What is all this stuff???
Visual SA BEST Return Kit Reference

These pages list the SA BEST Return Kit (RK) items, and include photos for clarification. For more information regarding control system hookup (and other useful info), please refer to the resources available on your workflow and at the following locations:

Education and Training for the BEST Robotics community (bestedu.bestrobotics.org)

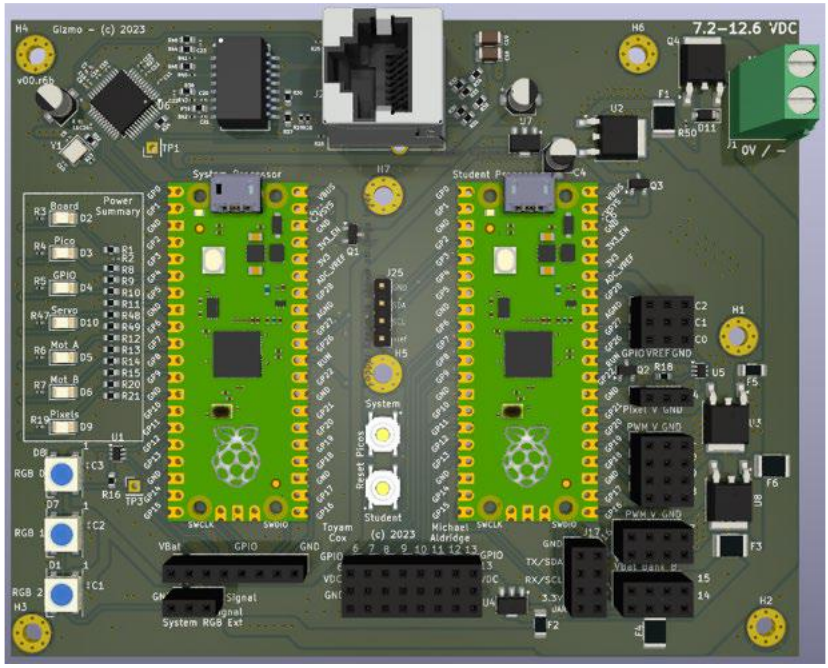
Gizmo landing page, Gizmo Mechatronics Platform (gizmoplatform.org)

Links under "Resources" to documentation, software development, and forums.

Gizmo – *new for SA BEST in 2025!***:**

This is the "brain" of the control system. There is firmware installed on the system processor. Teams will only access the system processor if they need to re-bind the Gizmo to a driver station. Teams may download software to the student processor. There is a BEST default program pre-loaded to help you get started.

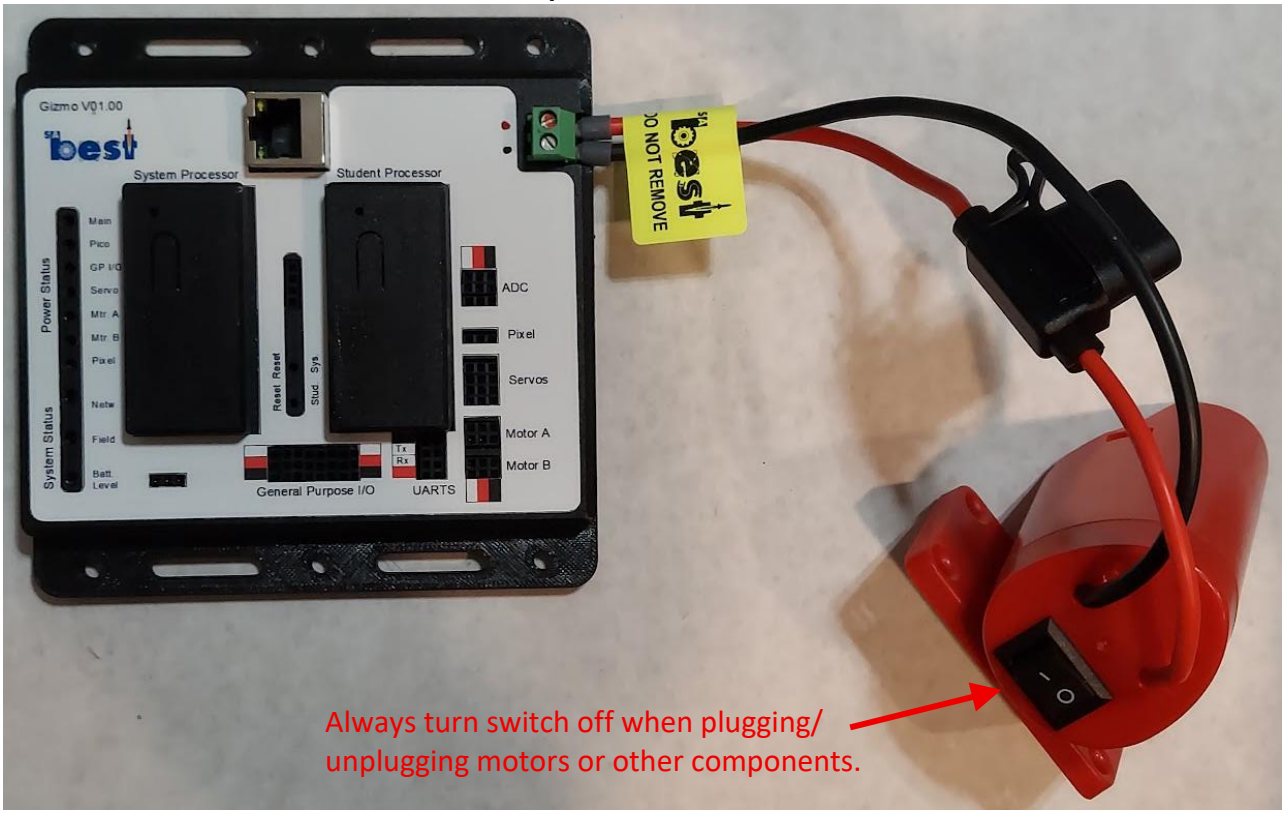
What's inside the case, Gizmo board + Picos:

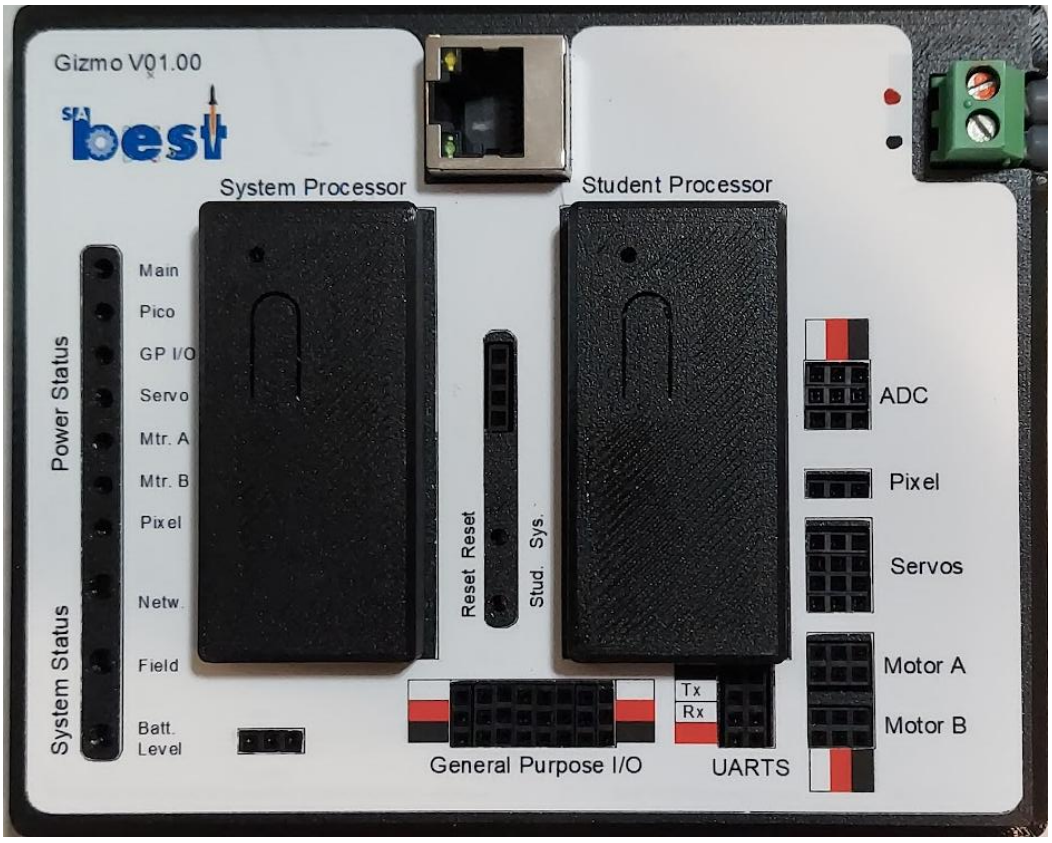


Your SA BEST-provided Gizmo has an attached battery connector that includes a power switch. ALWAYS turn off power when plugging/unplugging motors or other components.

