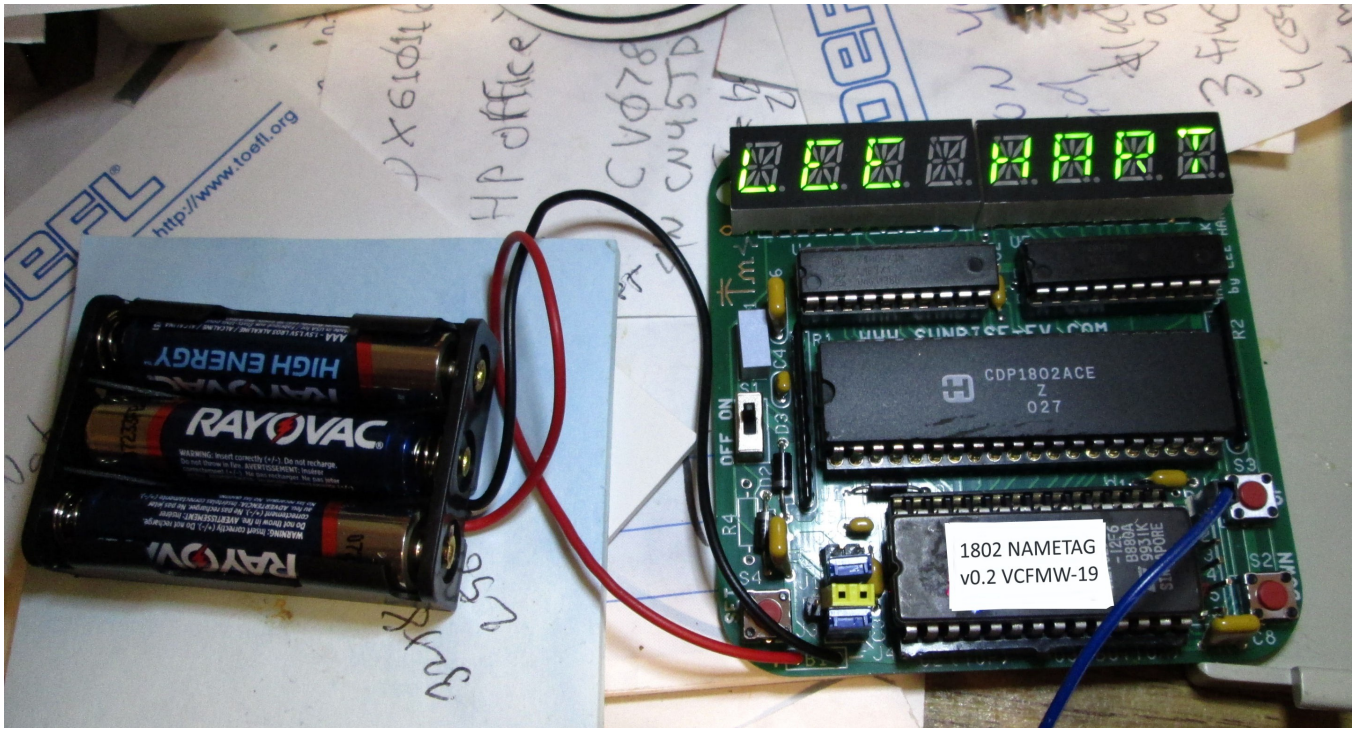
An 1802 BADGE

for the Vintage Computer Festival Midwest

by Lee Hart, David Madole, Chuck Yakym, and Herb Johnson – 30 March 2025



What is it?

- A cool retro nametag that displays a scrolling message of your choice
- Celebrates the 50th anniversary of the introduction of the microprocessor
- Classic user interface that is functional and educational
- Minimum size, cost, and parts count
- Maximum fun!

Description

The Badge is a complete working 1802 computer, built entirely with vintage parts and technology. Powered by batteries or a USB port, its LEDs display up to a 32-character scrolling alphanumeric message. On-board buttons let you set the message directly, or a serial port provides user interaction with any computer. It has:

- A CDP1802 microprocessor, running at 2 MHz
- 8K RAM (optional), with battery backup
- 8K EPROM (expandable up to 32K)
- An 8-digit 14-segment “starburst” LED display
- Software-driven 9600 baud TTL serial I/O port
- And, just a few components to tie it all together
- This is just rev.B – more to come!

For the complete manual, software, and more information, go to **http://www.sunrise-ev.com/1802.htm**

1802 Badge Parts List

QTY	ID#	Description	Source
3	A1,2,3	Nimh rechargeable AAA cells	tenergy ebay#278733418500
1	B1	battery holder for three AAA cells	greencell ebay#153299048475
3	C1,2,3	0.047uF 50v axial ceramic capacitor	jameco.com 2229811
1	C4	0.1uF 50v ceramic capacitor	jameco.com 2312439
1	C5	1000pF 50v ceramic capacitor	digikey.com BC5133-ND
3	C6,7,8	0.56uF (560nF) 50v ceramic capacitor	theelectronicgoldmine.com G18828
3	D1,2,3	1N5818 or 1N5819 Schottky diode	jameco.com 177957
	J1-J5	jumper wires (left over from cut leads)	
1	LED1,2	17-segment 4-digit LED display	* theelectronicgoldmine.com G21553
1	P1	6-pin stacking connector	samtec.com SSQ-106-03-G-S
1	R1	1meg x 5 SIP10 resistor network, isolated	mouser.com 652-4610X-2LF-1M
1	R2	5.6K x 4 SIP8 resistor network, isolated	mouser.com 652-4608X-2LF-5.6K
1	R3	47 ohm 5% 1/4w resistor	jameco.com 690742
1	S1	switch SPDT micro slide	lizardleds ebay#253329337174
3	S2,3,4	switch SPST tactile pushbutton	* theelectronicgoldmine.com G21644
1	U1	CDP1802 microprocessor	alltronics.com CDP1802ACE
1	U2	27C64 programmed EPROM, labeled “1802 NAMETAG v0.2 VCFMW-10”	# (order from me)
2	U2a	14-pin IC socket strip	jameco.com 2125675
	U3	8K RAM 0.3" wide (not supplied in basic kit)	mouser.com 913-AS7C164-15PCN
1	U4	74HC541 octal buffer	jameco.com 46050
1	U5	74HC573 octal latch	jameco.com 46076
1	Y1	2 MHz ceramic resonator with capacitors	mouser.com 520-ZTT200MG
1	PCB	Badge printed circuit board, rev.B	# (also get it from me)
2	hardware	#4-40 screw, nut, and jackscrew	hardware store
1	HW-597	CH340G USB to TTL serial adapter	survy2014 ebay#201414990214
1	clip	to hang the Badge on your shirt etc.	scrounge from an old convention badge

Notes:

Rev.A – Original release; it only went to developers, and couldn't write to RAM without WAIT states.
Rev.B – Fixed RAM writes so they don't have WAIT states. Added slot for clip to hang badge. Added jumper J5 to disable LEDs when writing to an EEPROM at U2.

