LPT-OTDR70 Optical Time-Domain Reflectometer
USER MANUAL

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A Foreword

Thanks very much for purchasing and using the **LPT-OTDR70** optical time-domain reflectometer. With high, precision and frontier technologies comprehensive, the product enjoys the highest quality and cost performances compared with similar products. The Company follows the ISO9000 standard always during production and adheres to the customer-oriented and quality-first principles. Please read carefully the manual, so as to facilitate the operation. We will spare no efforts to meet your requirements, providing you with operating devices with the highest cost performance and first-rate after-sales services. We always adhere to the principle of "high quality and thoughtful services", providing customers with satisfactory products and services as well as work convenience and shortcut.

The manual introduces the application, performance and features, basic principles, usage, maintenance and precautions of the **LPT-OTDR70** optical time-domain reflectometer, facilitating your quick understanding the usage and key points of the tester. To operate the product well and provide you with higher economic effectiveness, please read the manual carefully.

Mistakes and omissions can hardly be avoided due to time urgency and writer's knowledge limit. Your valuable comments and suggestions are highly welcome! We are sorry for any inconvenience caused due to our errors.

NOTE:

The manual is the first edition of the **LPT-OTDR70** optical time-domain reflectometer, with version number of A.1.

The manual contents are subject to change without prior notice. The right of term interpretation in the manual belongs to our company.

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B Instrument overview

The **LPT-OTDR70** optical time-domain reflectometer is a type of testing instrument featuring high performance and multiple functions that is designed for the FTTx network. It is used to measure such physical characteristics of optical fibers as the fiber optic cable length, transmission loss and joint loss, and position accurately the event points and failure points of the optical fiber link. It is widely used in such fields as engineering construction, maintenance test and emergency repair of the optical fiber communication system as well as R&D and production test of the optical fiber and cable.

The **LPT-OTDR70** optical time-domain reflectometer has the following features:

Super-short event dead zone of 0.5m, easy for testing the optical fiber patch cord;
● Minimum sampling resolution of 2.5cm for accurately positioning event points;
● Wide dynamic range of 50dB and data sampling points of 256k for long-distance and
multiple-branch communication network test;
● PON network online test;
● Both single-mode and multi-mode testing;
● Advanced anti reflection LCD capable of clear interface displaying in field environments;
● Multi testing modes, touch screen and shortcuts;
● Automatic communication fiber monitoring;
● Remote control;
● Dual USB ports capable of connecting with the USB disk and printer;
● Supporting Bellcore GR196 and SR-4731 formats;
● Multi-language operation interface;
● Optional built-in visual fault locator (VFL), optical power meter and end surface measurement
function;
● The type of the OTDR optical output connector can be changed freely, keeping the end surface
more convenient.

C Instrument composition

● **Mainframe: LPT-OTDR70** optical time-domain reflectometer.
● **Standard configuration:**

SERIAL No.	NAME	REMARKS
1	Power line assembly	Power line and power adapter: an input voltage of 100~240V, 50~60Hz, an output voltage and an output current of 19V and 3.42A respectively at 2.0A
2	User Manual	
3	Product certificate of conformity	
4	CD	Including simulation analysis software
5	Special portable soft bag of OTDR	
6	Special strap of OTDR	

PACKING CASE:

Special soft bag

Special engineering plastic case (optional)

D Instrument panel
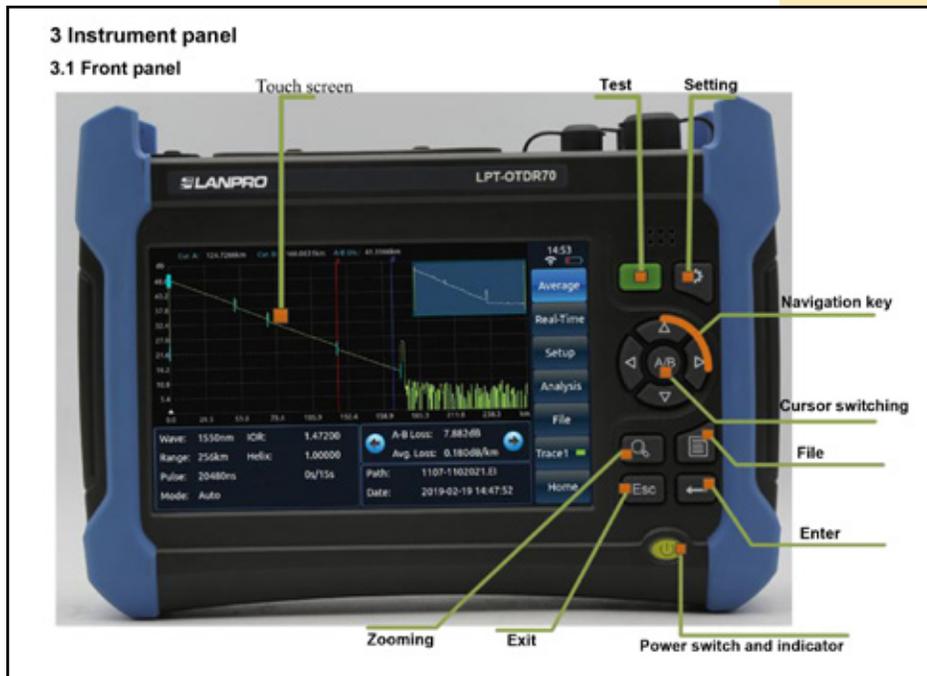
FRONT PANEL:

Fig.1-1 Front panel of the LPT-OTDR70 optical time-domain reflectometer
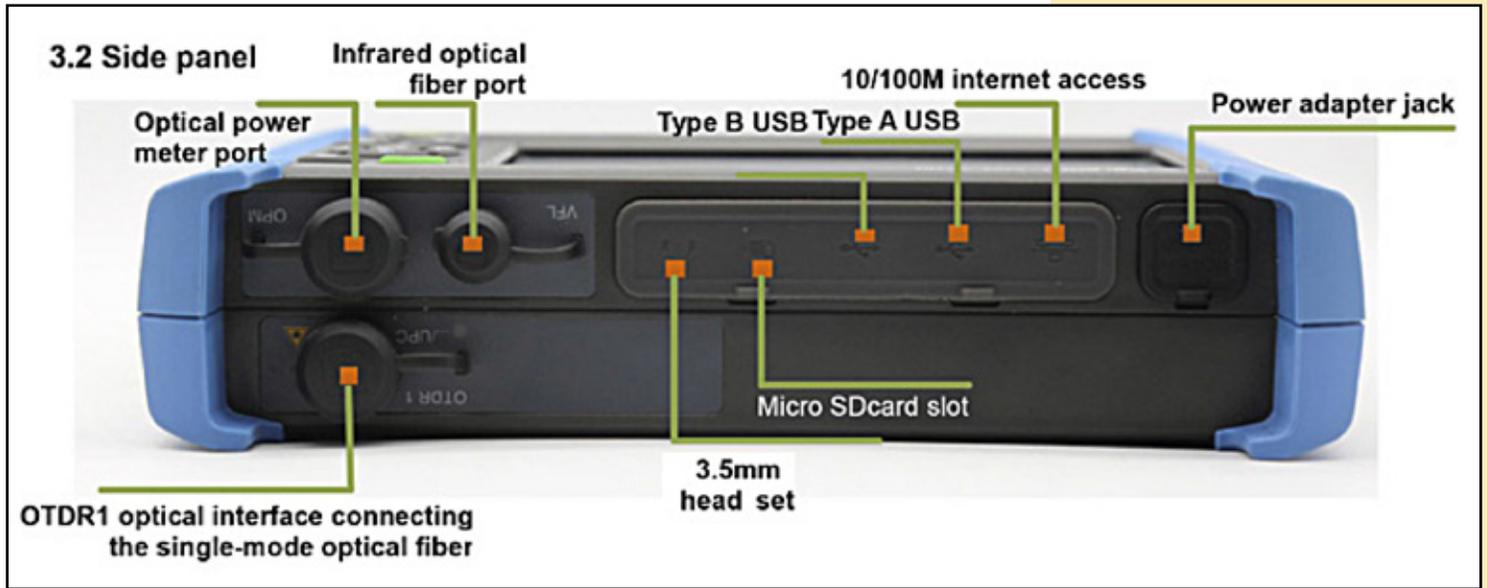
SIDE PANEL:

Fig.1-2 Side panel of the LPT-OTDR70 optical time-domain reflectometer

E **Main Operation Interface**

The **LPT-OTDR70** optical time-domain reflectometer can be provided with such options as the optical power meter, optical source, VFL and end face test as required. Click the main menu under the system menu to pop up the operation function module selection interface shown in Fig. 2-1.

Fig. 2-1 Diagram of the main operation interface

Click any of the **LPT-OTDR70**, optical power meter, fiber source, VFL, end surface inspection and help buttons to enter corresponding operation interface and realize relevant functions.

Click the system setting button to enter the system setting interface for general setting and network setting, as shown in Fig. 2-2.

General setting includes the start-up module setting, language setting, screen luminance setting, time setting and system upgrading.

Network setting includes the network setting, WIFI scanning and connection, Internet of things connection, and bluetooth connection.

Fig. 2-2 Diagram of the system setting interface

F Optical Time-domain reflectometer Module

MAIN OPERATION WINDOW:

Click **[OTDR]** shown in Fig. 2-1 to enter the OTDR operation interface. The **LPT-OTDR70** testing interface is shown in Fig. 3-1:

Fig. 3-1 Diagram of LPT-OTDR70 testing interface

(1): Showing current system time, battery capacity and WiFi connection status.

(2): Test result display zone. The test result is obtained via current cursor calculation. Average loss: the loss between A and B as well as the average loss of the optical section where cursors A and B locate; connection loss: the connection loss at the connection point of cursor A shown in the test result with four cursors shown on the OTDR main interface; reflection loss: the reflection loss between the fiber optic reflection peaks of cursors A and B shown in the test result on the OTDR main interface.

