



# SOLARBOTICS<sup>®</sup> Ltd

Your Hobby Electronics Resource



K PL PumLantern  
(pg. 2)



[www.solarbotics.com](http://www.solarbotics.com)  
1-866-276-2687

Catalogue 10  
2009 - 2010

# KITS

Solarbotics specializes in soldering-based kits based on BEAM technology, which means building simple, effective devices using (often) strange ways. We know from experience that documentation is **very important**, so you'll find that our kits have very clear and easy-to-follow instructions with many photos and explanations!

We use quality components and clever circuit board design to make sure your build is successful. We offer a 100% satisfaction guarantee for a risk-free building experience! If you get stuck or have a question just call us on our toll-free line for help.



## K HM - Herbie the Mousebot

Skill: 3/5

Simple, quick and hungry for light, this zippy robot will rocket around chasing a flashlight beam like Speedy Gonzales after cheese! The Herbie design has been featured in *"Junkbots, Bugbots, and Bots on Wheels"*, *"Absolute Beginner's Guide to Robotics"* and *"MAKE Magazine"*. We've made it even better by adding functional whisker and tail sensors that help it to detect and avoid objects! (Available in black, white, blue, and red)



## K SS - SolarSpeeder Solaroller

Skill: 1.5/5

The SolarSpeeder 2 Kit is a very quick palm-sized solar-powered racer. It can zoom 3 meters (10 feet) in under 40 seconds of charging in sunlight! It's a great beginner project and impressive racer.



**NEW!**

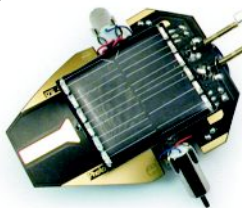
## K PL - PumLantern

Skill: 1.5/5



Based on our HexPummer, this kit charges all day from the SCC3733 solar cell. In the dark it "pumms" the four ultra-mega-super-bright LEDs and casts artistic silhouettes against the walls of the lantern. Customize your lantern shell by choosing colour and theme! See full details and video footage online.





### K PP - Photopopper Photovore 5.0

Skill: 3/5

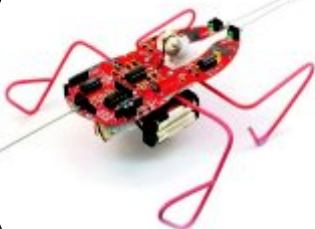
The palm-sized Photopopper version 5.0 has circuitry that makes this sun-powered robot chase light at almost 2 meters (6.6') a minute! Functional touch-sensor whiskers let it steer clear of obstacles. It's truly a self-sufficient robot!



### K TB - Turbot Tumbling Robot

Skill: 3/5

The Turbot seeks light unlike any robot you've ever seen! Two arms let it reach, scrape and hook its way over any terrain. If something manages to become ensnared, the victim is released so the Turbot can continue chasing light.



### K W3 - ScoutWalker III

Skill: 5/5

The ScoutWalker III uses advanced BEAM microcore circuitry for great agility in a two-motor walking robot. With two-stage turning gates, dual tactile-sensors and the ability to use Sumovore microcontroller brainboards, this is truly an exceptional 'bot!



Coming Soon - The **J DB** Beetlebot! This beginner-friendly, solderless kit will feature working tactile sensors to help it navigate an environment and avoid obstacles. Stay tuned to [www.solarbotics.com](http://www.solarbotics.com) for the latest updates!



#### Skill Ratings

- 1-2:** For beginners, documentation includes instructions for identifying parts and soldering a simple kit.
- 2-3:** Builder must have some mastery of mechanical tools for such tasks as wire bending or electronic tuning.
- 4-5:** Builders should be confident with installing, configuring and tweaking an advanced kit with several components.

## "HEY! WHERE ARE THE PRICES?"

You know what sucks? When you're browsing through a catalogue and order something... Only to find out that you paid too much (or too little), because the prices have changed since it was printed. So to counter this, *the very day* we send you this catalogue, we ran off a price sheet with completely up-to-date figures. No more guessing - we're keeping you on top of things with accurate information.

You can also get pricing from our website. We're constantly improving [Solarbotics.com](http://Solarbotics.com) to make it faster and easier to use. You'll find loads of additional information, images, resources, projects, articles, and more! Come by and visit our home on the web at: [www.solarbotics.com](http://www.solarbotics.com) (or our sister site, [www.hvwttech.com](http://www.hvwttech.com))

# K SV - SUMOVORE MINI-SUMO

Skill 5/5



There is no better Mini-Sumo kit! It's faster, less expensive and has more sensors than competitive kits. We put over 500 man-hours of effort and 22 prototypes into this design - we've worked hard to make it the best of its class! Check the stats and see for yourself:

- Fully conforms to mini-sumo competition requirements
  - 9V operation (6AA's - not included)
  - Powerful 143:1 gear motors (not servos!)
  - Supports up to FIVE edge sensors
  - Two active IR opponent detection sensors
  - Modular electronics construction
  - Includes "advanced behavior" discrete brain module
  - Optional rear-looking sensor
  - Optional line-follower mode
- Custom made 2-5/8" wheels with molded-on traction tires (black, red, blue, yellow)
- Powder-coated steel front plates (black, white, red, blue, yellow, speckled black/silver)

## SUMOVORE ADD-ONS



K SV-Atmel

**K SV-Atmel** - Sumovore Atmel ATmega8L Brainboard v2  
Program in practically any language, and download the code via ISP header or a simple parallel-port cable! This new version comes with I2C, SPI, and 5 LED process indicators.



K SV-PIC

**K SV-PIC** - Sumovore PIC 16F877A Brainboard v2  
Using one of the most popular styles of microcontrollers, this brainboard add-on features 33 I/O lines, eight 10-bit ADC, two PWN channels, in-circuit programming, five indicator LEDs, refined I/O usage, 3-pin RS-232 programming and more!



K SV-PICAXE

**K SV-PICAXE** - Sumovore PICAXE Brainboard v2  
Use convenient flowchart programming symbols or code in BASIC to give your Sumovore a unique personality with the PICAXE 28X2 microcontroller on this brainboard.



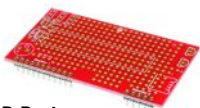
K SV-BS2

**K SV-BS2** - Sumovore BS2 Brainboard  
Parallax fans will appreciate adding a BS2 / Stamp Stack-compatible microcontroller to your Sumovore. (BS2 module is not included)



25030

**25030** - Stamp Stack II Microcontroller Kit  
This is a bread-board friendly, abuse-tolerant platform for programming a 100% Parallax BS2 compatible microcontroller. It'll even fit on the Sumovore, via the above K SV-BS2 add-on!



