SYSTEM1

By C R Harding

SYSTEM1

Parallel Buffer Board Interface
With Charge Pump interlock and single expansion slot

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Specifications

- Fully buffered PC Parallel port interface
- 5Volt logic 20mA drive capability.
- All signals terminated to connector pins
- Charge Pump protection circuit.
- Built in pull-up resistors on inputs
- High voltage pr-regulator 70V Max.
- LED's for power, charge pump enable and relay.
- High quality two layer, silkscreened PCB
- Single expansion slot
- Board size 100 X 66 mm, FR4, RoHS compliant.
- Compact low cost design.

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Hardware V1.1 Sept 08

System1 is a buffered parallel interface board with 20mA of drive capability with a combined charge pump interface. The board is an ideal link between a PC parallel port and various CNC stepper motor drive boards. The system1 has a single expansion slot which will accept the spindle module board used on the System4. The board has a high voltage pre-regulator circuit enable it

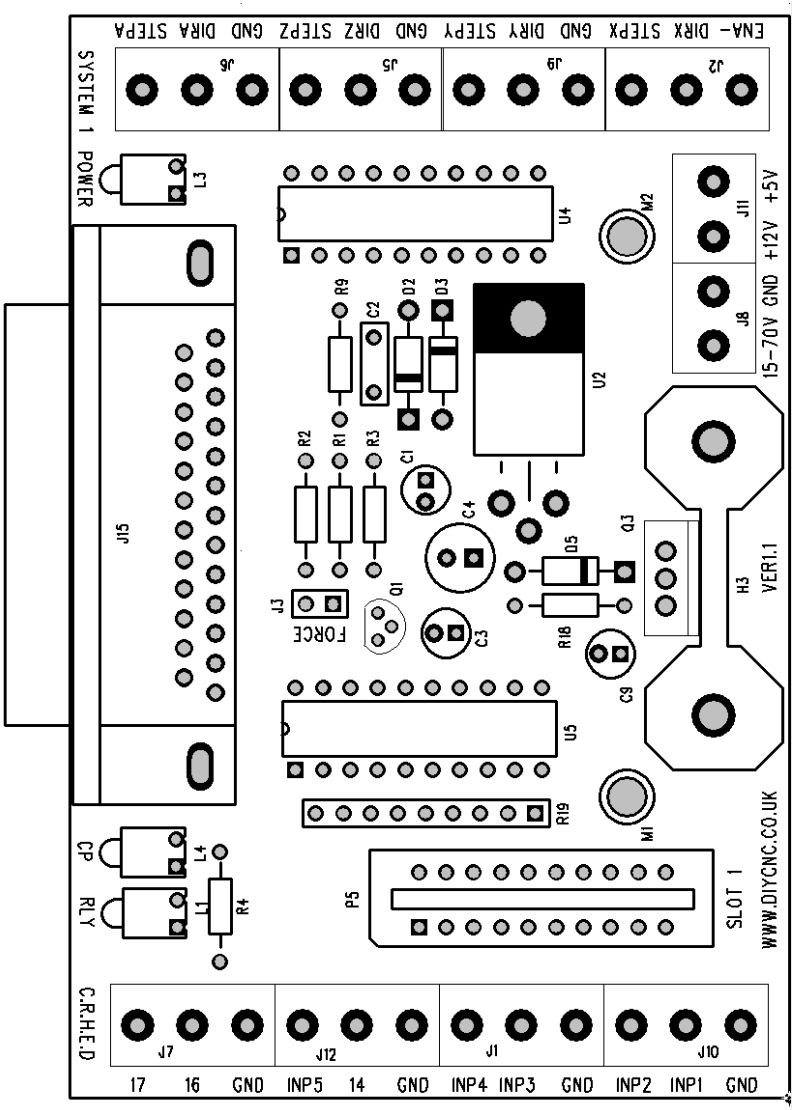
to connect to drive board power rails up to 70 volts. All the parallel port signals are taken to their own terminal blocks and marked with axis step and direction outputs, signal inputs from one to five and spare outputs 14,16 and 17. Pins 16&17 are also fed to the expansion socket and are used for spindle speed and relay control when fitted with the spindle control board.The charge pump uses the 12 kHz signal from the parallel port generated by the CNC software to operate a logic circuit that gives an active low output. Any piece of machinery that uses powerful motors can be dangerous if controlled by a computer that can be in an unknown state while being powered up or in a software crash condition. Using the charge pump circuit to disable power to motors is a safety device in that it only operates when the software is running correctly and under user control. The charge pump circuit is also used to disable the output signals so even if your stepper boards do not have an enable pin they will be disabled automatically when the charge pump signal is not present.
The output buffers can easily supply 20mA drive current, ideal for stepper motor drive boards with built-in opto-isolators than need more current than most PC Parallel ports can supply. Inputs are also buffered with 10k pull-up resistors so that a simple connection to ground creates a logic switching level.

