

# OPL-MAX Tutorial

## Overview

The OPL-MAX application supports multichannel serialized cable testing for Insertion Loss and Return Loss. It offers following features and functions:

Configuration of following measurements:

- Insertion Loss measurement
- Return Loss measurement
- Single wavelength or dual wavelength measurement

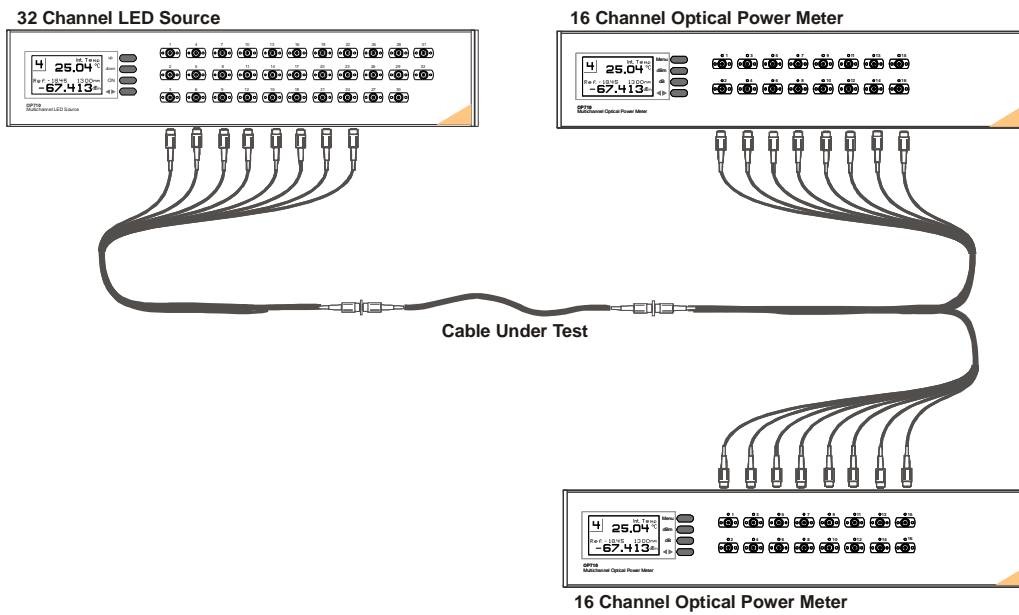
User selectable parameters for:

- Averaging reference measurement for better accuracy
- Data logging of reference measurements for traceability
- Pass/fail condition for IL in either direction for either wavelength
- User prompts

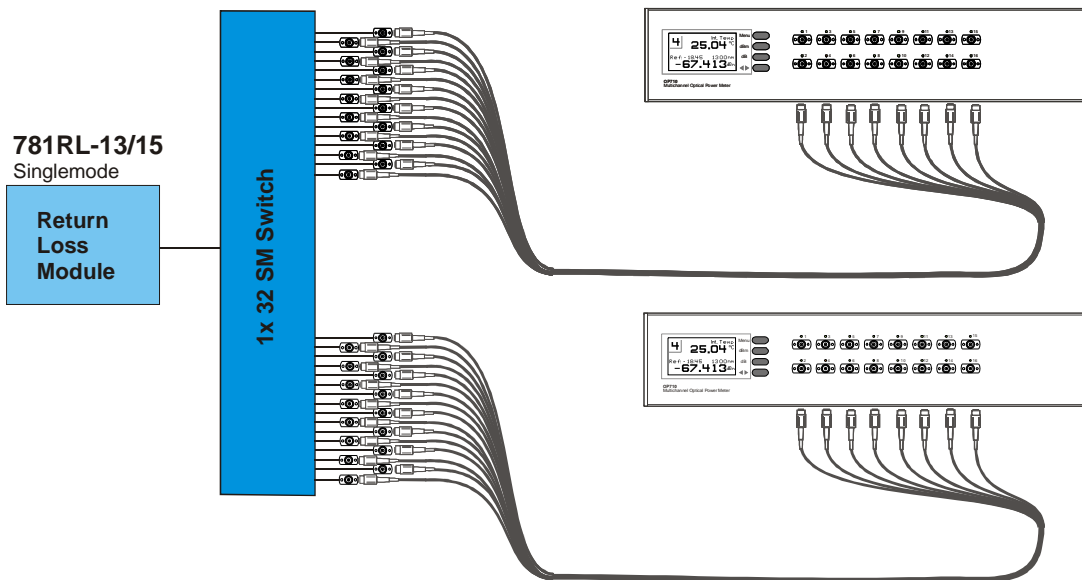
Data Handling

- Storage of the measurement data to individual EXCEL files for further processing.
- Test Report generation based on EXCEL template.
- Support of part number and sequencing serial number.
- Measurement log for audition purposes.

