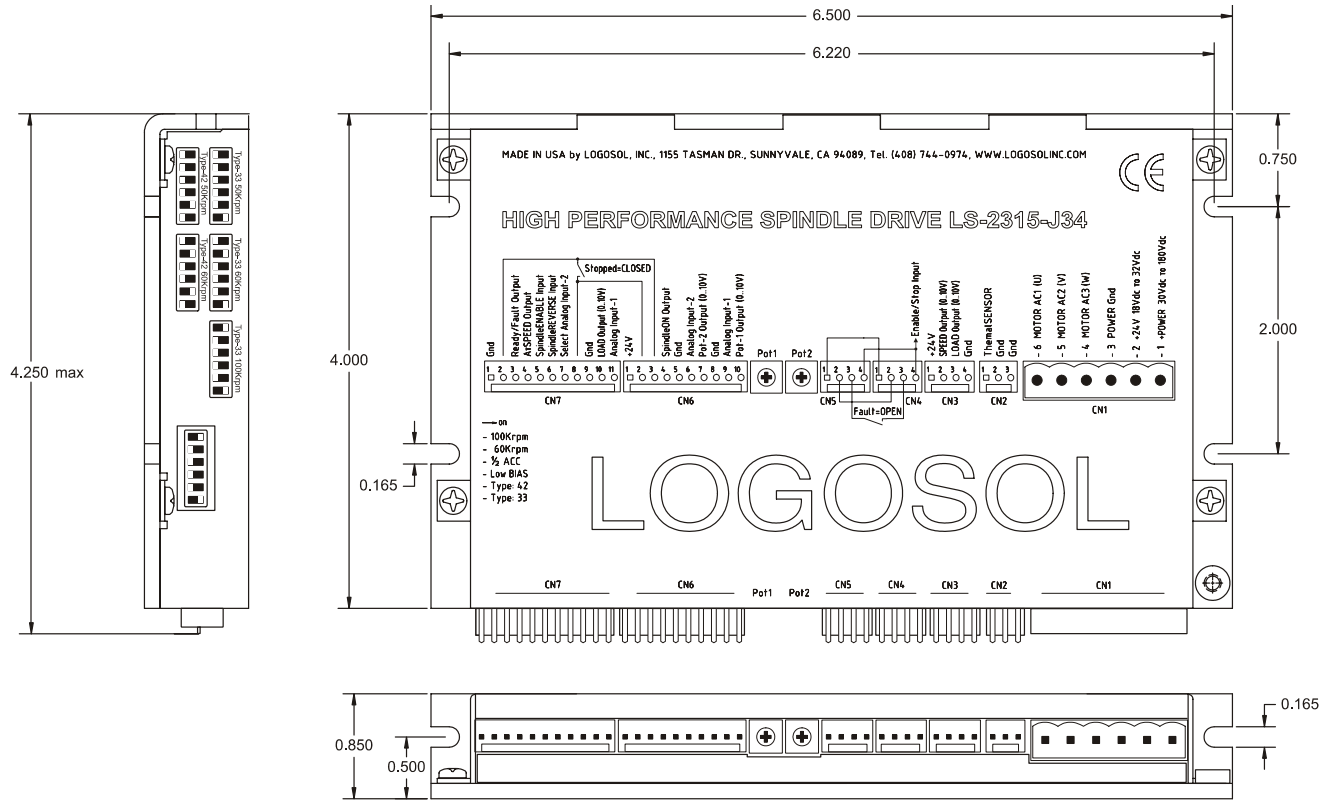
## TECHNICAL SPECIFICATIONS rated at 25°C ambient, POWER (+)=80VDC, Load=120μH motor

