MVT100 Assembly and Configuration

or

How I Learned to Stop Worrying And Love to Dabble

MVT100 kit by Stephen Adolph

based on the work of Geoff Graham

A journey chronicled by Steve Baker

Special thanks to Stephen Adolph for his patience and guidance with my numerous newbie questions

http://bitchin100.com/wiki/index.php?title=VT100

https://geoffg.net/terminal.html

Links and images current as of January 18, 2021

OK, so what is this thing?

The MVT100 is...

- A cool way to connect your Model T (vintage Tandy Model 100/102 laptops) to an external VGA monitor (in addition to the built-in 40x8 LCD)

- A relatively small hardware gadget that you build and then configure with setup software

- Easy to order and straightforward to assemble (assumes some degree of soldering skill)

This PDF is...

- A visual step by step guide to assembling and configuring the MVT100 gadget and software

- Targeted for folks like me who enjoy dabbling around with stuff but also sorta just want to know what to do to get the gadget to work

Pre-Assembly Checklist

Here's what you'll need to get it all working:

❏ The MVT100 parts kit (and a Model T, naturally)

❏ Soldering tools, multimeter, solder, etc.

❏ USB type B (MVT100 power, data) to USB type A (power source, and to a PC for configuration)

❏ Keyboard with PS/2 plug (to configure MVT100)

❏ VGA monitor (or more modern monitors w/D-Sub)

❏ VGA cable (to connect MVT100 to your monitor)

❏ RS232 Serial cable (ideally DB25 Male to DB9 Male; at least that's what I use on my Tandy 102)

    ❏ Another option is a DB25 Male to DB9 Female cable connected to a DB9 Male:Male adapter; this also works

The MVT100 PCB board

The various bits and pieces go here, with the pins sticking through to the back

This is where you do the soldering work, forming solder joints to the pads
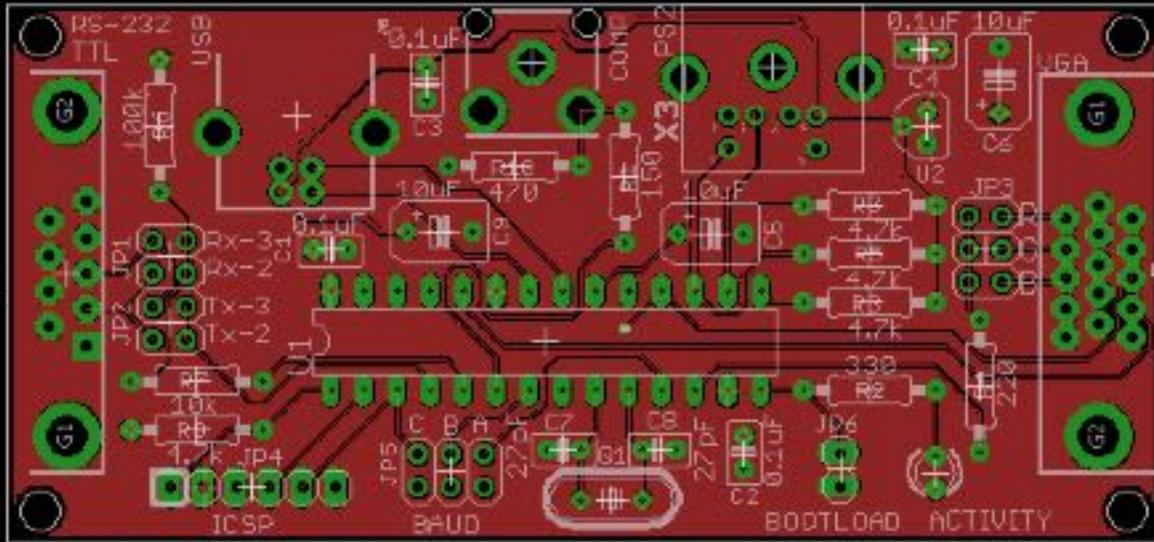
Front / Top
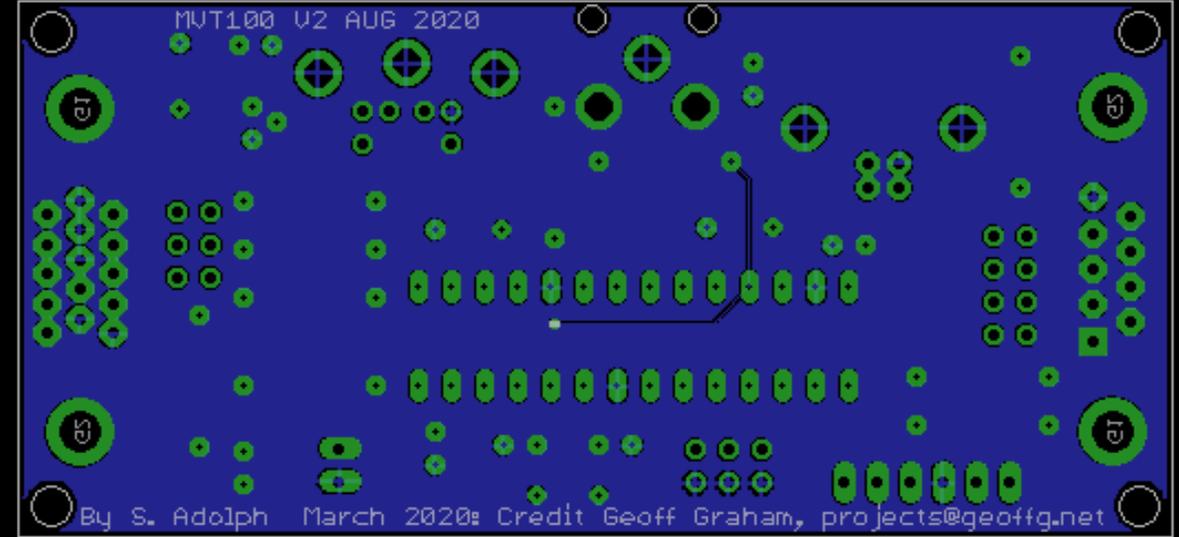
Back / Bottom

Images Source:
http://bitchin100.com/wiki/index.php?title=VT100#MVT100_PCB

Parts inventory and layout

Resistor (0.25W 5%)	PCB Location
150 Ω	R1
330 Ω	R2
4.7 KΩ (Qty. 4)	R3, R5, R8, R9
220 Ω	R4
100 KΩ	R6
10 KΩ	R7
470 Ω	R10

Capacitors	PCB Location
100 nF (Qty. 4)	C1, C2, C3, C4
10 uF (Qty. 3)	C5, C6, C9
27 pF (Qty. 2)	C7, C8

- Jumpers x2
- LED (positive/long pin goes "outside")
- 8MHz crystal (Q1)

- DE-15/HD-15 15-pin Female D Connector
- DB-9 9-pin female PCB mount

- Microchip
- 28-pin SDIP IC socket

Voltage regulator (U2)

The PCB itself

USB B Type Socket PCB mounting

6-pin Mini DIN Female connector

RCA jack

Header pins (0.1-inch pitch)
- 2x4 (JP1 + JP2)
- 1x2 (JP6)
- 2x3 Qty. 2 (JP3, JP5)
- 1x6 (JP4)

5

Resistors ... meter 'em to be sure

Resistor (0.25W 5%)	PCB Location
150 Ω	R1
330 Ω	R2
4.7 KΩ (Qty. 4)	R3, R5, R8, R9
220 Ω	R4
100 KΩ	R6
10 KΩ	R7
470 Ω	R10

The "Meter" technobabble means...

