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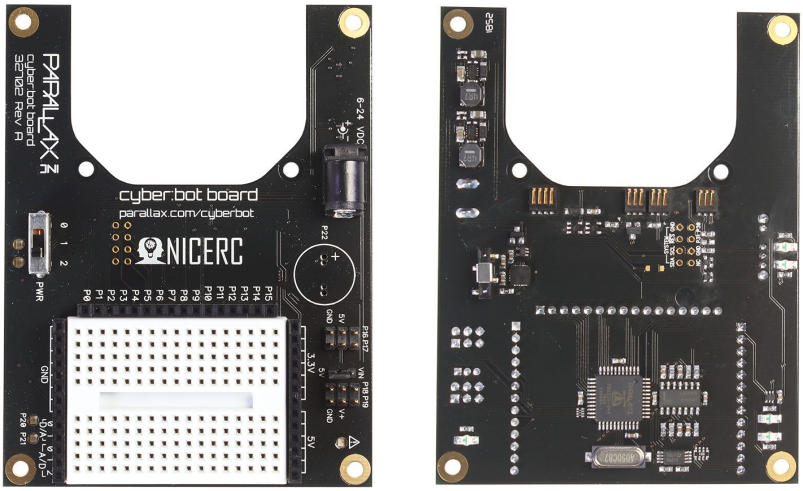
cyber:bot Board Product Guide (#32702)

The cyber:bot board merges a micro:bit module with the Parallax small robot chassis hardware. An onboard Propeller Multicore Microcontroller assists the micro:bit, handling the real-time servo motor control and sensor circuits built on the breadboard. Using the cyberbot Python library provided, the micro:bit seamlessly communicates with the Propeller through an I2C bus. This enables more robust robotic applications that go beyond what the micro:bit can do on its own, without any direct Propeller programming required.

The cyber:bot board and micro:bit module are included in the cyber:bot robot kit (#32700) a joint project of Parallax Inc. and NICERC, the National Integrated Cyber Education Research Center. This board is available individually as a replacement item for the cyber:bot robot.



Features

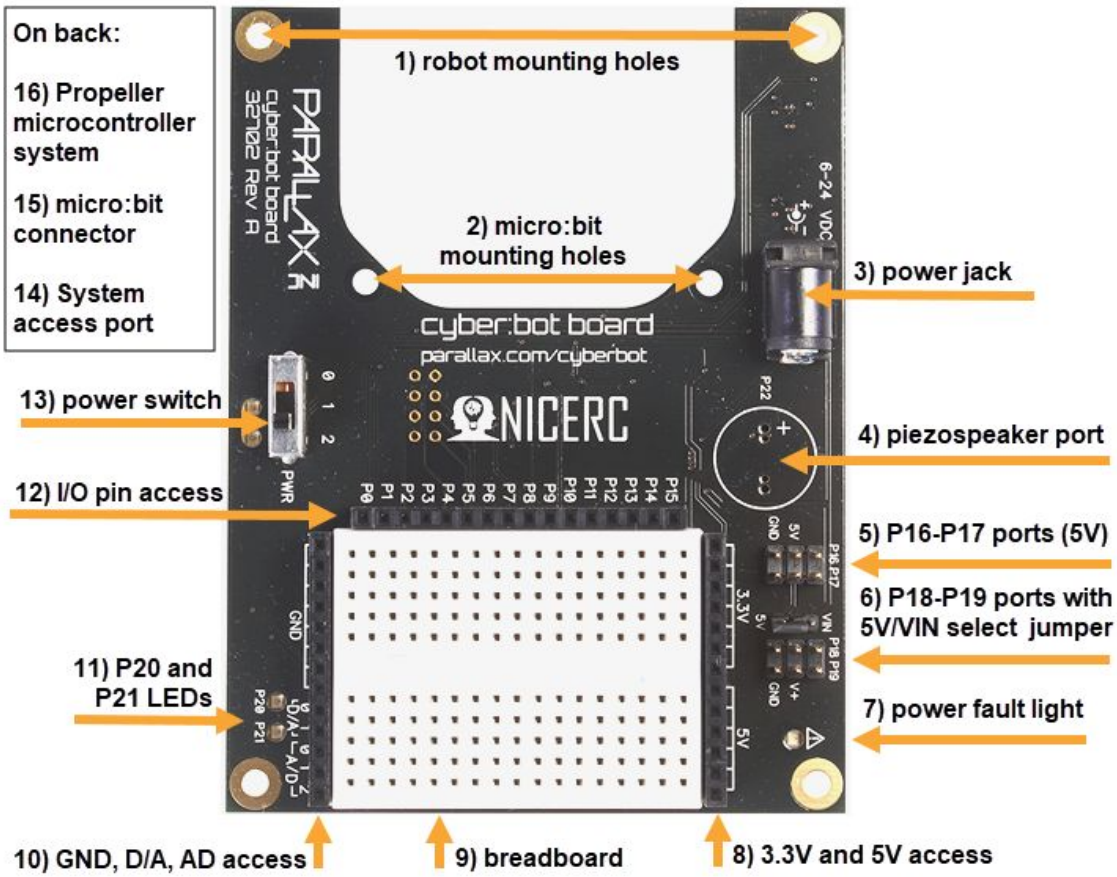
- Built-in 8-core Propeller P8X32A microcontroller, preprogrammed
- Solder-free prototyping with breadboard and header sockets for power and I/O
- Four servo/sensor ports with power-select jumpers
- Center-positive 2.1 mm barrel jack for external power supplies
- Analog output sockets provide two buffered variable-resolution D/A outputs
- Analog input sockets provide three A/D input connections to the micro:bit module
- Indicator lights show the status of system power, servo power, programming source, DAC output levels, wireless communication activity, and USB communication activity
- 3.3 V and 5 V switching voltage regulators with independent 1.8 amp outputs