## Typical Multimode Configuration



## Typical Singlemode Configuration



## Sequence File

The sequence file is in EXCEL format and can be modified easily using any version of EXCEL or compatible applications. The EXCEL file is configured into a header with overall cable information and the sequence section.

### Sequence File Header

The EXCEL header information is structured as follows

<b>OPL-Max Sequence File</b>			
Identification	ID		
<i>Partnumber</i>	PN		
<i>SerialNumber</i>	10101	10101	ZZ
Data File	Cable Description		
<i>Number of Sequences</i>	24		
<i>Lot Number</i>	LN1		
<i>Customer</i>	CC	<i>SalesOrder</i>	SO
<i>Cable ID</i>	CID	<i>CableSpec</i>	CSpec
<i>Description</i>	Cable Description	<i>CableType</i>	SMF28
<i>AverageMode</i>	4		

Each the italic identified fields have a corresponding filed in the general information of the measurement screen (see below).

Header information on measurement screen:

The screenshot shows the 'Setup' and 'Measure' tabs at the top. Below them are two main sections: 'Information' and 'Cable'.

**Information Section:**

- Work Order: Cable Description
- Part Number: PN
- Lot Number: LN1
- Operator: Operator
- Customer: CC
- Sales Order: SO

**Cable Section:**

- Cable ID: CID
- Cable Spec: CSpec
- Description: Cable Description
- Cable Type: SMF28
- Serial #: 10101, 10101, ZZ

## Measurement Sequence

Each row in the configuration file defines a measurement sequence for one particular cable type. A typical listing is shown below.

Termination	Source	Source Channel	WavelengthA	WavelengthB	OPM Rack	OPM Channel	Pass/Fail	Measurement
<string>	<num>	<num>	<num>	<num>	<num>	<num>		
Pin1	SM1	1	1310	1550	OPM1	1	0	0
Pin2	SM1	2	1310	1550	OPM1	2	0	0
Pin3	SM1	3	1310	1550	OPM1	3	0	0
Pin4	SM1	4	1310	1550	OPM1	4	0	0
Pin5	SM1	5	1310	1550	OPM1	5	0	0
Pin6	SM1	6	1310	1550	OPM1	6	0	0
Pin7	SM1	7	1310	1550	OPM1	7	0	0
Pin8	SM1	8	1310	1550	OPM1	8	0	0
Pin9	SM1	9	1310	1550	OPM1	9	0	0

The example shows a 12 channel measurement where each multimode (MM1) channel corresponds with the power meter channel (OPM1).

#	Termination	Source	Source	WLA	WLB	OPM	OPM	Pass/Fail	Meas. Typ
1	Pin1	MM1	1	850	1300	OPM1	1	FC-PC MM	IL only
2	Pin2	MM1	2	850	1300	OPM1	2	FC-UPC	IL only
3	Pin3	MM1	3	850	1300	OPM1	3	FC-APC	IL only
4	Pin4	MM1	4	850	1300	OPM1	4	LC-UPC	IL only
5	Pin5	MM1	5	850	1300	OPM1	5	FC-UPC	IL only
6	Pin6	MM1	6	850	1300	OPM1	6	FC-UPC	IL only
7	Pin7	MM1	7	850	1300	OPM1	7	FC-UPC	IL only
8	Pin8	MM1	8	850	1300	OPM1	8	FC-UPC	IL only
9	Pin9	MM1	9	850	1300	OPM1	9	FC-UPC	IL only
10	Pin10	MM1	10	850	1300	OPM1	10	FC-UPC	IL only
11	Pin11	MM1	11	850	1300	OPM1	11	FC-UPC	IL only
12	Pin12	MM1	12	850	1300	OPM1	12	FC-UPC	IL only

### Field Description of Sequences

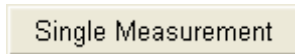
Column	Header	Description
A	Seq	Consecutive number
B	Termination ID	This text identifies the sequence step and is usually used to indicate the connector such as "PinA"
C	Source	Selects the source for the measurement. Available options are: SM1, SM2, MM1, MM2, RL1, NO
D	Source Channel	Selects the source channel for the measurement. For switched sources such as RL module and switch combination this is the output port of the optical switch.
E	Wavelength A	Wavelength(1) in [nm] of the first wavelength to be used to measure the insertion loss and/or return loss.
F	Wavelength B	Wavelength(1) in [nm] of the second wavelength to be used to measure the

		insertion loss. Leave the field blank if this is a single wavelength measurement.
G	OPM Unit	Selects the optical power meter. Available options are: OPM1, OPM2
H	OPM Channel	Selects the channel for the optical power meter for the measurement, the channels correspond to the optical port of the power meter.
I	Pass/Fail	This lists the index into the Termination Table, a separate EXCEL spreadsheet (Terminations.XLS) that defines the pass fail parameters. The termination table can be edited separately.
K	Measurement	The type of measurement is defined in this column, options are: IL only = 0 IL and RL = 1 RL =2 Bidirectional IL = 3 (if supported by the instrument)

(1) Note that the selected wavelength needs to be supported by the instrument in use.

