9600 Series Power Meter

9800 Series Light Source

OPERATION & MAINTENANCE GUIDE

TEMPO COMMUNICATIONS

KINGFISHER a TEMPO company

中国大陆代理商

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DECLARATION OF CONFORMITY

IN ACCORDANCE WITH ISO/IEC 17050:2004

KINGFISHER a TEMPO company

Manufacturer's Name: Kingfisher International Pty. Ltd.
Manufacturer's Address: 720 Springvale Road, Mulgrave, Victoria 3170, Australia

hereby declares, that the products listed below

Product Name: **Light Source, Power Meter**
Model Number: **9800 Series, 9600 Series**
Product Options: *This declaration covers all options of the above product(s)*

comply with the essential requirements of the applicable European Directives:

- Low Voltage Directive 2014/35/UE and the EMC Directive 2014/30/UE, and carries the CE marking accordingly
- Directive 2011/65/EU on restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS)
- Directive 2012/19/EU on waste electrical and electronic equipment (WEEE). The instrument can be disposed of local retail shop with WEEE collection point.

and conform to the following standards and specifications:

MIL-PRF-28800F: 1996 Performance specification- Test equipment for use with electrical and electronic equipment, general specification
IEC 60529: Ed. 2.2 / EN 60529: 1991 Degrees of protection provided by enclosures

Power Meter conforms to:
IEC 61315: Ed. 2.0 Calibration of fibre-optic power meters

EMC	**Limit**
IEC 61326-1 Ed. 2.0 / EN 61326-1:2013	
IEC CISPR 11 Ed. 6.1 / EN 55011:2016	Limits applicable to Group 1 Class B equipment
IEC CISPR 16-1:2004~2019	Limits applicable to Class B equipment
IEC CISPR 16-2:2003~2016	Limits applicable to Class B equipment
IEC 61000-4-2 Ed. 2.0 (2008) / EN 61000-4-2:2009	4kV CD, 8kV AD
IEC 61000-4-3 Ed. 3.2 / EN 61000-4-3:2006	3V/m, 80-1000MHz
ICES-001:2006 (Canada)	
CFR 47 FCC Part 15, Subpart B (Exempted devices) (USA)	

Safety

Light Source conforms to:
IEC 60825-1:2014 Safety of laser products - Equipment classification, requirements and user's guide
IEC 60825-2:2021 Safety of laser products - Safety of optical fibre communication systems (OFCS)
CFR 21part 1040.10 (FDA) Performance standards for light- emitting products-Laser products

Supplemental Information:

The product was tested in a typical configuration with Kingfisher International test systems.

28 Apr 2021
Date

Bruce Robertson
Name

Technical Director
Title

For further information, please contact your local Kingfisher International sales office, agent or distributor.

9600 Series Optical Power Meter

9800 Series Optical Light Source

Tempo series/model numbers with prefix "T"

Kingfisher series/model numbers with prefix "KI"

Congratulations on your purchase of this instrument, which has been engineered to provide the best possible reliability, convenient and performance. To get the best use from your equipment and ensure its safe operation, please spend a few minutes to read this manual.

Worldwide recognized accuracy and quality

ISO 17025

20533

Made in Australia. International Patents Granted

19th Edition, Nov 2023

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SERVICE, CALIBRATION AND SUPPORT

Applications Support

Please visit www.kingfisherfiber.com to see our comprehensive **Application Notes** written to support instrument users.

Look at www.kingfisherfiber.com to find distributor details from the **Contact Us** section.

Our local agents are able to offer excellent applications advice in your language and time zone.

Please visit our website on www.kingfisherfiber.com for a current list of regional Service & Calibration centres.

Otherwise if you are having difficulties please feel free to contact sales@kingfisher.com.au for applications support.

Instrument Service

Tel: (61) 3-8544-1700
Email: sales@kingfisher.com.au

Qualified personnel must perform adjustment, maintenance or repair of this product. To obtain service, please contact your local Kingfisher International distributor or our office in Australia

Instrument Returns

If returning equipment to Kingfisher International for service or calibration, please download and complete the **Return Material Authorization Form** located on the **Support** page on our web site www.kingfisherfiber.com .

To avoid delays and minimise disruption for our customers, Kingfisher International offers a fixed price repair service.

For the staff at our fully equipped service and calibration centre, it is their pleasure to keep your equipment performing at its very best.

INTRODUCTION AND APPLICATIONS

The 9000 Series Optical Power Meter and Optical Light Source offer both ease of use and superb measurement confidence. They are very convenient to use and, have reduced cost of ownership. Calibrations are ISO 17025 traceable.

This equipment can be effectively used by installers, technicians and engineers to test all types of fiber optic systems in various applications including SMF, MMF, POF, PCS and ribbon fiber:

- Tx / Rx absolute power levels in dBm
- Optical loss in dB
- Continuity testing with the versatile test tone features

The interchangeable optical connectors are drop and dust protected by a snap on cover. A wide variety of connector styles are available.

The instruments feature a tough polycarbonate housing with shock absorbent sides and corners, which has passed extensive drop testing.

Calibration can be performed by any suitably equipped laboratory. The recommended re-calibration cycle is 3 years.

Power Meter features

The standard power meters work with fiber core diameter up to 200 microns, with both PC and APC polish connectors.

Large area detector power meters work with fibers with up to 3 mm active area including MPO/ MTP connectors with up to 72 fibers.

Detector options include Germanium (Ge), Indium Gallium Arsenide (InGaAs), Silicon (Si), high power, large area and wavelength selective.

Power meter calibration options are available from 470 nm to 1625 nm with specified accuracy at power levels from +24 to - 60 dBm.

The display shows dBm, dB and linear units, and display hold is useful for data recording.

Superior measurement confidence is achieved with a unique Total Uncertainty Specification, which covers the full temperature, measurement and connector range. An ILAC/NATA traceable calibration certificate is supplied.

The sensitive optical tone detector displays the actual measured tone frequency in Hz. If a standard tone is detected, the buzzer sounds, which is useful for fiber identification and continuity testing. MultiFiber ID (new to A series) can also separately identify any of 12 test tones from a compatible source, greatly speeding up continuity / polarity testing.

Power stability testing is easily using the max/min recording function.

TamperLock mode (new to A series) is a useful way to lock the instrument features to enforce pre-set & error free operation. TamperLock operation is auditable and can be defeated on-site if needed.

Slow Mode (new to A series) can be used to increase signal averaging for noisy signals.

Light Source features

Multiple wavelength sources have 1 - 3 switchable wavelengths through one port, which makes operation faster.

Laser sources at 1490 / 1310 / 1550 / 1625 nm are used for testing single mode fiber systems. Laser source power levels can be adjusted 3 dB by the user in 0.1 dB increments.

LED sources at 850 / 1300 nm used for testing multimode fiber systems.

The 1300 nm LED source can also perform moderate distance single mode testing.

The 660 nm LED source option is ideal for POF testing in combination with 9600 XL power meters.

VFL laser sources at 635 and 650 nm have some specific advantages compared to common VFL pens such as: improved eye safety when no fiber is attached, replaceable through connector, proper connector interface which won't damage connectors by rotation, APC interface option, proper interchangeable connector adaptors, wider variety of laser options, tone options that work with a clip-on fiber identifier

Light sources have re-connection repeatability of 0.1dB. Combined with the instrument excellent stability, this provides more accurate measurement results and improved test confidence.

TamperLock mode is a useful way to lock & pre-set the instrument features to simplify operation. TamperLock operation is auditable and can be defeated if needed.

AutoTest can be used with a suitable Autotest compatible power meter such as the 2600 series (not the 9600 series) to synchronise the power meter and light source wavelengths and other parameters.

A multiFiber ID feature (new to A series) provides easy multi-fiber identification of up to 12 fibers at a time. To use this feature, multiple light sources are set up on multiple fibers, with each one set to a different tone. When a tone is detected by a power meter, a buzzer sounds, and the corresponding fiber ID number is displayed.

