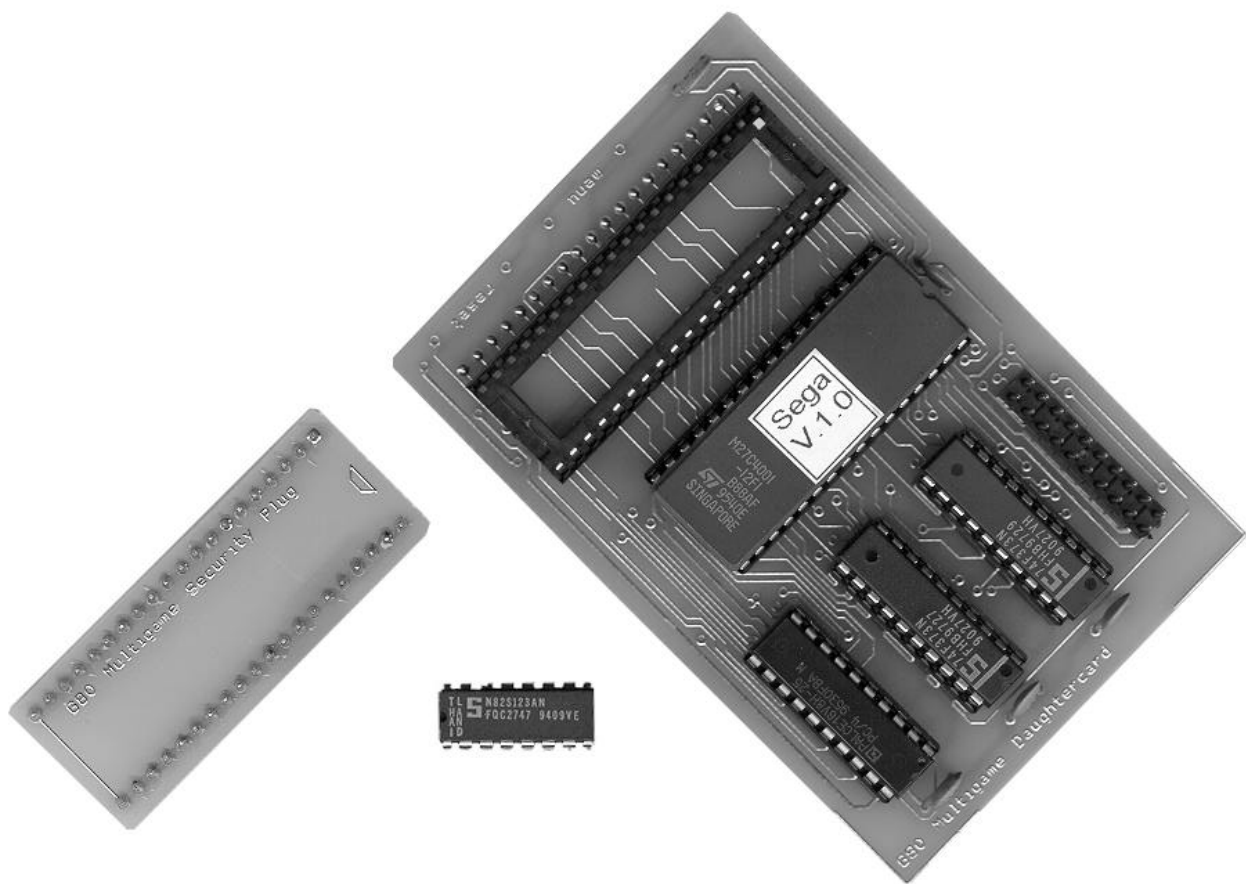


# Sega G-80 Multigame Instruction Manual Version 1.0



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## Notice Regarding this Upgrade

### Warning!

Although this upgrade has been tested and the techniques used will not directly cause harm to your Sega G-80 System, if you do something wrong, you can very seriously damage the game electronics!

To perform this upgrade you should:

- Be familiar with safe handling procedures for electronic components.
- Be able to remove and replace socketed IC's (chips) without causing damage.
- Be able to follow directions.

Arcade games are rugged equipment, but anytime you start messing around with something (particularly something electronic) you accept a certain amount of risk that you may break something.

This kit carries with it no guaranty of compatibility to your particular game. Although this kit has been tested in several Sega G-80 arcade games and CPU boards, there's a remote possibility that some of them are different. If you carefully follow these instructions, you'll do fine and everything will work. I'll try to help walk you through any problems you have, but if this looks like it's above your confidence level please recruit someone locally to install the kit for you!

