TINY CONTROLS PRIVATE LIMITED
Advanced CNC Systems

PP-BOB2-v2

Parallel Port Breakout Board

CNC Step/Direction Interface

OPERATION MANUAL

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Chapter 1 — Safety Information

Read this chapter before wiring, configuring, or operating the PP-BOB2-v2.

1.1 Warning Levels

This manual flags hazards and important operating notes at four levels, shown throughout in the same visual format:

Level	Meaning
DANGER	A hazard that will cause death or serious injury if not avoided.
WARNING	A hazard that can cause death or serious injury if not avoided.
CAUTION	A hazard that can cause minor injury or equipment damage if not avoided.
NOTE	Operational information carrying no injury hazard.

1.2 Electrical Safety

> ⚠ **WARNING**
> Disconnect power at its source before wiring the board, the host PC, or any connected drive or relay load. Do not work on live connections.

Apply a supply voltage of +24V DC to the board's 24V/GND terminals. Confirm polarity before applying power — reversed polarity is not protected against.

> **CAUTION**
> The relay contacts (N/O, COM, N/C) switch whatever load is wired to them at the load's own voltage and current — the board does not limit or fuse the switched circuit. Rate the wiring and any downstream contactor for the actual load.

The five input terminals (P10–P13, P15) are opto-isolated and rated for 24V; they do not need an external series resistor at 24V. Do not apply a voltage outside the board's rated input range.

1.3 Motion Safety

> **DANGER**
> The emergency-stop input (P15/ESTOP) only reports switch state to the host software — the board itself does not cut power or halt any axis. Motion actually stops only if the CNC software (e.g. Mach3) is correctly configured to act on this input. A hardwired emergency-stop chain that removes power at the drives is what makes a machine safe, not this signal alone.

The board buffers and passes through step/direction signals from the parallel port — it has no independent motion logic of its own. Whatever the host software commands is what the connected drives execute.

> ⚠ **WARNING**
> With the charge pump jumper (J1) at position 2–3, the output buffers are permanently enabled and drive whatever signal is present on the parallel port pins, with no charge-pump

interlock. Know which J1 position is mounted before connecting motor drives.

CAUTION

The TEST output (P1) generates a continuous 4 kHz signal for testing a stepper driver axis. Do not leave a drive connected to TEST while also expecting normal step/direction control from the host — the two are not arbitrated.

1.4 General Safety Rules

- Read this manual, in particular Chapter 3 (Installation and Wiring), before wiring or commissioning the board.
- Only qualified personnel should wire, configure, or service the board.
- Verify jumper positions (J1–J5) match the intended configuration before connecting motor drives or relay loads.
- Configure and test the emergency-stop input in the host CNC software before relying on it — see Chapter 5.
- Do not bypass the host software's emergency-stop configuration to work around a wiring fault — find and fix the cause instead.
- Keep this manual accessible to anyone commissioning, operating, or servicing the board.

Chapter 2 — Overview

2.1 General Description

In this manual, the PP-BOB2-v2 Parallel Port Breakout Board is termed the Breakout Board, or simply BOB.
The BOB is a flexible interface card between a CNC machine and a PC parallel port, compatible with Mach3, TurboCNC, EMC2, KCAM, and similar software. It translates signals between the CNC machine and the PC and isolates the PC motherboard from electrical problems on the machine side.
The board gives step and direction outputs to drives for 4 axes. The X-axis output is double-buffered and brought out on two separate terminals (X1, X2), so two motors can be driven on the same axis — hardware slaving, used in gantry-style machines. All outputs are buffered and brought out to screw terminals. Outputs can be set pull-up or pull-down, and the common (COM) polarity is jumper-selectable.
Three relays are provided on the board, and an isolated 0–10V analog output is provided for controlling spindle speed via a VFD.
An on-board charge pump is provided for safety of the card. It is jumper-configurable, operates from frequencies as low as 200Hz to more than 15kHz, and can be disabled — disabling it frees the buffered signal for use as a general-purpose output.
Input terminals are compatible with 24V and filtered for noise immunity. LED indicators on every input and output make signal debugging easy. A DB-25 connector and a 26-pin box header are provided for the PC connection.