* = The LED display and pushbutton switch are out of stock at thelectronicgoldmine.com. There are probably other sources, but I haven't tracked them down yet. But you can order them directly from me (Lee Hart, leeahart@earthlink.net)

= The programmed EPROM and PCB are special parts. You can also order them directly from me (Lee Hart, leeahart@earthlink.net)

An IC socket is only supplied for EPROM U2. You can socket the others ICs if you like. For RAM IC U4, use socket pins so it will fit under U3 (digikey.com ED5037-ND or mouser.com 575-055210).

Assembly

Check the parts list to be sure you have all the parts. Mount all parts on the TOP (printed) side and solder them on the bottom side. Put a check mark in the box as you install each part. Note: ICs come with their pins bent slightly outward. To fix this, stand the IC on its side on the table, and tip it slightly inward so the pins are straight and will fit into the holes on the board.

( ) LED1: 4-digit LED display. Install it so the side with printed text is on the bottom.

( ) LED2: 4-digit LED display. Install it the same way as LED1.

( ) U4: 74HC541. Install so lettering is right side up.

( ) C2: capacitor. 0.047uF, yellow, marked “R5C 473”.

( ) U5: 74HC573. Install so lettering is right side up.

( ) J5: Nothing needs to be installed here.

( ) C4: capacitor. 0.1uF, yellow, marked “104”.

( ) C6: capacitor. 0.56uF, yellow, marked “RMC 56K”.

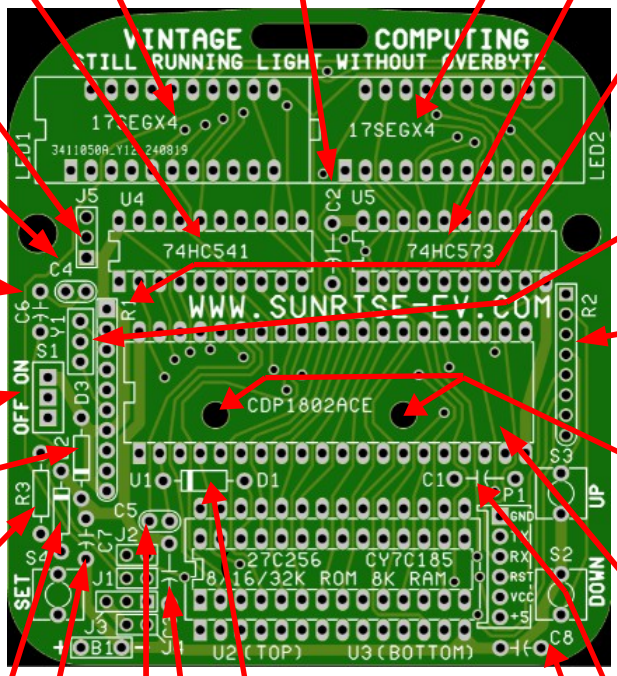
( ) S1: Slide switch.

( ) D3: 1N5818 diode. Banded end down.

( ) R3: 47ohm resistor. Only install to use with nimh batteries!

( ) D2: 1N5818 diode. Banded end up (↑).

( ) C7: 0.56uF capacitor. Yellow, marked “RMC 56K”.



( ) D1: 1N5818 diode. Banded end on left.

( ) C3: 0.047uF capacitor. Yellow, marked “R5C 473”.

( ) C5: 1000pF cap4acitor. Yellow, marked “102 C5K”.

( ) R1: 10-pin resistor network, marked “B105G”. End with dot goes on top.

( ) Y1: 2MHz resonator Blue, marked 2000A

( ) R2: 8-pin resistor network, marked “B562G”. End with dot goes on top.

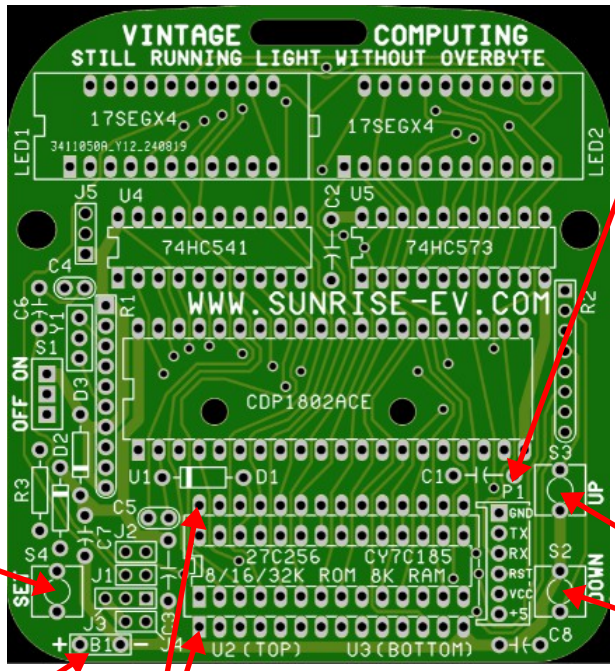
( ) #4 hardware: Mount jackscrews on bottom with nuts on top.

( ) U1: CDP1802ACE Microprocessor. Install it so lettering Is right side up.

( ) C1: capacitor. 0.0.47uF, yellow, marked “R5C 473”.

( ) C8: capacitor. 0.56uF, yellow, marked “R5C 56K”.

Assembly (continued)



( ) P1: stacking header Put the black body on top of the board, and solder the pins on the bottom. Don't cut off the extra pin length; they can be used to plug in USB serial adapters with sockets.

( ) S1: pushbutton.

( ) B1: battery holder. Solder the Red wire into the "+" hole. Solder the Black wire into the "-" hole.

( ) S3: pushbutton.

( ) S2: pushbutton.

( ) U2: EPROM marked "1802 Nametag v0.2".

a. Place the two 14-pin socket strips in the outer row of holes. Do not solder them yet.
b. Plug the EPROM into the socket strips. Be sure the text is right side up, and the notch is on the left end.
c. Now solder the pins of the socket strips to the board. (This insures the sockets are in the right places).