Please read these instructions completely through before starting. If at any point your PCB looks significantly different than what you see in here, please ask before trying something!

## Credits and Thanks:

I wanted to take a little space and thank a few people that helped in various ways with this particular project.

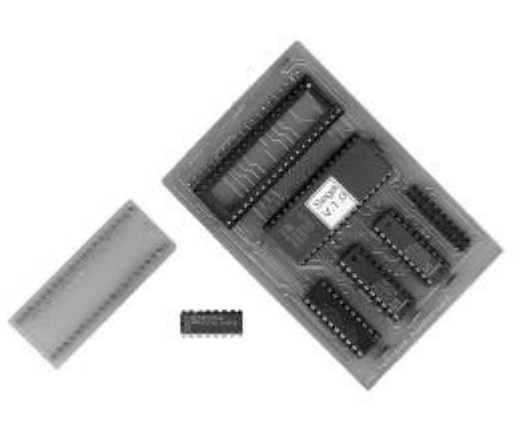
**Dave Fish** Dave performed the original hacks on the Sega game code to allow all games to run without their respective security chips. Without Dave's work, the multi-game would not be.

**Al Kossow** Al has been compiling all technical knowledge of the Sega G-80 system into a handy reference guide. Al also provided me full source code to his Macintosh G-80 simulator program so I could use it to modify the original games as needed.

**MarkJ, RayG, ZonnM, JoeW, PaulK,** and the rest of the "vectorlist" people that helped bounce ideas around and generally keep me motivated.

## Introduction:

The Sega G-80 Multigame (the “kit”) consists of two assembled printed circuit boards and a replacement PROM. When installed on the CPU board of Sega G-80 Vector Game (Star Trek, Zektor, Space Fury, Eliminator, or Tac/Scan) the kit eliminates the need for the EPROM board and allows all the Sega G-80 vector games to be played from a single cabinet. Games are selected from an on-screen menu system.



These instructions describe how to install the kit into a working Sega G-80 arcade game. No soldering is required and all operations are fully reversible. Please read all these instructions thoroughly before starting the conversion.

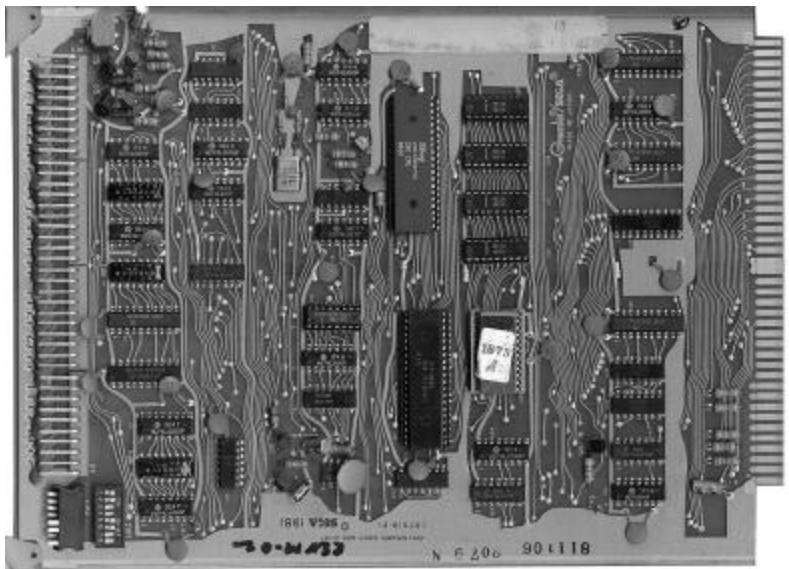
## Getting Started:

First, let's cover what you'll need in some detail. The kit is designed to be installed into any Sega G-80 Vector Arcade Game (“game” or “machine”), but in order to play all the games you need to have a Star Trek type control panel. Only Star Trek's control panel has enough buttons to support all the games.

