

# A REMOTELY CONTROLLED ANTENNA SWITCH

This project originally appeared in *QST*.<sup>1</sup> This switch can be used to automatically select the correct antenna when used with an ICOM MF/HF rig. Modifications would allow it to be used with other brands as well, or controlled manually. The switch can also be controlled manually.

## DESCRIPTION

Fig 22.75 is a block diagram of the system. The decoder connects to the rig via an accessory connector on the back of the transceiver. Many modern rigs have an accessory connector used for automatic bandswitching of amplifiers and other equipment. They usually use particular voltages on one of the accessory connector pins to indicate the selected band. A single length of coax and a multiconductor control cable run from the rig and the decoder box to the remotely located switch unit. The remote relay box is equipped with seven SO-239 connectors: one for the feed line (COMMON) and one for each antenna.

The details of the ICOM rear-panel accessory connector (ACC2) are provided here. Refer to the documentation for your rig for details if you have another brand. The connector on the ICOM provides the band signal, an 8.0-V reference and a 13.8-V supply tap. Table 22.6 shows the output voltage at the accessory socket when the radio is switched to the various bands.

The ACC2 connector pin assignments for the IC-735 are:

- Pin 1 +8 V reference
- Pin 2 Ground
- Pin 4 Band signal voltage
- Pin 7 +13.8 V supply

## DECODER CIRCUIT

The schematic for the decoder is shown in Fig 22.76. R1 through R7 divide the 8-V reference voltage from the rig to provide midpoints between the band signal levels. Three LM339 quad comparators do the work deciding which band the rig is on.

Two bands (1.8 MHz and 10 MHz) need only a single comparator because they are at the ends of the reference voltage range. All other bands use two comparators. One detects if the band signal is above a specific level while the other determines if it

<sup>1</sup>"A Remotely Controlled Antenna Switch," by Nigel Thompson, April 1993 *QST*.

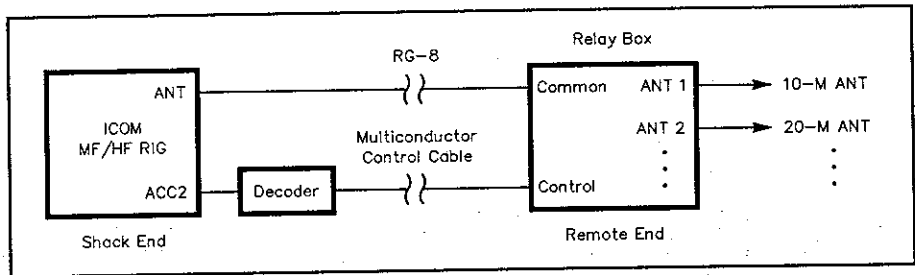


Fig 22.75—Block diagram of the remotely controlled antenna switch.

is below a specific level. If the signal is between the two levels, the output-relay driver transistor is turned on.

Because the LM339 has open-collector outputs, they can conveniently be connected together to a pull-up resistor so that the output signal goes high only if both LM339 sections are off. This provides a simple AND function without extra components.

LEDs are used to indicate which band is selected. Since they are in the base circuit of the relay-driver transistor they always indicate the correct band even when more than one driver transistor is connected to a single relay. Such a configuration would be used with a tribander; the outputs for 14, 21 and 28 MHz are simply wired to a single relay.

## RELAY BOX

The circuit of Fig 22.77 uses DPDT relays to short the antennas to ground when not selected. This helps prevent static buildup on the antenna which could damage the rig's front end upon connection to the feed line. An additional relay is energized whenever the rig is turned on. Its purpose is to ground the feed line when the rig is turned off.

The relays listed handle 100 W comfortably. Higher power versions of this switch will require relays with much higher voltage and current ratings.

## Alternative Designs

The simplicity of this design invites "hacking." If you have a tribander, you might consider modifying the design so that there is only one output for three bands. Simply change the resistor ladder to have two fewer nodes.

Radios with different signal levels can be accommodated by appropriately changing the values in the resistor ladder.

