



Agilent Technologies

Errata Notice

This document contains references to “Centellax.” Please note that the test and measurement product portfolio once owned by Centellax, Inc. is now part of Agilent Technologies. For more information about these products and support, go to **www.agilent.com/find/bert-news**.

40G BER Test System

Complete cost effective solution for 40, 28 and 25Gb/s device characterization and production testing



Key Features:

- Operates at data rates from 22 to 44Gb/s
- True PRBS pattern generation at full data rate
- Supports differential or single ended inputs and outputs
- High voltage drivers available for laser modulator testing
- Remote control through USB or GPIB
- Automatic receiver clock phase alignment
- High speed clock option for continuous operation from 22-44Gb/s
- Compact size

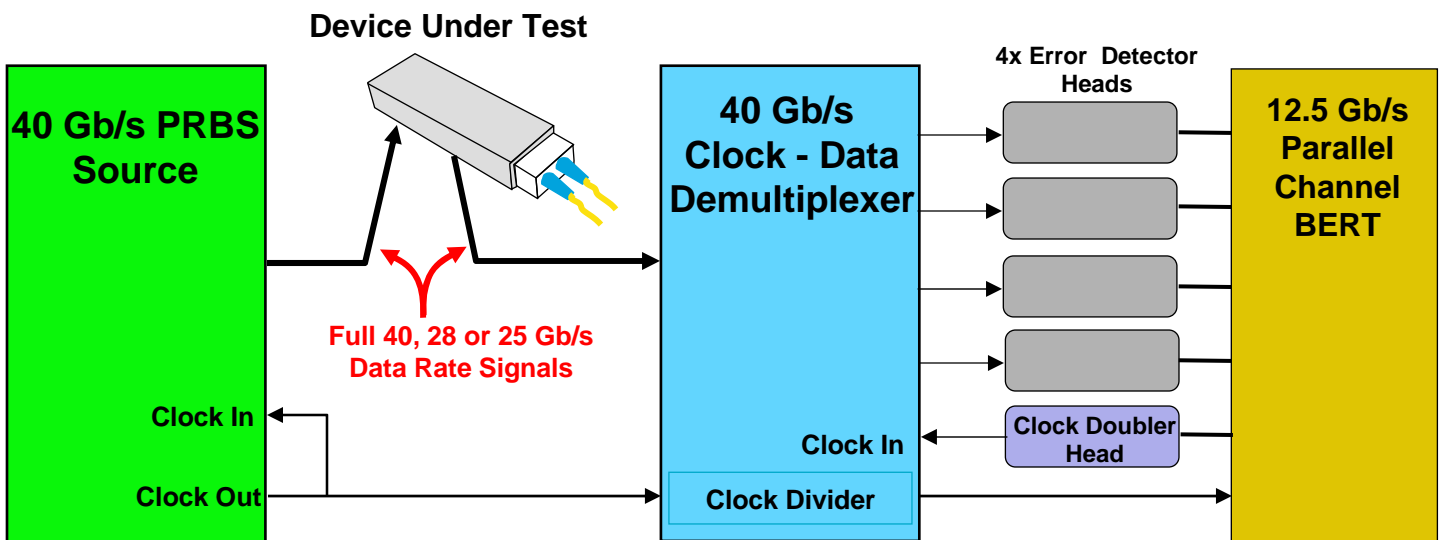
40Gb/s Bit Error Rate Testing at a price you can afford

In the past, bit error rate testing at 40Gb/s required a bench full of large, complex and expensive instruments. With our heritage of designing and manufacturing high performance instrumentation grade microwave ASICs and components, Centellax has been able to reduce the size and complexity of the instrumentation required for a high data rate BER test system - without compromising performance. The result is a compact system which is easier to set up and operate. Higher levels of integration reduce the cost to a point where full data rate testing is now affordable for both design characterization and production testing.

Modular System Architecture

The SB40B BER Test System is formed from three main components::

- **40 Gb/s PRBS Source** – Provides a true PRBS pattern at full data rate to stimulate the Device Under Test.
- **40 Gb/s Clock / Data Demultiplexer** – de-multiplexes the full rate output data stream from the Device Under Test into 4x 10 Gb/s sub-rate data streams. Also divides the high speed clock to provide 10 GHz clock output.
- **12.5 Gb/s Parallel Channel BERT** – Measures the Bit Error Rate of the 4x 10 Gb/s de-multiplexed data streams and provides clock control for the 40 Gb/s Clock / Data Demultiplexer.



