KI 7340 Series
Two Way Test Set + ORL

KI 7740 Series
Two Way Loss Test Set

OPERATING & MAINTENANCE GUIDE

KINGFISHER INTERNATIONAL

DECLARATION OF CONFORMITY

ACCORDING TO ISO/IEC GUIDE 22 AND CEN/CENELEC EN45014

Manufacturer's Name:	Kingfisher International Pty. Ltd.
Manufacturer's Address:	30 Rocco Drive Scoresby, Victoria 3179 Australia

Declares, that the product

Product Name:	**Optical Loss Test Set**
Model Number:	**KI 7340 / KI 7740 Series**
Product Options:	This declaration covers all options of the above product(s)

Conforms to the following European Directives:

The product herewith complies with the requirements of the Low Voltage Directive 73/23/EEC and the EMC Directive 89/336/EEC (including 93/68/EEC) and carries the CE Marking accordingly.

Conforms to the following product standards:

	Standard	**Limit**
EMC	IEC 61326-1:1997+A1:1998 / EN 61326-1:1997+A1:1998	
	CISPR 11:1997/EN 55011:1998 Group 1 Class B	
	IEC 61000-4-2:1995+A1:1998 / EN 61000-4-2:1995+A1:1998	4kV CD, 8kV AD
	IEC 61000-4-3:1995+A1:1998+A2:2000/	3 V/m, 80-1000MHz
	IEC 61000-4-3:1996+A1:1998+A2:2001	
	IEC 61000-4-4:1995/EN 61000-4-4:1995	0.5kV signal lines, 1kV power lines
	IEC 61000-4-5:1995/EN 61000-4-5:1995	0.5 kV line-line, 1kV line-ground
	IEC 61000-4-6:1996/EN 61000-4-6:1996	3V, 0.15-80 MHz
	IEC 61000-4-8:1993/EN 61000-4-8:1993	30 A/m
	IEC 61000-4-11:1994/EN 61000-4-11:1994	0.5 cycle/100%/each polarity
	Canada: ICES-001:1998	
	Australia/New Zealand: AS/NZS 2064.1	
Safety	IEC 61010-1:2001 / EN 61010-1:2001	
	Canada: CSA C22.2 No. 1010.1:1992	
	USA: UL 3111-1:1994	
	IEC 60825-1: 2001	
	FDA CFR 21 part 1040.10	
	FDA Accession No.: KI 7300 Series 0220392, KI 7700 Series 0220391	

Supplemental Information:

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

2006-May- 01
Date

Bruce Robertson
Name

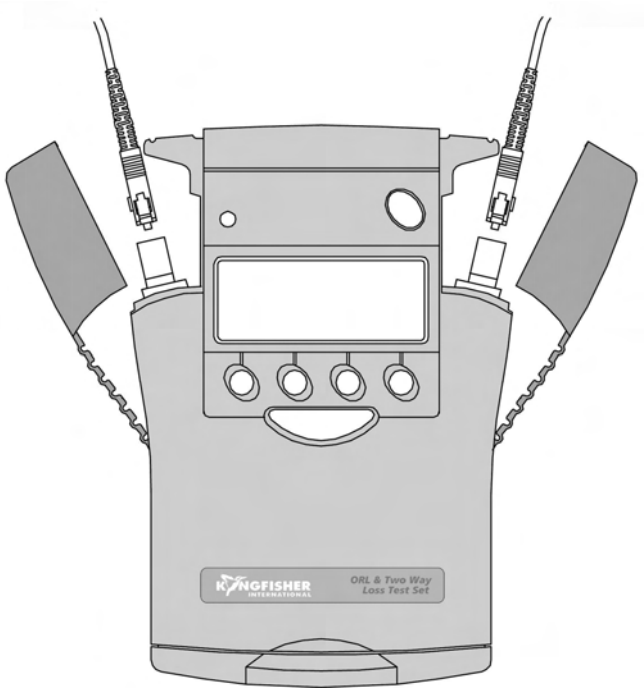
Technical Director
Title

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

OPERATING MANUAL

KI 7340 Series Two Way Test Set + ORL

KI 7740 Series Two Way Loss Test Set



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

For hints and tips from experts refer to our Application Notes on www.kingfisher.com.au

This manual was written using firmware V5.0

NATA
WORLD RECOGNISED
ACCREDITATION

INTERNATIONAL
QUALITY
MANAGEMENT
SYSTEM

4th Edition. May 2006.

CONTENTS

BEFORE READING FURTHER, REFER TO THE CONTROL PANEL PICTURE IN THE QUICK REFERENCE GUIDE SECTION OF THIS MANUAL

SERVICE & SUPPORT

Applications Support

Please visit www.kingfisher.com.au to see our comprehensive Application Notes, written to support our instrument users.

Our local agents are able to offer excellent applications advice in your language and time zone. Look at www.kingfisher.com.au to find distributor details from the Contact Us section.

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

Instrument Service

Qualified personnel must perform adjustment, maintenance or repair of this product. To obtain service:

- Contact your local Kingfisher International distributor.
- Look at www.kingfisher.com.au to find distributor details from the Contact Us section, or to get a Service Request Form from the Support page.
- Contact our office at: Tel: (61) 3-9757-4100
  Fax: (61) 3-9757-4193
- Email sales@kingfisher.com.au

Before returning equipment to Kingfisher for Service or Calibration, please obtain and complete a Service Request Form (on our web site www.kingfisher.com.au).

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

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

INTRODUCTION & APPLICATIONS

General:

The KI 734x / KI 774x Series Two Way Loss Test Sets are used to test all types of fiber optic systems and components:

- High speed optical loss testing in dB at up to 4 λ and two directions simultaneously
- Tx / Rx absolute optical power levels in dBm
- Optical Return Loss, KI734x series
- Optical Continuity testing with the test tone features
- Full CWDM, DWDM and out of band testing capability
- Options for singlemode & multimode fiber types
- Telecom construction or maintenance, CATV, LAN and R&D applications
- Quality assurance and acceptance testing
- Automated testing using external PC software

The KI 774x loss test sets provide a Two Way testing function, in addition to the usual light source and power meter functions.

In addition, the KI 734x test sets provide: zero warm up sources, CWDM source options, and an integrated ORL testing function.

The interchangeable optical connectors are drop protected during use, are dust protected by a snap on cover, and are easily disassembled for cleaning. A wide variety of connector styles are available, including LC, MU and interchangeable connector styles.

Autotest mode enables automatic bi-directional or two way multi-λ (wavelength) attenuation measurement.

The full feature ORL meter is suitable for acceptance testing of both components and installed cable systems.

These instruments feature very long battery life of 360 hours for the meter, and 190 hours for the source.

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

Calibration can be performed by any suitably equipped laboratory, without opening the instrument. The recommended re-calibration cycle is 3 years.

KITS™ PC reporting software allows real-time instrument control & data download, and is easily customised to suit most languages and reporting requirements. Real time display, data logging and label printing functions are included.

For simpler loss test sets or sources and meters, without the two way or ORL features, refer to the KI 3000B, KI 730x, KI 74xx, KI 760x and KI 770x series instruments.

INTRODUCTION & APPLICATIONS

These two way testers provide very high productivity for loss & ORL testing of high density fiber optic systems and devices.

Two Way Loss + ORL testing features

Two Way + ORL loss at both ends can be tested at up to 4 wavelengths in one operation, providing major operational savings. The ORL function includes user selectable offset and residual compensation functions, which are typically used in component test applications.

The real time display update in this mode is unique, and typically offers genuine time saving for users.

Power Meter features:

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

Warm up period, range-changing delays and user dark current zeroing are all eliminated.

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.

Power stability testing can be performed using the max/min recording function. The display can show dBm, dB and linear units, and can be put on hold for convenient data recording.

Standard power meters work with fiber core diameter up to 100 micron, with both PC and APC polish connectors.

Various detector options include Germanium (Ge), Indium Gallium Arsenide (InGaAs), Silicon (Si), and various attenuated versions.

The Ge detector is the most common detector for general use.

InGaAs detectors give much improved absolute accuracy compared to Ge detectors, which are excessively sensitive to wavelength and temperature above 1580 nm. This affects DWDM and CWDM applications.

Calibrations are available from 600 ~ 1650 nm, and power levels from +27 to -70 dBm.

Calibrations cover all popular application wavelengths, and CWDM calibrations are available from 1270 ~ 1610 nm, in 20 nm increments.

Light Source features:

Multi- wavelength sources have switchable wavelengths through one port, which makes operation faster.

Laser sources are used for testing single mode fiber systems.

LED sources at 850 / 1300 nm are used for testing multimode fiber systems. Optional LED source standards compliance is available.

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

GENERAL SAFETY SUMMARY

The following general safety precautions 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 manual, for safety markings and 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 or loss of life. Do not proceed beyond a **WARNING** sign until the indicated 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.

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.

The Performance Tests give procedures for checking the operation of the instrument. 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 (see page 4).

WARNING! You MUST return instruments with malfunctions to a Service Center for repair and calibration (see page 4).

Operating Environment
This equipment can be operated at temperatures between -15 °C and +55 °C and at relative humidity of <95 %.

Storage & Shipment
This equipment can be stored or shipped at temperatures between -25 °C and +70 °C and at relative humidity of less than 95 %. Protect the units from temperature extremes that may cause condensation within it.

GENERAL SAFETY SUMMARY

Safety

These instruments contain no hazardous optical or electrical items. The following information is for your reference: 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.

This instrument is manufactured under an ISO9001 approved Quality System, and conforms to CE Mark and C-tick EMC specifications.

Optical power levels in fiber optic systems can cause permanent eye injury and damage to eyesight. Organisations and users operating 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 increase eye hazard. Always disconnect the source before using an optical magnifier.

The laser module has a built-in safety circuitry which will usually disable the optical output in the event of a fault condition, however this cannot be guaranteed. An equipment assurance program is recommended to check for safe laser operation.

Laser & LED Safety Information

Laser	Fabry-Perot or DFB Semiconductor Laser
λ	1270 ~1625 nm depending on model
LED	Surface emitting Semiconductor LED
λ	850 or 1300 ±100 nm depending on model
Max CW output power[1]	<1 mW
Minimum beam waist diameter	9 µm
Minimum Numerical Aperture	0.1

Safety Class according to IEC 60825-1 (1998) – International & 21 CFR 1040.10 (1995) – USA

850~1625 nm	Class 1

Maximum Permissible Levels for various standards & wavelengths:

IEC 60825-1 (1998) [2]	
1310/1550 nm	8.9 mW / 10 mW
21 CFR 1040.10 (1995) [2]	
1310/1550 nm	2 mW / 8.1 mW

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

Note 2: Max. 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.

BATTERY & EXTERNAL POWER

These instruments are powered by two 1.5 V dry Alkaline 'C' size or 'AA' size batteries.

Instrument Function	'C' size battery run time in hours:
Optical Power Meter only	360
Source / Two Way tester / ORL	190 in Autotest

About 30 % capacity is obtained when using 2 x 'AA' alkaline 1.5V or NiMH 1.2V cells using the supplied battery size adaptors, or 50 % capacity when using 2 x 1.2 V rechargeable 'C' size batteries.

The supplied 'AA' to 'C' size battery size adaptors enable convenient purchase of batteries in almost any location, since most shops around the world stock AA batteries.

When the batteries are low, a low-battery indicator is shown on the display. At this stage, there is approximately enough energy for another 10 hours of use, which allows a day's work to be completed.

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

To switch on the instrument for permanent operation: hold the [POWER] key down for 3 seconds during turn-on until 'PERM' is shown in the display.

To change the batteries, open the cover of the battery compartment at the base of the instrument, remove the batteries, insert new ones (check polarity) and close the cover again.

For operation of the instrument by external power, use Kingfisher AC adaptor OPT103B.