Specifications

- Power Requirements: 6-24 VDC, 2.1 mm center-positive plug
- Communication Interface: I2C bus to micro:bit module
- Operating temperature: 32 to 158 °F (0 to 70 °C)
- Dimensions: 4 x 3.05 x 0.8 in (10.16 x 7.75 x 2.0 cm)

Feature Descriptions

Read the sections below for details about each labeled feature.



1) robot mounting holes

Four mounting holes allow the cyber:bot robot to be used with the Parallax Small Robot Chassis. These plated mounting holes are connected to the board's ground plane. For illustrated directions, see the tutorials at https://learn.parallax.com/cyberbot.

2) micro:bit mounting holes

These unplated holes allow a micro:bit module to mount underneath the cyber:bot board, separated slightly by a spacer. The micro:bit must be positioned with its LED matrix showing through the top of the cyber:bot board. For illustrated directions and hardware required, see the tutorials at https://learn.parallax.com/cyberbot.

3) power jack

The 2.1 mm center-positive power jack accepts 6 to 24 VDC, although a maximum of 15 VDC is recommended. This input powers the cyber:bot board, including the power access headers, and optionally the 3-pin ports. It will also power an attached micro:bit module, that isn't receiving power from the USB port.

Parallax's 5V AA battery pack (753-00007), 7.5 V, 1.5 A supply (#750-00009) and 12 V, 2 A supply (750-00003) work well with this board.

4) Piezoelectric Speaker Socket

The piezoelectric speaker socket holds a two-pin 0.3" pitch piezoelectric speaker. The leads are inserted through a set of holes on the top of the cyber:bot board, to contacts underneath the board; the minimum recommended lead length is 0.3"). The positive lead on the piezo speaker must connect to the left side of the socket, as indicated by the **+** label.

5) P16-P17 ports (5V)

Propeller I/O pins P16 and P17 are accessible through 3-pin ports along the edge of the board. These are designed to connect a sensor, standard servo, or other 3-pin device to the board.

The pins in each port are labeled with the I/O pin number, 5V, and GND. These ports receive power only when the the power switch is position 2.

