Model NF-0100
Signal Converter

Convert your reference signal from sine to square and fiber optic

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1.0 Summary

Frequently a sine wave is not the most desirable format for a reference. In some applications, a very high slew rate is required, and a square wave is needed.

Very often, copper coaxial cable is not the ideal transport means for a reference or other signal. In an electromagnetically active environment, copper coaxial cable can pick-up noise and degrade the reference. Fiber optic cable is basically immune to electromagnetic interference.

The NF-0100 was designed to easily convert a reference signal to a more compatible format:

- sine wave to a square wave
- square wave to a sine wave
- sine wave to a fiber optic signal - 650,1300 nm - single and multi-mode
- fiber optic to a sine or square wave
- pulsed waveform (such as PPS) to fiber optic
- pulsed fiber optic back to electrical pulse

A pair of properly configured NF-0100 can add a simple fiber optic channel to a reference system to solve an electromagnetic interference problem or used for a long-distance reference need.

The simple 1x1x3 inch module requires no rack space and simply installs in series with existing cabling and requires only a single power voltage of 7 to 15 VDC at less than a watt. A simple power adapter is available to operate from global AC power.

Another application for the product is a as a sine to square wave converter. Connecting a square wave to a client over coaxial cable can be problematic. A cable with a 50 MHz bandwidth can easily be used for a 10 MHz sine. However, a cable handling a 10 MHz square wave with a 1ns rise time requires a bandwidth on the order of 300 MHz The NF-0100 can be configured to accept a 10 MHz sine wave and generate a square wave at the client allowing low cost coaxial cable to be used for the sinewave.

In addition to 10 MHz, the NF-0100 series can be used to optically transmit a square wave of any frequency from DC to 10 MHz Ideal for PPS distribution.

The various wavelengths offer cost, capability and performance trade-offs. For an in-house system already cabled with a certain wavelength fiber, the selection becomes easier with the options offered.

Use the NF-0100 to solve a persistent noise problem, to handle a slew rate demand on the reference system or get a low noise reference to a remote location and assure system synchronization.

2.0 Configuration Control

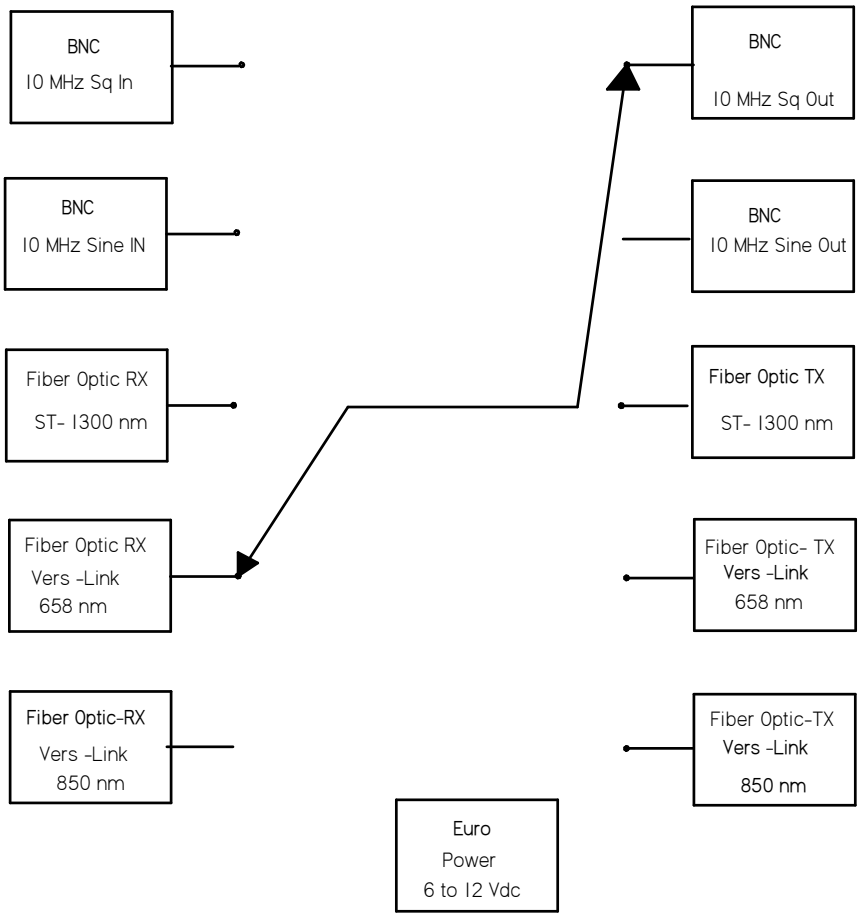
The versatility of the NF-0100 makes it a very desirable solution to many noise and capability problems. Defining the factory configuration for your application is critical and the following part number syntax should help