GENERAL SAFETY SUMMARY

The following safety signs and symbols specify general safety precautions which must be observed during all phases of operation, service and repair of this instrument.

Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture and intended use of the instrument. Kingfisher International assumes no liability for the customer's failure to comply with these requirements.

Before operation, review the instrument and user manual for safety instructions. You must follow these to ensure safe operation and to maintain the instrument in safe condition.

WARNING!

The **WARNING!** sign denotes a hazard. It calls attention to a procedure, practice or the like, which, if not correctly performed or adhered to, could result in injury. Do not proceed beyond a **WARNING!** sign until the indicated safety conditions are fully understood and met.

CAUTION!

The **CAUTION!** sign denotes a hazard. It calls attention to an operating procedure, or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part, or all, of the product. Do not proceed beyond a **CAUTION!** sign until the indicated conditions are fully understood and met.

Safety Symbols

The apparatus will be marked with this symbol when it is necessary for the user to refer to the instruction manual in order to protect the apparatus against damage.

Initial Inspection

Inspect the shipping container for damage. If there is damage to the container or cushioning, keep them until you have checked the contents of the shipment for completeness and verified the instrument both mechanically and electrically. If the contents are incomplete, mechanical damage or defect is apparent, or if an instrument does not pass the operator's checks, notify the nearest Sales/Service Office.
To check instrument performance, please refer to **Performance Verification Tests** section of this manual.

WARNING! You must return instruments with malfunctions to a Service Centre for repair and calibration.

Operating Environment

The range of Kingfisher equipment covered by this manual can be operated at temperatures between -15 °C and +55 °C and at relative humidity of <95 %.

Storage and Shipment

The range of Kingfisher equipment covered by this manual can be stored or shipped at temperatures between -25 °C and +70 °C and at relative humidity of less than 95 %. Protect the unit from temperature extremes that may cause condensation within it.

Safety

This instrument contains no hazardous optical or electrical items. When using this equipment, optical safety precautions should be observed commensurate with the maximum available source power, since most of this power can also be coupled out of the instrument.

WARNING! Observe optical safety when using high power.

Optical safety requirements at high power levels **MUST** be observed or eye damage is likely. Organisations and users operating optical equipment with these power levels **MUST** determine and observe relevant safety precautions, which are beyond the scope of this manual.

Never look into the end of an optical cable or connector which might be attached to an active source.

Do not enable a laser when there is no fibre attached to the optical output connector.

Optical magnifying instruments (e.g. microscope) increase eye hazard unless they contain suitable optical attenuating filters. Disconnect the source before using an optical magnifier.

The laser module has a built-in safety circuitry which will disable the optical output in the case of a fault condition, however, this cannot be guaranteed.

An equipment assurance program is recommended to check for safe laser operation.

Kingfisher Laser Eye Safety Information

This information on laser eye safety compliance covers all standard product variants.

Wavelength	
Visual laser	635 / 650 ± 5 nm
Surface emitting LED[3]	850 /1300 ±50 nm
VCSEL laser	850 ±20 nm
Infra-red laser	1310 / 1490 / 1550 / 1625 ±20 nm

Max CW output power[1]	
635 nm visual laser	0.63 mW
650 nm visual laser	5.01 mW
850 / 1300 nm surface emitting LED[3]	0.01 mW
850 nm VCSEL laser	0.63 mW
1310 / 1490 / 1550 / 1625 nm infrared laser	1.00 mW

International Standard IEC 60825-2:2021 & IEC 60825-1:2014

Wavelength	*Instrument hazard level*
635 nm	Class 1
650 nm	Class 2M
850 / 1300 / 1310 / 1490 / 1550 / 1625 nm	Class 1

USA Standards ANSI Z136.2 / 21 CFR 1040.10 (1995)

Labelling for this product defers to IEC 60825 as per CDRH Laser Notices No. 50 (2007) & 56 (2019). Annual FDA reports are lodged by Kingfisher.

Maximum permissible CW output power[2]

IEC 60825-2:2021 – Class 1

650 nm, MM or SM fiber	1.95 mW
850 nm, MM or SM fiber	3.88 mW
1310 nm, MM fiber	77.8 mW
1310 nm, SM fiber	25.8 mW
1550 nm, SM fiber	10.2 mW

Note 1: Specified CW output power is the optical power that the Source can produce at its output connector. Refer to specification sheet for actual operating power.

Note 2: Maximum permissible CW output power is the highest optical power that is permitted within the appropriate laser class. Refer to specification sheet for actual operating power.

Note 3: LED devices are no longer identified in the latest revision of IEC 60825-1.

WARNING!

Optical power levels in fiber optic systems can cause permanent eye injury and damage to eyesight.

BATTERY POWER

These instruments are powered by two 1.5 V dry alkaline 'AAA' size batteries. Alternatively, use re-chargeable NiCad or NiMH batteries:

Model	Battery run time in hours
9600 Optical Power Meter	300
9800 Optical Light Source	Laser/LED source: 40/35 hours in Autotest, typical

When the batteries are low, the low battery indicator is shown on the display. At this stage, there is approximately enough energy for another 20 hours of use.

To save energy, the instrument automatically turns off after 10 minutes without operation.

To change the batteries, open the cover of the battery compartment at the side of the instrument, remove the batteries and insert new ones.

When an instrument is put away for storage, it is good practice to remove batteries to prevent the possibility of battery acid leakage damaging the equipment.

CAUTION!

Do not use lithium batteries or other batteries with a nominal voltage greater than 1.8 V. The instrument may be damaged.

Protect our environment! Batteries purchased from Kingfisher agents can be returned to them for appropriate disposal.

OPTICAL CONNECTOR

Light Source and Standard Power Meter

To access the optical connector, grasp the top left corner of the instrument, and pull off the cover.

To install an adaptor, align the locating slot on the side of the through adaptor with that on the instrument connector, and press it on.

To remove an adaptor, press button on the front of the instrument and then pull off the adaptor. It is easier to pull off the adaptor with a test lead in place, since this gives better grip.

Different styles of connector adaptor (ST, SC, FC, MU, LC/F3000, E2000/LSH, D4, MU, 2.5mm universal, SMA and LSA/DIN etc.) can be easily fitted by the user.

CAUTION! When not in use, keep the test port and connector covered. Do not touch connector tip with your fingers, since body oils and dirt can impair connector performance.

The supplied standard adaptors have ceramic sleeves and do not cause metal dust contamination, which can cause connector failure and fiber fuse at very high power levels.

CAUTION! Do not use damaged or incompatible connectors.

CAUTION! When using bare fiber adaptors, do not scratch the detector lens with a glass fiber end.

Power Meter

Power meter can be used with **both** PC **and** APC connector styles.

Bare fiber adaptors must achieve fiber eccentricity of ± 100 microns, and end tolerance of ± 300 microns relative to the ferrule end. Preferred bare fiber adaptors consist of a connector with fiber retention device or other end stop.

For regular work with bare fibers, it is preferable to use an alternative arrangement such as a multimode pigtail with a v-groove or mechanical splice.

Large Area Power Meter

Power meters with a large area .detector do not have a snap-on dust cover, and may not have any connector fitted as delivered.

The threaded connector adaptor is easily installed or removed by rotating the adaptor. For model, 9600XL-Ge7, when fitting an MPO connector adaptor, continue rotating the adaptor clockwise until a “click” is felt. At this point the adaptor is rotationally aligned with the rectangular detector chip on power meter.

CAUTION! It is suggested to always leave a connector adaptor in place to physically protect the detector.

Note these adaptors are usually metallic, so if they are used on high power systems, extra cleaning of the connector after insertion into the adaptor is advisable.

A light source is **either** PC **or** APC connector specific. This is determined when ordering the instrument.

OPTICAL CONNECTOR

CAUTION! The use of bare fiber adaptors is not recommended as permanent instrument damage will occur.