If total power draw from all connections to the 5 V regulator, including the servo headers, exceeds 1.8 A, the regulator may temporarily decrease voltage or disable the output, then resume normal operations when the load is no longer present.

6) P18-P19 ports with 5V/VIN select jumper

Propeller I/O pins P18 and P19 are accessible through 3-pin ports along the edge of the board. These are designed for use with the cyber:bot robot's continuous rotation servos, but may be used with other 3-pin sensors or devices, with caution.

The pins in each port are labeled with the I/O pin number, V+, and GND. The voltage at V+ is set with a shunt jumper next to the P18 port. Regulated 5V is the default. If the jumper is set to VIN, the ports will receive unregulated voltage supplied at the power jack.

These ports receive power only when the the power switch is position 2, and the jumper is in use. If the jumper is removed entirely, these ports will not receive any power.

If total power draw from all connections to the 5 V regulator, including these ports, exceeds 1.8 A, the regulator may temporarily decrease voltage or disable the output and then resume normal operations when the load is no longer present.

If excessive power is drawn from VIN, the board may temporarily disconnect power and automatically reconnect it, when a load reaches a point around 3.5 A.

CAUTION: When the jumper is in the VIN position, only connect devices to the P18 and P19 ports that are rated for the voltage supplied to VIN.

7) power fault light

The red LED near the ⚠ symbol is used to to indicate when a power fault has occurred. When cyber:bot battery voltage is low, or power draw is too high (possibly indicating a short circuit on the breadboard), the LED will blink red. If the faults are resolved, the LED will continue blinking for a short period of time, then stay off as long as the faults do not occur again.

8) 3.3V and 5V access

Sockets alongside the breadboard provide access to regulated 3.3 V and 5V for circuit-building.

5V and 3.3 V switching regulators on the back of the cyber:bot board can deliver up to 1.8 A each, with a 6 to 24 volt input, although a maximum of 15 VDC is recommended. The 3.3 V regulator powers components of the cyber:bot board, as well as the the micro:bit module. The 5 V regulator always powers the P16-P17 ports, and optionally the P18-P19 ports.

If the power draw from either regulator exceeds 1.8 A, the regulator may temporarily decrease voltage or disable the output, then resume normal operations when the load is no longer present.

9) breadboard

This breadboard has 34 5-socket rows, arranged in 2 columns of 17 The columns are separated by a valley in the middle. Any two wires plugged into the same 5-socket row become electrically connected. The socket spacing is 0.1".

10) GND, D/A, A/D access

GND sockets may be used to to connect breadboard circuits to ground using jumper wires.

D/A sockets provide access to two digital-to-analog outputs from the Propeller microcontroller. D/A 0 is the analog output from P20, and D/A 1 is the analog output from P21.

The analog output voltage range is 0 to 3.3 V. When written as a digital I/O pin, a low output will produce 0 V and a high output will produce 3.3 V.

A/D sockets A/D 0, A/D 1, and A/D 2 provide direct access to three of the micro:bit module's analog to digital inputs; they are not connected to the Propeller microcontroller.

Nominal input voltage range is 0 to 3.3 V, when using USB power.

Maximum input voltage range will vary, when the cyber:bot board is powering the micro:bit module. The maximum measured voltage, under common conditions, will be around 3.0 V, and under extreme conditions it may drop to, but not below, 2.7 V and up to, but not above 3.3 V.

11) P20 & P21 LEDs

These yellow LEDs give a visual indicator of the output voltage at D/A sockets 0, for P20, and 1, for P21. The LEDs will vary in brightness with the analog voltage, with full brightness at 3.3 V. Setting either output as a digital high will set the corresponding LED to full brightness, and setting it as a digital low will turn off the corresponding LED.

12) I/O pin access

Access to Propeller I/O pins P0...P15. Use jumper wires to connect these I/O pins to circuits on the breadboard.

13) power switch

The power switch has 3 settings. LEDs below the switch will indicate the setting.