### Test the Sequence File

Connect all the necessary fibers consistent with the sequence that has been loaded. The "Single Measurement" button exercises all the sequence steps one-time and records the measurement data. If the reference has not been taken yet the user is prompted to take the reference. If the sequence involves Return Loss measurement the user is also prompted to reference the Return Loss.



Execute a single measurement sequence; if reference has not been taken the user is prompted for the reference.



## Reference

To measure insertion loss the optical power from the launch or reference cable is measured in a first step. This reference power is stored for each channel and each wavelength and displayed on the *Reference* screen.

If the sequence calls for a return loss measurement the user is prompted to reference the return loss measurement. Referencing the return loss involves selecting a reference channel for RL (see Instrument Setup), disconnecting the reference cable of that channel from the cable to be measured and letting the return loss module “find” the reflection of the reference cable.

The screenshot shows the 'Reference' screen with a 'Measurement Data' table and a large display area. The table has columns for 'Seq#', 'Desc', 'Wavelength', and 24 columns for channels 1-12, each with 'Stand' and 'Pin' sub-columns. The 'Ref' button is highlighted with a red arrow.

Seq#	1	2	3	3	5	4	5	6	7	8	9	10	11	12
Desc	Stand	Stand	Pin3	Stand	Pin5	Stand	Pin5	Pin6	Pin7	Pin8	Pin9	Pin10	Pin11	Pin12
IL/RL	IL	IL	IL	RL	RL	IL	IL	RL	RL	IL	IL	IL	IL	IL
Wavelength	1310	1550	1310	1550	1310	1550	1310	1550	1310	1550	1310	1550	1310	1550
9:46:27 AM	-20.9	-24.8	-20.9	-24.9	0.0	0.0	-20.9	-24.8	0.0	0.0	-20.9	-24.9	-20.9	-24.9
10:19:49 AM	-20.9	-24.9	-20.9	-24.8	53.0	47.0	-20.9	-24.8	37.0	44.0	-20.9	-24.9	-20.9	-24.9
12:30:57 PM	-20.9	-24.9	-20.9	-24.9	43.0	63.0	-20.9	-24.8	74.0	73.0	-20.9	-24.9	-20.9	-24.9

**Ch:6-6 Ref=-24.87 dBm @ 1550**

Connect SN:10101  
Press [Test] to measure

1.1.0.18DTR

## Test

Connect the cable with the corresponding serial number to the reference cable and press the Test button. The programmed test sequence is executed and the test results filled into the Measurement Data screen as well as into the EXCEL data file. The EXCEL data file is assigned during the setup or can be changed in Setup | Data File.

The pass/fail condition is indicated with green as pass and red as fail.

The screenshot shows a software interface for cable testing. At the top, there are tabs for 'Reference' and 'Measurement Data', and a 'Col. Width' dropdown set to '32'. Below this is a data table with columns for 'Seq#', 'Desc', 'Wavelength', 'Limit', 'Min', 'Ave', and 'Max'. The 'Ave' row shows a value of -0.04 dBm for channel 9-9 at 1310 nm. A large central display area shows the message 'Ch:9-9 IL=-0.04 dBm @ 1310' in blue text. At the bottom, there are buttons for 'Ref', 'Next', 'Test', 'Retest', and 'Print'. The 'Test' button is highlighted with a red arrow. A status bar at the bottom left says 'Connect SN:10102 Press [Test] to measure' and the bottom right shows the version '1.1.0.18DTR'.

