Motorola R2600 Service Monitor LCD Conversion

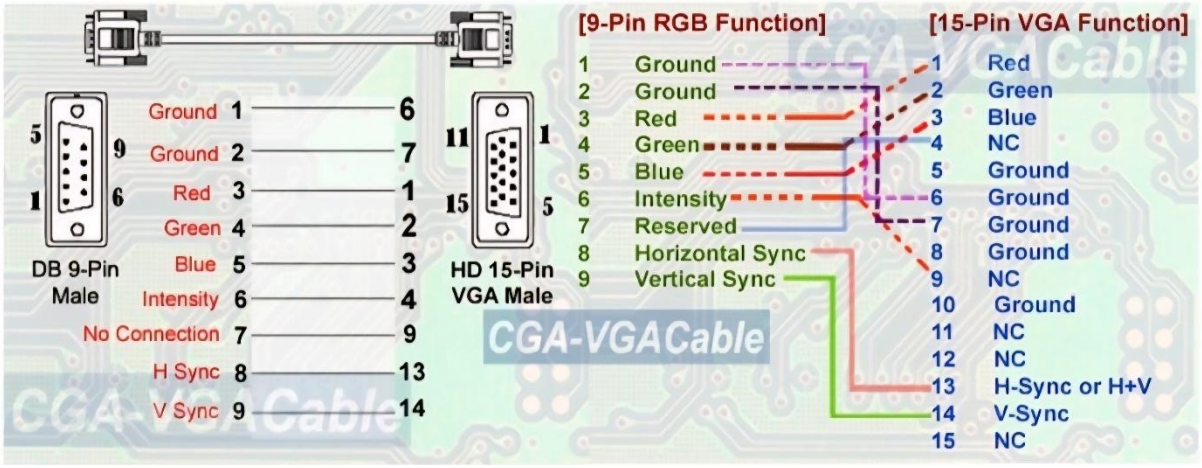
Jack Davis K6YC 3/17/26

After several years of reliable service my R2600 service monitor CRT video display failed. The problem was a dried out 8 uF non polarized capacitor in the H drive circuit. I replaced it and it ran for almost another year and it failed again. This time it was an open IRF640N Power MosFET Horizontal output transistor. I ordered some from a supplier on Amazon and replaced it. It was labeled as an IRF640N but it immediately turned into a piece of wire and took out the Horizontal Flyback HV transformer and a 1/8 Watt zero Ohm resistor. I think it was made out of Chinesium and not Silicon. No amount of searching would find any cross reference to a replacement HV transformer.

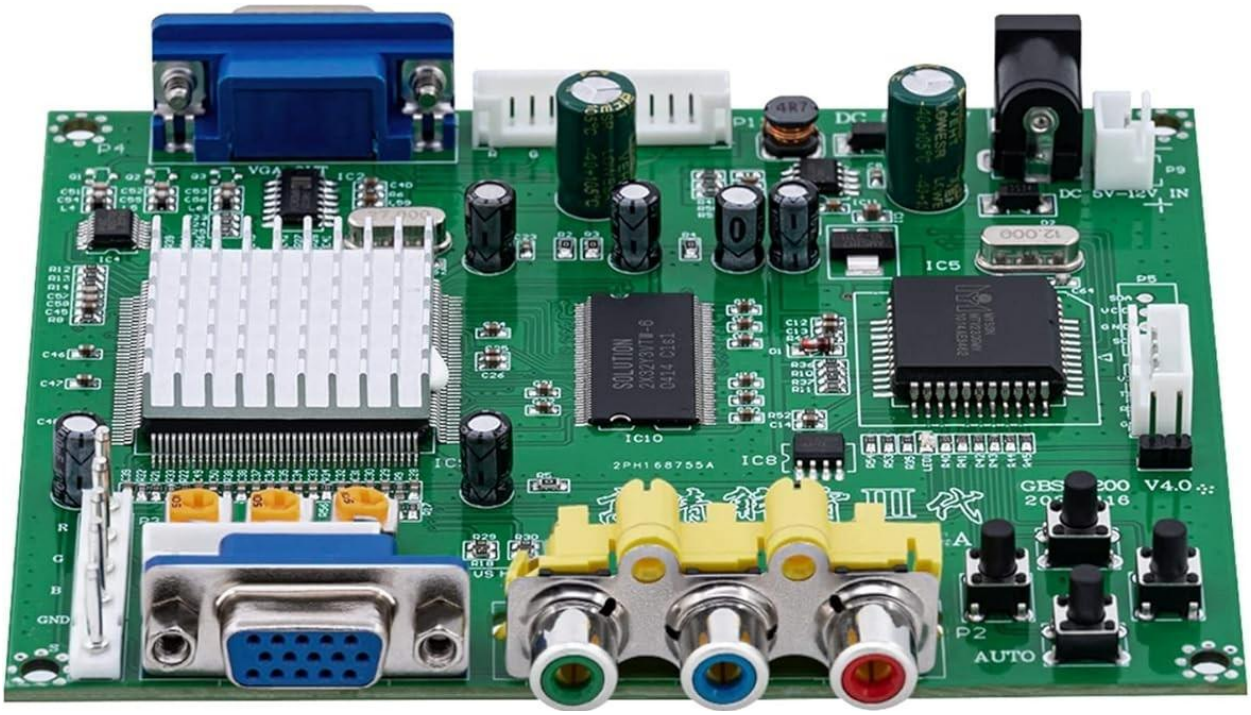
Down the rabbit hole I went!