+POWER LS-231-J34	30Vdc to 180Vdc Motor power supply, 200V Absolute Maximum
+24V	18Vdc to 32Vdc I/O power supply, 35V Absolute Maximum
+24V Current	0.25A Max.
MOTOR CURRENT LIMIT LS-231-J34	12A
MIN LOAD INDUCTANCE	100μH
PWM SWITCHING FREQUENCY	39.06KHz
MOTOR DRIVE FREQUENCY LS-231-J34	DIP SW selectable Min: 83.3Hz, Max: 1666.6 Hz
DIGITAL OUTPUTS Source driver Ready/Fault (CN7pin3) AtSPEED (CN7pin4) SpindleON (CN6pin4)  +24V (CN6pin1, CN3pin1)	24V (18Vdc to 32Vdc Max). Short protection. Output clamp diode. 0.1A  0.1A for all outputs combined
RELAY OUTPUTS Stopped, FAULT	Dry Relay contacts
ANALOG OUTPUT LOAD Output (CN7pin10 and CN3pin3) SPEED Output (CN3pin2) Pot-2 Output (CN6pin7) Pot-1 Output (CN6pin10)	0 .. 10Vdc / 1mA max
DIGITAL INPUTS SpindleENABLE, SpindleREVERSE, Select Analog Input-2, Enable/Stop	8.5KOhm to Gnd, OPEN=LOW LOmin=-0.5V<LO< 6.5V; 15V<HI<HImax=36V
ANALOG INPUT Analog Input-1, Analog Input-2	0..10V, 66KOhm to Gnd
MOTOR THERMAL PROTECTION INPUT ThermalSENSOR	OK < 1.65KOhm, Overheat > 1.65KOhm
LEDs ORANGE, GREEN, RED	Device status and diagnostics
MOTOR DRIVER PROTECTION Short circuit Over-temperature shut off	Motor output to motor output, Motor output to GND Activated at 80 °C
POWER DESSIPATION (max) LS-2315-J34	45W
THERMAL REQUIREMENTS Storage temperature range Operating temperature range	-30 to +85 °C 0 to 45 °C
MECHANICAL Size Weight	6.5" x 4.0" x 0.85" 0.8 lb. (0.36 kg)
MATING CONNECTORS CN1 - MOTOR AND POWER CN2 CN3, CN4, CN5 CN6 CN7	RECOMMENDED CONNECTOR TYPE EM2565-06-H Terminal Block 6 Poles 5.08mm Molex 22-01-3037 housing with 08-50-0114 pins (3 pcs.) Molex 22-01-3047 housing (3 pcs.) with 08-50-0114 pins (12 pcs.) Molex 22-01-3107 housing with 08-50-0114 pins (10 pcs.) Molex 22-01-3117 housing with 08-50-0114 pins (11 pcs.)

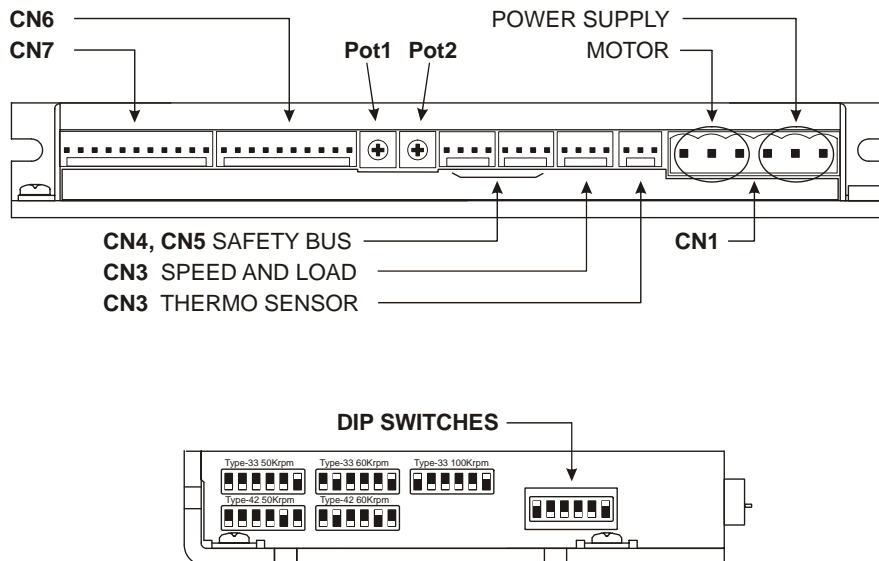
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## DIMENSIONAL DRAWING