Suitable external power packs are easily available, and must meet the following requirements:
Rated for local mains supply voltage & safety requirements
Regulated or unregulated DC output 6 ~12V at 300 mA max
Connection polarity: +ve pin

Use of the external power supply disconnects the batteries as a safety precaution, since accidental charging of alkaline cells is hazardous. Rechargeable batteries must be removed for charging by an external charger.

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! Some batteries (notably nickel-cadmium) contain toxic heavy metals, so please dispose of them by returning them to a re-cycling centre. Batteries purchased from Kingfisher agents can be returned to them for appropriate disposal.

OPTICAL CONNECTOR

To access the optical connectors, grasp a top corner of the instrument, and pull off the cover. Do this on both sides of the instrument.

The optical port is mounted on a swivel, which allows the connector to be angled outwards for accessibility, and then pushed back and covered with the snap cover to provide dirt and drop protection.

To install a through 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 on the latest model of these instruments, press the release button on the back 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.

On older models without the release button, move the connector port to its mid-way point, then pull off the adaptor.

Different styles of connector adaptor can be easily fitted by the user: ST, SC, FC, MU, LC / F3000, E2000 / LSH, and LSA / DIN, SMA.

When not in use, keep the test port and connectors covered and away from dust.

Do not touch connector tips with your fingers, since body oils and dirt can impair connector performance.

The supplied standard adaptors have ceramic sleeves to avoid connector metal dust contamination. This contamination can cause connector failure and fiber fuse at very high power levels. Ceramic connector sleeves also work better in cold conditions.

CAUTION! Do not use damaged or incompatible connectors.

WARNING! If using a connector inspection microscope to inspect the optical interface, be sure to always remove the batteries first, to prevent accidental source operation.

Power Meter port:

This port can be used with **both** PC **and** APC connector styles.

For the power meter port, 1.25 mm & 2.5 mm universal adaptors are available. However we recommend that these are not so convenient for regular use, due to the possibility of measurement errors if a test lead becomes partially disengaged from the adaptor.

Bare fiber adaptors must achieve fiber eccentricity of ± 100 microns, and an 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.

CAUTION! Do not scratch the detector lens with glass fiber end when using bare fiber adaptors, or the instrument will be permanently damaged.

OPTICAL CONNECTOR

Light Source / Two Way / ORL port:

A light source is **either** PC **or** APC connector specific. This is determined when ordering the instrument, and can only be changed at the factory.

CAUTION! The use of bare fiber adaptors with the source is not recommended as permanent instrument damage will occur, and very unstable measurements are likely.

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.

CAUTION! Do not attempt to clean any connector when a very high power level (eg > 0 dBm) is being emitted. This is a dangerous work practice, and above about +10 dBm, can result in immediate & permanent connector damage.

Light Source / Two Way / ORL port:

WARNING! Be aware of and observe relevant optical safety requirement procedures. Disable all sources when cleaning optical interfaces.

Preferred Procedures

To clean the interface without removing the adaptor, you can use a "stick" style connector cleaner for 1.25 or 2.5 mm ferrules. This cleans both the adaptor and end face in one operation.

Alternatively first remove the interchangeable adaptor to access the glass interface. Then blow away any dust or dirt with compressed air. If this is not sufficient, then clean the interface by rubbing a lint-free lens cloth over the surface using small circular movements.

Power Meter port:

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 the interface without removing the adaptor, you can use a "stick" style connector cleaner for 1.25 mm ferrules. This cleans both the adaptor and end face in one operation.

Alternatively first remove the interchangeable adaptor to access the glass interface. Then use a soft brush, alcohol, air can or 'Blu Tac' to remove dirt on the glass end face.

GETTING STARTED & TURNING ON

This and following sections show you how to use your instrument:

Check that the required optical connector adaptors have been fitted. (see previous 'Optical Connector' section).

Put the batteries into the instrument (see previous 'Battery Power' section).

To turn the instrument on, press the [POWER] button. The display will come on, and briefly displays the firmware version. If the battery is low, this will be indicated on the display with a battery symbol.

To turn the instrument off, press [POWER] again for 2 seconds.

To stop the instrument turning off 10 minutes after the last key press: press and hold [POWER] for 3 seconds during turn-on. 'On' and then 'Perm' on the display indicates that the unit will stay on permanently.

These instruments have extra functions accessed via a hidden keypad, to simplify training and support for inexperienced users. To access this hidden keypad, lift up the display cover. The display cover can also be cleaned easily at this point.

To disable or enable the buzzer, press and hold down the [SHIFT] button for 3 seconds.

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

To view all display segments: during instrument turn-on, hold down the grey button at the bottom left of the display.

Power Meter port:

This port is on the right hand side of the instrument. After turn-on, the power meter performs a self-calibration sequence, and then displays absolute power in dBm at the previously set λ.

If 'HI' or 'LO' are displayed, the input is out of range.

The power meter requires no warm up, and no user adjustment of dark current to achieve its specified performance.

See the following 'Autotest' or 'Power Meter Manual Operation' sections for further information.

Source / Two Way / ORL port:

This port is on the left hand side of the instrument.

After instrument turn-on, the light sources are always off. Further operator intervention is always required to turn on a source.

On the KI 774x series instruments, the light source requires a warm up period at the set wavelength, to achieve specified stability.

On the KI 734x series instruments, the specified stability is achieved with no warm up period.

On this port, the Two Way Autotest, ORL test or source functions depend on how the instrument is used.

See the following 'Autotest', 'Light Source Manual Operation' or "ORL Meter Manual Operation" sections for further information.

AUTOTEST OVERVIEW

Overview

Using these instruments, Autotest provides easy to use Two Way Loss Testing, with average loss displayed in real time.

For the KI 734x series instruments, ORL testing is tightly integrated so that no extra effort is required to perform this test. Refer to section "Return Loss Meter Manual Operation" for details on how to perform user offset and zero functions, which can also be set in Autotest mode.

Autotest performs automated measurement and λ detection by data exchange between instruments. Minimal operator knowledge is needed: Turn on the instrument(s), connect a test lead, and select [AUTOTEST] on one instrument. Subsequent operation is automated, although some choices can be made for convenience.

Both local and remote referencing is supported, and in Two Way mode, a pass/ fail test function is provided.

Autotest remains synchronised for about 8 seconds after disconnection, so the user can change optical connections without re-starting Autotest each time. This provides productivity gains.

Two Way Loss Test Sets in Autotest mode are usually used in matched pairs. A single instrument also works in stand-alone mode to achieve one direction testing.

Autotest reduces source warm up drift and battery consumption compared to manual operation.

To realise the full benefit of Autotest, use the KITS™ PC software in the field with a laptop PC to achieve real-time data acquisition, acceptance testing and reporting. KITS™ includes a comprehensive on-line manual. Please download this software off our web site and try it.

Instrument Compatibility

Any sensible combination of Loss Test Set(s), or source and meter can be used, as long as they are Autotest compatible. Functionality will be as follows:

A pair of identical Two Way Test Sets: Two Way average loss at multiple λ, plus ORL each end for KI 734x instruments.

Any other Autotest Source & Meter combination: One way loss at all matching source and meter λ. Bi-directional testing in this mode is supported by KITS™, using successive measurements.

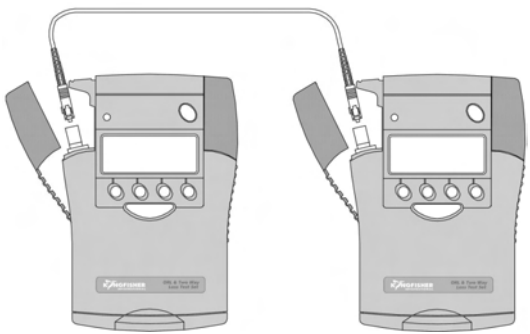
TWO WAY + ORL AUTOTEST OPERATION (+ pass / fail)

Two Way + ORL Loss Testing

This is the preferred method of loss testing with these instruments. It requires a matched pair of instruments, which perform automated testing and bi-directional data exchange between the two instruments.

A pair of KI 774x instruments test Two Way loss at all source wavelengths. A pair of KI 734x instruments test Two Way loss, and also the ORL at each end, at all source wavelengths.

Turn on both instruments and connect the device to be tested (eg test lead etc) to the two way test port (left port) of both instruments.



To start Autotest, on one instrument only, press [AUTOTEST].

Both instruments now display the same two way average loss in dB, and the display rotates through all available source λ.

Both units also display 'A◂ ▸B'. The unit where Autotest was initiated shows the 'A' flashing, and it has become the Master unit. The other unit will flash 'B', and it has become the Slave unit. In most respects, the units behave the same way, however the A unit will remain in Autotest until the user turns this mode off.

On either instrument, to display the loss of only one λ at a time, press [-/+].

To display further detail, eg the loss in one direction, repeatedly press [SELECT] on the hidden keypad. This display mode shows 'A◂ B' etc. On the KI 734x Series instruments, this also includes ORL measurements.

When displaying loss in one direction, the reference value shows on the left of the display. Alternatively selecting [ABS / REL] displays the actual measured dBm value and source nominal output power.

To exit Autotest mode, **Either** disconnect the optical test lead, **Or** on the Light Source, press [MENU]. Then select [Menu] on the meter, or wait 8 seconds for Autotest to timeout.

Autotest λ Selection Mode

If the required regular testing uses fewer wavelengths than the instrument has available, then it may be convenient to reduce the number of active Autotest wavelengths. For example, instead of the source rotating through 1310 / 1490 / 1550 / 1610 nm, it can be set to test at 1310 / 1550 nm only. Enter set-up: [POWER] / [SOURCE]

Then:
Press [-/+] to change λ.
Press [right hand grey button below the screen] to view the “in” “out” status of each λ
To toggle ‘In/Out’ state for each λ. Press [SHIFT] then [right hand grey button below the screen]
Autotest now operates only with λ’s selected as ‘In’.

To run this mode from the main menu: press [SHIFT] then [AUTOTEST].

The settings will be retained at the next turn on.

User to User Communication

Display update for both instruments can be started or stopped from either instrument using the [HOLD] function, which also activates the buzzer each end. This is also a **handy communication method** between two users, so they can synchronise while working through successive fibers. This works as follows:

- Press [HOLD] at the “local” end, to make “remote” end beep and flash the [HOLD] symbol.
- Then at the “remote” end, press [HOLD] to resume the display update and make the “local” end beep.

This communication function is also linked with KITS™ software, so that the far end user knows when a reading has been saved in KITS™, and the near end user knows when the far end user has moved to the next fiber, and so is ready for the next reading.

Note that all operation and data acquisition can be controlled from one end only, so a relatively unskilled operator can be used at the other end.

Referencing: Both local and remote reference methods are supported.

The Two Way remote reference method is useful for long distance testing, It has slightly lower accuracy, which is quite adequate for general link loss testing.

The alternative local reference method is useful for short distance testing. It provides high accuracy and so is useful for testing device or patch-lead loss, and may be used with both Two Way and single directional less testing.

When setting the reference value, use test leads with a similar fiber type to the system under test. This is particularly important with multimode systems.

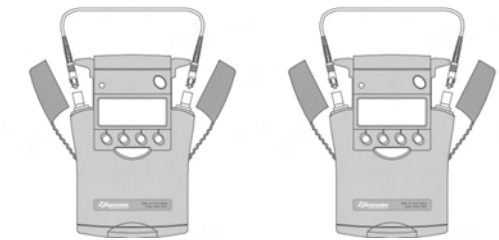
Note that excess connector loss between the patch-lead and source port, will be added to the final loss measurement, so care should be taken to use test leads in good condition with clean connectors.

The number of test jumpers used when taking a reference is a function of test requirements and standards compliance, not the instruments involved, so this issue is beyond the scope of this manual. For simplicity, we show one test lead.

