

OpenBuilds® BlackBox X32 Specifications

Plug and Play easy connections that work directly with the OpenBuilds® Xtension wiring ecosystem

4 x High Powered 4.0A (Peak) Stepper Drivers

Up to 1/32nd Microstepping (Defaulted to 1/8 for higher torque)

Build in Cooling solution / through airflow design

Easy current adjustment

Capable of full 2/3/4-axes motion control

Dual configurable onboard Relays for Plasmas, Spindles, etc

Router (Enable) and VFD Spindle (Direction, Enable, 0-10v) Supported

PWM Output for Lasers

Servo Output for Pen Plotters

Up to 24v 5A Switched Output for Coolant or LED devices

3x Optocoupled Endstop Inputs with power supply (5/24v) suitable for passive or active mechanical, optical and inductive switches

1x Optocoupled XYZ Probe Input

Door sensor input

USB Interface for Plug and Play

WIFI Support

SD Card Support

High performance 32 Bit Processor

Easy V-Slot/C-Beam compatible mounting

Dimensions: 171mm (Mounting flange included) x 80mm x 36.4mm

Supported by OpenBuilds CONTROL software and all major CAM workflows

Powered by highly customizable and configurable GrblHAL Firmware

Product Information					
Product Name		BlackBox Motion Control System X32		Brand	Copper Pour
Model		CP-0005		Series Model	CP-0005
input voltage	24V	Input frequency	DC	Input current / power	24V 10A
Output voltage		24V		output current	10A
Modulation Type		BPSK/QPSK/16QAM/64QAM/DBPSK/DQPSK/CCK/GFSK Π/4-DQPSK 8-DPSK As per https://espressif-docs.readthedocs-hosted.com/projects/espressif-esp-faq/en/latest/hardware-related/RF-related.html		Antenna Type	Onboard the ESP32 Module
Antenna gain		2dBi		Work temperature	-40°C to +125°C
Voltage Range		5V			

Introduction to the OpenBuilds BlackBox Features

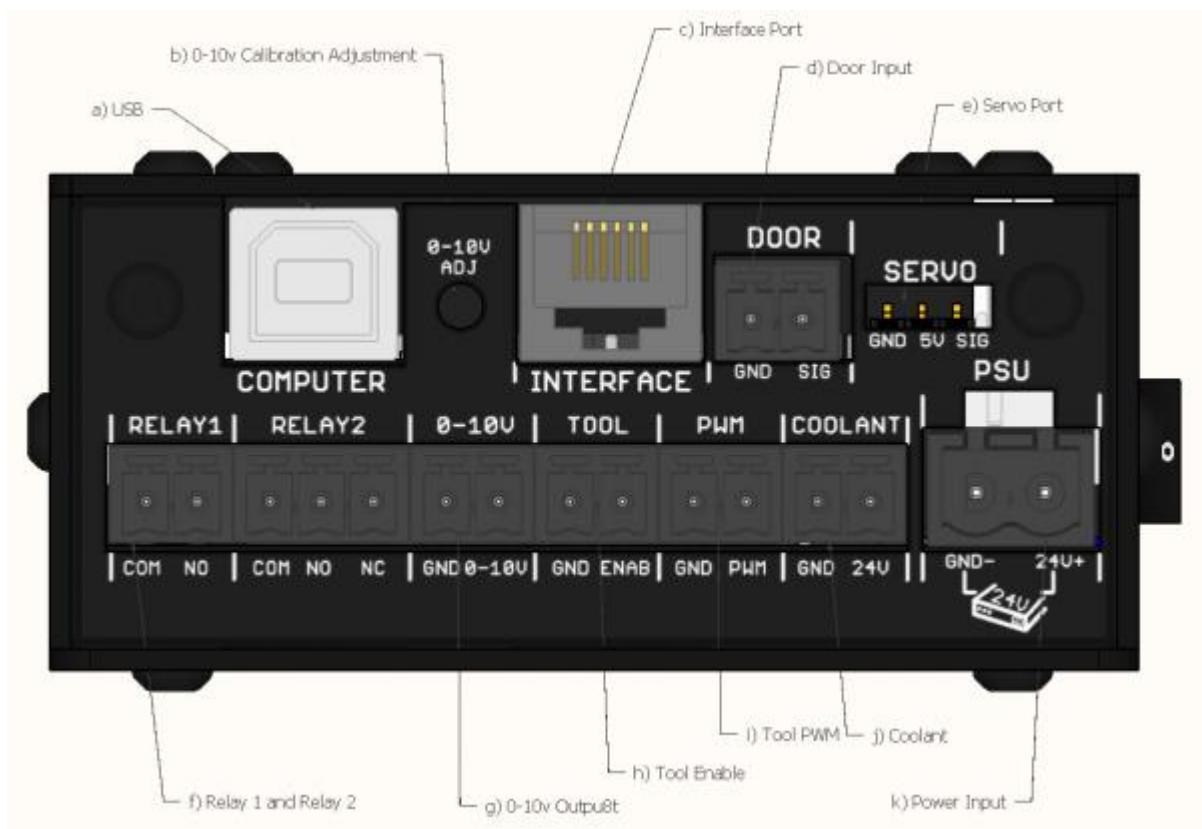
1. Front Side



- a) USB LEDs: Flashes in Blue/Green to indicate serial data transmit/receive traffic
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- b) Power Switch: Used to turn the Main Power off, can be used in case of an emergency to bring the machine to an immediate stop
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- c) Status LEDs
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- Door LED: On when the Door input signal is active
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- Tool On: Indicates the Tool is Enabled
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- Tool PWM: Shows the proportional RPM or output power of the PWM/0-10v outputs
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- Coolant LED: Shows status of the Coolant signal (M8 = on, M9 = off)
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- Probe LED: Lights up when the Probe Input activates
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- Motors Enabled LED: Indicates when the firmware has the Motor Drivers Enabled. In Grbl Settings set \$4=1 (required for BlackBox drivers to function correctly) and \$1=255 (to keep motors always enabled)
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- d) Mode and Reset Buttons: Reset: Restarts the Firmware; Mode button used to put microcontroller into Bootloader mode
- e) Power LED: If the Power LED is Green: Power Input OK
- f) Current Adjustment: Adjust stepper driver current, see Section [2.2.1 Current Adjustment](#)
- g) Fault Indicators: Indicates a problem with the stepper driver on the relevant axis: The LED indicates
 - Overtemperature Fault: Adjust current down a little, Check Fan
 - Overcurrent Fault: Adjust current down a little
 - Short Circuit Fault: Check Wiring
 - Undervoltage: Check input Voltage

