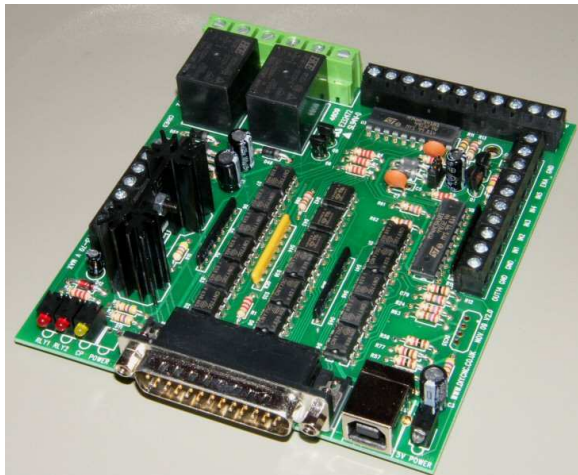


# Optoport V2

C R H Electronics Design



# Optoport V2

## Optical isolated Parallel port interconnection board with high voltage regulator, charge pump and relay control circuits

By C R Harding

### Specification

- Full optical isolation of all inputs and outputs.
- Four XYZA Axis outputs to stepper control boards.
- Integrated Charge pump logic line protects all outputs.
- Five logic input lines with built in pull-ups.
- Onboard high voltage regulator (70V Max).
- Reverse power polarity protection
- LED status indicators for Power, CP, Relays 1 & 2.
- USB input power socket or DC/DC convertor option
- Improved Charge pump signal sensitivity & override jumper
- Optional charge pump amplifier circuit.
- Board size 108 X 117 mm. FR4, Immersion gold, 1oz copper, RoHS compliant.
- Two 12A control relays with 2 way contacts.
- 5V & 12V spare power output rails (100mA max)

**Manual V2.0 Nov 09**

**Hardware V2.0 Nov 09**

The Optoport board is an optical isolated parallel breakout board with the addition of a charge pump circuit and relay control outputs. It is always a worry when connecting equipment signals together that there are not offset voltages or ground differentials that could effectively damage the computer ports or worse. By using Opto-isolating buffers on all signals between the two pieces of equipment you effectively remove the direct ground connection and any other offset voltages present. The worst case scenario is that the

optical units themselves or buffer chips may be damaged; it would take thousands of volts to break the barrier that they provide. Unlike the basic parallel brake-out boards the Optoport board has designated X, Y, Z & A motor control step and direction pins that will need to be matched in the user software. All these step and direction signals are actually treated the same way in hardware and can be made interchangeable if there is no software option. The chart fig1 gives the pin-out reference used in the design. The Charge pump circuit uses the 12 KHz signal on pin one of the parallel port generated by the CNC software when the program is up and running correctly. The logic level obtained from the signal controls either an enable or sleep pin on the stepper motor drive board or boards. This effectively prevents any false movement of the motors while the machine is being powered up or down or even a software crash condition. Version 1.3 hardware, now has a charge pump override jumper J13. This can be used for test purposes or connected permanently if your software does not support a charge pump signal. (Note: Figs 2-4 show the original board) The charge pump signal is also gated into the buffer chips so that they are disabled without this signal present. This means that driver boards that have no enable signal pins are still made safe by having their input signals removed. This charge pump signal is also gated into both relay outputs so no false triggering of the relays can occur while the software is not running. Unlike the basic parallel boards the Optoport has its own high voltage pre-regulator circuit. This enables higher power rail voltages from stepper motor boards to a 70V maximum. The 12V output from this circuit is then passed to standard 5V regulator to drive the IC's. An external 5V and 12V terminals are made available to feed other circuits, sensors, etc. The Optoport board has five signal inputs. All of the inputs have a pull-up resistor to power creating a logic high condition. You may wire micro switches directly between input and ground to create a logic changing input with no additional components. The inputs use a high impedance CMOS buffer chip so that only a few tens of micro amps being necessary to switch levels. Do not apply more than 5Volts to these inputs if being driven from other sources.

Notes : The control software must have the charge pump signal set to pin1 and be present for the board to be enabled unless the override link is on.