TWO WAY + ORL AUTOTEST OPERATION (+ pass / fail)

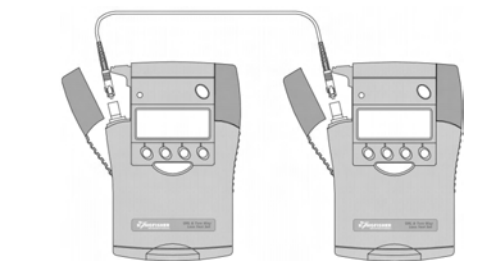
Remote Reference: On both instruments independently (they may be a long way from each other):

Connect the two way port to the power meter port of the same instrument. Select [POWER], [AUTOTEST], [Abs/Rel], hold [Set Ref] for 3 seconds. Meters display about 0.00 dB R.



Remote reference set-up

Local Reference: Connect the two way port of both instruments. Select [POWER], [AUTOTEST] hold [Set Ref] for 3 seconds. Meters display about 0.00 dB R.



Local Reference set-up

Pass / Fail Mode

The Two Way pass / fail mode is convenient for quick, low skill acceptance testing. It tests using all available loss and ORL wavelengths.

To set up the thresholds:

To set the loss threshold, in meter mode, press [SHIFT], [LEVEL], [-/+] to adjust, [SET] to save.

Alternatively, if 'Default' key is pressed, the value defaults to 12.00 dB. Press [SET] to save.

To set the ORL threshold, in ORL mode, press [SHIFT], [LEVEL], [-/+] to adjust, [SET] to save.

Alternatively, if 'Default' key is pressed, the value defaults to -25.00 dB RL. Press [SET] to save.

To use this mode:

In Two Way mode, press [LEVEL] to enter Pass / Fail display mode.

To exit, press [LEVEL] or [SELECT].

ONE WAY AUTOTEST OPERATION

One Way Loss Testing

This mode of operation will be achieved if a two way tester is used on its own, or if various types of Autotest instruments are used.

This mode of operation is for Autotest sources, meters, or simple loss test sets, and data communication is one way only.

Initiate Autotest Operation

Turn on the instrument(s), and connect a test lead. On the **light source**, press [AUTOTEST]. This is all that is required.

The meter automatically sets to the correct λ and displays the absolute power in dBm, with the wavelength displayed at the top right.

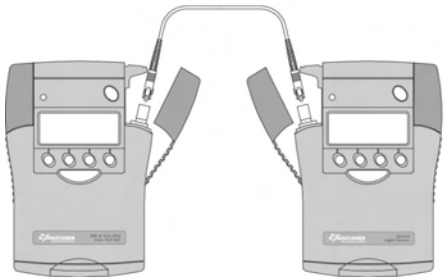
This display mode may show 'A ▸ B' (depending on display type).

Alternatively, to enter Autotest λ Selection Mode, press [SHIFT] before pressing [AUTOTEST] (see previous description).

If a multi λ light source is used, the display rotates through all source wavelengths. To display only one λ at a time, press [-/+] to rotate the displayed wavelength, or to return to the usual mode. There may be some delay before the display is updated. In this mode, "nm" flashes to show that the λ is locked.

The nominal source power transmitted from the source is displayed on the left hand side of the display.

Press [Abs/Rel] to make the meter display relative power (dB R). The reference value displays on the left side of the display.



Power Meter or Two Way Tester Light Source or Two Way tester

Reference Methods: both local and remote reference methods are supported.

The remote reference mode is especially useful for long distance testing, and is generally used with a bi-directional loss test method.

The local reference method is especially useful for short distance testing, and is typically used with single direction test methods.

Note that excess connector loss between the patch-lead and source port, will be added to the final loss measurement, so care should be taken to use test leads in good condition with clean connectors.

When setting the reference value, use test leads with a similar fiber type to the system under test. This is particularly important with multimode systems.

The number of test jumpers used when taking a reference is a function of test requirements and standards compliance, not the instruments involved, so this issue is beyond the scope of this manual.

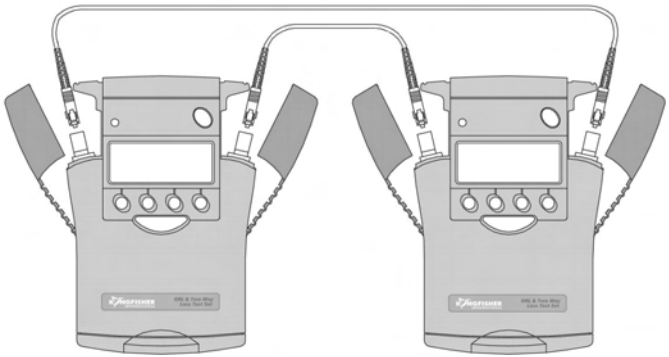
To **set a reference**, go into relative mode and press [SET REF] on the meter for 3 seconds. This stores the reference at all relevant wavelengths.

To exit Autotest mode, **Either** disconnect the optical test lead, **Or** on the Light Source, press [MENU]. Then select [Menu] on the meter, or wait 8 seconds for Autotest to timeout.

Single Two Way Tester

Simultaneous Autotest Measurement on two fibers

Loss Test Sets support this as shown in the following picture:



Simultaneous one way loss testing

Put each instrument into Autotest before connecting the patch-leads. Note the results will be stored on both instruments and then merged later, so records management needs extra care.

Use of KITS™ PC Software with Autotest

To realise the full benefit of Autotest, use the KITS™ PC software in the field with a laptop to achieve real-time data acquisition, acceptance testing and reporting. Full operating sequences are given in the KITS™ on-line manual. KITS™ also supports bi-directional test results using non bi-directional instruments. KITS™ also enables merging of test results from multiple instruments.

POWER METER MANUAL OPERATION

This mode of operation is typically used to measure Tx / Rx absolute power levels, to perform continuity testing using the tone detector, or to perform loss testing if an Autotest light source is not available.

On a Loss Test Set, if the power meter section is used in this mode with any source turned on, the instrument links the source and meter wavelengths to simplify operation. To access all other meter wavelengths, first turn off the light source.

WARNING! Observe optical safety procedures relevant to the power levels being measured, especially for the high power H3 meter.

After instrument turn-on, the meter is operational at the last used λ.

- To enter this mode, select [POWER METER].
- To scroll the calibrated wavelength, press [-/+]. The calibrated λ is displayed on the top right side of the display.
- To toggle absolute / relative display mode, press [ABS/REL]. The display will show 'dB R' or 'dBm'.
- To stop / start display update, press [HOLD]. The symbol will flash when the display is on hold.
- To store a new reference, press [SET REF] for 3 seconds.
- When in relative mode, the reference value is displayed on the left hand side of the display.
- To toggle log / linear display mode, access the hidden keypad and press [dBm/W].
- To display minimum and maximum values over a period, access the hidden keypad and press [MAX/MIN]. The display shows 'Max/ Min' values in sequence. Press [MAX/MIN] for 3 seconds to re-start the recording process. This function re-sets automatically when instrument parameters are altered. This is a handy data logging function for field use.
- If the meter detects a test tone between 150 Hz and 9999 Hz, the display will change to show the actual measured modulation frequency in Hz.
- If a standard tone is detected (eg 270 Hz, 1 KHz, 2 KHz), a buzzer will sound. This is useful for fiber identification and signalling. The meter can also be used to check the actual modulation frequency of test sources (between 150 Hz and 9999 Hz).
- 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.

This mode of operation is typically used to perform continuity testing with the test tone generator, if an Autotest compatible power meter is not available.

After instrument turn on, the display shows 'source off'. To turn on the source emitter, press [SOURCE].

The source is scrolled or turned off using [-/+], (eg 1310, 1490, 1550, 1610 nm, off).

For the simplest level of operation, the sequence is simply: [POWER], [SOURCE].

The active wavelength is shown on the right hand side of the display. Source power level is at the left hand side of the display. Modulation frequency (if relevant) is at the center of the display.

To modulate the source, press [MOD], and the modulation frequency is displayed.

To select a different modulation frequency, press [SOURCE] / [KHz] / [+/-] scroll from 0.27 KHz, 1 kHz, 2 kHz / [SET].

Laser Output Power Adjustment

To adjust laser output power, turn the laser on, then select [LEVEL] / [-/+] to adjust the level, then [SET]. This function does not operate in Autotest mode and is not available on LED sources.

KI 734x series instruments measure Optical Return Loss (ORL) using the Optical Continuous Wave Reflectometer (OCWR) method. This measures the accumulated reverse power at the point of measurement.

This method is accurate, and suitable for acceptance testing. However it can not locate a reflection source, and has limited optical range. An OTDR is better for some of these tests.

Available ORL test λ are the fitted source λ.

To verify correct operation of the ORL meter, refer to the performance test section at the back of this manual.

Operation

No warm up is needed. Take particular care to ensure all connectors are clean.

To display ORL, select: [POWER], [RETURN LOSS], [-/+] to change the λ. The ORL measurement will now be displayed in dB RL. The following offsets may be used to improve accuracy.

To re-set to factory defaults, select [SHIFT], [DEFAULTS] then [SET] to store.

ORL Zero Function.

This compensates for stray (residual) reflections prior to making a low level measurement. Using this feature, the instrument can read accurately up to 10 dB below the stray reflection level, however at the expense of increased noise when making low level measurements.

Set up the stray optical condition. A small diameter mandrel wrap is commonly used for this, to block al light.

On the hidden keypad select [SHIFT], [NF SET].

To display the stored value, select [MAX/MIN]. Then to adjust the stored value, [-/+], and then [SET] to store.

Perform the zero function whenever the stray ORL condition may have changed.

These limitations apply: If the zeroed value is x dB:

From x to (x+10) dB: resolution is limited to 0.1 dB.

From x to (x-10) dB: resolution is limited to 1 dB, which is also the display range limit.

User Calibration Mode (UCAL)

Return loss is affected by twice the forward loss. To compensate for this in a test jig:

Set up the reference optical condition.

On the hidden keypad select [SHIFT], [RL ADJ]. The offset value is shown on the left of the display. Select [RL ADJ] again to show reference only. Then [-/+] to adjust the display to the required value, and [SET] to store. A non-zero value is always displayed on left of display.

STORING & RECALLING READINGS

Overview

There are various ways of storing and recording data:

Meter Reference Value:

The power meter reference value for each λ is stored in non-volatile memory. It is displayed on the left of the display when in relative (dB) mode.

Meter Display Hold:

To hold the display at its current value, press [HOLD]. Press [HOLD] again to continue updating the display.

Automatic MAX/MIN Recording:

To display the minimum and maximum power meter or ORL value over a period, access the hidden keypad and press [MAX/MIN]. The display will show the maximum and minimum values in sequence. Press [MAX/MIN] for 3 seconds to re-set. The function re-sets when instrument parameters are altered.

Note: This function records drift, but may not accurately record transients faster than about 0.1 Hz, due to the integrating data converter.

User Memory:

The non-volatile user memory stores test data, which can then be displayed or downloaded to an Excel spreadsheet in the KITS™ software.

Two Way Autotest Data is stored as follows:

For each λ: two way average dB. For each direction: dBm, dB R, reference dBm, source dBm, source s/n, λ KI 734x only: ORL at each end.

One Way Autotest Data is stored as follows:

For each λ: dBm, dB R, reference dBm, source dBm, source s/n, λ.

Power Meter Data is stored as follows:

dBm, dB, reference dBm, λ.

ORL Data is stored as follows:

dB RL, zero offset, user calibration factor, λ.

Source Data is stored as follows:

Nominal output dBm, λ.

STORING & RECALLING READINGS

Operation

Operation is via the hidden keypad. To display the current memory location at top right: press [SELECT], and [CANCEL] to exit.

Store

To store in the next location: press [STORE]. The display shows 'busy' while new data is stored. In Hold mode, existing data will be stored.

To store data starting at a particular location, or over-write a record: press [SELECT], [-/+], [SET], [STORE].

Recall

Data can only be stored in Autotest mode. To recall data, exit Autotest first.

To read from any location: press [RECALL], and [-/+]. To display the relative and reference values, press [Abs/Rel]. To show a second λ, press [-/+].