I borrowed an **Acer V196WL Multisync** monitor from a friend and sure enough it decoded the video present on the 9 pin connector on the side of the R2600. I made up an adapter cable from 9 pin CGA to 15 Pin HD VGA connector and it looked good and was even in color. The Intensity signal is not used. The CGA video appears to be in a 640 X 480 format with a 16 KHz Horizontal rate and a 59 Hz Vertical rate. Most VGA monitors operate at a minimum of 31 KHz so they cannot display the 16 KHz CGA rate.

RGB DB 9-Pin VGA HD 15-pin



The Quest Begins!



The first Upconverter I found was a circuit board made in China called a **GBS-8200 or GBS-8220**. They are quite inexpensive and I got one for $27.00 from Amazon. It says it will convert CGA video to VGA but it will not work on the R2600. The CGA video is a combination of 5 signals; Red, Blue and Green video and Horizontal and Vertical sync. The GBS boards only work with Red, Green and Blue video with Composite sync. These boards were made to convert older console type video games like Pac Man and Frogger to modern VGA monitors. I could have built a combiner board to make Composite sync out of the supplied separate H and V sync. I decided to look elsewhere because the board actually failed while I was trying to make it work. One of the set up menus went missing while I was trying to set it up. Fortunately Amazon took it back as a defective item return. There is a lot of material on the internet about modifying the software and firmware on these modules. So much of it is confusing and even contradictory. I decided there must be a better solution without reinventing the wheel.

Off on another hunt!

My next lead was for the **XVGA Box GBS-8219**. This is the Swiss Army Knife of VGA converters. It was really user friendly and had over the top features. They are on eBay anywhere from $170 to $350 and mostly come from sellers in China. I found one in the USA that was used for $90 so I ordered it and installed it. It has many different settings and can be a bit confusing as the supplied documentation is not very clear and a lot of the settings tend to interact with each other. This was most likely designed for older CNC and automated machinery where cost was not as much of an issue. It is actually the most versatile Upconverter I found and it even has a 9 pin input connector for CGA video of any flavor. Well-made and nicely packaged! Wow! What a find!

Then the manure hit the mixmaster.

This module radiated broadband noise. It raised the noise floor on the spectrum analyzer 8 to 10 dB and reduced the sensitivity of the off air receiver by the same amount. I tried ferrite beads, noise chokes and shielding to minimize the radiation. For example the NWS Weather Radio on 162.55 MHz would totally be inundated as soon as power was applied to the converter. It radiated so much that my Radio Shack Weather monitor receiver on the shelf above my workbench was also swamped out. It was pretty ugly! I know this may be harmonically related to the 16 KHz horizontal frequency but I certainly did not want to compromise any functionality of the monitor. This was a real setback as the video performance was great!

Then I went looking for a reasonable priced converter that would work OK with the R2600. Looking on eBay I saw a listing for an **Altinex SR208-100** new in the box. I called the company that made it and asked if it would work on CGA Red, Green, Blue H, V signals and the applications guy said I don't know, nobody ever asked about that.

The seller on eBay had them listed for $28.04 or Best Offer so I thought OK I will offer $20.00. Bingo I got a notice my offer was accepted. The seller is **G Tech Resale** and they have more than 10 of them available. It was shipped promptly and was exactly as advertised it was brand new and ready to go. The box contains a VGA cable that can be cut to solder onto the back of the CGA connector mounted to the controller board. The setup menus are not as versatile but they are perfectly fine for this use. Wow I struck gold!

Oops, we have a problem!

The issue is it needs 5 volts at a little over an amp to power it. I rigged up a 7805 voltage regulator and an anodized heat sink. It ran really hot and I wasn't at all happy with it. I located a buck regulator on Amazon to convert the 12 Volts for the CRT monitor to 6 volts **JAMHER DC Buck Converter Waterproof DC 12V to 5V 3A 15W** for the **Altinex SR208-100**. They come in a pack of 2 for $9.99! The current draw dropped in half and I could see no issues with RF interference and it ran cool.

Input voltage: DC 12V(wide voltage 9-22V)