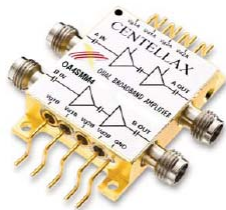
Typical Test Setup

System Configuration

The **TG1P4A PRBS Source** can produce PRBS 7, 15, or 31 patterns, providing flexible trade-off between test duration and pattern dependent stress level. An internal low jitter clock source provides operation at 39.8 Gb/s. Ordering options are available to substitute clock frequencies to support 28 and 25.78125 Gb/s operation. Alternatively the generator can be clocked from an external source for operation at any rate between 22 and 44 Gb/s (half-rate clock required). An ordering option, OPTHSC, provides a suitable half-rate clock solution for this purpose.



Data outputs are differential, and can be used in single-ended applications by terminating the unused output with a 50 ohm load. The PRBS Source also provides pattern trigger and clock outputs, which can be used to trigger a sampling oscilloscope to view the bit stream or a classic eye diagram.



When testing optical receivers, it is often necessary to use an optical modulator with a laser as a data source. Optional modulator driver amplifiers increase the voltage of the PRBS Source output to allow driving Lithium Niobate MZ or Electro-Absorptive modulators. A range of modulator driver amplifiers is available from Centellax.

The **TR1D4A Clock and Data Demultiplexer** 1:4 de-multiplexer can accept differential or single ended input signals, and has 4x data outputs at $\frac{1}{4}$ of the bit rate. Also included in the TR1D4A are separate clock dividers which can be used to provide the correct divided-clock rate for the BERTs measuring the data outputs.



Electronic control of the high speed clock phase shifter allows for automatic clock-data timing of the TR1D4A clock and data inputs.



The **PCB1250 Parallel Channel BERT** with 4x **TR2P1A Error Detector** heads monitors the De-multiplexer Data outputs bit error ratio. The **TG3C1A Clock Doubler** head facilitates electronic phase adjust of the TR1D4A clock input for optimizing clock-data phase for the TR1D4A de-multiplexer.

The PCB1250 can be controlled manually through the front panel, or remotely through IEEE-488 (GPIB) or USB.

System Automation

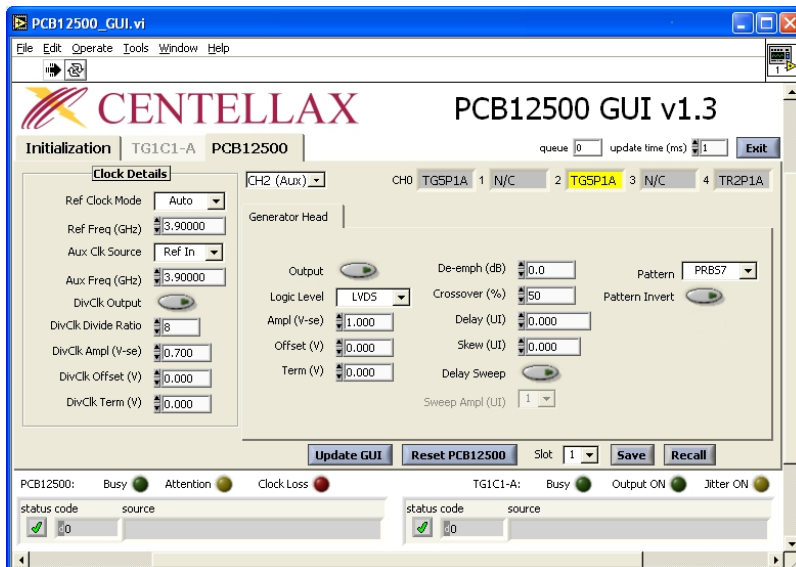
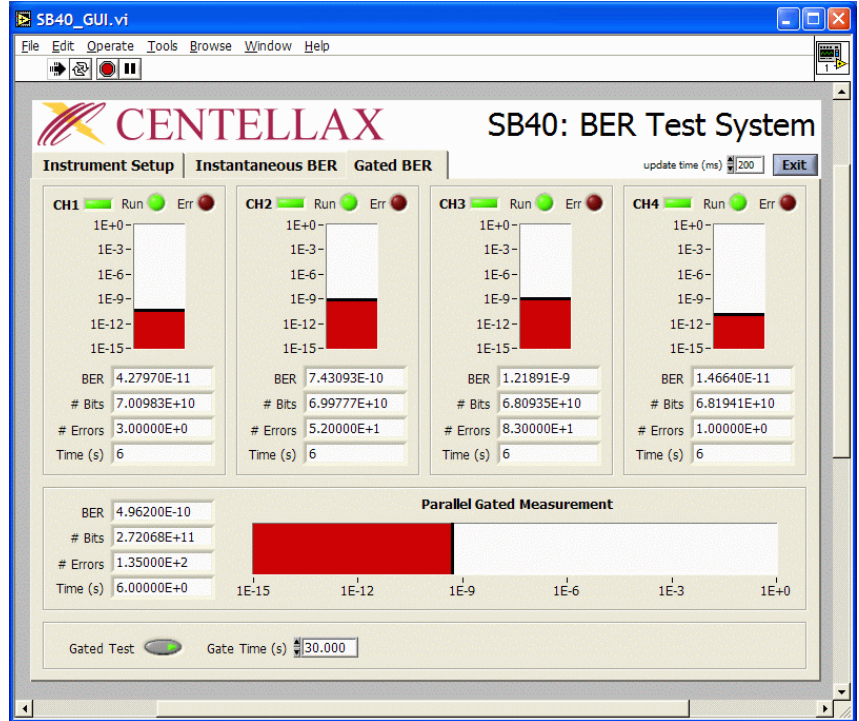
In both production testing as well as engineering characterization, automation of the system for instrument control and results data collection are essential.

