

The Deluxe TennaDipper II

Design by: KD1JV

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The "Tenna Dipper" provides a simple means of determining the 50 ohm resonant frequency of an HF antenna or ATU (Antenna Tuning Unit).

Features:

- Wide tuning range: ~3 MHz to ~30 MHz in two ranges.
- Four digit LED frequency readout.
- Small size and battery operation makes the unit ideal for use in the field.

Usage:

- Trimming length of a resonant dipole antenna.
- QRM free adjusting of antenna tuners.
- Adjusting short, portable vertical antennas.

How it works:

A voltage controlled R/C oscillator generates a 5 volt square wave signal.

This signal drives a resistive Wheatstone bridge. One leg of the bridge is the "unknown" resistance - the antenna.

A wide band step up transformer is connected across the bridge to detect the signal produced when the bridge is unbalanced and this signal is further amplified by a Darlington pair transistor amplifier.

A high brightness LED is used to visually indicate the current in the collector of the amplifier.

When the antenna impedance at the unknown leg of the bridge is equal to 50 ohms, the bridge is in balance and the LED will go out.

The TennaDipper, "dips" the brightness of the LED to find the 50 ohm match, hence the name.

Using the TennaDipper

Finding the resonant frequency of coax fed dipole antennas:

Connect the feed line to the TennaDipper and adjust the frequency until the SWR indicating LED goes from bright to very dim or completely out.

Then read the resonant frequency of the antenna on the display.

Adjusting an antenna or antenna tuner to a specific frequency (or band)

Connect the TennaDipper to the antenna or tuner input (if using a tuner) and set the oscillator to the desired frequency.

Adjust the antenna or tuner to make the TennaDipper indicating LED to be very dim or go out completely.

Antenna tuners and some antennas may show multiple dips as it might be resonant at several frequencies.

The TennaDipper is very handy for adjusting short vertical antennas such as the PAC-12 or MP-1.

Set the TennaDipper frequency to the desired band and connect to the antenna.

You can watch the brightness of the LED from a distance, so you don't have to run back and forth between the antenna and the 'Dipper.

Since the proximity of your body to the antenna can affect the match, once the match is close, be sure to step a few feet away from the antenna to make fine adjustments and find the perfect match.

Recommended tools for assembling this kit

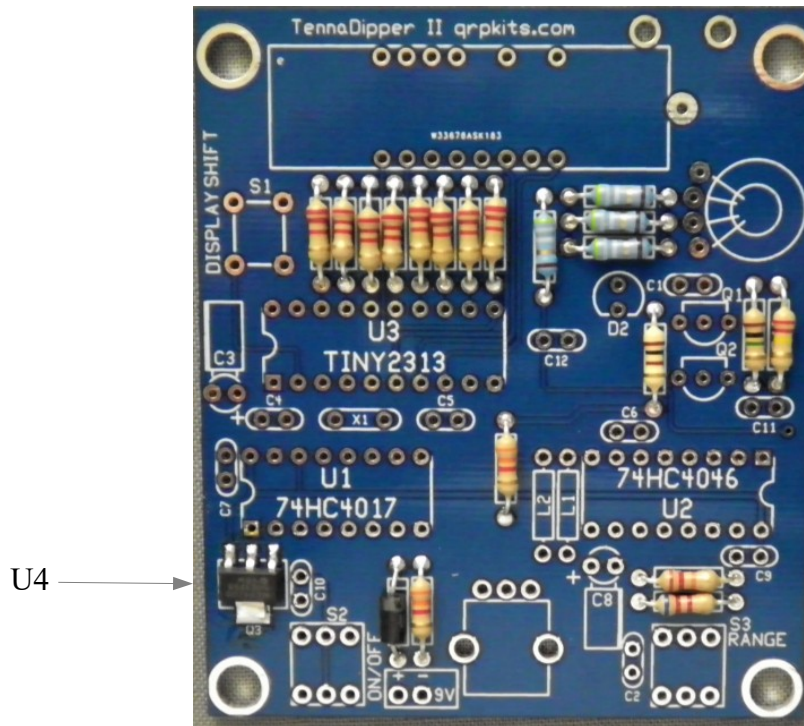
- Soldering iron and solder
- Magnifier
- Drill and bits (Note: A set of step bits makes drilling the case much easier)
- Coarse and fine files
- Sandpaper
- Multimeter
- Small Screwdrivers
- Hole punch
- Exacto knife or similar razor knife

