Servo Drive Board – 100V/20A

Features:

- Standard stepper input interface - STEP & DIRECTION
- 5 volts incremental encoder input – differential or TTL level
- Output for driving brushed DC PM servo motor
- Output bridge rated 100V 34A continuous
- Peak and average current limiter
- Full PID filtering
- Optional SPI interface for host control
- Kp Ki Kd can be adjusted via trim pots or via SPI
- Multiplying Step / Encoder transition via SPI or DIP switches
- Size 89 x 89 x 25 mm (3.5 x 2.5 x 1.0 inch)
- Low cost

Description:

The R990H Servo Drive Board is a RT990H based motion controller. It accepts STEP and DIRECTION commands from host. The host is usually a PC running CNC software which outputs the STEP and DIRECTION commands via parallel port. This is an upgraded high speed version of the popular R990 driver.

The R990H board can simplify the replacement of stepper motors with DC servomotors and encoders to produce a high-end closed loop servo system.

The minimum host interface is STEP and DIRECTION and R990H will use the predefined parameters and trim-pots for setting up the PID gains. Optionally, the host can use the STEP and DIR line as CLOCK and DATA line in standard SPI fashion and setup the control parameters.

See the RT990H.pdf datasheets for detailed description of operation.

Electrical specifications:

Model:		R990H	
Supply voltage for motor:	V_M	12-100	V
Supply voltage for control circuit:	V_C	15 – 36	V
Supply Current (no encoder connected, Vc = 24 V):	I_C	20	mA
Maximum peak motor current for t < 1 ms	I_{PEAK}	100	A
Maximum continuous motor current	I_{MAX}	20	A
Default PWM frequency	f_{PWM}	19.5	kHz
Adjustable average current limit [typical]	I_{LIM}	2-20	A
Operating temperature	T	0-70	^{O}C

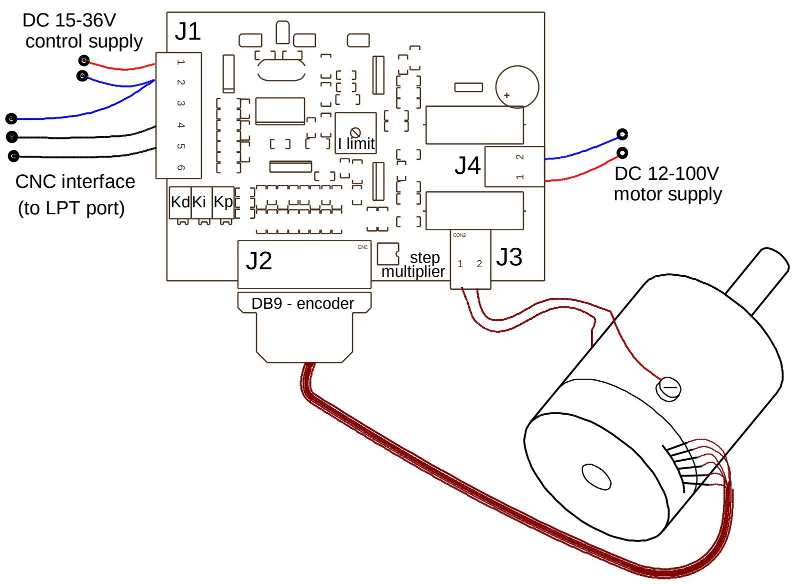
Pin descriptions:

J1 – interface

Pin No	Name	Description
1	+Vc	External power supply 17 – 36 V DC
2	0V	External power supply 0V
3	STEPPER/SPI	Host interface [Pin 1 of DB25 (LPT1) for RT990H.EXE test software]
4	DIR/Din	Host interface [Pin 3 of DB25 (LPT1) for RT990H.EXE test software]
5	STEP/CLK	Host interface [Pin 2 of DB25 (LPT1) for RT990H.EXE test software]
6	ERR/Dout	Host interface [Pin 10 of DB25 (LPT1) for RT990H.EXE test software]

J2 – DB9 – Encoder connection

Pin#	Signal Name	Description
1	+ 5V	Positive supply for encoder
2	Ch – A (non inv.)	Encoder input channel A
3	Ch – A (inv.)	Encored input channel A
4	Ch – B (non inv.)	Encoder input channel B
5	Ch – B (inv.)	Encoder input channel B
6	Shield	Cable screen
9	0V / signal ground	Supply for encoder



Setup procedure:

Download the latest RT990H.exe from http://rutex.com/. Do a preliminary test on the bench to familiarize yourself with the drive. For this test setup, start with lower *Vm* and use a current limiting power supply. Note that the drive must be mounted to a large heatsink.

