

TransWarp GS GAL and Oscillator Upgrade Guide

From: ReactiveMicro.com Revised: 9-28-10

We have found that although the TransWarp GS can currently be pushed to a maximum 18.75 MHz stably, your results may differ. **We make no warranties** because you have or will be purchasing something from us that your TransWarp GS will reach a certain speed. In this document are a few things we have learned in the course of our research that may help you achieve the fastest possible speed for your TransWarp GS and also help troubleshoot error messages that may occur. If you have any additional information or findings please contact [Support](#) so we can update this document accordingly.

Error/Fail Messages (Please email [Support](#) if you have an addition/correction.)

You may receive an error message screen when booting with the TransWarp GS installed or running the Self Test located in the Desk Accessory menu (IIGS Control Panel). Below are the error messages we have been able to document and the possible reasons for them.

Error 301 (boot): By far the most common error we have found. This can be caused by either a defective 32k Cache Board or a defective Static RAM on the Cache Board. Try reseating the Cache Board and all Static RAMs. You may also try using a pencil eraser to clean the Pins of the Static RAM chips and Cache Board header Pins. Heat can also affect this issue by causing the Static RAMs or GALs to start to become unreliable. Try placing a fan blowing on the Cache Board and GALs to see if this helps resolve the issue. See pics below for example. We have tested several Fans and will be offering one in our [Store](#) soon. Email [Support](#) in the mean time if specs are desired.

Error 302 (boot): This caused when replacing U60 and U63 and 72 MHz or faster Oscillator installed.

Error 305 (boot): Could be a speed related issue. The TransWarp GS should have the newer version or [High Speed GALs](#) installed whenever possible. When faster speed Oscillators are installed then what the original GALs were designed to handle error 305 can be the result. Installing a set of [High Speed GALs](#) should resolve this issue.

Error 401 (boot): Not sure of the difference, but very similarly resolved by following solutions for Error 301.

Error 405 (boot): This caused when replacing U60 and U63 and 72 MHz or faster Oscillator installed.

Error 602 (boot): This caused when replacing U60 and U63 and 72 MHz or faster Oscillator installed.

Error 0001 (boot): Major card failure. Can be caused by IC U63.

Language Card (Self Test): When configuring the TransWarp GS we recommend setting the Desk Accessory menu (IIGS Control Panel) option 'AppleTalk/IRQ' to ON. This may help solve some Language Card error issues. We have also found that running the TransWarp GS at speeds above 12 MHz can also cause this error, usually within a few minutes of testing. One likely symptom is the boot screen for the TransWarp GS being visually off - having extra lines, missing graphics, frozen animation, incorrect colors, etc. Replacing U60 and U63 with AHCT series ICs can help resolve this error well. We will be offering these ICs and offer a replacement service in our [Store](#) soon. Email [Support](#) in the mean time if an upgrade is desired.

Cache RAM (Self Test): We have found that running the TransWarp GS at speeds above 12 MHz can cause this error, usually within a few minutes of testing. Replacing U60 and U63 with AHCT series ICs can help resolve this error – assuming the Cache Board is good. We will be offering these ICs and offer a replacement service in our [Store](#) soon. Email [Support](#) in the mean time if an upgrade is desired.

Note 1: We have tried different families of replacement ICs in different places – ATCQ, F and AHCT where possible. To date we haven't found any benefit of different ICs except where noted above. Should you discover something different in your testing please email [Support](#).

Note 2: We have tried different value parts in locations C37, C32, R13 and R14. These parts control the Output Pulse Duration from the 74x123 in location U63. Nothing seemed to make a difference. Should you discover something in your testing please email [Support](#).

Notes from Research and Experimentation (Please email [Support](#) if you have an addition/correction.)