Parts list

✓	QTY	Part number	Description
	1	CD74HC4046AEE4	74HC4046 in 16 pin DIP package
	1	CD74HC4017E	74HC4017 in 16 pin DIP package
	1	ATTINY2313-20PU	20 pin Dip Programmed for TennaDipper
	1	1N5817	Diode
	2	MPS5179	NPN RF TRANSISTOR in TO-92 plastic case
	1	MCP1703-5002E/DB	5V Surface Mount Regulator, (Location labeled as "Q3" on PCB)
	1	4 DIGT 7 segment LED	
	1	T-1 super bright red LED	3mm clear LED
	1	10 K LINEAR POT	9 mm vertical shaft pot
	2	DPST latching PB SW	8x8mm latching switch
	1	13mm TAC Switch	PB Switch, 6x6x13mm shaft length
	1	Molded Inductor 0.68 uH	Blue/Gray/Silver/Silver or Gold
	1	Molded Inductor 6.8 uH	Blue/Gray/Gold/Silver or Gold
	1	FT37-43 TOROID	
	1	10.00 MHz HC49US	Crystal
	5	49.9 OHM 1 % 1/4W	Yellow/White/White/Gold/Brown
	1	100 OHM 5% 1/4W	Brown/Black/Brown/Gold
	8	2.2 K OHM 5% 1/4W	Red/Red/Red/Gold
	2	3.3 K OHM 5% 1/4 W	Orange/Orange/Red/Gold
	1	6.2 K OHM 5% 1/4 W	Blue/Red/Red/Gold
	1	22 K OHM 5% 1/4W	Red/Red/Orange/Gold
	1	220 K OHM 5% 1/4W	Red/Red/Yellow/Gold
	1	1 MEG OHM 5% 1/4W	Brown/Black/Green/Gold
	4	22 pdf Mono NPO 0.1" LS	
	5	0.1 ufd MONO X7R 0.1" LS	
	2	10 ufd ALUM ELECTRO	5mm diameter electrolytic capacitor
	1	20 pin DIP socket	
	1	2 feet # 30 magnet wire	
	1	BNC Jack	All Metal Board mount, right angle
	1	RED FILTER FILM	Approximately 2" X 0.75"
	1	9V battery clip	
	1	CIRCUIT BOARD	TennaDipper II board
	1	Plastic case	
	1	Panel Overlay	Panel overlay on peel and stick adhesive sheet
	1	Knob	Small knob
	2	Switch button covers	Color may vary

Assembly:

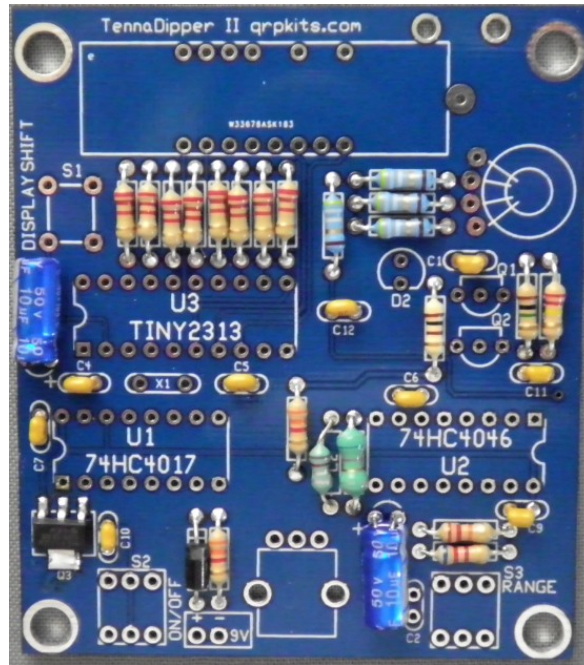
- First install the MCP1703 surface mount (SMT), voltage regulator, U4.
Note: The location may be labeled as "Q3" on some boards.
- Apply a small amount of solder to **one** of the three solder pads for U4 (the ones that are in a row).
- Holding U4 with your needle nose pliers or tweezers, place it over the pads and use the tip of the soldering iron to heat and gently push on the lead into the solder on the pad where you applied solder.
- Adjust the alignment if necessary by heating the pad and shifting U4 to align all of its leads.
- Then heat and flow a little solder to all of the leads of the part.



