ARRL Periodicals Archive – Search Results

A membership benefit of ARRL and the ARRL Technical Information Service

ARRL Members: You may print a copy for personal use. Any other use of the information requires permission (see Copyright/Reprint Notice below).

Need a higher quality reprint or scan? Some of the scans contained within the periodical archive were produced with older imaging technology. If you require a higher quality reprint or scan, please contact the ARRL Technical Information Service for assistance. Photocopies are $3 for ARRL members, $5 for nonmembers. For members, TIS can send the photocopies immediately and include an invoice. Nonmembers must prepay. Details are available at www.arrl.org/tis or email photocopy@arrl.org.

QST on CD-ROM: Annual CD-ROMs are available for recent publication years. For details and ordering information, visit www.arrl.org/qst.

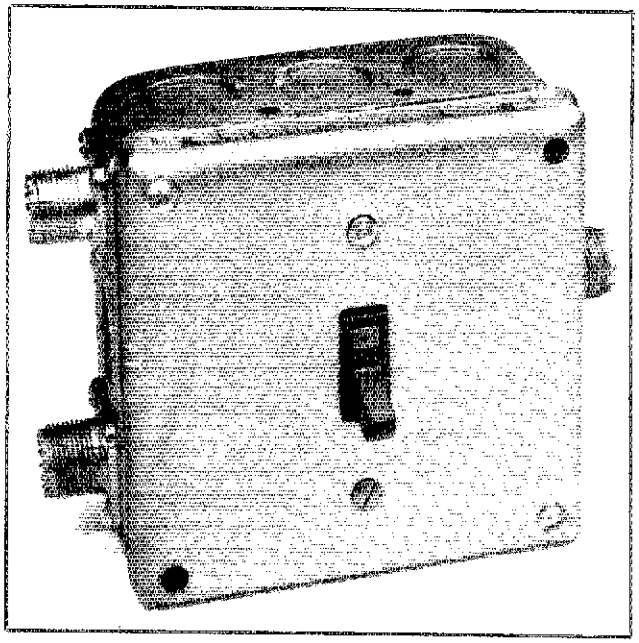
Non-Members: Get access to the ARRL Periodicals Archive when you join ARRL today at www.arrl.org/join. For a complete list of membership benefits, visit www.arrl.org/benefits.

Copyright/Reprint Notice

QST Issue: Aug 1986
Title: Inexpensive RF Switches for the Ham Shack
Author: Paul Follini, VE1CZX

Click Here to Report a Problem with this File

Inexpensive RF Switches for the Ham Shack



Save a few bucks in the shack—use wall-toggle switches as RF switches!

By Paul Follini, VE1CZX
RR 4
Amherst, NS B4H 3Y2
Canada

Standard toggle wall switches, such as those used in home electrical systems, work well in RF switching applications. Although it might appear unorthodox to use 60-Hz devices at RF, there is nothing in the design of these switches that makes them unsuitable for use in transmission lines for frequencies up to at least 30 MHz. Indeed, they have heavier contacts and greater contact spacing than the rotary-wafer type of switch commonly used for RF switching.

Toggle wall switches and their enclosures are available at any electrical supply house and at most hardware stores. The price of a switch is about $1.25, and an enclosure costs about a dollar. The most useful type of switch is what electricians call a "three-way switch." It has a single-pole, double-throw configuration.

These switches have a number of advantages over the rotary type, in addition to low cost. They are rugged—a wall switch is rated at 15 A, which is a hefty load. They are easy to work with and to mount. No chassis work is required since their standard enclosures accept them without the requirement for drilling holes. The enclosures have removable walls, so that there is easy access to the switch terminals, and they are designed for side-to-side ganging to facilitate multi-pole switch configurations.