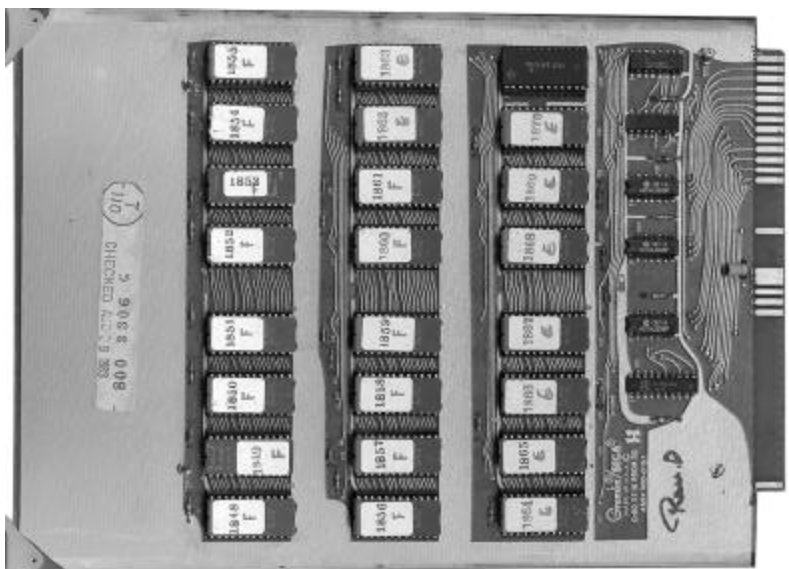
## Remove the CPU and EPROM card:

Start with the machine turned off and unplugged from the wall. Open your game to gain access to the “card cage”. Depending on the machine, you might need to remove a metal cover to gain access to the cards inside the card-cage. You will need to remove the cables connected to the CPU board (the one with the most cables attached to it). **Make SURE you mark or somehow identify where the cables need to re-connect to the cards!**

Press the “release” levers on the edges of the CPU board to eject the card. (This can be very difficult if the card hasn’t been removed in 15 years...) The CPU card looks like this:



Locate the EPROM card (it should be the only card without any cables attached to the end). Press the release levers on the EPROM card and remove it as well. The EPROM card for different games will have different numbers of chips on it. It will look something like this:



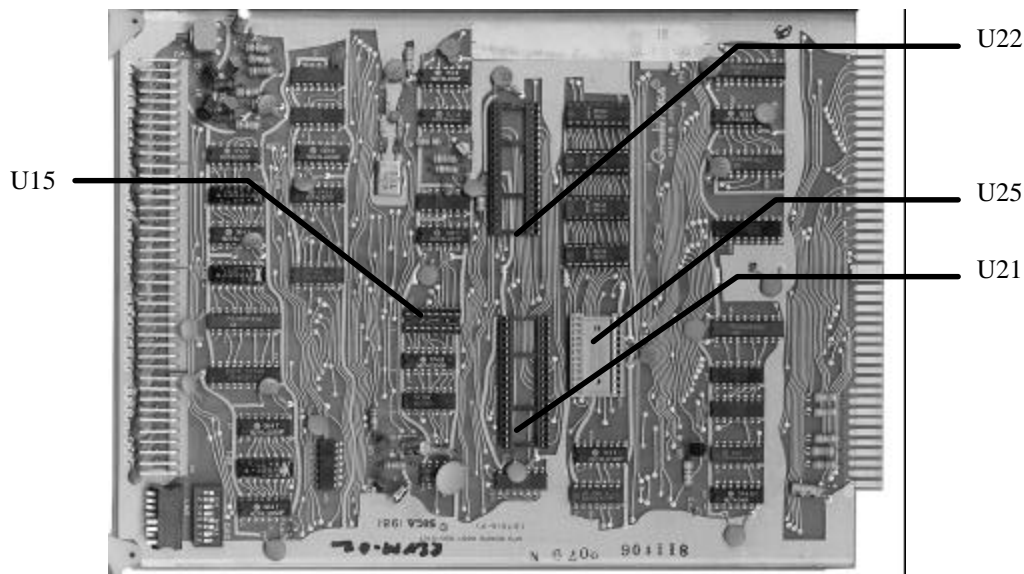
Put the EPROM card somewhere safe. You won’t need it in your game anymore.

## Upgrading the CPU card:

We'll be removing four chips from the CPU card. They are:

- U15 – a 16 pin PROM
- U21 – a 40 pin security chip
- U25 – a 24 pin 2K EPROM
- U22 – a 40 pin Z-80 processor (usually U22 is not labeled on the PCB)

Using a small-blade standard screwdriver or chip puller, remove the four chips listed above and place them in a static-safe area. (Be sure you didn't bend any pins—if you did, bend them back carefully.) You can put the EPROM, security chip, and PROM with the EPROM card as we will not need them any longer.