K BB-Proto

**K BB-Proto** - Brainboard Prototyping PCB  
This board plugs into the expansion ports of any new "Version 2" brainboard. It offers additional features useful to the main brainboards, like three servo headers, raw 6V and regulated 5V power, I2C throughput and transistor, RJ11 and IC footprints.



### K CMD - L298 Compact Motor Driver

Skill: 2/5

The L298 motor driver IC is a very popular, but hard-to-use chip. This kit tames the beast and offers extra benefits like 5V regulated logic power output, indicator LEDs and robust screw terminal connectors.



### K SMD - L293D Motor Driver

Skill: 1/5

Replace the guts of a standard servo and turn it into a logic-signal controlled gear motor! The L293D chip is set to supply 1.2A and 36V - much higher than standard servo electronics. Not only does this device fit in a standard servo body, but it can also drive all of the Solarbotics gear motors, such as the GM4 pictured to the left.



### K MSE / K MSE-U - MSE Solarengine Kit

Skill: 3/5

For true Do-It-Yourself, here's a cassette mechanism to hack into solar-powered device! The circuit on the solar cell turns light into bursts of motion from the cassette components.

Available in two flavours:

Rapid fire, with SCC2433-MSE cell (**K MSE**)

High performance, with SCC3733-MSE cell (**K MSE-U**)



### Sym1381 / SymFLED - Symmet Parts Bundle

Skill: 2/5

This set of parts contains all you need to build yourself a self-mobile, symmetrical robot. We include basic instructions showing how to free-form a 1381 or flashing LED-based solarengine and how to build the basic device.

**Note:** The 1381 version is a bit harder to build, but performs better than the simpler FLED version. This is a parts bundle, and does **not** include the same 100% satisfaction guarantee as our kits.



### K SAND - Sandwich PCB & Components

Skill: 1.5/5

This project is featured in the Book "**Robot Building for Beginners**" by David Cook. This parts bundle comes complete with the components necessary to build a line-following "Sandwich" Robot, (with the exception of the DPDT switch and Molex headers which are optional and do not affect the performance or assembly of the robot). Your choice of red, yellow, black or blue wheels.



This **SandPCB** is *just* the circuit board used in the above K SAND kit, and does not include any components.

- ALL Solarbotics documentation is available online for your review.
- Solarbotics publishes full schematics of our kits to make customizing easier!
- No wimpy plastic snap-together blocks - use REAL construction techniques to build your robot.
- We offer volume and educational discounts. Contact [sales@solarbotics.com](mailto:sales@solarbotics.com) for a quote!

# ELECTRONIC MOTORS

Solarbotics gear motors are *good*, but not as excellent as the \$100 European-made type (hey - we're realistic). But for a fraction of the cost, you can get a motor that will fulfill your requirements in a compact, powerful, *sturdy* package. Many even have safety clutches NOT found in expensive motors!



The 224:1 **GM2** and **GM3** gear motors are quite strong, rated  $\approx 45\text{RPM}$  with over 50in\*oz at 6V, with a built-in (over-rideable) 40in\*oz safety torque clutch. The GM2 is easy to hack into a 14:1 motor - get details online!



The **GM6** and **GM7** series are smaller 120:1 versions of the GM2/3. They're speedier, and have proven themselves as effective mini-sumo robot motors. Offering  $\approx 164\text{RPM}$  and over 20in\*oz torque at 6V (with a safety clutch), whatever you put on the 2mm splined output shaft is going to move well!



The 143:1 **GM8** and **GM9** gear motors are shaped like their GM2/3 counterparts, but are touch thicker. At  $\approx 79\text{RPM}$  they make over 43 in\*oz torque (limited by safety clutch). They're what we use in our award-winning Sumovore robot kits!



The 228:1 **GM17** offers low-voltage power efficiency, but it generates decent torque! At 3V it turns 16RPM drawing only 20mA. Safety-clutch limited stall torque is 35in\*oz at 0.23A. These figures make it ideal for solar-powered applications. It also fits all the accessories designed for the GM2/3/8/9.



The **GMPW Deal** lets you choose a red, black, blue or yellow wheel to complement your GM2, GM3, GM8, GM9 or GM17 gear motor. Get this bundle and save! Let us know what colour you want, or you'll get what we think you want (mind you, our psychic powers are often quite terrible).



The **GM10** is a *small* 81:1 pager motor-powered gearbox that in standard configuration is an auto-centering actuator. One snip, and you have a speedy 5 gram gear motor. We even have the GM10W wheel to mate with it!

The **GM10W Deal** lets you save by getting a wheel and GM10 together. Choose from yellow, light grey, or black. Comes with two traction bands. Again, let us know what colour you want, or it's the luck-of-the-draw for you!

So you have a good idea of what each motor does - now what? Go check out our official site! You'll find specifications, datasheets, drawings, up to date prices, quantity discounts, and tons more useful stuff. [www.solarbotics.com](http://www.solarbotics.com)

Patterned after the excellent Sanyo gear motors, these metal units with brass heads offer similar performance at an affordable price!



- GM11a** - 56:1
- GM12a** - 100:1
- GM13a** - 150:1
- GM14a** - 298:1
- GM18** - 30:1



The **GM15** is a 25:1 Planetary gear motor 6mm in diameter. Need we say more? Ok, how about one cubic inch robots?



The 35:1 **GM19** is a powerhouse big-brother to the GM18, with a larger "030" style motor and a funky rotated gearhead. It does 576rpm @ 6V, 7in\*oz torque drawing 1.2A. Powerful!



To compliment our other metal gear motors, these new units have nifty sealed cylindrical gearboxes

- GM20** - 100:1
- GM21** - 360:1
- GM22** - 298:1

Get complete motor stats on our official website:  
[www.solarbotics.com](http://www.solarbotics.com)



You'll also find RoHS compliance information, helpful tips, articles, and more!