How to clean the optical connectors

Always clean the mating connector tip and ferrule before mating, using approved materials.

CAUTION! Do not attempt to clean an optical interface with anything hard that could scratch glass, or permanent instrument damage may occur.

Power Meter

The glass power meter interface does not make contact with the inserted connector - there is a slight air gap. Therefore it will not wear, and only needs occasional cleaning.

To clean, first remove the connector adaptor to access the glass interface, then use a soft brush, alcohol, air can or sticky material such as 'Blu tac' to remove dirt.

Large Area Power Meter

The window on the large area detector is delicate and should not be scratched, pushed or banged.

Light Source

To clean the interface, use stick style connector cleaner and blow away any dust or dirt with compressed air.

If this is not sufficient, clean the interface by rubbing a lint-free lens cloth over the surface using small circular movements

WARNING! Disable source when cleaning optical interface. Remove batteries before using a microscope to inspect instrument connector.

OPERATION: Power Meter

WARNING! Observe optical safety procedures relevant to the power levels being measured.

To switch on 9600 instrument for permanent operation, press and hold [POWER] during turn-on. 'Perm' on the display indicates that the unit will stay on permanently. Also during instrument turn on:

- to view all display segments, press and hold down [λ ◂]
- to display firmware version, press and hold down [HOLD]
- for quiet non-beeping operation, press and hold down [▸ λ]

Should the instrument fail to turn on, the microprocessor may need re-booting. To do this, remove the batteries for at least 40 seconds.

After turn-on, the instrument performs a self-calibration sequence, and then displays absolute power in dBm at the previously set wavelength. If 'HI' or 'LO' are displayed, the input is out of range.

To measure the operational power level in a fiber optic system, the meter is used in dBm or linear modes. To measure optical loss or attenuation, the power meter is used in dB mode, and the source power is taken as a reference.

To scroll wavelength, press [λ ◂] or [▸ λ]. The display shows the nominal wavelength in nm on the top right of the display.

To toggle logarithmic / relative/ linear display modes, press [dB / dBm / mW]. The display will show 'dB' or 'dBm' or 'nW'.

To stop / start display update, press [Hold]. The symbol will flash when the display is on hold.

To set reference, press and hold [Set Ref] for more than 3 sec.

When in relative mode, the reference value is displayed on the left hand side of the display.

To display max min recorded power, press and hold [Max Min]. To re-set this function, press [POWER].

When a multi-fibre ID tone (1 – 12) is detected by a power meter, a buzzer will sound and the corresponding fiber ID number (1 – 12) will be displayed.

When a standard tone is detected (e.g. 270 Hz, 1 KHz, 2 KHz), a buzzer will sound and the corresponding modulation frequency will be displayed. This is useful for fiber identification and signalling. The meter can also be used to check the actual modulation frequency of test sources.

If the meter detects a test tone higher than 200 Hz, the display will show the actual measured modulation frequency in kHz. Maximum displayed frequency is 2500 Hz.

SlowMode

Slow mode is used to measure power on unstable signals, or signals that accidentally trigger tone detection. In this mode, Autotest and tone detection are disabled, and measurement integration time is extended.

In SlowMode, the display will show average optical power of the modulated signal. The meter response will be slow

See Quick Reference Guide at the end of this manual for SlowMode operation

See later section for TamperLock operation.

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OPERATION: Light Source

WARNING! Observe optical safety procedures relevant to the light source power levels.

To switch on 9000 series instruments for permanent operation, press and hold [POWER] during turn-on. 'Perm' on the display indicates that the unit will stay on permanently. Also during instrument turn on:

- to view all display segments, press and hold down [λ ◂]
- to display firmware version, press & hold [HOLD] / [LEVEL]
- for quiet non-beeping operation, press and hold down [▸ λ]

Should the instrument fail to turn on, the microprocessor may need re-booting. To do this, remove the batteries for at least 40 seconds.

The light source may require a warm up period at the set wavelength for 15 min to achieve specified stability (ORL< 25dB).

After instrument is turned on, the display shows 'OFF; the emitters are off'. To enable a source emitter, press [λ ◂] or [▸ λ]. Operating wavelengths will be shown in the top corner on the right hand side and source power level on the left hand side.

To scroll wavelength, press [λ ◂] or [▸ λ].

The mode of operation described below is typically used to perform continuity testing with the test tone generator.

- Modulation is active only while the source is enabled. To select a modulation tone, press [MOD] to scroll through available settings.
- Press and hold [MOD], then press [λ ◂] to step down or [▸ λ] to step up the modulation tone or fiber ID number (1-12).
- Press and hold [MOD], then press [▸ λ] for 3 seconds to set tone to ID12.
- Press and hold [MOD], then press [λ ◂] for 3 seconds to turn off modulation.

Laser Output Power Adjustment

This operation mode can be useful so that both 1310 / 1550 nm have the same power meter reference level, to make dual λ testing easier.

- To decrease the laser output power, turn the laser 'on', then press [LEVEL].
- Press and hold [LEVEL], then press [λ ◂] to step down or [▸ λ] to step up the output power**.**
- Press and hold [LEVEL], then press [▸ λ] for 3 seconds to set output power to factory default. Alternatively, press [POWER].
- Press and hold [LEVEL], then press [λ ◂] for 3 seconds to set output power to minimum.

Note: This function is not available on the LED source option, and may be inaccurate on VCSEL laser sources.

TAMPERLOCK MODE

TAMPERLOCK

TamperLock Mode enables lower skill, repetitive and error-free measurements, such as fixed wavelength or laser output power.

This is useful to, for example, pre-set an instrument for use by unskilled personnel, or to just lock the instrument down for easy use for one specific application.

This achieves the operational simplicity of very basic instruments, yet allows the instrument to be re-configured as needed, so achieves both objectives.

To set up this mode, configure the instrument, and enter a unique PIN code. As long as this is maintained, the instrument is locked into this mode.

It's possible for a user to end / escape this mode (maybe they have changed work sites etc.). To re-apply the mode requires adding another PIN code.

After a job is complete, entering the known pin code will show a "pass" if the instrument is still in TamperLock mode, or "fail" if it has been escaped.

Power Meter

While in TamperLock Mode, user is prevented from changing wavelength, dB/dBm/mW, Hold, min max and SlowMode settings.

See Power Meter Quick Reference Guide at the end of this manual for TamperLock operations.

Light Source

While in TamperLock Mode, the user is prevented from changing wavelength or laser output power.

See Light Source Quick Reference Guide at the end of this manual for TamperLock operations.

AUTOTEST MODE

AUTOTEST

This feature is on the Light Source, not the power meter. It can be used with other Kingfisher power meters such as the 2000, KI 3000. KI 7000 series.

Autotest performs automated loss measurement and wavelength detection by data exchange between a Light Source and Optical Power meter. Major labour savings can be achieved.

Autotest detection remains activated for about 8 seconds after fiber disconnect, so the user can change optical connections without re-starting Autotest each time, thus achieving productivity gains. Autotest reduces source warm up drift and battery consumption compared to manual operation.

Autotest works in situations where high loss or wavelength selective elements stop some wavelengths from transmitting. The meter will detect and show whatever wavelengths are successfully received.

Instrument compatibility

Any Kingfisher Autotest source / power meter / loss test set / two-way tester can be used as a source & meter, for one direction loss testing. Both instruments must have matching source and meter wavelengths.

Initiating Autotest

Connect an Autotest light source to an Autotest power meter with an appropriate test lead, and turn on the instruments. On the light source, press [Auto], the light source will cycle through all available wavelengths (limited to 5*) and the meter will automatically switch to Autotest mode and follow it. The meter detects the correct wavelengths, and displays the nominal source power in dBm of the respective wavelengths.

See Light Source Quick Reference Guide at the end of this manual for Autotest operations

CARE OF YOUR INSTRUMENT

Follow the directions in this manual on optical connector care.