Electrical Characteristics

To evaluate the suitability of these switches for RF applications, capacitance between contacts, and between contacts and ground were measured. In each case, the total capacitance was less than 5 pF. SWR measurements show no increase when the switch is inserted between the transmitter and the antenna. Return-loss measurements were made in the ARRL Lab using the prototype shown in Fig 1. Fig 2 is a plot of return loss as a function of frequency. Table 1 shows the correlation of return loss and SWR. At 21 MHz, the return loss is approximately 20 dB, equating to an SWR of

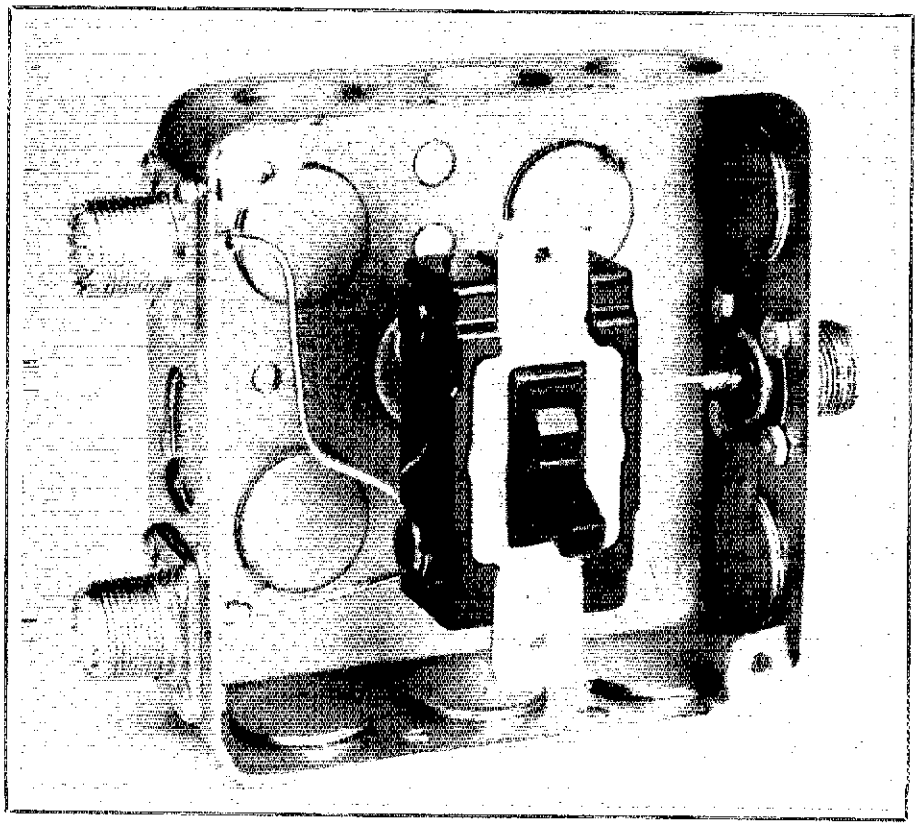


Fig 1—Prototype switch assembly using SO-239 receptacles.

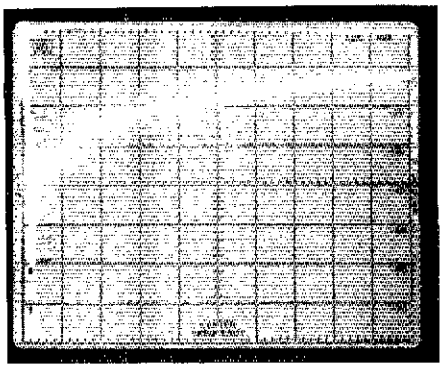


Fig 2—Return loss plotted as a function of frequency using the prototype of Fig 1. Each horizontal division is 5 MHz. Vertical divisions are each 10 dB. Return loss is plotted for frequencies between 1.5 and 50 MHz. The top line is a reference showing 0-dB return loss. The two lower traces are almost coincident and are the measurements at the two output ports.