Two Way mode: To see more details for that memory location and λ, eg 'A ▸ B' or 'A ◂ B' only, press [SELECT] successively.

Erase

A full memory is indicated by a repeating buzzer.

To clear all stored data press [RECALL MEMORY] & [CANCEL] simultaneously for 3 seconds. The display shows 'clr'.

Memory Capacity for Loss Test Sets

Memory capacity is determined by the configuration of your instruments. The following illustrates the working capacity of various configurations.

One Way	3,408 readings
One Way, 4 λ readings	1,962 readings (in Autotest)
Two Way, 2 λ readings	1,269 readings
Two Way, 3 λ readings	874 readings
Two Way, 4 λ readings	667 readings

For example, the memory capacity for a Two Way Test Set is 1,269 two way, two λ readings. So the combined capacity of an instrument pair is 2,538 two way, two λ readings.

PC INTERFACE

The PC interface can be used to access and control the instrument from an external computer. All functions can be accessed remotely. See next pages for available software

USB Interface

The USB interface requires only a standard USB 'A' ~ USB 'B' cable – as supplied, though some USB software drivers may need to be installed on your PC before this application can be utilized.

RS232 interface

The RS232 interface can be used in the same way as the USB interface and is found on older generation instruments The connection details of the instrument and connecting cables are as follows:

Some (out of spec) serial ports need a 10K resistor in the D connector across wires 1 & 2.

	Wire 1(Screen)	Wire 2	Wire 3
Instrument Jack Plug	Body (Gnd)	Ring (Tx)	Tip (Rx)
9 Pin D connector for RS232	Pin 5 (Gnd)	Pin 2 (Rx)	Pin 3 (Tx)

Baud Rate

The baud rate can be set to: 0.3, 0.6, 1.2, 2.4, 4.8, 9.6, 19.2 and 38.4 Kbaud.

The default baud rate is 9.6 Kbaud.

To set the baud rate, on the hidden keypad, press [SHIFT], [BAUD RATE], then [-/+] to set the rate, followed by [SET]. At turn on, the default is restored.

Local / Remote Modes

The hidden keypad enables the user to lock out the front panel controls, by pressing [LOCAL] or [REMOTE].

EXTERNAL SOFTWARE

KITS™ PC software

KITS™ PC software enables instrument control and transfer of live or stored data to an Excel spreadsheet. This is ideal for data logging and reporting applications typical in field applications.

Functions currently supported in V3.01U include:

- Live power meter display
- Data logging with graph and statistical information
- Label printing
- Loss testing spreadsheet with direct click-and-point data insertion or memory download.
- Two Way loss reporting by merging one-directional measurements.
- Optical return loss reporting
- Two Way loss reporting using Two Way option.

KITS™ is easily customised by intermediate level users of MS Excel and Notepad. This is convenient to change language, terminology or to add new reporting features.

This free software is evolving. Please visit our web site at www.kingfisher.com.au to download the latest version.

CARE OF YOUR INSTRUMENT

- Follow the directions in this manual on optical connector care.
- Use only high quality sealed alkaline 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 strong sunlight.
- Clean the instrument case using alcohol or other non 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 corner features, and is therefore drop resistant.

Power Meter:

- Limit an InGaAs or Ge power meter input to < +15 dBm.
- Limit the H3 power meter input to < +30 dBm for 2 minutes.

ACCURACY CONSIDERATIONS

All Measurements

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

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

In multimode systems, modal noise and general uncertainty are much worse than in single mode systems. Optimum measurement repeatability will be obtained by use of a standards compliant (overfilled) LED source, and a mandrel wrap.

Power Meter:

λ uncertainty affects power meter calibration. This is significant with a Ge detector in the 1550 nm band (eg > 1560 nm in cold weather), and an InGaAs detector in the 850 nm band, where absolute errors of the order of 1 dB are possible.

Do not use a Ge detector at λ's around or above 1580 nm. Only an InGaAs detector will be accurate at these λ's.

This λ sensitivity is why Ge detectors are used in 850 / 1300 nm multimode applications, and why InGaAs detectors are used in high end single mode applications. This issue affects absolute power measurements. It may not significantly affect attenuation measurements where the meter was referenced to the same light source.

Ge power meters are inherently non-linear by about 0.04 dB. Ge meters also have temperature dependent calibration drift at 1300 nm of typically 0.03 dB per 10 ºC.

Improved measurement stability on laser based systems is typically achieved by using an APC connector at the power meter interface, which reduces line reflections. This is important when measuring small connector losses.

Light Source:

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 (except the KI 7300 Series Loss Test Set) 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.

Due to emitter center λ uncertainty (eg ± 20 nm), fiber attenuation may vary with different light sources.

DWDM Loss and Power Measurements

The DWDM bands are typically within 1525 ~ 1610 nm. For this application, an InGaAs power meter detector gives much improved absolute accuracy compared to a Ge detector, which is excessively sensitive to wavelength and temperature above 1580 nm.

An InGaAs detector calibrated at 1550 nm typically gives good absolute accuracy at all DWDM wavelengths.

Testing optical loss at 1610 or 1625 nm is common, since this represents the worst case attenuation in most systems.

High power InGaAs detectors may be required to measure the system power level.

CWDM Loss and Power Measurements

The CWDM band is from 1270 ~ 1610 nm at 20 nm spacing, however 1490 ~ 1610 nm is more common since it avoids the water absorption peak at about 1383 nm.

The most common operating wavelengths for FTTH PON systems are currently 1310 / 1490 / 1550 nm.

The points raised about InGaAs and Ge detectors for DWDM also apply, with the additional issue that:

Because of the broad operating wavelengths encountered, the power meter calibration wavelength needs to be matched to the measured wavelength, or absolute errors may be excessive.

Many systems are measured at 1390 nm to test for the water peak, and at 1625 nm to measure the high end attenuation limit.

At 1625 nm, the fiber attenuation is actually very sensitive to wavelength, since the silica infra-red absorption zone is reached. So the wavelength tolerance of this particular laser is a major issue, especially since many older source instruments have a tolerance of 30 nm.

ORL Measurements

ORL measurements are typically divided into two classes:

1. Acceptance of installed cable systems, usually 20 – 35 dB. This is generally easily accomplished with an ORL meter. In these measurements, the provided ORL terminator may be usefully placed at the far end of the system.

2. Acceptance of components and patch leads, which may involve levels well below this. These measurements require an understanding of sources of reflection, and require additional steps.

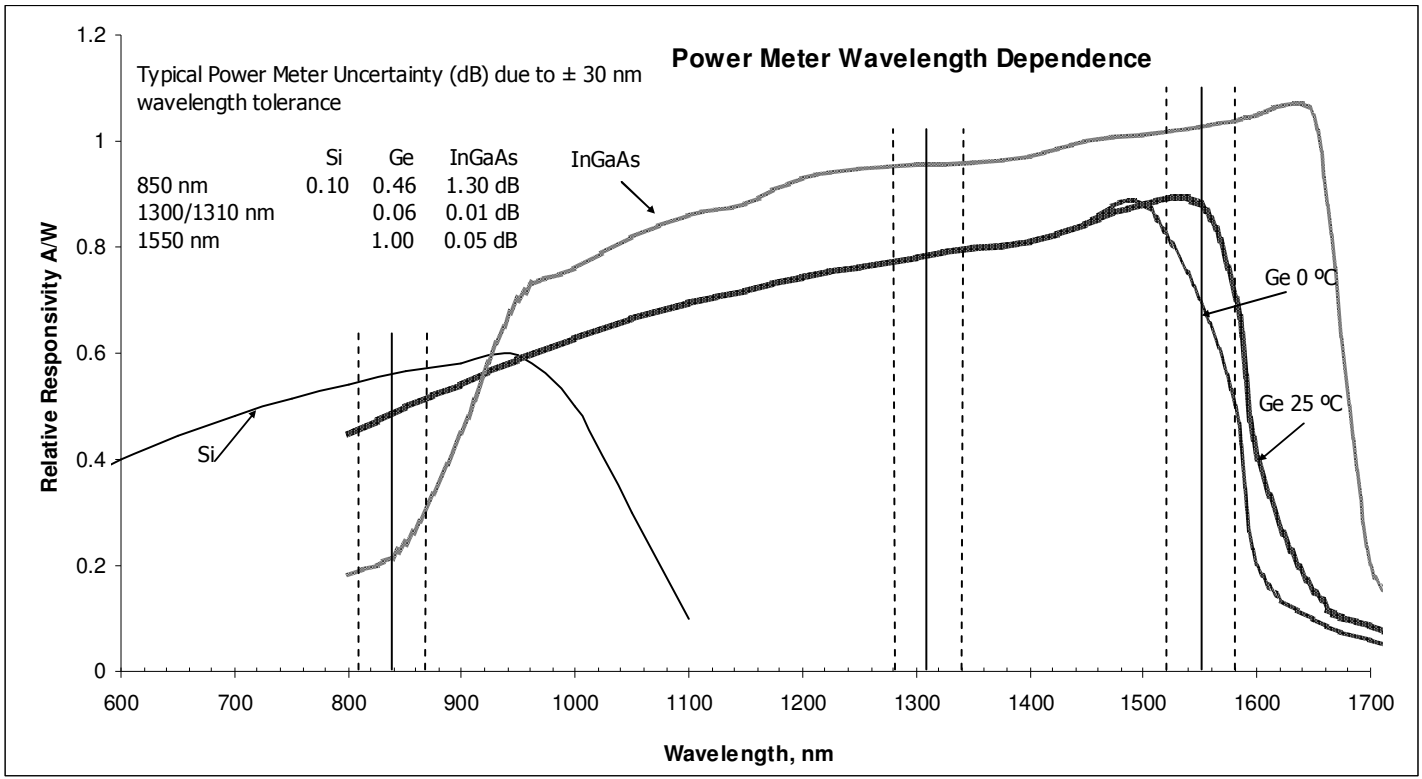
In Two Way mode, the port isolation can be an important contributor to the noise floor. A special instrument version has higher isolation for component acceptance testing. Using this equipment, very high throughput can be achieved in a factory environment.

When setting up ORL testing, a strong understanding of both PC and APC connector reflection effects may be required.

Use of ORL Zero Function

This function is very useful since it extends the practical linear measurement range by about 14 dB.

For typical mid-range measurements, it has a negligible effect on measurement noise. For low level measurements, it can cause up to 0.5 dB noise. If this happens, the solution is to reduce the residual light level further, and re-set the zero function.


Power Meter Wavelength Dependence
Typical Power Meter Uncertainty (dB) due to ± 30 nm wavelength tolerance
Si Ge InGaAs
850 nm 0.10 0.46 1.30 dB
1300/1310 nm 0.06 0.01 dB
1550 nm 1.00 0.05 dB
InGaAs
Ge 0 ºC
Ge 25 ºC
Si
Relative Responsivity A/W
Wavelength, nm
1.2
1
0.8
0.6
0.4
0.2
0
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700

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, including 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, including noise and drift (connectors and test leads must be absolutely clean and undamaged).

Autotest Sensitivity: The power level below which Autotest does not work.

ORL Meter:

Range: Display range.

ORL Accuracy: The ORL measurement absolute uncertainty.

Port Isolation: The passive ORL port isolation (when the instrument is turned off) as measured by another ORL meter.

Source:

Output Power: The CW output power at the specified λ, at the end of a reference cable.

Power Uncertainty / Repeatability: 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 9/125µm fiber, at constant temperature, within a specified temperature window, and at line voltage.

Center λ: The λ representing the center of mass of the selected peaks.

