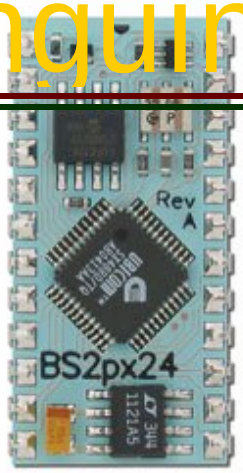
Penguin Tech

BASIC STAMP POWER

Edition 3



robots, code, and the basic stamp microcontroller

By humanoido

Build the Bat Penguin!

Did you know the stock Parallax Penguin Robot has a built in battery monitor? In this article, we'll show how to find the hidden and perhaps the most useful stock feature on your robot! Don't have a Penguin? Maybe you own a BoeBot? Just build the simple circuit as shown in the article and follow the directions.

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Contributors

- Bruce Bates
- David Buckley
- Michael Donahue
- J Wolfgang Goerlich
- Ken Gracey
- Steve Jones
- Vittorio Rossi
- Humanoido

Editorial

Welcome to the third issue of Penguin Tech Magazine! This time around it was a real challenge fitting all the great material into one issue – in fact, some of the regular columns will be absent this time. The realization is that some projects seem to demand more space. PT is still held at 8-pages, ideal for printing resources, manageable file sizes, fast web exchanges, and within capabilities of a simple publishing program. Ed.

Battery Monitor Introduction

How can you make a battery monitor for your Penguin Robot without using any add-on parts and not spending a penny? Another impossibility? Don't fret because this exclusive PTech article will show you how to accomplish this wondrous feat. Stock Penguins have the guts for a battery monitor. This circuit uses the LED and light sensor – both exist on Penguin's CPU board, and it's a cinch to add the same on other robots.

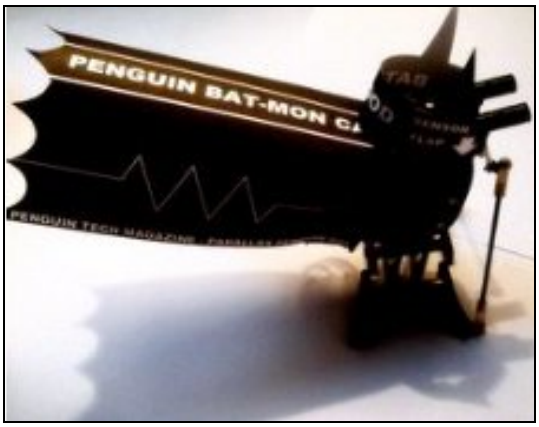
The Power LED is the Key

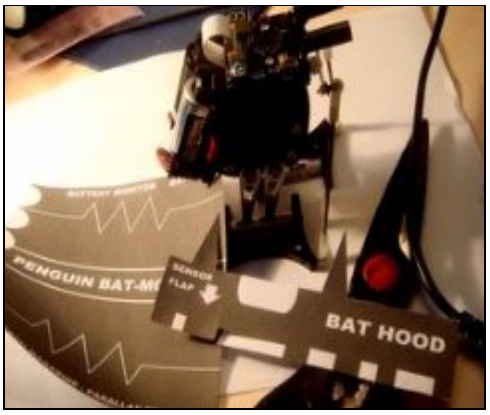
The tiny blue power LED on Penguin's motherboard is the mother-load of help when it comes to taking care of onboard batteries! It's shows battery level power. Notice, when batteries are new, the LED is bright? When batteries need replacing, the LED is significantly dim. A more quantitative method of brightness level, compared to visual inspection by human eyes, is needed. Meet Bat Penguin!

The Bat Theory

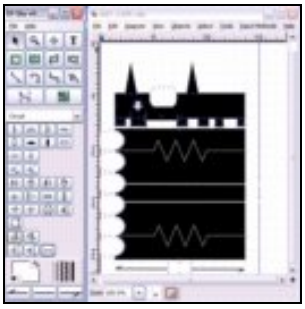
This is *Battery Eye* that watches the power LED. When activated it can determine light level of the power LED using one CaS light level sensor (see photos p.3). The CaS sensor is a cadmium sulfide photocell. Each Penguin has two at the front of the top board. This cell is sensitive to light, and is built into a resistor-capacitor circuit. RC Time is a measurement of how long it takes for a capacitor to lose a certain amount of its stored charge as it supplies current to a resistor. See *What's a Micro*, Parallax. The discharge time is measured and becomes a function of the light level. Previously calibrated data helps determine battery voltage. As the battery voltage decreases, the LED intensity will change. Measuring this amount of change will approximate the battery voltage. Knowing battery voltage and having a condition indicator can avoid many pitfalls before they happen. Knowing when to replace batteries is one of the best things ever to happen to Penguin!