SKU	Description	Gear Ratio	Unloaded RPM		Unloaded Current (mA)		Stall Current (mA)		Stall Torque (gm*cm)		Dimensions (mm)		
			3V	6V	3V	6V	3V	6V	3V	6V	Length	Width	Height
GM2	Offset/Inline	224:1	24	46	50	400	NA	3500	4100	55	48	23	
GM3	90 Degree	224:1	24	46	50	400	NA	3500	4100	70	22.5	37	
GM4	Servo Body	325:1	67	77	93	322	529	2529	3668	40.6	20	38	
GM6	Mini Offset/Inline	120:1	64	157	97	326	563	972.1	1519.3	37	21	27	
GM7	Mini 90 Degree	120:1	75	146	92	310	524	981	1712.4	53	13	19	
GM8	Offset/Inline	143:1	40	78	52	400	700	3200	5500	55	48	23	
GM9	90 Degree	143:1	40	78	52	400	700	3200	5500	70.5	27	23	
GM10	Centering Pager Gearmotor	81:1	454	233	20	118	220	158.5	228.26	14.3	25.4	28.8	
GM11a	Metal Gearhead	56.8:1	181	370	42	428	760	427	441	33.3	12	10	
GM12a	Metal Gearhead	100:1	85	169	32	290	456	1120	1960	30	12	10	
GM13a	Metal Gearhead	150:1	58	109	38	258	480	1344	2268	33	12	10	
GM14a	Metal Gearhead	298:1	33.3	75	40	456	830	1638	3234	33	12	10	
GM15	Pager Gear Motor	25:1	920	1550	200	210	350	35.28	69.33	20	6	6	
GM17	Centered 3mm output shaft	228:1	12	30.6	16	24	253	492	3135	51	27	37	
GM18	Metal Gearhead	30:1	297	556	54	292	528	256.2	387.8	33.2	12	10	
GM19	Metal Gearhead	35:1	385	706	176	1156	2128	541.8	674.8	34.8	15.3	15.6	
GM20	Metal Gearhead	100:1	120	240	70	612	948	1526	2716	33.2	14	14	
GM21	Metal Gearhead	360:1	11	23	42	360	692	3570	7434	47.6	15.5	15.5	
GM22	Metal Gearhead	298:1	39	79	64	608	948	2884	3444	33.2	14	14	



The 325.1:1 full-rotation **GM4** uses the strong GWS05 servo mechanics, but no electronics! Ideal for replacing standard servos when you have an appropriate motor driver circuit (like our K SMD).



The GWS S03N **Servo** is a common, useful servo that is also very receptive to being converted into a gear motor by removing the internal drive circuitry.



The **22140** Modified GWS Servo has all the characteristics of a regular servo, but it doesn't have a rotation stop. It'll keep on spinning. Slap a servo-wheel on it, and you've got a really simple way to make a mobile robot chassis!



We carry two mini-servos that feature a ball-bearing supported output shaft and Futaba connectors (which work great for connecting to microcontrollers!). They come complete with mounting hardware and servo output arm options. Your choice of the **22150** Sub Micro Servo (NARO HP BB) or **22160** Pico Servo (PICO+ BB).



This general application **RM1a** is very good for torque solarengine designs, or small battery-powered robots. The output shaft works great with the RW or PRet accessories!



The **RM2** retrofits to the GM2/3/8/9, nearly tripling the output speed and doubling the torque! Be forewarned - the increase in power output comes with a sizeable increase in power consumption!



An **RM3** is the perfect replacement if you've worn out or blown up your 030 form-factor GM2/3/8/9 motor.



Quality pager motors are getting harder to find now that cheap clones are everywhere. Be assured that our **RPM2** pager motors are factory-fresh, and very high quality. At 1.5V they draw only 17.5mA @ 9700rpm, and 120mA stalled. At 3V they draw 32.1mA @ 31900, and 260mA stalled.



The **TPM2** is a *tiny* motor, about 4.1mm diameter by 19.7mm long (0.16"dia. x 0.78"). At 3V it spins 32,000rpm drawing only 27mA!



The **VPM2** vibrating disk motor measures 12mm dia. x 3.4mm thick (1/2" x 0.13"), and vibrates at 172Hz - 200Hz at 3 volts. No visible moving parts make this a very cool motion device!



The **MCM** metal cassette mechanism is a factory-fresh microcassette drive with a Mabuchi drive motor, belt & pulley mechanism, opto-reflector, tape read-head and pinch roller assembly. 59 grams of hacking DIY goodness!



The **MCM2** is a high-precision tape transport mechanism with one large pancake motor, and one worm-reduction gearmotor. They also have a variety of belts & screws, a brass pulley wheel, rubber capstan pinch roller, a fine spring and a fine coil. It's been the source of many a classic BEAM robot!

# WHEELS & ACCESSORIES



The **GMPW** wheels measure 69mm (2.72") by 7.62mm wide (0.3"), and are our own design specifically for the GM2/3/8/9/17 gear motor. They come complete with soft and durable over-molded silicon based tires and also include a 64-strip pattern for optical encoders (like our GMWW02 and GMWWK1)! Available in red, yellow, blue and black.



Solarbotics designed the **SW** injection-molded ABS wheel to fit most servo hubs (excluding Hitec), and give solid traction to your robot. Like the GMPW, there's an optical encoder pattern and a molded silicon tire. The hubs dimension out at 69mm (2.72") by 7.62mm wide (0.3"). Available red, yellow, blue, black and white.



The **GM10W** is a 25mm (1") diameter wheel custom made to mate with the GM10 pager gear motor. This makes it ideal for Microsumo robots! Comes with two traction bands per wheel and is available in black, light grey and yellow.



The **GMW** is a 30mm diameter, 7mm thick wheel that fit snugly onto the double-flat output shaft of GM2/3/8/9/17 gear motors. Each wheel has four edge mounting holes suitable for taking a #2x1/4" sheet metal screw, which are ideal for attaching even larger wheels! Comes complete with motor shaft mounting screw and washer.



The **RW2-3mm / RW2-1/16** wheel has a beautifully machined aluminum hub with a generously thick rubber tire for maximum traction. The assembly measures in at 31.2mm (1.23in) diameter and 11.2mm (0.44in) wide, and has a hub that's drilled for a **3mm or 1/16"** axle. It makes a nice, beefy wheel, ideal for small robots!



**RW2i-3mm / RW2i-1/16** is a narrow version of the RW2, that shaves a valuable 3.8mm (0.15") from the width by moving the set-screw hole to underneath the tire. You have to remove the tire to tighten it, but it's well worth it for designs that need the extra space! It comes with a generously thick rubber tire for maximum traction. Similar to the RW2, these hubs are drilled with your choice of **3mm or 1/16"** axle.



An **RW** is a 10mm OD, 1.5mm ID, 7mm wide rubber wheel. The same as used in our SolarSpeeder kit, they're ideal for do-it-yourself Solaroller builders.