Tools are provided with the SB40B system to simplify the setup and integration into an automated test system..

LabVIEW® open source code drivers and stand alone GUI are available at no charge, for the SB40B system. The application computes and the BER at the full 40Gb/s data rate.

Bar graphs display the computed BER of the full rate data stream, as well as BER on each de-multiplexed data output - giving a quick visual indication of any sub rate related bit errors.

This application also includes an auto-align function to optimize the clock-data phase at the input of the TR1D4A de-multiplexer.



A separate LabVIEW® application is available for the PCB12500 BERT. All of the operating parameters of the are displayed in a single window, allowing the user to instantly see the state of the instrument.

The PCB12500 also supports a SCPI compliant command set for users who wish to program outside of a LabVIEW environment.

Specifications

The following tables list specifications of the individual instruments relevant to application in the 40G BERT system. For complete specifications relevant to other applications, refer to the individual product data sheets.

TG1P4A PRBS Source

Data Output Signal Configuration		Differential. Will operate in single ended mode with unused output terminated
Data Line Coding		Non-Return to Zero (NRZ)
Data Patterns		2^N-1 PRBS patterns (N=7, 15, 31)
Data Rate Range		22 – 44 Gb/s
Data Output Amplitude		500 mV p-p typical, 450 mV p-p minimum
Data Output Levels	High Low	0 mV typical, -50 mV minimum -450 to -600 mV
Data Rise / Fall Time		6 ps typical, 8 ps maximum
Data RMS Jitter		400 fs typical, 1000 fs maximum,
Data Output Connector Type		V female (1.85 mm)
Internal Clock Data Rate		39.8 Gb/s standard 28 Gb/s (OPTC28) 25.78125 Gb/s (OPTC26)
External Clock Input	Frequency Power	Half-rate input (11 - 22 GHz) +13 dBm minimum, +16 dBm maximum
Pattern Trigger	Rate Pulse Width	$1/64$ * pattern repetition rate 64 * UI
Power Requirements		100 – 240 V AC, 50 – 60 Hz, 1.35 A maximum

Specifications

TR1D4A Clock and Data Demultiplexer

Data Input Signal Configuration		Differential. Will operate in single ended mode with unused input terminated
Data Input Bit Rate		3.5 – 44 Gb/s
Data Input Amplitude Range		150 – 1000 mV Single Ended
Data Input Connector Type		V female (1.85mm)
Clock Input	Frequency Amplitude	Half-rate input (1.725 – 22 GHz) 470-1200 mVpp
Data Output	Bit Rate Configuration Amplitude Connector Type	0.875 – 11 Gb/s Single Ended. Unused outputs must be terminated 210 – 270 mV, 240 mV nominal K female (2.92 mm)
Clock Outputs	Configuration Divide Ratio Amplitude Connector Type	Differential. Can be used single ended. All unused outputs must be terminated. Configurable - divide by 2/4/8/16 500 mV single ended, typical K female (2.92 mm)
Power Requirements		100 – 240 V AC, 50 – 60 Hz, 1.35 A maximum