BAT Penguin in action – with battery monitor and fully functional Bat Suit. Drawing files to create/ customize this outfit are in the downloads section.





BAT Penguin



Left: This is the assembled BAT Penguin, complete with functional Bat outfit. The cape supplements the hood which has a tiny shroud that helps light shield the active power LED and photoresistor. Middle: After printing the suit on paper, cut out the outline and cut the tabs. Right: The Bat suit is available in the original drawing DIA file, and as a jpg file.

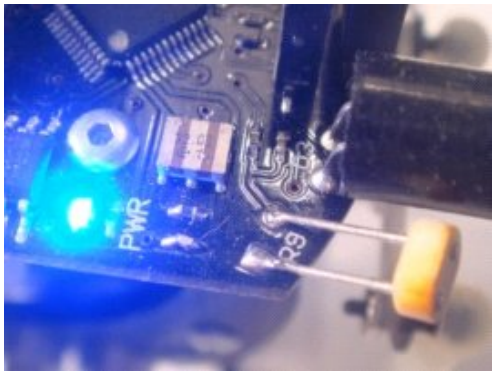
The Bat Suit The Bat outfit consists of two pieces: the hood and the cape. This is a functional suit, i.e. it consists of the sensor flap (as marked on the hood) which will actively shroud the motherboard CaS light detector and power LED. To duplicate the "power" suit, refer to the suit guide. At the bottom, 12.5 cm length is indicated. Copy and enlarge this stencil until the size is exact and print out. Cut out the paper making sure to carefully cut the two slips at the Sensor Flap location. Fit the suit by folding over the bottom tabs. The tabs fit under the motherboard. Fold out the Sensor Flap and form it to rest over the LED and CaS light detector. Apply a piece of black tape to completely seal the pair from outside light, making sure not to obstruct the blue LED. Note the positions of the hood and cape in the photos. The hood is held end to end by a small piece of black or clear Tape. The cape is also taped, this time to the sides of the battery compartment. Make certain the CaS light detector will be fully shielded from all room light, and that no light can get through the black tape or black shroud.

Seal and Eliminate Light Leaks This is no easy task. Aside from the LED, absolutely no other light, including reflections, must reach the photodetector. There's several ways to seal up the sensor from outside light. 1) the Bat-Shroud, 2) Tape, 3) Clay, and 4) Paper Mache, or any combination of the above. With the shroud in place and Penguin Robot under medium light from a lamp, run the main program. Continue to put flat black paper and then layers of tape across the CaS cell and LED, until the reading is stabilized to one number that does not change. The first layer of flat black construction paper will help eliminate reflections near the sensor under the tape. Because tape does not always stay in position, more ideally use a small lump of non-conductive moldable dark art clay as it more firmly anchors its position. (Do not obstruct the line of sight from the LED to the CaS cell.) If this is not available, try mixing water, small newspaper strips and flour into a moldable paper Mache mix. Press in place when batteries are removed from the robot. Paper Mache is quite messy – try not to spread material to other places on the circuit board. Smooth over the shroud as much as possible and when dry, paint it black with a marking pen to prevent light from going through.

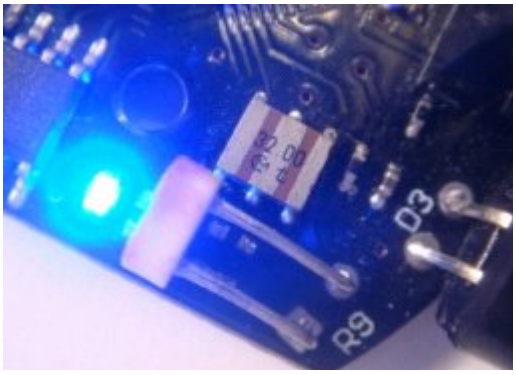
How to Activate the Device Now for the amazing stuff. Referring to the photos, fold over the right hand CaS light level detector 180 degrees. *Do this only once so as not to stress the wire leads.* Adjust the sensor to face the power LED as close as possible. Be careful not to stress the base of the light sensor leads where they enter the board -- fold the leads and don't pry the leads where they enter the board. When adjusted, the sensor should make contact with the board and directly face the LED.