(3): Global display of small waveforms: To display always the Global overview waveforms of the test curve.

(4): Reference origin point.

(5): Current active cursor. The active cursor is in red, the location of which can be changed via the button or touch screen, with the remaining cursors shown in blue. The active cursor can be set circularly between cursors on the screen via the button.

(6): The distance between the cursor location and the reference origin point; the location between cursors A and B.

(7): Menu bar.

(8): Test condition display bar. Displaying such test conditions as current test range, wavelength, pulse width and test mode.

(9): Name and saving time of the file read at present. It shows the name and saving time of the file read if current test curve is the one saved in the file read.

(10): Color indication of current test curve. The icon indicates the color of the test curve of current serial number.[*2]

(11): Vertical scale value (dB/).

(12): Horizontal scale value (m/ , km/ , ft/ , kft/ or mi/).
Click [**Analyze**] on the main operation interface shown in Fig. 3-1 to analyze current trace curve and show the event list, the diagram of which is shown in Fig. 3-2.

G Event list window

Click **[Analyze]** on the main operation interface shown in Fig. 3-1 to analyze current trace curve and show the event list, the diagram of which is shown in Fig. 3-2.

Fig. 3-2 Diagram of LPT-OTDR70 analysis interface

The meaning of each item shown in the event list is shown below (here take the distance unit km as an example):

EVENT TYPE:

Indicating the event point can be the optical fiber start point.

Indicating the event point is the descending event point.

Indicating the event point is the ascending event point.

Indicating the event point is the reflection event point.

Indicating the event point can be the terminal of the optical fiber.

(2) No.: Number of current event.

(3) Distance (km): Distance between current event point and reference origin point.

(4) Attenuation (dB/km): Average loss of the optical fiber section ahead of current event point.

(5) Loss (dB): Connection loss measured at current event point. * It indicates the connection loss measured currently is bigger than the set critical threshold of the connection loss.

(6) Reflection (dB): Reflection loss measured at current event point. * It indicates the reflection loss measured currently is bigger than the set critical threshold of the reflection loss.

(7) Accumulative total (dB): Total loss of the optical section between current event point and reference origin point.

H **Graphical analysis window**

Select graphical analysis, and click mode switching to conduct graphical analysis on current track curve and show the graphical analysis interface, with the graphical analysis window shown in Fig. 3-3.
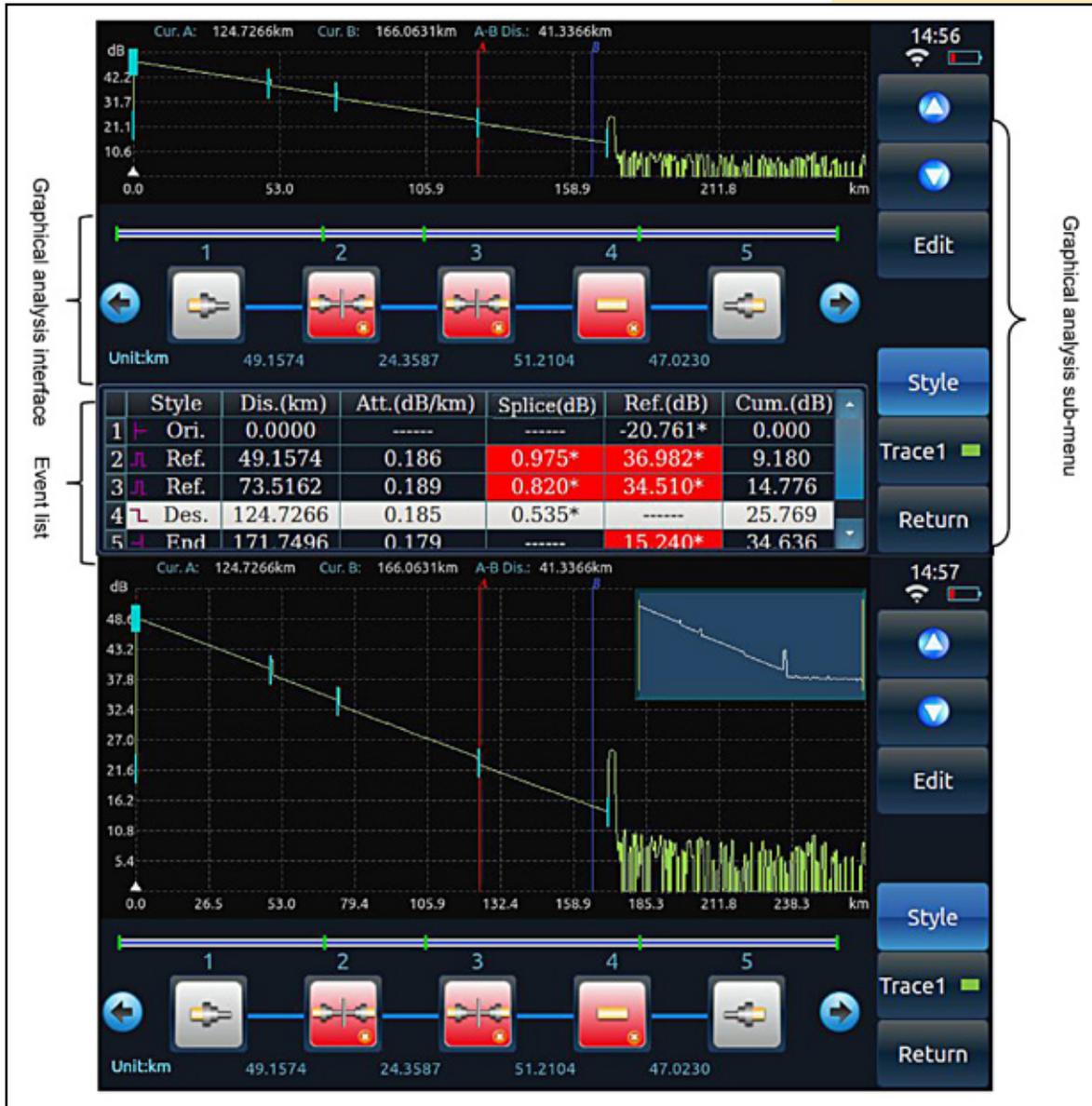

