

## **Honeywell H-112 Mini Computer**

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### **Getting Started v1.7A**

So if you have unzipped this H-112 Emulator file and are reading this then you may be interested in learning a little more about this antique computer and how to operate it.



### **Introduction**

The first thing you notice when comparing it to a modern PC is just how many buttons, lights and switches it has. Not just a 'power on' and maybe a 'reset' button as we are used to today. That's because computers built in the 1960's and early 70's were designed to be programmed in Binary. This means you could enter instructions or data into the memory of the H-112 by pressing some of those buttons and operating the switches. Believe me this is a very slow way to program a computer and after some hours your index finger feels the strain.

Back when this machine was built there were very few home computes. The microprocessor hadn't yet been invented and so if you wanted a computer at home you either had to design and build it yourself using things like transistors, relays and maybe if you were lucky a few of the early and primitive chips. Or you had to get hold of an old computer at scrap prices as new even the simplest computer cost many thousands of pounds (more like tens of thousands of pounds in today's money). I had designed my own machine but got lucky and managed to buy in the early 70's a scrap Honeywell H-112 mini computer.

Now I would love to give you an H-112 to play with but believe me there aren't many of them still in existence so you need to go to a museum like the 'Time-Line Archive' to see one. But I can do the next best thing. Modern PC's are very fast and versatile and so with a bit of programming they can be persuaded to 'Emulate' another computer, in this case the H-112.

### **First look at the H-112 Emulator**

So double click on the '**h112emuv17.exe**' file and away you go.

On the screen you should see a number of windows, the emulator is designed to work with a 1920 x 1080 pixel display. If your display has a different resolution then you can try going to the top of the screen and clicking on 'Screen Size' and then clicking on 1280 x 720 which is normally correct for 17 inch screens or if the windows are still not in the correct position on the screen you can pull them into the position you want by clicking near the top of a window and holding the mouse button depressed and dragging the window to the position you want.

Now you should see in the middle of the screen the H-112 control panel which we will be playing with in a minute. The H-112 was designed to be used with a teletype (rather like an old telex machine) which could print out what the computer sent to it and you could input text via the teletype keyboard. At the top of the screen is a display area which can either work like a teletype, so what the H-112 outputs will be printed to this area and what's there will be scrolled as new lines are added rather like the paper coming out of a teletype printer. Or it can work as a Digital Group Display with 20 lines of 64 characters. With the advantage that the computer could position to any point on the screen and print text. But most of the time we will be using it rather like that old mechanical teletype.

Below the control panel and to the right is an electronic cassette simulation to allow us to load and save programs and data to cassette. Rather as I did back in the early 1970's. Well you don't want to enter everything via those control panel buttons do you?

### **Pushing the buttons**

So first press one of the register buttons, there are 3 of them **Register A**, **Register P** and **Register W**. These registers as they are called are very important because it's where everything happens. Register P is the program counter it tells the computer from which location in the memory it should take the next instruction. Register W is the working register so everything read from the memory is put there and we shouldn't forget Register A this is where the computer does all of it's real work, arithmetic and comparing things with the contents of memory locations.

Now press some of the buttons labelled 1 to 12 (please don't press 13 this has some special functions) and you setting the bits in the registers in binary. Whatever patterns you make these could become instructions for the computer or data for the computer to work on. Notice that when you change registers and change back again the bits you entered are still there.

Now if we don't want to program the computer in binary then we have to use something called Assembler language which is really binary but simplified so that it looks a little bit like English (but not much). So for example if I wanted to tell the computer to load something into Register A then as binary bits it might look something like this :-

**0001010110**

or in Assembler we would write it as **LDA 86** (Load A with the contents of location 86) though this is decimal and H112 assembly language programmers mostly work with something called octal and so it would be **LDA 126**. But lets not get involved in numbering systems and languages at the moment let's just see how we can load a program or programs which someone else has written into the computer and run them.

