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VBR-310
OPERATION MANUAL

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Overview	EXFO Electro-Optical Engineering is pleased to introduce the A word from EXFO VBR-310 Variable Back Reflector. Our commitment to superior design in all our fiberoptic instrumentation is respected throughout the industry and is based on four goals: simplicity of operation, extensive features, reliable operation and a dedicated interest in the needs of our customers.
Description of	The VBR-310 Variable Back Reflector is an instrument used VBR-310 to generate levels of back reflection in order to simulate components and physical phenomena in fiber cables. The VBR-310 therefore determines backreflection tolerances of equipment under test. The VBR-310 can execute a program which commands the unit to step through back reflection levels of selected step size. The instrument may be programmed using the RS-232C or IEEE-488 interface (user defined).
Nomenclature	The following typographic conventions have been adapted throughout the text. - <i>Terms in italics</i> represent keys of VBR-310. - Terms in bold represent displays, readings, LED indicators.
Verifying that the complete	The VBR-310 variable back reflector package contains the set is following items: 1 - VBR-310 test instrument. 2 - Certificate of calibration. 3 - Operation manual 4 - AC cord We recommend you compare your order with our invoice to verify that it is complete. If any damage has occurred during shipment or an item is missing, notify EXFO immediately.
Power Supplies	The VBR-310 operates on: 110/220V AC line voltage, 12-VDC or rechargeable battery pack. Battery expectancy is typically 10 hours under normal use.

LCD An illustration showing a sample of the display is seen below.

OPERATION OF THE VARIABLE BACK REFLECTOR

Turning the set on The rectangular switch on the front panel of the unit turns the VBR-310 on and off. At power up, the instrument displays the maximum back reflection reading at the calibrated wavelength in the upper portion of the LCD.

Note The VBR-310 does not immediately display the back reflection after power up. The delay allows the filter to reposition itself to display maximum back reflection and for its own opto-mechanical recalibration. This is indicated by a marker on the far right of the LCD, the marker disappears when the selected level is reached.

LED Indicators There are four LED indicators located at the top left of the front panel. When the instrument is powered up, the "**Local**" LED is lit indicating that the unit is being operated locally and not through a computer interface. The remaining three indicators represent interface states. "**Talk**" is lit when the VBR-310 sends a message to a computer via an IEEE interface. "**Listen**" is lit when the instrument receives a message. "**Remote**" is lit when the instrument is in communication with the master computer interface.

Shutter This key opens and closes the VBR-310 light shutter. When the shutter is in the closed position, the unit produces the minimum back reflection level, -55 ± 2 dB at the input port.

Prog This key is used to program back reflection step size and interval time. Executing the program instructs the VBR-310 to step through 60 steps, at the selected step size and time interval. To set the number of levels to be cycled through, press the "**prog**" key and use the up and down arrows. Press the "**prog**" key again to now select the time interval. Continue to press "**prog**" after each entry (ie hours, minutes, seconds). The step size is selected next, where the resolution is .1 or .5 dB. Press "**prog**" a final time to exit the program mode.

Start prog Press the "**start prog**" key to start the program mode. If the VBR-310 is in the step or manual mode, each step will be executed upon pressing the up arrow key. If the unit is however in the scan mode, indicated by "**SCAN**" displayed in the right corner of the display press

the "*start prog*" key to automatically execute the program. The program will be executed continuously until the program mode is exited. To exit the program mode, press "*start prog*".

Lambda select	The key switches the VBR-310 between the two calibrated wavelengths, 1300 and 1550 nm,. Each calibrated wavelength is displayed above the backreflection level.
Step/Scan	The <i>step/scan</i> key switches the VBR-310 between stepping and scanning through possible back reflection levels. The VBR-310 always defaults to the "step" mode, which is not indicated on the LCD display. When in the "scan", the " scan " appears on the LCD.
Increment Arrow	Press the <i>increment arrow</i> key to increase the absolute value (ie decrease back reflection).
Decrement Arrow	Press the <i>decrement arrows</i> key to decrease the absolute value (ie increase back reflection).
Fine/coarse	Press the " <i>fine/coarse</i> " key to change the step size. Step sizes are either .1 or 1 dB. (An LED above this key indicates the step size is .1 or 1 dB. While in the program mode the step size is 0.1 or 0.5 dB).

