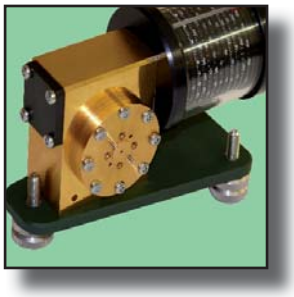
FLANN MICROWAVE

Microwave Products

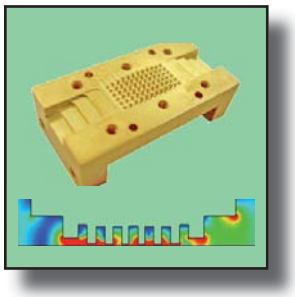
2010

FLANN MICROWAVE




THE
HOME
OF
INNOVATION
AND
QUALITY






Microwave Products

Microwave Products

This Catalogue presents the full and extended range of Flann's products. Customised models are not included. Should your requirements not be met by the products shown herein please contact our sales office to discuss your needs.

Warranty

Flann warrants each product of its manufacture to be free from defects in material and workmanship. Our obligation under this warranty is limited to servicing or adjusting any product returned to our address for that purpose and to make good at our facility any part or parts thereof (except tubes, transistors, integrated circuits, batteries, diodes and crystals) within one year after making delivery to the original purchaser and which in our examination shall disclose to our satisfaction to have been thus defective. Such returns must have prior authorization from Flann and must be returned as our detailed instructions with transportation charges prepaid. Warranty returns or repairs must first be authorized by Flann. Flann does not authorize any third party to assume for them any other liability in connection with the original sale than the foregoing. ***Unauthorized tampering with sealed screws will invalidate the warranty and may result in damage to the product.***

Design Changes

Flann reserves the right to make changes in the design of its products without reference and without incurring any obligation to make the same alterations on products previously purchased.

Specification Changes

Flann reserves the right to change any specification or withdraw any product noted herein without prior notice.

Repairs

Customers wishing to return products for repairs, or for any other reason, please contact Flann for instructions prior to shipping. It is necessary to provide model number, serial number and a detailed description of the fault, including all symptoms, prior to the return of the product.

FLANN MICROWAVE LIMITED

Founded in 1956, internationally renowned, Flann Microwave Limited specialise in the design and manufacturer of precision, high quality, high performance microwave equipment and components in the frequency range of 320 MHz to 500 GHz.

MISSION STATEMENT

To provide the Microwave Industry with the design, development and manufacture of reliable and consistent product with competitive pricing.

CAPABILITY

RF Design: tools include Ansoft HFSS, Mician Microwave Wizard, Mathematical Modelling and In-house Developed Design and Synthesis tools

Mechanical Design: AutoCAD Inventor 3D modelling and Edge CAM

Electronic Design: Motion Control/Robotics, System Design, Control Software & Control Processors utilizing IEEE-488, RS-232, RS-485 and Ethernet

Manufacturing: CNC Machine tools, Vertical machining centres, Lathes, Manual Machine tools – Milling and Turning

Fabrication & In-house Processes: Highly skilled fitters / assemblers, soldering and brazing, Electro-Plating, Electro-Forming, Anodising, Alochrome and Paint Spraying

Test and Measurement: Vector Network Analysers up to 130 GHz, Scalar Network Analysers up to 200 GHz. Strong relations with Research and National Standards Laboratories.

CUSTOMERS

We serve our customers in a broad range of markets including Test & Measurement, Commercial & Military Communications, Radar, Satellite, Industrial Applications, EW as well as Research and National Standards Laboratories.

Flann are actively involved in easing customer project time, space and weight limitations by design and optimisation of multi-function assemblies, using either discrete components or single block designs.

PRODUCTS

Standard and custom waveguide components, antennas, sub assemblies and programmable instrumentation available from 320 MHz to 500 GHz in rectangular waveguide and 2 GHz to 40 GHz in double ridged, with power capability ranging from microwatts to Megawatts**.**

New Products

mmWave Components extended up to 500 GHz

- Calibration Kits up to 500 GHz
- Many standard products extended to 330 GHz
- Calibration Components up to 500 GHz
- Attenuators
- Frequency Meters
- Directional Couplers
- New generation Switch Drivers

Calibration Kits

Frequency Meters

Switch Drivers

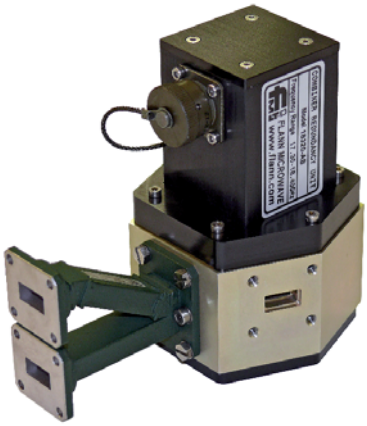
Directional Couplers

Satcom Products - see our Satcoms Catalogue or visit www.flann.com for more details

- Waveguide Switches
- High power Terminations
- Orthomode Transducers
- Combining / Redundancy Units

High Power Terminations

Waveguide Switches

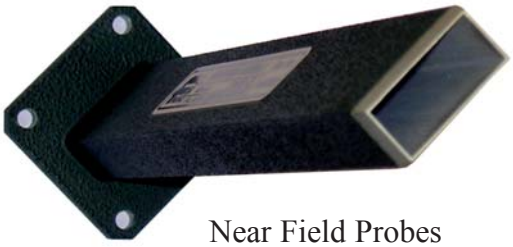


Combining / Redundancy Unit

Orthomode Transducers

New Products

NRL Standard Gain Horns
Near Field Probes



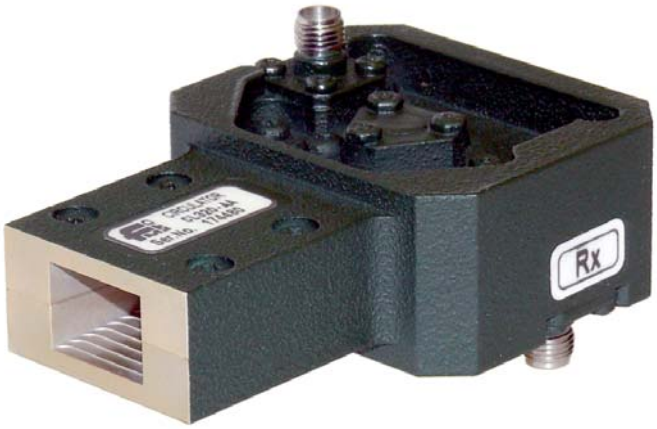
Near Field Probes

NRL Standard Gain Horns

E-BAND-ANTENNAS

E-Band Antennas

HIGH PREFORMANCE ANTENNAS WITH
OPTIONAL INTERGRATED CIRCULATOR



Contents

Contents

For the latest in our product range please view our web site at www.flann.com Or contact our Sales Team, details on the back cover of this catalogue.

Product Series Number Index

The third, fourth and fifth digits of Flann instrument model numbers denote the generic instrument series number.
Listed below are the Instrument Series numbers and their descriptions.

Programmable Rotary Vane Attenuators, Phase Changers & Control Processors

Model CP2020

Model 23621

Our new generation of Programmable Attenuators & Phase Changers provide higher measurement resolution, faster drive speed and an extendable attenuation range (85 dB) when used with the new Flann Control Processor CP2020. Additionally, the CP2020 will recognise any Flann Programmable unit connected to either of its drive ports.

Features:

- **Models from 3.3 GHz (WR229) to 330 GHz (WR3)**
- **IEEE-488.2 (GPIB) bus control**
- **Full waveguide frequency ranges**
- **High accuracy**
- **High repeatability**
- **Proven reliability**

Programmable Rotary Vane Attenuators:

- **0 dB to 60 dB continuously variable attenuators - up to 85 dB in Steps Mode**
- **Direct dB scale read-out with manual control option**
- **Low phase change variation with attenuation**
- **Attenuation increments of 0.1 dB or better (0.01 dB below 21 dB)**

Programmable Rotary Vane Phase Changers:

- **Continuously variable 0° to 360°**
- **Phase change increments of 0.2 degrees**
- **Direct reading**

Applications:

- **Automated test & measurement systems (ATE)**
- **Remote control systems**
- **Automated production testing of microwave radios**
  - **Fade margin**
  - **Bit error rate (BER)**
  - **Gain control**

For Programmable Switches and Switch Drivers see pages 73 -74

For compatibility with our previous range of Series 610 and 611 Programmable Attenuators please refer to page 9

Programmable Rotary Vane Attenuators & Phase Changers

General Description

Flann Programmable Rotary Vane Attenuators and Phase Changers are well proven Precision Rotary Vane instruments driven by high resolution stepper motors, ensuring high accuracy and repeatability. The translation between the mechanical positioning of the instruments and the attenuation or phase shift characteristics is interpreted by the microprocessor based Control Processor.

Control Processors are available offering combinations of local (front panel) control and/or control via GPIB (IEEE-488.2). Sophisticated error detection and reporting verifies system performance, guaranteeing error free system operation. Positional stepping errors are non-cumulative.

Programmable Rotary Vane Attenuators

This range of Programmable Rotary Vane Attenuators uses a very high speed five phase stepper motor which, when used in conjunction with the sophisticated motor control circuitry and software of the Control Processor, provides precise, very fast positioning typically 1 second from 0 dB to 60 dB.

Programmable Rotary Vane Phase Changers

The Series 670 Rotary Vane Phase Changers employ the same high performance drive circuitry and precision mechanisms as the programmable attenuator range and operate at a repositioning rate of 1480 degrees per second with continuous phase change in both the forward and reverse directions. The smallest incremental phase change is 0.2˚.

Other features include:

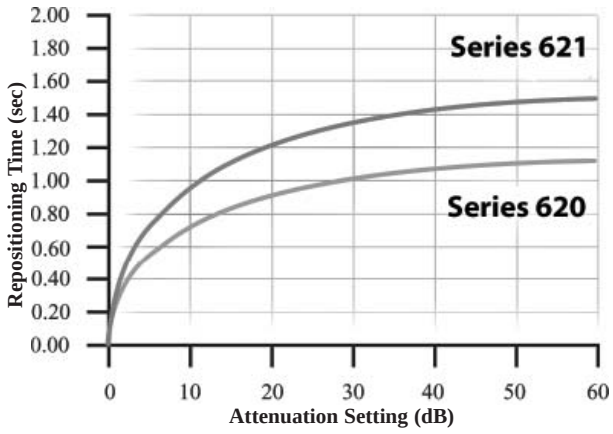
- **High repeatability / resettability**
- **Continuously variable over full attenuation / phase change range**
- **No momentary loss of signal during repositioning**
- **High Reliability**
- **Proven Performance!**

Two options of Programmable Attenuators are available:

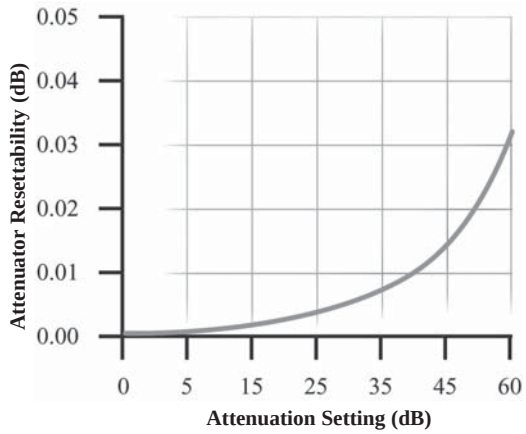
- **Series 620 Programmable Rotary Vane Attenuators** without helical readout scale.
- **Series 621 Programmable Rotary Vane Attenuators** offering the additional feature of a high resolution visual helical scale. This unit can also be used as a stand-alone manual attenuator, i.e. not under power from a Control Processor.

Figure 1 below illustrates the repositioning and resettability performance for the Series 620 and 621 Programmable Rotary Vane Attenuators.

Attenuator Repositioning Time (secs)



Attenuator Resettability



Please note:
The new series of programmable attenuators can be used with either the previous series of CP92 control processors or the latest series CP2020; an adaptor cable must be specified with order when using the CP92 versions of Control Processor.

Programmable Rotary Vane Attenuators
Series 620 and Series 621

NOW UP TO 500 GHz

Model 23621

Two basic types of Programmable Rotary Vane Attenuators, Series 620 and 621, are available. The Series 620 has been extended to include models down to 3.3 GHz. The new Series 621 models offer an additional high resolution helical readout scale offering manual control.

High Speed Operation:

Programmable Rotary Vane Attenuators are fitted with a high speed drive motor capable of repositioning the attenuator from 0 dB to 60 dB(see note 1) in less than 1.1 seconds when driven by our dedicated Control Processors.

Model 15620

Specifications: All ranges 0 dB to 60 dB with the following accuracy[1]

	WG10 to WG29	WG30	WG31	WG32	(260-400)	(325-500)
Attenuation accuracy	0 dB to 60 dB 0.1 dB or 1% whichever is greater	0 dB to 50 dB 0.15 dB or 1.2% whichever is greater	0 dB to 45 dB 0.2 dB or 1.5% whichever is greater	0 dB to 40 dB 0.3 dB or 2% whichever is greater	0 dB to 35 dB 0.4 dB or 2.5% whichever is greater	0 dB to 30 dB 0.5 dB or 3% whichever is greater

Operating temperature range: +5°C to +35°C (Refer to Flann for wider temperature range consideration)

Note 1: Customised models with extended attenuation ranges can be supplied. Please contact our Sales Team for further details.

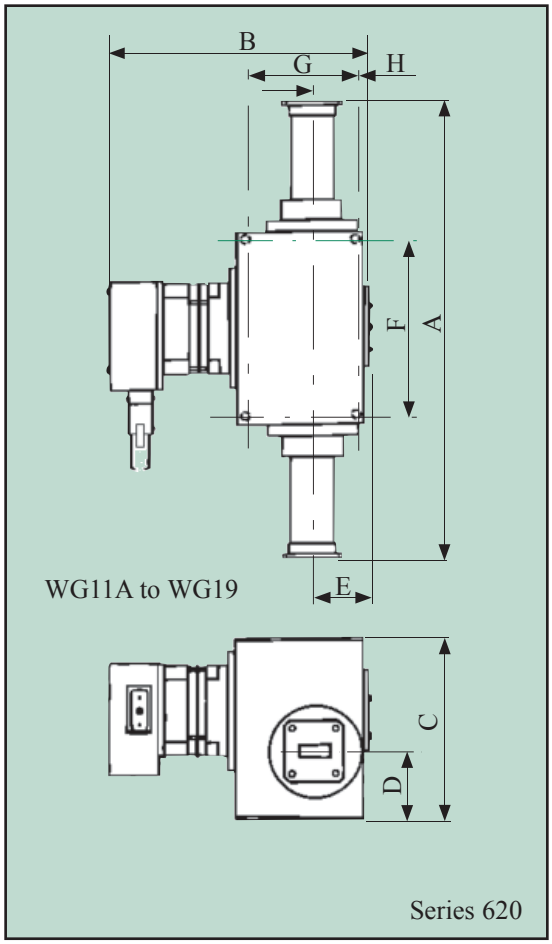
Model Series 620 or 621	Frequency Range (GHz)	Waveguide				VSWR (better than)	Max Insertion Loss (dB)	Max Power (Watts)
		WG	WM	R	WR			
11A620/11A621	3.30 - 4.90	11A	-	40	229	1.15	0.25	10.0
12620/12621	3.94 - 5.99	12	-	48	187	1.15	0.25	10.0
13620/13621	4.64 - 7.05	13	-	58	159	1.15	0.25	9.0
14620/14621	5.38 - 8.18	14	-	70	137	1.15	0.25	8.0
15620/15621	6.58 - 10.0	15	-	84	112	1.15	0.25	6.0
16620/16621	8.20 - 12.5	16	-	100	90	1.15	0.25	4.0
17620/17621	9.84 - 15.0	17	-	120	75	1.15	0.25	3.0
18620/18621	11.9 - 18.0	18	-	140	62	1.15	0.3	2.0
19620/19621	14.5 - 22.0	19	-	180	51	1.15	0.4	1.5
20620/20621	17.6 - 26.7	20	-	220	42	1.15	0.6	1.0
21620/21621	21.7 - 33.0	21	-	260	34	1.15	0.8	0.75
22620/22621	26.4 - 40.1	22	-	320	28	1.15	0.9	0.5
23620/23621	33.0 - 50.1	23	-	400	22	1.15	1.0	0.3
24620/24621	39.3 - 59.7	24	-	500	19	1.15	0.8	0.25
25620/25621	49.9 - 75.8	25	-	620	15	1.15	1.0	0.15
26620/26621	60.5 - 92.0	26	-	740	12	1.15	1.3	0.1
27620/27621	73.8 - 112.0	27	-	900	10	1.15	1.5	0.07
28620/28621	92.3 - 140	28	-	1200	8	1.20	1.8	0.05
29620/29621	114 - 173	29	-	1400	6	1.25	2.2	0.035
30620/30621	145 - 220	30	-	1800	5	1.30	2.7	0.02
31620/31621	172 - 261	31	-	2200	4	1.40	3.0	0.015
32620/32621	220 - 330	32	-	2600	3	1.55	3.5	0.01
710620/710621	260 - 400	-	710	-	'2.8'	1.75	4.0	0.007
570620/570621	330 - 500	-	570	-	'2.2'	2.20	4.5	0.005

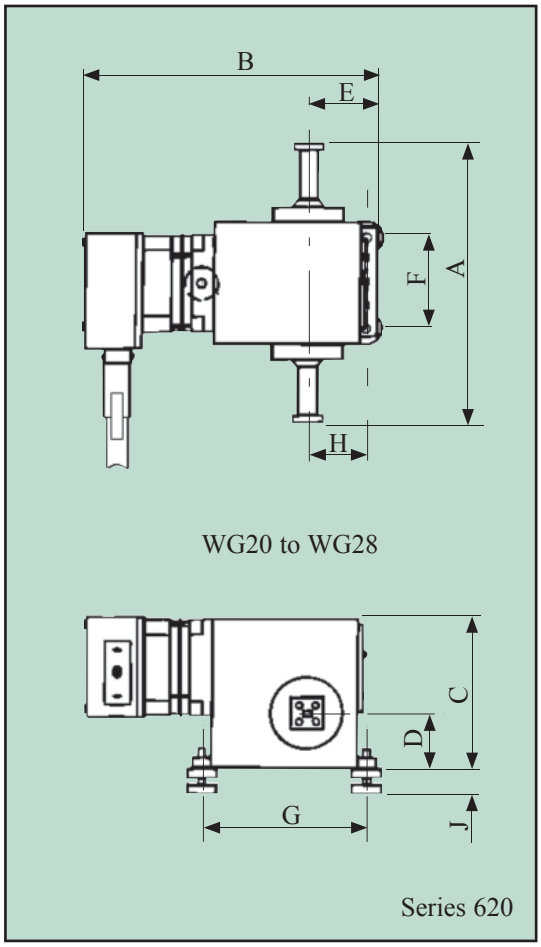
ORDERING INFORMATION
Model: Description
Example: Model 19620 or 19621 Programmable Rotary Vane Phase Changer
Outline dimensions available on request.

Series 620/621

Outline Dimensions

Model	Series 620 WG 11A-WG19							
	Dimensions (mm)							
	A	B	C	D	E	F	G	H
11A620	687	206.8	166	66	64	110	110	54
12620	560	196	155	55	63.8	110	92	51.3
13620	520	196	155	55	63.8	110	92	51.3
14620	420	196	155	55	63.8	110	92	51.3
15620	340	173	120	43	40.9	116	73	30.9
16620	300	173	120	43	40.9	116	73	30.9
17620	276	173	120	43	40.9	116	73	30.9
18620	250	173	120	43	40.9	116	73	30.9
19620	250	173	120	43	40.9	116	73	30.9



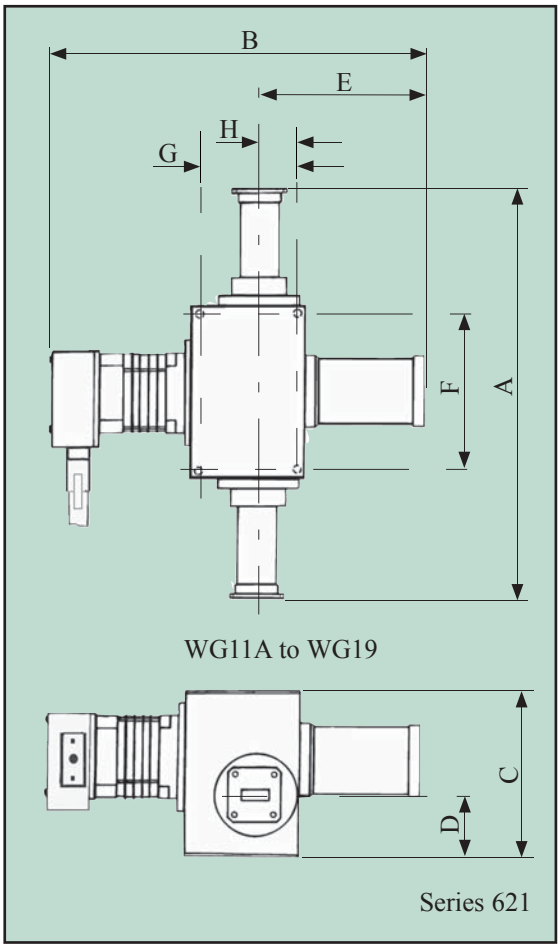


Model	Series 620 WG20 - WG32								
	Dimensions (mm)								
	A	B	C	D	E	F	G	H	J
20620	250	173.5	94	35	43	95	100	37	13/21
21620	225	173.5	94	35	43	95	100	37	13/21
22620	174	173.5	95.5	35	43	56	100	37	13/21
23620	140	173.5	95.5	35	43	50	100	37	13/21
24620	134	173.5	95.5	35	43	50	100	37	13/21
25620	100	181.5	95.5	35	46.7	56	103	41.7	13/21
26620	89	181.5	95.5	35	46.7	56	103	41.7	13/21
27620	89	181.5	95.5	35	46.7	56	103	41.7	13/21
28620	89	181.5	95.5	35	46.7	56	103	41.7	13/21
29620 30620 31620 32620	Dimensions available on request								

Customised systems are available to suit special applications. Please contact our sales team for full details.

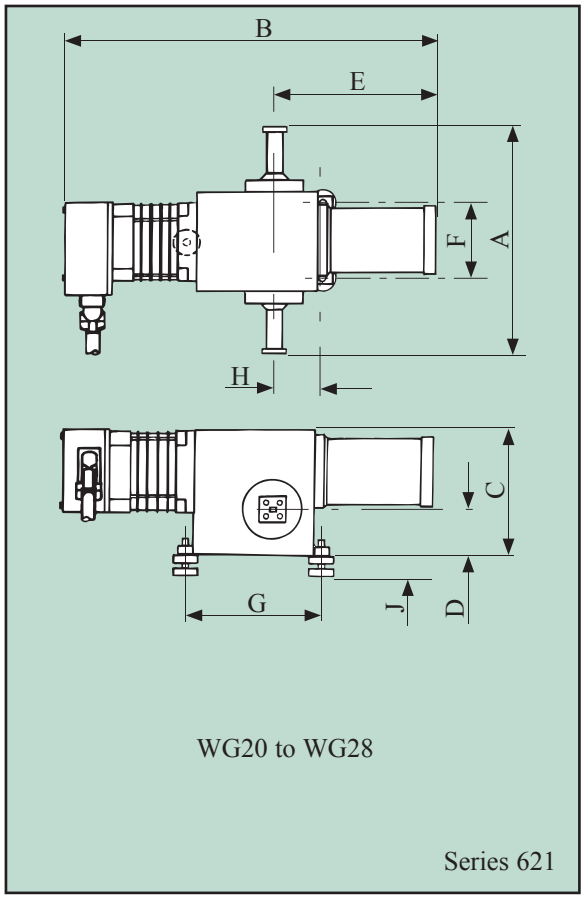
Outline Dimensions

	Series 621 WG11A -WG19							
	Dimensions (mm)							
	A	B	C	D	E	F	G	H
11A621	687	311	166	66	148.5	110	110	54.0
12621	560	296	155	55	145.8	110	92	51.3
13621	520	296	155	55	145.8	110	92	51.3
14621	420	296	155	55	145.8	110	92	51.3
15621	340	273	120	43	122.9	116	73	32.9
16621	300	273	120	43	122.9	116	73	32.9
17621	276	273	120	43	122.9	116	73	32.9
18621	250	273	120	43	122.9	116	73	32.9
19621	250	273	120	43	122.9	116	73	32.9



WG11A to WG19

Series 621



WG20 to WG28

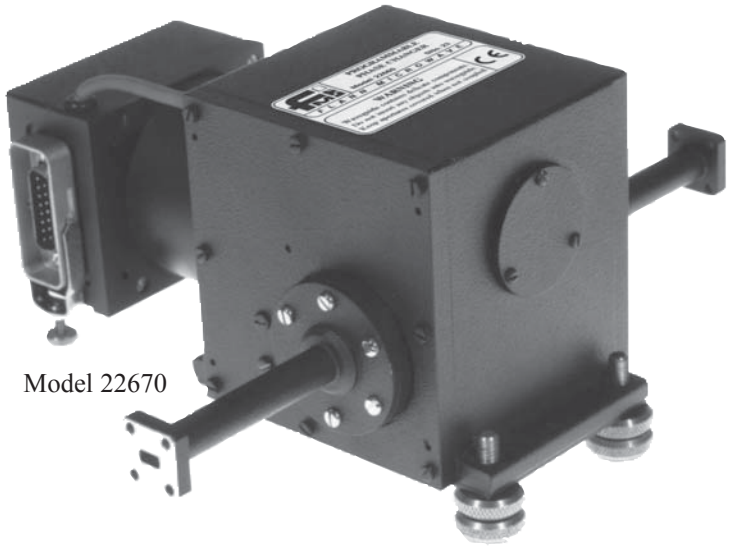
Series 621

Model	Series 621 WG20 -WG32								
	Dimensions (mm)								
	A	B	C	D	E	F	G	H	J
20621	250	273.5	95.5	35	118.7	95	100	37	13/21
21621	225	273.5	95.5	35	118.7	95	100	37	13/21
22621	174	274.5	95.5	35	118.7	56	100	37	13/21
23621	140	274.5	95.5	35	118.7	50	100	37	13/21
24621	134	274.5	95.5	35	118.7	50	100	37	13/21
25621	100	281.5	95.5	35	125.7	56	103	41.7	13/21
26621	89	281.5	95.5	35	125.7	56	103	41.7	13/21
27621	89	281.5	95.5	35	125.7	56	103	41.7	13/21
28621	89	281.5	95.5	35	125.7	56	103	41.7	13/21
29621 30621 31621 32621	Dimensions available on request								

Customised systems are available to suit special applications. Please contact our sales team for full details.

Programmable Rotary Vane Phase Changers
Series 670

NOW UP TO 330 GHz



Model 22670

Features

- **3.3 GHz - 330 GHz**
- **0.2 Degree Increments**

The Programmable Rotary Vane Phase Changers Series 670 includes models suitable for operation in frequency bands from 3.3 GHz to 330 GHz.

The stepper motor driven units provide continuous phase change in both forward and reverse direction with the smallest increment of 0.2 degrees; the rate of phase change is 1480 degrees per second when driven by the appropriate Flann Control Processor. Please see page 13 for technical details of Control Processor.

Specifications:
Operating Temperature Range 5˚C to 35˚C
(Please refer to Flann for wider temperature range consideration.)

Model	Frequency Range (GHz)	Waveguide			Accuracy	VSWR (better than)	Max Insertion Loss (dB)	Max Power (Watts)
		WG	R	WR				
11A670	3.30 - 4.90	11A	40	229	3˚	1.25	1.0	10.0
12670	3.94 - 5.99	12	48	187	3˚	1.25	1.0	10.0
13670	4.64 - 7.05	13	58	159	3˚	1.25	1.0	10.0
14670	5.38 - 8.18	14	70	137	3˚	1.25	1.0	10.0
15670	6.58 -10.0	15	84	112	3˚	1.25	1.0	10.0
16670	8.20 - 12.5	16	100	90	3˚	1.25	1.0	10.0
17670	9.84 - 15.0	17	120	75	3˚	1.25	1.0	5.0
18670	11.9 - 18.0	18	140	62	4˚	1.30	1.0	5.0
19670	14.5 - 22.0	19	180	51	4˚	1.30	1.0	4.0
20670	17.6 - 26.7	20	220	42	4˚	1.30	1.0	3.0
21670	21.7 - 33.0	21	260	34	4˚	1.30	1.0	2.5
22670	26.4 - 40.1	22	320	28	4˚	1.30	1.0	2.0
23670	33.0 - 50.1	23	400	22	4˚	1.50	1.0	1.5
24670	39.3 - 59.7	24	500	19	4˚	1.50	1.5	1.0
25670	49.9 - 75.8	25	620	15	5˚	1.50	1.5	0.7
26670	60.5 - 92.0	26	740	12	5˚	1.50	2.0	0.5
27670	73.8 -112.0	27	900	10	6˚	1.75	2.5	0.3
28670	92.3 -140.0	28	1200	8	6˚	1.75	3.0	0.2
29670	114 - 173	29	1400	6	Specifications available on request			
30670	145 - 220	30	1800	5				
31670	172 - 261	31	2200	4				
32670	220 - 330	32	2600	3				
Dimensions: Full details are available on request								

ORDERING INFORMATION
Model: Description
Example: Model 12670 Programmable Rotary Vane Phase Changer
Outline dimensions available on request.

Control Processor
Series CP2020

Model CP2020

The new Control Processor Model CP2020 controls all Flann programmable products including Rotary Vane Attenuators, Phase Changers and Polarizers.

Applications:

- Automated production testing of microwave radios and satellite communication payloads
  - Fade margin testing
  - Gain control
  - Bit Error Rate
- Automated test and measurement systems
- Remote control systems
- Extraordinary resolution & settability at low attenuations

Attenuator Performance

- 0 dB to 60 dB in less than 1.1 seconds
- 0 dB to 120 dB in less than 2.2 seconds (2 attenuators connected in series)
- 3 GHz to 140 GHz (in waveguide bands)
- IEEE488.2 GPIB Bus Control

  Will position to:
  0.01 dB between 0 dB & 21 dB
  0.02 dB between 21 dB & 30 dB
  0.05 dB between 30 dB & 48 dB
  0.1 dB between 48 dB & 60 dB

Phase Changer Performance

- Continuous phase change in either forward or reverse direction
- Smallest phase change increment is 0.2°
- Rate of phase change is 1480 degrees per second.

Controlling Cable Requirements

- A conversion cable is required when driving
  - Series 610
  - Series 611
  - Series 660

  instrumentation using a CP2020

- Unchallenged accuracy, reliability and repeatability
- Built in self test and diagnostics
- Control of 1 or 2 attenuators giving a possible attenuation range of 120 dB
- Universal line input, automatically switched between 115 V and 230 V
- Steps mode operation allows greater control over instrument positioning
- Recognises any Flann programmable products when connected to the drive ports
- Extended drive cable capability - up to 20 meters
- HS488 High speed GPIB capability - up to 8 Mb/s
- Ability to learn previous CP92 series GPIB commands

Precision Rotary Vane Attenuators
Series 110

NOW UP TO 500 GHz

For Programmable Vane Rotary Attenuators see page 8-11

Features

- 1% accuracy
- 0 dB - 60 dB
- Direct Reading
- Unsurpassed Reliability
- 2.60 GHz to 500 GHz

Applications

- Instrumentation
- Calibration

Model 30110

Flann Precision Rotary Vane Attenuators are considered by many to represent the 'Industry Standard' in precision waveguide attenuators, offering high accuracy and unsurpassed repeatability and reliability.

The Rotary Vane Attenuator is the ideal instrument for use in waveguide systems where broadband direct reading of attenuation is required, particularly as a standard for reflectometer and swept systems.

The Flann Rotary Vane Attenuator consists of a rotating circular waveguide section flanked by a pair of low VSWR rectangular to circular transitions. The three waveguide sections are fitted with stable high attenuation elements which ensure close agreement of the attenuation characteristic to the theoretical law. The attenuation is directly related to the relative angular position of the attenuating element in the centre section (Ø) and can be seen to follow the law 40 log (sec Ø). The attenuation is insensitive to frequency; variations of phase with attenuation are negligible. Choking of the rotating joints is employed to minimise RF leakage whilst sound mechanical design ensures the instruments are free from backlash. A precision 10 turn, 75 mm diameter helical drum scale provides extremely high resolution as the table below indicates:-

Attenuation (dB)	Repeatability (dB)
10	0.002
20	0.003
40	0.005
60	0.008

Attenuation repeatability over a 0 dB to 60 dB attenuation range

Attenuation scale range	1-4dB	4-30dB	30-40dB	40-60dB
Scale increment	0.01dB	0.1dB	0.2dB	0.5dB

Discrimination of the drum scale over a 0 dB to 60 dB attenuation range

By using high value attenuation markings on the scale, symmetrically positioned about the maximum attenuation position, the user is able to verify the attenuation characteristic alignment which gives the highest confidence in the accuracy of subsequent measurements.

Custom Built Units:-

Special attenuators can be supplied with a calibration range in excess of 60 dB. Combined rotary vane attenuator and rotary vane phase changer units are also available; these units are usually coupled at the circular waveguide section thereby minimising mismatch errors at low attenuation settings.

Precision Rotary Vane Attenuators
Series 110

NOW UP TO 500 GHz

Specifications: All ranges 0 dB to 60 dB with the following accuracy[1]

	WG10 to WG29	WG30	WG31	WG32	(260-400)	(325-500)
Attenuation accuracy	0 dB to 60 dB	0 dB to 50 dB	0 dB to 45 dB	0 dB to 40 dB	0 dB to 35 dB	0 dB to 30 dB
	0.1 dB or 1% whichever is greater	0.15 dB or 1.2% whichever is greater	0.2 dB or 1.5% whichever is greater	0.3 dB or 2% whichever is greater	0.4 dB or 2.5% whichever is greater	0.5 dB or 3% whichever is greater

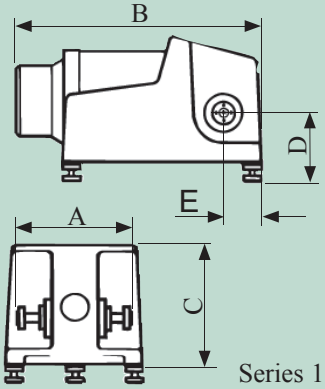
Operating temperature range: +5°C to +35°C (Refer to Flann for wider temperature range consideration)

Note 1: Customised models with extended attenuation ranges can be supplied. Please contact our Sales Team for further details.

Model	Frequency Range (GHz)	Waveguide				VSWR (better than)	Maximum Insertion Loss (dB)	Maximum Power (Watts)	Dimensions (mm)					Weight (kg)
		WG	WM	R	WR				A	B	C	D	E	
10110	2.60 - 3.95	10	-	32	284	1.15	0.25	12	935	358	198	88.2*	108	28
11A110	3.30 - 4.90	11A	-	40	229	1.15	0.25	10	687	358	198	81.2*	108	13
12110	3.94 - 5.99	12	-	48	187	1.15	0.25	10	560	244	149	66/75	58	8.5
13110	4.64 - 7.05	13	-	58	159	1.15	0.25	9	520	244	149	66/75	58	8.0
14110	5.38 - 8.18	14	-	70	137	1.15	0.25	8	420	244	149	66/75	58	6.0
15110	6.58 - 10.0	15	-	84	112	1.15	0.25	6	340	226	119	45/54	44	4.0
16110	8.20 - 12.5	16	-	100	90	1.15	0.25	4	300	226	119	45/54	44	3.8
17110	9.84 - 15.0	17	-	120	75	1.15	0.25	3	276	226	119	45/54	44	3.8
18110	11.9 - 18.0	18	-	140	62	1.15	0.3	2	250	226	119	45/54	44	3.4
19110	14.5 - 22.0	19	-	180	51	1.15	0.4	1.5	250	226	119	45/54	44	3.4
20110	17.6 - 26.7	20	-	220	42	1.15	0.6	1	250	226	119	45/54	44	3.3
21110	21.7 - 33.0	21	-	260	34	1.15	0.8	0.75	225	226	119	45/54	44	3.2
22110	26.4 - 40.1	22	-	320	28	1.15	0.9	0.5	174	227	119	55/64	36	2.5
23110	33.0 - 50.1	23	-	400	22	1.15	1.0	0.3	140	227	119	55/64	36	2.5
24110	39.3 - 59.7	24	-	500	19	1.15	0.8	0.25	134	227	119	55/64	36	2.3
25110	49.9 - 75.8	25	-	620	15	1.15	1.0	0.15	100	227	119	55/64	36	2.3
26110	60.5 - 92.0	26	-	740	12	1.15	1.3	0.1	89	227	119	55/64	36	2.3
27110	73.8 -112.0	27	-	900	10	1.15	1.5	0.07	89	227	119	55/64	36	2.3
28110	92.3 - 140	28	-	1200	8	1.20	1.8	0.05	89	227	119	55/64	36	2.3
29110	114 - 173	29	-	1400	6	1.25	2.2	0.035	58	227	119	55/64	36	2.3
30110	145 - 220	30	-	1800	5	1.30	2.7	0.02	42.8	127.5	79.5	46/55	41.5	1.0
31110	172 - 261	31	-	2200	4	1.40	3.0	0.015	38	127.5	79.5	46/55	41.5	1.0
32110	220 - 330	32	-	2600	3	1.55	3.5	0.01	32	127.5	79.5	46/55	41.5	1.0
710110	260 - 400	-	710	-	'2.8'	1.75	4.0	0.007	28	127.5	79.5	46/55	41.5	1.0
570110	330 - 500	-	570	-	'2.2'	2.20	4.5	0.005	23	127.5	79.5	46/55	41.5	1.0

*** Non-adjustable mounting feet**

ORDERING INFORMATION
Model: Description
Example: Model 16110 Rotary Vane Attenuator



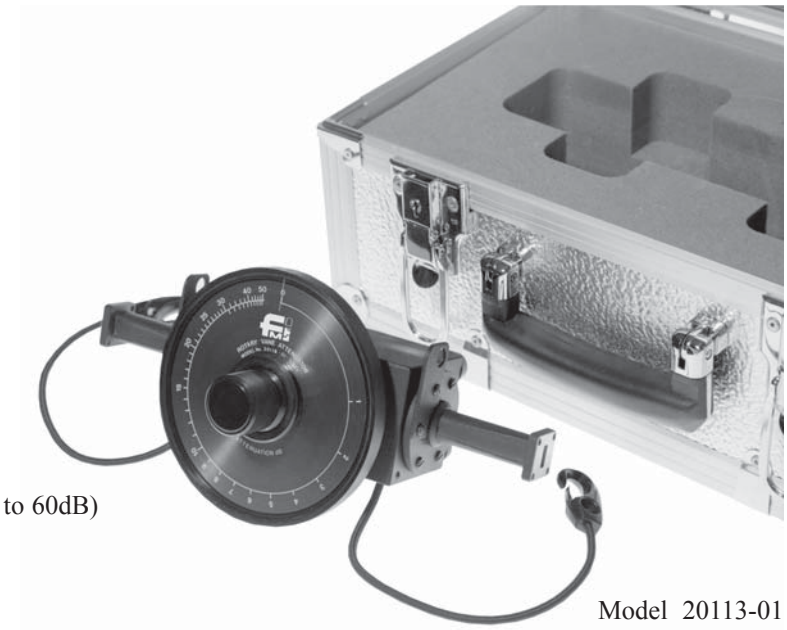
Series 110

For standard flange types and recommendations see pages 111 onwards

Field Useable Rotary Vane Attenuators
Series 113

Features

- **Direct Reading**
- **Continuously Variable**
- **Splash Proof**
- **Ruggedised Transportation Case**
- **Low Cost**



Model 20113-01

Specifications

Attenuation Range	0 dB to 50 dB (Optionally 0 dB to 60dB)
Attenuation Accuracy	0.5 dB
VSWR	1.15 : 1

The Flann range of Field Useable Rotary Vane Attenuators, Series 113, has been developed in response to the specific requirements of major UK and European communication companies, operating national point to point Microwave Radio Networks, for Fade Margin and Bit Error Rate measurements in a field test environment.

Models in the range utilise many of the components from the highly regarded precision rotary vane attenuators produced by the company. Each instrument features a direct reading scale calibrated in 1 dB increments from 0 dB to 50 dB. The attenuation accuracy is 0.5 dB over the full waveguide frequency band. Models with an extended attenuation range up to 60 dB are available to special order.

Reliability in a field test environment is enhanced by the splash proof design. Two expandable securing straps allow hands-free attenuator operation in difficult situations. The units are optionally available housed in a fitted rugged aluminium transportation case.

The attenuators can be supplied fitted with ancillary pieces of test equipment to suit specific applications; in some instances these may be accommodated within the transportation case. For example, ancillary components could include flexible waveguides, waveguide to coaxial adaptors or fixed attenuators for an extended attenuation range.

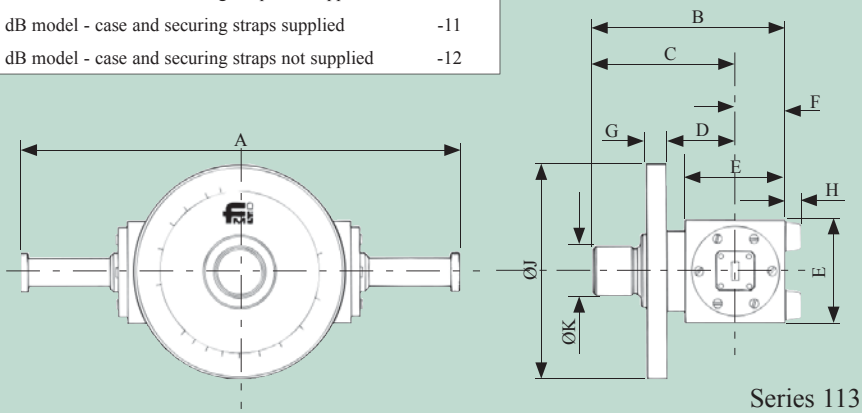
Models are available in other waveguide sizes and frequency ranges. Details on request.

Model	Waveguide			Frequency Range (GHz)	Flange to Flange Length (mm)
	WG	WR	R		
15113	15	112	84	6.58 - 10.0	340
17113	17	75	120	9.84 - 15.0	276
18113	18	62	140	11.9 - 18.0	250
20113	20	42	220	17.6 - 26.7	250
22113	22	28	320	26.4 - 40.1	174

Model	Dimensions (mm)									
	A	B	C	D	E	F	G	H	ØJ	ØK
15113	340	140	95.5	55	89	44.5	12	10	120	28
17113	276	108	79.5	39	57	28.5	12	10	120	28
18113	250	108	79.5	39	57	28.5	12	10	120	28
20113	250	108	79.5	39	57	28.5	12	10	120	28
22113	174	108	79.5	39	57	28.5	12	10	120	28

Option	Model Suffix
50 dB model - case and securing straps supplied	-01
50 dB model - case and securing straps not supplied	-02
60 dB model - case and securing straps supplied	-11
60 dB model - case and securing straps not supplied	-12

ORDERING INFORMATION
Model: option suffix; description
Example: Model 17113-01 special rotary vane attenuator, 50 dB option with case and securing straps



Series 113

Variable Attenuators
Series 080

NOW UP TO 330 GHz

Features

- 0 dB - 20 dB Attenuation
- VSWR Better than 1.10:1

The Flann Series 080 of Variable Attenuators is suitable for applications where calibrated attenuators are not required, such as level-setting or padding.

Models 11A080 to 20080 inclusive
Each unit consists of a length of waveguide with a bearing tube mounted on an external H plane wall. Passing through the tube is a close fitting plunger which carries, and varies the position of, the attenuation element within the waveguide. A locking screw is provided to secure the element at the required position. The attenuating elements are ni-chromed glass.

Model 22080 to 24080
These units are similar to the above but provided with a threaded drive mechanism to the attenuating element and a locking ring for securing at a fixed position. The attenuating element is of ni-chrome evaporated on glass.

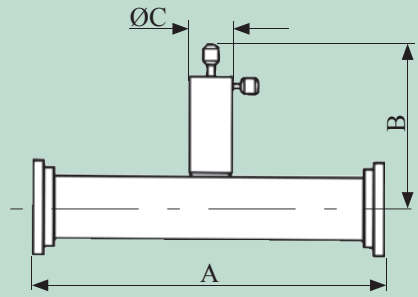
Model 20080

Model 25080 to 32080
On these units the attenuating element of ni-chromed glass is introduced into the waveguide via a slot in the broad wall. Vane position is varied by a threaded drive mechanism.

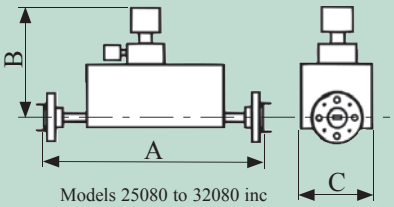
Specifications:

Attenuation Range	0 dB - 20 dB
VSWR (maximum)	1.10 : 1

Model	Frequency Range (GHz)	Waveguide			Maximum Insertion Loss (dB)	Maximum Power (Watts)	Dimensions (mm)		
		WG	R	WR			A	B	C
11A080	3.30 - 4.90	11A	40	229	0.2	2.0	275	125	22
12080	3.94 - 5.99	12	48	187	0.2	2.0	229	11	22
13080	4.64 - 7.05	13	58	159	0.2	1.5	ON REQUEST		
14080	5.38 - 8.18	14	70	137	0.2	1.0	240	93	22
15080	6.58 - 10.0	15	84	112	0.2	1.0	180	85	19
16080	8.20 - 12.5	16	100	90	0.2	0.75	131	84	19
17080	9.84 - 15.0	17	120	75	0.2	0.75	120	80	19
18080	11.9 - 18.0	18	140	62	0.3	0.75	100	70	19
19080	14.5 - 22.0	19	180	51	0.3	0.75	90	67	19
20080	17.6 - 26.7	20	220	42	0.3	0.5	76	56	19
21080	21.7 - 33.0	21	260	34	0.4	0.5	ON REQUEST		
22080	26.4 - 40.1	22	320	28	0.4	0.5	70	45	16
23080	33.0 - 50.1	23	400	22	0.5	0.5	69	42	16
24080	39.3 -59.7	24	500	19	0.6	0.5	90	45	16
25080	49.9 - 75.8	25	620	15	0.5	0.3	90	45	30
26080	60.5 - 92.0	26	740	12	0.5	0.3	90	45	30
27080	73.8 - 112	27	900	10	0.6	0.3	90	45	30
28080	92.3 - 140	28	1200	8	0.6	0.3	90	45	30
29080	114 - 173	29	1400	6	1.0	0.2	90	45	30
30080	145 - 220	30	1800	5	1.2	0.1	90	45	30
31080	172 - 261	31	2200	4	1.2	0.1	90	45	30
32080	220 - 330	32	2600	3	1.5	0.1	90	45	30



Models 14080 to 24080 inc



Models 25080 to 32080 inc

ORDERING INFORMATION
Model: Description
Example: Model 16080 Variable Attenuator

Series 080

For standard flange types and recommendations see pages 111 onwards

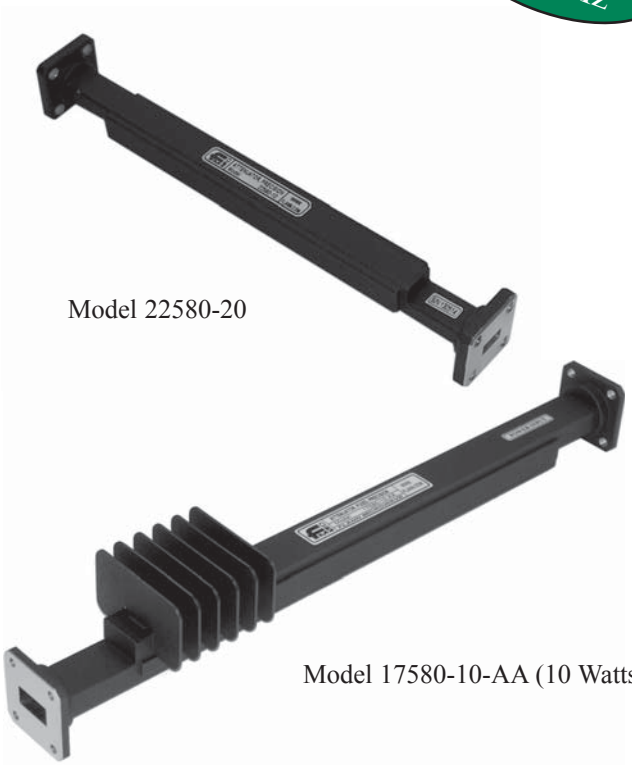
Precision Fixed Attenuators
Series 580 / 582

NOW UP TO 500 GHz

Features

- **Very High Stability**
- **Attenuation variation with frequency less than ± 1.5 dB over full waveguide band @ 500 GHz**
- **Very Low Coupling Sensitivity vs Temperature**
- **High Power Versions Available**

The Flann range of Precision Fixed Attenuators, Series 580 & 582, are very highly stable devices **eminently suitable for use in attenuation transfer standards and verification standards** for attenuation measurement systems or network analysers. The units are based on directional couplers and offer low attenuation variation with frequency, typically less than 0.5 dB, and low VSWR over the full waveguide band.



Model 22580-20

Model 17580-10-AA (10 Watts)

Standard attenuation values
3, 6, 10, 20, 30, 40, 50 and 60 dB.
Alternative attenuation value and high power handling units can be manufactured to special requirements.

Model	Frequency Range (GHz)	Waveguide				Attenuation				VSWR (better than)
		WG	WM	R	WR	Sensitivity (±dB)	Nominal Accuracy (dB)			
							3 - 6	10	20 - 60	
14580	5.38 - 8.18	14	-	70	137	0.5	0.5	0.5	1.0	1.10
15580	6.58 - 10.0	15	-	84	112	0.5	0.5	0.5	1.0	1.10
16580	8.20 - 12.50	16	-	100	90	0.5	0.5	0.5	1.0	1.10
17580	9.84 - 15.0	17	-	120	75	0.5	0.5	0.5	1.0	1.10
18580	11.9 - 18.0	18	-	140	62	0.5	0.5	0.5	1.0	1.10
19580	14.5 - 22.0	19	-	180	51	0.5	0.5	0.5	1.0	1.10
20580	17.6 - 26.7	20	-	220	42	0.75	0.5	0.75	1.2	1.10
21580	21.7 - 33.0	21	-	260	34	0.75	0.5	0.75	1.2	1.10
22580	26.4 - 40.1	22	-	320	28	0.75	0.5	0.75	1.2	1.10
23582	33.0 - 50.1	23	-	400	22	0.75	0.5	0.75	1.2	1.15
24582	39.3 - 59.7	24	-	500	19	0.75	0.5	0.75	1.2	1.15
25582	49.9 - 75.8	25	-	620	15	0.75	0.5	0.75	1.2	1.15
26582	60.5 - 92.0	26	-	740	12	1.0	0.5	0.75	1.5	1.15
27582	73.8 - 112	27	-	900	10	1.0	0.75	1.0	1.5	1.15
28582	92.3 - 140	28	-	1200	8	1.0	0.75	1.0	1.5	1.15
29582	114 - 173	29	-	1400	6	1.0	0.75	1.0	1.5	1.20
30582	145 - 220	30	-	1800	5	1.0	0.85	1.2	2.0	1.25
31582	172 - 261	31	-	2200	4	1.2	0.85	1.2	2.0	1.30
32582	220 - 330	32	-	2600	3	1.2	0.85	1.2	2.0	1.40
710582	260 - 400	-	710	-	'2.8'	1.5	1.0	1.5	2.5	1.60
570582	330 - 500	-	570	-	'2.2'	1.5	1.0	1.5	2.5	2.00

ORDERING INFORMATION
Model: attenuation value suffix; description Example: Model 22580-20 precision fixed 20 dB attenuator

For standard flange types and recommendations see pages 111 onwards

Calibrated Variable Attenuators
Series 020

NOW UP TO 500 GHz

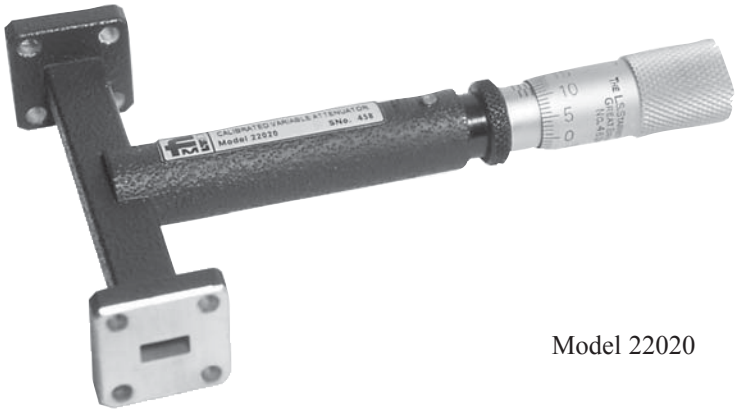
Features

- **Models from 1.72 GHz to 500 GHz**
- **0 dB - 30 dB Calibrated Attenuation Range**
- **Low VSWR**

Specifications:

Calibrated attenuation range	0 dB - 30 dB
500 GHz VSWR (maximum)	1.35 : 1

The Flann Series 020 of Calibrated Variable attenuators are fitted with astable precision attenuating elements driven across the waveguide section by a micrometer.



Model 22020

The micrometer drive is free from backlash, permitting attenuation calibration to a high accuracy. The micrometer is fitted with a locking device which enables the adjusting mechanism to be set and locked at any setting. The attenuating elements are constructed from an extremely stable ni-chromed glass composite.

On models 08020 to 24020 the vane is introduced transversely across the waveguide.

Models 25020 - 570020 have a vane introduced through a slot in the centre of the broad wall.

A calibration is provided at the centre band frequency unless otherwise specified.

Calibration at additional frequencies can be provided at extra cost.

