BY DON LANCASTER

Pseudoscience Strikes Again

Plus important EE Internet sites, a MIDI music book, the BASIC Stamp II microcomputer, and more.

IT'S NOW OUR MONSOON SEASON OUT HERE IN ARIZONA. FOR SOME WEIRD REASON, THIS SEEMS TO BRING THE PERPETUAL-MOTION FOLKS AND PSEUDOSCIENCE ENTHUSIASTS OUT OF THE

woodwork. I've recently been seeing one a day. One was a "motors and magnets" drop in. Uh, sure, a magnet offers a repulsive force. But only a few permanent-magnet developers seem to pick up on the fact that you have to think *cyclically*. The energy you will need to get your magnets into a position where they can do the repulsion *always* exceeds any possible output.

The second was an individual who genuinely believes he has a workable *zero point energy* solution. For some strange reason, he is sorely lacking development funds. He does appear a lot more credible than most. To be fair, I'll have to put this one in my "wait and see" mode. But I won't be holding my breath.

Meanwhile, all of the cold-fusion diehards appear to have gone into a "circle the wagons" state. They also seem to be running critically low on ammunition. They are now centered on an *Infinite Energy* magazine and an *CFNET* online resource. The fact that they have now allied themselves with pyramid power (now renamed as *tetrahedral superscalars*) does not bode well.

Genuine new energy developments certainly will emerge. And research certainly should continue. So should independent thinking. For instance, the August 18th issue of *Science* tells us about a dramatic improvement in lower cost polymer solar cells on pages 920-921. These are still woefully inefficient and totally unstable, but they just got a whole lot better.

Any legitimate new energy development should meet these guidelines: It must (A) economically generate *one net watt* of useful power in (B) a simple experiment.
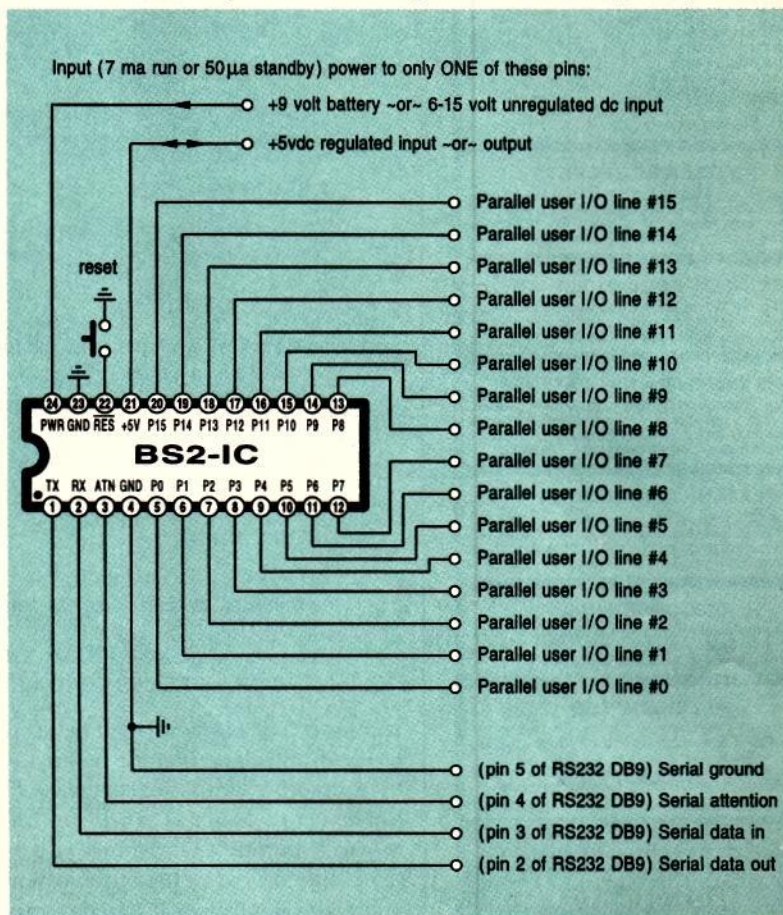

FIG. 1—THE BASIC STAMP II has greatly improved capabilities over its earlier release. This is an entire $49 computer the size and shape of a 24 pin DIP.

