



User Manual KITS™ V3.04

Build 600

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What is KITS™?

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KITS™ software is your powerful partner to improve productivity in all stages of handling fiber optic loss measuring. It can automate measurement, pass/fail analysis and record keeping using the KI 7000 Series of fiber optic Power Meters and Loss Test Sets. It can also be used with other instruments by performing manual data entry.

Benefits include improved productivity, lower required skill level, higher measurement confidence and extensive report customising capability. KITS™ enables customized professional reporting to your customers, while making the measurement process simpler and faster. KITS™ can be easily modified for any other language, including Chinese, Arabic etc.

KITS™ can form an essential element in the creation and maintenance of a corporate database of cable information, since data files can be easily interfaced to most databases through Excel import utilities built into commercial database software, or using Excel Smart Tags if used with Office XP or beyond.

What's New In V3.03

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New in V3.03

- CWDM enabled
- Data password protection
- Instrument memory dump
- Print labels with custom fiber numbering
- One wavelength memory download
- Report numbering enhanced to facilitate re-saving reports

New in V3.02

- CWDM loss testing
- Protect test results with a password in Preferences
- Support for printing labels with custom fiber numbering
- Custom report filenames can be used
- Supports one wavelength memory download

New in V3.00

- Improved support for 2 way Autotest in Loss Testing Sheet
- Meter Reading Sheet support for 2 way Autotest and Return loss
- Bug fixes and refinements
- Improved instrument communications response time
- Printing support for return loss
- Support for US distance units
- New digital security certificate
- Intergrated update and set-up into one program

New in V2.23

- Support for 2 way Autotest in Loss Testing Sheet

New in V2.22

- Support for Return Loss Readings
- Updated for Win2000/XP and Office XP environments
- Improved install, un-install and system administration
- Digital security certificate
- Faster software loading & operation

- Printing directly from Excel print menu

Versions & Support

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There are three KITS™ license versions:

- **Free version 3.20F** - 90-day evaluation version with no instrument links (older version).
- **User version 3.03U** - with instrument link for direct data transfer to an Excel spreadsheet.
- **Programmer version 2.24P** - as above, plus facility for Visual Basic programming of the software objects into other 32 bit programs such as web browsers, Labview, PowerPoint, Word etc. With additional programmer's manual.

For support, visit our Web site at www.kingfisher.com.au, contact your agent, or e-mail us on [Sales](#).

To receive technical support, let us know your KITS™ version and build number, located in KITS™, under *Kingfisher \ about KITS*, and also your instrument firmware version and serial number. The instrument firmware version is displayed during instrument start-up, and the serial number is on the rear label.

If you have ideas for useful features or changes, please send your comments to [Bruce](#) We may be able to add your ideas to a future release.

System Requirements

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- Microsoft Windows 2000 / XP.
- Microsoft Office 2000 and XP.
- 47 MB of disk space
- RS232 serial communications port. Alternatively a USB port can be used with Kingfisher option OPT188, a USB to RS232 converter cable, which is installed on the PC as a device.
- This release of KITS™ is fully functional with KI 734x ORL and Two Way Loss Test Sets with firmware version 5.00 or later. It is backward compatible with earlier firmware versions, which may provide reduced functionality. The firmware version is displayed on the instrument LCD during turn on. Firmware upgrades must be performed at a service centre.

Software Installation / Removal

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Before installation of KITS™ can be made, you must first ensure that the following programs are installed: -

- Net Framework v1.1 (free download from Microsoft)
- Net Framework Language Pack (free download from Microsoft) and,
- Microsoft Office. Only when these programs have been installed, can KITS™ be installed.

KITS™ must be properly installed. Attempts to move the program after installation will fail.

Note: If installing on Windows NT, Win 2000 or Win XP, the user must be logged into the computer using an administrator profile.

- If installing from a CD: Insert disk into CD drive, the CD will auto-start, and you can select the option to install KITS™.
- If installing from a file: Double click on the setup.exe file, and the set-up program will start. In some IT configurations this file should be run from the local machine.
- If you accept the licence conditions, select **Yes**.
- Specify if the icon should be visible to all users of this PC, or name a specific profile.
- Accept the default installation directory *C:\Program Files \ Kingfisher \KITS*, or specify another directory. Installed at the same time are convenient sub-directories for data, reports and templates.
- Accept where Set-up puts icons on the desktop and task bar, or change the settings. Alternatively, to manually create a shortcut, right click on the installed *C:\Program Files \ KINGFISHER \ KITS \ Templates \ KITS303.xlt* template file, and select **Create Shortcut**. KITS™ does not use a *.exe file, it runs using an Excel spreadsheet.
- If setup is run again, the user will be prompted to perform a repair, modify (custom) or uninstall.
- Having now installed KITS™, run the program. You will be shown an initial splash screen saying that it is '***Searching for compatible power meter...***'. If you do not have a power meter connected at the time, click on the splash screen to enter the application. Go straight to *Tools \ Add-ins* and tick the '*Kiforms*' box. You only need to do this on initial installation. This will allow the units to fully interface with the software when later connected.

Note:

- If updating from a previous version of KITS™, accept where set-up backs up templates, reports and data files, or specify another directory. However, if you have customised KITS™ (eg. to change logos or error messages) you will need to perform a manual back-up of the previous version before proceeding.
- Alternatively, if installing from files: Then double click on any update.exe files supplied, and the set-up program will start. (In some IT configurations installation files should be run from the local machine). After this installation process is done, double click on any update.exe files supplied and install this.
- To use a **comma** for the decimal point: This is set in the Windows regional settings. If it hasn't been done already, select **My Computer \ Control Panel \ Regional Settings \ Number**, enter a comma “,” for the decimal symbol, and OK.
- To use **miles** for distances: This is set in the Windows regional settings. If it hasn't been done already, select **My Computer \ Control Panel \ Regional Settings \ Number**, select “US” for the measurement system, and OK. To use **km** for the distance select “Metric” for the measurement system.
- **Excel tip:** MS Outlook is generally installed as part of MS Office. If the Outlook Journal function is not used, speed up all other applications by turning this off (it's installed active). Open Outlook, select **Tools \ Options \ Journal** tab, and de-select all items in ‘Also record files from’. Select OK and exit.
- If KITS™ seems to hang for no reason on a laptop, this may be due to the laptop power management settings. KITS™ is a realtime data acquisition program, and the power management may need to be disabled.