The **PRet** plastic retainer is a plastic nub designed to press-fit onto a 1.5mm shaft (like our RM1a). They make some great micro wheels by using some stretched silicon tubing for tires!



The **GMTT** is a 14 durometer Shore 'A' elastomer tire specifically molded to offer maximum traction. They work great with the old-style SW and GMPW wheels, and increase diameter from 67mm to 71mm.



This Bondhus 0.050" allen-key style **HexW050** hex wrench is ideal for tightening hex socket set screws like the ones used in our RW2 and RW2i wheels. It won't strip out like cheaper wrenches.



The **MMFC** is a solderable fuseclip that's great for holding the RPM2 in place.



A **M1.7x0.35** is a 1.7 (dia) x 0.35 (mm/thd) x 4mm long bolt. This matches the metric thread of the two bolt-holes on the faceplates of the GM11a/12a/13a/14a/18 gear motors.



**GMB28**    **GMB39**

The GM2/3/8/9 gear motors have convenient holes for mounting, but these precision laser-cut steel brackets add to their versatility! **GMB28** fits GM2 and GM8, **GMB39** fits GM3 and GM9.



The GM15 is a tiny powerhouse, so you have to be careful with it. Avoid snipping off the included connector, by using the **FPinGM15** 1.27mm pitch dual-position connector to mate it to your project.



Need a high mobility solution for your next project? The **GMT** is a 23mm (7/8") wide x 12mm (1/2") long tread link that's very well designed, using 1/16" steel pins press-fit into precision CNC-drilled (not molded!) mounting holes. Minimum of 14 links needed for one track.



The **GMTC** cogs interface our popular GM2/3/8/9/17 series gear motors with the very cool GMT tread links. They've been precision molded to mate with the gear motor's double-flat output shafts.



The **GMTI** idler matches the same dimensions as the driver cog (38mm dia x 15mm wide), but is drilled out to 1/4" (6.4mm). This lets you use a standard #8 bolt as the idler axle.



A **GMTpkg** package includes a pair of GM2/3/8/9/17 style gear motors, two GMTI idlers, two GMTC driver cogs (keyed to fit the GM2/3/8/9/17), and forty GMT links and pins sets (20 per side). This set saves more than 10% over buying the parts individually!



This "Incremental quadrature encoder system" is specially designed by Nubotics to retrofit to our GM2, GM3, GM8, GM9 or GM17 gear motor. Great for controlling a robot for dead reckoning, tracking odometry (distance traveled), stalled motor, or closing the feedback loop for position/velocity/acceleration. Our new GMPW wheels have a compatible reflector pattern built-in to work with this! Comes as a single (**GMWW02**) or dual (**GMWWK1**) pack.



Due to the longer shaft lengths on the GM2 and GM3, the encoder wheel reflector is a bit too far away from the sensors on the Wheel Watcher. Use the **GMWWS** spacer to bring the reflector back into range.

# ABOUT SOLARBOTICS

Solarbotics has been operating for more than 15 years, with a focus on BEAM robotics. This means we know what we're doing very well. You will see from our online documentation, video, and photos that we want to bring you the best products we can.

Solarbotics has kits for any skill level, all of which require soldering. Don't know how to solder? No problem, we can teach you! Nobody does documentation better, which means you won't be left wondering how to put parts together. Our 100% satisfaction guarantee means you have no risk of failure.

We also stock unique parts for robot builders, so if you need gear motors, solar cells, or just simple parts that you need to know will work, check us out. We stand 100% behind everything we sell.

## WHAT IS BEAM?

BEAM is the style of robotics that gave Solarbotics our start in 1992. In 1989, Mark Tilden invented the techniques of *BEAM Robotics* combining simple robust electronics with clever mechanics (and frequently solar power) to produce capable, autonomous robots. BEAM is an acronym Mr. Tilden coined from **B**iology, **E**lectronics, **A**esthetics, and **M**echanics.

**Biology** - We look to nature for inspiration to see if there's a shortcut to use on our designs. Simple, tiny brains govern the actions of many, many capable insects, and we try to use similar design elements in our own BEAM creations.

**Electronics** - This is about *appropriate* electronics. Where digital microcontrollers rule the actions of most robot designs, we like to explore the ancient, mystical ways of analog and minimalist electronics. BEAMers are notorious for taking a chip, and twisting it into doing new and novel thing that it wasn't ever meant to do - often with surprisingly good results!

**Aesthetics** - This means "the degree of pleasantness an object has to the eye". A sports car is aesthetically pleasing. An ocean sunset is aesthetically pleasing. A pile of dog-doo is aesthetically... *not* pleasing. As a design element for BEAM, it refers to how a robot is finished. A clean, well-built robot with a protective shell will survive in its environment better than a robot with loose motor mounts and wires strung all over the place where they can be snagged and yanked loose. Looking cool counts!

**Mechanics** - Clever mechanics can take care of huge design problems. Adding more code or sensors to a robot won't matter if the robot's design places the sensors in the wrong place to start with. Good mechanics means your robot should be more than an inverted trash can with wheels.

These design principles have worked well for us - give them a try!



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## Important Notes

- **Pricing is available on [www.solarbotics.com](http://www.solarbotics.com) or as a separate price sheet.**
- The product SKU is the text found in **bold font** inside the item description.
- Prices and availability are subject to change without notice. When price discrepancies occur between the price sheet and the website, the website is taken as correct.
- Orders are processed in currency based on destination. US and International orders use the USD price listed, and Canadian use the CAD price listed - no exceptions! Orders received calculated in the wrong currency will be returned.
- We accept: Visa, MasterCard, PayPal (paypal@solarbotics.com), USD / CAD Money Orders and purchase orders with credit approved. (Expect delays for clearance of cheques). Please make money orders payable to Solarbotics Ltd. Money orders from the US or International locations must be International US Dollar - we cannot accept anything else and will return it to you.
- Placed an order on solarbotics.com *and* hwwtech.com? Let us know and provide each order number - we'll be happy to combine them for you!

### Shipping Rates

To get an accurate shipping quote, fill you cart at [www.solarbotics.com](http://www.solarbotics.com), view "My Cart" and use the shipping calculator. You'll get shipping options and pricing simply by entering your country and postal code. Give it a try! And yes - we **DO** ship to international locations.



