



REMark

On Heathkit Computing

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This is an experimental publication to capture and share knowledge and experiences with Heathkit computers. Each issue will address one or more topics of interest to collectors, hobbyists and computer historians. - Glenn Roberts, Editor.

Useful Things to do With an H8/89

Tom Williams recently asked “what are ten useful things to do with one's H8/H89?” It’s a fair question. Certainly many of the office and business functions that these machines were once used for can now be done so much faster and easier on modern hardware. And yet rather than haul our Heathkit machines to the recycle center we treat them like computer royalty? Why? So I took some liberties in answering his question, but here’s my list (I ended up with 12!). I encourage others to edit/comment and add their own rewarding experiences!

1. Play Games

Games were always a big part of early home computing and we have preserved a pretty good collection of them for the Heathkit platforms. These are not very well organized at the current time (perhaps a topic for a future *REMark* issue to map this all out!).

One very good source of games is Les Bird’s collection of old disk images:

<https://sebhc.github.io/sebhc/software.html>

Scroll down to his “Application Archive” section, where he has archived hundreds of old disk images - 9 volumes at the current time! The “contents” links let you bring up a web page index and search for your favorite game titles or disks with “GAMES” in their name. There are many in there. Some of my favorites include the original Crowther & Woods ADVENTURE, plus MUNCHKIN (Pac-Man like game), INVADERS (think Galaga), YWING and YWING2. If you look you’ll find others such as. PIRATES, SPACEWAR, LIFE, SNAKE, ODYSSEY, REBOUND, WARRIOR, BUGS, MISSL... Many of these are native (machine language) programs but there are also many BASIC programs that you can run and modify to meet your needs.

Les also has a pretty complete collection of the old Heath User Group (HUG) disk images, and there were quite a few game disks in there. Scroll down to “HUG Application Library.”

https://sebhc.github.io/sebhc/software.html#HUG_Application_Library

Mark Garlanger also has a very nice collection of old software titles, organized by the original vendor and often including the original instruction sheets

<https://heathkit.garlanger.com/software/library/>

To play these games you will either need to reconstitute the original disk image or extract the game files from the H8D or H17disk file and copy it to your H8/89 using modem software or (if you have one) a USB interface. These techniques are worth discussing further so let's defer that to a future issue of *REMark*s...

2. “Recreationally” Compute

“Recreational computing” is about writing programs that help your computer to “do something”. It can be very enjoyable and rewarding to take on a challenge and solve it. For example, when we added Universal Serial Bus (USB) interface capability to the H8 there was a need for software to copy files to and from USB flash drives. I ended up writing a set of utilities to do that. When we needed the software to support a clone of the Z67 hard drive we had to reverse engineer the code and drivers that we found, since source code could not be found. Another example is the software developed by Dwight Elvey to archive and restore disk images from an H8/89 to a PC.

https://sebhc.github.io/sebhc/software/Utilities/H89LDR9_README.TXT

This has always been a fun aspect of home computing. During the heyday of Heathkit computing HUG assembled a large library of software that was largely written by HUG members themselves - and much of that has been preserved (see link in item 1 above).

3. Learn a Language

It's never too late to learn. We've heard from a number of H8/89 users that they're actually enjoying going back and learning one or more of the languages they didn't have time to delve into years ago. Compilers for C, Pascal, Fortran, Cobol and more are now freely available. Or maybe try your hand at FOCAL, FORTH, PILOT or PL/M. Of course, there is also rich support for writing and debugging 8080 and Z80 assembly language. And learning a language in a simple environment like this can be a lot less intimidating than in, say, a modern Linux, Macintosh or Windows environment. There's just a lot less to master and it's easy to take “baby steps”. There are even some nice tutorial pieces in the old *REMark* magazines:

<http://pestingers.net/pages-images/heathkit/computers/remark-magazines/remark-cvrs.htm>

4. Reminisce

Ok so some of us just enjoy reminiscing about the “good old days” (if you’ve ever attended a Vintage Computer Fest you know what I’m talking about.) Reading through some old *REMark* or *Sextant* magazines you can relive some of the fun and perhaps pick up on some things you missed back then. Building out a system that you couldn’t afford in 1980 somehow gives you a sense of accomplishment and closure. Vintage computing is a lot like vintage automobile collecting - it brings you back to a simpler time and lets you relive some of the excitement. Remember when it was almost unthinkable to have your own computer? Remember when you bought your first Heathkit computer? Perhaps at one of the Heathkit Electronics Centers? Remember going to HUG meetings and perhaps HUGCON? It was a fun time!