Resistors:

Next mount all the resistors along with L1, L2 and diode D1

Location	QTY	Value	Color code
R3, 4, 5, 6, 7, 8, 9, 10,	8	2.2 K	Red/Red/Red/Gold
R18	1	6.2 K	Blue/Red/Red/Gold
R16	1	22 K	Red/Red/Orange/Gold
R1, 2, 11, 12	4	49.9 Ohm 1%	Yellow/White/White/Gold/Brn
R14	1	1 Meg	Brown/Black/Green/Gold
R15	1	100 ohms	Brown/Black/Brown/Gold
R13	1	220 K	Red/Red/Yellow/Gold
R17, 19	2	3.3 K	Orange/Orange/Red/Gold
L1 (looks like resistor)	1	0.68 uHy	Blue/Gray/Silver/Silver or Gold
L2 (looks like resistor)	1	6.8 uhy	Blue/Gray/Gold/Silver or Gold
D1	1	1N5817	Note polarity line, match with line on board.



Capacitors:

Now install the capacitors:

Location	Qty	Value	Markings/Type
C1, 7, 9, 10, 11	5	0.1 ufd	104 monolithic
C4, 5, 6 12	4	22 pfd	22pf monolythic
C2		Not used	
C3, C8	2	10 ufd long lead is +	Alum electrolytic NOTE: these two caps must be mounted laying flat to the board.

Wind and mount T1:

- First wind 30 turns of #30 magnet wire on the FT37-43 core.
- Then wind an additional 5 turns second winding in the space between the start and finish of the 30 turn winding.
- Trim and tin the wire ends either by scraping the insulation or using a blob of solder.
- The 30 turn wire ends go into the two outside pads and the 5 turn winding wire ends go into the two inside holes.