Table 1
Reflection Coefficient and SWR vs Return Loss

Return Loss (dB)	Reflection Coefficient	SWR	Return Loss (dB)	Reflection Coefficient	SWR
1	0.8913	17.3910	31	0.0282	1.0580
2	0.7943	8.7242	32	0.0251	1.0515
3	0.7079	5.8480	33	0.0224	1.0458
4	0.6310	4.4194	34	0.0200	1.0407
5	0.5623	3.5698	35	0.0178	1.0362
6	0.5012	3.0095	36	0.0158	1.0322
7	0.4467	2.6146	37	0.0141	1.0287
8	0.3981	2.3229	38	0.0126	1.0255
9	0.3548	2.0999	39	0.0112	1.0227
10	0.3162	1.9250	40	0.0100	1.0202
11	0.2818	1.7849	41	0.0089	1.0180
12	0.2512	1.6709	42	0.0079	1.0160
13	0.2239	1.5769	43	0.0071	1.0143
14	0.1995	1.4985	44	0.0063	1.0127
15	0.1778	1.4326	45	0.0056	1.0113
16	0.1585	1.3767	46	0.0050	1.0101
17	0.1413	1.3290	47	0.0045	1.0090
18	0.1259	1.2880	48	0.0040	1.0080
19	0.1122	1.2528	49	0.0035	1.0071
20	0.1000	1.2222	50	0.0032	1.0063
21	0.0891	1.1957	51	0.0028	1.0057
22	0.0794	1.1726	52	0.0025	1.0050
23	0.0708	1.1524	53	0.0022	1.0045
24	0.0631	1.1347	54	0.0020	1.0040
25	0.0562	1.1192	55	0.0018	1.0036
26	0.0501	1.1055	56	0.0016	1.0032
27	0.0447	1.0935	57	0.0014	1.0028
28	0.0398	1.0829	58	0.0013	1.0025
29	0.0355	1.0736	59	0.0011	1.0022
30	0.0316	1.0653	60	0.0010	1.0020

1.22:1. At lower frequencies, SWR is less. The prototype switch was tested on 15 meters with 1000 W forward and 600 W returned (SWR of 8.5:1) with no evidence of arcing. This design should handle the RF levels encountered in amateur HF radio use.

Applications

If you are using SO-239, or other standard-type receptacles, any enclosure configuration is acceptable. If you wire the coaxial transmission line directly into the switches, the best enclosures to use are those with built-in cable clamps. These clamps are about the right size for most standard coaxial cables. Arrange the cables so they enter and leave the box in as straight a line as possible. Strip the outer insulation off the cable and screw the clamps down snugly to make a good grounding contact, but not tight enough to crush the cable. If you use small-diameter cable, wrap the braid with bare hookup wire to give the clamps a good bite on the braid. Strip about ½ inch of insulation from the center conductor of the coaxial cable. Form the conductor into a hook and secure it under the terminals of the switch. Bond all sections of the enclosure with bare wire,