Fig. 3-3 Diagram of LPT-OTDR70 graphical analysis interface

Meaning of each graph in the graphical analysis window is shown below:

 Indicating the event point can be the optical fiber start point.

 Indicating the joint meets the pass-through condition.

Indicating the joint connection loss exceeds the threshold, failing to meet the pass-through condition.

Indicating the connector meets the pass-through condition.

Indicating the connector or reflector connection loss exceeds the threshold, failing to meet the pass-through condition.

Indicating there is a macrobend.

Indicating the event point can be the optical fiber end point.

I   **Overview of main menu structure and functions**

The main menu bar is displayed by default in the main operation window, including seven menu item buttons, as shown in Fig. 3-4.
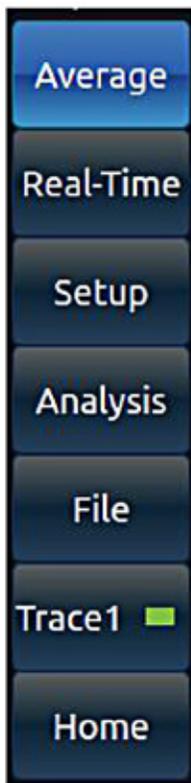
Fig. 3-4 Menu item buttons in the main menu bar of LPT-OTDR70

Functions of all buttons on the menu bar are shown below:

[Avg.:] It is used to control the **LPT-OTDR70** progressive average of the average times set against the lost curve tested; after test, the contents shown on the button changes automatically from **[Stop]** to **[Avg.:]**, and the OTDR test stops at the same time.

[Real Time]: It is used to control the **LPT-OTDR70** for real-time refreshing or stopping test, which is available only in the manual test mode. Click the button in the manual test mode to change the content shown on the button to **[Stop]**, and the OTDR will refresh the test on the fiber loss curve under test in real time; click it again to change the content shown on the button back to **[Real Time]**and stop the **LPT-OTDR70** test.

[Setting]: It is used to enter the parameter setting sub-menu to set such items as the OTDR test condition, reference origin point and optical cable information.

[Analyze]: It is used to analyze current curve and provide the event list. It will provide a prompt if no event points are found.

[File]: It is used to enter the file operation sub-menu. It is used to realize such functions as reading, saving, deleting, transferring and printing files.

[Curve I]: It is used to show the curve selection window, from which the curve number can be selected, so that current active curve can be switched between curves I, II, III and IV. Curves I, II, III and IV are in green, yellow, orange and blue respectively.

[Main Menu]: It is used to return to the main menu of the instrument for module selection and system setting.

