

DirtyBee CARROT BOB User Manual

DirtyBee

Contents

1.	SUMMARY	2
2.	CONNECTOR	3
3.	POWER INTERFACE	4
4.	ETHERNET	5
5.	INPUT INTERFACE	5
6.	OUTPUT INTERFACE	6
7.	ANALOG SPINDLE INTERFACE	7
8.	ENCODER INTERFACE	7
9.	STEPPING INTERFACE	8
10.	HANDWHEEL INTERFACE	9
11.	PID CALIBRATION	10
12.	MECHANICAL	13
13.	ELECTRICAL CHARACTERISTICS	14
14.	VERSION	14

1. Summary

DityBee CARROT BOB is a FPGA card used RIO Firmware for LinuxCNC.

LinuxCNC is opensource object,website: www.linuxcnc.org

RIO is opensource object,website: <https://github.com/multigcs/riocore>

Features:

- **24 VDC single power supply**, with a built-in isolated power supply module. The input, output, and FPGA sections are fully isolated.
Communication with the host is via Ethernet, providing complete electrical isolation between the board and the host.
- **5 stepdir output interfaces**, supporting a maximum pulse frequency of **190 kHz**, with ESD protection.
- **8 isolated digital input interfaces**, supporting **24 V signal levels**. NPN or PNP sensor input mode can be selected using jumpers.
- **1 high-speed encoder interface**, with differential signal input, supporting a maximum frequency of **750 kHz**. Provides an auxiliary **5 V power supply** and ESD protection.
- **2 relay output interfaces**.
- **1 isolated analog spindle interface**, with **0–10 V output** and **CW(Clockwise) output signal**, featuring ESD protection.
- **1 handwheel interface**, with ESD protection.
- **Tool-free pluggable spring terminals** for quick and easy wiring.

- **DIN-rail mountable**, compatible with standard **35 mm DIN rails**.

Note:

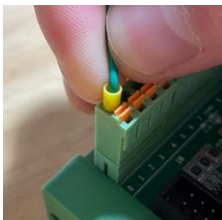
The stepdir interfaces, encoder interface, and handwheel interface are **not electrically isolated from the FPGA**.

2. Connector

The FPGA card features pluggable spring terminals, enabling quick and easy wiring.



The terminal models are E0510/E0310. Use a wire crimping tool to crimp the terminals.

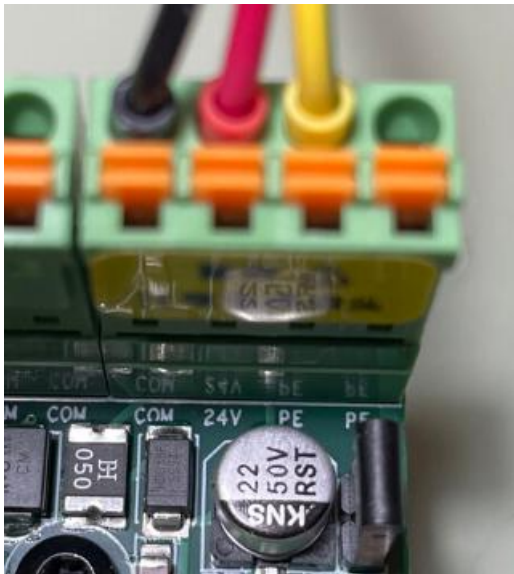


Simply insert the ferrule terminal into the corresponding terminal opening—no tools required.



Press down the **orange release tab** with a flat-head screwdriver to remove the ferrule terminal.

3. Power Interface



COM Power Negative (-)

24V Power Positive (+)

PE Protective Earth

Note:

Incorrect power supply may cause the control card to malfunction or even result in permanent damage.

When a 24 VDC power supply is connected, the power indicator will light up.

To ensure safe and stable system operation, reliable protective grounding (PE) is required. Do not share the power supply with other high-power 24 VDC devices, such as stepper motor drivers.

The control card consumes approximately 1 W with no external load (Ethernet cable connected and the card responding to ping requests).

Note:

A low-ripple industrial DIN-rail power supply is recommended.

