

UNIQUE MICROWAVE SWITCHES

Several microwave switches with unique characteristics have been developed by the Guidance Communications Group. These switches, which couple many inputs to a common output, feature fast switching speeds with minimum delay time. They make possible lower insertion losses (switch ON) and higher isolation (switch OFF) than any commercially available product.

The basic unit is a single pole—eight throw switch developed by J. V. Smith from an idea of G. W. Luke, Jr. This unit has a switching speed of about 50 millimicroseconds with a delay time of the order of 1 millimicrosecond. Insertion loss (switch ON) is held to about 1 db and isolation (switch OFF) is greater than 30 db. The switch may be optimum-tuned to any point in its range with essentially flat characteristic response within ± 50 mc of the operating frequency.

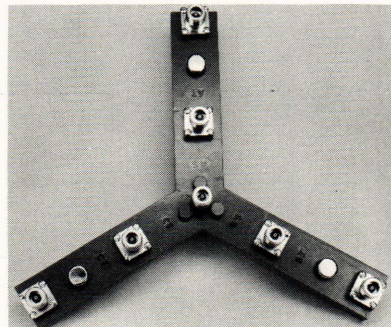
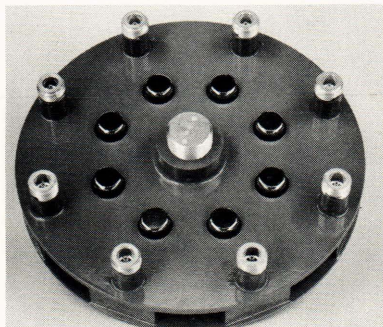
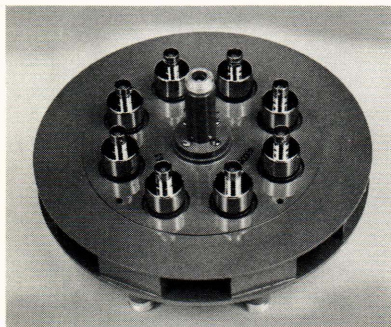
Switching is accomplished by triggering a Philco 1N263 germanium diode, which is enclosed in a choke crystal mount equipped with a switching input connector, Type BNC. By using a Philco 1N3093 diode, the power handling capability may be increased from the present 1 milliwatt to greater than 500 milliwatts. The low insertion-loss figure is obtained by mounting a Teflon sleeve inside the switch, around the crystal assembly, to act as a broadband impedance-matching device.

The 8:1 switch consists of eight lengths of waveguide radiating symmetrically from a common hub. At the hub and on each arm, Type N connectors couple the input and/or output signals to the switching crystals which are mounted at the mid-point of each arm. This switch is now being produced, to APL specifications, by Waveline, Inc., Caldwell, N. J.

In a modified version of the 8:1 switch, the insertion loss and isolation are doubled by adding a second crystal mount to each arm. Experimentation has also shown that by extending the waveguide and adding a second crystal and connector set, each arm can have a separate ON-OFF function. This capability is embodied in a Y-configuration 3:1 switch, in which the inputs may be coupled individually to a separate output or alternately to the common point.

These versatile switches may be combined into banked groups to provide a multiple of possible switching functions. For instance, some applications of the 8:1 switch are: 32:1 using 5 switches, 64:1 using 9 switches, 192:3 using 27 switches, and so forth.

The main adverse feature of the multiple-throw switches is their variation in isolation at the extreme band edges. However, as noted, it has been shown that this condition can be improved by adding properly spaced diode assemblies. The existing switches provide sufficiently flat characteristics for most applications.



Left—8:1 microwave switch. Type N output connector in center is common to each arm. Choke crystal mounts containing switching diodes couple triggering voltages through BNC connectors. *Center*—Reverse of 8:1 switch. Tuner in center is for adjusting for optimum operation at desired center frequency. Eight Type N input connectors are on outer perimeter. *Right*—3:1 and/or 1:1 microwave switch. Signals coupled through input connectors at mid-point of each arm may be switched by inner set of crystals to common output connector or by outer set of crystals to individual output connectors. Crystal triggering voltages are coupled through BNC connectors on reverse side.