

Elizabeth Amateur Radio Club

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Repeater Over Timer

Posted by **kgooley** on Wednesday 13th May 2009. Last Updated Tuesday 7th September 2010.

Here's a simple timer that beeps after a preset time following the start of transmission to remind the operator not to time out the repeater. It has made a good club project at the Elizabeth Amateur Radio Club here in VK5, enabling members with only limited construction experience to improve on their skills and make a useful gadget in the process.

If you are like me and I suspect many readers are, then now and again while chatting on a repeater, you get carried away and time out the repeater. A discussion with a friend or a club net can be interesting and engrossing and you can tend to forget time. There have been several attempts to get over this problem in the past. References 1 and 2 give two versions of a timer using a pair of 555-type timers, the second adds an RF actuated facility so that no access to the transmitter PTT line is required. Jim VK5TR (formerly VK5JST) ref 3 uses a microcontroller to add a 'bell and whistle' or two.

The timer presented here is based on ref 2 but goes a step further in that it is RF actuated but draws only leakage current from the battery when not in use. This means that the timer can be left connected to the 9 volt battery and current is only drawn when the VHF or UHF transmission starts. After the beep at the conclusion of the timing period and the operator lets go the PTT, the circuit switches off to once again only draw a very small current from the battery. Current drawn did not register on the writer's DMM with a resolution of 0.1 microamp.

Circuit Description

The timer circuit itself is centred on IC1 and is essentially the same as that in ref 1 and 2. In the quiescent condition with no RF being picked up on the antenna, TR2 is off and so is TR1. This latter device is an N channel mosfet acting as a switch in the negative lead to the battery. In this condition there is only the leakage current in the mosfet drawn from the battery. The drain to source diode built into the mosfet is also reverse biased.

RF coming into the pickup is rectified by the voltage doubler rectifier D1, D2 and the associated capacitors. When the voltage across C2 reaches about 0.6, TR2 turns on pulling the gate of TR1 towards the +9 volt rail. This turns on TR1 applying 9 volts to the timer. The two halves of the timer IC are connected as monostable multivibrators which start the timed period when a negative-going trigger pulse is applied to the trigger pin. As mentioned before the circuit is similar to those published in ref 1 and 2. However I found that a better trigger circuit was required in this case where the RF controlled switching can cause the supply volts to be turned on and off several times in succession. TR3 and its associated components provide a delay of about 100 ms or so after the 9 volts is applied before TR4 is turned on. When this occurs, the trigger pulse of about 20 ms is generated. The delay gives the two timer circuits time to settle before the first timer is triggered.

The negative pulse on pin 6 of IC1A starts the main time delay during which the operator will be chatting away on his transmission. RV, R7 and C9 determine the timer period and are therefore the ones to adjust if you want to change the range of adjustment. Pin 5 goes high during the timing period and the LED, D6 is lit. At the end of the period, the second timer is triggered and pin 9 goes high sounding the piezo-buzzer for about half a second.

The operator is thus reminded he has been yacking on for long enough on the repeater or some might say too long and the PTT is released.

RF pickup

Some experimentation may be required with the arrangement of the RF pickup. A simple length of wire laid near the rear of the radio will be adequate in some cases. Winding the wire around the coax cable a few turns may improve the reliability. In other cases winding the wire around the coax and taking it back to the timer box will be an arrangement less susceptible to RF pickup from other sources such as nearby broadcast stations [3]. The returning wire should be connected to the + battery terminal. It is difficult to be too specific about the precise type of RF pickup required as it depends on the power level of the VHF or UHF transmitter and the level of leakage from the coax.

Construction

The Elizabeth Amateur Radio Club has produced a kit for this project including a professional PCB. The constructor can use the kit, or of course make his or her own PCB or build the project on strip board or whatever. The PCB is designed to fit in a nice plastic box, Hammond type 1593N. All references to the PCB assume the board is oriented with the components side up and the piezo buzzer at the top right hand corner. The four holes for the pins should be drilled out to 1.0mm and the 3 for the trimpot, RV to 1.1mm. The single pad between the upper end of R1 and C1 is not used. This is a good project to get started with SMD components because TR1 is one of the largest types of SMD devices available and should be able to be handled by most constructors. Also if you do happen to drop it you have a good chance of finding it again. TR1 should be soldered first to the bottom of the PCB. Hold the device in place carefully aligned with the pads. A toothpick is a good help with this. Solder one of the small pads. Check the alignment again and correct if necessary. Solder the remaining pads and check for shorts.

Turn the PCB over and insert the 4 diodes and the resistors first. They require the leads to be bent to suit a 0.4 inch pad spacing. A lead bending jig is useful for this if one is available. Once a few components have been inserted in the PCB, turn the board over flat on the bench and solder the leads in place. Some light pressure of the board will ensure that the components are pressed against the board.

Repeat for the remaining resistors and diodes and trim the leads. Fit the 556 IC1 ensuring the notch in the end of the IC is uppermost. Insert the remaining components and solder them in place. The piezo buzzer should be inserted with the + sign to the top. Solder the 4 pins in place for the battery and RF pickup.

Drill a 5mm hole in one of the box end plates for the LED and a 2mm hole in the other for the RF pickup. While we are drilling, it will be found useful to drill several holes in the box lid above the buzzer. Wire the LED to the PCB using the supplied hook-up wire. Ensure the pin next to the flat on the LED is connected to the lower hole of D6 on the PCB.

Solder one end of the 500mm length of hook-up wire to the pin nearest the top left corner of the PCB and feed the wire through the 2mm hole in the second end panel. If a shielded pickup (coax cable) is required, solder the centre conductor to the pin nearest the corner of the PCB and the braid to the adjacent pin.

Solder the battery snap wires to the 9 volts + and - pins, red to + black to the - of course.. The PCB is fixed to the case with either 3 or 4 screws. Some case halves have only 3 mounting holes.

Testing the Timer

Fit a 9 volt battery to the snap or connect a bench power supply set to 9 volts. Correct operation may be tested without RF being applied to the pickup wire by connecting the top end of R2 to the +ve battery lead using a clip lead.

The LED should light as soon as the clip lead is in place. After the preset time the buzzer should sound for about 1 second and the LED go out. The preset time is adjusted using RV from about 1 minute to 3.5 minutes. If it is desired to reduce the length of the beep, reduce the value of R12 and conversely increasing R12 will increase the length of the beep.

If all is well, disconnect the clip lead and test the Timer with RF from a handheld or other transceiver. As soon as RF is applied, the LED should go on and timing commence. Holding a HH with 1 watt output anywhere near the Timer should be sufficient.

A 2m mobile radio with 10 watts output will operate the timer with the pickup lead wound around the antenna coax 4 or 5 turns. Use of a higher powered radio will require less coupling. If a low powered radio is being used and/or the coax is well shielded it may be necessary to remove 20mm or so of the sheath of the coax in a convenient position and pass a thin wire under a few wires of the braid. Use the minimum coupling required to operate the Timer. Tape up the modified area of the coax.

Conclusion

A simple timer has been described which will remind operators on repeaters when they have been talking on the repeater for long enough. The project has been a good one for the Elizabeth Amateur Radio Club enabling experienced and less experienced members alike to build a useful device for the shack. Kits for the project are available from the Club. Refer to the ad in Amateur Radio magazine or to the Club website at www.earc.org.au

References

1. Austermler, Keith KB9STR 'An RF Driven On-air Indicator' QST
2. Poland, Allen K8AXW 'RF Activated Timer' QST January 2007
3. Tregellas, Jim VK5TR 'The Sniffit' Amateur Radio October 2008