Output voltage: DC 5V

Output current: 3A

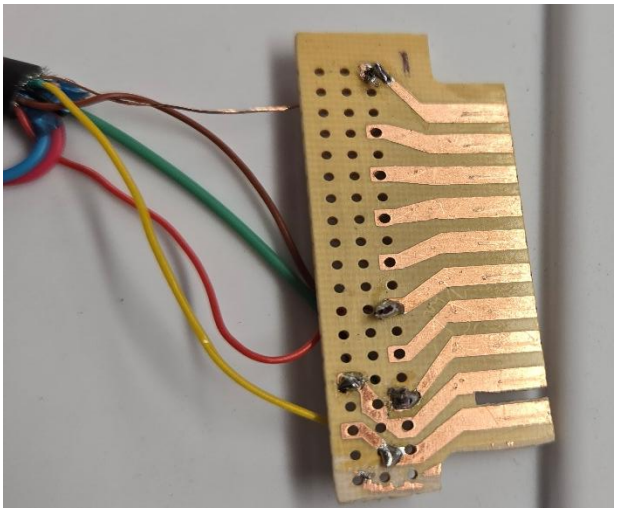
Output power: 15W

Conversion efficiency: >95%

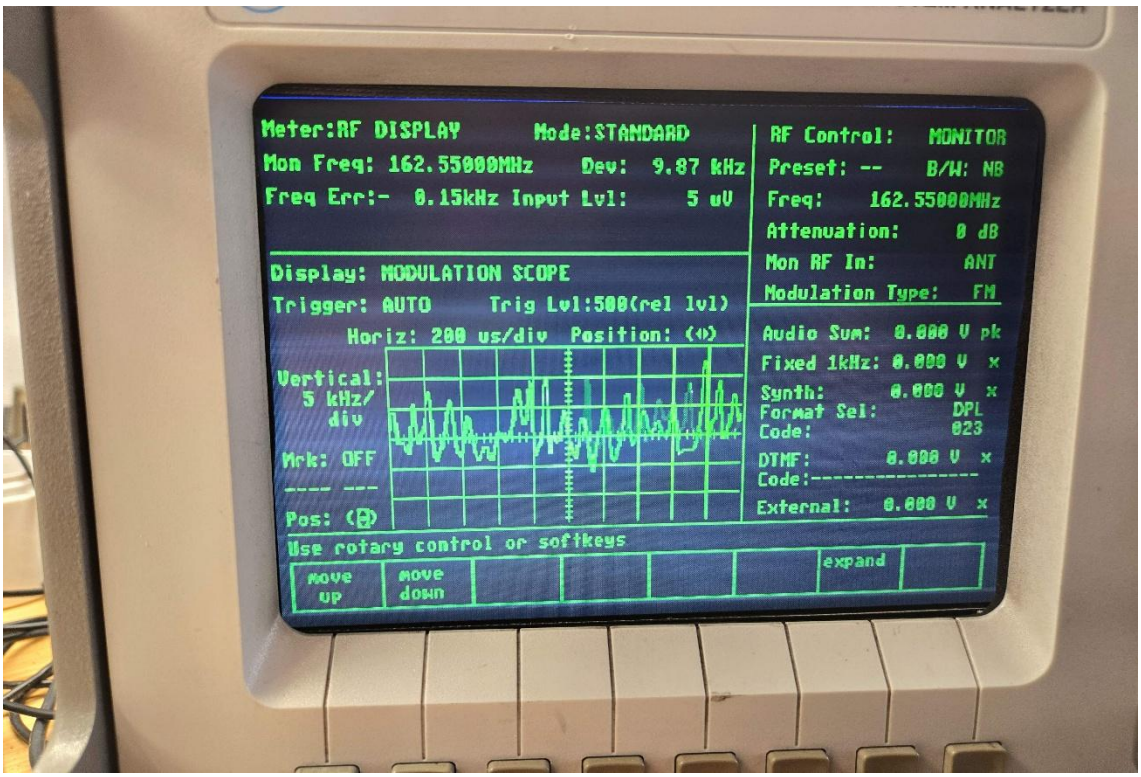
Working temperature:-25℃ to 65℃

The next step was to figure out how to get the video signals to the Upconverter. The first thing I tried was to use the existing signal on the 20 pin plug to the old CRT monitor. The connector supplies +12 volts, Green Video, H sync, V sync and Ground. There is also 3 leads to the front panel brightness control. I thought about using the panel brightness control to adjust the back light intensity but I didn't really see the need for it. My first try was successful for a Monochrome display. You could use the green to drive the Upconverter for a green display, or apply green to the Red and Green inputs for an

Amber display or drive all 3 channels with green to get a white display. I didn’t want to cut the cable andI had a small chunk of a PC board edge connector with the correct spacing so I used it to connect to the 20 pin edge connector.