For fun, peruse the old Heathkit catalogs, which Mark Garlanger has posted on his site:

<https://heathkit.garlanger.com/catalogs/>

5. Demonstrate “The Early Days”

Most of us have a few canned demonstrations we can perform when we’re (inevitably) asked “so what can it do?” Granted, not everyone will be impressed by these but those who can bring their mind back to the late 1970s perhaps will. You can add music and video capabilities to your system and that will help. Some collectors post videos of their demonstrations on YouTube.

6. Automate Things

Home automation is not all that new - the original H8/89 systems could talk to the BSR X-10 control module via a serial interface ([https://en.wikipedia.org/wiki/X10_\(industry_standard\)](https://en.wikipedia.org/wiki/X10_(industry_standard))) to automate home lighting and pretty much anything that ran on house current.

In today’s world this is often done using Arduino or Raspberry Pi computers interfaced via General Purpose I/O (GPIO) but much the same functionality can be accomplished with a simple parallel interface using the Intel 8255 Programmable Peripheral Interface. For example, Terry Smedley recently posted an example of this on the SEBHC Google Group list:

https://groups.google.com/g/sebhc/c/KahRb-hQ_Vw/m/uJ1onZLiAwAJ

Terry was able to build an Inter-Integrated Circuit (I²C) Protocol implementation that opens up a world of interfacing capabilities including temperature sensing, analog-to-digital conversion, LCD and LED displays, and pulse-wave modulation servo controllers. Many of the real-world interfacing devices available from AdaFruit (<https://www.adafruit.com/>) and SparkFun (<https://www.sparkfun.com/>) can now be connected to your Heathkit computer!

7. Engineer Enhancements

Back in the 70s and 80s the development of a new board or peripheral for a Heathkit computer was generally out of reach for the average computer hobbyist, instead small companies took on this role. Today things are quite different. There are now freely available circuit board design tools and the entry cost for producing PC boards is well within reach of the hobbyist.

Components, for the most part, are still readily available from suppliers like [Jameco](#), [Mouser](#), [DigiKey](#) and others. In 2009, Les Bird developed a set of reverse-engineered clones of all the boards needed to have a functioning H8 computer, including the backplane, front panel, Z80 cpu board, memory, serial I/O and H17 disk controller:

https://sebhcg.github.io/sebhcg/pcbs/H8-2000_Construction.html

Norberto Collado has taken things much further with a full line of boards and accessories for the H8 and H89:

<http://koyado.com/Heathkit/Welcome.html>

In addition, tools like 3-D printers and computer numerical control (CNC) routers have allowed hobbyists to build impressive enclosures and even engineer their own replacement components. You really are limited only by your own imagination!

8. Preserve Computer History

Much as we'd like to deny it, we're all getting old. The people who developed these early systems are mostly now retired. Sadly some have passed away. Many are still interested and active through the SEBHC Google Group. So who's taken charge of archiving and protecting this precious history, particularly software and documentation? There are some organizations but it turns out much more can be done.

The most perishable commodity is probably the software. Disks from 40 years ago often are not readable. Much has been lost. Though we have a sizable library of HUG disks many are still missing in action. Even more rare is the source code for much of this - often it has been lost forever.

I believe we all have a role to play as computer "archeologists." We must constantly be on the lookout for software items and documentation that have not been archived and make sure that they are preserved and shared. David Troendle and I, for example, have largely re-created the original source code for the Heath Disk Operating System (HDOS) by scanning the paper listings and running the result through optical character recognition (plus a fair amount of hand editing!)

Preserving the hardware is key too. Most of us have learned the tricks needed to keep these old machines in running order.

9. Build a Collection

Lots of people enjoy building collections and it can be fun and not too hard to put together a nice collection of Heathkit computing hardware. Whether via eBay, going to estate sales or connecting with your fellow collector it can be very satisfying to track down the components you need to put together your “dream” machine collection. Auction purchases even sometimes yield surprises such as enhancements and add-ons that weren’t documented in the auction listing. A number of computer hobbyists have created small “museums,” where they curate their collection of vintage systems. Assuming you have the will to restrain yourself to just Heathkit you can still build quite a collection including H8, H89, ET3400, Z100, and even Hero robot collections (and their associated peripherals and software...)

