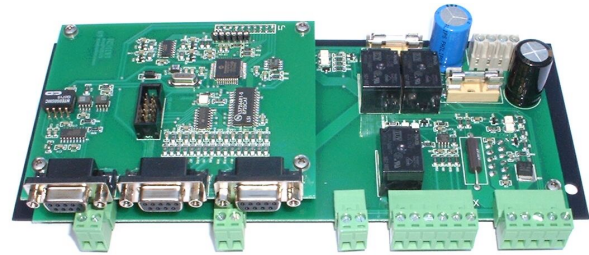


## Plasma controller.

### Features:

- Based on STEPEX technology.
- Two 100V/20A servo drivers for brushed DC PM servomotor with encoders - axes.
- 5 volts incremental encoder inputs – differential or TTL level.
- 36V/6A motor driver for the torch lifter.
- Voltage control plasma THC with interface for initial height sensing.
- Build-in Estop circuitry.
- RS232 interface for host PC.
- Opto-isolated RS232 (R510B only).
- Optional slave axes – X and/or Y.
- Low cost.

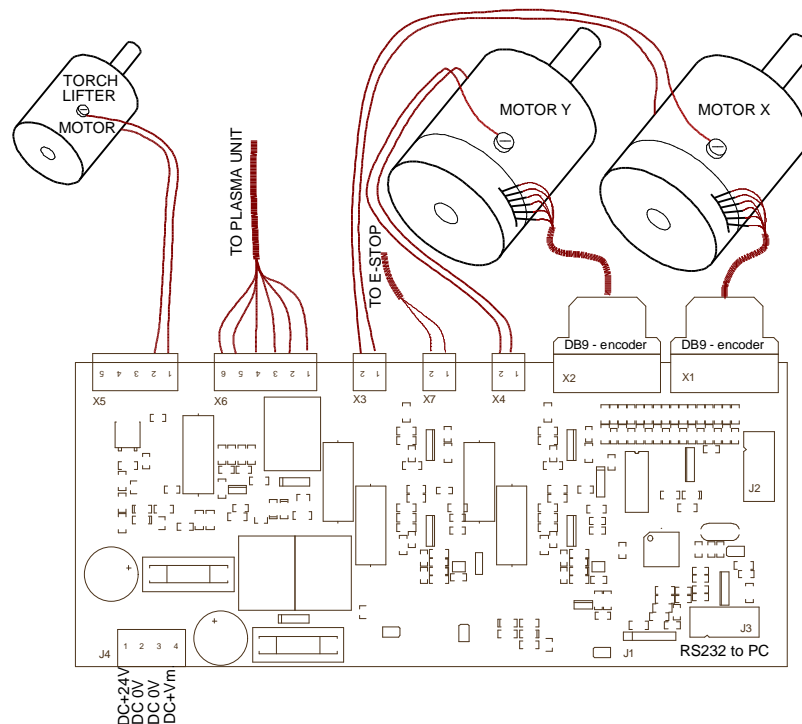


**R510B**

### Description:

The R510A/B is an interface between PC, plasma unit and physical electromechanical hardware on the machine, such as servo motors, encoders etc. It is connected to the PC via standard DB9 serial port (RS232). The PC has to run software such as pCut(Pro) or similar application compatible with STEPEX hardware. See the [www.rutex.com](http://www.rutex.com) for information about the pCut(Pro). The minimum interface for plasma is a relay contact (start the plasma). Optionally the R510A/B can sense the Arc On relay – current relay, as GO command and Arc Voltage for Plasma THC function. There is a driver for torch lifter motor – small DC PM brushed motor as well as interface for initial height sensing. The R510A and R510B are electrically almost identical. The difference is that the R510B has opto-isolated RS232 interface.

