

# Variable Fiber Optical Splitter/Coupler (1x2, 2x2, SM, PM)

(Protected by U.S. patent 7,403,677B1 and pending patents)

## Product Description

The Variable Fiber Optical Splitter/Coupler splits an incoming optical signal among the two output optical fibers (1x2) with a continuously variable ratio controlled by a voltage from 0 to 5V. This device can be composed with two input/output (2x2). The device does not create extra loss during the transition and is bidirectional. When the electrical control signal is removed, the splitter returns to the original ratio of 100:0. The all-solid-state crystal design meets the most demanding requirements of ultra-high reliability, fast response time, and continuous operation over 25 years. The Variable Fiber Optic Splitter has passed Telcordia and space reliability qualification tests.

The unit comes with driving board having a control signal input SMA connector and a wall plug-in power supply. Several frequency version of drivers are available. As an Electro-optical crystal-based device, the variable splitter output has certain degree of variations due to environmental changes. A driver with power stabilization with feedback in out output is available in special version.



## Performance Specifications

Variable Fiber Optical Splitter	Min	Typical	Max	Unit
Central Wavelength	450		2000	nm
Insertion Loss <sup>[1]</sup>	1260-1650nm	0.6	1	dB
	850-1260nm	0.8	1.3	dB
	760-850nm	1	1.5	dB
	650-850	1.5	1.9	dB
	450-580	2	2.5	dB
Cross Talk at 100% Split Single Stage <sup>[2]</sup>	20	25	35	dB
Cross Talk at 100% Split Dual Stage <sup>[2]</sup>	35	40	50	dB
Splitting Variation	Output 1	100-0		%
	Output 2	0-100		%
	Type	Continuous		
Repetition Rate	DC	20	1000 <sup>[3]</sup>	kHz
Response Time			1000	ns
Polarization Dependent Loss		0.1	0.35	dB
IL Temperature Dependency		0.25	0.5	dB
Polarization Mode Dispersion		0.1	0.2	ps
Return Loss	48	50	60	dB
Operating Temperature	-5		70	°C
Optical Power Handling <sup>[4]</sup>		300		mW
Storage Temperature	-40		85	°C
Package Dimension		65.8x8.5x8.4		mm

[1] Excluding connectors. Wavelength < 850nm can be implemented in the special version.

[2] Cross talk is measured at 5kHz, which may be degraded at the high repeat rate.

[3] Split ratio may be degraded significantly at 1MHz.

[4] Defined at 1310/1550nm. For the shorter wavelength, the handling power may be reduced.

## Features

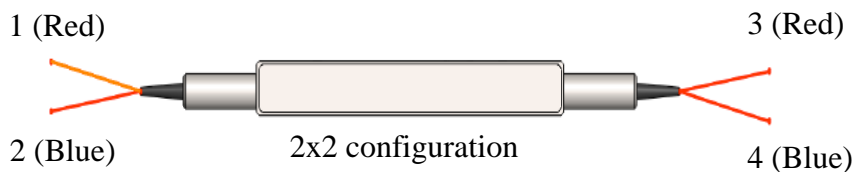
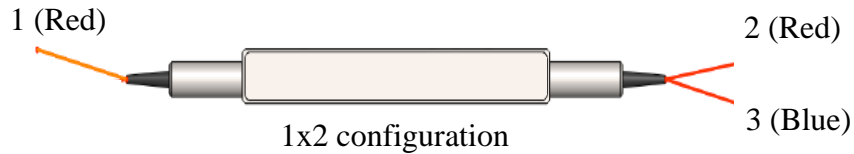
- High Speed
- High Reliability
- Low Insertion Loss
- Compact

## Applications

- Instrumentation
- Power balance
- Sensor

# Variable Fiber Optical Splitter/Coupler (1x2, 2x2, SMF, PMF)

## Port Diagram and Function



For 2x2 configuration, without applying voltage, light from port 1 passes to port 3 and light from port 2 passes to port 4, respectively. When a voltage is applied, the light from port 1 splits between port 3 and 4 and the light from port 2 splits between port 4 and 3, respectively with the same ratio. Portions of lights from port 1 and 2 incoherently add at output port 3 and 4 proportionally.

## Frequently Asked Questions

**Q:** The spec states "repetition". Does it mean that the unit only works for a periodic signal?

**A:** It works for any signal with a bandwidth of less than 100 kHz generally. For NP type of NSVS can reach up to 1MHz with some degradation of split ratio (not 100/0). The optical response follows the input electrical signal shape to some extent with distortion. The repetition rate is a way to indicate how fast the system can respond.

**Q:** What is the difference between NS splitter and NS switch?

**A:** The device is the same; however, NS splitter is driven by an analogy circuit, while NS switch by a digital circuit that is much faster.

## Operation Instruction

1. Plug in the accompanied power supply
2. Plug in a 0-5V control signal to the input SMA connector (golden color). One can use a DC power supply first, and then a function generator. The optical output will change from maximum to minimum or from minimum to maximum depending on which port is measured.
3. Do not adjust settings on the board

# Variable Fiber Optical Splitter/Coupler (1x2, 2x2, SMF, PMF)

## Regular Driving Board Selection

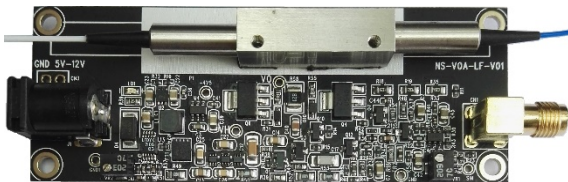
The module comprises a NanoSpeed (NS) switch mount either on a VOA control circuit board or a feedback control board. Below 100kHz repetition rate and feedback control configurations, the module uses standard version of NVOA of single stage or dual stage. For high repeat rate up to 1MHz repetition, the module uses NP type of VOA with special driver.