- Taxes, duties, brokerage fees, etc., are the responsibility of the importer (that's you). These fees are outside the knowledge and control of Solarbotics Ltd. Please contact your local taxation office for details.
- For bulk discounts and purchase orders (credit references required), please email sales@solarbotics.com.
- Please contact us at sales@solarbotics.com with any questions you may have. A sales representative will usually return your email within 1-2 business days.
- Solarbotics is open Monday to Friday, 9am to 5:30pm Mountain Standard Time.
- "SOLARBOTICS" is a trademark of Solarbotics Ltd. Reg. CIPO / USPTO.

**Didn't find the answers you're looking for?**

Try the support section on our website:

**<http://www.solarbotics.com/faq/>**

# OTHER USEFUL INFORMATION

## Product Support & Return Policy

Solarbotics stands fully behind our products. If you find any defect with your purchase, we will be happy to exchange it for you.

\*Solarbotics is proud to offer a 30 day money back guarantee on all of the product that we sell. Please note the following conditions:

- All products returned must be in resalable condition. Products that have been used, damaged or somehow altered will not be accepted for return and will be shipped back at the owner's expense.
- All shipping fees are non-refundable.
- Please call us to request an RMA (Returned Merchandise Authorization) to ensure our knowledge of the return. Goods returned without an RMA will NOT be accepted.
- Determining appropriate shipping methods and their associated costs for returning goods is the responsibility of the customer.
- Customer credit will be applied upon receiving the returned item.

## Kit Support

All of our kits come with a 100% satisfaction guarantee, as happy owners build happy robots! If for any reason you are having some troubles with your kit, we offer assistance in this order:

- Unlimited, free-of-charge telephone (1-866-276-2687) or email (support@solarbotics.com) support. If that doesn't resolve your problem...
- ...we will gladly repair your kit! While we won't finish building it for you, we'll repair any problems that are causing the failure. This includes free parts and labour. If you require an RMA, email (sales@solarbotics.com) or call (1-866-276-2687) to arrange a return and receive further instructions. We will **not** accept a repair unless a valid RMA has been arranged.

## Privacy Policy

Solarbotics Ltd. is a limited company in the Province of Alberta, Canada, and complies with the Personal Information Protection Act. For full details, please visit our website at: <http://www.solarbotics.com/info/privacy-policy/>. In short, we're not evil or nosey - we only collect the information needed to process your order. All provided information is kept private and we do not share it.

# SOLAR CELLS

Get complete solar cell data online at [www.solarbotics.com](http://www.solarbotics.com)!



These **SCPD** Siemens BPW-34 1/8" square clear-epoxy encapsulated photodiodes generate 0.47V (open circuit) and 1.8mA (short circuit) in noon-day sunlight. Use 6 or more for tiny BEAM applications!



Our **SCC2433B-MSE** polycrystalline solar cell offers 4.5V (open circuit) and 18mA (short circuit) in a 24x33mm package. Use as a regular solar cell, or take advantage of the included Miller Solar Engine circuit for your own compact designs!



The **SCC3733** is a 37x33mm cell that generates 6.7V (open voltage) and 15mA (short circuit) in direct sunlight. And like the SCC2433B above, it includes an optional-use Miller Engine circuit.



This **SCC3766** is a large epoxy-encapsulated 37x66mm cell that's nominally rated at 6.7V and 30mA. Direct-sunlight tests show just over 8V open-circuit, and 44mA short-circuit!

# ADVANCED

Do you have the unquenchable desire to program all the bits and bytes in a microcontroller? Step right up to our Advanced section, where you'll find some neat-o parts for diving deeper into programmable electronics.



The **28920** Freeduino SB is our version of the open source project *Arduino Deicimila*. Ours is a "semi-kit" - we've installed the small SMD components, so you just need to solder on the larger parts. It features a power switch, adjustable analog reference trimpot and a mini-B USB jack. See more Arduino accessories online!



The **34020** BVR Breadboard voltage regulator kit makes it easy to add regulated, switchable power to your breadboard by using practically any 2.1mm DC adapter.

## Breadboarding

Load yourself up on some of the essentials for breadboard prototyping.

- 21020** 1-panel breadboard, durable with nickel plated contacts for low clip resistance
- 21000** 2-panel breadboard, has 4 isolated power rails and 3 quick-connect banana posts
- 21005** 3-panel breadboard, has 5 isolated power rails and 4 quick-connect banana posts
- 21010** Economy wiring kit, 140 pieces of various sizes and colors of solid core wire
- 34010** 6VDC @ 500mA power adapter, accepts 2.1mm center pin, 5.5mm outer cylinder
- 34040** 12V DC @ 1A power adapter, accepts 2.1mm center pin, 5.5mm outer cylinder

## PICAXE

This is a beginner-friendly microcontroller environment that uses convenient flowchart programming symbols. You can even go ahead and turn your flowchart programs in to BASIC programs, and fully harness full power of the PICAXE microcontroller!



The AXE Stack mounts on any breadboard for total prototyping flexibility. 18-pin (**28570**) and 28-pin (**28580**) versions are available, and each Stack comes with a PICAXE microcontroller.

## PICAXE IC's

- 28410** PICAXE-08 IC, 40 lines, 5 I/O pins, 1-4 outputs, 1-4 inputs
- 28415** PICAXE-08M IC, 80 lines, 5 I/O pins, 1-4 outputs, 1-4 inputs
- 28435** PICAXE-14M IC, 80 lines, 11 I/O pins, 1-5 outputs, 6 inputs
- 28425** PICAXE 18X SMD IC, same specs as the 18X but in a 300mil SOIC package
- 28440** PICAXE-18A IC, 80 lines, 13 I/O pins, 8 outputs, 5 inputs
- 28450** PICAXE-18X IC, 600 lines, 14 I/O pins, 9-17 outputs, 5 inputs
- 28504** PICAXE-20M IC, 80 lines, 16 I/O pins, 8 outputs, 8 inputs
- 28484** PICAXE-28X2 IC, 1000 lines, 22 I/O pins
- 28485** PICAXE-28X2 IC - Low Voltage, same as the 28X2, but operates at 1.8-3.6V
- 28492** PICAXE-40X2 IC, 1000 lines, 32 I/O pins
- 28494** PICAXE-40X2 IC - Low Voltage, same as the 40X2, but operates at 1.8-3.6V

Check out [www.solarbotics.com/advanced/](http://www.solarbotics.com/advanced/) for PICAXE starter bundles, accessories, and additional specifications.

# SHERLINE MACHINING TOOLS

Sherline makes the best table-top sized machine tools, with an *impressive* set of available accessories. USA-made, they use top-notch equipment to manufacture these small (*not* toy) machining tools.

