KI 5000 Optical Return Loss Meter

USER INSTRUCTION MANUAL

KINGFISHER

USER INSTRUCTION MANUAL

KI 5000 SERIES

RETURN LOSS METER

Serial No:

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

Made in Australia

CONTENTS

INTRODUCTION

The KI5000 Series Return Loss Meter is designed to measure the accumulated back reflection in optical fibre systems.

The instrument contains all the light sources, optical system and optical detectors required to perform the measurement, and has been designed to eliminate the effects of warm-up and aging of the sources on measurement accuracy.

Two versions are available:

- An inexpensive Led based unit most suited to acceptance and field measurements on fibre lines, which is fitted with a physical contact (PC) connector interface and convenient interchangeable connector adaptors

- A laser based unit with a wide dynamic range suitable for extended measurements, fitted with slant polish connector interface.

The equipment has been designed to withstand the rigours of field use, and is extremely simple to operate. Field users report faster and more accurate testing than has been previously possible.

User Calibration is not normally required, owing to the nature of the measurement circuitry which compensates for variations in emitted power levels from the internal source. This significantly reduces the lifetime cost of ownership.

Also available from Kingfisher are a range of complimentary laser and led sources, optical power meters and talk sets.

1. TYPICAL APPLICATIONS

- Acceptance testing of fibre optic transmission lines;
- Fault finding of fibre optic transmission lines;
- Checking connectors, splices and other components;
- Precision measurement of return loss;
- May be used as a light source for attenuation measurements.
- The analog output enables the instrument to be used in automated measurement systems, or to extend resolution to 0.0l dB.

2. SPECIFICATIONS

Size/Weight
Instrument 190 x 120 x 95mm (7.4" x 4.7" x 3.7")1 kg (2.2lb)
Carry Case 280 x 330 x 150mm (11" x 13" x 5.9")1.9kg (4.2lb)
Shipping weight 3kg (6.6lb)

Power
Internal nicad batteries. Auto turn-off, low battery indicator. 10hrs operation, 16hrs re-charge from external charger, 9V/200mA dc

Environmental/Reliability

Operating:	-5 to 55°C non condensing
Storage:	-30 to 70°C
Reliability:	35 years MTBF at 25°C

Optical
1300/1550nm (as relevant)

LED:	-30dBm output approx
LASER:	-10dBm output approx

Range:
LED version O to -40dB
Laser version O to -60dB

Accuracy
Calibration accuracy at -14.7dB
25°C and 99% certainty: ±0.5dB
Calibration uncertainty over 0-50°C at -14.7dB = ±0.7dB. Linearity after noise floor correction: ±0.05dB
(Note: Calibration is performed by two independent methods, which are cross-correlated for improved overall certainty.)

Display
Resolution: 0.1dB, 13mm digits
Response time: 2 seconds

Analogue Output
1 mv/dB uncalibrated
Impedance: 10k
via 4mm jack sockets

Lasers emissions are class 3A according to AS2211/1991 & IEC 825, Class 1 to CFR21.

Ordering Information

ITEM	MODEL/OPTION No
KI 5000 Optical Return Loss Meter	
1300/1550nm LED unit	KI 5002-PC
1300/1550nm LASER unit	KI 5003-SP
1300nm LED unit	KI 5004-PC
1550nm LED unit	KI 5005-PC
1300nm LASER unit	KI 5006-SP
1550nm LASER unit	KI 5007-SP
Note: Due to rapid developments, please contact factory before ordering SP connector options.	
Interchangeable Optical Connector Adaptors (order one or more)	
DIN 47256	001
FC	002
SC	003
ST	004
HMS-10/A (2.5mm SMA)	006
HMS-10/B (2.5mm BNC)	007
DIAMOND 2.5mm	007A
DIAMOND 3.5mm	007B
F & G	007C
D4	008
BICONIC	010
Special Connector Option	507
Accessories: Standard	
Operation Manual	108
Battery Adaptor	102
Hard Carry Case	142
Accessories: Optional	
Carrying Strap	104
Emergency Power Pack	100
Index Matching Gel	012
Re-Calibration	771
Low Reflection Termination	704
Patchcords or Pigtails (Please specify your requirements)	601

Please enquire for special options

3. POINTS TO REMEMBER

3.1 Safety

This instrument emits a power of less than 0.5 mW cw at either l300 or l550 nm. The output is non-hazardous to the naked eye, however remember that the invisible optical radiation can be hazardous to the eye if viewed through a magnifying device.