PCB12500 Parallel Channel BERT with TR2P1A Error Detector, TG3C1A Clock Doubler Heads

Data Rate	1.5 – 12.5 Gb/s
Data Line Coding	Non-Return to Zero (NRZ)
Data Patterns	2 ^N -1 PRBS patterns (N=7, 10, 15, 23, 31)
Data Input Sensitivity	0.1 – 2.0 V, single ended
Data Threshold Adjustment	-1.0 to +1.0 V, 1mV steps
Data Delay Adjustment	-1000 to +1000 UI, 1mUI steps
Autoalign	Sets optimum Data Threshold and Data Delay
BER Measurement Period	0 to 99,999.999 seconds in 1 msec steps
BER Results	Bit Error Rate, Error Count, Bit Count, Measurement Seconds
Data Connectors	K female (2.92 mm)
Remote Control Interface	IEEE-488 (GPIB) or USB2.0
Power Requirements	100 – 240 VAC, 50 – 60 Hz, 170 W maximum

Specifications

Physical and Environmental

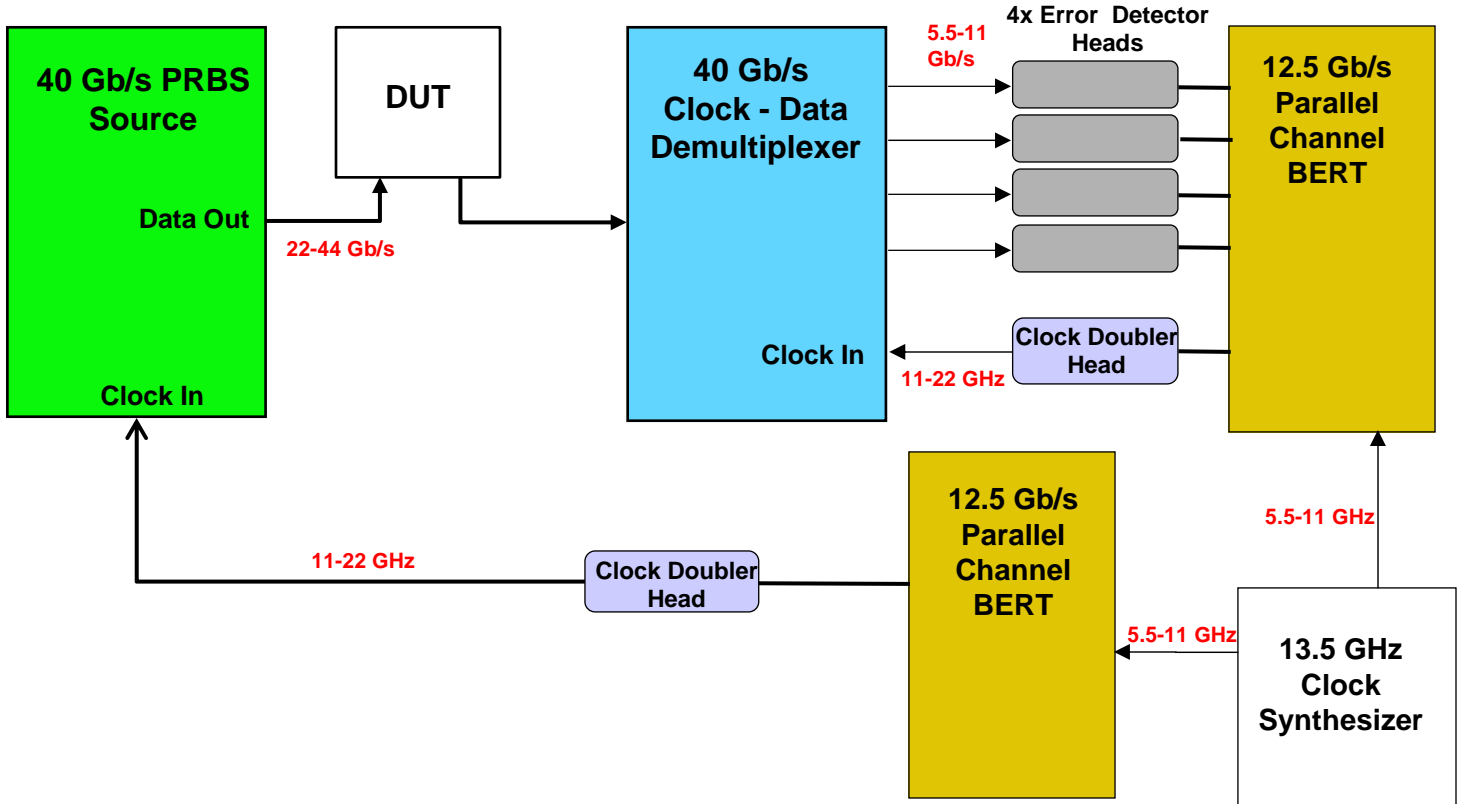
Temperature, Operating	+10° to +40° C
Temperature, Non-Operating	- 40° to +70° C
Dimensions (<i>Height, Width, and Depth</i>)	
TG1P4A 40G PRBS Generator	63.5 mm (2.5 in) x 230.2 mm (8 in) x 254 mm (10 in)
TR1D4A 40G Clock and Data De-multiplexer	63.5 mm (2.5 in) x 254 mm (10 in) x 254 mm (10 in)
PCB12500 Parallel Channel BERT	100 mm (3.9 in) x 214 mm (8.4 in) x 425 mm (16.7 in)
TR2P1A Error Detector Head	33 mm (1.3 in) x 72 mm (2.8 in) x 130 mm (5.1 in)
TG3C1A Clock Doubler Head	33 mm (1.3 in) x 72 mm (2.8 in) x 130 mm (5.1 in)
Mass	
TG1P4A 40G PRBS Generator	2.7 kg (6 lbs)
TR1D4A 40G Clock and Data De-multiplexer	3.2 kg (7 lbs)
PCB12500 Parallel Channel BERT	3.3 kg (7.1 lbs)
TR2P1A Error Detector Head	0.38 kg (13.4 oz)
TG3C11A Clock Doubler Head	0.38 kg (13.4 oz)

