

COUPLERS AND SAMPLERS

Couplers and samplers are similar to power dividers in that they each divide an RF signal into two or more signals. However, power divider outputs are of roughly equal amplitudes; couplers and samplers have a main line with one or more auxiliary lines. Most of the input signal remains on the main line, a small amount of the input signal is extracted by the auxiliary line.

Directional couplers sample signals flowing in one direction only. These include parallel line couplers and loop couplers. The signal sampler extracts all signals regardless of the direction of flow. These include direct-coupled resistive samplers as well as electrostatic and electromagnetic probe samplers.

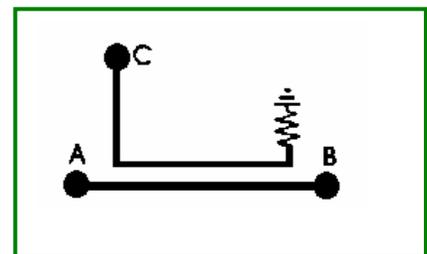
Directional couplers are commonly used as power combiners, similar to the use of hybrids to both divide and combine signals. Signal samplers, on the other hand, are used only occasionally to combine signals, usually to add a test signal.

Parallel Line Coupler (CB): Microlab parallel line couplers provide flat coupling, high directivity and low VSWR over one full octave or more. They consist of a quarter-wave auxiliary line coupled to a main line. One end of the auxiliary line is permanently fitted with a carefully matched termination, thus assuring optimum directivity. This termination may be separated from the coupler and mounted remotely, thus improving the power rating of the coupler itself. Directivity is approximately 20 dB for printed couplers, 25 dB or more for air-dielectric couplers. Units can be supplied with coupling ranging from 3 dB to 50 dB.



Parallel Line Coupler CB-48N

These couplers are frequently used as power combiners. A 10 dB coupler will exhibit a 10 dB path loss from terminal A to terminal C and will exhibit the same 10 dB path loss if power is applied to terminal C and removed from terminal A. The high directivity of the coupler is preserved when it is used as a combiner.



COUPLERS AND SAMPLERS - Sample main line signal in one or both directions

Microlab Series	Description	Typical Directivity	Typical Coupling Range	Coupling Variation	Frequency GHz	Band Width	High Power	Small Size	Low Cost	Power Combiner
CB & CK	Parallel Line Coupler	25	3-30	small	0.2-18	octave+	yes	yes	no	yes
CE	Loop Coupler	20	30-50	small	0.2 - 4	15%	yes	yes	no	yes
CF	Dual Loop Coupler	20	30-50	small	0.2 - 4	15%	yes	yes	no	yes
HM	Resistive Sampler	0	10-30	flat	DC - 5	wide	no	yes	yes	no
HY	Loop Sampler	0	20-60	6dB/octave	0.05-12	wide	yes	yes	yes	no
HZ	Capacitive Sampler	0	20-60	6dB/octave	0.05-12	wide	yes	yes	yes	no

Loop Coupler (CE & CF): Microlab loop couplers consist of a directional loop loosely coupled to a main transmission line. One end of the loop is connected to a built in terminating resistor mounted in a carefully matched housing. Users may wish to compensate for the inherent 6 dB per octave coupling variation of the loop with an external network. These devices are primarily used for loosely coupled applications (30 dB or more) and for frequencies under 4 GHz.



CE Single Loop Coupler



HM Resistive Sampler

Resistive Sampler (HM): These resistive samplers consist of a resistive network coupled to a short length of 50 Ohm line. A small portion of the RF signal is coupled through a resistive network to the auxiliary output; the balance of the input signal is transmitted with negligible reflection or loss. The coupling is fixed, non-directional and independent of frequency over an extremely broad bandwidth. Coupling can range from 10 to 30 dB. A single unit can operate from DC up to several Gigahertz. Average power input is limited to 5 or 10 Watts by the resistive network. These units are not used as power combiners.

Probe Samplers (HY-HZ): These samplers consist of an auxiliary line terminated in a probe connected to a short section of coaxial line. Probe coupling to the main line is continuously adjustable and may be locked at any convenient position.



The HY probe consists of a non-directional loop, which intercepts the magnetic field in the main line and also provides a DC return in the branch line.

The probe in the HZ sampler is electrostatic and is capacitively coupled to the main line without providing a DC return. Both of these samplers are capable of handling high power as they do not contain resistive elements. Coupling increases by 6 dB per octave, unless special compensating filters are employed. These units are not used as power combiners.

COMMON ORDERING ERRORS

Failure to specify directivity: Customers are often attracted to the lower cost of a signal sampler compared to a directional coupler without properly evaluating the need for directivity. A coupler must be employed if the application requires sampling of only the forward (or reverse) signal. A sampler combines the forward and reverse signals and may provide misleading information.

A hybrid is not a reflectometer: Systems users may want to use a single unterminated parallel line directional coupler to simultaneously measure both the forward and reflected signals, to use it as a reflectometer. This practice may produce serious measurement errors unless both outputs are very carefully matched. Better performance is generally achieved by using two couplers in series, each with its own built-in termination.

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