( ) Battery holder: There is a bare wire on the back of the battery holder. Cover it with a couple layers of tape to prevent shorts. Then mount it to the back of the board with the two #4 flat-head screws.

Jumper Options

There are four jumpers to select the size and type of ROM at U2, and one to enable/disable the LED display when writing to an EEPROM at U2. The current kit comes with an 8K EPROM at U2 (and no RAM at U3), so set the jumpers as follows.

Use scrap pieces of wire for jumpers. Or, you can install 0.025" square pin headers (not supplied), and use shorting jumpers if you want to change them.

( ) J1: Leave it open (no jumper).
( ) J2: Leave it open (no jumper)
( ) J3: Short the center pin to the left pin (closest to S4).
( ) J4: Short the two pins.
( ) J5: Leave it open (no jumper).

Let's See It Work!

Now for the big moment. The batteries supplied will probably need to be charged before use, as it's safer to ship them that way. So use the USB-serial adapter (supplied) to power the badge. **BE CAREFUL NOT TO PLUG IT IN BACKWARDS!** The bottom of the adapter labels its 5V and GND pins; plug it in so the +5V and GND pins match the labels on the board. (See Appendix B for information on installing and using this adapter.)

You should be rewarded with a (random) scrolling message!

Note: The 1800 mAH claim on the batteries is a lie; they are more like 300 mAH (but that's still 8-10 hours of running time).

The PCB has holes for #4 hardware to mount the battery holder on the back. Also, there is a bare wire on the back of the battery holder: **Insulate** it with a couple layers of tape so it won't short to anything on the board!

Operation

To set the 32-character message with the buttons:

1. Press and hold SET. This stops the display scrolling.
2. Press both UP and DOWN together to clear the display to all blanks.
3. Press UP or DOWN to display the desired first character. There are 64 characters to choose from (A-Z, a-z, 0-9, and some punctuation). Use a lowercase “l” for the digit “1”, and capital “S” for the digit “5”. You can hold a button down to auto-repeat.
4. When the desired character is shown, release the SET button momentarily to step to the next character.

To edit the message already loaded:

1. Press and hold the SET button when the character you want to change appears in the right-most location.
2. Press UP or DOWN to change it to a different character.
3. Release the SET button momentarily to step to the next character.
4. Release the SET button when finished.

(Yeah, it's a bit awkward. But the software was barely finished in time for the show! We're still working on improving it!)

Serial Port

The serial port is a TTL asynchronous data transfer type using Transmit Data, Receive Data and a common ground. It is similar to the RS-232 standard, but uses 5V and 0V logic levels and non-inverted data (Idle = 5V = logic 1). You can use a TTL to RS-232 adapter to talk to any traditional terminal or computer with an RS-232 serial port. Or, you can use a TTL-to-USB serial adapter which are supported by most modern computers and operating systems. As a bonus, the 5V power from the USB port is used to power the board and charge the batteries (if you have rechargeable batteries and R3 is installed).

Connector P1 is for connecting a USB adapter. Pin 1 = GND, pin 2 = TX (serial data out from the Badge), pin 3 = RX (serial data in to the Badge), pin 4 = RST (reset the 1802), pin 5 = VCC, and pin 6 = +5V.

On many adapters, the DTR or RTS signal is available as an output. These are normally high when the Terminal is off-line or disconnected, and goes low when the Terminal is on-line or connected. The Badge can use the falling edge of this signal to reset the 1802. Alas, the adapter supplied does not bring this signal out to a pin. But if you're adventurous, you can add it (see Appendix B). Or, just use an external pushbutton to ground pin 4 to reset the 1802.

The serial port uses the following configuration: 9600,N,8,1 (9600 baud, No parity, 8 data bits, and 1 Stop bit).

To set the scrolling message with the serial port:

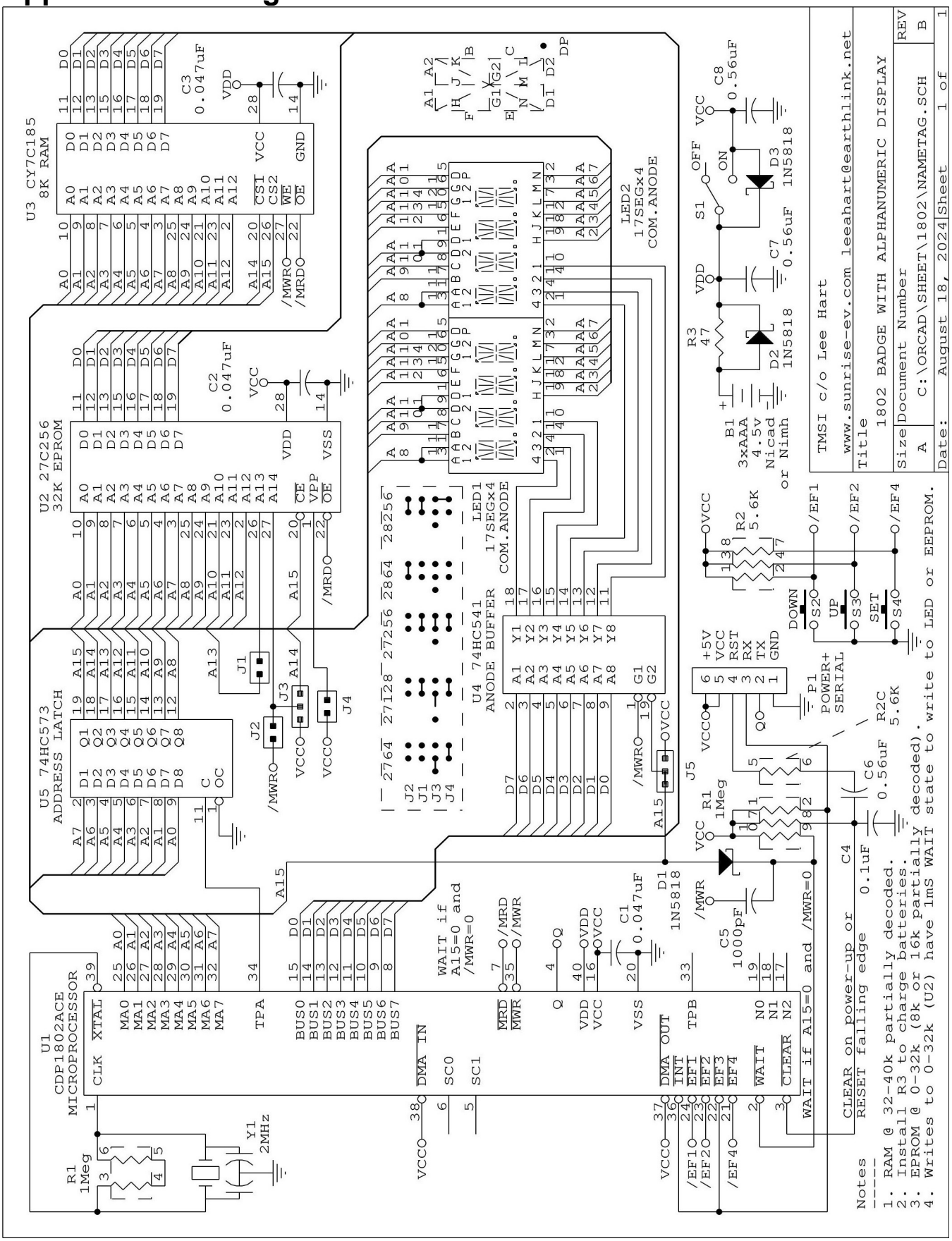
1. Turn the Badge off. Unplug the USB adapter from the Badge if it was plugged in.
2. Hold down the DOWN button.
3. Plug in the USB adapter. The Badge will automatically turn on, and you should see a set of 32 blanks framed with < > on your Terminal.
4. Type the desired message. You can use A-Z, a-z, 0,2,3,4,6,7,8,9, period, dash, slash, and at-symbol. Use lowercase “l” for digit 1, and uppercase “S” for digit 5. Characters not available will be ignored.
5. When you have entered the last character, hit the ENTER key to end. Unplug the USB adapter, and turn the Badge on. You should see your message!

