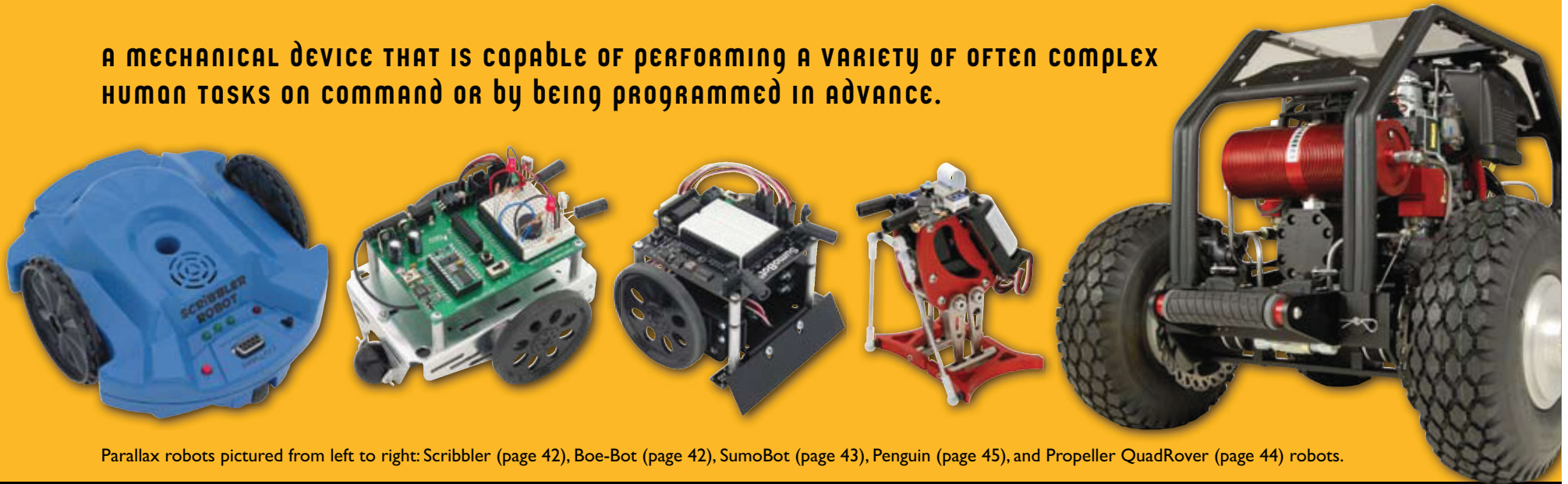# ROBOT:

A mechanical device that is capable of performing a variety of often complex human tasks on command or by being programmed in advance.

Parallax robots pictured from left to right: Scribbler (page 42), Boe-Bot (page 42), SumoBot (page 43), Penguin (page 45), and Propeller QuadRover (page 44) robots.

A young robot enthusiast programs a Scribbler robot.

A teacher plays "follow the leader" with Boe-Bot robots.

OSURC's custom QuadRover modification (see page 44).

ROLL:

to move along a surface by revolving or turning over and over, as a ball or a wheel

Scribbler Robot - #28136; $79.99

Perfect for beginners age eight and up, this reprogrammable robot comes fully assembled including a built-in BASIC Stamp 2 microcontroller brain. It arrives pre-programmed with eight demo modes and can be programmed in pictures with the Scribbler Program Maker GUI or with text via the BASIC Stamp Editor. *Scribbler components:*

• 3 photoresistor light sensors
• 2 Infrared object sensors
• 2 Infrared line detection sensors
• 2 independent DC motors
• Stall sensor
• Speaker with full range of notes
• 3 LED indicator lights

The Scribbler Robot kit includes: fully assembled Scribbler robot, programming cable (Serial), Scribbler Robot Start-up Guide, software and documentation on CD-ROM. *Requires 6 AA alkaline, standard or NiMH batteries, not included.*