3.2 Optical Connector

The optical connector is a delicate precision component, and requires care in use. Please carefully observe the following:

- Never try mating incompatible or damaged connectors into the socket.
- Always clean the mating connector before mating.
- Always replace the dust cap after use.
- Never clean the optical connector with hard or abrasive items.

Owing to the particularly high performance requirements of the connector on a Return Loss Meter, extra care is recommended to avoid the chance of damaging the tip. It is strongly recommended that, where possible, the instrument be used with a permanently attached patchcord, so that connector wear is caused on the patchcord,and not on the instrument.

Optical connectors are rated to have a life of around 1,000 insertions. If used with a 'sacrificial' patchcord, this enables an instrument to do 1000 x 1000 = 1 million measurements before the connector is likely to show signs of wearing out.

Replacement of the optical connector must be performed at an authorised service centre.

To clean the connector, wiping gently with a soft lens tissue is normally adequate. For more thorough cleaning, alcohol can be used to dissolve dirt. Do not use acetone or more active solvents, since these can dissolve the epoxy glue which is used within the connector assembly.

To ensure continued high connector performance, the instrument is designed so that a patchcord can be left permanently attached, even when the instrument is stored.

3.3 External Power

This instrument runs off any 9V/200 mA dc battery adaptor (3.5mm jack, +ve tip). Check that the supplied adaptor has the correct mains voltage rating.

The unit is diode protected from reverse polarity input, and will not suffer damage if reverse inputs are applied.

It can also be charged from 12V vehicle systems in an emergency, however care should be exercised to ensure that over charging does not occur. For this application:

a. Only start charging after the low battery indicator starts operating

b. Do not charge for more than 10 hours.

4. GETTING TO KNOW THE KI 5000 SERIES

4.1 Inspection

On arrival, please carefully inspect for any obvious physical damage. If any damage is evident, immediately notify the relevant carriers and keep all packaging for inspection. Refer to the back of this manual for returns instructions.

4.2 Powering Up

Check the compatibility of the supplied mains power unit with your mains power supply. Check the setting of the 110/240V selector, if applicable. Connect the power unit to the mains, and plug the output jack plug into the instrument power socket. If the battery is completely flat, turn the instrument off and wait a moment before the unit will become operable.

Turn the 'power' switch to '1', and the display will come on. To select the appropriate test wavelength, set the selector switch and the green Led indicators will indicate which wavelength is operational. A low battery condition is indicated on the display by 'Lo batt'. The unit will remain calibrated with the low battery indicator showing, and automatically cuts out if the battery voltage gets too low for proper operation. The unit will automatically turn off after 15 minutes to conserve battery power.

4.3 Connecting a Patchcord & Making Return Loss Measurements

Please read section 3.2 'optical connector' before using the instrument.

Once a patchcord is attached, and the unit is turned on, the measured return loss will be automatically displayed in dB.

For improved accuracy, refer to Section 5 for the noise floor correction factor.

The following pages explain more about the meaning of this measurement.

Before doing anything further, you should understand return loss in fibre optic systems.

4.4 What is Return Loss?

'Return Loss' is simply the proportion of back-reflected power at any point in an optical system, and is analogous to VSWR in electrical terminology, however it is created and affected by different parameters.

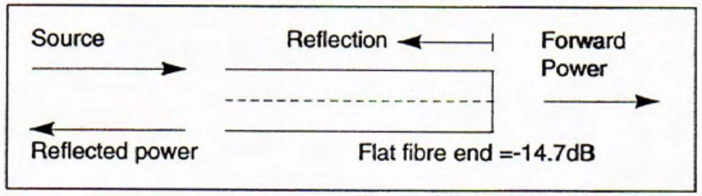
Your Return Loss Meter measures return loss at the particular point in the system where it is attached. This return loss is the accumulated effect (at the point of measurement) of all the back reflections in the optical system. The measured return loss will vary along the system depending on how optical loss in the system attenuates the various sources of reflections.

Optical reflections in a fiber system are caused whenever the light hits a physical discontinuity in the fibre, or a change in the optical index of the fibre.