MORE OUTPUTS—

There are now sixteen user defined parallel I/O lines. Each can source or sink 20 mils over the full supply range.

MORE MEMORY—

There is now a 2K nonvolatile program memory, good for several hundred BASIC statements, plus lots of data storage.

IMPROVED MEMORY ACCESS—

Data may now be prewritten into memory before downloading your Basic program. You can also read or write nonvolatile memory data.

FULL TIME SERIAL—

The serial port is now usable at runtime, following simple software commands. The baud rate can go as high as 38,400.

TOUCH TONE OUTPUT—

Simultaneously generates a touch tone audio tone pair. Can also be used to generate one or two sinewaves of any frequency to 32 kHz.

BSR OUTPUT—

Directly generates the BSR home remote control tones. For use with a TW513 or TW523 power line interface module.

PWM OUTPUT—

Simple commands output any number of variable duty cycle pulses. Making for ultra-simple D/A conversion.

POTENTIOMETER INPUT—

Directly measure an analog potentiometer. Can also be used to measure RC charging or discharge times.

BIT SHIFTING—

Shift bits in from parallel to serial. Or shift bits out serial to parallel. Valuable for talking with other microcontrollers.

CYCLE COUNTER—

Count the cycles on any pin for a given time period. Input frequency can be as high as 150 kHz.

POWER MATH—

New single command math features now include square root, sine, cosine, and absolute value. One degree accuracy on trig.

POWER LOGIC—

Unusual new bit and digit manipulation features include a priority encoder, decimal digit selector, order reversal, and lots more.

FIG. 2—NEW OR IMPROVED FEATURES of the Basic Stamp II.

It must (C) be easily verified by disinterested outsiders. It must be created by a credible individual who is (D) both trade-journal and on-line research literate. They must also be (E) totally devoid of paranoid, patent, political, or puritanical hangups, and backed up by (F) some reasonable and likely theoretical framework based on physics.

The latest perpetual-motion flap on the Internet involved the usual screwup: You can not measure AC power with a voltmeter and an ammeter! You never could and you never will. As usual, their "over unity energy gain" was in fact nothing but awful labwork. More on this in my HACK49.PDF or in my Hardware Hacker reprints.

The *Skeptical Enquirer* is a good source for pseudoscience debunking. All of the latest new pseudoscience developments show up in the *KeelyNet BBS*.

The sad thing about wasting your time on any pseudoscience is that the odds of success are zero. There are so many new and exciting things you could be trying instead, such as my new magic sinewaves, that mystery band, those PIC chips, X-Y flutter-wumpers, isopods, DNA computing, spread-spectrum communication, book-on-demand publishing, desktop finishing, fluxgates, car alternator steppers, Santa Claus machines, short haul telemetry, sonoluminescence, or Navicubes. More on these in the *Incredible Secret Money Machine II.* Also see EMERGOP4.PDF.

The BASIC Stamp II

Lance Wally of Parallax just sent me a few samples of his new BASIC Stamp II, a PIC-based microcontroller the size and shape of a 24-pin DIP integrated circuit. The pinouts are shown in Fig. 1, and new features in Fig. 2.

You program the Basic Stamp by connecting it to a PC's serial port and then executing host software. That places tokenized BASIC commands in the Stamp's internal non-volatile memory. Once programmed, the stamp may be taken anywhere or be used any way you care to.

Because of the nonvolatile serial EEPROM flash memory, you can reprogram the Basic Stamp as often as you like, making for simple debugging and reuse. You can power your stamp from a nine-volt battery or an unregulated 6- to 15-volt source applied to its built-in voltage regulator. Or, you can instead directly input a five-volt regulated DC system supply voltage. The operating current is typically seven milliamperes. Some standby options can reduce this down into the 50-microampere range.