- Test to ensure you know which resistor is which (or learn how to read the various color stripes; I like the act of metering so that's my thing)

- Put the meter into resistance check (Look for the Ohm Ω shape)

- Place the meter leads on the pins (fortunately it doesn't matter which lead goes to which pin)

- The meter should tell you what the resistor is; place it accordingly
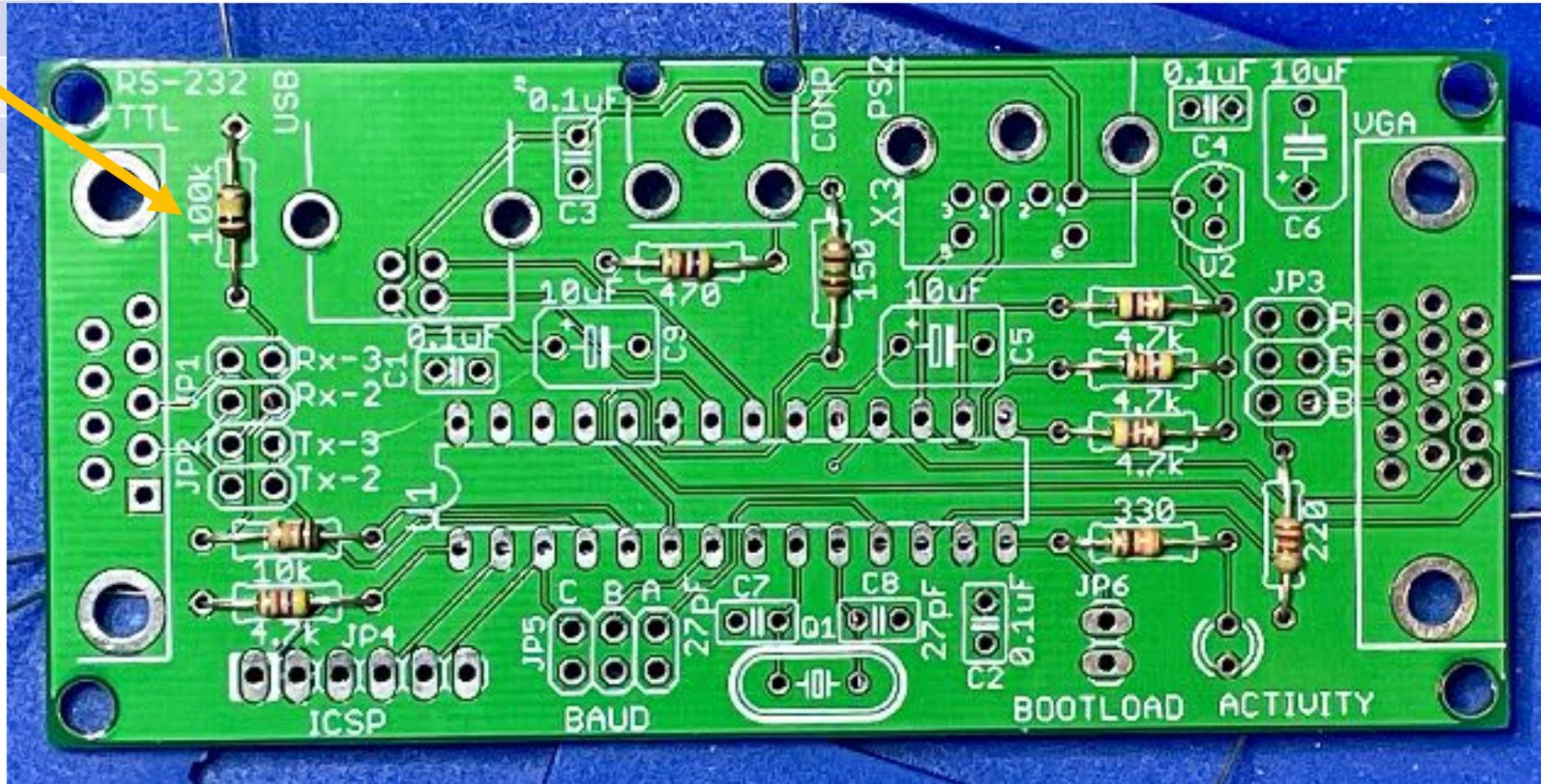
CAPACITORS

Capacitors	PCB Location
100 nF (Qty. 4)	C1, C2, C3, C4
10 uF (Qty. 3)	C5, C6, C9
27 pF (Qty. 2)	C7, C8
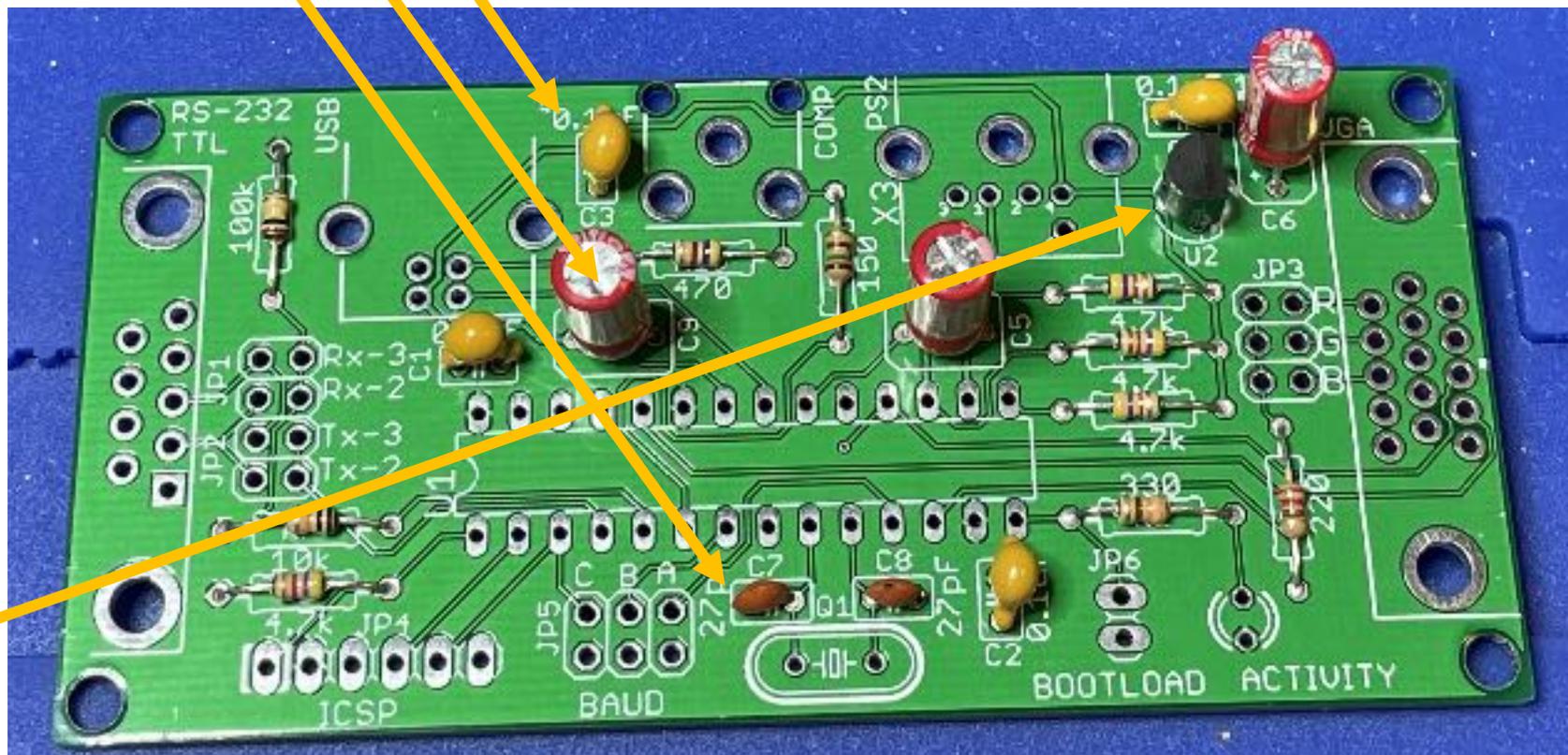
MISC. NOTES…

- I DIDN'T METER THE CAPACITORS SINCE THEY'RE EASIER TO TELL APART

- THIS ALSO SHOWS THE VOLTAGE REGULATOR INSTALLED IN U2 (IN THE NAME OF LOVE)

Jump!! _Go ahead and jump!_

These are the jumper Header pins (0.1-inch pitch)

- 2x4 (JP1+JP2)

- 2x3 Qty. 2 (JP3, JP5)

- 1x6 (JP4)