- Use only high quality sealed alkaline or NiMH or NiCad batteries.
- During prolonged storage, remove batteries to eliminate the possibility of acid leakage.
- During storage and transport, keep the instrument in its carry case to protect against crushing, vibration, dust and moisture.
- The instrument is resistant to normal dust and moisture, however it is not waterproof. If moisture gets into the instrument, dry it out carefully before using it again.
- Where possible, keep instrument away from direct sunlight.
- Clean the instrument case using alcohol or other none solvent cleaning agents. Acetone or other active solvents may damage the case.
- The instrument housing is made of tough polycarbonate material with impact absorbing rubberised sides and corner features and is therefore drop resistant.
- Carefully observe operational precautions for the type of fiber optic connector interface fitted. Refer to previous section.

Power Meter

- Input optical power must not exceed the damage level specified for each detector type.

ACCURACY CONSIDERATIONS

All Measurements

Keep optical connectors clean and in good condition. APC connectors will generally provide improved power stability on single mode systems.

For better loss testing accuracy, use an APC connector plugged into the power meter. This will reduce line reflections and improve repeatability.

To reduce the effect of polarisation changes, test leads should be neat, coiled and physically stable.

In multimode systems, modal noise and general uncertainty are much worse than in single mode systems and optimum measurement repeatability will be obtained by use of a mandrel wrap on the source patch lead.

Wavelength uncertainty affects power meter calibration. This is significant with a Ge detector in the 1550 nm band (e.g. > 1560 nm in cold weather). Or worse with InGaAs detectors @ 850 nm.

For general measuring from 660 to 1550 nm, Ge meters offer adequate accuracy for many field users.

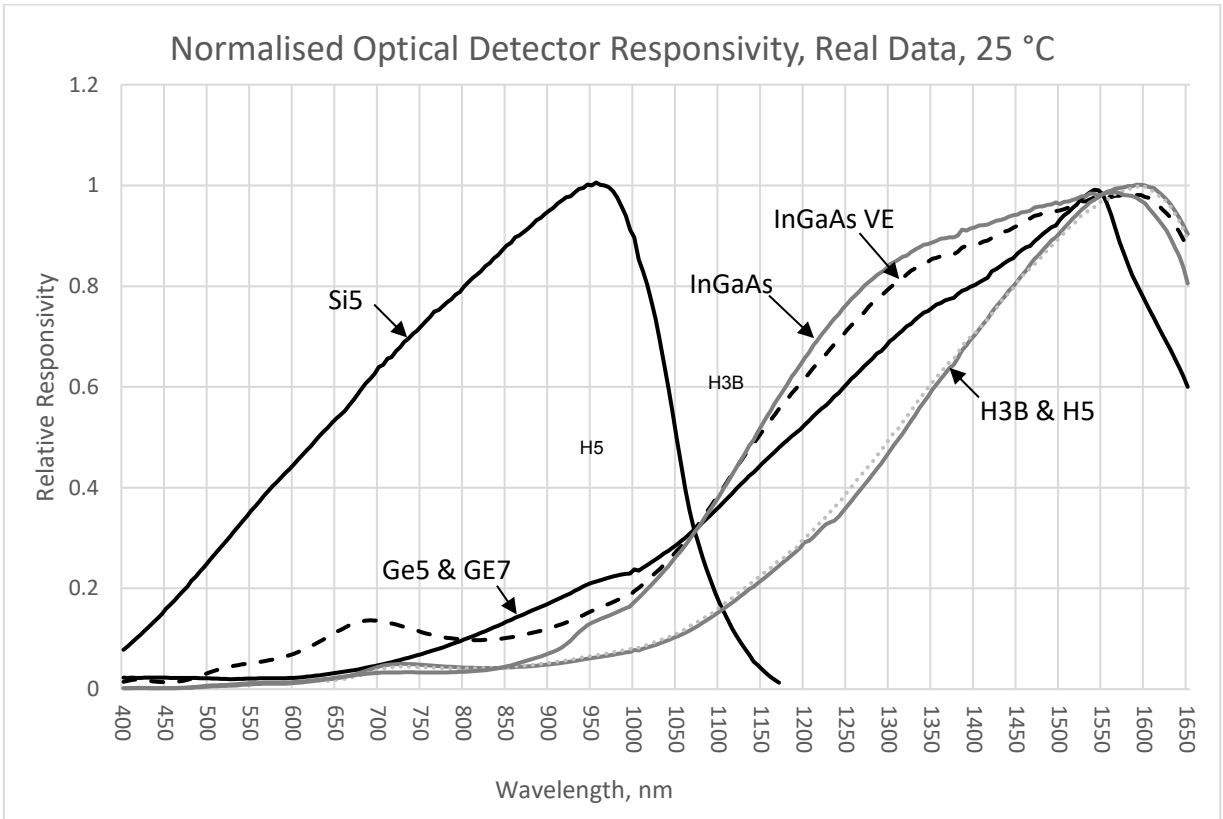
For better accuracy or linearity at wavelengths from 1000 – 1550 nm, or wavelengths above 1550 nm, the InGaAs meter is preferred.

For high power testing, the H series meters offer excellent accuracy, power handling, wavelength and connector reflections insensitivity.

Light source power may drift. When you have finished a test, go back to the start position to check if the light source power is still within acceptable limits. Specifications are for typical drift, warm up, and with a specified level of return loss. Actual drift will vary between instruments and test situations.

Most available laser sources are sensitive to reflections. Varying reflections can induce laser source instability of around 0.3 dB. This is very difficult to verify without a special test system, but can cause errors. Reduced reflection will result in improved repeatability.

Due to emitter centre wavelength uncertainty (e.g., ± 20 nm), fiber attenuation may vary with different light sources.


Normalised Optical Detector Responsivity, Real Data, 25 °C
Relative Responsivity
Wavelength, nm
1.2
1
0.8
0.6
0.4
0.2
0
400
450
500
550
600
650
700
750
800
850
900
950
1000
1050
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1450
1500
1550
1600
1650
Si5
InGaAs VE
InGaAs
H3B
H5
H3B & H5
Ge5 & GE7

DEFINITION OF TERMS

Power Meter

Power Range: the range of input powers for which the instrument can be used.

Maximum Input Power: the input power not to be exceeded to avoid destroying the instrument.

Uncertainty at Reference Conditions: the uncertainty for the specified set of reference conditions, which includes all uncertainties in the calibration chain, from the national laboratory to the test meter (connectors and test leads must be absolutely clean and undamaged). Reference conditions are the conditions during the responsivity calibration.

Total Uncertainty: the uncertainty for a specified set of operating conditions which includes noise and drift (connectors and test leads must be absolutely clean and undamaged).

Light Source

Output Power: the CW output power at the specified wavelength at the end of a reference cable.

Power Uncertainty / Repeatability: the uncertainty in power level at the end of a reference cable.

Short / Long Term (Power) Stability: in CW mode, the uncertainty of the power level observed over a given time, compared to the mean power during this time. Measured with an averaging optical power meter, a 9/125 or 62.5 µm fiber, at constant temperature, and within a specified temperature window.

Centre wavelength: the wavelength representing the centre of mass of the selected peaks**:**

$$\lambda_{cw} = (1/P_o)\Sigma(P_i\,\lambda_i)$$

where P_i and λ_i are the power and wavelength of each spectral component and P_o is the total power.

Spectral Bandwidth: FWHM (full width at half the maximum), describes the spectral width of the half-power points of the laser, assuming a Gaussian envelope of the spectral power distribution. The half-power points are those where the power-spectral density is one half of the peak amplitude of the Gaussian curve:

$$\Delta\lambda_{RMS} = \left(\frac{\Sigma\, P_i\, \lambda_i^2}{P_{total}} - \lambda_{center}^2 \right)^{1/2}$$

and

$$\Delta\lambda_{FWHM} = M\,\Delta\lambda_{RMS}$$

where: λ_{center} = center wavelength of laser diode (in vacuum)
P_{total} = ΣP_i = total power, in watts
P_i = power of i^{th} longitudinal mode
λ_i = wavelength of i^{th} longitudinal mode (in vacuum)
M = multiplication factor; for a source with a Gaussian envelope M = 2.35; for other types of spectra, use M = 2.35 as well.