Model	Frequency Range (GHz)	Waveguide			VSWR (Max)	Calibration Accuracy (±dB)	Calibration Frequency (GHz)	Maximum Insertion Loss (dB)	Maximum Power (Watts)
		WG	R	WR					
08020	1.72 - 2.61	8	22	430	1.07	0.2	2.17	0.2	4.0
10020	2.60 - 3.95	10	32	284	1.07	0.2	3.28	0.2	2.5
11A020	3.30 - 4.90	11A	40	229	1.07	0.2	4.10	0.2	2.0
12020	3.94 - 5.99	12	48	187	1.07	0.2	4.97	0.2	2.0
13020	4.64 - 7.05	13	58	159	1.07	0.2	5.85	0.2	2.0
14020	5.38 - 8.18	14	70	137	1.07	0.2	6.78	0.2	1.0
15020	6.58 - 10.0	15	84	112	1.07	0.2	8.29	0.2	1.0
16020	8.20 - 12.5	16	100	90	1.07	0.2	10.35	0.2	1.0
17020	9.84 - 15.0	17	120	75	1.07	0.2	12.42	0.2	0.75
18020	11.9 - 18.0	18	140	62	1.07	0.2	14.95	0.3	0.75
19020	14.5 - 22.0	19	180	51	1.07	0.3	18.25	0.3	0.75
20020	17.6 - 26.7	20	220	42	1.07	0.3	22.15	0.3	0.5
21020	21.7 - 33.0	21	260	34	1.07	0.3	27.35	0.3	0.5
22020	26.4 - 40.1	22	320	28	1.07	0.3	33.25	0.4	0.4
23020	33.0 - 50.1	23	400	22	1.07	0.4	41.55	0.5	0.35
24020	39.3 - 59.7	24	500	19	1.07	0.4	49.50	0.6	0.3
25020	49.9 - 75.8	25	620	15	1.07	0.5	62.85	0.5	0.25
26020	60.5 - 92.0	26	740	12	1.07	0.5	76.25	0.5	0.2
27020	73.8 - 112	27	900	10	1.07	0.75	92.9	0.9	0.15
28020	92.3 - 140	28	1200	8	1.07	1.0	116.2	1.0	0.12
29020	114 - 173	29	1400	6	1.1	1.3	130.0	1.2	0.1
30020	145 - 220	30	1800	5	1.12	1.0	182.5	1.3	0.08
31020	172 - 261	31	2200	4	1.14	1.0	216.5	1.5	0.06
32020	220 - 330	32	2600	3	1.18	1.25	273.5	1.7	0.05
710020	260 - 400	-	-	'2.8'	1.25	1.5	330	1.8	0.04
570020	330 - 500	-	-	'2.2'	1.35	2.0	415	2.0	0.03

Calibrated Variable Attenuators
Series 020

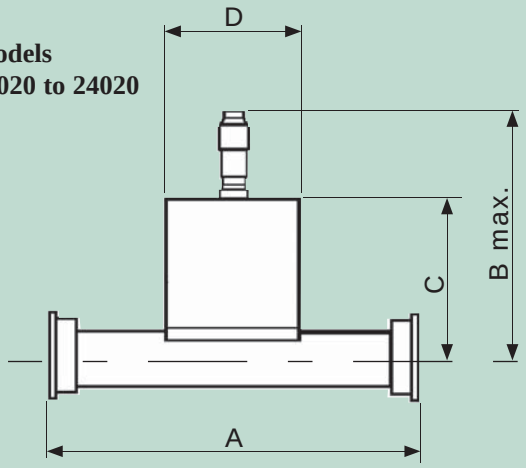
NOW UP TO 500 GHz

Model	Dimensions (mm)			
	A	B Max	C	D
10020	430	223	138	151
11A020	380	217	132	151

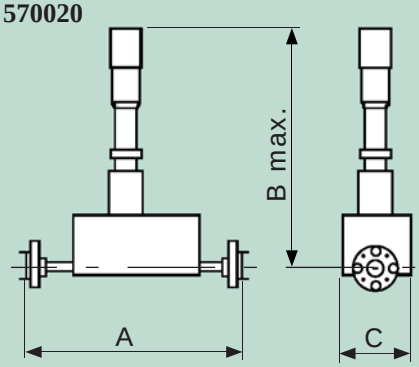
Model	Dimensions (mm)			
	A	B Max	C	Dia D
12020	370	145	92	86
13020	340	141	89	86
14020	310	138	86	64
15020	240	132	83	64
16020	180	127	79	64
17020	180	125	78	64
18020	150	100	54	35
19020	125	97	52	35
20020	80	95	51	35
21020	80	94	50	35
22020	70	100	56	12.7
23020	70	99	55	12.7
24020	70	98	55	12.7

Model	Dimensions (mm)		
	A	B	C
25020	90	96	30
26020	90	96	30
27020	90	96	30
28020	60	96	30
29020	60	96	30
30020	30	96	30
31020	30	96	30
32020	30	96	30
710020	20	96	30
570020	20	96	30

Models
08020 to 24020



Models
25020 to 570020



ORDERING INFORMATION
Model: description, calibration frequency (if different from centre band)
Example: Model 18020 calibrated variable attenuator, calibration frequency 14 GHz

Series 020

For standard flange types and recommendations see pages 111 onwards

Fixed Attenuators
Series 081

Features

- **Full Waveguide Band**
- **Low Frequency Sensitivity**

The fixed attenuators, Series 081, are low VSWR devices suitable for operating over the full waveguide band.

For most models the variation of attenuation with frequency, over the operational frequency range, is typically 10% of the nominal attenuation value.

Standard models are available in a range of attenuation values from 3 dB to 30 dB. Units with attenuation values of 40 dB and 50 dB are available to special order. Higher attenuation values can also be accommodated - details on request.

Model 26081-06

Specifications:
Attenuation sensitivity (dB) over the operational frequency range - 10% of nominal attenuation value.

Model	Frequency Range (GHz)	Waveguide			VSWR (better than)		Flange to Flange length (mm)
		WG	R	WR	Models 3 to 25 dB	Models >30 dB	
12081	3.94 - 5.99	15	48	187	1.10	1.20	229
14081	5.38 - 8.18	14	70	137	1.10	1.20	280
15081	6.58 - 10.0	15	84	112	1.10	1.20	180
16081	8.20 - 12.5	16	100	90	1.10	1.20	130
17081	9.84 - 15.0	17	120	75	1.10	1.20	120
18081	11.9 - 18.0	18	140	62	1.10	1.20	120
19081	14.5 - 22.0	19	180	51	1.10	12.0	110
20081	17.6 - 26.7	20	220	42	1.10	1.20	76
21081	21.7 - 33.0	21	260	34	1.10	1.20	76
22081	26.4 - 40.1	22	320	28	1.10	1.20	70
23081	33.0 - 50.1	23	400	22	1.10	1.20	70
24081	39.3 - 59.7	24	500	19	1.10	1.20	70
25081	49.9 - 75.8	25	620	15	1.10	1.20	60
26081	60.5 - 92.0	26	740	12	1.10	1.20	50
27081	73.8 - 112	27	900	10	1.10	1.20	50
28081	92.3 - 140	28	1200	8	1.10	1.20	50

See Series 580/582 or Series 020 for higher frequency models to 500 GHz

Standard Attenuation Values	Suffix
3 dB	**03**
6 dB	**06**
10 dB	**10**
20 dB	**20**
30 dB	**30**

ORDERING INFORMATION
Model: attenuation value suffix; description
Example: Model 26081-06 fixed attenuator

OTHER ATTENUATION VALUES ARE AVAILABLE TO ORDER

Series 081

For standard flange types and recommendations see pages 111 onwards

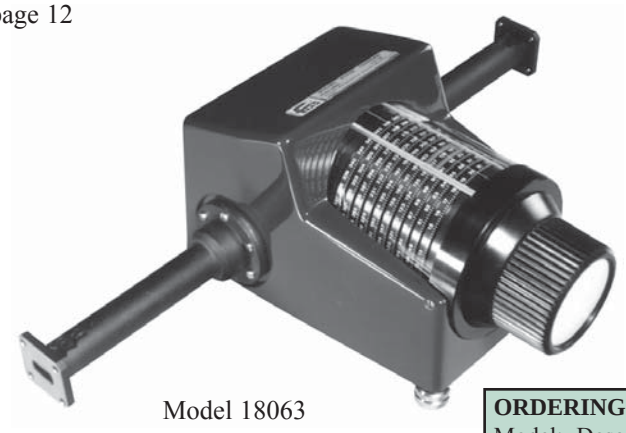
Rotary Vane Phase Changers
Series 063

NOW UP TO 330 GHz

For Programmable Rotary Phase Changers see page 12

Features

- Direct Reading
- 0˚ – 360˚ Continuous Phase Change
- High Repeatability
- Low Insertion Loss



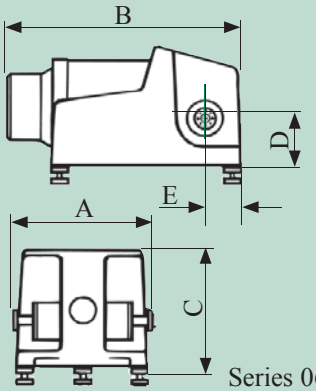
Model 18063

The Flann Series 063 of instruments facilitates the continuous control of phase change over the range 0˚ to 360˚. A ten turn drum scale is linearly calibrated in degrees and indicates differential phase change to a smallest increment of 0.2˚.

The rotary vane phase changer consists of a pair of rectangular to circular, stepped or tapered, electroformed transitions providing good VSWR whilst ensuring minimal overall length. Each transition incorporates a mode suppression vane and dielectric quarter wave plate.

The differential phase change is determined by the relative angular position of the dielectric half wave plate housed in the rotating circular waveguide section. The Rotary Vane Phase Changer is direct reading and frequency insensitive making it suitable for use in microwave bridges and precise phase change measurements.

ORDERING INFORMATION
Model: Description
Example: Model 23063 Rotary Vane Phase Changer



Model	Frequency Range (GHz)	Waveguide			Accuracy	Maximum Insertion Loss (dB)	VSWR (better than)	Maximum Power (Watts)	Dimensions (mm)				
		WG	R	WR					A	B	C	D	E
08063	1.72 - 2.61	8	22	430	3˚	1.0	1.25	15	ON REQUEST				
10063	2.60 - 3.95	10	32	430	3˚	1.0	1.25	15	1375	358	198	88.2*	108
11A063	3.30 - 4.90	11A	40	229	3˚	1.0	1.25	15	991	340	153	81.2*	85
12063	3.94 - 5.99	12	48	187	3˚	1.0	1.25	10	777	244	147	66/75	58
13063	4.64 - 7.05	13	58	159	3˚	1.0	1.25	10	750	244	147	66/75	58
14063	5.38 - 8.18	14	70	137	3˚	1.0	1.25	10	680	244	147	66/75	58
15063	6.58 - 10.0	15	84	112	3˚	1.0	1.25	10	620	226	117	45/54	44
16063	8.20 - 12.5	16	100	90	3˚	1.0	1.25	10	496	226	117	45/54	44
17063	9.84 - 15.0	17	120	75	3˚	1.0	1.25	5	446	226	117	45/54	44
18063	11.9 - 18.0	18	140	62	4˚	1.0	1.30	5	388	226	117	45/54	44
19063	14.5 - 22.0	19	180	51	4˚	1.0	1.30	4	388	226	117	45/54	44
20063	17.6 - 26.7	20	220	42	4˚	1.0	1.30	3	378	226	117	45/54	44
21063	21.7 - 33.0	21	260	34	4˚	1.0	1.30	2.5	335	226	117	45/54	44
22063	26.4 - 40.1	22	320	28	4˚	1.0	1.30	2.0	230	227	117	55/64	36
23063	33.0 - 50.1	23	400	22	4˚	1.0	1.30	1.5	196	227	117	55/64	36
24063	39.3 - 59.7	24	500	19	4˚	1.5	1.30	1.0	184	227	117	55/64	36
25063	49.9 - 75.8	25	620	15	5˚	1.5	1.30	0.7	156	227	117	55/64	36
26063	60.5 - 92.0	26	740	12	5˚	2.0	1.30	0.5	136	227	117	55/64	36
27063	73.8 - 112	27	900	10	6˚	2.5	1.30	0.2	119	227	117	55/64	36
28063	92.3 - 140	28	1200	8	6˚	2.5	1.50	0.2	119	227	117	55/64	36
29063	114 - 173	29	1400	6	Specifications available on request				Dimensions available on request				
30063	145 - 220	30	1800	5									
31063	172 - 261	31	2200	4									
32063	220 - 330	32	2600	3									

For standard flange types and recommendations see pages 111 onwards

* Non adjustable mounting feet

Calibrated Phase Changers
Series 060 / 061

NOW UP TO 330 GHz

Features

- **0˚ – 180˚ Calibrated Phase Change Range**
- **Low Insertion Loss**

The Flann Series 060 / 061 instruments are fitted with low VSWR dielectric elements coupled to a precision micrometer drive. The micrometer indicates the relative position of the dielectric element in the waveguide. All models provide a minimum of 180 degrees phase change and exhibit a very low insertion loss. The micrometer is fitted with a locking device which enables the adjusting mechanism to be locked at any setting. Two calibrations are provided at standard frequencies within each waveguide band. Alternatively the two calibration frequencies may be specified by the customer.

In the standard models 06060 to 22060 the dielectric element is introduced into the waveguide in a transverse manner. The standard 060 series instruments do not cover the top 15% of the waveguide frequency band.

Model 20060

When full band coverage is essential special models can be supplied at extra cost and are designated the 061 Series. For example, model 18061 is a full band model covering the frequency range 11.9 GHz to 18.0 GHz. Models 06061 to 22061 have VSWR better than 1.3:1 over the full waveguide band.

Models in the waveguide sizes WG23 (WR22) to WG32 (WR8) introduce the dielectric element into the waveguide via a slot on the centre line of the broad wall and are suitable for the full band operation as standard.

*** For full waveguide band coverage order Model 061.**

Model	Frequency Range (GHz)	Waveguide			VSWR (better than)	Calibration Accuracy	Standard Calibration Frequencies (GHz)	
		WG	R	WR				
06060*	1.14 - 1.73	6	14	650	1.1	**2˚**	1.34	1.53
08060*	1.72 - 2.61	8	22	430	1.1	**2˚**	2.02	2.31
10060*	2.60 - 3.95	10	32	284	1.1	**2˚**	3.05	3.50
11A060*	3.30 - 4.90	11A	40	229	1.1	**2˚**	3.83	4.37
12060*	3.94 - 5.99	12	48	187	1.1	**2˚**	4.62	5.31
13060*	4.64 - 7.05	13	58	159	1.1	**2˚**	5.44	6.25
14060*	5.38 - 8.18	14	70	13	1.1	**2˚**	6.31	7.25
15060*	6.58 - 10.0	15	84	112	1.1	**2˚**	7.72	8.86
16060*	8.20 - 12.5	16	100	90	1.1	**2˚**	9.63	11.07
17060*	9.84 - 15.0	17	120	75	1.1	**2˚**	11.56	13.28
18060*	11.9 - 18.0	18	140	62	1.1	**2˚**	13.93	15.97
19060*	14.5 - 22.0	19	180	51	1.1	**2˚**	17.00	19.50
20060*	17.6 - 26.7	20	220	42	1.15	**2˚**	20.63	23.67
21060*	21.7 - 33.0	21	260	34	1.15	**3˚**	25.46	29.23
22060*	26.4 - 40.1	22	320	28	1.15	**3˚**	30.97	35.53
23061	33.0 - 50.1	23	400	22	1.15	**3˚**	38.70	44.40
24061	39.3 - 59.7	24	500	19	1.15	**3˚**	46.10	52.90
25061	49.9 - 75.8	25	620	15	1.25	**3˚**	58.53	67.17
26061	60.5 - 92.0	26	740	12	1.25	**3˚**	71.00	81.50
27061	73.8 - 112	27	900	10	1.25	**3˚**	85.87	97.93
28061	92.3 - 140	28	1200	8	1.25	**3˚**	108.20	124.1
29061	114 - 173	29	1400	6	Specifications available on request			
30061	145 - 220	30	1800	5				
31061	172 - 261	31	2200	4				
32061	220 - 330	32	2600	3				

NOW UP TO 330 GHz

Outline Dimensions

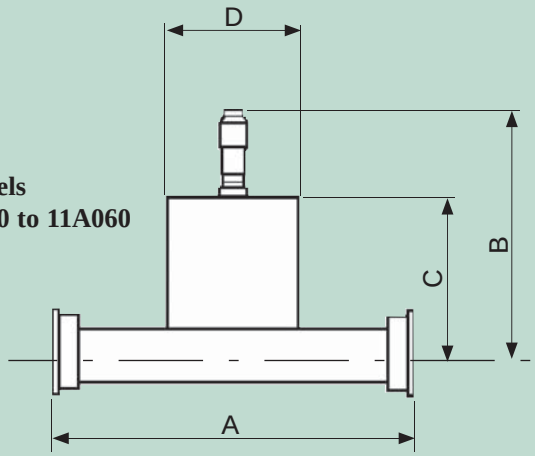
Model	Dimensions (mm)			
	A	B Max	C	D
06060	1250	372	216	400
08060	850	242	157	151
10060	480	223	138	151
11A060	450	217	132	151

Model	Dimensions (mm)			
	A	B Max	C	Dia D
12060	370	145	92	86
13060	340	141	89	86
14060	310	138	86	64
15060	240	132	83	64
16060	180	127	79	64
17060	180	125	78	64
18060	150	100	54	35
19060	125	97	52	35
20060	80	95	51	35
22060	70	100	49	12

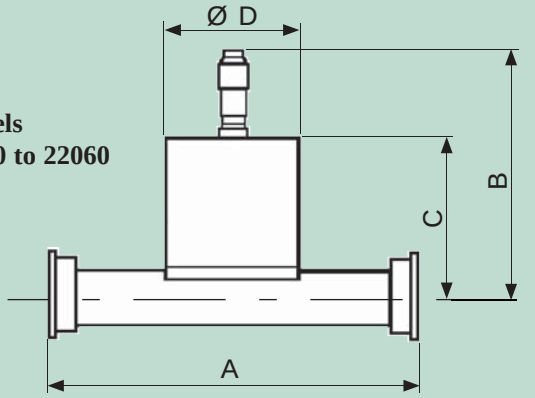
Model	Dimensions (mm)		
	A	B Max	C
23061	90	96	30
24061	90	96	30
25061	90	96	30
26061	90	96	30
27061	90	96	30
28061	90	96	30
29061	Dimensions available on request		
30061			
31061			
32061			

ORDERING INFORMATION
Model: Description
Example: Model 13060 Calibrated Phase Changer
The Full waveguide band model would be 13061

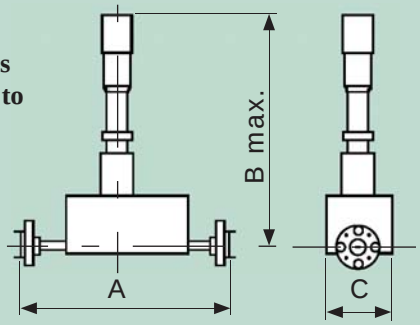
Models 06060 to 11A060



Models 12060 to 22060



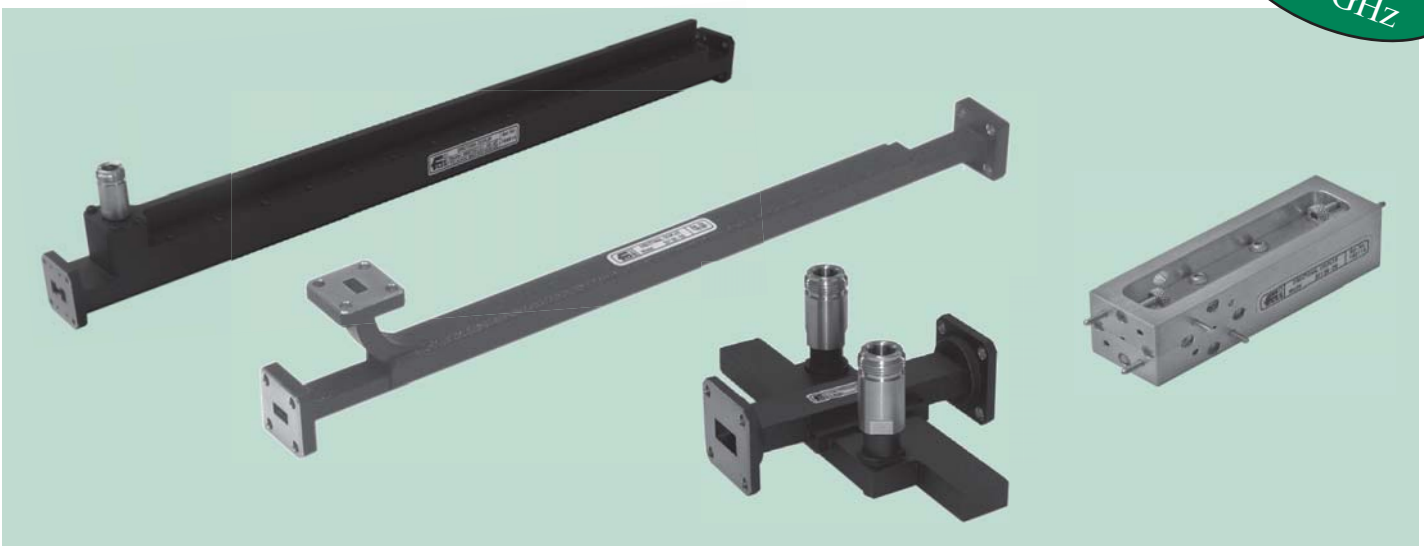
Models 23061 to 28061



Series 060/061

Couplers
Selection Guide

NOW UP TO 330 GHz

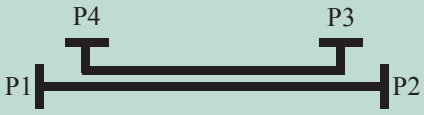


OPTIONS AVAILABLE:

Multihole Directional Couplers
General Information

Flann Directional Couplers have many applications:
it is important that their capabilities and specifications are understood.

Consider the 4 port directional coupler illustrated schematically.



Four Port Directional Coupler Schematic

For the purpose of this analysis if P1 is the power incident at Port 1 then the output powers at Ports 2, 3 and 4 are P2, P3 and P4 respectively. If P2' is the power incident at Port 2 then P1', P3' and P4' are the output powers at Ports 1, 3 and 4 respectively.

The three most important parameters in the specification of directional coupler performance are Coupling, Directivity and Through Loss which can be defined as follows:-

Coupling (dB) = *10 log (P1/P3)* .....(1)
or = *10 log (P2'/P4')*
Directivity (dB) = *10 log (P3/P4)*
or = *10 log (P4'/P3')*
Through Loss (dB) = *10 log (P1/P2)* .....(2)
or = *10 log (P2'/P1')*

In determining the above expressions, unused ports should be terminated with reflectionless loads.

A parameter referred to as Isolation is sometimes used when characterising directional couplers where:-

Isolation (dB) = *10 log (P1/P4)*
or = *10 log (P2'/P3')*

It can be shown that:-

Isolation (dB) = Coupling (dB) + Directivity (dB)

This must be borne in mind whilst comparing the specifications from other manufacturers. For a matched coupler in low loss waveguide the main arm through power, P2, is equal to the input power minus the powers coupled to the secondary arm,

i.e. $P2 = P1 - (P3 + P4)$
or $P1' = P2' - (P4' + P3')$

For a high directivity coupler P4 and P3' are negligible, hence:-

$P2 = P1 - P3$
or $P1' = P2' - P4'$

also

Through Loss (dB) = *10 log (P1/(P1 - P3))*
or = *10 log (P2/(p2' - P4'))*

The table shows, for power incident at Port 1 only, the percentage powers at Ports 2 and 3 and Through Loss for a matched high-directivity coupler of negligible waveguide loss. At lower frequencies waveguide absorption losses are small. However at millimetric frequencies absorption losses are significant and affect the measured performance of couplers. If the power absorbed within the coupler is Pa then the through loss in dB can be defined as:-

Through loss = 10 log (P1/(P1 - P3 - Pa).....(3) assuming P4<<P3 (ie high directivity).

Consider a 3 dB coupler with an absorption loss of 0.5 dB. If engineered to have a coupling of 3 dB, as in expression (1), 50.11% of the input power at Port 1 is coupled to Port 3. By using expression (3) it can be shown that an absorption loss of 0.5 dB represents 10.875% of the input power, thus effectively reducing the power at Port 2 to 39.01%. This represents a Through Loss of 4.09 dB.

The table also illustrates the effect of an absorption loss of 0.1 dB and 0.25 dB on the relative powers at Ports 2 and 3:- the coupling value of Flann directional couplers is the true value as defined in the expression (1) above. Millimetre band models must be used with the understanding that there is an additional main guide loss.

The Directivity of a coupler is essentially dependent on the following factors:-
(i) The design of coupling structure and the accuracy to which it can be manufactured.
(ii) The inherent VSWR of the coupler's internal termination (3 port devices).
(iii) Discontinuities and perturbations in the waveguide.
(iv) The dimensional accuracy of the waveguide at the measurement port.
In four port couplers the VSWR of the bends in the secondary arm are often the most significant factor limiting directivity performance. For example a 4 port coupler with a 1.05 VSWR bend in the secondary arm will give, at best, a 32.2 dB directivity.

Flann directional couplers have specified directivities which include the interface at the measurement port when connected to an ideal termination. It is important when making comparisons that users should enquire whether alternative manufacturers have also followed similar test procedures when quoting performance. *It is not uncommon that when measuring directivity, terminations are inserted into the measuring port's terminal flange.* ***This is not a Flann recommended procedure.***

The terms used in Flann Directional Coupler specifications are:-

Nominal Coupling Accuracy

This is the mean coupling value expressed as a percentage of the Nominal Coupling. For example a 10 dB coupler which has a specified Nominal Coupling Accuracy of 5% could have a mean coupling value within the limits 9.5 to 10.5 dB.

Coupling Sensitivity

This is the variation of actual coupling about the mean coupling value over the specified operating frequency band. For example the actual coupling value of a nominal 9.6 dB coupler could vary from 9.1 to 10.1 dB over the specified frequency range.

Directivity

The directivity of a directional coupler is the ratio, in dB, of the power in the forward direction of the secondary guide to that in the reverse direction of the secondary guide when the primary guide is fed only in the forward direction.
i.e. Directivity (dB) = $10 \log_{10} (P_3/P_4)$ when signal is input to P_1 only.

Coupling (dB)	% Power at Port 3	Waveguide Absorption Loss							
		0 dB @ 5 GHz		0.1 dB @ 25 GHz		0.25 dB @ 65 GHz		0.5 dB @ 140 GHz	
		% Power at Port 2	Through Loss (dB)	% Power at Port 2	Through Loss (dB)	% Power at Port 2	Through Loss (dB)	% Power at Port 2	Through Loss (dB)
3	50.1	49.0	3.02	47.60	3.22	44.29	3.54	39.01	4.09
6	25.1	74.9	1.26	72.60	1.39	69.29	1.59	64.01	1.94
10	10.0	90.0	0.46	87.72	0.57	84.41	0.74	79.13	1.02
20	1.09	9.0	0.044	96.72	0.14	93.41	0.30	88.13	0.55
30	0.1	99.9	0.044	97.62	0.10	94.31	0.255	89.03	0.505
40	0.01	99.99	0.0004	97.71	0.10	94.40	0.250	89.12	0.500

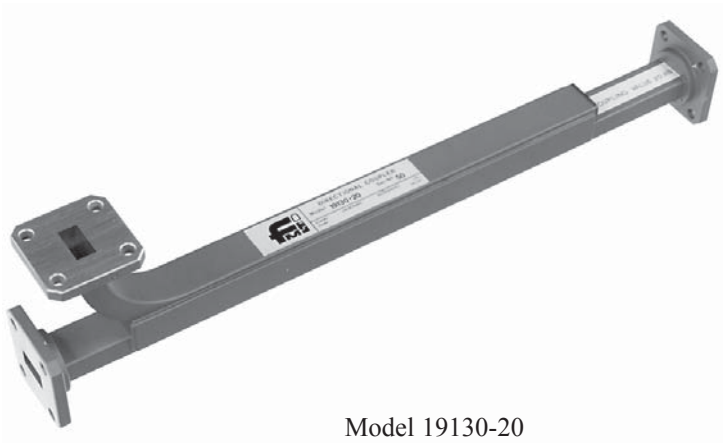
Multihole Directional Couplers
Series 130

Features

- **Systems Grade**
- **Ideal For Power / Frequency Sampling & Monitoring**

The Flann series 130 of multihole directional couplers provides the user with a measurement facility over the entire waveguide frequency range at very modest cost.

These couplers have a good directivity performance whilst retaining the minimal frequency sensitivity associated with higher quality units. The standard coupling values are 10 dB and 20 dB.



Model 19130-20

IMPORTANT! *All directivities quoted include the measuring port and flange performance when connected to an ideal termination.*

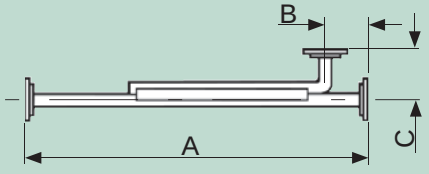
Specifications:

Model	Frequency Range (GHz)	Waveguide			Minimum Directivity (dB)	Coupling (10 dB &20 dB)		Primary Arm VSWR	Secondary Arm VSWR
		WG	R	WR		Sensitivity (± dB)	Nominal Accuracy (dB)		
10130	2.60 - 3.95	10	32	284	35	0.5	5%	1.03	1.10
11A130	3.30 - 4.90	11A	40	229	35	0.5	5%	1.03	1.10
12130	3.94 - 5.99	12	48	187	35	0.5	5%	1.03	1.10
13130	4.64 - 7.05	13	58	159	35	0.5	5%	1.03	1.10
14130	5.38 - 8.18	14	70	137	35	0.5	5%	1.03	1.10
15130	6.58 - 10.0	15	84	112	35	0.5	5%	1.03	1.10
16130	8.20 - 12.5	16	100	90	35	0.5	5%	1.03	1.10
17130	9.84 - 15.0	17	120	75	35	0.5	5%	1.03	1.10
18130	11.9 - 18.0	18	140	62	35	0.5	5%	1.03	1.10
19130	14.5 - 22.0	19	180	51	33	0.5	5%	1.03	1.10
20130	17.6 - 26.7	20	220	42	33	0.75	7%	1.03	1.20
21130	21.7 - 33.0	21	260	34	33	0.75	7%	1.03	1.20
22130	26.4 - 40.1	22	320	28	33	0.75	7%	1.03	1.20

Model	Dimensions (mm)				Weight (kg)	
	A		B	C		
	10 dB	20 dB			10 dB	20 dB
10130	1215	1029	85	130	10.6	8.0
11A130	965	817	70	100	5.7	4.6
12130	853	733	60	90	4.3	3.0
13130	785	676	55	75	3.5	2.6
14130	706	615	50	60	2.6	2.2
15130	534	460	35	50	1.5	1.3
16130	476	417	35	45	1.0	0.8
17130	387	338	35	40	0.8	0.6
18130	340	298	30	35	0.5	0.4
19130	300	262	30	35	0.4	0.3
20130	228	201	25	25	0.18	0.16
21130	215	194	25	25	0.18	0.16
22130	180	162	24	29	0.16	0.14

ORDERING INFORMATION
Model: Coupling Value Suffix; Description
Example: Model 10130-10 Multihole Directional Coupler 10 dB coupling Directivity >35 dB

Coupling Values	Suffix
10 dB	**10**
20 dB	**20**



Series 130

Multihole Directional Couplers
Series 131

Features

- **High Directivity**
- **Models from 2.6 GHz to 40.1 GHz**

The Flann Series 131 Directional Couplers are suitable where high quality is to be incorporated at moderate cost.

A high directivity is offered in all waveguide sizes within the frequency range 2.6 GHz to 40.1 GHz. The standard coupling values are 3, 10 and 20 dB, other values for example 6, 30 and 40 dB can be supplied.

IMPORTANT! *All directivities quoted include the measuring port and flange performance when connected to an ideal termination.*

4 port couplers can be supplied to order, however the directivity will be less than for 3 port units.

Model 18131-10

Specifications:

Model	Frequency Range (GHz)	Waveguide			Minimum Directivity (dB)	Coupling (3, 10 & 20 dB)		Additional Primary Arm Loss (dB)	Primary Arm VSWR *	Secondary Arm VSWR
		WG	R	WR		Sensitivity (±dB)	Nominal Accuracy (dB)**			
10131	2.60 - 3.95	10	32	284	40	0.5	5%	Not Applicable	1.03	1.10
11A131	3.30 - 4.90	11A	40	229	40	0.5	5%		1.03	1.10
12131	3.94 - 5.99	12	48	187	40	0.5	5%		1.03	1.10
13131	4.64 - 7.05	13	58	159	40	0.5	5%		1.03	1.10
14131	5.38 - 8.18	14	70	137	40	0.5	5%		1.03	1.10
15131	6.58 - 10.0	15	84	112	40	0.5	5%		1.03	1.10
16131	8.20 - 12.5	16	100	90	40	0.5	5%		1.03	1.10
17131	9.84 - 15.0	17	120	75	40	0.5	5%		1.03	1.10
18131	11.9 - 18.0	18	140	62	40	0.5	5%		1.03	1.10
19131	14.5 - 22.0	19	180	51	40	0.5	5%		1.03	1.10
20131	17.6 - 26.7	20	220	42	43	0.75	7%	0.3	1.03	1.10
21131	21.7 - 33.0	21	260	34	43	0.75	7%	0.4	1.03	1.10
22131	26.4 - 40.1	22	320	28	43	0.75	7%	0.5	1.03	1.10

New **See Series 136 for higher frequency models up to 330 GHz.**

* Primary arm VSWR specification is 1.10:1 for all 3 dB couplers
** Nominal coupling accuracy for 3 dB and 6 dB couplers is ± 0.5 dB.

See overleaf for dimensions and ordering information.

Outline Dimensions

Model	Dimensions (mm)					Weight (kg)		
	A			B	C			
	3 dB	10 dB	20 dB			3 dB	10 dB	20 dB
10131	On request	1215	1029	85	130	On request	10.6	8.0
11A131	1432	965	817	70	100	8.4	5.7	4.6
12131	1233	853	733	60	90	6.2	4.3	3.0
13131	1108	785	676	55	75	4.7	3.3	2.6
14131	991	706	615	50	60	3.7	2.6	2.2
15131	766	534	460	35	50	2.0	1.5	1.3
16131	658	476	417	35	45	1.3	1.0	0.8
17131	538	387	338	35	40	1.0	0.8	0.6
18131	465	340	298	30	35	1.0	0.8	0.6
19131	397	300	262	30	35	0.4	0.4	0.3
20131	314	228	201	25	25	0.25	0.18	0.16
21131	284	215	194	25	25	0.25	0.18	0.16
22131	237	180	162	24	29	0.20	0.16	0.14

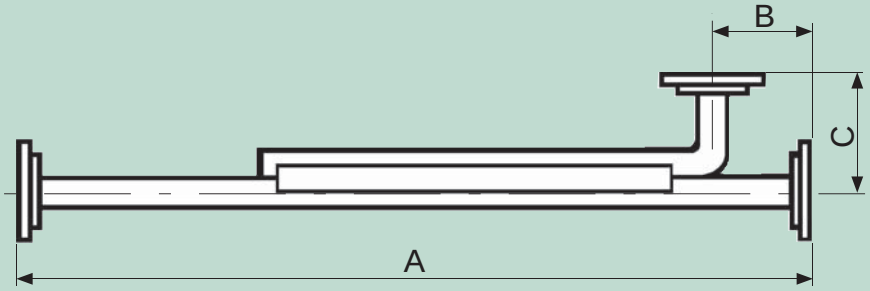
ORDERING INFORMATION
Model: Coupling Value Suffix; Description
Example: Model 10131-20 Multihole Directional Coupler Directivity >40 dB, 20 dB coupling

Note:
If a 4 port coupler is required, add 4P to the ordering code: For example 18131-20-4P. Please note that the directivity will be reduced by approximately 8 dB for 4 port couplers.

Standard Coupling Values	Suffix
3 dB	**03**
10 dB	**10**
20 dB	**20**

Other Coupling Values	Suffix
6 dB	**06**
30 dB	**30**
40 dB	**40**

Dimensions & Weights upon request



Series 131

For standard flange types and recommendations see pages 111 onwards

Double Ridge Couplers
Series WRD131

Features

- **Directivity > 40 dB - a new industry standard**
- **Flat Coupling Response**
- **Models up to 40 GHz**
- **Coupling values from 10 dB to 50 dB**

Flann has developed a new range of double ridge multihole coupler for standard double ridge waveguide sizes and tailored to any special bandwidth requirements.

Our unique design of the coupler array combined with precision machining practice provides better than 40 dB directivity full band with typical directivities better than 45 dB achieved.

Flann is now able to provide a service to make any standard or non-standard type of coupler within the constraints of commercial viability.

We are now able to offer the industry's only 40 dB directivity coupler with a full band coupling flatness of less than +/-1 dB.

All double ridge couplers are available in nominal coupling values from 10 dB to 50 dB.

Specifications:

Model	Frequency Range (GHz)	Waveguide Size	Minimum Directivity dB	Coupling Sensitivity ± dB	Primary Arm VSWR (better than)	Secondary VSWR (better than)
WRD200131	2.0 - 4.8	WRD200D24	40	0.8	1.1	1.35
WRD350131	3.5 - 8.2	WRD350D24	40	0.8	1.1	1.35
WRD475131	4.75 - 11.0	WRD475D24	40	0.8	1.1	1.35
WRD580131	5.8 - 16.0	WRD580D28	40	0.8	1.1	1.35
WRD650131	6.5 - 18.0	WRD650D28	40	0.8	1.1	1.35
WRD750131	7.5 - 18.0	WRD750D24	40	0.8	1.1	1.35
WRD110131	11.0 - 26.5	WRD110C24	35	0.8	1.1	1.35
WRD180131	18.0 - 40.0	WRD180C24	35	0.8	1.1	1.35

Options Include:

- **Higher Directivity**
- **Ultra Flat Coupling**
- **Improved Secondary Arm VSWR**
- **SMA and N Type Connectors**

ORDERING INFORMATION

Please contact our Sales Team for more details.

Model: Coupling value suffix; description
Example Model WRD650131-10 Double ridge multihole coupler, 10 dB coupling, 40 dB directivity

Series WRD131

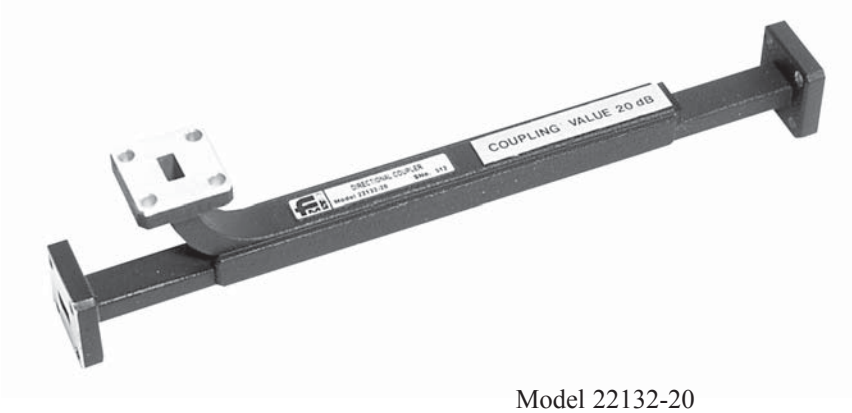
Multihole Directional Couplers
Series 132

Features

- **46 dB High Directivity**
- **Models up to 40.1 GHz**
- **Low Coupling Sensitivity**

The Flann Series 132 directional couplers provide a very high directivity and have been designed for use in quality waveguide measurement systems within the frequency range 3.3 GHz to 40.1 GHz.

The configuration is of a 3 port instrument incorporating a built-in low reflection termination. The coupling array is designed to achieve low sensitivity of coupling versus frequency whilst maintaining main arm VSWR. The standard coupling values are 3, 10 and 20 dB for each waveguide size. Other values can be supplied, for example 6, 30 and 40 dB.



Model 22132-20

IMPORTANT! *All directivities quoted include the measuring port and flange performance when connected to an ideal termination.*

Specifications:

Model	Frequency Range (GHz)	Waveguide			Minimum Directivity (dB)	Coupling (3, 10 & 20 dB)		Additional Primary Arm Loss (dB)	Primary Arm VSWR*	Secondary Arm VSWR
		WG	R	WR		Sensitivity (±dB)	Nominal Accuracy (dB)**			
10132	2.60 - 3.95	10	32	284	35	0.5	5%	N/A	1.03	1.10
11A132	3.30 - 4.90	11A	40	229	46	0.5	5%	N/A	1.03	1.10
12132	3.94 - 5.99	12	48	187	46	0.5	5%	N/A	1.03	1.10
13132	4.64 - 7.05	13	58	159	46	0.5	5%	N/A	1.03	1.10
14132	5.38 - 8.18	14	70	137	46	0.5	5%	N/A	1.03	1.10
15132	6.58 - 10.0	15	84	112	46	0.5	5%	N/A	1.03	1.10
16132	8.20 - 12.5	16	100	90	46	0.5	5%	N/A	1.03	1.10
17132	9.84 - 15.0	17	120	75	43	0.5	5%	N/A	1.03	1.10
18132	11.9 - 18.0	18	140	62	43	0.5	5%	N/A	1.03	1.10
19132	14.5 - 22.0	19	180	51	43	0.5	5%	0.2	1.03	1.10
20132	17.6 - 26.7	20	220	42	43	0.75	7%	0.3	1.03	1.20
21132	21.7 - 33.0	21	260	34	43	0.75	7%	0.4	1.03	1.20
22132	26.4 - 40.1	22	320	28	43	0.75	7%	0.5	1.03	1.20

New **See Series 137 for higher frequency models up to 330 GHz.**

* Primary arm VSWR specification is 1.10:1 for all 3 dB couplers.
** Nominal coupling accuracy for 3 dB and 6 dB couplers is ± 0.5 dB.
Please refer to page 26 for definitions of Flann coupler specifications.

See overleaf for dimensions and ordering information.

Outline Dimensions

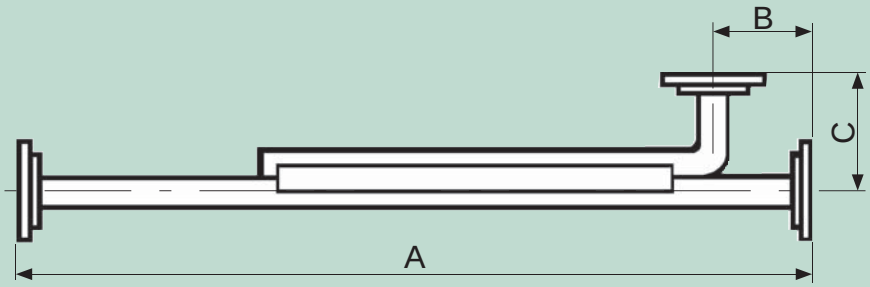
Model	Dimensions (mm)					Weight (kg)		
	A			B	C	3 dB	10 dB	20 dB
	3 dB	10 dB	20 dB					
10132	On request	1215	1029	85	130	On request	10.6	8.0
11A132	1432	965	817	70	100	8.4	5.7	4.6
12132	1233	853	733	60	90	6.2	4.3	3.0
13132	1108	785	676	55	75	4.7	3.3	2.6
14132	991	706	615	50	60	3.7	2.6	2.2
15132	766	534	460	35	50	2.0	1.5	1.3
16132	658	476	417	35	45	1.3	1.0	0.8
17132	538	387	338	35	40	1.0	0.8	0.6
18132	465	340	298	30	35	1.0	0.8	0.6
19132	397	300	262	30	35	0.4	0.4	0.3
20132	314	228	201	25	25	0.25	0.18	0.16
21132	284	215	194	25	25	0.25	0.18	0.16
22132	237	180	162	24	29	0.20	0.16	0.14

ORDERING INFORMATION
Model: coupling value suffix; description
Example: Model 16132-03 multihole directional coupler 03 dB coupling, directivity >46 dB

Standard Coupling Values	Suffix
3 dB	**03**
10 dB	**10**
20 dB	**20**

Other Coupling Values	Suffix
6 dB	**06**
30 dB	**30**
40 dB	**40**

Dimensions & Weights upon request



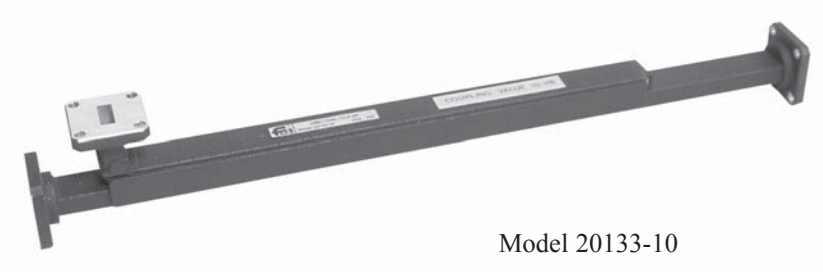
Series 132

For standard flange types and recommendations see pages 111 onwards

Multihole Directional Couplers
Series 133

Features

- **50 dB Directivity**
- **Low Coupling Sensitivity**



Model 20133-10

The Flann Series 133 of ultra-high directivity multihole couplers has been developed principally for laboratory applications involving network analyser or reflectometer systems.

The couplers are a 3 port design with an extremely low reflection termination built into the fourth arm. The standard coupling values are 10 dB and 20 dB.

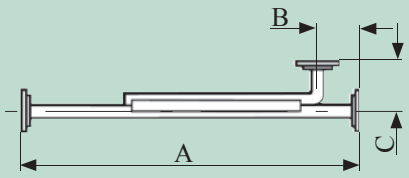
IMPORTANT! *All directivities quoted include the measuring port and flange performance when connected to an ideal termination.*

Specifications:

Model	Frequency Range (GHz)	Waveguide			Minimum Directivity (dB)	Coupling (10 dB & 20 dB)		Primary Arm VSWR	Secondary Arm VSWR
		WG	R	WR		Sensitivity (± dB)	Nominal Accuracy (dB)		
11A133	3.30 - 4.90	11A	40	229	50	0.5	5%	1.03	1.10
12133	3.94 - 5.99	12	48	187	50	0.5	5%	1.03	1.10
13133	4.64 - 7.05	13	58	159	50	0.5	5%	1.03	1.10
14133	5.38 - 8.18	14	70	137	50	0.5	5%	1.03	1.10
15133	6.58 - 10.0	15	84	112	50	0.5	5%	1.03	1.10
16133	8.20 - 12.5	16	100	90	50	0.5	5%	1.03	1.10
17133	9.84 - 15.0	17	120	75	50	0.5	5%	1.03	1.10
18133	11.9 - 18.0	18	140	62	48	0.5	5%	1.03	1.10
19133	14.5 - 22.0	19	180	51	48	0.5	5%	1.03	1.10
20133	17.6 - 26.7	20	220	42	46	0.75	7%	1.03	1.20
21133	21.7 - 33.0	21	260	34	46	0.75	7%	1.03	1.20
22133	26.4 - 40.1	22	320	28	46	0.75	7%	1.03	1.20

Model	Dimensions (mm)				Weight (kg)
	A		B	C	
	10 dB	20 dB			
11A133	1044	1044	70	100	6.0
12133	920	920	60	90	5.0
13133	802	802	55	75	2.5
14133	765	765	50	60	3.0
15133	620	620	35	50	1.8
16133	528	528	35	45	1.1
17133	427	427	35	40	0.85
18133	356	356	30	35	0.50
19133	330	330	30	35	0.40
20133	250	250	25	25	0.20
21133	235	235	25	25	0.20
22133	180	180	24	29	0.18

ORDERING INFORMATION
Model: coupling value suffix; description
Example: Model 14133-20 multihole directional coupler 20 dB coupling, directivity >50 dB



Series 133

Note: Please refer to page 26 for definitions of Flann coupler specifications.

Multihole Directional Couplers
Series 136 / 137

NEW !

Features

- **High Directivity - up to 40 dB (Series 136)**
- **Very High Directivity - up to 44 dB (Series 137)**
- **Models from 33.0 GHz to 500 GHz**

Applications

- **Power Sensing**
- **Network Analyser**
- **Reflectometer Systems**

The Flann Series 136 / 137 Split Block Directional Couplers offer exceptional directivity at higher frequencies.

Series 136, high directivity and Series 137, very high directivity, are offered in all waveguide sizes within the frequency range 33.0 GHz to 500 GHz. The standard coupling values are 3, 10 and 20 dB, other values, for example 6, 30, 40, 50 and 60 dB, can be supplied.

Model 30136-06

IMPORTANT! *All directivities quoted include the measuring port and flange performance when connected to an ideal termination.*

The specifications shown below are for 3 port models. 4 port models are available to special order.

Specifications:

Model	Frequency Range (GHz)	Waveguide				Minimum Directivity (dB)	Coupling				Additional Primary Arm Loss (dB)	Primary Arm VSWR	Secondary Arm VSWR
		WG	WM	R	WR		Sensitivity (±dB)	Nominal Accuracy (dB)					
								3 - 6	10	20 - 60			
23136	33.0 - 50.1	23	-	400	22	40	0.75	0.5	0.75	1.2	0.6	1.06	1.10
24136	39.3 - 59.7	24	-	500	19	38	0.75	0.5	0.75	1.2	0.7	1.06	1.10
25136	49.9 - 75.8	25	-	620	15	38	0.75	0.5	0.75	1.2	0.8	1.06	1.10
26136	60.5 - 92.0	26	-	740	12	38	1.00	0.5	0.75	1.5	1.0	1.08	1.10
27136	73.8 - 112	27	-	900	10	36	1.00	0.75	1.0	1.5	1.1	1.08	1.10
28136	92.3 - 140	28	-	1200	8	34	1.00	0.75	1.0	1.5	1.3	1.12	1.15
29136	114 - 173	29	-	1400	6	32	1.00	0.75	1.0	1.5	1.4	1.12	1.20
30136	145 - 220	30	-	1800	5	30	1.00	0.85	1.2	2.0	1.6	1.12	1.25
31136	172 - 261	31	-	2200	4	28	1.20	0.85	1.2	2.0	1.8	1.15	1.30
32136	220 - 330	32	-	2600	3	26	1.20	0.85	1.2	2.0	2.0	1.20	1.40
710136	260 - 400	-	710	-	'2.8'	24	1.50	1.0	1.5	2.5	2.2	1.30	1.60
570136	330 - 500	-	570	-	'2.2'	22	1.50	1.0	1.5	2.5	2.6	1.40	2.00

ORDERING INFORMATION
Model: coupling value suffix; description
Example: Model 32136-20 multihole directional coupler 20 dB coupling, directivity >30 dB

Series 136

Model	Frequency Range (GHz)	Waveguide				Minimum Directivity (dB)	Coupling				Additional Primary Arm Loss (dB)	Primary Arm VSWR	Secondary Arm VSWR
		WG	WM	R	WR		Sensitivity (±dB)	Nominal Accuracy (dB)					
								3 - 6	10	20 - 60			
23137	33.0 - 50.1	23	-	400	22	44	0.75	0.5	0.75	1.2	0.6	1.06	1.10
24137	39.3 - 59.7	24	-	500	19	42	0.75	0.5	0.75	1.2	0.7	1.06	1.10
25137	49.9 - 75.8	25	-	620	15	42	0.75	0.5	0.75	1.2	0.8	1.06	1.10
26137	60.5 - 92.0	26	-	740	12	42	1.00	0.5	0.75	1.5	1.0	1.08	1.10
27137	73.8 - 112	27	-	900	10	40	1.00	0.75	1.0	1.5	1.1	1.08	1.10
28137	92.3 - 140	28	-	1200	8	38	1.00	0.75	1.0	1.5	1.3	1.12	1.15
29137	114 - 173	29	-	1400	6	36	1.00	0.75	1.0	1.5	1.4	1.12	1.20
30137	145 - 220	30	-	1800	5	34	1.00	0.85	1.2	2.0	1.6	1.12	1.25
31137	172 - 261	31	-	2200	4	32	1.20	0.85	1.2	2.0	1.8	1.15	1.30
32137	220 - 330	32	-	2600	3	30	1.20	0.85	1.2	2.0	2.0	1.20	1.40
710137	260 - 400	-	710	-	'2.8'	28	1.50	1.0	1.5	2.5	2.2	1.30	1.60
570137	330 - 500	-	570	-	'2.2'	26	1.50	1.0	1.5	2.5	2.6	1.40	2.00

ORDERING INFORMATION
Model: coupling value suffix; description
Example: Model 30137-10 multihole directional coupler 10 dB coupling, directivity >34 dB

Series 137

Note: Please refer to page 26 for definitions of Flann coupler specifications.

Multihole Directional Couplers
Series 230 / 231

NOW UP TO 330 GHz

Features

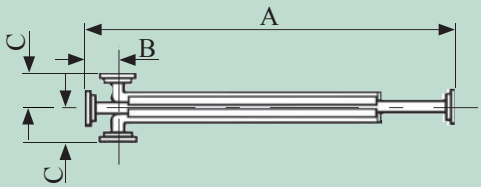
- **High Directivity**
- **3 Way Signal Splitter**
- **± 0.2 dB Balance Between Coupled Arms**

The Flann Multihole Power Splitter consists of a central waveguide with coupling arrays in the broad walls designed to divide the input signal into three signals of equal magnitude.

Model 22230

Normally the instrument is a 4 port device as illustrated. However, for network analyser applications where only two equal amplitude signals are required the central output port may be terminated. Precision machining methods ensure that the full band frequency sensitivity between secondary waveguide ports is better than ± 0.2 dB. The coupling to each output port is 4.8 dB down with respect to the input signal. Directivity for most models is greater than 40 dB.

IMPORTANT! *All directivities quoted include the measuring port and flange performance when connected to an ideal termination.*



ORDERING INFORMATION
Model Description
Example: Model 20230 Multihole Directional Coupler
3 Way Power Splitter

Series 230

Specifications:

Model	Frequency Range (GHz)	Waveguide			Maximum Directivity (dB)	Sensitivity Between Coupled Ports (dB)	Dimensions (mm)			Weight (kg)
		WG	R	WR			A	B	C	
10230	2.60 - 3.95	10	32	284	40	±0.2	1773	85	130	19.0
11A230	3.30 - 4.90	11A	40	229	40	±0.2	1407	79	100	9.3
12230	3.94 - 5.99	12	48	187	40	±0.2	1213	60	90	8.4
14230	5.38 - 8.18	14	70	137	40	±0.2	976	50	60	5.0
15230	6.58 - 10.0	15	84	112	40	±0.2	753	35	50	3.0
16230	8.20 - 12.5	16	100	90	40	±0.2	649	35	45	1.9
17230	9.84 - 15.0	17	120	75	40	±0.2	522	35	40	1.4
18230	11.9 - 18.0	18	140	62	40	±0.2	438	30	35	0.9
19230	14.5 - 22.0	19	180	51	40	±0.2	392	30	35	0.7
20230	17.6 - 26.7	20	220	42	38	±0.3	310	25	25	0.4
22230	26.4 - 40.1	22	320	28	38	±0.3	228	24	29	0.3
23231	33.0 - 50.1	23	400	22	36	±0.3				
24231	39.3 - 59.7	24	500	19	33	±0.3				
25231	49.9 - 75.8	25	620	15	33	±0.3				
26231	60.5 - 92.0	26	740	12	30	±0.4				
27231	73.8 - 112	27	900	10	27	±0.5				
28231	92.3 - 140	28	1200	8						
29231	114 - 173	29	1400	6						
30231	145 - 220	30	1800	5						
31231	172 - 261	31	2200	4						
32231	220 - 330	32	2600	3						

Specifications available on request

Note: Please refer to page 26 for definitions of Flann coupler specifications.