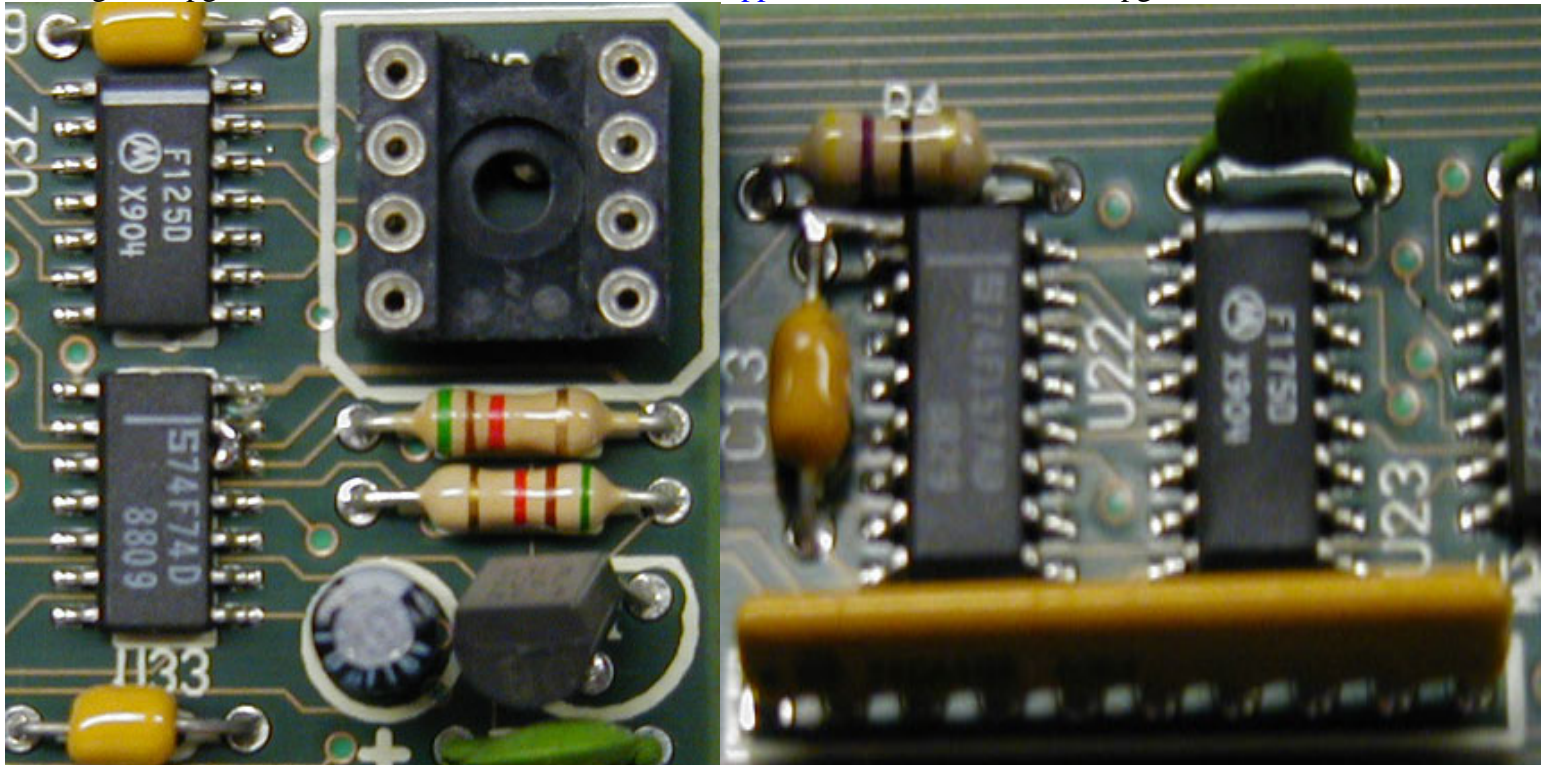
To operate the TransWarp GS with the 8k Cache Board installed the TC4 and TC5 Bow Ties on the back of the card should be connected. To operate the TransWarp GS with the 32k Cache Board installed the TC4 and TC5 Bow Ties on the back of the card should be cut. All other Bow Ties should be connected. We have found some TransWarp GS boards with TC1 cut. It should be reconnected and if the card experiences issues then the CPU and/or GALs should be replaced.