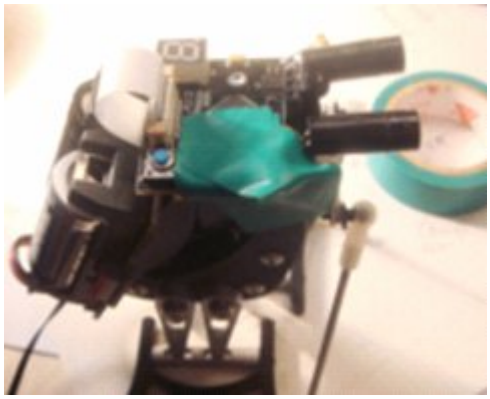
Regaining Power LED Function After the shroud is installed, the power LED light is invisible. Aside from the power switch position, on/off status is unknown. To regain the function, code has a simulated power LED, from a graphic character on the segment display. Note - with the LED blocked, RC will be extremely high, possibly above 4,000 and less than 1,000 when the LED is on and not blocked.

Calibrating Bat Penguin must be calibrated or it will not work properly. Calibrate by using a meter that can read voltages called a voltage ohmmeter or VOM, and batteries for at 5 to 4.9 volts. A variable bench power supply regulated in increments would make calibration easier. The combined battery set voltage is measured, not the voltage across single batteries. The Lithium Photo CR123A is a 3-volt battery. New batteries may read slightly higher. Penguin operates from a 6-volt battery supply. Calibrate batteries under load/drain with Penguin on. Depleted batteries may erroneously read high voltages when not loaded. Maintain room temp. In summary, the code is used as a calibration program. RC values for 5 & 4.9 volts are noted and placed into the program. This



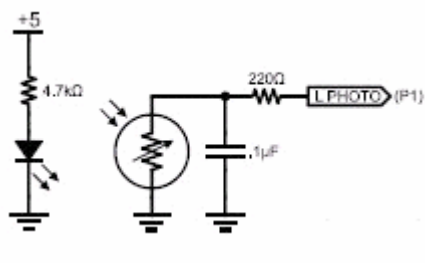
Left- CPU board awaits a tiny modification. Right- the CaS light level sensor is manually bent back 180 degrees towards the power LED. Now the right photosensor can read the LED brightness level and determine the battery condition.





Left - use several built-up layers of tape as a short term light shield. Right - to measure voltage, connect positive (red +) and negative (black -) leads to the two metal tabs on the bottom of the CR123A holder. The measurement shown is the combined voltage of two batteries in series.

Left- Calibrate in darkness - a light sensitive cell sees light from the LED. The sensor determines resistance based on observed light brightness. Note: the light sensor is very sensitive to reflections and this may affect readings. Right- Penguin's built-in battery monitor circuit. The circuit can be duplicated for Boebot or Scribbler.



becomes upper/lower limits, above 5-v and below 5-v. Five volts can be considered the lowest safe operating v-level. Anything lower trips audible/visual alarms. This value may be changed to fit differences of each penguin robot and calibrations.

Code Bat code adds a battery related monitor function. This is a step by step summary of the program's accomplishments: 1-RC time raw measurement**,** 2-Generate Power LED Substitute (PLS), 3-Report Raw RC**,** 4-PLS Status on Debug Screen**,** 5-Battery Test**,** 6-Battery Report**,** 7-Determine Alarm Condition, 8-Activate Alarm Function if Needed, 9-Recycle. Status is on the Debug screen. In summary, when the batteries begin to deplete, the blue power led will lose brightness. The CaS photo cell is bent backwards facing the LED. RC measurements are taken and compared with voltage calibration values. If the number is too low or too high, the battery condition is reported as good or bad. If bad, alarms will go off and it's time to replace the batteries.

The Alarm The alarm is very unique as it comprises both alternating display of 2 graphics and audible alarm. This loops in the program until the batteries are removed or Penguin is powered down. The alarm also reports to the Debug screen when a computer is attached. It's all about avoiding the Throes of Death! For the first time, Penguin can avoid an untimely death. Not letting batteries deplete too much is very important. Robots go through a death routine often involving random behaviors, some of which can over-stress the servos. The more complex the robot, the more complex the process. Some humanoids will fall down to the floor flailing arms in some unnatural manner, and go through a final writhing or twitching process. Penguin biped is balanced – power on or off, so the action is typically that as described elsewhere.