10. Teach Computing

Heathkit computers always let you “get close” to the hardware, in fact basic survival skills back then included the ability to patch code and pause execution to probe machine code in memory for bugs and problems, load and dump code to tape or disk, etc. Both the H8 and H89 supported this but the H8 stands out because of its front panel design. Using the front panel keypad and LEDs you can interrupt any running program, probe memory, set breakpoints and single step through execution.

This can be an excellent way to teach the basics of digital computing. Some students today don’t even learn machine or assembly language. For example, the Vintage Computer Federation (vcfed.org) operates a museum in Wall NJ and offers tours. It is often the case that younger generation computer hobbyists on the tour get quite enthused by discovering the internals of these early digital computers, something that’s lost when using a modern PC box.

11. Learn Morse Code

In the 1970s and 80s there was a close affinity between Heathkit computing and amateur radio. Perhaps this was in part because historically Heathkit has engineered and sold many amateur radio kits, so naturally radio enthusiasts were strongly represented among the ranks of early Heathkit computer buyers. There are also a number of amateur radio applications in the HUG software library for tasks such as learning and sending Morse code, antenna design and radio teletype (RTTY) control. Maybe your Heathkit computer will inspire you to get your amateur radio operator’s license!

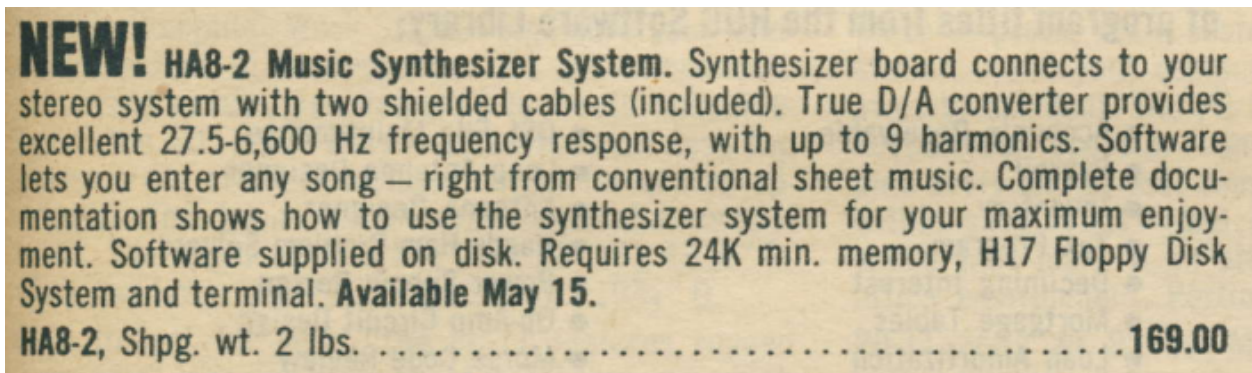
12. Make Some Music

In 1975, Steve Dompier published an article in the *People’s Computer Company Newsletter* (later republished in [Dr. Dobb’s Journal](#)) describing a simple technique for generating musical tones on an AM radio by deliberately generating electromagnetic interference (EMI) using his MITS Altair 8800 computer. In 1975 this was considered very “cool”! Plus it was a short enough

program to be entered and executed from the front panel - you didn't even need a terminal or cassette interface!

Not to be outdone, Heathkitters came up with their own musical mod. Though the speaker in the H8 was designed to emit a fixed frequency tone it was discovered that a relatively simple modification (bending out pin 9 on IC112 of the front panel circuit) allowed for any audible frequency to be generated! This led to music software first published in *HUG Software Volume 1* and later updated and adapted for use with the H17 on HUG disk number 885-1031 (available in Les' archive).