- 1x2 (JP6)
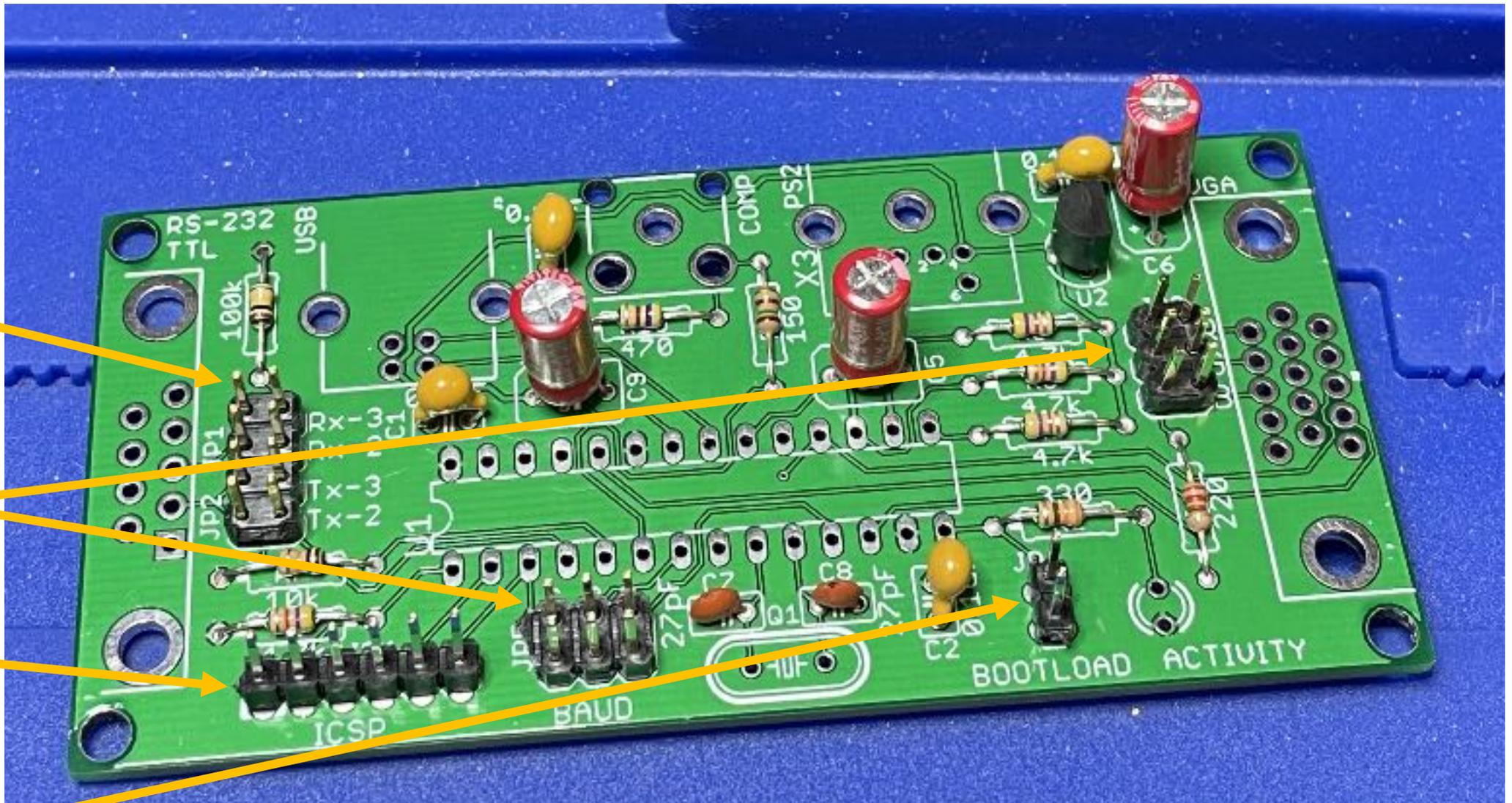
SOCKET TO ME!
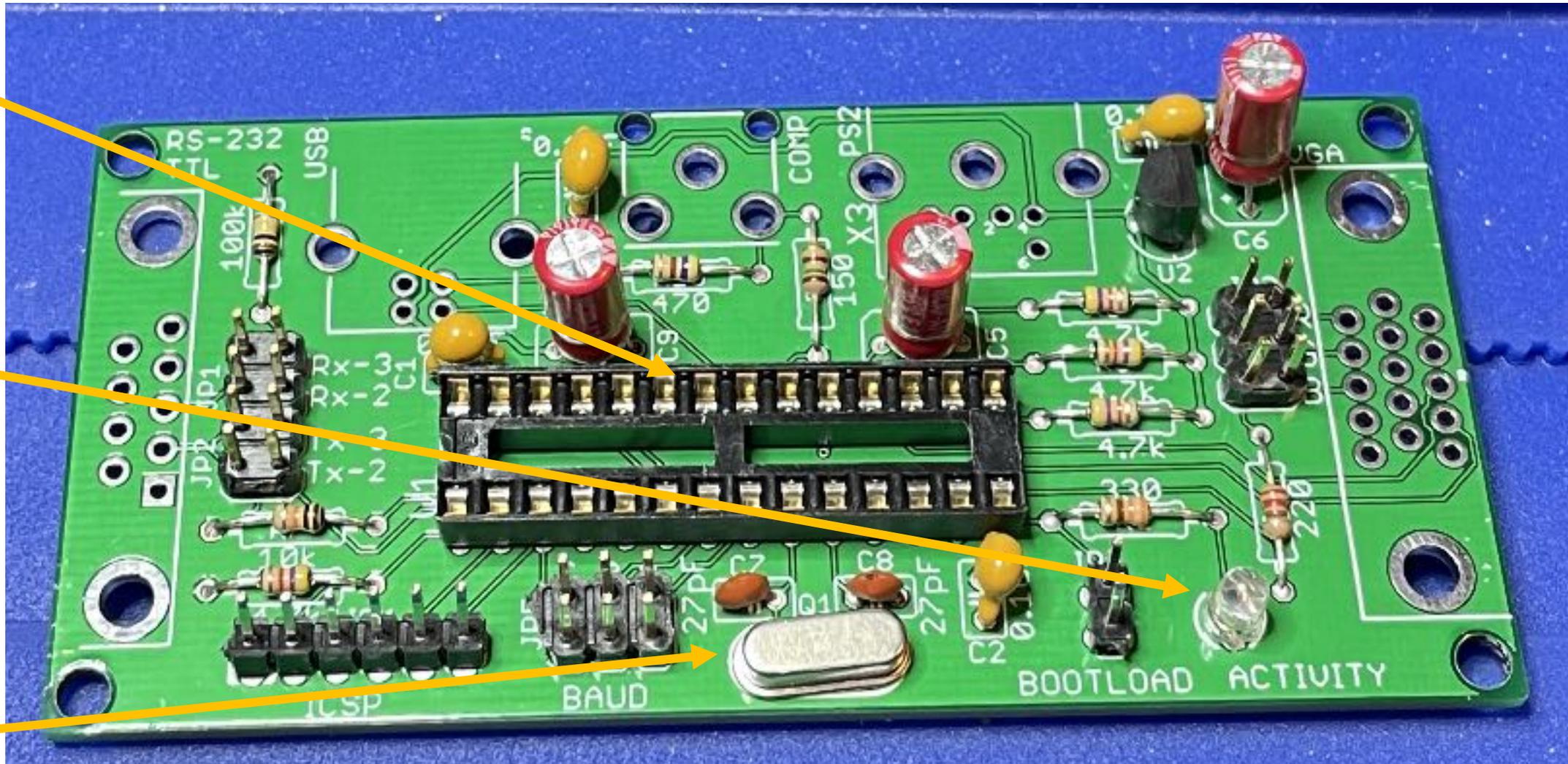
- **28-PIN SDIP IC SOCKET**