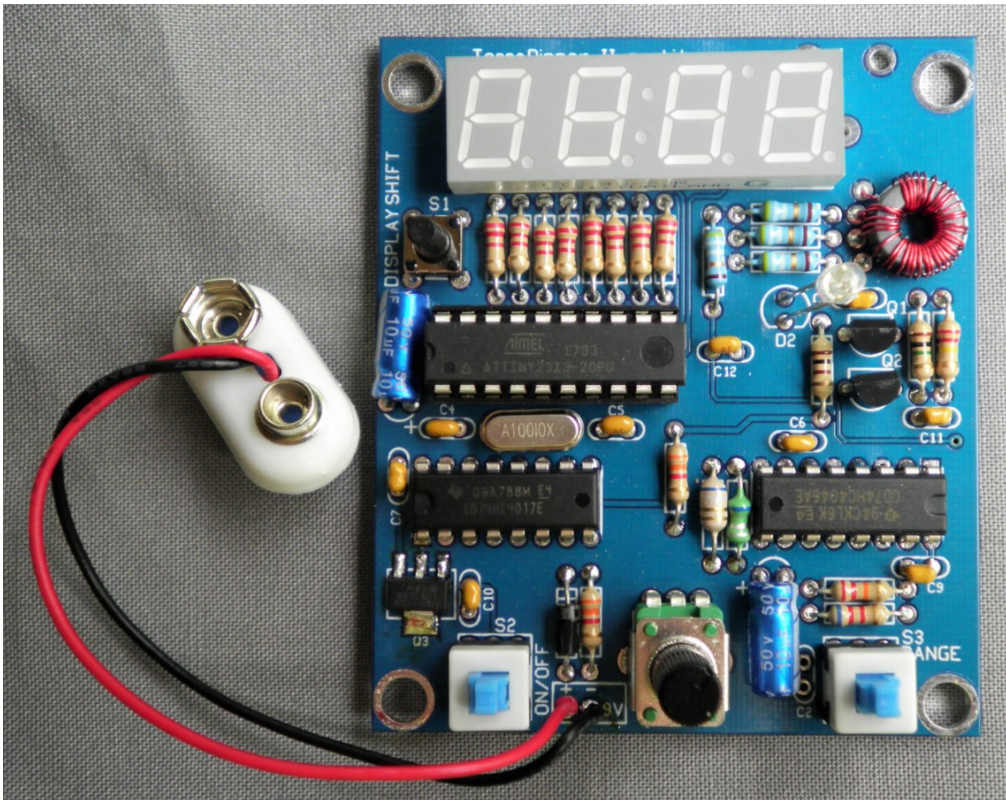


Install the Remaining parts:

	Location	Part	Description
	Q1, Q2	MPS5179	Transistors TO-92
	U2	74HC4046	16 pin dip IC – DO NOT USE SOCKET – Using a socket here will affect tuning range and stability of oscillator.
	U1	74HC4017	16 pin DIP IC – Socket can be used if desired
	U3	Install the 20 pin IC socket – check for any leads bent over and not sticking through pads before soldering.	Insert Tiny2313 chip into socket after remaining parts on board are installed.
	Display	4 digit LED display	Due to missing pins, this part can only go in one way.
	X1	10 MHz crystal (A100)	
	D2	Clear LED T1 size	Short leg goes into hole next to flat side of part outline. To get the spacing correct from the board, mount board with LED into case before soldering leads. (Top of LED lens will be about 13/32" from top of board).
	S1	13mm TACT push button switch	
	V2	9 mm, 10 K pot	
	S2, S3	Latching PB switch	

You can now install U3, the programmed TINY2313 into the socket.

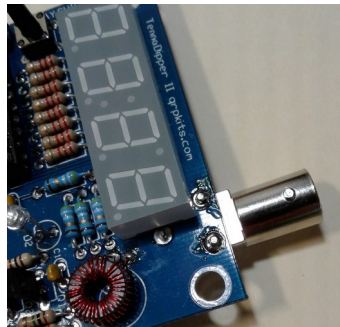
Wire the battery holder to the board, red wire to the '+' pad and black wire to the '-' pad.



If not already installed, add the button covers to the switches by pressing them onto the switch shafts.

Testing:

- Connect a 9V radio battery to the battery clip and turn unit ON with the on/off switch.
- The frequency display should light up, showing all 8's and decimal points lit for a couple of seconds. This indicates all the segments are working. Then the current frequency will be displayed, in MHz. [xx.xx]
- The SWR indication LED should be fully bright.
- Check the tuning range of the oscillator by adjusting V2 and the range switch, SW2.
- Low range: Typically about 3.0 MHz to 11.7 MHz
- High range: Typically about 11.0 MHz to 30 + MHz (note SWR LED may dim slightly above 27 MHz.)
- Clicking the display shift switch, S1, will make the display change from showing the frequency in MHz with 10 kHz resolution to displaying the frequency in kHz, with 100 Hz resolution. This is indicated by the decimal point shifting from between the 2nd and 3rd digit to between the 3rd and 4th digit.
- In the kHz display range, you will notice that the R/C oscillator is not extremely stable, as the 100 Hz digit will be jumping around. This is normal.
- Now test the operation of the SWR bridge by placing the extra 49.9 ohm resistor across the ANT pads. The SWR LED should go completely out.
- If the board passed all these tests, it is now fully functional and ready to mount in the case.
- Install the BNC connector on the bottom of the board with the pins coming through the top side near the right end of the display.

