



Overview:

The Eye-BERT Micro Family of products provide low cost, easy to use, electrical and optical test solutions offering high performance bit error rate testing at a fraction of the cost while providing a rich set of features not found in other bit error rate testers. Features include: variable bit rate, user programmable patterns, optical power and temperature monitoring, and transceiver register read / write capability. Some models offer one-click transceiver testing which automatically tests the pluggable transceiver based on the information it reads from the module and generates a detailed test report complete with manufacturer, part number, serial number, date code, fiber type, link length, speed, and test results. The Units are supplied with anti-skid bumpers for bench use and are small enough to be integrated into larger systems for dedicated link verification. A summary of the Eye-BERT Micro models is listed below; for more details see the individual data sheets.

Model	Rates	Interfaces
Eye-BERT Micro LR (100357A-XXX)	6.312 Mbps – 125Mbps (continuous)	Electrical SMA, 1310nm, 1550nm
Eye-BERT Micro (100286A)	125Mbps – 4.25Gbps (banded)	Pluggable: any MSA compliant SFP or SFP+
Eye-BERT Micro 10G (100292A)	9.95Gbps – 11.3Gbps (continuous)	Pluggable: Any MSA compliant XFP
Eye-BERT MicroX10 (100495A-X10)	1.224Gbps – 14.5Gbps (banded)	Pluggable: Any MSA compliant SFP, SFP+, or SFP28
Eye-BERT MicroX30 (100495A-X30)	1.224Gbps – 29Gbps (banded)	Pluggable: Any MSA compliant SFP, SFP+, or SFP28

Warnings and Precautions:

- Do not exceed manufacturers recommended optical input power on any port
- Use only compatible fiber optical connectors and modules
- Use only the supplied 5VDC power supply as applicable
- Observe ESD precautions when handling
- Proper ventilation and/or heat sinking may be required depending on the environment and transceiver power dissipation

Installing the Software and Starting the Application

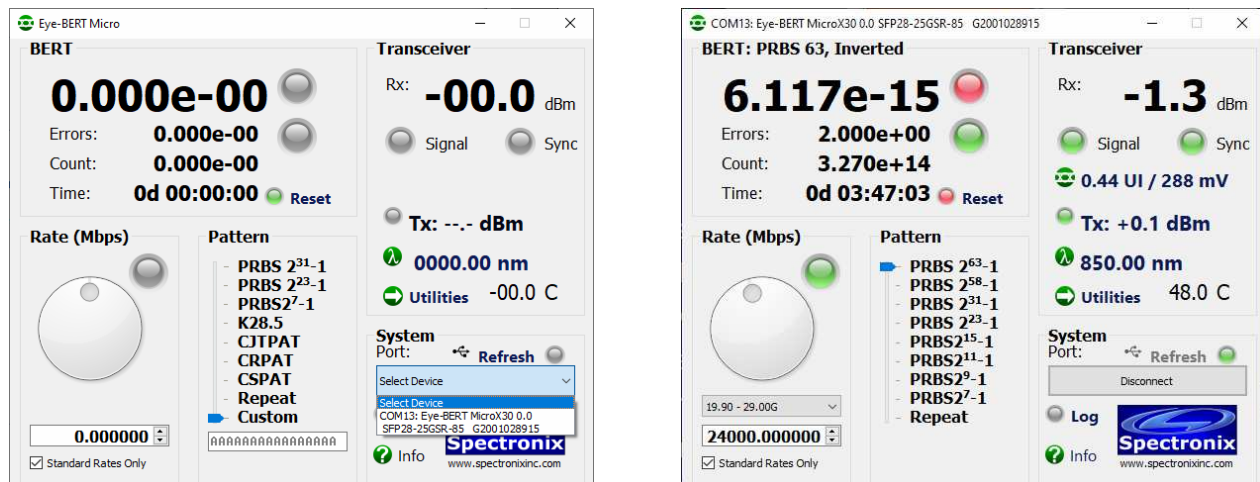
Regardless of the model, all Eye-BERT Micro's use the same easy to operate software application and USB driver.

