C4 – SAFETY CHARGE PUMP BOARD Rev. 6.2
User manual Rev. 1

1. Overview.

This board takes advantage of Mach ability to send a specific frequency through one of the pins of the parallel port when the program is in control of the system. CNC machinery can be very dangerous, and you could have a risk of the machine doing something different that what you intend the machine to do if the program loses control of your system. Mach be can be programmed in a way, so when it is "in control", it delivers a 12.5 KHz signal through one of the pins. This card lets you use this signal to work as an On/Off switch for your system, enabling a powerful safety system for your equipment. If you ever had windows crash on you, then this card is for you. The port can also do weird things while the system is coming up, or down.
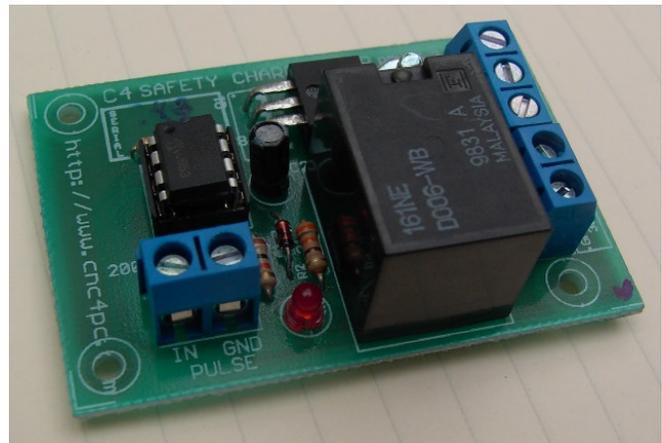

Fig. 1. C4 Safety Charge Pump Board

2. Features

- **Takes advantage of the 12.5 KHz signal from Mach.** When Mach *X* is in control it can emit a 12.5 KHz signal that can be used as an On-Off safety switch for your system.

- **Microcontroller based system.** New since revision 5 of this board. They now come with a microcontroller that allows the implementation of more complex algorithms for sampling and analyzing the signal.

- **TTL compatible.** 5V and 3.3V signal can be connected to the pulse input.

- **You can use it to control your Parallel Port Interface Card or any other device that can control your system.** This device acts as an On/Off switch for your system. When hooked up, you can control what is powered or not.

3. Specifications

INPUT SPECIFICATIONS	
On-state voltage range	2 to 5V DC
Minimum on-state input current	5 uA
Maximum off-state voltage	0.8V
Maximum input signal voltage	(5V power supply voltage) + 0.3V
Typical time to activate the relay *	35ms
Typical time to deactivate the relay **	105ms

* Time passed since an input pulse is detected until the algorithm validates the input frequency.

** Time passed since a wrong input frequency is detected until that the algorithm determinates that there is a problem.

ELECTROMECHANICAL RELAYS SPECIFICACTIONS	
Maximum Current (AC)	7A@240VAC; 10A@125VAC
Maximum Current (DC)	15A@24VDC; 10A@28VDC

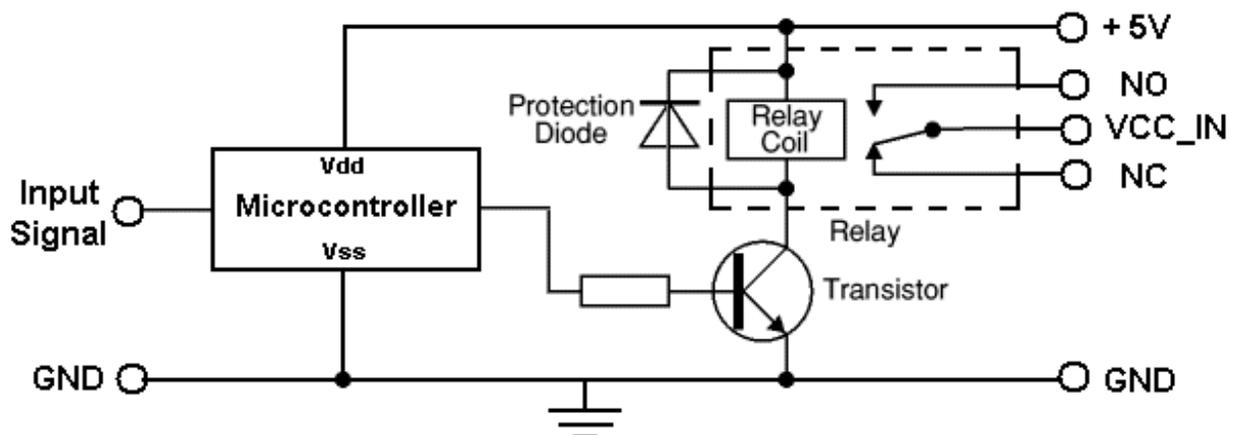| GENERAL SPECIFICATIONS	
Dimensions	Millimeters: 60L x 40W x22D
External power	5V DC @ 300mA