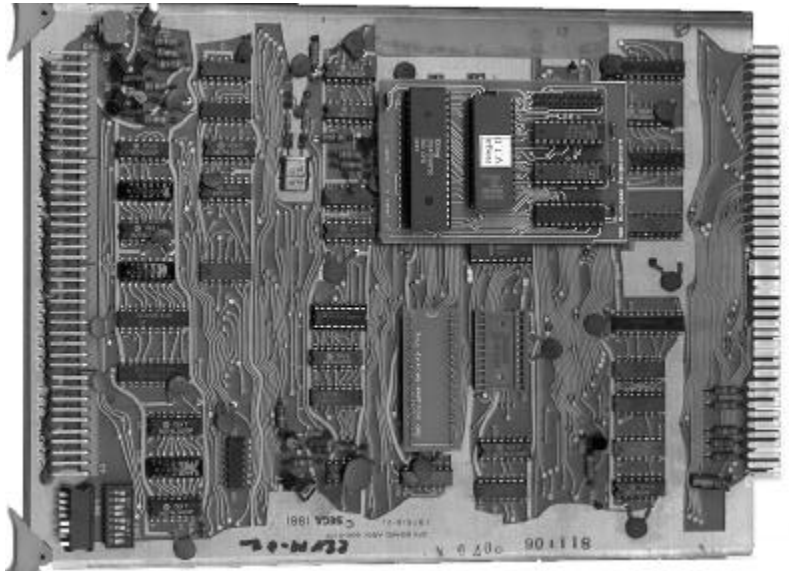


Take the Multigame Daughtercard and hold it so that the empty 40 pin socket is at the bottom, closest to you. Carefully place the Z-80 processor you removed from U22 into the socket on the Daughtercard. Pin one of the Z-80 should be in the lower-left corner and the “notch” of the IC should be on the left-side of the board like the EPROM above it on the Daughtercard. Press the Z-80 down firmly into the socket. Make sure you didn't miss any pins or bend any under.

Take the CPU card and hold it so the “card edge” is closest to you. The red “test” switch should be in the upper-right hand corner. Take the Daughtercard and orient it so the Z-80 is closest to the red “test” switch. The three smaller chips on the daughtercard should be closest to you. Make sure the pins on the daughtercard are lining up with the socket at U22 and firmly press the Daughtercard into the socket. It should seat with a “chunk” sound. The card should be covering the SRAM's at U26 - U29. Make sure all the pins line up and go into the socket.

Take the “G80 Multigame Security Plug” and orient it so the “notch” is facing the Daughtercard. (The text should be “right-side up” as you look at it. Press it firmly into the empty socket at U21. Make sure all the pins line up and go into the socket.

Place the replacement PROM in socket U15 so that the notch is pointed towards the end of the CPU card that the red “test” switch is on. The notch should be facing the same direction as the 7400 at U14 and the 7408 at U13. Press it firmly into the socket. Make sure all the pins line up and go into the socket.



### **Put it back together and test:**

The CPU card is now complete. Plug the CPU card back into the card cage. Note that the CPU card takes up more space with the Daughter card now, so you may want to re-arrange the order of cards in the cardcage to give an empty slot next to the CPU card. Putting the CPU card in the “first” card slot so that there isn’t a neighboring card next to the Daughtercard works well too.

Re-attach the cables and make sure the CPU card is seated properly in the card cage. (It should be flush with the other cards and the removal levers should rest flat against the front of the circuit board.)

Plug the machine back in. You’ll want to be able to get at the red “test” switch for the next step with the power to the machine on. Depending on your cabinet there might be different safety-switches you need to set to allow the machine to run with the door open. Turn the machine on. A game intro-screen should start as normal. If you don’t get a picture after a few moments, turn the game off, remove the CPU card and check your work. Look for bent pins and pins that are out of the sockets. The kit is hand-tested before shipping, so there shouldn’t be any surprises.

## Try it out:

Assuming you now have a game on the screen, coin-up and play around for a minute. The Star Trek control panel is used like so:

Game	Spinner	“Warp”	“Photon”	“Thrust”	“Fire”
Star Trek	rotate	warp	photon	thrust	fire
Eliminator	-	rotate left	rotate right	thrust	fire
Space Fury	-	rotate left	rotate right	thrust	fire
Tac/Scan	rotate	-	-	add ship	fire
Zektor	rotate	-	-	thrust	fire

You may have noticed that “thrust” and “fire” are reversed from how the control panel is labeled. If you like, open your control panel and swap wires or switches on “thrust” and “fire”. Do that with the power off, just in case. (There’s a technical reason for having to swap wires, but I won’t go into it. Trust me.)