2.2 What's Included

- Breakout Board
- Cable wire with DB-25 connector

2.3 Specifications

Feature	Specification
Communication terminals	Parallel port terminal for PC connection, plus 26-pin box header
Axes	4 axes plus X-slave
Axes drive control type	Step/Dir
Digital outputs	14
Digital inputs	5
Analog output	0–10V, isolated, 1 channel
Test output	4kHz signal
Relays	3
Supply voltage	24V DC
Max power consumption	24V / 0.5A
Ambient temperature range	0–55°C
Dimensions	135 x 95 mm

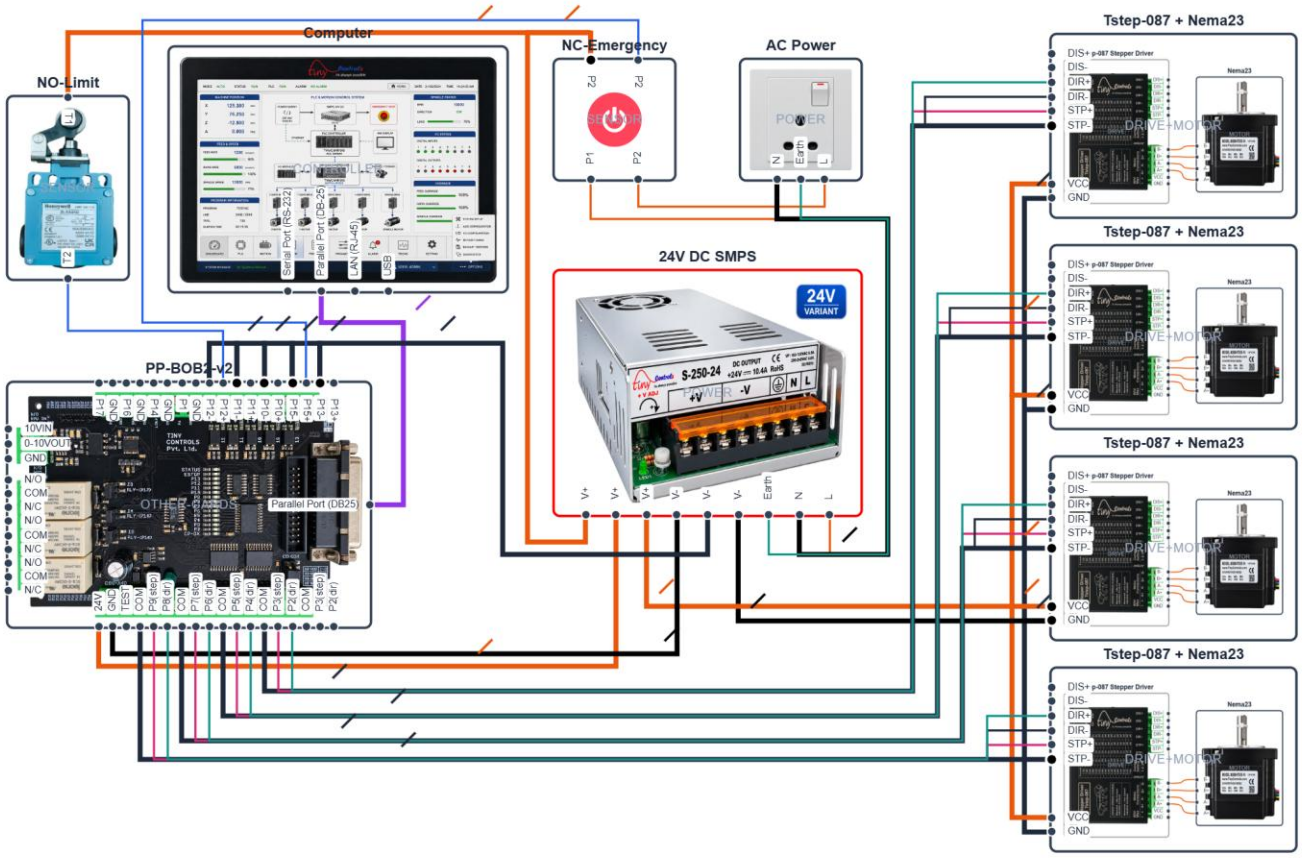
Weight	40g

Chapter 3 — Installation and Wiring

3.1 Board Terminals

Signal	Direction	Function
24V, GND	Input	+24V DC power supply.
TEST (P1)	Output	4kHz test signal, or charge pump signal input from host — selected by J1.
P2, P3, COM × 2	Output	X1/X2-axis Step, Dir, common — duplicated on two terminals for gantry slaving.
P4, P5, COM	Output	Y-axis Step, Dir, common.
P6, P7, COM	Output	Z-axis Step, Dir, common.
P8, P9, COM	Output	A-axis Step, Dir, common.
P10–P13	Input	General-purpose opto-isolated inputs, active low.
P15	Input	Emergency-stop input, opto-isolated, active low — drives the ESTOP LED.
P14, P16, P17	Output	General-purpose outputs, or relay 2/3/1 drive — selected by J4/J5/J3.
N/O, COM, N/C × 3	Output	Relay 1/2/3 dry contacts.
10V IN	Input	VFD analog reference input, isolated.
0–10V OUT	Output	Isolated 0–10V analog output to VFD.
DB-25 / 26-pin header	Bidirectional	Parallel port connection to PC.

Figure 3.1 — Electrical Connection Diagram



NOTE

This diagram shows the BOB wired into a complete system — a PC running Mach3, 24V DC supply, emergency-stop switch, limit switch, and four Tstep-087 + Nema23 drive/motor stacks — as one worked example, not the only valid configuration. The board itself is a generic parallel-port breakout; connect whatever drives, relays, and switches the installation needs to the terminals in the table above.

3.2 Connecting Outputs

Axes outputs: the board has dedicated Step, Dir, and COM outputs for four independent axes, named X, Y, Z, and A. The X-axis output is double-buffered and brought out on two individual terminals, X1 and X2, for hardware slaving of two motors on the same axis in gantry-style machines. In total there are five 3-pin terminal blocks carrying COM, Step, and Direction. If an axis isn't used, its outputs can be repurposed as general-purpose outputs.
Analog output 0–10V: this circuit is fully isolated from the rest of the board. Feed a 10V reference from the VFD into the 10V IN terminal, and draw a proportional 0–10V control signal from the 0–10V OUT terminal.
Test: generates a 4kHz signal, for testing a stepper driver axis independently of the host software.

3.3 Connecting Inputs

Power supply: apply a supply voltage of +24V DC at the board's power input. Confirm polarity before applying power.
Input terminals: the board has five opto-isolated inputs, on signals P10, P11, P12, P13, and P15. All are filtered for noise and are active low — driving the opto-isolator's input pulls the signal low.
Signal P15 is dedicated to the emergency switch; the ESTOP LED shows this signal's activity.

3.4 Jumper Settings

J1: at position 1–2, the charge pump on signal P1 is enabled — configure the CNC software to output a charge pump signal on P1, and the output buffers stay enabled only while that signal is present. Charge pump operates from 200Hz to more than 15kHz.

Jumper	Position 1–2	Position 2–3
J1	Charge pump on P1 enabled	Charge pump disabled
J2	COM output pulled down to ground (0V)	COM output pulled up to Vcc (+5V)
J3	P17 controls the relay, via PWM signal	P17 acts as a general-purpose output signal

Jumper	Position 1–2 (mounted)	Position 1–2 (removed)
J4	P14 controls the relay	P14 acts as a general-purpose output signal
J5	P16 controls the relay	P16 acts as a general-purpose output signal

NOTE
J4 and J5 use mounted/removed rather than a 1–2 / 2–3 position pair — confirm which convention applies before changing a jumper.

3.5 LED Indicators

LED	Function
P2–P9	Activity of the respective output terminal.
P10–P13, ESTOP	Activity of the respective input terminal.
P14, P16, P17	Activity of the respective signal.
CP-OK	Glows when a valid charge pump signal is detected at P1.
STATUS	Blinks fast: no PWM signal at P17. Blinks slow: PWM duty under 10%. Glows continuously: PWM duty 10% or greater.