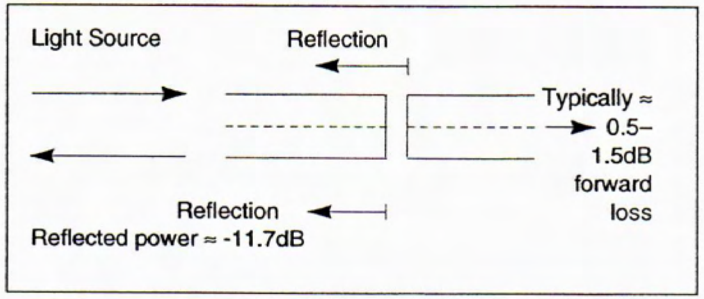
The most common causes of reflection are generally:

- connectors
- unterminated fiber ends (eg unused coupler ends)
- detector terminations
- mechanical splices
- intrinsic fibre backscatter
- attenuators and other instruments or fixtures

A flat polished fibre end will produce a back reflection level of almost exactly -14.7dB.



A connector consists of two fiber ends together, and if it is causing reflections, the effect will be doubled, to produce about -11.7dB back reflection.



In a fibre system a few Km long, and with multiple connectors, the fibre loss is not very large (eg 1Km = 0.4dB loss at 1300nm), so the reflection effect can rapidly build up to be very large, -10dB is common.

The effect of this is:

a. Multiple optical signals bouncing around the system create noise or bit error rates in the receiver.

b. If high reflections get back to the laser source, the reflections make the laser 'squeggle' or 'chirp' and upset its coherence and wavelength stability, creating dispersion and amplitude variations which seriously affect transmission.

These factors are most relevant in high quality video transmission systems, data systems running at around 256 M bit and above, and coherent systems. Reports also claim that 1550nm systems are more susceptible than 1300nm systems.

An 'infinitely long' piece of 'perfect' fibre will generally produce an accumulated back reflection of about -32dB, so this represents a limit to the field measurement of a transmission system, however, with care, short lengths of fibre and connectors can yield a return loss of up to -60dB or more.

Note also that the general fibre backscatter is diffuse in terms of its impluse response, whereas a discontinuity creates a reflective impulse 'event' which is more likely to result in a system disturbance.

A good fusion splice causes a reflection of around -70dB.

It is worth noting that high performance lasers & DFB lasers are far more sensitive to reflected noise than any other item. It is quite common for such a laser to require a reflection level of better than eg. 55dB. The practical solution to this, is to install an optical isolator just in front of the laser.

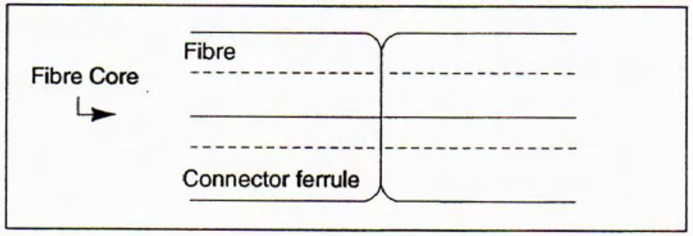
4.5 Techniques to Reduce Optical Reflections:

4.5.1 Physical Contact (PC) Type Connectors

These may look identical to a non-PC connector, however they are specially polished so that the fibre protrudes slightly from the connector end, and when mated with a similar connector, the fibre cores touch each other, so continuity of the fibre transmission path is maintained.

This type of connector is used on the Return Loss Meter fitted with interchangeable type connectors, and typically achieves between -25 to -55 dB back reflection. It only works when mated with a matching PC-Type connector (otherwise it behaves like an unterminated fibre end).

Physical Contact Connector



Typical connectors available in this special format are:

FC, D4, ST, SC, Din 47256, etc. and some Biconic types.

4.5.2 Slant polished type connector (SP).

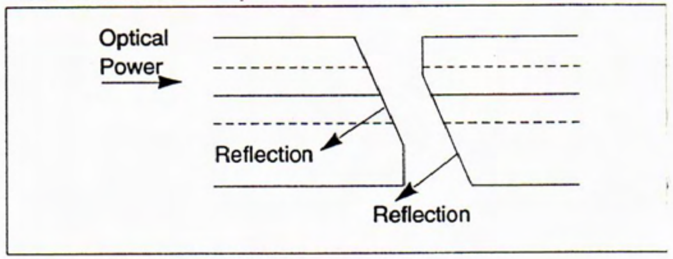
Also referred to as 'CAG' or 'Controlled Air Gap' type polish.

This may look identical to a non-SP connector, however it is specially slant polished so that the reflected light is deflected from the fibre core (offset angle typically 6-10°).