Read through the Gizmo basics document (The_Team_Experience_v6.SA.pdf) available in your workflow for more info about the Gizmo system.

Gizmo as-provided to team:





The Gizmo is delivered to you with the BEST default program installed, which includes the following setup:

BEST Gizmo Default Program (Tank Mode)

Port & Function	Logitech F310 Controller	Description
Not Used	Not Used	None
Servo 3	Not Used	None
Servo 2	Not Used	None
Servo 1	Left Trigger Left Shoulder None pressed	Move servo to 0 degrees Move servo to 90 degrees Servo defaults to 45 degrees
Motor 4	Right Trigger Right Shoulder	Move motor forwards Move motor backwards
Motor 3	Right Joystick (Fwd/Rev)	Move motor forwards or backwards
Motor 2	Not Used	None
Motor 1	Left Joystick (Fwd/Rev)	Move motor forwards or backwards
	Start Button	Toggle Tank vs. Arcade Mode

BEST Gizmo Default Program (Arcade Mode)

Port & Function	Logitech F310 Controller	Description
Servo 4	Not Used	None
Servo 3	Not Used	None
Servo 2	Not Used	None
Servo 1	Left Trigger Left Shoulder None pressed	Move servo to 0 degrees Move servo to 90 degrees Servo defaults to 45 degrees
Motor 4	Right Trigger Right Shoulder	Move motor forwards Move motor backwards
Motor 3 (mixed w/Motor 1)	Left Joystick (Fwd/Rev) Left Joystick (Left/Right)	Move forwards or backwards Turn left or right
Motor 2	Not Used	None
Motor 1 (mixed w/Motor 3)	Left Joystick (Fwd/Rev) Left Joystick (Left/Right)	Move forwards or backwards Turn left or right
	Start Button	Toggle Tank vs. Arcade Mode

Note: this is the "out-of-the-box" configuration, and may be used to control a functioning robot… BUT, you can tailor the robot function (*i.e.*, make it easier to drive, and/or do some other cool stuff) if you delve into custom programming using one of the options available to BEST teams (refer to separate documentation on installation and use of the programming environments):

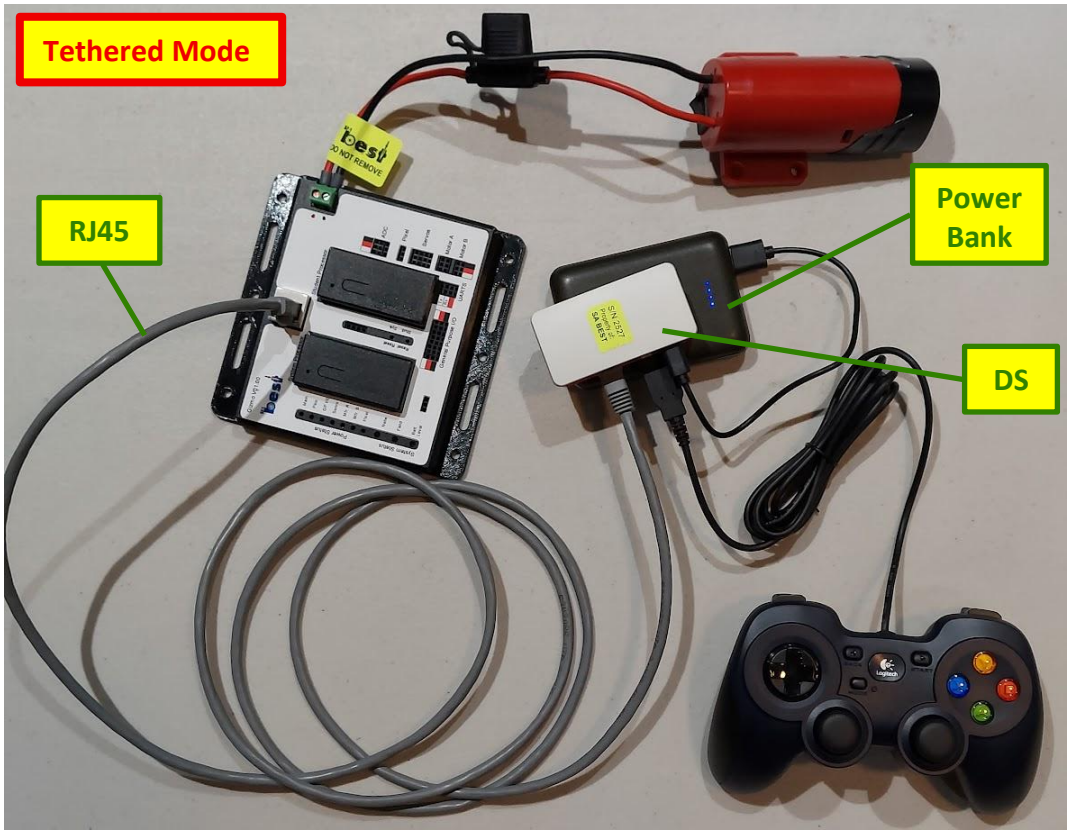
Driver Station (DS) and Joystick:

The joystick & driver station allow a driver to control the robot in several configurations:

Tethered: RJ45 ethernet cable between DS and Gizmo.

Wireless practice mode: DS communicates with Gizmo wirelessly.

Wireless competition mode: DS attaches to Field Management System to communicate with Gizmo on the game field. When not on the field on game day, teams will use the tethered mode.



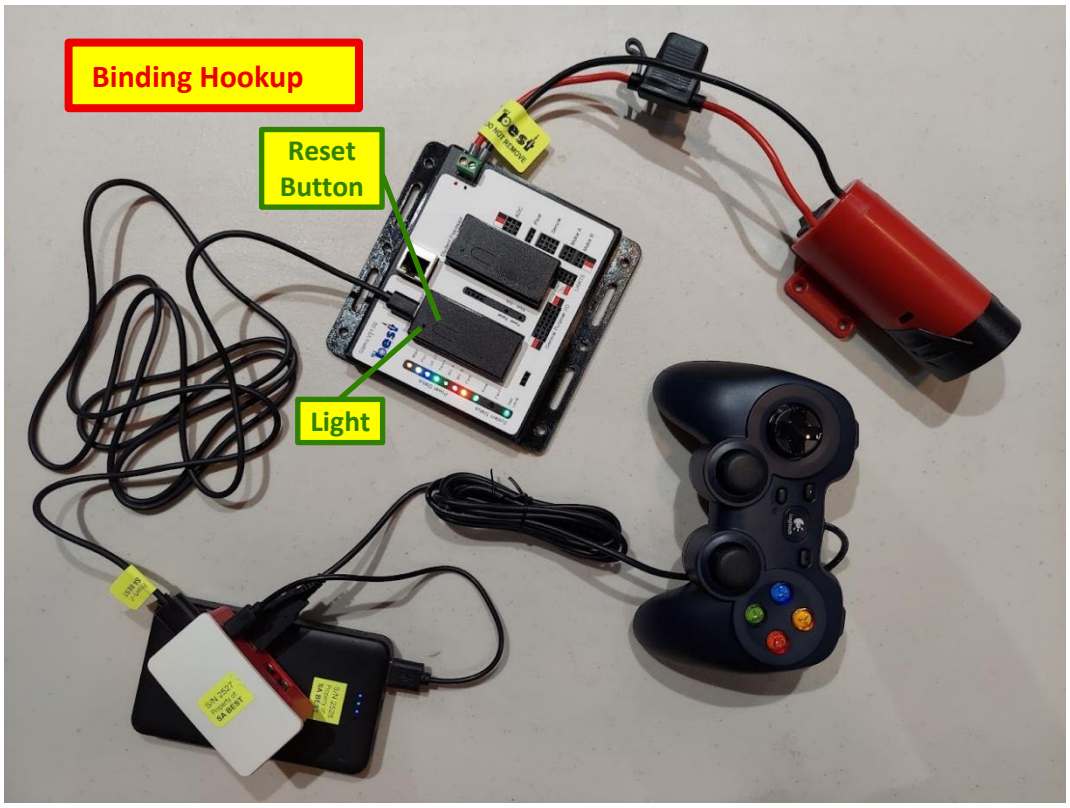
Power Bank (w/ USB–micro charge cable) – provides power for the driver station and Joystick. Recharge with the included USB–micro charge cable.

Note: SA BEST has included a USB switch in your kit. It may be convenient to install this between your power bank and the USB-micro powering the DS. Then you can cycle the power on the DS without plugging/unplugging cables.