4. Simplified schematic

Fig. 2. C4 Simplified Schematic

5. SCHP signal validation algorithm.

Being a Microcontroller based board, it implement an special algorithm to validate or invalidate the SCHP signal. A brief description of this algorithm is done next.

The algorithm analyzes the signal in this way:

Count the number of pluses are present in the SCHP signal over 15mS. If the number of pulses is in a valid range an *success* occurs, else a *fail* occurs.
To validate the SCHP signal two consecutives successes should occurs. To invalidate the SCHP signal is previously was validate, are necessary 7 consecutives fails.

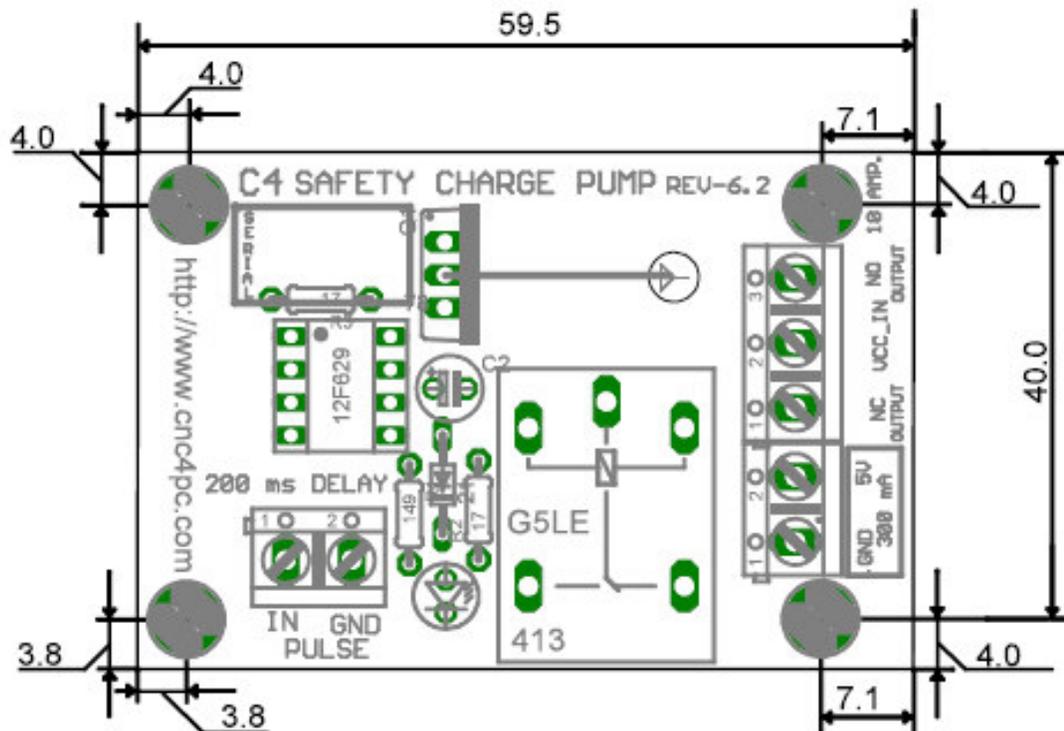The valid frequency range is **3000Hz-15500Hz.**

6. Dimensions

Fig. 3. C4 dimensions

All dimensions are in Millimeters.