**Fig1**

<b>Parallel Port Pin</b>	<b>Optoport Output</b>	<b>Input/Output</b>
<b>1</b>	<b>Charge pump signal</b>	<b>Out</b>
<b>2</b>	<b>X Direction</b>	<b>Out</b>
<b>3</b>	<b>X Step</b>	<b>Out</b>

<b>4</b>	<b>Y Direction</b>	<b>Out</b>
<b>5</b>	<b>Y Step</b>	<b>Out</b>
<b>6</b>	<b>Z Direction</b>	<b>Out</b>
<b>7</b>	<b>Z Step</b>	<b>Out</b>
<b>8</b>	<b>A Direction (4<sup>th</sup> Axis)</b>	<b>Out</b>
<b>9</b>	<b>A Step (4<sup>th</sup> Axis)</b>	<b>Out</b>
<b>10</b>	<b>Input 1</b>	<b>In</b>
<b>11</b>	<b>Input 2</b>	<b>In</b>
<b>12</b>	<b>Input 3</b>	<b>In</b>
<b>13</b>	<b>Input 4</b>	<b>In</b>
<b>15</b>	<b>Input 5</b>	<b>In</b>
<b>14</b>	<b>Output</b>	<b>Out</b>
<b>16</b>	<b>Relay2</b>	<b>Out (SPDT)</b>
<b>17</b>	<b>Relay1</b>	<b>Out (SPDT)</b>
<b>18-25 computer ground</b>	<b>Isolated ground reference</b>	

## **Connections**

A typical system wiring setup is shown in Fig 2. Unless you purchased the DC/DC convertor option you will need two cables from your computer to the Optoport board. A standard parallel port 25 way male to female lead provides all the signal information. A standard USB A to B lead provides a 5 volt power supply for the Opto isolator inputs. If your setup does not require input signals back from the CNC equipment then this cable can be omitted. Power for the Optoport is usually taken from the stepper motor supply rail or voltage source. The minimum requirement is 15V with a maximum of 70V. If this voltage range is not available then a separate power supply will be required. Fig3 is a simple limit and stop switch serial circuit using a single input back to the computer. All switches are normally closed; any switch operation breaks the ground circuit and lets the input go high. Configure controlling software to stop on change of input signal pin parallel port (10). Other inputs could be used for home switches or separate banks of limit switches for each axis. The software manual usually describes these functions in more detail. Fig4 shows connecting relay output two to controlling spindle motor and Relay one a coolant pump. The pump or motor is simply connected to the normally open connection and power applied to the common. Activating the relay closes the contacts completing the circuit. Utmost care should be taken handling the Optoport board when there are live mains connections connected

to the PCB as the relay terminals are exposed on the underside of the board. It is better to bolt the board down to the case or a side panel with a small gap to stop fingers being inserted underneath.

**Fig 2 Shows older revision of board but connections have not changed.**

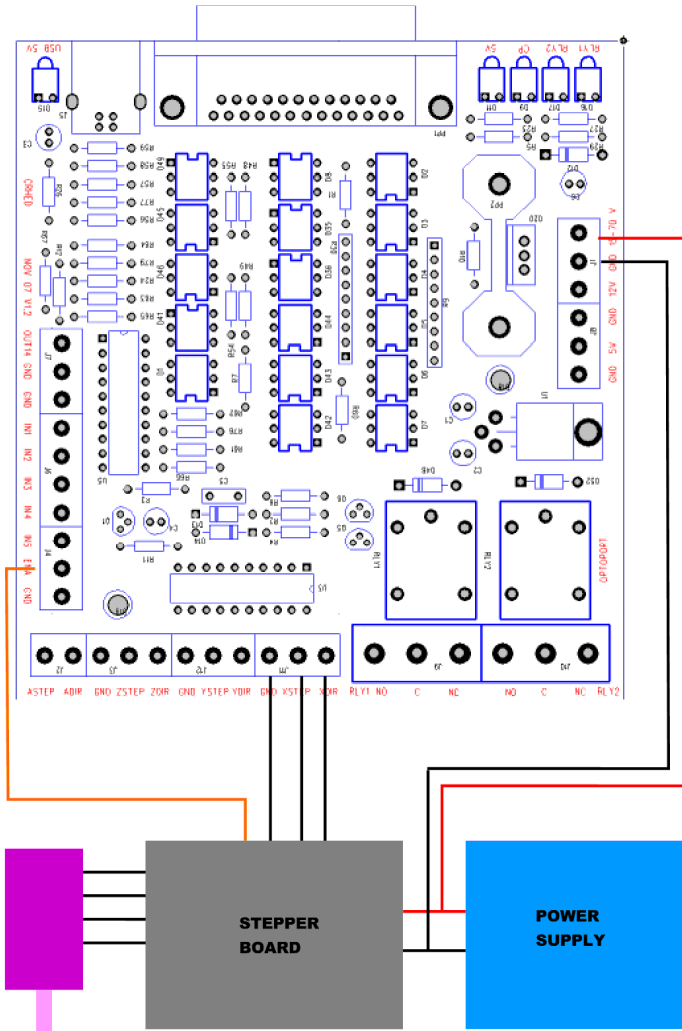


Fig3 Shows older revision of board but connections have not changed.