- **LED (THE LONGER POSITIVE PIN GOES IN THE "BOTTOM" PAD, WITH THE SHORTER NEGATIVE PIN IN THE "TOP" INSIDE PAD)**

- **8MHZ CRYSTAL (Q1); SORRY MINE IS A BIT OFF-CENTER; I'M STILL NOT VERY GOOD...**

PS/2 and Composite and USB– Oh My!
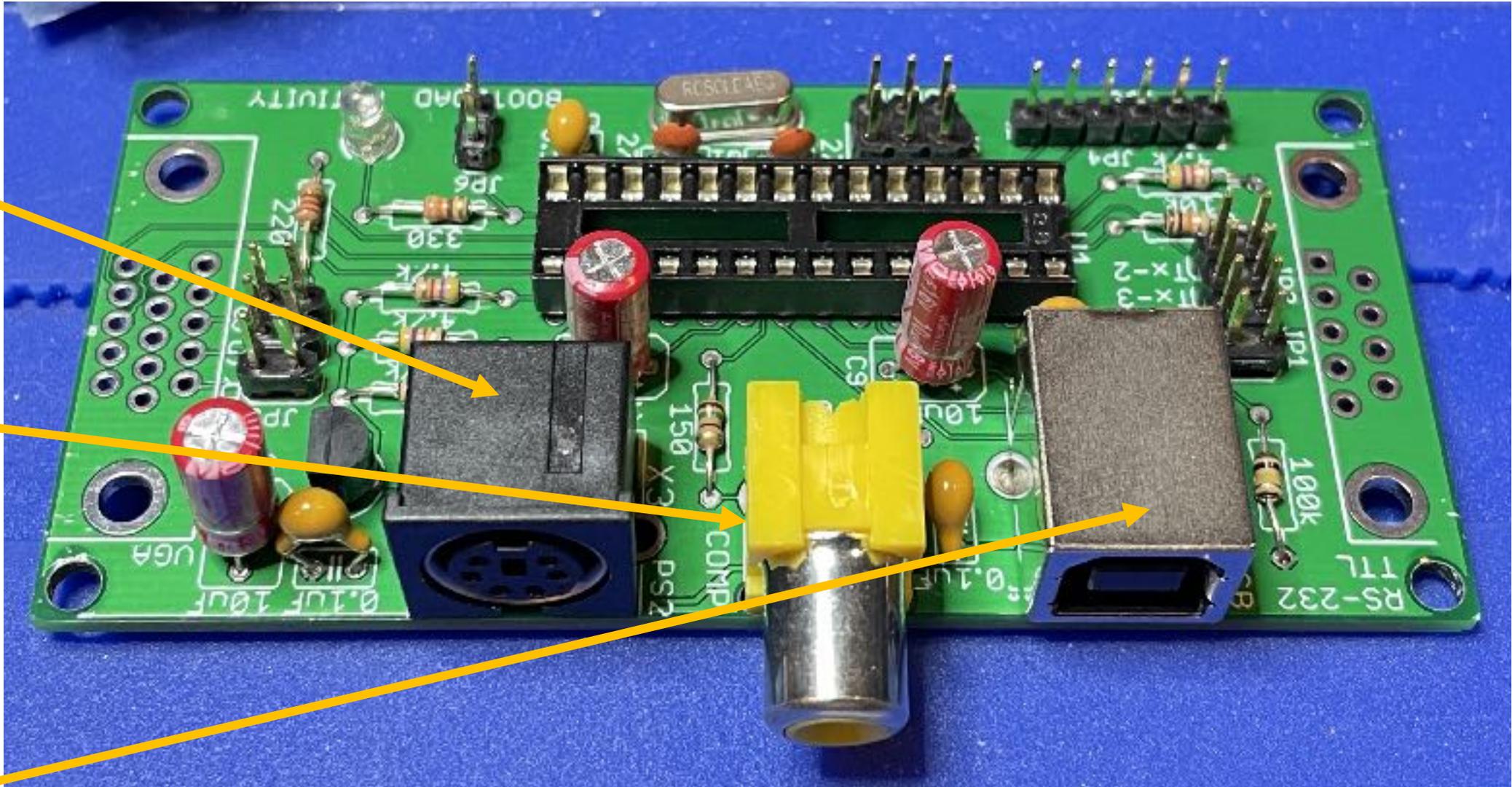
6-pin Mini DIN Female connector

RCA jack for composite video

USB B Type Socket PCB mounting

VGA and RS232 Serial Ports

DE-15/HD-15 15-pin Female D Connector

DB-9 9-pin female PCB mount
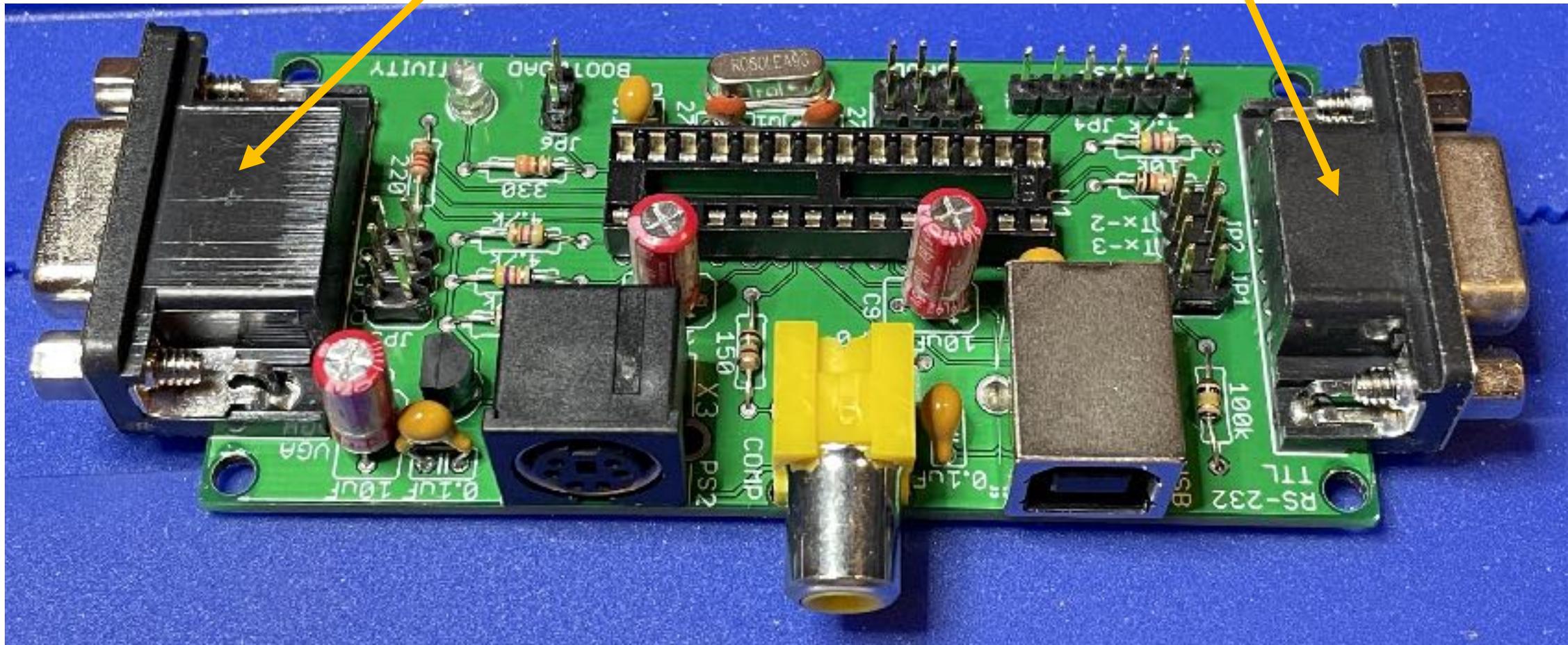
A LA PEANUT BUTTER SANDWICHES

Microchip PIC 32MX250F 128B-I/SP Microcontroller (plugged into the IC socket)
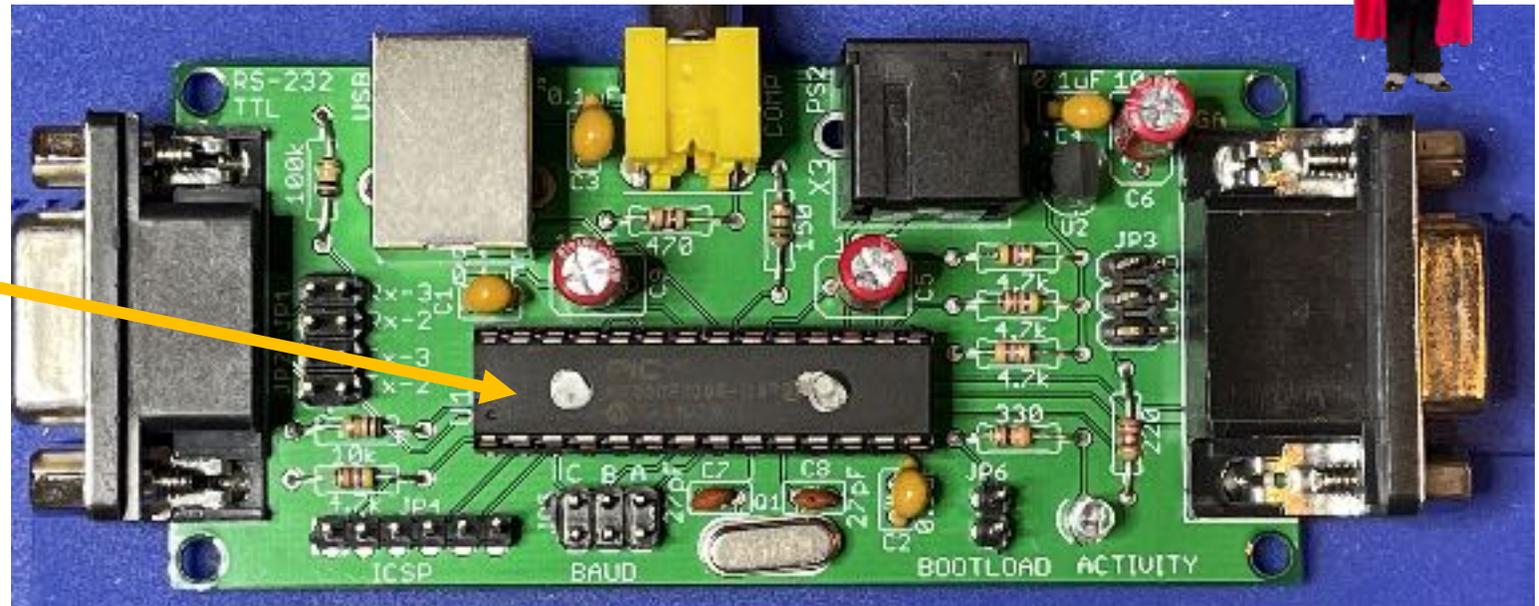
Despite my nascent soldering skills (as evidenced in this photo of my "hey I'm new at this" results), *the unit works!*