Get more information at:

[http://www.solarbotics.com/sherline\\_machining\\_tools/](http://www.solarbotics.com/sherline_machining_tools/)



# BOOKS

From our very own Dave Hryniw to Gareth Branwyn and David Cook, we are proud to offer these excellent books on hobby electronics and robots. This is just a few of what we carry - check out the full selection at [http://www.solarbotics.com/robot\\_books/](http://www.solarbotics.com/robot_books/)



**JBB** "*Junkbots, Bugbots & Bots on Wheels*" is written by Solarbotics' founder Dave Hryniw, with contributing chapters by Mark Tilden. It has seven detailed BEAM projects of varying complexity and a healthy dose of useful BEAM information. It's an excellent source for any aspiring BEAM roboticist or educator looking for an inexpensive way to bring robotics into a classroom.



**RBFB** "*Robot Building for Beginners*" by David Cook is one of the most impressive absolute-beginner books we can recommend. Over 545 pages Cook builds a line-following robot by exploring (in great detail) the parts, tools and techniques needed to complete the project. An excellent "ground-level" robotics book, and is an ideal companion to "Junkbots"!



**ABG** "*Absolute Beginner's Guide to Robots*" by Gareth Branwyn is well-written and inviting, with engaging ideas and fascinating factoids about robots and robot-related arts and sciences. You are led gently into the world of robotics, and 400 pages later you emerge with a respectable knowledge of robotics and a skill-set suitable to creating hobby robots.



**10160** "*Programming and Customizing the PICAXE Microcontroller*" by David Lincoln is a great resource for anyone who is interested in learning and mastering the PICAXE microcontroller. It's loaded with ready-to-build projects that are easy enough for anyone to successfully complete, and with enough depth that experienced builders will find value in them.

The geniuses at O'Reilly Media bring a do-it-yourself mind set to all the technology in your life. It's loaded with projects that help you make the most of your technology at home and away from home. Celebrate your right to tweak, hack, and bend technology!



Just discovered Make Magazine and need to catch up on everything that's come out? Here's your solution - these sets include all issues for the first (**10220**) or third (**10232**) year.



**10200** *The Best of Make: 75 Projects* is a collection of projects from the first 10 issues of Make Magazine, using a whopping 380 full-colour pages. Some projects include Tilt-Shift Photography, Cigar Box Guitar, and LED Throwies.



**10190** *Makers* features the people behind more than 70 of the cool projects seen in Make Magazine. Get this hardcover 184 page full-colour book while they are still in stock!



**10180** *Making Things Talk* is about getting microcontrollers, PCs and web servers all talking to each other. Get totally different devices to communicate so you can build some really neat stuff!



**10210** *The Eccentric Cubicle* is written by a true, hardcore do-it-yourselfer who shows you step-by-step how to build some pretty amazing things to protect, defend, and supply your cubicle!



**10260** *The Best of Instructables Volume 1* contains over 120 do-it-yourself projects on 336 colour pages. With excellent documentation and images, it's a great read for building something neat or just flipping through.

# CUSTOM PARTS BUNDLES

Many BEAM projects are simple and effective, so they're often featured in books and magazines. Get started by using one of our bundles. Remember, you'll need to have your own copy of the book or article to make use of the bundle!



**ABGM Mousey** from *Absolute Beginner's Guide to Building Robots* by Gareth Branwyn, also featured in *Make Magazine*, Volume 2. Using a mouse shell and recycled parts, it seeks light and reacts to collisions by reversing and zipping off in a new direction.



**Make12BeetleBot** by Jerome Demers from *Make Magazine*, Volume 12. This is a elegant and basic design that creates a robot with the ability to use sensors to navigate obstacles.



**Make06Trimet** from *Make Magazine*, Volume 6. Create a simple, rotating solar-powered desk toy by hacking together a cassette mechanism, solar cell and a few other components.



**Make06SolarRoller** from *Make Magazine* Volume 6. Take a solar cell, cassette mechanism, and some basic electronics to make a simple roller device that charges in the light before taking off in a burst of speed.

The **MF08 Bundle** is one big bundle comprised of the above four MAKE projects. It'll save you about \$20 over buying individually!



We also carry parts bundles for the following projects found in *Junkbots*, *Bugbots*, and *Bots on Wheels*:

**-JBBW** Walker      **-JBBMS** Mini Sumo      **-JBBHB** Headbot  
**-JBBHRB** Herbie      **-JBBAB** Adaptive Bicore




There are also a handful of bundles for building solarengines and more projects from other publications. Check them out at: [www.solarbotics.com/custom\\_parts\\_bundles/](http://www.solarbotics.com/custom_parts_bundles/)



*Please note: We cannot offer the same 100% satisfaction guarantee on bundles as we do on full kits!*

# SWITCHES

Need your creation to turn off and on, reset, or change modes? Try one of our switches, we have some great ones. And relays too! Which are also a kind of switch - really!

- |              |   |  |
|--------------|---|--|
| <b>SWT1</b>  | SPDT slide switch, a good power switch for medium sized robots                |   |
| <b>SWT2</b>  | SPDT toggle switch, with solderable body and metal toggle lever               |  |
| <b>SWT3</b>  | DPDT micro slide switch, ideal for switching sensor hookups                   |   |
| <b>SWT4</b>  | DPTT micro slide switch, with left/stop/right capability                      |  |
| <b>SWT7</b>  | DPDT micro top-mount slide switch, measuring 8.5mm x 3.65mm x 5.38mm          |  |
| <b>SWT9</b>  | SPDT snap lever switch, useful for tactile sensors with solderable metal tabs |  |
| <b>SWT10</b> | SPST pushbutton switch, great for small circuits like our Sumovore add-ons    |  |
| <b>RE1</b>   | DPDT 5V relay, 1A at 120VAC or 2A at 24VDC, good for motor power routing      |  |

# CAPACITORS

Capacitors see a lot of action in electronic projects, especially in BEAM applications. From cushioning circuit power surges to motor noise suppression, we have a solid selection of useful, popular capacitors.



