

# **4Mb Memory Upgrade for Casio FZ-1/10/20!**

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## **Introduction**

The information contained in this article has been sourced from the Casio FZ World newsletter, dated March 1993 Issue no 8. I have included the info for the benefit of other FZ owners, while no copyright was applied to the original article, my appologies if I have stepped on any toes..

I have not tried this mod, due to difficulty in finding reasonably priced 80ns memory chips suitable in the UK. There is a reasonable amount of soldering involved in this project, not to be recommended to the beginner, if you don't understand any of the terms used in this article then it is definately not for you. You have been warned...

*Stuart Robertson*

Don't believe it? Well, it's true. I obtained the FZ-1 schematics from CASIO and noticed that the ASIC (application specific integrated circuit) that controls the wave memory had some control lines that were not being used. In fact, it appeared that CASIO, at one time, had these signals routed to the memory expansion slot but then erased them. I decided to wire in some memory hoping that CASIO supported the extra memory in the OS (operating system).

Guess What? It worked! I can now sample almost a full minute at 36khz. The Operating System apparently tests for the amount of memory in the system upon power-up. The OS seems to support up to 4 meg. of RAM and works (as far as I have tested) just like the 1 meg memory upgrade except that the amount of available sample in the FZ-1 is increased by 4X instead of 2X.

Interested? Well, now is the time to tell you that this project requires a fair amount of technical know-how and if you are the least bit squeamish about opening up your FZ-1 then this project is not for you. Also, I have not answered all the technical questions associated with this project so I'm open to any and all comments or questions.

## **THE TECHNICAL NITTY-GRITTY**

On the main circuit board is an ASIC that is labelled GAS. This is the device that controls the wave memory (addressing, refresh, etc.). The memory is arranged in banks of 256k X 16 bits. There are two of these banks (1 megabyte) on the main circuit board. CASIO markets a 1 megabyte expansion board that also contains two of these memory banks. The GAS selects individual banks of memory via separate RAS (row address strobe) signals to each banks of memory. The GAS has a total of 8 RAS signals (ras0-ras7). Each RAS can enable one bank of memory which is 1/2 megabyte (256k X 16 bits). Therefore, the GAS ASIC can select a total of 4 megabytes of memory. CASIO is presently only using ras0-ras3. Ras0-ras1 selects the main board memory while ras2-ras3 selects the expansion board memory. It is obvious by looking at the schematic, that ras1-ras7 were at

one time routed to the expansion slot. Now, the pins on the expansion slot that were ras4-ras7 are now routed to ground. Ras4-ras7 still exists on the GAS ASIC but they are not routed on the circuit board so you will have to solder wires (30awg) to these pins on the GAS to gain access to these signals. This is what keeps anyone from marketing a memory expansion board greater than 1 meg for the FZ-1.

## **HOW I IMPLEMENTED THE MEMORY IN MY FZ-1**

There are of course many ways to add the expansion memory. I chose the way easiest for me. Others may have a better idea.

The DRAM installed by CASIO on the system board in my FZ-1 is from Panasonic. It is the MN41256-08. The-08 means that it is 80 nanosecond dram (access time from row address).. There are two rows of dram on the system board. Each contains 16 of the Panasonic devices. Each row is one bank of dram (256 X 16 bits).

I chose to use 100ns drams because that is what I had on-hand. The dram I am using is Texas Instruments TMS4256-10. this is standard dynamic rams much like that used in most IBM compatible AT's. Unfortunately, this puts the timing of CAS-going-low-to-data-valid timing in negative margin in my FZ-1 so I have modified the CAS (column address strobe)signal to improve the timing. I suggest that anyone attempting this project only use 80ns DRAM's, they're more expensive but will guarantee dependable data in the FZ-1.

Since all of the banks of memory have common signals except the ras lines, I decided to solder each bank of dram directly on top of the main board memory banks. More precisely, I placed a DRAM device directly on top of a Main board DRAM and soldered the top device's pins directly to the pins of the DRAM device on the main board except for pin4 (RAS) which I bent horizontal and cupped short so as not to short to the adjacent device. This was done to each NB41256-08 on the main board. The ras pins that were bent horizontal were wired together within each row of DRAM. Remember, each row makes a bank of DRAM. This was done three times resulting in three layer of dram devices on top of the original system board dram. this makes a total of 4 megabytes. Obviously, if I had Casio's 1 meg upgrade I would only have needed two layers of dram devices.

The ras signals from the GAS needed to be buffered and inverted so I dead-bugged a 74HC04 on top of a device near the system board dram. I then wired the unused RAS signals from the GAS to the inputs of the gates of the 74HC04. this is tricky since the GAS is a surface-mount ASIC and the pins are very small. See Figure 1 for the GAS pin outs.

### **TagPinDescription**

RAS040System board DRAM control

RAS139ie fist 1mb RAM

RAS2381mb Expansion DRAM control

RAS337ie 2nd 1mb of RAM

RAS436The DRAM control pins that

RAS535are currently unused

RAS632The DRAM control pins that  
RAS731are currently unused

I soldered 33 ohm resistors to the outputs of the 74HC04 for termination. Then I wired from the resistors to the ras pins that were previously wired together in each row and level.

That's it! that's all it takes to have a 4 megabyte FZ-1.

## **TESTING**

If you are going to try this project, I suggest that the memory be added one bank at a time and tested before adding the next bank. A good test is to turn on the FZ-1, go directly into the sampling menu and check to see if 7.28 seconds (per bank of memory) was added to the total sampling length. Then take a sample using the maximum available time with no input. Next, display the waveform and magnify the end of the sample as much as possible. Look at the noise level and make sure that it is no greater than BEFORE you started the project.

If you have something that generates a good sine wave or any known waveform, then sample it and make sure that it reproduces accurately. If all is OK then proceed to the next bank.

## **BETTER IMPLEMENTATIONS**

I guess the best way to implement the extra memory would be to design a 3 megabyte upgrade board and wire the ras lines where CASIO originally had routed them. This would be a good solution but not cheap to implement. If CASIO had been nice enough to leave the ras signals at the expansion slot then someone could sell their board and recoup some of their development costs. As it stands, not many people would buy a board when they have to open their sampler and solder on some delicate devices to route control signals.

Another implementation is possible if you own a CASIO 1 meg expansion board. The ram can be placed on this board making it a 3 meg board. The RAS: lines will still have to be wired to the expansion slot, but I believe this is the easiest implementation and recommend it over the others.

## **IN CONCLUSION**

No project would be complete without a disclaimer so here goes: This article was written simple to disseminate information and to generate conversation among FZ-1/10M owners. Each person will have to access his/her own risk. My FZ-01 is only used at home and therefore my financial risk is low. There are still a couple of (probably more) outstanding questions. They are : Why did CASIO choose to limit the amount of memory in the FZ-1? Maybe the power supply could not handle the added memory or, 80ns drams are hard to come by and CASIO would rather ship two 2meg machines than one 4meg machine. Or....Does the extra memory cause any operational problems in the FZ-1? As of this writing I have not found any problem that relates to the extra memory but I have not fully tested the FZ-1 after the upgrade.

If anyone chooses to upgrade their FZ-1 to 4meg, I would be interested in any and all

feedback. I am willing to help via the SOCO BBS by answering (or at least making an earnest effort) any questions.