The original CPU on the TransWarp GS should be replaced with the [newer 14 MHz one](#) even if the board appears to be operating correctly. The original CPUs had numerous issues and shouldn't be considered reliable or stable.

We believe the different GAL revisions were created to deal with reliability issues and bugs in the early 65C816 CPUs that Western Design Center had produced. Later Nintendo contracted Sanyo re-engineer the die of the 65C816 CPU, fix a lot the known bugs, and reduced power consumption by utilizing small technology which in turn allowed for the faster speeds we see today. The original set of GALs (1A, 2A, 3B, 4A, 5A, 6A, 7A, 8A) will reach around 15 MHz. To go any faster the GALs must be replaced with something faster then stock 16V8-15ns and 20V8-25ns. We also recommend using the latest known version of the GALs (1A, 2B, 3E, 4B, 5A, 6A, 7A, 8B) but using the earlier version may provide a small speed increase. We still need to fully test this assumption though. Mainly 3E seems to be the key to hitting the faster speeds. Heat will also be an issue with the GALs and active cooling (i.e. – fan) is required at most speeds above 13 MHz. We have tested several Fans and will be offering one in our [Store](#) soon. Email [Support](#) in the mean time if specs are desired.

To reach up to 18.75 MHz you will need ROM v1.8s installed on a 32k Cache Board – both of which we sell in our [Store](#). ROM v1.5w DOES NOT work on the 32k Cache Board. As mentioned above, heat will also be an issue with the GALs and active cooling is required at speeds above 13 MHz. You may also need to replace U60 and/or U63 on the back of the card with more modern logic. We use an F series for U60 and an AHCT series for U63. In cases of a 'stubborn' card that just won't pass a certain speed we replace ALL ICs from U60 to 63 ICs with modern logic. We will be offering this upgrade service in our [Store](#) soon. Email [Support](#) in the mean time if an upgrade is desired.

To reach up to 18.75 MHz there are also some mods that need to be done to a couple ICs on the board. The ICs are located on the face of the TransWarp. Just left of the Oscillator at U33, and just right of the 40 Pin Test Header on the top of the board at U22. U33 needs the trace cut between Pins 13 and 14, and then solder together Pins 12 and 13. U22 needs Pin 1 lifted from the PCB, and then solder Pin 1 to the Cap at C13. See pics below for examples. We will be offering this upgrade service in our [Store](#) soon. Email [Support](#) in the mean time if an upgrade is desired.



We also recommend replacing the old Electrolytic Capacitors on the TransWarp GS board. They are now well past their designed lifespan. This will help ensure that power issues are kept in check as originally designed. We will be offering this upgrade service in our [Store](#) soon. Email [Support](#) in the mean time if an upgrade is desired.

The AE 8/23k Cache Board will only reach around 16 MHz or less. To break 16 MHz you will need the specially designed [32k Cache Board from ///SHH Systeme](#) available in our [Store](#).

Static RAMs of at least 35ns should be used on the Cache Board. We have tested 35ns Static RAMs and they do work when the TransWarp is running at 18.75 MHz.

We HIGHLY recommend a [Low Profile ZIF Socket](#) be installed on your IIGs motherboard to help prevent damage to the TransWarp GS CPU Cable. There's no need to desolder the existing CPU Socket on the IIGs motherboard. Just insert the ZIF Socket in to the motherboard Socket. Be sure to take care when inserting the CPU Cable in to the ZIF Socket as we have found you can easily bend a Pin or incorrectly insert the Cable in to the ZIF Socket and sometimes not know it. Always double check that the CPU Cable is inserted correctly before turning on your IIGs.

NEVER use a ZIP GSX CPU Cable on a TransWarp GS. It will damage your board! [New TransWarp GS CPU Cables](#) can be purchased from our [Store](#).

We have found that heat can be an issue with the TransWarp GS. We recommend placing a fan blowing directly on the GALs and Oscillator of the TransWarp GS. This can help resolve the TransWarp GS crashing or locking up. It won't help with speed, but it will help make the board more stable. Any additional cooling, like the IIGs System Saver, is also recommended. Below is an example of how we mount the Fan on the TransWarp GS.