MEASUREMENT PROCEDURE

Let us precede the description of the VBR-310 connector ports by an application example. Let a 565 Mbps transmission bay be connected to the input signal port. The output signal port is then connected to the receiver bay. The signal at the output port is therefore a sample of the input signal less a constant due to the internal optical loss. As the backreflection of the unit is selectively increased, the stability of the transmitter deteriorates. A sample of the corrupted signal is seen at the output port then influencing the receiver bay which allows the bit error rate to be measured using a BER tester.

Input	A fiber optic light source is connected to the input port. A back reflecting test set with built-in source can be used instead of a source alone, to provide back reflection readings.
Reflect Monitor	A power meter may be connected to this port to provide a backreflection reading. It serves to verify the calibration of your VBR-310 set. This can be done by setting a reference on the power meter then increasing the back reflection generated by the VBR; the power meter reading increases by the same value. If a power meter is not being connected to this port, it is desirable to terminate the port.
Output	A power meter can be connected to this port. The power reading here remains constant. This signal provides a sampling of the input signal, thereby monitoring the source stability. A bit error tester can also be connected to this port.

MAINTENANCE AND REPAIR

There are no user-serviceable components in the VBR-310. Your instruments has been designed to require a minimum of maintenance and to provide you with accurate optical Back reflection readings for many years. The optical ports or output connector must be kept clean at all times to ensure repeatability of measurements. This optical connector can be cleaned with a cotton swab dipped in denatured alcohol; blow-dry afterwards with compressed air.

Maintenance of Fiberoptic Connectors

With the end-cap removed from the optic cable, carefully clean the exposed end with a cotton swab dipped in denatured alcohol. Blow-dry the connector afterwards with compressed air.

Recalibration

Periodic recalibration is recommended by EXFO Electro-Optical Engineering to maintain accuracy. Although not imperative, we recommend an annual recalibration to maintain the meter within the specified calibration tolerances.

Service and Repair

Instruments and accessories manufactured by EXFO Electro-Optical Engineering are designed, inspected and tested to ensure product reliability and performance.

If you are having trouble with an instrument or accessory manufactured by EXFO Electro-Optical Engineering, we suggest that you first refer to the operation section of this manual. If you need further assistance in determining the instrument's problem, call our service department. Our service personnel can usually solve the problem over the phone or determine if service or repair is required.

Certificate of Calibration

Your VBR-310 fiberoptic Variable Back Reflector is shipped with a "Certificate of Calibration". This document certifies that your instrument was tested before shipment.

Warranty

EXFO E.O. Engineering warrants products manufactured by it to be free from defects in material and workmanship and to meet the applicable specifications under normal use and service for a period of 12 months from the date of original shipment. EXFO E.O. Engineering's obligation under this warranty is limited to the repair or replacement of such products which, after having been returned to the factory or a designated location, shall be examined and, in the opinion of EXFO E.O. Engineering, found defective and that such defect was not induced by causes external to the product. This warranty does not cover recalibration for instruments whose calibration is specified on the calibration certificate to be less than one year.

Alternatively, EXFO E.O. Engineering may elect to issue credit for any defective product. Products to be repaired or replaced shall be returned prepaid to the designated place of repair in accordance with authorization, packing and shipping instructions issued by EXFO E.O.

Engineering. Return shall not be made until such authorization and instructions are issued. Each returned product shall be accompanied by a statement or report fully stating the claimed defects and any other pertinent information concerning the failure.

EXFO E.O. Engineering's responsibility under this warranty does not apply to any products which have been repaired, worked upon or altered by persons not authorized so as to in EXFO E.O. Engineering's sole judgement injure the stability or reliability of such product, or which have been subject to misuse, negligence or accident, or where applicable, the serial number has been altered, erased or removed.

CAUTION ! Under no circumstances should anyone, besides EXFO's trained personnel, open the case of an instrument since permanent damage to the unit could occur. The opening of a unit's case immediately **VOIDS** all warranties on EXFO E.O. Engineering's behalf. Removal of the warranty sticker across the seam of the case will **NULLIFY** EXFO E.O. Engineering's warranty. Furthermore, removal of the case screws will also **VOID** the unit's warranty.