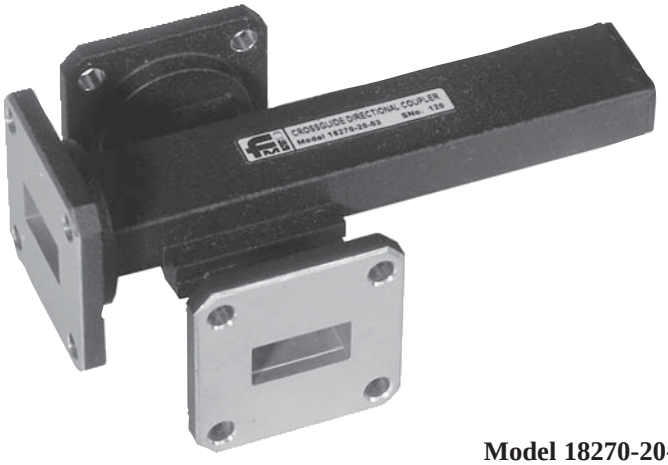
For standard flange types and recommendations see pages 111 onwards

Crossguide Directional Couplers
Series 270

NOW UP TO 330 GHz

Flann Crossguide Couplers consist of two waveguides joined at 90˚ with the coupling element mounted in the common broad wall. Couplers are available in 3 or 4 port configurations and standard coupling values are 20, 30, 40 and 50 dB; directivity for models up to 18 GHz is better than 20 dB over the specified frequency range.

The compactness of the crossguide coupler suits many applications where space is at a premium and directivity is not the prime consideration, e.g. power and frequency monitoring and isolating local oscillators. Models are available with combinations of waveguide and coaxial ports. Special multiport crossguide couplers can be manufactured to suit customers' requirements.

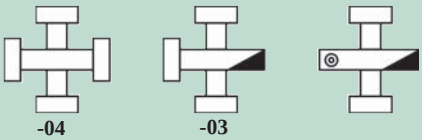


Model 18270-20-03

Specifications:

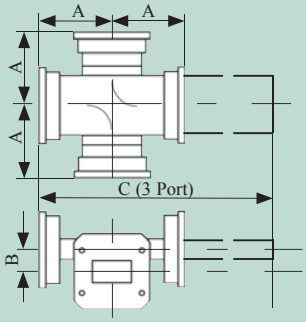
Model	Frequency Range (GHz)	Waveguide			Minimum Directivity (dB)	Coupling		Dimensions (mm)			Weight (kg)	
		WG	R	WR		Sensitivity (dB)	Nominal Accuracy (dB)	A	B	C	3 Port	4 Port
10270	2.60 - 3.95	10	32	284	20	±1.5	±2	90	34	308	5.0	4.9
11A270	3.30 - 4.90	11A	40	229	20	±1.5	±2	62.5	29	256	2.3	1.9
12270	3.94 - 5.99	12	48	187	20	±1.5	±2	61.5	22	227	2.1	2.0
13270	4.64 - 7.05	13	58	159	20	±1.5	±2	58	21	224	1.8	1.7
14270	5.38 - 8.18	14	70	137	20	±1.5	±2	55	15.5	179	1.4	1.3
15270	6.58 - 10.0	15	84	112	20	±1.5	±2	42.5	12.6	164	0.7	0.65
16270	8.20 - 12.5	16	100	90	20	±1.5	±2	36	10.5	136	0.4	0.4
17270	9.84 - 15.0	17	120	75	20	±1.5	±2	32.5	9.5	108	0.35	0.35
18270	11.9 - 18.0	18	140	62	20	±1.5	±2	30	8	96	0.25	0.25
19270	14.5 - 22.0	19	180	51	18	±1.5	±2	30	7	90	0.22	0.22
20270	17.6 - 26.7	20	220	42	18	±1.5	±2	22.5	4.5	65	0.1	0.1
21270	21.7 - 33.0	21	260	42	18	±2	±2	22.5	4.5	65	0.1	0.1
22270	26.4 - 40.1	22	320	28	18	±2	±2	20.7	3.8	50	0.07	0.07
23270	33.0 - 50.1	23	400	22	15	±2	±2	20	3.0	48	0.08	0.08
24270	39.3 - 59.7	24	500	19	15	±2	±2	20	2.5	48	0.08	0.08
25270	49.9 - 75.8	25	620	15	15	±2	±2	14	2.0	34.5	0.07	0.07
26270	60.5 - 92.0	26	740	12	10	±2.5	±2.5	14	1.6	34.5	0.07	0.07
27270	73.8 - 112	27	900	10	10	±2.5	±2.5	14	1.4	34.5	0.07	0.07
28270	92.3 - 140	28	1200	8	10	±2.5	±2.5	14	1.1	34.5	0.07	0.07
29270	114 - 173	29	1400	6								
30270	145 - 220	30	1800	5								
31270	172 - 261	31	2200	4								
32270	220 - 330	32	2600	3								

Specifications available on request



-04 **-03**

-13 (APC7) Models 10270 to 18270 only
-23 (Type N) Models 10270 to 18270 only
-33 (SMA) Models 14270 to 20270 only
-43 (K Type) Models 19270 to 22270 only



ORDERING INFORMATION
Model: Coupling Value Suffix-Type and Number of Ports; Description
Example: Model 17270-30-33 Crossguide Directional Coupler 30 dB Coupling 3 Port with SMA in coupled arm (the fourth arm is fitted with a termination)

Note: Please refer to page 26 for definitions of Flann coupler specifications.

Series 270

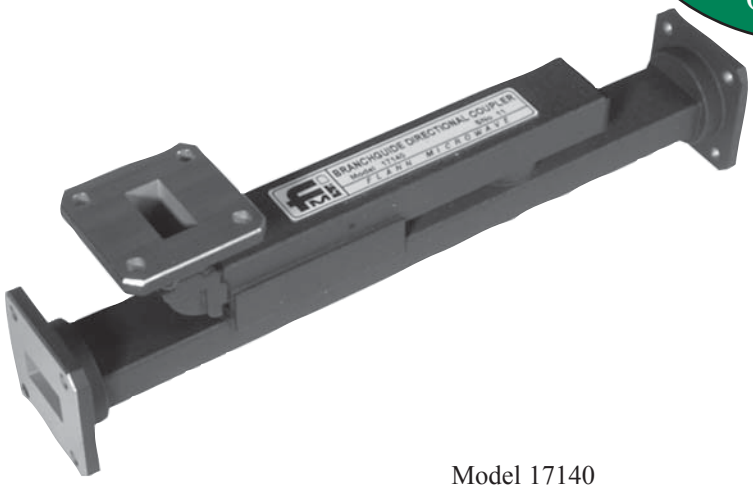
For standard flange types and recommendations see pages 111 onwards

Branch Guide Directional Couplers
Series 140

NOW UP TO 40.1 GHz

Branch Guide Directional Couplers from the Flann Series 140 are particularly suited to applications where multihole couplers cannot be accommodated or tighter coupling values than those achievable from cross guide couplers are required.

Models are available in both 3 and 4 port configurations and standard coupling values are 3 dB, 6 dB and 10 dB. Couplers operating over the full waveguide band are available but for optimum coupling and directivity performance we recommend that the operating frequency range is limited to 25% of the full waveguide band. Please state the operating frequency range required when ordering.



Model 17140

Specifications:

Model	Frequency Range (GHz)	Waveguide			Typical performance for models operating over 25% of the full waveguide band.				
					Coupling Accuracy (dB)			Coupling Sensitivity(dB)	Directivity better than (dB)
		WG	R	WR	3 dB	6 dB	10 dB		
10140	2.60 - 3.95	10	32	284	0.3	0.4	0.5	±0.25	25
11A140	3.30 - 4.90	11A	40	229	0.3	0.4	0.5	±0.25	25
12140	3.94 - 5.99	12	48	187	0.3	0.4	0.5	±0.25	25
13140	4.64 - 7.05	13	58	159	0.3	0.4	0.5	±0.25	25
14140	5.38 - 8.18	14	70	137	0.3	0.4	0.5	±0.25	25
15140	6.58 - 10.0	15	84	112	0.3	0.4	0.5	±0.25	25
16140	8.20 - 12.5	16	100	90	0.3	0.4	0.5	±0.25	25
17140	9.84 - 15.0	17	120	75	0.3	0.4	0.5	±0.25	25
18140	11.9 - 18.0	18	140	62	0.3	0.4	0.5	±0.25	25
19140	14.5 - 22.0	19	180	51	Specifications available on request				
20140	17.6 - 26.7	20	220	42					
21140	21.7 - 33.0	21	260	34					
22140	26.4 - 40.1	22	320	28					

ORDERING INFORMATION
Model: Coupling value suffix: number of ports: operating frequency range; Description
Example: Model 16140-06-3P 8.93 GHz to 11.07 GHz Branch Guide Directional Coupler, 6 dB, 3 Port, 8.93 GHz to 11.07 GHz (operating frequency range)

Note: When ordering please state the required operating frequency range.

Models are available in other waveguide sizes and alternative coupling values for special applications. Full details on request.

Standard Coupling Values	Suffix
3 dB	**03**
6 dB	**06**
10 dB	**10**

Please refer to page 26 for definitions of Flann coupler specifications.

Series 140

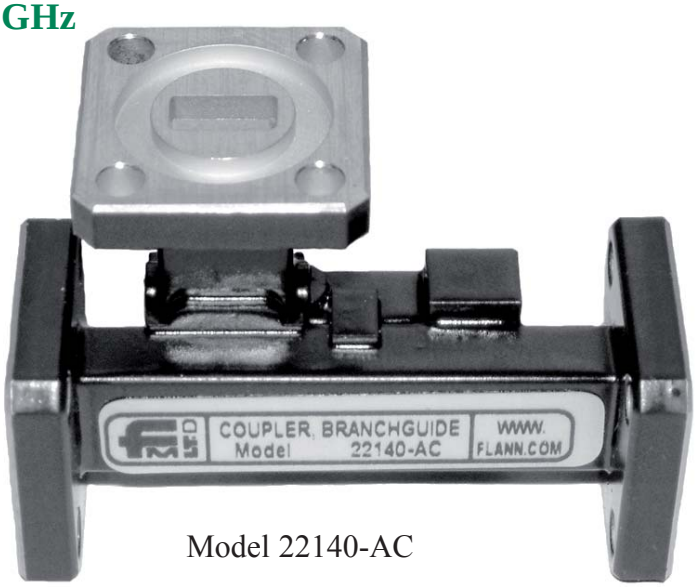
For standard flange types and recommendations see pages 111 onwards

Special & Customised Directional Couplers

Flann are able to design and manufacture Directional Couplers for special customer applications. Shown below is an example of a special very high power coupler; many other configurations of multihole, branch guide and cross guide are available up to 330 GHz.

Example:

- **20 kW peak at 30 GHz to 39 GHz**
- **30 % Bandwidth**
- **Compact**
- **Robust**
- **Models up to 330 GHz**



Model 22140-AC

To provide the compactness of a crossguide coupler but with greater power handling capability, Flann have developed a special branchguide coupler design.

Evaluation has shown the coupler to be able to handle a pulsed signal of 20 kW peak through the main arm with no degradation over time.
The 20 dB coupler illustrated above has been manufactured in WG22 (WR28) and is capable of operating over a 30% bandwidth.

This model has been proven to operate at greater than 20 kW peak power.

Model	Frequency (GHz)	Coupling (dB)	Directivity (dB)
22140 - AC	30 - 39	20	20

ORDERING INFORMATION

PLEASE CONTACT THE SALES TEAM FOR MORE INFORMATION ON OUR STANDARD AND OPTIONAL MODELS

Special & Customised Directional Couplers

In addition to our standard range of Multihole, Crossguide and Branch Guide Directional Couplers we are able to provide special and multiple couplers designed and manufactured to meet customer requirements.
All Couplers can be manufactured in brass, copper or aluminium.

Customised designs for systems applications include:

- Non-standard coupling values
- Special configurations
- Custom designs for narrowband applications
- Multiple Element
- Couplers integrated with other devices for example Attenuators, Phase Changers and Waveguide to Coax Adaptors.
- Compact, lightweight Aluminium units for system applications
- High Power applications

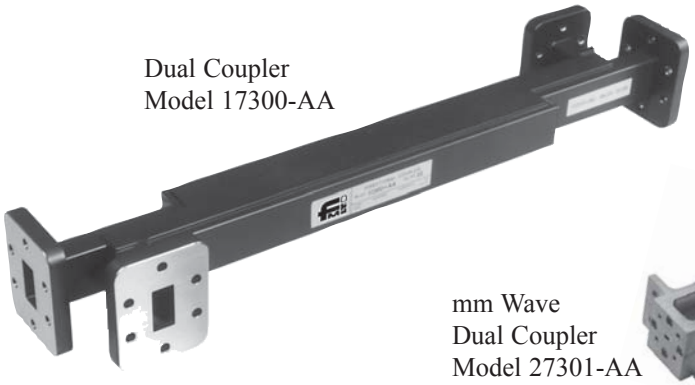
Double and Triple Crossguide Couplers

Among the most commonly requested special directional couplers are Double and Triple Crossguide Couplers. The elements of the coupler may have differing coupling values, coupling directions and port configurations. Special couplers are also available which include the integration of other devices such as attenuators, phase changers and waveguide to coax adaptors.

Due to the specialised nature of multiple element coupler applications it is not possible to detail fully specific models. Please contact our sales office to discuss your special application requirements.

Dual Multihole Couplers - Series 300

Flann is able to provide Dual Multihole Couplers designed and manufactured to meet the requirements of your special applications. The units may have coupling values, directivities, coupling directions and input/output ports configured to suit customer requirements. Please contact our sales office for applications assistance.



Dual Coupler
Model 17300-AA

mm Wave
Dual Coupler
Model 27301-AA

Note: Please refer to page 26 for definitions of Flann coupler specifications.

For standard flange types and recommendations see pages 111 onwards

Terminations
Product Overview

Low Power

Short

Series 170	Compact models offering VSWR better than 1.10:1	Page 41
Series 171	Ultra Short, narrow band	Page 42

Precision

Fixed (Rectangular and Double Ridge)

Series 040	VSWR better than 1.01:1 Models available up to 330 GHz	Page 43
Series WRD040	Double Ridge full band Models up to 40 GHz	Details on request
Series 043, 044 & 045	Metrology Grade, VNA Calibration Kit models Precision Flanges Models up to 110 GHz	Pages 102 - 104

Sliding (Rectangular and Double Ridge)

Series 540	Low VSWR	Page 44
Series 541, 542 & 543	Metrology Grade, VNA Calibration Kit Models Very Low VSWR Precision Flanges Models up to 110 GHz	Pages 102 - 104
Series 54*	Metrology Grade, VNA Calibration Kit Models Finite VSWR of sliding element Precision Flanges Models up to 110 GHz	Details on request

High Power

Rectangular

Series 101	Models up to 10 kW Natural Convection Forced Air Liquid cooled	Pages 45 - 47

Double Ridge

Series WRD101	Models up to 10 kW Natural Convection Forced Air Liquid cooled	Page 48

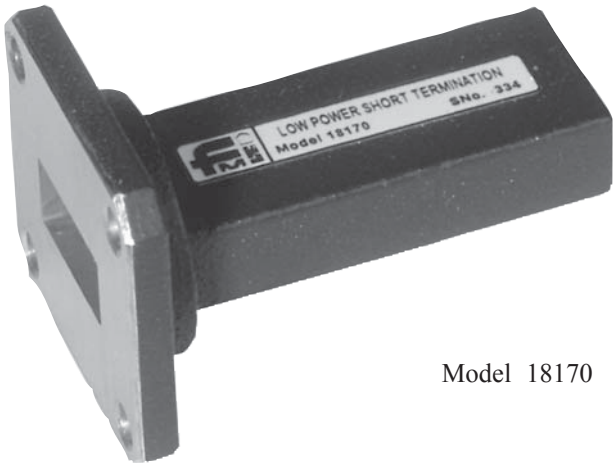
Short Low Power Terminations
Series 170

NOW UP TO 330 GHz

Features

- **Low VSWR**
- **Ideal for Systems Use**
- **Robust**

Flann series 170, short, low power terminations provide a maximum VSWR of 1.10 : 1 within a minimal overall length. They are particularly suitable where space is at a premium.

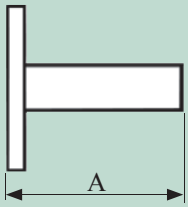


Model 18170

Specifications:

Model	Frequency Range (GHz)	Waveguide			Max Mean cw power (Watts)	VSWR (better than)	Dimension A (mm)	Weight (kg)
		WG	R	WR				
10170	2.60 - 3.95	10	32	284	5	1.10	200	2.10
11A170	3.30 - 4.90	11A	40	229	4	1.10	170	1.10
12170	3.94 - 5.99	12	48	187	2	1.10	140	0.90
13170	4.64 - 7.0	13	58	159	1.5	1.10	125	0.75
14170	5.38 - 8.18	14	70	137	1	1.10	105	0.60
15170	6.58 - 10.0	15	84	112	1	1.10	80	0.25
16170	8.20 - 12.5	16	100	90	0.5	1.10	70	0.15
17170	9.84 - 15.0	17	120	75	0.3	1.10	55	0.11
18170	11.9 - 18.0	18	140	62	0.3	1.10	50	0.08
19170	14.5 - 22.0	19	180	51	0.3	1.10	43	0.06
20170	17.6 - 26.7	20	220	42	0.3	1.10	32	0.03
21170	21.7 - 33.0	21	260	34	0.2	1.10	30	0.02
22170	26.4 - 40.1	22	320	28	0.2	1.10	25.5	0.02
23170	33.0 - 50.1	23	400	22				
24170	39.3 - 59.7	24	500	19				
25170	49.9 - 75.8	25	620	15				
26170	60.5 - 92.0	26	740	12				
27170	73.8 - 112	27	900	10				
28170	92.3 - 140	28	1200	8				
29170	114 - 173	29	1400	6				
30170	145 - 220	30	1800	5				
31170	172 - 261	31	2200	4				
32170	220 - 330	32	2600	3				

Specifications available on request



ORDERING INFORMATION
Model: description
Example: Model 22170 short low power termination

Series 170

For standard flange types and recommendations see pages 111 onwards

Ultra - Short Terminations
Series 171

Features

- **Minimal Length**
- **Broadband**
- **Higher Power Options**

A very short termination has been developed for integration into systems were space is a premium. The WG22 version offers the following performance for a total length of 8 mm.
Other frequencies and higher powered versions are also available, specifications on request.

Specifications:

Model	Frequency Range (GHz)	VSWR (better than)
16171-AA	9.3 - 9.9	1.12
22171	26.4 - 40.1	1.8
22171-A*	30 - 33	1.3
22171-AA	33.0 - 35.0	1.15
22171-A*	36.0 - 40.0	1.25

ORDERING INFORMATION

PLEASE CONTACT THE SALES TEAM FOR MORE INFORMATION ON OUR STANDARD AND OPTIONAL MODELS

Precision Low Power Terminations
Series 040

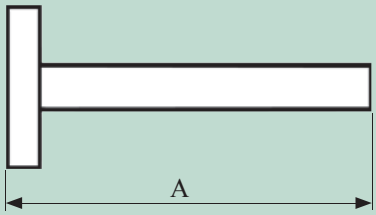
NOW UP TO 330 GHz

Model 19040

Features

- **Low VSWR - better than 1.01:1**
- **Models from 1.14 GHz to 330 GHz**

Flann series 040, precision - low power terminations have a very low VSWR which makes them eminently suitable for use in VSWR measurements.



ORDERING INFORMATION
Model: description
Example: Model 22040 Precision low power termination

Series 040

Model	Frequency Range (GHz)	Waveguide			VSWR (better than)	Max Mean CW Power (Watts)	Dimension A (mm)	Weight (kg)
		WG	R	WR				
06040	1.14 - 1.73	6	14	650	1.01	30		
08040	1.72 - 2.61	8	22	430	1.01	20	**On Request**	**On Request**
09A040	2.17 - 3.3	9A	26	340	1.01	15		
10040	2.60 - 3.95	10	32	284	1.01	10	382	3.2
11A040	3.30 - 4.90	11A	40	229	1.01	6	347	1.65
12040	3.94 - 5.99	12	48	187	1.01	5	302	1.25
13040	4.64 - 7.05	13	58	159	1.01	4	282	1.15
14040	5.38 - 8.18	14	70	137	1.01	3	252	1.0
15040	6.58 - 10.0	15	84	112	1.01	2	202	0.75
16040	8.20 - 12.5	16	100	90	1.015	1	192	0.45
17040	9.84 - 15.0	17	120	75	1.015	0.75	152	0.26
18040	11.9 - 18.0	18	140	62	1.02	0.75	132	0.18
19040	14.5 - 22.0	19	180	51	1.02	0.75	112	0.13
20040	17.6 - 26.7	20	220	42	1.02	0.75	82	0.08
21040	21.7 - 33.0	21	260	34	1.02	0.75	78	0.07
22040	26.4 - 40.1	22	320	28	1.02	0.50	78	0.05
23040	33.0 - 50.1	23	400	22	1.02	0.50	66	0.04
24040	39.3 - 59.7	24	500	19	1.03	0.50	52	0.03
25040	49.9 - 75.8	25	620	15	1.03	0.40	42	0.03
26040	60.5 - 92.0	26	740	12	1.04	0.40	35	0.02
27040	73.8 - 112	27	900	10	1.05	0.30	30	0.015
28040	92.3 - 140	28	1200	8	1.06	0.20	25	0.015
29040	114.0 - 173.0	29	1400	6	1.10	0.15	20	0.015
30040	145.0 - 220.0	30	1800	5	1.15	0.12	20	0.015
31040	172.0 - 261.0	31	2200	4	1.15	0.10	20	0.015
32040	220.0 - 330.0	32	2600	3	1.15	0.08	20	0.015

For standard flange types and recommendations see pages 111 onwards

Sliding Terminations
Series 540

NOW UP TO 140 GHz

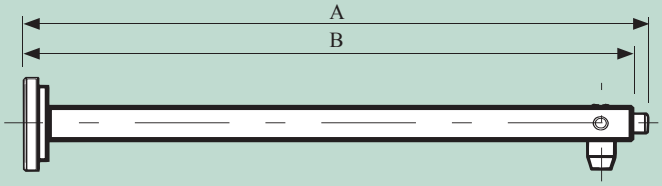
Features

- Low Housing VSWR
- Low Sliding Element VSWR
- Models from 1.14 GHz to 140 GHz

Model 17540

The Flann Series 540 Terminations consist of a length of uniformly sized waveguide. Within the waveguide is a close fit sliding load which moves in a precisely controlled manner. It is desirable to use a sliding termination when measuring low VSWR values.

The effect of sliding the termination enables the user to deduce low VSWR values to a greater accuracy than that achieved by a fixed termination technique.



ORDERING INFORMATION
Model: Description
Example: Model 24540 Sliding Terminations

Series 540

Model	Frequency Range (GHz)	Waveguide			Housing VSWR (better than)	Sliding Element VSWR (better than)	Dimensions (mm)		
		WG	R	WR			A	B	C
06540	1.14 - 1.73	6	14	650	1.006	1.020	On Request		
08540	1.72 - 2.61	8	22	430	1.006	1.020	1097	856	73
10540	2.60 - 3.95	10	32	284	1.006	1.015	719	543	48
11A540	3.30 - 4.90	11A	40	229	1.006	1.015	771	632	42
12540	3.94 - 5.99	12	48	187	1.006	1.010	638	506	37
13540	4.64 - 7.05	13	58	159	1.006	1.010	575	462	32
14540	5.38 - 8.18	14	70	137	1.006	1.010	492	388	28
15540	6.58 - 10.0	15	84	112	1.006	1.008	406	322	24
16540	8.20 - 12.5	16	100	90	1.006	1.006	347	289	19
17540	9.84 - 15.0	17	120	75	1.008	1.006	317	255	18
18540	11.9 - 18.0	18	140	62	1.010	1.008	267	218	18
19540	14.5 - 22.0	19	180	51	1.010	1.010	237	184	15
20540	17.6 - 26.7	20	220	42	1.010	1.010	185	140	14
22540	26.4 - 40.1	22	320	28	1.012	1.015	117	97	12
23540	33.0 - 50.1	23	400	22	1.015	1.020	156	136	15
24540	39.3 - 59.7	24	500	19	1.02	1.025	156	136	15
25540	49.9 - 75.8	25	620	15	1.025	1.030	101	85	14
26540	60.5 - 92.0	26	740	12	1.03	1.035	94	79	14
27540	73.8 - 112	27	900	10	1.035	1.040	84	71	14
28540	92.3 - 140	28	1200	8	1.04	1.050	On Request		

Note: Other models of sliding terminations are available from our range of calibration kit components detailed on pages 99 to 105. Special models are available with micrometer drive and extra low leakage levels, for use in high sensitivity systems.

For standard flange types and recommendations see pages 111 onwards

High Power Terminations
Series 101

NEW !

Features

- 0.32 GHz to 330 GHz
- Industry leading performance
- Low VSWR over full waveguide range
- Sealed, 15 psig Standard
- Models up to 10 kW

Applications

- System Dummy Loads
- HPA Testing

Please note the tables below detail Flann standard high power terminations that are available from stock or on short delivery. Other models with alternative power handling or body styles are also available - please contact our Sales Team for product assistance.

Model 18101-1500-CH10 UBR140

Natural Convection High Power Range up to 300 Watts

Model	Frequency Range (GHz)	Waveguide			Maximum Power (Watts)		Maximum VSWR	Dimensions (mm)		
		WG	R	WR	Natural Convection	Forced Air (3 m/s)		L	BX	AX
10101-125-CN0	2.60 - 3.95	10	32	284	150	220	1.08:1	247	38.1	76.2
10101-200-CV1					200	300	1.08:1	273	80.4	84
11A101-100-CN0	3.22 – 4.90	11A	40	229	125	180	1.08:1	205	32.3	61.4
11A101-200-CV1					200	300	1.08:1	243	75.5	84
12101-75-CN0	3.94 – 5.99	12	48	187	100	150	1.08:1	170	25.4	50.8
12101-300-CH3					300	450	1.08:1	170	63	88.9
13101-60-CN0	4.64 – 7.05	13	58	159	75	110	1.08:1	140	23.4	43.6
13101-250-CH3					250	370	1.08:1	140	62.7	81.8
14101-50-CN0	5.38 – 8.2	14	70	137	55	80	1.08:1	120	19.1	38.1
14101-300-CH1					300	450	1.08:1	173	122.2	120
15101-37-CN0	6.58 – 10.0	15	84	112	40	60	1.08:1	106	15.6	31.8
15101-250-CH1					250	370	1.08:1	131	119	94
16101-27-CN0	8.20 – 12.5	16	100	90	27	40	1.08:1	82	12.7	25.4
16101-240-CV1					240	600	1.10:1	240	81	84
17101-21-CN0	9.84 – 15.0	17	120	75	19	28	1.08:1	63.5	12.1	21.6
17101-300-CH1					300	700	1.08:1	240	121.8	45
18101-16-CN0	11.9 – 18.5	18	140	62	19	28	1.08:1	76	9.9	17.8
18101-275-CH1					275	600	1.08:1	240	113	40
19101-13-CN0	14.5 - 22.0	19	180	51	14	21	1.08:1	62	8.5	15.0
19101-275-CH1					275	600	1.08:1	240	117	40
20101-10-CN0	17.6 – 26.7	20	220	42	11	16	1.08:1	58	6.4	12.7
20101-250-CH1					250	600	1.07:1	237	106	35
21101-7-CN0	21.7 – 33.0	21	260	34	9	13	1.08:1	52	6.4	10.7
21101-250-CH1					250	600	1.07:1	237	106	35
22101-5-CN0	26.4 – 40.1	22	320	28	7	10	1.08:1	47	5.6	9.1
22101-250-CH1					250	600	1.08:1	127	119	81
23101-4-CN0	33.0 – 50.1	23	400	22	6	9	1.08:1	45	4.9	7.7
23101-250-CV1					250	600	1.08:1	127	68.5	138

Many models available from STOCK

Natural Convection Ratings

Natural Convection specified power rating @ +40°C ambient – no direct sunlight.
Ambient power rating adjustment is -/+5%W per +/-10°C.
Vertical design rating is with flange mounted below heatsink - or derate 25%
Vertical design mounted horizontally derate 35%
Horizontal design mounted vertically derate 30%
Horizontal design mounted horizontally but axis through 90° derate 15%

General Specifications

Non shedding ceramic elements.
Low out-gassing (load element total mass loss < 1.0%, collected volatile condensable materials < 0.10%)

Natural Convection

Terminations incorporating heat sinks are orientation sensitive due to the flow of air over the heat sink. Flann model number includes a 'V' or 'H' code to differentiate which is the recommeded orientation. It should be noted that the waveguide broad wall should be vertical in the 'H' configuration.

Forced Air

Where stated the standard natural convection design can be used at 2 - 3 times its rated power with forced air cooling; 3 m/s velocity over all heatsink surfaces.

Blown Version (Fan Assisted)

Liquid Cooled (Water, Oil, Glycol)

High Power Terminations
Series 101

NEW !

Natural Convection Very High Power Range up to 1.5 kWatts

Model	Frequency Range (GHz)	Waveguide			Maximum Power (Watts)		Maximum VSWR	Dimensions (mm)		
		WG	R	WR	Natural Convection	Forced Air (3 m/s)		L	BX	AX
10101-550-CV1	2.60 – 3.95	10	32	284	550	800	1.08:1	273	124.4	200
11A101-1500-CH1	3.22 – 4.90	11A	40	229	1500	3700	1.10:1	438	154	198
12101-1500-CH1	3.94 – 5.99	12	48	187	1500	3700	1.10:1	438	147	198
13101-1500-CH1	4.64 – 7.05	13	58	159	1500	3700	1.09:1	438	145.5	198
14101-1500-CH1	5.38 – 8.2	14	70	137	1500	3700	1.08:1	438	132.8	198
15101-1500-CH2	6.58 – 10.0	15	84	112	1500	3700	1.10:1	247	215.5	161
16101-1500-CH1	8.20 – 12.5	16	100	90	1500	3700	1.08:1	415	125	198
17101-1500-CH2	9.84 – 15.0	17	120	75	1500	3700	1.07:1	415	205.8	92
18101-1500-CV2	11.9 – 18.5	18	140	62	1500	3700	1.07:1	430	233	90
19101-1500-CV2	14.5 - 22.0	19	180	51	1500	3700	1.07:1	430	233	90
20101-1000-CV2	17.6 – 26.7	20	220	42	1000	2500	1.07:1	237	222	90
21101-1000-CV2	21.7 – 33.0	21	260	34	1000	2500	1.07:1	237	222	90
22101-1000-CV2	26.4 – 40.1	22	320	28	1000	2500	1.08:1	237	219	90
23101-500-CV2	33.0 – 50.1	23	400	22	500	1200	1.08:1	127	218.5	90

Many models available from STOCK

Natural Convection Ultra High Power Range up to 10.0 kWatts

Model	Frequency Range (GHz)	Waveguide			Maximum Power (Watts)		Maximum VSWR	Dimensions (mm)		
		WG	R	WR	Natural Convection	Forced Air (3 m/s)		L	BX	AX
11A101-4000-CH2	3.22 – 4.90	11A	40	229	4000	10000	1.10:1	438	238	278
12101-3800-CH2	3.94 – 5.99	12	48	187	3800	9500	1.10:1	438	231	262
13101-3700-CH2	4.64 – 7.05	13	58	159	3700	9200	1.09:1	438	229.5	253
14101-3600-CH2	5.38 – 8.2	14	70	137	3600	9000	1.08:1	438	216.8	246
15101-3400-CH2	6.58 – 10.0	15	84	112	3400	8500	1.08:1	422	215.5	229
16101-3200-CH2	8.20 – 12.5	16	100	90	3200	8000	1.08:1	415	209	214
17101-2900-CH2	9.84 – 15.0	17	120	75	2900	7200	1.07:1	415	205.8	191
18101-2700-CH2	11.9 – 18.5	18	140	62	2700	6700	1.07:1	415	201	176
19101-2500-CH2	14.5 - 22.0	19	180	51	2500	6200	1.07:1	415	201	161

Model 17101-1500-CH20 UBR120

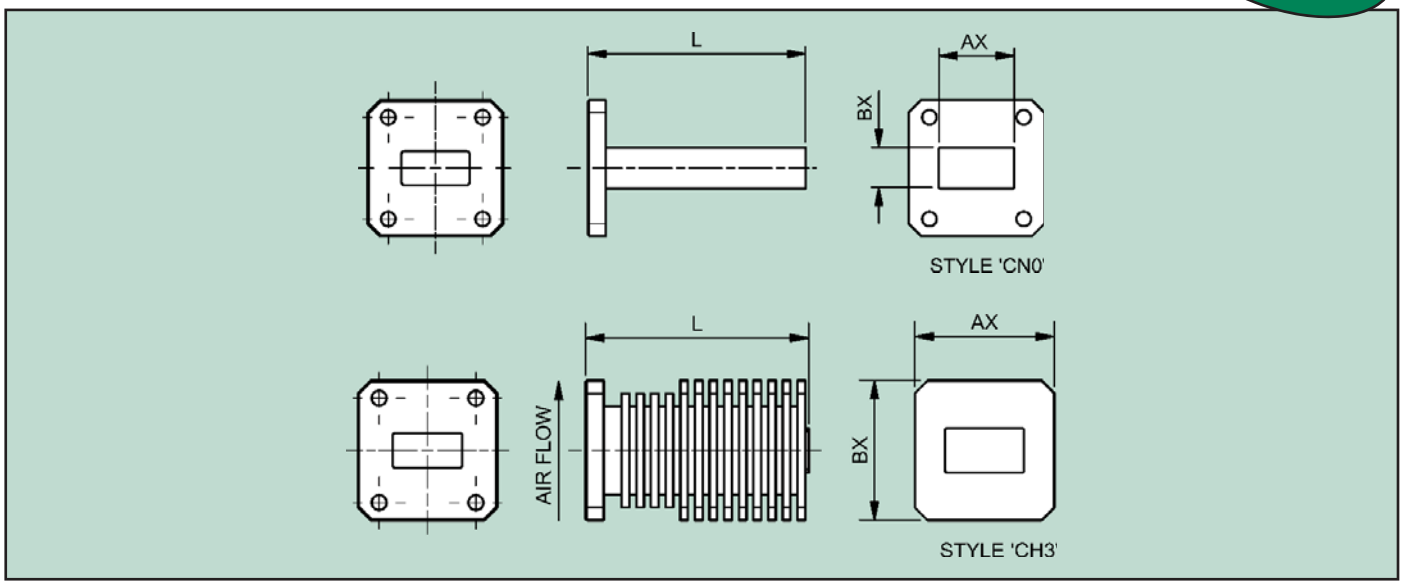
ORDERING INFORMATION: - BASIC OPTIONS

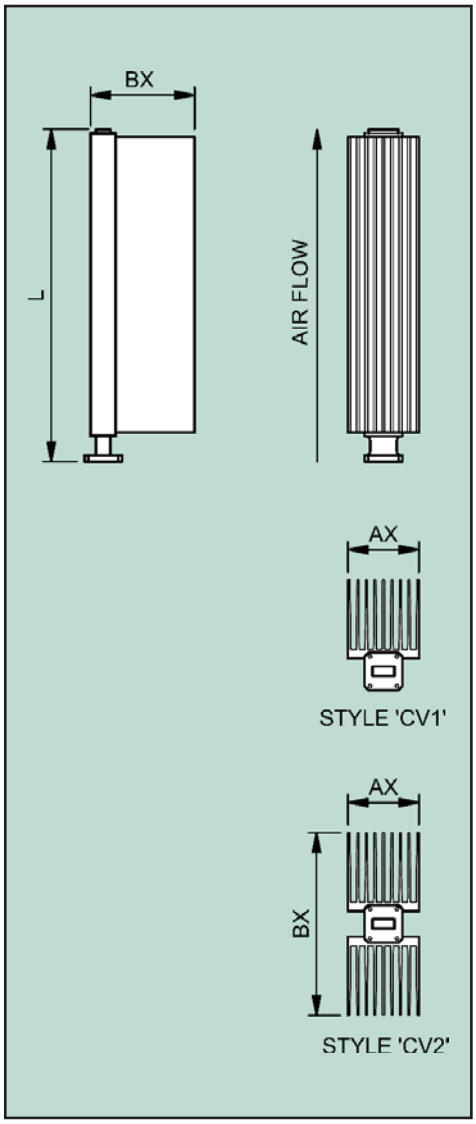
Model Description: Waveguide WG15, 1500 Watts, PBR 84 Flange	**Model Number:**	15	101	-1500	-C	H	2	0	PBR84
Waveguide: WG10 (WR284) to WG23 (WR22)									
Series: 101									
Power: Maximum Power Handling (Watts)*									
Cooling Style: C = Convection, F = Integral Fan, L = Liquid, P = Plate/Heatpipe									
Preferred Orientation: N = None, H = Horizontal, V = Vertical									
Heat Sink Style: 0 = No Fins, 1 = Single, 2 = Double, 3 = Peripheral									
Other Options: 0 = Standard									
Flange Type: For standard flange types and recommendations see page 111 onwards									

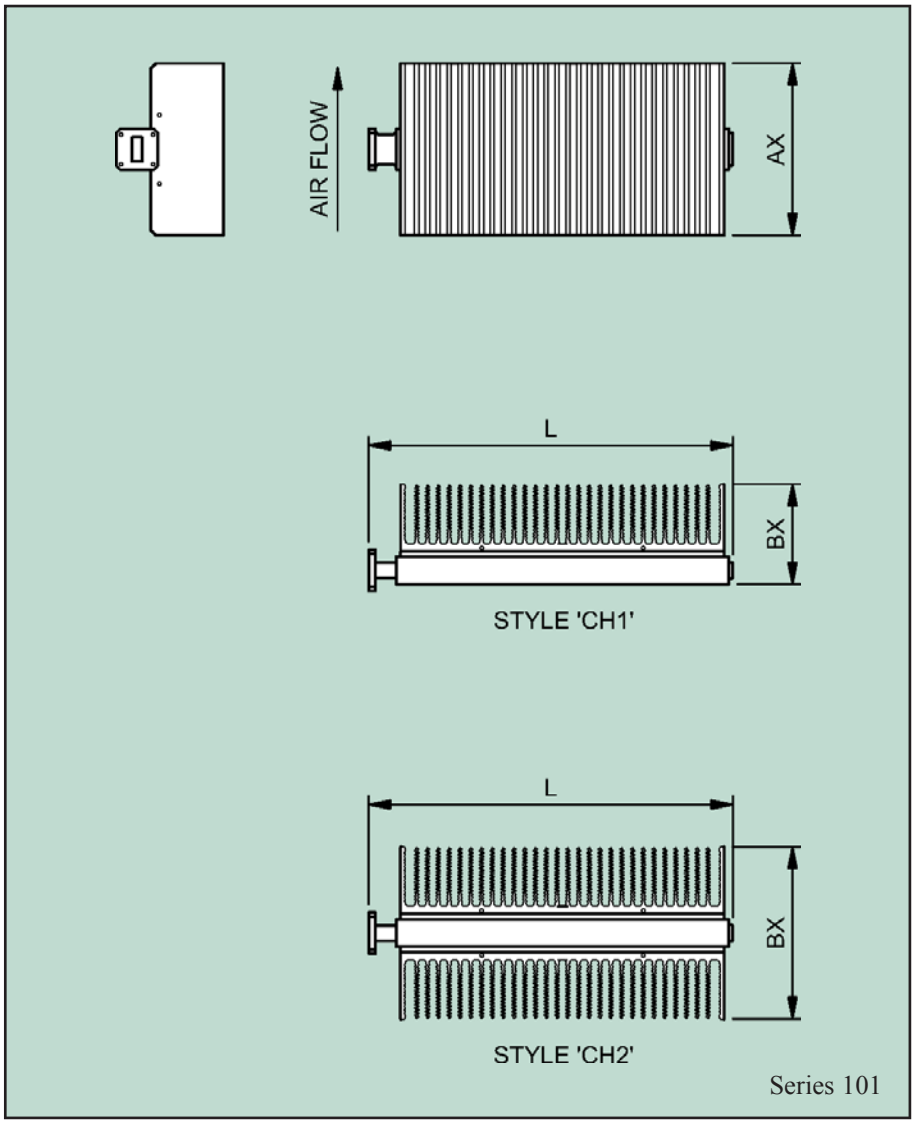
* Dependent on Cooling / Heat Sink Style and orientation. Please contact the Sales Team for other standard values

High Power Terminations
Series 101

NEW !







For standard flange types and recommendations see pages 111 onwards

Double Ridge High Power Terminations
Series WRD101

Features
- 2.0 GHz to 40 GHz
- Low VSWR over full frequency range
- Models up to 7500 Watts

Applications
- Radar
- System Dummy Loads

All terminations have been designed to give high durability and reliability using ceramic elements encapsulated in aluminium body.

Terminations operating at higher power levels can be manufactured on request.

Model WRD750101-700-CH20

Model	Frequency Range (GHz)	Waveguide Size	Maximum Power* (Watts)		Maximum VSWR	Dimensions** (mm)		
			Natural Convection	Forced Air (3 m/s)		L	BX	AX
WRD350101-85-CN0	3.5 - 8.2	WRD350D24	85	120	1.10:1	245	20.7	40.8
WRD350101-3000-CH2			3000	7500	1.10:1	416	218.6	210
WRD475101-55-CN0	4.75 - 11.0	WRD475D24	55	80	1.10:1	175	15.4	30.2
WRD475101-2500-CH2			2500	6200	1.10:1	416	203.1	170
WRD580101-40-CN0	5.80 - 16.0	WRD580D28	40	60	1.10:1	136	11.9	22.4
WRD580101-2500-CH2			2500	6200	1.10:1	416	202.3	170
WRD650101-32-CN0	6.50 - 18.0	WRD650D28	32	48	1.10:1	117	10.7	20.8
WRD650101-2000-CH2			2000	5000	1.10:1	416	202.3	132
WRD750101-30-CN0	7.50 - 18.0	WRD750D24	30	45	1.10:1	110	10.7	20.1
WRD750101-2500-CH2			2500	6200	1.10:1	416	202.3	171
WRD110101-20-CN0	11.0 - 26.5	WRD110C24	20	30	1.10:1	95	7.6	14.0
WRD110101-1000-CH2			1000	2500	1.10:1	226	193.2	95
WRD180101-10-CN0	18.0 - 40.0	WRD180C24	10	15	1.10:1	60	5.4	9.4
WRD180101-500-CH1			500	1200	1.10:1	226	106	95

* Maximum powers may need pressurising or SF6 to prevent cw breakdown
** See Page 47 for definition of dimensions

ORDERING INFORMATION: - BASIC OPTIONS

Model Description: Waveguide WRD180, 500 Watts, C1A Flange	**Model Number:**	**WRD180**	**101**	**-500**	**-C**	**H**	**2**	**0**	**C1A**
Waveguide: WRD200 to WRD180									
Series: 101									
Power: Maximum Power Handling (Watts)***									
Cooling Style: C = Convection, F = Integral Fan, L = Liquid, P = Plate/Heatpipe									
Preferred Orientation: N = None, H = Horizontal, V = Vertical									
Heat Sink Style: 0 = No Fins, 1 = Single, 2 = Double, 3 = Peripheral									
Other Options: 0 = Standard									
Flange Type: For standard flange types and recommendations see page 111 onwards									

*** Dependent on Cooling / Heat Sink Style and orientation.
Please contact the Sales Team for other standard values

Calibrated Frequency Meters
Series 070

NOW UP TO 330 GHz

Features

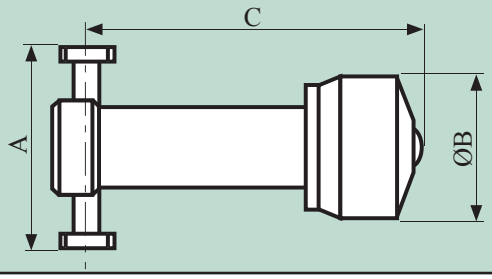
- **High Accuracy**
- **High Q**
- **Full Band**

In designing a satisfactory frequency meter cavity, great care must be used in the selection of the operating mode of resonance, the diameter and the coupling elements in order that non-ambiguous operation is achieved over the full waveguide band.

The Flann Series 070 Frequency Meters consist of a high Q electroformed precision cavity located on the rectangular waveguide narrow wall. The cavity operates in the TE_{111} mode and is tuned by a non-contacting choked piston. All models have a minimum tuned response of 1 dB. A micrometer drive ensures precise control of the piston position enabling frequency measurement to a high accuracy. Each instrument is supplied with calibration data.

Model 17070

ORDERING INFORMATION
Model: Description
Example: Model 22070 Calibrated frequency meter



Series 070

Model	Frequency Range (GHz)	Waveguide			Calibrated Accuracy (%)	Typical Loaded Q	Dimensions (mm)		
		WG	W	WR			A	B	C
14070	5.38 - 8.18	14	70	137	0.010	7000	110	63	173
15070	6.58 - 10.0	15	84	112	0.010	6300	102	63	161
16070	8.20 - 12.5	16	100	90	0.010	5500	90	50	125
17070	9.84 - 15.0	17	120	75	0.010	5200	90	50	111
18070	11.9 - 18.0	18	140	62	0.012	4700	90	50	107
19070	14.5 - 22.0	19	180	51	0.012	4200	90	50	104
20070	17.6 - 26.7	20	220	42	0.012	3700	90	50	101
22070	26.4 - 40.1	22	320	28	0.025	3000	70	50	122
23070	33.0 - 50.1	23	400	22	0.025	2800	60	50	113
24070	39.3 - 59.7	24	500	19	0.030	2300	60	50	104
25070	49.9 - 75.8	25	620	15	0.035	2100	60	50	103
26070	60.5 - 92.0	26	740	12	0.035	1800	60	50	105
27070	73.8 - 112.0	27	900	10	0.050	1600	60	50	101
28070	92.0 - 140	28	1200	8	0.080	1200	60	50	95
29070	114 - 173	29	1400	6	Specification available on request				
30070	145 - 220	30	1800	5					
31070	172 - 261	31	2200	4					
32070	220 - 330	32	2600	3					

For standard flange types and recommendations see pages 111 onwards

Direct Reading Frequency Meters
Series 072

NOW UP TO 330 GHz

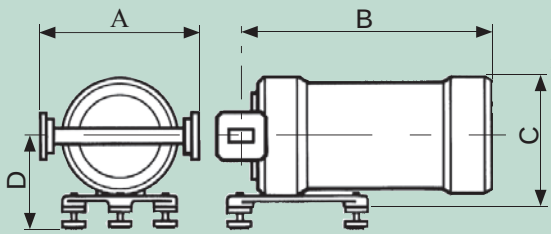
Features

- Direct Reading
- Up to 0.08% Accuracy
- High Q
- High Resolution

The Flann Series 072 Direct Reading Frequency Meters are simple to operate and offer a high degree of measurement accuracy over the appropriate recommended waveguide frequency range. The design uses a TE_{111} mode high Q cavity tuned by a precision non-contacting piston. Care has been exercised in the design to achieve wide band operation without ambiguous response.

The drive mechanism is coupled to a helical drum scale directly calibrated in GHz. The frequency scale length for most models is in excess of 2500 mm and provides high resolution throughout the frequency band. The Frequency Meters are of the absorption type and the minimum tuned response for all models is 1 dB, so the customer is able to detect the resonance absorption. Models are available in most waveguide bands covering 3.94 GHz to 330 GHz.

Model 20072



ORDERING INFORMATION
Model: Description
Example: Model 23072 Direct reading frequency meter

Series 072

Specifications:

Model	Frequency Range (GHz)	Waveguide			Accuracy (%)	Typical Loaded Q	Smallest Scale Increments (MHz)	Dimensions (mm)			
		WG	R	WR				A	B	C	D min/max
12072	3.94 - 5.99	12	48	187	0.08	8,000	2	160	192	108	71/80
15072	6.58 - 10.0	15	84	112	0.08	6,300	2	135	226	109	71/80
16072	8.20 - 12.5	16	100	90	0.10	5,500	2	135	217	109	71/80
17072	9.84 - 15.0	17	120	75	0.10	5,200	5	135	212	109	71/80
18072	11.9 - 18.0	18	140	62	0.12	4,700	5	135	206	109	71/80
19072	14.5 - 22.0	19	180	51	0.12	4,200	5	135	205	109	71/80
20072	17.6 - 26.7	20	220	42	0.12	3,700	10	135	203	109	71/80
22072	26.4 - 40.1	22	320	28	0.12	3,000	10	100	169	110	71/80
23072	33.0 - 50.1	23	400	22	0.15	2,300	20	116	183	109	71/80
24072	39.3 - 59.7	24	500	19	0.15	2,300	20	92	176	109	71/80
25072	49.9 - 75.8	25	620	15	0.18	2,100	25	86	176	109	71/80
26072	60.5 - 92.0	26	740	12	0.18	1,800	26	86	176	109	71/80
27072	73.8 - 112	27	900	10	0.25	1,600	50	86	162	109	71/80
28072	92.3 - 140	28	1200	8	0.40	1,200	50	82	162	109	71/80
29072	114.0 - 173.0	29	1400	6	Specifications available on request			82	162	109	71/80
30072	145.0 - 220.0	30	1800	5				60	195	85	48/57
31072	172.0 - 261.0	31	2200	4				60	195	85	48/57
32072	220.0 - 330.0	32	2600	3				60	195	85	48/57

For standard flange types and recommendations see pages 111 onwards

Waveguide to Coax Adaptors
Model Selection

Models 750 MHz to 110 GHz

Male & Female Variants

Brass, Copper & Aluminium Options

Standard & Special Flange Styles

Connector	Full Band	Narrow Band	End Launch
N	**093-NF10 & 094-NF10** Page 52	**093-NF11 onwards & 094-NF11 onwards** Pages 53 & 54	
SMA	**094-SF40** Page 57	**094-SF41 onwards** Pages 58 & 59	
K (2.9 mm)	**093-KF20 & 094KF20** Page 60	**093-KF21 onwards** Page 60	**373-**** Page 63
	093-KM20 Page 60		
APC7	**093-AP70** Page 55	**093-AP71 onwards** Page 55	
	Series 096-AP Page 56		
2.4 mm	**093-TM30 & 093-TF30** Page 62		**373-**** Page 63
V (1.85 mm)	**093-VF50 & 094-VF50** Page 61		**373-**** Page 63
	093-VM50 & 094-VM50 Page 61		
1.0 mm	**093-WF60** Details on request		
WRD (N, SMA, APC7 & K)	**093** Page 64		

Other connector types are also available including: **Cable Direct Entry**
7 - 16
GR 900
Special & Customised

Broadband Waveguide to Coax N Type Adaptors
Series 093-NF / 094-NF

Features

- **Very Low VSWR**
- **Full Waveguide Band Models**
- **Manufactured from Brass or Aluminium***

Model 11A094-NF10

The series 093/094-NF broadband Waveguide to Coax Adaptors offer enhanced VSWR performance over the full waveguide frequency band. Models in WG14 to WG18 feature an improved mechanical design offering greater durability and reliability whilst maintaining existing high performance specifications. Minor dimensional changes may be incorporated from time to time; please contact our Sales Team for latest information if the space available is limited.

The adaptors are fitted with Type N Female connectors as standard; adaptors fitted with type N male connectors are available to special order, please contact our Sales Team for further details.

Narrowband models covering typically 20% of the full waveguide band with a VSWR of 1.05 are also available.

Model	Frequency Range (GHz)	Waveguide			VSWR (better than)	*Dimensions (Brass)			Weight (kg) [Brass]
		WG	R	WR		A	B	C	
06093-NF10	1.14 - 1.73	6	14	650	1.20	108.2	169.5	65.5	3.95
08093-NF10	1.72 - 2.61	8	22	430	1.20	61.4	110.5	51.5	2.23
09A093-NF10	2.17 - 3.3	9A	26	340	1.20	64.0	98.4	45.8	1.80
10094-NF10	2.6 - 3.95	10	32	284	1.15	66.6	89.5	41.2	0.98
11A094-NF10	3.3 - 4.9	11A	40	229	1.15	50.9	74.0	38.4	0.70
12094-NF10	3.94 - 5.99	12	48	187	1.14	49.5	66.5	36.4	0.67
13094-NF10	4.64 - 7.05	13	58	159	1.13	51.0	66.0	33.8	0.57
14094-NF10	5.38 - 8.18	14	70	137	1.10	55.8	69.0	33.2	0.38
15094-NF10	6.58 - 10.0	15	84	112	1.12	45.8	59.9	31.6	0.33
16094-NF10	8.2 - 12.5	16	100	90	1.12	54.0	64.0	44.9	0.18
17094-NF10	9.84 - 15.0	17	120	75	1.12	42.2	52.0	44.2	0.15
18094-NF10	11.9 - 18.0	18	40	62	1.12	47.2	56.0	44.0	0.12

ORDERING INFORMATION
Model: Description
Example: Model 14094-NF10 Broadband waveguide to type N female coax adaptor
If the adaptor is required to be manufactured in aluminium please suffix the order information with \ AL
Example: Model 14094-NF10\AL

*Note 1 The dimensions of aluminium adaptors may vary from those manufactured in brass.
Note 2 Models with suffix NF10 are broadband units. Please see page 53 for narrowband models.

Series 094-NF

For standard flange types and recommendations see pages 111 onwards

Narrow Band Waveguide to N Type Coax Adaptors
Series 093-NF / 094-NF

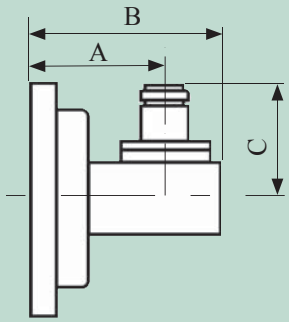
Model
11A094-NF16

Model
17094-NF19

Features

- **Very Low VSWR**
- **Alternative Narrow Band Models on Request**
- **Manufactured from Brass or *Aluminium**

The following tables indicate a wide choice of adaptor specification. Flann waveguide to coaxial adaptors in this series are fitted as standard with 'N' type female connectors. 'N' type male connectors are available on most models to special order; please contact our sales office for further details. Alternative requirements can be accommodated provided the customer submits full details of the specification required.