SPECIFICATIONS

General Specifications:

Size:	124 x 81 x 25 mm, 4.9" x 3.2" x 1"
Weight:	150 gm, 0.3 lb
Power Meter XL Series	160 gm, 0.4 lb
	Shipping 0.5 Kg, 1.1 lb.
Operating/ Storage:	-15 to 55 °C / -25 to 70 °C.
Power:	2 alkaline 'AAA' cells
Case:	Polycarbonate, 2.5 meter drop tested.
Calibration:	Performed without opening instrument. Recommended calibration cycle: 3 years.
Display:	4 digit high custom contrast LCD Linear: 3 digits (100-999) or 0.01 nW
Power Meter:	
Tone detection:	200~ 2500 Hz ±2%.

SPECIFICATIONS

9800 Optical Light Source:

	1310 or 1310/1550 nm Laser	1310/1625 nm Laser	1310/1490/ 1550 nm Laser	1310/1550/ 1625 nm Laser	635 nm Laser	650 nm Laser	850 nm VCSEL	850 / 1300 nm LED	660 nm LED	Comments
Power (dBm) @ Fiber Type(μm)	0 @ 9/125	0 @ 9/125	-4 @ 9/125	-4 @ 9/125	-2 @ 9/125	+7 @9/125	-2 @ 62.5/125	-20 @ 62.5/125 -22.5 @ 50/125 -32 @ 9.5/125	-6 @ 1000 POF	± 1 dB (@ 9/125, 62.5/125, 1000 POF only)
Short term stability (dB)	0.04[1]	0.06[1]	0.04[1]	0.06[1]	N/A	N/A	0.12[1]	0.01	0.01	For 15 min, typical, ± Δ 2°C, after warmup
Stability over temp (dB)	0.6	0.6	0.6	0.6	N/A	N/A	0.8	0.35	0.35	Typical, over temperature
λ initial tolerance (nm)	20	20	20	20	5	5	20	NA	5	At 25 °C
λ width, nm	3	3	3	3	3	3	< 1	NA	20	FWHM, typical
λ nm/°C	0.4	0.4	0.4	0.4	0.1	0.1	0.1	0.4	NA	Typical
Mode Controlled Source	NA	NA	NA	NA	NA	NA	Mode controlled[2]		NA	
Reconnection repeatability (dB)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.05	NA	95 % confidence
Modulation		270 Hz, 1 kHz, 2 kHz ± 2 %								
Blinking 2 Hz	NA	NA	NA	NA	Yes	Yes	NA	NA	Yes	
Laser output		Adjustable over 3 dB in 0.1 dB steps					NA	NA	NA	

1) ORL < -25 dB.

2) Multimode source: mode distribution @ 50/125 is compliant with the following standards: IEC 61280-4-1 {Ed.1.0}, TIA/EIA 526-14A and TIA TSB-178.

SPECIFICATIONS

9600 Series Optical Power Meter

Detector type	Response λ (nm)	Damage level (dBm)	Calibration λ (nm)	Tone & mulit-fiber ID sensitivity (dBm)	Power range (dBm)	Midrange linearity[1] (dB)	Calibration Accuracy[2] (%)	Polarization Sensitivity (dB)	λ Sensitivity[4] ± 30 nm (dB)	Max Fiber Core Size (um)
InGaAs	600 ~ 1700	+15	*850* **1300, 1310, 1390, 1490, 1550, 1577,** 1610, 1625	*-40* -50	+5 ~ -60	0.04	2 (0.09 dB)	< 0.005	0.2	100
H3B (InGaAs)	800 ~ 1700	+27[3]	*850* **1300, 1310, 1390, 1490, 1550, 1577, 1590,** 1610, 1625	*-20* -30	+24 ~ -40	0.04	2 (0.09dB)	< 0.005	0.2	100
H5 (InGaAs)	800 ~ 1700	+25[3]	*850* **1300, 1310, 1390, 1490, 1550, 1577, 1590,** 1610, 1625	*-30* -40	+15 ~ -50	0.04	2 (0.09dB)	< 0.005	0.2	100
VE (Visual Enhanced InGaAs)	470 ~ 1650	+15	***635, 650, 850*** **1300, 1310, 1390, 1490, 1550,** *1610, 1625*	*-40* *-50*	+5 ~ -60	0.04	2 (0.09dB)	< 0.005	0.3	50
						typical		*typical*	*typical*	

Note 1: Mid-range linearity @ 1550 nm for InGaAs or 850 nm for Si. Non-coherent light, with APC connector. Excludes top 5 dB and bottom 10 dB of range.

Note 2: Calibration condition: non coherent light, -35 ± 5 dBm, 23 ± 1˚C, ± 0.5 nm, 20 ± 3 nm FWHM, PC ceramic connector, 50 µm fiber.

Note 3: H3B can sustain the damage level for 2 minutes.

Note 4: At calibration wavelengths in bold type.

9600XL Series Large Area Optical Power Meter

Detector type	Response λ (nm)	Damage level (dBm)	Calibration λ (nm)	Power range (dBm)	Midrange linearity[1] (dB)	Calibration Accuracy[2] (%)	Polarisation Sensitivity (dB)	λ Sensitivity[4] ± 30 nm (dB)
5 mm Ge	600 ~ 1650	+15	660,780,1610,1625 850,**1300,1310,1390,1490,** 1550, 1577	*+10 ~ -35* *+10 ~ -40*	0.06	2	< 0.005	0.2
7 mm Ge	600 ~ 1650	+15	660,780,1610,1625 850,1**300,1310,1390,1490,**1550 ,1577	*+10 ~ -30* *+10 ~ -40*	0.06	2	< 0.005	0.2
5 mm Si	350 ~ 1100	+10	470, 520, 635, 650, 660, 780, **850,** 980	*+5 ~ -50* +5 ~ -60	0.04	2	< 0.005	0.2
					typical		*typical*	*typical*

Note 1: Mid-range linearity @ 1550 nm for InGaAs & Ge, or 850 nm for Si. Non-coherent light, with APC connector. Excludes top 5 dB and bottom 10 dB of range.
Note 2: Calibration condition: non coherent light, -35 ± 5 dBm, 23 ± 1˚C, ± 0.5 nm, 20 ± 3 nm FWHM, PC ceramic connector, 50 µm fiber.
Note 4: At calibration wavelengths in bold type.

ORDERING INFORMATION

9600 Series Optical Power Meter:

Instrument, Power Meter InGaAs	9600A - InGaAs
Instrument, Power Meter H3B	9600A - H3B
Instrument, Power Meter H5	9600A - H5
Instrument, Power Meter VE	9600A - VE

Tempo model numbers with prefix "T"
Kingfisher model numbers with prefix "KI"

Standard Accessories:

SC connector adaptor, QRG, ISO 17025 traceable calibration certificate, quality assurance certificate, wrist strap, carry pouch.

Optical Connectors:

The power meter works with both PC and APC connectors.

Optional Interchangeable Connector Adaptors:

Description	P/N	Description	P/N
ST	OPT040	LC	OPT076
SC	OPT046	Multi connector	OPT077
FC	OPT051	MU	OPT080
D4	OPT055	Universal 2.5mm	OPT081
E2000/LSH, blue	OPT060	Universal 1.25mm	OPT085
E2000/LSH, green	OPT060G	SMA 905/906	OPT082
LSA/DIN 47256 blue	OPT071	LC	OPT072
HFBR	OPT078		

9600XL Series Large Area Optical Power Meter:

Large Area (5mm) Ge Power Meter	9600XL – Ge 5
Larger Area (7mm) Ge Power Meter	9600XL – Ge 7
Large Area Si Power Meter	9600XL – Si 5

Standard Accessories:

QRG, ISO 17025 calibration certificate, quality assurance certificate, wrist strap, carry pouch, OPT227:MPO12xn Adaptor (only for 9600XL-Ge7), OPT228:MPO16xn Adaptor (only for 9600XL-Ge7).