7. Connection instructions

Precautions

Always be sure that the polarity and voltage of the external power connected to 5V and GND power input are correct. Overvoltage or reverse-polarity power applied to these terminals can cause damage to the board, and/or the power source. Ensure that your external power supply can supply at least 300mA.
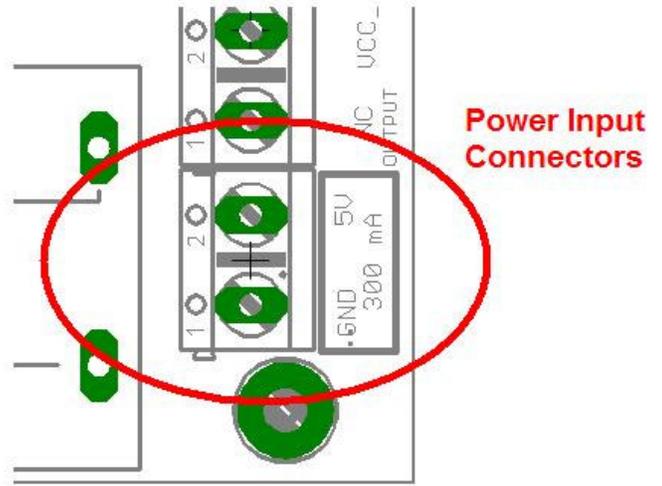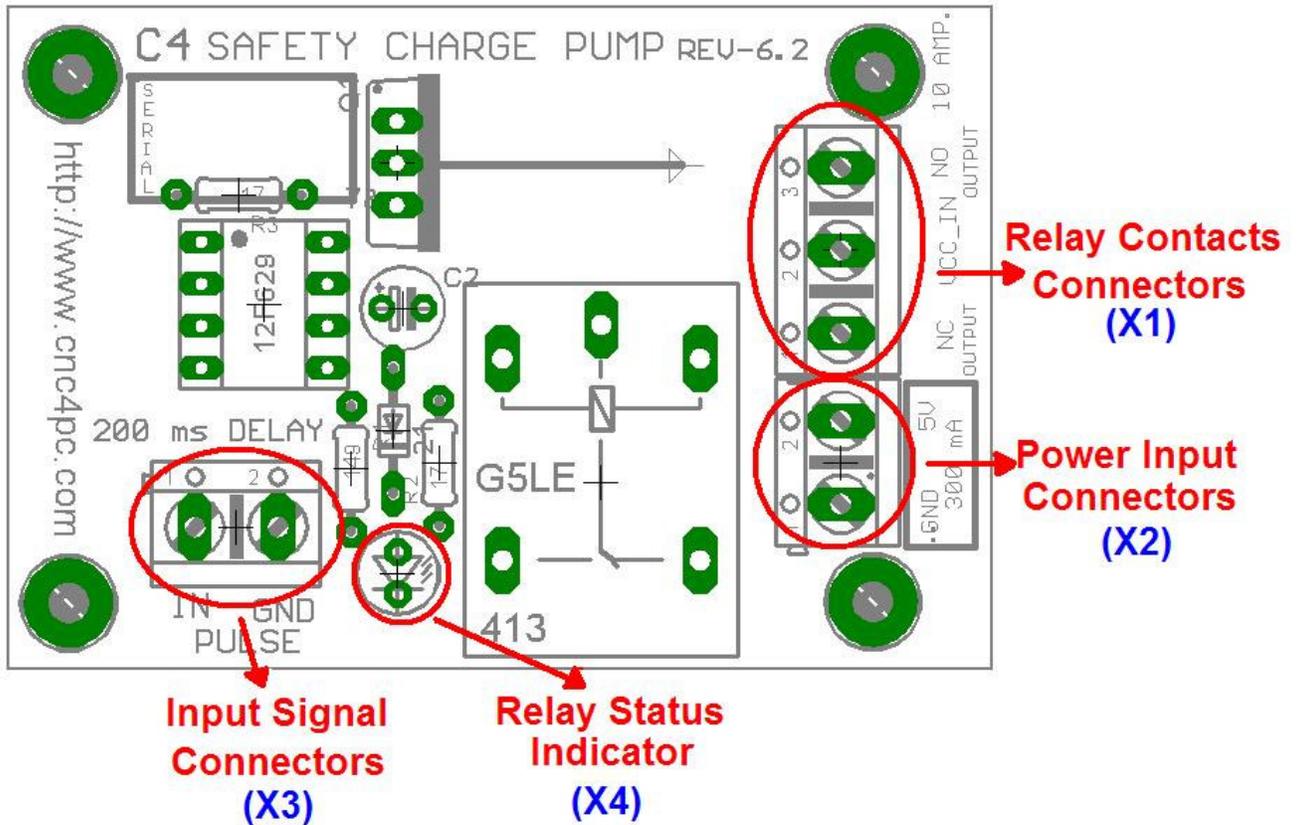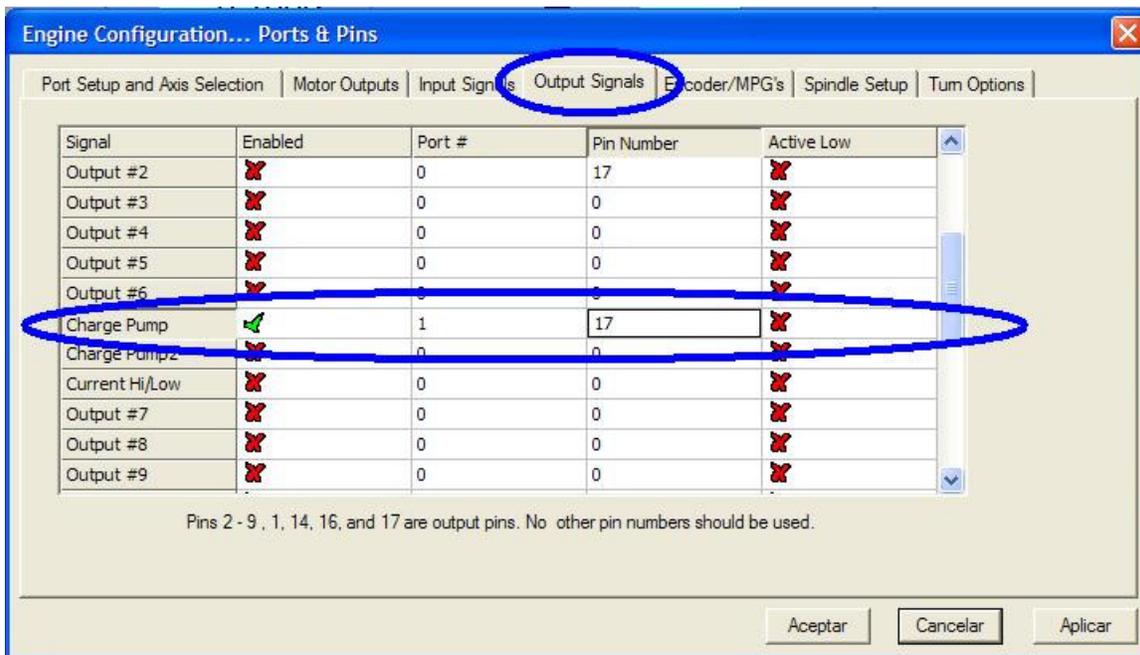