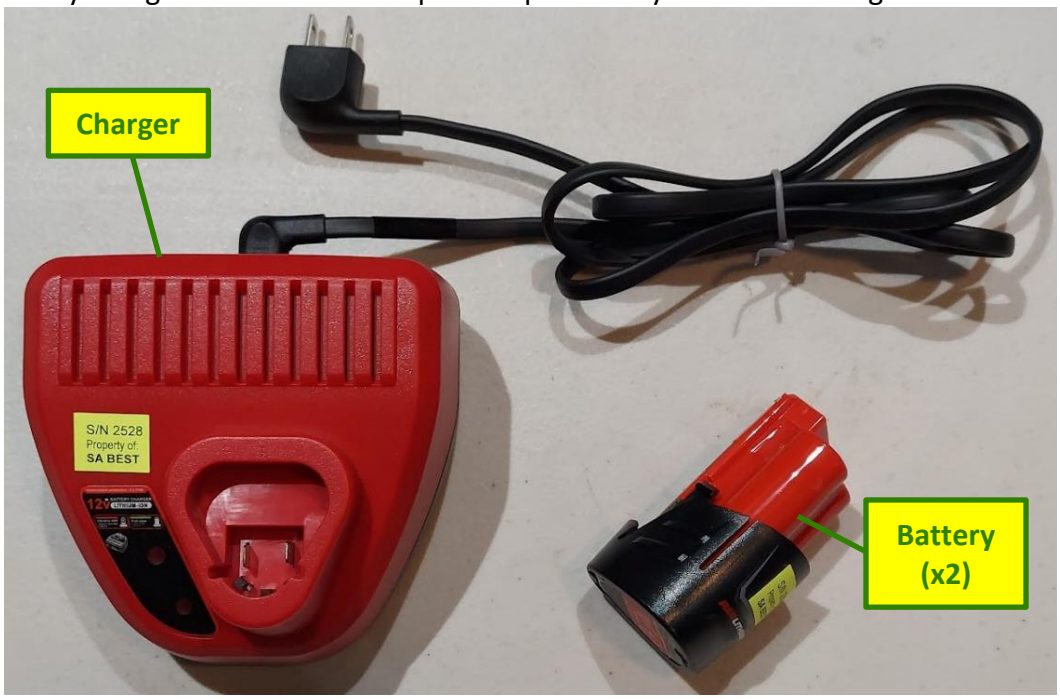
Binding: The Gizmo and DS must be properly "bound" for the communications to work. Team Gizmo/DS were bound prior to distribution, and the most reliable method is described below.

1) Power up the driver station (plug USB-micro from power bank to DS, make sure that power bank is on!). You should see lights on the ethernet port of the DS. Wait 15 seconds or so to make sure the DS has booted up.
2) There is a switch on the back of the joystick, make sure that it is in the "D" position. Plug the joystick into the DS, using the USB port near the DS power port, as shown in the "Binding Hookup" figure below.
3) Install a battery into the Gizmo, leave power off for now.
4) Plug a USB-micro data cable into the camera port of the DS and plug the micro end into the System Processor port on the Gizmo, as shown in the "Binding Hookup" figure.
5) You should see the green light on the System Processor blinking, wait a few seconds, then turn on the Gizmo.
6) The Gizmo lights may flash. If the Gizmo is properly bound in practice mode, you will see a green "Network" light and a white flashing "Field" light. Both lights flashing red means that the Gizmo has not been bound to any DS. Both lights flashing purple means that the Gizmo is waiting to be bound to a new DS. If you don't get the green network and white flashing field light within a minute or so, push the button (next to the light on top of the system processor) for about 2 seconds to reboot the processor.

NOTE: Not all USB-micro cables are data cables. Most are power only and will not work for the Gizmo data connection. The 6-ft USB-micro cable provided in your kit is a data cable.



12V Battery Charger (w/ power cable) and Batteries – standard power tool 12V batteries and battery charger. These batteries provide power to your robot through the Gizmo.