1. Insert the CD or download the application from www.spectronixinc.com, run the "Eye-BERT Micro Install.exe" installation program. **Windows 7 Users and above: right click the file and select "Run as administrator".**
2. Connect power to the Eye-BERT Micro using the supplied 5VDC adapter (select models).

3. Plug the Eye-BERT Micro into a free USB port. When the hardware installation wizard asks for the driver location, browse to “cdc_NTXPV764.inf” located in the installation directory. Note, on some operating systems such as Window 7, manual USB driver installation may be necessary. If the hardware installation wizard fails, go to “My Computer” > “Properties” > “Hardware” > “Device Manager”, and find the “Spectronix” or “SERIAL DEMO” entry under “Other Devices” and select “Update Driver”. At this point you will be able to browse to the location of the driver.
4. Start the application from the program start menu

Using the Supplied Eye-BERT Micro Application

At start-up the Eye-BERT Micro Application searches for compatible Eye-BERT Micro devices and lists them in the “Port” drop down box; this list can be updated by pressing the “Refresh” button. The Eye-BERT Micro must be powered on and connected to a USB port prior to launching the Eye-BERT Micro Application. Once the user selects a device from the list, the connection LED will turn green, the applicable options will be displayed, and the fields will begin to update.



The Eye-BERT Micro can operate in either “Bit Error Rate Test” mode or “Repeat” mode. In repeat mode the input signal is retimed and retransmitted, this is useful for clock recovery and jitter clean-up. In bit error rate test mode the Eye-BERT Micro generates the specified pattern / bit rate while the detector attempts to synchronize to the pattern and count the bit errors. Additional special test patterns are provided on some models which are intended for jitter testing and are not supported by the pattern detector. Refer to the specific model for variations in capabilities and operation.

Testing with the Eye-BERT Micro

Generating a Test Pattern:

The rate knob and drop-down box (some models) are used to set the bit rate at which the Eye-BERT Micro operates; rate options will vary depending on the model. When the “Standard Rates Only” box is selected the dial will lock to standard data rates only. Un-checking this box allows the user to select any valid data rate. The user can also change the rate directly using the spin box and pressing <enter>. The indicator next to the rate dial will change to red if there is a frequency error.

The pattern slider bar is used to change the generator test pattern or select repeat / retime mode; pattern capability varies by model type. On most models, the repeat mode simply retimes and


retransmits the input signal and is not supported by the pattern detector. All PRBS patterns, K28.5, and DCD patterns are supported by the pattern detector and can be used for bit error testing. The CJTPAT, CRPAT, and CSPAT patterns are intended only for jitter testing and are not supported by the pattern detector. The operation of the “Custom” pattern varies by model:

- Eye-BERT Micro LR (pulse generator): generates a pulse stream with a pulse repetition rate as selected by the “Rate” setting / 100 and a duty cycle per the duty cycle dialog box 1-99%. For example, using a rate of 100Mbps and a duty cycle of 1% gives a 10nS pulse every 1uS. This function is not supported by the pattern detector.
- Eye-BERT Micro (40 bit custom pattern): generates a repeating 40 bit custom pattern as dictated by the 10 character hex pattern in the dialog box. This is supported by the pattern detector and can be used for bit error rate testing.
- Eye-BERT Micro 10G (64 bit custom pattern): generates a repeating 64 bit custom pattern as dictated by the 16 character hex pattern in the dialog box. This is supported by the pattern detector and can be used for bit error rate testing.
- Eye-BERT MicroX: custom patterns are not supported. When using the repeat / retime mode, the pattern detector and error counters remain functional. The unit will identify the incoming PRBS pattern, report the BER, and retransmit a retimed copy of the input.