Optional Interchangeable Connector Adaptors:

Description	P/N	Description	P/N
ST	OPT202	FC	OPT204
SC	OPT201	POF FC	OPT204-POF
Senko CS	OPT200	SMA905/906	OPT203
POF SC	OPT201-POF	MMC/MT Ferrule	OPT233
POF ST	OPT202-POF	HFBR	OPT231
Biconic	OPT205	POF Universal 2.5mm	OPT225-POF
Universal 1.25mm	OPT224	Universal 2.5mm	OPT225
MPO12	OPT227	Toslink	OPT230
MPO16	OPT228	LC	OPT226A
		POF Multi connector	OPT229

ORDERING INFORMATION

To order 9600XL Series Large Area Optical Power Meter, please specify instrument and at least one optional interchangeable connector adaptor.

Optional Accessories for 9600XL Series:

Option, Carry Case for two 2xxx / KI3xxx / KI7xxx (OPT153), Option, Carry Case include Cletop & Cleaning Sticks for 2xxx / KI3xxx / KI7xxx (OPT154B)

ORDERING INFORMATION

9800 Series Optical Light Source:

Instrument, Source 635 nm VFL Laser	9807A
Instrument, Source 650 nm VFL Laser	9808A
Instrument, Source 660 nm LED	9809AM
Instrument, Source 850-1300 nm LED	9812A
Instrument, Source 1310 nm Laser	9820A
Instrument, Source 1310-1550 nm Laser	9822A
Instrument, Source 1310-1550 nm Laser, APC	9822A – APC
Instrument, source 1310-1625 nm Laser, APC	9825A-APC
Instrument, Source 1310-1490-1550 nm Laser	9827A
Instrument, Source 1310-1490-1550 nm Laser, APC	9827A - APC
Instrument, Source 1310-1550-1625 nm Laser, APC	9828A-APC
Instrument, Source 850 nm VCSEL	9840A

Tempo model numbers with prefix "T"
Kingfisher model numbers with prefix "KI"

Standard Accessories:

SC connector adaptors, QRG, 50μm and 62.5μm mandrel wraps (LED source only), quality assurance certificate, carry strap, soft carry pouch.

Optical Connectors:

The source ferrule type is fixed as either PC or APC depending on the instrument model. Green is associated with APC connectors.

Optional Interchangeable Connector Adaptors:

Description	P/N	Description	P/N
ST	**OPT040**	LC (plastic body)	**OPT072**
FC	**OPT051**	LC (metal body)	**OPT076**
HFBR	**OPT078**	MU	**OPT080**
E2000/LSH, blue	**OPT060**	Universal 2.5mm	**OPT081**
E2000/LSH, green	**OPT060G**	Universal 1.25mm	**OPT085**
LSA/DIN 47256 blue	**OPT071**	SMA 905/906	**OPT082**
POF Multi	**OPT077**	SC	**OPT046**

CALIBRATION AND MAINTENANCE

There are no internal user adjustments. Calibration is performed without opening the instrument.

Before commencing calibration:

- Clean all optical connectors very carefully.
- Ensure that all devices have been at a stable room temperature for over an hour, and that the light source is fully warmed up at the wavelength to be calibrated.
- Ensure that all installed batteries are in good working condition.

To enable calibration mode, remove belt clip and anti-tamper label at the back of the instrument and insert a 2.54 mm (0.1") pitch programming shunt across pins. Manipulation of the shunt is easier with needle nose pliers.

Figure1. Calibration opening, positioned at the back of the instrument underneath belt clip and covered by anti-temper label.

Perform calibration as per instructions below. When calibration is complete, remove the calibration shunt, and place an anti-tamper label over the hole. Do not forget to update your calibration records and to schedule the next calibration service.

Power Meter Calibration

Calibration is a transfer process. It is performed by setting up a light source at a stable, but non-critical power level between 0 and -30 dBm, and adjusting the meter reading to the same value as that shown by a reference meter.

Required are laser and LED light sources with accurate, calibrated wavelengths and good power stability, a power meter with appropriate calibrated wavelengths, single mode and multimode test leads. Check the calibration certificates on your reference equipment to ensure current validity.

Known calibration constants can be re-entered directly without using other equipment. This is useful in case old calibration constants are to be put back.

Record the existing calibration offsets, re-enter or adjust known offsets at this point or calibrate the meter at the selected wavelength as follows:

Note: this process may not be as accurate as the original factory calibration process.

- Inserting the 2.54 mm (0.1") pitch programming shunt across pins will put the instrument into calibration mode. It will display 'CAL'.
- Press [λ ◀] or [▶ λ] to set the wavelength to be calibrated.
- Record the light source power measured by reference power meter.
- Transfer this power level to the meter to be calibrated:

  Press [HOLD] to display power reading. Press [HOLD] again to display current offsets. Record the current (old) value. Press [HOLD] again, then [λ ◀] or [▶ λ] to adjust reading to match the noted reference reading. Press [HOLD] again to display current offsets. Record the current (new) value.

  Note: Toggling the [HOLD] button will show the power reading and the offsets on the display.
- To set the new value, press and hold [dB/dBm/ mW] until the instrument beeps. The display will show 'CAL' and calibrated wavelength.
- Repeat above process for other wavelengths.

CALIBRATION AND MAINTENANCE

Light Source Calibration

The emitter power level can be re-calibrated, and the current checked.

Required are reference power meter with appropriate calibrated wavelengths, single mode and multimode test leads, an anti-tamper label. Check the calibration certificates on your reference equipment to ensure current validity.

CAUTION! Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

Calibrate the source at the selected wavelengths as follows:

- Inserting the 2.54 mm (0.1") pitch programming shunt across pins will put the instrument into calibration mode. It will display 'CAL'.
- Press [λ ◂] to set the wavelength to be calibrated. Measure light source power using the reference meter.
- Press [▸ λ] to display DAC values from 0 to 1023 and emitter current.
- Set the emitter power to the required level by pressing [MOD] to reduce and [LEVEL] to increase output.
- Press [λ ◂] to save new value and to exit.
- To return to factory default setting, press [λ ◂].
- Repeat the above process for any additional wavelengths if required.

Opening the Instrument:

CAUTION!

- Do not open unless warranty has expired and you are authorised to do so. Opening the unit will invalidate any warranty claim.
- This unit contains static sensitive devices. Anti-static handling procedures should be observed at all times when handling internal circuits.
- There are no internal user adjustments. All calibration is performed without opening the instrument. The optical sensor / connector assembly is not user serviceable.

Procedure:

- Open battery compartment and remove the batteries. Pull open the optical connector cover.
- Place the instrument face down on a soft mat, remove belt clip and undo the screws in the rear housing. The instrument can now be gently pulled apart.
- Further disassembly from this stage should be easily apparent to a technician.
- Re-assembly is the reverse of the previous procedure.

PERFORMANCE VERIFICATION TESTS

The tests procedures described in this section are for performance verification of a 9600A-InGaAs Optical Power Meter and 9822 Optical Light Source.

It is not possible to give detailed test procedures for all instrument options, so some parameters may need adjusting to the appropriate specifications.

Required Equipment: this is the required equipment for the performance tests listed. Any equipment that satisfies the critical specifications of the equipment given in the table may be substituted for the recommended models.

Test Record: results of the performance test may be tabulated on a photocopy of the Test Record provided at the end of the test procedure. It is recommended that you fill out the Test Record and refer to it while doing the test. Alternatively, a soft copy of this manual may be obtained from our web site.