Best Seller! Boe-Bot Robot Kit (Serial with USB Adapter) - #28132; $159.99

**Best Seller! Boe-Bot Robot Kit (USB) - #28832; $159.99**

What makes the Boe-Bot great is the BASIC Stamp microcontroller's flexibility of programming when coupled with breadboard circuit construction. Following along in Robotics with the Boe-Bot, users quickly learn about embedded projects, from wiring and components to programming and mechanical dependencies. The kit includes a set of passive components (wires, resistors, capacitors), sensors (photoresistors, bumpers, infrared sensors) and hardware (whisker touch-sensor kit) to complete the different projects.

The Boe-Bot robot is built on a high-quality brushed aluminum chassis that provides a sturdy platform for the continuous rotation servo motors and BASIC Stamp 2 on a Board of Education. Many mounting holes and slots may be used to add custom robotic equipment or off-the-shelf Parallax add-ons. The rear wheel is a slider ball held in place with a cotter pin. Drive wheels are molded to fit precisely on the servo spline and held in place with a small screw.

The Boe-Bot robot takes about 1-2 hours to put together, though each project in the *Robotics* text provides a unique new experience of wiring and source code tuning. Completing the entire set of projects takes 50 hours and is suitable for anybody over 12 years of age. The Board of Education (and BS2-IC) may also be removed to be used as your platform for the other kits in the Stamps in Class series (see).

We're particularly proud of Andy Lindsay's *Robotics with the Boe-Bot* text. The text includes 41 activities for the Boe-Bot robot with structured PBASIC 2.5 source code support and bonus challenges with solutions in each chapter. Starting with basic movement and proceeding to sensor-based projects, customers quickly learn how the Boe-Bot is expandable for many different robotic projects. No previous robotics, electronics or programming experience is necessary.

A great resource for STEM programs!
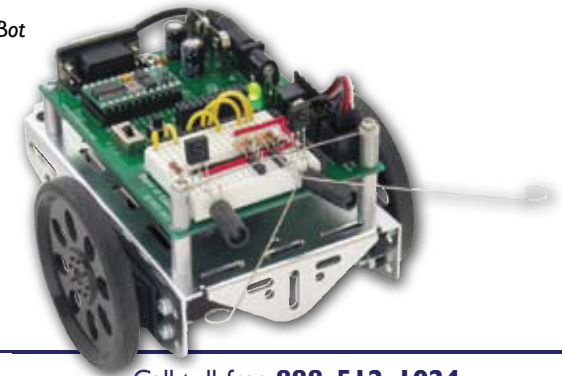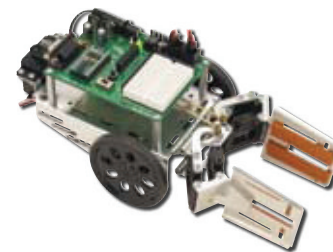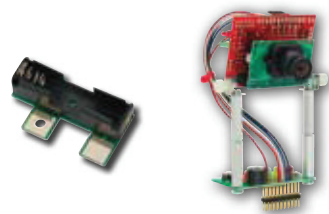
The **Tank Tread Kit** (#28106; $34.99) gives your Boe-Bot robot the ability to traverse unfriendly terrain. Simply remove the wheels and attach the gears and treads.

The **Boe-Boost** (#30078; $4.99) increases the battery capacity of the Boe-Bot from four to five AA cells.

Track images by detecting color with the **Boe-Bot CMUcam** (#30051; $139.99), designed specifically for our Boe-Bot robot.

The **QTI Line Follower Kit** (#28108; $29.99) mounts underneath the front of the Boe-Bot chassis and uses infrared emitter/receiver modules to provide line following capability. Four sensors included.

The **Crawler Kit** (#30055; $24.99) attaches easily to your Boe-Bot and runs on standard Boe-Bot source code with only minor adjustments for ground speed. Sample PBASIC code available online.

The **Gripper Kit** (#28202; $54.99) adds pick-up and carry capability to your Boe-Bot. It features parallel plates that open, clamp onto, and lift objects all with one cleverly utilized Parallax Standard Servo.

The **Digital Encoder Kit** (#28107; $39.99) answers a customer request for wheel position feedback used to improve dead-reckoning, solve mazes, contests, and map paths of travel.

Best Seller! SumoBot Robot Competition Kit (Serial with USB Adapter and Cable) - #27402; $219.99

Build and program two SumoBot Robots designed to wrestle in the mini-sumo competition ring! The electronics consists of a surface-mounted BS2 module and an array of infrared sensors to detect your opponent and the edge of the Sumo Ring. Additional components include piezospeakers, resistors, pushbuttons and LEDs to build custom breadboard circuits for program mode selection and sensor state feedback. The hardware package includes black anodized aluminum chassis and scoops, servo motors, wheels, two battery packs (8 AA batteries not included), mounting standoffs, and screws for two complete robots.

This kit comes with two printed texts. The *SumoBot Manual* has assembly instructions and test programs that take you from basic moves to one-on-one combat. When your bots are up and running, give them a competitive edge and expand your skills by following the step-by-step activities in *Applied Robotics with the SumoBot* - an advanced text in our Stamps in Class series. Activities include friction analysis, self-calibrating sensors, memory optimization with multipurpose variables and a sensor flags register, and state-machine diagrams for sensor-based navigation. EEPROM data logging lets you record your robot's sensor and program states during a match, then display them afterward in the BASIC Stamp Editor's Debug Terminal - an excellent way to troubleshoot and analyze the performance of your program strategies.

Hold your wrestling matches on the durable 36 x 36 in. SumoBot Robot Competition Ring Poster, designed to use with the instructions and programs included in *Applied Robotics with the SumoBot*.

SumoBot Robot Kit (not pictured) - #27400; $159.99
Includes electronics, hardware and components for single robot, serial programming cable, and SumoBot Manual.
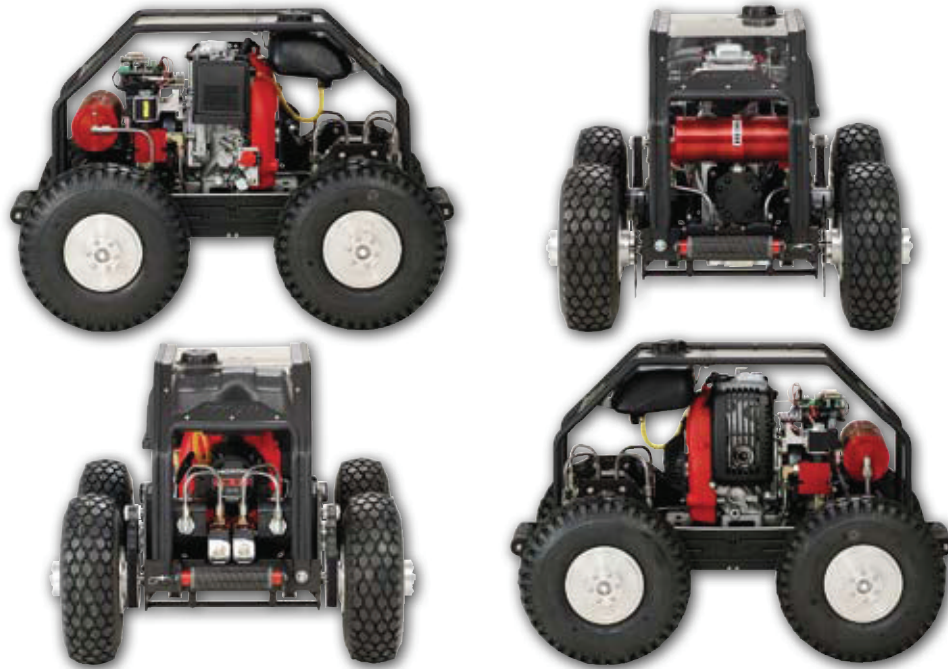
Propeller QuadRover Robot - #28195; $4,999.00

This gas-powered robot is built using a Honda 2.5 HP 4-stroke engine and hydraulic power system. It is controlled by a Propeller chip for the ultimate in customizable robots; eight 32-bit cogs at 20 MIPS each create endless programming possibilities. A 64 KB EEPROM leaves 32 KB for non-volatile data storage, and ample expansion ports provide plenty of flexibility for added sensors.

Four solenoid valves allow for the hydraulic power to be independently enabled, disabled, or reversed for either side of its skid steer system. The robot can rotate in position by making a complete hydrostatic turn or by braking one side and making an arc-turn, which can be accomplished at low or high speed. Straight-away top speed is up to 12 miles per hour. Servo controlled throttle and disk brakes make for precise acceleration and deceleration.

The Propeller QuadRover robot ships fully assembled and ready to program. The electronics include a Propeller-powered control board with connections for GPS, compass, and 3-axis accelerometer sensors. A remote is also included. Prior to operation the user needs to add the hydraulic oil and gasoline, load the Propeller program and perform benchtop testing. This process requires up to a full day. Shipping package measures approximately 29 x 19 x 23 in (73 x 48 x 58 cm). Robot weighs 89 lbs. (shipping weight 135 lbs.).

OSURC and the Propeller QuadRover

In early 2008, Parallax supplied students from the Oregon State University Robotics Club (OSURC) with a Propeller QuadRover and armed them with a few electronic parts to get them on their way. In June 2008, at the Mars Desert Research Station in Hanksville, Utah, the team won Grand Prize in the NASA University Mars Rover Challenge! Combining their knowledge, creativity and determination with the toughness and reliability of the Propeller QuadRover, the team was able to take first place in 3 of 4 tasks to take the overall win. Oregon State was pushed over the top by being the only team to successfully locate the "distressed astronaut" during the navigation challenge. Congratulations!

WALK:

to advance or travel on foot at a moderate speed or pace; proceed by steps

Penguin Robot Kit (Red) - #27313; $199.99
Penguin Robot Kit (Blue) - #27314; $199.99
Penguin Robot Kit (Clear) - #27315; $199.99
Penguin Robot Kit (Black) - #27316; $199.99

The Penguin robot is a precision-machined 4 inch tall biped with an embedded BASIC Stamp 2px24 microcontroller. The Penguin walks forward with a tilt-stride action and turns by sweeping both feet on the ground in opposite directions. This basic biped design works best in the Penguin's small scale. The Penguin's parts have a close-tolerance fit and are designed to make use of precise electronic control. Set aside three hours to assemble a Penguin robot.

Writing code for the Penguin is easy. First, the servo center and tilt/stride limits are set and written to EEPROM using the "Penguin-ServoCalibration.bpx" program from our web site. Subsequent programs use the values stored in EEPROM, making it easy to share Penguin code without having to adjust servo PULSOUT constants in each program.

Sensors are added into the subroutines, and a direction of travel is executed by assigning a value to the WALK variable (forward, back, left or right). Sensors are monitored between walking movements, without the headache of linking walking movements being handled by the rest of the PBASIC program.

The Penguin robot performs best on your desk or other hard surfaces. It is not designed for long-distance adventuring across thick carpet, but a tight, low-pile carpet is an acceptable walking surface. The Penguin's electronics are fully assembled and wired to an assortment of sensors and output devices.

Two CR-123A lithium batteries are included in the kit, and also sold separately (#752-00003; $2.75).

IN CONTROL:

TO EXERCISE AUTHORITATIVE OR DOMINATING INFLUENCE OVER; DIRECT

What kind of motor would you like to control? Parallax provides a variety of motor controllers for your latest application. Coupled with one of our microcontrollers, these motor controllers provide you with an efficient setup.
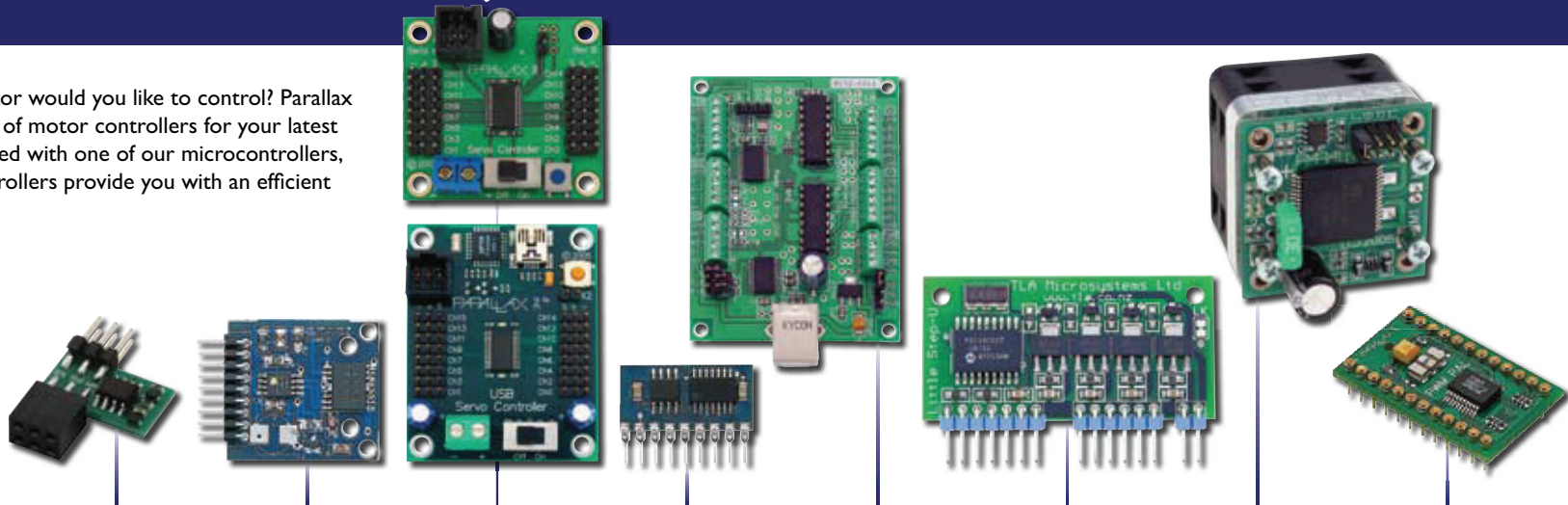
PRODUCT	ServoPAL	Motor Mind B	Parallax Servo Controller	Micro Dual Serial Motor Controller	BiStep Motor Controller (USB)	Little Step-U	HB-25 Motor Controller	PWMPAL
Stock Code; Price	#28824; $19.99	#27961; $29.99	Serial; #28023; $39.99 USB; #28823; $39.99	#30052; $23.99	#27969; $109.99	#27938; $69.99	#29144; $49.99	#28020; $29.99
Ease of Use	●●●●●	●●○○○	●●●○○	●●●●○	●●○○○	●●○○○	●●●●○	●●○○○
Motor Type	Servos	DC Motors	Servos	DC Motors	Unipolar and Bipolar Stepper Motors	Unipolar Stepper Motors	DC Motor	DC Motors/Servos
# of Motors	2	1	16 (32 w/2 PSC units)	1 or 2	1 or 2	1	1 (or 2 turning in the same direction)	4
Amps & Volts	6.5 VDC	30 V; 3.5 A peak, 2 A continuous	4 - 7.5 V	1.8 - 9 V @ 1 A Peak/Motor	6.5 to 15 V; 1 A	35 V; 3 A	6 - 16 V; Up to 25 A continuous	0.3 Hz; Up to 20 kHz

* Ease of Use rating system: 5 black dots (easiest to use) to 1 black dot (more difficult to use).

New! Motor Mount & Wheel Kit with Position Controller - #27971; $279.99

Finally your robot can have the mobility and style it deserves! With the Motor Mount and Wheel Kit, powerful 12 VDC motors are combined with precisely machined aluminum hardware to provide the power, strength, and beauty demanded by your mid-sized robot. All custom parts are CNC machined in-house at Parallax headquarters in Rocklin, CA. The mounting block makes securing this kit a breeze; and the included 6 in. (15.3 cm) pneumatic rubber tires are durable enough to handle smooth or rugged terrain without hesitation.

The included Position Controllers use a quadrature encoder system to reliably track the position and speed of each wheel and report the data on demand. They can also be interfaced with HB-25 motor controllers (#29144; sold separately on facing page) to automatically provide smooth speed ramping and accurate position control. This leaves the main processor free to handle more important tasks like reading GPS coordinates, processing sensors, and maneuvering complex environments.
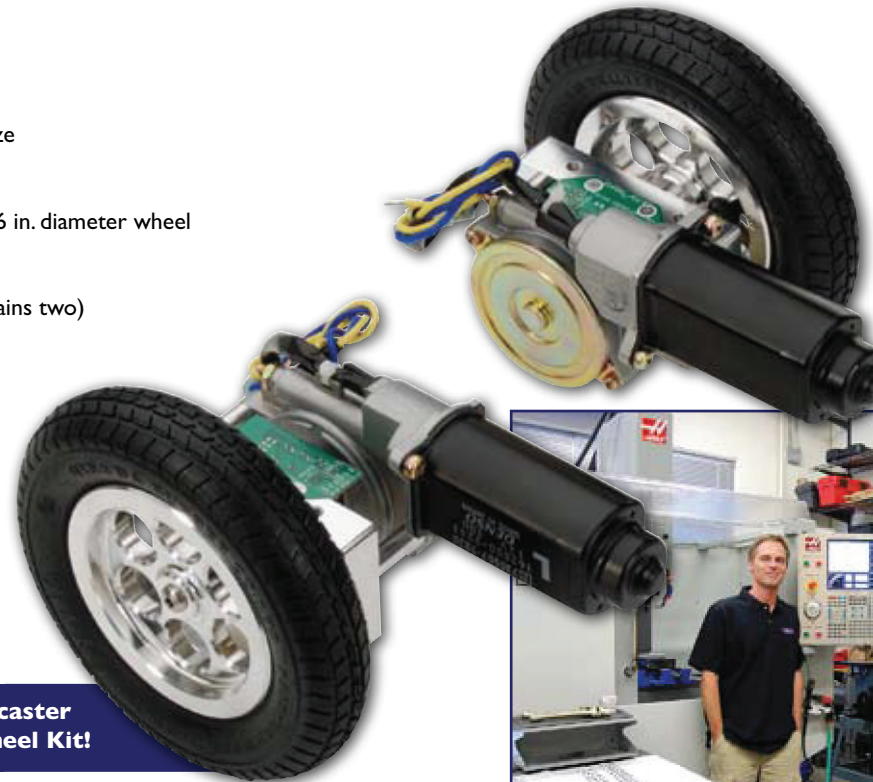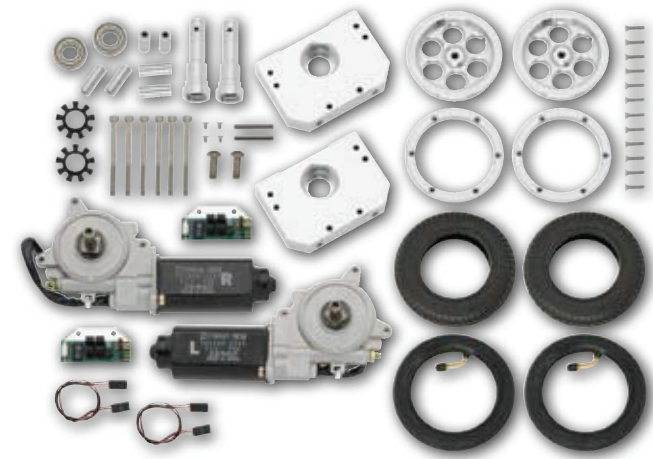
Features of the Motor Mount & Wheel Kit include:

• Powerful 12 VDC motors provide plenty of torque
• Precision machined 6061 aluminum hardware
• Conveniently positioned screw holes make mounting this kit a breeze
• Rugged pneumatic tires are well-suited for a variety of terrains
• 5 V supply for Position Controllers
• 36 encoder positions per revolution; approx. 0.5 in. resolution with 6 in. diameter wheel
• Compatible with any microcontroller
• Single I/O line can control up to 4 Position Controllers
• Strong yet light - only 3.2 lbs (1.45 kg) per wheel assembly (kit contains two)

Key Specifications:

• ~150 RPM @ 12.0 VDC, 1.50 A, no load
• ~190 RPM @ 14.5 VDC, 1.60 A, no load
• 4.5 to 5.5 VDC supply range for Position Controllers
• 50 mA average supply current at 5.0 VDC for Position Controllers
• 36 encoder positions per revolution. Approx. 0.5 inch (1.27 cm) linear distance per position
• 19.2 kbps serial communication
• Operating temp range: -40 to 185 °F (-40 to 85 °C)

All of the aluminum parts in the Motor Mount & Wheel Kit have been machined on our CNC mill at our headquarters in Rocklin, California.

Coming in 2009! A high-quality machined aluminum caster wheel to coordinate with your Motor Mount and Wheel Kit!

MOVE:

GWS Naro Servo - #900-00014; $11.99

The GWS Naro Servo is smaller and lighter than our Parallax Standard Servo but delivers great performance and 11 oz-in of torque. It is recommended for smaller robots or in project where space is tight. Two GWS Naro Servos are employed to make the Parallax Penguin walk. Size: 22 x 11.24 x 21.35 mm. Weighs just 0.31 oz. Voltage requirements: 4.8 to 6 VDC.

Parallax (Futaba) Standard Servo - #900-00005; $12.99
Parallax (Futaba) Continuous Rotation Servo - #900-00008; $12.99

Our Standard and Continuous Rotation servos are made exclusively by Futaba. Both servos may be controlled easily from a BASIC Stamp or SX chip I/O pin using PBASIC's or SX/B's PULSOUT commands. The Continuous Rotation Servo is especially well-suited to robotics applications and includes an adjustable potentiometer port to center the servo.

	Standard Servo	Continuous Rotation Servo
Voltage	5 to 9 VDC	5 to 7.5 VDC
Movement	Holds position in 180° range	Bidirectional continuous rotation
Performance	41.6 oz-in torque @ 6V	0 to 50 RPM, linear response to PWM
Weight	42.5 g (1.50 oz)	42 g (1.48 oz)
Dimensions	approx. 2.2 x 0.8 x 1.6 in (5.58 x 1.9 x 4.06 cm) excluding servo horn	

Servo-compatible 3-lead extension cables: 10-inch (#805-00011; $1.99) and 14-inch (#805-00012; $2.50)

4-Phase 12 Volt Unipolar Stepper Motor - #27964; $10.99

Stepper motors are ideal for precision control, and may be easily operated in forward and reverse directions at varying speeds. This four-phase motor has a step angle of 7.5 degrees and requires 12 VDC for operation. It is used and included in the StampWorks Experiment Kit (see page 03).