*Note The dimensions of aluminium adaptors may vary from those manufactured in brass.

Series 09*-NF

Model	Frequency Range (GHz)	Waveguide			VSWR (better than)	*Dimensions (Brass)			Weight (kg) [Brass]
		WG	R	WR		A	B	C	
06093-NF11	1.215 - 1.415	6	14	650	1.05	108.2	179.5	65.5	3.95
06093-NF12	1.25 - 1.365	6	14	650	1.05	108.2	179.5	65.5	3.95
06093-NF13	1.37 - 1.49	6	14	650	1.05	108.2	179.5	65.5	3.95
06093-NF14	1.44 - 1.56	6	14	650	1.05	108.2	179.5	65.5	3.95
06093-NF15	1.537 - 1.645	6	14	650	1.05	108.2	179.5	65.5	3.95
06093-NF16	1.4 - 1.7	6	14	650	1.10	108.2	179.5	65.5	3.95
06093-NF17	1.2 - 1.425	6	14	650	1.05	108.2	179.5	65.5	3.95
06093-NF18	1.14 - 1.45	6	14	650	1.10	108.2	179.5	65.5	3.95
08093-NF11	2.06 - 2.24	8	22	430	1.05	61.4	110.5	51.5	2.23
08093-NF12	2.36 - 2.54	8	22	430	1.05	61.4	110.5	51.5	2.23
08093-NF13	2.2 - 2.3	8	22	430	1.05	61.4	110.5	51.5	2.23
08093-NF14	2.3 - 2.7	8	22	430	1.10	61.4	110.5	51.5	2.23
08093-NF15	2.0 - 2.3	8	22	430	1.10	61.4	110.5	51.5	2.23
09A093-NF11	2.4 - 2.5	9A	26	340	1.05	64.0	98.4	45.8	1.80
09A093-NF12	2.216 - 2.35	9A	26	340	1.05	64.0	98.4	45.8	1.80
10094-NF11	2.4 - 2.5	10	32	284	1.05	66.6	89.5	41.2	0.98
10094-NF12	2.65 - 3.25	10	32	284	1.10	66.6	89.5	41.2	0.98
10094-NF13	2.7 - 3.2	10	32	284	1.10	66.6	89.5	41.2	0.98
10094-NF14	2.765 - 3.035	10	32	284	1.05	66.6	89.5	41.2	0.98
10094-NF15	2.815 - 3.085	10	32	284	1.05	66.6	89.5	41.2	0.98
10094-NF16	3.865 - 3.135	10	32	284	1.05	66.6	89.5	41.2	0.98
10094-NF17	3.115 - 3.385	10	32	284	1.05	66.6	89.5	41.2	0.98
10094-NF18	3.4 - 3.8	10	32	284	1.10	66.6	89.5	41.2	0.98
10094-NF19	3.415 - 3.685	10	32	284	1.05	66.6	89.5	41.2	0.98
10094-NF20	3.465 - 3.735	10	32	284	1.05	66.6	89.5	41.2	0.98
10094-NF21	2.5 - 3.5	10	32	284	1.10	66.6	89.5	41.2	0.98
10094-NF22	2.7 - 2.9	10	32	284	1.05	66.6	89.5	41.2	0.98
10094-NF23	2.7 - 3.1	10	32	284	1.05	66.6	89.5	41.2	0.98
10094-NF24	2.5 - 2.7	10	32	284	1.05	66.6	89.5	41.2	0.98
10094-NF25	3.0 - 3.6	10	32	284	1.10	66.6	89.5	41.2	0.98
10094-NF26	2.4 - 2.7	10	32	284	1.05	66.6	89.5	41.2	0.98
10094-NF28	2.65 - 3.15	10	32	284	1.05	66.6	89.5	41.2	0.98
11A094-NF11	3.4 - 4.2	11A	40	229	1.05	50.9	74.0	38.4	0.70
11A094-NF12	3.6 - 4.4	11A	40	229	1.05	50.9	74.0	38.4	0.70
11A094-NF13	4.2 - 4.8	11A	40	229	1.05	50.9	74.0	38.4	0.70
11A094-NF14	3.3 - 4.3	11A	40	229	1.10	50.9	74.0	38.4	0.70
11A094-NF15	3.5 - 4.3	11A	40	229	1.07	50.9	74.0	38.4	0.70
11A094-NF16	3.7 - 4.2	11A	40	229	1.05	50.9	74.0	38.4	0.70
11A094-NF17	3.6 - 4.0	11A	40	229	1.05	50.9	74.0	38.4	0.70
11A094-NF18	3.6 - 4.2	11A	40	229	1.05	50.9	74.0	38.4	0.70
12094-NF11	4.095 - 4.295	12	48	187	1.05	49.5	66.5	36.4	0.67
12094-NF12	4.18 - 4.21	12	48	187	1.05	49.5	66.5	36.4	0.67
12094-NF13	4.2 - 4.4	12	48	187	1.05	49.5	66.5	36.4	0.67
12094-NF14	4.595 - 5.005	12	48	187	1.05	49.5	66.5	36.4	0.67
12094-NF15	4.7 - 4.9	12	48	187	1.05	49.5	66.5	36.4	0.67
12094-NF16	4.89 - 5.09	12	48	187	1.05	49.5	66.5	36.4	0.67
12094-NF17	5.395 - 5.805	12	48	187	1.05	49.5	66.5	36.4	0.67
12094-NF18	5.2 - 5.7	12	48	187	1.05	49.5	66.5	36.4	0.67
12094-NF19	5.1 - 5.3	12	48	187	1.05	49.5	66.5	36.4	0.67
12094-NF20	5.6 - 5.65	12	48	187	1.05	49.5	66.5	36.4	0.67
12094-NF21	5.4 - 5.9	12	48	187	1.05	49.5	66.5	36.4	0.67
12094-NF22	5.15 - 5.35	12	48	187	1.05	49.5	66.5	36.4	0.67
12094-NF23	4.7 - 5.8	12	48	187	1.10	49.5	66.5	36.4	0.67
12094-NF24	5.2 - 5.4	12	48	187	1.05	49.5	66.5	36.4	0.67
12094-NF25	5.4 - 5.95	12	48	187	1.05	49.5	66.5	36.4	0.67
12094-NF26	5.1 - 5.56	12	48	187	1.05	49.5	66.5	36.4	0.67
12094-NF27	3.94 - 4.9	12	48	187	1.08	49.5	66.5	36.4	0.67
12094-NF28	4.35 - 5.15	12	48	187	1.10	49.5	66.5	36.4	0.67
12094-NF29	3.7 - 4.85	12	48	187	1.08	49.5	66.5	36.4	0.67
13094-NF11	5.2 - 5.4	13	58	159	1.05	51.0	66.0	33.8	0.57
13094-NF12	5.1 - 5.6	13	58	159	1.10	51.0	66.0	33.8	0.57
13094-NF13	5.0 - 5.1	13	58	159	1.05	51.0	66.0	33.8	0.57
14094-NF11	5.4 - 5.9	14	70	137	1.05	55.8	69.0	33.2	0.38
14094-NF12	6.14 - 6.7	14	70	137	1.05	55.8	69.0	33.2	0.38
14094-NF13	7.125 - 7.725	14	70	137	1.05	55.8	69.0	33.2	0.38
14094-NF14	7.725 - 8.4	14	70	137	1.05	55.8	69.0	33.2	0.38
14094-NF15	7.9 - 8.4	14	70	137	1.05	55.8	69.0	33.2	0.38
14094-NF16	7.25 - 7.75	14	70	137	1.05	55.8	69.0	33.2	0.38
14094-NF18	7.7 - 8.2	14	70	137	1.05	55.8	69.0	33.2	0.38
14094-NF19	5.87 - 6.43	14	70	137	1.05	55.8	69.0	33.2	0.38
14094-NF20	5.85 - 6.425	14	70	137	1.05	55.8	69.0	33.2	0.38
14094-NF21	5.925 - 6.425	14	70	137	1.05	55.8	69.0	33.2	0.38
14094-NF22	6.4 - 7.1	14	70	137	1.05	55.8	69.0	33.2	0.38
14094-NF23	5.9 - 6.4	14	70	137	1.05	55.8	69.0	33.2	0.38
14094-NF25	5.2 - 5.4	14	70	137	1.10	55.8	69.0	33.2	0.38
14094-NF26	5.85 - 6.455	14	70	137	1.05	55.8	69.0	33.2	0.38
14094-NF27	6.7 - 7.3	14	70	137	1.05	55.8	69.0	33.2	0.38
14094-NF28	5.8 - 6.5	14	70	137	1.05	55.8	69.0	33.2	0.38
14094-NF30	7.11 - 7.75	14	70	137	1.06	55.8	69.0	33.2	0.38
14094-NF31	7.25 - 7.9	14	70	137	1.05	55.8	69.0	33.2	0.38
14094-NF32	6.425 - 7.125	14	70	137	1.05	55.8	69.0	33.2	0.38
14094-NF33	7.1 - 7.5	14	70	137	1.05	55.8	69.0	33.2	0.38
14094-NF35	6.4 - 7.2	14	70	137	1.05	55.8	69.0	33.2	0.38
14094-NF36	5.29 - 5.31	14	70	137	1.05	55.8	69.0	33.2	0.38
14094-NF37	7.7 - 8.5	14	70	137	1.07	55.8	69.0	33.2	0.38
14094-NF38	7.125 - 7.9	14	70	137	1.05	55.8	69.0	33.2	0.38
14094-NF39	5.38 - 8.5	14	70	137	1.10	55.8	69.0	33.2	0.38

For standard flange types and recommendations see pages 111 onwards

Narrow Band Waveguide to N Type Coax Adaptors
Series 093-NF / 094-NF

Model	Frequency Range (GHz)	Waveguide			VSWR (better than)	*Dimensions (Brass)			Weight (kg) [Brass]
		WG	R	WR		A	B	C	
15094-NF11	7.2 - 8.4	15	84	112	1.10	45.8	59.9	31.6	0.33
15094-NF12	7.25 - 7.75	15	84	112	1.05	45.8	59.9	31.6	0.33
15094-NF13	7.36 - 8.05	15	84	112	1.05	45.8	59.9	31.6	0.33
15094-NF14	7.75 - 8.5	15	84	112	1.05	45.8	59.9	31.6	0.33
15094-NF15	7.9 - 8.4	15	84	112	1.05	45.8	59.9	31.6	0.33
15094-NF16	8.7 - 9.4	15	84	112	1.05	45.8	59.9	31.6	0.33
15094-NF17	8.428 - 8.478	15	84	112	1.05	45.8	59.9	31.6	0.33
15094-NF18	8.3 - 9.2	15	84	112	1.05	45.8	59.9	31.6	0.33
15094-NF19	7.25 - 7.75	15	84	112	1.05	45.8	59.9	31.6	0.33
15094-NF20	8.5 - 9.6	15	84	112	1.10	45.8	59.9	31.6	0.33
15094-NF21	9.345 - 9.405	15	84	112	1.10	45.8	59.9	31.6	0.33
15094-NF22	7.7 - 8.3	15	84	112	1.05	45.8	59.9	31.6	0.33
15094-NF23	7.125 - 8.0	15	84	112	1.10	45.8	59.9	31.6	0.33
15094-NF24	7.125 - 7.75	15	84	112	1.06	45.8	59.9	31.6	0.33
15094-NF25	7.7 - 8.5	15	84	112	1.05	45.8	59.9	31.6	0.33
15094-NF26	6.7 - 8.0	15	84	112	1.10	45.8	59.9	31.6	0.33
15094-NF27	8.0 - 9.0	15	84	112	1.10	45.8	59.9	31.6	0.33
15094-NF28	7.125 - 7.725	15	84	112	1.06	45.8	59.9	31.6	0.33
15094-NF29	7.4 - 7.8	15	84	112	1.05	45.8	59.9	31.6	0.33
15094-NF30	7.1 - 7.4	15	84	112	1.05	45.8	59.9	31.6	0.33
15094-NF31	7.125 - 8.5	15	84	112	1.10	45.8	59.9	31.6	0.33
15094-NF32	7.5 - 8.4	15	84	112	1.05	45.8	59.9	31.6	0.33
16094-NF11	8.5 - 9.5	16	100	90	1.05	54.0	64.0	44.9	0.18
16094-NF12	8.85 - 9.7	16	100	90	1.05	54.0	64.0	44.9	0.18
16094-NF13	9.0 - 9.8	16	100	90	1.05	54.0	64.0	44.9	0.18
16094-NF14	9.7 - 10.4	16	100	90	1.05	54.0	64.0	44.9	0.18
16094-NF15	11.05 - 11.25	16	100	90	1.05	54.0	64.0	44.9	0.18
16094-NF16	11.35 - 12.25	16	100	90	1.05	54.0	64.0	44.9	0.18
16094-NF17	10.95 - 11.7	16	100	90	1.05	54.0	64.0	44.9	0.18
16094-NF18	8.5 - 9.6	16	100	90	1.05	54.0	64.0	44.9	0.18
16094-NF19	9.25 - 9.55	16	100	90	1.05	54.0	64.0	44.9	0.18
16094-NF20	10.5 - 12.5	16	100	90	1.08	54.0	64.0	44.9	0.18
16094-NF21	10.7 - 11.7	16	100	90	1.07	50.9	64.0	44.9	0.18
16094-NF22	9.0 - 10.0	16	100	90	1.05	50.9	64.0	44.9	0.18
16094-NF23	9.3 - 10.1	16	100	90	1.05	50.9	64.0	44.9	0.18
16094-NF24	9.1 - 9.6	16	100	90	1.05	50.9	64.0	44.9	0.18
16094-NF25	8.4 - 8.50	16	100	90	1.05	50.9	64.0	44.9	0.18
16094-NF26	10.0 - 10.5	16	100	90	1.05	50.9	64.0	44.9	0.18
16094-NF27	9.2 - 10.0	16	100	90	1.05	50.9	64.0	44.9	0.18
16094-NF28	8.2 - 10.0	16	100	90	1.08	50.9	64.0	44.9	0.18
17094-NF12	12.4 - 13.0	17	120	75	1.05	42.2	52.0	44.2	0.15
17094-NF14	14.0 - 14.5	17	120	75	1.10	42.2	52.0	44.2	0.15
17094-NF15	14.0 - 14.25	17	120	75	1.05	42.2	52.0	44.2	0.15
17094-NF16	12.75 - 13.25	17	120	75	1.05	42.2	52.0	44.2	0.15
17094-NF17	14.0 - 14.5	17	120	75	1.05	42.2	52.0	44.2	0.15
17094-NF18	13.2 - 14.2	17	120	75	1.05	42.2	52.0	44.2	0.15
17094-NF19	10.7 - 11.7	17	120	75	1.05	42.2	52.0	44.2	0.15
17094-NF21	13.0 - 14.3	17	120	75	1.10	42.2	52.0	44.2	0.15
17094-NF23	12.8 - 13.2	17	120	75	1.05	42.2	52.0	44.2	0.15
17094-NF29	13.1 - 13.6	17	120	75	1.05	42.2	52.0	44.2	0.15
17094-NF31	12.5 - 13.5	17	120	75	1.10	42.2	52.0	44.2	0.15
17094-NF33	12.25 - 13.5	17	120	75	1.10	42.2	52.0	44.2	0.15
17094-NF34	12.7 - 13.3	17	120	75	1.07	42.2	52.0	44.2	0.15
17094-NF35	10.7 - 11.7	17	120	75	1.07	42.2	52.0	44.2	0.15
17094-NF36	12.0 - 12.5	17	120	75	1.10	42.2	52.0	44.2	0.15
17094-NF39	10.0 - 12.0	17	120	75	1.10	42.2	52.0	44.2	0.15
18094-NF11	14.1 - 14.5	18	140	62	1.05	47.2	56.0	44.0	0.12
18094-NF12	14.5 - 14.62	18	140	62	1.05	47.2	56.0	44.0	0.12
18094-NF13	16.4 - 17.6	18	140	62	1.10	47.2	56.0	44.0	0.12
18094-NF14	14.0 - 14.4	18	140	62	1.05	47.2	56.0	44.0	0.12
18094-NF16	14.0 - 14.5	18	140	62	1.10	47.2	56.0	44.0	0.12
18094-NF17	15.9 - 17.1	18	140	62	1.10	47.2	56.0	44.0	0.12
18094-NF18	14.0 - 15.5	18	140	62	1.10	47.2	56.0	44.0	0.12
18094-NF19	14.0 - 16.0	18	140	62	1.10	47.2	56.0	44.0	0.12
18094-NF20	16.35 - 16.65	18	140	62	1.05	47.2	56.0	44.0	0.12
18094-NF21	13.6 - 14.0	18	140	62	1.05	47.2	56.0	44.0	0.12
18094-NF22	14.3 - 15.4	18	140	62	1.10	47.2	56.0	44.0	0.12
18094-NF23	13.1 - 13.6	18	140	62	1.07	47.2	56.0	44.0	0.12
18094-NF24	12.0 - 14.0	18	140	62	1.10	47.2	56.0	44.0	0.12
18094-NF26	14.4 - 15.35	18	140	62	1.10	47.2	56.0	44.0	0.12
18094-NF28	16.3- 16.7	18	140	62	1.10	47.2	56.0	44.0	0.12
18094-NF29	13.0 - 14.5	18	140	62	1.10	47.2	56.0	44.0	0.12
18094-NF30	14.2 - 15.5	18	140	62	1.07	47.2	56.0	44.0	0.12
18094-NF31	14.0 - 15.35	18	140	62	1.10	47.2	56.0	44.0	0.12
19093-NF11	14.5 - 18.0	19	180	51	1.25	47.8	60.5	26.5	0.08
19093-NF12	17.7 - 19.7	19	180	51	1.25	47.8	60.5	26.5	0.08
19093-NF14	18.0 - 18.5	19	180	51	1.20	47.8	60.5	26.5	0.08
19093-NF15	17.3 - 18.0	19	180	51	1.10	47.8	60.5	26.5	0.08

ORDERING INFORMATION
Model: frequency band suffix; Description
Example: Model 18094-NF13 Waveguide to Type N female coax adaptor
(Frequency range 16.4 GHz to 17.6 GHz VSWR 1.10 Max)

If the adaptor is required to be manufactured in aluminium please suffix the order information with \ AL
Example: Model 18094-NF13\AL

*Note: The dimensions of aluminium adaptors may vary from those manufactured in brass.

Alternative narrowband units can generally be accommodated, details on request.

Series 094-NF

For standard flange types and recommendations see pages 111 onwards

Waveguide to APC7 Coax Adaptors
Series 093-AP

Features

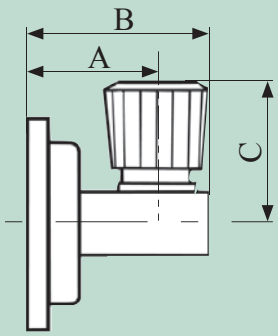
- **Full Band & Narrow Band Models Available**
- **Manufactured from Brass or Aluminium***

Models are available for both full waveguide band operation and also for limited band applications where much improved VSWR performance is offered.

The following tables indicate a wide choice of adaptor specification. Alternative requirements can be accommodated provided the customer submits full details of the specification required.

The Flann Series 093-AP Waveguide to Coax Adaptors are fitted with a precision APC7 hermaphroditic connector.

Model 18093-AP70



ORDERING INFORMATION

Model: frequency band suffix; Description
Example: Model 16093-AP75 Waveguide to APC7 coax adaptor (Frequency Range 11.40 GHz to 12.00 GHz, VSWR 1.05 max)
If the adaptor is required to be manufactured in aluminium please suffix the order information with \ AL
Example: Model 16093-AP75\AL

*Note: The dimensions of aluminium adaptors may vary from those manufactured in brass.

Series 093-AP

Model	Frequency Range (GHz)	Waveguide			VSWR (better than)	*Dimensions (Brass)			Weight (kg) [Brass]
		WG	R	WR		A	B	C	
06093-AP70	1.14 - 1.73	6	14	650	1.10	105.8	151.0	75.8	3.30
06093-AP71	1.2 - 1.56	6	14	650	1.05	105.8	151.0	75.8	3.30
06093-AP72	1.215 - 1.365	6	14	650	1.05	105.8	151.0	75.8	3.30
08093-AP70	1.72 - 2.61	8	22	430	1.15	111.8	150.0	61.8	2.10
08093-AP71	1.75 - 1.95	8	22	430	1.05	111.8	150.0	61.8	2.10
09A093-AP70	2.17 - 3.3	9A	26	340	1.10	Details on Request			
10093-AP70	2.6 - 3.95	10	32	284	1.10	59.4	85.5	51.5	1.30
10093-AP72	2.9 - 3.1	10	32	284	1.03	59.4	85.5	51.5	1.30
10093-AP73	2.4 - 2.6	10	32	284	1.05	59.4	85.5	51.5	1.30
11A093-AP70	3.3 - 4.9	11A	40	229	1.10	45.8	65.0	47.6	0.60
11A093-AP71	3.7 - 4.2	11A	40	229	1.05	45.8	65.0	47.6	0.60
12093-AP70	3.94 - 5.99	12	48	187	1.10	44.0	62.0	38.0	0.60
12093-AP71	5.45 - 5.65	12	48	187	1.05	44.0	62.0	38.0	0.60
12093-AP72	5.2 - 5.4	12	48	187	1.05	44.0	62.0	38.0	0.60
13093-AP70	4.64 - 7.05	13	58	159	1.10	51.8	68.5	44.1	0.50
13093-AP71	5.5 - 6.0	13	58	159	1.05	51.8	68.5	44.1	0.50
13093-AP72	5.0 - 5.1	13	58	159	1.05	51.8	68.5	44.1	0.50
14093-AP70	5.38 - 8.18	14	70	137	1.10	34.9	50.0	41.9	0.40
15093-AP70	6.58 - 10.0	15	84	112	1.10	45.5	58.0	40.3	0.18
15093-AP71	7.1 - 7.5	15	84	112	1.05	45.5	58.0	40.3	0.18
15093-AP72	7.5 - 7.9	15	84	112	1.05	45.5	58.0	40.3	0.18
15093-AP73	7.5 - 9.0	15	84	112	1.07	45.5	58.0	40.3	0.18
16093-AP70	8.2 - 12.5	16	100	90	1.10	54.0	64.0	39.1	0.13
16093-AP71	8.6 - 9.4	16	100	90	1.05	54.0	64.0	39.1	0.13
16093-AP72	9.7 - 10.4	16	100	90	1.05	54.0	64.0	39.1	0.13
16093-AP73	10.6 - 11.4	16	100	90	1.05	54.0	64.0	39.1	0.13
16093-AP74	10.9 - 11.7	16	100	90	1.05	54.0	64.0	39.1	0.13
16093-AP75	11.4 - 12.0	16	100	90	1.05	54.0	64.0	39.1	0.13
17093-AP70	9.84 - 15.0	17	120	75	1.10	42.2	52.0	38.8	0.10
17093-AP71	11.7 - 14.5	17	120	75	1.07	42.2	52.0	38.8	0.10
18093-AP70	11.9 - 18.0	18	140	62	1.10	47.2	56	38.4	0.08
18093-AP71	14.0 - 14.5	18	140	62	1.03	47.2	56	38.4	0.08
18093-AP72	15.5 - 17.5	18	140	62	1.07	47.2	56	38.4	0.08
18093-AP73	14.5 - 16.5	18	140	62	1.07	47.2	56	38.4	0.08
18093-AP74	17.3 - 18.1	18	140	62	1.10	47.2	56	38.4	0.08
18093-AP75	16.3 - 16.7	18	140	62	1.05	47.2	56	38.4	0.08
18093-AP76	13.0 - 14.5	18	140	62	1.10	47.2	56	38.4	0.08

Alternative narrowband units can generally be accommodated, details on request.

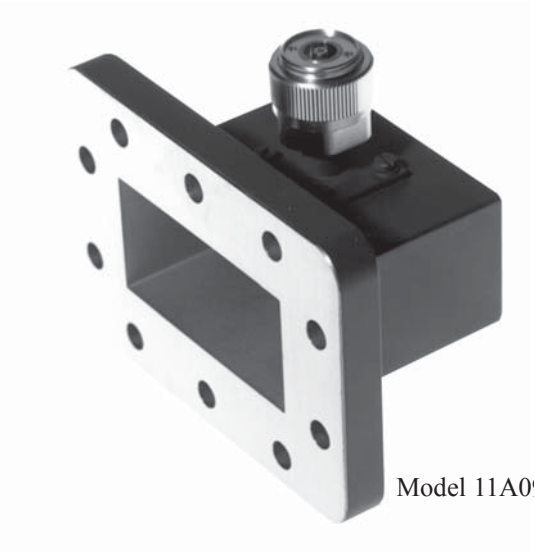
For standard flange types and recommendations see pages 111 onwards

Waveguide to APC7 Coax Adaptors
Series 096-AP

Features

- **VSWR better than 1.05:1**
- **Full Waveguide Band Coverage**
- **7 mm Precision (APC) Connector**
- **Manufactured from Brass or Aluminium***

The Series 096-AP Waveguide to Coax Adaptors offer a very low VSWR over full waveguide bands up to 18 GHz. The units are fitted with a precision 7 mm (APC7) connector for repeatable connection.



Model 11A096-AP70

Model	Frequency Range (GHz)	Waveguide			VSWR (better than)	*Dimensions (Brass)		
		WG	R	WR		A	B	C
06096-AP70	1.14 - 1.73	6	14	650	1.05	105.8	151.0	75.8
08096-AP70	1.72 - 2.61	8	22	430	1.05	111.81	148.5	61.8
10096-AP70	2.6 - 3.95	10	32	284	1.05	59.4	85.5	51.5
11A096-AP70	3.3 - 4.9	11A	40	229	1.05	55.8	76.0	47.6
12096-AP70	3.94 - 5.99	12	48	187	1.05	62.70	81.5	41.7
13096-AP70	4.64 - 7.05	13	58	159	1.05	51.8	68.5	42.9
14096-AP70	5.38 - 8.18	14	70	137	1.05	55.9	71.0	41.90
15096-AP70	6.58 - 10.0	15	84	112	1.05	45.5	58.0	40.3
16096-AP70	8.20 - 12.5	16	100	90	1.05	54.0	64.0	39.1
17096-AP70	9.84 - 15.0	17	120	75	1.07	42.2	52.0	38.8
18096-AP70	11.9 - 18.0	18	140	62	1.07	47.2	56.0	38.5

ORDERING INFORMATION

Model: Description

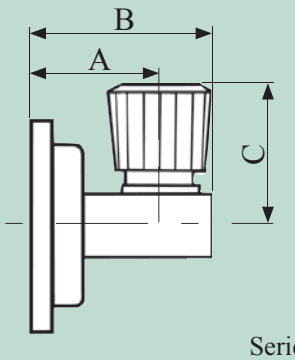
Example: Model 16096-APC70 Waveguide to APC7 coax adaptor

Please note: Narrowband options are not available for this series of Waveguide to Coax Adaptors.

If the adaptor is required to be manufactured in aluminium please suffix the order information with \ AL

Example: Model 16096-APC70\AL

*Note The dimensions of aluminium adaptors may vary from those manufactured in brass.



Series 096-AP

For standard flange types and recommendations see pages 111 onwards

Waveguide to SMA Coax Adaptors
Series 094-SF

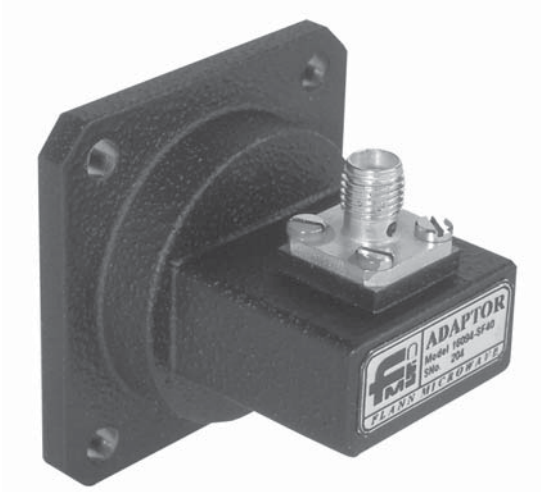
Features

- **Very Low VSWR**
- **Full Waveguide Band models**
- **Manufactured from Brass or *Aluminium**

The Flann Series 094-SF waveguide to coax adaptors offer enhanced VSWR performance over the full waveguide frequency band.

The adaptors are fitted with SMA Female connectors as standard. However, models are optionally available with male connectors, please contact our sales team for further details.

Narrowband models covering typically 20% of the full waveguide band with a VSWR of 1.05 are also available.



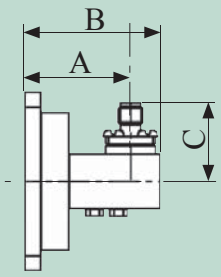
Model 16094-SF40

Model	Frequency Range (GHz)	Waveguide			VSWR (better than)	*Dimensions (Brass)		
		WG	R	WR		A	B	C
11A094-SF40	3.3 - 4.9	11A	40	229	1.15	51.5	72.3	59.0
12094-SF40	3.94 - 5.99	12	48	187	1.15	60.2	78.5	24.5
13094-SF40	4.64- 7.05	13	58	159	1.15	32.6	46.5	22.8
14094-SF40	5.38 - 8.18	14	70	137	1.15	35.8	46.5	21.4
15094-SF40	6.58 - 10.0	15	84	112	1.12	37.5	48.5	19.8
16094-SF40	8.2 - 12.5	16	100	90	1.12	34.5	45.3	17.9
17094-SF40	9.84 - 15.0	17	120	75	1.12	26.2	34.5	17.1
18094-SF40	11.9 - 18.0	18	140	62	1.12	38.5	47.3	17.0
19094-SF40	14.5 - 22.0	19	180	51	1.20	27.3	34.5	16.4
20094-SF40	17.6 - 26.7	20	220	42	1.20	21.5	27.9	15.1

ORDERING INFORMATION
Model: description
Example: Model 18094-SF40 waveguide to SMA female coax adaptor

If the adaptor is required to be manufactured in aluminium please suffix the order information with \ AL
Example: Model 18094-SF40\AL
Note: models with suffix SF40 are full band units. Please see page 58 for narrowband models.

*Note The dimensions of aluminium adaptors may vary from those manufactured in brass.



Series 094-SF

For standard flange types and recommendations see pages 111 onwards

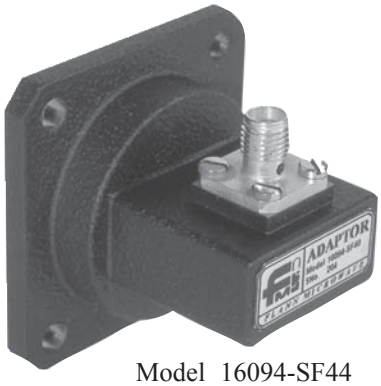
Narrow Band Waveguide to SMA Coax Adaptors
Series 094-SF

Features

- **Very Low VSWR**
- **Alternative Narrowband Models on Request**
- **Manufactured from Brass or *Aluminium**

*Note The dimensions of aluminium adaptors may vary from those manufactured in brass.

The following tables indicate a wide choice of adaptor specifications. Flann Waveguide to Coax Adaptors in this Series are fitted with SMA female connectors as standard. SMA male connectors are available on most models to special order; **please contact our sales team for further details.** Alternative requirements can be accommodated provided the customer submits full details of the specification required.



Model 16094-SF44

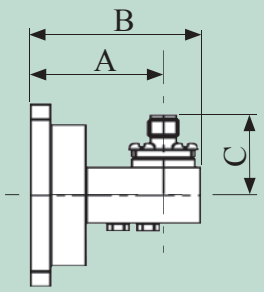
Model	Frequency Range (GHz)	Waveguide			VSWR (better than)	*Dimensions (Brass)			Weight (kg) [Brass]
		WG	R	WR		A	B	C	
12094-SF41	5.2 - 5.4	12	48	187	1.05	60.2	78.5	24.5	0.63
12094-SF42	5.295 - 5.305	12	48	187	1.05	60.2	78.5	24.5	0.63
12094-SF43	4.3 - 5.1	12	48	187	1.10	60.2	78.5	24.5	0.63
12094-SF44	4.75 - 5.1	12	48	187	1.05	60.2	78.5	24.5	0.63
12094-SF45	5.4 - 5.9	12	48	187	1.05	60.2	78.5	24.5	0.63
13094-SF41	5.2 - 5.4	13	58	159	1.05	32.6	46.5	23.6	0.50
13094-SF42	5.1 - 5.6	13	58	159	1.05	32.6	46.5	23.6	0.50
14094-SF41	6.4 - 7.1	14	70	137	1.05	35.8	46.5	21.4	0.38
14094-SF42	5.4 - 5.6	14	70	137	1.05	35.8	46.5	21.4	0.38
14094-SF43	5.7 - 6.5	14	70	137	1.08	35.8	46.5	21.4	0.38
14094-SF44	7.1 - 7.7	14	70	137	1.05	35.8	46.5	21.4	0.38
14094-SF46	7.4 - 8.18	14	70	137	1.05	35.8	46.5	21.4	0.38
14094-SF47	5.4 - 5.9	14	70	137	1.05	35.8	46.5	21.4	0.38
15094-SF41	7.212 - 7.712	15	84	112	1.05	37.5	48.5	19.8	0.21
15094-SF42	7.938 - 8.438	15	84	112	1.05	37.5	48.5	19.8	0.21
15094-SF43	7.25 - 7.75	15	84	112	1.05	37.5	48.5	19.8	0.21
15094-SF44	7.9 - 8.4	15	84	112	1.05	37.5	48.5	19.8	0.21
15094-SF45	7.1 - 8.5	15	84	112	1.10	37.5	48.5	19.8	0.21
15094-SF46	7.8 - 8.6	15	84	112	1.05	37.5	48.5	19.8	0.21
15094-SF48	7.4 - 7.9	15	84	112	1.05	37.5	48.5	19.8	0.21
15094-SF49	8.15 - 8.65	15	84	112	1.05	37.5	48.5	19.8	0.21
15094-SF50	7.2 - 7.8	15	84	112	1.05	37.5	48.5	19.8	0.21
15094-SF51	7.4 - 8.1	15	84	112	1.10	37.5	48.5	19.8	0.21
16094-SF41	8.6 - 9.43	16	100	90	1.05	34.5	45.3	17.9	0.13
16094-SF42	9.22 - 10.08	16	100	90	1.05	34.5	45.3	17.9	0.13
16094-SF43	10.0 - 10.4	16	100	90	1.05	34.5	45.3	17.9	0.13
16094-SF44	10.0 - 11.0	16	100	90	1.10	34.5	45.3	17.9	0.13
16094-SF45	11.0 - 11.3	16	100	90	1.05	34.5	45.3	17.9	0.13
16094-SF46	11.3 - 11.9	16	100	90	1.05	34.5	45.3	17.9	0.13
16094-SF47	9.25 - 9.75	16	100	90	1.05	34.5	45.3	17.9	0.13
16094-SF48	10.95 - 11.7	16	100	90	1.10	34.5	45.3	17.9	0.13
16094-SF49	8.5 - 9.6	16	100	90	1.05	34.5	45.3	17.9	0.13
16094-SF50	11.15 - 11.6	16	100	90	1.05	34.5	45.3	17.9	0.13
16094-SF51	10.5 - 11.5	16	100	90	1.10	34.5	45.3	17.9	0.13
16094-SF52	9.0 - 9.6	16	100	90	1.05	34.5	45.3	17.9	0.13
16094-SF53	9.85 - 10.15	16	100	90	1.05	34.5	45.3	17.9	0.13
16094-SF57	10.7 - 11.7	16	100	90	1.10	34.5	45.3	17.9	0.13
17094-SF41	10.9 - 11.3	17	120	75	1.05	26.2	34.5	17.1	0.10
17094-SF42	11.4 - 11.9	17	120	75	1.10	26.2	34.5	17.1	0.10
17094-SF43	12.4 - 12.6	17	120	75	1.05	26.2	34.5	17.1	0.10
17094-SF44	14.0 - 14.5	17	120	75	1.05	26.2	34.5	17.1	0.10
17094-SF45	10.7 - 11.7	17	120	75	1.10	26.2	34.5	17.1	0.10
17094-SF46	11.4 - 12.5	17	120	75	1.10	26.2	34.5	17.1	0.10
17094-SF47	11.2 - 11.7	17	120	75	1.05	26.2	34.5	17.1	0.10
17094-SF48	13.7 - 14.8	17	120	75	1.05	26.2	34.5	17.1	0.10
17094-SF49	11.6 - 12.2	17	120	75	1.05	26.2	34.5	17.1	0.10
17094-SF50	12.7 - 13.3	17	120	75	1.05	26.2	34.5	17.1	0.10
17094-SF51	11.7 - 12.5	17	120	75	1.05	26.2	34.5	17.1	0.10
17094-SF52	12.0 - 12.5	17	120	75	1.05	26.2	34.5	17.1	0.10
17094-SF53	10.5 - 13.5	17	120	75	1.08	26.2	34.5	17.1	0.10
17094-SF54	12.5 - 12.75	17	120	75	1.05	26.2	34.5	17.1	0.10
17094-SF55	13.0 - 14.3	17	120	75	1.05	26.2	34.5	17.1	0.10
17094-SF56	10.9 - 11.7	17	120	75	1.05	26.2	34.5	17.1	0.10
17094-SF57	12.25 - 12.75	17	120	75	1.05	26.2	34.5	17.1	0.10
17094-SF58	12.6 - 13.4	17	120	75	1.10	26.2	34.5	17.1	0.10
17094-SF59	12.5 - 13.0	17	120	75	1.05	26.2	34.5	17.1	0.10
17094-SF60	13.0 - 13.5	17	120	75	1.05	26.2	34.5	17.1	0.10
17094-SF61	10.95 - 11.7	17	120	75	1.10	26.2	34.5	17.1	0.10
17094-SF62	11.7 - 12.75	17	120	75	1.10	26.2	34.5	17.1	0.10
17094-SF63	12.2 - 12.8	17	120	75	1.05	26.2	34.5	17.1	0.10
17094-SF64	12.5 - 13.5	17	120	75	1.10	26.2	34.5	17.1	0.10
17094-SF65	12.7 - 13.2	17	120	75	1.05	26.2	34.5	17.1	0.10
17094-SF66	10.5 - 12.7	17	120	75	1.08	26.2	34.5	17.1	0.10
17094-SF67	12.75 - 13.25	17	120	75	1.05	26.2	34.5	17.1	0.10
17094-SF69	13.5- 14.5	17	120	75	1.05	26.2	34.5	17.1	0.10
17094-SF70	10.9 - 12.75	17	120	75	1.12	26.2	34.5	17.1	0.10

Narrow Band Waveguide to SMA Coax Adaptors
Series 094-SF

Model	Frequency Range (GHz)	Waveguide			VSWR (better than)	*Dimensions (Brass)			Weight (kg) [Brass]
		WG	R	WR		A	B	C	
18094-SF41	13.6 - 13.8	18	140	62	1.05	38.5	47.3	17.0	0.08
18094-SF42	14.0 - 14.5	18	140	62	1.05	38.5	47.3	17.0	0.08
18094-SF43	15.4 - 16.5	18	140	62	1.05	38.5	47.3	17.0	0.08
18094-SF44	16.4 - 17.6	18	140	62	1.05	38.5	47.3	17.0	0.08
18094-SF45	17.3 - 18.0	18	140	62	1.05	38.5	47.3	17.0	0.08
18094-SF46	13.4 - 14.6	18	140	62	1.05	38.5	47.3	17.0	0.08
18094-SF47	14.04 - 14.21	18	140	62	1.05	38.5	47.3	17.0	0.08
18094-SF48	15.1 - 15.7	18	140	62	1.05	38.5	47.3	17.0	0.08
18094-SF49	13.6 - 14.0	18	140	62	1.05	38.5	47.3	17.0	0.08
18094-SF50	13.1 - 14.2	18	140	62	1.05	38.5	47.3	17.0	0.08
18094-SF51	14.0 - 15.5	18	140	62	1.10	38.5	47.3	17.0	0.08
18094-SF52	11.7 - 12.2	18	140	62	1.10	38.5	47.3	17.0	0.08
18094-SF53	17.3 - 18.1	18	140	62	1.05	38.5	47.3	17.0	0.08
18094-SF54	11.7 - 12.5	18	140	62	1.10	38.5	47.3	17.0	0.08
18094-SF55	11.925 - 12.125	18	140	62	1.05	38.5	47.3	17.0	0.08
18094-SF56	13.1 - 13.6	18	140	62	1.05	38.5	47.3	17.0	0.08
18094-SF57	15.0 - 15.6	18	140	62	1.05	38.5	47.3	17.0	0.08
18094-SF58	14.4 - 15.5	18	140	62	1.05	38.5	47.3	17.0	0.08
18094-SF59	14.5 - 15.5	18	140	62	1.10	38.5	47.3	17.0	0.08
18094-SF60	16.0 - 17.0	18	140	62	1.08	38.5	47.3	17.0	0.08
18094-SF61	14.6 - 15.25	18	140	62	1.05	38.5	47.3	17.0	0.08
18094-SF62	14.25 - 14.5	18	140	62	1.05	38.5	47.3	17.0	0.08
18094-SF63	17.5 - 18.6	18	140	62	1.15	38.5	47.3	17.0	0.08
18094-SF66	14.0 - 16.0	18	140	62	1.05	38.5	47.3	17.0	0.08
19094-SF41	17.3 - 18.1	19	180	51	1.10	27.3	34.5	16.4	0.06
19094-SF43	14.5 - 15.35	19	180	51	1.10	27.3	34.5	16.4	0.06
19094-SF46	16.0 - 17.0	19	180	51	1.10	27.3	34.5	16.4	0.06
19094-SF47	14.5 - 15.5	19	180	51	1.15	27.3	34.5	16.4	0.06
19094-SF51	18.0 - 18.5	19	180	51	1.10	27.3	34.5	16.4	0.06
19094-SF53	17.0 - 18.5	19	180	51	1.10	27.3	34.5	16.4	0.06
19094-SF54	20.0 - 22.0	19	180	51	1.10	27.3	34.5	16.4	0.06
20094-SF41	17.6- 19.7	20	220	42	1.10	21.5	27.9	15.1	0.04
20094-SF42	21.9 - 22.4	20	220	42	1.10	21.5	27.9	15.1	0.04
20094-SF43	18.9 - 19.8	20	220	42	1.10	21.5	27.9	15.1	0.04
20094-SF44	23.7 - 24.3	20	220	42	1.10	21.5	27.9	15.1	0.04
20094-SF45	17.6 - 20.0	20	220	42	1.10	21.5	27.9	15.1	0.04
20094-SF46	20.5 - 23.5	20	220	42	1.10	21.5	27.9	15.1	0.04
20094-SF50	21.3 - 22.95	20	220	42	1.10	21.5	27.9	15.1	0.04
20094-SF51	21.2 - 23.6	20	220	42	1.10	21.5	27.9	15.1	0.04
20094-SF52	17.7 - 19.7	20	220	42	1.10	21.5	27.9	15.1	0.04
20094-SF53	21.0 - 24.0	20	220	42	1.10	21.5	27.9	15.1	0.04

ORDERING INFORMATION
Model: frequency band suffix; description
Example: Model 17094-SF44 Narrow Band waveguide to SMA coax adaptor (frequency range 14.00 GHz to 14.50 GHz VSWR 1.05 max)

*Note The dimensions of aluminium adaptors may vary from those manufactured in brass.



Series 094-SF

For standard flange types and recommendations see pages 111 onwards

Waveguide to K Type Coax Adaptors
Series 093-KF/KM and 094-KF

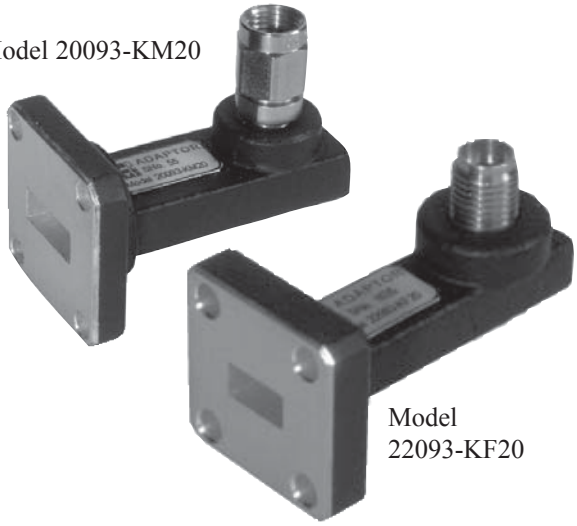
Features

- **Low VSWR**
- **Models up to 40 GHz**
- **Manufactured from Brass or *Aluminium**

The new Series 093-KF/KM and 094-KF range of Waveguide to Coax Adaptors feature an improved mechanical design offering greater durability and reliability. Minor dimensional changes may have been incorporated; please contact our Sales Team for further information if available space is limited.

Adaptors in this range are fitted with Precision 'K' type connectors and are available for frequency ranges up to 40 GHz. Narrowband models, specifically optimised and offering reduced VSWR, are also available. Male and Female connectors are offered, see table below for full details.

Model 20093-KM20



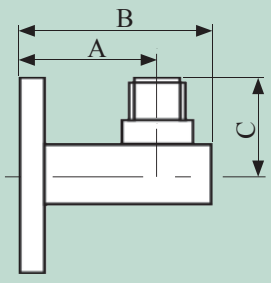
Model 22093-KF20

Model	Frequency Range (GHz)	Waveguide			VSWR (better than)	*Dimensions (Brass)		
		WG	R	WR		A	B	C
18094-KF20	11.9 - 18.0	18	140	62	1.10	37.1	45.5	17.9
18093-KF20	11.9 - 18.0	18	140	62	1.12	37.1	45.5	17.9
19094-KF20	14.5 - 22.0	19	180	51	1.10	36.3	45.5	17.0
19093-KF20	14.5 - 22.0	19	180	51	1.20	36.3	45.5	17.0
19093-KM20	14.5 - 22.0	19	180	51	1.20	36.3	45.5	19.4
19093-KF21	20.2 - 20.8	19	180	51	1.05	36.3	45.5	19.4
20094-KF20	17.6 - 26.7	20	220	42	1.10	28.6	37.0	16.1
20093-KF20	17.6 - 26.7	20	220	42	1.20	28.6	37.0	16.1
20093-KM20	17.6 - 26.7	20	220	42	1.20	28.6	37.0	19.3
20093-KF21	21.2 - 23.6	20	220	42	1.10	28.6	37.0	16.1
20093-KM21	21.2 - 23.6	20	220	42	1.10	28.6	37.0	19.3
20093-KM23	23.0 - 24.0	20	220	42	1.10	28.6	37.0	19.3
21094-KF20	21.7 - 33.0	21	260	34	1.15	28.7	37.0	16.1
21093-KF20	21.7 - 33.0	21	260	34	1.25	28.7	37.0	16.1
21093-KM20	21.7 - 33.0	21	260	34	1.25	28.7	37.0	18.8
21093-KF22	24.5 - 27.0	21	260	34	1.10	28.7	37.0	16.1
22094-KF20	26.4 - 40.1	22	320	28	1.15	28.4	36.5	15.7
22093-KF20	26.4 - 40.1	22	320	28	1.20	28.4	36.5	15.7
22093-KM20	26.4 - 40.1	22	320	28	1.20	28.4	36.5	17.9
22093-KF22	37.0 - 39.5	22	320	28	1.10	28.4	36.5	15.7
22093-KF23	27.0 - 29.5	22	320	28	1.10	28.4	36.5	15.7
22093-KF24**	40.5 - 42.5	22	320	28	1.30	28.4	36.5	15.7
22093-KF25	28.0 - 32.0	22	320	28	1.15	28.4	36.5	15.7
22093-KF26	33.0 - 35.0	22	320	28	1.10	28.4	36.5	15.7
22093-KF27	28.0 - 31.0	22	320	28	1.10	28.4	36.5	15.7
22093-KM21	28.0 - 28.7	22	320	28	1.15	28.4	36.5	15.7
22093-KM22	37.0 - 39.5	22	320	28	1.10	28.4	36.5	15.7
22093-KM23	27.0 - 29.0	22	320	28	1.10	28.4	36.5	15.7
22093-KM24	40.5 - 42.5	22	320	28	1.30	28.4	36.5	15.7
22093-KM25	28.0 - 32.0	22	320	28	1.15	28.4	36.5	15.7
22093-KM26	33.0 - 35.0	22	320	28	1.10	28.4	36.5	15.7

ORDERING INFORMATION

Adaptor, Waveguide to Coax, Precision K Female
Model: Frequency band and adaptor type suffix; Description
Example: Model 22094-KF20 Waveguide to K type female coax adaptor
(Frequency Range 26.4 GHz to 40.1 GHz, VSWR 1.15)

Adaptor, Waveguide to Coax, Precision K Male
Model: Frequency band and adaptor type suffix; Description
Example: Model 20093-KM20 Waveguide to K Type male coax adaptor
(Frequency Range 17.6 GHz to 26.7 GHz, VSWR 1.20)



Models optimised for narrowband applications are also available - details on request.
If the adaptor is required to be manufactured in aluminium please suffix the order information with \ AL
Example: Model 20093-KM20\AL
*Note The dimensions of aluminium adaptors may vary from those manufactured in brass.
**Note This adaptor is a special model optimised for use outside the frequency band.

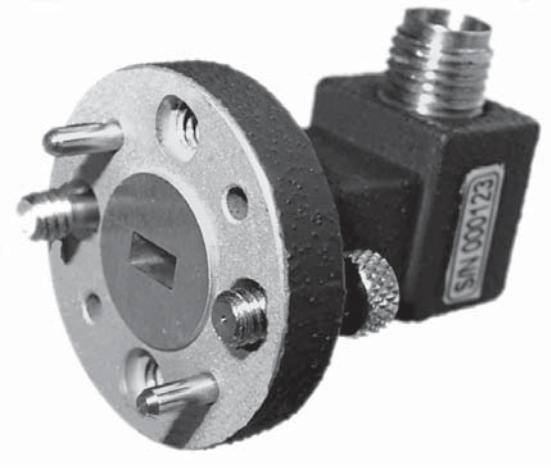
Series 093-KF/KM 094-KF

For standard flange types and recommendations see pages 111 onwards

Waveguide to 1.85 mm V Connector®* Coax Adaptor
Series 093/094-VF and VM

Features

- 1.85 mm V Connector®*
- Low VSWR
- Models Available in 3 bands from 33 GHz
- Male or Female Connectors Available
- Two Grades Available



Model 25094-VF50

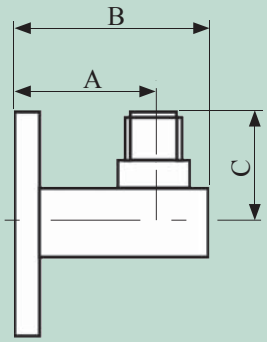
The Flann adaptors fitted with 1.85 mm coax connectors incorporate a split pin centre conductor providing excellent reliability and repeatability; these adaptors can also be integrated with filters, couplers, attenuators and antennas.
The model illustrated above is a 25094-VF50, fitted with a standard UG-385/U flange.
Please contact our Sales Team with your requirements for all waveguide to coax adaptors.
If you cannot find a suitable waveguide to coax adaptor in our extensive range we are able to design a model to your specific needs.

Model	Frequency Range (GHz)	Waveguide			VSWR (better than)	Dimensions (mm)		
		WG	R	WR		A	B	C
23093-VF50	33.0 to 50.0	23	400	22	1.40	24.0	29.0	16.6
23094-VF50	33.0 to 50.0	23	400	22	1.30	24.0	29.0	16.6
23093-VM50	33.0 to 50.0	23	400	22	1.30	24.0	29.0	21.2
23094-VM50	33.0 to 50.0	23	400	22	1.30	24.0	29.0	21.2
24093-VF50	39.3 to 60.0	24	500	19	1.40	20.0	25.0	14.5
24094-VF50	39.3 to 60.0	24	500	19	1.30	20.0	25.0	14.5
24093-VM50	39.3 to 60.0	24	500	19	1.30	20.0	25.0	19.3
24094-VM50	39.3 to 60.0	24	500	19	1.30	20.0	25.0	19.3
25093-VF50	50.0 to 67.0	25	620	15	1.30	30.4	35.0	14.4
25094-VF50	50.0 to 67.0	25	620	15	1.25	30.4	35.0	14.4
25093-VM50	50.0 to 67.0	25	620	15	1.30	30.4	35.0	19.2
25094-VM50	50.0 to 67.0	25	620	15	1.25	30.4	35.0	19.2

ORDERING INFORMATION

Adaptor, waveguide to coax, precision V female
Model: description
Example: Model 24094-VF50 Waveguide to 1.85 female coax adaptor (frequency range 39.3 GHz to 60 GHz, VSWR 1.30)

Adaptor, waveguide to coax, precision V male
Model: description
Example: Model 25094-VM50 Waveguide to 1.85 male coax adaptor (frequency range 50 GHz to 67 GHz, VSWR 1.25)



Series 093/094-VF/VM

* V Connector® is a registered trademark of the Anritsu Corporation

For standard flange types and recommendations see pages 111 onwards

Waveguide to 2.4 mm Coax Adaptors
Series 093-TF/TM

Features

- **Male and Female Connectors Available**
- **Models up to 50 GHz**
- **Full Band & Narrow Band Models**

The Series 093-TF/TM Waveguide to Coax Adaptors feature an improved mechanical design offering greater durability and reliability.

The Adaptors are fitted with 2.4 mm male or female coaxial connectors which are suitable for operation over full waveguide bands up to 50 GHz.

Models optimised for limited and narrowband applications are also available to special order.
Full details on request.

Model
22093-TF30

Model	Frequency Range (GHz)	Waveguide			VSWR (better than)
		WG	R	WR	
19093-TF30	14.5 - 22.0	19	180	51	1.25
19093-TM30	14.5 - 22.0	19	180	51	1.25
20093-TF30	17.6 - 26.7	20	220	42	1.20
20093-TM30	17.6 - 26.7	20	220	42	1.20
21093-TF30	21.7 - 33.0	21	260	34	1.25
21093-TM30	21.7 - 33.0	21	260	34	1.25
22093-TF30	26.4 - 40.1	22	320	28	1.25
22093-TM30	26.4 - 40.1	22	320	28	1.25
23093-TF30	33.0 - 50.1	23	400	22	1.30
23093-TM30	33.0 - 50.1	23	400	22	1.30
23093-TF31	40.0 - 50.0	23	400	22	1.20
23091-TM31	40.0 - 50.0	23	400	22	1.20

ORDERING INFORMATION

Model: Adaptor type suffix; Description
Example: Model 22093-TF30 Waveguide to 2.4 mm female coax adaptor

Series 093-TF/TM

For standard flange types and recommendations see pages 111 onwards

Broad Band End Launch Adaptors
Series 373

Features

- Compact Design
- Low VSWR across the band
- Designs up to WG27 (WR10)
- Available in DC or Non-DC coupled designs
- Narrow Band Models Available

Model 25373-VF50

Flann is pleased to announce our new line of end launch waveguide to coaxial adaptors. The Series 373 of end launch adaptors are available in waveguide sizes from WG10 (WR284) to WG27 (WR10)

The compact, precision Flann design keeps costs to a minimum and enables short lead times to be offered. Depending on the operating frequency band, coaxial connectors are available in APC7, Type N, SMA, 2.92, 2.4 mm and 1.85 mm configuration.