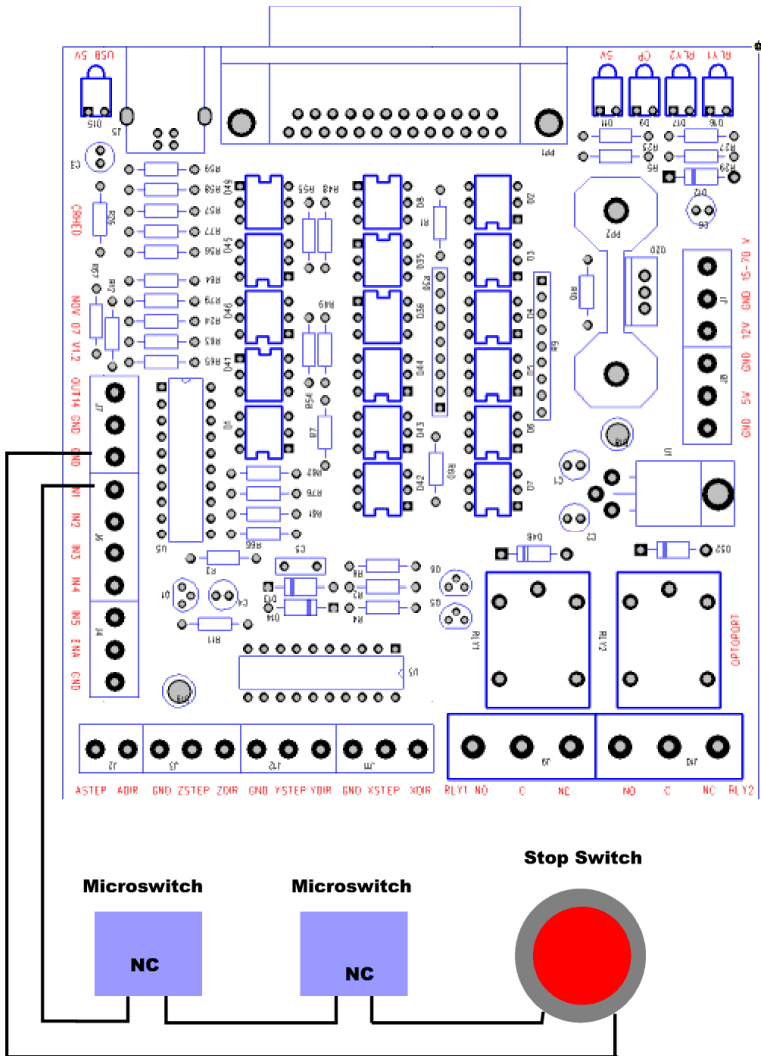
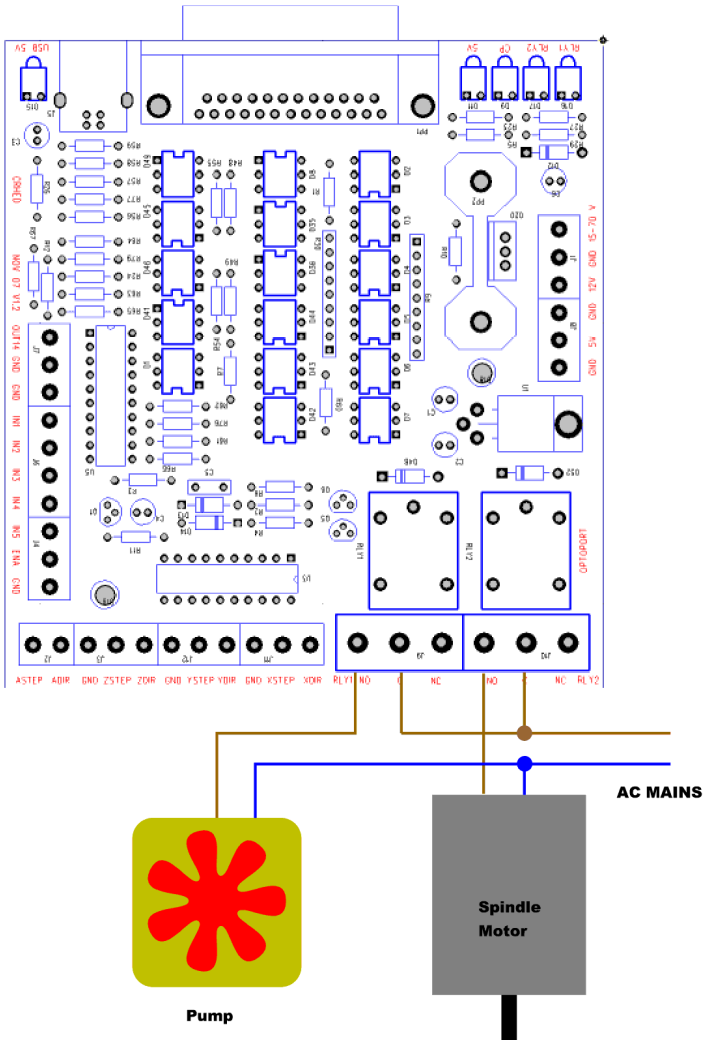