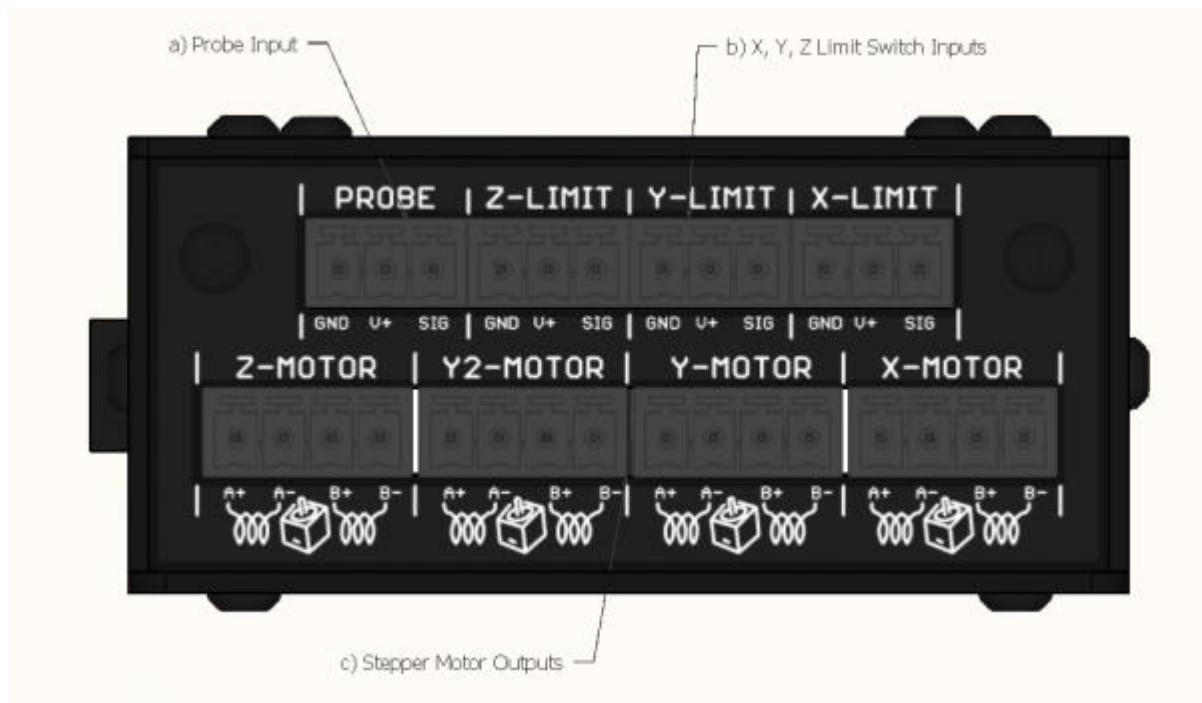
2. Left Side



- a) USB: Port for connecting the controller to your computer
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- Drivers: Section 4.1 Install Device Drivers
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- Troubleshooting: Section 6.3 Troubleshoot USB Connection / Firmware Not detected
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- b) 0-10v Calibration: Used to calibrate the 0-10v Spindle control signal
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- Calibration: Section 3.3.5 0-10v Analog Signal / VFD
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- c) Interface Port: For connecting to accessories
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- d) Door Switch Input: (Advanced feature) Refer to Section 3.6 Connect Door Sensor
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- e) Servo: Used for pen-plotter applications: See Section 3.3.6 RC Servo

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- f) Relays
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- Relay 1: Normally Open SPST relay, by default configured as Tool Enable (Plasma trigger, VFD Enable, etc)
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- Relay 2: Normally Open SPDT relay, by default configured as Tool Direction (VFD Direction, etc)
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- g) 0-10v Output: Typically used with VFD Spindles. See Section [3.3.5 0-10v Analog Signal / VFD](#)
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- h) Tool Enable: 0/3.3V signal reflecting tool on/off state. Typically used as a logic signal for switching a Mains relay / IoT relay for spindle control
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- i) Tool PWM: 0-3.3v PWM signal reflecting tool rpm/power. Typically used a PWM signal for DC motor controllers, Lasers, etc
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- j) Coolant: General output, switchable with M8/M9, refer to Section [3.7 Coolant Output](#)
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- k) Power Input: Connect to 24v Power Supply. Double check polarity before powering on. See Section [3.1 Connect Power Supply](#)
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3. Right Side



- a) Probe Input: Connect to a Probe, see Section [3.5.1 OpenBuilds XYZ Probe Plus](#) and [3.5.2 OpenBuilds Z Touch Plate](#) as well as more information on [XYZ Probe Plus Documentation](#)
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- b) Limit Switch Inputs: Connect Limit switches: See Section [3.4.1 OpenBuilds Xtension Limit Switches](#) and [3.4.2 Micro Limit Switch Kit](#)
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- c) Stepper Motor Outputs: Connect motors: See Sections [3.2.1](#), [3.2.2](#) and [3.2.3](#) for connection details, and [6.1 Identify Motor Coils](#) for troubleshooting information
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This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications.

However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception,

which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

To maintain compliance with FCC's RF Exposure guidelines, This equipment should be installed and operated with minimum 20cm distance between the radiator and your body: Use only the supplied antenna.