There is an optional breadboard area about three inches square. Included are battery clips, the reset button, and a DB-9 connector for

RS-232 serial access. Improved features include more memory, better and faster serial communication, BSR and touchtone outputs, and more output lines. Programs can now contain up to 600 BASIC instructions. There is also a modest performance improvement.

This is by far the easiest microcontroller to use, ever. I particularly like its A/D conversion that makes use of RC discharges and the D/A conversions based on pulse-width modulation (PWM). I've uploaded the new Basic Stamp II manual to my GEnie PSRT along with the earlier Stamp I introduction, instruction sets, and application notes.

Some alternatives

The BASIC stamp is the best starting point when you decide to become microcomputer literate. And its PIC chip is by far the best low-cost microcontroller available today. First because of its 3˘ speed and 3˘ program length advantages. Second, because it is cheap, simple, and fun to use. And third, because the PIC encourages creative new algorithms.

As we've seen in the past, the PIC makes it totally unthinkable to ever again use the 555 timer or any other "bits and pieces" solution. But there are some useful BASIC Stamp alternatives. I've listed several of them in our resource sidebar.

Any interpreted language will chew up resources and slow you down. So, once you're past your bare beginnings of understanding a microcontroller, your stamp may end up a little slow and a tad cramped.

As always, the solution is to drop into machine language in which you select only the exact code you need. This trades off speed for storage and lets you create your own custom integrated circuit in the process. You can begin with the *PIC Data Handbook* and that *Microcontroller Applications Handbook* offered by *Microchip Technology*. I've posted a PIC introduction as HACK88.PDF.

Scott Edwards offers lots of useful PIC products. His *PIC Software Tools* has machine language equivalents to most of the Stamp commands. You select only the ones you really need.

The 6805 has 1232 bytes of user EPROM or OTP programming space that can **not** be run time modified.

It also has 64 bytes of user RAM, that normally get used as variable storage (at bottom) and as a stack (at top).

You are also allowed to insert short programs, subroutines, or indirectly written access links into your user RAM area. This is the key to adding your new address modes.

To add an indexed indirect load addressing mode, first reserve four contiguous user RAM bytes. Then write the following bytes to user RAM during chip setup time...

```
NULOAD  EQU #D0        ; Stash code at $00D0

OPCODE  EQU #$D6       ; Want LDA (opr),X opcode
BASEHI  EQU #$06       ; Default base high address
BASELO  EQU #$00       ; Default base low address
RETURN  EQU #$81       ; RTS opcode

        LDA OPCODE     ; poke LDA (opr),X opcode
        STA NULOAD     ;
        LDA BASEHI     ; poke default high address
        STA NULOAD+1   ;
        LDA BASELO     ; poke default low address
        STA NULOAD+2   ;
        LDA RETURN     ; poke RTS opcode
        STA NULOAD+3   ;
```

To use your new indirect indexed addressing mode, you stuff your two calculated values of BASEHI into NEWLOAD+1 followed by BASELO into NEWLOAD+2. Then simply do a...

```
        JSR NULOAD     ; get indirect indexed value
```

Your new instruction will get a data value from the sum of an indirectly calculated 16-bit address and an 8-bit offset in your X register. Indirect or indirect indexed loads, jumps, logic, and even subroutine calls can be handled similarly. There is often a 12 clock cycle speed penalty.

FIG. 3—ADDING NEW ADDRESSING MODES to the 6805 microcontroller.

These run a lot faster and take up far less memory. Scott also offers stamp extenders and interfaces for servos, LCD displays, thermometers, touchtone decoders, and A/D converters. Meanwhile, Steve Ciarcia over at *Micro Mint* has an *Intel* approach to low-end micros in his new low-cost *Domino* series. These are well done "sort of Stampish" solutions. If you

like Intel chips (I definitely do not), these might be a good route to explore.