Seq#	1	2	3	3	5	4	5	6	7	8	9	10	11	12															
Desc	Stand	Stand	Pin3	Stand	Pin5	Stand	Pin5	Pin6	Pin7	Pin8	Pin9	Pin10	Pin11	Pin12															
IL/RL	IL	IL	IL	RL	RL	IL	IL	RL	IL	IL	IL	IL	IL	IL															
Wavelength	1310	1550	1310	1550	1310	1550	1310	1550	1310	1550	1310	1550	1310	1550															
Limit																													
Min	0.00	-0.13	-0.02	-0.07	0.00	0.00	-0.03	-0.01	0.00	0.00	-0.03	0.08	0.04	-0.03	0.03	0.06	0.00	-0.05	-0.02	-0.03	-0.06	0.09	0.04	-0.01	-0.05	0.01	0.03	0.00	
Ave	0.00	-0.13	-0.02	-0.07	59.00	56.00	-0.03	-0.01	65.00	37.00	-0.03	0.08	0.04	-0.03	0.03	0.06	0.00	-0.05	-0.02	-0.03	-0.06	0.09	0.04	-0.01	-0.05	0.01	0.03	0.00	
Max	0.00	-0.13	-0.02	-0.07	59.00	56.00	-0.03	-0.01	65.00	37.00	-0.03	0.08	0.04	-0.03	0.03	0.06	0.00	-0.05	-0.02	-0.03	-0.06	0.09	0.04	-0.01	-0.05	0.01	0.03	0.00	
1010110101ZZ	1	0.00	-0.13	-0.02	-0.07	59.0	56.0	-0.03	-0.01	65.0	37.0	-0.03	0.08	0.04	-0.03	0.03	0.06	0.00	-0.05	-0.02	-0.03	-0.06	0.09	0.04	-0.01	-0.05	0.01	0.03	0.00

If the cable passes the selected pass/fail criteria which detail parameters are set in the Termination setup then Next button is activated, in case of a fail condition the Retest button is activated.

*Test sequences passes*

The screenshot shows the software interface after a successful test. A large green message box displays 'Passed Press [Next] for next cable'. Below the message, the 'Next' button is highlighted in blue, while the other buttons ('Ref', 'Test', 'Retest', 'Print') are in a standard grey color.

To print the test report for the current cable press Print. The report will be printed according to the template that has been setup in Setup | Test Report Setup.

To measure the next cable press Next and connect the next cable with the prompted serial number.

### Test sequence fails

**Failed**  
Press [Retest] or [Next]

Ref   Next   Test   Retest   Print

A failed cable can be retested by pressing Retest. Usually the cable is disconnected, cleaned and connected again as most likely the cause for a high insertion loss or low return loss is a contaminated connector. The number of retests is set on the main setup screen:

Setup | Measure

Sequence | Data File | Test Report Setup | Instruments

Load New Sequence   Single Measurement   Number of Retests: 6

#	Termination	Source	Source Ch	WLA	WLB	OPM	Ref WLB	dBm WLA	dBm WLB	dB WLA
---	-------------	--------	-----------	-----	-----	-----	---------	---------	---------	--------

### Print/Review Test Report

Pressing the Print button opens up EXCEL or EXCEL Viewer and generates the test report for printing.

**Failed**  
Press [Retest] or [Next]

Ref   Next   Test   Retest   Print

## Data File

All data files are stored in EXCEL (filename.XLS) format in the file and location indicated on the Setup | Data File page.

Setup | Measure

Sequence | Data File | Test Report Setup | Instruments

EXCEL File Information

Fixed data file

C:\Program Files\OptoTest\OPLMax Demo\NewData2.xls

File Structure

Sub directory = PN + Partnumber  
Filename = WO + workorder + serial number

Prompt if file exists (prevent automatically overwrite)

Fixed data file

All the measurement data is stored into the same data file.

NOTE: Newly taken data will overwrite already existing data. This option is meant to run experimental test where data retention is not critical or only a hardcopy is produced for each measurement using Print.

File Structure

All the measurement data is stored in a file structure, for each measurement a new file is created, the filename is constructed from the workorder and serial number preceded by a "WO".

The subdirectory is assigned based on the "PN" + the current part number.

# Test Report

The Test Report is based on an EXCEL template file (Template.XLS) for example:

<b>OPL-MAX</b>		Test Report				
		Date				
		Operator				
		DataFile				
<b>Information</b>						
Workorder	Lot Number/ID	Part Number	Customer	Sales Order		
<b>Cable Specifications</b>						
Cable ID	Serial Number	Fiber Type	Core	Cable Spec		
<b>Additional</b>						
Calibration	Description	Equipment	Calibration Date			
<b>Test Data</b>						
Test Point	Wavelength (nm)	IL (dB)	IL Spec (dB)	RL(dB)	RL Spec(dB)	Pass/Fail

For each test report this template file is copied into assigned data file (another spreadsheet) and the header information and data points are transferred into the corresponding cells.

The cell allocation is done in the Test Report Setup Screen on the Setup | Test Report Setup page.