Model	Frequency Range (GHz)	Waveguide			VSWR (better than)
		WG	R	WR	
19373-TF30	14.5 - 22.0	19	180	51	1.25
19373-TM30	14.5 - 22.0	19	180	51	1.25
20373-KF20	17.6 - 26.7	20	220	42	1.25
20373-KM20	17.6 - 26.7	20	220	42	1.25
21373-TF30	21.7 - 33.0	21	260	34	1.25
21373-TF31	19.7 - 30.0	21	260	34	1.25
22373-KF20	26.4 - 40.1	22	320	28	1.25
22373-KM20	26.4 - 40.1	22	320	28	1.25
23373-TF30	33.0 - 50.1	23	400	22	1.25
23373-TM30	33.0 - 50.1	23	400	22	1.25
25373-VF50	50.0 - 67.0	23	400	22	1.25

ORDERING INFORMATION

Model: Adaptor type suffix; Description
Example: Model 23373-TF30 Waveguide to 2.4 mm female coax adaptor

Series 373

For standard flange types and recommendations see pages 111 onwards

Double Ridge Waveguide to Coax Adaptors
Series WRD093

Features

- 1.25:1 VSWR Fullband
- Narrow Band Versions Available
- Models up to 40GHz
- Female & Male Coax Connectors

We are proud to include in our latest catalogue, our new series of WRD waveguide to coax adaptors which have been designed to give high durability and reliability.

Adaptors can be fitted with SMA, APC7 and N type connectors for use up to 18 GHz, K connectors are fitted to the WRD 180 units covering the 18 GHz to 40 GHz band.

Narrowband models, specifically optimised can be manufactured on request.

Model	Frequency Range GHz	Waveguide Size	Connector Options	Waveguide Flange	Fullband VSWR Max
WRD200093-SF40	2.0-4.8	WRD-200D24	SMA	WRD200C1	1.25
WRD350093-SF40	3.5-8.2	WRD-350D24	SMA	WRD350C1	1.25
WRD475093-SF40	4.75-11.0	WRD-475D24	SMA	WRD475C1	1.25
WRD580093-SF40	5.8-16.0	WRD-580D28	SMA	WRD580C1	1.25
WRD650093-SF40	6.5-18.0	WRD-650D28	SMA	WRD650C1	1.25
WRD750093-SF40	7.5-18.0	WRD-750D24	SMA	WRD750C1	1.25
WRD200093-AP70	2.0-4.8	WRD-200D24	APC	WRD200C1	1.25
WRD350093-AP70	3.5-8.2	WRD-350D24	APC	WRD350C1	1.25
WRD475093-AP70	4.75-11.0	WRD-475D24	APC	WRD475C1	1.25
WRD580093-AP70	5.8-16.0	WRD-580D28	APC	WRD580C1	1.25
WRD650093-AP70	6.5-18.0	WRD-650D28	APC	WRD650C1	1.25
WRD750093-AP70	7.5-18.0	WRD-750D24	APC	WRD750C1	1.25
WRD200093-NF10	2.0-4.8	WRD-200D24	N	WRD200C1	1.25
WRD350093-NF10	3.5-8.2	WRD-350D24	N	WRD350C1	1.25
WRD475093-NF10	4.75-11.0	WRD-475D24	N	WRD475C1	1.25
WRD580093-NF10	5.8-16.0	WRD-580D28	N	WRD580C1	1.25
WRD650093-NF10	6.5-18.0	WRD-650D28	N	WRD650C1	1.25
WRD750093-NF10	7.5-18.0	WRD-750D24	N	WRD750C1	1.25
WRD110093-KF20	11.0-26.5	WRD-110C24	K(female)	WRD110C1	1.25
WRD110093-KM20	11.0-26.5	WRD-110C24	K(Male)	WRD110C1	1.25
WRD180093-KF20	18.0-40.0	WRD-180C24	K(Female)	WRD180C1	1.25
WRD180093-KM20	18.0-40.0	WRD-180C24	K(Male)	WRD180C1	1.25

ORDERING INFORMATION

Model: Adaptor type suffix; Description
Example: Model WRD18093-KF20 Double Ridge Waveguide to K female coax adaptor

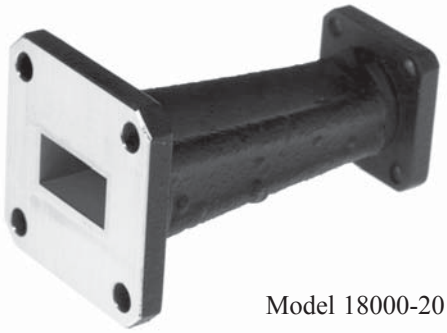
Series WRD093

Rectangular Waveguide to Waveguide Tapered Transitions Series 000

NOW UP TO 330 GHz

Features

- **Low VSWR**
- **Minimal length**



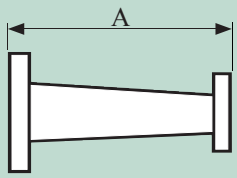
Model 18000-20

Waveguide to waveguide tapered transitions provide a gradual dimensional change between two sizes of waveguide.

The larger components are accurately fabricated from laser cut plates; smaller tapers are precision electroformed "in house". In applications where waveguide frequency bands overlap the transitions exhibit low VSWR and low insertion loss whilst maintaining high mode purity.

For most models with overlapping frequency bands, the VSWR is typically better than 1.03 in the common part of the frequency ranges. Tapered Transitions not listed can be made to special order.

ORDERING INFORMATION
Model: Description
Example: Model 18000-22 Waveguide tapered transition
WG18 (WR62) to WG22 (WR28)



Series 000

Model	Waveguide to Waveguide						Overall Length (mm)	Weight (kg)
	WG	R	WR	WG	R	WR		
08000-10	8	22	430	10	32	284	210	Details on
09A000-10	9A	26	340	10	32	284	134	request
10000-11A	10	32	284	11A	40	229	130	1.60
10000-12	10	32	284	12	48	187	130	1.58
10000-15	10	32	284	15	84	112	173	1.38
10000-16	10	32	284	16	100	90	173	1.36
11A000-12	11A	40	229	12	48	187	110	0.93
11A000-14	11A	40	229	14	70	137	135	0.95
12000-13	12	48	187	13	58	159	85	0.90
12000-14	12	48	187	14	70	137	85	0.85
12000-17	12	48	187	17	120	75	105	0.75
13000-14	13	58	159	14	70	137	80	0.78
14000-15	14	70	137	15	84	112	75	0.45
14000-16	14	70	137	16	100	90	75	0.40
15000-16	15	84	112	16	100	90	72	0.25
16000-17	16	100	90	17	120	75	58	0.18
16000-18	16	100	90	18	140	62	50	0.25
16000-20	16	100	90	20	220	42	50	0.13
16000-25	16	100	90	25	620	15	75	0.10
16000-26	16	100	90	26	740	12	69	0.09
17000-18	17	120	75	18	140	62	40	0.15
17000-19	17	120	75	19	180	51	60	0.15
17000-22	17	120	75	22	320	28	65	0.10
18000-19	18	140	62	19	180	51	60	0.13
18000-20	18	140	62	20	220	42	56	0.10
18000-22	18	140	62	22	320	28	50	0.10
19000-20	19	180	51	20	220	42	50	0.12
20000-22	20	220	42	22	320	28	50	0.05
20000-23	20	220	42	23	400	22	40	0.05
20000-24	20	220	42	24	500	19	40	0.05
20000-25	20	220	42	25	620	15	60	0.05
21000-22	21	260	34	22	320	28	50	0.05
22000-23	22	320	28	23	400	22	50	0.05
22000-24	22	320	28	24	500	19	35	0.05
22000-25	22	320	28	25	620	15	35	0.04
22000-26	22	320	28	26	740	12	30	0.04
22000-28	22	320	28	28	1200	28	30	0.03
23000-24	23	400	22	24	500	19	35	0.04
23000-25	23	400	22	25	620	15	30	0.05
24000-25	24	500	19	25	620	15	35	0.05
24000-26	24	500	19	26	740	12	35	0.04
25000-26	25	620	15	26	740	12	25	0.03
25000-27	25	620	15	27	900	10	35	0.03
26000-27	26	740	12	27	900	10	25	0.03
26000-28	26	740	12	28	1200	8	25	0.03
27000-28	27	900	10	28	1200	8	25	0.02
27000-29	27	900	10	29	1400	6	25	0.03
28000-31	28	1200	8	31	2200	4	25	0.02
28000-32	28	1200	8	32	2600	3	25	0.02
30000-31	30	1800	5	31	2200	4	25	0.02
30000-32	30	1800	5	32	2600	3	Specification available on request	
31000-32	31	2200	4	32	2600	3		

For standard flange types and recommendations see pages 111 onwards

Flange to Flange Waveguide Straights, Adaptors and Spacers Series 441 / 445

NOW UP TO 330 GHz

Manufactured in:-

- **Brass**
- **Copper**
- **Aluminium**

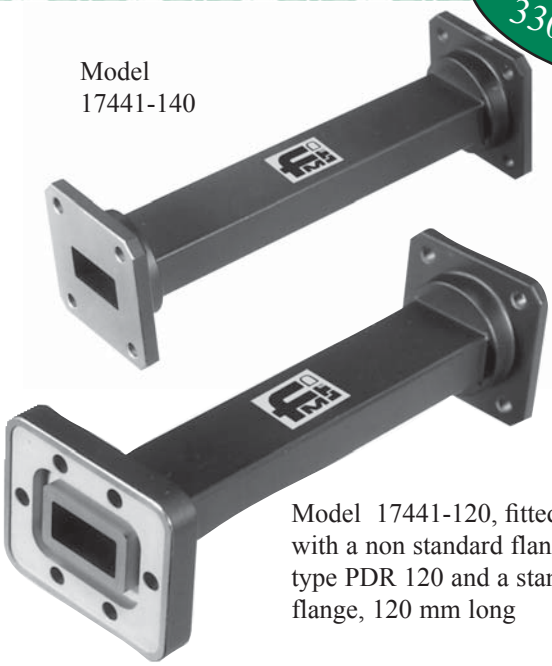
The Flann Series 441/445 of Waveguide Straights and Flange to Flange Adaptors are available in waveguide bands from 1.14 GHz to 330 GHz.

The overall length and flange types fitted at each end, must be specified at time of enquiry.

Note: Waveguide Straights are supplied fitted with Flann standard flanges unless otherwise specified by the customer. See page 111 for standard flange types and recommendations.

Customers requiring precision waveguide sections offering greater aperture and length dimensional accuracy are requested to refer to the Waveguide Calibration Kit section, (starting on page 99) for details.

Model 17441-140



Model 17441-120, fitted with a non standard flange type PDR 120 and a standard flange, 120 mm long

Waveguide Straights and Flange to Flange Adaptors

Model	Frequency Range (GHz)	Waveguide		
		WG	R	WR
06441	1.14 - 1.73	6	14	650
08441	1.72 - 2.61	8	22	430
10441	2.60 - 3.95	10	32	284
11A441	3.30 - 4.90	11A	40	229
12441	3.94 - 5.99	12	48	187
13441	4.64 - 7.05	13	58	159
14441	5.38 - 8.18	14	70	137
15441	6.58 - 10.0	15	84	112
16441	8.20 - 12.5	16	100	90
17441	9.84 - 15.0	17	120	75
18441	11.9 - 18.0	18	140	62
19441	14.5 - 22.0	19	180	51
20441	17.6 - 26.7	20	220	42
22441	26.4 - 40.1	22	320	28
23441	33.0 - 50.1	23	400	22
24441	39.3 - 59.7	24	500	19
25441	49.9 - 75.8	25	620	15
26441	60.5 - 92.0	26	740	12
27441	73.8 - 112	27	900	10
28441	92.3 - 140.0	28	1200	8
29441	114.0 - 173.0	29	1400	6
30441	145 - 220	30	1800	5
31441	172 - 261	31	2200	4
32441	220 - 330	32	2600	3

Waveguide Spacers

Model	Frequency Range (GHz)	Waveguide		
		WG	R	WR
16445	8.20 - 12.5	16	100	90
17445	9.84 - 15.0	17	120	75
18445	11.9 - 18.0	18	140	62
19445	14.5 - 22.0	19	180	51
20445	17.6 - 26.7	20	220	42
22445	26.4 - 40.1	22	320	28
23445	33.0 - 50.1	23	400	22
24445	39.3 - 59.7	24	500	19
25445	49.9 - 75.8	25	620	15
26445	60.5 - 92.0	26	740	12
27445	73.8 - 112	27	900	10
28445	92.3 - 140.0	28	1200	8
29445	114.0 - 173.0	29	1400	6
30445	145 - 220	30	1800	5
31445	172 - 261	31	2200	4
32445	220 - 330	32	2600	3

Model 22445-10

Model 22445-5

ORDERING INFORMATION
STRAIGHTS & FLANGE TO FLANGE ADAPTORS - SERIES 441
Model - Length (mm) Input Flange : Output Flange
If the adaptor Spacer is required to be manufactured in aluminium please suffix the order information with \ AL
Description Example: Model 22441-120-UG599/U. UBR 320
WG flange to flange Adaptor, 120 mm long, flange UG599/U. And PBR 320

ORDERING INFORMATION
Spacers - Series 445
Description Example: Model 22445-5-UG599/U
WG22 Spacer, 5 mm long, flange detail: UG.599/U

Series 441/445

For standard flange types and recommendations see pages 111 onwards

Rectangular to Circular Waveguide Transitions
Series 64*

NOW UP TO 330 GHz

Features

- Low Ellipticity Ratio
- Precision Electroformed
- Linear to Linear Polarization Versions
- Linear to Circular Polarization Versions

Each transition consists of a short length of rectangular waveguide and a stepped or tapered section leading into circular waveguide.

Models are available optionally fitted with combinations of rectangular port flanges, circular port flanges, resistive elements and dielectric elements. The standard rectangular flange types are listed in the table below. Alternative flange types can be fitted to order. The circular waveguide ports are fitted with the flange as detailed below or to customers requirements as other flange styles are available to special order.

The simple rectangular to circular waveguide transition will launch linearly polarized waves into the circular waveguide section (10643 to 32643). However, line reflections from the circular waveguide section may interact with the incident wave resulting in cross polarization.

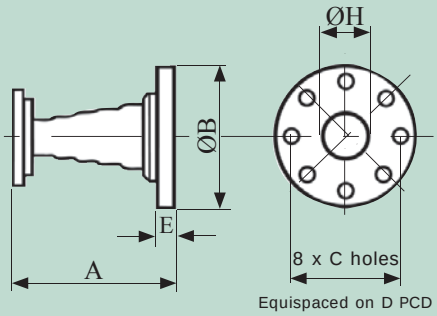
If cross polarization is undesirable then the transition selected should be one fitted with a resistive film element to absorb the cross polarized waves (models 10644 to 32644).

For circular polarization, the transitions are fitted with resistive film element and have an extended circular waveguide section containing a dielectric quarter wave plate (models 10648 to 32648).

ORDERING INFORMATION
Model: polarization suffix
(Series 648 only); description

Example: Model 18648-RH rectangular to circular waveguide transition, right hand polarization (fitted with a dielectric quarter wave plate producing right hand polarization)

Series	Rectangular Port Flange Fitted	Circular Port Flange Fitted	Resistive Vane Fitted	Dielectric Quarter Wave Plate Fitted
643	Yes	Yes	No	No
644	Yes	Yes	Yes	No
648-**	Yes	Yes	Yes	Yes
	LH for left hand polarization (standard)			
	RH for right hand polarization (optional)			



Series 64*

Model	Frequency Range (GHz)	Waveguide			Overall Length A		Rectangular Port Flange Type	Circular Port Flange Dimensions					Weight (kg) Series 643/4 Only
		WG	R	WR	Series 643 & 644	Series 648		B	C	D (PCD)	E	H	
1064*	2.6 - 3.95	10	32	284	241	on request	5985-99-083-1560/0010	146	6.9	132.0	11	73.9	4.30
11A64*	3.3 - 4.9	11A	40	229	178	330	UDR 40	101	5.4	93.0	7	59.7	1.90
1264*	3.94 - 5.99	12	48	187	140	249	UAR 48	89	5.4	80.0	7	48.8	1.50
1364*	4.64 - 7.05	13	58	159	120	on request	UAR 58	89	5.4	80.0	7	41.4	1.10
1464*	5.38 - 8.18	14	70	137	102	232	UAR 70	76	4.4	60.3	7	35.8	0.80
1564*	6.58 - 10.0	15	84	112	82.5	222	UBR 84	60	3.2	52.0	7	28.6	0.30
1664*	8.2 - 12.5	16	100	90	76.0	174	UBR 100	56	3.2	48.0	6	23.4	0.25
1764*	9.84 - 15.0	17	120	75	64.0	149	UBR 120	56	3.2	48.0	6	19.4	0.20
1864*	11.9 - 18.0	18	140	62	51.0	120	UBR 140	50	3.2	41.0	6	16.1	0.10
1964*	14.5 - 22.0	19	180	51	51.0	120	UBR 180	50	3.2	41.0	6	13.3	0.10
2064*	17.6 - 26.7	20	220	42	77.5	141	UBR 220	50	3.2	41.0	5	10.9	0.10
2164*	21.7 - 33.0	21	260	34	67.5	122.5	UBR 260	50	3.2	41.0	5	8.8	0.10
2264*	26.4 - 40.1	22	320	28	51.5	79.5	UG-599/U	44	3.2	35.0	3.5	7.3	0.06
2364*	33.0 - 50.1	23	400	22	46.0	on request	UG-383/U	Fixing detail as for UG-383/U				5.8	0.06
2464*	39.3 - 59.7	24	500	19	43.0	68	UG-383/U MOD					4.8	0.05
2564*	49.9 - 75.8	25	620	15	33.5	61.5	UG-385/U	Fixing detail as for UG-385/U				3.9	0.03
2664*	60.5 - 92.0	26	740	12	28.0	51.5	UG-387/U	Fixing detail as for UG-387/U				3.1	0.03
2764*	73.8 - 112	27	900	10	28.0	43	UG 387/U MOD					2.6	0.03
2864*	92.3 - 140	28	1200	8	28.0	on request	UG 387/U MOD					2.0	0.03
2964*	114 - 173	29	1400	6	Dimensions available on request								
3064*	145 - 220	30	1800	5									
3164*	172 - 261	31	2200	4									
3264*	220 - 330	32	2600	3									

For standard flange types and recommendations see pages 111 onwards

Waveguide Twists
Series 450

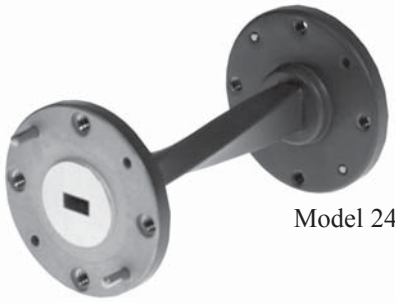
NOW UP TO 330 GHz

Features

- **Manufactured from Brass or Aluminium**
- **Low VSWR**
- **Right and Left Hand Models Available**
- **Models from 2.60 GHz to 330 GHz**

Flann Twists are manufactured from sections of standard waveguide which have been precisely twisted whilst maintaining the internal waveguide dimensions. Standard models are 90˚ left hand twists. Other configurations are available to special order, including:

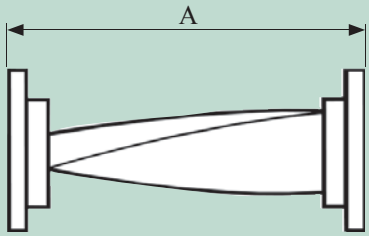
a) 90˚ left hand (standard)
c) 90˚ right hand
b) 45˚ left hand
d) 45˚ right hand



Model 24450 - 90LH

Model 21450-90LH

Model	Frequency Range (GHz)	Waveguide			Dimension A (mm)	VSWR (max)	Weight (kg)
		WG	R	WR			
11A450	3.22 - 4.90	11A	40	229	Specification/dimensions available on request		
12450	3.94 - 5.99	12	48	187			
13450	4.64 - 7.05	13	58	159			
14450	5.38 - 8.18	14	70	137			
15450	6.58 - 10.0	15	84	112	187	1.03	0.45
16450	8.20 - 12.5	16	100	90	150	1.03	0.25
17450	9.84 - 15.0	17	120	75	150	1.03	0.20
18450	11.9 - 18.0	18	140	62	150	1.03	0.14
19450	14.5 - 22.0	19	180	51	120	1.03	0.10
20450	17.6 - 26.7	20	220	42	85	1.03	0.06
21450	21.7 - 33.0	21	260	34	85	1.055	0.05
22450	26.4 - 40.1	22	320	28	54	1.035	0.035
23450	33.0 - 50.1	23	400	22	54	1.06	0.035
24450	39.3 - 59.7	24	500	19	54	1.06	0.035
25450	49.9 - 75.8	25	620	15	46	1.07	0.045
26450	60.5 - 92.0	26	740	12	46	1.08	0.025
27450	73.8 -112.0	27	900	10	42	1.09	0.025
28450	92.3 -140	28	1200	8	42	1.07	0.025
29450	114 - 173	29	1400	6	Specification/dimensions available on request		
30450	145 - 220	30	1800	5			
31450	172 - 261	31	2200	4			
32450	220 - 330	32	2600	3			



ORDERING INFORMATION
Model: angle of twist, LH (left hand) or RH (right hand); description
Example: Model 22450-90LH 90˚ left hand waveguide twist

Series 450

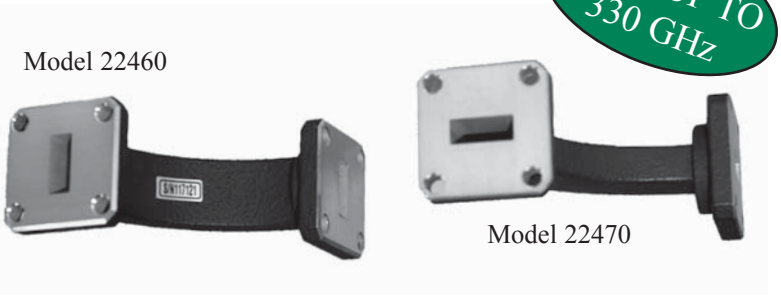
For standard flange types and recommendations see pages 111 onwards

Waveguide E and H Plane Bends
Series 460 / 470

NOW UP TO 330 GHz

Features

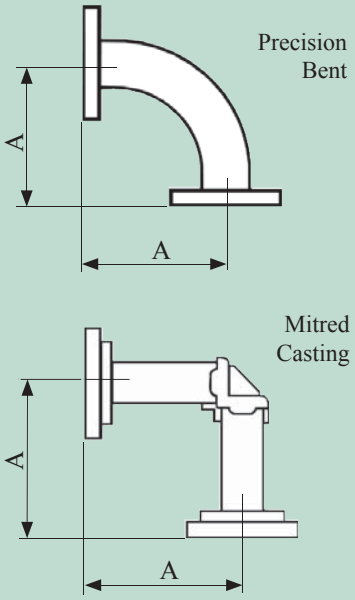
- Low VSWR
- E Plane Models - Series 460
- H Plane Models - Series 470
- Brass or Aluminium
- 90º Standard; 30º 45º & 60º Available



Model	Frequency Range (GHz)	Waveguide			VSWR Max	Dimension (A)	Weight (kg) Brass
		WG	R	WR			
10460 10470	2.60 - 3.95	10	32	284	1.05	100	2.5
11A460 11A470	3.30 - 4.9	11A	40	229	1.05	90	1.05
12460 12470	3.94 - 5.99	12	48	187	1.05	80	1.05
13460 13470	4.64 - 7.05	13	58	159	1.05	75	0.90
14460 14470	5.38 - 8.18	14	70	137	1.05	70	0.66
15460 15470	6.58 - 10.0	15	84	112	1.05	60	0.31
16460 16470	8.20 - 12.5	16	100	90	1.05	50	0.20
17460 17470	9.84 - 15.0	17	120	75	1.05	40	0.18
18460 18470	11.9 - 18.0	18	140	62	1.05	30	0.12
19460 19470	14.5 - 22.0	19	180	51	1.05	30	0.09
20460 20470	17.6 - 26.7	20	220	42	1.05	38	0.05
21460 21470	21.7 - 33.0	21	260	34	1.06	38	0.045
22460 22470	26.4 - 40.1	22	320	28	1.06	38	0.035
23460 23470	33.0 - 50.1	23	400	22	1.06	28	0.045
24460 24470	39.3 - 59.7	24	500	19	1.06	28	0.045
25460 25470	49.9 - 75.8	25	620	15	1.07	21	0.025
26460 26470	60.5 - 92.0	26	740	12	1.08	21	0.025
27460 27470	73.8 -112	27	900	10	1.09	21	0.025
28460 28470	92.3 -140	28	1200	8	1.10	21	0.020
29460 29470	114 - 173	29	1400	6	1.12	Dimensions available on request	
30460 30470	145 - 220	30	1800	5	Specifications/dimensions available on request		
31460 31470	172 - 261	31	2200	4			
32460 32470	220 - 330	32	2600	3			

Flann Waveguide Bends are available in E and H plane configuration with an angle of 90˚. Bends of 30˚, 45˚ and 60˚ can be supplied to special order.

Bends in the range WG10 to WG19 inclusive utilise a mitred casting with a VSWR typically better than 1.05. Bends from WG20 to WG28 inclusive are sections of waveguide which are precisely bent to the required angle with a VSWR of typically 1.05 to 1.10 depending on the model.



ORDERING INFORMATION
Model: Bend Angle Suffix; Description
Example: Model 23460-45 45˚ waveguide Bend WG23, 45º, E plane bend

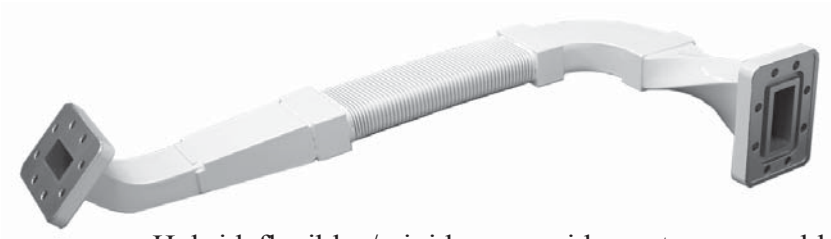
Bend Angle (º)	Suffix
90	90
60	60
45	45
30	30

Series 460/470

Customised Waveguides and Assemblies

Below are examples of customised and customer specific designs, please consult our Sales Team for your special requirements.

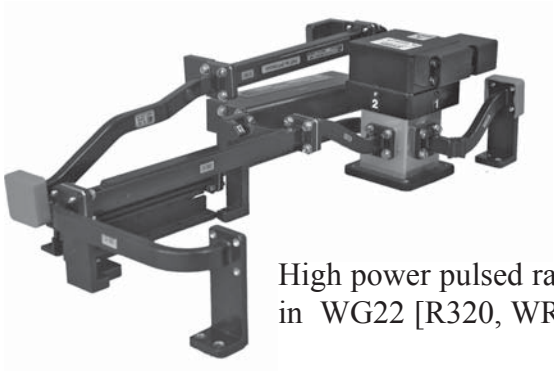
Customised Waveguide Assemblies



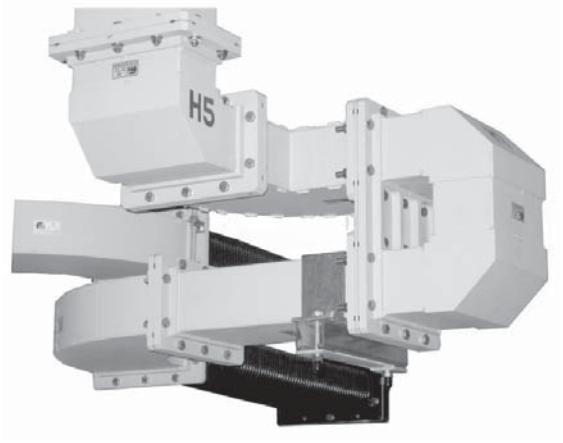
Hybrid flexible / rigid waveguide system assembly in WG14 & 15 [R70 & R84, WR137 & WR112]

Millimetric waveguide sections in WG25 [R620, WR15]

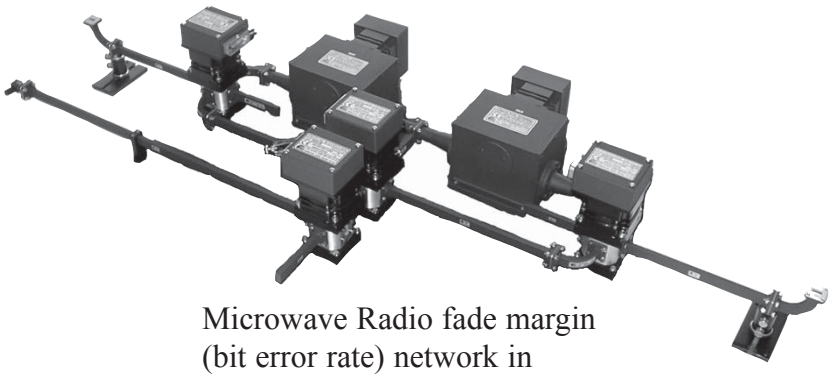
Custom Waveguide Networks



High power pulsed radar subsystem in WG22 [R320, WR28]



High power pulsed radar subsystem in WG6 [R14, WR650]



Microwave Radio fade margin (bit error rate) network in WG20 [R220, WR42]

Please contact our Sales Team for further information.

Waveguide Switches & Driver

SWITCHES

Features

- Manual and Motorised Models
- 2 or 3-Channel Rotor
- High Repeatability
- High Reliability
- High Isolation
- Motorised Speed & Precision modes of operation
- Low VSWR

DRIVER

Features

- GPIB
- USB
- 19" Rack Mountable

The Flann range of waveguide switches, Series 333, includes manual and motorised models operating in the frequency bands up to 140 GHz.
The 4 port switches are optionally available with 2-channel or 3-channel rotors in most waveguide sizes and offer high isolation between non-coupled ports.

Test & Measurement Manual Switches - Series 333-2 (or -3) Page 72

Precision manual switches offering unsurpassed accuracy and repeatability. Available with 2 or 3-channel rotor.

Test & Measurement Motorised Switches - Series 333-2E (or -3E) Page 73

Stepper motor driven switches offering superior reliability and repeatability to alternative solenoid operated units.
A feature unique to the Flann Series 333 of electrical switches is the user's ability to choose between "speed" and "precision" modes of operation. In "speed" mode switching time is minimised by using all possible rotor positions. In "precision" mode, only one of the two possible rotor positions is used ensuring optimum microwave path repeatability.
Standard drive cable length is 2 metres for all models - cable lengths of up to 5 metres available. Available with 2 or 3-channel rotor.

Switch Driver - Model SD5902 Page 74

New

Available for the control of one or two Series 333 switches. The Model SD5902 offers local control via the front panel and remote control via both USB and GPIB interfaces. Refer to page 74 for specifications.

Test & Measurement DC Motor Driven Switches - Series 334-2E (or -3E) Page 75

Series 334 is a DC motor driven switch operating in the frequency bands from 8.2 GHz to 112 GHz with the same high performance specification as the Series 333 manual switch. A high speed DC Motor driven switch offering high reliability alternative to solenoid or TTL operated units. Available with 2 or 3-channel rotor.

Test & Measurement Double Ridge Waveguide Switches DC Motor Driven - Series WRD334-2E Page 75

Double ridge waveguide version switches of the Series 334 switch. Manual versions also available on request.

System & Network Switches - Series 336 Page 76

New

2.6 GHz to 40.1 GHz
Low Loss & High Power
Very Cost Competitive
Many Models available from stock

Manual Waveguide Switches
Series 333

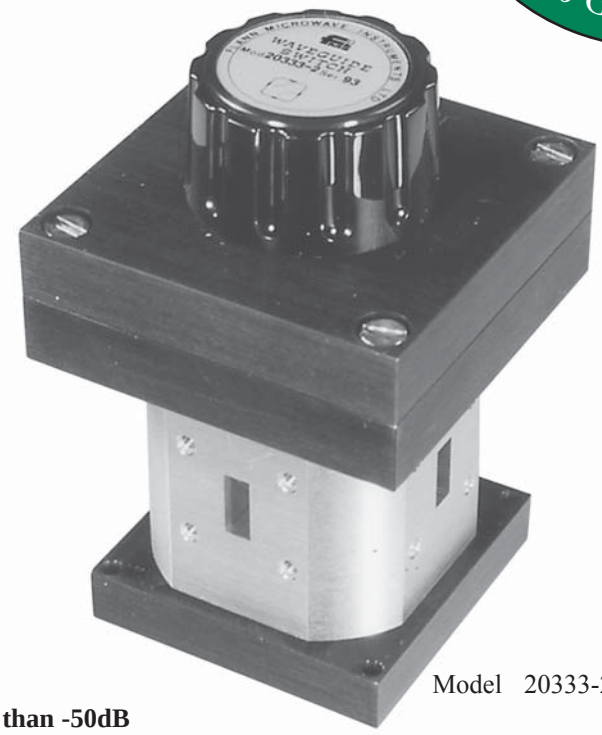
NOW UP TO 330 GHz

Features

- Models up to 330 GHz
- High Accuracy
- High Repeatability
- 2 or 3-Channel Rotor
- High Isolation

The Flann range of Manual Waveguide Switches, Series 333, are 4 port devices and are optionally available with 2 or 3-channel rotor. Efficient choke design ensures a high RF isolation between non-coupled ports.

Accurate channel to port alignment and excellent repeatability are achieved by a light yet positive rotor indexing mechanism. The well proven design ensures long reliable service without deterioration in performance.



Model 20333-2

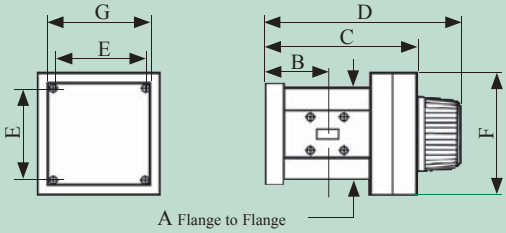
Specification: Isolation (minimum): 75 dB Repeatability better than -50dB

Model	Frequency Range (GHz)	Waveguide			VSWR (max)	Insertion Loss (dB)	Dimensions (mm)**							Weight (kg)	Model
		WG	R	WR			A	B	C	D	E	F	G		
15333-*	6.58 - 10.0	15	84	112	1.10	0.2	Dimensions available on request								**15333-***
16333-*	8.2 - 12.5	16	100	90	1.10	0.15									**16333-***
17333-*	9.84 - 15.0	17	120	75	1.10	0.2									**17333-***
18333-*	11.9 - 18.0	18	140	62	1.10	0.2									**18333-***
19333-*	14.5 - 22.0	19	180	51	1.10	0.3	55	29	71	92	50	60	56	0.95	**19333-***
20333-*	17.6 - 26.7	20	220	42	1.10	0.3	44	30	73	94	45	60	50	0.8	**20333-***
21333-*	21.7 - 33.0	21	260	34	1.10	0.4	44	30	73	94	45	60	50	0.55	**21333-***
22333-*	26.4 - 40.1	22	320	28	1.10	0.4	44	28	69	90	45	60	50	0.7	**22333-***
23333-*	33.0 - 50.1	23	400	22	1.10	0.4	47	28	69	90	45	60	50	0.7	**23333-***
24333-*	39.3 - 59.7	24	500	19	1.10	0.5	47	28	69	90	45	60	50	0.7	**24333-***
25333-*	49.9 - 75.8	25	620	15	1.10	0.6	44	28	69	90	45	60	50	0.6	**25333-***
26333-*	60.5 - 92.0	26	740	12	1.10	0.8	44	28	69	90	45	60	50	0.6	**26333-***
27333-*	73.8 - 112	27	900	10	1.10	1.0	44	28	69	90	45	60	50	0.6	**27333-***
28333-*	93.2 - 140	28	1200	8	1.15	1.2	44	28	69	90	45	60	50	0.6	**28333-***
	The suffix "-2" denotes a 2-channel rotor whilst "-3" denotes a 3-channel rotor.														

** These dimensions refer to 2-channel rotor switches only; for 3-channel rotor switch dimensions consult our Sales Team.

2-Channel Rotor Type 2

3-Channel Rotor Type 3



ORDERING INFORMATION
Model: Rotor Type; Description
Example: Model 22333-2 Manual waveguide switch 2-Channel Rotor

Series 333

Motorised Waveguide Switches
Series 333-*E

NOW UP TO 330 GHz

Features

- **Models up to 330 GHz**
- **High Accuracy**
- **High Repeatability**
- **2 or 3-Channel Rotor**
- **High Isolation**

Model 27333-3E

Specification:
Isolation (minimum): 75 dB
Repeatability better than -50 dB

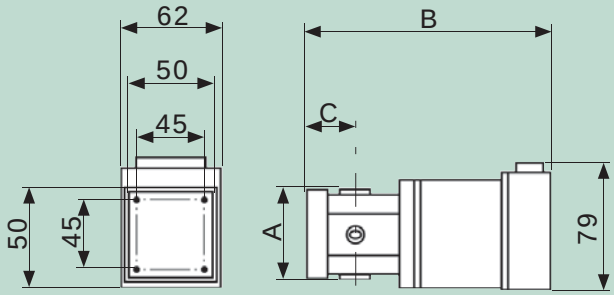
See page 74 for Switch Driver

Model	Frequency Range (GHz)	Waveguide			VSWR (Max)	Insertion Loss Max (dB)	Dimensions			Model
		WG	R	WR			A (mm)	B (mm)	C (mm)	
15333-*E	6.58 - 10.0	15	84	112	Specification/dimensions available on request					**15333-*E**
16333-*E	8.2 - 12.5	16	100	90						**16333-*E**
17333-*E	9.84 - 15.0	17	120	75	1.10	0.2	56.0	152	34.8	**17333-*E**
18333-*E	11.9 - 18.0	18	140	62	1.10	0.2	50.0	147	32.2	**18333-*E**
19333-*E	14.5 - 22.0	19	180	51	1.10	0.3	55.0	140	29	**19333-*E**
20333-*E	17.6 - 26.7	20	220	42	1.10	0.3	44.0	140	29.7	**20333-*E**
21333-*E	21.7 - 33.0	21	260	34	1.10	0.4	44.0	140	30	**21333-*E**
22333-*E	26.4 - 40.1	22	320	28	1.10	0.4	44.0	137	28	**22333-*E**
23333-*E	33.0 - 50.1	23	400	22	1.10	0.4	47.0	137	28	**23333-*E**
24333-*E	39.3 - 59.7	24	500	19	1.10	0.5	47.0	137	28	**24333-*E**
25333-*E	49.9 - 75.8	25	620	15	1.10	0.6	44.0	137	28	**25333-*E**
26333-*E	60.5 - 92.0	26	740	12	1.10	0.8	44.0	137	28	**2633 -*E**
27333-*E	73.8 - 112	27	900	10	1.10	1.0	44.0	137	28	**27333-*E**
28333-*E	92.3 - 140	28	120	8	1.15	1.2	44.0	137	28	**28333-*E**
	The suffix "-2E" denotes a 2-channel rotor whilst "-3E" denotes a 3-channel rotor.									

** These dimensions refer to 2-channel rotor switches only; for 3-channel rotor switch dimensions consult our Sales Team.

2-Channel
Rotor Type 2

3-Channel
Rotor Type 3



ORDERING INFORMATION
Model: rotor type, E; description
Example: Model 22333-2E Motorised waveguide switch, 2-channel rotor

Our range of waveguide switches is subject to continual development and additional models, not detailed in this catalogue, may be available to special order. Please consult our sales office for information.

A Flann switch driver is essential for driving any of the electrically operated switches listed.
Please see page 74 for details.

Series 333-*E

For standard flange types and recommendations see pages 111 onwards

Switch Driver
Series SD5902

NEW !

For use with Series 333-*E Switches

Features

- **Speed and Precision Modes of Operation**
- **GPIB**
- **USB**
- **19" Rack Mountable**
- **Universal Line Supply**

Model SD5902

The Series SD5902 Waveguide Switch Driver is designed to control the Flann microwave range of Series 333-*E Precision Waveguide Switches. It provides the interface between an IEEE 488 Bus (GPIB) or Universal Serial Bus (USB) and Precision Waveguide Switches, and allows for manual operation with display of current status. The SD5902 will drive either a 2-channel or a 3-channel switch without the need to reconfigure.

The Series SD5902 operates on any mains supply voltage without the need to select.

Speed and Precision Modes of Operation

An important new feature of our GPIB based driver, when used in conjunction with series 333-2E and 333-3E switches, is user selectable "Speed" or "Precision" operating modes. In "Speed" mode the switch repositioning time is minimised by using all possible rotor positions. In "Precision" mode only one of the 2 possible rotor positions is utilised providing optimum microwave path repeatability by ensuring the same rotor position is used each time a particular path is selected. Users who do not require such precision should use the "Speed" mode, to optimise the setting time.

Operation

The opto electronic position sensors provide either two or four signals depending upon the type of rotor (2 or 3 channel). The outputs of the sensors are TTL compatible, positive logic. The motor output shaft drives the microwave switch rotor through a loose coupling, which is designed to allow the precision indexing mechanism to operate correctly without excessive settling time. Full power is only applied to the motor during switch repositioning.

System Performance	Max Switching Time	(2-Channel)	180ms* (Speed Mode), 475ms* (Precision Mode – worst case)
		(3-Channel)	250ms* (Speed Mode), 500ms* (Precision Mode – worst case)
Power Requirements	Line Voltage	90 - 264 V AC	
	Line Frequency	47 - 63 Hz	
	Power Consumption	50 W Max (Motor Running), 25W Max (Motor Stationary)	
	Supply Fuse	20mm T2.5A Slow Blow (On rear panel)	
Electrical Specifications	GPIB Connector	24-Way, compatible with Amphenol 57 Series (IEEE488 Standard)	
	Switch Output Connector	15-Way D-Type Female	
	Switch Cable Length	5 m Max	
	Motor Steps per Revolution	500	
Mechanical Specifications	Operating Orientation	Any	
	Dimensions (mm)	58H × 483W × 300D (2.28"H × 19.0"W × 11.8"D)	
	Weight	2.15 kg (4.74 lb)	
	Direction of Rotation	Unidirectional: Counter-clockwise when viewed from the top	

DC-Motor Driven Waveguide Switches
Series 334-*E / WRD334-*E

Features

- **Switching Time < 500 ms**
- **High Accuracy**
- **High Repeatability**
- **High Isolation**
- **2 or 3-Channel**
- **Simple TTL - Level Control & Indicators**

Model WRD180334-2E

Model 20334-2E

Operation

The Flann Series 334 DC-Motor driven waveguide switches use the same high-repeatability rotor/stator design as the unrivalled Series 333 switches. They may be controlled directly by a PC (for example by the standard printer port) or remote buttons and indicators. TTL-level control pins are provided for each of the switch positions: four for 3-channel switches and two for 2-channel switches. A logic 'low' on the appropriate control line causes the switch to move to the corresponding position. Indicator pins are provided for each switch position that indicate 'high' when the switch is correctly positioned. These are capable of sourcing up to 25mA at 5V (more than adequate to directly drive an LED).

Model	Frequency Range (GHz)	Waveguide			VSWR (Max)	Insertion Loss Max (dB)	Isolation Minimum (dB)	Model
		WG	R	WR				
16334-*E	8.2 - 12.5	16	100	90	1.10	0.2	75	**16334-*E**
17334-*E	9.84 - 15.0	17	120	75	1.10	0.2	75	**17334-*E**
18334-*E	11.9 - 18.0	18	140	62	1.10	0.2	75	**18334-*E**
19334-*E	14.5 - 22.0	19	180	51	1.10	0.3	75	**19334-*E**
20334-*E	17.6 - 26.7	20	220	42	1.10	0.3	75	**20334-*E**
21334-*E	21.7 - 33.0	21	260	34	1.10	0.4	75	**21334-*E**
22334-*E	26.4 - 40.1	22	320	28	1.10	0.4	75	**22334-*E**
23334-*E	33.0 - 50.1	23	400	22	1.10	0.4	75	**23334-*E**
24334-*E	39.3 - 59.7	24	500	19	1.10	0.5	75	**24334-*E**
25334-*E	49.9 - 75.8	25	620	15	1.10	0.6	75	**25334-*E**
26334-*E	60.5 - 92.0	26	740	12	1.10	0.8	75	**2633 -*E**
27334-*E	73.8 - 112	27	900	10	1.10	1.0	75	**27334-*E**
WRD180334-*E	18.0 - 40.0	WRD180-C24			1.15	0.2	75	**WRD180334-*E**
	The suffix "-2E" denotes a 2-channel rotor whilst "-3E" denotes a 3-channel rotor.							

Electrical Specifications	Supply voltage	10 V - 34 V DC
	Power Consumption	1.5 W Peak
	Control Interface	TTL-level control and indicators
	Connector	MIL-C-26482 Shell 12, 10 Pin Plug (Mating cable socket supplied) (Pattern 105 compatible)

ORDERING INFORMATION

Model description

Example: Model 22334-2E D.C. Operated waveguide switch, 75 dB isolation, 2-channel rotor.

Various Driver options are available for the switch, please contact our Sales Team for details.

Our range of waveguide switches is subject to continual development and additional models, not detailed in this catalogue may be available to special order. Please consult our sales office for information.

2-Channel Rotor Type 2

3-Channel Rotor Type 3

Series 334/WRD334

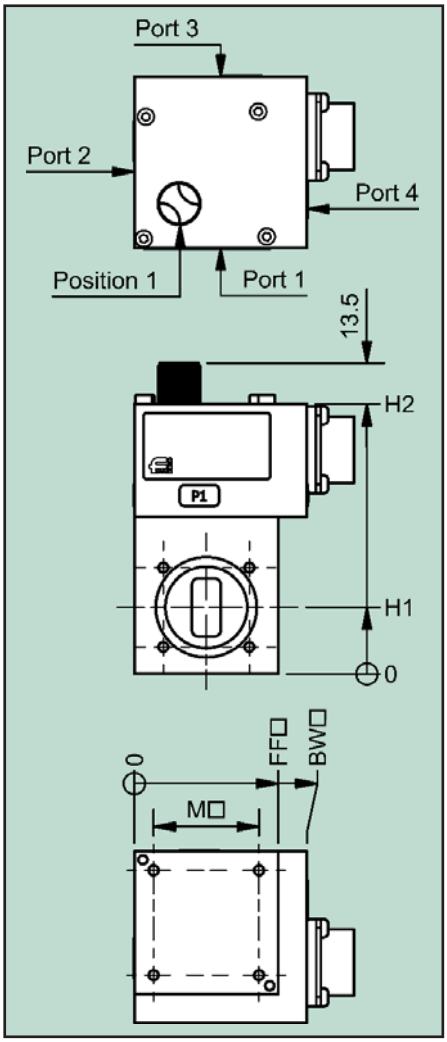
DC-Operated 2-Channel Waveguide Switches
Series 336

NEW !

Many models available from
STOCK

Features
- 2.6 GHz to 40.1 GHz
- Low Loss & High Power
- High Speed
- High Reliability
- Internal and External Usage
- Sealed, 15 psig Standard

Applications
- SATCOM Systems
- Networks
- SNG



Specifications:

Model Number	Frequency Range (GHz)	Waveguide			Return Loss (dB)	Isolation (dB)	Insertion Loss (dB)	Max Mean Power (kW)	Switching Speed (ms)
		WG	R	WR					
14336	5.38 – 8.20	14	70	137	> 32.3	> 85	< 0.02	13	< 70
15336	6.58 – 10.0	15	84	112	> 32.3	> 85	< 0.03	9	< 60
16336	8.2 - 12.5	16	100	90	> 32.3	> 85	< 0.04	5.5	< 60
17336	9.84 – 15.0	17	120	75	> 32.3	> 85	< 0.04	5	< 50
18336	11.9 - 18.5	18	140	62	> 32.3	> 85	< 0.05	3.75	< 50
22336	26.4 - 40.1	22	320	28	> 28.3	> 75	< 0.10	0.8	< 50
WRD580336	5.8 - 16.0	WRD580-D28			> 23.1	> 65	< 0.20	1.1	< 60

Dimensions & Weight:

Model Number	BW mm (inch)	FF mm (inch)	H1 mm (inch)	H2 mm (inch)	M mm (inch)	Weight kg (lb)
14336	62 (2.44)	57.2 (2.25)	34.9 (1.37)	119 (4.69)	44.5 (1.75)	< 0.8 (1.76)
15336	62 (2.44)	57.2 (2.25)	25.5 (1.00)	101 (3.98)	44.5 (1.75)	< 0.7 (1.54)
16336	57.2 (2.25)	47.6 (1.87)	26.7 (1.05)	98 (3.86)	34.9 (1.375)	< 0.6 (1.32)
17336	57.2 (2.25)	47.6 (1.87)	22.2 (0.87)	90 (3.55)	34.9 (1.375)	< 0.55 (1.21)
18336	57.2 (2.25)	47.6 (1.87)	19.7 (0.78)	84 (3.31)	34.9 (1.375)	< 0.55 (1.21)
22336	47.6 (1.87)	35.0 (1.38)	14.6 (0.57)	73.5 (2.89)	28.6 (1.125)	<0.4 (0.88)
WRD580336	57.2 (2.25)	47.6 (1.87)	22.2 (0.87)	90.5 (3.56)	34.9 (1.375)	< 0.55 (1.21)

PLEASE CONTACT OUR SALES TEAM FOR MORE INFORMATION ON OUR STANDARD AND OTHER MODELS

ORDERING INFORMATION: - BASIC OPTIONS

Model Description: Waveguide WG17, PBR 120 Flange, +28 Volt DC, M4 34.9mm, Side Connector, MIL connector 14 shell 19 Pin, Circuit A, Latching, No Locking Key, No additional option

Model Number: 17 336 -0 0 0 S 0 A L 0 0

- Waveguide Type / Size: WG10 (WR284) to WG22 (WR28) and WRD580 to WRD180
- Series: 336
- Flange Type: 0 = Grooved, 1 = Cover
- Voltage: 0 = +28Vdc, 1 = -28Vdc, 2 = +12Vdc, 3 = -12Vdc
- Mounting Holes: 0 = Metric, 1 = Imperial
- Connector Position: S = Side, T = Top
- Connector Type / Style: 0 = MIL 14-19, 1 = MIL 14-12, 2 = MIL 12-10, 3 = MIL 10-6, 4= RS-485 MIL 10-6, 8-2
- Electrical Arrangement: Circuits A, B, C, D, E, F, G, H, I, J, K, L M
- Latching: L = Latching, F = Fail-Safe
- Locking and Key Removal: 0 = No locking, 1 = Tubular lockable position '1'
- Options: 0 = No option, 1 = Weatherproof (Manual override knob protected from ice)

Phase Combining / Redundancy Solutions
Series 520

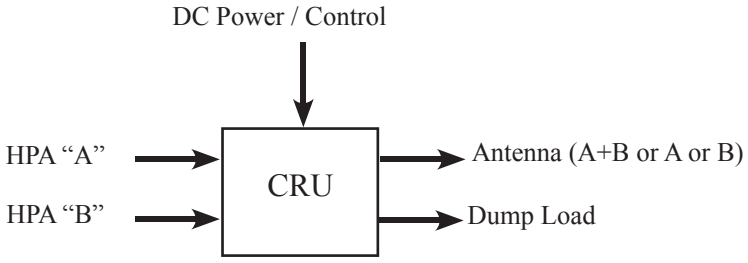
NEW !

Features
- **Efficient HPA Combining**
- **Full Power HPA Redundancy**
- **High Speed Switching**
- **Fully Integrated Solution**

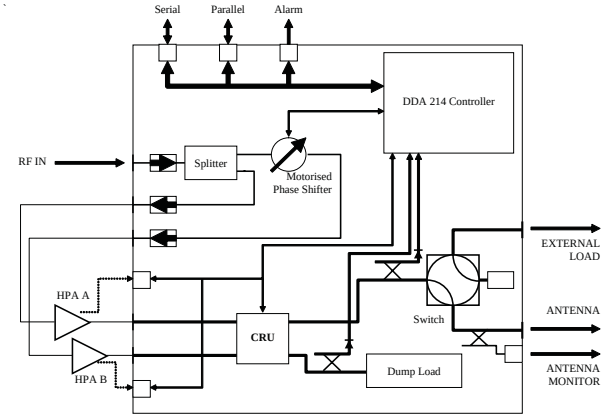
Applications
- **Mobile Installations**
- **Fixed / Ground Installations**
- **SNG Trucks**




The Series 520 suite offers various solutions supporting multiple High Power Amplifier configuration and combining requirements.
The entry level CRU module routes the outputs of two HPAs to an Antenna and High Power Load as in a "Hot Standby" system. Or it combines both HPA outputs to an Antenna to increase power in difficult Satcom uplink budget situations.
The complete phase optimised Combiner / Redundancy System is available with a separate Hub Box and rack mount Controller or fully integrated into a single box controlled via a laptop dialogue box.



General System Schematic



A Typical System Schematic

Typical RF Specification	
Frequency Range	12.75 GHz - 14.5 GHz
RF Power handling	> 1 kW on both channels simultaneously
System Insertion Loss (Redundancy Mode)	< 0.35 dB
Switching Speed (Combining to Redundancy Mode)	< 50 ms
VSWR	< 1.25 : 1
Antenna Power Monitor	-50 dB

ORDERING INFORMATION

PLEASE CONTACT THE SALES TEAM FOR MORE INFORMATION ON OUR STANDARD AND OPTIONAL MODELS

Matched Hybrid Tees
Series 380

NOW UP TO 330 GHz

Features

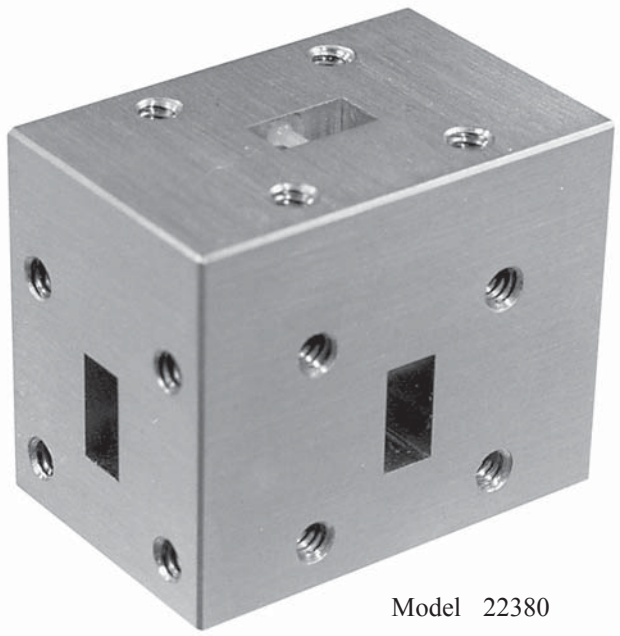
- **Models from 1.14 GHz to 330 GHz**
- **30 dB Isolation**
- **1.30 : 1 VSWR (maximum)**

The Series 380 Matched Hybrid Tees manufactured by Flann have been designed to provide very high quality performance in terms of isolation, VSWR and bandwidth, in frequency bands up to 330 GHz.