Fig. 4. C4 Power input connectors.

Fig. 5. C4 interface components

Step 1. Ensure that all external power sources are set to **OFF.**

Step 2. Configuring the *Charge Pump* in *Mach X*: To do this use the dialog *Config / Ports and pins / Output Signals*. Enable the *Charge Pump* output and configures it as is shown in the Fig. 6   Next, press the *apply* button.

Fig. 6. Charge Pump configuration

Step 3. Connect the 5V power supply to the Power Inputs Connectors (X2).

Step 4. Connect the pulse signal to the Inputs Connectors (X3).

Step 5. Before connecting the relay, test the board and Mach *X.* turn on the external power supplies and start Mach. When "RESET" is pressed the relay and the Relay Status indicator LED (X4) should activate.

Step 6. Turn off the external power supplies and connect external Relay contacts (X1).

This connection depends on what you need the system to turn on/off.

NO= Normally Open.
NC=Normally Closed.
In the **VCC_IN** contact connect the voltage or signal required in the NO or NC contact. A wiring diagram example is shown in http://cnc4pc.com/Tech_Docs/C4R6WG.pdf.

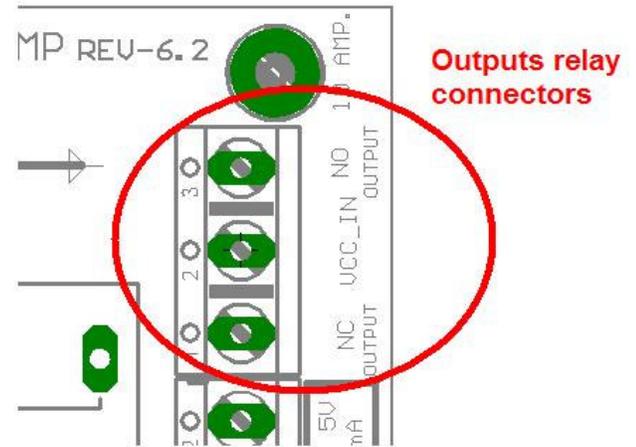Ensure not to exceed the Relay specifications.

Fig. 7. C4 Outputs relay connectors.

Step 7.Turn on the external power supplies.

8. Troubleshooting.

SYMPTOM: THE BOARD DOES NOT REACT TO THE SIGNAL.

POSSIBLE CAUSE	POSSIBLE SOLUTIONS
- **Pin conflict or mach3 configuration**. It is possible that the port address used for the pin is not right, or that there is a pin conflict with the. That is that you are using that same pin twice. (it could be assigned to a different function).	- Go to the device manager in windows, and check the memory address used for the parallel port you are using. Usually it will be 378 for LPT1. Check also that the port does not have a conflict. Then in mach3, go to Ports & Pins / Port Setup and Axis Selection. Check the memory address is correct. - Check that the pin you are using is not been used anywhere else in your setup. Got to motor output and output signals, and check all the entries.
- **The board does not like the waveform it is getting.** Some breakout boards could invert the signals or modify the pulse width. Changing the active low status of the	- Play with the active low status of the pin used for the frequency.

pin used also inverts the waveform.	
- **The signal or frequencies are not getting to the board.** It could be the cable or that you are passing the signal through the same breakout board that you are enabling/disabling, so the outputs could be disabled, so they will not get to the breakout board.	- Try a different cable. - Test the pins in the cable (before they reach the breakout board) with a multimeter. - If the signal is passing through the same breakout board that you are trying to enable/disable make sure you implement the circuit in this wiring diagram: http://cnc4pc.com/Tech_Docs/E_STOP_N_EN_Wiring.pdf.
- **Problems with Mach3 Pulse Generation.** Mach3 could have installation problems (you did not restart immediately after installation), or there could be something creating a conflict. Some dongle devices might cause this, other software, like QuickTime or drivers for touch screen.	- Test this in a different PC. - Follow Art's suggestions for optimizing up WinXP: http://www.machsupport.com/downloads/XP_Optimization.txt.

Disclaimer:
Use caution. CNC machines could be dangerous machines. DUNCAN USA, LLC or Arturo Duncan are not liable for any accidents resulting from the improper use of these devices. The C11G is not fail-safe device, and it should not be used in life support systems or in other devices where its failure or possible erratic operation could cause property damage, bodily injury or loss of life.