Software Description

It all starts with the power-on reset. The 1802 starts running the program in EPROM U1. Notice that there is no RAM! The 32-character message is stored in the 1802's registers. :-)

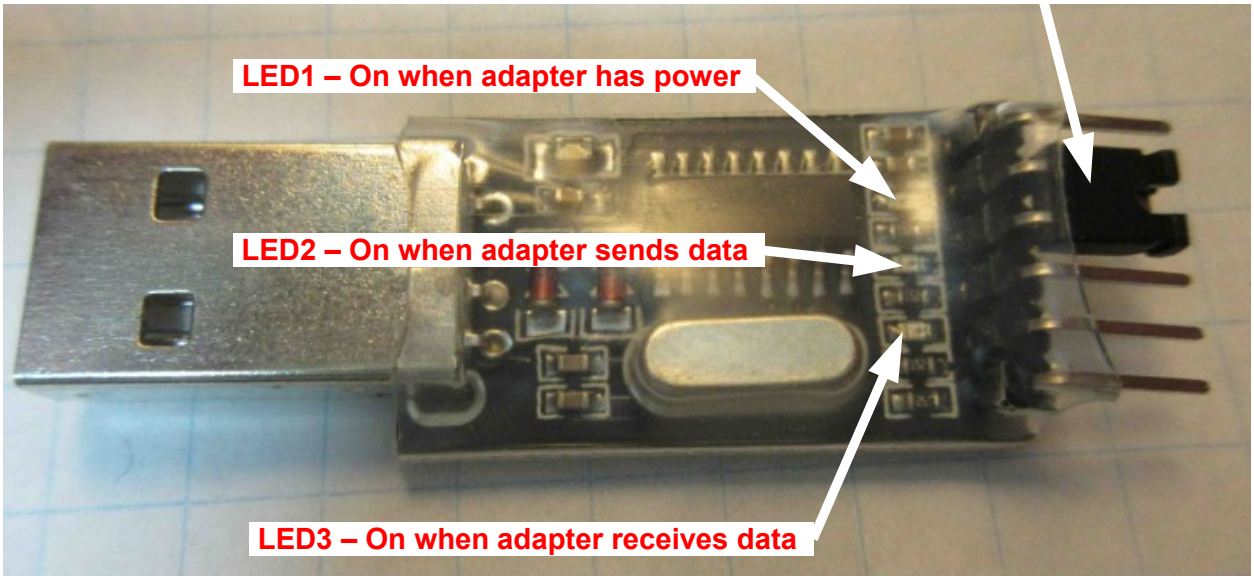
The program will produce a scrolling display on the LED digits. The message is random at first start-up, but will be retained by the batteries even with S1 in the “off” position. Power consumption when “off” is tiny (just a few microamps) so fully-charged batteries will last for years. The Badge is all CMOS, so power consumption when “on” is also low – only 10-20ma running on batteries.

Appendix A -- Badge Schematic



Appendix B - CH340G USB-TTL Adapter

This device converts a modern computer's USB port into a vintage serial port. The (included) jumper configures it for 3.3V (short VCC to 3V3) or 5V (short VCC to 5V) output levels. The 1802 Badge uses 5V levels; the VCC-5V connection is already made on the Badge PC board, so **REMOVE** this jumper.

