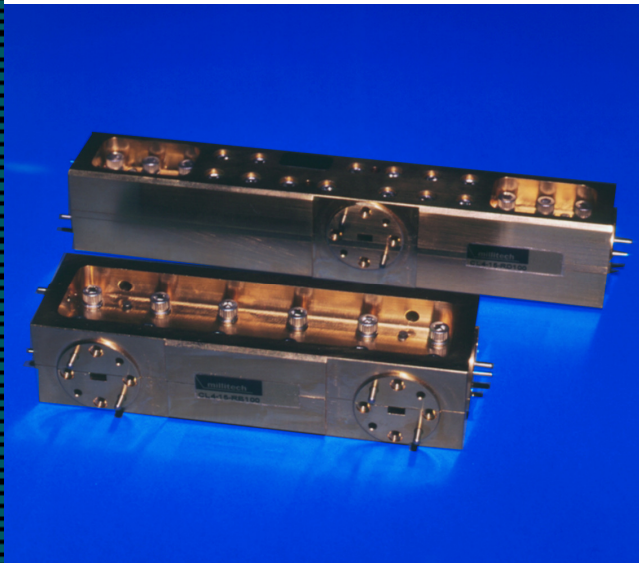


**SERIES CL4**
**4-PORT HIGH DIRECTIVITY DIRECTIONAL COUPLERS**

**FEATURES:**

- Low insertion loss as low as 0.8 dB
- High directivity
- VSWR as low as 1.1:1
- Full waveguide band operation

**APPLICATIONS:**

- Test and instrumentation
- Subsystems
- Precision measurement systems

**DESCRIPTION**

Millitech series CL4 4-port high directivity directional couplers are available from 18 to 170 GHz, with coupling values of 10, 20, 30, and 40 dB. These couplers have directivity of up to 35 dB with insertion loss as low as 0.8 dB for frequencies below 60 GHz, and 1.5 dB for W-band (WR-10). They can operate over full waveguide bands with coupling flatness of less than  $\pm 0.7$ dB.

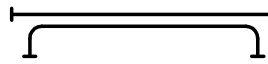
Series CL4 4-port couplers are offered in two types of configurations: bi-directional couplers and dual couplers. Figure 1 illustrates the port configuration of these 4-port couplers.

Bi-directional couplers require an extreme load to be connected to one of the coupled arms.

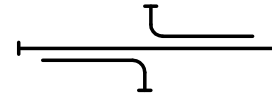
Dual couplers are essentially two complete directional couplers, back-to-back (in-line), each with an internal load. They are useful for monitoring or sampling signals in both directions of the main arm simultaneously, (e.g., transmitted and reflected signals).

Series CL4 couplers are produced using a rugged split-block construction. High directivity couplers are convenient for extracting or introducing a small fraction of power from and/or into a waveguide circuit. These couplers are particularly suitable for measurement of RF power (transmitted or reflected) in circuits, for scalar network analyzers, and for signal sampling in instruments or subsystems. Millitech also produces series CL3 3-port high directivity couplers and series CGC crossguide couplers. Millitech also offers a waveguide stand that supports split-block couplers in measurement tests or subsystems (series WCS).