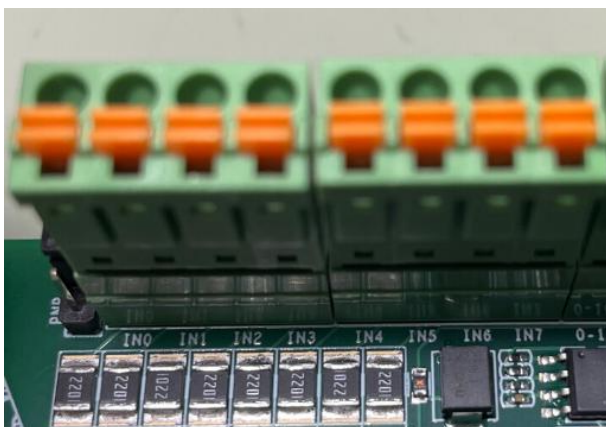
4. ETHERNET



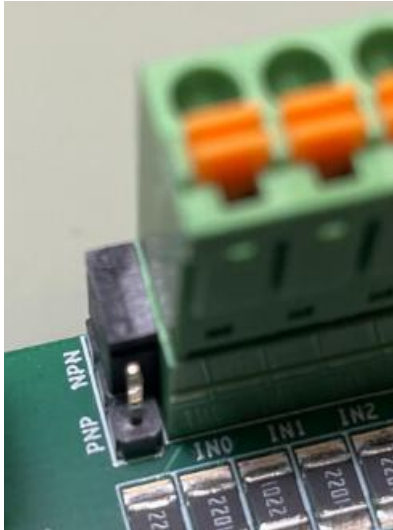
Connect the RJ45 interface of the LinuxCNC host to the RJ45 interface of the control card using an Ethernet cable. A shielded Cat 6 or higher category Ethernet cable is recommended.

Default IP address of the control card: 10.10.10.10

5. Input Interface

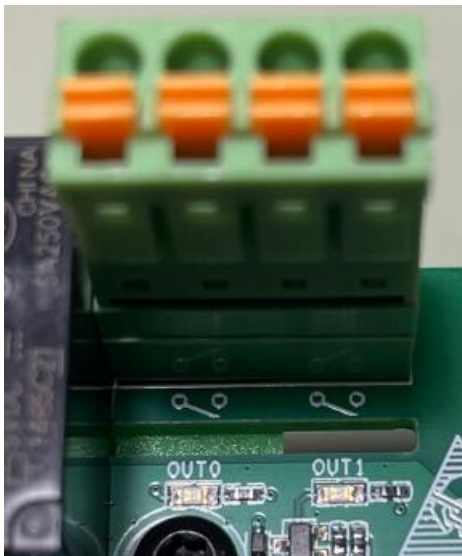


8-channel input interface with bidirectional optocoupler isolation. **Channels 6 and 7 feature a 2.5 ms input filter**, making them suitable for connecting input signals with mechanical contact bounce, such as tool setters.



The sensor input type can be selected using jumpers

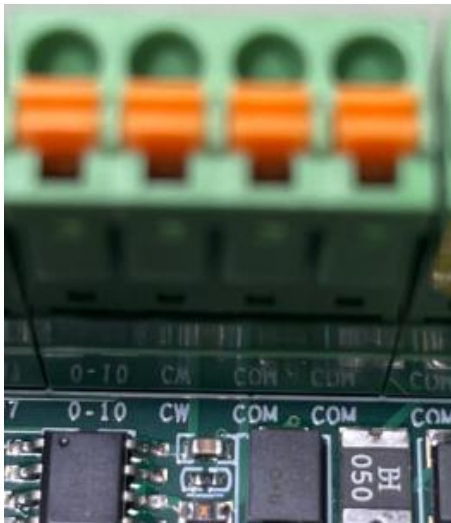
6. Output Interface



2 relay outputs with normally open (NO) contacts.

Contact rating: Refer to the markings on the relay housing. Derating is required for inductive loads.

7. Analog Spindle Interface



The 0 – 10 V signal is generated by filtering, isolating, and amplifying a 5 V PWM signal through an optocoupler. **Linearity is moderate.**

The CW signal is provided as an open-collector transistor output, with a maximum control voltage of 30 V and a maximum protected current of 10 mA.

8. Encoder Interface



G GND

5V 5V@100mA

A- Incremental encoder differential input A-

A+ Incremental encoder differential input A+

B- Incremental encoder differential input B-

B+ Incremental encoder differential input B+

Z- Incremental encoder differential input Z-

Z+ Incremental encoder differential input Z+

RS422 differential signal input, Incremental encoder interface

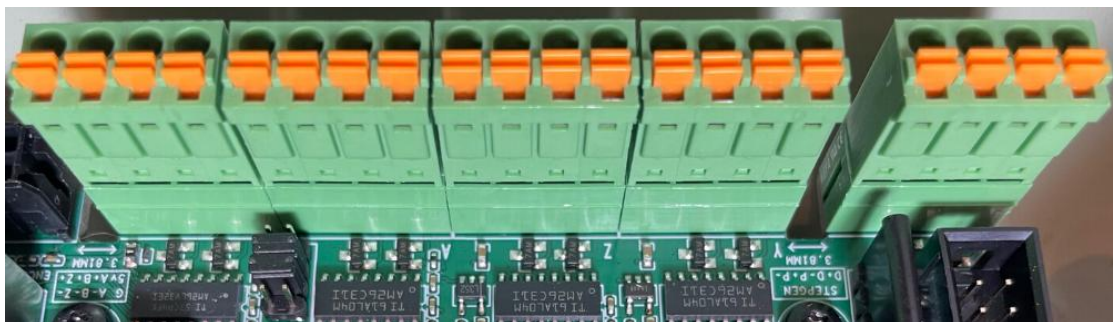
The signal names are indicated by the silkscreen markings in the upper-left corner or on the back of the control card.