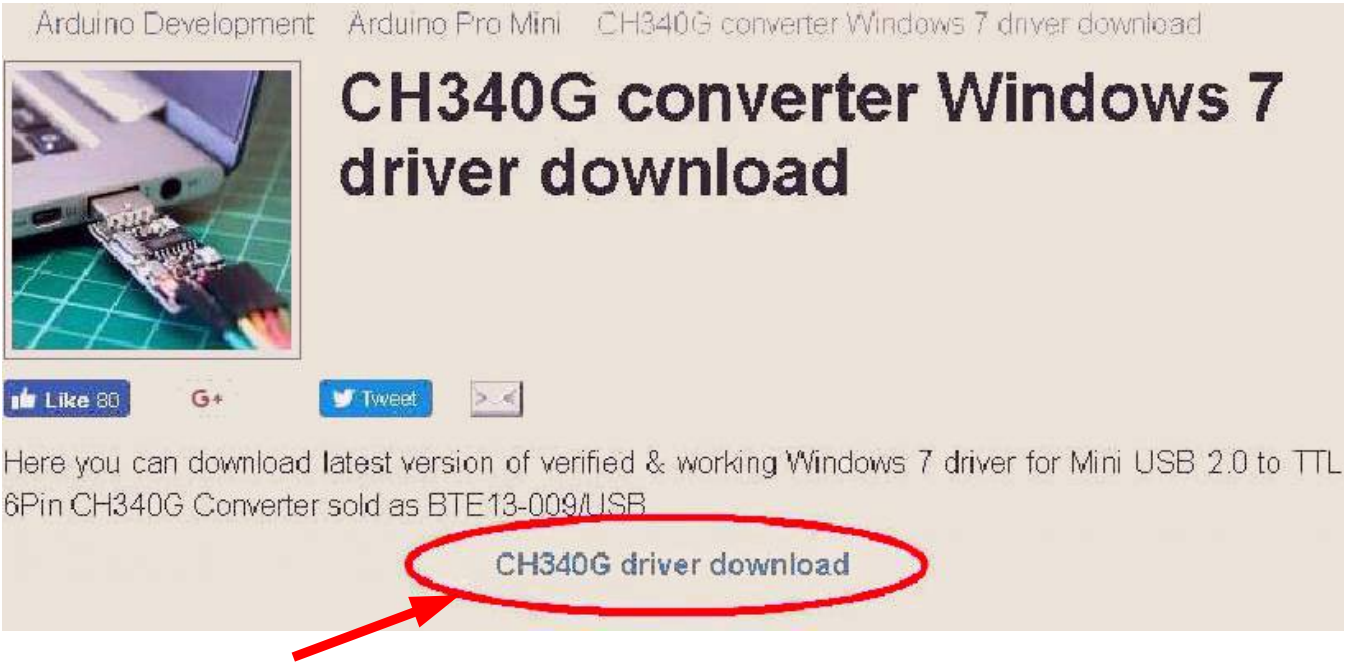


It's a typical modern “no documentation or support” gadget. We do not support it for them; so use these notes at your own risk. This is just an unofficial and independent description of how we got it to work with Windows 7. It **should** work with other version of Windows and other operating systems; but you'll have to find the drivers, and the key pokes and mouse strokes to install it will be a little different.

A driver **must** be downloaded and installed manually **BEFORE** you plug in the module! For Windows 7, one source is http://www.arduined.eu/ch340g-converter-windows-7-driver-download/. This is an Arduino site, and believed to be legitimate and less likely to contain malware or viruses. If this URL is no longer valid, or you need one for a different operating system, search for “CH340G driver”. The manufacturer's own driver is at http://www.wch.cn/downloads/CH341SER_ZIP.html (Google can translate it for you).

As an example, here are step-by-step instructions for installing the driver for Windows 7:

1. Find a website that lists a driver for your operating system and version. For Win7, we'll use the one on the Arduino page http://www.arduined.eu/ch340g-converter-windows-7-driver-download/.



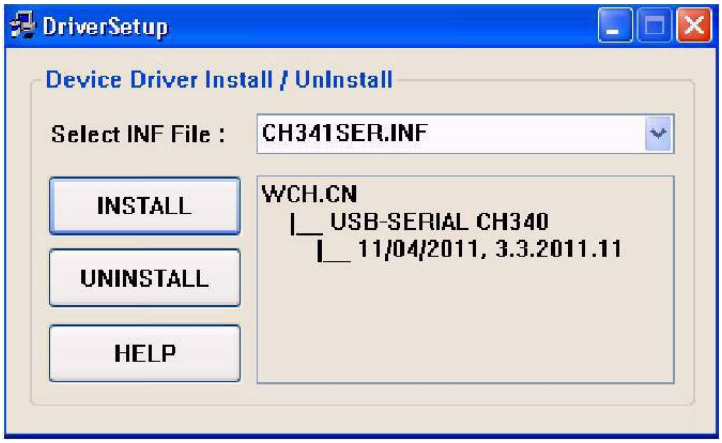
2. Click on the link to download the driver. This downloads **CH341SER.zip** which is a ZIP file. It must be "unzipped" to extract all the files inside it.

3. Open your **Downloads** folder (or wherever you or your computer puts downloaded files).

4. Right-click on the **CH341SER.zip** file, then click "Extract All..." This creates a new folder named **CH341SER** in your Downloads folder with all the new files and subfolders unzipped inside it.

5. Open (double-click) the new **CH341SER** folder. Inside it, you will see *another* "CH341SER" folder, and an "INSTALL" folder.

6. Open (double-click) this inside "CH341SER" folder. Inside it are a bunch of files including a **SETUP.EXE** program. Aha! Run (double-click) the SETUP program to display this dialog box...

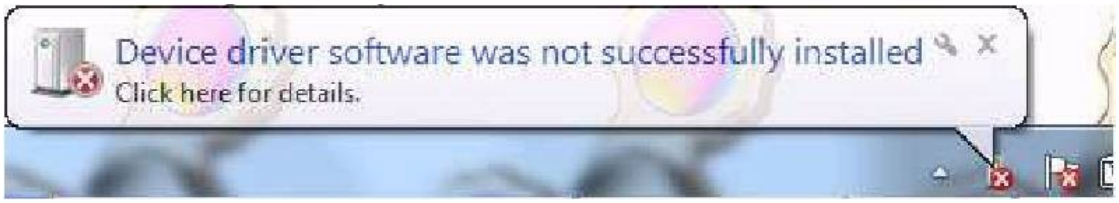


7. Click **INSTALL**. You should get the following message box. (Please forgive poor Engrish.)

8. **Now** you can plug the USB adapter into your computer. Windows should detect the new USB device, and look for the driver for it. It **might** find the new driver all by itself, in which case you should now have a new COMn port.

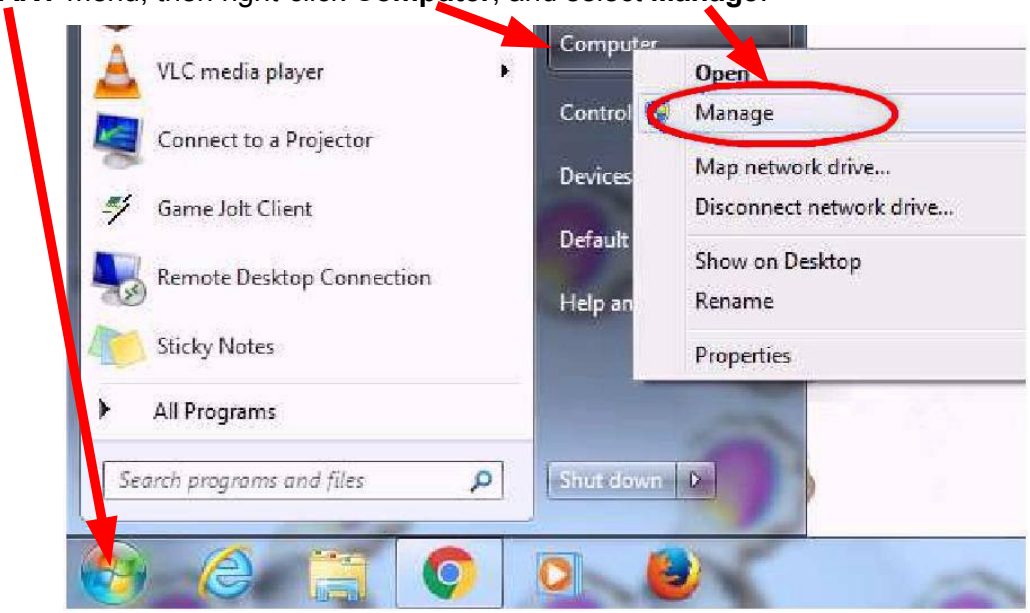
9. If this doesn't work, you have to manually guide Windows to new driver. When you plugged in the USB adapter, Windows may ask you where find the driver for it. Try telling it to look in the new CH341SER folder you created.