Each Matched Hybrid Tee is constructed from precision machined sections and accurately assembled to ensure a high degree of symmetry within the device. Signal introduced into either the series, E plane or shunt, H plane input port results in a balanced power split at the output ports of the "through" waveguide.

When the E plane input is used the balanced output signals will be 180˚ out of phase: using the H plane input produces balanced output signals which are in phase.

The specification relates to 20% bandwidths. However, other requirements can be considered upon request.

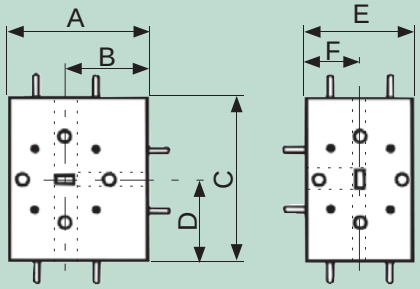


Model 22380

Matched hybrid tees are available in lower frequency bands; details on request.

Model	Frequency Range (GHz)	Waveguide			Bandwidth	VSWR	Balance	Isolation
		WG	R	WR				
20380	17.6 - 26.7	20	220	42	20% of frequency range	1.3 max (with 'through' waveguide ports correctly terminated)	± 0.5 dB	30 dB minimum
22380	26.4 - 40.1	22	320	28				
23380	33.0 - 50.1	23	400	22				
24380	39.3 - 59.7	24	500	19				
25380	49.9 - 75.8	25	620	15				
26380	60.5 - 92.0	26	740	12				
27380	73.8 - 112	27	900	10				
28380	92.3 - 140	28	1200	8				
29380	114 - 173	29	1400	6	Specifications available on request			
30380	145 - 220	30	1800	5				
31380	172 - 261	31	2200	4				
32380	220 - 330	32	2600	3				

Model	Dimensions (mm)					
	A	B	C	D	E	F
20380	28	17	34	17	22	11
22380	25	15	30	15	20	10
23380	37.5	22.5	45	22.5	30	15
24380	37.5	22.5	45	22.5	30	15
25380	25	15	30	15	20	10.4
26380	25	15	30	15	20	10.4
27380	25	15	30	15	20	10.4
28380	25	15	30	15	20	10.4
29380	Dimensions available on request					
30380						
31380						
32380						



ORDERING INFORMATION
Model: Centre Frequency; Description
Example: Model 27380-94 Matched Hybrid Tee, Centre Frequency 94 GHz

Series 380

For standard flange types and recommendations see pages 111 onwards

Un-matched Hybrid Tees
Series 390

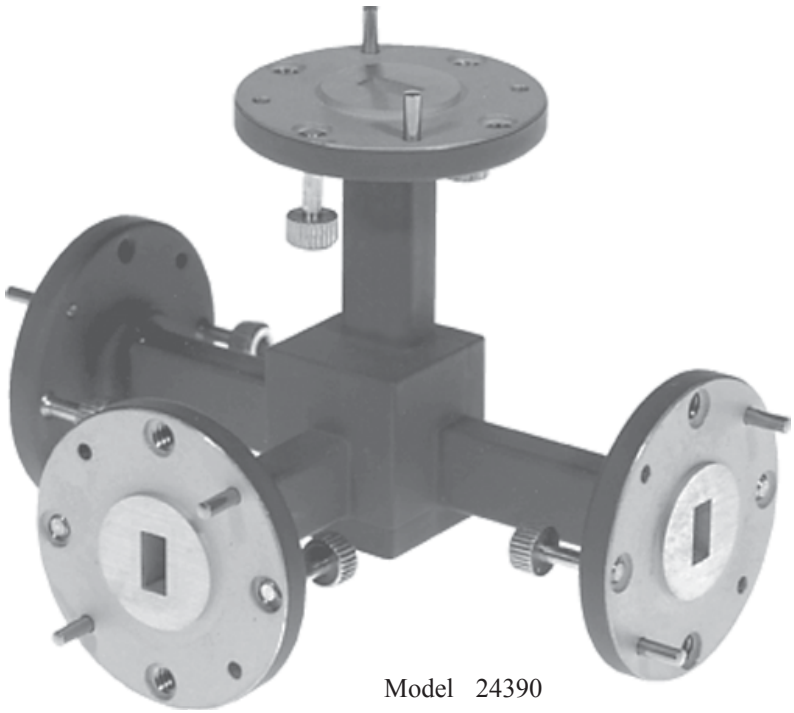
Features

- **Models from 1.14 GHz to 140GHz**

The Flann Series 390 range of un-matched Hybrid Tees are waveguide sections accurately machined and assembled to form a conventional hybrid tee junction.

Precise machining yields the symmetrical construction necessary to ensure high isolation between the E and H plane ports and balanced power division in the "through" waveguide.

The H plane input provides in-phase outputs whilst the E plane input provides outputs of opposite phase.

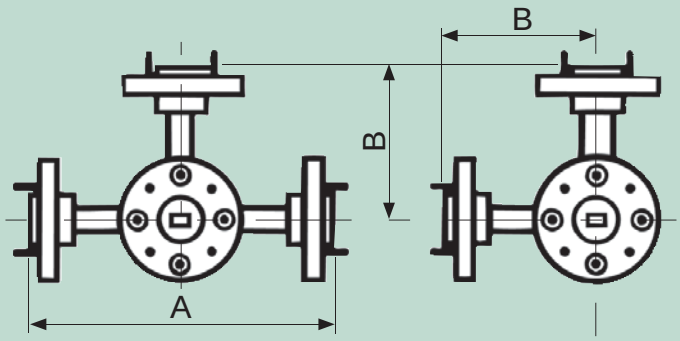


Model 24390

Un-matched hybrid tees are available in lower frequency bands; details on request.

Model	Frequency Range (GHz)	Waveguide			Dimensions (mm)	
		WG	R	WR	A	B
20390	17.6 - 26.7	20	220	42	70	35
22390	26.4 - 40.1	22	320	28	70	35
23390	33.0 - 50.1	23	400	22	70	35
24390	39.3 - 59.7	24	500	19	70	35
25390	49.9 - 75.8	25	620	15	48	24
26390	60.5 - 92.0	26	740	12	48	24
27390	73.8 - 112	27	900	10	48	24
28390	92.3 - 140	28	1200	8	48	24

ORDERING INFORMATION
Model: Description
Example: Model 22390 Hybrid Tee, Un-matched



Series 390

For standard flange types and recommendations see pages 111 onwards

Matched E and H Plane Tees
Series 400 / 410

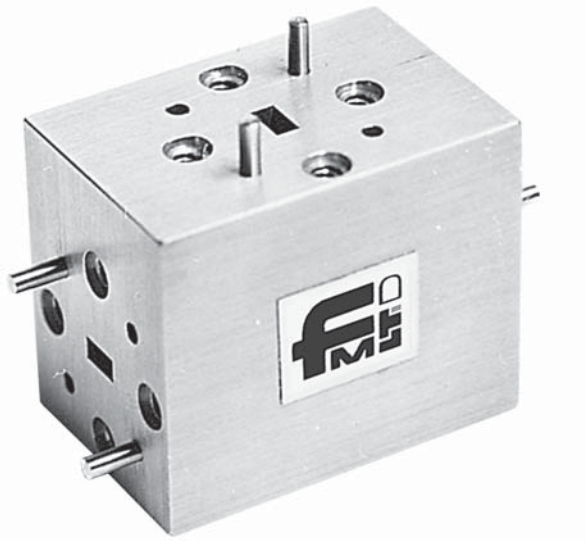
NOW UP TO 330 GHz

Features

- **Models from 1.14 GHz to 330 GHz**
- **E Plane Models - Series 400**
- **H Plane Models - Series 410**

The Series 400 E plane and Series 410 H plane matched tees are constructed from precision machined sections accurately assembled to form the completed component.

H plane tees, when fed via the shunt arm, divide the signal equally between the through ports and in phase. When E plane tees are fed via the series arm the signal divides equally but 180˚ out of phase.



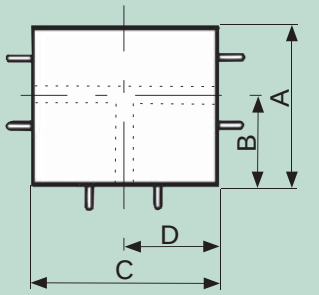
Model 25400

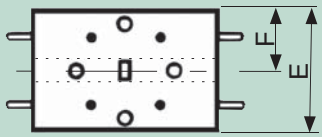
Matched tees are available in lower frequency bands; details on request.

Model		Frequency Range (GHz)	Waveguide			VSWR	Balance Between Co-linear Ports
E Plane	H Plane		WG	R	WR		
20400	20410	17.6 - 26.7	20	220	42	1.3 max (with 'through' waveguide ports correctly terminated)	±0.5 dB
22400	22410	26.4 - 40.1	22	320	28		
23400	23410	33.0 - 50.1	23	400	22		
24400	24410	39.3 - 59.7	24	500	19		
25400	25410	49.9 - 75.8	25	620	15		
26400	26410	60.5 - 92.0	26	740	12		
27400	27410	73.8 - 112	27	900	10		
28400	28410	92.3 - 140	28	1200	8		
29400	29410	114 - 173	29	1400	6	Specifications available on request	
30400	30410	145 - 220	30	1800	5		
31400	31410	172 - 261	31	2200	4		
32400	32410	220 - 330	32	2600	3		

Model		Dimensions (mm)					
E Plane	H Plane	A	B	C	D	E	F
20400	20410	28	17	34	17	22	11
22400	22410	25	15	30	15	20	10
23400/	23410	37.5	22.5	45	22.5	30	15
24400	24410	37.5	22.5	45	22.5	30	15
25400	25410	25	15	30	15	20	10.4
26400	26410	25	15	30	15	20	10.4
27400	27410	25	15	30	15	20	10.4
28400	28410	25	15	30	15	20	10.4
29400	29410	Dimensions available on request					
30400	30410						
31400	31410						
32400	32410						

ORDERING INFORMATION
Model: Description
Example: Model 25410; Tee, Matched, H Plane





Series 400/410

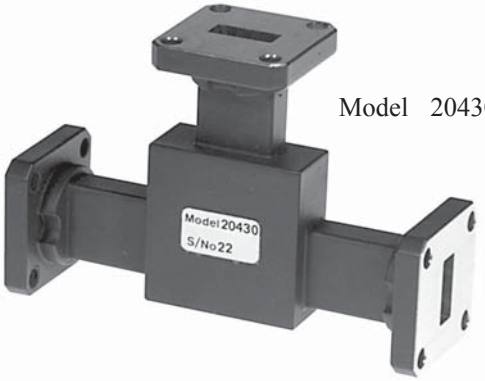
For standard flange types and recommendations see pages 111 onwards

Un-matched E and H Plane Tees
Series 420 / 430

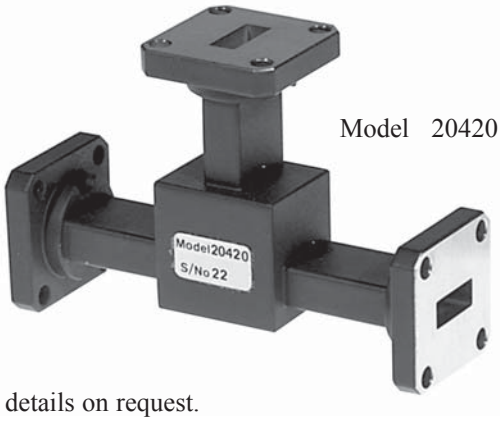
Features

- **Models from 1.14 GHz to 140 GHz**
- **E Plane Models - Series 420**
- **H Plane Models - Series 430**

The tees are manufactured from sections of standard waveguide precisely assembled to produce excellent dimensional symmetry ensuring good power division characteristics. Outputs from H plane tees are in phase whereas E plane tees outputs are of opposite phase.



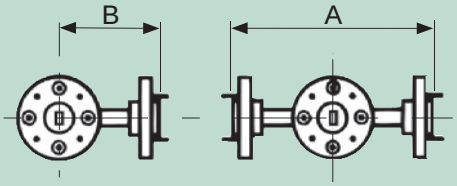
Model 20430



Model 20420

Un-matched tees are available in lower frequency bands; details on request.

Model		Frequency Range (GHz)	Waveguide			Dimensions (mm)	
E Plane	H Plane		WG	R	WR	A	B
20420	**20430**	17.6 - 26.7	20	220	42	70	35
22420	**22430**	26.4 - 40.1	22	320	28	70	35
23420	**23430**	33.0 - 50.1	23	400	22	70	35
24420	**24430**	39.3 - 59.7	24	500	19	70	35
25420	**25430**	49.9 - 75.8	25	620	15	48	24
26420	**26430**	60.5 - 92.0	26	740	12	48	24
27420	**27430**	73.8 - 112	27	900	10	48	24
28420	**28430**	92.3 - 140	28	1200	8	48	24



ORDERING INFORMATION
Model: Description
Example: Model 27420 Tee, Un-matched, E Plane

Series 420/430

For standard flange types and recommendations see pages 111 onwards

Lens Horn Antennas

NOW UP TO 330 GHz

APPLICATIONS INCLUDE:

- MVDS (multipoint video distribution systems)
- LMDS (local multipoint distribution services)
- Point to Point Radio Links
- Vehicle Anti-collision Radars
- Traffic Control Systems
- Traffic Tolling Systems
- Secure Communications Systems
- Short Range Radar
- Radiation Monitoring Systems
- Electro-Magnetic Compatibility (EMC) Measurements
- Compact/Mobile Systems
- Dual Polarized Systems

FEATURES:

- Models up to 330 GHz
- "Off the shelf" and customised models
- Ideally suited for small and large quantities
- Linear, dual and circular polarization
- Rectangular or circular feed
- Choice of mounting configurations
- Optional protective membrane

Without doubt the antenna has a vital role to play in every microwave transmission system. The antenna is a potential point of weakness which may erode the quality of your design. Through the antenna, spurious information can enter the system or valuable information can "leak" out. The antenna is also one of the highest cost components within a microwave transmission system and yet most radio designers automatically specify antenna designs that are basically 50 years old. All the electrical characteristics, and those equally vital mechanical aspects such as mounting arrangements, support structures, wind loading, etc, are well worth critical re-appraisal. Future telecomms requirements, in the new era of information super highways, will undoubtedly overwhelm the ability to provide more frequencies: better antenna performances will materially assist the conservation of those frequency channel resources.

Flann has produced a range of Radiocommunications Agency approved High and Standard Performance Antennas covering all of the major link bands. Our antennas will satisfy the most demanding applications for point to point communication systems. Performances substantially exceed the licensing bodies' requirements. Super High Performance LHAs are also available which achieve performance levels unattainable from parabolas. In developing and refining the Lens Horn Antenna, Flann has sought to open and change entrenched ideas on the form an antenna should take. In concert with microwave radio manufacturers and operators, Flann has supported the Radiocommunications Agency in establishing improved performance standards of equipment so that the communications industry as a whole can benefit by serving the customer.

E - BAND (71 GHz to 86 GHz) FLANN LENS HORN ANTENNAS

THE BEST & ONLY CHOICE

BEATS ALL PARABOLIC ALTERNATIVES!

Lens Horn Antennas

There are many good reasons to use Lens Horn Antennas

Lens Horn Antennas offer many significant microwave and mechanical performance advantages over alternative designs.

Idealy suited to mmWave band applications e.g. E - Band

Reduced aperture size

The nominal aperture size of a parabola is 25% larger than a lens horn antenna (LHA) for the same gain/bandwidth. The advantageous reduction in size is due to the high illumination efficiency of the lens.

No back spill

Since energy is not directed rearward the edge spill-over does not occur in a LHA as is the case with parabolas. To direct all the radiated energy forward with the same efficiency a parabola would need to be larger. Achievement of equivalent back spill performance by a parabola requires side skirts and absorbing materials.

Superior boresight cross polarization

The axial symmetry of a LHA, together with the lack of beam distortions due to feed waveguides or supports, ensure superior cross polar characteristics.

More suited to compact integrated packages

The conical shape of a LHA permits circuit boards etc to be built around the flare. The microwave TX/RX assembly is then very accessible for servicing.

Superior sidelobe performance

Energy from a parabola that is scattered due to reflective surface imperfections, feed supports, feed structure and back scatter, manifest themselves in increased sidelobe levels. In a LHA performance is primarily controlled by the accuracy of a precision, computer controlled, machined component made to an exacting microwave design. Flann's "Standard" LHAs have the inherent improved sidelobe performance compared to parabolas. For more demanding applications our range of "High Performance" antennas have a further 6 dB improvement in sidelobe levels.

More resistant to accidental damage

The parabola has three critical areas of damage susceptibility - the reflector dish, the feed structure and the precise positioning of the feed structure relative to the dish. The reflective surface is exposed to the environment and the mounting supports are frequently attached to the dish contour. Careless or accidental damage caused during mounting can ruin the parabolic antenna's performance. A LHA has that enormous structural rigidity inherent in a cone, furthermore denting of this cone will have minimal effect on performance, except close to the neck, since it is not a critical reflective surface. The cone function is to give a highly stable support for the lens and to contain any minor internal reflected energy.

Less wind resistance

When compared to a parabola, with its typical skirt, a LHA has a silhouette one third smaller, its conical shape is naturally more aerodynamic.

Reduces tower costs

With lower wind resistance an obvious economy to tower costs is easily apparent. The smaller size and absence of back spill permit dense packing of antenna clusters with clear advantages.

Environmentally more acceptable

The smaller silhouette, for a given gain, means that a LHA is less obtrusive: an obvious advantage in environmentally sensitive applications. In some cases, the use of smaller antennas may obviate the requirement for planning consent prior to installation, a significant factor smoothing speed of application.

Less expensive

Lens Horn Antennas are significantly less expensive than parabolas of similar performance and are ideally suited to both low and high volume applications.

Improved weather protection

Unlike parabolas the radio element of a Lens Horn Antenna is located behind both a focusing lens and a weatherproofing membrane. As a result the LHA does not suffer from the effects of condensation that may occur in the feed horn of parabolas. The outer membrane is constructed from material with a low thermal mass which combats the effects of ice and snow. These two factors alone mean that the LHA will outperform the parabola in the most harsh of climatic conditions.

In accordance with our company policy, manufacturing techniques are constantly being reviewed and refined in order to bring about operational improvements and cost savings. No matter whether your requirement is for one, ten, 1,000 or 10,000 - Flann can supply.

Lens Horn Antennas

Features

- **Compliant to ETSI and FCC Specifications**
- **Radiocommunications Agency Approved Models**
- **"High" and Standard" Performance Categories**

In addition to standard models detailed below Flann also offers special and customised antennas - in any quantity!

The listed antennas, on pages 85 to 87, are examples of Flann's Lens Horn Antenna design and manufacturing capability. We are able to design models to a higher or lesser performance to suit most applications and will be pleased to discuss your special Lens Horn Antenna requirements in frequency bands up to 112 GHz.
Lens Horn Antennas, designed and manufactured by Flann, have been approved to the Department of Trade and Industry MPT specifications set by the Radio-communications Agency (RA) - the UK's leading authority. Microwave radio manufacturers have incorporated Flann LHAs in their systems with great success by fully utilising the many advantages inherent in lens horns over parabolic alternatives.

The MPT specifications are among the most stringent of those anywhere in the world communications market - Flann LHAs surpass these exacting standards by a considerable margin.

Flann offers models of LHA which conform to the new UK-MPT Performance Specifications

Note: the MPT specifications form the basis of the standards adopted by the European Telecommunications Standard Institute (ETSI).

The radiation patterns for two models of Flann LHA are shown below.

Figure 1 below shows a typical radiation pattern for High and Standard Performance antenna operating in the 21.2 GHz to 23.6 GHz , MPT1409 band.

Typical H Plane Radiation Pattern, 21.2 GHz to 23.6 GHz

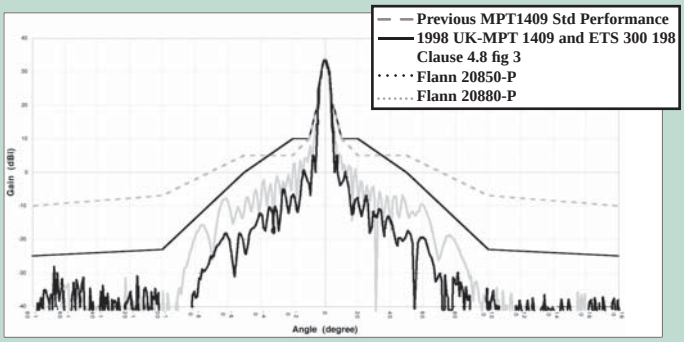


Figure 1 shows the typical H Plane radiation pattern envelopes for Flann "Standard Performance" Lens Horn Antenna Model 20850-P, 34 dBi gain, and "High Performance" Lens Horn Antenna 20880-P, 34 dBi gain. Also indicated are the new Radiocommunications Agency UK-MPT1409 and ETS 300 198 Clause 4.8 fig 3 specification limits together with the previous MPT1409 "Standard Performance" specification. Models 20850-P and 20880-P are certified by the Radiocommunications Agency as complying with the previous MPT1409 Standard and High Performance specification.

Figure 2 below shows the radiation pattern of a High Performance Antenna operating in the 37.5 GHz to 40 GHz MPT1414 band.

Typical H Plane Radiation Pattern, 37.5 GHz to 40 GHz

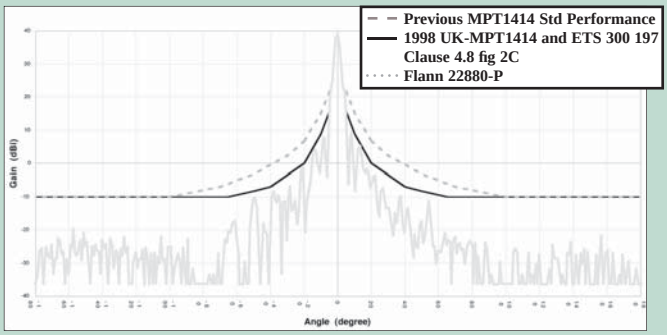


Figure 2 shows the typical radiation envelope for a Flann "High Performance" Lens Horn Antenna Model 22880-P operating in the frequency band 37.5 GHz to 40 GHz, UK-MPT1414 and ETS 300 197 Clause 4.8 fig 2C specification limits together with the previous MPT1414 "Standard Performance" specification. Model 22880-P is certified by the Radiocommunications Agency as complying with the previous MPT1414 "High Performance" specification.

Lens Horn Antennas

Listed below and continued on pages 86 and 87 are the performance specifications of currently available Lens Horn Antennas

FREQUENCY RANGE 7.9 GHz - 8.5 GHz WG15 R84 WR112						Regulatory Specifications
Model	Diameter (mm)	Nominal Mid Band Gain (dBi)	Nominal 3 dB Beamwidth		VSWR	
			E (Deg)	H (Deg)		
15820-F	150	20.5	14.9	17.4	<1.5	N/A
15820-P	250	25.0	9.0	10.5	<1.5	N/A

FREQUENCY RANGE 8.0 GHz - 8.5 GHz WG16 R100 WR90						
Model	Diameter (mm)	Nominal Mid Band Gain (dBi)	Nominal 3 dB Beamwidth		VSWR	
			E (Deg)	H (Deg)		
16810-F	150	20.5	15.0	17.4	<1.5	N/A
16820-F	150	20.5	15.0	17.4	<1.5	N/A

FREQUENCY RANGE 8.0 GHz - 10.5 GHz WG16 R100 WR90						
Model	Diameter (mm)	Nominal Mid Band Gain (dBi)	Nominal 3 dB Beamwidth		VSWR	
			E (Deg)	H (Deg)		
16810-F	150	21.5	13.3	15.5	<1.5	N/A

FREQUENCY RANGE 10.0 GHz - 10.5 GHz WG16 R100 WR90						
Model	Diameter (mm)	Nominal Mid Band Gain (dBi)	Nominal 3 dB Beamwidth		VSWR	
			E (Deg)	H (Deg)		
16810-F	150	22.5	12.0	14.0	<1.5	N/A
16820-F	150	22.5	12.0	14.0	<1.5	N/A

FREQUENCY RANGE 12.4 GHz - 12.8 GHz WG17 R120 WR75						
Model	Diameter (mm)	Nominal Mid Band Gain (dBi)	Nominal 3 dB Beamwidth		VSWR	
			E (Deg)	H (Deg)		
17820-F	150	24.5	9.7	11.3	<1.5	N/A

FREQUENCY RANGE 15.2 GHz - 16.0 GHz WG18 R140 WR62						
Model	Diameter (mm)	Nominal Mid Band Gain (dBi)	Nominal 3 dB Beamwidth		VSWR	
			E (Deg)	H (Deg)		
18820-F	150	26.0	7.9	9.2	<1.5	N/A

FREQUENCY RANGE 16.4 GHz - 17.6 GHz WG18 140 WR62						
Model	Diameter (mm)	Nominal Mid Band Gain (dBi)	Nominal 3 dB Beamwidth		VSWR	
			E (Deg)	H (Deg)		
18820- F	150	27.0	7.2	8.4	<1.5	N/A

ORDERING INFORMATION

Flann Antennas are identified through a basic numbering system as outlined below:

**810 is a basic low cost applications antenna
**820 is an economy grade antenna
**850 is a standard performance antenna
**880 is a high performance antenna

Continued on pages 86/87

Lens Horn Antennas

Continued from page 85

FREQUENCY RANGE 17.7 GHz - 19.7 GHz WG20 R220 WR42						Regulatory Specifications
Model	Diameter (mm)	Nominal Mid Band Gain (dBi)	Nominal 3 dB Beamwidth		VSWR	
			E (Deg)	H (Deg)		
20880-T	100	24.5	9.1	10.7	<1.2	N/A
20820-R	175	29.0	5.2	6.1	<1.5	N/A
20820-P	250	32.4	3.7	4.3	<1.5	N/A

FREQUENCY RANGE 21.2 GHz - 23.6 GHz WG20 R220 WR42						
Model	Diameter (mm)	Nominal Mid Band Gain (dBi)	Nominal 3 dB Beamwidth		VSWR	
			E (Deg)	H (Deg)		
20820-T	100	26.0	7.8	9.1	<1.5	N/A
20820-W	125	27.5	6.2	7.2	<1.5	N/A
20820-F	150	29.3	5.3	6.1	<1.5	N/A
20850-P	250	33.5	3.1	3.6	<1.5	MP 1409 PT3 Fig 3.1[1]
20880-P	250	34.0	3.1	3.6	<1.2	MPT1409 PT3 Fig 3.2[2]

FREQUENCY RANGE 21.2 GHz- 26.5 GHz WG20 R220 WR42						
Model	Diameter (mm)	Nominal Mid Band Gain (dBi)	Nominal 3 dB Beamwidth		VSWR	
			E (Deg)	H (Deg)		
20880-P	250	34.5	3.0	3.5	<1.2	MPT1409 PT3 Fig 3.2[2] & MPT1420 PT3 Fig 3[2]

FREQUENCY RANGE 27.5 GHz - 29.5 GHz WG22 R320 WR28						
Model	Diameter (mm)	Nominal Mid Band Gain (dBi)	Nominal 3 dB Beamwidth		VSWR	
			E (Deg)	H (Deg)		
22850-F	150	31.5	4.1	4.7	<1.5	N/A
22850-P	250	36.0	2.4	2.8	<1.5	N/A
22880-P	250	36.0	2.4	2.8	<1.2	N/A

FREQUENCY RANGE 31.0 GHz - 31.8 GHz WG22 R320 WR28						
Model	Diameter (mm)	Nominal Mid Band Gain (dBi)	Nominal 3 dB Beamwidth		VSWR	
			E (Deg)	H (Deg)		
22880-F	150	32.0	3.9	4.6	<1.2	N/A

FREQUENCY RANGE 37.5 GHz - 39.5 GHz WG22 R320 WR28						
Model	Diameter (mm)	Nominal Mid Band Gain (dBi)	Nominal 3 dB Beamwidth		VSWR	
			E (Deg)	H (Deg)		
22850-F	150	34.0	3.1	3.7	<1.5	MPT1414 PT3 Fig 3.2[1]
22880-F	150	34.0	3.0	3.5	<1.2	MPT1414 PT2 Fig 3.1[2]
22880-P	250	38.5	1.8	2.1	<1.2	MPT1414 PT3 Fig 3.1[2]

[1] Flann Antennas type approved to previous MPT1409 and 1414 Standard Performance specification
[2] Flann Antennas which have previously been type approved to High Performance specification MPT1409 and 1414 also meet the new UK-MPT1409 and 1414 specification. Furthermore, antennas which meet UK-MPT1409 and UK-MPT1414 also meet the requirements of ETS 300-198 clause 4.8 Fig 3 and ETS 300-197 Fig 2C respectively.

ORDERING INFORMATION

Flann Antennas are identified through a basic numbering system as outlined below:

**810 is a basic low cost applications antenna
**820 is an economy grade antenna
**850 is a standard performance antenna
**880 is a high performance antenna

Lens Horn Antennas

FREQUENCY RANGE 40.5 GHz - 42.5 GHz WG24 R500 WR19						Regulatory Specifications
Model	Diameter (mm)	Nominal Mid Band Gain (dBi)	Nominal 3 dB Beamwidth		VSWR	
			E (Deg)	H (Deg)		
24880-F	150	34.5	2.8	3.2	<1.2	N/A

FREQUENCY RANGE 54.2 GHz - 57.2 GHz WG25 R620 WR15						
Model	Diameter (mm)	Nominal Mid Band Gain (dBi)	Nominal 3 dB Beamwidth		VSWR	
			E (Deg)	H (Deg)		
25850-L	130	36.0	2.4	2.8	<1.2	MPT1416 PT3 Fig 3.1
25880-L	130	36.0	2.4	2.8	<1.2	MPT1416 PT3 Fig 3.2
25880-R	175	38.5	1.8	2.1	<1.2	N/A

FREQUENCY RANGE 57.2 GHz - 58.2 GHz WG25 R620 WR15						
Model	Diameter (mm)	Nominal Mid Band Gain (dBi)	Nominal 3 dB Beamwidth		VSWR	
			E (Deg)	H (Deg)		
25820-L	130	36.5	2.4	2.9	<1.5	MPT1415 PT3 Fig 3.1
25850-L	130	36.5	2.4	2.9	<1.2	MPT1415 PT3 Fig 3.1
25850-F	150	37.5	2.1	2.5	<1.2	MPT1415 PT3 Fig 3.1
25850-P	250	42.0	1.2	1.4	<1.2	MPT1415 PT3 Fig 3.1

FREQUENCY RANGE 59.0 GHz - 64.0 GHz WG25 R620 WR15						
Model	Diameter (mm)	Nominal Mid Band Gain (dBi)	Nominal 3 dB Beamwidth		VSWR	
			E (Deg)	H (Deg)		
25810-T	100	34.5	2.9	3.4	<1.5	N/A

FREQUENCY RANGE 75.0 GHz - 80.0 GHz WG26 R740 WR12						
Model	Diameter (mm)	Nominal Mid Band Gain (dBi)	Nominal 3 dB Beamwidth		VSWR	
			E (Deg)	H (Deg)		
26810-F	150	40.0	1.6	1.8	<1.5	N/A
26820-F	150	40.0	1.6	1.8	<1.5	N/A
26810-M	200	42.5	1.2	1.4	<1.2	N/A

FREQUENCY RANGE 93.0 GHz - 95.0 GHz WG27 R900 WR10						
Model	Diameter (mm)	Nominal Mid Band Gain (dBi)	Nominal 3 dB Beamwidth		VSWR	
			E (Deg)	H (Deg)		
27820-P	250	46.5	0.8	0.9	<1.5	N/A

Customised models in alternative frequency bands are also available, please contact our Sales Team for further information

ORDERING INFORMATION

Flann Antennas are identified through a basic numbering system as outlined below:

**810 is a basic low cost applications antenna
**820 is an economy grade antenna
**850 is a standard performance antenna
**880 is a high performance antenna

Example: 22880 is a high performance antenna in WG22; R320; WR28.

Sectoral Horns
Series 244 / 245

NOW UP TO 330 GHz

Features

- Low Cost
- High Performance
- Customised Designs Available
- Greater Spectrum Efficiency
- Manufactured from Brass or Aluminium
- E or H Plane Available
- Quotations on Request

Model 24244

Model 24245

The use of the sector antenna has become a very effective method of achieving the broadcast type of coverage required of the base station transmission system as used in LMDS/MVDS systems.
Flann Microwave has developed a series of compact, high performance, low cost sectoral hub antennas for LMDS/MVDS applications. The 64˚ azimuth beam angle is designed to provide the best circular coverage pattern when illuminated from the circle edge taking into account path losses and attenuation due to rain.

Sectoral Antenna v Omnidirectional Alternatives

More revenue potential per base station

Omnidirectional antennas are always located at the centre of the coverage area whereas sectoral antenna base stations can be located anywhere on the cell edge and can therefore illuminate up to 4 cells from one base station allowing a 4:1 ratio of revenue generating cells to cost generating transmitter sites.

Customised Base Station Antennas

The requirement to serve a number of small areas from a single base station has resulted in the development of the multiple beam technique, for which the sectoral antenna is ideal. Power splitting is through the use of branch guide couplers whilst polarization and direction orientation can be achieved using compact waveguide bends and twists.

Customised Foot Prints

A multiplicity of elements and arrays can be incorporated in a single enclosure to provide a defined radiation pattern. Edge fed circular and centre fed circular are possible configurations.

Customised Antenna, Filter and Splitter Assemblies

Assemblies of antenna elements fitted with purpose designed filters fed via two or three way power divider networks can be designed and manufactured to suit the special needs of individual applications. The arrays and the elements within each array can be positioned either prior to, or after installation to enable fine tuning.

Simple and compact design

The design and manufacture of omnidirectional antennas at millimetre wave frequencies is both complex and costly whereas the sector antenna and in particular the 64˚ sector antenna is a simple device offering **much lower manufacturing costs.**

Customised Antenna Enclosures

In order to be sure of a design which does not in any way compromise system performance, it is important to give careful considerations to all aspects of the antenna radome assembly and its integration with the transmitter. Flann can provide efficient, practical and individually customised solutions to your transmitter construction which minimize installation, servicing and system running costs while assuring you of the system's durability and high performance in all conditions.

Standard Gain Horns
Series 240

NOW UP TO 330 GHz

Features

- Weatherproof Options
- Mounting Brackets Options
- Manufactured Brass or Aluminium
- Higher frequency models available

Model 22240-25

The Flann Standard Gain Horns have a wide range of applications, (e.g. as transmitting, receiving or sampling antennas or for feeding reflectors).

The absolute gain of a standard gain horn is calculable from the flare dimensions. Flann Standard Gain Horns are precision components providing accurate and repeatable gain references.

The lower frequency horns, models 06240 to 17240 inclusive, are accurately fabricated from brass sheet or aluminium. Models 18240 to 32240 inclusive are copper electroformed on precision mandrels which ensure high accuracy and repeatability. Typical gain/bandwidth curves are provided for all standard gain horns. 10 dB, 15 dB, 20 dB, 25 dB, 30 dB and 33 dB gain horns are also available in many waveguide sizes.

NB:- 25 dB models are approximately three times the overall length of the corresponding 20 dB models

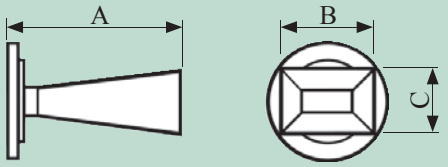
Specifications:

Variation of mid-band gain with frequency ..... ± 2 dB
Maximum VSWR (20 dB models)..... 1.2 : 1

ORDERING INFORMATION

Model: Gain Suffix; Description
Example: Model16240-20 Standard Gain Horn, 20 dB
-01 Membrane
-02 Mounting Bracket
-03 Membrane and Mounting Bracket

Gain	Suffix
10 dB	10
15 dB	15
20 dB	20
25 dB	25



Series 240

Model	Frequency Range (GHz)	Waveguide			Standard Mid-Band Gain (dB)	Dimensions (mm)		
		WG	R	WR		A Overall	B Internal	C Internal
06240	1.14 - 1.73	6	14	650	10	478	240	175
08240	1.72 - 2.61	8	22	430	10	318	160	115
10240	2.60 - 3.95	10	32	284	15	352	203	145
11A240	3.30 - 4.90	11A	40	229	15	290	154	114
12240	3.94 - 5.99	12	48	187	20	495	230	165
13240	4.64 - 7.05	13	58	159	20	419	209	148
14240	5.38 - 8.18	14	70	137	20	375	170	123
15240	6.58 - 10.0	15	84	112	20	328	146	110
16240	8.20 - 12.5	16	100	90	20	245	109	79
17240	9.84 - 15.0	17	120	75	20	215	94	67
18240	1.9 - 18.0	18	140	62	20	153	75	57
19240	14.5 - 22.0	19	180	51	20	139	67	50
20240	17.6 - 26.7	20	220	42	20	120	52	38
22240	26.4 - 40.1	22	320	28	20	85	35	25
23240	33.0 - 50.1	23	400	22	20	68	28	20
24240	39.3 - 59.7	24	500	19	20	54.5	23	18
25240	49.9 - 75.8	25	620	15	20	45.5	19	13
26240	60.5 - 92.0	26	740	12	20	38.5	15	11
27240	73.8 - 112	27	900	10	20	32.5	13	9
28240	92.3 - 140	28	1200	8	20	27.5	10	8
29240	114 - 173	29	1400	6	20	24.5	8.5	6.5
30240	145 - 220	30	1800	5	20	21.0	7.0	5.0
31240	172 - 261	31	2200	4	20	18.0	6.5	4.5
32240	220 - 330	32	2600	3	20	12.0	6.0	4.0

For more compact horn antennas and higher gains see Lens Horn Antennas pages 82 to 87

For standard flange types and recommendations see pages 111 onwards

NRL Standard Gain Horns
Series 240-NRL

NEW !

Features
- **Models up to 330 GHz**
- **Comply with U.S. Naval Research Lab Report (NRL) Report No. 4433**
- **Standard and Special Flange Types Available**

Model 12240-18NRL

Applications
- **Measurement Standard**
- **Calibration**

Typical Performance

- VSWR better than 1.2:1
- Variation of gain wrt mid-band ± 2 dB

Flann offer a complete range of Standard Gain Horn Antennas designed to the requirements of the Naval Research Laboratory (NRL) Report No. 4433.

These antennas are the industry recognised standard for gain calibration by the substitution method as described by ANSI/IEEE Standard 149-1979 Test Procedure for Antennas.

Model	Frequency Range (GHz)	Waveguide			Design Point	
		WG	R	WR	Frequency (MHz)	Gain (dBi)
04240	0.95 -1.15	04	9	975	1000	13.7
06240	1.130 - 1.70	06	14	650	1300	15.5
08240	1.70 - 2.6	08	22	430	1970	15.5
10240	2.60 - 3.950	10	32	284	3000	18.0
12240	3.950 - 5.880	12	48	159	4500	18.0
14240	5.77 - 8.33	14	70	137	6315	22.1
15240	6.980 - 10.0	15	84	112	7595	18.0
16240	8.1 - 12.4	16	100	90	9375	22.1
18240	12.4 - 18.07	18	140	62	16040	24.7
20240	18.070 - 26.550	20	220	42	24000	24.7
22240	26.550 - 38.960	22	320	28	35290	24.7

Scaled versions to 330 GHz

ORDERING INFORMATION

Model: Gain suffix; NRL; Description
Example: Model 12240-18NRL-AA NRL Standard Gain Horn, 18 dB

Series 240-NRL

Near Field Probes
Series 246

NEW !

Features

- **Models up to 330 GHz**
- **Low End Diffraction**

Applications

- **Planar & Cylindrical Near Field Measurements**
- **Calibration**

Flann offer a complete range of small aperture open-ended near field waveguide probes designed specifically for planar and cylindrical near field measurements and calibration.

The end diffraction is minimised by utilising a 10° chamfer to give a knife edge aperture of less than 0.5 mm radius.

Standard probe lengths include 100 mm, 200 mm & 300 mm.

Custom lengths and flanges are available on request.

Typical Performance

- VSWR better than 2.5:1
- Variation of gain wrt mid-band ± 2 dB

ORDERING INFORMATION

Model: Description
Example: Model 18246 WG18 Near-field probe

Series 246

Dual Polarized Horn
Series DP240

Features

- Frequency Range 2 GHz to 18 GHz
- Dual Polarization
- Close Phase and Amplitude Tracking Between Ports
- High Isolation
- Low Cross Polarization
- Integral Mounting Bracket Option
- Weatherproofed

Model DP240-AA

Typical applications include:

- Electromagnetic Interference (EMI) Measurement
- Antenna Measurement
- Radar Cross Section Measurement

The Flann Dual Polarized Horn, Model DP240 is a multi-octave, coaxially fed, quadridged horn suitable for many applications requiring a high performance over a broad band.

These high performance units covering the frequency range 2 GHz to 18 GHz offer high isolation with low phase and amplitude imbalance between ports. The horn maintains a low VSWR while the precision electroformed construction ensures very low cross polarization levels.

Electrical Specifications	Frequency Range	2 GHz to 18 GHz
	Gain	5 dBi to 18 dBi
	Polarization	Simultaneous Horizontal & Vertical
	3 dB Beamwidth	60° to 10° Nominal
	Typical VSWR Better than	2.5:1
	Cross Polarization	-20 dB Maximum
	Isolation Between Ports	25 dB Typical
	Maximum Power CW	10 Watts
	Phase Tracking Between Ports	± 17° Maximum
	Amplitude Tracking Between Ports	± 1.3 dB Maximum
RF Coaxial Connectors	SMA Female	
Dimensions	Aperture Diameter	135 mm
	Overall Length	300 mm
	Weight	2.75 kg (3.2 kg DP240-AB)

ORDERING INFORMATION:

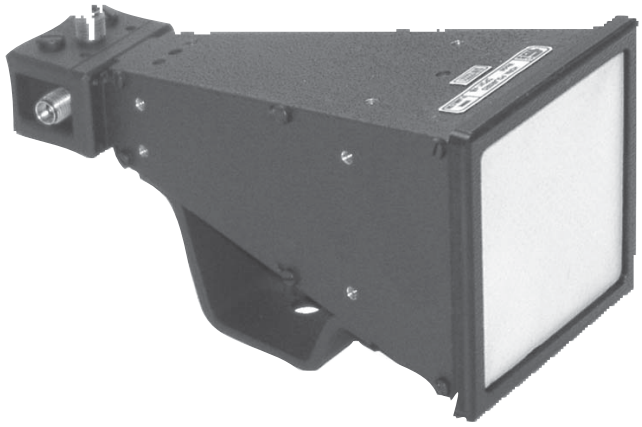
Model DP240-AA; Dual Polarized Horn, 2 GHz to 18 GHz
Model DP240-AB; Dual Polarized Horn, 2 GHz to 18 GHz with integral mounting bracket

Series DP240

Dual Polarized Horn
Series DP241

Features

- Frequency Range 18 GHz to 40 GHz
- Optional Ranges in 6 GHz to 50 GHz
- Dual Polarization
- Close Phase and Amplitude Tracking Between Ports
- High Isolation
- Low Cross Polarization
- Mounting Bracket
- Weatherproofed



Model DP241- AB

Typical applications include

- Electromagnetic Interface (EMI) measurement
- Antenna Measurement
- Radar Cross Section Measurement

The Flann Dual Polarized Horn, Model DP241 - AB, is a multi-octave, coaxially fed, quadridged horn suitable for many applications requiring a high performance over a broad band. The standard antenna covers the frequency range 18 GHz - 40 GHz and offers high isolation with low phase and amplitude imbalance between ports. Other frequency options are available within the 6 GHz to 50 GHz band.

The horn maintains a low VSWR while the precision-machined construction ensures very low cross polarization levels.

Special Dual Polarized Horns are also available operating up to 50 GHz using 2.4 connectors.

The standard DP241-AB will function down to 6 GHz with a reduced performance.

Electrical Specifications	Frequency Range	18 GHz to 40 GHz (Options, operational from 6 GHz to 50 GHz
	Gain	10 dBi to 18 dBi
	Polarization	Simultaneous Horizontal & Vertical
	3 dB Beamwidth	25° to 17° Nominal
	Typical VSWR Better than	2.5:1
	Cross Polarization	-20 dB
	Isolation Between Ports	25 dB
	Maximum Power CW	5 Watts
	Phase Tracking Between Ports	± 25° Maximum
	Amplitude Tracking Between Ports	± 1.5 dB Maximum
RF Coaxial Connectors		2.9 K Type Female
Dimensions	Aperture	50 mm x 50 mm
	Overall Length	150 mm
	Weight	< 0.5 kg

ORDERING INFORMATION:

Model DP241-AB; Dual Polarized Horn, 18 GHz to 40 GHz with integral mounting bracket
Model DP241-AC; Dual Polarized Horn, 6 GHz to 50 GHz (2.4 mm connector)

Series DP241

Omni Directional Antenna
Series MD249

NOW UP TO 330 GHz

Features

- **Low VSWR**
- **360˚ Azimuth Coverage**
- **60˚ Elevation Coverage**
- **Models within the range 1.5 GHz - 330 GHz available**
- **Waveguide Interface Models available**

The Flann Omni Directional Antennas series MD249, provide 360˚ coverage in azimuth and 60˚ coverage in elevation; these antennas are suitable for applications requiring a good all round coverage.

Model MD249-AB

Typical applications include:-

- **Wireless LAN**
- **Source Tracking**
- **Outside Broadcast**
- **Air to Ground Downlinks**

Model MD249-AA

Typical Specfication:- (Model MD 249-AA)

Specified Frequency Range	59 GHz to 65.5 GHz	All Broadband widths up to 2:1
Functional Frequency Range	50 GHz to 70 GHz	All Broadband widths up to 2:1
Nominal Gain	2 dB	
Gain Variation Elevation	±1.5 dB	
Gain Variation Azimuth	±1 dB	
Polarization	Vertical	
Nominal Half Angle 3 dB Beamwidth	Typically Greater than 30˚	
Nominal Half Angle 10 dB Beamwidth	Typically Greater than 60˚	
VSWR (Max)	1.65:1	
Typical Power Handling	5 Watts	
RF Coaxial Connectors	1.85 mm Male or Female or Type N, SMA, K for lower frequency ranges	

Special Customised Wideband Antennas

Flann's broadband circularly polarized airborne antenna range has been developed specifically for use in EW/ ECM simulations applications.

Typical Performance

- **Operating Range:** **8 GHz to 14 GHz**
- **Gain:** **16 dBiL**
- **Polarization:** **Circular**
- **Ellipticity (ICR):** **< ± 2 dB**
- **VSWR:** **1.6:1 Max**
- **Mean 3 dB Beamwidth:** **± 12˚**
- **Alternative Designs are Available to Customer Specifications**

Each of the antennas is specifically designed to achieve the highest level of gain and best ellipticity ratio, available for a given aperture size.
The broadband nature of the design means that we can deliver bandwidths up to 2.4:1 therefore reducing the number of test antennas needed to cover a wide band for ECM / EW simulation tests.

Shown is a specialised antenna designed to meet a customer's very exacting requirements.

ORDERING INFORMATION

PLEASE CONTACT THE SALES TEAM FOR MORE INFORMATION ON OUR STANDARD AND OPTIONAL MODELS

Low Pass Filters
Series 280

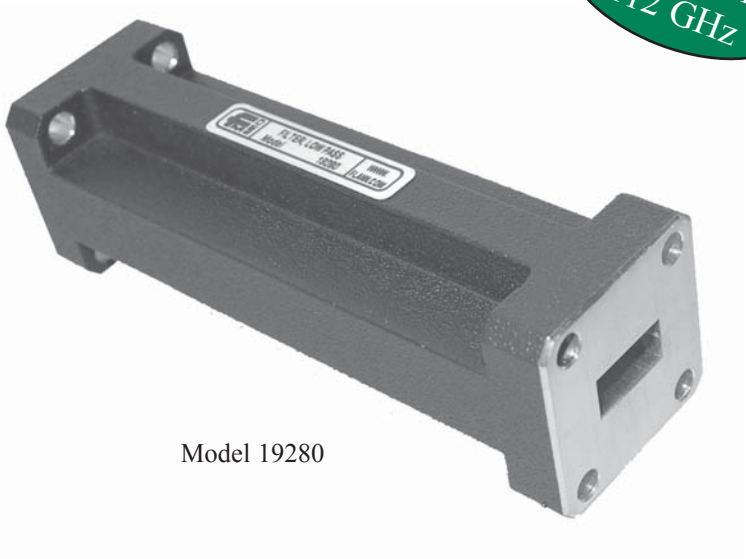
NOW UP TO 112 GHz

Features

- 40 dB Stop Band Rejection
- Models Available from 2.6 GHz to 112 GHz
- High Frequency Models Available on Request

Low pass filters simplify measurements in microwave systems and enhance system performance by effectively reducing undesirable signals, i.e. harmonics, to an acceptably low level.

All models provide a very wide 'stop band' of frequencies above the recommended waveguide band. The pass band VSWR is generally better than 1.5:1 and insertion loss less than 1.5 dB.



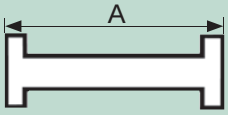
Model 19280

Filters of this type are particularly suitable for applications involving swept or slotted line measurements.

A range of standard models is available as detailed below. Customised and special models can be combined with other devices. For example a low pass filter combined with waveguide to coax adaptor can also be supplied.

Model	Waveguide			Passband Frequency Range (GHz)	Stop Band Frequency Range (GHz)	Stop Band Rejection (dB)	Maximum Insertion Loss (dB)	VSWR Generally better than	Dimension A (mm)
	WG	R	WR						
10280	10	32	284	2.60 - 3.95	5.20 - 11.85	>40	0.5	1.15	500
11A280	11A	40	229	3.30 - 4.90	6.60 - 14.70	>40	0.5	1.15	450
12280	12	48	187	3.94 - 5.99	7.88 - 17.97	>40	0.5	1.15	375
14280	14	70	137	5.38 - 8.18	10.76 - 24.54	>40	0.5	1.15	250
15280	15	84	112	6.58 - 10.0	13.16 - 30.00	>40	0.5	1.15	200
16280	16	100	90	8.20 - 12.5	16.40 - 37.50	>40	0.5	1.15	160
17280	17	120	75	9.84 - 15.0	19.68 - 45.00	>40	0.5	1.15	140
18280	18	140	62	11.9 - 18.0	23.80 - 54.00	>40	0.5	1.15	110
19280	19	180	51	14.5 - 22.0	29.00 - 66.00	>40	0.5	1.15	100
20280	20	220	42	17.6 - 26.7	35.20 - 80.10	>40	0.5	1.15	80
21280	21	260	34	21.7 - 33.0	43.4 - 99.0	>40	0.5	1.2	80
22280	22	320	28	26.4 - 40.1	52.80 - 120.3	>40	0.75	1.2	60
23280	23	400	22	33.0 - 50.1	66.00 - 150.3	>38	1.0	1.3	50
24280	24	500	19	39.3 - 59.7	78.60 - 179.1	>38	1.0	1.3	50
25280	25	620	15	49.9 - 75.8	99.8 - 227.4	>38	1.0	1.4	
26280	26	740	12	60.5 - 92.0	Specifications / dimensions available on request				
27280	27	900	10	73.8 - 112					

ORDERING INFORMATION
Model: Description
Example: Model 22280 Low pass filter



Models are available at higher frequency bands. Details upon request.

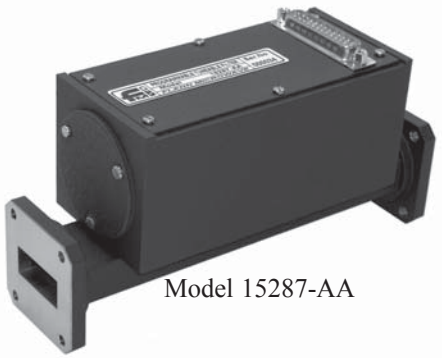
Series 280

For standard flange types and recommendations see pages 111 onwards

Microwave Tuneable Filters
Programmable Series 287 & Manual Series 288

Features

- Bandpass & Bandstop
- Narrow bandwidths < 0.5%
- 15% frequency tuning range
- Passband designs within the 1 GHz to 45 GHz Range
- Bus controlled or manual
- High power versions
- Very low insertion loss & high Q
- Programmable - BUS Controlled GPIB or Manual
- Other Interfaces available

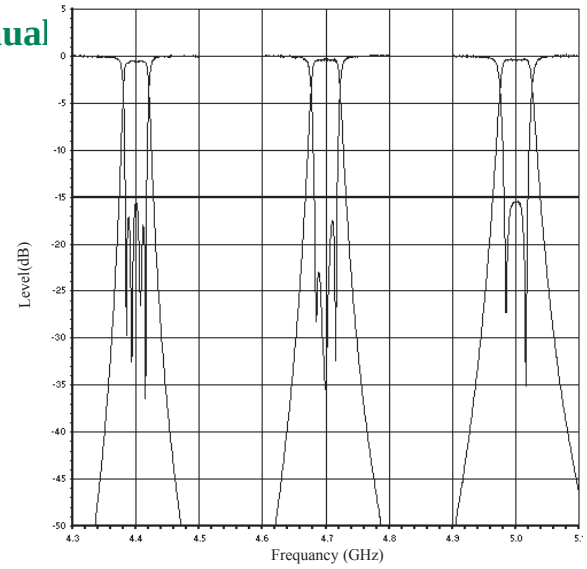


Model 15287-AA

Flann have developed a range of tuneable bandpass and bandstop filters. The generally excepted combination of high power handling with very low insertion loss, by convention, mutually necessitated the use of high Q cavity filters.