Controlling the Transmitter

The transmitter output signal can be enabled or disabled on any model by pressing the “Tx” button; the LED indicates the state of the transmitter. On models with a pluggable transceiver, the optical output power is also displayed on the “Tx” button when supported by the transceiver. The Eye-BERT MicroX utilizes register based transmitter control which may not be supported by all SFP transceivers and can generate an error when using the automated SFP test utility.

Transmitter Wavelength

On models that use pluggable transceivers, the transmitter wavelength is indicated on the  button. If a tunable module is used, the output wavelength can be changed. Pressing the wavelength button opens the “Set Wavelength” dialog box. The current wavelength (nm) and frequency (THz) is displayed at the bottom of the window for reference. Adjusting either the frequency or wavelength dial will change the other dial to the corresponding value to the nearest 50GHz channel. Press <OK> to set the new wavelength.



Receiver Measurements

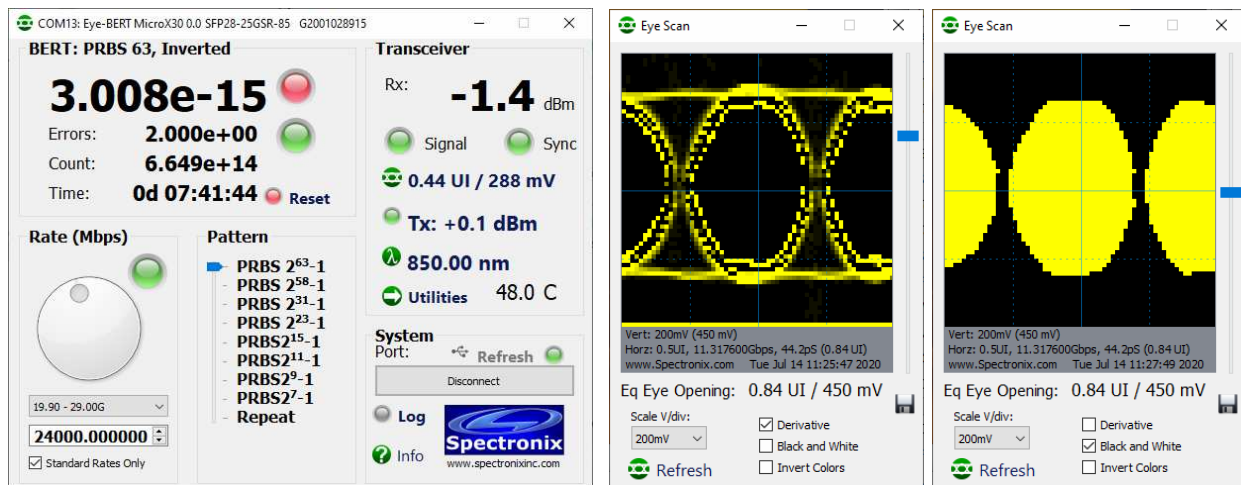
Signal and Sync LEDs along with the receiver measurements are provided to give the user an indication of the received signal quality. The signal LED turns green when the input amplitude is

above the minimum transceiver threshold. The Sync LED turns green when the receiver CDR / pattern detector has locked to the incoming signal.

The receiver measurement indicates either the received optical power (pluggable transceiver models) or the received bit rate.

Eye Opening Monitor

Certain models are equipped with an eye opening monitor and eye-scan capability. When supported, the current eye opening measurement is displayed just under the “signal” and “sync” indicators. Eye opening measurements are continuously updated while a valid input signal is present. The horizontal eye opening is displayed in terms of unit interval (UI) with a range of 0 to 1, and the vertical eye opening in units of mV peak to peak. The eye-scan window is displayed by selecting the eye opening icon / measurement area. Vertical scaling options from 50 to 200mV/div are provided to accommodate signal amplitude variations; pressing the “Refresh” button initiates a new scan at the selected scale. Post processing display options are provided, with the default being the derivative function resulting in a traditional eye scan appearance; deselecting this function provides an outline of the eye opening area. Options for black and white, color inversion, and contrast adjustment (right most slider) are also provided. Pressing the disk icon saves the eye scan as a bitmap file.