This type of connector achieves about -50dB of back reflection, however it generally has a higher forward loss in excess of 1dB.

It has the advantage of maintaining excellent back reflection properties even when not mated with another connector.

Slant Polish Connector



4.5.3 Slant Polish PC Connectors

Also referred to as 'APC' or 'Angled Physical Contact' type polish.

This combines both slant polish and physical contact techniques, and gives the best possible overall performance, eg. low forward loss, very low return loss and low - un-mated loss.

Typical mated return loss levels can be virtually unmeasurable, although -60 to -70dB is often quoted, since this is the limit of most measurement equipment.

4.5.4 Index Matching Gel

This can be used to improve the properties of mechanical splices and connectors, and in excess of -40dB can be achieved. Exact performance depends on optical index matching between the gel and fiber core, which is prone to some variation. Care is required when using index matching gel, since it is very difficult to clean off connectors once it is applied. A liberal and repetitive cleaning with solvent (eg. alcohol) is required to ensure its removal. It is not recommended to use gel as a regular part of testing, since it will inevitably contaminate connectors. However, if a 'permanent' patchcord is being used on the instrument some index match gel on the instrument output connector may improve its performance, if needed.

If connectors do get accidentally contaminated with gel, they then tend to attract dust and dirt which seriously degrades performance. Therefore, the use of index matching gel should be very carefully controlled.

4.5.5 Miscellaneous Problems:

Frequently, users tend to overlook the fibre endpoint of a system- eg. at the detector, or a loose end somewhere, or some fixture such as an attenuator.

Special precautions are required to reduce the reflections in a detector, eg. slanted fibre end, slanted detector element and suitable optics (if any).

4.5.6 Miscellaneous Solutions:

If during measurement the system has a 'loose end' somewhere, this should be optically terminated. A few techniques are:

a. Attach an optical termination which essentially is a connectorised pigtail with a low back reflection termination.

b. Wind the fibre end for about a metre around a broomstick or similar to create high loss. This can be used in combination with an optical termination to produce a termination better than -60dB.

c. Crunch the fiber end to produce a jagged break - this can be a bit erratic, but when it works, produces excellent results.

d. Put a drop of index matching gel on the end point.

Once you understand the fundamental nature of what causes back reflections, finding where they come from usually is a question of progressively eliminating the possible contributors.

5. ACCURACY CONSIDERATIONS

Your instrument has been designed to produce excellent accuracy. Effects of warm-up, detector non-linearity, gain inaccuracy and aging have been reduced to such a level where they are no longer a consideration.

The only significant considerations are:

1. Initial calibration, which is within ±1dB over temperature;

2. The effect of the measurement noise floor. This noise floor is variable, and therefore cannot be cancelled during calibration, however you can make corrections as per the graph on the next page.

The noise floor is defined as the reading the instrument gives when there is no optical back reflection. In cases where a 'permanent' patchcord is attached to the instrument, the noise floor can include reflections (if relevant) from the instrument connector, since this contribution would remain stable as long as the connector is not disturbed.