Now you have another item from your wish list and improved your robot 100%. With a little extra code, memories can be saved before the batteries fail. ●

Humanoido

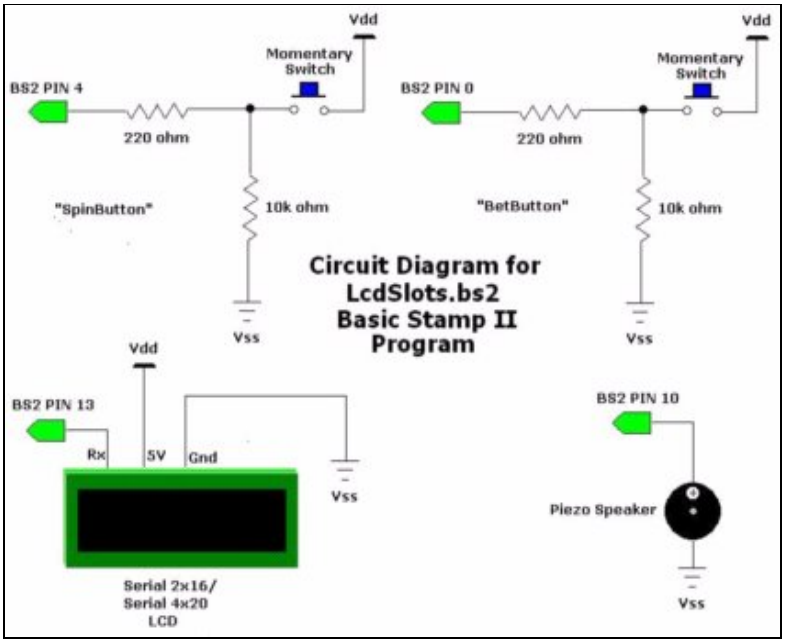
Build a HomeWork Board Slot Machine

by Mike Donahue

Above- Photo shows the Basic Stamp II LCD Slot Game created using a HomeWork Board. Below- LCD display shows the current bet, cash and spin indicator – realism on a simple two line LCD. Photos & schematic by Mike Donahue.

Fantastic HomeWork Board Project Invention & Design by Mike Donahue *Mike is a great inventor when he experiments with Basic Stamp projects, always creating designs that maximize learning experiences. His latest Casino hardware and software project is a real winner!*

This program is a simple slot machine game for the BS2. It displays to a 2X16 serial LCD but I think it will also work with a 4x20 serial display. Game sounds are provided by a piezo speaker. It uses two momentary pushbuttons (one for betting and the other to *spin* the reels). You can win up to 65,553 dollars and bet up to $99 at one time (if you have the money). Payoff credits range from 2 (one cherry) to 100 (3 diamonds). Credits are then multiplied by the bet amount, so the largest single payoff possible is 9,900 dollars. There is no provision for storing winnings above $65,553 so you will lose all your money if you get greedy. In the 1st version, there were no *lemons* or blank spots on the slot reels and the odds of winning were ridiculously high. If you do some adjustments to the three LOOKUP tables you can change the odds. Note: I've updated the circuit diagram and code with this article. For more information about the active-high pushbutton circuits you can find them in the Parallax *What's a Micro controller* book (on the front cover) and on page 76. You can also find an illustration on page 139 of the *Basic Stamp Syntax and Reference Manual*. The piezo speaker positive terminal is directly connected to PIN 10 of the Stamp. The other terminal goes to Vss. The LCD Rx line is connected to PIN 13 of the Stamp. The LCD 5V line connects to Vdd and the GND