Table 22.6

## ICOM Accessory Connector Output Voltages by Band

Band (MHz)	Output Voltage
1.8	7 - 8.0
3.5	6 - 6.5
7	5 - 5.5
14	4 - 4.5
18, 21	3 - 3.5
24, 28	2 - 2.5
10	0 - 1.2

Note: The voltage step between bands is not constant, but close to 1.0 V, and the 10-MHz band is not in sequence with the others.

Manual control can be added using a second resistive divider to deliver the signal levels the transceiver would normally provide. See Fig 22.78. This divider and switch are connected between the radio jack and the existing resistive divider in the control box. Use a switch on the decoder input to select automatic or manual control.

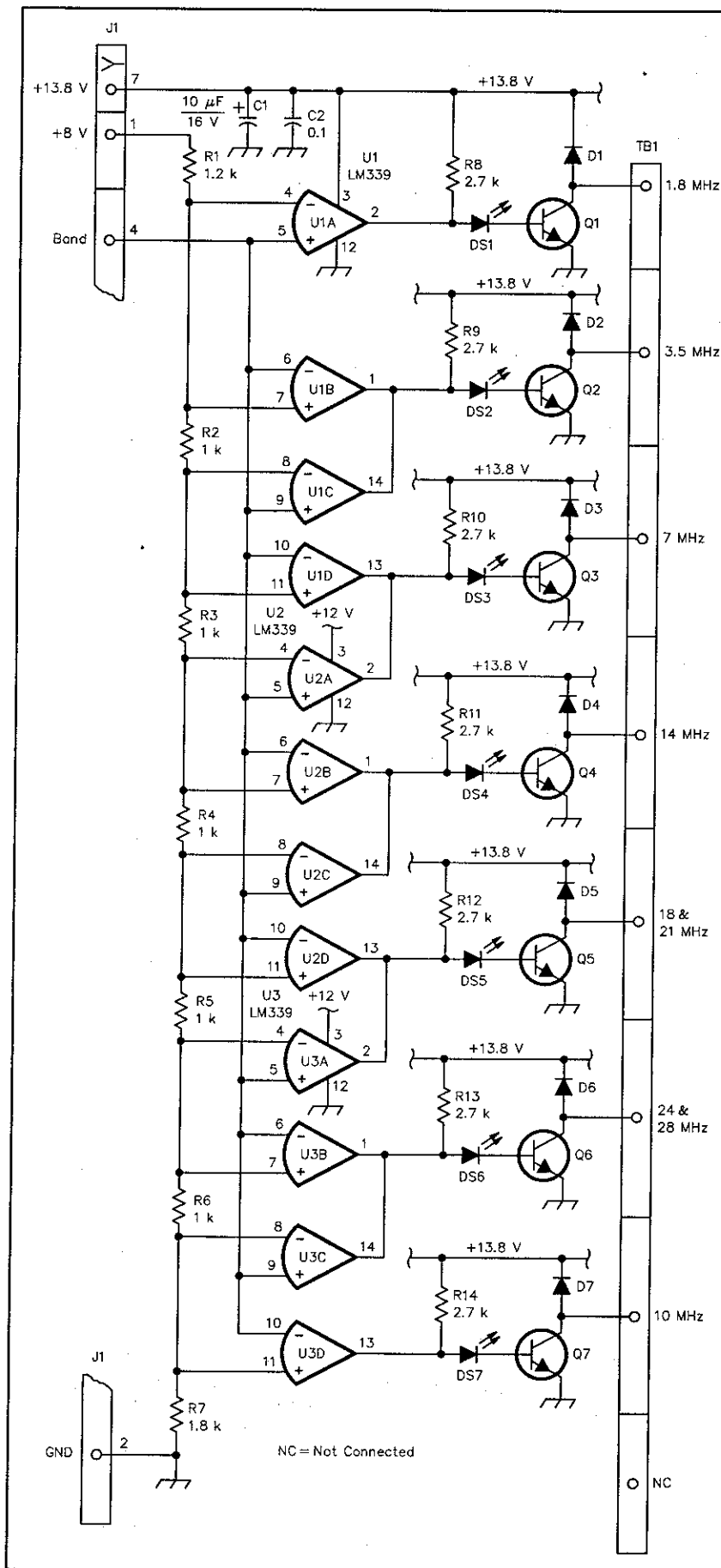
## CONSTRUCTION

A PC board is available for the control circuit.<sup>2</sup> The controller can be built using a relatively small enclosure. A 7-pin DIN plug is used for the ICOM radios. Other manufacturer's connectors vary.

