IQS-12002

R&D AND MANUFACTURING–OPTICAL

DISCONTINUED PRODUCT

- High performance: ±0.9 % uncertainty for the calibration power meter
- User-friendly and intuitive Windows™ software with step-by-step procedures
- Flexible: modular and expandable
- Calibration and verification of any power meter, attenuator, source and OTDR

IQS Optical Calibration System

System Overview

Verification and calibration of fiber-optic test instruments

EXFO offers the IQS-12002 Optical Calibration System for in-house instrument verification. The IQS-12002 OCS puts you in control of all your calibration operations. With this powerful system, you can calibrate your power meters as often as you need. Verify your sources, attenuators, and OTDRs regularly without undergoing downtime and costly shipping. Traceable to NIST standards, the IQS can evolve with your needs. From the most basic setup to the most sophisticated, EXFO's IQS-12002 can be custom-designed to fit your requirements.

The IQS-12002 OCS performs automated, comprehensive tests.

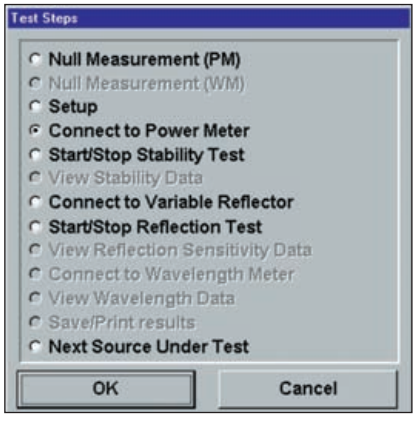
- Absolute power calibration and linearity measurement of fiber-optic power meters
- Output power level and power stability of light sources
- Optical return loss, insertion loss, linearity, and repeatability measurements of optical attenuators
- OTDR attenuation and distance range verification (manual procedure, using calculation templates)

Integrated Solution

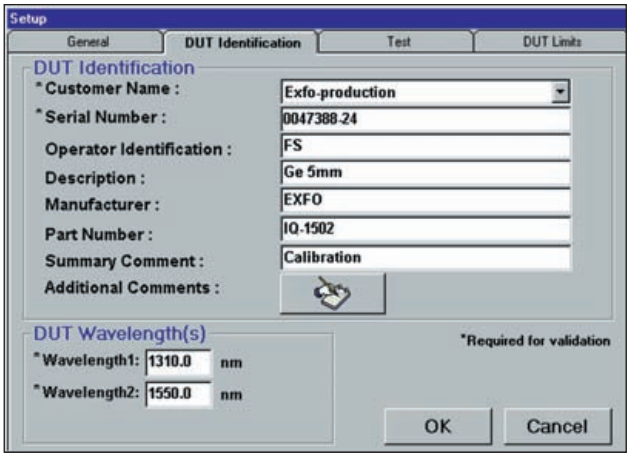
The IQS-12002 calibration software. integrates the operation of test and measurement instruments and provide an automated turnkey approach to all your testing needs. This efficient and user-friendly software controls measurement from start to finish according to user-selected parameters. Moreover, it eliminates the possibility of data-entry and reporting errors while avoiding costly procedural mistakes.

In addition, time-saving features, like Pass/Fail testing and automatic prompting for the next device under test, considerably increase the system's efficiency when compared to traditional test systems. The built-in flexibility of the IQS-12002 calibration software, combined with the modular design of the IQS-500 Intelligent Test System, give the user the freedom to quickly reconfigure any tests for different products as well as control module operation. A single software package performs single- or dual-wavelength tests on singlemode fiber.

A convenient step summary indicates the progress of the user-defined test sequence.



Test steps



Detailed information about DUT

Main features of the IQS-12002 software

- Step-by-step operating instructions in both graphical and text formats, using an intuitive and flexible software
- All detailed information about each device under test is saved in a database
- Generate detailed reports with data tables and graphs that can be printed in summary or detailed format
- Industrial PC-based Windows 98™ environment