Figure 1. 4-Port Coupler Configurations



Bidirectional Coupler



Dual Coupler

## ELECTRICAL SPECIFICATIONS

Model Number	CL4-42	CL4-28	CL4-22	CL4-19	CL4-15	CL4-12	CL4-10	CL4-08
Frequency Band and Range (GHz)	K 18-26.5	Ka 26.5-40	Q 33-50	U 40-60	V 50-75	E 60-90	W 75-110	F 90-140
<b>4-Port Bidirectional Couplers *1</b>								
Coupling Value (dB)*2	10, 20	10, 20	10, 20	10, 20	10, 20	10, 20	10, 20	10, 20
Coupling Flatness (±dB)†	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Insertion Loss (dB)†*3	0.8	0.8	0.8	0.8	1.1	1.5	2.0	2.2
Directivity (dB) (min)*4	35	35	35	35	33	31	31	27
Main Line VSWR†	1.1:1	1.1:1	1.1:1	1.1:1	1.1:1	1.15:1	10.15:1	1.2:1
Secondary Line VSWR†	1.1:1	1.1:1	1.1:1	1.1:1	1.1:1	1.15:1	1.15:1	1.2:1
Coupling Value (dB)*2	30, 40	30, 40	30, 40	30, 40	30, 40	30, 40	30, 40	30, 40
Coupling Flatness (±dB)†	0.7	0.7	0.7	0.7	0.7	0.7	0.7	---
Insertion Loss (dB)†*3	0.8	0.8	0.8	0.8	1.1	1.5	2.0	---
Directivity (dB) (min)*4	33	33	33	33	30	28	28	---
Main Line VSWR†	1.1:1	1.1:1	1.1:1	1.1:1	1.1:1	1.15:1	1.15:1	---
Secondary Line VSWR†	1.1:1	1.1:1	1.1:1	1.1:1	1.1:1	1.15:1	1.15:1	---
<b>4-Port Dual Couplers</b>								
Coupling Value (dB)*2	10, 20	10, 20	10, 20	10, 20	10, 20	10, 20	10, 20	10, 20
Coupling Flatness (±dB)†	0.7	0.7	0.7	0.8	0.8	0.8	0.9	1.0
Insertion Loss (dB)†*3	1.0	1.0	1.0	1.2	1.5	1.9	2.0	2.4
Directivity (dB) (min)*4	35	35	35	35	33	31	31	27
Main Line VSWR†	1.1:1	1.1:1	1.1:1	1.1:1	1.1:1	1.15:1	1.15:1	1.2:1
Secondary Line VSWR†	1.1:1	1.1:1	1.1:1	1.1:1	1.1:1	1.15:1	1.15:1	1.2:1
Coupling Value (dB)*2	30, 40	30, 40	30, 40	30, 40	30, 40	30, 40	30, 40	30, 40
Coupling Flatness (±dB)†	0.7	0.7	0.7	0.9	1.0	1.1	1.2	---
Insertion Loss (dB)†*3	1.0	1.0	1.0	1.2	1.5	1.9	2.0	---
Directivity (dB) (min)*4	33	33	33	33	30	28	28	---
Main Line VSWR†	1.1:1	1.1:1	1.1:1	1.1:1	1.1:1	1.5:1	1.5:1	---
Secondary Line VSWR†	1.1:1	1.1:1	1.1:1	1.1:1	1.1:1	1.5:1	1.5:1	---

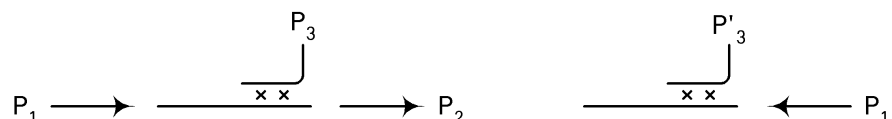
\*1 – All specifications for the bi-directional coupler are tested using an external load series WTR.

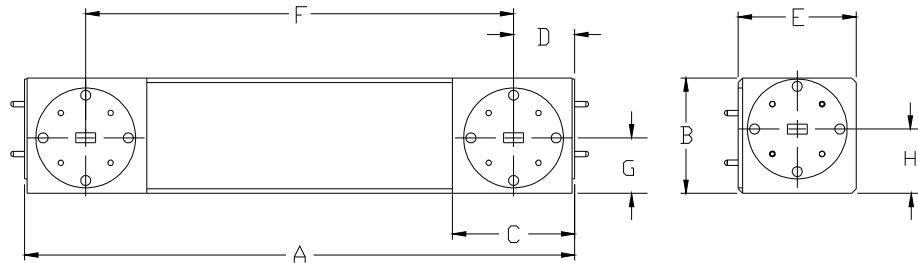
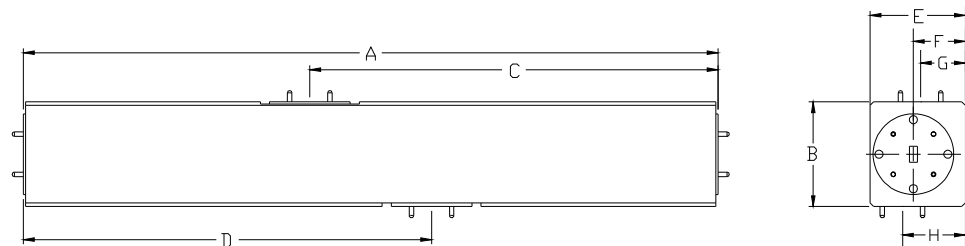
\*2 – Coupling value =  $-10 \log_{10} (P_3/P_1)$