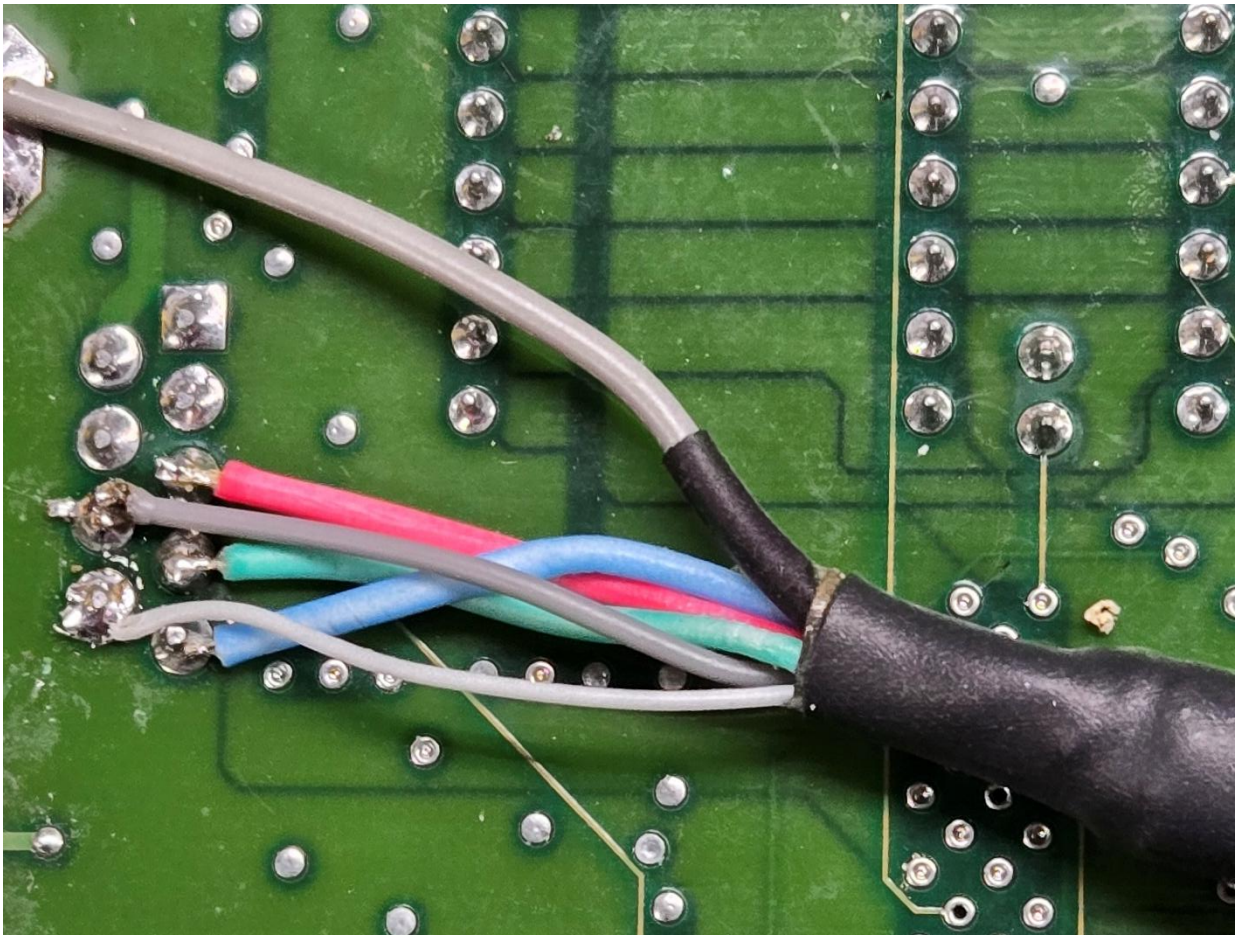


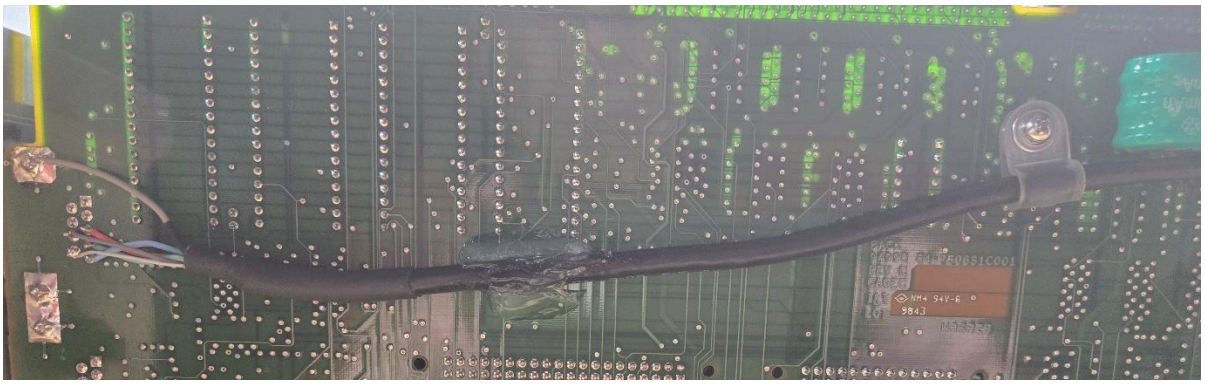
If you are happy with a monochrome display this is about as simple as it gets. Does not look much different from the CRT image. No need to remove the power supply or add any other video cables.



But wait, there’s More!

I decided to go for the full color display. I did not want to use the external EGA 9 pin connector. I cut the VGA cable that came with the **Altinex Upconverter** in two and soldered it to the rear of the 9 pin video connector. I used an ohmmeter to verify the connections to the 15 pin VGA connector. The cable wiring is the same as the cable used for the 9 Pin to 15 Pin adapter cable. I used some silicon sealant to anchor the cable as well as a plastic loop connector under one of the mounting screws. The old screw was too short for the clip so I had to find a slightly longer 4/40 screw. If you use silicon sealant to mount your cable be sure it's not the stuff that smells like vinegar. It has acetic acid in it and is quite corrosive to the copper lands on the PC board. Some RTV silicon has it so just give it the sniff test before you smear it on. It is quite easy to access the video board by removing the 4 torx screws that hold the power supply on the back of the instrument. While I had it out, I decided to replace the **55615303059 3Volt 150 MAH NI-MIH** memory battery. I ordered it from my local Batteries + store but they are also available on line. It was a lot easier to replace with the board removed from the instrument.