## SERVO DRIVE LAYOUT



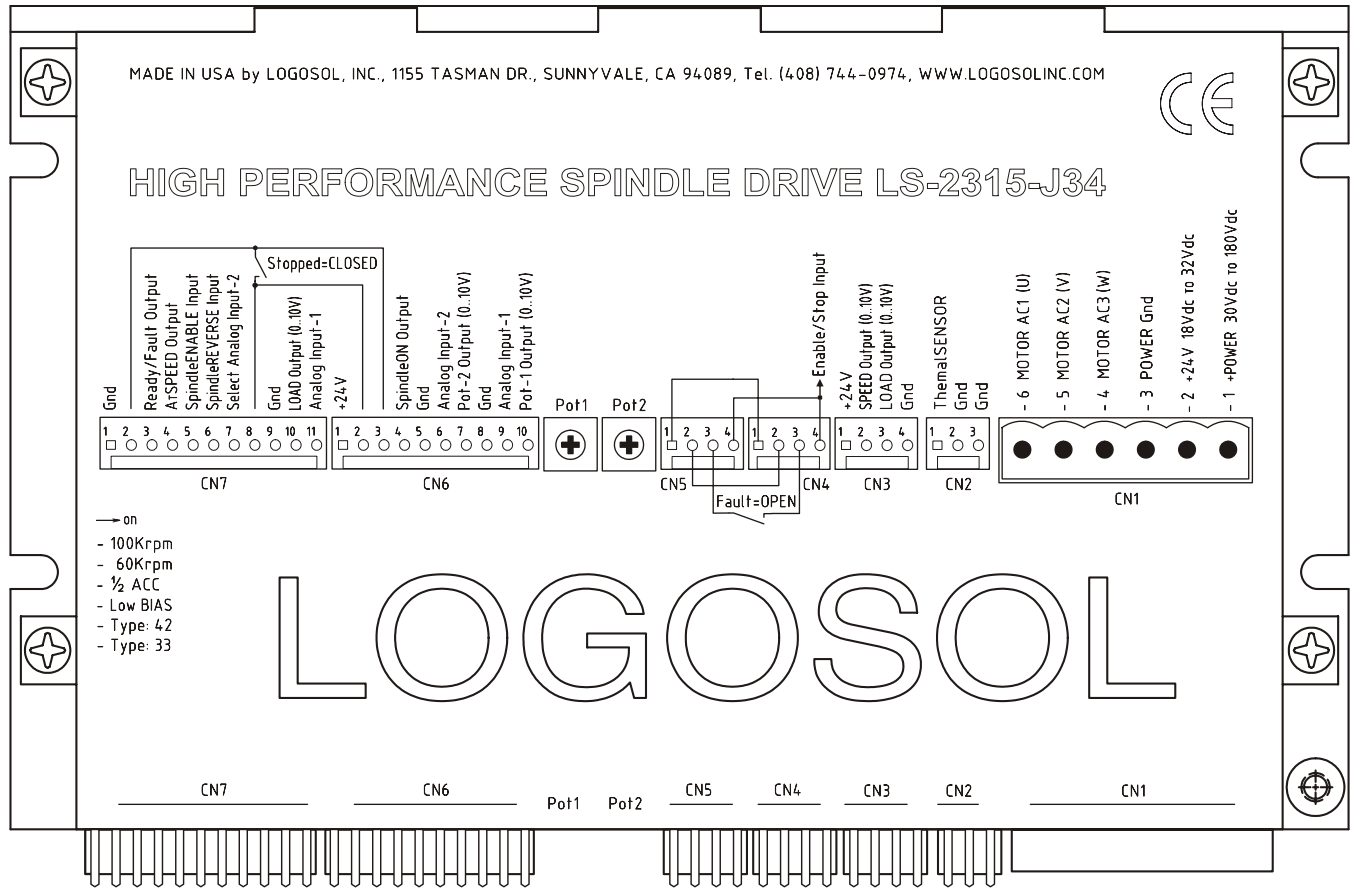
## ORDERING GUIDE

PART NUMBER	MODEL	DESCRIPTION
912231501	LS-2315-J34	High Performance Spindle drive for Type 33/42 spindle motors.
230601061	LS-2315-CN	Matting connector kit for LS-2315

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## CONNECTORS AND PINOUT



## DIP SWITCHES

SW	NAME	DESCRIPTION
1	Type 33	Should be ON if Type 33 motor is used.
2	Type 42	Should be ON if Type 42 motor is used.
3	Low BIAS	ON= Spindle Low Bias mode (Lower free running motor current, temperature and slower dynamic response)
4	1/2 ACC	OFF=Fast, ON=Slow (1/2) Spindle Acceleration / Deceleration (For Spindle motors with heavy rotors and/or heavy tools)
5	60Krpm	SW5=OFF SW6=OFF Speed range 5000rpm to 50000rpm SW5=ON SW6=OFF Speed range 5040rpm to 60000rpm
6	100Krpm	SW5=OFF SW6=ON Speed range 5200rpm to 100000rpm Type 33 only SW5=ON SW6=ON Reserved (DIP switch wrong setting)

## CONNECTORS

### CN1 – POWER AND MOTOR

PIN	SIGNAL	DESCRIPTION
1	+POWER 18Vdc TO 180Vdc	Motor Driver Power supply positive terminal
2	+24V 18Vdc TO 32Vdc	I/O and logic power supply
3	POWER Gnd	Power supply ground
4	MOTOR AC3 (W)	Output to Spindle motor phase W
5	MOTOR AC2 (V)	Output to Spindle motor phase V
6	MOTOR AC1 (U)	Output to Spindle motor phase U

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## CN2 – MOTOR THERMO SENSOR INPUT

PIN	SIGNAL	DESCRIPTION
1	ThermalSENSOR	Thermo resistor or contact to Gnd. OK < 1.65KOhm, Overheat > 1.65KOhm
2	Gnd	Signal ground
3	Gnd	Signal ground