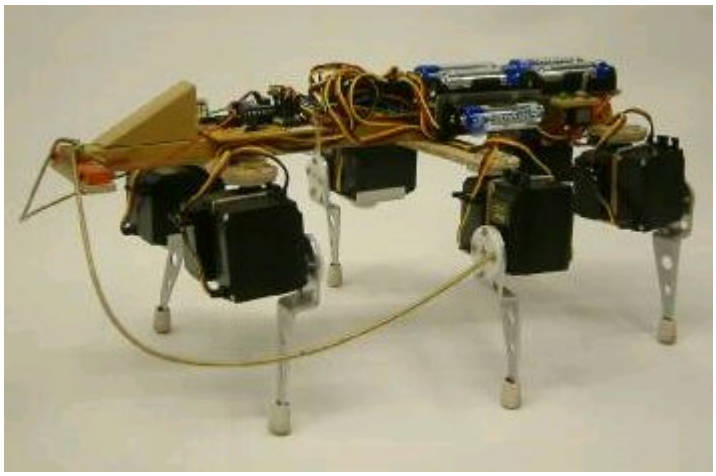


goes to Vss. The LCD mode setting is 19,200. This is a Youtube video of the LCD Slot Game in action:
http://www.youtube.com/watch?v=5eLInu7toTc
I am submitting version 1.2 of my Basic Slot Game LcdSlots1.2.bs2. Please disregard version 1.1. Odds for one cherry are approximately 3 to 1. Odds of three diamonds are 512 to 1. The LOOKUP tables had to be adjusted to correct some errors in odds distribution. The diagram was drawn by me using MS-Paint. I must point out an error in my diagram. I swapped the PIN designations for the two momentary switches. I have corrected this in my new diagram. I also have updated my program to include a scrolling information screen and added "lemon" characters to the slot reels. The new program has reduced winning odds. I felt that they were too high in the original version. This brings me to the matter of odds. I can't honestly tell you what they are. I chose this project because I wanted to write a program that would incorporate as many Basic Stamp programming concepts as possible like decision structures, looping routines, serial communication, display formatting, look-up tables, random number generation, user interface, sound and, in the case of my revised program, EEPROM storage and retrieval. I thought a game would be the perfect choice for this. Aside from the LCD display, everything I needed for the project came from the *$79 What's a Microcontroller?* kit. ● **Mike Donahue**

Build Robots with the Right Materials

by David Buckley

A problem exists because lots of people have no real experience of building anything so they have no experience of materials.



David Buckley built Simplhex, a six legged walker with a wooden chassis and aluminum legs. A newer Simplex clone uses all wood.

They may have lots of theoretical knowledge such as the eutectic points of various alloys and be able to define **Martensite** but without hands on experience are forced to refer to what other people have used in the past for similar projects. So their choices end up based on things like - what materials *Honda* uses in *Asimo*, what they learned about in school/college, what they use at work, etc., most of which are inappropriate for something with a budget of less than $1,000,000, a one off, or an experimental design with an operating life measured in tens of hours at the most, i.e. the sort of robots we build.

Wood: My six legged walker, *Simplhex*, built in 1994 with a wooden chassis and aluminum legs (see photo)

http://davidbuckley.net/DB/Simplhex.htm has had a hard life and has worn flats on the ends of its legs after walking continuously for three days at an exhibition (using a power umbilical) but it only covered about 4 miles. According to research carried out in the early 80s, the average play life of a toy was 20 minutes. It didn't matter how long it would last during the time it was played with. Now, some of my wooden robots are 25 years old and they show no sign of crumbling into dust! Considering the wooden boat found by the *Great Pyramid at Giza* my robots have well over 4000 years to go. If robot builders learned from modelers who make working boats, cars and aircraft, they would find making robots a lot easier. **Iron and steel** are nice as well as strong but require workshop equipment. My *Cycler* robots http://davidbuckley.net/FR/Cycler/Cycler.htm have steel welded steel frames.

Carbon fiber and resin is good for making super strong light weight parts but the comments below on Glass fiber apply equally to Carbon fiber.

Glass fiber and resin is good for making rigid complex shapes but not something you should use in your house. Trimming and modifying glass fiber parts creates very fine dust from the resin and small particles of glass fiber. Quite definitely not something you should do in your house. *If you breathe in the dust it is probably going to stay in your lungs until you die!* Not only that, the glass fibers are very dangerous if inhaled. They make your skin itch and if you breathe them in they do that to your lungs forever. One person I know nearly died with what was diagnosed as *Crone's disease*, coincidentally just after completing a big glass fibering job. The covers of my *Cycler robots* are glass fiber moldings. Cutting **plastics** generates static electricity which cause the dust to stick to everything including me. If you breathe in plastics dust it too probably will stay in your lungs until you die!

My robotic leg for *Shadow*, http://davidbuckley.net/FR/ShadowLeg/ShadowLeg.htm is made from **Acetal** with steel and **aluminum** sub parts because that is what suited the finished product. Machined aluminum castings would also have been suitable but would have required much more work and have taken far longer to make. The proto type *Shadow Leg* http://davidbuckley.net/FR/ShadowLeg/ShadlegPrototype.htm was made from **MDF sheet** because it was much easier to work than **Acetal**, cheaper, so if I made a mistake or changed the design I could just throw away the part or, more importantly I could use **wood-glue** to add on pieces. *Zeaker* used a **modified ABS plastic electronics project box** because it was the right size and had the right look.

My *GroundHogs Clarissa-May and Snowdrop*, **Stamp-1** based robot vehicles were constructed from **ABS and PVC**.

I used **Corrugated Cardboard** as used in big boxes for the prototype *Alex Animatronics head*, very quick and easy to cut and join with **hot melt glue**, but it isn't very strong and the dust from inside the corrugations, although you can't see it, I find unpleasant and nearly as bad as **fiberglass**.