λ CW = (1/ Po)Σ(P_i λ_i) Where: Pi and λi are the power and λ of each spectral component and Po 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)
$P_{total} = \Sigma P_i$ = 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

KI 734x & KI 774x - Source Specification

	1310 / 1550 nm	Other lasers	LED	Comments
2 λ source power, dBm 3 or 4 λ power, dBm	-7 -10	-7 -10	-26[2]	± 1 dB
KI734X Short term stability, dB	0.03	0.05[1]	0.01	15 min, max no warm up, Δ 3°C
KI774X Short term stability, dB	0.04[1]		0.01	Typ, 15 min, ± Δ 2°C after warm-up,
KI734X Stability over temp, dB	0.2	0.2	0.35	Max, over Temperature
KI774X Stability over temp, dB	0.6		0.35	Typical, over temperature
λ tolerance, nm	20	6.5	30	At 25 °C
λ width, nm	3	< 1	35 / 100 850/1300	FWHM, typical
λ nm/°C	0.4	0.1	0.4	typical
Reconnection Repeatability, dB	0.1		0.05	95 % confidence
Modulation	270 Hz, 1, 2 KHz, ± 2 % square wave			
Laser output	Adjustable over 6 dB in 0.01 dB steps			

Note 1: For ORL < -25 dB
Note 2: 1300 nm LED power into SMF: > - 40 dBm

ORL Specification

	Laser		LED
	3 or 4 λ	1 or 2 λ	
Range[3]	0 ~ 65 dB	0 ~ 60 dB	0 ~ 45 dB
Port Isolation	Standard > 30 dB Optional > 50 dB		> 22 dB
ORL accuracy	0 ~ 50 dB: 0.5 dB 50 ~ 65 db: 1 db after zero offset	0 ~ 45 dB: 0.5 dB 45 ~ 60 dB: 1 dB after zero offset	0 ~ 30 dB: 0.5 dB 30 ~ 45 dB: 1 dB after zero offset
Wavelength	See source options		See source options

Note 3: Range is less for PC connector. After a zero offset, range is 10 dB better than the residual level.

Optical Interface Specifications:

Singlemode PC polish: 9 µm fibre cores
Core concentricity tolerance: 0.25 µm

Singlemode APC polish: 8° angle, 9 µm fibre cores
Core concentricity tolerance: 0.25 µm

Multimode: 62.5 µm fibre cores

Two Way Specification:

Autotest Sensitivity > – 50 dBm

Maximum operational detector power: +5 dBm

Absolute maximum input power: +15 dBm

SPECIFICATIONS

KI 734x - Power Meter Specifications

Detector Type	Calibration λ nm	Response λ nm	Power Range dBm	Damage Level dBm	Autotest Sensitivity dBm	Mid range Linearity[1] dBm	Calibration Accuracy %	Polarisation Sensitivity dB	Total Uncertainty[3] dB
Si	600, 650, 660, 780, 850, 980	350 ~ 1100	+0 to -70	+15	-47	0.02	1 %	< 0.005	0.3
Ge	*780,* 820, 850, 980, 1270, 1290, 1300, 1310, 1330, 1350, 1370, 1390, 1410, 1430, 1450, 1470, 1490, 1510, 1530, 1550, 1570, 1590, 1610, 1625	600 ~ 1650	*+10 to -65* +10 to -70	+15	*-45* -50	0.04	1 %[2]	< 0.005	0.5
InGaAs	*820, 850,* 980, 1270, 1290, 1300, 1310, 1330, 1350, 1370, 1390, 1410, 1430, 1450, 1470, 1490, 1510, 1530, 1550, 1570, 1590, 1610, 1625, 1650	800 ~ 1700	*+5 to -60* +5 to -70	+15	*-40* -50	0.02	1 %[2]	< 0.005	0.3
H3B (InGaAs)	1270, 1290, 1300, 1310, 1330, 1350, 1370, 1390, 1410, 1430, 1450, 1470, 1490, 1510, 1530, 1550, 1570, 1590, 1610, 1625	800 ~ 1700	+27 to -50	+30[4]	-30	0.02	1 %	< 0.005	0.35

KI 774x - Power Meter Specifications

Detector Type	Calibration λ nm	Response λ nm	Power Range dBm	Autotest Sensitivity dBm	Mid range Linearity[1] dBm	Calibration Accuracy %	Polarisation Sensitivity dB	Total Uncertainty[2] dB
Si	600, 650, 660, 780, 850, 980	350 ~ 1100	+0 to -70	-47	0.02	3 %	< 0.005	0.3
Ge	850, 1300, 1310, 1550, 1590, 1610, 1625	600 ~ 1650	+10 to -65 +10 to -70	-45 -50	0.04	3 %	< 0.005	0.5
InGaAs	850, 1300, 1310, 1550, 1610, 1625	800 ~ 1700	+5 to -60 +5 to -70	-40 -50	0.02	3 %	< 0.005	0.3
H3 (InGaAs)	850, 1300, 1310, 1550, 1610, 1625	800 ~ 1700	+27 to -35 +27 to -45	-20 -30	0.02	3 %	< 0.005	0.4

Note 1: Mid range linearity excludes top 3 dB and bottom 10 dB of range.
Note 2: Calibration condition: non coherent light, -35 ± 5 dBm, 23 ± 5 °C, ± 1 nm, 10 ± 3 nm FWHM, PC ceramic connector, 62.5 µm fiber.
Note 3: Includes contributions due to: varying optical connector types, calibration uncertainty, full temperature, dynamic range and fiber core diameter up to 200 µm.
Note 4: H3 can sustain the damage level for 2 minuets

SPECIFICATIONS

General Specifications:

Size:	190 x 130 x 70 mm, 7.5" x 5.1" x 2.8".
Weight:	500 gm, 1.1 lb. Shipping 1.5 Kg, 3.3 lb.
Operating/ Storage:	-15 to 55 °C / -25 to 70 °C.
Power:	2 alkaline 'C' cells 7.6 A/hr, (or 2 'AA' cells - using supplied adaptor) or external 9V DC with 2.5 mm '+ve' pin. Selectable auto-off and low battery indicator and back lit display.
Case:	Polycarbonate, 1 meter drop tested.
Hidden Keypad:	For setting advanced functions
RS232:	3.5 mm jack connector, 0.3 ~ 38.4 K baud
Calibration:	Performed without opening instrument. Recommended calibration cycle: - Every 3 years.
Display:	4 digit high contrast LCD
Resolution:	Log: 0.01 dB. Linear: 3 digits (100 – 999) or 0.01 nW.
Tone detection:	150 ~ 9999 Hz ±1%.
Damage level:	Si, Ge, InGaAs: > +15 dBm H3: > +30 dBm for 2 minutes
Max / Min:	Recording feature for stability testing.

This instrument is manufactured under an ISO9001 approved Quality System, and conforms to CE Mark and C-tick EMC specifications.

Kingfisher International maintains an ongoing program of product and process improvement, and reserves the right to improve or amend specifications without notice.

ORDERING INFORMATION

KI 734x Series - Two Way Loss Test Set + ORL / No Warm-up

850 nm LED APC, Si Meter, ORL	**KI 73411A - Si - APC**
850 / 1300 nm LED APC, Ge Meter, ORL	**KI 7344A - Ge - APC**
1310 / 1550 nm PC, InGaAs Meter, ORL	*KI 7343 - InGaAs*
1310 / 1550 nm APC, InGaAs Meter, ORL	*KI 7343 - InGaAs - APC*
1550 / 1610 nm PC, InGaAs Meter, ORL	*KI 7346 - InGaAs*
1550 / 1610 nm APC, InGaAs Meter, ORL	*KI 7346 – InGaAs - APC*
1310 / 1550 nm PC, H3 Meter, ORL	**KI 7343A - H3B**
1310 / 1550 nm APC, H3 Meter, ORL	**KI 7343A - H3B - APC**
1550 / 1610 nm PC, H3 Meter, ORL	*KI 7346 - H3*
1550 / 1610 nm APC, H3 Meter, ORL	*KI 7346 - H3 - APC*

KI 774x Series - Two Way Loss Test Set

850 nm LED PC, Si Meter, ORL	**KI 77411A - Si**
850 / 1300 nm LED PC, Ge Meter	**KI 7744A – Ge**
1310 / 1550 nm PC, InGaAs Meter	**KI 7742A - InGaAs**
1310 / 1550 nm APC, InGaAs Meter	**KI 7742A - InGaAs - APC**
1310 / 1550 nm PC, H3 Meter	**KI 7742A - H3**
1310 / 1550 nm APC, H3 Meter	**KI 7742A - H3 – APC**
1310 / 1550 nm PC, H5 Meter	**KI 7742A – H5**
1310 / 1550 nm APC, H5 Meter	**KI 7742A – H5 – APC**

Non-Bold – No-longer available as 'new', but technical support still available.

KI 734x Series - Two Way Loss Test Set + ORL / No Warm-up

1550 nm PC, InGaAs Meter, ORL	**KI 73421A - InGaAs**
1550 nm APC, InGaAs Meter, ORL	**KI 73421A - InGaAs - APC**
1310 / 1550 nm PC, InGaAs Meter, ORL	**KI 7343A - InGaAs**
1310 / 1550 nm APC, InGaAs Meter, ORL	**KI 7343A - InGaAs - APC**
1490 / 1610 nm PC, InGaAs Meter, ORL	**KI 73412A - InGaAs**
1490 / 1610 nm APC, InGaAs Meter, ORL	**KI 73412A - InGaAs - APC**
1550 / 1610 nm PC, InGaAs Meter, ORL	**KI 7346A - InGaAs**
1550 / 1610 nm APC, InGaAs Meter, ORL	**KI 7346A - InGaAs - APC**
1310 / 1490 / 1550 nm PC InGaAs Meter, ORL	**KI 7347A - InGaAs**
1310 / 1490 / 1550 nm APC InGaAs Meter, ORL	**KI 7347A - InGaAs - APC**
1310 / 1550 / 1625 nm PC, H3 Meter, ORL	**KI 73410A - InGaAs**
1310 / 1550 / 1625 nm APC, H3 Meter, ORL	**KI 73410A - InGaAs - APC**
1310 / 1390 / 1550 / 1610 nm PC InGaAs Meter, ORL	**KI 7348A - InGaAs**
1310 / 1390 / 1550 / 1610 nm APC InGaAs Meter, ORL	**KI 7348A - InGaAs - APC**
1310 / 1490 / 1550 / 1610 nm PC InGaAs Meter, ORL	**KI 7349A - InGaAs**
1310 / 1490 / 1550 / 1610 nm APC InGaAs Meter, ORL	**KI 7349A - InGaAs - APC**

ORDERING INFORMATION

Standard Accessories:

ST, FC, SC, metal-free optical connector adaptors, , KITS™ PC software and cable, manual, batteries, 'AA'-to-'C' size battery converter, NATA traceable calibration certificates, carry strap or tilt bail, leather pouch & protective holster.

KI734X instruments only: PC Low Reflection Terminator, APC Low Reflection Terminator.

Optical Connectors

These instruments have interchangeable optical connectors. The power meter works with both PC and APC connectors. The light source ferrule type is fixed and customer specified as either PC or APC. Green is associated with APC connectors. Order any number of additional adaptors.

Optional Interchangeable Connector Adaptors

E2000/LSH, blue	**OPT060**	SMA 905/906	**OPT082**
E2000/LSH, green	**OPT060G**	Universal 1.25mm	
LSA/DIN 47256	**OPT071**	Universal 2.5mm	**OPT081**
LC / F3000	**OPT072**	Metal Free	**OPT090**
MU	**OPT080**		

To order metal free connector, specify: connector style + OPT090

Optional Accessories

Power Pack, 90~240V IEC	**OPT103B**
Carry case, 2 instruments	**OPT153**
USB-RS232 converter	**OPT188**

Instrument Options:

TIA/IEC standard compliance for LED sources: Class 1 CPR into 50 μm fiber, Center Wavelength and Spectral Width Including 50 & 62.5 μm multimode mandrel wraps	**OPT091**
> 50 dB ORL port isolation, single mode	**OPT092**

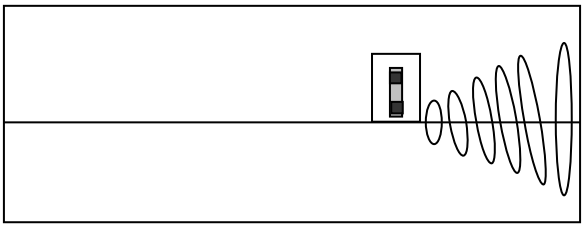
Please visit our web site at www.kingfisher.com.au for other fiber optic test instruments.