## CN3 – SINDLE SPEED AND LOAD

PIN	SIGNAL	DESCRIPTION
1	+24V	Protected power output (+24V)
2	SPEED Output (0..10V)	Analog Spindle Speed output. (0..10Vdc / 1mA) 10V = 100%. speed.
3	LOAD Output (0..10V)	Analog Spindle LOAD output. (0..10Vdc / 1mA) 10V = Max. load. Wired to CN7pin10.
4	Gnd	Signal ground

## SAFETY BUS

### CN4

PIN	SIGNAL	DESCRIPTION
1		Wired to CN5pin1
2		Wired to CN5pin2
3	FAULT	Normally open Fault relay contact (CN4)
4	Enable/Stop	Drive Enable/Stop input. OPEN = Stop. Wired to CN5pin4.

### CN5

PIN	SIGNAL	DESCRIPTION
1		Wired to CN4pin1
2		Wired to CN4pin2
3	FAULT	Normally open Fault relay contact (CN5)
4	Enable/Stop	Drive Enable/Stop input. OPEN = Stop. Wired to CN4pin4.

## SPINDLE CONTROL INTERFACE

### CN6

PIN	SIGNAL	DESCRIPTION
1	+24V	Protected power output (+24V)
2	Stopped	Spindle Stopped normally open relay contact (CN6)
3		CLOSED when SpindleENABLE input (CN7pin5) is LOW and Spindle is stopped.
4	SpindleON Output	HIGH (+24V) when spindle drive is activated.
5	Gnd	Signal ground
6	Analog Input-2	Spindle speed analog command input #2. (0V = Min. speed, 10V=Max. speed) Selected (used) when CN7pin7 is HIGH.
7	Pot-2 Output (0..10V)	Pot2 regulated output. (0..10Vdc / 1mA). 10V = fully CW
8	Gnd	Signal ground
9	Analog Input-1	Spindle speed analog command input #1. (0V = Min. speed, 10V=Max. speed) Selected (used) when CN7pin7 is LOW. Wired to CN7pin11.
10	Pot-1 Output (0..10V)	Pot1 regulated output. (0..10Vdc / 1mA). 10V = fully CW

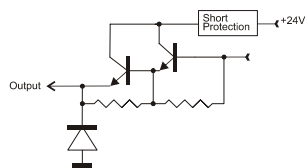
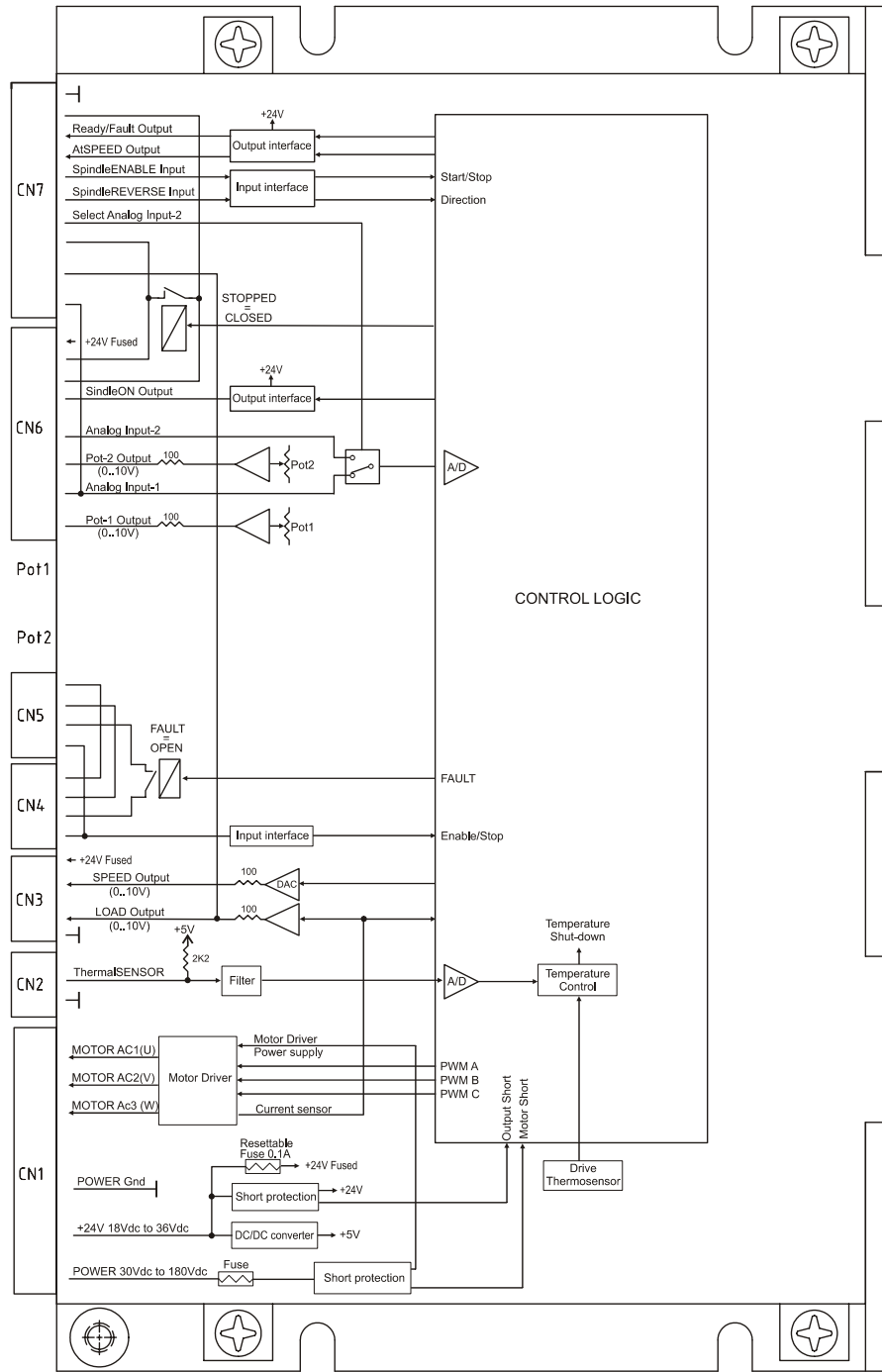
### CN7