Note:

a) If using the encoder signals from a servo motor, the servo motor encoder is generally an active output device, so there is no need to connect 5 V and GND.

b) A built-in 120 Ω termination resistor is provided.

9. StepDir Interface



D+ differential signal direction +

D- differential signal direction -

P+ differential signal pules +

P- differential signal pules -

5-channel differential pulse signal interfaces, with a maximum pulse

frequency of 190 kHz.

Differential-input motor drivers are recommended. If using single-ended or common-anode wiring, the 5 V power supply must be sourced from the encoder 5 V output. The encoder 5 V output has a maximum current capacity of 100 mA. When all five pulse axes/encoders are used simultaneously, verify that the 5 V power supply is not overloaded.

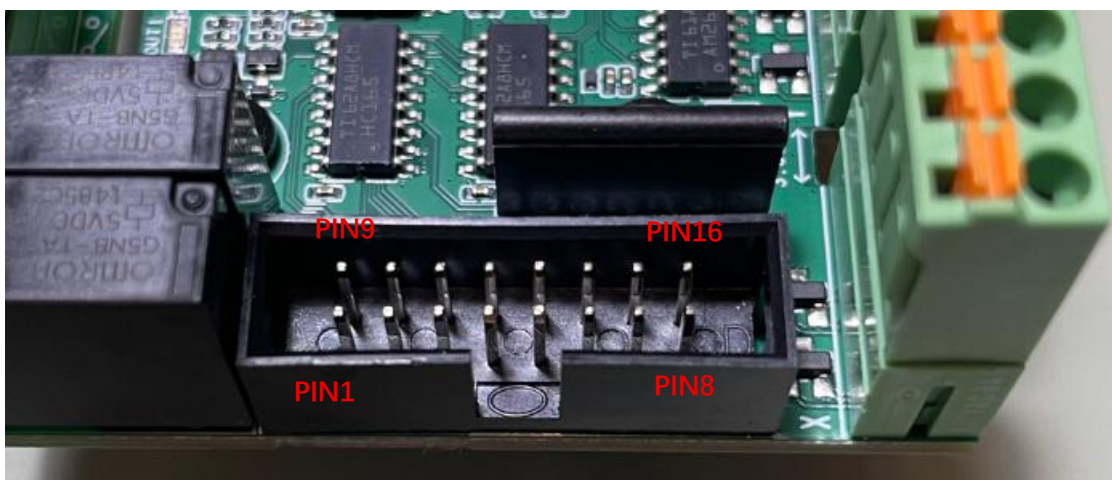
Using an Oscilloscope to Check the Waveform

Connect the oscilloscope probe ground clip to the encoder GND.

Note:

The pulse interfaces are compatible **only with motor drivers that accept 5 V pulse signals**. They **cannot be used to drive motor drivers with 24 V pulse inputs**.

10. Handwheel Interface



PIN	IDC3	DB25	Describe
1	COM	-	Common Terminal
2	X100	-	Rate x100
3	X1	-	Rate x1
4	5C	-	Axis select 5 (C)
5	Z	-	Axis select Z
6	X	-	Axis select X
7	GND	-	MPG GND
8	5V	-	MPG 5V
9	ESTOP	-	Emergency Stop
10	X10	-	Rate x10
11	6(NC)	-	Axis select 6 (Unused)
12	4A	-	Axis select 4 (A)
13	Y	-	Axis select Y
14	B/	-	MPG B-
15	A/	-	MPG A-
16	NC	NC	Unused

11. PID Calibration



Click "Setting" → "Calibration"