- 0 — Off. No LEDs lit.
- 1 — power to the cyber:bot board, right LED lit. This includes P0-P15 via the I/O pin access socket, and power to the micro:bit module.
- 2 — power available from position '1', as well as power to the servo ports; see [Servo Headers]

14) system access port

The system access port consists of eight plated thru-holes in a 2x4 group with 0.1" spacing. It is visible on the top of the cyber:bot board left of the NICERC logo, and the labels labels are on the back of the cyber:bot board.

The system access port allows for monitoring signals that the cyber:bot board uses internally. It is used, during manufacturing, for testing and programming.

System Access Port Pin Assignments

Label	cyber:bot function
SDA	Internal I2C Bus Data
SCL	Internal I2C Bus Clock
RES	Internal Reset
GND	Ground
NC	No Connection
GND	Ground
P31	Propeller internal serial bus input
P30	Propeller internal serial bus output

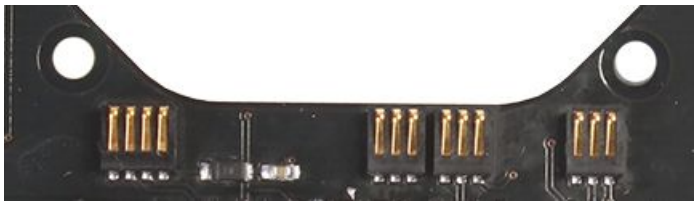
15) micro:bit connector

The spring pins on the underside of the cyber:bot board provide the electrical interface to a micro:bit module mounted underneath.

The micro:bit will run, on its own, when powered by a USB host or charger. When the cyber:bot board is powered and the power switch is in the '1' or '2' position, the cyber:bot board will provide power to the micro:bit, when USB power isn't available.

Left to right, the spring pins on the cyber:bot board connect to the micro:bit pin numbers in the table below. The micro:bit pin numbers and functions were taken from the following source:

https://microbit-micropython.readthedocs.io/en/latest/pin.html



micro:bit connector pin assignments

micro:bit pin number	micro:bit pin function	cyber:bot function
35	GND	GND
34	P20	I2C SDA
33	P19	I2C SCL
32	3.3 V Input	3.3 V Output
19	P2	A/D 2
18	No Connection	No Connection
17	No Connection	No Connection
15	No Connection	No Connection
14	P8	I2C Ready
13	P1	A/D 1
7	No Connection	No Connection
6	P4	Battery Monitor
5	P0	A/D 0

16) Propeller microcontroller system

The cyber:bot board includes a Parallax Propeller P8X32A multicore microcontroller system. The Propeller comes pre-programmed with cyberbot firmware that handles real-time I/O control, increasing the available I/O ports, managing servos, and providing functionality not otherwise available on the micro:bit module. The Propeller requires no programming by the user, communicating directly with the micro:bit over an I2C bus in the background.