Noise Floor Correction Factor
KI 5000

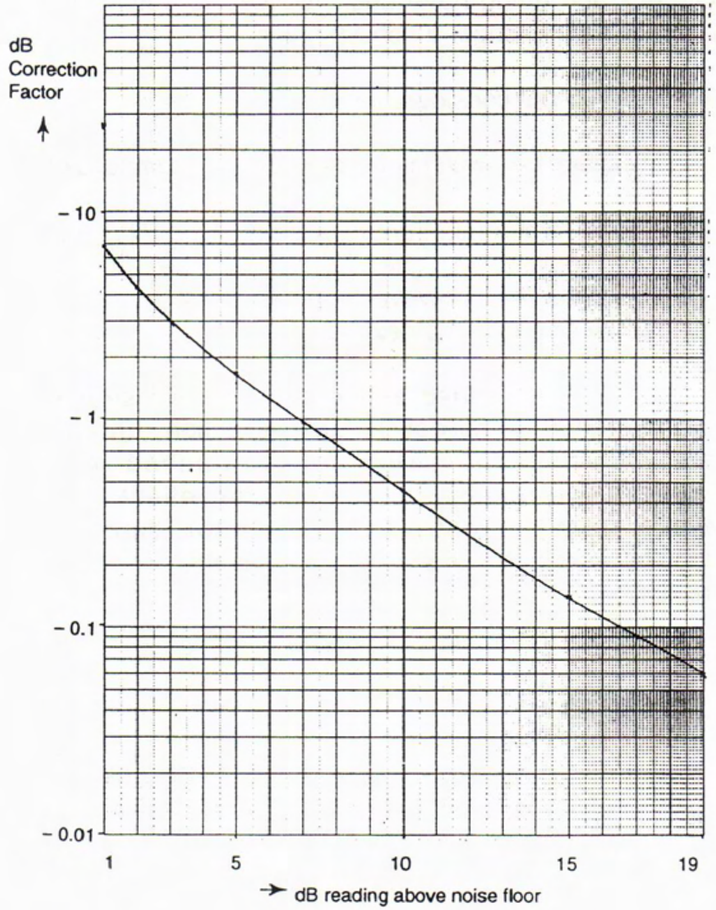
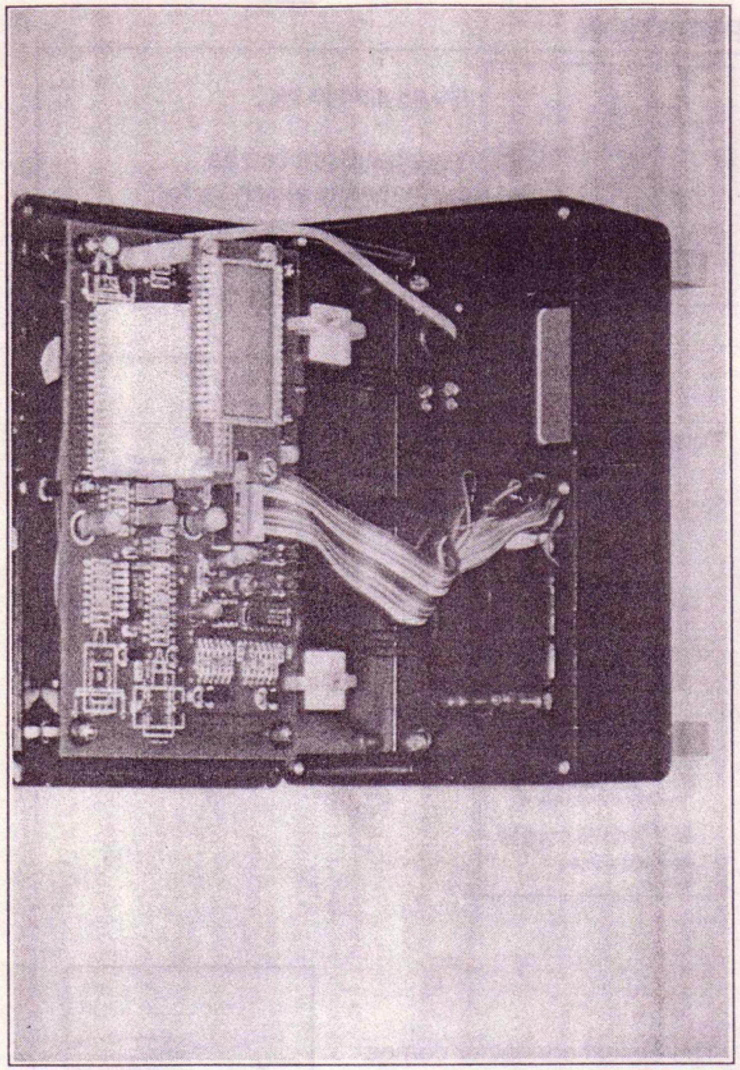


Figure 1

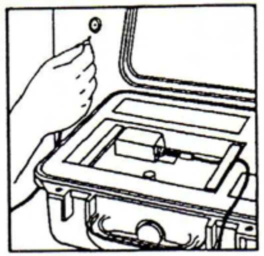
KI 5000 – Unit can be operated from case
Figure 2

KI 5000 – Accessories standard & optional
Figure 3



KI 5000 – Internal view of the instrument
Figure 4

OPERATION

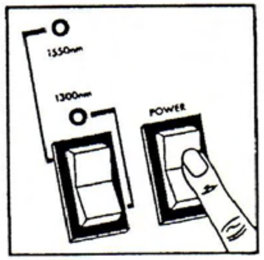


It's as simple as:

Your patchord can be permanently attached, for improved accuracy and convenience

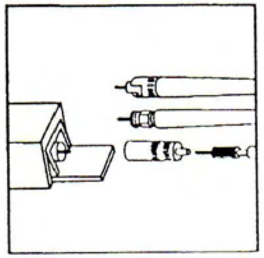
Turn the unit on

Select the required wavelength



The return loss is now displayed

The optical connector comes apart easily for cleaning and upgrading



6. CARE OF YOUR INSTRUMENT

• This instrument is fully functional without removing it from the carry case, which provides excellent protection in normal use. For field use, it is good practice to only remove the instrument from its carry case when really necessary.