Compliance

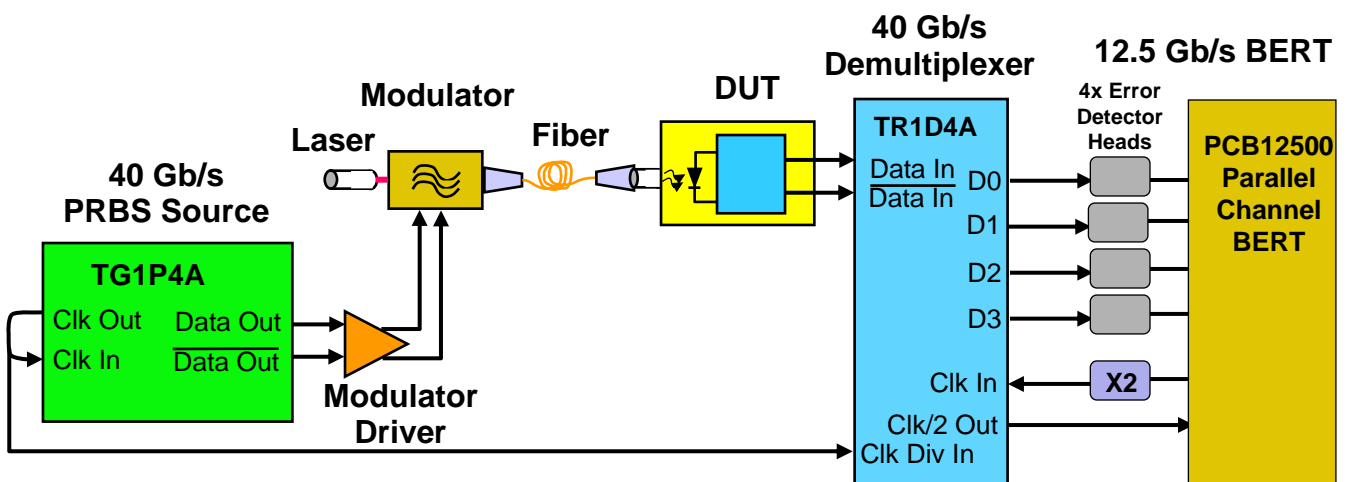
EMC	Complies with: European EMC Directive 2004/108/EC, IEC/EN 61326 CISPR 11 Group 1 Class A AS/NZS CISPR 11 ICES/NMB-001
Safety	Complies with: European Low Voltage Directive 2006/95/EC, IEC/EN 61010-1 CSA C22.2 No. 61010-1 UL 61010-1 This product is designed to be used in an indoor environment to Pollution Degree 2 (IEC 61010) and Enclosure Protection level IP20 (IEC 60529)