10. If you plugged in the USB adapter before you installed the driver, or if Windows can't find the downloaded driver, you'll get an error message like...

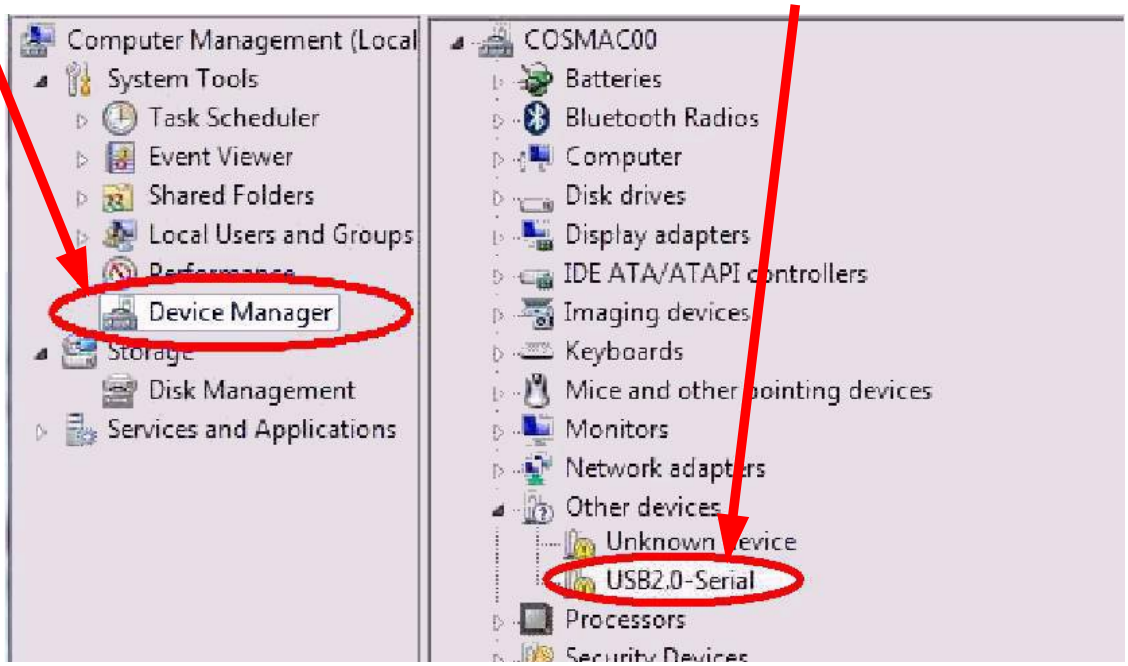


In this case, you have to manually guide Windows to find and install the driver. Briefly, you go to the **Device Manager**, right-click to update the driver, then select “Choose my own path”, and point that path to the CH341SER folder you created above. Here is the procedure in detail...

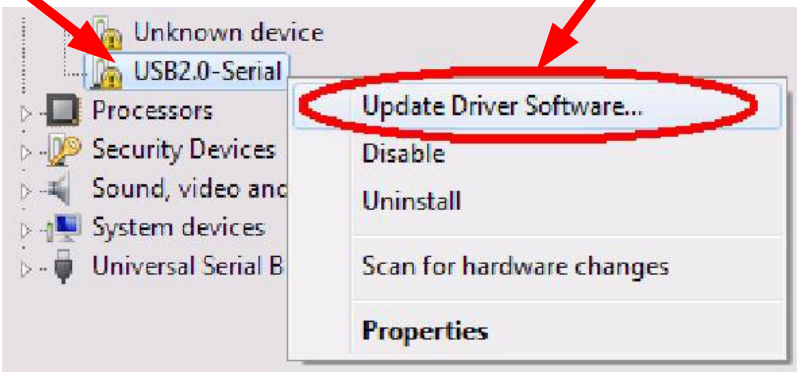
11. Click on the **START** menu, then right-click **Computer**, and select **Manage**.



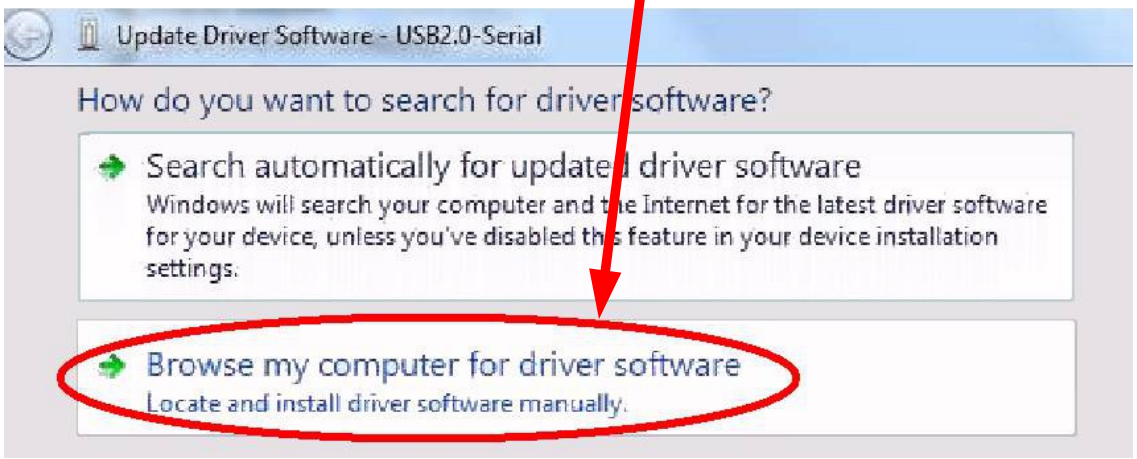
12. This opens the Computer Management menu as shown below. Under “System Tools”, click the **Device Manager**, then under “Other Devices” look for the **USB2.0-Serial** device.