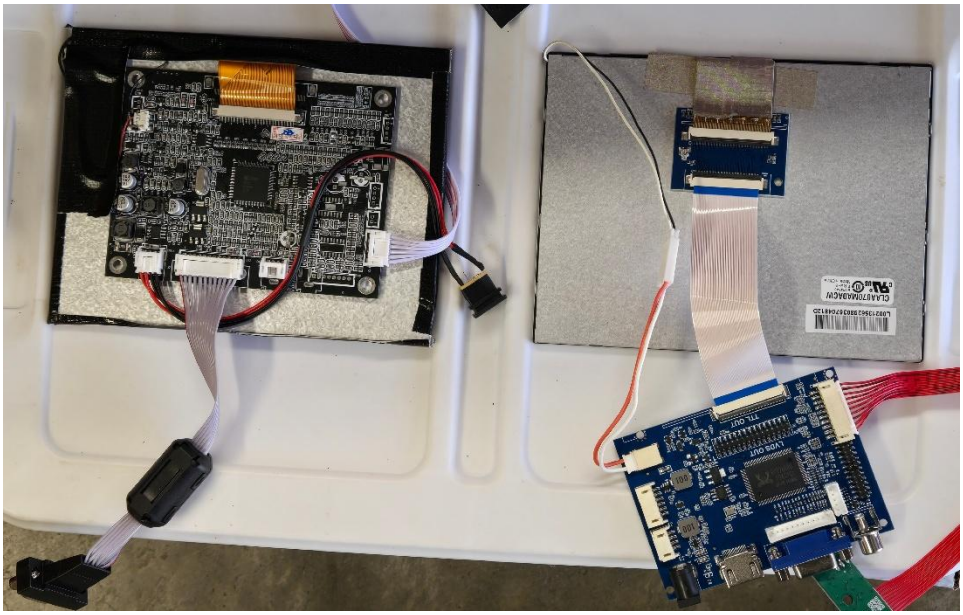




I removed the old CRT monitor PC board and the picture tube. The board is held in with some plastic spacers that just need to be squeezed with a long nose pliers to release. Be careful when removing the tube and don't damage the rubber seal on the face. Mine was still a bit tacky and wanted to stick to the CRT. I removed the sheet metal screws from all 4 corners and pulled the tube back from the front panel. I left the 2 mounting brackets for later use. Now there was a lot of room to mount the new electronics.

Now to find a suitable LCD display!

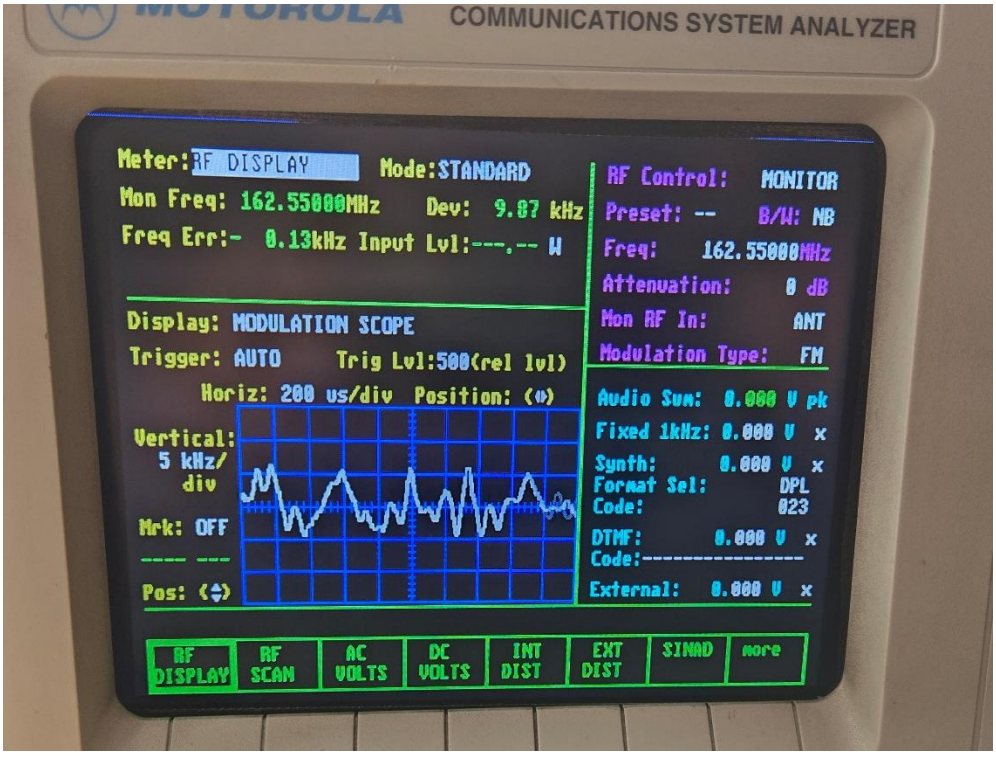
The LCD display that fits the best is 4:3 Aspect Ratio 7 Inch diagonal display. You want one that is 800 X 600, 960 X 720, 1024 X 760 Resolution. Overall I found the 800 X 600 to be the best choice based on the cost and performance. They come in sets with the actual LCD display screen plus the driver board. I ordered a couple of them just to see which type would work the best.



The one on the left was the winner!