Because the controller requires no power supply of its own, it takes up very little space on the operating table.

The relay box uses SO-239 connectors for the common feed-line and antenna connections and a 9-pin D-sub connector for the control cable. The relay box can be placed in a weatherproof enclosure to guard against the elements.

<sup>2</sup>See the References chapter for a template.



**Fig 22.76**—Schematic of the remotely controlled antenna switch control-box circuit. Part numbers in parentheses are RadioShack; equivalent parts can be substituted. Unless otherwise specified, resistors are  $\frac{1}{4}$ -W, 5%-tolerance carbon-composition or film units.

**D1-D7**—1N4003 (276-1102).

**DS1-DS7**—LED.

**J1**—7-pin female DIN chassis-mount connector.

**Q1-Q7**—Almost any NPN transistor capable of sinking 150 mA (for the RadioShack relays used in this project), ZTX657s or equivalent. Other types include MPSA05, MPSA06 and 2N4401 (276-2058).

**U1-U3**—LM339N (276-1712).

**K1-K7**—12-V, DPDT relay with 10-A/125-V ac contacts (275-218). (Presently, local RadioShack stores stock the 275-218c [note suffix] relay, with a contact rating of 15 A.—Ed.)

**Misc:** decoder enclosure (approximately  $2\frac{1}{2} \times 4 \times 3$  inches HWD), relay enclosure (approximately  $3 \times 6 \times 8$  inches HWD). 7 single-hole-mount SO-239 connectors.