Whenever the Basic Stamp is not "enough," you might instead want to consider the 65C265-based *Mensch* computer offered by *Western Design Center*. We looked at this gem last month and in MUSE93.PDF. This one includes PCMCIA card access, a

NAMES AND NUMBERS

Amsco Publications
257 Park Avenue South
New York NY 10010
(212) 886-6500

Atmel
2125 O'Nel Drive
San Jose CA 95131
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Biophotonics International
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Pittsfield MA 01202
(413) 499-0514

Gem Star Development
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Pasadena CA 91101
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GEnie PSRT
401 N Washington Street
Rockville MD 20850
(800) 638-9636

Infinite Energy
PO Box 2816
Concord NH 03302
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International Rectifier
233 Kansas Street
El Segundo CA 90245
(310) 322-3331

KeelyNet BBS
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Mesquite TX 75149
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Maxim
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Sunnyvale CA 94086
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Microchip Technology
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MicroMint
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Vernon CT 06066
(203) 875-2751

Motorola
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(800) 546-5461

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5485 Pineview Lane
Plymouth MN 55442
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Buffalo NY 14226
(716) 636-1425

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(520) 428-4073

Sysop News & Cyberworld
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Topeka KS 66615
(913) 478-3157

Texas Instruments
PO Box 809066
Dallas TX 75380
(800) 336-5236

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graphics and text video display, an printer add-on, 12-megabyte address-ibility, and full expandability.

Meanwhile, *Motorola* is offering a bargain $95 development kit for its 6805 microprocessor. The part number is 68HC705J1A. The one-piece hardware includes a programmer, tester, verifier, and even an in-circuit (but not real time) emulator, along with development software that runs on a PC. I found both their assembler and debugger to be fast, fun, and easy to use. Some additional startup resources appear in the sidebar.

A 6805 programming trick

Being a 6502 person, I never go anywhere in microland without an *indexed indirect* addressing mode. This ultra power addressing scheme lets you reach anywhere you want that is so much as near an on-the-fly calculated 16-bit address. At first glance, the Motorola 6805 seems to lack any addressing scheme even remotely as powerful. But, as Fig. 3 shows, there is one ultra-sneaky trick that you can pull to fake indirect indexed power.

Unlike many micros, the 6805's working registers are *inside* of its address space map. Normally, your program goes into the 1280 bytes of write-once memory and your data and variables go in a 64-byte stash of read-write RAM shared with the system stack. Now for the sneaky part: There's nothing keeping you from executing short blocks of program code inside of the register and variable stash! For instance, set aside four user RAM "variables" that happen to sit beside each other, say $D0-D3. Now force feed this subroutine...