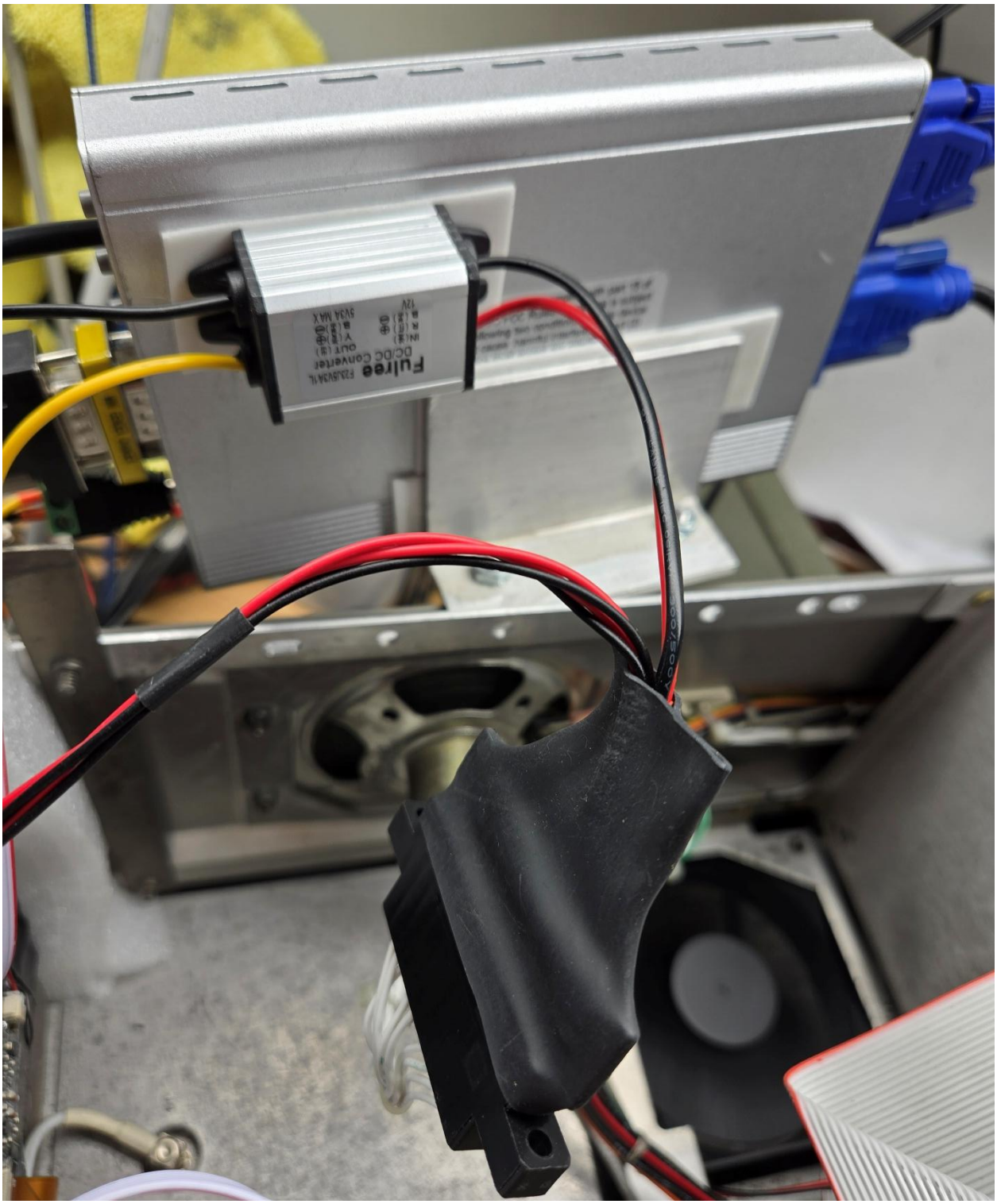
The one I found to work the best is a 50 Pin TTL connector model with the VGA connector on a pigtail cable. This becomes much easier to mount as it will not require a VGA cable to connect between the Upscaler and the monitor. I used some double stick tape to attach the controller board to the rear of the LCD display and it was by far the easiest method. I covered the exposed portion of the metal frame with some black duct tape as it was slightly visible in the front panel cutout. The actual monitor I used came from China VIA eBay and was described **as VGA 7inch 800x600 LCD Screen + controller A070SN02VGA.** The price was $29.00 plus tax and shipping. It actually arrived quickly in 8 business days. I debated about putting a piece of plastic in front of the LCD using a piece of anti-reflective Lexan for a picture frame but I decided not to. Had I waited to put the duct tape on the LCD screen I might have used the tape to hold the two pieces together to protect the LCD.

The rubber bezel that was on the glass face of the CRT is still very pliable and slightly sticky so the screen was actually held in place quite well. I went a little cheap on actually mounting the monitor to the case. I cut two 1 inch strips of the foam packing that one of the monitors was shipped in and wedged them between the old CRT mounting ears and the back of the LCD. It was going to be temporary but it worked so well I left it. If it ain't broke don't fix it! Once I got the video size and positioning adjusted I had to move it slightly to center it. The little push button set up board can actually be detached once the monitor is set up, the non-volatile memory remembers the settings. What I did was use some double stick tape to secure it to the next module to the monitor well facing upward.