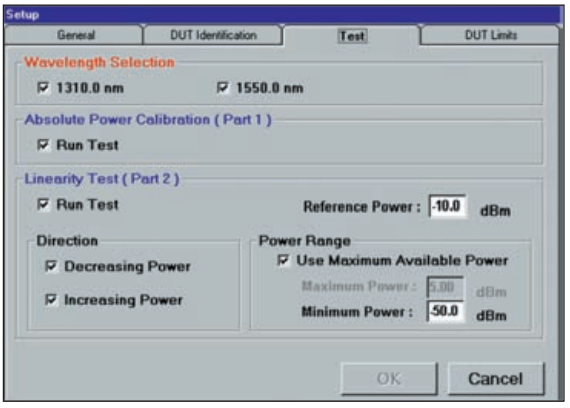
Optical Power Meter Calibration

- Standard system for the Telco industry
- Singlemode, 1310/1550 nm
- Absolute power calibration from –3 to –40 dBm (–10 dBm recommended by NIST)
- Linearity measurements with an uncertainty of ±0.01 dB up to more than 0 dBm
- ±0.9 % calibration traceable to NIST

Product calibration and verification of specifications are important steps in ensuring compliance to required quality assurance programs such as ISO-9000. Power meters and other fiber-optic instruments must be periodically verified to guarantee that their optical calibration constants remain the same over a certain period of time. The optical-calibration constants are related to the spectral responsivity curve of the detector (amps per watt versus wavelength).

The two key issues characterizing the calibration and verification of fiber-optic power meters are:

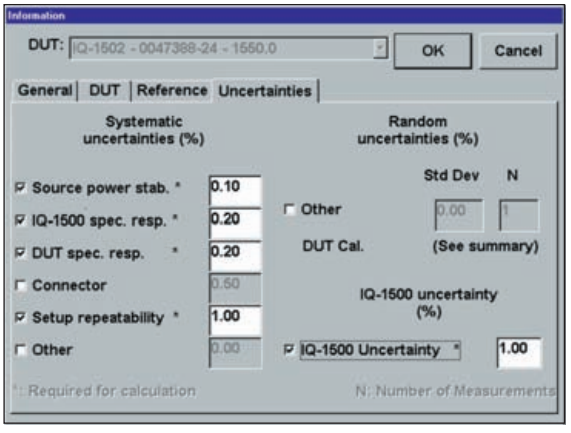
- Absolute-response calibration at one or more wavelengths (absolute power calibration)
- Response linearity with varying input-power levels (optical linearity measurement)



Typical test for absolute-power calibration and linearity of power meters

Absolute-Power Calibration

The power reading of the device under test, or DUT (power meter), is compared to the power reading of a highly accurate reference power meter (IQS-1500) traceable to a primary reference standard of NIST (USA) at the calibration light source wavelength. The IQS-2400 DFB laser, with its excellent power stability over short periods, is preferred because its central wavelength can be accurately located, and the error due to the spectral width is lesser than that of a Fabry-Perot laser. The calibration software takes into account many system and random sources of error and provides a calibration factor and total uncertainty calculation.