• The optical connector is arranged so that a patchcord may be left permanently attached. Also, the connector is fully drop protected when the connector is attached. For field use, it is good practice to leave the patchcord attached, since this eliminates the possibility of getting dirt in this critical connector.

• When the patchcord must be removed, be sure to close the connector cover to keep out dust.

• When the hard carry case is closed, this provides waterproof and dustproof protection to the instrument. Therefore during field use, keep the lid shut when the instrument is not in use;

• Try and avoid strong sunlight falling on the instrument. This can cause it to get very hot, which is bad for any electronic equipment;

• Try and ensure that the connecting patchcord leaves the carry case via the front. If it leaves near the hinge, it may get broken if the lid falls on it.

7. ANALOG OUTPUT

The analog output is not isolated from the instrument electronics, except via 4.7K resistors, and is intended for connection to typical data acquisition systems. Avoid the use of this output in situations that could result in voltages being fed back into the analog output. A floating power supply(eg. the battery adaptor) should be used to charge the batteries in this application.

For precision laboratory measurement, the user may find it an advantage to calibrate the output with respect to the displayed value. The displayed value is the factory calibrated item, not the analog output.

Output level is 1mV/dB ±10%, 10KΩ impedance.

8. MAINTENANCE

8.1 IMPORTANT: READ THIS BEFORE OPENING AN INSTRUMENT

NOTE: Opening the equipment will invalidate the warranty or calibration.

This equipment contains delicate and expensive fibre optic and opto-electronic components. DO NOT OPEN unless:

1. You are authorised to do so;
2. You have familiarity with handling fine fibres, etc.
3. You have laboratory facilities.

The only user-serviceable parts inside are:

Changing the nicad batteries;
Changing the charger or battery fuse;

Changing one of the front panel controls/connectors/ attempting re-calibration.

These are no other user-adjustable items internally. Other electronic malfunction would imply returning the unit to an authorised service centre.

CAUTION !
Never allow a hot soldering iron to touch the fine fibres - this will cause instant damage. If using a soldering iron, make certain that any fibres are protected from any contact with the heat.

CAUTION !
This unit contains devices with extreme sensitivity to damage by electrostatic discharge. Full static control measures must be observed at all times.

8.2 Cleaning the Optical Connector

Procedures for cleaning the optical connector thoroughly will depend on the type.

Under no circumstances should hard or abrasive items be used when cleaning the connector.

The interchangeable connector series can be cleaned without dismantling anything except unscrewing the optical adaptor: use a lens tissue soaked in alcohol for thorough cleaning.

The fixed connector option supplied with the laser based instrument requires dismantling to remove really bad contamination, however before doing this, try cleaning the connector carefully. A medical cotton bud type ear cleaner, damped in alcohol, is effective for doing this, followed by an air blast to remove dust.

If this cleaning procedure does not work, then dismantle the connector housing as follows:

Remove the two screws on the slide;
Then remove the two screws holding the cover down; The connector can then be unplugged.

To clean the connector tip, use a lens tissue soaked in alcohol; clean the through adaptor, then re-assemble.

When replacing the cover, be careful not to over-tighten the screws.

8.3 Opening the Instrument

1. Read section 8.1 before starting;
2. Place the instrument face down on a bench, and remove the 6 screws holding the baseplate to the instrument body;
3. Hold the baseplate onto the unit, and place the instrument on its side with the connector nearest the bench;
4. Gently open the baseplate by pulling on the top edge. The unit should open easily and will look like Fig 4.
5. Note the position of the internal fibre going to the output connector.

Note also that all other opto-electric and fibre components are protected underneath the PCB;

6. To further separate the unit for maintenance, unplug the ribbon connector, and dismantle the optical connector, retracting the optical output completely from the outer casing;
7. The two wire-wrap ties may then be cut to completely separate the instrument to two halves.

In this way, it is easy to do repairs on the main body with minimal risk of damage to the fibre and electronic components.

8.4 Re-assembly

This is the reverse of the previous section.