<b>CP0.001μF</b>	0.001μF capacitor, for noise suppression
<b>CP0.01μF</b>	0.01μF monolithic capacitor, for high-frequency bicore circuits
<b>CP0.1μF</b>	0.1μF monolithic capacitor, useful as high frequency decoupling capacitor
<b>CP0.22μF</b>	0.22μF monolithic capacitor, for bicore/microcore experiments
<b>CP0.47μF</b>	0.47μF monolithic capacitor, for long delay or stabilization purposes
<b>CP1.0μF</b>	1.0μF monolithic capacitor, non-polarity sensitive with many applications
<b>CP6.8μF</b>	6.8μF monolithic capacitor, for longer delay experiments
<b>CP22μF</b>	16V 22μF electrolytic capacitor, cushions circuit power surges
<b>CP330μF</b>	330μF 16V capacitor, measuring 8.15mm x 12mm (0.32" x 0.47")
<b>CP1000μF</b>	1000μF 6.3V capacitor, only 8mm x 13mm (5/16" x 1/2")
<b>CP3300μF</b>	3300μF 6.3V capacitor, good for short-pulse solar engine circuit designs
<b>CP4700μF</b>	4700μF 6.3V capacitor, packs a useable wallop of energy
<b>CP4700μF-16V</b>	4700μF 16V capacitor, a standard workhorse for filtering power spikes
<b>CP0.35F</b>	0.35 FARAD 2.5V double layer capacitor, 40mm long by 5.3mm round
<b>CP1.0F</b>	1.0 FARAD 2.5V capacitor, Panasonic AL Gold series
<b>CPAG1.0F</b>	1.0 FARAD 2.5V aerogel capacitor, with 0.4ohms of resistance

# POGO PINS

Pogo pins are small spring-loaded electronic probes, and are normally used for testing circuitboards and JTAG applications, but we like to use them for bot limbs too!



## 40-Series Pogo Pins:

**PP8-40** (Round), **PPH-40** (Holder)

0.27mm (0.01") diameter, 11.5mm (0.45") long, 1.5mm (0.06") plunge depth



## 50-Series Pogo Pins:

**PP1-50** (Cone), **PP2-50** (4-sided point), **PPH-50** (Holder)

0.68mm (0.03") diameter, 16.4mm (0.65") long, 2.5mm (0.10") plunge depth



## 75-Series Pogo Pins:

**PP2-75** (4-sided point)

1.0mm (0.04") diameter, 17.0mm (0.67") long, 2.5mm (0.10") plunge depth



## 111-Series Pogo Pins:

**PP1** (Masher), **PP3** (Chisel), **PP4** (Cup),  
**PP6** (6-point), **PP8** (Round), **PPH1** (Holder)

1.5mm (0.059") diameter, 33.0mm (1.3") long, 6.5mm (0.25") plunge depth





Does your project require exact figures, drawings or statistics? Many items on solarbotics.com have additional resources as downloadable files or documents. If you still can't find what you're searching for, contact us at [sales@solarbotics.com](mailto:sales@solarbotics.com) and we'll be glad to help!

# CHIPS & ICs

There is a huge selection of integrated circuits to pick from when designing your project. We don't pretend to offer all there is, but what we have are tested, proven, and useful.





The **1381x** Panasonic 1381 trigger, latest CMOS technology for solarengine designs. Comes in eight types: **C** (2.0V), **E** (2.2V), **J** (2.7V), **L** (3.0V), **N** (3.4V), **Q** (3.8V), **S** (4.0V), **U** (4.6V)  
Note: triggers operate in range listed to +0.2V of their rating.

<b>74HC240</b>	74HC240 octal inverting buffer, lower output drive current, switches near ½ Vcc	
<b>74AC14</b>	74AC14 6 gate hex inverter chip, useful for signal conditioning	
<b>74AC240</b>	74AC240 inverter buffer chip, an octal (8-channel) inverter buffer chip	
<b>74HCT240</b>	74HCT240 inverter chip, less power and lighter loads, good for solar applications	
<b>74AC245</b>	74AC245 buffer chip, 8 channels of buffering, great for small-motor driving	
<b>L298</b>	SGS Thompson L298, brute motor driver meant for up to 4 amperes at 46 volts	
<b>L293D</b>	SGS Thompson L293D, handles 2 motors drawing 600mA each, with 1.2A spikes	
<b>8212</b>	Maxim 8212 voltage monitor, voltage detection and reset drop	
<b>74HC4066</b>	74HC4066 quad bipolar switch, useful for two-direction signal paths	
<b>74AC139</b>	74AC139 1of4 decoder, twists motor h-bridge controllers or drivers	
<b>74HC86</b>	74HC86 EXCLUSIVE-OR gate, high-speed CMOS device	
<b>LM386</b>	LM386 audio op-amp, good up to 15V, dissipating 1.25W maximum	
<b>LM324</b>	LM324 op-amp, 4 independent operational amplifiers, supply voltages up to 32V	
<b>LM339</b>	LM339 quad comparator, twice as many comparators as LM393	
<b>LM393</b>	LM393 dual-comparator, dual-comparator chip and heart of the "Sandwich Bot"	
<b>LM2937</b>	LM2937 5V regulator, "Low Drop-Out" (LDO) 5 volt regulator	
<b>LM555</b>	LM555 audio op-amp, designed for speakers but runs motors too!	
<b>ATmega8L</b>	Atmel ATmega8L and other Freeduino / Arduino compatible microcontrollers!	
<b>PIC16F877A</b>	Microchip PIC16F877A, 20MHz/4MIPS processor, 33 I/O lines, 8 10-bit ADCs	



# PINS & SOCKETS

Don't like to desolder parts? Check out our dip carriers, sockets and pins.

<b>DC-8Pin</b>	8-pin DIP socket carrier, useful for ICs like the LM386, LM393, 8212	
<b>DC-14Pin</b>	14-pin DIP socket carrier, good for use with the 74AC14, 74HCT4066, LM324	
<b>DC-16Pin</b>	16-pin DIP socket carrier, usable with the our L293D and 74AC139	
<b>DC-20Pin</b>	20-pin DIP socket carrier, suitable for 74XX240 and 74XX245 type ICs	
<b>DC-24WPIn</b>	24-pin wide DIP socket carrier, ideal for mounting BS2-compatible modules	
<b>DC-28Pin</b>	28-pin DIP socket carrier, for ATmega8L or other 28 pin DIP devices	
<b>DC-40WPIn</b>	40-pin wide DIP socket carrier, PIC16F877A or other 40 pin DIP devices	
<b>Apin</b>	Long 18mm (3/4") socket pins, for sensors, rocker points, etc.	
<b>SPin30</b>	30-pin SIP socket, take pins off individually for small component replacements	



# SENSORS

Solarbotics pioneered some very effective, inexpensive touch-sensor designs. Add some optical sensors, and you're well on your way to making some very capable robot!