Signal Type			Connectors
0	sine		sine and square- BNC
1	square		1300 nm fiber- ST
2	Fiber		650 nm Versitile

Novus NF0100 Signal Converter Part Number Guide		
Input	**Output**	**Model Number**
10 MHz sine	10 MHz Square	NF0100-0-1
10 MHz Square	10 MHz Sine	NF0100-1-0
10 MHz sine	Fiber 650 nm	NF0100-0-2
10 MHz sine	Fiber 1300nm Multi	NF0100-0-3
10 MHz sine	Fiber 1300nm single	NF0100-0-4
Fiber 650 nm	10 MHz Sine	NF0100-2-0
Fiber 1300nm Multi	10 MHz Sine	NF0100-3-0
Fiber 1300nm single	10 MHz Sine	NF0100-4-0
Fiber 650 nm	10 MHz Square	NF0100-2-1
Fiber 1300nm Multi	10 MHz Square	NF0100-3-1
Fiber 1300nm single	10 MHz Square	NF0100-4-1
DC to 10 MHz Square	Fiber 1300nm Multi	NF0100-1-3
Fiber 1300nm Multi	DC to 10 MHz Square	NF0100-3-1

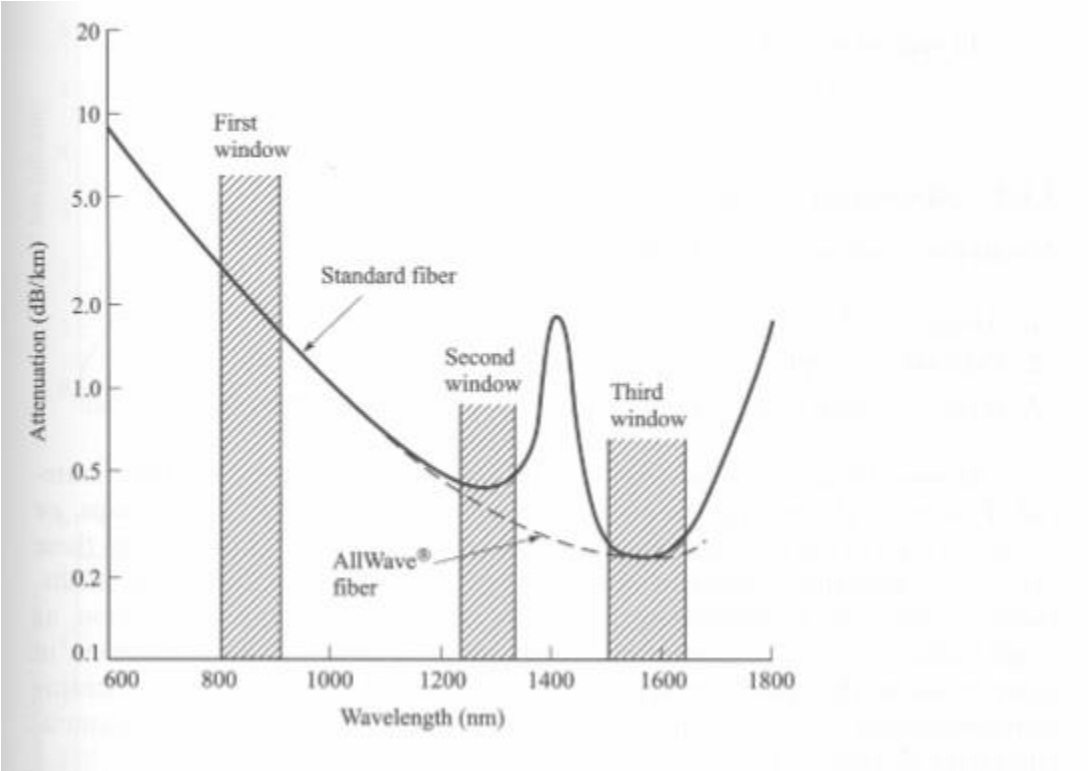
ST Connector

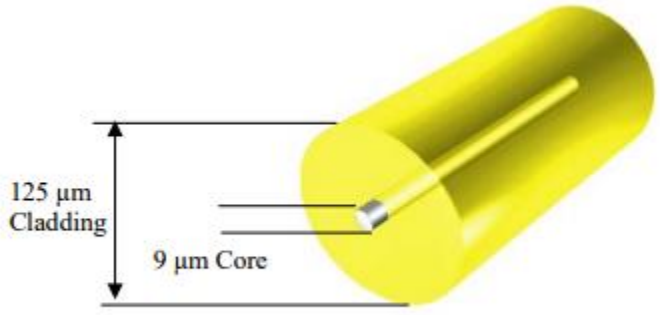
Versatile Connector


BNC
10 MHz Sq In
BNC
10 MHz Sine IN
Fiber Optic RX
ST- 1300 nm
Fiber Optic RX
Vers -Link
658 nm
Fiber Optic-RX
Vers -Link
850 nm
Euro
Power
6 to 12 Vdc
BNC
10 MHz Sq Out
BNC
10 MHz Sine Out
Fiber Optic TX
ST- 1300 nm
Fiber Optic- TX
Vers -Link
658 nm
Fiber Optic-TX
Vers -Link
850 nm

2.0 Fiber Optic Overview

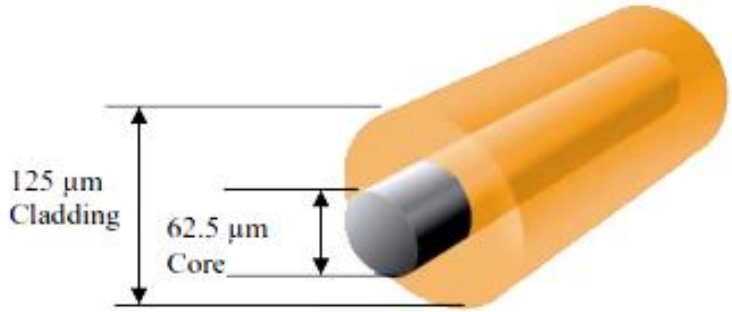
Fiber optic technology affords the ability to communicate a precision reference through an electromagnetically active environment with a minimum of reference degradation. Fiber optic technology also allows long-distance connections with minimal losses. The NF-0100 easily handles distances of over 3 km. The converter is offered at wavelengths of 650 and 1300 nm and multi-mode and single-mode. There are cost and performance advantages to each.