Online Manual

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- **Help Hints**. The on-line help icon links to the online manual, which encourages users to learn faster.

- Get around the on-line manual using the [Next Section](#) and [Back to contents page](#) hyper-links.
- There are two different help arrangements. There is an on-line html style document, and a separate MSWord document. The Word document can be easily edited by users to allow for specific work instructions, languages etc.
To print the MSWord manual: Go to the KITS™ directory, open the *User Guide.doc* file, and print it.
- To return to the spreadsheet, use the '**back**' button on the Web toolbar (normally a light blue arrow on left side), or select Excel on the Windows start bar.

General Overview

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The KITS™ Excel Workbook contains five Sheets, and links with a KI 7000 Series ORL & Two Way Loss Test Set, One Way Loss Test Set, Two Way Loss Test Set or Power Meter. The software provides full interactive control of the measurement and acquisition process.

- **Loss Testing Sheet** - For cable acceptance testing applications, this enables direct report writing and pass / fail determination as the test is performed.
- **Data Logging Sheet** - This enables flexible data logging, and includes a graph and statistical functions.
- **Label Printing Sheet** - This enables printing of small labels with loss testing results, for attaching to patch leads, equipment racks, log books etc.
- **Meter Reading Sheet** - This gives a large power meter display on the computer screen, including data that is otherwise hidden on the instrument display.
- **Meter Dump Sheet** - This enables the dumping of the stored memory when operating with more than 2 wavelengths.

KITS™ is written using Microsoft's COM specification, also referred to as ActiveX / OLE automation. This enables powerful features to be embedded within a program format that looks and feels like a familiar program (Excel), even though major new features are provided.

An Excel user of average ability can easily modify the KITS™ Excel template. Terminology, language and extra reporting data fields are easily changed.

Getting Started

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1. Connect a KI 734x Series ORL & Two Way Loss Test Set or other KI 7000 Series Power Meter to any spare RS232 serial port on the PC, using the supplied connecting lead. Ensure the jack plug is pushed fully into the instrument. Alternatively the OPT188 USB to serial converter cable can be used. This must first be installed as a device on the local computer.
2. If a new RS232 lead is needed, the connection details are as follows. Some (out of spec) serial ports need a 10 K resistor in the D connector across wires 1 & 2.

| | Wire 1 | Wire 2 | Wire 3 |
|----------------------|-------------|------------|------------|
| Instrument Jack Plug | Body (Gnd) | Ring (Tx) | Tip (Rx) |
| 9 Pin D connector | Pin 5 (Gnd) | pin 2 (Rx) | Pin 3 (Tx) |
| 25 pin D connector | Pin 7 (Gnd) | Pin 3 (Rx) | Pin 2 (Tx) |

3. Turn on the meter and PC.

4. On the PC screen, select the **KITS™** icon. The meter reading sheet will appear.
5. KITS™ scans available serial ports to find the attached meter. If this fails, check the serial connection, that the meter is on, and try again.
Note: KITS™ 3.20F demo version does not connect to a power meter. It activates a power meter simulation instead.
6. When KITS™ finds the meter, the meter reading display will be live on the PC screen. If the power meter is in Autotest mode, the table will fill with real time information. See [Autotest](#).
7. Note the sheet tabs at the bottom of the screen. Click on these to go to other functions.
8. When **Disconnect** is displayed on the button, the meter is connected to the KITS™, so live instrument measurements or memory downloads can be transferred to KITS™. When **Connect** is displayed, the instrument is not connected (so some features will not work), and data can be entered manually into the Loss Testing Sheet. This is useful when entering data from other types of instruments, over an intercom etc. To change status, or attempt a re-connection, select this button.
9. **To create a custom template:** On the toolbar, select **Kingfisher \ save template**, give the template a file name, and select **Save**. To re-open a previously saved template, select **Kingfisher \ open template** and select the required template. For details on customising the template, refer to the section in this manual: [Customising the workbook and creating a template](#).
10. Two instruments can be plugged in to two serial ports and two copies of KITS™ opened simultaneously. Manually select the serial ports in this case. To do this, select **Kingfisher \ preferences \ general** tab and select a com port.
 - **Excel tip:** To improve your screen display, On the Excel main toolbar, you can select **View \ Full Screen**.

Quick Tour / Demonstration

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This demonstrates loss measurement using a source and meter or simple loss test set. Much simpler Two Way Tester operation is then discussed.

1. To do this tour, you will need a KI 734x Series ORL & Two Way Loss Test Set or a KI 7000 Series Source and Power Meter. KITS™ software is assumed to be already installed.
2. Turn on the instruments. It is convenient to defeat the auto-timeout by holding down the green [POWER] button for 3 seconds during turn on.
3. Clear the power meter memory: To do this, hold down [CANCEL] & [RECALL MEMORY] together for a few seconds, then 'clr' will show.
4. Connect the source and meter ports with a test lead, and select [AUTOTEST] (on the source). The meter will briefly display 'auto' and then change to Autotest mode without any intervention.
5. Save say 12 new Autotest meter readings into memory, eg select [STORE] 12 times.
6. Connect the Loss Test Set or Power Meter to the PC with the RS232 lead. The RS232 connector on the instrument is an audio jack style connector marked 'RS232'. The nine pin D type connector is suitable for a typical PC.
7. Start KITS™. KITS™ will find the instrument, and then display the meter reading on the Meter Reading Sheet in real time. Since the meter is in Autotest mode, all relevant loss testing data is also displayed in the table below, and updated in real time. Use the software controls to start and stop the display update, disconnect and re-connect the meter, and change between absolute and relative display modes. In relative mode, you can set the reference value to zero, or define it as any number. The wavelength control does not operate in Autotest mode.

8. Select the on-line help icon, and you will find detailed, clear and concise operational instructions written by technical staff *for* technical staff. Alternatively you can find help from the toolbar by selecting Kingfisher, and then in the drop down, select 'User Manual (Word)' or 'User Manual (HTML)' versions.
9. Set the Light Source to 'Manual' mode (eg not Autotest). Wait 8 seconds while the meter quits Autotest. Change to the data-logging sheet (use tab at bottom of screen). Select [Start Autolog], name a file, and watch the data logging progress. Try bending the patchlead to create varying losses, and watch the graph auto-scale. You can interrupt this, and then continue. You can easily change any of the auto-logging parameters.
10. Change to the Loss Testing sheet (tab at bottom of screen). Set the Light Source to 'Autotest' mode.