Be particularly careful to:

1. Replace the cable ties;

2. Ensure that no fibre is poking out before assembling the two halves, or the fibre will get cut during assembly.

8.5 Changing the Batteries

You will need 4 x AA size nicad batteries with solder tags and 50 mA charge current, or get a (side-by side) battery park with solder terminals. These can be obtained from Kingfisher.

Note: do not attempt to solder on batteries without solder tags, or internal damage will result.

1. Open the instrument as instructed in section 8.3 and get the two instrument halves completely separated. You will see that the battery clamp is held in 3 places;

2. Unscrew the two screws (which also secure a handle) and the LED nut. You should then be able to remove the battery housing, and access the batteries;

3. Take care to re-wire the new batteries with the correct polarity, and re-assemble.

Be sure that the battery terminals cannot move and get shorted to the metal casing.

8.6 Fuses

Before changing fuses, pull out the ribbon cable connector. There are two internal fuses, 20mm fast-acting types, with functions as follows:

1. F1 protects the instrument from gross abuse of the battery charging input. If it blows, check your charger, F1=200mA;

2. F2 protects the batteries from internal short circuits. If it blows, there is a serious fault and the instrument must be returned for service, F2=1 Amp.

8.7 Changing the Operator Controls

All controls are easily replaced by a competent technician, except for the optical connector.

Items are as follows:

1. Battery charger socket – any standard 3.5 mm mono jack socket (enclosed type preferred);

2. LEDs-2mA (low current) 5mm type-any manufacturer;

3. Handles - replacements available from UK, RS (Radiospares) P/N 509-917;

4. LCD:Seiko P/N SP521P;

5. Switches:C&K type 7101-J16-2-B-E gray button/black bezel.

Procedure:

Separate the instrument into two halves as in section 8.3. The procedure for then changing any one item should be self-evident to a technician.

9. CALIBRATION

9.1 Discussion

It is most unlikely that calibration is ever required. Technically, the only events that could indicate such a requirement are:

1. Gross offset voltage or bias current shift on the optical detector amplifier. A CMOS input amplifier with silicon-gate self-aligned type construction is used. These devices offer very good long term stability, and major shifts are rare. This type of error would be indicated by a sudden shift in the noise floor, and corrected by procedure A.

Note: A degraded optical connector can produce the same apparent problem. Test the noise floor by putting index matching gel on the connector - if the connector is cracked, it is possible to get misleading results anyway - an optical inspection may be necessary.

2. An apparent gain error in readings. This would generally indicate that someone has tampered with an internal potentiometer, and is corrected by procedure B. This can also be the result of a damaged optical connector.

3. An apparent offset shift in the instrument (eg. constant offset error). This would generally indicate a shift in the optical parameters of an internal coupler, and is corrected by procedure C.

Note to Calibration Laboratory

Routine checking is of course a reasonable course of action on this instrument. Routine calibration adjustment is not recommended, since Return Loss calibration is notoriously uncertain, and the theoretical accuracy & stability of this instrument will exceed most attempts at external calibration.

If an instrument is suspect, calibration should be attempted only with the help of someone experienced at handling optical fibres. The unit contains expensive and delicate optical components. Try and determine the nature of the problem, so that a particular procedure can be tackled.

9.2 Equipment

9.2.1 Procedure A

- A patchcord to connect the instrument output to an attenuator;
- Attenuator, able to do approx. 0-60dB in 10dB increments at about 0.2dB accuracy (eg. W&G model OLA-25);
- Patchcords to enable this attenuator to be coupled to an ST connector;
- Nut spinner or socket set for nuts 5.5mm AF;
- Potentiometer adjusting tool.
- Electrical lead with crocodile clips each end.

9.2.2 Procedure B

- Two 10kΩ resistors, 1% with crocodile chips;
- One 10MΩ resistors, 1% (5% usable) with crocodile;
- Potentiometer adjusting tool;
- Electrical lead with crocodile clips each end.
- Nut spinner or socket set for nuts 5.5mm AF;
- ST-ST patchcord

9.2.3 Procedure C

- Potentiometer adjusting tool;
- Lens tissues & alcohol for Patchcord with flat-polished or PC polished connector on one end, plus lens tissues and alcohol, for fixed FC-APC connector type units (laser based units).
- Electrical lead with crocodile clips each end.

9.3 Calibration Procedure

9.3.1 Procedure A - Trimming Detector Amplifier.

Note: This is only performed on an instrument that is (approximately) correctly calibrated.

