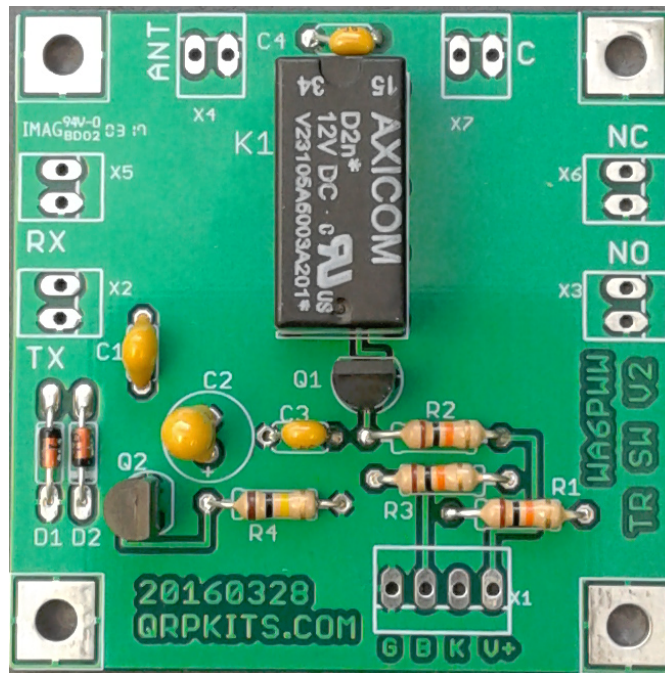


# Pacific Antenna Easy TR Switch



## Kit Description

The Easy TR Switch is an RF sensing circuit with a double pole double throw relay that can be used to automatically switch an antenna between a separate receiver and transmitter.

It also has a second switched pair of inputs and outputs that can be used for other switching applications such as muting or switching an audio channel or even to switch a remote amplifier or pre-amplifier.

Manual operation is achieved through use of control inputs to disable RF switching and to key the relay.

## Features and Specifications

- Provides automated or manual switching
- Two independent sets of inputs and outputs
- Automatic Rf sensing requiring as little as 100mW of RF
- Frequency range of 160-6M
- Power handling of up to 150 Watts
- All parts mount on a small, 2 x 2 inch circuit board module

## Support

PACIFIC ANTENNA  
QRP KITS.COM  
[qrpkits@gmail.com](mailto:qrpkits@gmail.com)

## Recommended Tools

- Temperature Controlled Soldering Station with small tip or a 15-35 watt soldering iron with small tip.
- Solder 60/40 or 63/37 Tin-Lead
- Small Diagonal Cutters
- Small Needle Nose Pliers
- Pencil, Pen, and/or Highlighter
- BRIGHT work light

## Optional

- Magnifying headpiece or lighted magnifying glass.
- Multi-meter
- Solder Sucker or Solder Wick
- Knife or Wire Stripper
- Cookie Sheet to build in and keep parts from jumping onto the floor.