EXFO E.O. Engineering shall not be liable for damages resulting from the use of the purchased product, nor shall be responsible for any failure in the performance of other items to which the purchased product is connected or the functioning of an entire system of parts of any system of which the purchased product may be a part.

EXFO E.O. Engineering reserves the right to make changes in the design or construction of any of its products at any time without incurring any obligation to make changes whatever on units purchased. Accessories, including but not limited to fuses, pilot lamps and batteries used with EXFO E.O. Engineering's products are not covered by this warranty. A test set-up charge will apply to any returned instrument which, after test, is found to meet the applicable specifications.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED OR STATUTORY, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OR MERCHANTABILITY AND FITNESS OF A PARTICULAR PURPOSE. IN NO EVENT SHALL EXFO E.O. ENGINEERING BE LIABLE FOR SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES.

Repairs Under Warranty

Please feel free to call our service department for any suspected problem. If the instrument cannot be repaired by telephone assistance, our service personnel will provide you with a Return Authorization Number to return your instrument to EXFO E.O. Engineering for service or repair. Instrument freight charges must be prepaid to EXFO Electro-Optical Engineering. All repairs carried out under warranty are returned prepaid to the customer.

EXFO Electro-Optical Engineering will not be responsible for any product returned without a Return Authorization Number (R.A.N.).

If you have any question concerning our policy, do not hesitate to contact our service department. It is also your responsibility to insure the instrument during shipment.

Repairs Out of Warranty

Out-of-warranty repairs are also provided on all of EXFO Electro-Optical Engineering's fiber optic instruments. This service is billable to the customer for both parts and labour. All instrument freight charges must be prepaid returned by the customer and an evaluation of costs involved will be provided on request.

All products manufactured by EXFO Electro-Optical Engineering, under warranty or out of warranty, are to be returned according to EXFO's return procedure. For any return, please contact our service department at:

Attention: Service Department
Tel: (418)683-0211
1-800-683-EXFO
Fax: (418)683-2170

When you do, you will receive a Return Authorization Number along with all the necessary information on the return procedure.

Note:

The return of any instrument to EXFO has to be made according to EXFO's procedures. Any instrument sent back to EXFO not according to the standard company procedures will be refused and returned to sender.

TRANSPORTATION AND STORAGE

Although your EXFO Electro-Optical Engineering fiber optic instrument is designed to be rugged and field portable, transportation damage can occur from improper handling. Therefore, we recommend that the following steps be taken to minimize the possibility of damage.

Use the supplied shock-proof carrying case when transporting your instrument in the field. If the instrument is to be shipped, repack it in the original packing material for best protection. When not in use, store instrument at room temperature in a clean and dry area. Avoid areas of high humidity, large temperature fluctuations, keep the instrument away from direct sunlight and avoid unnecessary mechanical shocks.

OPTICAL SPECIFICATIONS

Model	VBR-310
Fiber Type	Singlemode
Calibration Wavelengths (nm)	1300 and 1550
Dynamic Range (dB)	-15 ±1 to -55 ±2 dB
Resolution (dB)	±0.1
Linearity (dB)	±0.2

Repeatability (dB) ±0.15
Accuracy (dB) ±0.40

GENERAL SPECIFICATIONS

Size: 26 X 22.5 X 9 cm / 10 ^{1/4} X 8 ^{7/8} X 3 ^{1/2} in.
Weight
 unit: 4 kg / 9 lbs
 shipping: 7 kg / 15 lbs
Speed: -15 to -55 in 20 seconds maximum.
Environment: Operating: -10 °C to +40 °C
 Storage: -30 to +60 °C
 Humidity: 0 to 90% non-condensing
Power: Line voltage (85 - 264 V AC, 47 - 63 Hz)
 DC supply (12 VDC ±3, 1.5 A)
 Built-in rechargeable battery pack (12 hours)

Standard
accessories: AC cord, carrying handle, built-in rechargeable battery,
 operation manual.

Appendix A

RS-232C Interface (VBR-310)

A standard RS-232C computer interface may be provided as an option with the VBR-310 model. The interface lets you perform all the functions of the back reflector remotely through a PC XT/AT IBM compatible computer equipped with a serial port.

Requirements

Hardware required to operate the VBR-310 with a computer:

- 1) A PC XT/AT compatible computer equipped with a DB 25 serial port connector.

