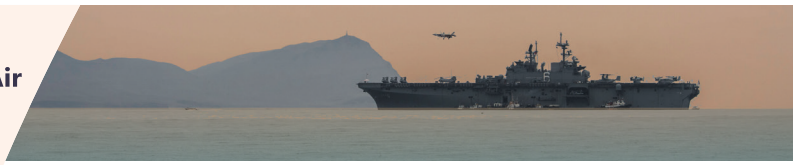
Supporting RF Systems on Land, on the Sea, and in the Air



Dual-Mode Ferrite Phase Shifters

Ka to C-Band
Latching • Reciprocal
Economical • Efficient

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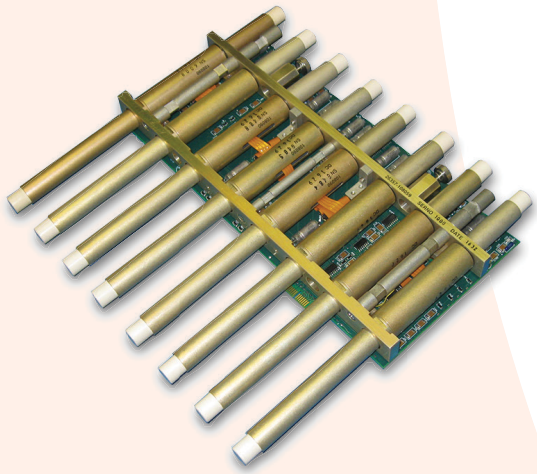


MAG's Dual-Mode phase shifters are the only latching, reciprocal ferrite phase shifters successfully produced in large quantities, and are ideal for passive phased array antenna applications. These units, available in frequencies from C-Band to Ka-Band, allow Electronically Steerable Arrays (ESAs) to be deployed at reasonable cost with good power handling capabilities. One successful application is in the United States Air Force AN/APQ-164 B-1B offensive radar system (ORS). MAG designed and built more than 130,000 units for this program.

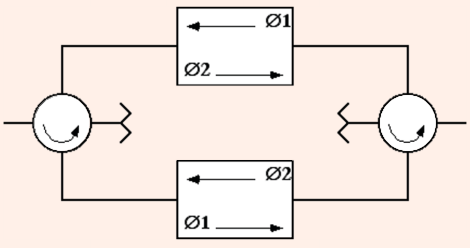
MAG Dual-Mode Phase Shifters are deployed in a variety of systems on land, on the sea, and in the air. Dual-Mode technology is reciprocal and latching; light in weight; and is economical in both cost and size. Its compact cross-section makes it a good choice for multi-element, two-dimensional ESAs.

MAG's Dual-Mode phase shifters use a quadrantally symmetric ferrite rod so that circularly polarized energy will propagate through it without change of field distribution. The name "Dual-Mode" comes from the fact that the structure supports opposite-sense circularly polarized modes in the transmit and receive directions so that phase changes resulting from command state changes will be reciprocal. External latching yokes fitted to the ferrite rod provide a closed magnetic path for latching operation. Resistive films, incorporated in dielectric sections both ends of the rod, absorb undesired cross-polarized fields. See the table on the reverse side for typical data at various frequency ranges.

Dual-Mode Ferrite Phase Shifters

PARAMETER	FREQUENCY BAND				
	C	XL	X	Ku	Ka
Percent Bandwidth	9	6	8	5	4
Insertion Loss (dB)	1.0 avg.	1.0 avg.	1.0 avg.	1.0 avg.	1.25 max.
Insertion Loss Modulation (dB)	±0.2	±0.2	±0.2	±0.2	±0.2
Maximum Return Loss (dB)	-15.0	-17.0	-13.98	-17.69	-15.56
Peak RF Power (Watts)	250 min.	200 min.	1000 min.	28 min.	100 min.
Average RF Power (Watts)	10 min.	10 min.	6 min.	4 min.	4 min.
RMS Phase Error (Degrees)	6	5	6	10	4
Reciprocity (Degrees)	±3	±3	±3	±3	±4
Switching Time (Microseconds)	75	120	160	80	60
Switching Rate (Hz)	2000	526	2000	200	1000
Size (Inches)	4.3 x Ø .82	4.8 x Ø .64	3.8 x Ø .53	2.2 x Ø .35	2.2 x Ø .32
Weight (Ounces)	3.0	2.4	1.4	0.4	0.3
Operating Temperature Range (Degrees C)	-20 to 70	-10 to 65	-20 to 85	-20 to 49	-25 to 55

This diagram depicts a reciprocal device realized using nonreciprocal ferrite components.



Sample of programs supported by MAG as OEM:

APQ-164 B-1B ORS
APQ-181 B-2
APS-143 CP-140 Imaging
APY-1/2 E-3 AWACS
AR320 3D Air Defense
ARTS-V1 / CLPS
ARTS-V2
ASARS-2 Synthetic Aperture
ARSR-4 FAA Long Range
ASTOR
DWSR-2501C Doppler Weather
Global Hawk Synthetic Aperture
I-15/23 Reflectarray
I-30 Simulator
MPN-14K Landing Control
PAAS Test Range
Princeton Plasma Physics Laboratory
RAC 3D Air Defense
Skyshield 35 Air Defense
Smart-L 3D Air Defense
SPN-35C Approach Control
SPQ-9B Surveillance / Tracking
TPAAS Test Range
TRS-3D Multimode
TRS22XX 3D Air Defense
ZPQ-1 Predator TESAR

MAG DMSMS program support:

MPQ-64 Sentinel SHORAD
APY-1/2 E-3 AWACS
BMEWS / PAVE PAWS
HAWK
SPN-35C Approach Control
MSQ-T43 MTE System

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