Aluminum is strong and light. The hard part is joining it. It can be **welded, pop-riveted and screwed**, each of which requires workshop equipment. Lots of people seem to enjoy carving large **lumps of aluminum** into complex shapes using CNC machines. The materials used for a robot seem often to be dictated by how people want it to look, not by what would be a good material to use, so they spend a lot of time and effort making them out of **Acrylic sheet or Aluminum** so they look like robots! Acrylic sheet is nice and shiny, however people used to ask of *MM-3*, "where did you get the metal work done?" (they expected some machine shop made the parts). Actually *MM-3* was made from **plywood** and covered with **Solar-film**, an iron on covering for model aircraft which gave it a shiny metallic silver finish. *MM-3* was made on the living room table of my apartment. If you need an extra hole in an **aluminum chassis** you have to be very careful not to get particles of aluminum in the electronics, especially where they could short out tracks under an IC! Wood dust on the other hand won't short out anything. It is important to differentiate between the different requirements for *robots,* e.g. *Honda* have a corporate image to consider; robots in films are very rarely robots at all but are generally puppets made by skilled prop makers and brought life by puppeteers; combat robots have to be very strong; commercial robots have to be robust with low maintenance requirements and for industrial robot arms incredible precision; and in general, commercial robots have to fulfill the customers requirements. To finish, no matter what people might have you believe it is not possible to finalize a robot design on **paper or in CAD**, especially in the CAD programs you can afford, unless you are *NASA* or *Boeing*. The effects of Gravity are not apparent in CAD, nor generally are the strengths of the parts. There will always be modifications to be made. If not, you are either brilliant, lucky, or have overlooked how to make the design a LOT better. ●

David Buckley

Extended Memory Reader – by Vittorio Rossi

```
Penguin Extended Memory Word Reader

Input a page to view (0-7)
? 7
Input location FROM (0-2047)
? 21
Input location TO (0-2047)
? 21

Location        Low Byte        HIGH Byte
21              65535           65535
```

Left- The extended Rossi version of Penguin Memory Reader includes additional features. EMR has discovered a Penguin Robot without center servo values calibration. This useful code can be adapted to run on other stamps with paged memory capabilities.

Taking a program and extending its features is one way to gain new functions and capabilities. *Penguin memory reader*, original code by humanoido, was expanded by adding several extensions. This includes the ability to select a page (0 through 7) to read, ability to read a range of memory from 0 to 2047 (specify starting and ending memory cells reading low byte and high byte). The new **Extended Memory Reader** can be found in the downloads section with *Penguin Tech #3* code. ● **Vittorio Rossi**

Stamp External Clock

Clock! V 2.l3 by Loris Bognanni has a legible face in 12/24 hour scales and is practical for timing of events down to the nearest second.

Timing continuous battery discharge over a short time needs a clock with easy visibility. *Clock! By Loris Bognanni* fits the requirement. This analog time-piece is for a computer desktop. Features include numerous skins, setting the width of minute, hour, and second hands, transparency, size, style, position, color, border, alarms and it even has a calendar. The setup file is 3.2 Mb. Download at http://www.gljakal.com/clock/. ●

Cards & Letters

Penguin Tech Magazine is making a small splash! Here's some cards, letters, and postings sent this way. A very big thank you! for everyone's appreciation, kind words and making this dream possible!

Very nicely done! Mike Green

Thanks, Humanoido - this looks like just the information I need to get back to playing with my Penguin. *Wozoo*

Great effort, Humanoido! You're making Parallax and all of us very proud! Erco

This is fantastic! Just printed it out and it is immediately obvious how much work and love went into this. *Whit*

Love the stuff that you put out, very useful for all sorts of BS2px stuff. SRLM

I really appreciate your great work... I was considering buying a penguin, and after looking at your programs I am now so excited that I have just ordered one. *vrossi*

Humanoido, I got a chance to sit down and read it today. You did a great job with the layout and look forward to more issues. Thanks, Eric

Just downloaded and read PT#1 - brilliant, a really professional and well written magazine. *David Buckley*

Your excellence and enthusiasm continue! Congrats on another fine magazine. You've maintained momentum from issue #1, and your layout, content & writing are first rate! Thanks for caring enough to do this. I don't even have a Penguin and I look forward to issue #3. Erco

Thanks. I did a search and found an 8 page premier issue in pdf form. You didn't post a link, so I hope this is what you were referring to. If it is, it seems very well put together. You are to be complimented for such a fantastic resource... *Servello*

I read both issues of your publication and it is first rate. Nice job! I wish your magazine all the success it deserves! Thank-you, Mike Donahue