In 1980 a company with the name New Orleans General Data Services (NOGDS) came out with the HA-8-2 for the H8. This was a very powerful D to A conversion board that produced high quality musical output suitable for outputting to home stereo systems. The board was re-marketed by Heathkit:



NEW! HA8-2 Music Synthesizer System. Synthesizer board connects to your stereo system with two shielded cables (included). True D/A converter provides excellent 27.5-6,600 Hz frequency response, with up to 9 harmonics. Software lets you enter any song — right from conventional sheet music. Complete documentation shows how to use the synthesizer system for your maximum enjoyment. Software supplied on disk. Requires 24K min. memory, H17 Floppy Disk System and terminal. **Available May 15.**

HA8-2, Shpg. wt. 2 lbs. **169.00**

Subsequently, NOGDS developed the HA-8-3 which not only did multi-voice sound (via the AY-3-8910 Programmable Sound Generator) but included color video, joystick and math co-processing elements:

The Heath HA-8-3 Color Graphics Board lets you create colorful displays for your H-8 Computer

\$495⁰⁰

- Includes advanced color video generator, programmable sound generator for maximum enjoyment
- Capable of accepting up to four X-Y joystick consoles and an arithmetic processing chip (both not included)
- Board is fully assembled and tested, for fast and easy installation in your Heath H-8 Computer

The Heath HA-8-3 Color Graphics Board will add colorful capabilities to your H-8. It connects to the Heath/Zenith GDZ-1320 Color Video Display above (preferred), or to other video devices which accept the NTSC composite video signal. The HA-8-3's advanced features make it a very useful accessory board.

This Color Graphics Board includes the TI-9918 Color Video Display Generator from Texas Instruments — the most advanced color video generator available. The TI-9918 produces vivid color pictures for color video displays — as well as monochrome levels for black-and-white monitors.

Maximum resolution of the TI-9918 Video Display Generator is 256 x 192 pixels. The video display screen consists of 35 display planes: the External Video, Backdrop and Pattern Planes — as well as Sprite Planes 0 to 31. The planes are stacked, with the external video the innermost or lowest plane. The sprite 0 plane is the outside or highest plane.

The Color Video Display Generator can produce three color display modes:

The **Pattern Mode** causes the pattern plane to be broken up into groups of 8 x 8 pixels, called pattern positions. Since the full image is 256 x 192 pixels, there are 32 x 24 pattern positions on the screen in Pattern Mode. Within each pattern position, two unique colors are allowed.

In **Text Mode**, the pattern plane is broken into groups of 6 x 8 pixels, called text

positions. There are 40 x 24 text positions on the screen in this mode. Sprites do not display in the screen, and two colors are defined for the entire screen.

In **Multicolor Mode**, the screen is broken into groups of 4 x 4 pixels. This provides a grid of 64 x 48 positions on the screen. With each of the 3072 positions, one unique color is allowed.

The TI-9918 Video Display Generator can also display eight different levels of gray, for black-and-white displays.

The **AY-3-8910 Programmable Sound Generator**, built into the Color Graphics Board, is a Large-Scale Integrated (LSI) circuit which is capable of making nearly any sound desired for your game or other application, under software control. The analog sound outputs can each provide 4 bits of digital-to-analog conversion, greatly enhancing the dynamic range of the sounds produced.

To perform sound effects while allowing the processor to continue its other tasks, the PSG can continue to produce sound after the initial commands have been given by the control processor. Realistic sound production with more than one effect is accomplished by the 3 independently controllable channels.

Eight channels of analog-to-digital conversion are provided, for up to four X-Y joystick consoles (not included). Each channel has 4 bits of parallel input/output for switches and LEDs. A built-in socket will accommodate the AMD-9511 Arithmetic Processor Chip (not supplied), which permits extremely rapid floating point, trigonometric and transcendental computations — as well as hardware multiplication and division of both integer and floating point numbers.

Demonstration software for our Color Graphics Board is supplied on a 5.25-inch single-density, single-sided, hard-sectored floppy diskette. Additional software for this Color Graphics Board will be developed and offered by SOFTSTUFF™ in the near future. Due to the use of wait states and a special 18 VDC power requirement, proper operation of the Heath HA-8-3 Color Graphics Board is guaranteed only when it is used with Heath memory boards — or with other memory boards which use fully static single-supply RAM chips.

HA-8-3, Assembled and tested, Shpg. wt. 3 lbs. \$495.00

That's just a quick overview of music options for the H8. There were some similar boards for the H89.

Music is clearly a topic that deserves more attention in a future *REMARKS* issue!

So that's my top 12. Feel free to add to the list!

- Glenn (glenn.f.roberts@gmail.com)

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