MOTORS:

Large Motor (x2):

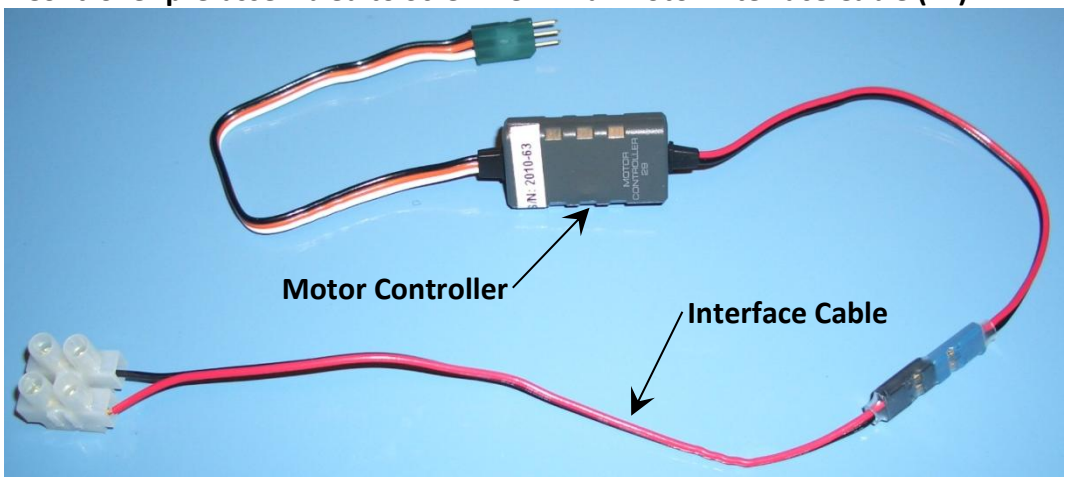
Small Motor (x2):

Wires must be attached to the motors using crimp-on connectors from your BEST consumable kit (*hint:* look in bag #3 inside the small box within your consumable kit).

>>> ***do not solder wires to the motors*** <<<

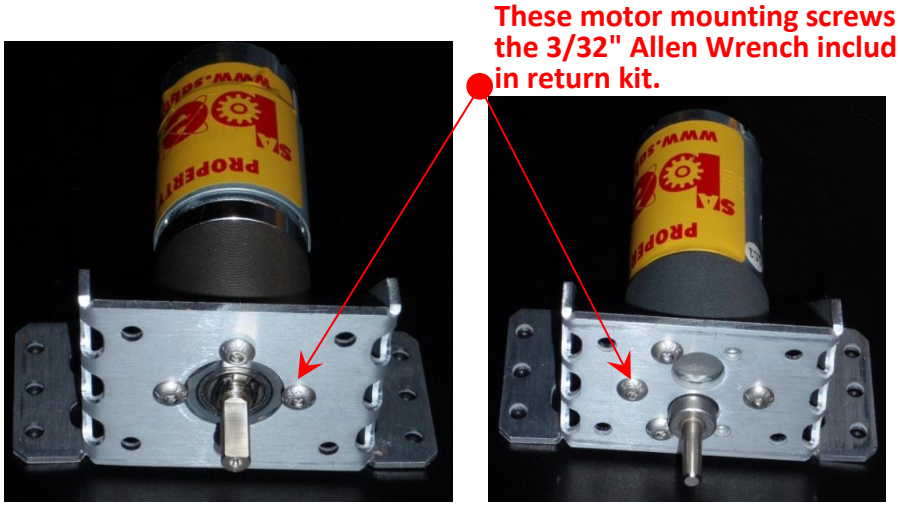
Motors may only be connected to the Gizmo using an External Motor Controller: motor leads attach to (screw terminals of) a **Screw Terminal Motor Interface Cable** attached to an **External Motor Controller**, which attaches to any Gizmo motor port 1 through 4. NOTE: the external motor controllers in your SA BEST RK have been pre-assembled (using heat-shrink) to the screw terminal motor interface cables, for improved reliability – please do not disassemble them.

Motor Controller pre-assembled to Screw Terminal Motor Interface Cable (x4):



Note: do not disassemble this unit. Contact SA BEST for replacement if not working.

Motors may be mounted using the brackets & included screws from your consumable kit (NOTE: an Allen wrench is included in this return kit that fits these screws), with the screws going into the threaded holes on the face of the motor (surface near the motor shaft). *Although these holes will accept other 8-32 machine screws from your BEST consumable kit, the other screws are too long and can damage the motors.*