\*3 – Insertion loss =  $-10 \log_{10} [(P_2+P_3)/P_1]$

\*4 – Directivity =  $10 \log_{10} (P_3/P_1)$

† - Max



**OUTLINE DRAWINGS**
**4-Port Bidirectional Coupler**

**4-Port Dual Coupler**

**MECHANICAL SPECIFICATIONS**

Model Number	CL4-42	CL4-28 * <sup>1</sup>	CL4-22	CL4-19	CL4-15	CL4-12	CL4-10	CL4-08
<b>4-Port Bidirectional Couplers</b>								
A (in/mm)	---	6.21/157.73	5.48/139.19	4.9/124.46	3.83/97.28	3.38/85.85	3.28/83.31	3.0/76.2
B (in/mm)	---	0.93/23.62	1.3/33.02	1.3/33.02	0.86/21.84	0.86/21.84	0.86/21.84	0.86/21.84
C (in/mm)	---	---	1.65/41.91	1.65/41.91	1.2/30.48	1.2/30.48	1.2/30.48	1.03/26.16
D (in/mm)	---	0.69/21.08	0.83/21.08	0.83/21.08	0.6/15.24	0.6/15.24	0.6/15.24	0.53/13.46
E (in/mm)	---	1.33/33.78	1.33/33.78	1.33/33.78	1.2/30.48	1.2/30.48	1.2/30.48	0.85/21.59
F (in/mm)	---	4.83/122.68	3.83/97.28	3.25/82.55	2.61/66.29	2.16/54.86	2.06/52.32	1.94/49.27
G (in/mm)	---	0.39/9.9	0.59/15.0	0.60/15.2	0.39/9.9	0.39/9.9	0.40/10.2	0.40/10.2
H (in/mm)	---	0.54/13.7	0.71/18.0	0.70/17.8	0.47/11.9	0.46/11.7	0.46/11.7	0.45/11.43
<b>4-Port Dual Couplers</b>								
A (in/mm)	---	9.3/236.22	8.0/203.20	6.8/172.72	5.3/134.62	4.6/116.84	4.4/111.76	---
B (in/mm)	---	1.2/30.48	1.2/30.48	1.2/30.48	0.85/21.59	0.85/21.59	0.85/21.59	---
C (in/mm)	---	5.1/129.54	4.4/111.76	3.8/96.52	2.95/74.93	2.65/67.31	2.55/64.77	---
D (in/mm)	---	5.1/129.54	4.4/111.76	3.8/96.52	2.95/74.93	2.65/67.31	2.55/64.77	---
E (in/mm)	---	1.16/29.46	1.42/36.07	1.42/36.07	0.94/23.88	0.93/23.62	0.94/64.77	---
F (in/mm)	---	.58/14.73	0.72/18.29	0.71/18.03	0.71/18.03	0.47/11.94	0.47/11.94	---
G (in/mm)	---	0.43/10.92	0.59/14.99	0.60/15.24	0.38/9.65	0.39/9.91	0.41/10.41	---
H (in/mm)	---	0.73/18.54	0.84/21.34	0.82/20.83	0.82/20.83	0.54/13.72	0.53/13.46	---
Flange MIL.F-3922	54-001*	/54-003*	67B-006	67B-007	/67B-008	67B-009	/67B-010	/67B-00M08

\* With #4-40 threaded holes.

\*1 – Dimensions given for this model are for a round flange. Dimensions incorporating a square flange will vary slightly. Consult Millitech for these dimensions.

## HOW TO ORDER

Specify Model Number CL4-XX-ABCCØ
<b>XX</b> = Waveguide Band <b>WR</b> – number
<b>A</b> = Flange Type <b>R</b> – round (WR-22 through WR-08 only) <b>S</b> – square (WR-42 through WR-28 only)
<b>B</b> = Configuration <b>B</b> – bidirectional <b>D</b> – dual
<b>CC</b> = Coupling Level <b>10</b> = 10 dB <b>20</b> = 20 dB <b>30</b> = 30 dB <b>40</b> = 40 dB

## EXAMPLE

**To Order:** a CL4 coupler in WR-28 with a square flange, 10 dB coupling level in bidirectional configuration

**Specify:** CL4-28-SB100