Multi-Mode Fiber

This is the classic fiber optic cabling and is far and away the most prevalent fiber type in use today inside buildings. The most commonly installed core size is 62.5 micrometers (µm) and the outer cladding size is 125 µm. Note: Other core sizes available are 50 µm, 100 µm, etc. ¬ 62.5/125 µm , 50/125 µm ¬



Multiple light paths ¬
Relatively inexpensive
Primarily used for LANs

The 'multi' in multi-mode comes from the fact that light travels down the cable in multiple paths. Essentially, the light beam is 'bounced' off the cladding as it travels down the core. There are actually two distinct methods:

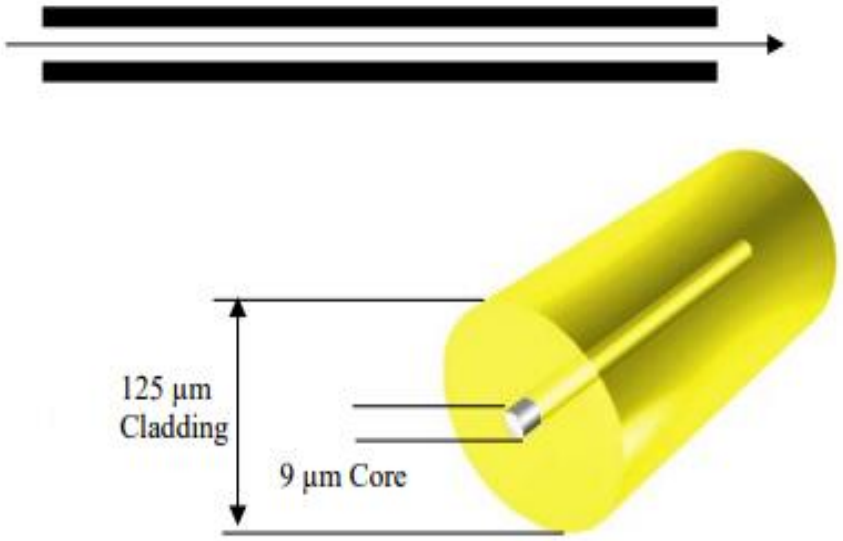
Step index - the light path is irregular and highly angular

Graded index - the light path is sinuous and regular in nature

Of the two methods, graded index is the current standard used by nearly all LAN/WAN equipment. Because of the light transmission characteristics of multi-mode, the quality of the fiber cable need not be high. In addition, multi-mode transmitters are relatively inexpensive and plentiful. The compromise with multi-mode is phase noise. The multi-path effect creates edge jitter that compromises phase noise. The lower cost may be acceptable. Also, with the

use of a local LOCK-IN amplifier, the phase noise can be brought back to reasonable levels while maintaining system synchronization.

Single-Mode Fiber
For more demanding applications, a second fiber cable type (single-mode) is available. Single-mode fiber uses a smaller core diameter, between 8 and 12 µm (9 being the average), with the same cladding diameter as multi-mode. ¬ 9/125 µm



Single light path
Somewhat more costly
More difficult to terminate
Essentially unlimited bandwidth
Primarily used for MAN/WANs
Low phase noise

Unlike multi-mode, single-mode fiber does NOT take multiple paths. A single light beam is transmitted down the fiber and does not interact with the cladding/core boundary. Until recently, single mode was an expensive solution compared to multi-mode. However, the price of the cable is now nearing that of multi-mode and the active optics required for single-mode are becoming less expensive. Also, commonly used for applications where greater distance is required than can be achieved with multi-mode fiber.

Fiber Type and Mode	Fiber type	Connector
650nm multi	200 um Plastic-Clad Silica (PCS)	Versatile
1300 multi-mode	50/125 um, 62.5/125um	ST
1300 single mode	9/125 um	ST

Fiber Type and Mode	Attenuation
	dB/Km
650nm multi	8
1300 multi-mode	0.5
1300 single mode	0.5

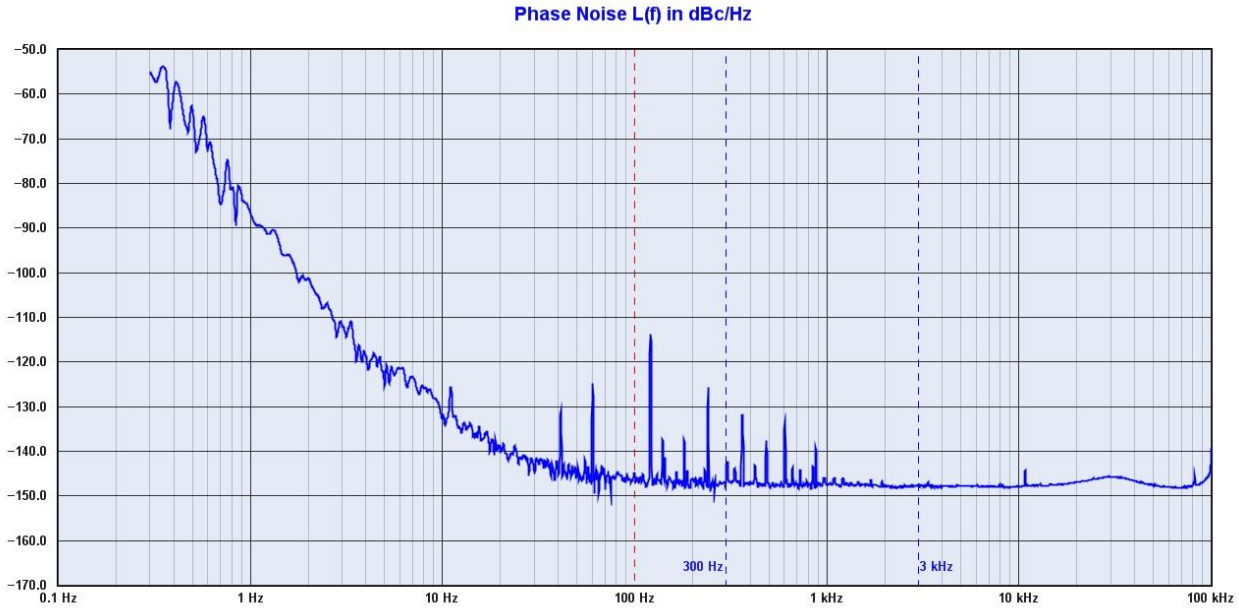
2.1 Phase Noise Performance

Phase noise is degraded through the process of conversion from sine to square, fiber optic dispersion and conversion from square back to sine again. The table below summarizes the performance of the different wavelengths and single versus multimode performance. The phase noise plot shows actual measured data comparing 650 versus 1300 nm multimode.

Fiber type and Mode	Attenuation	Phase Noise				
	dB/km	Frequency offset Hz				
		1	10	100	1kHz	10kHz
650nm	8	-95	-110	-115	-125	-130
1300nm Multi-mode	0.5	-105	-125	-130	-130	-130
1300nm single mode	0.5	-105	-125	-130	-130	-130
Low Noise 1300nm	0.5	-90	-130	-145	-145	-145

Low Noise Option

LN option available on 1300 nm products only.



Trace	Input Freq	Input Amplitude	dBc/Hz at 100 Hz	RMS Jitter	Duration	Acquired	Instrument
PCB203	10.000 MHz	5.1 dBm	-145.5	5.4E-14 s	5m 0s	3000 pts	TimePod 5330A

2.2 Types of fiber to be used

The NF-0100 requires the use of the following fiber types:

Fiber Type and Mode	Fiber type	Connector
650nm multi	200 um Plastic-Clad Silica (PCS)	Versatile
1300 multi-mode	50/125 um, 62.5/125um	ST
1300 single mode	9/125 um	ST

2.3 LED

LED provides an indication that power is present within the unit.

3.0 Rear Panel

3.1 Power connector

This two-pin connector provides power. The unit requires 7 to 15 VDC. The internal regulator is a 5 volt linear therefore the closer you are to 7 volts, the lower the power dissipation. Alternatively, a power adapter can be purchased that operates from 90 to 240 VAC (50/60 Hz) - Novus PA06. The DC source should be filtered to prevent high frequency noise from compromising phase noise.

The power connector is a 2-pin terminal block connector that mates to (ON-Shore Tech Part# OSTTJ0211530). Wires are installed and secured with a slotted screwdriver.

4.0 Functional Description

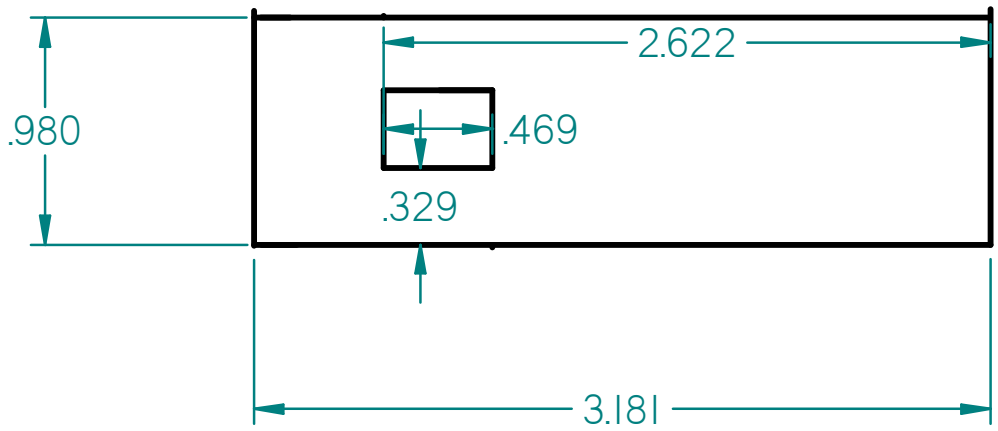
4.1 Bandwidth

The bandwidth extends from 0.5 kHz to 10 MHz for the 1300nm links and DC to 10 MHz for the 650 nm parts. The 650 nm link can operate all the way to DC and therefore an excellent candidate for PPS distribution. The unit can only be configured to output a sine wave at 10 MHz. All other frequencies are a 5 VDC CMOS output.

4.2 Outputs

The unit outputs a number of signal types.

6.0 Mechanical



7.0 Technical Specification

Sine Input Amplitude	6 to 14 dBm dB into 50 Ohms, or 3.3 VDC or 5 VDC square wave	
Power Required	7 to 15 VDC power @100mA adapter available. Powered directly from specific Novus reference products	
Output Power	10 MHz sine - 10 dBm±2 dB, square wave 5 VDC CMOS	
Square/Sine Connector	BNC	
1300 nm fiber	ST connector - over 10 km range, power typical - 20 dBm	
650 nm fiber	Versatile multi-mode transmit power -13 dBm range 200 um – 200m	
Indicators	Green LED - power present	
Impedance	Sine 50 Ohms, Square (1 K to 50 Ohm - contact factory)	
Power Connector	Power connector mate is a ON-Shore Tech Part# OSTTJ0211530	

Environmental and Mechanical

Operating Temperature	0 to 50°C non-condensing	
Storage Temperature	-40 to 70°C	
Height	1.0”	
Width	1.0”	
Depth	3.0”	
Weight	< 0.25 lbs	

8.0 LIMITED HARDWARE WARRANTY

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(b) after receiving return authorization –RMA- from NOVUS, the defective item is returned with transportation prepaid to NOVUS, Independence, Missouri, with transportation charges prepaid by Buyer …see RMA policy in Terms and conditions, and

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