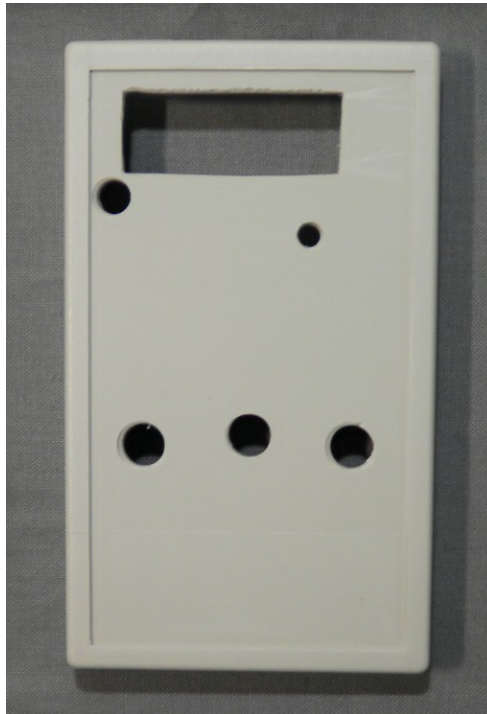


Preparing the case:

Templates for the front panel and end panel templates are at the end of this manual for accurately cutting out the display window and drilling the holes for the switches, tuning pot LED and BNC connector.

- Print a copy of the template and trim to size. It is sized to fit inside the recessed area.
- Be sure to have your print options set to 100% or actual size and check that the printout fits within the recessed area. It will have some space at the bottom since it is not sized to fill the entire recess.
- Be sure to locate the template at the correct end of the cover. The top end of the case is where the removable end panel is located and is the opposite end of the case from the battery holder area.
- Be careful drilling the larger holes. The drill bit can sometimes bind and spin the box if you are not holding on to it tight.
- A set of step bits will make drilling into the plastic much easier.
- One way to cut the display window is to drill a few large holes in the middle of the cutout area and then trim the edges with a sharp hobby knife or preferably a nibbling tool.
- If the drilling and cutting template gets damaged, simply print another and replace it.
- File the edges of the display opening to smooth and enlarge it slightly if needed for the display.
- Test by occasionally fitting the board into the case during this process.

This is approximately how the case front panel should look when finished.



Location of hole for BNC jack is on the end plate.

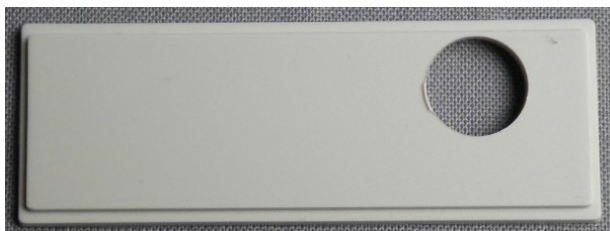
Shown from inside side on the template. Recessed edges of the end panel go towards outside of box.

Place the template on the inside (flat side) of the end panel, mark and drill a 7/16th inch hole for the BNC as shown.

Inside of panel



Outside of panel



Be sure to clean the case of any oil or other material before adding the panel cover.

Rubbing alcohol or soap and water can be used to clean the case after drilling.

Allow the case to dry fully before applying panel cover.

