

# Attenuators, Terminations, Dividers/Combiners, Couplers, Detectors and Bias Tees

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RLC Electronics' series of attenuators, terminations, directional couplers and in phase dividers/combiners represents a complete line of stripline, microstrip and airline devices.

In a stripline device, the central conductor is of thin, rectangular shape. Two ground planes parallel the central conductor. Usually, the intervening space is fully filled with a dielectric material. A large number of conductors may be enclosed within a common pair of ground planes.

In microstrip there is only one ground plane parallel to the central conductor with the space filled with a dielectric material.

Airline has a thicker central conductor than stripline and no dielectric material between the ground planes.

Advantages of stripline microstrip and airline construction compared to coaxial or waveguide methods are primarily:

- 1) **Size Reduction:** an 8-inch long coaxial line may be "folded" into a one (1) inch square area.
- 2) **Eliminate connectors:** incorporate two (2) directional couplers to sample forward and reverse power, and a diode switch in a single package use three (3) connectors instead of seven (7).
- 3) **Cost reduction:** complex conductor patterns may be photographically reproduced and etched on substrate. The coaxial equivalent might have a dozen separately machined, assembled, and soldered parts.

Many combinations of these devices can be made to special requirements. Multioctave devices are available upon request.



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## Attenuators

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An attenuator is a network designed to produce a known loss when inserted between a specific input and output impedance. The value of attenuation is normally expressed as a ratio in decibels and is the same regardless of the direction in which the measurement is taken. There are many methods of fabrication derived from a few basic designs. The structures used to form the resistance networks are T,  $\pi$ , or distributed sections.

## Terminations

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A termination is a single port network designed to terminate a transmission line. This may be used as a dummy load for testing equipment such as transmitters or as a reference in microwave test systems. Since it is a one-port device, the termination must be capable of dissipating all the power imparted to it (less any reflected power which is kept to a minimum) by the system.

## Dividers/Combiners

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The function of a power divider is to direct the energy coming into an input port to two or more output ports. This must be accomplished while maintaining a very good impedance match at each port. In addition, it is usually desirable to maintain high isolation between the output ports over the frequency of operation.

RLC dividers are of the "Wilkinson" type and employ microstrip quarter-wave matching transformers of two or more sections. This type of divider produces identical, in-phase outputs. The high isolation is accomplished by means of internal terminating resistors that dissipate no power under perfect matching conditions. These power dividers may be used as in-phase power combiners simply by using the outputs as inputs.

## Couplers

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The coupler is used for sampling or injecting signals with negligible effect on the transmission line.

## Detectors

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A crystal detector is a two-port device used to convert RF power to DC power for use in measuring or evaluating the RF while operating in a DC system. The RF port is the RF input and the output is DC voltage directly proportional to the RF power at the input. RLC Electronics' broadband crystal detectors operate from 10 MHz to 26.5 GHz. These units can be connected to RLC Electronics' couplers to meet your requirements.

The most common diode device used in detectors was a point contact silicon semiconductor. In recent years this has been replaced by the low barrier Schottky diode which has become available by modern thin film technology. These new semiconductors allow greater uniformity and more consistent specifications.

## Bias Tees

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RLC Bias Tees are specifically designed to inject a D.C. or low frequency signal onto the microwave line without affecting the flow of RF in the main transmission line.



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