### Simplified connection R510A only – see last page for R510B:



## Electrical specifications:

Model:		R510A/B	
Supply voltage for axis motors:	$V_M$	12-100	V
Supply voltage for control circuit:	$V_C$	18 - 36	V
Supply Current (no output connected, $V_c = 24$ V):	$I_C$	<0.2	A
Maximum motor current X, Y	$I_{PEAK}$	20	A
Maximum motor current Z	$I_{MAX}$	6	A
Default PWM frequency X&Y (Z)	$f_{PWM}$	18(25)	kHz
Adjustable average current limit [typical]	$I_{LM}$	1-20	A
Operating temperature	$T$	0-70	°C

## Pin descriptions:

### X1 & X2 – DB9 – Encoder connection (R510A/B)

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 <u>A</u>
4	Ch – B (non inv.)	Encoder input channel B
5	Ch – B (inv.)	Encoder input channel <u>B</u>
6	Shield	Cable screen
9	0V / signal ground	Supply for encoder

### X4 & X3 – X & Y servo motor (R510A/B)

Pin No	Name	Description
1	Motor1	Brush DC PM motor
2	Motor2	Brush DC PM motor

### X5 – torch lifter interface (R510A/B)

Pin No	Name	Description
1	Motor_Z1	torch lifter motor (brushed PM-DC24V)
2	Motor_Z2	torch lifter motor (brushed PM-DC24V)

3	Proxy_24V	+ Supply for Proxy sensor & solenoid
4	Proxy_PNP	Feedback from proxy sensor
5	Proxy_Gnd	Negative return for proxy sensor & solenoid

## X6 – plasma interface (R510A/B)

Pin No	Name	Description
1	Plasma_Start1	Relay contact to start the plasma
2	Plasma_Start2	Relay contact to start the plasma
3	Plasma_FB1	Arc on relay feedback (Current relay)
4	Plasma_FB2	Arc on relay feedback (Current relay)
5	Arc_Volt1	Arc voltage feedback - from 50:1 divider
6	Arc_Volt2	Arc voltage feedback - from 50:1 divider

## X7 – E-STOP (R510A/B)

Pin No	Name	Description
1	Estop1	Normally closed contact of E-STOP mushroom
2	Estop2	Normally closed contact of E-STOP mushroom

## J4 – Supply connector (R510A/B)

Pin No	Name	Description
1	+Vc	18 - 36V supply for internal circuitry and torch lifter motor
2,3	0V	Supply return (0V/gnd)
4	+Vm	12 – 100V supply for servo motors

## J3 – RS232 (R510A only).

IDC10 flat ribbon connector to DB9.

## X10 – RS232 (R510B only).

Opto-isolated DB9 connection.

## J2 – Slave driver(s) (R510A/B).

IDC10 interconnection for slave driver(s). Contact Rutex how to connect the R2010 as slave drive(s).

## J1 – Programming connector.

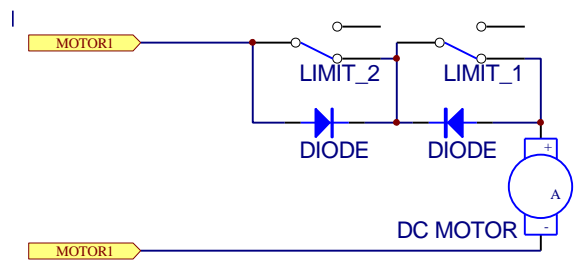
In circuit programming connector for reprogramming firmware in the R510A/B – cable is same as for R900 boards.

**Setup:** All internal parameters of R510A/B can be configured via serial port. This includes Kp, Ki and Kd of PID, average current limiting points of servo drivers, PWM frequency etc. See the documentation for pCut or the StepexLib.

**Maximum peak current for axes servo driver:** The output MOSFET bridge is rated 34A / 100V continues (peak current 100A for < 1 ms). R510A/B has built it 'cycle by cycle' current limiter – similar to popular R990H driver. This current limiter is set to around 20 Amps. This current limiting point can be slightly lower in real application due to the fact that noise might be induced to the sensing circuitry. Make sure, that is no motor wires are routed above or close to the servo drive.