See section 'Getting Started & Turning On' to:
Re-boot the microprocessor.
Turn on all display segments.

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

All Calibrations

To enable calibration mode, open the battery compartment, remove the anti-tamper label, and insert a 2.54 mm (0.1") pitch programming shunt. Manipulation of the shunt is easier with needle nose pliers. The instrument will display 'CAL' & installed options.



View Inside Battery Compartment

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.

Before commencing calibration:

- Clean all 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 λ to be calibrated.
- Ensure that all installed batteries are good.
- When calibration is complete, remove the calibration shunt, and place an anti-tamper label over the aperture in the battery compartment.
- Do no forget to update your calibration records, and schedule the next due date.

System Rollback (version 5.0 and above)

If in the event of wrong calibration constants being entered and stored, or the instrument becoming otherwise corrupted, all factory settings can be restored by the following method.

To restore all factory settings, first enter 'CAL' mode then press and hold [RECALL MEMORY] for 3 seconds.

Power Meter:

Calibration is a transfer process. It is performed by setting up a singlemode laser source at a stable but non-critical power level between -10 and -30 dBm, and adjusting the meter reading to be the same value as that shown by a reference meter.

Required are laser light sources with accurate, calibrated λ and good power stability, a power meter with appropriate calibrated λ, singlemode test leads, an anti-tamper label, and a 2.54 mm (0.1") programming jumper. Check the calibration certificates on your reference equipment, to ensure current validity.

Record the existing calibration offsets as follows:

- Put the instrument in calibration mode.
- Press [POWER METER], (change procedure here to calibrate two way port) [-/+] to set the λ, and [MAX/MIN] twice to display the offset. Note the offset down for each λ.
- Re-enter known offsets at this point, or calibrate the meter at the selected λ as follows:
- Measure and record the source power using the reference meter.
- Transfer the same power level to the meter to be calibrated, set [MAX/MIN] to display power, then [-/+] to adjust the reading to match the noted reference reading. Note: The optical power is measured only when entering this mode. It is not continuously updated. (Firmware version 5.00 continuously updates the measured power).
- Set [MAX/MIN] to read and note the new stored calibration offsets, and then [SET] to store and exit, or [CANCEL] to abandon and exit.
- Go back and check the source power with the reference meter, to ensure source drift is within limits.
- Remove the programming shunt, and place a new sticker over the aperture.

Two Way Detector Calibration

The two way measurement option has an internal power meter within the 'two way' port, in addition to the standard 'power meter' port. This is calibrated as follows:

Follow the procedure for Power Meter Calibration, except that after selecting [POWER METER], next select [-/+] to select the detector. The active detector is indicated by <<< or >>> on the display.

Source Calibration & Current Check

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

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

Required are a power meter with appropriate calibrated λ, singlemode test leads, an anti-tamper label, and a 2.54 mm (0.1") programming jumper. Check the calibration certificates on your reference equipment, to ensure current validity.

- Put the instrument in calibration mode.
- Connect a calibrated power meter with a known good patch lead (the patch lead loss forms part of the calibration condition).
- Press [SOURCE], leave in, and then press [LEVEL]. The display will now show the expected power level, cal factor (main display) and laser current in mA (top right). Note the existing values for future reference. Set meter λ to match.
- Adjust the [-/+] button to change the source output level, to match the displayed level on the source display, or to re-enter a known cal factor (The laser current can not go above a level that has been set for the individual laser during manufacture).
- Note new calibration values and laser currents for future reference, then press [SET] to store settings and exit, or [CANCEL] to exit without storing settings.
- Remove the programming shunt, and place a new sticker over the aperture.

ORL Calibration

Calibration is performed by setting up a known reflection condition, and adjusting the reading accordingly.

A convenient calibrated reflection is a good clean PC termination, which will have a –14.65 dB glass/air reflection. This can be double-checked easily by measuring more than one termination.

Required are a reflection, an anti-tamper label, and a 2.54 mm (0.1") programming jumper.

- Put the instrument in calibration mode.
- On the meter to be calibrated, record the existing calibration offsets as follows: Select [RETURN LOSS], [-/+] to set the λ, and [MAX/MIN] twice to display the offsets. Note them down, or re-enter known offsets at this point.
- Attach the known reflection. You may also want to add an allowance for twice the expected forward loss of the connection to the instrument. This is just an estimate. 0.2 dB is typical, in which case set the display to -14.85.
- Set [MAX/MIN] to display power, then [-/+] to adjust the reading to the required value. Note: The ORL is measured only when entering this mode. It is not continuously updated.
- Set [MAX/MIN] to read and note the new stored calibration offsets, and then [SET] to store and exit, or [CANCEL] to exit without storing settings.
- Remove the programming shunt, and place a new sticker over the aperture.

Opening the Instrument:

Caution! Do not open unless the warranty has expired, and you are authorised to do so. Opening the unit will invalidate any warranty claim.

- There are no internal user adjustments. All calibration is performed without opening the instrument. The optical sensor / connector assembly is not user serviceable.
- This unit contains static sensitive devices. Anti-static handling procedures should be observed at all times when handling internal circuits.
- Do not open this instrument unless you are familiar with handling optical fibers. Disturbing the optical fiber assembly may result in instrument malfunction or damage.

Procedure:

- Use static protected procedures.
- Remove the batteries, and leave the battery cover open. Pull open the optical connector covers.
- Place the instrument face down on a soft mat, and undo the 6 screws in the rear housing.
- The instrument can now be gently pulled apart.
- The instrument will come into two halves joined by a ribbon cable. The optical section is located in the upper half, with the microprocessor, supply, calibration constants and controls in the lower half.
- The hinged display cover can be removed at this point.
- The ribbon connector can be disengaged to completely separate the instrument halves.
- Further disassembly from this stage should be easily apparent to a technician.
- Re-assembly is the reverse of the previous procedure. Ensure that the ribbon cable connectors are properly secured so they cannot shake loose. This will be either a moulded rubber retainer, or adhesive tape.

General electrical parameters are as follows:

Vss to GND = 3V3, -Vss = -3V3, battery power down current about 0.2 mA, active power meter current about 20 mA. The laser current is unpredictable.

All tests can be performed without access to the interior of the instrument. The test equipment given corresponds to tests carried out with FC/PC connectors on the DUT (device under test).

The procedures in this section test the performance of a KI 7343A-InGaAs Loss Test Set.

Due to the large number of possible instrument configurations, it is not possible to give detailed test procedures for all options in this manual, so some parameters may need adjusting to the appropriate specifications.

Required Equipment This is the required equipment for the performance test is 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 this 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 that were 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.

Make sure 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 so that they won't move during measurements.

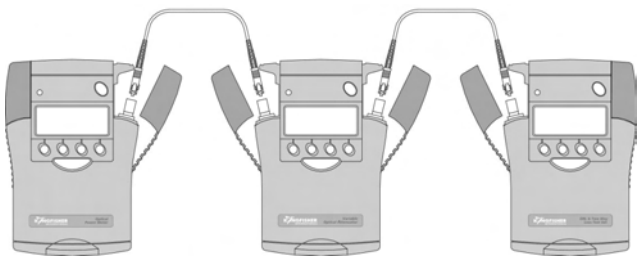
Make sure that the ambient conditions are in the following ranges:

Temperature	21 ± 3 ºC
Relative humidity	45 to 75 %

To switch on the Device Under Test (DUT) for permanent operation: hold the [POWER] key down for 3 seconds during turn-on until 'PERM' is shown in the display.

Power Meter Section Accuracy Test (table 4)

1. Connect the reference equipment as shown in figure below.



LTS / Power Meter **KI7010A / KI7020A Attenuator** **LTS / Source**

Test set-up for the Power Meter Accuracy Test

2. Switch on all instruments.
3. Set all instruments to 1310 nm.
4. Change the attenuation of the attenuator until the reference 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 -10.00 dBm, set the attenuator to 2.5 dB and correct the appropriate values in the test report.

5. Repeat for settings no 2 ~ 5 for reference power meter readings of -20, -30 dBm, -40 dBm, -50 dBm (last reading not relevant to H series power meters).

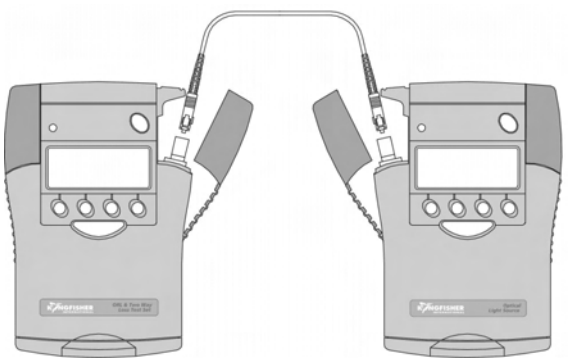
Measure the DUT:

Re-connect the attenuator output cable to the DUT power meter port, and select the correct wavelength on the DUT Power Meter.

6. Set the attenuator to its value for step 4. Note the displayed power level of the DUT in the test record.
7. Repeat this for the other attenuator settings.
8. Repeat for each additional λ as required.

Light Source Section Output Power Test (table 5)

9. Connect the equipment as shown in figure below.



LTS / Power Meter **LTS / Source**

Test set-up for both the Output Power and Short Term Stability Tests

10. Switch on the instruments.
11. Set the Optical Power Meter to 1310 nm (some instruments require warming up at this point each time the λ is changed).
12. Set the DUT λ to 1310 nm. Setting the λ automatically enables the source.
13. Note the value shown on Table 5.
14. Repeat for each additional λ as required.

Light Source Section Optional Short - Term Stability Test
(table 5)

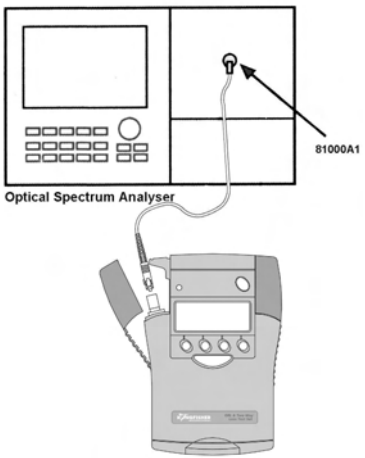
15. Make one photocopy of this page for each source wavelength to be tested.
16. Connect the equipment as shown.
17. Set the optical power meter to 1310 nm.
18. Set the DUT λ to 1310 nm. Setting the λ automatically enables the light source.
19. Let the unit warm-up for 15 minutes, then note the power in the table below.
20. Record the power every 30 seconds for 3 minutes.
21. Calculate max – min values for stability (< 0.1 dB).
22. Notes this figure on Table 5.

Time from Start	Power, dBm	Drift, dB	Tick max / min values
00 sec		0.00	
30 sec			
60 sec			
90 sec			
120 sec			
150 sec			
180 sec			

Alternatively, the instrument max/min recording function can be used to record the data.

Light Source Section Optional Centre λ and Bandwidth (FWHM) Test. (Table 6)

23. Connect the equipment as shown in figure below.
24. Switch on the instruments and allow to fully warm up.
25. Set the DUT λ to 1310 nm. Setting the λ automatically enables the Source.
26. On the OSA, press the [Instr Preset] key.