### **Loading and Running a program**

Now on your PC you are used to loading and running programs, maybe it's Microsoft WORD or EXCEL or something similar and those programs are hundreds and sometimes thousands of megabytes in size. Now the poor old 112 only has 8Kilo Words (that's about 12 Kilobytes) of memory and that's it. So you might think that you can't do much but programmers in the 1960's and 70's were much more efficient at using memory than programmers today and you can actually do quite a lot with 8KW of memory if you know how.

### **Small Simple Programs First**

Lets start with some simple programs and then go on to something much more complicated.

First we need to place a cassette into the cassette drive which we do by typing it's name into the cassette window. Type '**demo1**'

Now we need to prepare the control panel to load and run the programs on the cassette '**demo1**', yes, there are several programs on this cassette which we are going to load into the H-112 all in one go.

First press '**Master Clear**' at the right hand side of the control panel to reset everything in the computer. Now press the '**Load**' button and it should light up. This machine has what is called a '**Hardware Loader**' so it can load programs from paper tape or in this case a cassette all by itself. All we need to do now is press the '**Start**' button and the programs are loaded. If it did you should hear the word '**Loaded**' and Load light should go out. If you didn't did you mistype the cassette name ? And you notice it was quick wasn't it, actually much quicker than a real H-112 loading from paper tape or even cassette. But why should we wait we want to get on with running some programs.

### **Running your first Programs**

Press that '**Master Clear**' button again. This is important because it will reset all of the Registers to Zero. Especially the '**P Register**' which will tell the H-112 to take it's first instruction from location zero. Press the '**Run/Stop**' button which lights up because we want to RUN a program and now press '**Start**'. You will see that the H-112 is outputting lines of characters to the display at the top of the screen. If you select any of the registers you will see that the values in them are changing as the H-112 goes from one instruction to the next doing what the program has asked it to do. The output is in '**Digital Group**' display mode and so the lines may appear very quickly. Try going to the top of the screen and under speed selecting '**Slowest**' (Speed 0) and when you have finished set it again to '**Standard**' (Speed 3). When you are ready click the '**Run/Stop**' button to stop the program and that's it's you've run your first H-112 program.

### Some more small Programs

Now press that **'Master Clear'** button again, we do this before running any program to make sure everything is reset and ready to go.

Now select **'Register P'** and press bit **'8'** which should light up. This tells the computer to run a program starting at location 200 Octal. Don't worry too much about why bit 8 is 200 Octal at the moment you can learn more about numbering systems later if you want to.

Now press the **'Run/Stop'** button and as before **'Start'** and 'nothing happens' well the light came on next to **'Master Clear'** to show you the program is running and if you select the **'P'** register you see a couple of the lights blinking. And as it's only a couple you can guess that this is a very small program indeed. In fact it just takes input from the keyboard and outputs it to the display. So click on the **'Teletype Window'** to select it, because you want to enter your keyboard characters to the teletype/DG Display device. What you type goes into the H-112 and the computer outputs it to the Teletype/DG Display at the top of the screen. Notice the spacing of the characters on the screen – in teletype mode the characters are much closer together as you will see in a minute, in DG Display mode they are evenly spaced with 64 characters/line. You may notice that if you hit the **'Enter'** or **'Carriage Return'** key you go to the next line. When you are finished click the **'RN/STP'** (Run/Stop) button to stop the program.

Now press **'Master Clear'** as always to reset everything and select Register P and set bit **'9'** Which is 400 octal. Now press **'RN/STP'** and then **'Start'** and a little program now runs outputting to the screen but in teletype mode (which is shown at the bottom of the window) which means more characters per line and it scrolls the paper or in this case the lines up the page. To more accurately simulate a real teletype the speed of printing is reduced compared to DG Display mode. This is a good program to try the speed control at the top of the screen, try the various speeds between **'Slowest'** and **'Super Fast'** and when you have finished return the speed to **'Standard'** (Speed 3) and then press **'RN/STP'** again to terminate the program.