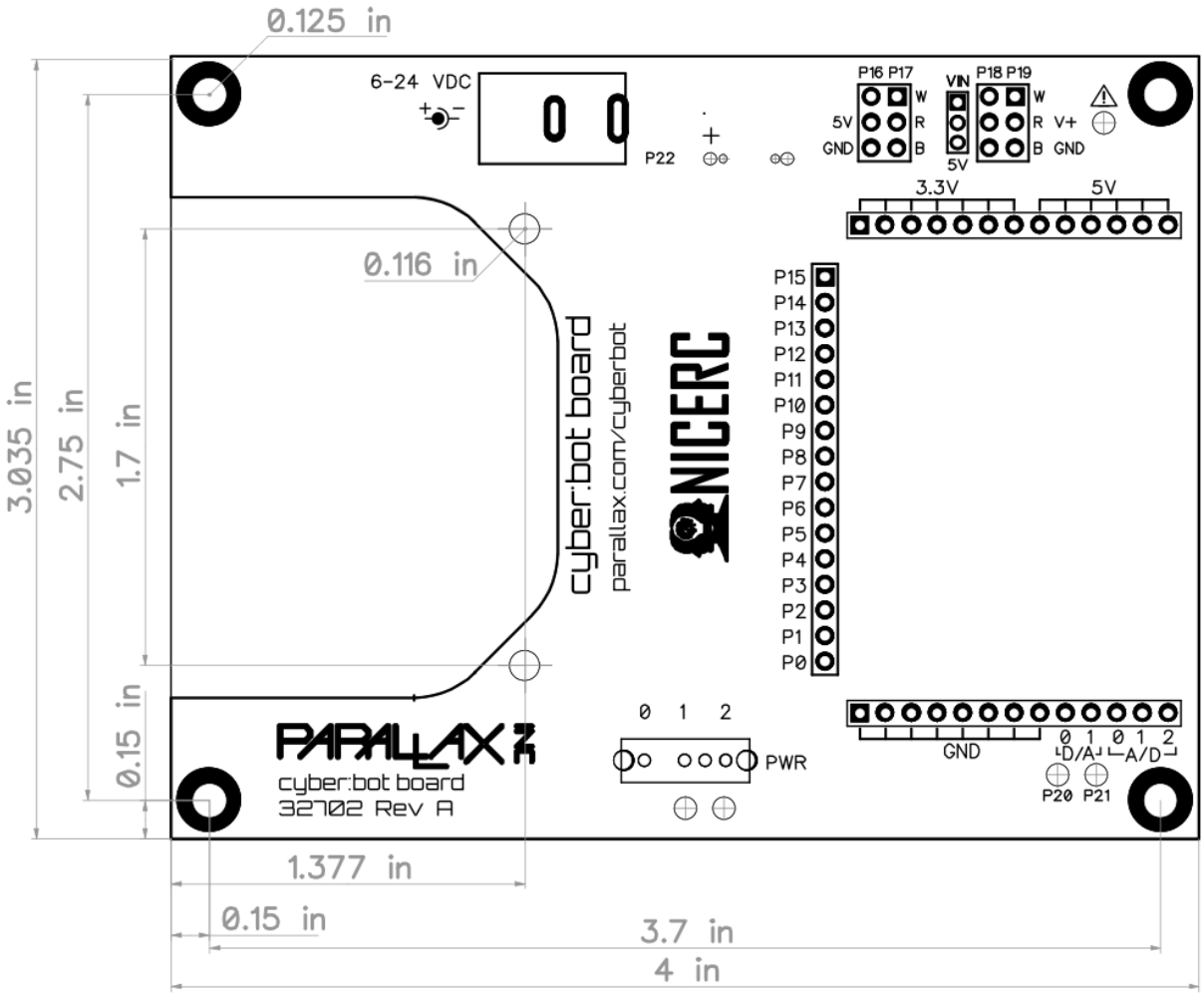
The Propeller support circuitry includes a 5 MHz crystal oscillator and a 64MB EEPROM for the cyber:bot firmware. The Propeller circuitry is powered when the power switch is in the '1' or '2' position.

The user has access to Propeller I/O pins P0-P22, as described in the table below, via micro:bit programs that use the cyber:bot API. See the cyber:bot tutorials and reference for details.

Propeller microcontroller I/O pin assignments

Pin	User Access	Function
P0–P15	Read/Write	General-purpose I/O access alongside the breadboard
P16–P17	Read/Write	General-purpose I/O accessible via the 3-pin ports, which have 5V fixed voltage supply.
P18-P19	Read/Write	General-purpose I/O accessible via the 3-pin ports, which have a selectable VIN/5V supply. Intended as servo ports for the cyber:bot system.
P20–P21	Write	Duty modulated D/A converter signals goes to: • Logic buffered yellow LED circuit for brightness control • DA0 (P20) and DA1 (P21) analog outputs on the header below the breadboard
P22	Write	Piezo speaker socket
P23		Internal I2C ready signal
P24		Internal voltage monitor
P25		Internal power-fault LED control
P26–P27		No connection
P28		I2C bus SCL
P29		I2C bus SDA
P30		Propeller internal serial bus output
P31		Propeller internal serial bus input

PCB Dimensions



Revision History

Version 1.0: original release.