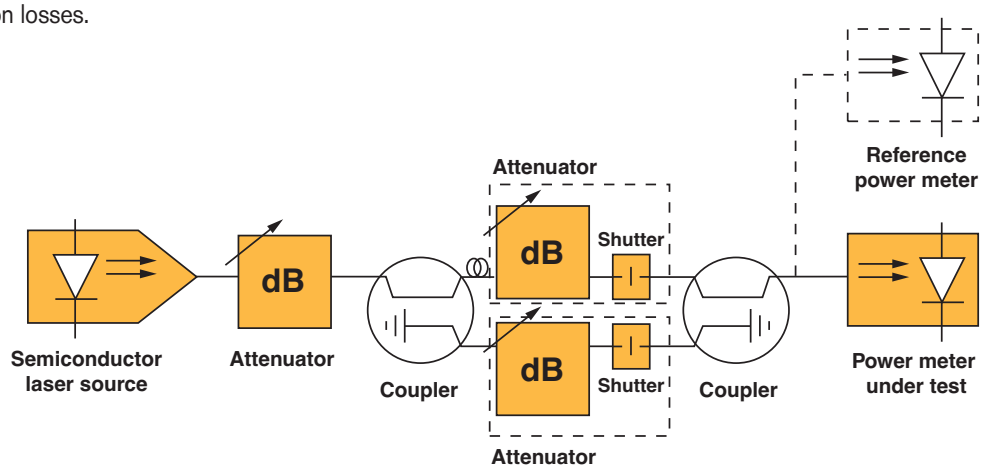


Uncertainty calculations

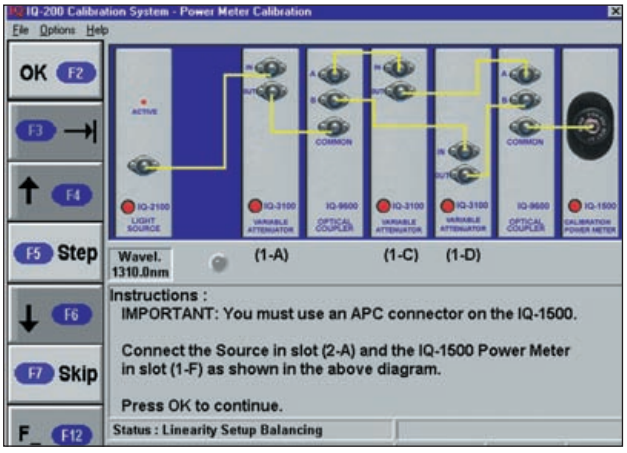
Optical Linearity

The superposition method consists of verifying, as a function of the dynamic power range of the DUT, that the sum of half the power read in each branch of a 1x2 coupler is equal to the total power read by the two branches simultaneously. The software can be configured to test for both increasing and decreasing power.

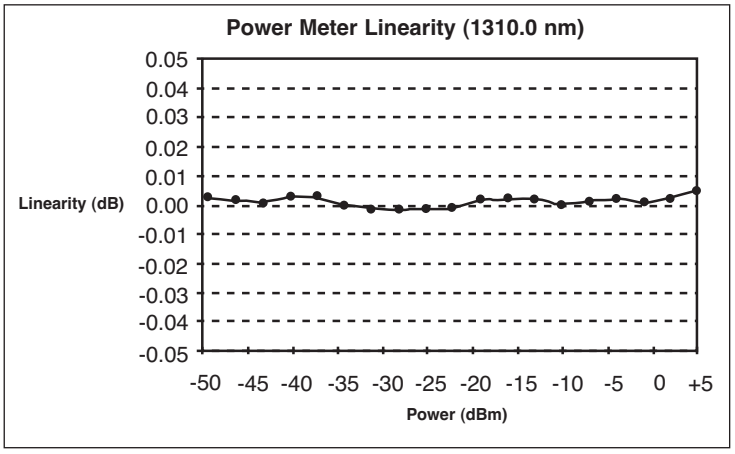
This is more precise than using a direct line attenuator. The setup includes variable attenuators (IQS-3100) and optical couplers (IQS-9600) with low insertion losses.



Typical setup of power-meter linearity test



Typical power-meter linearity test setup



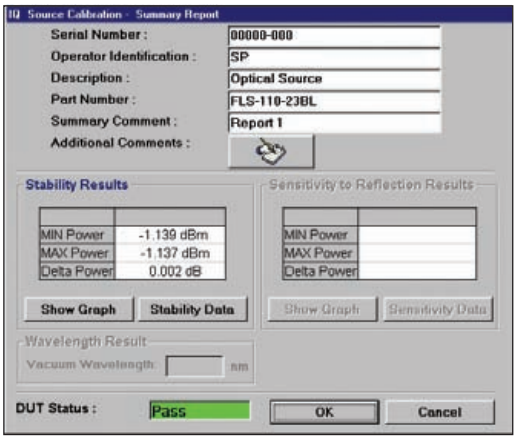
Graphical results of power-meter linearity

Optical Light Source Verification

Light sources using semiconductors can only be verified to ensure they meet their stated specifications. The IQS Optical Calibration System tests all source parameters with a single application.

The verified parameters are:

- Output power level
- Power stability

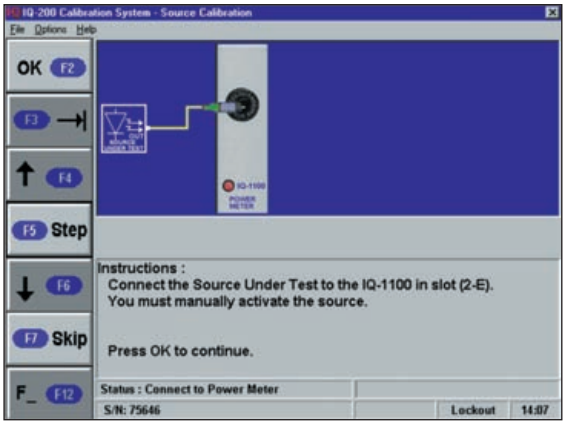


Summary report of tests performed on a light source

Output Power Level and Power Stability

Any source output power fluctuates as a function of time. The source power level and stability must be stated for both the short term (e.g., 15 minutes) and the long term (e.g., over one to eight hours) depending on the applications. To record power stability, the source is connected to a power meter (IQS-1100), and its output power is monitored by the power meter as a function of time.