1. Follow procedure in section 8.3 for opening the instrument;

2. Use the nut spinner to remove the 6 nuts screwing down the PCB;

3. GENTLY lift the front edge of the PCB, taking care while doing so that the fibre underneath is not damaged. Observe at the back left hand side underneath the PCB, an ST receptacle (detector). Carefully unplug the connector and put it out of the way;

4. Plug your ST patchcord into the receptacle, and then GENTLY lower the PCB back onto its supports, taking care not to damage any fibres;

5. Connect a crock. clip lead to a PCB support pillar, and to the battery holder in the lid. This reduces spurious electrical interference;

6. Turn the instrument on, and set VR1 so that display reads approximatley as follows:

   LED unit: -43dB
   Laser unit: -65dB

7. Connect the ST patchcord to the attenuator, and use another patchcord to connect the attenuator to the instrument output;

8. Set the attenuator to 60dB, and turn on the instrument;

9. Step through attenuator ranges 0 to -60 dB in 10 dB steps, and note the instrument readings.

Within the limits of the noise floor, the readings should remain linear up to the points set in step 6.

This procedure is completed by re-assembling the instrument.

The aim of step 6 is to establish an approximate 10 pa bias current in the detector, which avoids the possibility of spurious readings should the return loss be outside the range which the instrument can measure. It ensures that all instruments show a similar out-of-range performance characteristic (see section 5).

9.3.2 Procedure B - Gain Adjustment

The gain adjustment is most accurately achieved by electrical methods. Optical methods are prone to far more variation. The general method is to simulate various detector currents with resistors, and set the gain accordingly. The unit should be at a reasonably stable temperature for best accuracy.

1. Follow the procedure for opening the instrument in section 8.3;
2. Use the nut spinner to remove the 6 nuts securing the PCB;
3. Gently lift the front edge of the PCB, taking care whilst doing so that the fibre underneath is not damaged;
4. Observe on the left side of the PCB, two ST optical connectors, carefully unplug these and put them out of the way. Connect both ends of your ST-ST patchcord into the detectors. This ensures a zero – light condition. Put the PCB back in place;
5. Connect a croc. clip lead to a PCB support pillar, and to the battery holder in the lid. This reduces spurious electrical interference;
6. Observe two 2-pin headers near R11 on the PCB. Connect a 10kΩ resistor across each header, turn on the instrument and note the displayed reading;
7. Replace the resistor on the header nearest R11 with the 10MΩ resistor, and note the new displayed reading;
8. If the gain is correct, the reading should have changed by exactly -30dB. If there is a gain error, correct it by adjusting VR5 until the 30dB change is achieved when swapping resistors;
9. Re-assemble unit as per section 8.3 on re-assembly/ assembly

9.3.3 Procedure C - Offset Adjustment

Offset adjustment is done optically. The simplest overall technique is to assume that a well polished flat optical connector end produces a Return Loss of exactly -14.7dB.

If any back reflectance standards etc. are available, these may of course be used.

1. Follow the procedure for opening the instrument;
2. Either:

a) Carefully clean the optical output connector if the instrument has interchangeable connectors;

or:

b) If the unit has a fixed type FC-APC connector, plug in a patchcord with either a polished connector or calibrated back reflection at the other end;

3. Turn on the instrument, and adjust the pots VR2 & VR3 to set the appropriate reading (eg. -14.7dB or the calibrated reflection value). The unit is adjusted independently for each wavelength.

Note some allowance will be required for forward and return connector loss if a termination is screwed on. Assume a return-trip loss of 1dB, therefore the back reflection would be reduced by 1dB approximately.

10. INSTRUMENT RETURNS

Before returning an instrument for repair, please check with Kingfisher or its authorised representative to obtain a Return Materials Authorisation (RMA) number. Please also state clearly the nature of the repair/maintenance needed.

11. DISCLAIMER & WARRANTY

Information in this manual is given in good faith for the benefit of the user. It cannot be used as the basis for claims against Kingfisher or its representatives if accidental damage or inconvenience result from use or attempted repair of the equipment.

Kingfisher products are guaranteed against defective components and workmanship for a period of 1 year from the date of delivery, unless otherwise specifically stated in the original purchase or contract agreement.

This warranty specifically excludes damage to the optical connector, or incorrect use. Opening the unit will invalidate the warranty.

Liability is limited solely to repair of the equipment.