It's always a joy to see content presented as nicely as you have done. You obviously have some professional layout experience with an eye for good graphic design, and it shows. Keep up the good work! – Phil Pilgrim

I must say I'm totally impressed and humbled by the work you've accomplished. Ken Gracey

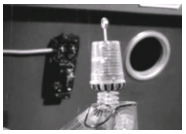
By the way, the PT Mag is AMAZING. You absolutely BLOW me away. *Ira Chandler*

Penguin Board Revision

Members of *Penguin Robot Society* made suggestions for Penguin Robot board revisions, submitting requests to Parallax: Connect power LED to EEPROM clock circuit (when Penguin sleeps, LED is off for power savings). Change LED color to mid-spectral range for better sensor recognition. Socket sensors (allows ports and reconfiguring for various applications), revise display wiring to use all segments and decimal point (will enable moving text effects & more graphics!), install 3-way power switch (turn off power to servos, run non-servo code, and develop code in a lower power mode). ●

Files/Code available for download

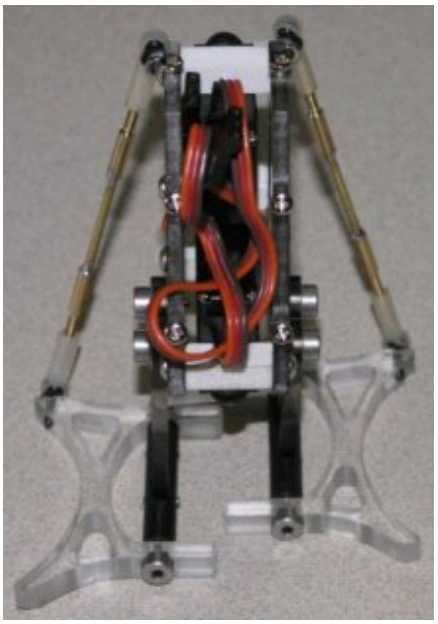
Penguin_bat.bpx
penguin_bat_suit.jpg
BAT_CAPE.dia
LcdSlots1.2.bs2
LcdSlotsDiagram1.1.JPG
penguin_memory_reader.bpx
penguin_extended_
memory_reader.bpx

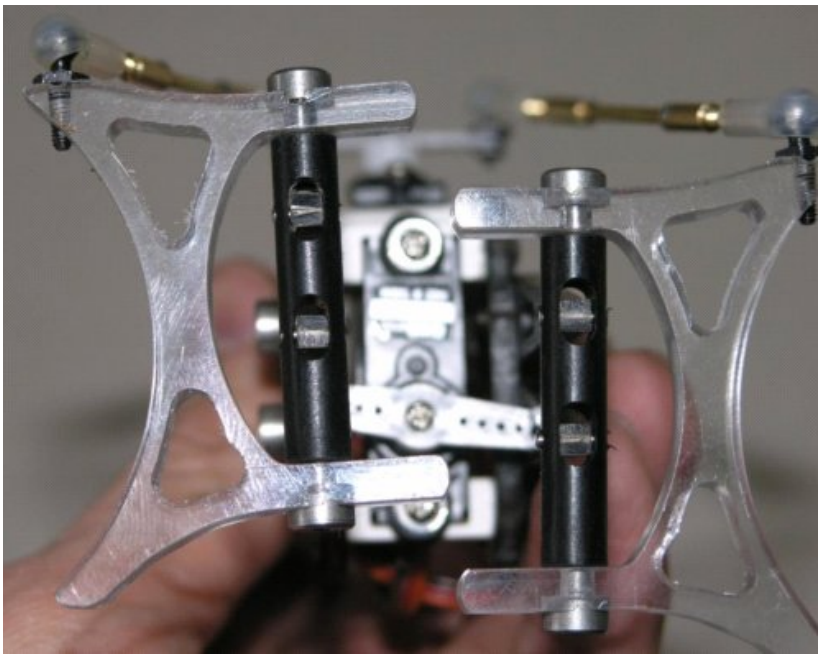


RETRO WORLD
Famous robot appeared as Robert, in the 1960s TV series Fireball XL-5.

Steve Jones' Homebrew Penguin Engineering

Contributions by Steve Jones and J. Wolfgang Goerlich





Top Left- Penguin Mechanics: the main body is a darker see-through acrylic material and awaits the power pack board and the BS2px microcontroller motherboard from Parallax Inc. A transparent Penguin is very unique and one of a kind.

Middle- the back view shows the two sets of servo cables and how the feet are pinned to the ankles.

Right- from the left side, brass hobby aircraft linkages are soldered together meticulously at the exact length requirement for smooth walking. These are adjustable at each end by threads which turn in or out of ball joint mounts.