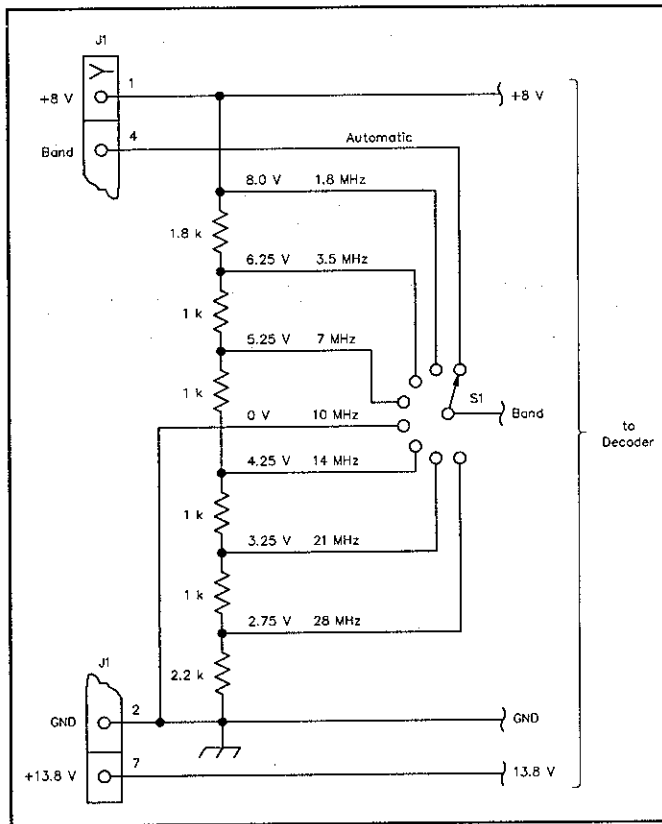
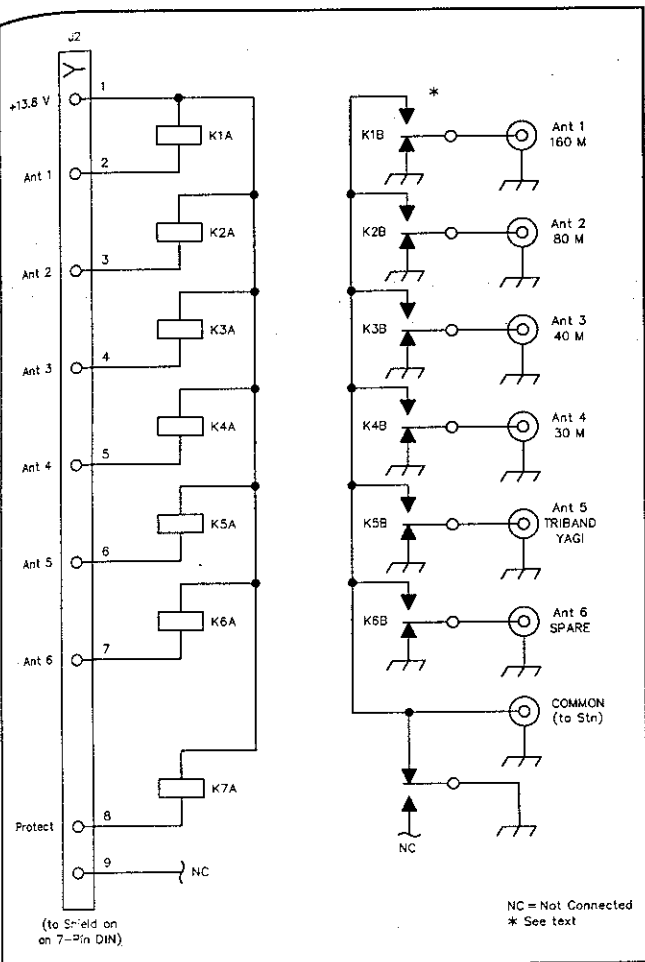
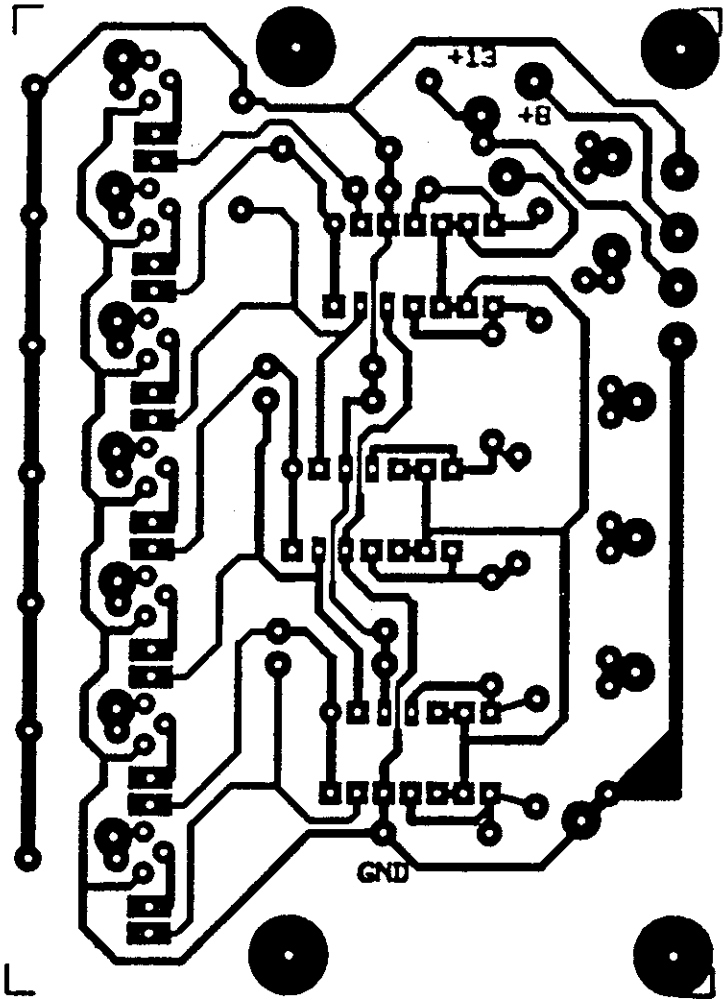
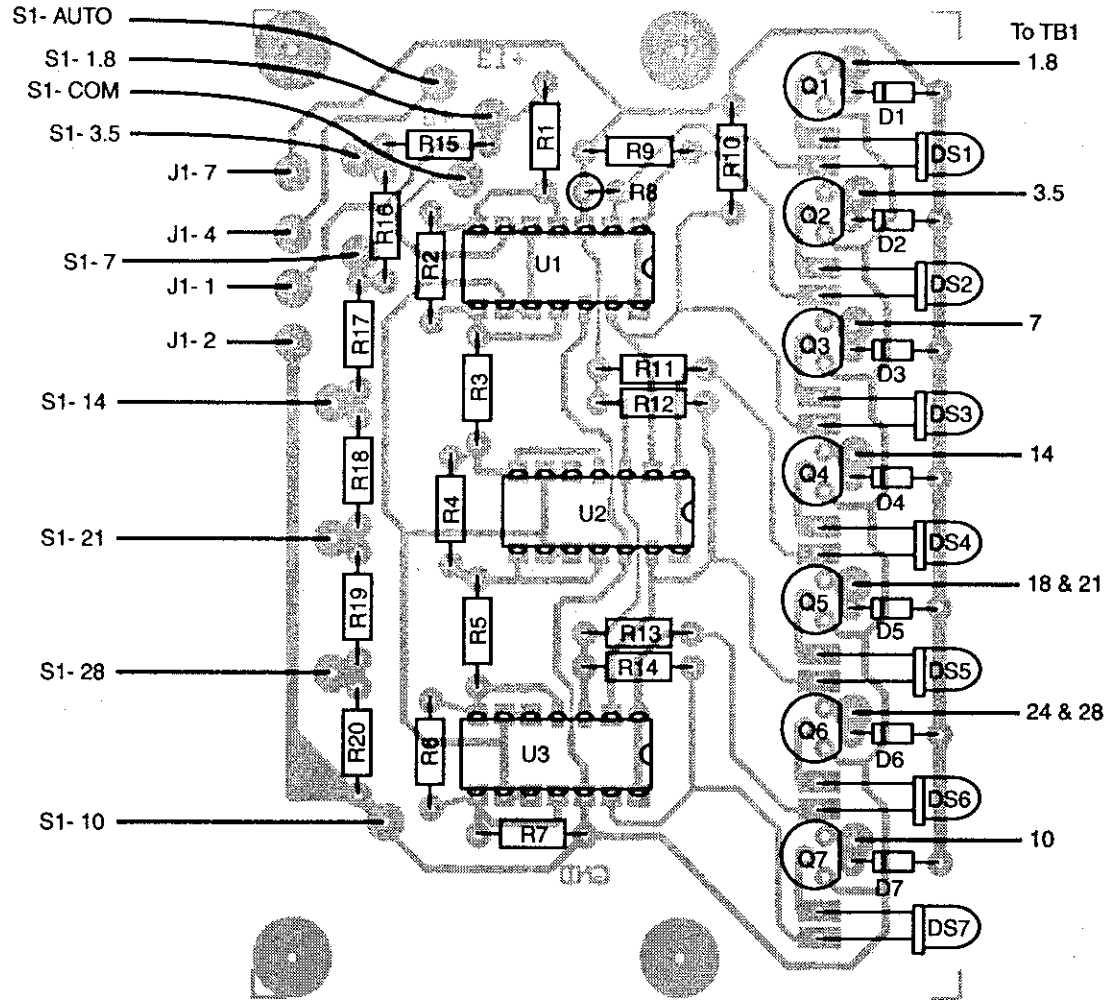


Fig 22.78—The addition of a multiposition switch provides a means of selecting automatic or manual control of relay switching with ICOM rigs. Rather neatly, this circuit also furnishes a remotely controlled antenna switch for non-ICOM rigs.

Fig 22.77—Relay box schematic. The normally open and normally closed contact pairs of the DPDT relays are individually connected in parallel to increase current-handling capability. J2 is a DB9M chassis-mount connector (RS 276-1537).



(A)



(B)

A Remotely Controlled Antenna Switch, Chapter 22