PIN	SIGNAL	DESCRIPTION
1	Gnd	Signal ground
2	Stopped	Wired to CN6pin3. See CN6 pin2 and pin3 description.
3	Ready/Fault Output	Digital output. HIGH (+24V) when Spindle drive is ready. OPEN when FAULT condition is present.
4	AtSPEED Output	Digital output. HIGH (+24V) when spindle drive is activated and the command velocity is reached.
5	SpindleENABLE Input	Digital input. HIGH = Enable (activate) spindle rotation with commanded velocity and direction. LOW(OPEN) = Disable (decelerate) spindle.
6	SpindleREVERSE Input	Digital input. OPEN = LOW HIGH = Reverse the spindle rotation. (Must be set at least 1mS before SpindleENABLE input (CN7pin5).
7	Select Analog Input-2	Digital input. HIGH = Selects Analog Input-2 (CN6pin6) for speed command. LOW(OPEN) = Selects Analog Input-1 (CN6pin9, CN7pin11) for speed command.
8	Stopped	Wired to CN6pin2. See CN6 pin2 and pin3 description.
9	Gnd	Signal ground
10	LOAD Output (0..10V)	Analog Spindle LOAD output. (0..10Vdc / 1mA) 10V = Max. load. Wired to CN3pin3.
11	Analog Input-1	Spindle speed analog command input #1. (0V = Min. speed, 10V=Max speed) Selected (used) when CN7pin7 is LOW. Wired to CN6pin9.

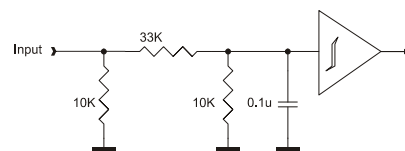
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## LS-2315 BLOCK DIAGRAM