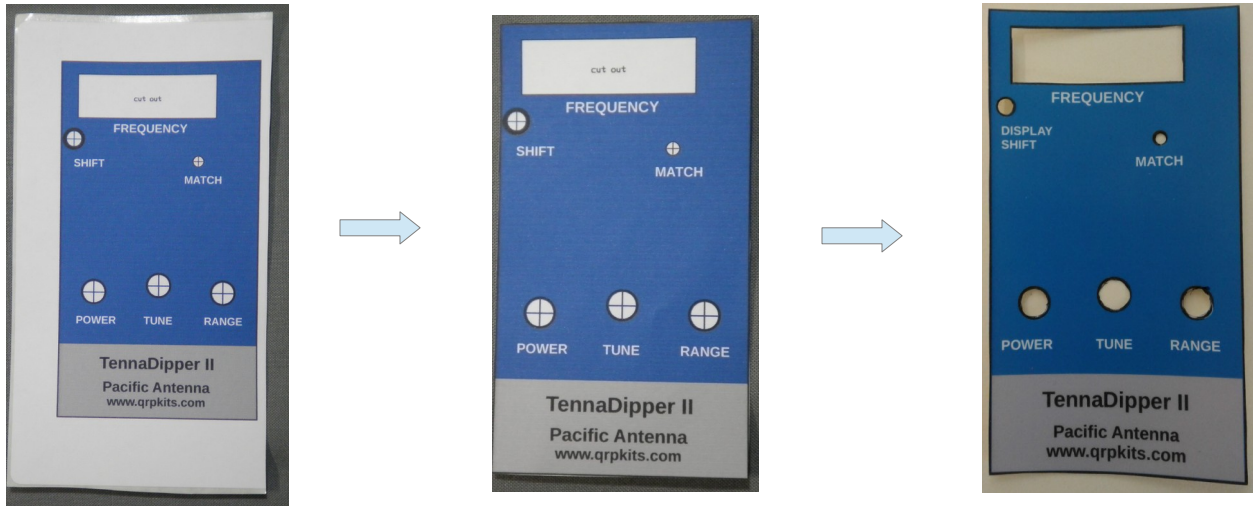
Applying the panel overlay

The panel overlay is supplied on an adhesive substrate.

If not already done, trim it to size by trimming to the outside edge of the black line.

Trim out the display window area to the inside of the black line framing it using a razor blade or cutter.

If you have a hole punch, you can also punch the holes for the controls and LED at this time.



If not, leave these and you can use the case holes as a guide to trim the holes using an Exacto knife once it is applied to the panel.

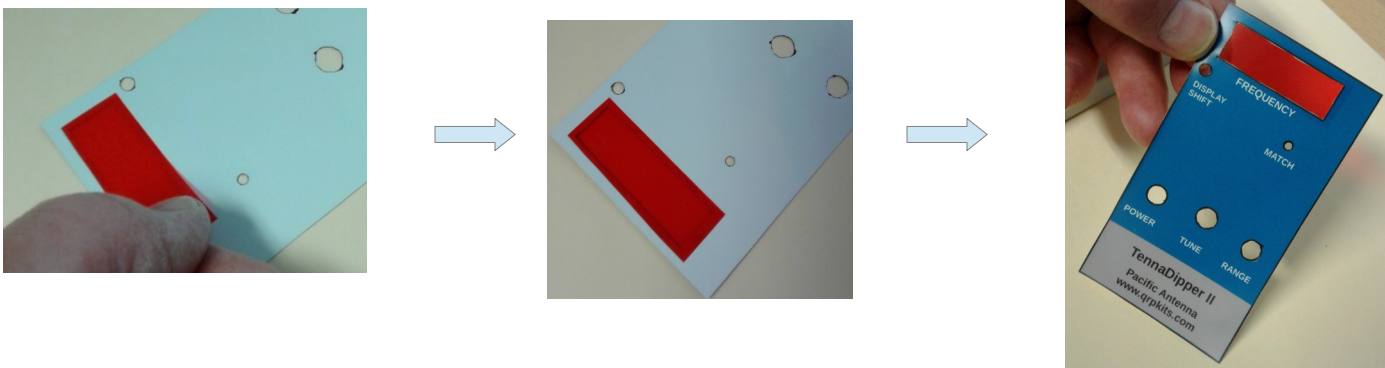
Trim the red mylar window cover just slightly larger than window opening using the panel cover as a guide as shown below:



Then peel off the protective sheet to expose the adhesive layer on the back side of the panel cover.

