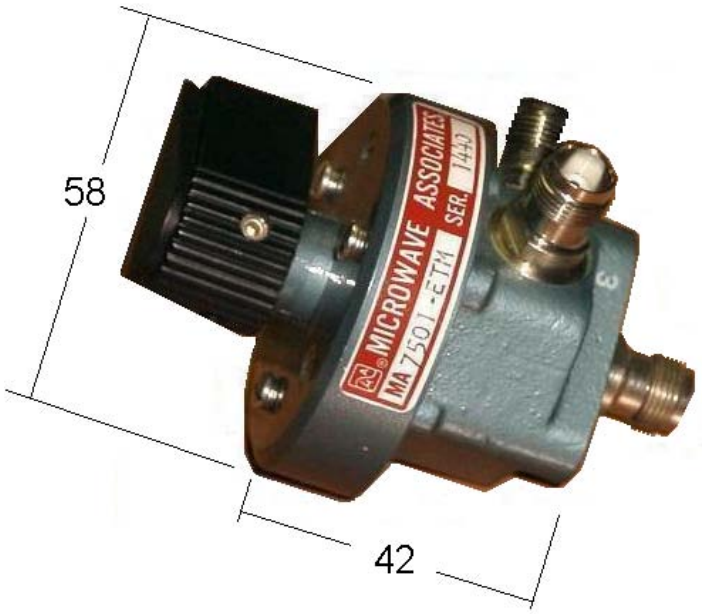
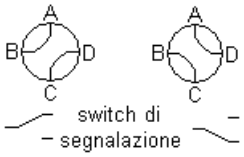
Manual coax switch described here has some special qualities, it has been tested in our laboratory and we found very good performance by far exceeding the specifications of the manufacturer.

It has three positions that are switched manually by a knob, the panel mounting is made with three screws. Connectors are TNC female, why this choice? This switch is manufactured for military and professional applications, in order to reach such small size it would not be possible to use the N connector, the BNC is not approved by Mil rules or professional applications and not suitable for use in aeronautics but the TNC connector, like N type, works very well even at 10 GHz.

MaCom MA 7501 - ETM	original MaCom specifications	some measurements made in our lab
Positions	3 in manual mode	
Frequency range	dc - 11 GHz	
Isolation	dc - 3 GHz > 60 dB	30 MHz > 130 dB 150 MHz > 100 dB
		450 MHz > 90 dB 1.3 GHz > 85 dB
	3 - 11 GHz > 40 dB	2.3 GHz > 80 dB 5 GHz > 45 dB
Insertion loss	dc - 5 GHz < 0.3 dB	dc - 2 GHz < 0.1 dB 2 - 3 GHz < 0.2 dB
	5 - 11 GHz < 0.5 dB	3 - 10 GHz < 0,3 dB
Max power	dc - 30 MHz 3 KW	
	30 - 300 MHz 1.2 KW	
	300MHz - 3GHz 300 W	
Max RMS voltage	500 V	
VSWR	dc - 5 GHz < 1.3	
	5 - 11 GHz < 1.5	
Connectors	TNC female	
cod.	**SW-MA7501**	Price on request



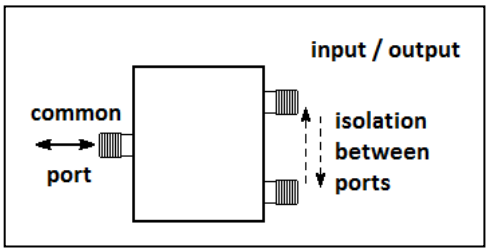
wavguide SWITCH

Waveguide switch transfer #		frequency	pow sup	cod.	price €
	PM 7289X-06 Sivers Ima very compact size 48 x 48 x 80 mm	8 - 12 GHz	24 V	**SW-WR90**	on request
	R 86.68.63 Radiall manual activation, can be used also in manual mode, size 60 x 60 x 140 mm (ask for 24 GHz)	15 - 22 GHz	28 V	**SW-WR51**	on request

TRANSFER switch can be used in normal mode (SPDT), just using only three port, being memory type it is provided of an auxiliary contact to indicate the current state.