Output interface schematic

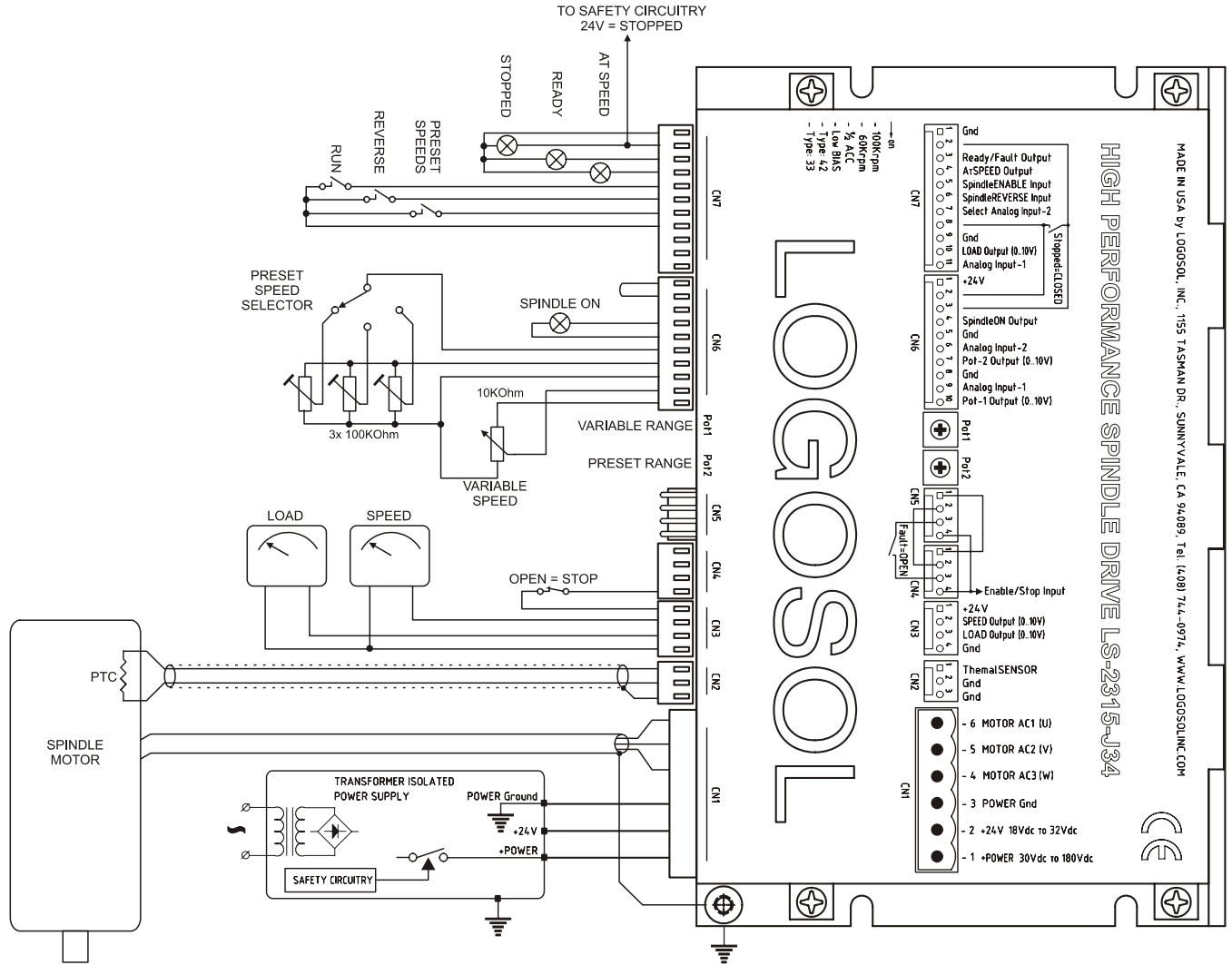


Input interface schematic

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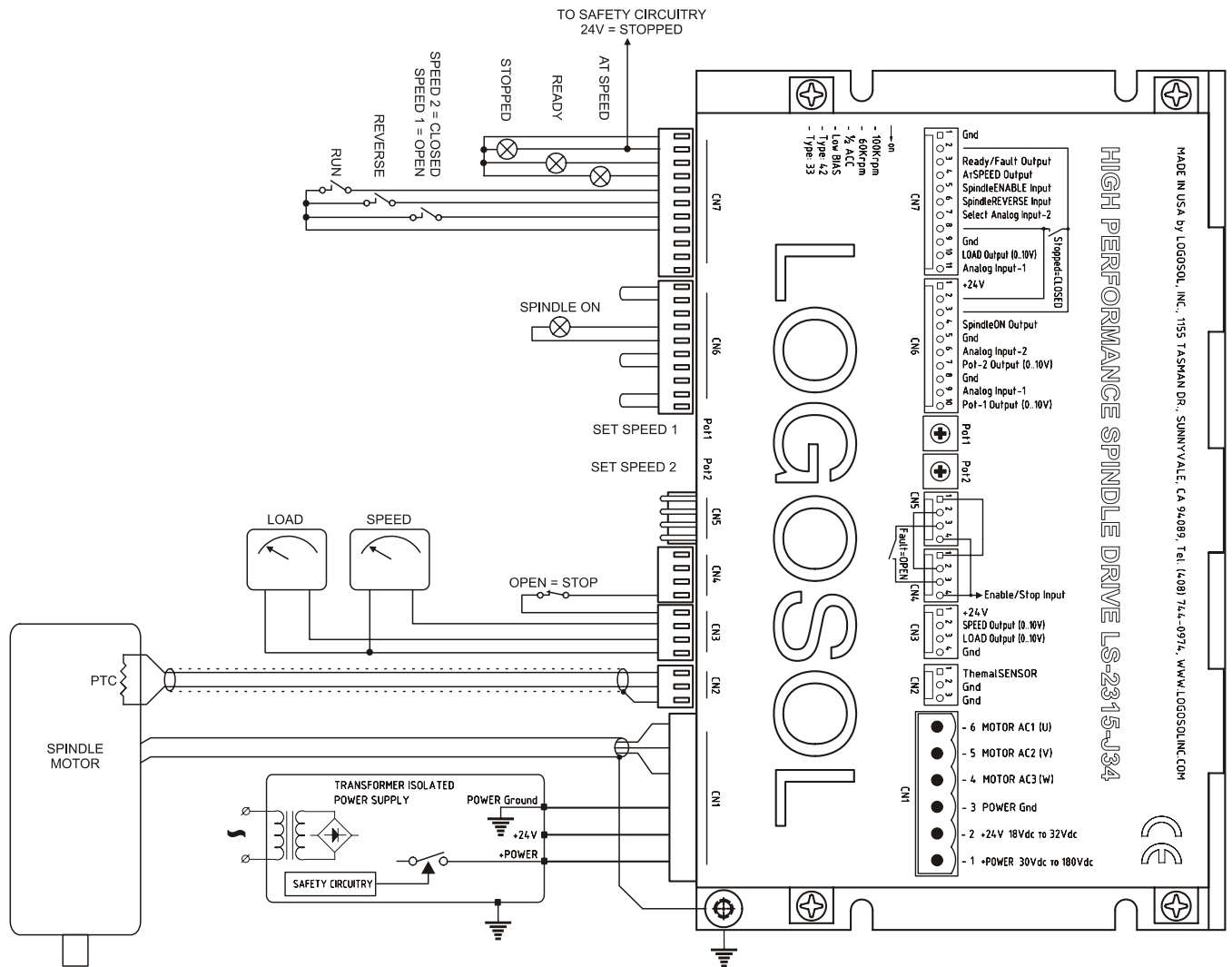
## SAMPLE APLICATIONS