Place the panel cover face down and carefully place the red film onto the adhesive side over the display opening.

Make sure to leave as much as possible of the adhesive strip at the top of the display exposed for good adhesion to the case.



Applying the Panel Cover:

Make sure the case surface is clean, dry and free of any oil or residues from drilling.

Carefully align the adhesive overlay with the edges of the recessed area of the case and apply.

Start from one edge and press as it is applied to avoid trapping air bubbles under the cover.



If that happens, you can gently press them to one edge or use a needle to puncture them and press air out.

If not already punched or cut out, trim out the holes for the LED, shift button, tuning pot, power switch and range switch.

Assemble the Tenna Dipper into the Case:

Install the assembled board into the case making sure it seats onto the posts of the bottom case half.

Make sure the battery snap goes into the battery area.

Insert the screws to hold the case together.

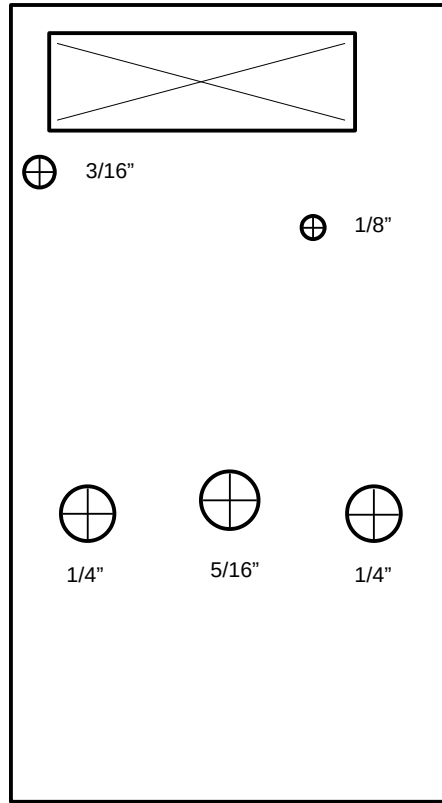
Congratulations!

This completes assembly of your TennaDipper II kit.

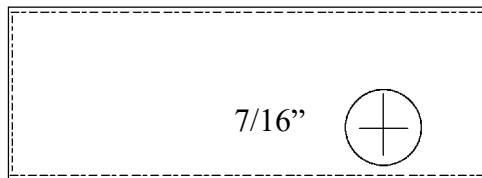


Case Templates:

Front Panel



End panel drill template shown from inside (flat side)

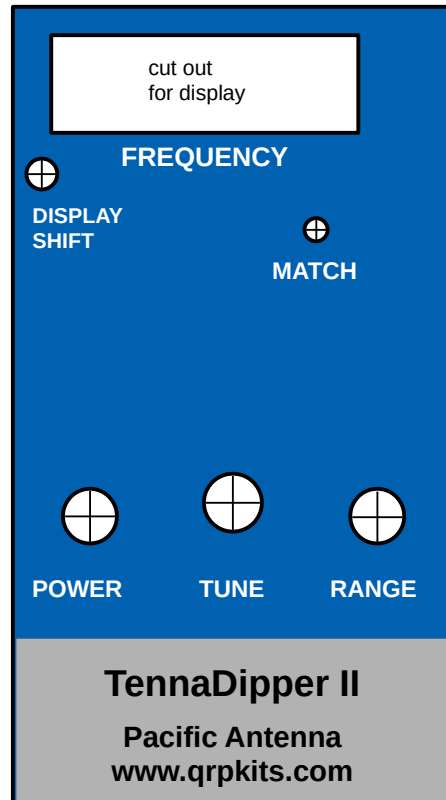


Front Panel Graphic

A front panel overlay is supplied with the kit.

This is provided to allow printing of a replacement front panel if needed.

Print at full size (100%) and trim to outer edge of black frame



Schematic:

