

39.8-56 Gbps PRBS SOURCE

Operating Manual



TG2P5A

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Section 7: *Warranty/Product Service*

Centellax, Inc. Standard Warranty Test Instrument and Accessory Products

Centellax, Inc. (“Centellax”) warrants that the Test Instrument(s) and Accessory(s) (“Product(s)”) it manufactures is/are free from defective material and workmanship for a period of one (1) year subject to the following terms and conditions. Centellax will remedy any such warranted defect subject to the followings:

This warranty requires the Product to be delivered to Centellax intact for examination with an RMA number and with all transportation charges prepaid to the factory, within one (1) year from the date of sale to the original customer. Centellax will determine in its sole discretion when such defect exists. Centellax will return the repaired or replaced Product to the customer at its cost unless the shipment needs to be expedited or the shipment is international, in which cases customer will pay for return shipment.

During the warranty period, Centellax will, at its sole option, either repair or replace Products, which prove to be defective.

This warranty is only for the benefice of the original buyer registered with Centellax and is not assignable. This warranty does not extend to any of Centellax’ Products which have been subject to misuse, neglect, accident, improper installation, or used in violation of operating instructions. This warranty does not extend to Products, which have been repaired, calibrated, or altered in any way by a facility that is not approved, in writing, by Centellax to perform such work. This warranty does not apply to any Product where the seals or serial number thereof has been removed, defaced or changed, nor to Products not of our own manufacture.

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Additional information with regard to the applications and maintenance of this equipment may be available from time to time.

Centellax reserves the right to modify or change the warranty without notice.

Product Service

For information and pricing on standard factory service, please contact service@centellax.com.

Note: This product contains no user or factory adjustments. There is no calibration cycle or certificate.

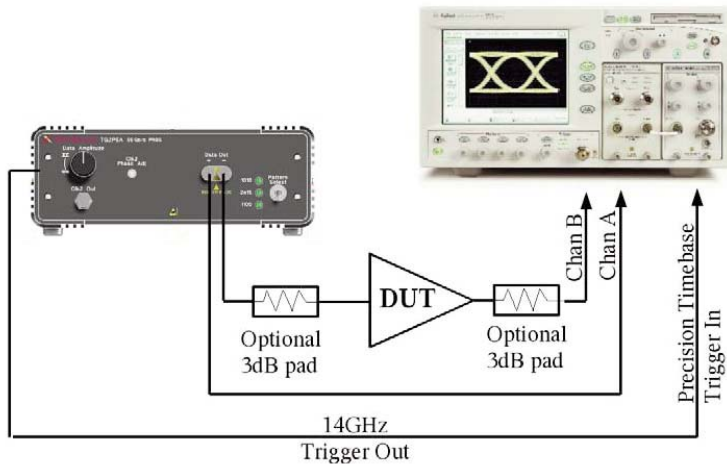
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Section 6: *Application Example*

A typical residual or additive jitter test system is shown in the below figure. Additive jitter measurements require a precise, low jitter clock. The TG2P5A features an exceptionally low jitter internally-referenced, frequency-stable, microwave oscillator which can be used as the reference clock.



Note: to maintain the integrity of the mm-wave system the user must select the appropriate connectors and minimize the length of microwave cabling.

Centellax can provide driver amplifiers, other application specific measurement accessories and application support. Contact Centellax for test system and measurement support.

Email: support@centellax.com or call: 866-522-6888.

39.8-56Gbps PRBS SOURCE TG2P5A *Operating Manual*

Section 1: *Introduction*

This manual is designed to familiarize users with the fundamental operations of the Centellax TG2P5A PRBS Source.

Section 2: *Description*

The Centellax TG2P5A is designed to be used as the source for testing new 100 Gigabit Ethernet applications designed at one-half data rate, or 56Gbps. The TG2P5A, in conjunction with a high speed Digital Communications Analyzer, can be used to make EYE and jitter measurements of 56Gbps components such as modulator drivers, optical modulators, MUX, and DEMUX components.

The square wave patterns are ideal for separating data dependent jitter from random jitter for system jitter characterization. The superior rise time, fall time, and excellent jitter of the TG2P5A make it desirable for production component test where the source performance needs to be as good as possible to meet production specification margins.

The low price of the TG2P5A make it desirable for manufacturing environments which are cost sensitive. The TG2P5A comes with an internal fixed 56G clock source or it can be used with an external clock source for other data rates in the 39.8-56Gbps range.

Section 3: Specification

Performance Specification Table

Parameter	Specifications			Units
	Min	Typ	Max	
Data Outputs	Min	Typ	Max	Units
Bit Rate	39.8	56.0	56.0	Gbps
Amplitude (single-ended)	400	-	800	mV
Rise/Fall Times (20-80%)	-	7	8.0	ps
Rise/Fall Times (10-90%)	-	10	11.5	ps
Jitter (RMS/PPK)	-/-	450/3.0	500/4.0	fs/ps
(Internal) Clock/4 Output	Min	Typ	Max	Units
Frequency (1/4 of bit rate)	-	14.000	-	GHz
Frequency Stability	-	-	+/-20	ppm
Amplitude (single-ended)	1.0	1.7	2.2	Vppk
Duty Cycle	48	-	52	%
Clock/4 Output	Min	Typ	Max	Units
Frequency	9.9	-	14.0	GHz
Input Amplitude	1.0	1.5	3.5	Vppk
Duty Cycle	45	50	55	%
(Buffered) Clock/4 Output	Min	Typ	Max	Units
Amplitude	1.0	1.5	2.0	Vppk
Duty Cycle	48	-	52	%
(Doubled) Clock/2 Output	Min	Typ	Max	Units
Amplitude	1.0	1.7	2.0	Vppk
Duty Cycle	48	-	52	%

Clk/4 Input:

External clocks are connected to this port. Remove the factory installed jumper cable between “Clk Input” and “Clk Output”. Terminate the “Clk Output” with 50 Ohm SMA termination. An external quarter-rate clock from 9.9 to 14 GHz can be used to drive the PRBS with the required drive power 3dBm. The resultant output data ranges from 39.8 to 56 Gbps.

Clk/4 Buf Outputs:

The Clk/4 Buf output is provided on the rear panel. This is merely a buffered version of the input clock. This may be used as a scope trigger or as a clock for a sub-rate de-multiplexer.

Pattern Trigger:

In many situations, including the use of standard time-bases, the pattern trigger can provide a trigger event synchronized to the start of the PRBS pattern. The pattern trigger output provides a trigger edge at one fourth of the PRBS pattern repetition rate.

NOTE: The pattern trigger is not applicable for the static “1010” pattern and the “1100” data pattern.

Mux4 Clk Phase:

The Mux4 clock phase provides the ability to invert the clock phase delivered to the final 56Gbps Mux. This switch position may be changed to optimize the clock phase to the 56Gbps Mux. Whenever the clock frequency is modified this adjustment may be necessary. The best way to test this is by looking at the Eye diagram and adjusting the switch position for the best Eye waveform.

DCD Bias Adjust:

The DCD Bias adjust is provided to optimize the clock duty cycle distortion. Each time the clock frequency is modified, a clock duty cycle distortion adjustment may be necessary. This may require a timing calibration adjustment, accessed through the top cover of the PRBS using a size C (0.07” blade) jeweler’s screwdriver for tuning. This can be adjusted by looking at the front panel clock divided by 2 output and adjusting the clock duty cycle for 50%. Imperfect clock duty cycle distortion will be evident by adjacent cycle jitter on the data outputs.

Amplitude Knob

The TG2P5A has a linear amplitude adjustment knob located on the front panel of the instrument. This allows a 6dB adjustment of the data output amplitude, from 200mV to 400mV single-ended, or 400mV to 800mV differential. This is useful for testing the effect of input amplitude on the device under test.

CLK2 Out

The clock divided by 2 output can be used as a scope trigger or as the clock output for a half rate demultiplexer.

Rear Panel

The TG2P5A rear panel is illustrated in the figure below. This section describes the clock connectors, the pattern length switches and the trigger output features.



+12V:

The TG2P5A is powered from an external AC to DC power module which is supplied by Centellax. The TG2P5A draws about 2A at +12VDC.

Power:

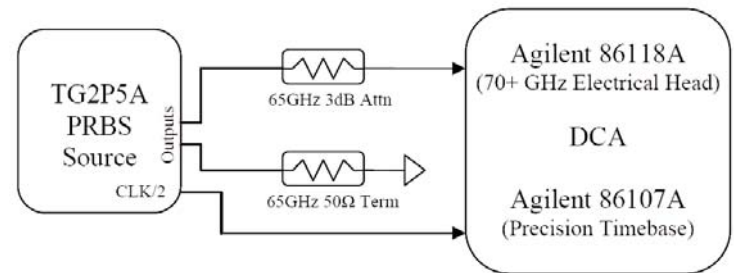
The rear panel power switch enables power to the PRBS Source. When power is applied the PRBS is initialized and reset.

Clk/4 Output:

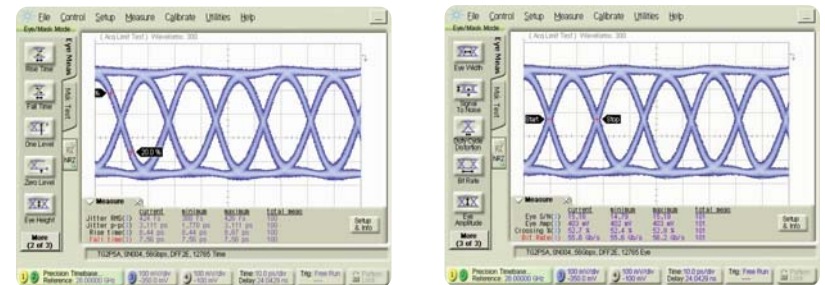
The PRBS Source TG2P5A provides a fixed period internal reference clock. The clock is set to provide a 56Gbps bit stream. The internal clock is an exceptionally low phase noise, frequency stable 14GHz oscillator. A factory provided external cable, located on the rear panel, connects the “Clk/4 Out” to the PRBS “Clk/4 In” connector.

Section 4: Performance Verification

The figure below shows the setup required to verify performance of the source. The performance verification is a single ended output measurement. A Digital Communications Analyzer is used to verify the quality of the pattern generator waveform. Care must be taken to terminate the unused output with a 1.85mm (V) 65 GHz 50ohm termination (provided). Use a 3dB 1.85mm (V) pad between the TG1P4A output and the Agilent 86118A 70 GHz electrical sampling head. The oscilloscope is triggered using the front panel CLK/2 output connected to the Agilent 86107A precision timebase. For best results use a short high quality 1.85mm (V) cable to connect the output of the TG2P5A to the Sampling heads.



Support for verification set-up and DCA set-up procedures is available from Centellax.



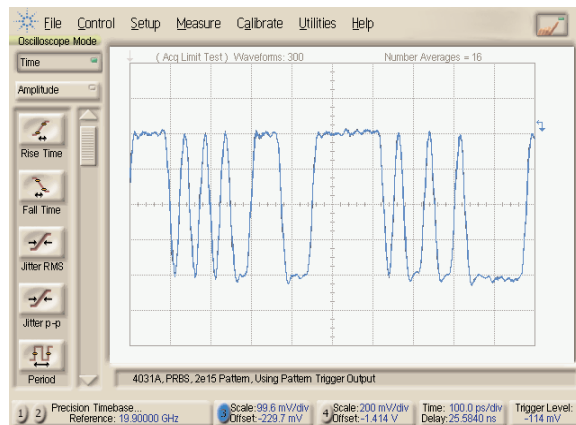
56 Gbps Eye Output from TG2P5A

Section 5: Operation

The TG2P5A PRBS is an instrument grade source which provides a best-in-class wave form. The quality of the TG2P5A Eye diagram, a “Perfect Eye”, is often required for accurate, high resolution measurements with minimal residual jitter.

The TG2P5A is a versatile PRBS Source with precision triggering needed for accurate jitter and timing measurements. Completely self-contained, the PRBS Source is an excellent companion to modern digital oscilloscopes, such as the Agilent 86000 series Digital Communication Analyzer.

For R&D applications, the TG2P5A provides the engineer with a precise, flexible PRBS Source with the triggering needed for broadband precision timebase receivers. The compact source can be placed close to the DUT for minimal waveform distortion from cable losses. The custom design SiGe components in the TG2P5A design provide very fast rise and fall time edges, low intrinsic jitter, and high signal to noise ratio. A pattern trigger output is provided for “scope mode” presentation of the data pattern on the Digital Communications Analyzer.



[2¹⁵-1]
Pattern
using
Pattern
Trigger

For manufacturing applications, the TG2P5A Source provides a low cost, high quality waveform needed for performance verification of 100GE components.

Typical manufacturing applications include the characterization of residual (additive) jitter, eye distortion, and rise/fall time of high speed components such as driver amplifiers, optical modulators, TIA, and Limiting Amplifiers. The TG2P5A can also be used for the characterization of 56Gbps transmission systems driven with PRBS signals. The 56Gbps PRBS pattern is an ITU compliant polynomial, (X¹⁵ + X¹⁴ + 1), so it can be used with any ITU compliant error detector.

Front Panel

There is a pattern select switch which can select from a “1010” pattern, a “1100” pattern, or the PRBS 15 pattern.

One of the three front panel LED pattern indicator lights indicates which pattern is selected when TG2P5A is powered on.

The TG2P5A output is a differential signal on the two 1.85mm (V) female output connectors. NOTE: if a differential signal is not required, the unused output must be terminated with a 1.85 mm (V) 65 GHz 50Ohm termination (provided by Centellax).



Retimer Phase Adjustment:

Use of an external clock may require a timing calibration adjustment, accessed through the top cover of the PRBS using a size C (0.07” blade) jeweler’s screwdriver for tuning. This tuning aligns the clock to data on the output retimer for optimal performance. This must be re-adjusted if the clock frequency is modified. To adjust the phase a DCA is needed. View the data output eye on the DCA, and adjust the phase with a screwdriver to obtain the cleanest eye.

Caution: excessive force on the tuning mechanism will cause damage to the internal “mechanical stops”.