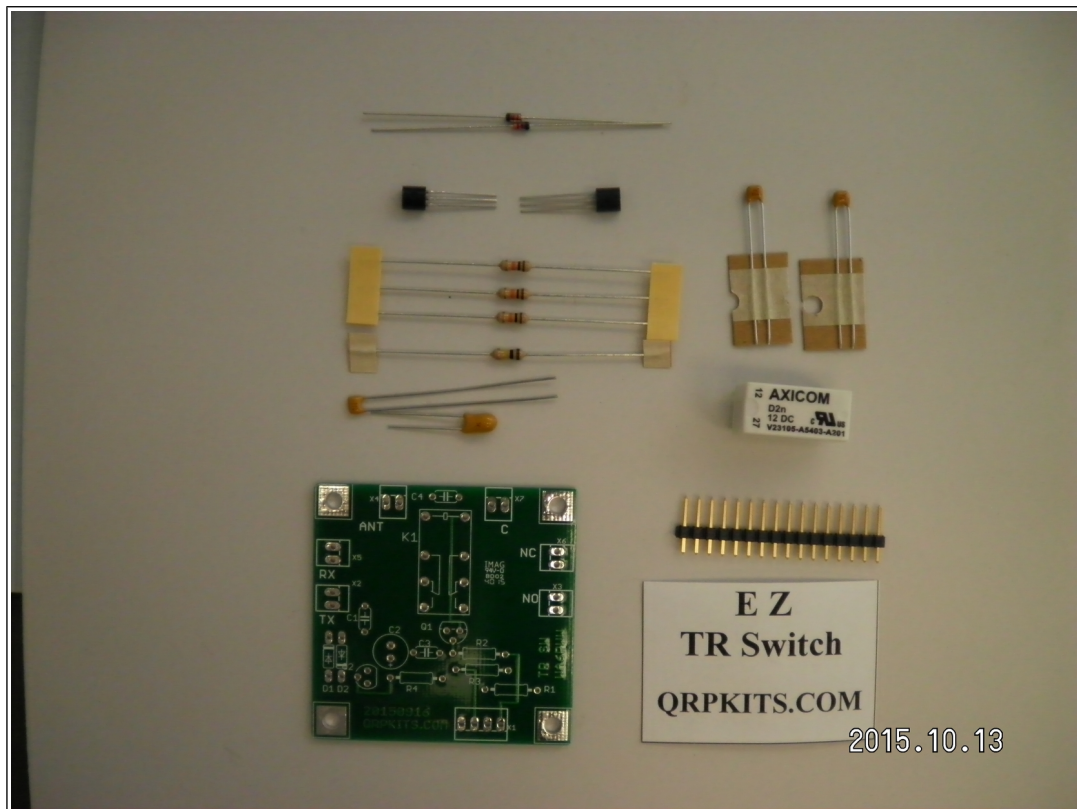
## Construction Techniques

- Please take time to inventory the parts before starting. Report any shortages to QRPKITS.com (In many cases it may be faster and cheaper to pull a replacement from your parts supply, but please let us know if we missed something.)
- Pre-sorting the resistors and capacitors can speed up the assembly and reduce mistakes.
- There is no need to print out the whole assembly manual unless you want a copy. Print the Parts List and Schematic (last two pages) then view the rest of the manual on a computer, laptop, or tablet. The Parts List has columns for inventory and construction.
- You can insert several parts at a time onto the board. When you insert a part bend the leads over slightly to hold the part in place, then solder all at the same time. Clip the leads flush.
- Most parts should be mounted as close to the board as possible. Transistors should be mounted about 1/8" above the board. Solder one lead on ICs or IC sockets and then check to make sure the component is flush before soldering the remaining leads.
- Use a Temperature Controlled Soldering Station with small tip or 15-35 watt soldering iron with small tip. Conical or very small screw driver tips are best.
- DO NOT use a large soldering iron or soldering gun.
- If you are a beginner, new to soldering, there are a number of resources on the web to help you get on the right track soldering like a pro. Google Soldering Techniques.

## Parts List

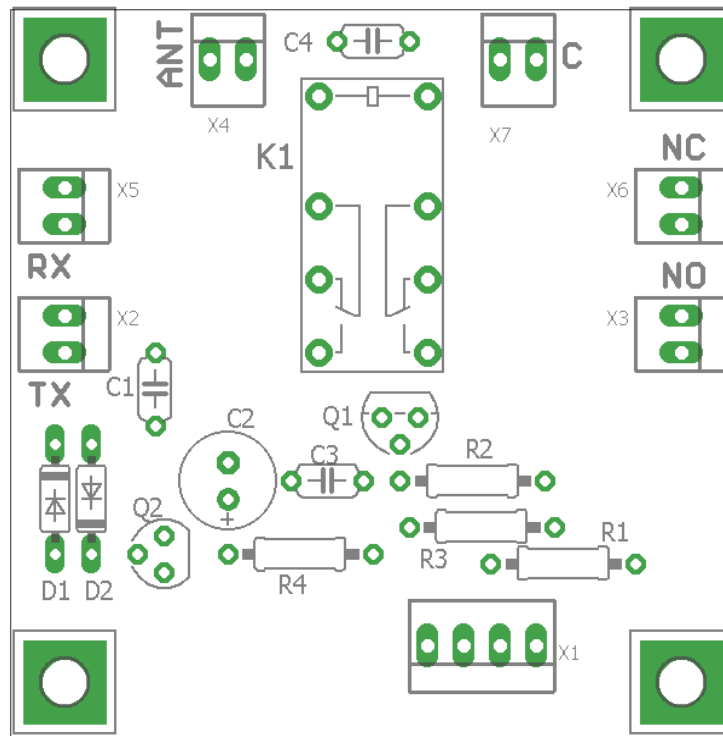
| Qty | Value  | Component      | Description                                     |
|-----|--------|----------------|---|
| 3   | 10K    | R1, R2, R3     | Resistor, 1/4W, Brown-Black-Orange-Gold         |
| 1   | 100K   | R4             | Resistor, 1/4W, Brown-Black-Yellow-Gold         |
| 2   | 1N4148 | D1, D2         | Diode, glass body                               |
| 1   | 22pF   | C1             | Monolythic Capacitor, marked 22 or 220          |
| 1   | 47pF   | C1 alternate 1 | Monolythic Capacitor, marked 47 or 470          |
| 1   | 10pF   | C1 alternate 2 | Disk Capacitor, marked 10                       |
| 2   | 0.1uF  | C3, C4         | Monolythic Capacitor, marked 104                |
| 1   | 4.7uF  | C2             | Tantalum polarized capacitor, marked 4u7 or 475 |
| 1   | 2N3906 | Q1             | PNP Transistor                                  |
| 1   | BS170  | Q2             | N-Channel MosFet                                |
| 1   | Relay  | K1             | Axicom V23105 12V relay                         |
| 1   | PCB    | PCB            | Circuit Board                                   |