Stick a pin (or two) in it!

⚠ Place a jumper pin here in **Rx-3** (the "first" jumper in **JP1**) or **Rx-2** (the "second") depending on your serial cable

⚠ Place a jumper pin in **JP3** to pick an output color (I chose the bottom/blue one… seems fun)
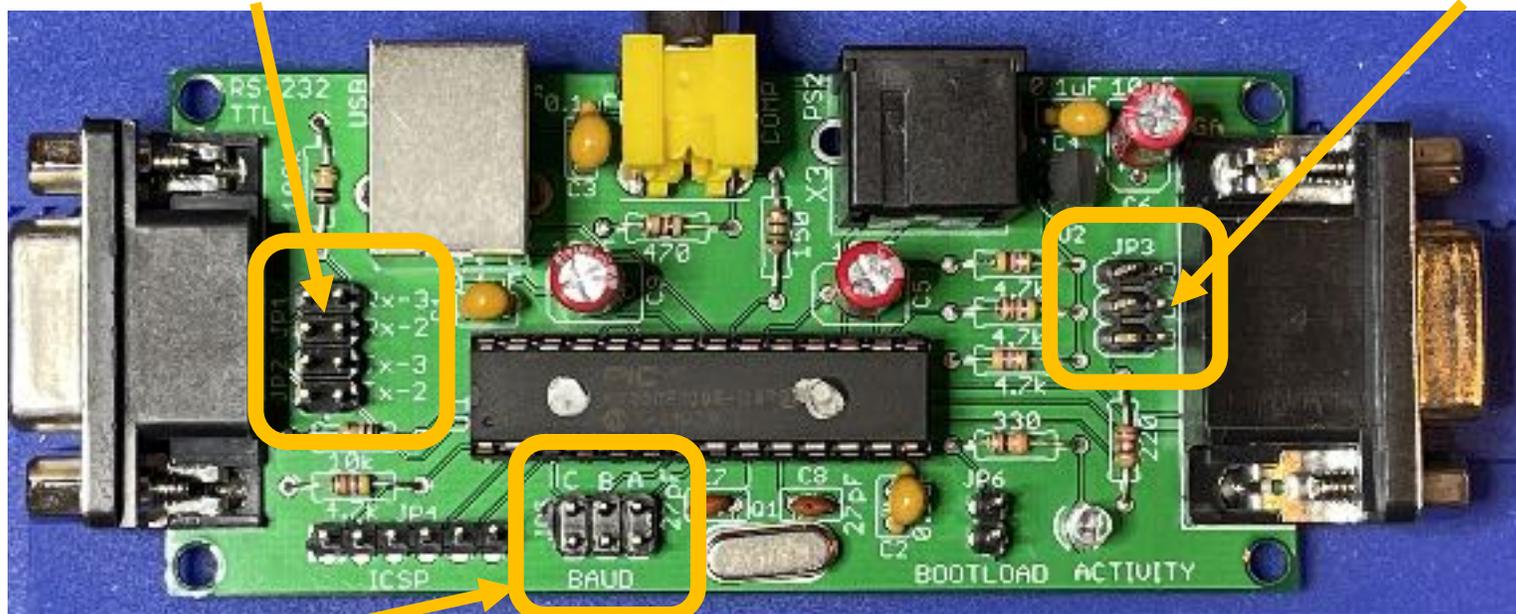
- **NOTE:** The JP1 setting (Rx-3 vs. Rx-2) depends on if your serial cable is a crossover cable or a regular cable
- My DB25 male to DB9 female cable seems to be a crossover cable, so I set my jumper to Rx-2 (the second one)
- *Additional note that JP-2 (the bottom half, the Tx stuff) is not really needed, but know that it's there if you do need it someday (not likely, but y'never know I suppose…)* ;-)

BAUD RATE SELECT

A	B	C	
●	●	●	115200
●	●	○	57600
●	○	●	38400
●	○	○	19200
○	●	●	9600
○	●	○	4800
○	○	●	2400
○	○	○	Configurable default 1200

Here are how the Baud pins work… but per expert guidance (heya, Stephen) we can leave these un-jumped and just configure it via the firmware

13

APPLY POWER AND LOOK FOR LED

1 APPLY 5vDC POWER TO THE USB TYPE B PORT...

2 ... AND THE LED SHOULD LIGHT UP (PRETTY NEAT)

3 ... BUT IF THE LED DOESN'T LIGHT, THEN TEST FOR 3.3v ACROSS C4 (POSITIVE ON THE LEFT) AND C6 (POSITIVE ON THE BOTTOM)

You can also meter the LED (positive on the bottom)

HUH? WHAT DOES THAT MEAN?

- WELL, WHAT I DID WAS APPLY POWER TO THE BOARD
- CONFIGURE MY MULTIMETER TO MEASURE DC VOLTAGE
- APPLY THE LEADS TO THE TWO SIDES OF THE CAPACITORS (ONE CAP. AT A TIME, OF COURSE)
- IF YOU SEE ANYTHING AROUND 3.3v THEN THAT'S GOOD
- IF NOT, TRY CHECKING YOUR VARIOUS SOLDER JOINTS

If all goes well, you'll see...
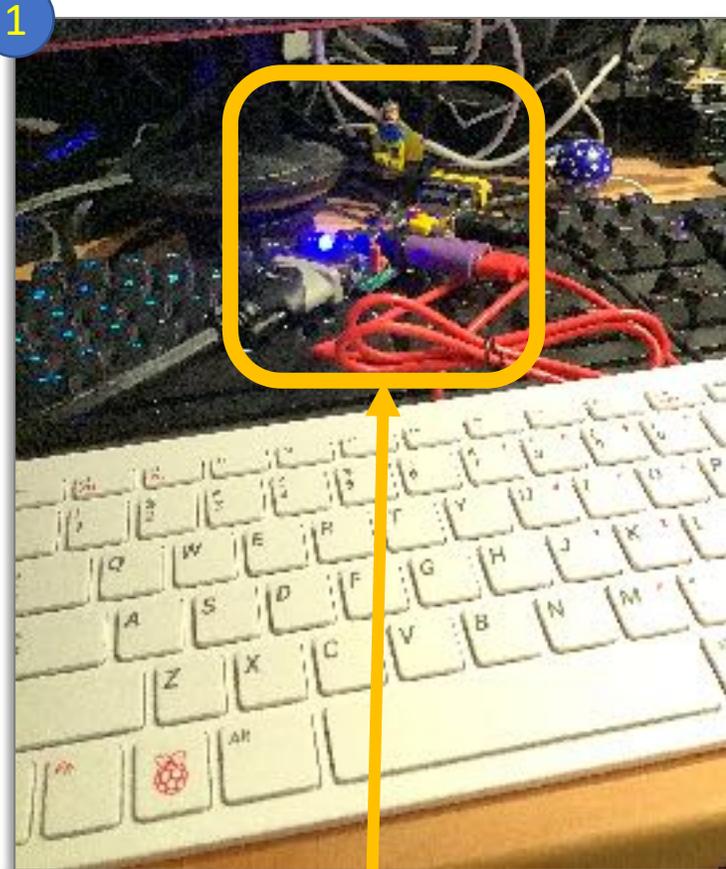
VGA cable (left connection), PS/2 keyboard (center) and USB Power via the Mac (right)