Standalone Application with 3 fixed and 1 variable speeds.

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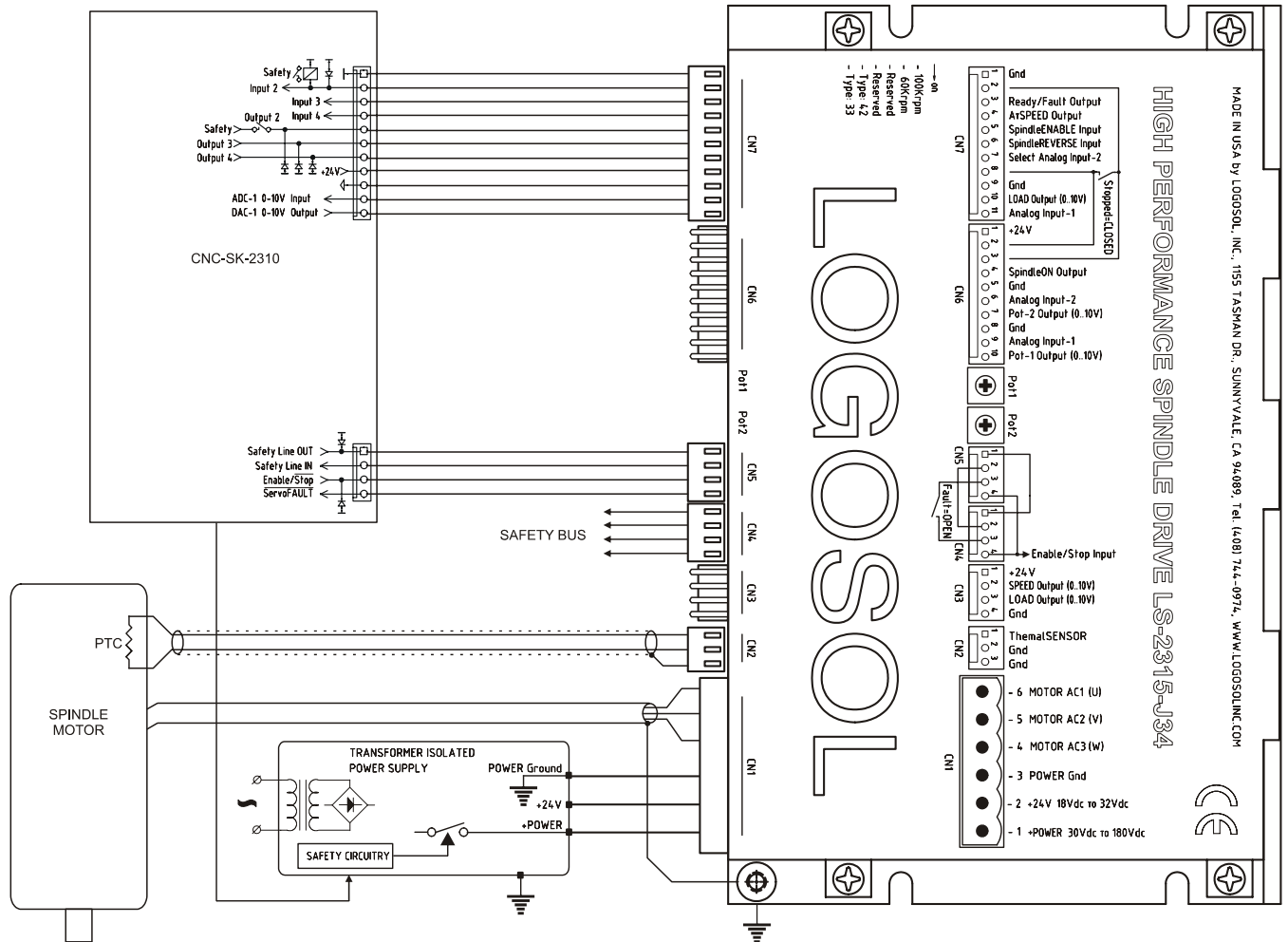