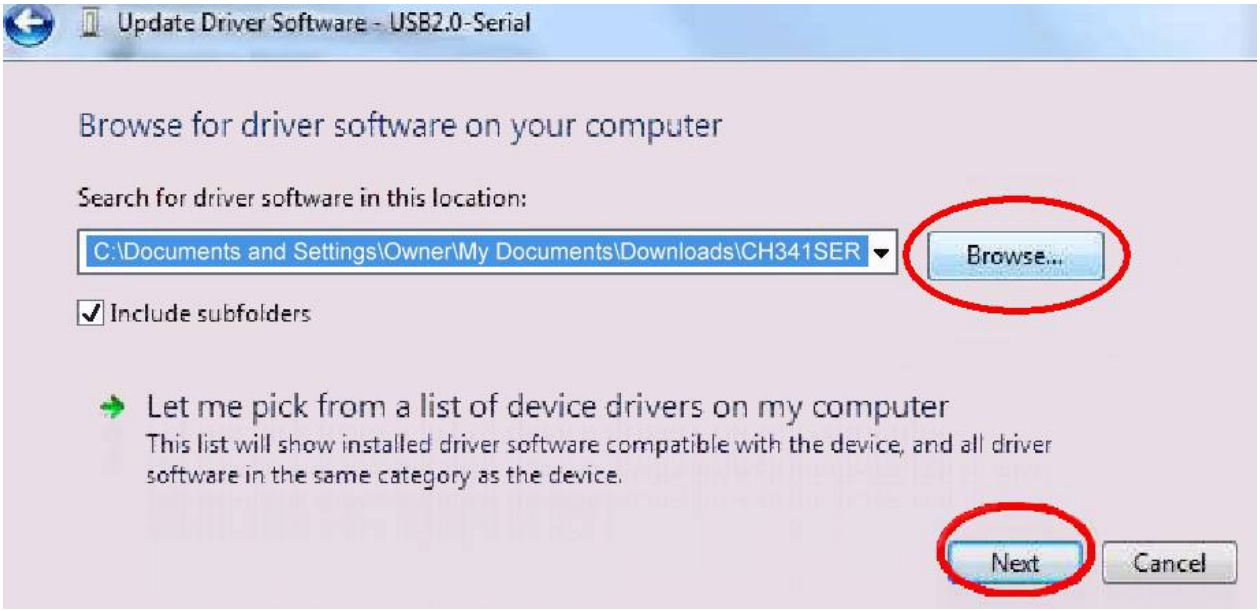
13. Right-click the **USB2.0-Serial** device, and then select the **Update Driver Software...** option.



14. Click the **Browse my computer for driver software** option.



15. (Installing the driver... continued...) The following dialog box (or its equivalent) should pop up. Click the **Browse...** button, find the **CH341SER** folder with the driver files, and click on it so it appears in the “Search for driver software in this location:” box. Be sure the “Include subfolders” box is checked. Then click the **Next** button to install it.



16. Remove, and then re-insert your CH340G USB-serial adapter. Now Windows should find it, and use the correct driver. (You should no longer get the error message in step 10.)

Testing the USB-TTL Adapter

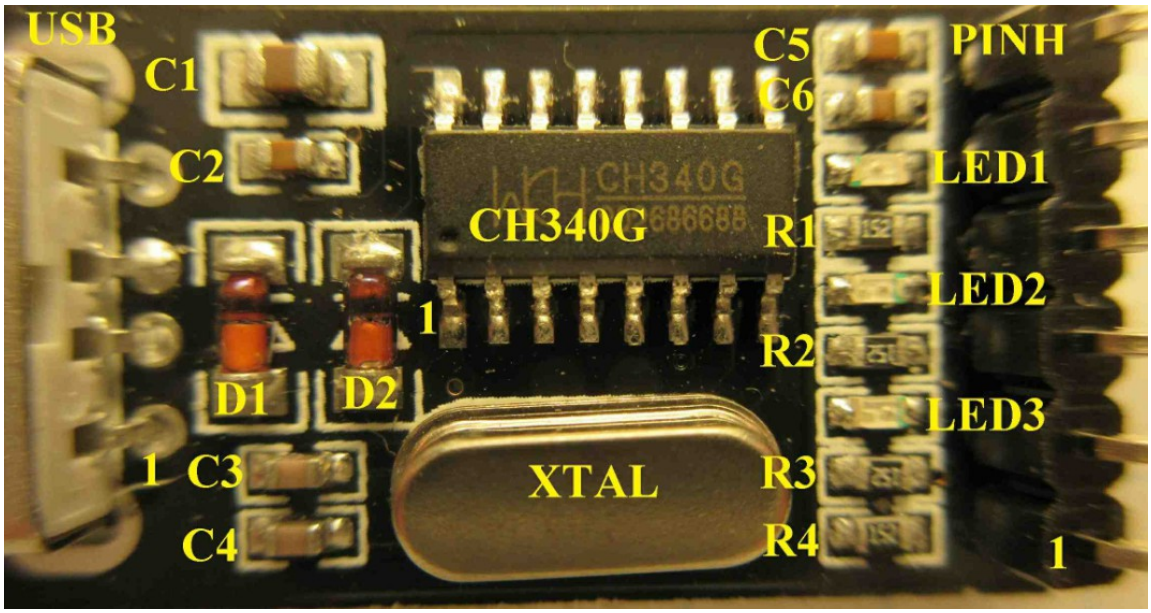
TEST the Adapter before you plug it into your 1802 Badge. Use the jumper (on the adapter) to short TXD to RXD, and plug it into your PC. Run your Terminal program (Hyperterm, RealTerm, TeraTerm etc.). Configure it for 9600N8 (9600 baud, No parity, 8 Data bits), and No hardware or software handshaking. When you tell it to “connect”, any keys you type on the keyboard should be echoed and appear on the screen. TXD and RXD are normally high, and go low on Start bit and zero data bits.

You'll need some kind of Terminal program. There are dozens of free Terminal programs, for every computer and operating system. They usually come as part of the operating system. For decades, Windows came with “Hyperterm”, but they've stopped providing it. It's not very good; but it works and is very common and free to download.