Test Failure: if the equipment under test fails any performance test, return the instrument to the nearest Sales/Service Office for repair.

Instrument Specification: specifications are the performance characteristics of the instrument that are certified, and are the limits against which the equipment under test can be tested.

Any changes in the specifications due to manufacturing changes, design, or traceability to NATA, will be covered in a manual change supplement, or revised manual. Such specifications supersede any previously published.

General Instructions

Perform each step in the order given, using the corresponding test equipment. Use Tables 1 ~ 3 to record general test details.

The SMF / MMF test lead fiber type and PC / APC connector polish must be matched to the instrument type.

Ensure that all optical connections are dry and clean. **DO NOT USE INDEX MATCHING OIL**. For cleaning, use the cleaning instructions given in the section 'Optical Connector'.

Make sure that all patch cords are fixed to the table to avoid movements during measurements.

Ensure that the ambient conditions are in the following ranges:

Temperature:	21 ± 3 ºC
Relative humidity:	45 to 75 %

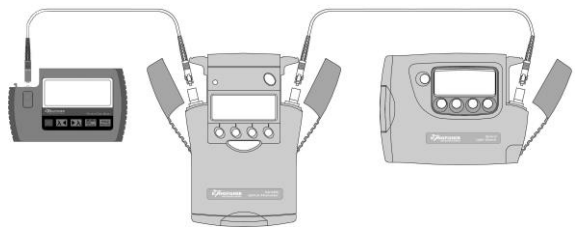
Instrument / Accessory	Recommended Model	Required Characteristics	Alternative Model
Optical Light Source	9822A		2400 series, 2800 series
Optical Power Meter	9600A-InGaAs		2600 series
Optical Attenuator	KI7013B		
For optional test only			
Optical Spectrum Analyzer	Agilent 71450B or equivalent		

Table 1. Required Equipment for 9600 and 9800 Performance Verification Tests.

Optical Power Meter

Accuracy Test

1. Connect the equipment as shown in Figure 2:



Power Meter **Attenuator** **Light Source**

Figure 2.Test set-up for 9600 Power Meter Accuracy Test

2. Switch on all three instruments.
3. Set all instruments to 1310 nm.
4. Change the attenuation of attenuator until the optical power meter displays -10.00 dBm. Note the attenuator setting in setting 1 of Table 4.

   If the laser source is not powerful enough to give -10 dBm, set the attenuator to 2.5 dB and correct the appropriate values in the test report.

   Repeat the above for reference power meter readings of -20dBm, -30 dBm, -40 dBm and -50 dBm (settings 2 ~ 5).
5. Measure the DUT:

   Re-connect the attenuator output cable to the DUT.

   Set the attenuator to its value for setting 1.

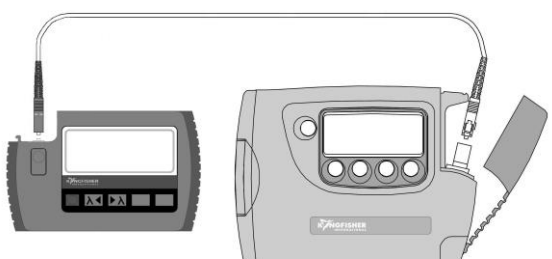
   Note the displayed power level of the DUT in the test record.

   Repeat the above for attenuator settings 2 ~ 5.
6. Repeat the Power Meter Accuracy Test at 1550 nm.

Optical Light Source

Output Power (CW) Test

1. Connect the equipment as shown in Figure 3.
2. Switch on the instruments.
3. Set the Optical Power Meter to 1310 nm
4. On Light Source, enable the source and set the wavelength to 1310 nm.
5. Note the measured power level value in the test report in Table 5.
6. Repeat the above on 1550 nm.



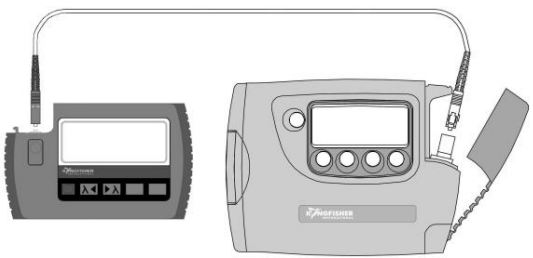
Light Source **Power Meter**

Figure 3. Test set-up for 9800 Light Source Output Power (CW) Test

Optical Light Source

Short Term Stability Test (optional)

1. Connect the equipment as shown in Figure 4. For better stability, ensure that connector plugged into power meter has APC termination.



Light Source **Power Meter**

Figure 4. Test set-up for 9800 Light Source Short Term Stability Test

2. Set the optical power meter to 1310 nm.

3. On Light Source, enable the source and set the wavelength to 1310 nm.

4. Let the unit warm-up for 15 minutes then note the power.

5. Record the power every 30 seconds for 3 minutes.

6. Calculate max-min values for stability (< 0.1dB).

7. Record test results in Table 5.

Time	Measured power, dBm	Drift, dB	Tick max/min values
00 sec		0.00	
30 sec			
60 sec			
90 sec			
120 sec			
150 sec			
180 sec			

Optical Light Source

Centre wavelength and Spectral Bandwidth (FWHM) Test (optional)

1. Connect the equipment as shown in Figure 5.

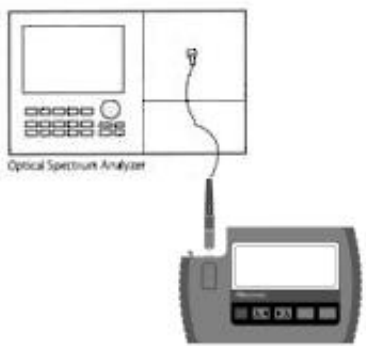


Figure 5. Test set-up for the centre wavelength and spectral bandwidth

2. Switch on the instruments and allow to fully warm up.
3. On Light Source, enable the source and set the wavelength to 1310 nm.
4. On the OSA, press the [Instr Preset] key
5. Press [Auto/Meas] and wait until 'End of Automeasure' is displayed
6. Choose [User] and select the type of source to be measured (FP for Fabery Perot laser).
7. To show the display in linear mode:
   - Press [Menu].
   - Press [Amptd] on the left side of the display.
   - Press [Linear] on the right side of the display.
8. To ensure interference - free reading of the display it is advisable to stop the repeating calculations.
   - Press [User].
   - Press [Single Sweep].

   If the trace on the display is not clear, you can change resolution by using the span key.
9. From the displayed measurements check and note the values for "mean wavelength" (Centre wavelength) and "FWHM" (Spectral Bandwidth) in the test report, Table 6.
10. Repeat the test with the source wavelength set to 1550 nm.

Model:	Date:
Serial No.:	Ambient Temperature: °C
Options:	Relative Humidity: %
Firmware Revision:	Line Frequency: Hz
Test Facility:	Customer:
Performed by:	Report No:
Special Notes:	

Table 2. General Test Record for 9600 and 9800

PERFORMANCE VERIFICATION TESTS

	Description	Model	Trace No.	Calibration Due Date
1.	Optical Light Source			
2.	Optical Power Meter			
3.	Optical Attenuator			
4.				
5.				
6.				
7.				
8.				
9.				
10.				

Accessories
Singlemode Fiber
Connector Adaptors

Table 3. Equipment Record for 9600 and 9800 Performance Verification Tests.