Standalone Application with 2 fixed speeds.



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Interfacing with CNC-SK-2310 Safety module.

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## LED DIAGNOSTIC

RED LED	GREEN LED	ORANGE LED	Spindle ENABLE Input	FAULT Relay	Ready/Fault Output	Stopped Relay	SpindleON Output	AtSPEED Output	CONDITION
Slow Blink	OFF	OFF	X	Open	OFF	Open	ON	OFF	DIP switch wrong setting.
Alternate	OFF	Alternate	X	Open	OFF	Open	OFF	OFF	Digital output short.
ON	ON	ON	LOW	Open	OFF	Closed	OFF	OFF	No Motor Power.
Blink	OFF	ON	LOW	Open	OFF	Closed	OFF	OFF	Spindle motor or Spindle drive is over-heated.
ON	OFF	OFF	LOW	Closed	OFF	Closed	OFF	OFF	Safety bus Enable/Stop input is LOW (OPEN)
OFF	ON	OFF	LOW	Closed	ON	Closed	OFF	OFF	Drive is Ready.
OFF	ON	Blink	HIGH	Closed	ON	Open	ON	OFF	Spindle accelerating / decelerating.
OFF	ON	Blink	HIGH	Closed	ON	Open	ON	ON	Spindle is at command velocity.
Blink	Blink	Blink	HIGH	Closed	OFF	Open	ON	OFF	SpindleENABLE state error.
Blink	Blink	Blink	HIGH	Open	OFF	Open	ON	OFF	Motor Power drop during operation.
ON	ON	ON	HIGH	Open	OFF	Open	ON	OFF	No Motor Power.
Blink	OFF	ON	HIGH	Open	OFF	Open	ON	OFF	Spindle motor or Spindle drive is over-heated.
Alternate	ON	Alternate	HIGH	Open	OFF	Open	ON	OFF	Spindle motor is overloaded or not connected.
ON	OFF	OFF	HIGH	Open	OFF	Open	ON	OFF	Safety bus Enable/Stop input is LOW (OPEN)
Blink	OFF	OFF	HIGH	Open	OFF	Open	ON	OFF	Motor short.

### READY AFTER FAULT

Fault conditions during spindle operation are latched into the spindle drive.

When the fault reason is no more present and SpindleENABLE input CN7pin5 is LOW or OPEN the drive is in **READY AFTER FAULT** state.

The diagnostic LED's will alternate between ready state – green LED ON for 3sec. and the latched fault condition state for 1sec.

### FREE RUNNING SPINDLE SPEED (± 5%)

Analog Input-1 CN7 pin11 [V]	Type-33 50Krpm 	Type-33 60Krpm 	Type-33 100Krpm 	Type-42 50Krpm 	Type-42 60Krpm 
	5Krpm / V	6Krpm / V	10Krpm / V	5Krpm / V	6Krpm / V
0.0	Min rpm 5000	Min rpm	Min rpm	Min rpm 5000	Min rpm
0.5		5040	5200		5040
1.0		6000	10000		6000
1.5	7500	9000	15000	7500	9000
2.0	10000	12000	20000	10000	12000
2.5	12500	15000	25000	12500	15000
3.0	15000	18000	30000	15000	18000
3.5	17500	21000	35000	17500	21000
4.0	20000	24000	40000	20000	24000
4.5	22500	27000	45000	22500	27000
5.0	25000	30000	50000	25000	30000
6.0	30000	36000	60000	30000	36000
7.0	35000	42000	70000	35000	42000
8.0	40000	48000	80000	40000	48000
9.0	45000	54000	90000	45000	54000
10.0	50000	60000	100000	50000	60000