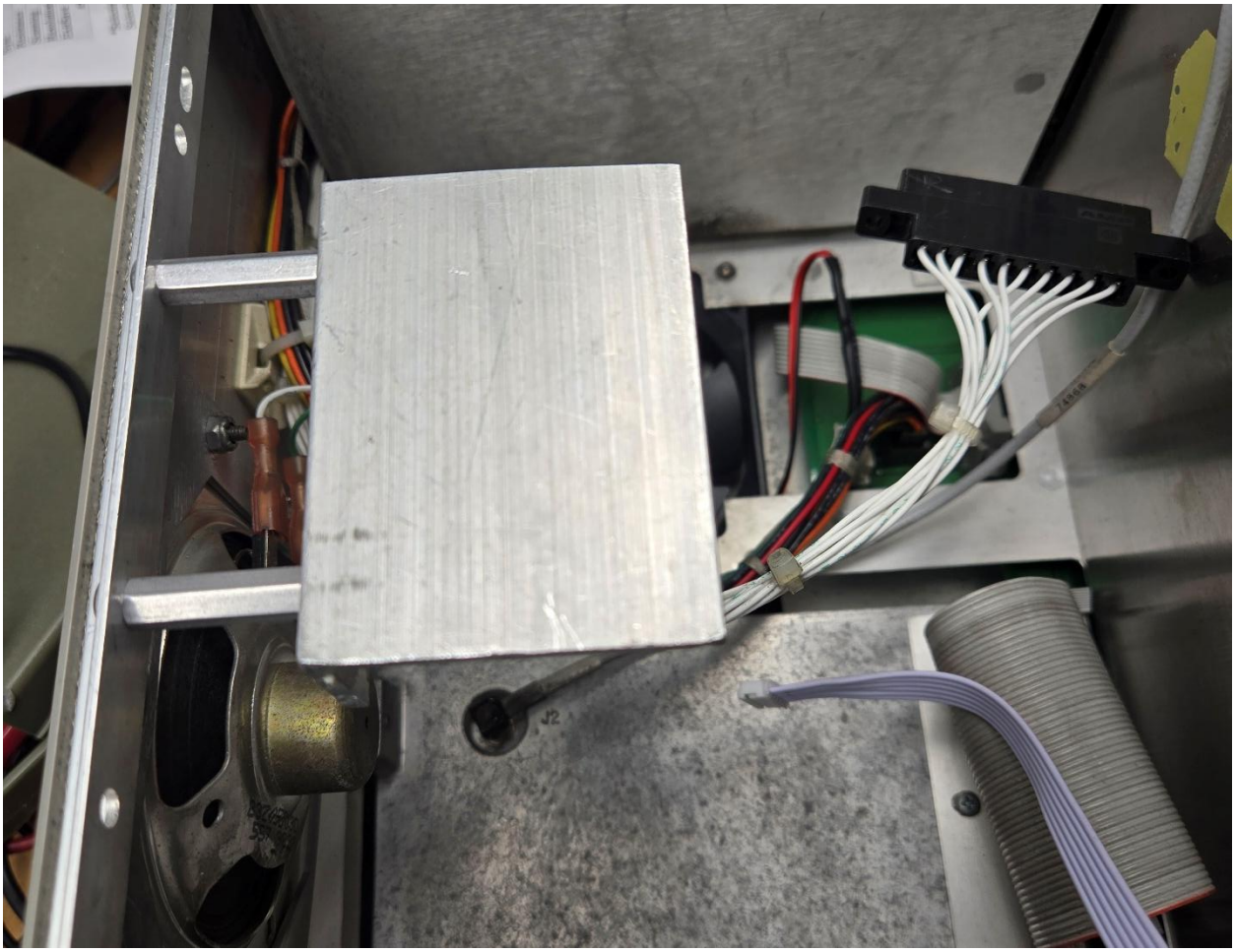
Now it was starting to look like a factory display!

Now to mount everything.

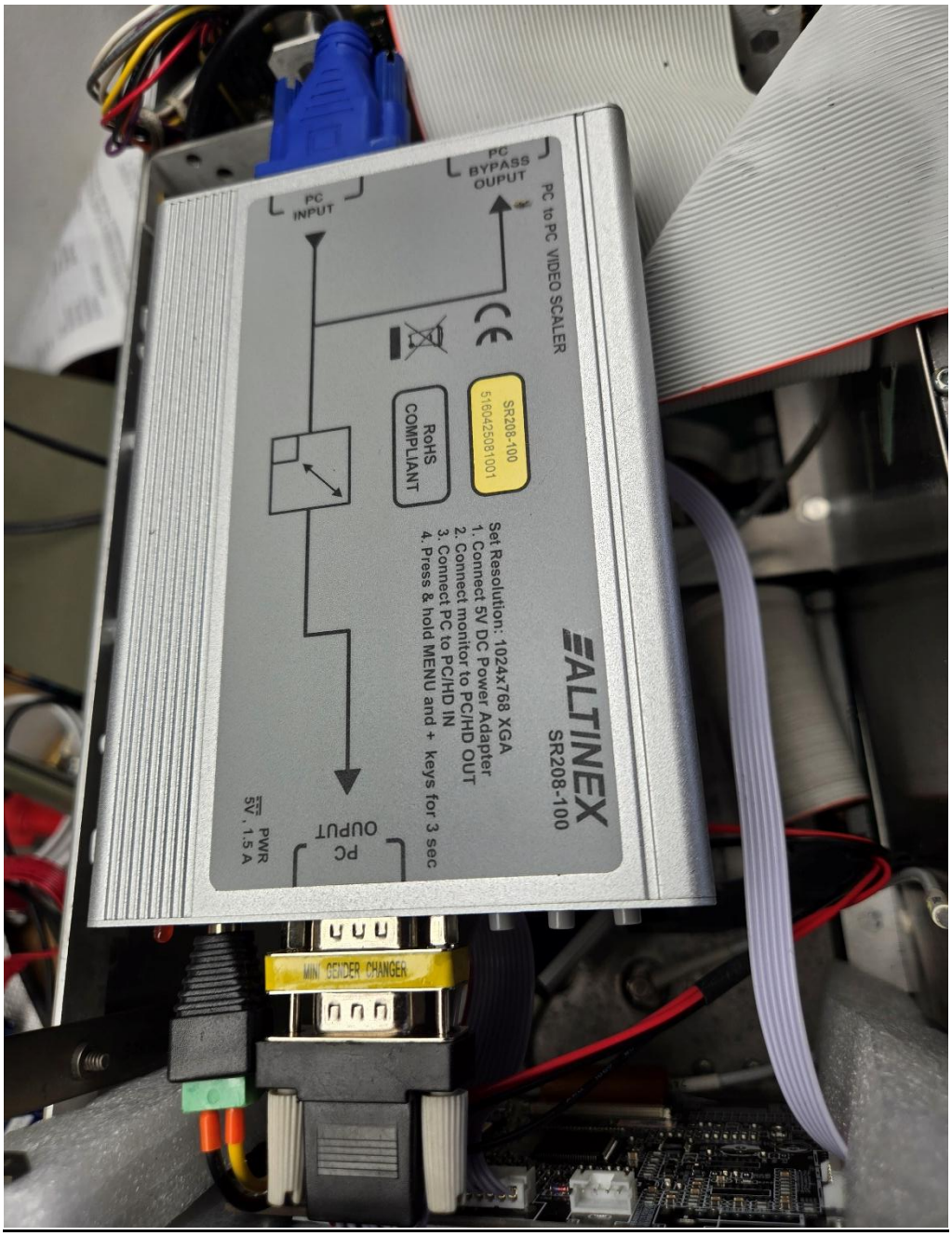


I had a couple of 8/32 aluminum hex stand off's that I used to mount the **Altinex SR208-100** to a piece of scrap ¾ X 1 ½ aluminum angle. The existing holes were used to mount the stand off's to the side of the case.