Note: The 'Date', 'Report/File No' and 'Meter S/N' have been automatically inserted.

In the boxes with a blue background, type some project-related text, including the Fiber No labels. Go to Setup \ Location Setup, and enter the locations of the two ends of the fiber, and select to which end the instrument connected to KITS™ is. You can also enter the number of fibers you are testing. Go to Setup \ Test Setup, and select any of [Loss Test A > B], [Loss Test B > A], [ORL Test at A] or [ORL Test at B] readings for your report. Select dual wavelength testing. Go to Setup \ Pass/Fail Setup, enter a simple Pass/Fail number or use a standard or custom formula to determine a value.

11. Still in the loss testing sheet, go to Setup \ Pass/Fail setup, and fill in the cable and optical details as required. A number of interactive defaults in this screen guide the user towards the most common test configurations, however other configurations can also be selected.
12. **To set the reference value:** As needed, go to Setup \ Set Reference, and set reference value (with the meter still in Autotest mode).
13. Now you have set up your test, with the meter still in Autotest mode, click on a green [2nd value], or yellow [Ref level] cells, and you will get 4 values entered; 2 reference values and two 2nd values. Go ahead, fill some more values, and see how quickly you can work like this

If you have an **ORL meter** then you may also perform the optical return loss readings. An ORL reading is performed from one end of the fiber using the 'source' or left port of the KI 734x ORL & Two Way Loss Test Set.

Connect KITS™ to the ORL meter and connect the fiber to be tested to the meter's left port. Check that the location setup correctly indicates to which end of the fiber the instrument is attached. Clicking on the required ORL reading cell for the selected location will automatically initiate the ORL measurement for the selected wavelength and insert the result in the cell. Depending upon the type and purpose of the test, a non reflective termination (eg mandrel wrap) may be required at the remote end of the fibre. Note that ORL measurement is not possible during 1 Way Autotest mode.

If **2 Way Autotest** instruments are used at each end of the fibre under test, then all measurements for that fibre (including ORL from each end) can be automatically entered following a single click on any measurement cell related to that fibre. Both instruments are connected to the fibre using their left port. 2 Way Autotest mode is initiated by pressing the [AUTO TEST] button on either instrument.

14. Go to the Label Printing sheet (use tab at bottom of screen), and select [Create Labels]. The labels will update to the values you have just entered. Go to [Label Setup], and select the [Paper Format] and [Label Format] as required (eg company name etc). Any time you want to see how this is progressing, update the display using the [Create Labels] button
15. Go back to the Loss Testing Sheet. Print then save this file. The print-out is your final report, which can also be customised. Then use the [Clear] button to clear the report as needed. Then from [Setup] / [Location Setup] enter details as appropriate, connect KITS™ to 'meter connected at' end, go to the downloads tab, and download the 12 readings from the instrument.

This is a general demonstration of KITS. There is more information on each option in this manual.

Autotest

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Autotest synchronises source and meter wavelengths and transfers data along the optical fiber being measured. It requires both source and meter to be Autotest compatible instruments.

- Initiate 'Autotest' by selecting [AUTOTEST] on the **Light Source**, after which the meter and KITS™ will switch to 'Autotest' mode.
- The Meter Reading screen will automatically show a table of measurement parameters.
- If a dual wavelength source and meter are used, the Loss Testing Sheet can automatically fill in four values at each keystroke (eg both reference levels and 2nd values for two wavelengths in one direction).
- If '2 Way Autotest' capable instruments are used at each end of a fibre, the Loss Testing Sheet can automatically fill in all values with a single mouse click (ie both reference levels and 2nd values for each wavelength for each direction, plus the Optical Return Loss reading in each direction).

Using the Meter Reading Sheet

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This sheet allows the user to:

- see that the instrument and software are connected and working correctly;
- update a reference value manually or from the meter;
- view the optical power or return loss reading on the computer screen from a distance;
- view a live table of 1 or 2 way Autotest data, if the power meter is in 1 or 2 way Autotest mode;
- change wavelengths, and hold /continue display updates

Operation can be as follows (most of these operations are actually directly controlling the meter):

1. Select [**Connect**] if it is displayed, to connect KITS™ and the power meter
2. To Stop / Start the display update, select the [**Hold/Continue**] button.
3. To change the wavelength display, select the [**<**] or [**>**] buttons. (not in Autotest mode)
4. To toggle absolute / relative modes, select the [**Abs/Rel**] button.
5. The Meter Reading display shows various status indicators, e.g.:
 1. Connect / Disconnect
 2. Normal / Autotest
 3. Absolute power in dBm units, relative power in dBr units
 4. Reference value in dBm
 5. Current calibration wavelength in nm
 6. Hold
 7. Return Loss / Normal

6. Below the main display, the Autotest display shows available data when Autotest is in operation.
7. To set the current meter reading as the new reference, select **[Set ref]** (not available in 2 way Autotest mode).
8. To enter a reference manually, enter the reference value in the box, and select **[Define ref]** (not available in 2 way Autotest mode).

Loss Testing Sheet

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This section of the manual is a general description of this sheet.

For specific operation details go to [Next Section](#).

This sheet automates the task of Optical Attenuation Testing, Acceptance and Reporting.

- You control all general test parameters, which can be printed on the report.
- You can set the Pass/Fail criteria from a simple limit value, or from a formula. You can adjust the formula as required to comply with various standards.
- Use the top section of the sheet for general record keeping text.
- Use the middle section of the sheet for particular test details such as fiber count, fiber length and so on.
- The bottom section of the sheet contains test and Pass/Fail results.
- The data cells are colour coded:
 - light blue cells: - project text.
 - light yellow cells: - automatically inserted data based upon current test setup options.
 - light green cells: - cells selected for inclusion in the current test also based upon current test setup options

Generally using the mouse to click on green or yellow cells will result in automatic insertion of data from the connected instrument.