One of the [LittlePower IIGs Adapters](#) and a new ATX Power Supply is recommended, but shouldn't be necessary to operate your TransWarp GS at higher speeds. Not all Apple II Power Supplies are created equal either. You may want to try a couple different Supplies to see if it helps solve any issues or helps with increased speeds and stability. Also some Power Supplies require a properly wired outlet for them to even turn on. We recommend testing your outlet **BEFORE** plugging in your IIGs, and especially with a TransWarp GS installed. Most hardware stores will carry an Outlet Tester if you are unsure how to test your outlet. It's also worth noting that as mentioned above with the old Electrolytic Capacitors on the TransWarp GS board, it may be a good idea to also replace the old Electrolytic Capacitors on your IIGs motherboard.

Not all IIGs machines are created equal. Trying a TransWarp GS in a ROM1 or ROM3 may help yield additional clues as to whether your TransWarp GS or IIGs is the barrier when trying to reach certain speeds. You may also find owning several TransWarps GS boards and IIGs systems useful in diagnosing issues. Swapping parts from one board to another or one IIGs to another may help yield useful clues as to why one board works better than another.

If you own a TransWarp GS with the old square (PLCC) CPU Socket with a plastic cover over the CPU, then we recommend having the Socket replaced with a new one. The cover is easily damaged and could cause reliability issues for your TransWarp GS. We will be offering this upgrade service in our [Store](#) soon. Email [Support](#) in the mean time if an upgrade is desired.

Some CDAs/NDAs are known not to work correctly when running at 18.75 MHz. Names will be added here as they are confirmed. If you have any additional information or findings please contact [Support](#) and let us know so we can update this document accordingly.

There are two main testes that were performed when testing a TransWarp GS for stability. First was booting the IIGS and before anything loads pressing Control-Open Apple-Esc to enter the Desk Accessories menu (IIGS Control Panel). Select the TransWarp GS menu, then the Continuous Self-Test option. If the board passes for more then 15 minutes it's a pretty good indicator everything is stable. Generally we run the test for at least one hour. The next test is actually running and using GS/OS. Keep the OS as basic as possible – Don't have a lot of extras (CDAs/NDAs) loading at startup. We found if the system loads GS/OS and works for at least 30 minutes of use then it too is a pretty good indicator that the board is stable.

There is software called BenchMark v5.0 if you wish to document your speed results so you have a reference. You may also want to compare the results from board to board or system to system.

The 2B GAL was a DMA fix Applied Engineering issued for the board. It is an absolute requirement for TransWarp GS to work with at least some RamFAST SCSI boards (mostly revision C boards). To use the RamFAST revision D does not require the 2B GAL. The Apple II High Speed SCSI Card works with all TransWarp GS GAL versions. We also sell [GAL upgrade kits in our Store](#) and offer the [files for free](#) if you wish to burn your own set.

IIGS Self Test error message “System Bad: 05020000”: A TransWarp GS with ROM v1.5w will fail the IIGS system “Speed Test”. This is normal and nothing to worry about. Upgrade to v1.8s to fix this issue. We sell the [upgrade ROM in our Store](#).

There have been reports of issues with some Oscillators not working with the TransWarp GS or ZIP GSX. We have found this to be no fault of the TransWarp GS or ZIP GSX boards. Some Oscillators are what is known as ‘Tri-State’ which means Pin 1 controls whether the Oscillator is On or Off. If you suspect that you may have such an Oscillator then either reading the data sheet for the Oscillator will confirm your suspicions, or removing Pin 1 from the Oscillator may cause it to work. Pin 1 is not actually needed for any 5v Oscillator and can safely be removed or bent back out of the way for testing. We also offer [Oscillators in our Store](#).

When configuring the TransWarp GS we recommend setting the Desk Accessory menu (IIGS Control Panel) option ‘AppleTalk/IRQ’ to ON. See Error Messages - Language Card.