Typical Configurations

Typical Test Setup with OPTHSC High Speed Clock Option



Typical BER Test System for 40 Gb/s Optical Receiver



Ordering Information

Product Code

SB40B

Description

40Gb/s BER Test System

SB40B includes:

- 1x TG1P4A PRBS Source Opt003 broadband
- 1x TR1D4A 40G Clock and Data De-multiplexer
- 1x PCB12500 Parallel Channel Bert
- 4x TR2P1A Error Detector head
- 1x TG3C1A Clock Doubler head
- 1x Accessory kit containing:
 - 1x 10dB Coupler SMA
 - 1x male-male SMA adapter
 - 1x 25.4 cm (10") RF cable SMA male-male for splitting internal clock to go to generator clock in
 - 2x 91.5 cm (36") RF cable SMA male-male for connecting clocks to TR1D4A and PCB12500
 - 2x 14.0 cm (5.5") RF cable 1.85mm male-male for connecting TG1P4A to TR1D4A in loopback mode
 - 1x CD with LabView drivers, manuals, setup guide.

TG1P4A PRBS Opt 003 Source includes:

- 1x Power supply with AC Power cable
 - 1x Semi-rigid RF cable SMA male-male for connecting internal clock out to generator clock in
 - 1x 3 dB attenuator 1.85mm male-female for providing termination when connecting to AC coupled devices
 - 1x 50 Ω terminator 1.85mm male for unused output when driving single ended devices
 - 1x adjustment tool for phase delay control
 - 1x manual
- Standard 1 year warranty.

TR1D4A Clock Data Demultiplexer includes:

- 1x Power supply with AC power cable
 - 2x 1.85 mm to 2.92 mm RF adapters for adapting to lower data rate devices
 - 1x 50 Ω terminator 1.85 mm male for unused input when driven from single ended devices
 - 4x SMA 50 Ω terminators SMA male for unused de-multiplexed data outputs
 - 3x Semi-rigid RF cables SMA male-male for configuring clock output dividers & routing
 - 1x Allen wrench for locking phase adjustment control
 - 1x manual
- Standard 1 year warranty.

PCB12500 Parallel Channel BERT includes:

- 1x AC Power Cord
 - 1x printed Quick Start Guide
 - 1x CD with LabView drivers, users guide, quick start guide
- Standard 1 year warranty

TR2P1A Error Detector Head includes:

- 2x 12.7 cm (5 in) RF cables SMA male-male
 - 1x SMA male-male 50 Ω terminator
- Standard 1 year warranty.

TG3C1A Clock Doubler Head includes:

- 2x 12.7 cm (5 in) RF cables SMA male-male
 - 1x SMA male-male 50 Ω terminator
- Standard 1 year warranty.

Product Options

OPTC26 SB40B	Internal Clock Change for Operation at 25.78125 Gb/s (OPT113 TG1P4A)
OPTC28 SB40B	Internal Clock Change for Operation at 28 Gb/s (OPT112 TG1P4A)
OPTHSC SB40B	High Speed Clock for Continuous Operation from 22-44 Gb/s (includes TG1C1A; PCB12500; TG3C1A; TA0L30VA)
OPT101	European Power Cord
OPT102	UK Power Cord
OPT103	North American Power Cord
OPT300	+ 1 Year Warranty Extended to 3 Years
OPT301	+ 1 Year Warranty Extended to 5 Years
OPT320	+ Centellax Calibration – Per Incident
OPT321	+ Annual Centellax Calibration for 3 Years
OPT322	+ Annual Centellax Calibration for 5 Years

More Information

For additional information, to schedule a product demonstration, or to request a quote, contact your local authorized Centellax Distributor or:

Centellax Sales Department
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