- You can automatically configure the spreadsheet (using the **[Setup]** toolbar) to enable a wide variety of operating methods, such as number of wavelengths, test directions, and combinations of memory downloads or direct data entry. [Appendix A](#) is a summary of possible combinations.
- You can dump the contents of an instrument's memory into the spreadsheet, mapped as required.
- The spreadsheet supports Autotest operations. This automatically and simultaneously displays as many wavelength results as possible, and generates additional data that is transmitted from source to meter. Autotest is started from the **Light Source**. If 'Two Way' test instruments are used, '2 way Autotest' may be started from either end.
- You can save reports and files in various file formats for compatibility with other software, or printed as labels for attaching to equipment.
- You can clear some or all data. This is handy when creating multiple reports, since the project information generally only changes slightly between each report.
- **Excel tip:** Use the Excel 'fill' function to quickly spread a value across many cells. Select the cell to be copied, then place the cursor at the bottom right of the cell so a solid black cross appears. Hold down the left mouse button, drag across the cells that you want filled, and release the button.
- If you attempt to alter previously entered data, you will be prompted before the old data is erased.

- The 'Min. margin (dB)' column shows the lowest margin between the Pass/Fail value, and the measured average values. This is a handy quick way of examining consistency of results.

The two way averaging uses correct linear averaging mathematics. The mathematically incorrect calculation produces negligible errors when averaging almost similar numbers, however it effectively amplifies the discrepancies and leads to excessive and increasing lack of consistency between results as the numbers being averaged become less similar. The table demonstrates the process:

| Incorrect Maths | | | | | | | | Correct Maths | | | | | | | | |
|-----------------|---------------|---------------|---------------------------|---------------------------|--------------|--------------|---------|---------------|---------------|---------------------------|---------------------------|--------------|--------------|---------|-----------|----------------|
| Fiber No. | Ref level dBm | Ref level dBm | 2 nd value dBm | 2 nd value dBm | Link loss dB | Link loss dB | Average | Ref level dBm | Ref level dBm | 2 nd value dBm | 2 nd value dBm | Link loss dB | Link loss dB | Average | Pass/Fail | Min. Margin dB |
| | A | B | A | B | A to B | B to A | | A | B | A | B | A to B | B to A | | | |
| 1 | 0 | 0 | 0 | -10.00 | 10.00 | 0.00 | 5.00 | 0 | 0 | 0 | -10.00 | 10.00 | 0.00 | 2.60 | | |

If you look at the results in terms of linear maths, the second result is as follows:

Loss A to B is 90%
Loss B to A is 0%

The average loss is therefore 45%, or efficiency of 55%, or 2.6 dB. The 5 dB result of the incorrect calculation cannot be correct.

The theoretical reason that averaging log values is invalid, is that averaging involves adding n values (which is OK), and then dividing this by n, which when applied to a log, is effectively taking the nth root.

For more information on this issue: [Improved Accuracy In Optical Attenuation Testing](#)

Suggested Operating Sequence for Loss Testing Sheet

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1. To get to the Loss Testing sheet, select the **[Loss Testing]** tab at the bottom of the screen.
2. If previous unwanted data is on the sheet, select **[Clear]** on the toolbar to clear the data, and select from the choices offered. If the Sheet protection is removed, normal Excel delete commands can still be used, but are less convenient.
3. Fill relevant project description text on the light blue boxes. This text prints on reports, but does not affect the test data or Pass/Fail criteria.
4. The default 'Date' and 'Report/File No' names are inserted automatically. The saved file name is auto-incremented each time the [Save] function is used. You can also manually overwrite these two cells.
5. Select the **[Setup]** button to define the required test.
 - **[Location Setup]** specifies test location names, which end the KITS™ and meter are connected to, and the number of fibers.
 - **[Test Setup]** specifies which tests are being input, local / remote referencing methods, and wavelengths being tested. [Appendix A](#) summarizes the possible combinations.
 - **[Pass/Fail Setup]** specifies the optical parameters such as cable details and pass/fail criteria at each wavelength.
 - **[Memory Download]** gives quick access to the memory download dialogue.

- **[Set Reference]** provides a convenient form to view and set the optical reference value.
6. For accurate results with $A > B$ or $B > A$ tests, the meter needs a valid optical reference from the source before starting measurements. KITS™ supports both local and remote referencing methods. To set the reference value from the attached power meter, go to **[Setup] / [Set Reference]**, set up the meter to display the required value, and select **[Set]**. To manually set the reference value, type in the value and select **[Define]**.
 7. Set up the instruments so that the required power meter display is achieved.

To enter the measurement data:

Free version: do this manually, the meter cannot connect.

User / Programmer Versions: select a cell to enter data in the green **[2nd value]** cell. You can also enter the reference value automatically, and calculate the Pass/Fail status. In dual wavelength Autotest configuration, you can enter all four values simultaneously, depending on the settings in **[Setup]**.

8. If using 1 way instruments, bi-directional measurements can be achieved by performing single direction measurements from each end. The second set of values can be entered directly or downloaded.
9. You can change the fiber number to any required identifier.
10. When the report is complete, save the report using the **[Save]** button. Prompts will ask for file type, name and location.

Instrument Memory Dump

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- The instrument memory contents can be selectively dumped and mapped into a Loss Testing sheet.
- You can select from particular blocks of instrument memory, and select how to map these onto a work sheet. [Appendix A](#) is a summary of possible combinations of actions.

1. Select **[Setup] / [Location Setup]**
2. Specify the data in **[Meter connected at]**. This determines how the data will be transferred. Refer to [Appendix A](#) if you would like to review the options.
3. Select **[Setup] / [Memory Download]**.
4. In the dialog box, select the **[Start Memory]** location. This determines the first instrument memory location from which the download will start. The information display lets you verify the expected data. The 'Matched' tick boxes show if the memory wavelengths match the spreadsheet wavelengths. If they do not match, change the spreadsheet wavelengths. **[Type]** will indicate if the stored measurement is for Autotest ('Dual' or 'Dual 2 Way') or Manual ('Single').
5. Specify **[No. of Fibers]** to download. This determines the number of sequential memory locations that will be downloaded.
6. Specify the spreadsheet **[Start at Fiber No.]** number to start filling. This determines the first fiber in the spreadsheet at which the download will start.
7. Select **[OK]**, and the data will appear on the spreadsheet in the requested format.

Memory download supports 'power' and 'reference' readings only.