Fig4 Shows older revision of board but connections have not changed.



## KIT CONSTRUCTION

Building the board should take about one hour and a half. You will need a good soldering iron, preferably temperature controlled. The solder provided is lead free with a mild active flux. This helps it to flow easily, but you need an extra 50 degrees higher temperature compared to lead solders. With reference to the board layout diagram start by placing the individual resistors, electrolytic capacitors and diodes as these have the longest leads and will need cropping after soldering. Next place the resistor networks and small capacitors which also require slight cropping. The LED's have their own mounting blocks to position them at right angles to the PCB, make sure you orientate them correctly so that the longer anode lead goes to the square pad. Slide them into the plastic holder and then bend leads down at 90 degrees. Fit the CNY75 Opto isolation chips and the two 74HC541 buffer IC's. There are three transistors and a 5V regulator that is bolted to the board. The high voltage pre-regulator is bolted to the heat sink with the insulating washer between it and the heat-sink. These washers do not require silicone grease to help thermal contact. The heat-sink has two solder pillars that are placed into the PCB. Bolt the transistor to the heat sink without tightening the nut allowing slight movement of the transistor. Place the assembly into position on the board. Solder the connections, and then tighten the nut and bolt.

Finish off with the Parallel port connector, USB power connector, relays and the connector blocks. The blocks are manufactured in pairs or three terminals and there is an interlocking system built into the sides for multiplying the amount of terminals needed. Make sure that they are slid together before fitting to the PCB.

A fold out diagram at the back of the manual shows all component positions.

### Notes:

- Long lead on LED is anode (goes to square pad)
- Long lead on Electrolytic caps is positive (square pad)
- Fit insulating washer on transistor to heat-sink (failure to do this could result in a short circuit from power to ground)
- Dot on resistor networks is common and goes to square pad.

## Optoport board component list

### Capacitors

C1, C2, C3	100uF	16V
C4	1uF	50V
C5	0.1uF	63V
C6	10uF	25V

### Semiconductors

D1, D2, D3, D4, D5	CNY75	Opto
D6, D7, D8, D35, D36	CNY75	Opto
D41, D42, D43, D44, D45	CNY75	Opto
D46, D49	CNY75	Opto
D9	LEDRA	Yellow
D11	LEDRA	Blue
D12	ZENER	13V
D13, D14	DIODE	1N5819
D15	LEDRA	Green
D16, D17	LEDRA	Red
D20	BD681	TO-220-UP
D10, D48, D52	DIODE	1N4004
Q1, Q5, Q6	BC182	Transistor
U1	LM7805	Regulator
U3, U5	74HC541	Buffer
DC55	5V DC/DC convertor (Optional)	

### Resistors

R1, R2, R4, R6, R27, R29, R79	R1/4W	2.2k	5%
R30	RES-SIP9R	1k	
R9, R16	RES-SIP9R	270	
R15	RES-SIP9R	10k	
R5, R25, R26	R1/4W	470	5%
R10	R1/4W	4.7k	5%
R11	R1/4W	100k	5%
R60, R61, R62, R63, R24	R1/4W	270	5%
R12, R56, R57, R58, R59, R77	R1/4W	1k	5%

### Hardware

J2	TERM2	5mm
J1, J3, J4, J7, J8, J11, J12	TERM3	5mm
J5	USB1	TypeB socket
J6	TERM4	5mm
J9, J10	TERM20	7.5mm
J13	JUMPER	
PP1	DB25-HM	
PP2	HEATSINK637	
RLY1, RLY2	HRS4	Relay

5 X LED R/A mounts, 3mm nuts & bolts, mica washer

Any problems, missing components etc, please contact us by email or post.