Left- The small feet are the perfect size to statically balance the robot. They are machined from a see-through Plexiglas/plastic material. This may be the only Penguin Robot in existence with see-through feet! See-through feet are helpful when calibrating the compass using the directions print. All photos supplied by J. Wolfgang Goerlich.

Steve Jones is the owner of Bug 'n' Bots and the President of the Canadian National Robot Games. Photos show a homebrew Penguin Robot he built in early 2006...

Homebrew Penguin

It was a surprise to see Steve Jones unveil his homebrew Penguin Robot at the *Robot Bug'n'Bots BuildFest* as early as January 14th, 2006. Steve does CNC machining and drawings in TurboCAD, then passes the file to CAM software, it's converted to G-Code, then Mach2 runs the G-Code and all the plastic is machined. The Penguin Robot was actually created before the robot was marketed by Parallax. Steve did machining of parts using engineering drawings/ parameters specified by Penguin Robot designer Ken Gracey of Parallax. If you are near the Toronto area, you might come to one of Steve's BuildFests. The previous one was on June 9th. He holds these at the *Bug'n' Bots* store. According to the Buildfest write-up, he also completed a hexapod, B-B Hex, which was quoted as "being very zippy, and in a position of good competition for the ECRG walker event." ● ***J. Wolfgang Goerlich***

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Canadian National / Eastern Canadian Robot Games
http://www.robotgames.ca/

Penguin Tech Magazine

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PT is an independent non-profit publication (although donations are accepted to help us continue) and has no appreciable timetable. Issues are released worldwide when interesting projects become available and documented for everyone to enjoy. Material, ideas, concepts, and drawings may be used for your own personal projects for home and school use, unless otherwise noted. Although information is presented from working projects, it is considered "as is" and up to the user to determine suitability. The user assumes all risk and liability. Support is currently through the Parallax Forum. Special thanks to Ken Gracey and the Parallax support team, Vittorio Rossi, Ira Chandler & numerous others. For more information, contact the editor, humanoido, at email: penguin.robot@yahoo.com

Contributing authors are welcome. Penguin Tech journal is a concept by humanoido. Penguin Robot Society is a non profit organization comprised of Penguin Robot and Basic Stamp enthusiasts. © 10.08.08

Penguin ROBOT Society

Penguin Robot Page Goes Online!

http://www.robotinfo.net/penguin/

The story of how the Penguin web page was born is an interesting one. Before Penguin Tech Magazine, work began to create the Bible of Penguin – a web site that would contain all known Penguin Robot knowledge for enthusiasts. The first proto page was created but when it came time to upload, html features went awry. A partial site was placed online and work began for a better solution. In the next project phase, the idea was to subscribe to faster net, and create a CMS Content Management System page, where work is designed, and managed online. The idea was a good one, however, server connections from China, linking to USA locations crawled at 6k/bits per second, unusable for Penguin applications. The next idea: purchase high speed internet. Three China ISP companies were tried- each one was cancelled for the same reason. A partial CMS went up but no further work resulted. Time progressed and Penguin work continued feverously. The Penguin Robot Society increased membership while projects and a continuing collection of fascinating web material continued to grow. A way was need to get this info out to the world. As a result, the new Penguin Tech Magazine was born. It could convey the information in electronic or printed form. For all of its intentions, it became a success and project articles and information could now be posted through net speed bursts when they became available. All updating was accomplished offline and posting each issue only needed to occur one time. That led to suggestions for the web site again. A new solution appeared: centralize the web page overseas where access would result at very reasonable speeds. This is the solution that became successful. More to come! ●

The new home of Penguin Robot is dished out by an international server in Italy, helping centralize high speed access world wide.

Useful Links and References…

Penguin Robot Home Page	http://www.robotinfo.net/penguin/ NEW
Penguin Robot Society Email	penguin.robot@yahoo.com
Toddler & Penguin Tech Group	http://tech.groups.yahoo.com/group/toddler_robot/
Parallax Inc.	http://www.parallax.com/
Parallax Forums	http://forums.parallax.com/forums/
Robot Magazine	http://www.botmag.com/
David Buckley	http://www.davidbuckley.net/DB/inspired/KenGracey/KenGracey.htm#MiniToddler/

Where to find Penguin Tech Magazine and software downloads: at the Penguin Robot Home Page, at the Parallax Forums, at the Toddler & Penguin Tech Group. Penguin Tech Magazine tells an unfolding story of mystery and intrigue, of how you can do the most amazing fun projects with robots and Basic Stamp microcontrollers.

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