Label Printing

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To set up your label formats:

- In the Label Printing tab, select **[Label Setup]**. This free-format facility can define the label size and layout, fonts, the format within the label, and a choice of data types. There are various fields to print, for example: Company Name (2), Test Date, Batch, Fibre No., Pass/Fail, Loss Type, Wavelength, Test Result, Link Loss, Patchcord Loss, Return Loss.
- All fonts installed in Windows are available. To install additional Windows fonts, refer to your Windows manual.
- Labels showing loss testing results can be printed for attachment to equipment or connecting leads. You can print either sheets of labels, or one at a time on a small label printer.

To print labels:

1. In the Loss Testing Sheet, select **[Print]** / **[Print Labels]**
2. See what the printed labels will look like with the on-screen display. If this is OK, select **[Print Labels]**, or **[Print 1-by-1]** to select and print one label (the numbering is in the same order as the Fiber No.).
3. Select **[Create Labels]** to update the labels.

Manual Data Logging

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The data-logging sheet does not support Autotest or return loss modes. The Light Source and Power Meter **must** be in 'manual' mode.

1. Select the **[Data Logging]** tab (Free version will not connect to a power meter).
2. To clear existing data, select the **[Clear Log]** button.
3. To set the wavelength, use the arrow buttons next to **[Wavelength]**.
4. Select the relative mode if required using **[Relative Mode]**.
5. Optionally add a **[Description]**, which can be any text you like.
6. For each click of **[Manual Reading]**, a data point is logged. The data point index and the size of the log is automatically incremented.
7. To undo the last reading, select **[Undo Reading]**. This button decreases the data point index, but not the size of log value.
8. To save the data log, on the toolbar, select **[Save]** and enter details in dialog box.
9. A saved log can be later brought back into the spreadsheet. On the toolbar select **[Load]** and enter details in dialog box.
10. Chose to print 'Data+Summary', 'Graph+Summary' or 'Graph Only'.

Automatic Data Logging

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The data-logging sheet does not support Autotest or return loss modes. The Light Source and Power Meter must be in 'manual' mode.

The user specifies the time interval and number of data points to be analysed, stored and plotted on a graph. The data is written directly to disk, to minimise data loss in case of a process interruption.

1. To set the wavelength, use the arrow buttons next to **[Wavelength]**.

2. Define [**Size of Log**].
3. Define [**Log Interval (sec)**].
4. To select relative mode, select [**Relative Mode**].
5. Optionally add a [**Description**], which can be any text you like.
6. To clear existing data, select [**Clear Log**].
7. Select [**Start Autolog**] to start. You will be asked to select a log file. While logging is in progress, each data point is written direct to disk.
8. The log finishes when the number of log points reaches the specified size of log. To stop a log before it is completed, use [**Stop**]. Select [**Continue**] to continue.
9. The following statistical information is provided: max, min, mean, standard deviation and current reading.
10. Chose to print 'Data+Summary', 'Graph+Summary' or 'Graph Only'.
11. A saved log can be brought back into the spreadsheet, using [**Load**].

Customising the Workbook and creating a Template

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- The software is supplied as an Excel template. You can easily create and recall modified templates, which is very handy for working on assorted jobs, changing languages, terminology, and so on. For detailed instructions, see [APPENDIX D - KITS™ Customisation Instructions](#)
- Extra rows and columns can be inserted with the usual Excel commands, so that new data can be presented.
- Modified templates are also useful to store parameters such as printer settings, custom hyperlinks etc, which must be correctly selected when the template is stored.
- **Excel tip:** The supplied template is protected to prevent accidental alteration. To enable changes, on the Excel toolbar, select [**Tools**] \ [**Protection**] \ [**Unprotect Sheet**].
- **Excel tip:** To modify column width, in the Excel toolbar select [**Format**] \ [**Column**] \ [**Width**], and enter required value.
- To save the workbook as a template, on the toolbar select [**Kingfisher**] \ [**Save Template**]. To recall this template, you can use [**Kingfisher**] \ [**Open Template**] to access and run the file. To enable updating of 'Date' and 'Report/File No.' each time the template is used, clear the [**Date**] and [**Report/File No**] fields before saving the template.
- For extensive customising capability, you may like to ask about the Programmer release of KITS™. This is suitable for an organisation with in-house VB programmers, who can then write their own code to enable special functions. Since the program is written in a multi-tiered approach using Microsoft's COM (ActiveX / OLE automation) specification, this is a relatively simple task for a competent programmer.

Read [Appendix D](#) for more details about KITS™ customising.

Contact us

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Kingfisher International Pty Ltd.
30 Rocco Drive
Scoresby, Victoria, 3179, Australia

Freecall: 1 800 807 369,

Tel: (613) 9757 4100
 Fax: (613) 9757 4193
 E-mail: [Sales](mailto:Sales@kingfisher.com.au)
 Web site: www.kingfisher.com.au

6th Edition, Aug 2005

*Thanks for staying with us
 We hope you enjoy using our software*

APPENDIX A - Options & Actions

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Data Transfer from Meter(s) to Kits™

Assumption: If a direct transfer, or later download, is performed between an instrument and KITS™, there is no difference in what is transferred.

| Test Directions | Reference Options | Kits connected to meter at | Reference | | 2 nd value | | ORL | |
|----------------------------------|-------------------|----------------------------|-----------|---|-----------------------|---|-----|---|
| | | | A | B | A | B | A | B |
| A to B | Remote Reference | A | | | | | | |
| | | B | | | | | | |
| | Local Reference | A | | | | | | |
| | | B | | | | | | |
| B to A | Remote Reference | A | | | | | | |
| | | B | | | | | | |
| | Local Reference | A | | | | | | |
| | | B | | | | | | |
| Bi-Directional | Remote Reference | A | | | | | | |
| | | B | | | | | | |
| | Local Reference | A | | | | | | |
| | | B | | | | | | |
| ORL at A ORL at B | | A | | | | | | |
| | | B | | | | | | |
| 2 Way Autotest Bi-Directional | | A | | | | | | |
| | | B | | | | | | |

A **remote reference** is performed when two power meters are used to perform one loss test. One power meter is used to measure the Reference Level (eg the light source output power), and the other meter is used to measure the 2nd value. These measurements are performed sequentially, to minimise the effect of source drift over time. This method is commonly used with bi-directional testing where the two ends of the system to be measured are far apart. If this method is used with single directional testing, the absolute measurement accuracy of the two meters becomes critical. The bi-directional method is used to overcome this defect.