• Doctor Fate accessory sold separately

ASCII Video Terminal for Model 100 Ver 1.3.1_BB
Copyright 2020 Geoff Graham
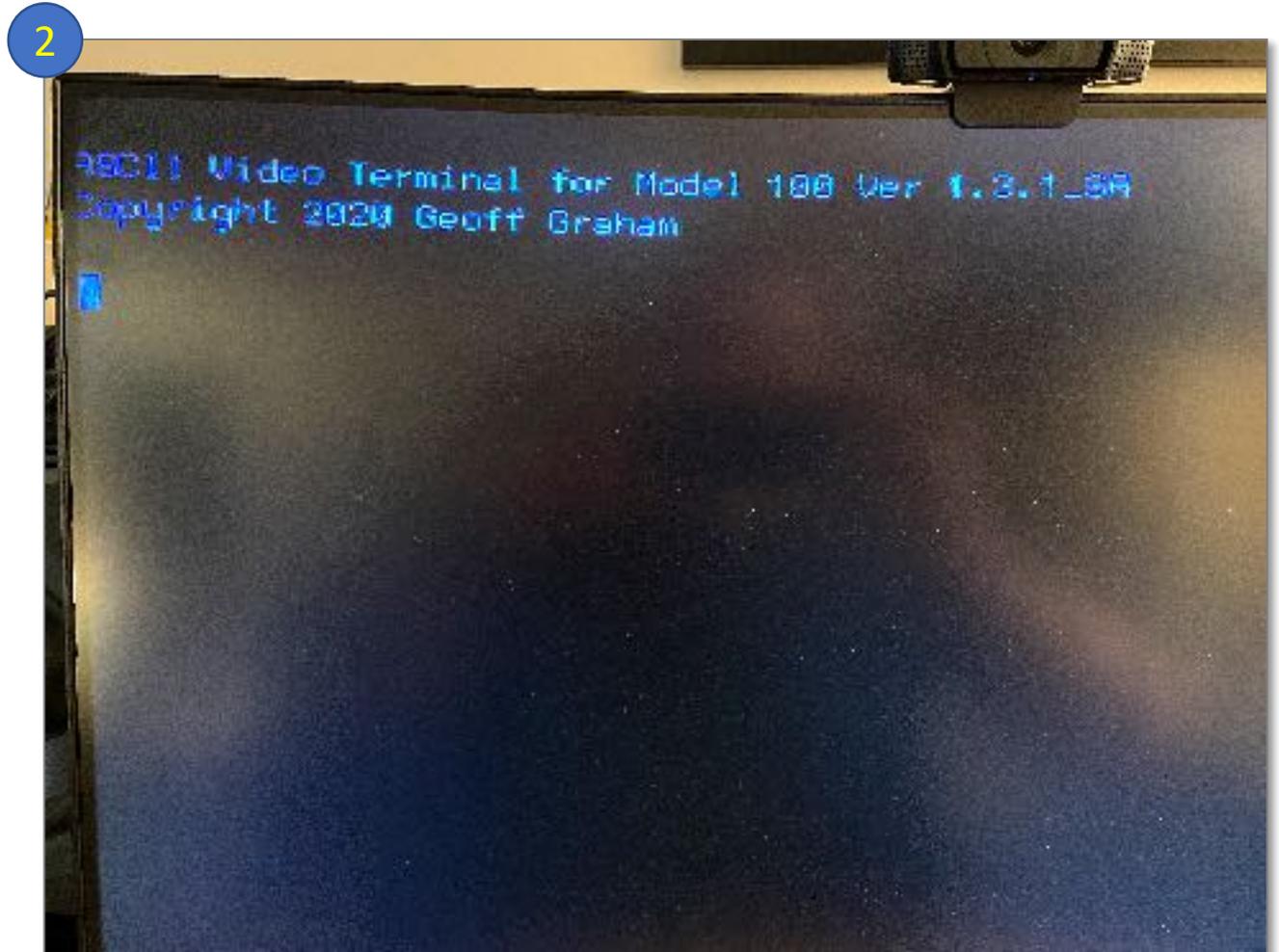
It's alive!
Alive!

Update the MVT100 firmware

First, download the updated firmware, the directions, and the update utility

http://bitchin100.com/wiki/index.php?title=VT100#MVT100_Terminal_Firmware_Update

1. Remove the power to the Terminal

2. Place a jumper across the two pins marked BOOTLOAD *(for MVT100, it's JP6)*

3. Connect the Terminal's USB to your Windows computer – the LED should illuminate but nothing will show on the video output; this is because the Terminal is now in upgrade (or "bootload") mode

4. Remove the jumper across the two pins marked BOOTLOAD – the LED should go out

5. Run the program PIC32UBL.exe; this is a Microsoft MFC-based VC++ application developed using "Microsoft Visual Studio .Net 2003" so depending on your operating system, you may need to install the latest .NET runtime on your computer for this to run correctly *(but trust me, it's worth it!)*

6. Tick the "Enable" check box in the USB area

7. Enter 0xFA8D into the PID text field

8. Click on the Connect button
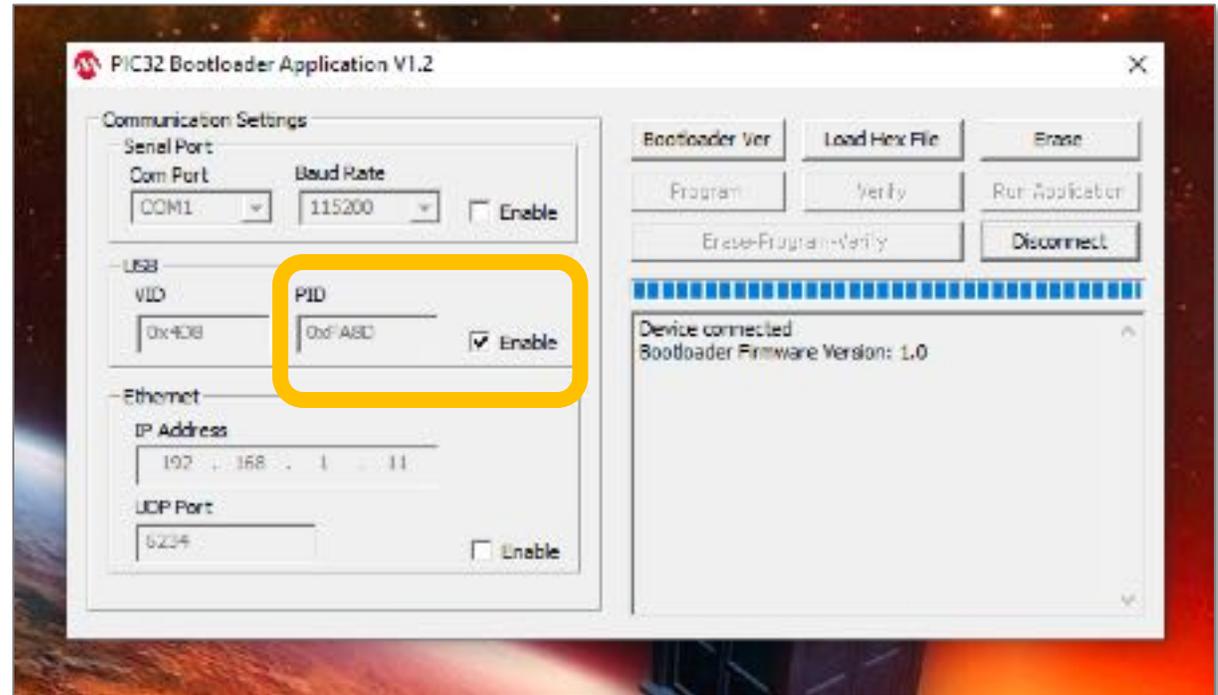
This is me running Windows 10 inside Parallels Desktop on a Mac Mini. Fun.