## Typical Parts Appearance



**Note:** Some parts may vary in appearance from those shown here due to source changes.

## Board Layout



Note: Pin 1 of X1 is the pad closest to the X1 Label (on the right above) and is the connection point for 12V power. The leftmost pin (4) is ground connection.

Install the following components on the PC board.

### Resistors

|    |   |
|----|---|
| R1 | 10K Ohm, 1/4W, Brown-Black-Orange-Gold  |
| R2 | 10K Ohm, 1/4W, Brown-Black-Orange-Gold  |
| R3 | 10K Ohm, 1/4W, Brown-Black-Orange-Gold  |
| R4 | 100K Ohm, 1/4W, Brown-Black-Yellow-Gold |

### Capacitors

|    |   |
|----|---|
| C1 | 10pF, 22pF or 47pF monolithic capacitor (selected based on power input)   |
| C2 | 4.7uf Tantalum <b>Note:</b> align + side lead with + pad on board outline |
| C3 | 0.1uF monolythic ceramic, marked 104                                      |
| C4 | 0.1uF monolythic ceramic, marked 104                                      |

### Transistors and diodes

|    |   |
|----|---|
| Q1 | 2N3906 (align flat to board outline with center pin away from flat) |
| Q2 | BS170 (align flat to board outline with center pin away from flat)  |
| D1 | 1N4148 (align band to board outline)                                |
| D2 | 1N4148 (align band to board outline)                                |

### Misc parts

|    |   |
|----|---|
| K1 | Axicom V23105 Relay, (only fits one way due to pin configuration) |
|----|---|

## Operation

The TR switch provides switching between two separate sets of contacts to two separate output/input pairs.

It will sense RF input on the TX inputs and switch at about 100mW of RF and can be used over a frequency range of 160-6M and up to 100 Watts of RF under matched conditions.

Manual switching can be enabled by grounding pin 3 (B) of the control inputs (X1) and then grounding pin 2 (K) to switch the relay manually.

### Selection of C1:

Capacitor C1 senses the RF signal and feeds the signal to Q2 to control switching. A set of 3 capacitors are supplied with values of 10, 22 and 47pF.

The 22pF capacitor should work over most conditions and is recommended as the default for most applications with power levels between 1 and 25W.

The 10pF capacitor should be used for C1 whenever the RF power level will usually exceed 25W.