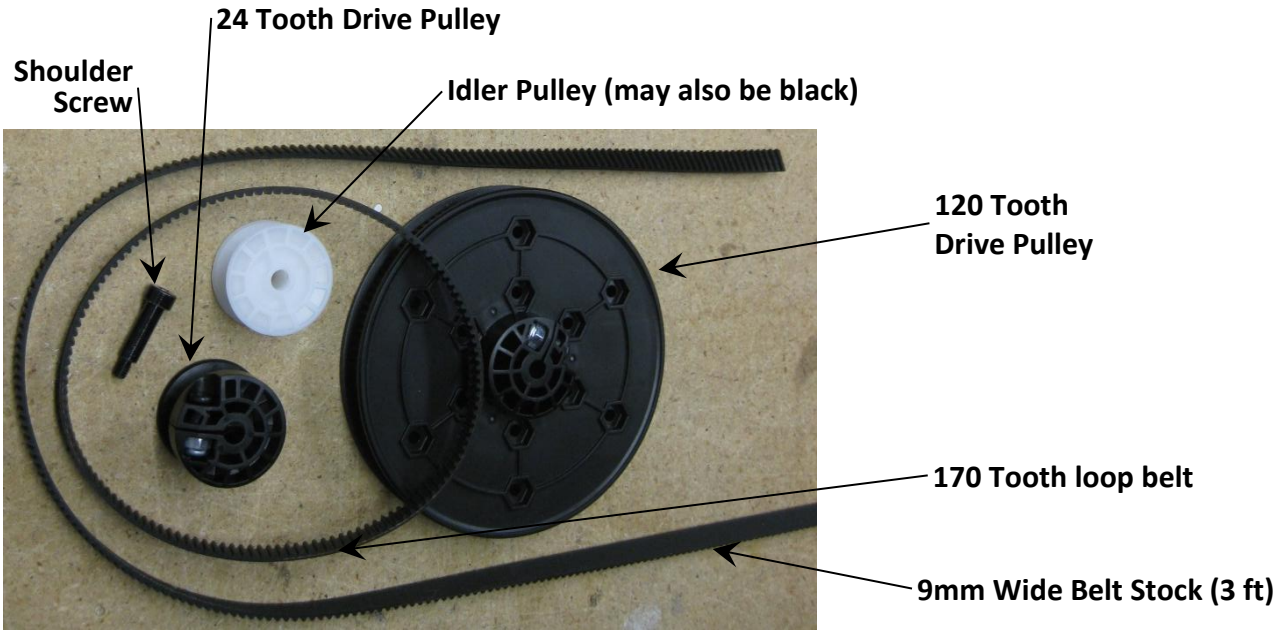


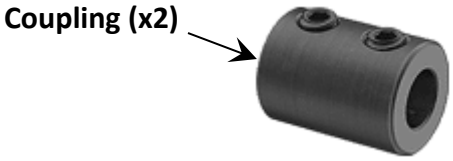
2-Wire Screw Terminal Sensor Interface Cable (x5) – black & white, typically used for digital input connection (like a consumable kit microswitch) to the Gizmo.

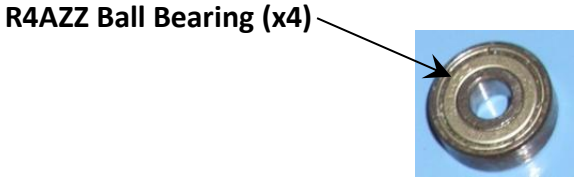
3-Wire Screw Terminal Sensor Interface Cable (x3) (not pictured), similar to the 2-wire, but with a 3-terminal block, and a red wire between the black & white ones. Typically used for analog input connection (like a consumable kit potentiometer) to the Gizmo.

DRIVE PARTS:

Do not drill holes in or otherwise modify any of the pulleys or loop belt. *Do not **glue*** anything to any of the pulleys or loop belt. The 3 ft length of belt, however, *may* be cut, glued, etc.