Source for these instructions:

http://bitchin100.com/wiki/images/9/95/Instructions.zip

16

Update the Firmware, continued

9. Click on **Load Hex File** and navigate to the updated firmware file which should have an extension of .HEX

10. The latest firmware is available at the Bitchin100.com wiki
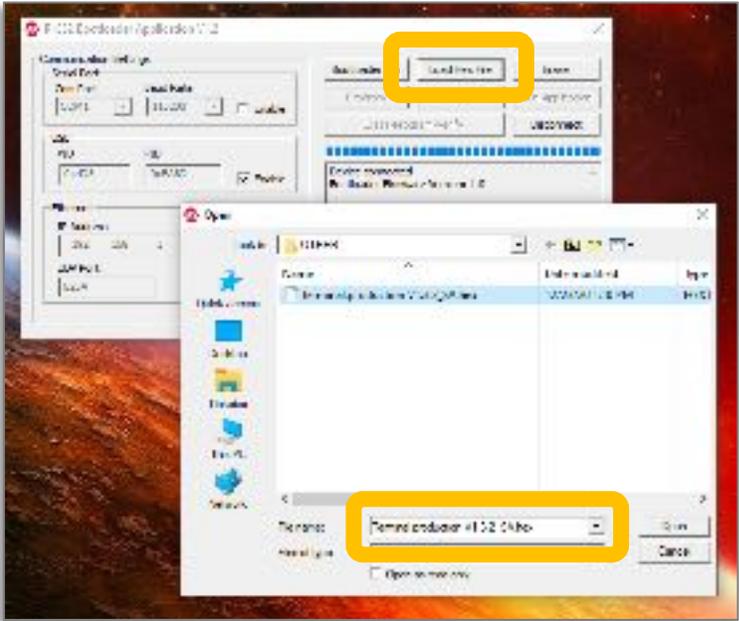
11. Click on **Erase-Program-Verify**

12. After 15 seconds the program should look like this…

13. … then click **Disconnect** and close
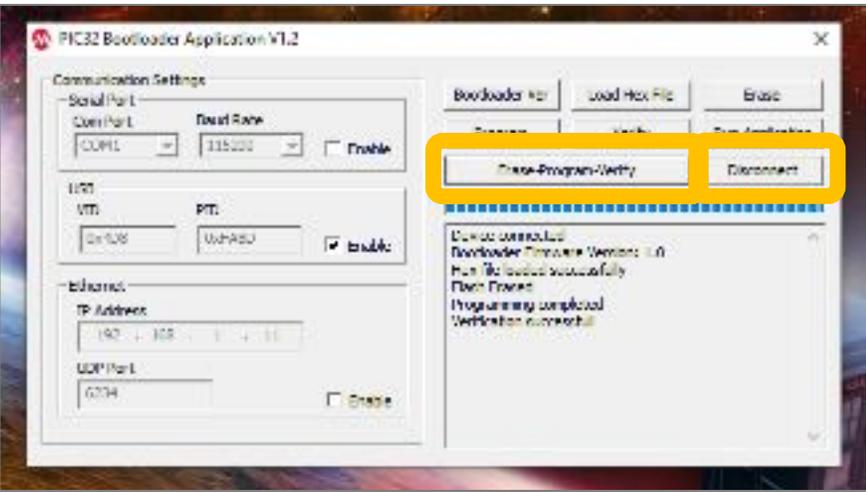
12. The firmware is now upgraded!!

13. You need to **remove power** and restart the terminal (plug it back in) to run the new firmware

14. Check that you have **removed the BOOTLOAD jumper** as that would put the Terminal back into bootload mode whenever power is applied
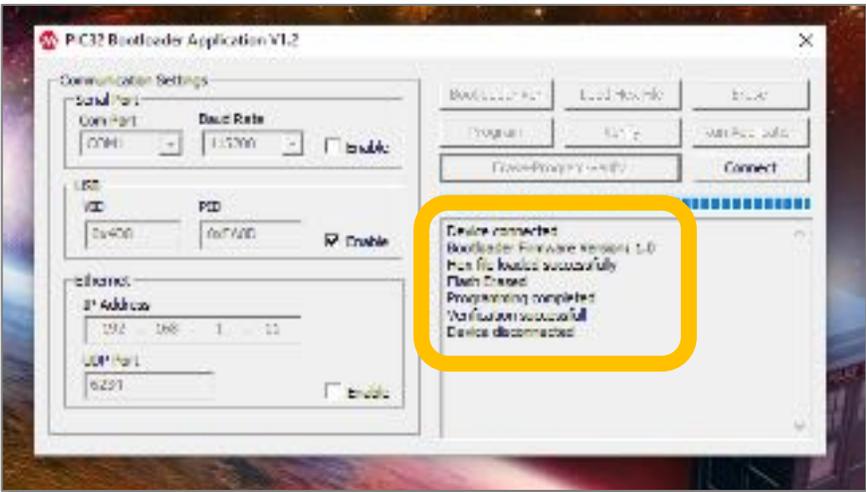
More action shots from Windows 10 inside Parallels Desktop on my Mac Mini. This should be pretty close to what you see if you have a straight-up Windows machine running. I think.

Source for these instructions:
http://bitchin100.com/wiki/images/9/95/Instructions.zip

CONFIGURATION TIME!
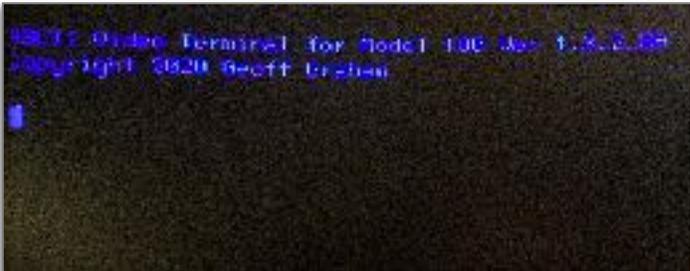
Remove power and then apply power again...

When you see the start-up message (version and copyright info) then press Shift+F12 on your PS/2 keyboard

- Press "F" to invert the serial connection

- Press G to set the baud rate (type "19200")

- Press K to save changes and restart terminal

The setup menu shown displays:

SET-UP MENU

A = Number of lines (for VGA)   (currently 24)
B = Composite output   (currently PAL)
C = Keyboard language   (currently US)

D = Number of bits and parity   (currently 8 NONE)
E = Number of stop bits   (currently ONE)
F = Invert Serial (for RS232)   (currently INVERT)
G = Configurable baudrate   (currently 19200)

H = Display start up message   (currently ON)

I = Reset to the original defaults
J = Discard all changes and exit
K = Save changes and restart terminal

Select item (enter A to K) :

Sorry for the lousy photos... my curved monitor definitely needs a good dusting!

TIME TO PUSH THE DRIVER SETUP CODE!

YOUR MILEAGE WILL CERTAINLY VARY… EACH SETUP IS DIFFERENT; I DRIVE A MAC MINI THAT RUNS WINDOWS 10 INSIDE OF PARALLELS DESKTOP TO COMMUNICATE WITH MY T102S AND TANDY WP-2 GADGETS.

NOTE THAT MVT100 DOESN'T WORK WELL WITH TS-DOS, SO TRANSFER OVER ANY FILES YOU WANT TO PLAY WITH BEFORE YOU RUN THE VT100.CO SETUP FILE. AFTER THAT, YOUR MODEL T IS BASICALLY ON ITS OWN.