Driver's repeat Rate	Part Number (P/N)
20kHz	NVDR-113235112
100kHz	NVDR-112221112
1000kHz <sup>[1]</sup>	NVDR-1PH210121
Power regulation driver <sup>[2]</sup>	NRDR-33001111

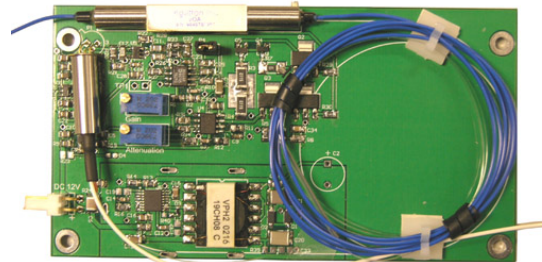
- [1]: This 1MHz driver with NPOA is limited to have the split ratio < 80% at the repeat rate > 500kHz.
- [2]: The power in one output port #2 is regulated at the fixed level while the power in another output may vary as the input power is changing. This fixed level is preset, unchangeable in the OEM version. This device can also be used as laser power stabilizer. The average response for the feedback control loop is micron-seconds.

## Electronics Dimensions (mm)

\*Product dimensions may change without notice. This is sometimes required for non-standard specifications.

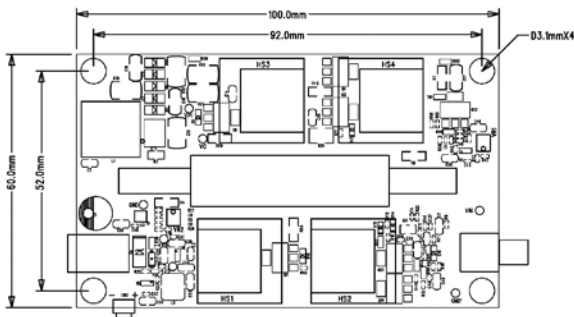


20kHz driver (87mmx32mm)



NRDR (100mmx48mm)

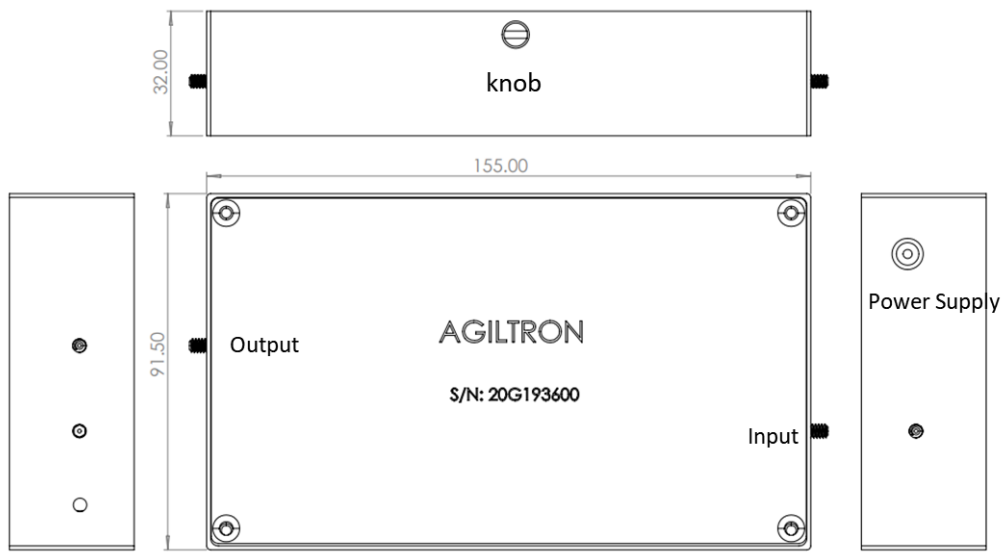
This NRDR is OEM version, doesn't have the capability of adjusting the preset.



100kHz driver (100mmx60mm)

# Variable Fiber Optical Splitter/Coupler (1x2, 2x2, SMF, PMF)

NSVS module with adjustable preset of feedback control (mm)



## Ordering Information

NSVS-	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Type	Wavelength <sup>[1]</sup>	Driver	Cross-Talk	Fiber Type	Fiber Length	Connector	
	1x2=11 2x2=22	2000nm =2 1060nm=1 1310nm=3 1550nm=5 1625nm =6 850nm=8 780=7 650=E 550=F 400=G Special=0	20Khz=2 100kHz = 3 1MHz = 5 Feedback-control <sup>[2]</sup> in module = 6 Special = 0	Single-Stage= 1 Dual-Stage= 2	SMF-28=1 HI1060=2 HI780=3 PM1550=5 PM980=9 Special=0	Bare fiber=1 900um tube=3 Special=0	0.25m=1 0.5m=2 1.0 m=3 Special=0	None=1 FC/PC=2 FC/APC=3 SC/PC=4 SC/APC=5 ST/PC=6 LC/PC=7 Special=0

[1]: Wavelength < 850nm or >1900nm will be implemented in the special version with a long lead-time.

[2]: One tap version stabilizes optical outpower in one output. If the input power is kept a constant, the splitter ratio is also stabilized. If the input power varies, only the power level in one output is stabilized. This device can also be used as laser power stabilizer. The average response for the feedback control loop is micron-second.