I used some double stick foam tape to mount the Upconverter to the aluminum angle and also mounted the 12 to 6 volt buck regulator on the bottom side of the module. It is right above the cooling fan for sufficient air flow. While I had it apart I replaced the old fan which was a bit noisy with a new **92 X 92 X 25 MM dual Ball Bearing 12 Volt fan**. I noticed the original fan was blowing down and out of the bottom of the case. I thought about reversing it to blow upward but because the heat load was being really reduced by removing the old CRT monitor I left it alone.



I routed the 15 pin VGA cable up the back of the processor board to the input I used an F to F 15 pin VGA adapter to plug plus the thumbscrews from another VGA cable to connect the monitor input to the Upsacaler output. This eliminated the need for a VGA cable to be in the way of things. When everything is screwed down the installation is very secure and looks like it belongs there

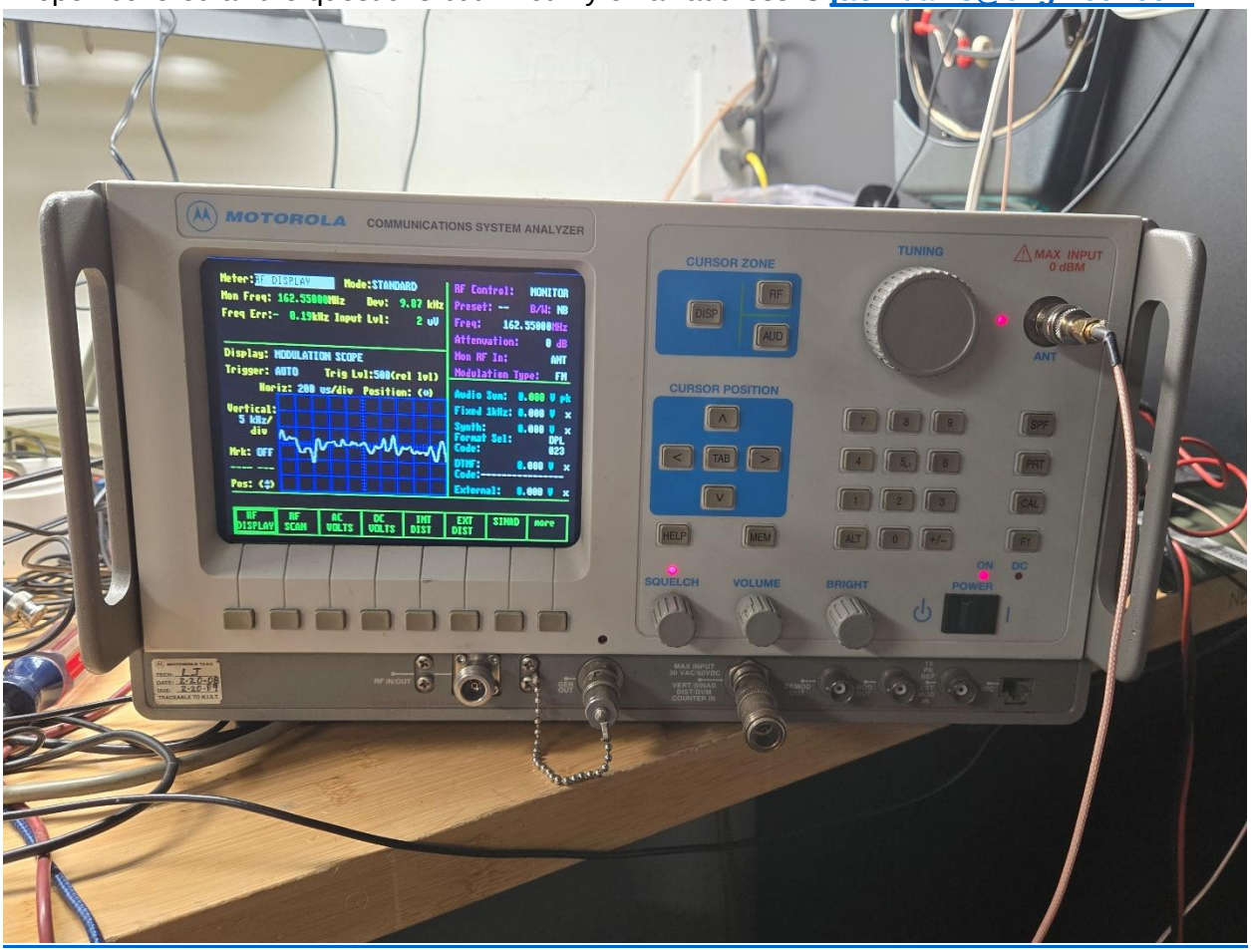


I hope this is of some benefit to the other users. Here is my cost summary for the entire project excluding tax a shipping.

Altenex SR208-100	$20.00
LCD display & Controller	$28.00
VGA F to F adapter	$3.00
Coax Power Plug	$1.75
Buck Voltage converter	$5.00
Total	$57.75

Here is the finished project! Looking like it was always meant to be.

I hope I covered all the questions but if not my email address is **jack.davis@engineer.com**



Good luck and 73’s

Jack