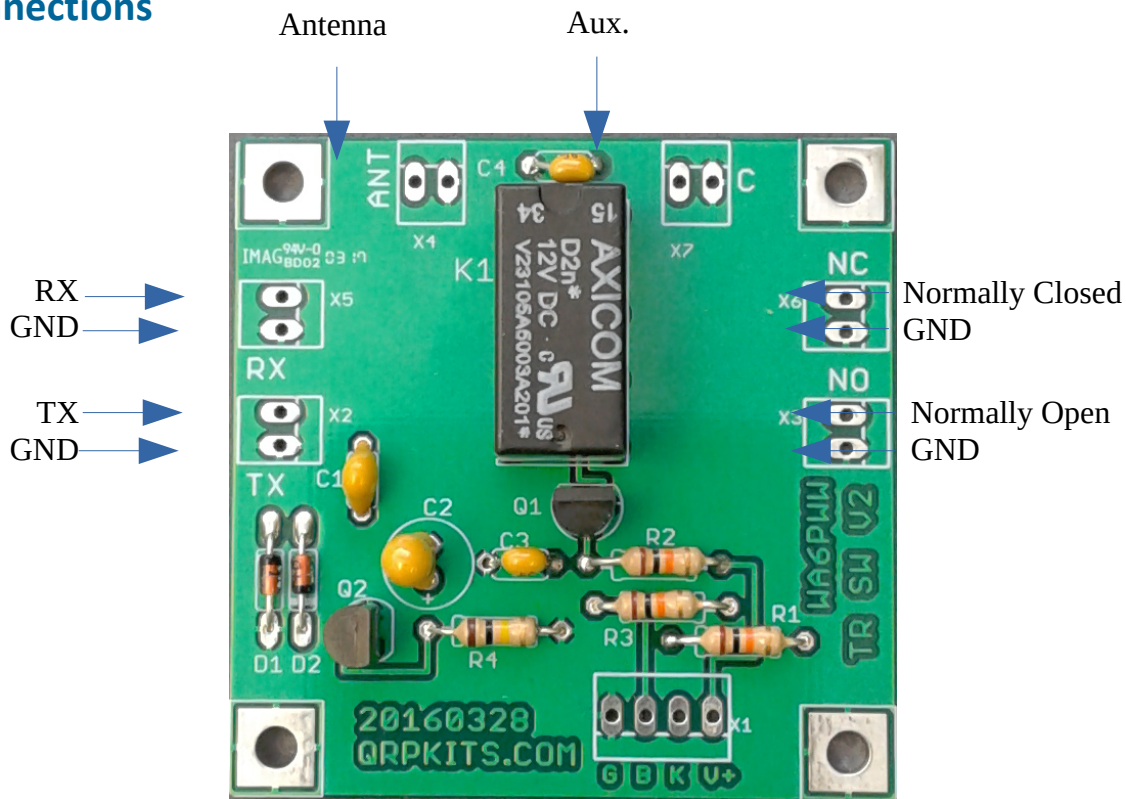
Use the 47pf if power levels of 5 Watts or less

If automated switching is not reliable on certain frequencies, or at certain power levels, the value of C1 may need to be adjusted up or down.

In general, increase C1 for lower frequency operation and decrease it for high frequency use and decrease the value of C1 as power input increases to avoid damage to Q2.

**Note:** some earlier kits may not have the 10pF capacitor included in the kit. If you plan to use the TR switch at power levels above 25 watts, and your kit did not include the 10pF capacitor, we will be happy to send you a replacement.

## Board Connections



The Antenna, RX and TX as well as the second switched pair (C, NC and NO) are as shown above.

For the pads marked RX, TX, NC and NO, the connection is to the upper pad and the lower pads are connected to ground on the board as shown above.

For antenna switching between a receiver and Transmitter, you will only need to use the ANT, RX and TX connections.

The Auxiliary contact set can be utilized to mute audio of a receiver by switching its output to a resistor during transmit instead of the speaker or headphones.