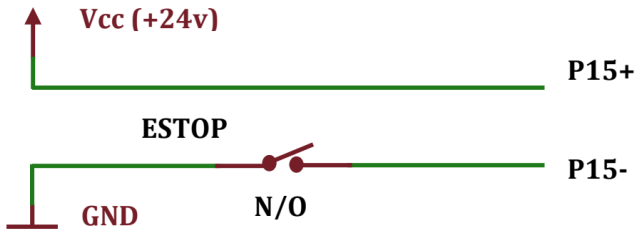
Chapter 4 — Example Circuits

> **NOTE**
> The circuits in this chapter are worked suggestions. They may not work unmodified with every switch, sensor, or voltage — verify against the actual device's datasheet before wiring it in.

4.1 Emergency Switch

Wire a normally-open emergency switch between P15+ and P15–. A diode (1N4007) and a 1k resistor protect the input; the ESTOP LED confirms activity when the switch is driven.

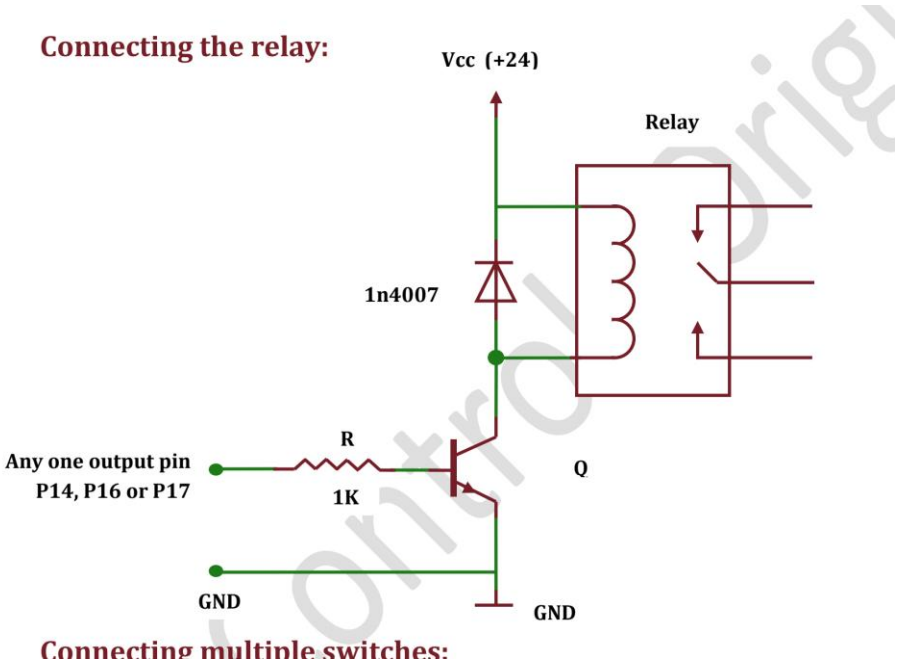
Figure 4.1 — Emergency Switch Circuit



4.2 Relay Drive

Any one of the general-purpose output pins (P14, P16, or P17) can switch an external relay coil through an NPN transistor: the output pin drives the transistor base, the transistor switches the relay coil between Vcc (+24V) and GND, and a flyback diode (1N4007) across the coil protects the transistor.

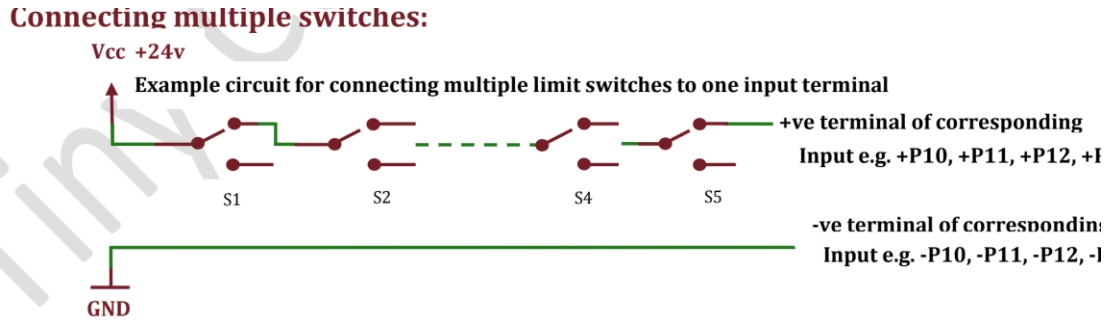
Figure 4.2 — Relay Drive Circuit



4.3 Multiple Switches on One Input

Several normally-open switches (S1, S2, S4, S5, …) can be wired in parallel onto one input terminal: every switch's + side ties to the input's + terminal (e.g. +P10), every switch's – side ties to the input's – terminal (e.g. –P10). Any one switch closing asserts the input.