Note:

Although the RS-232C type interface is common to many computers, only IBM compatible computers may be used with the VBR-310.

- 2) A GP-60 RS-232C interface cable, supplied with your instrument.
- 3) A software diskette containing several programs and a read-me file that contains specific instructions on how to operate the application software.

Installation

These are step-by-step instructions in order to set up the VBR-310 with the RS-232C interface on a compatible PC XT/AT computer.

Step 1:

Turn the VBR-310 OFF.

Step 2:

Connect the cable with the stereo jack end (the smallest end) into the receptacle on the back panel of the VBR-310.

Step 3:

Connect the cable's DB 25 connector end on either serial port 1 or 2 of your PC XT/AT IBM compatible computer.

Step 4:

If you have both interfaces, set all the dip switches on the back of the VBR-310 to on (A1 to A6).

Step 5:

Turn your VBR-310 ON.

Step 6:

Boot up your computer with a DOS system and insert the software diskette #1 into drive A. (continued)

Note:

We assume that you are familiar with the DOS system and its commands. If you are not, you should refer to a specialized book on the subject (probably supplied with your computer).

Step 7:

Type **A:** and hit the **ENTER/RETURN** key. You may survey the contents of the diskette by typing **DIR** and the **ENTER/RETURN** key.

Note:

Before executing any of these programs or doing any programming, it is **highly recommended** that you read through or print the README.DOC

file which contains information on the different programs and useful subroutines that you could include in many of your own programs. You may also find information on any software updates.

We also suggest that you print out a listing of the demo program.

Step 8:

You access the information contained in the README.DOC file by typing **README** followed by the ENTER/RETURN key (this executes the README.BAT batch file which enables you to read the README.DOC file).

Programming

The diskettes included with your RS-232C interface package contain a demo program and a "README" file to help you make your own programs. Remember that, with the RS interface, all commands used in your program must be sent with right and left arrows (> ... <. Refer to Appendix C for a complete listing of the commands.

Examples:

To set the back reflection at -28 dB, send >A-28.0<.

The VBR-310 unit then sends the ASCII character ";" which means that the unit is acknowledging the command. The unit will then bring the attenuation to the desired value.

Communication Protocol

The software on the diskettes has been written using a PC compatible computer. The communication protocol is 9600 Baud, 8 bit, no parity, one stop bit using serial port 1 or 2. A number of application examples are included on your software diskette. It is important to go through the entire Readme File before operating the unit.

Appendix B

IEEE-488 (GPIB) Interface

General

The IEEE-488 or GPIB (General Purpose Interface Bus) was developed to provide a standard interface between instruments from diverse sources. For example, power meter, attenuator, computer. Please note that the IEEE-488 interface only operates using AC power. Ensure that the AC electrical cord is properly connected.

IEEE Interface

The interface functions define the receiving, processing and **Functions** sending operations of data by the VBR-310. The following codes define the IEEE-488 interface that has been implemented on the VBR-310. More details can be found in the IEEE-488 guidebook.

SH1: Complete source handshake functions.

AH1: Complete acceptor handshake functions.

L4: Basic listener unaddressed to listen on TAG.

T6: Basic talker functions, serial poll unaddressed to talk LAG.

SR1: Service Request capability.

RL1: Including the Remote/Local operation selecting function.

PPO: Not including the parallel poll function.

DC1: Including the device clear function.

DT1: Including the device trigger function.

CO: Not including the control function.

EO: Tri-state bus.

Requirements

Hardware required to operate the VBR-310 on a computer:

Note:

- 1) A PC XT/AT compatible computer equipped with a GPIB \ IEEE-488 card and connector.
Although the IEEE-488 interface is common to many computers, only IBM compatible computers may be used with the VBR-310.
- 2) A GP-130 IEEE-488 interface cable, **not supplied** with your instrument.
- 3) A software diskette containing several programs and a read-me file that contains specific instructions on how to operate the application software.

Installation

These are step-by-step instructions in order to set up the VBR-310 with the IEEE-488 interface on a compatible PC XT/AT computer.

Step 1:

Turn the VBR-310 OFF.

Step 2:

Connect one end of the GPIB cable into the receptacle on the back panel of the VBR-310 unit.