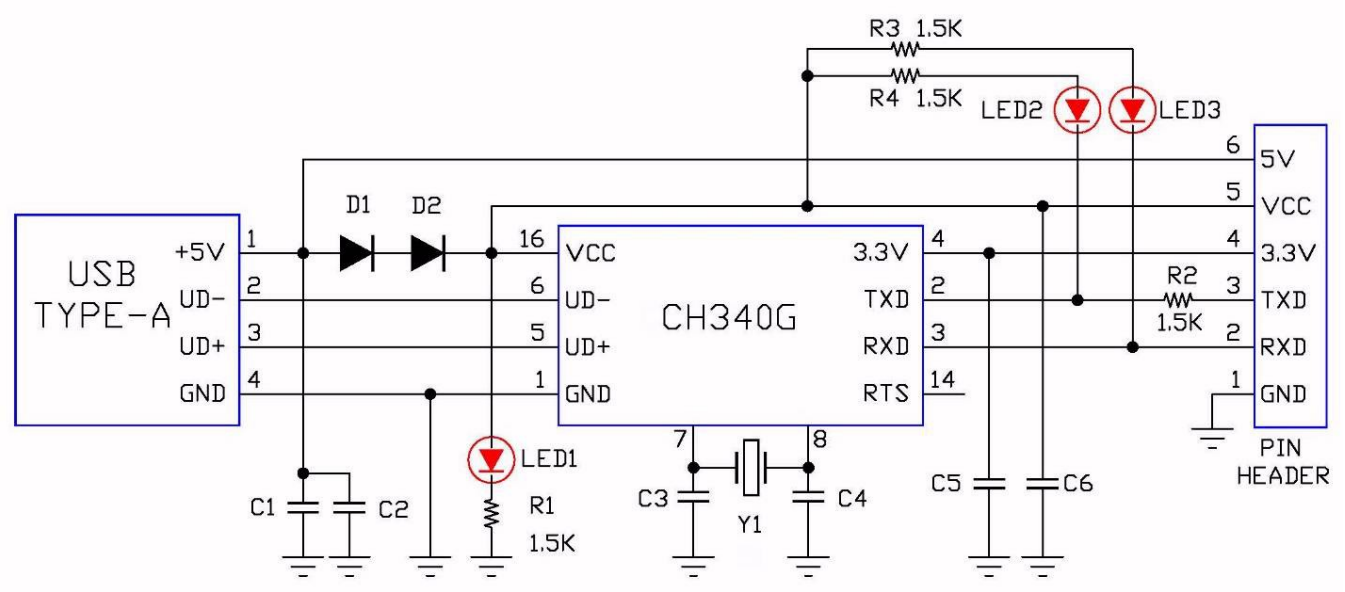
Once this works, remove the jumper and plug the Adapter into connector P1 on the 1802 Badge. The “GND” pin of the adapter goes in the Badge socket at the top marked “**–**“ and is the one closest to the edge of the board. **BE SURE NOT TO PLUG IT IN BACKWARDS !** If you do, it reverses the +5v and GND connections, and can destroy the Badge!

A good plan is to “key” the adapter so it can't be plugged in backwards. To do this, **CUT OFF** the adapter pin labeled “3V3”. Plug the mating hole on the 1802 Badge (P1 pin 4, labeled “RST”) with a piece of a toothpick etc.

If you want to use the adapter with some other gadget, you won't want to cut off the 3V3 pin. It is used to set the adapter's serial output logic level to either 5v or 3.3v. The 5V pin provides +5v power from the USB port to power things (like the 1802 Badge). The 3V3 pin provides a small amount of 3.3v power from the CH340G chip, and is not able to drive any significant load.



Top of the Adapter board, with shrink-wrap removed and parts labeled.

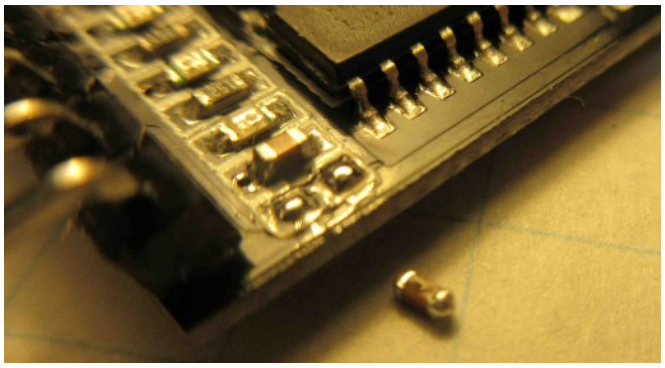


Schematic

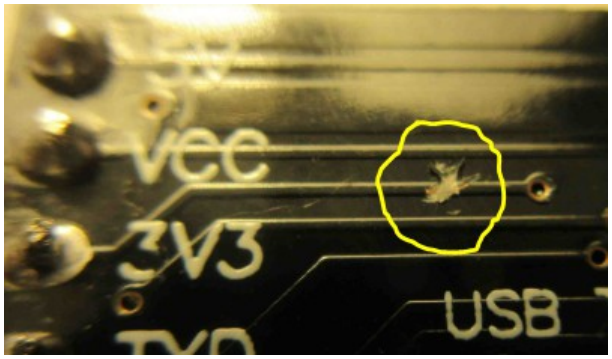
Modification to add RTS (Optional – Not for mere mortals!)

Most terminal programs set RTS high initially, or when you use their “hang up” or “disconnect” command; and set RTS low when you use their “on-line” or “connect” command. RTS can thus be used to reset the 1802 on the Badge (and other devices). RTS is available on pin 14 of the CH340G chip, but is not brought out to the 6-pin header. This modification replaces the 3V3 pin with the RTS signal.

1. Remove C5.

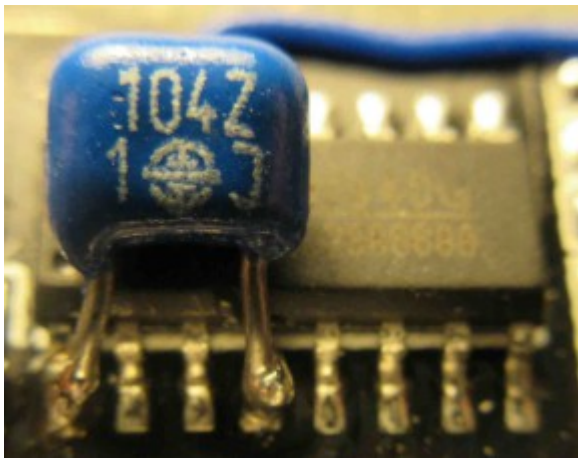


2. Cut Trace to 3V3 pin.



3. Add a jumper wire from CH340G pin 14 to the outer pad of C5.

4. Add a new 0.1uF decoupling capacitor between pin 1 and pin 4. (This replaces the one removed in step 1.)



Your terminal program's connect/disconnect commands should now control the level on the 3V3 pin of the USB adapter. When plugged into the 1802 Badge, switching from “off-line” to “connect” will reset the 1802, and then let the 1802 program run.