Test set-up for the centre λ and spectral bandwidth

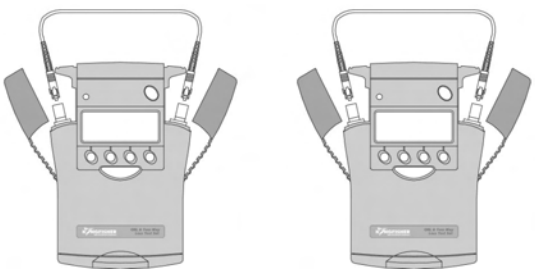
27. Press [Auto/Meas] and wait until 'End of Automeasure' is displayed.
28. Choose [User] and select the type of source to be measured (FP for Fabry Perot laser).
29. To show the display in linear mode:
    a. Press [Menu].
    b. Press [Amptd] on the left side of the display.
    c. Press [Linear] on the right side of the display.
30. 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.
31. From the displayed measurements check and note the values for "mean λ" (Centre λ) and "FWHM" (Spectral Bandwidth) in Table 6.
32. Repeat the test with the DUT set to additional λ's.

Two Way Loss Test Performance Verification (table 7)

This tests the Two Way loss test accuracy, range and linearity for a pair of instruments.

Two Way Calibration Test

33. Connect the instruments as shown in below, using one test lead per instrument.

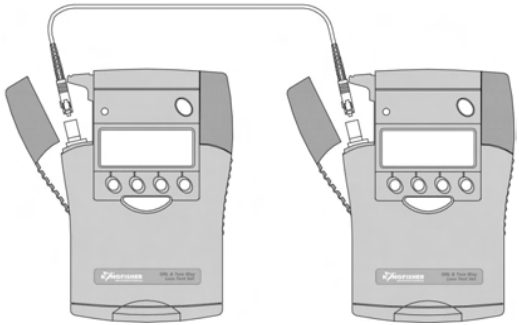


34. On both instruments: switch on, set [AUTOTEST], and warm up for a few minutes.

35. On both instruments, push [ABS / REL] then [SET REF] for 3 seconds. The displays should read approximately 0.00 dB.

36. On one instrument, remove the test lead, and re-connect the other test lead as below:

37. The display should now read between -0.50 and 0.50 dB for all λ's.



38. Note the maximum displayed value for each λ on Table 7.

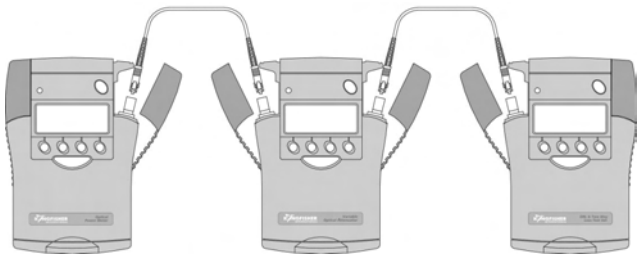
If this test fails, clean the test leads, and try again. Or try a new set of test leads. If it still fails, the two way function requires re-calibration.

Two Way Loss Test Performance Verification, continued. (table 7)

Two Way Linearity Test

This test is a continuation of the previous procedure. This part tests the range and linearity of the Two Way Autotest function:

39. Re-connect the equipment as shown in figure below. Note that multimode instruments require a multimode attenuator.



LTS / Power Meter **KI7010A / KI7020A Attenuator** **LTS / Source**

40. On the attenuator, use [-/+] to set the λto 1310 nm (or other λ),and [SET], then use [-/+] to set the attenuation to 5 dB.

41. Make sure that Autotest is still updating. If it isn't the test has failed. If it is, on Table 7, note the attenuation reading of the DUT at 1310 nm.

42. Single mode instruments: Repeat the readings for attenuator settings of 15 dB, 25 dB, and 35 dB.

43. Multimode instruments: Repeat the readings for attenuator settings of 15 dB, 20 dB.

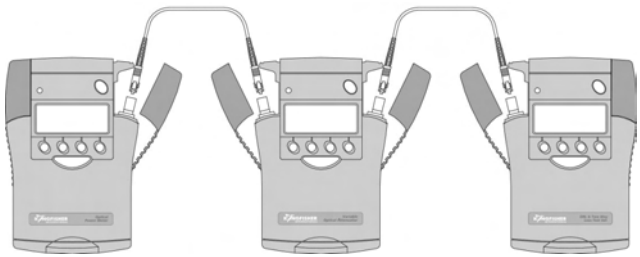
44. Repeat for each additional λ as required, however this test typically only needs performing at one wavelength.

Failure of this test means that the instrument requires service.

One Way Loss Test Performance Verification (table 7)

This tests One Way Autotest range and linearity for one loss test set, and also verifies tone detector operation. To test power meter absolute accuracy & linearity, refer to the Power Meter Section Accuracy Test.

45. Connect the equipment as shown in figure below. A single LTS can also be used, with connections to both ports. Note that multimode instruments require a multimode attenuator.



LTS / Power Meter **KI7010A / KI7020A Attenuator** **LTS / Source**

46. Switch on all instruments: set [AUTOTEST on the source], and allow to warm up for a few minutes.

47. Use [-/+] to set the attenuator to 1310 nm (or other λ),and [SET].

48. Use [-/+] to set the attenuator to 5 dB.

49. Make sure that Autotest is still updating. If it isn't the test has failed. If it is, on Table 7, note the attenuation reading of the DUT at 1310 nm.

50. Laser source with Ge or InGaAs meter: Repeat the readings for attenuator settings of 15 dB, 25 dB, and 35 dB.

51. LED source with Ge or InGaAs meter: Repeat the readings for attenuator settings of 15 dB, 20 dB.

52. Laser source with H series meter: Repeat the readings for an attenuator setting of 15 dB dB.

53. Repeat for each additional λ as required, however this test typically only needs performing at one wavelength.

Failure of this test means that the instrument requires service.

ORL Verification Test for KI 734x Instrument with PC Connector (table 8)

This verification test uses artefacts supplied with the units:
PC/APC test lead, multimode or singlemode.
PC terminator OPT704.
APC terminator OPT704A.

Very carefully, clean **all** the optical connectors to be used, and the left hand instrument port.

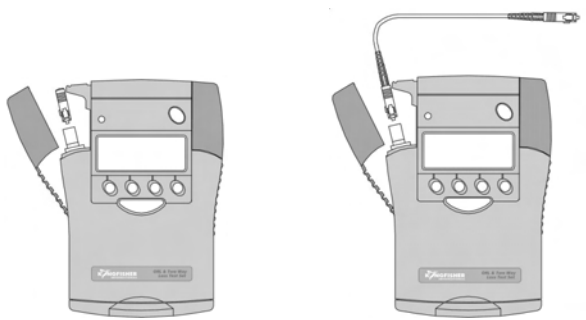
54. Re-set the meter to factory ORL defaults: select [SHIFT], [DEFAULTS,] then [SET] to store.
55. To display ORL on the DUT, select: [POWER], [RETURN LOSS], and [-/+] to select the active λ.
56. With nothing connected to the ORL port, note the ORL reading:
57. A reading of between -14.15 dB RL and -15.15 dB RL is within calibration specification.
58. Repeat this step for additional λ's.
59. Plug the PC polish Low Reflection Terminator OPT704 into the ORL port, and note down the reading.

For singlemode instruments, a reading between -35 and 'Lo' dB RL indicates terminator and instrument are working correctly.

For multimode instruments: a reading between -20 dB and 'Lo' RL indicates terminator and instrument are working correctly.

60. To verify the supplied PC-APC test lead and OPT OPT704A APC terminator: Plug the PC end of the test lead into the ORL port. Plug the APC terminator into the far end of the test lead, using an additional through adaptor not supplied.

The reading should meet the previous singlemode or multimode condition.



ORL Verification Test for KI 734x Instrument with APC Connector

This verification test uses artefacts supplied with the units:
PC/APC test lead, multimode or singlemode.
PC terminator OPT704.
APC terminator OPT704A.

Very carefully, clean **all** the optical connectors to be used, and the left hand instrument port.

Re-set the meter to factory ORL defaults: select [SHIFT], [DEFAULTS], then [SET] to store.

61. To display ORL, select: [POWER], [RETURN LOSS], [-/+] to select the active λ.

62. Plug the APC end of the patch lead into the ORL port, and note the reading.

A reading between -13.65 dB RL and -15.65 dB RL is within calibration specification.

Repeat this step for additional λ's.

63. Plug the APC polish Low Reflection Terminator OPT704A into the ORL port, and note the reading.

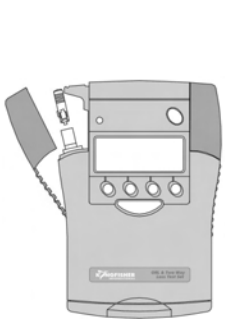
Singlemode instruments: a reading between -50 and 'Lo' dB RL indicates terminator and instrument are working correctly.

Multimode instruments: a reading between -35 and 'Lo' dB RL indicates terminator and instrument are working correctly.

64. To verify the supplied PC-APC test lead and OPT OPT704 PC terminator: Plug the APC end of the test lead into the ORL port. Plug the PC terminator into the far end of the test lead, using an additional through adaptor not supplied.

Singlemode: a reading between -35 and 'Lo' dB RL indicates the terminator, patch lead and instrument, are working correctly.

Multimode: A reading between -20 dB and 'Lo' RL indicates the terminator, patch lead and instrument, are working correctly.



PERFORMANCE VERIFICATION TABLE

Table 1: Required Major Equipment for all tests on Kingfisher Fiber optic Tester:

Instrument / Accessory	Recommended Model	Required Characteristics	Alternative Model
Optical Light Source	KI 7402A		KI 7400, KI 7800
Optical Power Meter	KI 7600A		KI 7700
Optical Attenuator	SMF KI 7010A / MMF KI7020A		
Connector Interfaces	ST, FC or SC		
Singlemode Fiber			
FC Connector Adaptor			
2.5 mm programming shunt			
Needle nose pliers			
Anti-tamper labels			
For optional test only			
Optical Spectrum Analyser	71450B		71452B, (8164xA,B)
Connector Adaptors			
Singlemode Fiber			

PERFORMANCE VERIFICATION TABLE

Table 2: General Test Record for Kingfisher Fiber Optic Tester

DUT Two Way Loss Test Set Model:	Date:
DUT Serial No.:	Ambient Temperature: ºC
DUT Options:	Relative Humidity: %
DUT Firmware Rev.:	Line Voltage & Frequency:
Test Facility:	Customer:
Performed by:	Report No.:

Special Notes:

PERFORMANCE VERIFICATION TABLE

Table 3: Equipment Record for Kingfisher Fiber Optic Tester

	Description	Model No.	Trace No.	Cal. Due Date
1.	Optical Light Source	KI 7402A	_____	_____
2.	Optical Power Meter	KI 7600A	_____	_____
3.	Optical Attenuator	KI 7010A	_____	_____
4.	_____	_____	_____	_____
5.	_____	_____	_____	_____
7.	_____	_____	_____	_____
8.	_____	_____	_____	_____
9.	_____	_____	_____	_____
10.	_____	_____	_____	_____

Accessories	#	Product
Singlemode Fiber	1	
Connector Interfaces	1	OPT060G

PERFORMANCE VERIFICATION TABLE

Table 4: Kingfisher Optical Power Meter Accuracy Test Record:

Model: **KI 7343A-InGaAs Two Way Loss Test Set + ORL** Report No.:_____ Date:_____

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

Note 1: This is for the KI 7343A-InGaAs. For the KI 7344A-Ge or H series instruments, increase by ±0.2 dB.