A **local reference** is performed when one power meter is used to measure both Reference Level and 2nd value measurements. This commonly used in a situation where both ends of a system can be accessed readily by the one meter (for instance loop-back testing, or bench testing)

Bi-directional testing is typically used with the remote referencing method in situations where the two ends of the system are far apart. This method eliminates the effect of absolute calibration discrepancies between two power meters. This method is affected only by short-term source stability and power meter linearity. Source long term stability and meter calibration accuracy are both eliminated. So this is the preferred method for telecom use.

Appendix B - Bi-Directional Test Procedures for 1 way instruments

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This note details two methods of fiber loss testing and reporting using Kingfisher KI 7000 Series instruments. These are both bi-directional test methods, however in one method the data is taken directly using a portable computer (laptop), and in the other method data is stored in the instrument memory, and transferred to a PC at a later stage. Other operational combinations are also possible.

Definitions

- At end A, the Source is called SA, the meter is called MA, and a PC is called PCA
- At end B, the Source is called SB, the meter is called MB, and a PC is called PCB
- The fibers are called fiber 1, 2, 3 etc

Direct Method

This is the fastest method, with the work done directly on the laptop. Measurement data is input directly into KITS™ software at each end, and then the two reports are merged together. There is no need to use the instrument memory.

Equipment Required:

- Two KI700 series ORL meters with RS-232 cable. We used 1310 / 1550 nm sources here.
- Two Laptop PCs with KITS installed. < /ul>

Step 1: Measurement

1. At each end, connect the meters to the PC with the RS232 cable, and turn on the PC. Turn on both sources and select Autotest on both sources (hold the 'power' button to defeat auto-off). Turn on both meters. Hold down the 'power' button to defeat auto-off. On both PCs, Start KITS and select the Loss Testing sheet. To obtain extra information, please use the Help button.
2. KITS Loss Testing sheet (say PCA): Enter general job details in the blue boxes. This file will become the 'master' file, with all of the general data. It is not necessary to enter this data in the other PC.
3. KITS Loss Testing sheet (both PCs): On the toolbar, select Setup / Location Setup, check the following (default) settings in the dialog box:
Terminal Names: Terminal A: A, Terminal B: B
Connected to meter from: SA at end A, SB at end B
adjust the number of fibers in the spreadsheet (no limit)
then click OK.
4. KITS Loss Testing sheet (both PCs): On the toolbar, select Setup / Test Setup, check the following (default) settings in the dialog box:
Test Directions:

A -> B
 B -> A
 ORL at A
 ORL at B

Reference: Remote reference
 Select dual wavelength test.

5. KITS Loss Testing sheet (both PCs): On the toolbar, select Setup / Pass Fail Setup, check the following settings in the dialog box:

Put cable details information in the relevant boxes. This is used to calculate the pass/fail values in the other tabs. Click on the 1310nm Pass/Fail tab. For this example, we use the standard formula. Or make your own Custom Formula, or use a Simple Limit. Then click OK.

6. If you want to store these settings as a template, go to Kingfisher / Save Template. This means that someone else in the office can perform this stage prior to use.
7. Reference both sources: Connect SA to MA with a test lead (or two test leads and a through connector, depending on requirements). On PCA KITS Loss Testing sheet, select Setup / select Set Reference.
Then do the same for end B.
8. You are now ready to start testing, so connect SB and MA to fiber 1.
PCA KITS Loss Testing sheet: on fiber 1, click on any coloured cell. In a few seconds, data will fill Ref Level A, and 2nd Value or ORL A for both wavelengths.
Continue for Fiber 2, 3 etc as relevant.
9. To measure in the other direction, perform step 7 in the other direction

Step 2: Merging KITS files

10. KITS Loss Testing sheet (both PCs): On the toolbar, select Save / As Excel 97 Workbook / , and Save. Notice that the file name auto-increments.
11. Transfer both data files to the same PC into the KITS / Reports directory. A floppy disk, modem or E-mail can be useful for this. The instruments are not required for this process.
12. Start KITS Loss Testing Sheet. On the toolbar, select Load / From Excel 97 Workbook, and the file from PCB.
KITS Loss Testing Sheet: On the toolbar, select Merge, select the other file from PCA, and make detail selections if required (the defaults should be OK):
Report Data Mapping: Direct
Merge Destination Selection: All Test Data
Method: Fill-in
View Report: Current
and then OK.
The data will then transfer to the open sheet.
13. Save the open sheet with the merged data. The process is complete. You can print the report at this stage.

Indirect Method

This is slower than the direct method, however it does not require on-site computers. Measurement data is stored into both power meters, and then both are downloaded into KITS software later. KITS 2.22 does not support memory downloads of return loss data.

This method minimises on-site equipment and expertise, but requires more steps overall.

A variant of these two methods is to use the direct method with one power meter (as the previous method), and the indirect method with the other. This can save time if one PC only is available.

Equipment Required:

- Two KI700 series dual wavelength Light Sources. We used 1310 / 1550 nm sources here.
- Two KI700 series Power Meters with RS-232 cable. We used an InGaAs meter here
- One on-site or off-site PC with KITS installed.

Step 1: Measurement

1. Turn on and select Autotest on both sources. Turn on both meters. (hold the 'power' button to defeat auto-off)
2. If relevant, clear the power meter memory (button Recall+Cancel for 3 seconds) or start at a particular start location (button Select -/+). Make a note of this location.
3. Reference both sources:
Connect SA to MA with a test lead (or two test leads and a through connector, depending on requirements), and hold down Set ref till 2 beeps, push ABS/Rel button again. Note which s/n source is at which location.
Repeat at end B.
4. You are now ready to start testing:
Connect SB and MA to fiber 1.
To store a reading, on MA select 'store' on the hidden keypad.
Continue for Fiber 2, 3 etc as relevant.
5. Perform the previous step in the other direction.