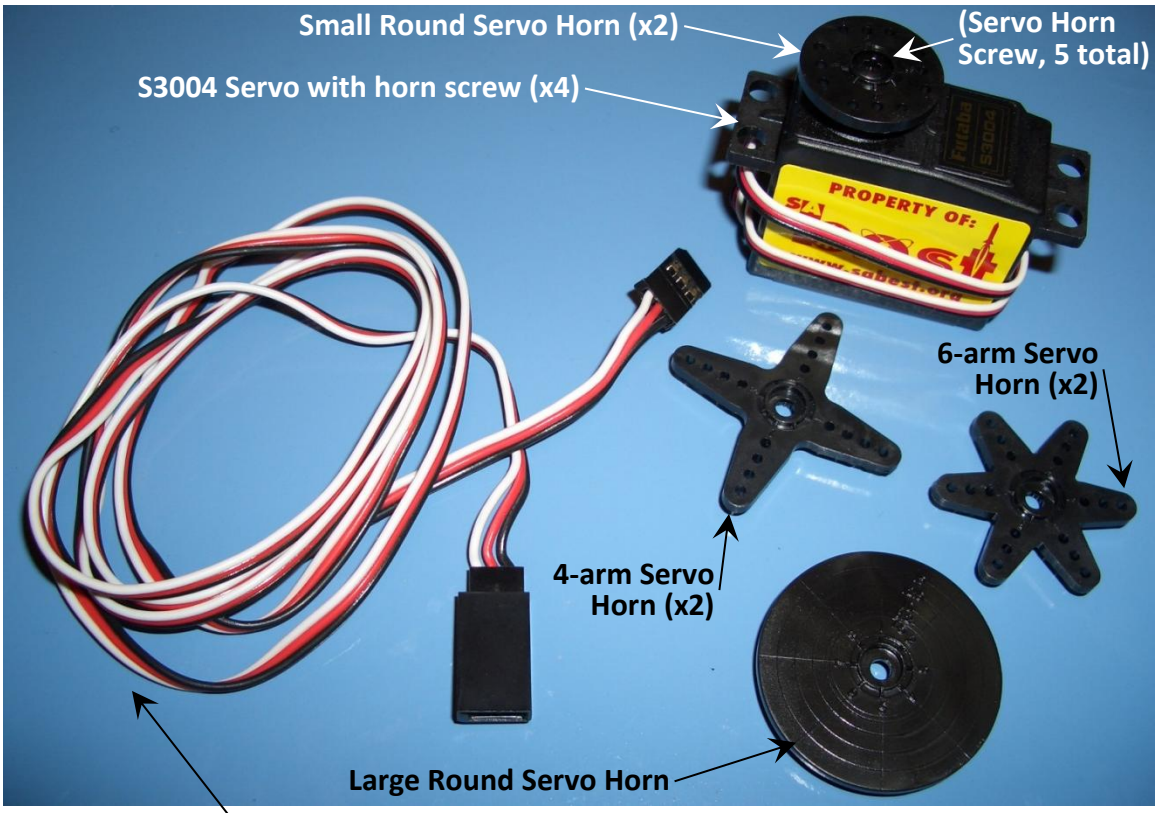






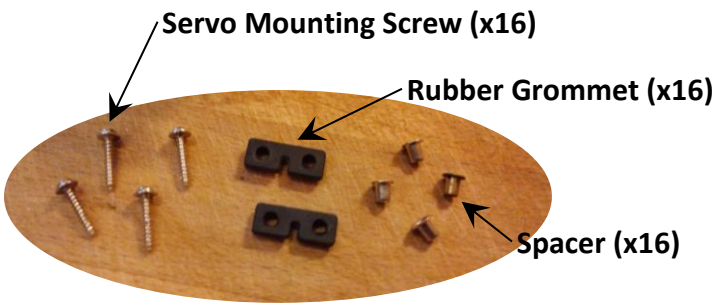
SERVO PARTS:

Provided Servos have been modified to add pins at the end of the servo cable, so that they can plug directly in to the Gizmo ports. Servos may plug in to any servo channel 1 – 4. Use the servo mounting hardware (grommets/ spacers/mounting screws) to mount the servos to your robot.



Servo Extension Wires:
3x 6" long
5x 24" long
2x 40" long
Note: Servo extension wires may also be used with the IR sensors.

Servo Mounting Hardware:



NOTE: Servo extension wires are specifically to be used for servos and the IR sensors. They **may NOT** be used to attach to motor controllers. The wires are not large enough to handle the higher electrical load.

Infrared (IR) Sensor Kit (x3) – These sensors require assembly including soldering. Please read through the "BEST IR Sensor Assembly Instructions" document, and associated soldering information, prior to opening sensor kit package. If you are new to soldering: practice, practice, practice before attempting assembly of the sensor kit.

Return all IR sensors to SA BEST, whether or not you opened / assembled / used them. If you choose not to use one or more sensors, please leave the package(s) unopened and return them as-is (also return sensor(s) you did assemble and use!).

Note: Servo Extension Wires (SEWs) may be used with the IR sensors or with the Servos. Typically, a SEW is used to connect the IR receiver to a Gizmo digital I/O port, and another SEW is used to connect the IR transmitter either to the IR receiver or to a Gizmo digital I/O port.

Additional information on the BEST control system and ways to assemble it may be found in your workflow. Look for files labeled "Kit info", including the SA BEST Kit Overview Presentation.