Bit Error Rate Measurements

Selecting a bit rate and test pattern enables BER testing. The upper left section of the main window reports the bit error rate, the number of bit errors, the total number of bits tested, and the total test time in days, hours, minutes, and seconds. The indicator next to the bit error rate shows red if the BER is not zero and the one next to the error counter flashes red when an error is received. The “Reset” button is used to reset all counters to zero.

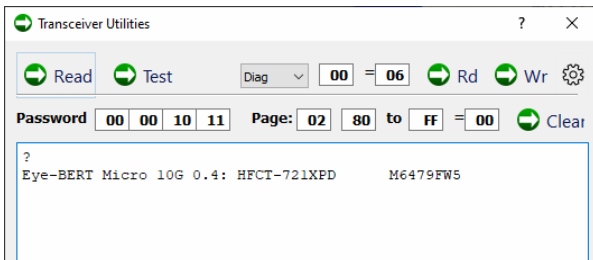
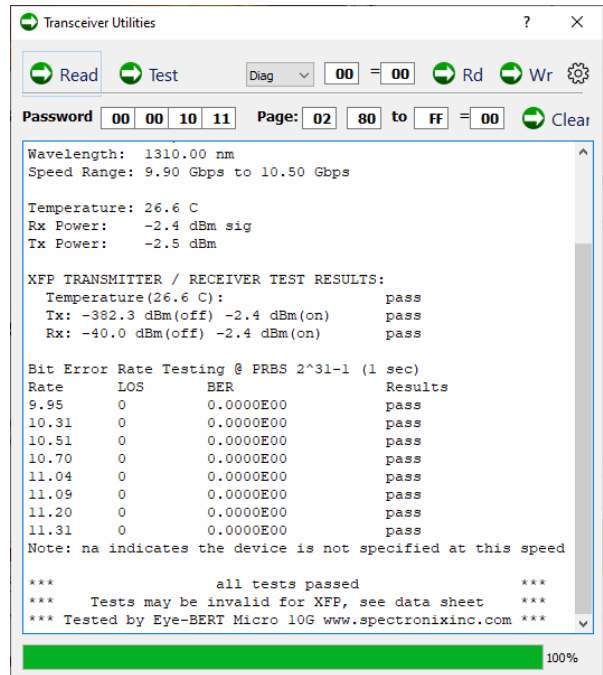
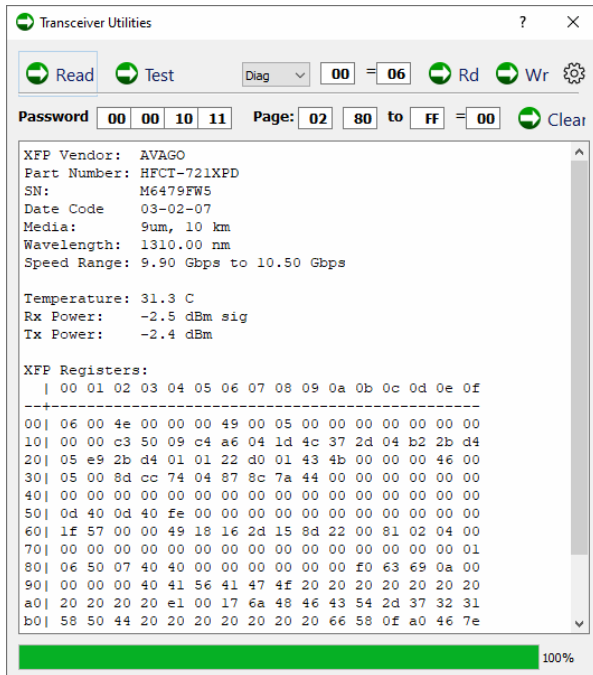
Select models, such as the Eye-BERT MicroX are able to identify the received PRBS pattern and count errors regardless of the pattern generator settings. These models only need to be set to the same bit rate as the incoming signal and will display the received pattern and polarity just above the BER.