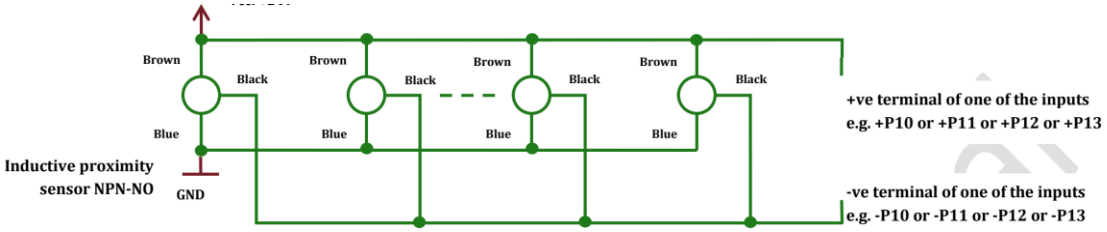
Figure 4.3 — Multiple Switches on One Input



4.4 Inductive Proximity Sensor

An NPN-NO inductive proximity sensor wires its three leads directly to the input terminal and supply: black to the input's + terminal (e.g. +P10), brown to Vcc (+24V), and blue to GND.

Figure 4.4 — Inductive Proximity Sensor Wiring



Chapter 5 — Mach3 Configuration Example

This chapter walks through configuring Mach3 for the PP-BOB2-v2's default pin assignments. Screen layouts vary by Mach3 version — the menu paths and field names below are what to look for, not a pixel-exact guide.

5.1 Native Units

Config → Select Native Units. Choose Inches for Imperial units, and confirm any prompt that appears.

5.2 Port Address

Config → Ports and Pins, "Port Setup and Axis Selection" tab. If using the PC motherboard's parallel port, the standard address is 0x378 — confirm the actual address for the port in use.

5.3 Motor Outputs

Config → Ports and Pins, "Motor Outputs" tab. For each axis used:

- Enable X, Y, Z, A-axis and Spindle by checking the enable column.
- Step pin column: X = 2, Y = 4, Z = 6, A = 8, Spindle = 17.
- Dir pin column: X = 3, Y = 5, Z = 7, A = 9, Spindle = 17.

> **NOTE**
> Enabling all four axes isn't mandatory — on a lathe, for example, enable only X and Z. If an axis moves in the wrong direction, tick "Dir Low Active" for that axis.

5.4 Input Signals

Config → Ports and Pins, "Input Signals" tab.

- Enable Input #1–#4.
- Set their pin numbers to 10, 11, 12, and 13 respectively.

5.5 Emergency Stop

Config → Ports and Pins, "Input Signals" tab.

- Enable ESTOP.
- Set its pin number to 15.
- Tick "Emulated" for bench testing without a physical switch attached.

> ⚠ **WARNING**
> This step is what actually makes P15 stop the machine in Mach3 — see the Chapter 1.3 warning. Verify it works, with a real switch, before relying on it.

5.6 Output Signals

Config → Ports and Pins, "Output Signals" tab.

- Enable Output #1 and Output #2 (relays via J4/J5) and set their pin numbers to 14 and 16 respectively.
- Enable the charge pump output and set its pin number to 1.

5.7 Spindle Setup

Config → Ports and Pins, “Spindle Setup” tab. M3/M4 commands spin the spindle clockwise/counter-clockwise respectively. Tick “Disabled” under Spindle Relays in the relay control section — spindle speed is controlled through the 0–10V PWM output instead.
Click Apply, then OK, to save.

5.8 Motor Tuning

Config → Motor Tuning. Set the tuning parameters for each axis, and click “Save Axis Settings” after every change — unsaved changes are lost.

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