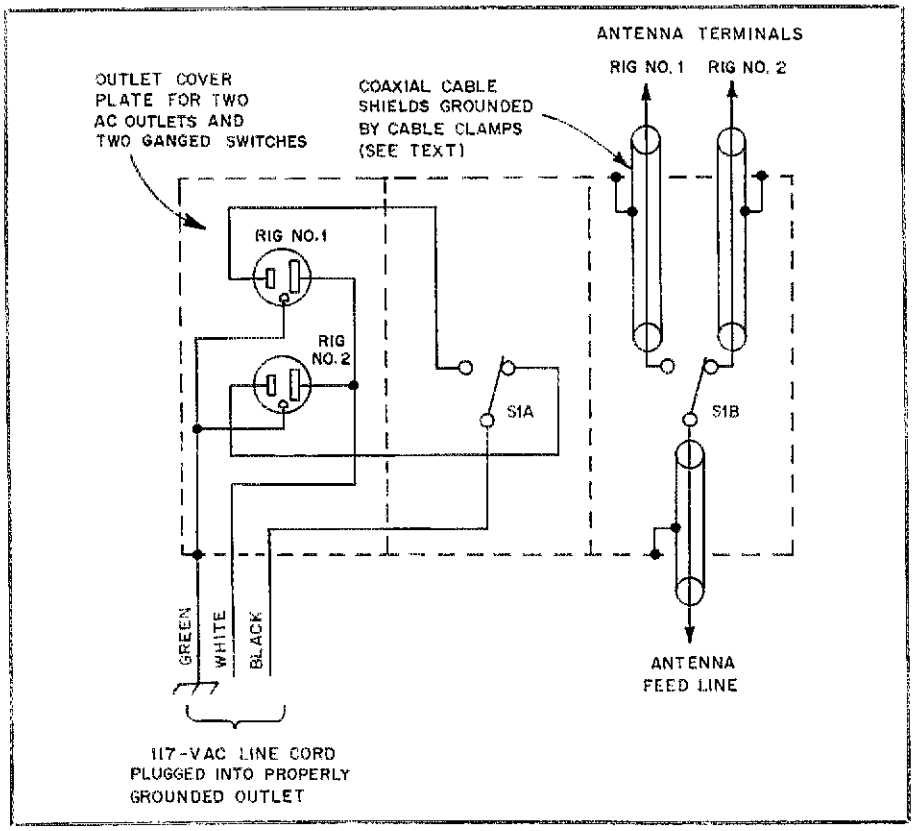


Fig 3—Power and antenna switching for two rigs.

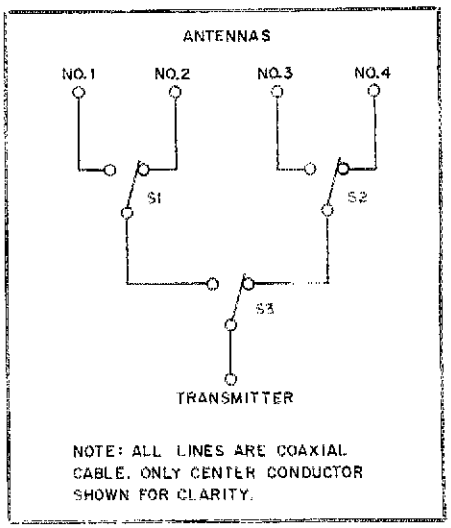


Fig 4—Three toggle wall switches used to select one of four antennas.

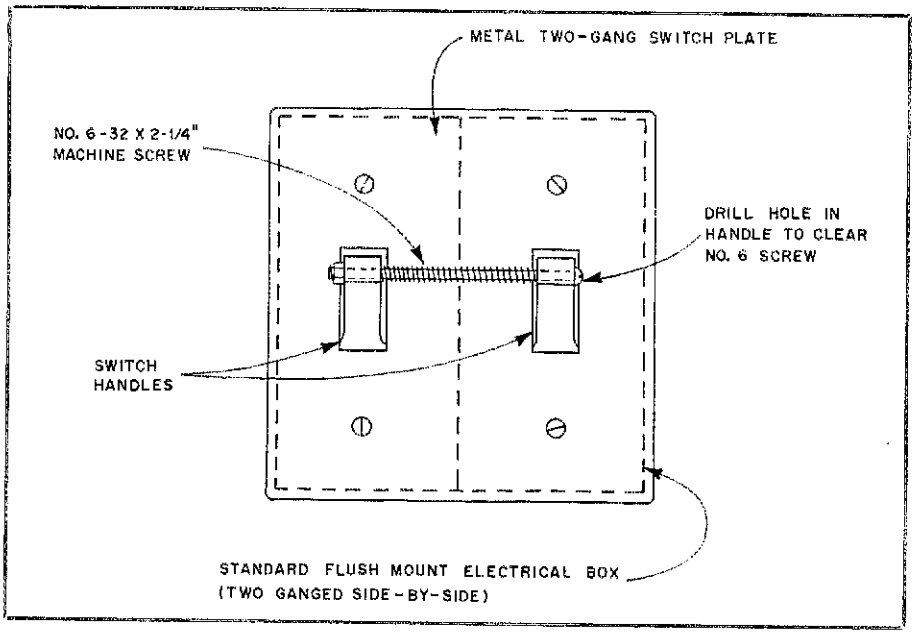


Fig 5—Two switches may be ganged together mechanically to form a double-pole double-throw (DPDT) configuration.