INJECT TS-DOS (OR TEENY) USING MCOMM V2.50 OR WHATEVER YOU PREFER. *YOU NEED A WAY TO LOAD THE CONFIG FILE ONTO THE MODEL T.*
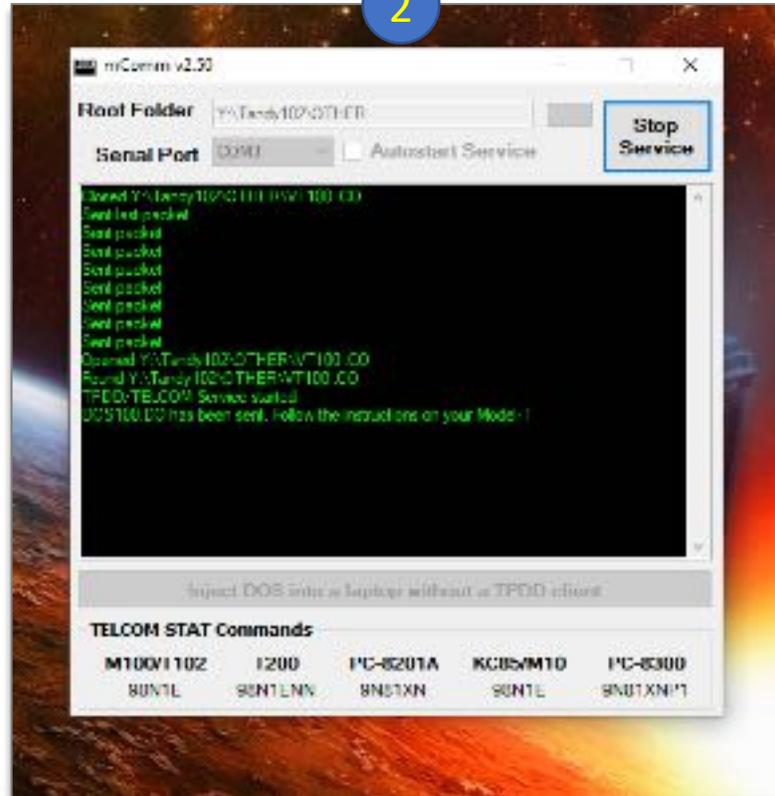
USE TS-DOS (OR TEENY, OR WHATEVER) TO TRANSFER THE VT100.CO FILE FROM YOUR PC TO THE MODEL T. *IT'S FUN!*
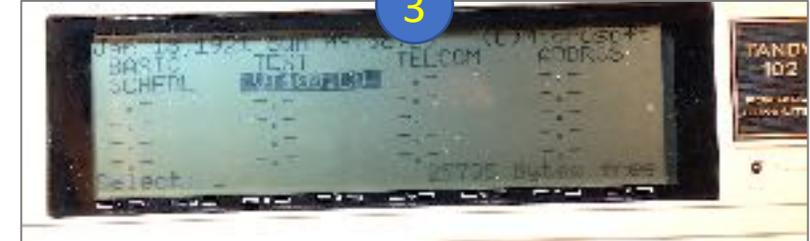
1. **DELETE** THE TS-DOS (OR TEENY, OR WHATEVER) AND GET READY TO RUMBLE
2. GO INTO BASIC AND **TYPE** "CLEAR 0, 60000" TO FREE UP THE SPACE YOU NEED
3. **SELECT** "VT100.CO" AND YOU'LL SEE THIS MESSAGE QUICKLY FLICK AT THE LCD TOP…

IT SAYS "VT100 DRIVER CODE INSTALLED." *I HEAR A SLIGHT CLICK WHEN I RUN THE SETUP CODE.*

Hello, world!

From the menu, select **BASIC** and then type "**screen 1**" … the **LCD** cursor should disappear

1

Then, anything you type should appear on the **VGA** monitor, and you should see the activity light on the **MVT100** board blip with each keystroke. Very cool!

2
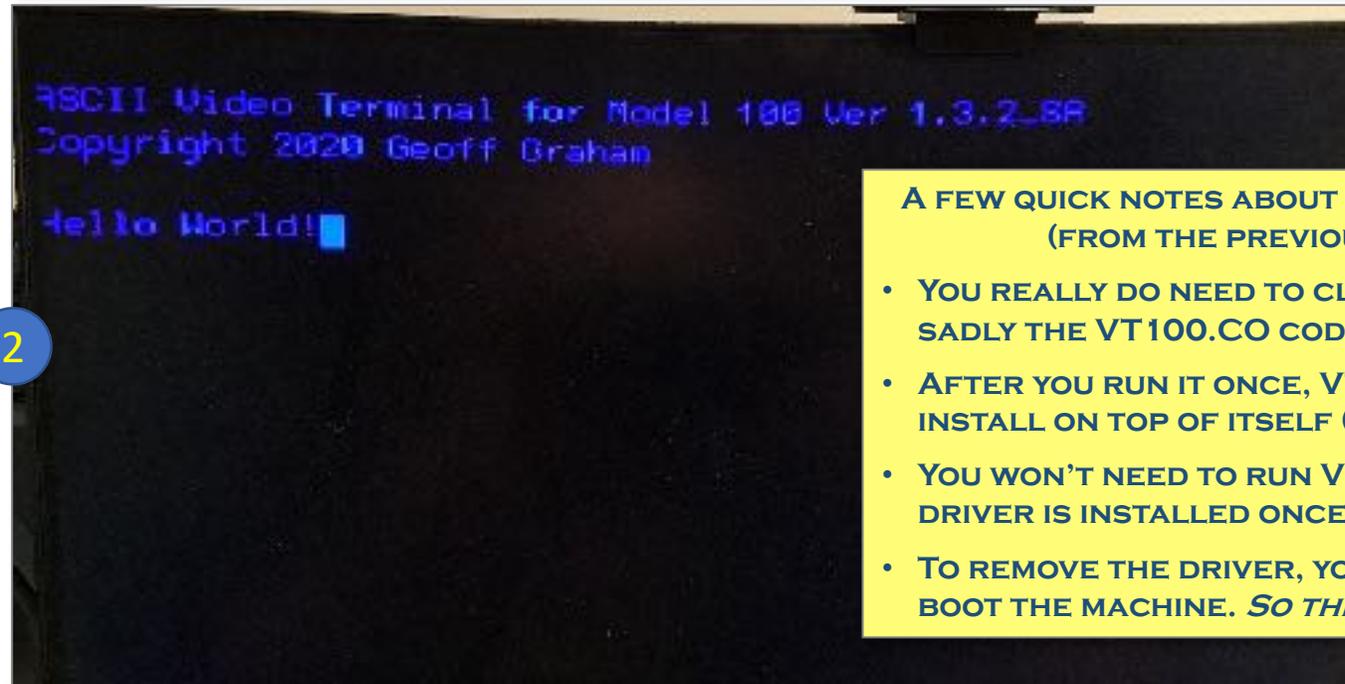
A few quick notes about the VT100.CO file (from the previous slide…)

- You really do need to clear **0,60000** or sadly the VT100.CO code won't run
- After you run it once, VT100.CO won't re-install on top of itself (it just beeps)
- You won't need to run VT100.CO again; the driver is installed once and only once
- To remove the driver, you'll need to cold-boot the machine. *So there ya go!*

A QUICK TEST DRIVE... JUST FOR FUN


```
TRS-80 Model 100 Software
Copr. 1983 Microsoft
22534 Bytes free
Ok
10 print "Hello, world!"
20 goto 10
run
```

```
Hello, world!
Hello, world!
Hello, world!
Hello, world!
Hello, world!
Hello, world!
Hello, world!
Hello, world!
Hello, world!
Hello, world!
Hello, world!
Hello, world!
Hello, world!
Hello, world!
Hello, world!
Hello, world!
Hello, world!
Hello, world!
Hello, world!
Hello, world!
Hello, world!
Hello, world!
Hello, world!
```

Well, I must admit that this is not quite the most complex BASIC code that I've ever written... but what I wanted to see is how the Model T would fill the screen with the "Hello, world" message. *Mission accomplished!*

Sorry again for the lousy photos... my curved monitor really, truly needs a good dusting!

What's Next? (Yep, a cliffhanger...)

- On its own, the MVT100 offers some *incredible* capabilities and expanded options for your Model T
  - Ability to drive both the Model T's built-in screen 0 and also the external VGA screen 1 at the same time, via code and wizardry
  - A fun, engaging experience using a modern monitor as you do coding and other fun stuff on your Model T

- ... yet there are some limitations on its own, too
  - Unable to use the RS232 port for anything else; for example, if you have a WiModem232 or GuruModem to login to the internets... uh, well... *bummer...*
    - *Unless of course you consider doing "The BCR Hack" which frees up the serial port and works with MVT100; this only takes one or two wires to be soldered to your Model T (one wire for the Model 100; two wires for the Tandy 102)*
    - http://bitchin100.com/wiki/index.php?title=BCR_TTL_SERIAL_HACK
  - Unable to use the incredible REX option rom swapper because of the hardware hooks that'd conflict *(remember that REX must be fully removed before you start this)*
  - Unable to transfer files back and forth, at least not with TS-DOS, Teeny, etc. (I haven't tried other send/receive programs and approaches, i.e., cassette, etc.)

- But wait, there's a bright future ahead!
  - REXCPM is a next-generation REX chip that supports CP/M and -- wait for it — yeah, it also works with MVT100 ... wow, the best of both worlds!
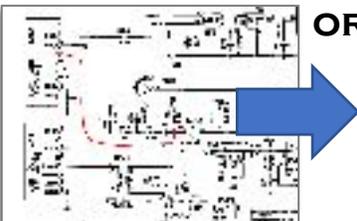
http://bitchin100.com/wiki/index.php?title=REXCPM

The adventure continues...