J Usage

Set the OTDR test mode and each test parameter first before testing the optical fiber link. It is shown in Fig. 3-5.
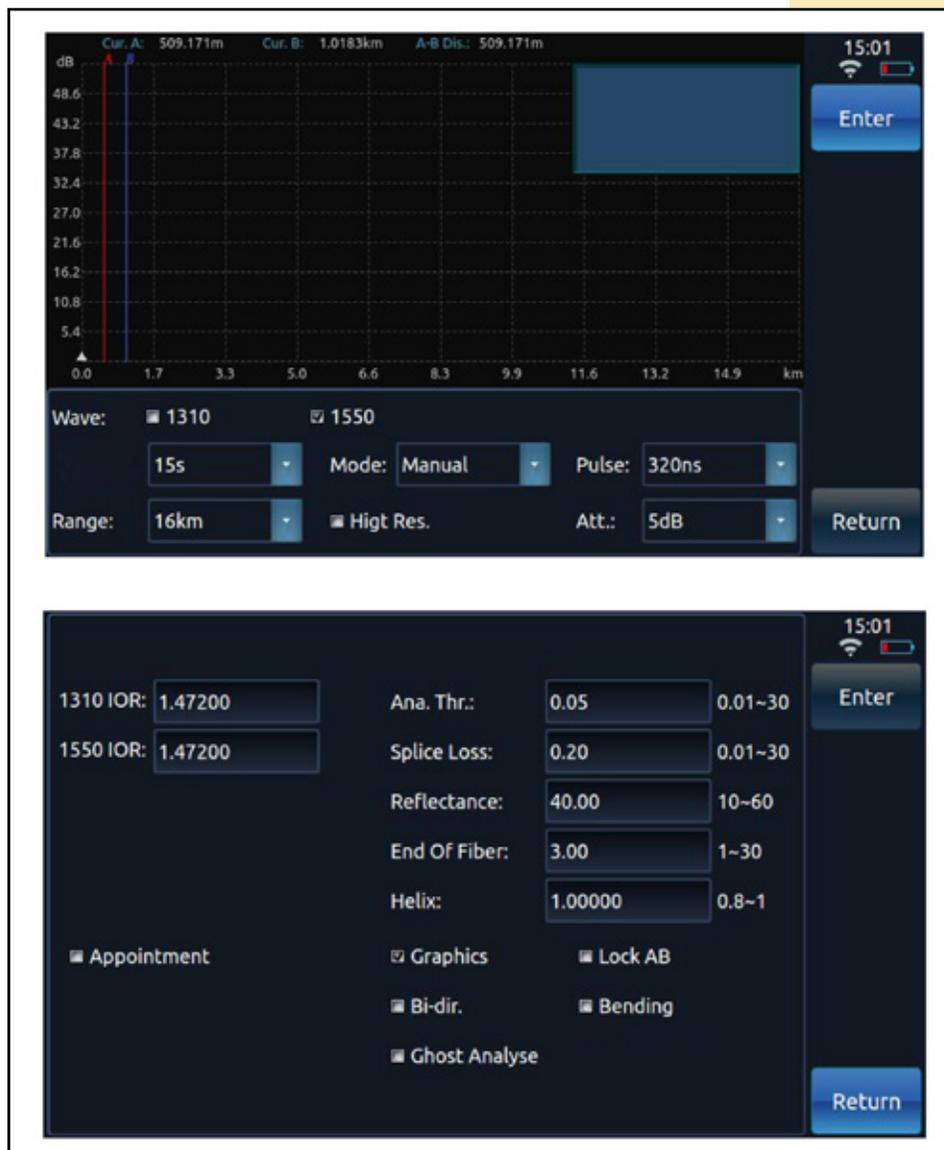

Fig. 3-5 Window of setting LPT-OTDR70 test conditions

<u>**TESTING OPTICAL FIBER LINK**</u>:

The operation steps are shown as follows:

● Select the test wave length.
● Set such test conditions as the test mode.
● Clean the optical fiber to be tested.
● Connect the optical fiber to be tested to corresponding OTDR fiber output port.
● Press the test button to obtain the waveform curve of the fiber under test.
● When the test stops:
◇ Select "Auto Test" or "Auto Analysis after Sampling" to analyze the test curve automatically, mark the event point as per the loss analysis threshold set, and provide the event list.
◇ Otherwise, click **[Analyze]** to analyze the test curve, mark the event point as per the loss analysis threshold set, and provide the event list.
● The test result can be viewed in the event list after curve analysis.

OTDR TEST MODE:

There are two OTDR test modes available, namely, the auto test and manual one.

● **Auto test:**

If the OTDR test mode is set to auto: Press the test key to adjust the test conditions automatically, test the optical fiber link under test, analyze the curve automatically, and show the test curve and event list in the main operation window.

● **Manual test:**

If the OTDR test mode is set to manual: Click **[Real Time]** in the main menu bar (and **[Real Time]** is changed to **[Stop]** at this time) to conduct sweep test on the optical fiber link under test in real time as per the test conditions set at present, and refresh the test curve in the main operation window continuously. If the OTDR test mode is set to manual: Press the test button or click **[Avg.]** in the main menu bar (and **[Avg.]** is changed to **[Stop]** at this time) to conduct average test on the optical fiber link under test as per the test conditions set. The test curve in the main operation window is subjected to averaging continuously till the average times shown on the main interface are equal to the set ones, and then the OTDR will stop testing at the same time.

OTDR TEST PARAMETERS:

The OTDR test parameters include the wavelength, range, pulse width, average times, refractive index, and cable correction coefficient.

● **Wave length: It is used to set the OTDR test wave length:**

◇ The number of wave lengths allowed by the OTDR depends on the module selected, with up to 4 wave lengths available for selection.
◇ Multi wave lengths can be selected in the average test and auto test modes. The instrument will test all wave lengths in turn till all of them are tested. Up to 4 wave lengths can be selected for test at the same time.
◇ If the module selected for the instrument includes both the single-mode and multi-mode ones, connect the optical fiber under test to corresponding test port, so as to obtain correct test curves.