Flann have addressed these needs by designing new tuning techniques to derive mechanically tuned filters; such filters were previously regarded as not practically achievable.
The Flann tuning technique provides high reliability with a sustained repeatable performance.

Models with BUS control can be integrated into automated / remotely controlled applications.



Response of a narrow passband tuneable filter over the frequency range 4.3 GHz to 5.1 GHz

Advantages of using Flann Tuneable Filters

Band Pass Type

- System designers can now use a single filter rather than networks of switched filters
- Power budgets have more margin than using varactor tuned filters
- Mobile operators can meet tighter emissions criteria when channel switching
- Radio users can have frequency agility with better security

Band Stop / Notch Type

- Radar operators can "low cost" test their own spurious emissions
- Communications users can trace unwanted received signals causing interference

Fixed Filters

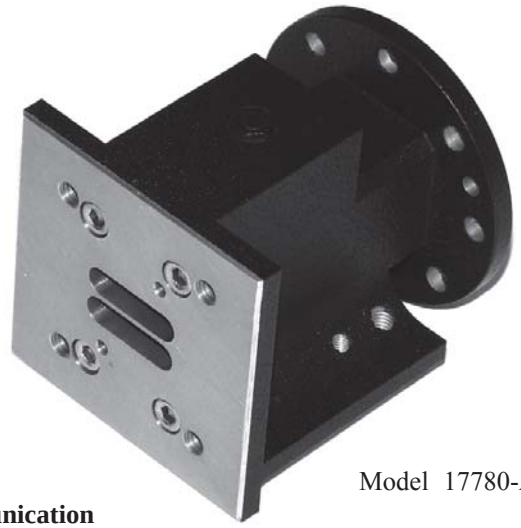
Features

- In Rectangular, Single or Double Ridge Waveguide
- Lowpass, Highpass or Bandpass types
- Bandwidths from 0.1 % to 40 %
- Passbands within the range 1 GHz to 130 GHz
- 1st, 2nd, 3rd & 4th Harmonic types
- Reflective and Absorptive

Orthomode Transducers
Series 780

Features

- **Isolation > 50 dB**
- **Models up to 140 GHz**
- **Broad & Narrow Band Options**
- **High Polarization Purity 50 dB (typical)**
- **Circular or Square Guide Interface Options**



Model 17780-AB

Applications

- **For Use With Dual Polarized Antennas**
- **For Polarization Diplexing**

Flann's OMT's offer the high performance demanded by today's communication systems, in which high polarization purity and high isolation are paramount.

The combination of low cross polar and high isolation characteristics provide optimum link performance.

Some examples of the models available are detailed in the table below.
Other models are available to suit many applications, frequency bands and power levels. Details on Request.

Model	In-Line Port (GHz)	Ortho Port (GHz)	Port Isolation (dB)	X- Polarization (dB)	Return Loss (dB)	Insertion Loss (dB)
15780 **	7.25 -7.75	7.9 - 8.4	50	50	26	0.1
17780 **	10.7 -12.75	13.75 - 14.5	48	48	26	0.1
20780 **	21.2 - 23.6	21.2 - 23.6	47	47	25	0.1
22780 **	27.5 - 29.5	27.5 - 29.5	45	45	23	0.2

Complimentary components are available for a complete antenna fed system from:
- High performance lens horn Antennas
- Polarizers - linear and circular
- Filters and Diplexers
- Isolators
- Waveguide to Coax adaptors (including NEW range of end feed coax)

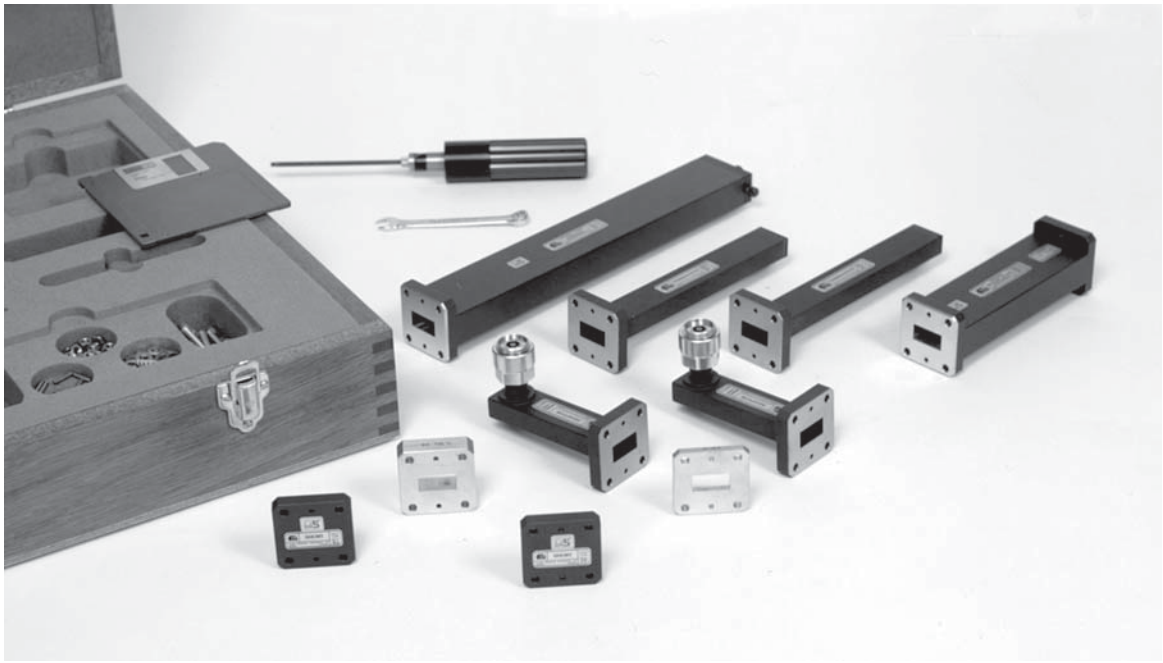
For other radio products:
See pages 96 & 97 for filters, page 51 for waveguide to coax adaptors & page 82 for antennas.
Please contact our Sales Team for more information on our new range of Radio Products.

Series 780

Waveguide Calibration Kits

NOW UP TO 500 GHz

- **Three Grades, each with defined accuracy**



For use with Vector Network Analysers - 1.14 GHz to 500 GHz.

Three grades of calibration kits and components are available that enable VNA users to select the one most suitable for the analyser type and measurement requirement. Various manufacturing techniques are employed and selected according to waveguide size and required accuracy.

Critical components in each grade of kit have defined accuracies - a feature unique to Flann Waveguide Calibration Kits.
Flann calibration kits contain all the components necessary to fully calibrate VNAs configured for waveguide measurements. A typical kit would include waveguide to coax adaptors, fixed terminations, a sliding termination, offsets, flush shorts and a waveguide section. Kits are supplied in a fitted hardwood case complete with connecting hardware, data disc and handbook.

METROLOGY
BRONZE

MODEST PERFORMANCE AND LOW COST

METROLOGY
SILVER

PRECISION

METROLOGY
GOLD

HIGH PRECISION

Waveguide Calibration Kits

Model Selection Table

Kit Grade	Kit Type	
	OOL	TRL / LRL
Metrology Bronze	708 series	703 series
Metrology Silver	730 series	720 series
Metrology Gold	750 series	740 series

Each kit type contains the following components

Components	Contents	
	OOL	TRL / LRL
Waveguide to Coax Adaptors 1.14 GHz to 22 GHz (WG6, WR650, R14) to (WG19, WR51, R180)	2 off	2 off
17.6 GHz to 110 GHz (WG20, WR42, R220) to (WG27, WR10, R900)	2 off optional extra	2 off optional extra
Fixed Termination	2 off	2 off
Flush Short	2 off	2 off
1/8 λ Offset	1 off	optional extra
1/4 λ Offset	optional extra	1 off
3/8 λ Offset	1 off	optional extra
Waveguide Section	1 off	1 off
Sliding Termination	1 off	optional extra
Data Disk	included	included
Torque Driver	included	included
Flange Bolts etc	1 set included	1 set included
Precision Flange dowels	1 set included	1 set included
Hardwood Case	included	included
Handbook	included	included

Note 1 - Flanges

Flann Calibration Kit components are fitted with "Precision Flanges" that are fully compatible with standard flanges whilst providing enhanced accuracy and repeatability. Please see page 119 - 121 for details. Kits are also available fitted with alternative flange styles or special flanges to customer specification. Details on request.

Note 2 - Waveguide to Coax Adaptors

The Waveguide to Coax Adaptors supplied with Flann Calibration Kits are of sufficient length to ensure the decay of unwanted evanescent modes.

Note 3 - Offsets

The length of each Flann offset section is designed to provide a phase balanced response over the recommended frequency range. Fractional wavelengths are specified with respect to a wavelength $\lambda_{g\circ}$ where:-

$$\lambda_{g\circ} = 2\left[\frac{\lambda ghf \,.\, \lambda glf}{\lambda ghf + \lambda glf}\right]$$

λ_{glf} is the waveguide wavelength at the lowest frequency of the operating range and λ_{ghf} is the waveguide wavelength at the highest frequency of the operating range.

ORDERING INFORMATION REQUIRED
1. Waveguide designation (size)
Example: WG27
2. Series selected
Example: 730 see above
3. Description
Example: Metrology Silver Grade, OOL type
4. Vector analysers to be used
Example: HP8513

Complete Ordering Example: 27730 Metrology Silver Waveguide Calibration Kit type OOL for use with HP8513 vector network analysers

Please Note: Calibration Kits in WG 20 and higher frequencies (17.6 GHz upwards) do not include Waveguide to Coax Adaptors. Please state at time of ordering if adaptors are required to be included in the kit.

A Guide to Calibration Kit Selection

Flann Calibration Kits have been developed in close cooperation with manufacturers and users of network analysers. Kits are available in each of the three grades, suitable for analyser configurations requiring OOL, TRL and LRL calibration kit styles. The selection of a calibration kit and its contents is largely dictated by the combination of analyser model, test set model and type of calibration routine to be implemented, i.e. full 12 term, single path 2 port, reflection only or TRL/LRL.

OOL - Offset/Offset/Load
TRL - Thru/Reflect/Line
LRL - Line/Reflect/Line

The waveguide Calibration Kits, as described in the preceding pages, contain the components necessary to fully calibrate Vector Network Analysers. Flann Calibration Kit components are available individually or to supplement standard kits. Specialised Calibration Kits or components for use with alternative measurement systems, such as six port reflectometers, are also available. Full details are available on request.

Note: The components included in Flann Offset/Offset/Load type calibration kits can also be used with the Anritsu/Wiltron 360 to achieve an LRL calibration.

The specifications and capabilities of network analysers are subject to constant evolution and development. Please consult us for Calibration Kit applications assistance if required.

Note 1 - Flanges

Flann Calibration Kit components are fitted with "Precision Flanges" that are fully compatible with standard flanges whilst providing enhanced accuracy and repeatability. Please see page 119 - 121 for details. Kits are also available fitted with alternative flange styles or special flanges to customer specification. Details on request.

Note 2 - Waveguide to Coax Adaptors

The Waveguide to Coax Adaptors supplied with Flann Calibration Kits are of sufficient length to ensure the decay of unwanted evanescent modes.

Note 3 - Corner Radius

Calibration Kits with specified corner radius are available - please contact our Sales Department for more details

Please Note: Calibration Kits in WG 20 and higher frequency sets (17.6 GHz upwards) do not include waveguide to coax adaptors. Please state at time of ordering if adaptors will be required.

Double Ridge Waveguide Calibration Kits are also available - please see page 105

ORDERING INFORMATION
Calibration Kit Model: model of specific analyser model with which Calibration Kit is to be used; Description
Example: Model 22730-HP8513 waveguide calibration kit, metrology silver, OOL, for use with HP 8513 analyser

METROLOGY BRONZE CALIBRATION KITS - 703 & 708 Series

Modest cost components realised from selected precision drawn waveguide intended for routine use offering a performance comparable to other commercially available kits. Suitable for basic measurement standards.

Waveguide Designation	WG WR R	06 650 14	08 430 22	09A 340 26	10 284 32	11A 229 40	12 187 48	13 159 58	14 137 70	15 112 84	16 90 100	17 75 120	18 62 140	19 51 180	20 42 220	21 34 260	22 28 320	23 22 400	24 19 500	25 15 620	26 12 740	27 10 900
Frequency Range (GHz)		1.14 to 1.73	1.72 to 2.61	2.17 to 3.30	2.60 to 3.95	3.30 to 4.90	3.94 to 5.99	4.64 to 7.05	5.38 to 8.18	6.58 to 10.0	8.20 to 12.50	9.84 to 15.0	11.9 to 18.0	14.5 to 22.0	17.6 to 26.7	21.7 to 33.0	26.4 to 40.1	33.0 to 50.1	39.3 to 59.7	49.9 to 75.8	60.5 to 92.0	73.8 to 112.0
Definitive Waveguide Dimensions (mm)		165.10 x 82.55	109.22 x 54.61	86.36 x 43.18	72.14 x 34.04	58.17 x 29.083	47.55 x 22.149	40.390 x 20.193	34.85 x 15.799	28.499 x 12.624	22.86 x 10.16	19.05 x 9.525	15.799 x 7.899	12.954 x 6.477	10.668 x 4.318	86.36 x 4.318	7.112 x 3.556	5.690 x 2.845	4.775 x 2.388	3.759 x 1.880	3.099 x 1.549	2.540 x 1.270
Precision Flange Type	(See Note 1)	UG417A/U	UG435A/U	UDR26	UDR32	UDR40	UAR48	UAR58	UAR70	UBR84	UBR100	UBR120	UBR140	UBR180	UBR220	UBR260	UG599/U	UG383/U mod	UG383/U	UG385/U	UG387/U mod	UG387/U mod
Waveguide Aperture/Tolerance (microns)		130	90	80	60	50	40	35	35	30	20	20	18	18	15	15	15	15	15	15	15	15
WAVEGUIDE TO COAX ADAPTOR Model**091 VSWR (better than) Connector Type	(See Note 2)	1.10 APC7	1.10 APC7	1.10 APC7	1.10 APC7	1.10 APC7	1.10 APC7	1.10 APC7	1.10 APC7	1.10 APC7	1.10 APC7	1.10 APC7	1.10 APC7	1.20 K	1.20 K	1.25 K	1.20 K	1.30 2.4mm	1.3 V	1.25* V		
FIXED TERMINATION Model **045 VSWR (better than)		1.02	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.015	1.015	1.02	1.02	1.02	1.02	1..02	1.02	1.02	1.03	1.035	1.04
FLUSH SHORT Model **191 Flatness (better than) (microns)		70	60	60	50	30	20	20	20	20	20	20	20	20	20	20	12	12	12	12	12	12
OFFSET($\frac{1}{8}\lambda_g$, 2 port)Model **491-01 Length, nominal (mm) Length tolerance (microns)		34.665 100	23.310 100	18.240 100	15.227 50	12.032 50	10.051 50	8.537 50	7.356 40	6.016 35	4.815 30	4.012 30	3.334 25	2.730 25	2.251 20	1.824 20	1.499 20	1.199 20	1.007 20	0.793 20	0.654 20	0.537 20
OFFSET($\frac{1}{4}\lambda_g$, 2 port) Model **491-02 Length, nominal (mm) Length tolerance (microns)		69.331 100	46.026 100	36.480 100	30.453 50	24.063 50	20.102 50	17.074 50	14.711 40	12.032 35	9.630 30	8.025 30	6.668 25	5.461 25	4.501 20	3.648 20	2.997 20	2.399 20	2.014 20	1.587 20	1.308 20	1.074 20
OFFSET($\frac{3}{8}\lambda_g$, 2 port) Model **491-03 Length, nominal (mm) Length tolerance (microns)		103.996 100	69.039 100	54.720 100	45.680 50	36.095 50	30.154 50	25.611 50	22.067 40	18.048 35	14.445 30	12.037 30	10.003 25	8.191 25	6.752 20	5.472 20	4.496 20	3.598 20	3.021 20	2.380 20	1.963 20	1.612 20
SLIDING TERMINATION Model **541 Element VSWR (better than)		1.02	1.02	1.02	1.015	1.015	1.01	1.01	1.01	1.008	1.006	1.006	1.008	1.01	1.01	1.015	1.015	1.02	1.025	1.03	1.035	1.04
WAVEGUIDE SECTION Model **440 Length, nominal (mm) Length tolerance (microns)		590 280	495 200	450 180	410 150	360 130	320 100	273 90	236 80	192 70	154 60	128 55	107 50	87 40	71 30	65 30	60 20	46 20	39 20	35 20	35 20	35 20

Note 1 - See Page 100 for details

Note 2 - See Page 100 for details

* VSWR is specified to 67 GHz, V Connector overmodes at 72 GHz

New

Calibration devices up to 500 GHz have been developed and supplied to support worldwide measurement activities. Please contact our Sales Team for further details

NOW UP TO 500 GHz

METROLOGY SILVER CALIBRATION KITS - 720 & 730 Series

Precision components suitable for applications where modest accuracies are required.

Waveguide Designation	WG WR R	06 650 14	08 430 22	09A 340 26	10 284 32	11A 229 40	12 187 48	13 159 58	14 137 70	15 112 84	16 90 100	17 75 120	18 62 140	19 51 180	20 42 220	21 34 260	22 28 320	23 22 400	24 19 500	25 15 620	26 12 740	27 10 900
Frequency Range (GHz)		1.14 to 1.73	1.72 to 2.61	2.17 to 3.30	2.60 to 3.95	3.30 to 4.90	3.94 to 5.99	4.64 to 7.05	5.38 to 8.18	6.58 to 10.0	8.20 to 12.50	9.84 to 15.0	11.9 to 18.0	14.5 to 22.0	17.6 to 26.7	21.7 to 33.0	26.4 to 40.1	33.0 to 50.1	39.3 to 59.7	49.9 to 75.8	60.5 to 92.0	73.8 to 112.0
Definitive Waveguide Dimensions (mm)		165.10 x 82.55	109.22 x 54.61	86.36 x 43.18	72.14 x 34.04	58.17 x 29.083	47.55 x 22.149	40.390 x 20.193	34.85 x 15.799	28.499 x 12.624	22.86 x 10.16	19.05 x 9.525	15.799 x 7.899	12.954 x 6.477	10.668 x 4.318	86.36 x 4.318	7.112 x 3.556	5.690 x 2.845	4.775 x 2.388	3.759 x 1.880	3.099 x 1.549	2.540 x 1.270
Precision Flange Type (See Note 1)		UG417A/U	UG435A/U	UDR26	UDR32	UDR40	UAR48	UAR58	UAR70	UBR84	UBR100	UBR120	UBR140	UBR180	UBR220	UBR260	UG599/U	UG383/U mod	UG383/U	UG385/U	UG387/U mod	UG387/U mod
Waveguide Aperture/Tolerance (microns)		65	45	40	30	30	20	20	15	15	10	10	10	10	10	10	10	10	10	10	10	10
WAVEGUIDE TO COAX ADAPTOR Model**094 VSWR (better than) Connector Type (See Note 2)		1.05 APC7	1.05 APC7	1.05 APC7	1.05 APC7	1.05 APC7	1.05 APC7	1.05 APC7	1.05 APC7	1.05 APC7	1.05 APC7	1.07 APC7	1.07 APC7	1.10 K	1.10 K	1.15 K	1.15 K	1.30 2.4mm	1.3 V	1.25* V		
FIXED TERMINATION Model **043 VSWR (better than)		1.02	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.015	1.015	1.02	1.02	1.02	1.02	1..02	1.02	1.02	1.03	1.035	1.04
FLUSH SHORT Model **192 Flatness (better than) (microns)		35	30	30	25	15	10	10	10	10	10	10	10	10	10	10	6	6	6	6	6	6
OFFSET($\frac{1}{8}\ \lambda_g$, 2 port)Model **492-01 Length, nominal (mm) Length tolerance (microns)		34.665 50	23.310 50	18.240 50	15.227 25	12.032 25	10.051 25	8.537 25	7.356 20	6.016 15	4.815 15	4.012 10	3.334 10	2.730 10	2.251 10	1.824 10	1.499 10	1.199 10	1.007 10	0.793 10	0.654 10	0.537 10
OFFSET($\frac{1}{4}\ \lambda_g$, 2 port) Model **492-02 Length, nominal (mm) Length tolerance (microns)		69.331 50	46.026 50	36.480 50	30.453 25	24.063 25	20.102 25	17.074 25	14.711 20	12.032 15	9.630 15	8.025 10	6.668 10	5.461 10	4.501 10	3.648 10	2.997 10	2.399 10	2.014 10	1.587 10	1.308 10	1.074 10
OFFSET($\frac{3}{8}\ \lambda_g$, 2 port) Model **492-03 Length, nominal (mm) Length tolerance (microns)		103.996 50	69.039 50	54.720 50	45.680 25	36.095 25	30.154 25	25.611 25	22.067 20	18.048 15	14.445 15	12.037 10	10.003 10	8.191 10	6.752 10	5.472 10	4.496 10	3.598 10	3.021 10	2.380 10	1.963 10	1.612 10
SLIDING TERMINATION Model **542 Element VSWR (better than)		1.02	1.02	1.02	1.015	1.015	1.01	1.01	1.01	1.008	1.006	1.006	1.008	1.01	1.01	1.015	1.015	1.02	1.025	1.03	1.035	1.04
WAVEGUIDE SECTION Model **442 Length, nominal (mm) Length tolerance (microns)		590 140	495 100	450 90	410 75	360 65	320 50	273 45	236 40	192 35	154 30	128 30	107 25	87 20	71 15	65 15	60 10	46 10	39 10	35 10	35 10	35 10

Note 1 - See Page 100 for details

Note 2 - See Page 100 for details

* VSWR is specified to 67 GHz, V Connector overmodes at 72 GHz

New

Calibration devices up to 500 GHz have been developed and supplied to support worldwide measurement activities. Please contact our Sales Team for further details

NOW UP TO 500 GHz

METROLOGY GOLD CALIBRATION KITS - 740 & 750 Series

High precision components eminently suited to demanding applications which extend VNA measurement capability.

Waveguide Designation	WG WR R	06 650 14	08 430 22	09A 340 26	10 284 32	11A 229 40	12 187 48	13 159 58	14 137 70	15 112 84	16 90 100	17 75 120	18 62 140	19 51 180	20 42 220	21 34 260	22 28 320	23 22 400	24 19 500	25 15 620	26 12 740	27 10 900
Frequency Range (GHz)		1.14 to 1.73	1.72 to 2.61	2.17 to 3.30	2.60 to 3.95	3.30 to 4.90	3.94 to 5.99	4.64 to 7.05	5.38 to 8.18	6.58 to 10.0	8.20 to 12.50	9.84 to 15.0	11.9 to 18.0	14.5 to 22.0	17.6 to 26.7	21.7 to 33.0	26.4 to 40.1	33.0 to 50.1	39.3 to 59.7	49.9 to 75.8	60.5 to 92.0	73.8 to 112.0
Definitive Waveguide Dimensions (mm)		165.10 x 82.55	109.22 x 54.61	86.36 x 43.18	72.14 x 34.04	58.17 x 29.083	47.55 x 22.149	40.390 x 20.193	34.85 x 15.799	28.499 x 12.624	22.86 x 10.16	19.05 x 9.525	15.799 x 7.899	12.954 x 6.477	10.668 x 4.318	86.36 x 4.318	7.112 x 3.556	5.690 x 2.845	4.775 x 2.388	3.759 x 1.880	3.099 x 1.549	2.540 x 1.270
Precision Flange Type (See Note 1)		UG417A/U	UG435A/U	UDR26	UDR32	UDR40	UAR48	UAR58	UAR70	UBR84	UBR100	UBR120	UBR140	UBR180	UBR220	UBR260	UG599/U	UG383/U mod	UG383/U	UG385/U	UG387/U mod	UG387/U mod
Waveguide Aperture/Tolerance (microns)		35	25	20	15	15	10	10	7	7	5	5	5	5	5	5	5	5	5	5	5	5
WAVEGUIDE TO COAX ADAPTOR Model**095 VSWR (better than) Connector Type (See Note 2)		1.05 APC7	1.05 APC7	1.05 APC7	1.05 APC7	1.05 APC7	1.05 APC7	1.05 APC7	1.05 APC7	1.05 APC7	1.05 APC7	1.07 APC7	1.07 APC7	1.10 K	1.10 K	1.15 K	1.15 K	1.30 2.4mm	1.3 V	1.25* V		
FIXED TERMINATION Model **044 VSWR (better than)		1.02	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.015	1.015	1.02	1.02	1.02	1.02	1..02	1.02	1.02	1.03	1.035	1.04
FLUSH SHORT Model **193 Flatness (better than) (microns)		15	15	15	12	8	8	5	5	5	5	5	5	5	5	5	3	3	3	3	3	3
OFFSET($\frac{1}{8}\ \lambda_g$, 2 port)Model **493-01 Length, nominal (mm) Length tolerance (microns)		34.665 25	23.310 25	18.240 25	15.227 15	12.032 15	10.051 12	8.537 12	7.356 10	6.016 7	4.815 7	4.012 5	3.334 5	2.730 5	2.251 5	1.824 5	1.499 5	1.199 5	1.007 5	0.793 5	0.654 5	0.537 5
OFFSET($\frac{1}{4}\ \lambda_g$, 2 port) Model **493-02 Length, nominal (mm) Length tolerance (microns)		69.331 25	46.026 25	36.480 25	30.453 15	24.063 15	20.102 12	17.074 12	14.711 10	12.032 7	9.630 7	8.025 5	6.668 5	5.461 5	4.501 5	3.648 5	2.997 5	2.399 5	2.014 5	1.587 5	1.308 5	1.074 5
OFFSET($\frac{3}{8}\ \lambda_g$, 2 port) Model **493-03 Length, nominal (mm) Length tolerance (microns)		103.996 25	69.039 25	54.720 25	45.680 15	36.095 15	30.154 12	25.611 12	22.067 10	18.048 7	14.445 7	12.037 5	10.003 5	8.191 5	6.752 5	5.472 5	4.496 5	3.598 5	3.021 5	2.380 5	1.963 5	1.612 5
SLIDING TERMINATION Model **543 Element VSWR (better than)		1.02	1.02	1.02	1.015	1.015	1.01	1.01	1.01	1.008	1.006	1.006	1.008	1.01	1.01	1.015	1.015	1.02	1.025	1.03	1.035	1.04
WAVEGUIDE SECTION Model **443 Length, nominal (mm) Length tolerance (microns)		590 70	495 50	450 45	410 40	360 35	320 30	273 25	236 20	192 18	154 15	128 15	107 12	87 10	71 7	65 7	60 5	46 5	39 5	35 5	35 5	35 5

Note 1 - See Page 100 for details

Note 2 - See Page 100 for details

* VSWR is specified to 67 GHz, V Connector overmodes at 72 GHz

New

Calibration devices up to 500 GHz have been developed and supplied to support worldwide measurement activities. Please contact our Sales Team for further details

NOW UP TO 500 GHz

Double Ridge Waveguide Calibration Kits

A range of Double Ridge Calibration Kits has been added to the company's extensive selection of rectangular waveguide Kits.

The Double Ridge Calibration Kits contain the standards and components required to fully calibrate VNA's configured for waveguide measurements. Kits are available to suit all models of VNA's in double ridge waveguide sizes from 3.5 GHz to 40 GHz.

A kit would typically include:

- Waveguide to Coaxial Adaptors
- Fixed Terminations
- Offsets
- Offset Shorts
- Sliding Termination (optional - depending on analyser type and calibration method)
- Data disc, hardware and handbook

All the components are supplied in a fitted hardwood case.

Model	Waveguide Designation	Frequency Range (GHz)	Calibration Type*
WRD200703	WRD200D24	2.0 to 4.8	TRL/LRL
WRD200708	WRD200D24	2.0 to 4.8	OOL
WRD350703	WRD350D24	3.5 to 8.2	TRL/LRL
WRD350708	WRD350D24	3.5 to 8.2	OOL
WRD580703	WRD580D28	5.8 to 16.0	TRL/LRL
WRD580708	WRD580D28	5.8 to 16.0	OOL
WRD650703	WRD650D28	6.5 to 18.0	TRL/LRL
WRD650708	WRD650D28	6.5 to 18.0	OOL
WRD750703	WRD750D24	7.5 to 18.0	TRL/LRL
WRD750708	WRD750D24	7.5 to 18.0	OOL
WRD180703	WRD180C24	18.0 to 40.0	TRL/LRL
WRD180708	WRD180C24	18.0 to 40.0	OOL

* TRL signifies Thru' Reflect Line LRL signifies Line Reflect Line OOL signifies Offset Offset Load

Kits in other double ridge waveguide sizes are also available. Details are available upon request.

New

Double Ridge Components additional to the Flann range

Also NEW to the Flann range of components is a comprehensive selection of other Double Ridge products including special designs to suit customer applications

NEW

- **Double Ridge Directional Couplers - including dual and triple designs to customer requirement**
- **Double Ridge Waveguide to Coax Adaptors**
- **Double Ridge Terminations, Fixed, Sliding & High Power**
- **Double Ridge Switches, Manual & Electrically Operated**
- **Double Ridge Waveguide Assemblies**

Waveguide Verification Kits
Metrology Gold Series 710 Metrology Silver Series 711

NOW UP TO 500 GHz

The Flann Series 710 of Waveguide Verification Kits enables VNA users to verify system measurement performance. Each Verification Kit consists of five 2-port mismatch waveguide sections and two precision fixed attenuators.

Each mismatch waveguide section is highly accurate, stable and provides a precisely quantifiable VSWR that is directly calculable from its physical dimensions. The mismatches, nominally quarter wavelength long, are manufactured to the same exacting standard as our Metrology Gold Calibration Kit Components.

The fixed attenuator designs are based on those of our extremely stable directional couplers, offering a very flat attenuation response over the full waveguide frequency band.

All components are fitted with modified flanges featuring precision dowels to ensure enhanced alignment and repeatability.

Each kit contains the following components:-

Mismatch, 2 Port	1.00 : 1
Mismatch, 2 Port	1.10 : 1
Mismatch, 2 Port	1.25 : 1
Mismatch, 2 Port	1.50 : 1
Mismatch, 2 Port	2.00 : 1
Precision Fixed Attenuator	20 dB
Precision Fixed Attenuator	40 dB

Kits are supplied in a fitted hardwood case complete with the necessary connection hardware and tools.

Model 22710

Model	Frequency Range (GHz)	Waveguide			Waveguide Aperture Tolerance of Mismatches Gold (microns)	Waveguide Aperture Tolerance of Mismatches Silver (microns)
		WG	R	WR		
06710 / 711	1.14 - 1.73	6	14	650	35	65
08710 / 711	1.72 - 2.61	8	22	430	25	45
10710 / 711	2.60 - 3.95	10	32	284	15	40
11A710 / 711	3.30 - 4.90	11A	40	229	15	30
12710 / 711	3.94 - 5.99	12	48	187	10	30
13710 / 711	4.64 - 7.05	13	58	159	10	20
14710 / 711	5.38 - 8.18	14	70	137	7	20
15710 / 711	6.58 - 10.0	15	84	112	7	15
16710 / 711	8.20 - 12.5	16	100	90	5	15
17710 / 711	9.84 - 15.0	17	120	75	5	10
18710 / 711	11.9 - 18.0	18	140	62	5	10
19710 / 711	14.5 - 22.0	19	180	51	5	10
20710 / 711	17.6 - 26.7	20	220	42	5	10
22710 / 711	26.4 - 40.1	22	320	28	5	10
23710 / 711	33.0 - 50.1	23	400	22	5	10
24710 / 711	39.3 - 59.7	24	500	19	5	10
25710 / 711	49.9 - 75.8	25	620	15	5	10
26710 / 711	60.5 - 92.0	26	740	12	5	10
27710 / 711	73.8 - 112.0	27	900	10	5	10
MODELS AVAILABLE UP TO 500 GHz Details on request						

ORDERING INFORMATION
Model: Description
Example: Model 16710 Waveguide Verification Kit

Series 710 / 711

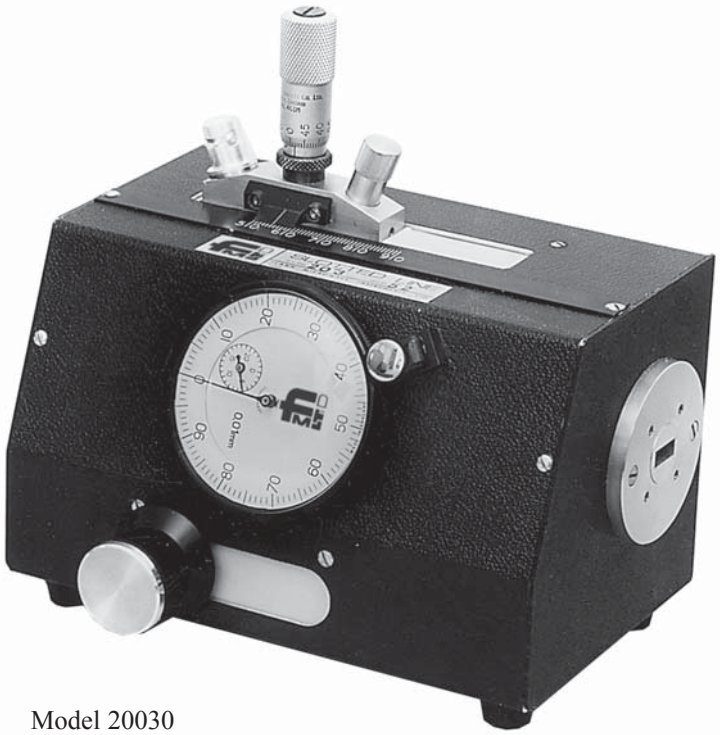
Waveguide Slotted Lines
Series 030

Features

- **Low Residual VSWR**
- **Low Slope VSWR**

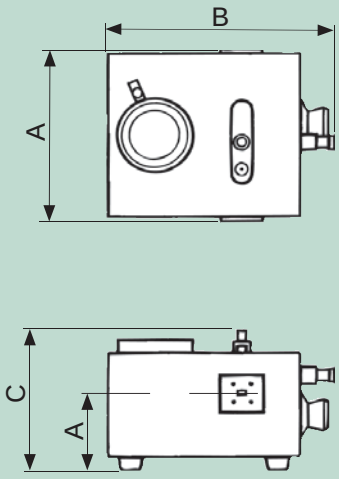
The Flann Series 030 of waveguide Slotted Lines is designed to facilitate the very accurate measurement of VSWR and impedance in waveguide.

The waveguide slotted section is precision machined and the slot matched to minimise slot effects on the waveguide impedance. High reliability is achieved by using selected ball races at all moving points and the use of sound kinematic principles of design. The tunable cavity and crystal detector ensure high sensitivity (not greater than 20 dB down for minimal probe insertion) over the full frequency range of each instrument.
The probe coupling is variable and carriage position is indicated to an accuracy of 0.01 mm relative to the reference flange face. A close fitting case surrounds the entire waveguide and carriage assembly* thereby preventing harmful dust particles from entering the mechanism.
[* except Model 10030 where only the carriage is fully enclosed.]
All models can, optionally, be fitted with precision flanges featuring precisely positioned alignment dowels which provide enhanced flange alignment and repeatability. See page 119 for details.



Model 20030

Model	Frequency Range (GHz)	Waveguide			Maximum residual VSWR	Dimensions (mm)			
		WG	R	WR		A	B	C	D
10030	2.6 - 3.95	10	32	284	1.007	432	225	265	90
11A030	3.3 - 4.9	11A	40	229	1.007	362	143	200	24
12030	3.94 - 5.99	12	48	187	1.007	320	168	200	60
14030	5.38 - 8.18	14	70	137	1.007	267	150	135	43
15030	6.58 - 8.18	15	84	112	1.007	240	140	123	43
16030	8.2 - 12.5	16	100	90	1.007	206	147	152	60
17030	9.84 - 15.0	17	120	75	1.007	206	147	152	60
18030	11.9 - 18.0	18	140	62	1.007	206	147	152	60
20030	17.6 - 26.7	20	220	42	1.01	152	138	121	50
22030	26.4 - 40.1	22	320	28	1.01	130	175	108	58
23030	33.0 - 50.1	23	400	22	1.02	130	175	108	58
24030	39.3 - 59.7	24	500	19	1.02	88	75	102	40
25030	49.9 - 75.8	25	620	15	1.03	75	75	102	40
26030	60.5 - 92.0	26	740	12	1.03	75	75	102	40
27030	73.8 - 112	27	900	10	1.04	91	91	102	40



ORDERING INFORMATION
Model: Description
Example: Model 22030 Slotted line

Series 030

For standard flange types and recommendations see pages 111 onwards

Precision, Variable Waveguide Short Circuits
Series 050 / 051

NOW UP TO 330 GHz

Features

- **Non-Contacting Choked Piston**
- **Precision Micrometer Lockable Drive**

The Flann Series 050 of Waveguide Short Circuits features a length of waveguide which houses a non-contacting choked, low-high-low impedance piston.

Millimetre wave units utilise a precision machined waveguide section. Careful choke design ensures freedom from spurious resonances. The piston is driven by a precision calibrated mechanism which enables accurate and resettable piston positioning.

The drive mechanism is fitted with a lock.
All units provide a high VSWR and an accurate reference to the flange face.

The piston movement for each model is greater than half of the waveguide wavelength at the lowest frequency. Variable short circuits can be used to establish an accurate reference plane for VSWR and impedance measurements.

Model 22050

The Flann Series 051 of Waveguide Short Circuits offers the user an automated version.
Please contact Sales for further information.

Model	Frequency Range (GHz)	Waveguide			Reflection coefficient	Dimension A (mm)
		WG	R	WR		
10050	2.6 - 3.95	10	32	284	>0.995	493
11A050	3.3 - 4.9	11A	40	229	>0.995	456
12050	3.94 - 5.99	12	48	187	>0.995	410
13050	4.64 - 7.05	13	58	159	>0.995	364
14050	5.38 - 8.18	14	70	137	>0.995	318
15050	6.58 - 8.18	15	84	112	>0.995	278
16050	8.20 - 12.5	16	100	90	>0.995	263
17050	9.84 - 15.0	17	120	75	>0.995	253
18050	11.9 - 18.0	18	140	62	>0.995	260
19050	14.5 - 22.0	19	180	51	>0.995	204
20050	17.6 - 26.7	20	220	42	>0.990	205
22050	26.4 - 40.1	22	320	28	>0.990	150
23050	33.0 - 50.1	23	400	22	>0.985	140
24050	39.3 - 59.7	24	500	19	>0.985	140
25050	49.9 - 75.8	25	620	15	>0.985	127
26050	60.5 - 92.0	26	740	12	>0.980	127
27050	73.8 - 112	27	900	10	>0.980	126
28050	92.3 - 140	28	1200	8	>0.980	126
29050	114 - 173	29	1400	6	Specification / dimesnsion available on request	
30050	145 - 220	30	1800	5		
31050	172 - 261	31	2200	4		
32050	220 - 330	32	2600	3		

ORDERING INFORMATION
Model: Description
Example: Model 22050 Precision variable waveguide short circuit

Series 050

For standard flange types and recommendations see pages 111 onwards

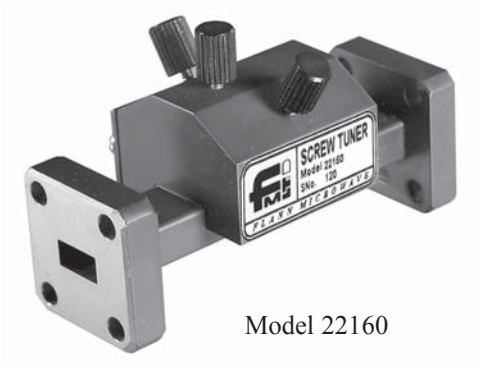
Waveguide Screw Tuners
Series 160 / 161

Features

- **Models from 1.72 GHz to 40 GHz**
- **Anti-backlash Adjustment**
- **Full Range Tuning**

In the Flann Series 160 and Series 161 designs, the screw stubs have sufficient penetration to ensure that, even at the lowest frequency, they can become resonant.

Anti-backlash arrangements are fitted to the screw threads to avoid erratic behaviour and minimise RF leakage.



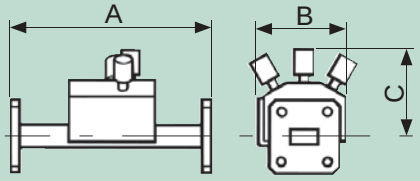
Model 22160


Model 20161

See Series 210 for higher frequency models up to 330 GHz.
Series 161 dimensions available on request

Model	Frequency Range (GHz)	Waveguide			Dimensions (mm)		
		WG	R	WR	A	B	C
08160	1.72 - 2.61	8	22	430	134	113	78
10160	2.60 - 3.95	10	32	284	95	76	59
11A160	3.3 - 4.9	11A	40	229	86	62	55
12160	3.94 - 5.99	12	48	187	75	51	54
14160	5.38 - 8.18	14	70	137	ON REQUEST		
15160	6.58 - 10.0	15	84	112	58	32	35
16160	8.20 - 12.5	16	100	90	48	28	43
17160	9.84 - 15.0	17	120	75	45	25	35
18160	11.9 - 18.0	18	140	62	34	22	34
19160	14.5 - 22.0	19	180	51	35	22	34
20160	17.6 - 26.7	20	220	42	44	19	30
22160	26.4 - 40.1	22	320	28	54	23	15

ORDERING INFORMATION
Model: Description
Example: Model 22160 Waveguide Screw Tuner



Series 160

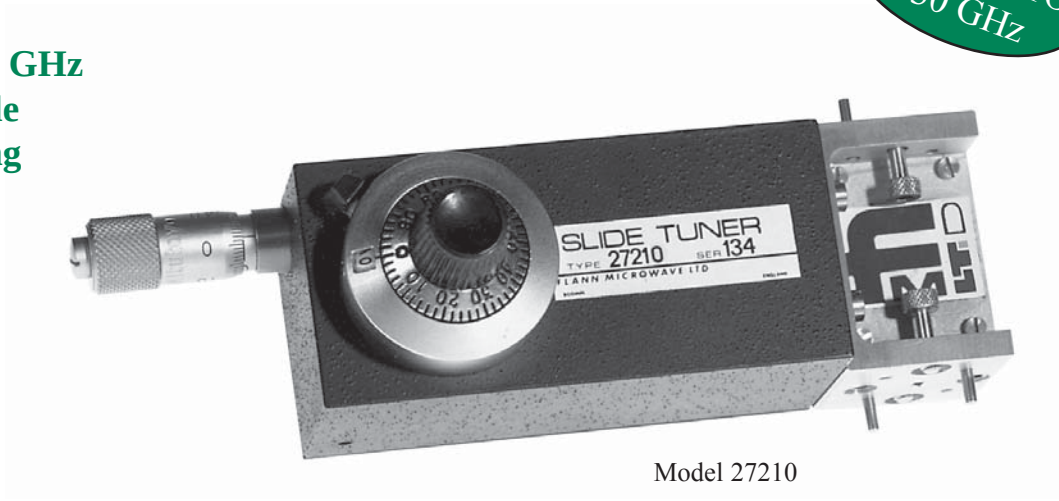
For standard flange types and recommendations see pages 111 onwards

Waveguide Slide Tuners
Series 210

NOW UP TO 330 GHz

Features

- **Models up to 330 GHz**
- **Highly Repeatable**
- **Full Range Tuning**
- **Lockable**



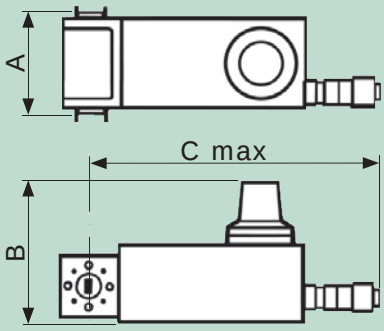
Model 27210

The Flann Series 210 Slide Tuners consist of a precision waveguide machined in two halves, with a slot along the centre of one broad wall. A variable penetration capacitive probe is introduced through the slotted wall of the waveguide.

Longitudinal movement of the probe is adjusted by a vernier control which may be locked after positioning. Slide tuners are often easier to adjust than other types of tuners in which the tuning controls are interactive. The units are of a mechanically sound design and adequate precautions are taken to avoid erratic tuning and slot resonance.

Model	Frequency Range (GHz)	Waveguide			Dimensions (mm)		
		WG	R	WR	A	B	C
23210	33.0 - 50.1	23	400	22	31.5	49	113
24210	39.3 - 59.7	24	500	19	31.5	49	112
25210	49.9 - 75.8	25	620	15	31.5	49	108
26210	60.5 - 92.0	26	740	12	31.5	49	108
27210	73.8 - 112	27	900	10	31.5	49	108
28210	92.3 - 140	28	1200	8	31.5	49	108
29210	114 - 173	29	1400	6	Dimensions available on request		
30210	145 - 220	30	1800	5			
31210	172 - 261	31	2200	4			
32210	220 - 330	32	2600	3			

ORDERING INFORMATION
Model: Description
Example: Model 23210 Slide Tuner



Series 210

For standard flange types and recommendations see pages 111 onwards

Waveguide and Flange Data

The following table details the Flann standard flanges. Most products are available with other flange styles and special Flanges

Frequency Range (GHz)	Waveguide Designation			Internal Dimensions (mm)	Flann 'Standard' flange details Please see page 113 - 118 for outline dimensions	
	British WG	IEC R	EIA WR		Flange Designation	Description
1.14 - 1.73	6	14	650	165.100 x 82.550	UG-417B/U Type (but without groove)	Rectangular, Ten hole fixing + 2 dowel holes
1.72 - 2.61	8	22	430	109.220 x 54.610	UG-435B/U Type (but without groove)	Rectangular, Ten hole fixing + 2 dowel holes
2.60 - 3.95	10	32	284	72.140 x 34.040	5985-99-083-1560 also drilled for the 5985-99-083-0010	Circular, Six/Eight hole fixing
3.30 - 4.90	11A	40	229	58.170 x 29.083	UDR 40	Rectangular, Ten hole fixing
3.94 - 5.99	12	48	187	47.550 x 22.149	UAR 48	Circular, Eight hole fixing
4.64 - 7.05	13	58	159	40.390 x 20.193	UAR 58	Circular, Six hole fixing
5.38 - 8.18	14	70	137	34.850 x 15.799	UAR 70	Circular, Six hole fixing
6.58 - 10.0	15	84	112	28.449 x 12.624	UBR 84	Square, Four hole fixing
8.20 - 12.5	16	100	90	22.860 x 10.160	UBR 100	Square, Four hole fixing
9.84 - 15.0	17	120	75	19.050 x 9.525	UBR 120	Square, Four hole fixing
11.9 - 18.0	18	140	62	15.799 x 7.899	UBR 140	Square, Four hole fixing
14.5 - 22.0	19	180	51	12.954 x 6.477	UBR 180	Square, Four hole fixing
17.6 - 26.7	20	220	42	10.668 x 4.318	UBR 220 Type	Square, Four hole fixing
21.7 - 33.0	21	260	34	8.636 x 4.318	UBR 260 Type	Square, Four hole fixing
26.4 - 40.1	22	320	28	7.112 x 3.556	UG-599/U	Square, Four hole fixing
33.0 - 50.1	23	400	22	5.690 x 2.845	*UG-383/U	Circular, Four hole fixing/doweled
39.3 - 59.7	24	500	19	4.775 x 2.388	*UG-383/U (Modified)	Circular, Four hole fixing/doweled
49.9 - 75.8	25	620	15	3.759 x 1.880	*UG-385/U	Circular, Four hole fixing/doweled
60.5 - 92.0	26	740	12	3.099 x 1.549	*UG-387/U	Circular, Four hole fixing/doweled
73.8 - 112	27	900	10	2.540 x 1.270	*UG-387/U (Modified)	Circular, Four hole fixing/doweled
92.3 - 140.0	28	1200	8	2.032 x 1.016	*UG-387/U (Modified)	Circular, Four hole fixing/doweled
114.0 - 173.0	29	1400	6	1.651 x 0.826	*UG-387/U (Modified)	Circular, Four hole fixing/doweled
145.0 - 220.0	30	1800	5	1.295 x 0.648	*UG-387/U (Modified)	Circular, Four hole fixing/doweled
172.0 - 261.0	31	2200	4	1.092 x 0.546	*UG-387/U (Modified)	Circular, Four hole fixing/doweled
217.0 - 330.0	32	2600	3	0.864 x 0.432	*UG-387/U (Modified)	Circular, Four hole fixing/doweled

Note: Products fitted with flange types marked thus * are supplied with two fixing screws per flange and provided with alignment dowels in accordance with MIL-DTL-3922/67C.

Standard product finishes

Plate: Tin nickel for the larger, low frequency products; gold plate for smaller and millimetric products.
Paint: Two part epoxy paint in mid brunswick green.

Waveguide Flanges, General Information

See pages 113 to 118 for "Standard" Flange Details and outline dimensions

- **Most waveguide flange types are available from WG6 (WR650) to WG32 (WR3)**
- **Special waveguide flanges can be supplied to order**

Flann is able to provide 'free fit' waveguide flanges for WG6 (WR650) to WG32 (WR3) for customers' own manufacturing assemblies.

.

Flange fixing hardware (nuts, bolts, gaskets, shims, etc) is also available. We are also able to supply special flanges to customers' requirements.

Standard Flanges

All waveguide products in this catalogue are fitted with Flann "Standard Flanges" as listed on page 111, except where stated.
Note: Choke flanges are not recommended for broadband waveguide equipment.
Details of the "Standard Flanges" as fitted to Flann products are shown on Pages 113 to 118.

Double Ridge Flange Definitions: C = Cover Flange, G = Grooved : 1 = Tap and Clear, 2 = All Tapped, 3 = All Clear : A = Aluminium, B = Brass. All instruments will be fitted with C1 flanges as standard.

Flanges and flange hardware - quotations for standard and special flanges are available on request. Flange fixing bolts, nuts, dowels and O ring seals are also available - details on request.

Anti-Cocking Flanges for Millimetric Waveguide Bands

- **Greatly improved performance and repeatability**
- **Fully compatible with standard "Mil spec" flanges**

The Millimetric flanges in the Series UG-381/U to UG-387/U are notorious for "cocking" during connection which results in leakage, increased insertion loss, discontinuity and poor repeatability. Flann produces a range of millimetric "Anti-cocking" flanges which provide greatly improved performance and repeatability whilst maintaining full compatibility with standard Mil spec flanges. "Anti-cocking" flanges are optionally available on most millimetric products in the Flann product range. Refer to page 122 for details. Customers requiring millimetric products fitted with anti-cocking flanges must request such flanges at the time of the initial enquiry. Purchase orders must specify anti-cocking flanges, if required, as such flanges can not be retro-fitted to products.

NOTE: Anti-cocking flanges must be specified at time of order.

Precision Flanges

Precision flanges are fitted as standard to all Flann calibration kit components and individual Metrology Grade Components.
Flann precision flanges are fully compatible with "standard" flange types. Precision flanges in the millimetric waveguide sizes also incorporate the "anti-cocking" feature. See from page 119 for details.

Waveguide Materials

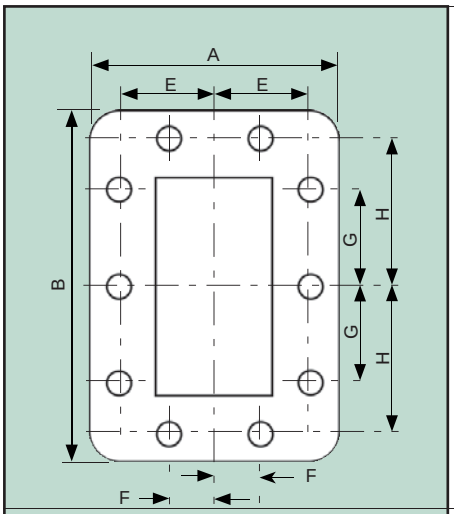
Flann is able to supply most products either in brass / copper waveguide or in aluminium. Metrology grade products have the waveguide sections machined to a high accuracy from solid material. The remaining products utilise premium drawn waveguide supplied to MIL specification or equivalent.

“Standard” Flange Data

The following flange details show the “standard” flange types as fitted to Flann products, unless otherwise stated. Full dimensional details of all “standard” flange types are available on request.

Alternative and custom flanges can be fitted to special order.

Flann is also able to supply most types of Flanges as separate items. Please contact our sales office for price and availability information.



Flann Standard Flanges

WG6 R14 WR650

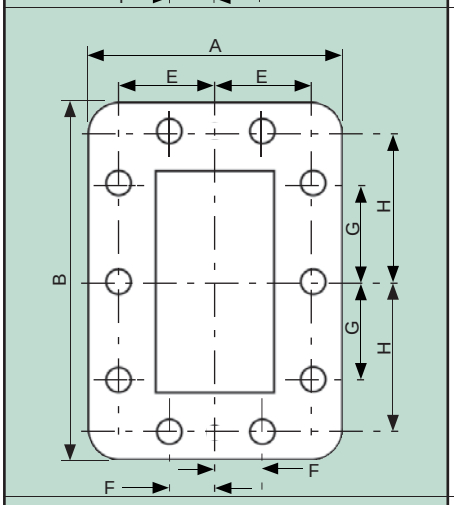
UG417B/U TYPE (without groove)

A	138.90
B	221.50
E	58.69
F	31.73
G	60.30
H	100.00
Holes	10 x 8.20 dia
Dowel Holes	6.35dia

Non-Standard Flanges

Full details on request

UDR 14
CPR 650F

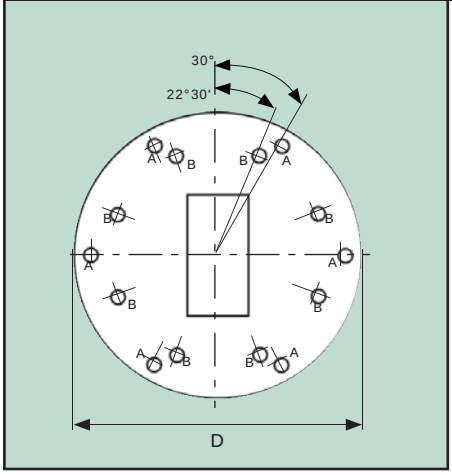


WG8 R22 WR430

UG435B/U TYPE (without groove)

A	106.38
B	161.14
E	43.69
F	23.83
G	45.39
H	70.99
Holes	10 x 6.71 dia
Dowel Holes	6.35dia

UDR 22
CPR 430F



WG10 R32 WR284

5985 - 99 - 083 --1560/0010

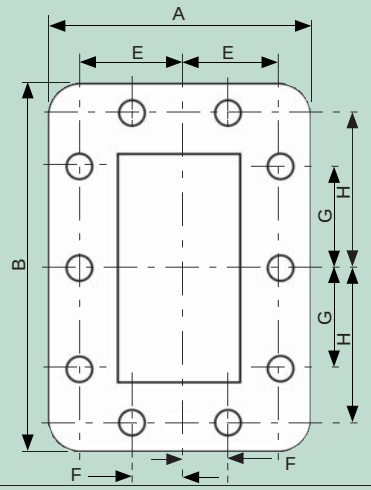
Holes A	6 x 6.52 dia on 136.52 PCD
Holes B	8 x 6.52 dia on 120.65 PCD
D	149.20 dia

UDR 32
CPR 284F
5985-99-083-0058 Type
UAR 32
UG-53/U

NOTE: ALL DIMENSIONS ARE IN MILLIMETERS

See pages 119 - 121 for details of Flann precision style flanges.