Step 3:

Connect the other end of the cable on the GPIB port of your PC XT/AT IBM compatible computer.

Step 4:

Set the A1-A6 dip switches on the back of the VBR-310 to select the desired address (decimal value between 0-30).

Step 5:

Turn your VBR-310 ON.

Step 6:

Boot up your computer with a DOS system and insert the software diskette #1 into drive A.

Note:

We assume that you are familiar with the DOS system and its commands. If you are not, you should refer to a specialized book on the subject (probably supplied with your computer).

Step 7:

Type "A:" and hit the "ENTER/RETURN" key. You may survey the contents of the diskette by typing "DIR:" and the "ENTER/RETURN" key.

Note: Before executing any of these programs or doing any programming, it is **highly recommended** that you read through or print the README.DOC file which contains information on the different programs and useful subroutines that you could include in many of your own programs. You may also find information on any software updates.

We also suggest that you print out a listing of the demo program.

Step 8: You access the information contained in the README.DOC file by typing "README" followed by the "ENTER/RETURN" key (this executes the README.BAT batch file which enables you to read the README.DOC file).

Programming The list of commands is found in Appendix C.

Serial polling Each time a serial polling is conducted by the controller, the status byte is returned. (See status byte in appendix C.)

Appendix C

IEEE-488 / RS-232C COMMANDS (VBR-310)

Note 1: "x" represents a number from 0 to 9, "E" represents scientific notation, and "_" indicates a blank space.

Note 2: Whenever the unit is displaying "- - -" the unit will return a -99.9 to your computer for easier computation.

Commands	Description	RS-232C Response
)	Lock the keyboard.	;
(Unlock the keyboard.	;
L ϕ	Select lowest wavelength (1300)	;
L1	Select highest wavelength (1550)	;
A \pm xx.x	Reflect input signal by xx.x dB	;
H ϕ	Turn shutter off	;
H1	Turn shutter on	;

Commands	Description	Response
>Sφ<	Read status byte If E = 1 then there is an error in the command. If M = 1 then the attenuation is currently changing.	00110M0E
>S1<	Get reading from VBR-310.	-xx.x;
>LL<	Get reflection limits min = insertion loss, max = maximum reflection	-xx.x,-xx.x;
>Plxxxφhhmmss<	A single step in the interface program mode. Program up to 60 steps, each specifying, a back reflection level and the period during which the reflection level will be held before executing the next step.	;

NOTE The VBR-310 offers two distinct program modes:
o A manual program mode, entered directly on the unit using its keyboard.
o An interface program mode which is inputted via the interface using your computer. While an interface program is present in the memory (marker #4 is on), manual programming becomes disabled: loading an interface program blocks the execution of a manual program.

I = selected wavelength

hh = the "hours" part of the time interval during which the attenuation remains stable. (value: 00 ≤ hh ≤ 23).

mm = the "minutes" part of the time interval during which the attenuation remains unchanged (value range: 00 ≤ mm ≤ 59).

ss = the "seconds" part of the time interval. (value range: 00 ≤ ss ≤ 59).

xxx = reflection value, in the high resolution format, that you want to program in the "Ref." mode.

>U<	Exits the interface program mode and resets "step count" to zero. Marker #4 is turned off.	;
-----	--	---

Note **This command must be executed prior to going in the field if you want to allow the execution of a program entered manually on the VBR-310.**

Ex.: Let us program,
time interval of 14 minutes and 30 seconds, a reflection
of -35.2 dB:

1- Reset the "step count" to zero: send >U<

2- Send >P3520001430<

3- Unlock the keyboard: Send ><

4- To run the program, depress the "start prog." Key.

The back reflector will then set the reflection to -35.2 and hold this for 14 m 30 s before executing any subsequent step in the program. Up to 60 steps can be entered separately.

REMEMBER! After an interface program is transferred to the VBR-310, execution of a **manual** program is impossible. Send >U< to enable it before terminating RS-232C session.

An application diskette is available containing basic RS-232C and IEEE programs to help you make your own programs. The VBR-310 is a slow device. That is it take several seconds to reach a given back reflection level. Consequently timeout setting must be set appropriately. For the IEEE device's timeout setting, we recommend a value above 60 seconds. If you use the RS-232C interface provided on the application diskette, we recommend that you parameter delay be set to 60 seconds.



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