Range (km): It is used to set the scanning curve range. The range of the **LPT-OTDR70** consists of the following levels: 400m, 800m, 1.6km, 3.2km, 8km, 16km, 32km, 64km, 128km, 256km and 512km (which varies with the module selected).

● **Pulse width (ns):** It is used to set the laser pulse width for the test. Large pulses width can be used to test long optical fibers, with sound test curve SNR, smooth curve, but poor resolution; small pulses width has high resolution, but can only test short optical fibers, with poor test curve SNR.

● **Average times:** It is used set the max. average times of the average test and auto one. The range of such times is 1-4000 in the average test mode. The range of such times is 5-20 in the auto test mode.

● **Refractive index:** The refractive index of the optical fiber or cable can be obtained from corresponding manufacturers. Refractive index can be set to 1.00000~2.00000.

● **Optical cable correction:** The Optical cable correction factor is provided in view of the difference between the fiber length and cable one after the fiber changes to the cable. It can be obtained from the cable manufacturer. The value can be set to 0.80000~1.00000. The default value is 1.00000.

● **Lock Cursors A&B:** Select it to lock the distance between cursors A&B. After that, to move any cursor is to move the Chapter III Optical Time-domain reflectometer Module 12 other together, with the distance between them keeping unchanged. Otherwise, when one of the cursors is moved, the other one will not move.

● **High resolution test:** Select it to rise the sampling points of the instrument to 256k, improving the resolution capability on short-distance events occurred on the optical fiber link under test.

EVENT ANALYSIS AND PASS-THROUGH THRESHOLD:

The event analysis and pass-through threshold can be set on the OTDR test condition setting interface.

◇ Loss analysis threshold: If the connection loss of the event point calculated is bigger than the loss analysis threshold during test curve data analysis, such event point will be marked; otherwise, it will be omitted.
◇ The fusion loss pass-through threshold: If the connection loss of the event point calculated is bigger than the fusion loss pass-through threshold set in the event list, the connection loss shall be marked with "*".
◇ The reflection loss pass-through threshold: If the reflection loss of the event point calculated is bigger than the reflection loss pass-through threshold set in the event list, the reflection loss shall be marked with "*".
◇ Optical fiber breakpoint threshold: If the connection loss of the event point is bigger than the optical fiber breakpoint threshold set, it is deemed to be the optical fiber breakpoint, and all events after such point will be omitted and not be displayed in the list.

GENERAL FAILURE AND SOLUTIONS:

Possible faults of the instrument and solutions are shown below:

GENERAL FAILURE AND DEBUGGING METHOD

FAILURE	CAUSE	SOLUTION
The instrument cannot be started up.	The battery is dead.	Charge the battery.
	External power supply is not connected.	Supply power via AC/DC adapter.
No response from the key	Check whether any key is kept being pressed.	Ensure no keys are kept being pressed.
Inaccurate length of the optical fiber being measured	a. Improper setting of the optical fiber refractive index. b. Improper setting of the optical fiber correction factor.	a. Set the optical fiber refractive index to the nominal one provided by the optical fiber manufacturer. b. Set the optical fiber correction factor to 1.0000 or the nominal one provided by the optical cable manufacturer.
Inaccurate average loss of the optical fiber measured	a. Too big length error of the optical fiber measured. b. Too long trailing at the front end of the test curve.	a. Refer to the previous item to measure the optical fiber length accurately. b. Clean the connector of the optical fiber under test or add a little matching solution, and then test the curve again.
There is only the front end reflection peak other than the test waveform on the screen, or the trailing of the front end reflection peak is too long.	The fiber end face is contaminated;	Wipe the fiber end face clean with absolute ethyl alcohol.
	The fiber end face inside the connector at the fiber output end of the instrument is contaminated.	Take out the connector at the fiber output end, and wipe the fiber end face clean with absolute ethyl alcohol.
	The ceramic core in the connector (ring flange) at the fiber output end is damaged, cracked or broken.	Change the ring flange.
	The optical fiber connector is not matched	The end face type of the optical fiber connector under test must match that in the OTDR optical output connector. Otherwise, the patch cord must be used for through connection.

<u>CAUSE FOR CURVE TEST AND ANALYSIS FAILURE:</u>

In case of big difference between the curve test and analysis result and that expected, or no expected result obtained, the cause can be one of the following:

● No test curves of the optical fiber are obtained. If there is only front end reflection peak rather than linearity curve reflecting the fiber properties for the test curve, check the following:

◆ Whether the end face type of the optical fiber under test is consistent with that at the fiber output port of the OTDR.
◆ Whether the fiber end face is contaminated.
◆ Whether the OTDR fiber output ring flange is damaged.
◆ Use the VFL function to check there is any high loss at the near end of the optical fiber link under test.

● There is severe trailing at the near end of the test curve.