Typical light source power stability vs. time diagram

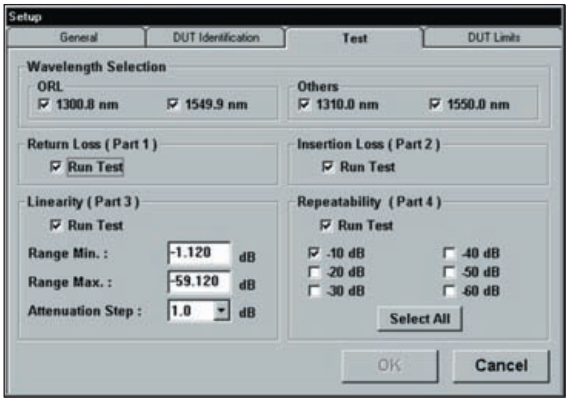


Typical light source verification setup

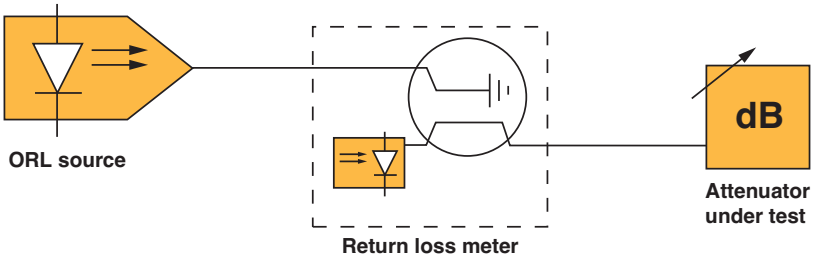
Optical Attenuator Verification

Attenuators can only be verified to ensure that they meet their stated specifications. The following tests are supported by the IQS Calibration System and the integrated IQS-12002 calibration software:

- Optical return loss
- Insertion loss
- Optical linearity
- Repeatability



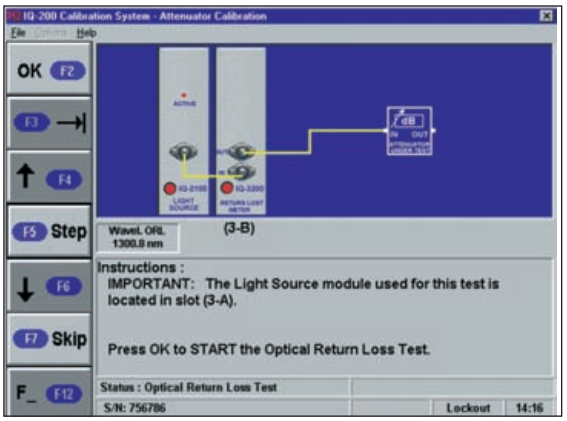
Typical tests performed on an attenuator



Typical return loss test diagram

Optical Return Loss

To measure the optical return loss of the DUT (attenuator), an ORL meter (IQS-3200) is used in conjunction with an ORL source (IQS-2100) to monitor the reflectance of the DUT. The IQS Optical Calibration System performs the return loss measurement in accordance with the EIA-TIA Fiber Optic Test Procedure (FOTP 107).

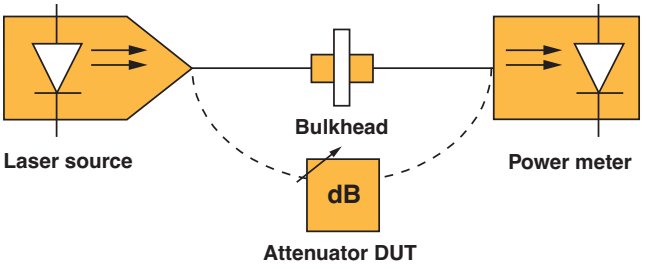


Typical return loss test setup for an attenuator

Insertion Loss

To test the attenuator's insertion loss, a power reference is first taken with a light source (IQS-2400) connected to a power meter (IQS-1100) using two patchcords connected to a bulkhead adapter.

The bulkhead adapter is then disconnected and replaced by the DUT (attenuator). The DUT is set to the minimum attenuation setting. The source transmits the signal through the DUT, and the power is read by the power meter.