Downloading and Merging Data

6. Connect a meter to the PC with the RS232 cable, and turn on PC and meter. Start KITS and select the Loss Testing sheet. Also note the Help button.
7. KITS Loss Testing sheet (say PCA): Enter general job details into the blue boxes.
8. KITS Loss Testing sheet (both PCs): On the toolbar, select Setup / Location Setup, check the following (default) settings in the dialog box:
Terminal Names: Terminal A: A, Terminal B: B
Connected to meter from: SA at end A, SB at end B
adjust the number of fibers in the spreadsheet (no limit)
then click OK.
9. KITS Loss Testing sheet (both PCs): On the toolbar, select Setup / Test Setup, check the following (default) settings in the dialog box:
Test Directions:
A -> B
B -> A
Reference: Remote reference
Select dual wavelength test.
10. KITS Loss Testing sheet (both PCs): On the toolbar, select Setup / Pass Fail Setup, check the following settings in the dialog box:

Put cable details information in the relevant boxes. This is used to calculate the pass/fail values in the other tabs. Click on the 1310nm Pass/Fail tab. For this example, we use the standard formula. Or make your own Custom Formula, or use a Simple Limit. Then click OK.
11. In the same dialog box, select the download tab:
Set up the various parameters depending the testing performed.
Select OK, and the data will transfer to KITS.
12. To download the data from the other meter:
Connect the other meter to the RS232 cable, and turn it on:

Go back to Setup / Location Setup, change 'connected to meter' to the other end. Select the Dowload tab, and then OK, and the data will transfer to KITS.

13. KITS Loss Testing sheet (both PCs): To save the data, on the toolbar, select Save / As Excel 97 Workbook / , and Save. Notice that the file name auto-increments.
14. The process is complete. You can print the report at this stage.

Appendix C: Improved Accuracy in Optical Attenuation Testing

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Summary

This paper points out a flaw in the industry standard method of calculating bi-directional optical attenuation in optical communications systems, This flaw tends to exaggerate problems due to poor measurement technique, resulting in needless re-work. A simple remedy for this problem is to use a spreadsheet to perform the required calculations.

Current Practice

Fiber optic communication systems are being installed at a massive rate, to cope with rapidly increasing data communications requirements worldwide.

A critical part of verifying the cable installation, is measuring end to end optical attenuation. This measurement is important to ensure that the system will perform to specification. The effect of optical attenuation on a typical communications link can be illustrated as follows:

Maximum attenuation over which the system can operate
(from transmission equipment specification sheets), say = 25 dB

Maximum installed cable attenuation with say 6dB
optical margin to allow for degradation over planned lifetime = 19 dB

In this example, the attenuation test must ensure that the installed cable attenuation is not more than 19 dB. To ensure this, the tester must make allowance for measurement uncertainty, which is say 1.5 dB, so:

Maximum measured attenuation will be no more than $19 - 1.5 \text{ dB} = 17.5 \text{ dB}$

The attenuation is commonly calculated by averaging a bi-directional measurement using a remote reference. There are various reasons given for this, but the most important practical reasons are that this method eliminates meter calibration errors and minimises the effects of source drift.

This paper does not attempt to analyse the various work practices surrounding this process, however it does analyse the outcome, because the simple maths involved contains a fundamental flaw, as follows:

Attenuation measured in one direction: x

Attenuation measured in other direction: y

Average attenuation: $(x + y) / 2$

This is of course simple stuff, however the hidden flaw is that it is mathematically incorrect for the logarithmic or dB units, which are commonly used. The example in Table 1 using both linear and logarithmic methods demonstrates this:

| Table 1. Example of Mathematical Averaging Error | | |
|---|---------------------------------|-------------------------------------|
| | <i>Averaging using dB units</i> | <i>Averaging using linear units</i> |
| Loss in one direction | 0 dB | 0 % |
| Loss in other direction | 100 dB | 100 % |
| Average | 50 dB (47 dB error) | 50 % (correct 3 dB) |

The mathematically correct answer is 3 dB, which is given by the linear maths. In this example, the error caused by attempting to average logarithms is massive, 47 dB.

Why is it that the industry standard approach has not been corrected a long time ago? The easy answer is of course that the two numbers being averaged are normally fairly similar, so the discrepancy is smaller and easily missed. It is also much easier to do a simple mental calculation to average almost similar numbers. For example, the average of 3 dB and 3.2 dB is near enough 3.1 dB. Also, it is only recently that field technicians have routinely carried computers.

Problems Resulting From the Averaging Error



Under ideal measurement situations, the errors are indeed small enough to ignore.

However when measurements are less than ideal, the more lossy measurement term comes to dominate. In fact, this discrepancy leads to an interesting problem, where all of a sudden 'all measurements are suspect', and total re-work is demanded. The error is summarised in Graph 1, which shows that the maths error produces real world errors when the (x and y) measurement differences are above 2 dB.

A Practical Example

Table 2 shows a 10 fiber cable, measured in each direction (at one wavelength) with a source and meter. For the sake of clarity of numbers, the cable loss is taken to be 0 dB, so the numbers in the table represent extra losses due to poor measurement practice:

| Table 2. Practical Example | | | | |
|-----------------------------------|---------------------------------|---------------------------------|------------------------------|-------------------------------|
| <i>Fiber No</i> | <i>Measured loss A>B, dB</i> | <i>Measured loss B>A, dB</i> | <i>Incorrect Log Average</i> | <i>Correct Linear Average</i> |
| 1 | 1.00 | 1.50 | 1.25 | 1.24 |
| 2 | 0.60 | 1.00 | 0.80 | 0.80 |
| 3 | 1.50 | 0.80 | 1.15 | 1.14 |

| | | | | |
|---------------------------|------|------|-------------|-------------|
| 4 | 2.00 | 0.40 | 1.20 | 1.14 |
| 5 | 0.40 | 2.10 | 1.25 | 1.16 |
| 6 | 0.80 | 3.00 | 1.90 | 1.76 |
| 7 | 1.80 | 1.00 | 1.40 | 1.38 |
| 8 | 2.00 | 0.80 | 1.40 | >1.36 |
| 9 | 1.00 | 0.50 | 0.75 | 0.74 |
| 10 | 3.00 | 1.00 | 2.00 | 1.89 |
| <i>Mean</i> | | | <u>1.31</u> | <u>1.26</u> |
| <i>Standard Deviation</i> | | | <u>0.40</u> | <u>0.36</u> |

In this example, the error caused by the log method is small but observable, with the 95 % confidence limit shifted by about 0.1 dB. This agrees with the previous statement that the maths error becomes an issue when the measurement discrepancies are of the order of 2 dB (in this case the average is 1.26 dB).

This example demonstrates that Graph 1 could be used to estimate the errors achieved in any particular situation.