They are components used to divide or sum RF signals, the same divider in fact can be used also reversed to sum signals, the name “divider” or “power splitter” that is used generically as is to be understood in a generic way and only for convention to determine the family of components. There are many types, with different circuit configurations depending on bandwidth, power handling, number of ports and the type of isolation between the RF ports, here are some examples:

- Low power, for receivers, instrumentation or small RF power, a classic example is to split the same signal on multiple receivers coming from the same antenna, or in the field of instrumentation to provide signal samples at 10 MHz for all laboratory instruments dividing the signal coming from a precision source.
- For high power, often used in order to coupling together various stages and be able to sum the output power, or simplier to combine some transmitters to a single antenna.



- Wilkinson combiners, -3dB hybrid, rat-race coupler, lange coupler, Gysel combiner etc…
- Antenna couplers, for coupling various antennas in phase in order to increase gain and directivity.
- With all the outputs in phase, 90° or 180°.

There are many applications for power splitters, the most common and obvious have already been listed above, other more particular are the following:
They can be used as dividers or summers at 90° to make I and Q modulators or demodulators, for laboratory use when it is necessary to sum two RF generators with high isolation between ports, for image rejection balanced mixer, for phase shifters, for impedance constant phase attenuators current controlled, etc…

port	signal divider (apparent loss)
2	-3 dB / port
3	-4.8 dB / port
4	-6 dB / port
6	-7.8 dB / port
8	-9 dB / port
10	-10 dB / port
12	-10.8 dB / port
16	-12 dB / port

In this table are lists the division factors (or sum) of the power expressed in dB depending on the number of ports, the results indicate the apparent loss in dB depending on the number of ports, for example a power splitter with 4 ports will have an output signal on each port corresponding to -6 dB relative to the signal on the common port. The loss is apparent since the signal is not lost but only divided between the various ports, the real loss instead depends on the used technology, on the frequency, combined especially with the desired bandwidth.

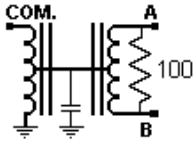
Power splitters main characteristics

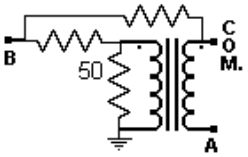
- **Number of ports:** it is the number of outputs (or inputs) on which you can split (or sum) the signal, typically are used the binary divisions of 2, 4, 8. Note that if you need a 4-way splitter you can also do it using three 2-way splitters.
- **Isolation between the ports:** it indicates the isolation between the division ports only when both the division port and the common one are perfectly terminated on the nominal impedance, a typical range of values is from 20 to 30 dB.
- **Insertion loss:** it is the real loss due to various factors, including the impact of bandwidth, frequency and used technology. Some loss examples: low power wideband dividers (10 - 1000 MHz) between 0.3 and 1 dB, high-power hybrid dividers at -3dB or Wilkinson with one octave band from 0.1 to 0.3 dB, instead for resistive power dividers the insertion loss is 6dB.
- **Power:** for this specification you have to consider both the real power of transit and the power dissipated by internal balance resistance. The internal balance resistance, for obvious reasons regarding technology and mechanic, rarely exceeds 10% of the maximum power of transit, so it is from 0.2W to 1W. The function of the balance resistance, whether internal or external, is to dissipate the power created by any unbalancement or breakdown on RF ports and not to dissipate reflection on the common port.
- **Phase balance:** indicates the difference between the output phases, for 2-way dividers typically 2° within an octave, from 2° to 4° for greater bandwidths, for greater divisions of course, the phase difference increases.
- **Amplitude balance:** indicates the difference in amplitude between the various outputs, it is a highly variable parameter and it depends on the used technology, the frequency, the bandwidth, etc… Typically it is from 0.2 to 0.6dB.

Simple hybrid HF - VHF couplers with FT….- 43 Amidon toroids

We tested in or lab these simple hybrid couplers, the goal is to provide a simple implementation using easy-to-find components (with the excellent Amidon ferrites, toroids for wideband tuned circuits)

3 dB divider-summer
with two FT…-43 ferrites
1 - 30 MHz high isolation
Very good return loss on all ports





- 6 dB hybrid
with one FT…-43 ferrite
1 - 200 MHz high isolation
quite good return loss