LinuxCNC Calibration

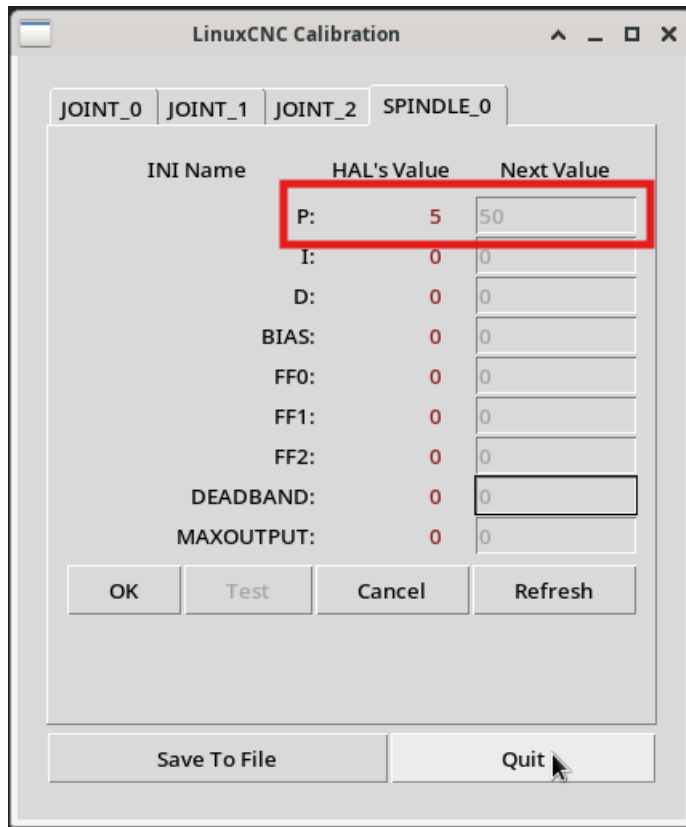
JOINT_0 JOINT_1 JOINT_2 SPINDLE_0

INI Name	HAL's Value	Next Value
P:	50	50
I:	0	0
D:	0	0
BIAS:	0	0
FF0:	0	0
FF1:	1	1
FF2:	0	0
DEADBAND:	0.0005	0
MAXOUTPUT:	0	0
SCALE_IN:	1280	1280
SCALE_OUT:	1280	1280

OK Test Cancel Refresh

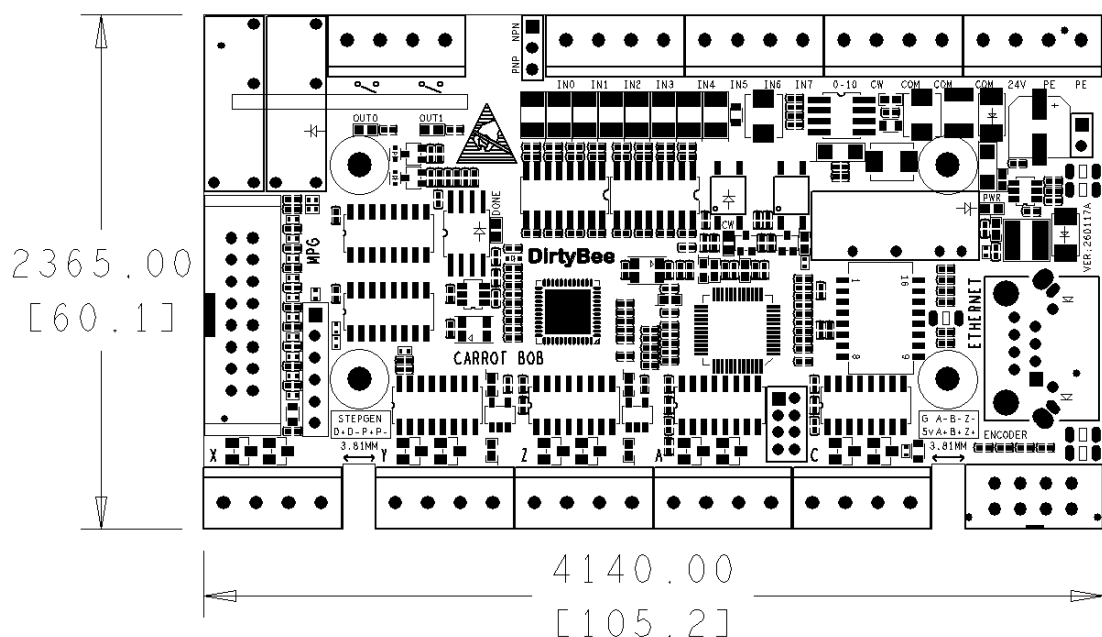
Save To File Quit

Set the deadband of joint_0 through joint_n to 0.0005. Check whether the P value is set to 50. If not, change it to 50, then click "Test" → "Save to File".



Adjust the spindle P value between 5 and 10 until the spindle orientation speed is appropriate. If no encoder is assigned, the Spindle option will not be displayed. Once the adjustment is complete, click “Test” → “Save to File”.

12. Mechanical



mil[mm]

13. Electrical Characteristics

Generate

Supply voltage	24V $\pm$ 10%	With reverse-polarity and ESD protection
Terminal Pitch	3.81mm	
Terminal Rated Current	2A	
Compatible Ferrule Terminal Models	E0310, E0510	10mm
Operating Temperature	0-60°C	

14. Version

Version	Description	Auther
V0.1		DirtyBee