PERFORMANCE VERIFICATION TABLE

Table 5: Kingfisher Optical Light Source power & stability test record:

Model: **KI 7343A-InGaAs Two Way Loss Test Set + ORL**	Report No.:	Date:

Output Power (CW) Test

λ	Minimum Spec.	Measurement Results
1310 nm	-8.00 dBm	_____ dBm
1390 nm	-8.00 dBm	_____ dBm
1490 nm	-8.00 dBm	_____ dBm
1550 nm	-8.00 dBm	_____ dBm
1610 nm	-8.00 dBm	_____ dBm
Measurement Uncertainty		_____ dB

Optional Short-Term Stability Test

λ	Measurement Results	Maximum Spec.
1310 nm	_____ dBpp	(0.10 dBpp) 0.04 dBpp typical
1390 nm	_____ dBpp	(0.10 dBpp) 0.04 dBpp typical
1490 nm	_____ dBpp	(0.10 dBpp) 0.04 dBpp typical
1550 nm	_____ dBpp	(0.10 dBpp) 0.04 dBpp typical
1610 nm	_____ dBpp	(0.10 dBpp) 0.04 dBpp typical
Measurement Uncertainty	_____ dB	

PERFORMANCE VERIFICATION TABLE

Table 6: Kingfisher KI 7343A-InGaAs Two Way Loss Test Set + ORL - optional wavelength test record:

	Central λ & Special Bandwidth (FWHM) Test (optional)			
	λ	Minimum Spec.	DUT Measurement Results	Maximum Spec.
	Centre λ			
	1310 nm	1290.00 nm	nm	1330.00 nm
	1390 nm	1470.00 nm	nm	1410.00 nm
	1490 nm	1470.00 nm	nm	1510.00 nm
	1550 nm	1530.00 nm	nm	1570.00 nm
	1610 nm	1590.00 nm	nm	1630.00 nm
	Spectral Bandwidth			
	1310 nm		nm	(6nm) 3 nm typical
	1390 nm		nm	(6nm) 3 nm typical
	1490 nm		nm	(6nm) 3 nm typical
	1550 nm		nm	(6nm) 3 nm typical
	1610 nm		nm	(6nm) 3 nm typical
	Measurement Uncertainty		dB	

PERFORMANCE VERIFICATION TABLE

Table 7: Kingfisher Two Way ( ) or One Way ( ) Verification Test:

Model:	**Instrument Connector Style** (tick): **APC** [ ] **PC** [ ]	Report No.:	Date:

Calibration Test

λ	Acceptable Range	Measurement Results
1310 nm	-0.5 to +0.5 dB	dB R
1390 nm	-0.5 to +0.5 dB	dB R
1490 nm	-0.5 to +0.5 dB	dB R
1550 nm	-0.5 to +0.5 dB	dB R
1610 nm	-0.5 to +0.5 dB	dB R

Fiber Type (tick): **Singlemode** [ ] **Multimode** [ ]

Linearity & Range Test

No	Attenuator Setting	Meter Reading	Linearity Calculation	Acceptable Linearity Range[1]	
1	5 dB		-		
2	15 dB		No 2 – 1 =	9.5 ~ 10.5	
3	20 / 25 dB		No 3 – 2 =	4.5 ~ 5.5 / 9.5 ~ 10.5	
4	35 dB		No 3 – 3 =	9.5 ~ 10.5	

Note1: The linearity range here is typically limited by attenuator linearity, rather than instrument performance.

PERFORMANCE VERIFICATION TABLE

Table 8: Kingfisher ORL Verification Test::

Model:	**Instrument Connector Style** (tick): **APC** [ ] **PC** [ ]	Report No.:	Date:

	ORL Calibration Test	**Acceptable Range**, all λ and fiber types	
	λ		Measurement Results
	1310 nm	**PC**: -14.15 ~ -15.15	dB R
	1390 nm	**APC**: -13.65 ~ -15.65	dB R
	1490 nm		dB R
	1550 nm		dB R
	1610 nm		dB R

	Residual Light Test		
		Acceptable Range	Measurement Results
	APC Connector, SMF	-50 ~ 'Lo'	dB R
	PC Connector, SMF	-35 ~ 'Lo'	dB R
	APC Connector, MMF	-20 ~ 'Lo'	dB R
	PC Connector, MMF	-20 ~ 'Lo'	dB R

- To remove **interchangeable connector**, press button on rear of case and pull off adaptor. This may be easier with a test lead attached.
- To defeat **auto power-off**, hold down [POWER] for 3 seconds at turn on until 'On' and 'Perm' are displayed.
- **Low battery** is indicated with a battery symbol.
- To access the **hidden keypad**, pull up display cover.

Two Way Autotest. Models KI 7x4x only

- **Remote reference:** On each instrument: Connect two way port to power meter port. Select [POWER], [AUTOTEST], [ABS/REL]. Press [SET REF] for 3 seconds. Meter displays about 0.00 dB.
- **Local reference:** Connect two way ports of both instruments. Select [POWER] on both instruments, [Autotest], For 3 seconds, press [Set Ref]. Meters displays about 0.00 dB.
- **Loss testing:** After referencing, connect two way port of both instruments to device under test. Select [POWER] on both instruments, then [Autotest] **on one unit.** 'Auto' shows while synchronising, then average loss.
- To show one λ (wavelength) only, scroll [-/+]. To show dBm/dB results for each direction, press [SELECT] successively in hidden keypad. Press [MENU] to exit.
- **Two Way Communication:** Press [HOLD] to make remote end beep and flash [HOLD]. Then at **Remote** end, press [HOLD] to **resume** display update. Local end beeps and stops [HOLD] flashing.
- Autotest remains synchronised 8 seconds after signal loss, to allow **quick connection change.**
- To **exit Autotest,** remove connection, or press [MENU].

One Way Autotest (two way supported via KITS™)

- **Reference:** Connect a two way/source port to a power meter port. Select [POWER] all instruments. On source press [AUTOTEST], Meter shows 'Auto' while synchronising. On meter: [ABS/REL]. For 3 seconds, press [SET REF]. Meter will display about 0.00 dB R.
- **Loss testing:** After referencing, connect test system to two way / source port on source and meter port on meter. Select [POWER] all instruments. On source press [AUTOTEST]. Meter shows 'Auto', then press [ABS/REL] to show loss. Use [-/+] to show one • only.
- Press [Hold] to **hold / resume** display update. In this mode, [STORE] stores the retained reading.
- Autotest remains synchronised for **8 seconds** after signal loss, to allow quick connection change.
- To **exit Autotest,** remove test lead or turn off source for >8 seconds.

Memory

- **Store** works in all modes, however **Recall** or **Clear** only work in Source, Meter or Return Loss modes.
- **Clear all memory:** press both [RECALL] and [CANCEL] simultaneously for 3 seconds. 'clr' will display.
- To **store** in next location, press [STORE].
- To **change next** store location, press [SELECT].

  [-/+], [SET] or [MENU].
- To **recall**, press [RECALL], [-/+] to scroll memory. Use [Abs / Rel] to see dB/dBm values. Hold down [Abs/Rel] to see reference level. **Autotest** memory recall: also use [-/+] to select next λ (wavelength).

  Two way test only: press [SELECT] repeatedly to scroll details.
- To **exit** memory display, press [MENU].

Simple Light Source

Select [POWER], [SOURCE], then:

- To **change** λ, or turn off, press [-/+].
- To **activate modulation**, press [Mod]. Modulation is cancelled in power meter mode.
- To **change modulation** frequency, while source is active press [KHz], [-/+], [SET] or [MENU].
- To change laser **power level**, while source is active press [Level], [-/+], [SET] or [MENU].

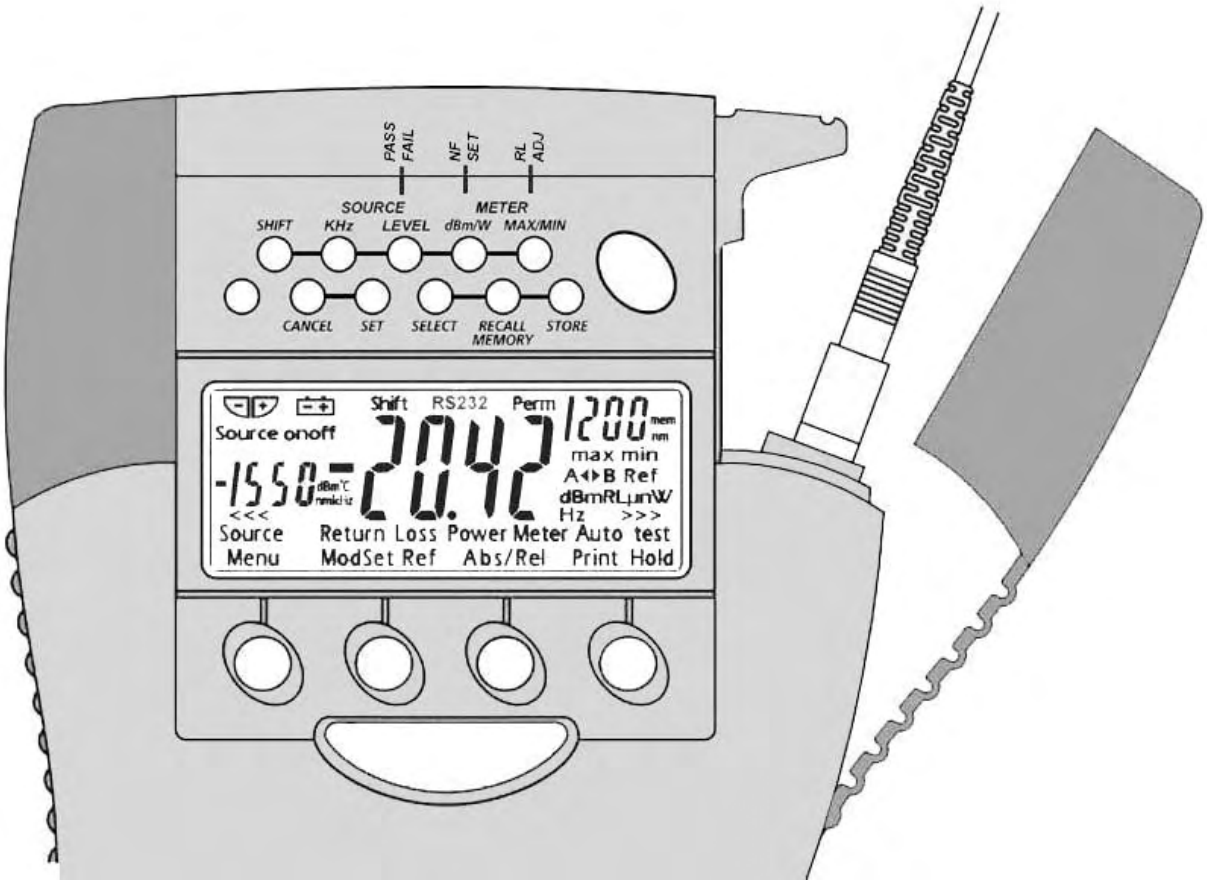
Simple Power Meter

- To **turn on & select** λ, press: [POWER].

  [POWER METER], [-/+] to select λ. If source is on, power meter λ tracks source λ.
- To **set reference**, press [ABS/REL] and hold [Set Ref] for 3 seconds (3 buzzer sounds) Meter displays about 0.00 dB R.
- To **stop / start display** update, press [HOLD].
- If a **test tone** is detected, meter will display 'Hz'.
- To display **linear mode**, press [dBm/W].
- To **display MAX/MIN** values, press [MAX/MIN] repeatedly. Hold [MAX/MIN] to reset (3 buzzer sounds).

Return Loss Meter. Model KI 734x only

- To **display ORL**, select: [POWER], [RETURN LOSS], [-/+] to set the λ.
- Set up the **residual** ORL optical condition. On the hidden keypad select: [SHIFT], [nf set], [-/+] to adjust if needed, then [MENU]. To display stored residual reference, hold [nf set] key.
- Set up the **reference** optical condition. On the hidden keypad select [SHIFT], [rl adj], [-/+] to adjust the display to the required value, and [MENU]. Offset value is shown on left of display.
- To re-set the residual and reference conditions to default values, select [SHIFT], [DEFAULTS].


PASS
FAIL
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KHz
LEVEL
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MAX/MIN
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RECALL
MEMORY
STORE
Shift
RS232
Perm
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max min
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dBm RL µm W
Hz
Source
Menu
Return Loss
ModSet Ref
Power Meter
Abs/Rel
Auto test
Print Hold

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USER NOTES