Effect of Using Different Sorts of Test Instruments

This error is somewhat affected by different sorts of loss testing instruments and working methods. In practical terms, the maths error is most relevant if two separate tests are averaged.

For example, if a simple source and meter are used to perform a bi-directional test, effectively 2 independent tests are set up and performed, and the maths error will be present.

If a bi-directional test instrument were used, effectively there would be no maths error due to multiple connector insertions, since the test is only set up once. However, the instrument would still need to use the correct maths internally. This is easily checked by performing a test on, for example, an optical isolator, which should average to only a few dB loss. Also, in this case, random bad connection errors are 100% shown in the final results, so more care is needed to ensure there are no bad connections.

Discussion

The practical effect of the maths error has been verified in conversations with senior field staff, who readily confirmed that they frequently specified re-testing, or re-work had been requested by others, where they were confident there was no actual problem. Having discussed the error, they agreed that the corrected maths would have resulted in fewer problems.

The effect of these delays on network specification, repair times and system rollout schedules is real. The solution is now very simple: average the measurements using a spreadsheet, which

incorporates the correct linear maths. The use of a PC is now very common for recording results.

Conclusion

A maths problem affecting the practical accuracy of end to end attenuation testing has been identified and demonstrated. The result of this problem is needless re-work and delay in cable installation and repairs. Due to the now common use of PC computers, this is easily fixed by use of a spreadsheet set up with the correct linear maths.

A free spreadsheet with correct maths and suitable for loss testing reporting is available for download on [KITS software](#).

Contact the author: [Bruce](#)

15 April 00

Appendix D: - KITS Customising Instructions

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KITS is supplied with an English user interface. The language, terminology or displayed data can be customised by anyone with a reasonable working knowledge of Excel and Notepad:

- New rows and columns can be inserted, to display new data as required.
- Most items within worksheet cells can be renamed. A few are modified by the KITS program, and can not be changed.
- Items in the KITS menu bar, dialog windows and error messages are defined in a separate text file, which can be edited.
- KITS also contains an XML map.
- Other modifications to VB code can be performed with the programmer version, which is not discussed in this note.

Languages such as Chinese, Arabic etc require special fonts sets and other language specific programs so that the computer can display the correct symbols.

Modifying Spreadsheet Cells

- Cell that change contents during the running of the program need not be changed. They are overwritten by the program.
 - Do not modify the contents of cells containing formulas.
 - To modify the buttons, the logo, and the Internet URL: modify the file caption.txt to assigning new items (see section on other customisable items).
 - The explanatory note in the upper right corner is a drawing. To change this, delete it and make a new drawing. The drawing should be grouped together into a single item.
1. Remove sheet protection (using Tools / Unprotect Sheet menu in Excel). Then modify the text in the cells as required.
 2. Remember to re-apply sheet protection when the required changes are done!

Modifying Menu Bar, Dialog Boxes and Error Messages

Open the text file named "errmsgs.txt". This file contains messages organised by message numbers. The file also contains comments that explain the usage of the messages in KITS. The messages can be modified as required. The comments can be left unchanged or deleted.

The messages in "errmsgs.txt" some times contain trailing space characters. These space characters are significant. When translating into another language, the trailing spaces must be preserved. Otherwise, the resulting error messages may be incorrectly formatted.

Making New Install Kits

If the original installation uses the compressed KITS.xl_ file, then the workbook template should be compressed using Microsoft compression utility "compress.exe". The compressed file should be named as KITS2.xl_ and put back into the installation files folder. Save the modified file as "errmsgs.txt" and put back into the installation files folder.

Other Customisable Items

The following items that appear in the workbook are customised in the file *caption.txt* installed into the "Custom" subfolder. To perform customisation, this should be modified. It can be edited with Windows notepad.

- The name of the custom toolbar can be changed. This is the *first line* in the "caption.txt" file
- The caption of the first menu item on the custom toolbar can be changed. This is the *second line* in the "caption.txt" file.
- The Internet URL can be customised. This is the *third line* in the "caption.txt" file.
- The logo used in the worksheets can be customised. This image is provided through an image file. The image can be of any of the following formats: bmp, gif or jpg. The name of the file containing the image is specified in the *fifth line* in the "caption.txt" file.
- The background image in the start-up screen can be customised. This image is provided through an image file. The image can be any of the following formats: bmp, gif or jpg. The name of the file containing the image is specified in the *fourth line* of the "caption.txt" file.
- The name of the program can be customised. This is the *sixth line* in the "caption.txt" file.
- The name of the help file can be customised. A different help file can be specified to be used with KITS. The name of this new help file must be specified as the *seventh line* in "caption.txt" file.

errmsgs.txt File Format

The format is defined as follows ({} denotes data which is optional):

[error code]

{<Part#>} {@}Error text part

{@} another line of the same error text part

{<Part#>} {@}Error text part

{@} another line of the same error text part

[error code]

....

[end]

Format Description

[error code] - error code identifier which is a numeric constant. This constant is of type of long integer. Any text below an error code line and the next error code line is regarded as parts of the error message.

<Part#> - identifies parts of a multipart message text. If two lines of text belong to a single part, the line-break is preserved. If the part identifier line has text data, then the part identifier is stripped off and the remainder treated as a regular line. If no part identifier is present for an error message, then all items are regarded as forming a single unidentified part. This part will be assigned as part 1. If a part identifier is skipped (eg. when Ids 1 and 3 are defined, but 2 is not), the skipped part's content is then undefined and could be any text from previous messages.

Leading spaces - leading spaces are suppressed automatically.

Trailing spaces - trailing spaces are preserved

@ - if this symbol is used at the start of a line, then this symbol itself will be stripped away, and all characters behind it preserved until the end of the line. This is used to preserve leading spaces

Blank lines - blank lines are suppressed. To deliberately introduce a blank line, use the @ symbol at the start of a line.

- if any line starts with this symbol, then the entire line is ignored. Since leading space is ignored, the line is ignored even if this symbol is preceded by spaces. To include a line that actually starts with this symbol, use the '@' symbol.

Examples

[10000]

<1> Instrument driver not initialised or linked

This is the second line with leading space suppressed

this is a comment

this line is also a comment. It is not part of the message

@ This is with leading space

<2> Instrument not supported

This is the second line

@ This is with leading space

[10001]

This is a single part message. No part identifier is given

[end]

End-User License Agreement for Kingfisher Software

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Warranty

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