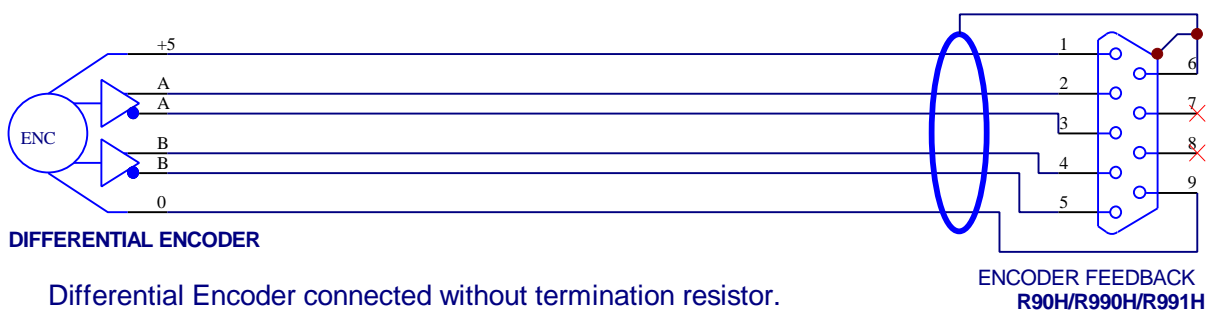
**E-stop:** Emergency stop switch should be connected to X7. If E-stop is not used a link must be connected to this connector. The E-stop circuitry disconnect the power from motors, release the plasma\_start relay and remove the power from solenoid for initial height sensing. The internal circuitry of R510A/B and encoders are not affected by E-stop.

**Limit switches:** The limit switches for axes as well as torch lifter should be normally closed and the contact should be bridged with diode that allows driving only to the opposite direction of the position of the limit. Note that the diodes and limit switches must be rated for anticipated current. If you cannot fit large enough limit switches on the machine then use high capacity interposing relays instead of limit switches driven by small limit switches on the machine. Alternatively use the R90LIM board.

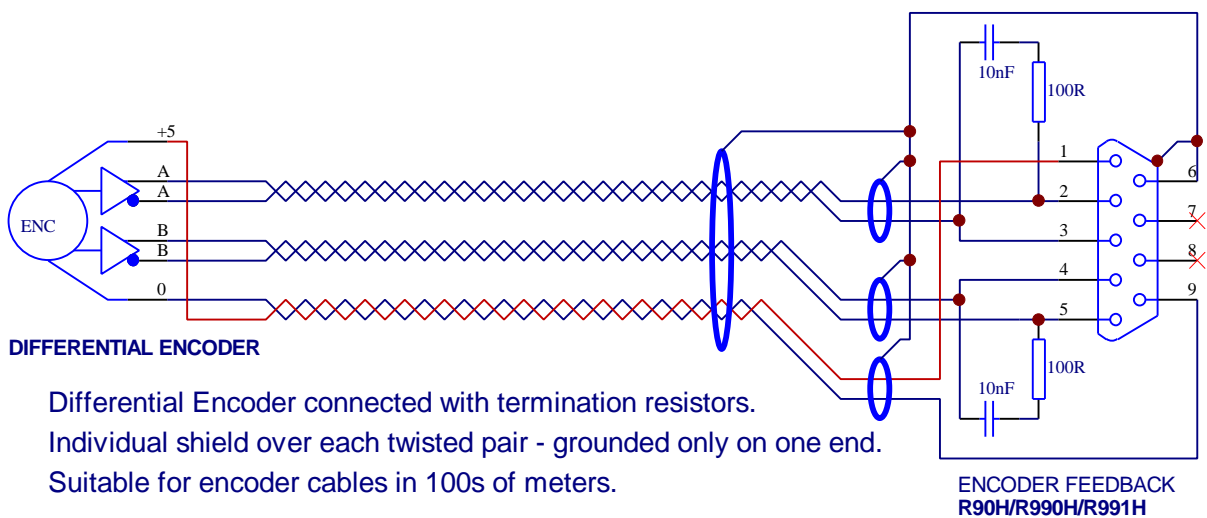


**Power supplies:** The R510A/B employs split power supply. The control supply  $V_c$  should be kept between 15 to 36 VDC at all the time. The  $V_m$  is fed via the E-STOP circuitry (relay) and must not exceed DC 100V. The  $V_m$  is used only for servomotors for axes. The motor for torch lifter is supplied from  $V_c$ . 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 calculation of filtering capacitor. The  $V_m$  capacitor should be located no more than 30 cm (1ft) away from R510A/B board. Switch mode power supplies should not be used, because they usually have not enough capacitance on the output to absorb the back EMF energy while motor is breaking.