So running small programs is pretty straight forward but when I owned my H-112 I wanted to be able to do much more and the easiest way to program a computer is with something called a **'High level language'**. Some you might have heard of that existed in the 1960's and 70's are Fortran, Basic or Cobol. Today there are hundreds of languages and you might wonder why so many. Well so do I sometimes but basically some languages are better at certain things. For example Fortran is good at maths and Cobol is good at juggling data and Basic, well Basic is a bit of a mix and was designed to do most things and be relatively easy for beginners to learn.

## Running a large Program with TBX (Tiny Basic Extended)

The H-112 didn't have any high level languages it was always programmed in Assembler and a full compiler or interpreter for a high level language would be not impossible but difficult to write and fit into a small 8K machine. But at the time mid 1970's micro computers were beginning to appear and they also only had small memories and so people began writing limited Basic interpreters called 'Tiny Basic' for these machines and I wrote one for the H-112 which I call TBX 'Tiny Basic Extended' which was Tiny Basic with some extras.

So let's load TBX. Do a '**Master Clear**' and then enter **tbxvbh** into the cassette window.

Press the '**Load**' button and then '**Start**'. TBX will be loaded into the H-112.

Press '**Master Clear**' again and then '**RN/STP**' followed by '**Start**' and you will see on the display at the top of the screen '**TINY BASIC EXTENDED REV. BH**'.

So now we have to either write a program in the TBX language and there is a handbook for TBX in the zip file you unzipped or more simply lets just load a program which I wrote to play Mastermind, the game where you choose 4 coloured pegs and the computer tries to guess which pegs you have chosen.

Remove the '**tbxvbh**' cassette from the cassette window (by using the backspace key) and enter '**mastermind**' and then click on the Teletype window to select it **and type the word 'LOAD'** followed by the '**Enter**' key. The only thing that happens is that on the next line a '.' appears. But the program has been loaded you can prove it by typing '**LIST**' followed by the '**Enter**' key and the whole program will be listed to the display in Teletype mode. But we want to run the program so just type '**RUN**' followed by the '**Enter**' key and away you go - enjoy the game.

You might also like to try the '**8Queens**' program which provides the 92 solutions to putting 8 queens onto a chessboard. Just delete the 'mastermind' entry from the Paper Tape Reader and enter '**8queens**' then select the Teletype window and as before type '**LOAD**' and then '**RUN**' and of course you can type '**LIST**' see the whole '**8queens**' program.

At the top of the screen you can select '**Speed**' to make the emulator run faster or slower. But remember any timing loops in programs will be affected by the speed you select. Try different speeds with the '**8queens**' program.

Both of these programs used the simple 'Teletype mode' of display with scrolling, the next program called **REVERSI** uses the 'Digital Group Display Mode' with extra features like 'Clear Screen etc. '**Reversi**' appeared in a 1979 issue of Byte and I never thought after I retired the H-112 in 1980 that I would be entering a new TBX program in 2015 but when I was sorting through my old magazines I found it and I modified it for TBX and entered it but unfortunately there were several problems with the program and it obviously had a number of bugs. Anyway I debugged it and it now runs correctly, so enjoy the game. Enter '**reversi**' into the cassette window and with TBX loaded and running type '**LOAD**' and then '**RUN**' and enjoy the game. The H-112 plays a pretty good game of Reversi at least I find it hard to beat.

Going further. Would you like to try writing your own program in TBX, well look at the TBX Handbook to learn how to use the language and perhaps take a careful look at the Mastermind game to see a typical program. One tip if you enter a cassette name for TBX then you can load from it but you can't write to it, It's write protected. To be able to write you must unprotect it by putting a '.' In front of the cassette name. Also if you want to create a listing of a TBX program then try my PC program 'TBX Lister' which will take the name of any TBX cassette and create a file with the same name and '.txt' as the ending instead of '.112' . Being a text file you can open it in any editor in Word etc. and print it out if you want.

If you are a real gluten for punishment and want to try writing in Assembler for the H-112 then you will probably need to download the H-112 programmers Reference Manual which is available on the internet and you might like trying the H-112 Mini-ASM program. To enter your programs.

And if you still have any other questions then you can try contacting me at :-

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