Transceiver Utilities

If the model supports pluggable transceivers, the “Utilities” button will be visible. Selecting this button will display the transceiver utilities window. From this window the user can read and write the registers and test the transceiver. Pressing the “Read” button will read and display all the transceiver registers as shown below.

The transceiver can be tested by connecting a loopback cable and attenuator. With APD receivers, be sure to use enough attenuation to prevent damage or saturation of the receiver. Press “Test” to begin the transceiver test; after about 20 seconds the results will appear in the window.

Individual registers can be read or written to using the “Rd” and “Wr” buttons along with the address and value text boxes. In the example below, entering 00 (hex) in the address button and pressing “Rd” displays the value of register 00 = 06 (hex). The value of a register can be changed by entering the address and data, then pressing the “Wr” button (all values are hexadecimal). Please note that not all registers are writable, refer the applicable SFF standard for more information.



Version 2.6 adds the ability to manually execute individual Eye-BERT Micro commands from the utilities window. For example, according to the software programming guide, command “?” returns information about the Eye-BERT Micro and the inserted transceiver. Typing “?” into the text area and pressing the gear icon will send the command to the Eye-BERT Micro and display the response in the text area. This can be helpful when developing custom software applications. Only the command/text on the last line in the window will be sent to the Eye-BERT Micro. Not all commands are suitable for use in this window; some respond too slowly and will time-out before their response is captured; others respond with binary data which will not be displayed correctly.

Data Logging

Data can be logged to an Excel compatible CSV file in one second intervals by pressing the “Log” button from the main window. During logging, the log LED will flash green/yellow to indicate logging is in process. Press the log button again to stop logging. An example log file is shown below.

Eye-BERT Micro 10G Log file Mon Dec 17 2012

Time	Rate	Pattern	Temp (C)	Rx (dBm)	Count	Errors	BER
14:47:34	1.13E+10	PRBS31	50.9	-8.9	3.64E+13	5.36E+02	1.47E-11
14:47:35	1.13E+10	PRBS31	50	-8.9	3.64E+13	5.36E+02	1.47E-11
14:47:36	1.13E+10	PRBS31	50	-8.9	3.64E+13	5.36E+02	1.47E-11
14:47:37	1.13E+10	PRBS31	50	-8.9	3.64E+13	5.36E+02	1.47E-11