Typical insertion-loss setup

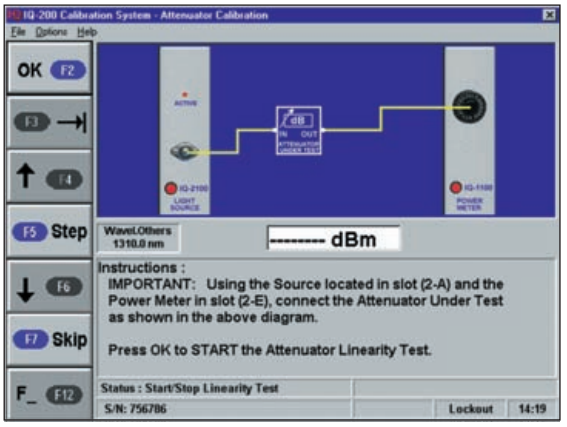
Optical Linearity

The optical linearity of the attenuator is tested over the requested attenuation range using a stable DFB source (IQS-2400 BLD) and a highly linear power meter (IQS-1103).

The discrepancy between the set attenuation of the DUT and the power-meter reading is equal to the linearity error.

Repeatability

The attenuator must also be tested for repeatability, i.e., when an attenuation is changed from a preset value to a new one, the attenuator will still provide the former when reset to the first value. Repeatability is critical when the change from one value to another, and back, is performed over a wide range of attenuations.



Optical attenuation linearity test setup

Optical Time-Domain Reflectometer Calibration

The OTDR both locates and characterizes faults such as those caused by broken fiber, connectors, or splices. The most critical parameters to be verified in an OTDR are attenuation and distance-range accuracy.

When it comes to performance, EXFO understands the need for precision. For this reason, EXFO provides a procedure to check the OTDR performance. This procedure is not intended to replace the manufacturer's recommended calibration service where other aspects of OTDR functionality such as mechanical integrity, output connector condition, laser output power, and dynamic range are verified.

The IEC Calibration Procedure was used as a reference to build this procedure, which is performed using calibrated fibers with known attenuation and range length. The fibers are obtained from a well known European calibration laboratory, the National Physical Laboratory (NPL).

EXFO's simplified and cost-effective procedure allows you to perform attenuation and distance-range verification of an OTDR by comparing the readings (attenuation and distance range) of the OTDR DUT with the calibrated values of NPL fibers. Templates are available to guide the user through the steps and calculations for each measurement.

- Two spools of fiber are supplied with typical lengths of 2.2 km and 12.8 km
- Precise calibration of attenuation uniformity and distance range performed by NPL
- Attenuation uniformity uncertainty (bidirectional measurement): ±0.006 dB/km
- Distance range uncertainty: ±0.5 m for 2.2 km, ±0.6 m for 12.8 km

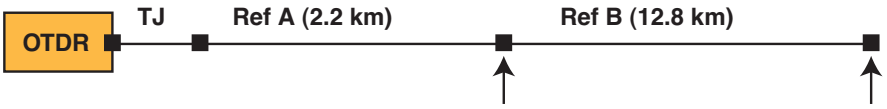


Diagram of attenuation uncertainty

OTDR calibration

SPECIFICATIONS [a]

Power meter calibration		
Wavelength (nm)	1310 ±1	1550 ±1
Absolute power reference uncertainty [b] (%)	±0.9	±0.9
Recommended optical power level for calibration (µW)	100 (–10 dBm)	100 (–10 dBm)
Linearity test power range (dBm)		
typical	0 to –90	0 to –80
minimum	–5 to –90	–5 to –70
Uncertainty of the linearity test [c] (dB)	±0.01	±0.01
Light source calibration		
Test	output power/stability	
Wavelength range (nm)	800 to 1700	
Power range of source (dBm)	+5 to –60	
Maximum no. of samples	3600	
Attenuator calibration		
Wavelength (nm)	1310 ±1	1550 ±1
Attenuation range (dB)	0 to 60	0 to 60
Uncertainty of the linearity test (dB)	±0.02	±0.02
Insertion loss and repeatability test resolution (dB)	0.001	0.001

GENERAL SPECIFICATIONS

Recommended reference conditions	
Temperature (operating)	23 °C ±1 °C
Maximum environmental specifications	
Temperature	
operating	23 °C ±5 °C
storage	–35 °C to 70 °C
Relative humidity	0 % to 80 % non-condensing

STANDARD ACCESSORIES

Instruction manual and IQS-12002 calibration software, IQS-1500 Certificate of Calibration, connection cards

Fiber type: singlemode
Warm-up time: 15 minutes minimum, 1 hour recommended
Recommended calibration interval: one year

NOTES

a. Uncertainties due to the DUT are excluded.
b. ±0.9 % with option Q1, ±2 % with option Q0.
c. Down to –60 dBm maximum at 1310 nm and 1550 nm if the power meter resolution remains 0.001 dB.