http://aip.org	American Institute of Physics
http://www.info.apple.com	Apple Computer technical library
http://www.bellcore.com	Bell Telephone Laboratories
http://www.civent.carlton.ca/ecl	Carlton University case studies
http://www.cmu.edu	Carnegie-Mellon university
http://www.englib.cornell.edu	Cornell University engineering library
http://www.monster.com	East coast technical employment
http://www.e2w3.com	Electrical engineer's hotlist
http://www.techweb.cmp.com	E.E. Times magazine
http://www.epri.com	Electric Power Research Institute
sci.electronics	Electronic circuits database
http://www.eff.org	Electronic Frontier Foundation
http://www.commerce.net	Electronic marketplace catalog
Gopher to: enews.com	Electronic newsstand online magazines
sci.electronics repair	Electronic servicing and repair
http://www.careermosiac.com	Employment database links
comp.software.eng	Engineering software listings
http://galaxy.einet/einet/einet.html	Enterprise integration network
FTP to: ftp.prep.ai.mit.edu	Free Software Foundation
http://www.ge.com	General Electric online database
http://www.nearnet.gnn.com	Global network navigator
http://www.harris.com	Harris Semiconductor technical data
http://www.ieee.org	Institute of Electrical & Electronic engineers
http://www.intel.com	Intel technical product data
http://www.ibm.com	IBM online database
http://www.www.spie.org	International Society for Optical Engineering
http://www.internic.net	InterNIC net locator
http://www-atp.linl.gov	Lawrence Livermore National Laboratory
FTP to: ra.nrl.navy.mil	Macintosh Engineering Users Association
http://www.marshall.com	Marshall Industries semiconductor reference
http://www-mtl.mit.edu	Massachussets Institute of Technology
http://www.mathworks.com	Mathworks help and technical support
http://www.mrc.uidaho.edu	Microelectronics Research Center
http://www.motserv.indirect.com	Motorola online data library
http://www.hypatia.gsfc.nasa.gov	National Aeronautics and Space Admin
http://www.nist.gov	National Institute Science & Technology
http://www.nsc.com	National Semiconductor product information
http://www.nec.com	NEC semiconductor components
http://www.ageninfo.tamu.edu/jobs.html	Online employment agency links
sci.optics	Optoelectronic resources
sci.physics.research	Physics and physical sciences
http://www.dynemo.ecn.purdue.edu	Purdue University ee labs
http://www.sandia.gov	Sandia National Laborarory
http://www.sri.com	Sarnoff Research Institute
http://www.stanford.edu	Stanford University design research center
sci.math	State of the art mathematics
http://www.sun.com	Sun Microsystems access links
http://sunsite.unc.edu/unchome.html	Sun Microsystems technology exchange
http://www.ti.com/sc/docs/schome.htm	Texas Instruments technical data
http://www.berkeley.edu	University of California Berkeley research
http://www.bunny.cs.uiuc.edu/jobs	University of Illinois career center
http://www.ee.umr.edu	University of Missouri Rolla
http://town.hall.org	US patent database
http://www.uspto.gov	US patent and trademark office
sci.electrical wiring	Wiring standards
http://www.yahoo.com	Yahoo Internet directory

For more details on these sites: http://techweb.cmp.com/eet/docs/eetff.html

FIG. 4—IMPORTANT INTERNET SITES for electronic engineering.

```
$00D0 FAKEIT LDA (XX YY),X
$00D3 RTS
```

where HH is the high eight bytes of your calculated address and LL is the low eight bytes from your calculated address. To use your new address mode, you stuff the address values

you want on into HH and LL and then call your new mode as an ordinary subroutine...

```
$03?? GETVAL JSR FAKEIT
```

Whenever control is passed back from the subroutine, the accumulator holds a copy of the value stashed at

the sum of the calculated 16-bit address and the offset in the X register. You also have the option of using a JMP into RAM plus a JMP back into the normal program space, or even an indexed jump.

Among many other possibilities, you might now load, store, or jump indirect indexed. You can even do a JSR to an indirect indexed subroutine—a feature that is sorely lacking on many microcontrollers. The only penalties for this sneaky ploy are the extra machine cycles involved and the "loss" of four bytes of user RAM. Note that a subroutine call on a 6805 takes *twelve* or *thirteen* clock cycles to execute. Any PIC can do the same thing in *two* clock cycles!

This month's contest

If you are not familiar with the 6805, what you have just read might seem like so much gibberish. But every microprocessor family has its *insider snippets*—short and sneaky code sequences that do amazing things in ways previously unthought of ways. As another insider snippet, we looked at a PIC generating a high quality sinewave in an astonishing *six bytes* of code back in HACK85.PDF. So, for this month's contest, just tell me your favorite insider snippet for any low-end micro.

As usual, there will be a dozen or more copies of my *Incredible Secret Money Machine II* book going to the better entries, plus an all expense paid (FOB Thatcher, AZ) *tinaja quest* for two for the best of all—or a tramway hunt if you prefer. The choicest (and hardest) pieces of the trace still remain. Bring your own catclaw, just in case we don't find enough on the route. Naturally, your 4WD vehicle gets an absolutely free Arizona pinstriping job. More information in GRAMTRAM.PDF. Be sure to send all your written entries to me here at *Synergetics* and *not* to the *Electronics-Now* editorial offices. To be fair to everyone, E-mail entries are not acceptable.

Important EE Internet sites

A detailed listing of the top one hundred EE Internet sites appeared