Model: _____ **Report No:** _____ **Date:** _____

Accuracy Test					
	Test Wavelength =				
Setting Number	Power meter Reference value	Attenuator Setting	Minimum Specification (-0.3 dB of Reference)	DUT Measurement results	Maximum Specification (+0.3 dB of Reference.)
1.	(~- 10.00 dBm)	_____ dB	(~- 10.30 dBm)	_____ dBm	(~- 9.70 dBm)
2.	(~- 20.00 dBm)	_____ dB	(~- 20.30 dBm)	_____ dBm	(~- 19.70 dBm)
3.	(~- 30.00 dBm)	_____ dB	(~- 30.30 dBm)	_____ dBm	(~- 29.70 dBm)
4.	(~- 40.00 dBm)	_____ dB	(~- 40.30 dBm)	_____ dBm	(~- 39.70 dBm)
5.	(~- 50.00 dBm)	_____ dB	(~- 50.30 dBm)	_____ dBm	(~- 49.70 dBm)
		_____		_____	
		Measurement Uncertainty		_____ dB	

Note 1: Minimum/Maximum Specification is for the 9600A-InGaAs. For the 9600-Ge, increase/reduce by ±0.2 dB. For the 9600A-H3B, increase/reduce by ± 0.1 dB.

Table 4. Accuracy Test Record for 9600 Series Optical Power Meter

Model:	Report No.		Date:	

Output Power (CW) Test

Wavelength	Minimum Specification	DUT Measurement Results	Maximum Specification
1310 nm	-1.00 dBm	_____ dBm	
1550 nm	-1.00 dBm	_____ dBm	
Measurement Uncertainty		_____ dB	

Short-Term Stability Test (optional)

1310 nm		_____ dBpp	(0.10 dBpp) 0.04 dBpp typical
1550 nm		_____ dBpp	(0.10 dBpp) 0.04 dBpp typical
Measurement Uncertainty		_____ dB	

Table 5. Output Power Test and Short Term Stability Test Record for 9800 Series Optical Light Source

PERFORMANCE VERIFICATION TESTS

Model:	Report No:		Date:	

Central Wavelength & Spectral Bandwidth (FWHM) Test (optional)

Wavelength	Minimum Spec.	DUT Measurement Results		Maximum Spec.
Centre wavelength				
1310 nm	1290 nm	_____	nm	1330 nm
1550 nm	1530 nm	_____	nm	1570 nm
Spectral Bandwidth (FWHM)				
1310 nm		_____	nm	(6nm) 3 nm typical
1550 nm		_____	nm	(6nm) 3 nm typical
Measurement Uncertainty		_____	dB	

Table 6. Central wavelength and Test Record for 9800 Series Optical Light Source

- To remove interchangeable connector adaptor, press the button on the front of the instrument and pull off adaptor.
- To defeat auto power-off, press and hold [POWER] for 3 seconds during turn on. 'Perm' is displayed on the top right of the LCD.
- Low battery is indicated with a battery symbol.
- During instrument turn on:
  - to view all display segments, press and hold [λ ◂]
  - to turn buzzer off, press and hold [▸ λ]
  - to display firmware version, press and hold [HOLD]
  - to start Slow mode, press and hold [dB/dBm/mW Set Ref]
- To scroll wavelength, press [λ ◂] or [▸ λ].
- To toggle logarithmic/relative/linear display modes, press [dB/dBm/mW].
- To stop / start display update, press [HOLD].
- To set reference, press and hold [Set Ref] for more than 3 sec. When in reference mode, the reference value is shown on the left hand side of the display.
- To display max min recorded power, press and hold [Max Min]. To re-set this function, press [POWER].
- When multi-fibre ID tone is detected by a power meter, a buzzer will sound and the corresponding fiber ID number will be displayed. This function is disabled in SlowMode.
- When a standard tone is detected (eg 270 Hz, 1 KHz, 2 KHz), a buzzer will sound and the corresponding modulation frequency will be displayed.
- If the meter detects a test tone higher than 200 Hz, the display will show the actual measured modulation frequency in kHz. This function is disabled in SlowMode.

SlowMode:

- In SlowMode, the display will show average optical power of the modulated signal. All tone detection is disabled

- To start SlowMode, press and hold [dB/dBm/mW Set Ref] while turning power meter on. "- tonE" will be displayed.
- To start SlowMode when power meter is already turned on, press and hold [λ◄], then press [dB/dBm/mW Set Ref]. "- tonE" will be displayed.
- To start SlowMode when test tone detection is active, press [dB/dBm/mW Set Ref].
- While SlowMode is on, alternating "►" and "**B**" symbols will be displayed.
- To exit SlowMode, press and hold [λ◄], then press [dB/dBm/mW Set Ref].
- Turning power meter off will end Slow Mode.

TamperLock Mode:

- While in TamperLock Mode, user is prevented from changing wavelength, dB/dBm/mW, Hold, min max and SlowMode settings.
- To start TamperLock Mode, press and hold [λ◄], then press and hold [HOLD].
  When display show "codE", enter six key sequence (all keys other than [POWER] can be used). Triple beep will be heard and display will show "LOut" to indicate completion.
- While TamperLock Mode is active, "**<<<**" and "**>>>**" symbols will be displayed.
- If power meter had been locked while in dB R mode, press and hold [Set Ref] to set reference.
- To clear TamperLock, turn off instrument then press [POWER] while holding down [λ◄] and [HOLD]. When display show "codE", enter six key sequence. If the correct sequence had been entered, "PASS" will be displayed indicating TamperLock had been cleared.
- In case where entered sequence was not correct, "FAIL x" will be displayed (where x is attempt count).
- TamperLock will be cleared after three unsuccessful attempts.

- To remove interchangeable connector adaptor, press the button on the front of the instrument and pull off adaptor.
- To defeat auto power-off, press and hold [POWER] for 3 seconds during turn on. 'Perm' is displayed on the top right of the LCD.
- Low battery is indicated with a battery symbol.
- During instrument turn on:
  - to view all display segments, press and hold [λ ◂].
  - to display firmware version, press and hold [LEVEL].
  - to turn buzzer off, press and hold [▸ λ].
- To enable source emitter, press [λ ◂] or [▸ λ] after turning on instrument. Operating wavelengths will be shown in the top corner on the right hand side and source power level on the left hand side. Do not enable a laser when there is no fibre attached to the optical output connector.
- To scroll wavelength, press [λ ◂] or [▸ λ].

ToneMode:

- Modulation is active only while the source emitter is enabled. To select a modulation tone, press [MOD] to scroll through available settings.
- Press and hold [MOD], then press [λ ◂] to step down or [▸ λ] to step up the modulation tone or fiber ID number.
- Press and hold [MOD], then press [λ ◂] for 3 seconds to turn off modulation.
- Press and hold [MOD], then press [▸ λ] for 3 seconds to advance to ID12.
- To exit, press [MOD] for 3 seconds. Alternatively, press [POWER] while holding [MOD].

Laser Output Power Adjustment (not available on LED source)

- To decrease the laser output power, turn the laser 'on', then press [LEVEL].
- Press and hold [LEVEL], then press [λ ◂] to step down or [▸ λ] to step up the output power.
- Press and hold [LEVEL], then press [λ ◂] for 3 seconds to set output power to the lowest level.

- Press and hold [LEVEL], then press [▸ λ] for 3 seconds to set output power to factory default. Alternatively, press [POWER].

AutoTest:

- To start AutoTest, press [POWER] then press [AUTO]. To end, press [AUTO] again or turn the instrument off.

TamperLock Mode:

- While in TamperLock Mode, user is prevented from changing wavelength or laser output power.
- Press [POWER], turn the emitter on, then press and hold [λ ◂] while pressing [LEVEL] for 5 seconds. Display will show "codE'.
- Enter 6 key sequence using any keys except [POWER]. Triple beep and "LOut" on display will indicate completion. To cancel your entry before completion, press [POWER].
- While TamperLock is active, "**<<<**" and "**>>>**" symbols will be displayed.
- To clear TamperLock Mode, turn off instrument then press [POWER] while holding down [λ ◂] and [LEVEL]. When display show "codE", enter six key sequence.
- If the correct sequence had been entered, "PASS" will be displayed indicating that TamperLock had been cleared.
- In case where entered sequence was not correct, "FAIL x" will be displayed (where x is attempt count).
- TamperLock will be cleared after three unsuccessful attempts.