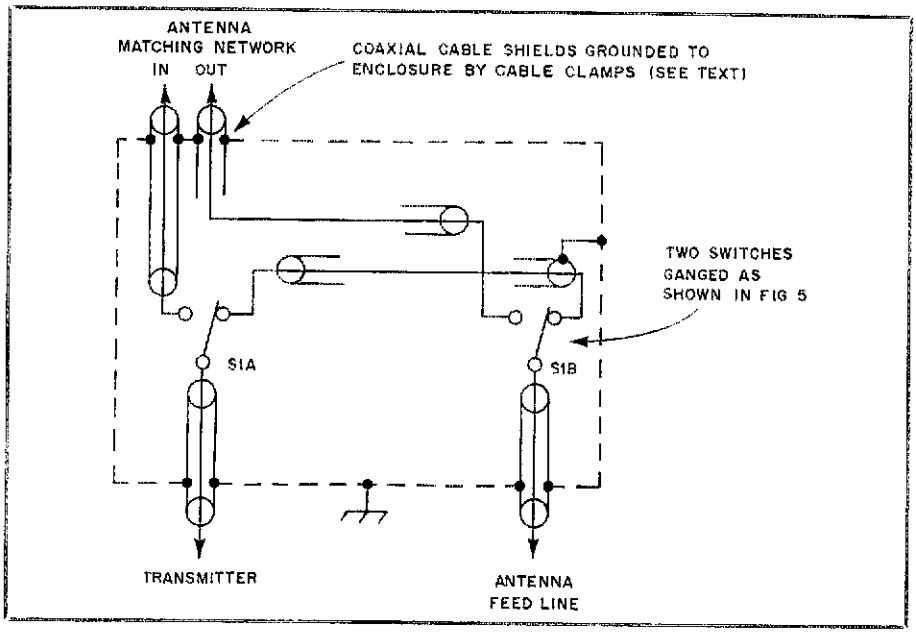


Fig 6—Two ganged (DPDT) switches used for switching an antenna matching network in and out of the feed line.

using the binding screws provided. Use metal switch-cover plates to ensure adequate shielding.

To illustrate the flexibility possible with these switches, some applications are shown in Figs 3 through 6. In Fig 3, two transmitters are switched on or off simultaneously with their antenna connections. This ensures that a transmitter will not inadvertently be operated into an open transmission line. Fig 4 shows how three switches can be used to select one of four antennas. Fig 5 shows how two switches can be ganged together mechanically to form a DPDT switch. Fig 6 shows two ganged switches used to switch an antenna matching network in or out of the transmission line, as needed.

Conclusions

The installations shown in Figs 3-6 are in use in my radio shack and have been giving good service. A couple of words of advice—*do not switch antennas when they are powered!* Live switching is inadvisable in this application, just as it is in any switching application because most switches can't withstand the high voltage transients that are generated. Also, always use metal enclosures with the switches—they provide RF shielding and shock protection.

New Products

REGENCY MX7000 SCANNER MONITOR

☐ The Regency MX7000 is one of the few scanners capable of covering frequencies as high as 1.3 GHz. In addition to covering all frequencies between 25 MHz and 550 MHz, it provides continuous coverage of all frequencies between 800 MHz and 1.3 GHz.

In addition to scanning as many as 20 preprogrammed channels, the scanner can also search through an entire band for an active frequency. When an in-use frequency is found, the frequency will appear on the digital display. The user then has the option of continuing to search or to store the new frequency in one of 20 channels. Search increments of 5, 12.5 and 25 kHz are available.

The multifunction, lighted LCD display shows channel numbers during the scan mode, channel and frequency when a call is received, loss of power, delay function status, channel lockout and search mode selection. Other sophisticated features include a 24-hour digital clock, priority channel, dual scan speeds and a scan or search delay that provides a pause when "calls" and "answers" are on the same frequency. The MX7000 is designed for home or mobile use, and comes with a telescoping whip antenna, ac power supply, dc power cord and a mobile mounting bracket.

The MX7000 is available through Regency scanner suppliers or by contacting Regency Electronics, Inc, 7707 Records St, Indianapolis, IN 46446, tel 312-372-7090. Suggested retail price: $699.95.—*Bruce O. Williams, WA6IVC*

Strays

I would like to get in touch with...

☐ anyone with a manual/schematic for a Sears 412-3573 2-m transceiver. Don Norman, AF8B, 41991 Emerson Ct, Elyria, OH 44035.