*Test Report Setup*

To change position of parameter in data sheet modify rows and columns for each of the fields.

	col	row
ID	0	0
Workorder	0	7
Partnumber	2	7
Lotnumber	1	7
Operator	4	3
Customer	3	7
SalesOrder	4	7
None	1	8
CableID	0	10
CableSpec	4	10
Description	1	13
DataStart	0	16
SerialNumber	1	10
FiberType	2	10
Date	4	2
FiberSize	3	10

Reset      Update

Each field such as Workorder, Partnumber and so on is assigned a destination cell in the spreadsheet (row, col). The data then is transferred accordingly.

The position of the [fields] are also shown in the representation of the data sheet (see below).

Template.xls      refresh      print test report template

[ID]						
OPL-MAX			Test Report			
			Date	[Date]		
			Operator	[Operator]		
			DataFile			
Information						
Workorder	Lot Number/ID	Part Number	Customer	Sales Order		
[Workorder]	[Lotnumber]	[Partnumber]	[Customer]	[SalesOrder]		
Cable Specifications	[None]					
Cable ID	Serial Number	Fiber Type	Core	Cable Spec		
[CableID]	[SerialNumber]	[FiberType]	[FiberSize]	[CableSpec]		
Additional						
Calibration	Description	Equipment	Calibration Date			
	[Description]					
Test Data						
Test Point	Wavelength (nm)	IL (dB)	IL Spec (dB)	RL(dB)	RL Spec(dB)	Pass/Fail
[DataStart]						

Reset: Revert the destination cells to the default location.

Update: Updates the test report setup after a change.

# Pass/Fail Criteria

All the Pass/Fail criteria are stored in a single EXCEL file, the default filename is Termination.XLS. To change the individual parameters double click on the particular row.

ID	Description	Wave A	Wave B	IL Max	IL Max	RL Min A	RL Min B
0	Standard	1300	1550	0.50	0.50	45.00	45.00
1	FC-PC MM	850	1300	0.50	0.50	36.00	36.00
2	FC-UPC	1310	1550	0.20	0.20	55.00	55.00
3	FC-APC	1310	1550	0.50	0.50	36.00	36.00
4	LC-UPC	1310	1550	0.50	0.50	25.00	25.00
5	Termination5	1300	1550	0.50	0.50	45.00	45.00
6	Termination6	1300	1550	0.50	0.50	45.00	45.00
7	Termination7	1300	1550	0.50	0.50	45.00	45.00
8	IT	1300	1550	0.50	0.50	45.00	45.00

The pass/fail entry can be edited individually.

3  
Wavelength: 1310 1550  
IL Max: 0.50 0.50  
RL Min: 36 36  
FC-APC  
Cancel OK

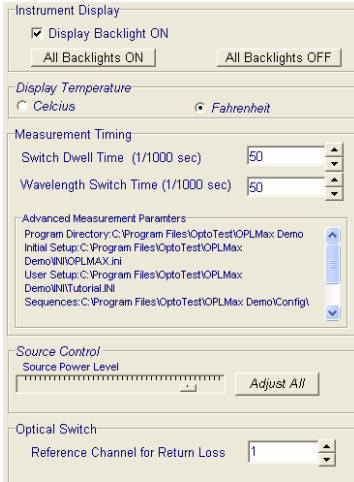
Wavelength:  
Wavelength of the IL and RL criteria.

ILMax: Criteria for Insertion Loss, values greater than the IL Max are FAIL condition.

RLMin: Criteria for Return Loss, values lesser than the RL Min are FAIL condition.

The bottom field is for the Description of the termination and used for identification in the sequences.

# Options



The general options of OPL-MAX are accessible through Setup | Instruments.

Instrument Display:

Control the backlight illumination of the display of the selected instrument in the instruments list to the left. This is a convenient tool to identify which instrument is which (OPM1, OPM2, and so on).

Display Temperature:

Switches the OPxxx displays between Celsius and Fahrenheit.

Measurement Timing

Switch Dwell Time:

The dwell time is the time the instrument waits and lets the source, switch and power meter settle before taking a measurement. By shortening the times to less than 300 milliseconds the insertion loss measurement will become less accurate however the overall measurement time will be shorter.

Advanced Measurement Parameters:

Wavelength Switching Time:

This is the time the system waits to allow the wavelength selection to settle.

Source Control:

Shows some of the current system files and global measurement parameters.

Optical Switch:

Allows adjustment of the power level of the source, a setting all the way to the left will TURN OFF the source

The Return Loss module is connected through an optical switch to the reference cable. To reference the return loss module the assumption is that all reference cables are of the same length, then the return loss module needs to be referenced only for one channel. This particular channel is allocated here.