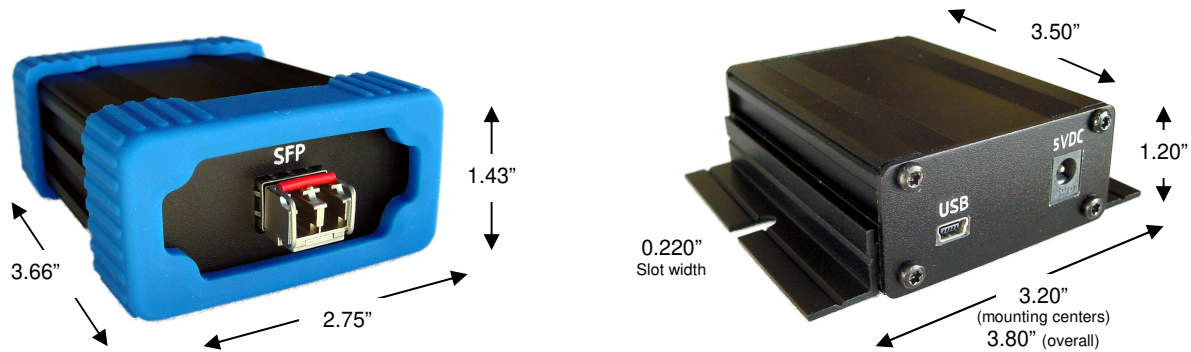
Thermal / Power Considerations

The Eye-BERT Micro enclosure provides a low thermal resistance path from the internal electronics and the transceiver module to the top of the extruded aluminum housing, therefore some minimal air circulation or heat sinking is recommended. The unit is designed to be used in an open “laboratory type” environment (such as on a bench) with some amount of air circulation or attached to a thermal sink using the flanges. Transceivers with advanced functions such as temperature stabilization, CDRs, and FEC dissipate more power and require additional thermal precautions. If a high power transceiver is used or the unit is subjected to elevated ambient temperatures or in a stagnant environment where heat build up might occur, it’s recommended that additional thermal management be employed such as using fans or heat sinking and thermal gasket material. When using a transceiver which supports digital diagnostics, the temperature may be monitored from the software user interface. Note, most commercial grade SFP/XFP modules are rated for an ambient temperature of at least 70°C.

When the Eye-BERT Micro is connected to an active (powered) USB port, the unit is on and generating heat whether or not the application is running. In order to turn the unit off either remove power or unplug / deactivate the USB connection. The unit will power down when the connected computer powers down, providing that the computer removes power from the USB cable. This allows the unit to remain connected to a system and powered on / off with the controlling computer.

Mechanical Dimensions

The unit is normally supplied with rubber anti-skid bumpers for stand-alone use. Upon special request, mounting flanges can substituted to allow hard mounting of the unit.

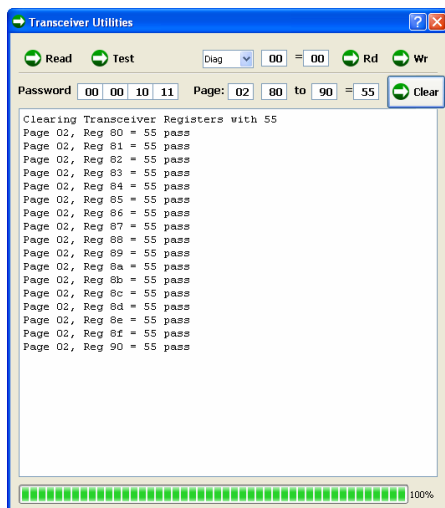


APPENDIX LETTER OF VOLATILITY

All products in the Eye-BERT Micro family contain both volatile and non volatile memory. Only the Eye-BERT Micro firmware application is stored in non volatile memory and program variables and settings are stored in volatile RAM which is cleared upon power down. The user has no means of altering the non volatile memory without opening up the unit and reprogramming the device using a special programming adapter.

XFP and SFP transceivers which are used with the Eye-BERT products contain user writeable EEPROM. While the Eye-BERT software does not automatically write to these locations, it does enable the user to manually do so. A transceiver clearing utility is provided as part of the Eye-BERT software.

From the "Utilities" screen, pressing the "Clear" button using the default settings will overwrite the user EEPROM as specified in the MSA standard. Alternatively, the user may wish to customize the address locations and data pattern as discussed below.



- 1) Enter the Password (XFP Only): To write to the user EEPROM on some XFPs, a password must be entered in the four password entry boxes. This password varies between manufacturers and devices; please consult the transceiver manufacturer for details. The default values may be used for popular models.
- 2) Enter the Page: Transceiver registers are arranged in pages. SFP transceivers utilize page A0 (serial ID), and A2 (diagnostics). XFP transceivers utilize 00 (diagnostics), 01 (serial ID), 02 (user EEPROM), 03:7F (vendor specific), and 80:FF (reserved). To read any page in the XFP, first write the page number to register 7F using the "Wr" button, then press the "Read" button.
- 3) Enter the Address Range: Enter the register address range to write to (hex). Note, not all registers are writable.
- 4) Enter the Data to be Written: The hex value in this box will be written to all registers in the address range when the "Clear" button is pressed.
- 5) Write the Data: Pressing the "Clear" button will attempt to write the specified data to all registers in the specified range. After writing, the data is read back to verify the memory was cleared successfully.
- 6) View the Newly Written Data (optional): Pressing the "Read" button will read and display all the values in the current page.