The board has 5V & 12V regulators which have spare capacity to drive other circuits. The board has thee LED's one indicating power on, a second that illuminates when the charge pump circuit is active and a third indicating if the relay on the spindle module has operated.

Power Input
With the high voltage regulator, absolute Maximum input voltage is 70V. This should be adequate for most users, simplifying power supply circuits and eliminating extra power supplies.

Expansion Connector
The board has a single expansion slot which can accept the Spindle module as used in the System4 or any future expansion boards when made available.

Board layout, of System1



Connecting the board

The board is marked with the various axis signals, inputs and outputs of the 25 way D connector which can need to be allocated in software. Fig 1 shows the usual setup conditions for inputs and outputs. Pins 16 & 17 are used to drive spindle control module if fitted.

Fig1

Parallel Port Pin	Bufferport Signal	Input / Output
1	Charge pump signal	Out
2	X Direction	Out
3	X Step	Out
4	Y Direction	Out
5	Y Step	Out
6	Z Direction	Out
7	Z Step	Out
8	A Direction (4th Axis)	Out
9	A Step	Out
10	In 1	Input
11	In 2	Input
12	In 3	Input
13	In 4	Input
14	14 Output	Out
15	In 5	Input
16	16 Output	Out
17	17 Output	Out
18-25 computer ground	GND	

Spare output power

Spare 5V & 12V power current is dependent on power supply input voltage thus increasing heat dissipation in the pre-regulator circuit. Recommended maximum spare current output 100mA for input voltages > 30V and 200mA spare current for voltages < 30V.

KIT CONSTRUCTION

Building the board should take less than one hour. You will need a good soldering iron, preferably temperature controlled. The solder provided is lead free with an 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 resistors as these have long leads and will need cropping after soldering. The resistor array on the inputs has a dot on one end of its body; make sure that it is by the square pad as this is the common point for all the resistors. After soldering and cropping the resistor leads place the various capacitors and the two diodes that will also require cropping. The diodes must be orientated correctly with the bar end (cathode) matching the silk screen legend and the square pad. The LED's are supplied with plastic mounting blocks the leads are bent at right angles so that they illuminate sideways on. The longer of the two leads on the LED's is the anode or positive and goes to the square pad. Slide the legs of the LED through the block, bend the leads over 90 degrees and place the legs through the PCB. Now bend slightly apart to hold into position before soldering. Try and keep the soldering of the LED's to a minimum as there plastic bodies soon melt with excess heat destroying there internal structure. If you have the high voltage option the power transistor is loosely bolted to the heat sink with a mica washer between the body and heat sink before fitting the whole assembly to the PCB and soldering into place. If available, a small bob of silicon grease on both sides of the mica washer will further aid cooling of the regulator. Solder the lugs on the heat-sink and then tighten the bolt holding the transistor. Finally solder the transistor. The 7805 regulator is also bolted to the P.C.B which helps with the cooling when drawing extra power. Now fit the two buffer I'C followed by the parallel connector and solder into place. Fit the transistors as there leads are formed in a triangle. Now add the force jumper and finally the connector blocks and expansion connector. The small blocks are manufactured in blocks of three terminals but there is an interlocking system built into there sides for multiplying the amount of terminals needed. Make sure that they are slid together before fitting to the PCB. The board has 2 fixing holes for mounting or can be supported via the parallel port screws.

Notes:

Jumper link J3 is normally left open, short out to check or override charge pump operation.
ENA- Enable output active low charge pump signal.
Long lead of LED is anode.
Long lead of electrolytic capacitor is positive

Component parts list.

C1	CAP-EL	10uF 25V
C2	CAP	0.1uF 100V
C3	CAP-EL	1uF 50V
C4	CAP-EL	100uF 16V
C9	CAP-EL	10uF 25V
R1	RES	100k
R2, R4, R9	RES	470 ohm
R3	RES	1k
R18	RES	4.7k
R19	RESNETWORK	8PIN 10k
B1	BD679	Transistor
U1	7805	Regulator
U4	74HC541	Buffer IC
U5	74HC244	Buffer IC
D2, D3	DIODE	1N5819
L4	LED	R/A 3 mm Red
D5	ZENER	13V 1.3W
L3	LED	R/A 3mm Blue
Q1	Transistor	BC182
H3	HEATSINK	TO-220
P5	20 way	0.1” pitch
J3	JUMPER SIP\2P	
J4	TERM3	5mm
J1, J2, J5, J6, J7	TERM3	5mm
J9, J10, J12, J14	TERM3	5mm
D1	CONNECTOR	DB25-HM

LED holders, nuts/bolts/mica washer

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Dimensions and support fixings are for M3 screws.