ORDERING INFORMATION

IQS-12002-XX-XX-XX-XX-XX-XX-XX-XX

Platform and expansion unit
PC-05 = 1 industrial computer + 1 IQS-510E-E3 (6 slots available)
PC-06 = 1 industrial computer + 2 IQS-510E-E3 (12 slots available)
PC-07 = 1 industrial computer + 3 IQS-510E-E3 (18 slots available)

Wavelength option
02 = IQS-2402BLD-P4-CU-M5-EA-EUI-89
03 = IQS-2403BLD-P4-23-M5-EA-EUI-89
23 = IQS-2402BLD-P4-CU-M5-EA-EUI-89, IQS-2403BLD-P4-23-M5-EA-EUI-89

Power meter calibration option
APC-Q1 = IQS-1502-Q1-B-XX, IQS-3100-B-EA-EUI-89, TJ-B58-58, TJ-B58-XX
APC-Q0 [a] = IQS-1502-Q0-B89, IQS-3100-B-EA-EUI-89, TJ-B58-58, TJ-B58-89
APLC-Q1 = IQS-1502-Q1-B-XX, IQS-9601-03-B01-EA-EUI-89, IQS-9601-03-B02-EA-EUI-89, IQS-3100-B-EA-EUI-89 (3x), TJ-B58-58-0.3M (6x), TJ-B58-XX
APLC-Q0 [a] = IQS-1502-Q0-B89, IQS-9601-03-B01-EA-EUI-89, IQS-9601-03-B02-EA-EUI-89, IQS-3100-B-EA-EUI-89(3x), TJ-B58-58-0.3M (6x), TJ-B58-89

Connector
58 = FC/APC
88 = SC/APC
89 = FC/UPC
91 = SC/UPC

Connector
58 = FC/APC
88 = SC/APC
89 = FC/UPC
91 = SC/UPC

Source and attenuator calibration
00 = Without attenuator calibration
SAV = IQS-1103-XX, TJ-B58-XX (2x), RAC-XX

Connector
58 = FC/APC
88 = SC/APC
89 = FC/UPC
91 = SC/UPC

Attenuator return loss
00 = Without attenuator return loss
ARL = IQS-2123ORL-EA-EUI-89, IQS-3200-B-EA-EUI-89, TJ-B58-58, TJ-B58-XX

Example: IQS-12002-PC-05-02-APC-Q0-89-ARL-91-SAV-91

NOTE

a. With connector 89.

OTDRCAL-50

OTDR Calibration kit include:
AOP–35 (2.2 km)
AOP–38 (12.8 km)
DC0022 (template)
DC0023 (template)

EXFO Corporate Headquarters > 400 Godin Avenue, Quebec City (Quebec) G1M 2K2 CANADA | Tel.: 1 418 683-0211 | Fax: 1 418 683-2170 | info@EXFO.com
Toll-free: 1 800 663-3936 (USA and Canada) | www.EXFO.com

EXFO America	3701 Plano Parkway, Suite 160	Plano, TX 75075 USA	Tel.: 1 800 663-3936	Fax: 1 972 836-0164
EXFO Europe	Omega Enterprise Park, Electron Way	Chandlers Ford, Hampshire S053 4SE ENGLAND	Tel.: +44 2380 246810	Fax: +44 2380 246801
EXFO Asia	151 Chin Swee Road, #03-29 Manhattan House	SINGAPORE 169876	Tel.: +65 6333 8241	Fax: +65 6333 8242
EXFO China	No. 88 Fuhua, First Road, Central Tower, Room 801 Futian District	Shenzhen 518048 P. R. CHINA	Tel.: +86 (755) 8203 2300	Fax: +86 (755) 8203 2306
	Beijing New Century Hotel Office Tower, Room 1754-1755 No. 6 Southern Capital Gym Road	Beijing 100044 P. R. CHINA	Tel.: +86 (10) 6849 2738	Fax: +86 (10) 6849 2662

SPIQS12002.2AN

Printed in Canada 08/04

EXFO EXPERTISE REACHING OUT