Pots:

1. Adjust all three pots (*Kp, Ki, Kd*) fully CCW. Note, that these pots are multiturn with 20 turns and no stops. Adjust *I lim* pot fully CCW. This is a single turn pot with a stop.
2. Connect motor, encoder and supplies to the R990H as per above drawing.
3. Gently increase *Kp* and by hand move rotor of motor. Verify that the drive corrects the error. If the motor runs away, the polarity of the motor must be swapped or channels A and B from the encoder must be swapped.
4. Increase the *Kp* until the system starts to oscillate. After that, increase the *Kd* to dampen the oscillations.
5. The *Kp, Kd* and acceleration of the systems should be fine tuned without any *Ki*, with your application software. The *Ki* should be applied when system is nearly finished. *Ki* corrects the steady error. Too much of *Ki* causes oscillations. Always, when increasing *Ki*, the *Kp* and *Kd* should be increased as well.
6. Adjust the *I lim* pot for required torque of the servo drive.

Maximum peak current.

The output MOSFET bridge is rated 34A / 100V continuous (peak current 100A for < 1 ms). R990H has a built in 'cycle by cycle' current limiter. This current limiter is set to about 20 Amps. This current limiting point can be slightly lower in real applications due to the fact that noise might be induced to the sensing circuitry. Make sure that no motor wires are routed above or close to the servo drive.

Maximum average current.

Changing value of I lim potentiometer will adjust the maximum average current. This is a single turn pot and if set fully CCW the current is limited to the minimum – about 1 Ampere. Fully CW allows the average current to reach maximum. Please note, that the current limiting point is dependent on the motor parameters and also varies slightly with the *Vm* voltage.

Maximum idle current.

Low inductance motors (i.e. 'pancake' type) might have a high idle current due to pulse width modulation and consequent ripple current. The high idle current can overheat the motor even in steady state. A small inductor in series with motor should be use to limit this current. A value of about 1 mH is in most cases sufficient. The inductors must be rated for the anticipated motor current.

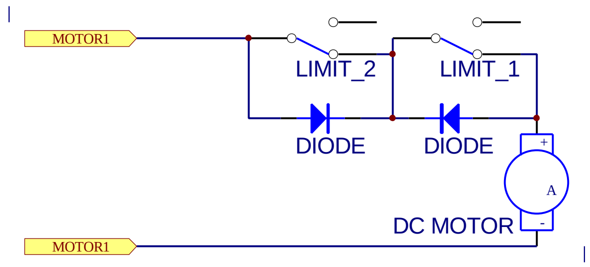
Step multiplier.

Step multiplier can be set by DIP switched. The dual DIP switch is binary coded and allows 4 different pre-sets:

DIP SW 1	DIP SW 2	Step Multiplier
Off	Off	10
On	Off	1
Off	On	4
On	On	20

Limit switches:

The limit switches for axes should be normally closed and the contact should be bridged with diode that allows driving only in the opposite direction of the limit switch. Note that these diodes and limit switches must be rated for anticipated current. If you cannot fit large enough limit switches on the machine, use high capacity interposing relays driven by small limit switches.

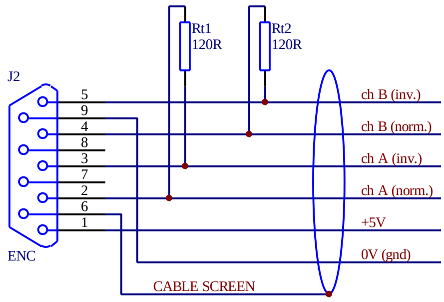


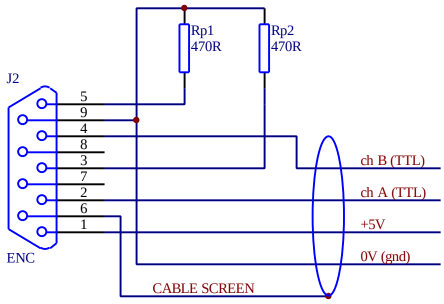
Power supplies.

The R990H employs split power supply practice. The control supply *Vc* should be kept between 15 to 36 VDC at all times. The *Vm* should be fed via the E-STOP circuitry (relay) and must not exceed DC 100V. None of these supplies have to be very well regulated. Usually a bridge and a capacitor are sufficient. The value of at least 1000uF per 1 Ampere should be used for the calculation of the filtering capacitor. The *Vm* capacitor should be located no more than 30 cm (1ft) away from R990H driver. If a single supply is desired, use only the Vm supply and connect a zener diode between *Vm* and *Vc* to drop the voltage (*Vzener* = *Vm – 20*).

Encoders.

The R990H accepts signals from 5V differential or TTL encoders. The equivalent input impedance is 1 kilo-ohm. Additional termination resistors might be required across the input terminals if long cables are used with differential encoders. The value of these termination resistors should be selected to mach the cables. The impedance of twisted pair cable can be anywhere between 40 to 300 ohms – check your cable data (typically 120 ohms). The single ended TTL encoder should be connected to one input only and a pull down resistor (470 - 1000 ohms) should be connected to other input. These pull-down resistors are not required for true CMOS encoders, which can sink and source same current.

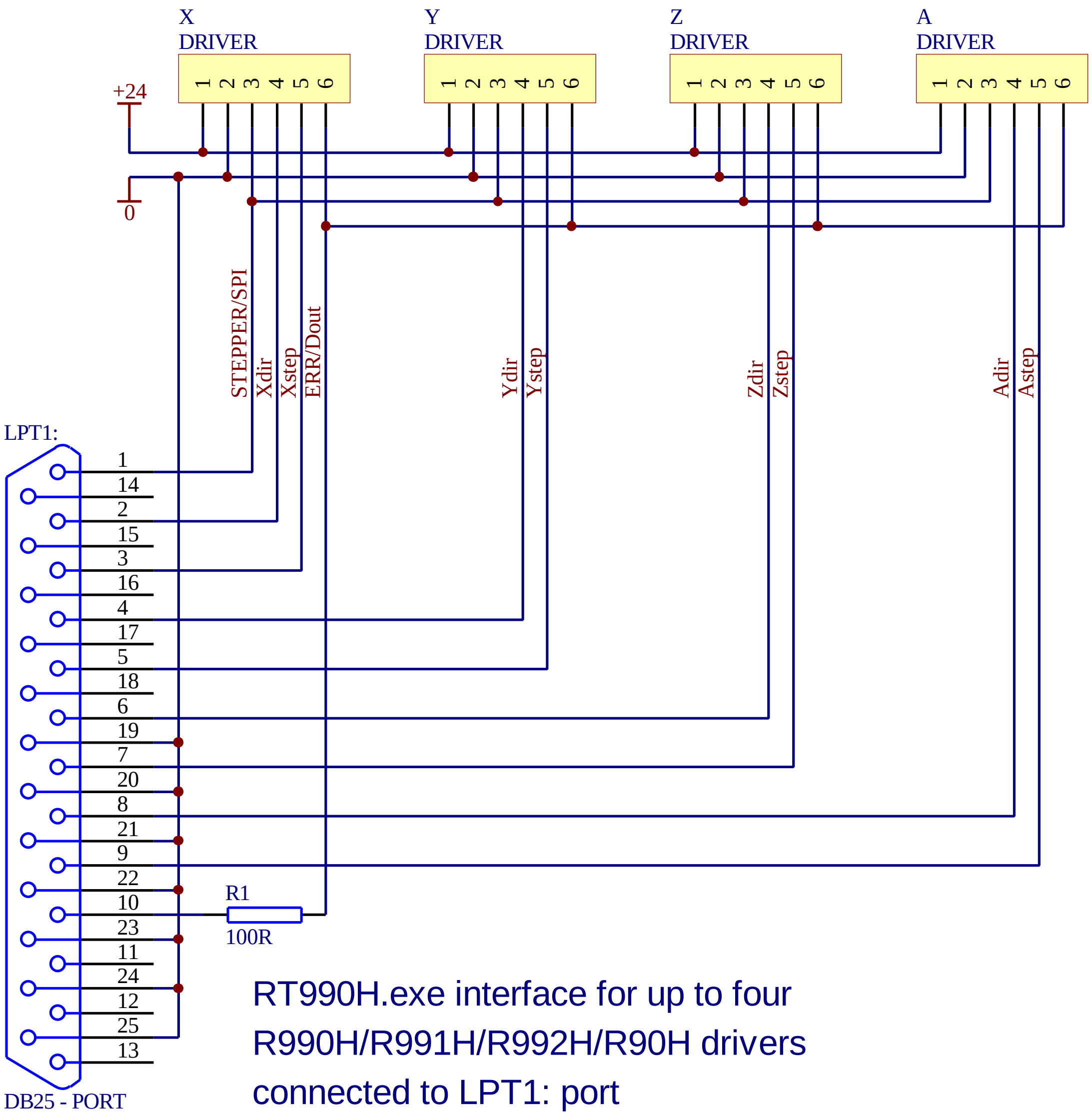




Connecting diffrential encoder
Rt1 and Rt2 are optional (40-300 ohms)
They might be required for long cable.

Connecting single-ended encoder
Rp1 and Rp2 are required for TTL
or Open collector encoders.

Interface for RT990H.exe test software:



RT990H.exe interface for up to four
R990H/R991H/R992H/R90H drivers
connected to LPT1: port