“Standard” Flange Data



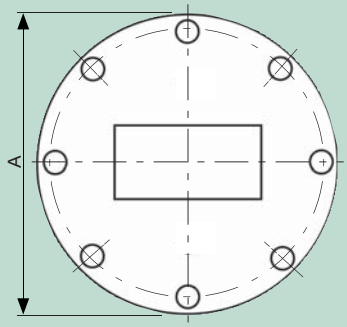
Flann Standard Flanges

WG11A R40 WR229
UDR 40

A 70.20
B 98.73
E..... 26.67
F..... 12.70
G 27.18
H 41.15
Holes..... 10 x 6.50 dia

Non-Standard Flanges
Full details on request

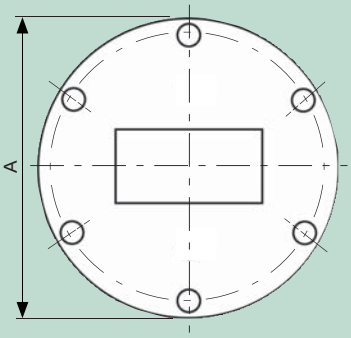
UER 40
CPR 229F
CMR 229



WG12 R48 WR187
UAR 48

Holes..... 8 x 5.15 dia on 82.55 PCD
A ..... 92.33 dia

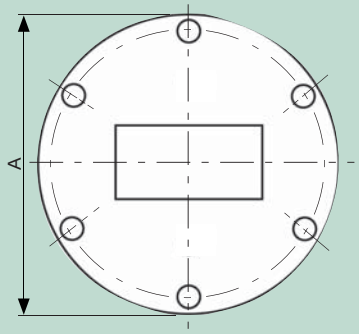
UDR 48
UER 48
CPR 187F
CMR 187



WG13 R58 WR159
UAR 58

Holes..... 6 x 5.15 dia on 76.20 PCD
A ..... 85.915 dia

UDR 58
UER 58
CPR 159F
CMR 159



WG14 R70 WR137
UAR 70

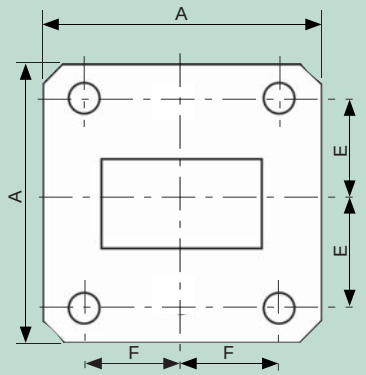
Holes..... 6 x 5.15 dia on 69.85 PCD
A ..... 79.50 dia

UDR 70
UER 70
CPR 137F
CMR 137

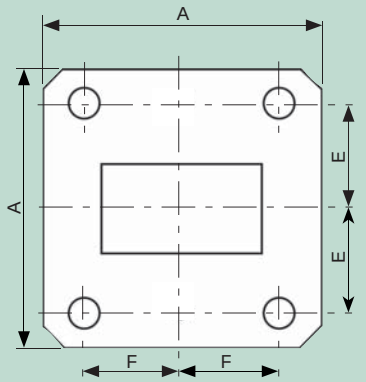
NOTE: ALL DIMENSIONS ARE IN MILLIMETERS

See pages 119 - 121 for details of Flann precision style flanges.

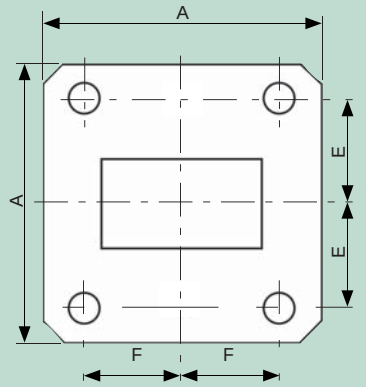
“Standard” Flange Data



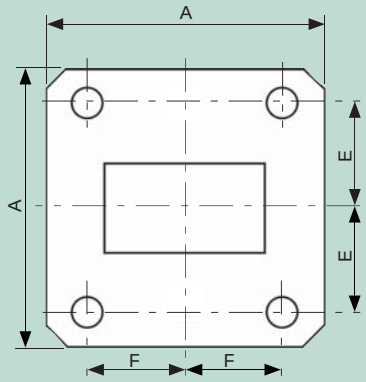
Flann Standard Flanges	Non-Standard Flanges Full details on request
WG15 R84 WR112 UBR 84 A ..... 47.90 E..... 18.72 F..... 17.17 Holes..... 4 x 4.255 dia	UDR 84 UER 84 CPR 112F CMR 112



WG16 R100 WR90 UBR 100 A ..... 41.40 E..... 16.26 F..... 15.49 Holes..... 4 x 4.255 dia	UDR 100 UER 100 CPR 90F CMR 90



WG17 R120 WR75 UBR 120 A ..... 38.30 E..... 14.25 F..... 13.21 Holes..... 4 x 4.085 dia	UDR 120

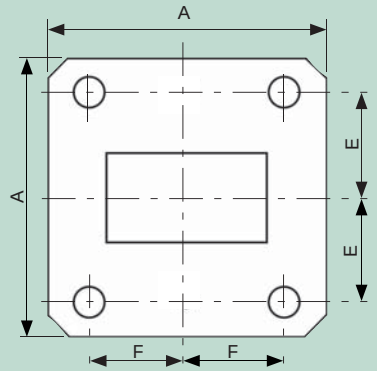


WG18 R140 WR62 UBR 140 A ..... 33.30 E..... 12.14 F..... 12.63 Holes..... 4 x 4.085 dia	UDR 140 UG-419/U

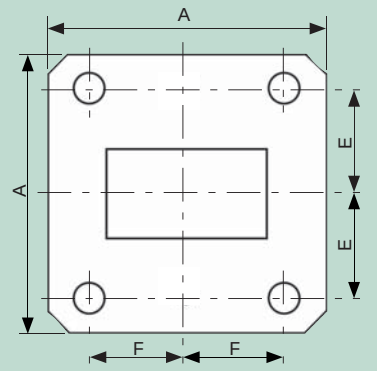
NOTE: ALL DIMENSIONS ARE IN MILLIMETERS

See pages 119 - 121 for details of Flann precision style flanges.

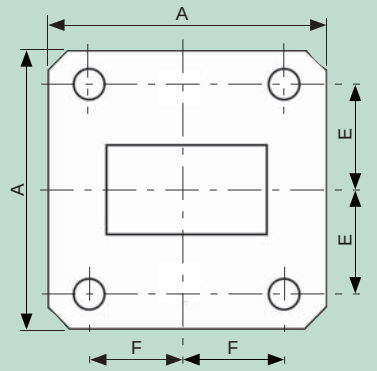
“Standard” Flange Data



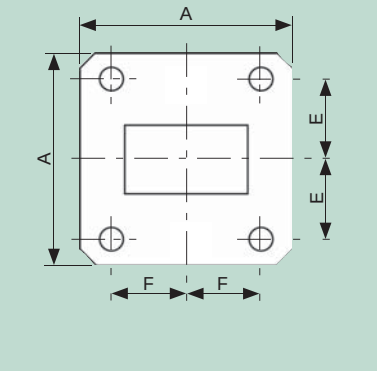
Flann Standard Flanges	Non-Standard Flanges Full details on request
WG19 R180 WR51 UBR 180 A ..... 30.10 E..... 11.25 F..... 10.29 Holes..... 4 x 4.085 dia	UDR 180



WG20 R220 WR42 UBR 220 TYPE A ..... 22.41 E..... 8.51 F..... 8.13 Holes..... 4 x 3.07 dia	UG-595/U UG-425/U



WG21 R260 WR34 UBR 260 TYPE A ..... 22.10 E..... 7.90 F..... 7.50 Holes..... 4 x 3.07 dia	Custom flanges can be considered



WG22 R320 WR28 UG-599/U A ..... 19.05 E..... 6.73 F..... 6.35 Holes..... 4 x 2.98 dia	UBR 320

NOTE: ALL DIMENSIONS ARE IN MILLIMETERS

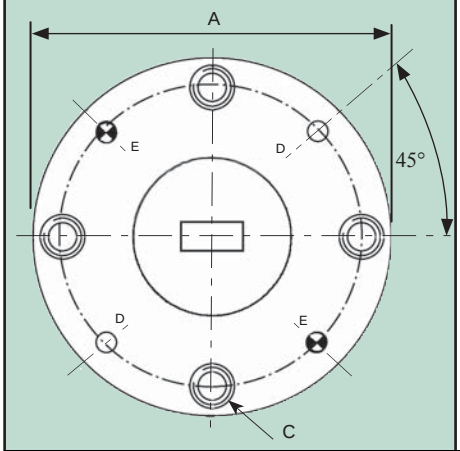
See pages 119 - 121 for details of Flann precision style flanges.

“Standard” Flange Data

Note: Products fitted with Circular, Four hole fixing/Doweled flanges WG23 (WR22) to WG28 (WR8) are supplied with two captive fixing screws per flange.

“Anti-cocking” Flanges - We strongly recommend that customers specify “anti-cocking” flanges on instruments in the waveguide range WG23 (WR22) to WG28 (WR8). “Anti-cocking” flanges provide better performance and repeatability than standard flanges whilst maintaining full compatibility with MIL spec types. Please refer to page 122 for details and outline dimensions.

Flann Standard Flanges

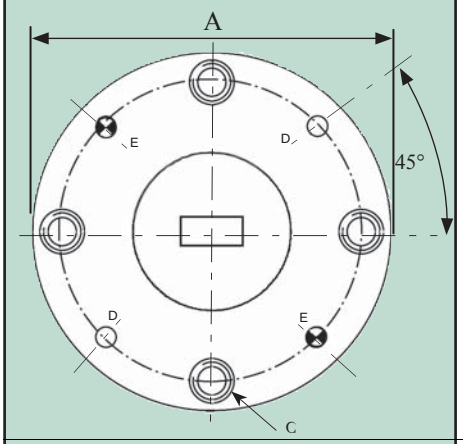


WG23 R400 WR22

UG-383/U (MIL-DTL-3922/67C-006)

Holes C .....4 x 4-40 UNC-2B
Holes D.....2 x 1.65 dia
Holes E .....2 x dowels 1.549/ 1.562 dia x 4 projection
All Holes on 23.81 PCD
A 28.55

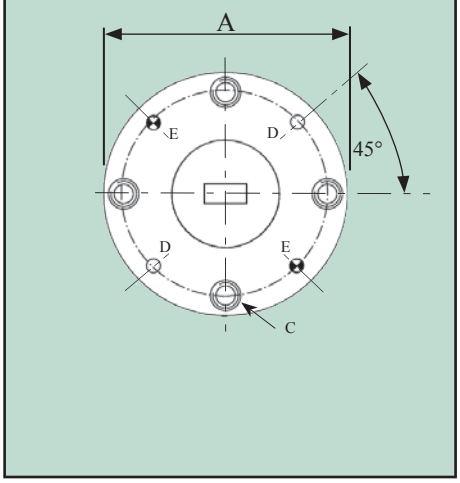
Non-Standard Flanges
Full details on request



WG24 R500 WR19

UG-383/U Modified (MIL-DTL-3922/67C-007)

Holes C .....4 x 4-40 UNC-2B
Holes D.....2 x 1.65 dia
Holes E .....2 x dowels 1.549/ 1.562 dia x 4 projection
All Holes on 23.81 PCD
A 28.55



WG25 R620 WR15

UG-385/U modified (MIL-DTL-3922/67C-08)

Holes C .....4 x 4-40 UNC-2B
Holes D.....2 x 1.65 dia
Holes E .....2 x dowels 1.549/ 1.562 dia x 4 projection
All Holes on 14.29 PCD
A 19.05

NOTE: ALL DIMENSIONS ARE IN MILLIMETERS

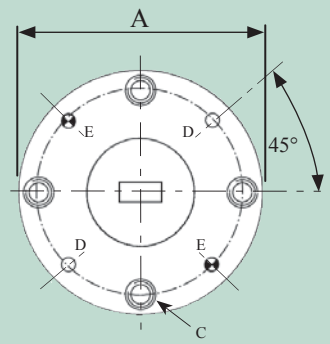
See pages 119 - 121 for details of Flann precision style flanges.

“Standard” Flange Data

Note: Products fitted with Circular, Four hole fixing/Doweled flanges WG23 (WR22) to WG28 (WR8) are supplied with two captive fixing screws per flange.

“Anti-cocking” Flanges - We strongly recommend that customers specify “anti-cocking” flanges on instruments in the waveguide range WG23 (WR22) to WG28 (WR8). “Anti-cocking” flanges provide better performance and repeatability than standard flanges whilst maintaining full compatibility with MIL spec types. Please refer to page 122 for details and outline dimensions.

Flann Standard Flanges



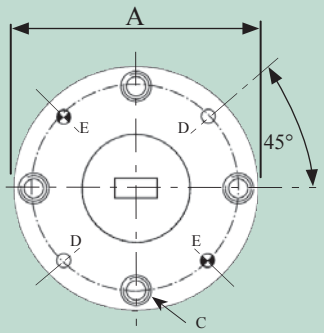
WG26 R740 WR12

UG-387/U (MIL-DTL-3922/67C-009)

Holes C .....4 x 4-40 UNC-2B
Holes D.....2 x 1.65 dia
Holes E .....2 x dowels 1.549/ 1.562 dia x 4 projection
All Holes on 14.29 PCD
A 19.05

Non-Standard Flanges
Full details on request

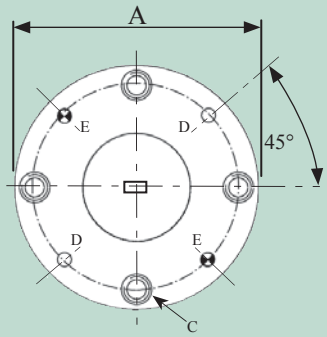
MIL-F3922/74-001



WG27 R900 WR10

UG-387/U Modified (MIL-DTL-3922/67C-010)

Holes C.....4 x 4-40 UNC-2B
Holes D.....2 x 1.65 dia
Holes E .....2 x dowels 1.549/ 1.562 dia x projection
All Holes on 14.29 PCD
A 19.05



WG28 R1200 WR8

UG-387/U Modified

Holes C.....4 x 4-40 UNC-2B
Holes D.....2 x 1.65 dia
Holes E .....2 x dowels 1.549/ 1.562 dia x 4 projection
All Holes on 14.29 PCD
A 19.05

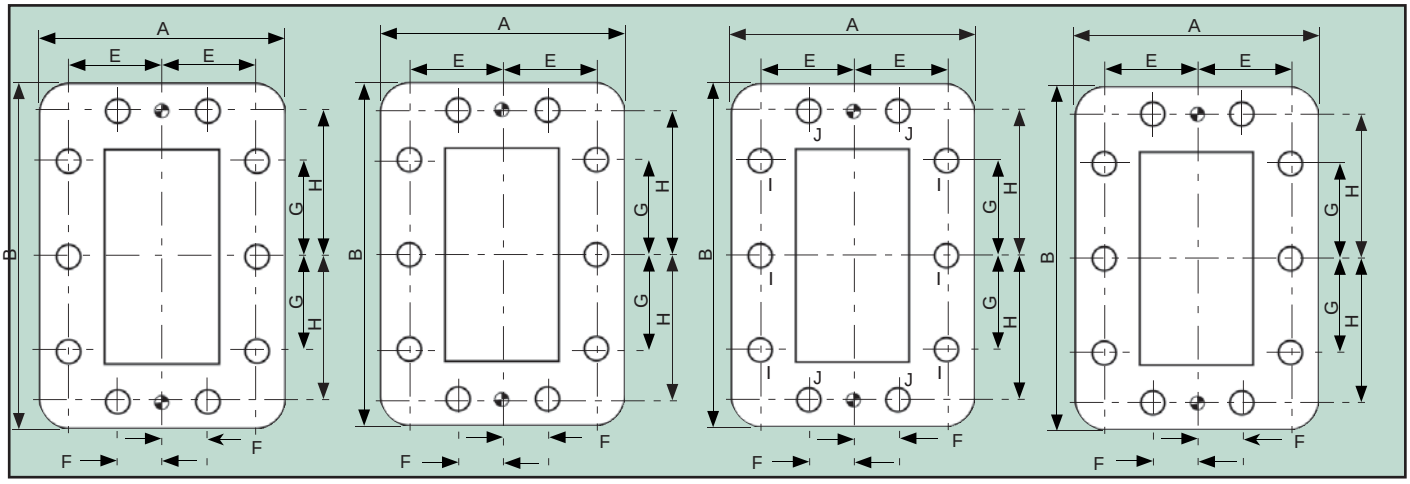
MIL-F3922/74-001

NOTE: ALL DIMENSIONS ARE IN MILLIMETERS

See pages 119 - 121 for details of Flann Precision Style Flanges.

Precision Style Flange Details

The following flange details show the precision style flange types as fitted to Flann calibration grade products, unless otherwise stated.
Full dimensional details of all precision style flange types are available on request.
Alternative flanges may be supplied to special order.



WG6 R14 WR650
UG417B/U TYPE (Without Groove)-PF

A	138.90
B	221.50
E	58.69
F	31.73
G	60.30
H	100.00
Holes	10 x 8.20 dia
Dowel Holes	2 x 6.375 dia

WG8 R22 WR430
UG435B/U TYPE (Without Groove)-PF

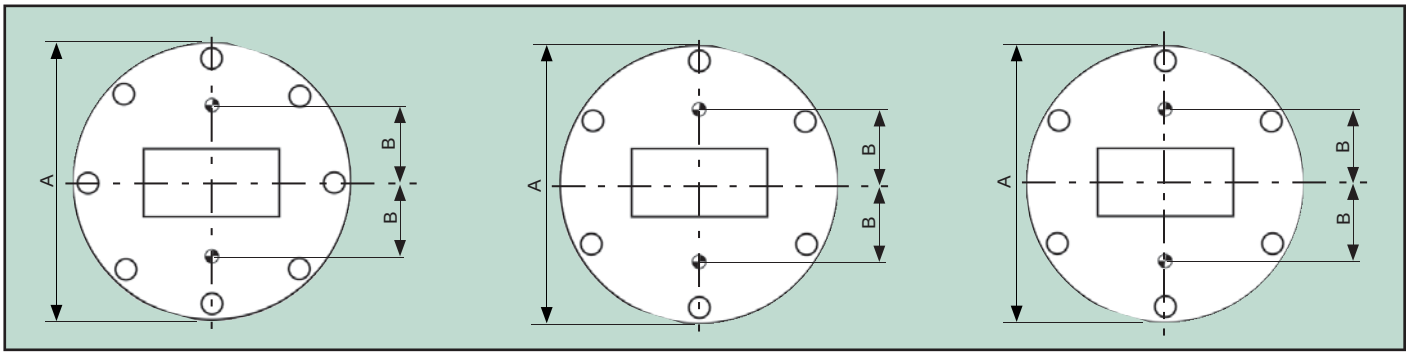
A	106.38
B	161.14
E	43.69
F	23.83
G	45.39
H	71.0
Holes	10 x 6.71 dia
Dowel Holes	2 x 6.375 dia

WG10 R32 WR284
UDR 32

A	76.20
B	114.3
E	29.57
F	14.68
G	32.54
H	48.61
Holes I	6 x 7 dia
Holes J	4 x 6.6 dia
Dowel Holes	2 x 6.375 dia

WG11A R40 WR229
UDR 40 -PF

A	70.20
B	98.73
E	26.67
F	12.70
G	27.18
H	41.15
Holes	10 x 6.50 dia
Dowel Holes	2 x 6.375 dia



WG12 R48 WR187
UAR 48 -PF

Holes	8 x 5.15 dia on 82.55 PCD
A	92.33 dia
Dowel Holes	2 x 6.375 dia
B	29.188

WG13 R58 WR159
UAR 58 -PF

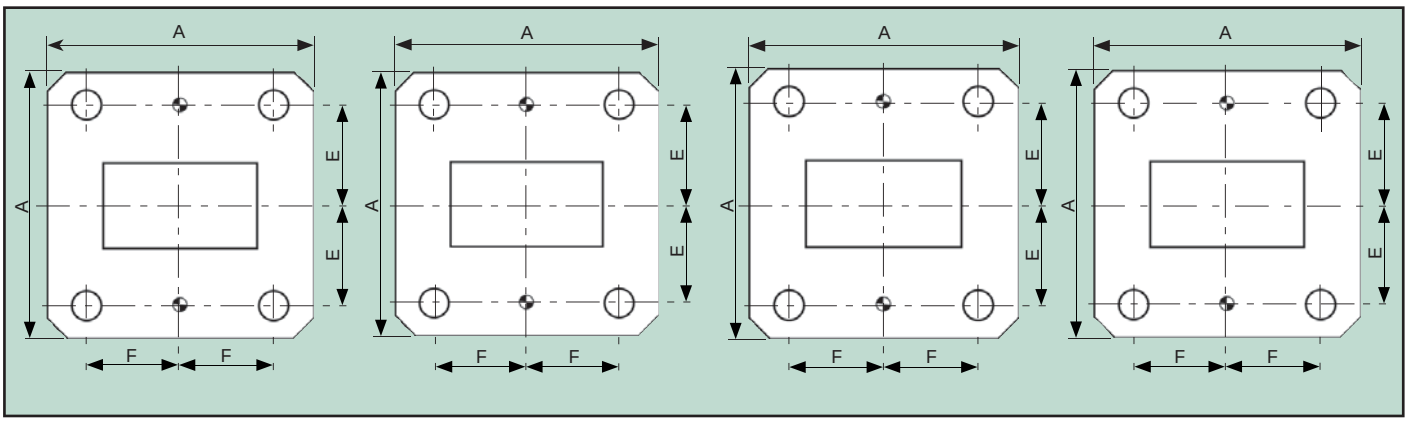
Holes	6 x 5.15 dia on 76.20 PCD
A	85.915 dia
Dowel Holes	2 x 6.375 dia
B	26.94

WG14 R70 WR137
UAR 70 -PF

Holes	6 x 5.15 dia on 69.85 PCD
A	79.50 dia
Dowel Holes	2 x 6.375 dia
B	24.695

NOTE: ALL DIMENSIONS ARE IN MILLIMETERS

Precision Style Flange Details



WG15 R84 WR112
UBR 84 -PF

A..... 47.90
E..... 18.72
F..... 17.17
Holes..... 4 x 4.255 dia
Dowel Holes..... 2 x 2.38 dia

WG16 R100 WR90
UBR 100 -PF

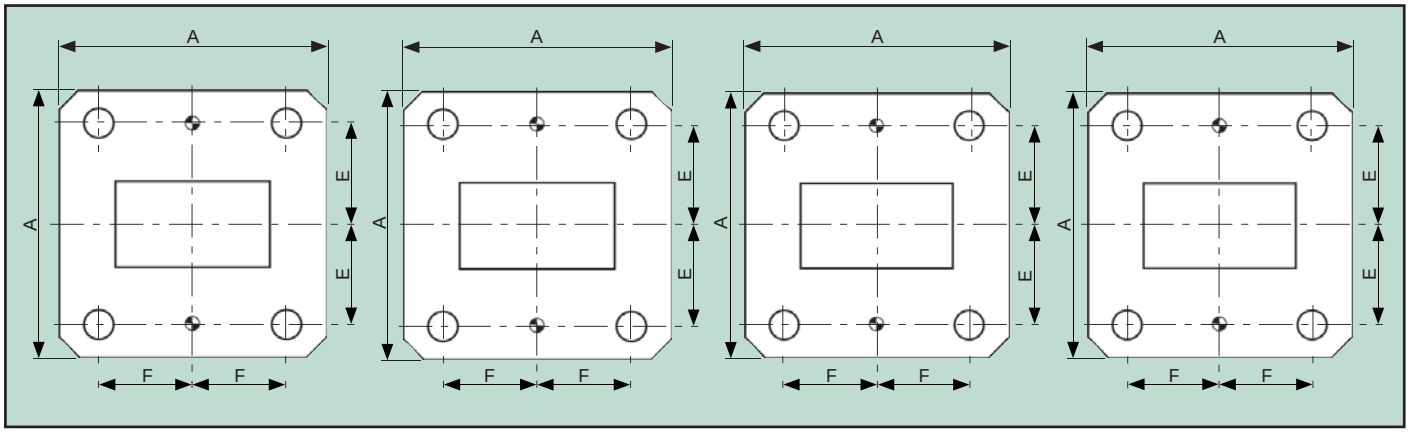
A..... 41.40
E..... 16.26
F..... 15.49
Holes..... 4 x 4.255 dia
Dowel Holes..... 2 x 2.38 dia

WG17 R120 WR75
UBR 120 -PF

A..... 38.30
E..... 14.25
F..... 13.21
Holes..... 4 x 4.085 dia
Dowel Holes..... 2 x 2.38 dia

WG18 R140 WR62
UBR 140 -PF

A..... 33.30
E..... 12.14
F..... 12.63
Holes..... 4 x 4.085 dia
Dowel Holes..... 2 x 2.38 dia



WG19 R180 WR51
UBR 180 -PF

A..... 30.10
E..... 11.25
F..... 10.29
Holes..... 4 x 4.085 dia
Dowel Holes..... 2 x 2.38 dia

WG20 R220 WR42
UBR 220 TYPE -PF

A..... 22.40
E..... 8.51
F..... 8.13
Holes..... 4 x 3.07 dia
Dowel Holes..... 2 x 2.38 dia

WG21 R260 WR34
UBR 260 TYPE -PF

A..... 22.10
E..... 7.90
F..... 7.50
Holes..... 4 x 3.07 dia
Dowel Holes..... 2 x 2.38 dia

WG22 R320 WR28
UG-599/U -PF

A..... 19.05
E..... 6.73
F..... 6.34
Holes..... 4 x 2.98 dia
Dowel Holes..... 2 x 2.38 dia

NOTE: ALL DIMENSIONS ARE IN MILLIMETERS

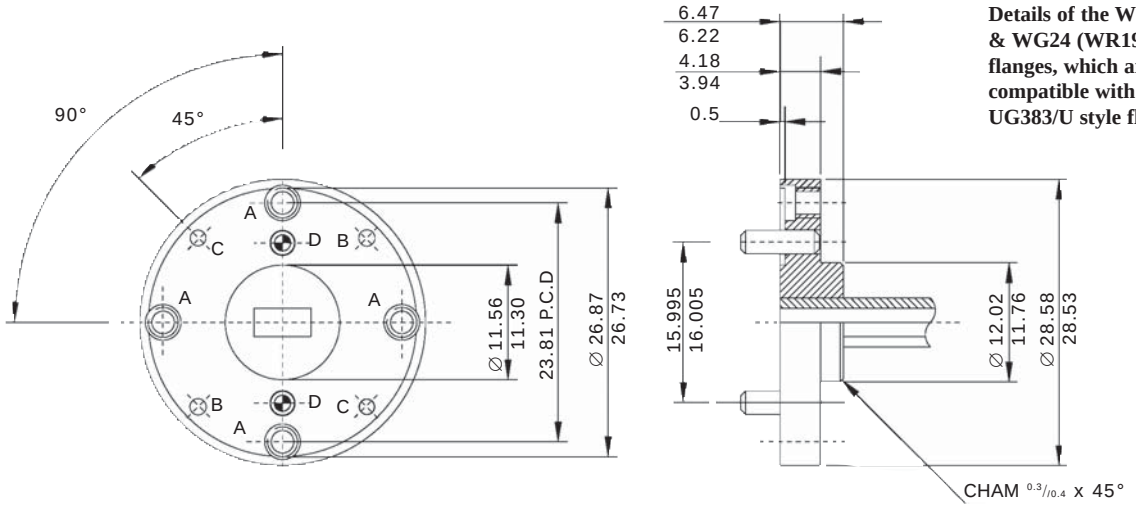
Precision Style Flange Details

WG 23 (WR 22) to WG 28 (WR 8) inclusive

- **Enhanced accuracy & performance**
- **Fully compatible with the standard "MIL spec" flanges**

Flann Precision millimetric flanges are fitted as standard to the Company's range of Network Analyser Calibration Kits and Metrology grade components. Our precision millimetric flanges incorporate an "anti-cocking" feature which minimizes the risk of leakage or discontinuity occuring at the interface.

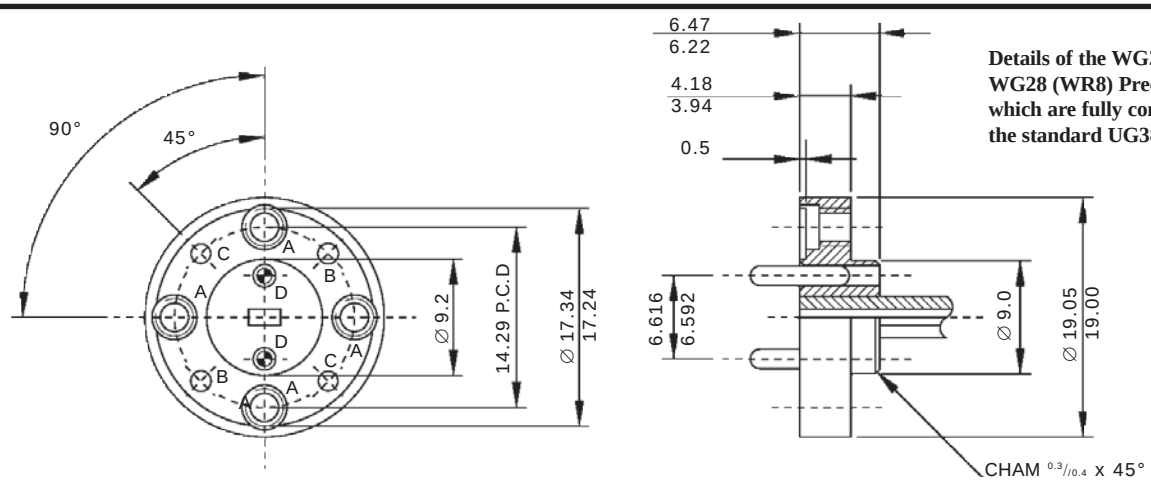
Note: Flann Precision flanges are compatible with standard MIL spec types if the additional precision dowels are not used.



Details of the WG23 (WR22) & WG24 (WR19) Precision flanges, which are fully compatible with the standard UG383/U style flange.

A Holes 4 off - 4.40 UNC-2B. C'bore 3.56 dia x 1.6 deep from flange face
B Holes 2 off - 1.65/1.66 dia. C'sink 2.3 dia @ 90˚ on front face
C Holes 2 off - Alignment pins 1.562/1.549 dia
D Holes 2 off - Drill and bore 2.25 dia through C'sink 2.8 dia @ 90˚ and ream 2.395/2.379 dia

Note: Dowels 'C' & Dowel holes 'B' & 'D' are precisely positioned with respect to the waveguide aperture after the flange has been fitted to the waveguide.



Details of the WG25 (WR15) & WG28 (WR8) Precision flanges, which are fully compatible with the standard UG385/U style flange.

A Holes 4 off - 4.40 UNC-2B. C'bore 3.56 dia x 1.6 dia deep from flange face
B Holes 2 off - 1.65/1.66 dia. C'sink 2.3 dia @ 90˚ on front face
C Holes 2 off - Alignment pins 1.562/1.549 dia
D Holes 2 off - Drill and bore 1.5 dia through C'sink 2.3 dia @ 90˚ and ream 1.588/1.600 dia

Note: Dowels 'C' & Dowel holes 'B' & 'D' are precisely positioned with respect to the waveguide aperture after the flange has been fitted to the waveguide.

Note: Instruments fitted with precision flanges are supplied with two fixing screws per flange.

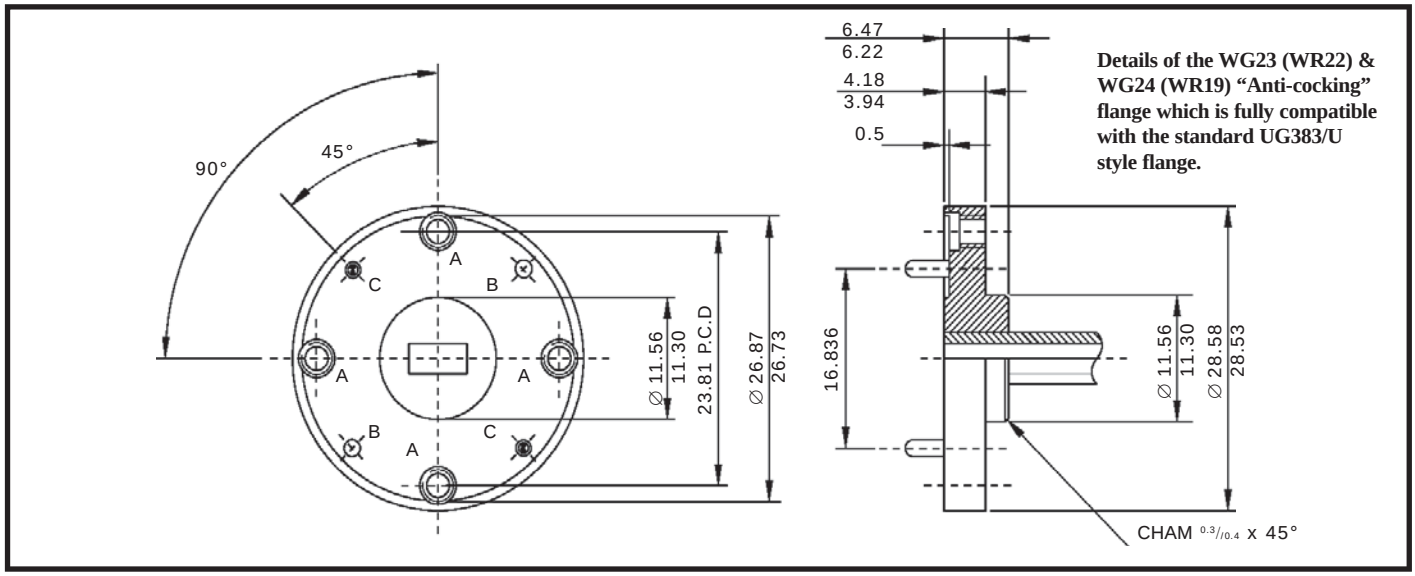
NOTE: ALL DIMENSIONS ARE IN MILLIMETERS

Anti-Cocking Flanges

- **Greatly improved performance & repeatability**
- **Fully compatible with standard "MIL spec" flanges**

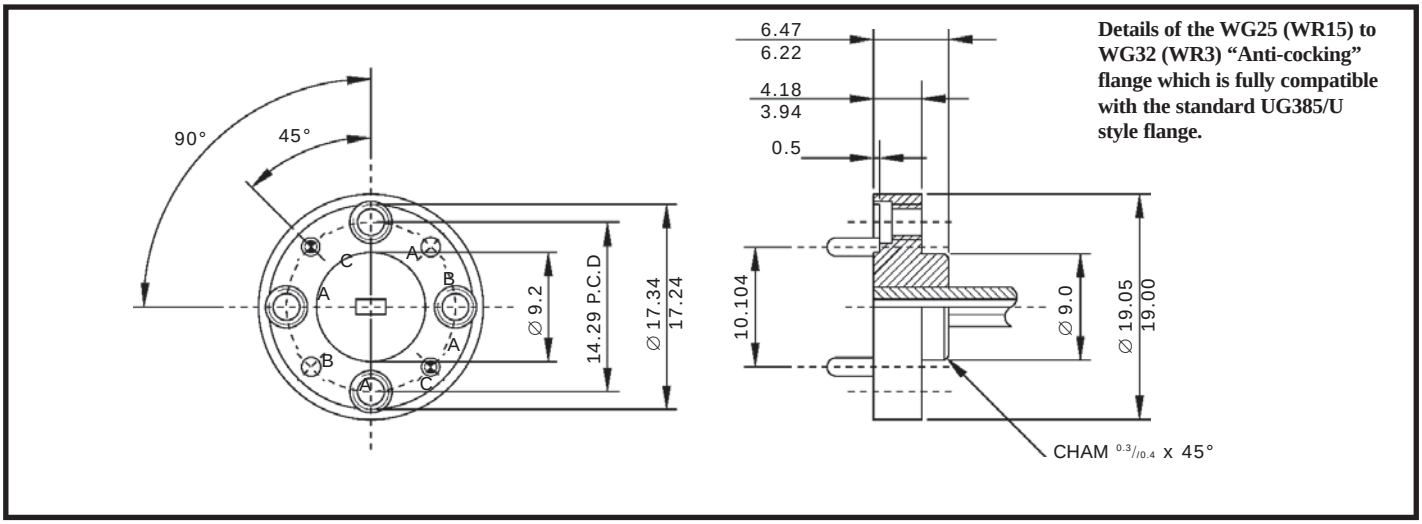
The standard MIL spec style of flanges, normally used in the frequency bands from 26.0 to 220 GHz, are designs with the serious disadvantage that "cocking" can easily take place unless extreme care is taken when tightening the clamping screws. "Cocked" flanges introduce high leakage levels and unnecessary discontinuities. In common with many other major manufacturers Flann offers "anti-cocking" flanges, which prevent cocking when connected to similar "anti-cocking" flanges; these flanges are fully compatible with standard MIL spec designs.

"Anti-cocking" flanges must be specified at time of order.
The Flann "anti-cocking" flanges are detailed below.



Details of the WG23 (WR22) & WG24 (WR19) "Anti-cocking" flange which is fully compatible with the standard UG383/U style flange.

A Holes 4 off - 4.40 UNC-2B. C'bore 3.56 dia x 1.6 deep from flange face
B Holes 2 off - 1.65/1.66 dia. C'sink 2.3 dia x 90˚ on front face
C Holes 2 off - Alignment pins 1.562/1.549 dia
Note: Dowels 'C' & Dowel holes 'B' are precisely positioned with respect to the waveguide aperture after the flange has been fitted to the waveguide.



Details of the WG25 (WR15) to WG32 (WR3) "Anti-cocking" flange which is fully compatible with the standard UG385/U style flange.

A Holes 4 off - Drill 4.40 UNC-2B. C'bore 3.56 dia x 1.6 dia deep from flange face
B Holes 2 off - 1.65/1.66 dia. C'sink 2.3 dia x 90˚ on front face
C Holes 2 off - Alignment pins 1.562/1.549 dia
Note: Dowels 'C' & Dowel holes 'B' are precisely positioned with respect to the waveguide aperture after the flange has been fitted to the waveguide.

Note: Instruments fitted with an anti-cocking flange are supplied with two fixing screws per flange.

NOTE: ALL DIMENSIONS ARE IN MILLIMETERS

VSWR & Return Loss Data

VSWR	STANDING WAVE RATIO (dB)	RETURN LOSS (dB)	TRANSMISSION LOSS (dB)	REFLECTION COEFFICIENT	TRANSMITTED POWER %	REFLECTED POWER %
1.00	0	µ	0	0	100.0	0
1.01	0.1	46.1	0	0	100.0	0
1.02	0.2	40.1	0	0.01	100.0	0
1.03	0.3	36.6	0.001	0.01	100.0	0
1.04	0.3	34.2	0.002	0.02	100.0	0
1.05	0.4	32.3	0.003	0.02	99.9	0.1
1.06	0.5	30.7	0.004	0.03	99.9	0.1
1.07	0.6	29.4	0.005	0.03	99.9	0.1
1.08	0.7	28.3	0.006	0.04	99.9	0.1
1.09	0.7	27.3	0.008	0.04	99.8	0.2
1.10	0.8	26.4	0.010	0.05	99.8	0.2
1.11	0.9	25.7	0.012	0.05	99.7	0.3
1.12	1.0	24.9	0.014	0.06	99.7	0.3
1.13	1.1	24.3	0.016	0.06	99.6	0.4
1.14	1.1	23.7	0.019	0.07	99.6	0.4
1.15	1.2	23.1	0.021	0.07	99.5	0.5
1.16	1.3	22.6	0.024	0.07	99.5	0.5
1.17	1.4	22.1	0.027	0.08	99.4	0.6
1.18	1.4	21.7	0.030	0.08	99.3	0.7
1.19	1.5	21.2	0.033	0.09	99.2	0.8
1.20	1.6	20.8	0.036	0.09	99.2	0.8
1.21	1.7	20.4	0.039	0.10	99.1	0.9
1.22	1.7	20.1	0.043	0.10	99.0	1.0
1.23	1.8	19.7	0.046	0.10	98.9	1.1
1.24	1.9	19.4	0.050	0.11	98.9	1.1
1.25	1.9	19.1	0.054	0.11	98.8	1.2
1.26	2.0	18.8	0.058	0.12	98.7	1.3
1.27	2.1	18.5	0.062	0.12	98.6	1.4
1.28	2.1	18.2	0.066	0.12	98.5	1.5
1.29	2.2	17.9	0.070	0.13	98.4	1.6
1.30	2.3	17.7	0.075	0.13	98.3	1.7
1.32	2.4	17.2	0.083	0.14	98.1	1.9
1.34	2.5	16.8	0.093	0.15	97.9	2.1
1.36	2.7	16.3	0.102	0.15	97.7	2.3
1.38	2.8	15.9	0.112	0.16	97.5	2.5
1.40	2.9	15.6	0.122	0.17	97.2	2.8
1.42	3.0	15.2	0.133	0.17	97.0	3.0
1.44	3.2	14.9	0.144	0.18	96.7	3.3
1.46	3.3	14.6	0.155	0.19	96.5	3.5
1.48	3.4	14.3	0.166	0.19	96.3	3.7
1.50	3.5	14.0	0.177	0.20	96.0	4.0
1.52	3.6	13.7	0.189	0.21	95.7	4.3
1.54	3.8	13.4	0.201	0.21	95.5	4.5
1.56	3.9	13.2	0.213	0.22	95.2	4.8
1.58	4.0	13.0	0.225	0.22	94.9	5.1
1.60	4.1	12.7	0.238	0.23	94.7	5.3
1.62	4.2	12.5	0.250	0.24	94.4	5.6

VSWR & Return Loss Data

VSWR	STANDING WAVE RATIO (dB)	RETURN LOSS (dB)	TRANSMISSION LOSS (dB)	REFLECTION COEFFICIENT	TRANSMITTED POWER %	REFLECTED POWER %
1.64	4.3	12.3	0.263	0.24	94.1	5.9
1.66	4.4	12.1	0.276	0.25	93.8	6.2
1.68	4.5	11.9	0.289	0.25	93.6	6.4
1.70	4.6	11.7	0.302	0.26	93.3	6.7
1.72	4.7	11.5	0.315	0.26	93.0	7.0
1.74	4.8	11.4	0.329	0.27	92.7	7.3
1.76	4.9	11.2	0.342	0.28	92.4	7.6
1.78	5.0	11.0	0.356	0.28	92.1	7.9
1.80	5.1	10.9	0.370	0.29	91.8	8.2
1.82	5.2	10.7	0.384	0.29	91.5	8.5
1.84	5.3	10.6	0.398	0.30	91.3	8.7
1.86	5.4	10.4	0.412	0.30	91.0	9.0
1.88	5.5	10.3	0.426	0.31	90.7	9.3
1.90	5.6	10.2	0.440	0.31	90.4	9.6
1.92	5.7	10.0	0.454	0.32	90.1	9.9
1.94	5.8	9.9	0.468	0.32	89.8	10.2
1.96	5.8	9.8	0.483	0.32	89.5	10.5
1.98	5.9	9.7	0.497	0.33	89.2	10.8
2.00	6.0	9.5	0.512	0.33	88.9	11.1
2.50	8.0	7.4	0.881	0.43	81.6	18.4
3.00	9.5	6.0	1.249	0.50	75.0	25.0
3.50	10.9	5.1	1.603	0.56	69.1	30.9
4.00	12.0	4.4	1.938	0.60	64.0	36.0
4.50	13.1	3.9	2.255	0.64	59.5	40.5
5.00	14.0	3.5	2.553	0.67	55.6	44.4
5.50	14.8	3.2	2.834	0.69	52.1	47.9
6.00	15.6	2.9	3.100	0.71	49.0	51.0
6.50	16.3	2.7	3.351	0.73	46.2	53.8
7.00	16.9	2.5	3.590	0.75	43.7	56.2
7.50	17.5	2.3	3.817	0.76	41.5	58.5
8.00	18.1	2.2	4.033	0.78	39.5	60.5
8.50	18.6	2.1	4.240	0.79	37.7	62.3
9.00	19.1	1.9	4.437	0.80	36.0	64.0
9.50	19.6	1.8	4.626	0.81	34.5	65.5
10.00	20.0	1.7	4.807	0.82	33.1	66.9
11.00	20.8	1.6	5.149	0.83	30.6	69.4
12.00	21.6	1.5	5.466	0.85	28.4	71.6
13.00	22.3	1.3	5.762	0.86	26.5	73.5
14.00	22.9	1.2	6.040	0.87	24.9	75.1
15.00	23.5	1.2	6.301	0.88	23.4	76.6
16.00	24.1	1.1	6.547	0.88	22.1	77.9
17.00	24.6	1.0	6.780	0.89	21.0	79.0
18.00	25.1	1.0	7.002	0.89	19.9	80.1
19.00	25.6	0.9	7.212	0.90	19.0	81.0
20.00	26.0	0.9	7.413	0.90	18.1	81.9
25.00	28.0	0.7	8.299	0.92	14.8	85.2
30.00	29.5	0.6	9.035	0.94	12.5	87.5

Waveguide Parameters

Rigid Rectangular Waveguide Data

Frequency Range (GHz) For TE_{10} Mode	Cut-off Freq (GHz) For TE_{10} Mode	Band Designation			WG Designation				Internal Dimensions		Theoretical Peak Power Rating (MW)	Theoretical Attenuation dB/30m /A, /B, /S*
		UK	USA	New	53-IEC R	RCSC WG	EIA WR	US (JAN)	Inches	mm approx		
0.32-0.49	0.256			B	3	00	2300		23.0 x 11.5	584.0 x 292.0	153.0-212.0	0.051-0.031/A
0.35-0.53	0.281			B, C	4	0	2100		21.0 x 10.5	533.0 x 267.0	120.0-173.0	0.054-0.034/A
0.41-0.62	0.328			B, C	5	1	1800	RG-201/U	18.0 x 9.0	457.0 x 229.0	93.4-131.9	0.056-0.038/A
0.49-0.75	0.393			C	6	2	1500	RG-202/U	15.0 x 7.5	381.0 x 191.0	67.6-93.3	0.069-0.050/A
0.64-0.98	0.513	P		C	8	3	1150	RG-203/U	11.5 x 5.75	292.0 x 146.0	35.0-53.8	0.128-0.075/A
0.76-1.15	0.605			C, D	9	4	975	RG-204/U	9.75 x 4.875	248.0 x 124.0	27.0-38.5	0.137-0.095/A
0.96-1.46	0.766			D	12	5	770	RG-205/U	7.7 x 3.85	196.0 x 98.0	17.2-24.1	0.201-0.136/A
1.14-1.73	0.908	L	L	D	14	6	650	RG-69/U	6.5 x 3.25	165.1 x 82.55	11.9-17.2	0.317-0.212/B 0.269-0.178/A
1.45-2.20	1.157			D. E	18	7	510		5.1 x 2.55	129.54 x 64.77	7.5-10.7	
1.72-2.61	1.372		LS, R	E	22	8	430	RG-104/U	4.3 x 2.15	109.22 x 54.61	5.2-7.5	0.588-0.385/B 0.501-0.330/A
2.17-3.30	1.736			E, F	26	9A	340	RG-112/U	3.4 x 1.7	86.36 x 43.18	3.1-4.5	0.877-0.572/B 0.751-0.492/A
2.60-3.95	2.078	S	S	E, F	32	10	284	RG-48/U	2.84 x 1.34	72.14 x 34.04	2.2-3.2	1.102-0.752/B 0.940-0.641/A
3.22-4.90	2.577			F, G	40	11A	229		2.29 x 1.145	58.17 x 29.083	1.6-2.2	
3.94-5.99	3.152	C	C	F, G	48	12	187	RG-49/U	1.872 x 0.872	47.55 x 22.149	1.4-2.0	2.08-1.44/B 1.77-1.12/A
4.64-7.05	3.711			G, H	58	13	159		1.590 x 0.795	40.39 x 20.193	0.79-1.0	
5.38-8.18	4.301			H	70	14	137	RG-50/U	1.372 x 0.622	34.85 x 15.799	0.56-0.71	2.87-2.30/B 2.45-1.94/A
6.58-10.0	5.259			I	84	15	112	RG-51/U	1.122 x 0.497	28.499 x 12.624	0.35-0.46	4.12-3.21/B 3.50-2.74/A
8.20-12.50	6.557	X	X	I, J	100	16	90	RG-52/U	0.9 x 0.4	22.86 x 10.16	0.20-0.29	6.45-4.48/B
9.84-15.00	7.868			J	120	17	75		0.75 x 0.375	19.05 x 9.525	0.17-0.23	5.49-3.83/A
11.90-18.00	9.486	J	Ku	J	140	18	62	RG-91/U	0.622 x 0.311	15.799 x 7.899	0.12-0.16	9.51-8.31/B-/A 6.14-5.36/S
14.50-22.00	11.574			J, K	180	19	51		0.510 x 0.255	13.0 x 6.48	0.080-0.107	
17.60-26.70	14.047			J, K	220	20	42	RG-53/U	0.420 x 0.170	10.668 x 4.318	0.043-0.058	20.7-14.8/B 17.6-12.6/A
21.70-33.00	17.328			K	260	21	34		0.340 x 0.170	8.636 x 4.318	0.034-0.048	13.3-9.5/S
26.40-40.10	21.081	Q	Ka	K	320	22	28	RG-96/U	0.280 x 0.140	7.112 x 3.556	0.022-0.031	-/B -/A 21.9-15.0/S
33.00-50.10	26.342			K, L	400	23	22	RG-97/U	0.224 x 0.112	5.69 x 2.845	0.014-0.020	-/B 31.0-20.9/S
39.30-59.70	31.357			L	500	24	19		0.188 x 0.094	4.775 x 2.388	0.011-0.015	
49.90-75.80	39.863		V	L, M	620	25	15	RG-98/U	0.148 x 0.074	3.759 x 1.880	0.0063-0.0090	-/B 52.9-39.1/S
60.50-92.00	48.350	O	E	M	740	26	12	RG-99/U	0.122 x 0.061	3.099 x 1.549	0.0042-0.0060	-/B 93.3-52.2/S
73.80-112.0	59.010		W	M	900	27	10		0.100 x 0.050	2.54 x 1.27	0.0030-0.0041	
92.30-140.00	73.840			M	1200	28	8	RG-138/U	0.080 x 0.040	2.032 x 1.016	0.0018-0.0026	152-99/S
114.0-173.00	90.840				1400	29	6	RG-136/U	0.065 x 0.0325	1.651 x 0.826	0.0012-0.0017	163-137/S
145.00-220.00	115.750		T		1800	30	5	RG-135/U	0.051 x 0.0255	1.295 x 0.648	0.00071-0.00107	308-193/S
172.00-261.00	131.520				2200	31	4	RG-137/U	0.043 x 0.0215	1.1 x 0.55	0.00052-0.00075	384-254/S
217.00-330.00	173.280				2600	32	3	RG-139/U	0.034 x 0.017	0.87 x 0.44	0.00035-0.00047	512-348/S

*** Suffix /A, /B or /S denotes material alloy of aluminium, brass or silver**

Reference Data

Power Conversion Chart

dBm		(mW)	dBm		(mW)	dBm		(W)	dBm		(W)
-20	=	0.010	0	=	1.00	+20	=	0.100	+40	=	10.0
-19	=	0.012	+1	=	1.25	+21	=	0.120	+41	=	12.6
-18	=	0.016	+2	=	1.58	+22	=	0.159	+42	=	15.8
-17	=	0.020	+3	=	2.00	+23	=	0.200	+43	=	20.0
-16	=	0.025	+4	=	2.51	+24	=	0.251	+44	=	25.1
-15	=	0.032	+5	=	3.16	+25	=	0.316	+45	=	31.6
-14	=	0.040	+6	=	3.50	+26	=	0.398	+46	=	39.8
-13	=	0.050	+7	=	5.01	+27	=	0.501	+47	=	50.1
-12	=	0.063	+8	=	6.30	+28	=	0.631	+48	=	63.1
-11	=	0.079	+9	=	7.94	+29	=	0.794	+49	=	79.4
-10	=	0.100	+10	=	10.00	+30	=	1.000	+50	=	100.0
-9	=	0.130	+11	=	12.60	+31	=	1.260	+51	=	126.0
-8	=	0.160	+12	=	15.80	+32	=	1.590	+52	=	158.0
-7	=	0.200	+13	=	19.90	+33	=	2.000	+53	=	200.0
-6	=	0.250	+14	=	25.10	+34	=	2.550	+54	=	251.0
-5	=	0.316	+15	=	31.60	+35	=	3.160	+55	=	316.0
-4	=	0.398	+16	=	39.80	+36	=	3.910	+56	=	398.0
-3	=	0.501	+17	=	50.10	+37	=	5.010	+57	=	501.0
-2	=	0.630	+18	=	53.10	+38	=	6.310	+58	=	631.0
-1	=	0.794	+19	=	79.40	+39	=	7.940	+59	=	794.0
									+60	=	1 KILOWATT

Conversion Factors and Fundamental Constants

1 inch (in) = 1000 mil	= 25.4 mm
1 mm ~ 0.0394 in	= 39.4 mil
Speed of Light in Vacuum	c 299 792 458 m/s
Permeability of Vacuum	μ_0 $4\pi \times 10^{-7} = 12.5663706144 \times 10^{-7}$ H/m
Permittivity of Vacuum	ε_0 $8.85418782 \times 10^{-12}$ F/m

Metric Units

Exa	E	10^{18}	Deci	d	10^{-1}
Peta	P	10^{15}	Centi	c	10^{-2}
Tera	T	10^{12}	Milli	m	10^{-3}
Giga	G	10^{9}	Micro	µ	10^{-6}
Mega	M	10^{6}	Nano	n	10^{-9}
Kilo	k	10^{3}	Pico	p	10^{-12}
Hecto	h	10^{2}	Femto	f	10^{-15}
Deca	da	10	Atto	a	10^{-18}

Notes

Notes

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