**Encoders:** R510A/B board has exactly same interface as R9xH boards. Follow the instruction in the R9xHbdi.PDF about connection or faultfindings.



Differential Encoder connected without termination resistor.  
 One overall shield over all the cores - grounded only on one end.  
 Suitable for encoders cables typically less then 5 to 10 meters.



Differential Encoder connected with termination resistors.  
 Individual shield over each twisted pair - grounded only on one end.  
 Suitable for encoder cables in 100s of meters.

**Plasma Interface:** The plasma unit must be able to be started from external contact. This dry contact is available between *Plasma\_Start1* and *Plasma\_Start2*.

As well, the plasma unit should have an output, which signalize that the arc is on. This is usually done by a current relay inside the plasma unit, which should close the contact between *Plasma\_FB1* and *Plasma\_FB2*. If this signal is not a dry contact, then connect a coil of additional relay to this signal (coil must be rated same as value of this signal e.g. AC 110V) and use contact of this relay to close *Plasma\_FB1* and *Plasma\_FB2* lines. This feedback is used to signal the controller to start the motion. Note, that this feedback can be masked in pCut (R510A.INI file) and a small delay could be used to start the motion after plasma is started.

Many of plasma units have already build in a voltage divider of the arc voltage. This is usually 25:1, 50:1 or 100:1. The voltage from this divider should be applied to *Arc\_Volt1* and *Arc\_Volt2*. A screened twisted pare cable should be used and screen should be terminated only on one end. If the plasma unit does not have suitable voltage divider installed, please see section *Selection of voltage divider for arc voltage*. This divider should be fitted inside, or very close to, the plasma unit to decrease the possibility of radiation of noise from arc current. Note, that maximum differential voltage between *Arc\_Volt1* and *Arc\_Volt2* is 5 Volts.

**Selection of voltage divider for plasma arc:** The function of voltage divider is to divide the arc voltage in ratio that the output voltage from the divider does not exceed 5V.

For example a 50:1 divider is used and required arc voltage is 125 volts. The output voltage from the divider is:  $125 / 50 = 2.050$  volts.

When selecting values of resistors for voltage divider an input impedance of 20-kilo ohms on *Arc\_Volt1&2* inputs should be taken in account in case of use high value resistors. The output of the divider should be bypassed by the capacitor (in ten or hundreds of nanofarads) to attenuate high frequency from arc and protected by a high-speed low voltage transient suppresser (such General Instrument SA5.0, SGS-Thomson BZW03P5V8, AVX-Kyocera VA100005A150).

A standard 50 : 1 divider is also available from Rutex (p/n R983).

**Torch lifter:** The up and down movement of the torch must be motorized and driven by standard brushed permanent magnet DC 24V motor. The limit switches for upper and lower limit should be normally closed and the contact should be bridged with diode that allows driving only to the opposite direction of the position of the limit. If initial height sensing is used, one or more normally open PNP type proximity switches should be used together with solenoid valve for air, which activates the spring, returned air cylinder for lowering the proxy switches to the height of the tip. The proximity switches can be substituted with mechanical switches with extended actuators and air cylinder together with solenoid valve can be substituted with electromechanical solenoid. The electromechanical solenoid should lower the actuators of the switches below the tip of torch, and when the actuator touch the plate solenoid should retract the switches above the tip of torch.

**Serial port – communication back to the PC:** R510A/B communicate back to the PC via serial port. It has RS232 interface to mach the PC. See the RT900 (Stepex) datasheet for packet description. Due to high speed of communication, it is not recommended to use cable longer then 1.2 m (4ft) between PC and R510A/B. It should be good quality screen data cable – DB9male to DB9female straight cable (no lines crossed). If longer distances are required, use 3<sup>rd</sup> party RS232 to RS422 opto-isolated converters on each end and then run 2 sets of screened twisted pares. You may use fiber-optic cable as well. R510A/B is using 2 signals: RXD, TXD. RXD and TXD have software handshaking.