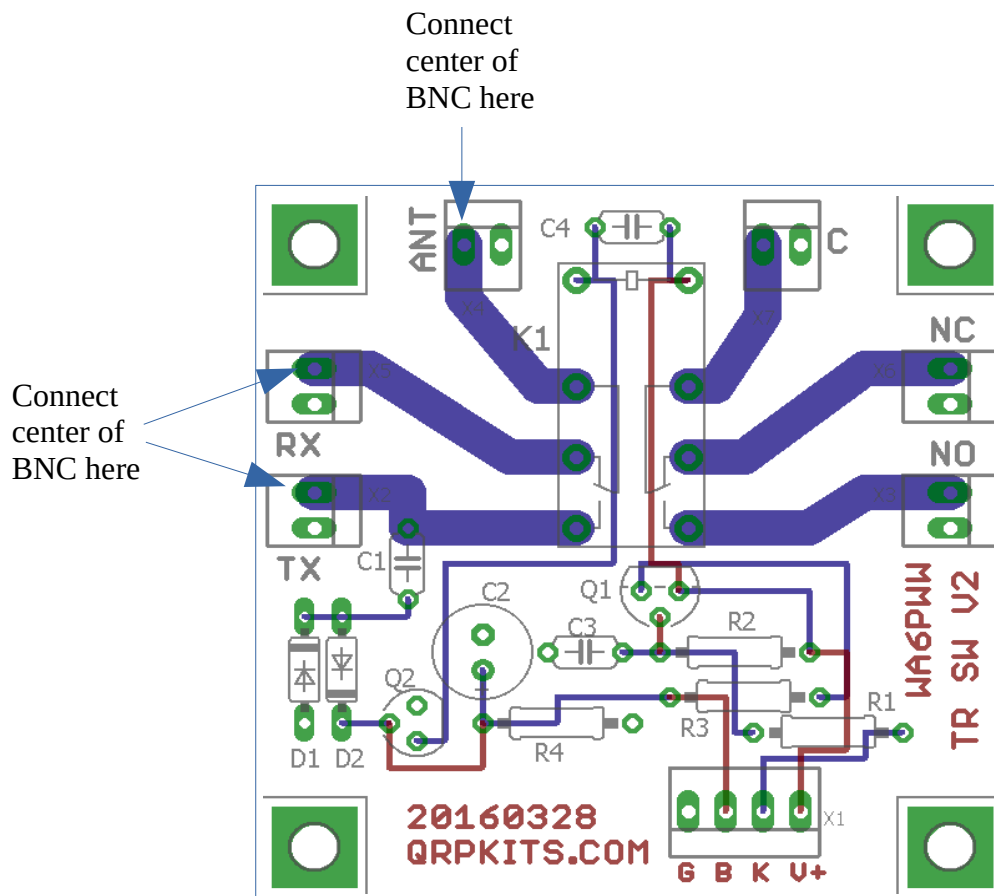
This would be accomplished by connecting the audio to the Aux input and connecting a speaker to the normally closed (NC) output and a 10 ohm or so resistor from the normally open output to ground.

If the TR switch is embedded into another system, jumper wires can be used to the appropriate pads for signals, power and control lines (if needed).

To connect of BNC or other external RF type connectors, the center will go to the upper pads and the shell or ground connection will go to the lower pads as shown below.

You can see the pads with traces and connected to ground by looking at the back of the board. As a guide, the trace locations are shown in the drawing below.

The additional switched contacts (if used), are connected in the same manner.



### X1: Control and Power input

Pin 1: V+; Pin next to X1 label on board, connects to a 12 Volt supply to power the TR switch.

Pin 2: K; External keying control line. Ground this pin to key the TR switch manually.

Pin 3: B; Bypass control line. Ground to disable automatic switching for manual keying.

Pin 4: Ground for power, control and key signals

|   |   |   |    |    |
|---|---|---|----|----|
| 4 | 3 | 2 | 1  | X1 |
| G | B | K | V+ |    |



## Troubleshooting

The Easy TR switch is intended to be easy to assemble and should operate without any problems. However, if it fails to operate, there are a few things to check:

Check the board for cold solder joints, these will appear rough rather than shiny. If in doubt, reheat connections to ensure a good connection.

Check for any solder bridges or solder whiskers that may short between adjacent pads

Verify correct location and orientation of the diodes D1 and D2 as well as the transistors Q1 and Q2. They should be oriented as shown on the PC board outlines.

Verify that power and ground are connected to Pads 1 and 4 of X1.

Test by connecting Pad 2 of X1 to ground with 12 power applied to Pin 1. You should be able to hear the relay click. If not, recheck components and solder connections as indicated above.

When applying RF to the TX input, you should hear the relay click. If possible, test at 7-10Mhz first to verify function and if not working at low or high frequencies, increase or decrease the value of C1 and retest.

Capacitor C1 is part of the RF sensing circuit that controls the automatic TR switching.

The kit is supplied with a 22pF capacitor for C1 and for most HF applications, this will work well.

For very low frequency use, (~3MHZ or below), or at low power (less than 1W) using the included 47pF or larger capacitor should improve switching performance

For high frequencies (~ 25MHz or above) 22pF or even less will usually be sufficient.

Some experimentation may be required to find the optimal capacitance for your specific application.

If you still experience problems, or have any questions, please contact us at [grpkits.com@gmail.com](mailto:grpkits.com@gmail.com) and we will be happy to assist you.



# Schematic