<b>TACT1</b>	1.77mm nickel plated steel spring tubing, great for heavy/stiff sensors	
<b>TACT2</b>	Dual small spring sensor parts bundle, like what we use in the Photopopper	
<b>TACT3</b>	Heavy duty sensor, suited for walking robots like our Scout Walker III	
<b>IR1</b>	Infrared optical sensor, Siemens SFH 205f, wide field of view, used in our K PP	
<b>CDS</b>	CdS light sensitive resistor, 160ohm - 700k sensitivity range, great robot eyes	
<b>QRD1114</b>	Fairchild QRD1114, infrared opto-reflector line sensor, effective range of ≈ 6cm	
<b>PNA4602</b>	38 Khz IR detector, well suited for building object-detection circuits	




# TRANSISTORS & FETS

Many of our designs use clever transistor-based circuits that are easy to build. So to accommodate a wide range of circuits, we carry a good variety of signal and small-power transistors and FETs.

<b>TR3904</b>	2N3904 transistor, used in several of the most basic solarengine designs	
<b>TR3906</b>	2N3906 PNP transistor, also commonly used in basic BEAM circuits	
<b>TR2222</b>	2N222 transistor, higher maximum current, better efficiency than a 3904	
<b>TR2907</b>	2N2907 PNP transistor, higher maximum current, better efficiency than a 3906	
<b>TRZVN2106</b>	ZVN2106 N-channel FET, low-voltage substitute for a 2N7000	
<b>TRZVP2106</b>	ZVP2106 P-channel FET, great for low-voltage, high efficiency solarengines	

# MISCELLANEOUS

Although it can be argued that much of Solarbotics should be filed under "miscellaneous" (we prefer the word "esoterica"), there are items that really don't fit in any special category.

<b>LMP1</b>	Light-use rectangular leg mounting pads, ideal for attaching legs	
<b>LMP2</b>	Heavy duty triangular leg mounting pads, easy fit on servo arms or GMW	
<b>LMP3</b>	Strong rounded leg mounting pads, strong and easily mounted to a GMW	
<b>CMH</b>	Major Henry Coil, 20.7mm/0.813" diameter, 1.5mm/0.06" thick	
<b>SHX</b>	0.032" diameter Multicore Hydro-X solder, with water-soluable flux	
<b>Wleg</b>	"Gumby Leg", 3-foot length of reformable 10-gauge solid copper wire	
<b>GRF</b>	Gumby Rubber Feet, that fit gumby leg wire for good grip and aesthetics.	
<b>Mag1</b>	3/4" neodymium magnet, strong with solderable chrome finish	
<b>BHoldAA</b>	Dual AA battery holder, with 6" (15.2cm) leads	
<b>BHoldAA 4 Cell</b>	Quadruple AA battery holder, creates 6V	
<b>BHoldAAA</b>	Dual AAA battery holder, with solderable pins	
<b>BHold9V</b>	9V battery connector, with 6" (15.2cm) wire leads	
<b>TBLK2</b>	2-Position terminal block, great for mounting tactile sensors	
<b>TBLK3</b>	3-Position terminal block, good for mounting heavy wire to circuit boards	

Sintra is an 8"x12" expanded PVC sheet that has excellent robot-building characteristics. Smooth and easy-to-form with a knife, it glues very easily with super-glue and epoxy.

<b>SIN2mm-W</b>	(white only)
<b>SIN3mm-R/DB/Y/B/W</b>	(red, dark blue, yellow, black, white)
<b>SIN6mm-W/B</b>	(white or black)

# HVW TECHNOLOGIES

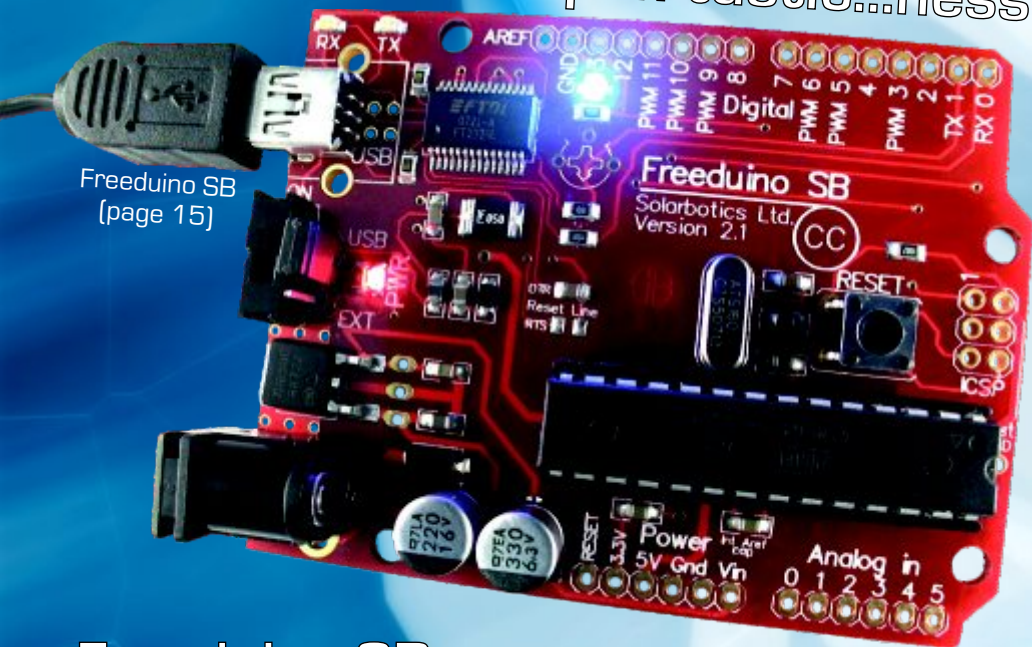


*Didn't quite find what you're looking for?*

Maybe you need to check out HVW Technologies. It's a division of Solarbotics that focuses on microcontrollers, programmers, LCDs, sensors, and a whole bunch of neat-o stuff. It carries popular brands like Parallax, Matrix Orbital, Sparkfun, Dimension Engineering, EFX-Tek, MicroEngineering Labs, Phidgets... and *many many more*. Seriously, you'll just have to check it out yourself:

**[www.hvwtech.com](http://www.hvwtech.com)**

Open Source + Atmel =  
Atmel awesome open tastic...ness



Freeduino SB  
(page 15)

## Freeduino SB

The 28920 Freeduino SB is our own special port of the Arduino project's Deicimila reference design. It's easy to assemble - we've installed the hard parts, leaving the easy ones for you. We've also included a bunch of neat features:

- power switch
- adjustable analog reference trimpot
- Mini-B USB connection
- blinky blue LED



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