Time to try the multigame functions. Press the red “test” switch on the CPU card. You should get a title screen for the multigame. Press the “player 1” start button to go to the menu screen. Press the “player 1” start button to move the selection arrows to a game to play. Press “player 2” start to begin that game. If you put the arrows on “-more-“ you can switch to the second menu. The available options are currently:

Option	Notes
Star Trek	Star Trek, with Star Trek control panel.
Eliminator	Eliminator, with Star Trek control panel. Limited to one-player game do to nature of control panel. Controls are remapped according to table above.
Space Fury	Space Fury, with Star Trek control panel. Controls are remapped according to table above.
Tac/Scan	Tac/Scan, with Star Trek control panel. Controls are remapped according to table above.
Zektor	Zektor, with Star Trek control panel. Controls are remapped according to the table above.
2-player Eliminator	Eliminator, with no control changes. You can use this with an Eliminator control panel to play 2-player games.
4-player Eliminator	4 player Eliminator, with no control changes. You can use this with a 4-player Eliminator control panel and control adapter to play 4-player games of Eliminator. Note—this seems to work fine on some machines, but hangs on others. I don’t know why. Your mileage may vary.

(Table continued on next page)

Space Fury	Space Fury, with no control changes. You can use this with a Space Fury control panel to play Space Fury.
Self Test	The self test runs much like a “standard” self test on the G-80. To skip tests, hold down both Player 1 and Player 2 start buttons for several seconds and then release them. ROM tests are not performed. Sound tests are limited to the Universal Sound Board and Star Trek Speech board. When complete, the test will run Star Trek.

## Adding a “menu” button:

If everything seems to be working at this point you can either close everything up and call it quits, or you can power-down and remove the CPU card again. You may have noticed that there two areas labeled “reset” and “menu” on the Daughtercard. By attaching a pair of small wires to the holes on either side of the labels you can add a hard-reset button to the game and/or a “menu” button. Run the pair of wires out of the card cage and attach them to a push-button normally-open momentary (PBNO momentary) switch. (Radio Shack has many to choose from.)

Pressing the “menu” button has the same function as pressing the red “test” button on the CPU card (it calls the menu). Pressing “reset” is a hard-reset and is useful mostly when developing programs and you need to “un-hang” the system. Don’t hold either button down too long—it’s possible to damage the monitor by having it on but not displaying anything on the screen.

Mount your “menu” and/or “reset” buttons where-ever you want.

## A note about sound:

The multigame does not currently support sound-switching with anything included with this kit. That means that whatever sound-card is in your machine will be what you get sounds for. There are basically three kinds of sound cards:

Sound Card Type	Games that use it
Universal Sound Board	Tac/Scan, Star Trek
Eliminator	Eliminator, Zektor
Space Fury	Space Fury

Sometime in the future we’ll try to come up with an “all-in-one” soundcard, but for now you’re stuck with either living with one sound card or making your own switching-system.

Speech boards are compatible between Zektor, Star Trek, and Space Fury. Once again, there’s no “built in” support for switching speech, but there’s nothing stopping you from doing it yourself if you have the technical know-how.



## Technical information:

This info is for any of you technical-types that want to make your own speech-switchers, sound switchers, or whatever. You'll notice that the Daughtercard has an expansion header on it. This gives you access to two 8-bit output latches. Holding the Daughtercard so that the Z-80 is on the right, the header pinout is as follows:

	D0	D1	D2	D3	D4	D5	D6	D7	
+5V	Latch2	Latch2	Latch2	Latch2	Latch2	Latch2	Latch2	Latch2	GND
+5V	Latch1	Latch1	Latch1	Latch1	Latch1	Latch1	Latch1	Latch1	GND

D7 is the most significant bit, D0 is the least significant bit. As games are selected the following values are placed on Latch1:

```
snd_map:                                ; D7654 3210
.db      h'10      ; star trek          0001 0000 (USB)
.db      h'21      ; eliminator         0010 0001 (elim/zek)
.db      h'42      ; space fury         0100 0010 (sf)
.db      h'13      ; tac/scan           0001 0011 (USB)
.db      h'24      ; zektor             0010 0100 (elim/zek)
.db      h'25      ; elim 2p            0010 0101 (elim/zek)
.db      h'26      ; elim 4p            0010 0110 (elim/zek)
.db      h'47      ; sf (original)      0100 0111 (sf)
.db      h'10      ; self test
```

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