If any severe trailing is found at the falling edge of the near-end reflection peak of the test curve, try to solve the problem as follows:

◆ Clean the end face of the optical fiber under test and the end face of the fiber output end with the absorbent ball dipped with proper absolute ethyl alcohol.
◆ Test the curve again with small pulse width (select the average test mode and set certain average times in this case).
◆ Test the curve again with big attenuation with current pulse width set (select the average test mode and set certain average times in this case).

● Event points are too close with each other in the test curve. In case of any adjacent event points being omitted, try to solve the problem as follows:

◆ Test the curve again with small pulse width (select the average test mode and set certain average times in this case).
◆ Set certain average times and conduct the test in the average mode, so as to rise the curve SNR.
◆ Poor test curve SNR

● Any poor test curve SNR can affect the curve analysis accuracy. Try to solve the problem as follows:

◆ Increase the average times properly in the auto test or average test mode.
◆ In the average test mode, set proper test range, and test again with large test pulse width.

● Improper OTDR test parameters set. In case of any big difference between such values and the optical fiber length and the actual ones, please check the following:

◆ Whether the refractive index and optical cable correction factor set are consistent with the nominal ones of the optical fiber or optical cable under test.
◆ If no, it will severely affect the measured length of the optical fiber under test.

K) Working Principles

During optical transmission via the optical fiber, small changes in optical fiber refractive index can result in rayleigh scattering, and refractive index saltation on the end face or failure point of the optical fiber can result in Fresnel reflection. Loss distribution and fusion loss can be determined by observing the backward rayleigh scattering strength change, and the optical fiber breakpoint and failure point determined by observing the Fresnel reflection.

L) Event point type

The event points on the optical fiber curve under test can be divided into two types, namely, the reflection event point and non-reflection event point.

The reflection event point is generally caused due to crack of the fixed connector or the fiber end, displaying a peak. It is as shown in the next figure.
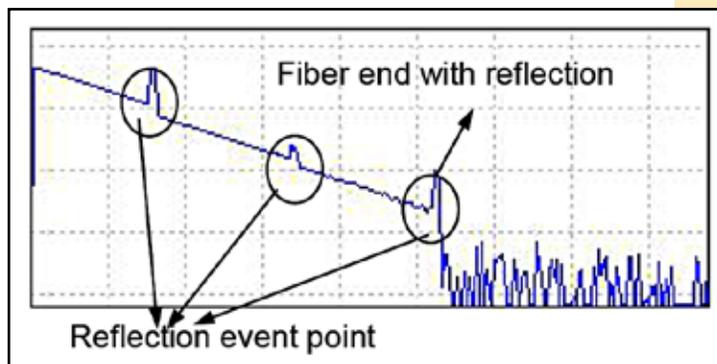
Non-reflection event includes the following generally: (as shown in the figure below)
● Descending event point
● Ascending event point
● Fiber end without reflection
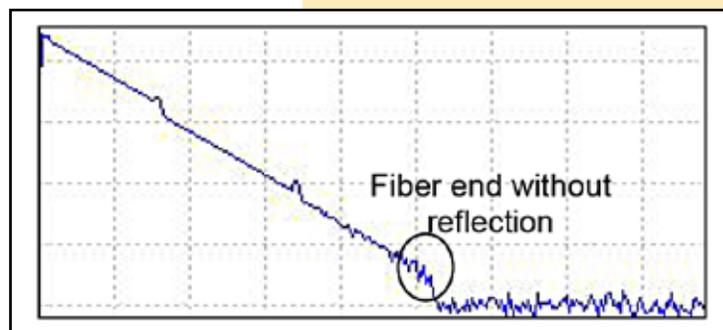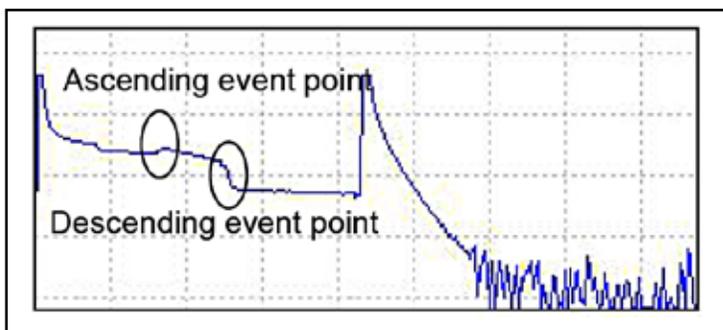
M Technical Parameters

GENERAL FEATURES:

GENERAL FEATURES OF THE **LPT-OTDR70** OPTICAL TIME-DOMAIN REFLECTOMETER ARE AS FOLLOWS:

NAME	CONTENTS
Display	800×480 and 7" TFT color LCD (provided with standard capacitive touch screen, with the resistance touch screen as an option)
Range (km)	0.4, 0.8, 1.6, 3.2, 8, 16, 32, 64, 128, 256 and 512 (single-mode, multi-mode 1300nm) 0.4, 0.8, 1.6, 3.2, 8, 16 and 32 (multi-mode 850nm)
Pulse width (ns)	3, 5, 10, 30, 80, 160, 320, 640, 1280, 5120, 10240 and 20480 (single-mode) 3, 5, 10, 30, 80, 160, 320, 640 and 1280 (multi-mode 850nm)
Refractive index setting range	1.00000~2.00000
Optical cable correction factor	0.80000~1.00000
Interface language	Available in Simplified Chinese, English, Russian and Korean (for other languages, please contact the local representative office)
Linearity	0.03dB/dB
Loss resolution	0.001dB
Optical output connector	FC/UPC (standard)
Electrical port	USB port, SD card port, and 10M/100M Ethernet port

Power supply	AC/DC adapter: allowable input voltage range: 100V~242V (1.5A), allowable frequency range: 50/60Hz; output DC: 17V±3V (2A) Internal lithium battery: 11.1V; Battery operating time: 8 h
Environmental requirement	Operating temperature: -10°C ~ 50°C Storage temperature: -40°C ~ 70°C Relative humidity: 5% ~95%, no condensing
Overall dimensions and weight	D×W×H : 252mm×180mm×55mm Weight: 1.8kg

N Main functions

- Test the optical fiber or cable length.
- Test the distance between any two points on the optical fiber curve.
- Test and display the loss between any two points on the optical fiber curve as well as the optical fiber attenuation constant.
- Test and display the connection loss of the connection joint on the curve.
- Test the reflection loss value.
- Search connection points automatically.
- Test waveform saving: to save the test waveform data and test conditions to the local memory or external U disk/SD card in the format of EI or BellCore GR196.
- File copying: to copy the data file saved locally to the U disk/SD card directly.
- Intelligent battery power indication.
- Real-time test: to facilitate the observation on docking effect of the optical fiber in real time.
- Remote control: to set the test conditions for the instrument via the computer, and test the loss distribution curve of the optical fiber.

O Main technical indicators

MAIN TECHNICAL INDICATORS OF THE OTDR:

(1) Ranging accuracy: $\pm(0.75m+sampling\ interval+distance \times 2.5\times 10^{-5})$ (omitting the refractive index error)
(2) Minimum event blind area[*2]: ≤0.5m (single-mode, with end face reflection loss of ≤45B)
(3) Minimum attenuation blind area[*2]: ≤3m (single-mode, with return loss of ≤55dB)
(4) Loss display resolution: 0.001 dB
(5) Maximum number of sampling points: 256k
(6) Linearity: 0.03dB/dB
(7) Refractive index range: 1.0000~2.0000

VFL FUNCTION (OPTIONAL):

(1) Operating wavelength: 650nm±20nm;
(2) Working output power: 2mW (typical);
(3) Operating mode: CW, 1Hz and 2Hz;

OPTICAL POWER METER FUNCTION (OPTIONAL):

(1) Wavelength range: 1200nm ~ 1650nm;
(2) Power range: -60dBm ~ 0dBm;
(3) Power test uncertainty at the calibration point: better than 0.22dB (-25dBm, CW and 1310/1550nm);
(4) Power test uncertainty in the optical path range: better than ±1.5dB.

OPTICAL SOURCE FUNCTION (OPTIONAL):

(1) Output wavelength: same with the OTDR operating wavelength;
(2) Output power: ≥-5dBm (23°C ±2°C);
(3) Operating mode: CW, 270Hz, 1kHz and 2kHz;

P Annex A: Cleaning the optical output port

Pay attention to the following when operating the instrument:

● Keep the optical output port clean, and clean it regularly with absolute ethyl alcohol.
● Cover the instrument with the dust cap after operation, and keep the dust cap clean.
● Clean regularly the ring flange connector at the optical output port. In case of any crack or breakage to the ceramic core in the ring flange, replace the ring flange in time.
Reasons for cleaning the optical fiber connector and optical output port are as follows:
● Since the optical fiber core is very small, any dust or particle adhering to the optical fiber connector
and optical output port can cover part of the optical fiber core at the output end, resulting in instrument performance reduction.

● Such dust or particle can wear the end face of the optical fiber connector at the output end, affecting the test accuracy and repeatability of the instrument.
Follow the safety precautions first before cleaning:
● Make sure the power supply of the instrument is cut off.
● Failing to follow relevant control, adjustment or operation procedures can result in dangerous radiation injury.
● Make sure to disable the optical source when cleaning any optical port.
● Do not look straight at any optical output port, so as to avoid any eye injury when the instrument is in operation.
Tools for cleaning the optical output port and connector
● Use such tools as the fiber cleaner and cleaning rod to clean the optical output port and connector.
● Otherwise, prepare as follows:

The absorbent ball and absolute ethyl alcohol.
Steps for cleaning the optical output port and connector

● Cut off the power supply of the instrument.
● Unscrew the flange cap completely.
● Pull out the flange slowly.
● Clean the end face of the optical output connector and the flange connector with the absorbent ball dipped with proper absolute ethyl alcohol.
● After that, put the flange slightly into the optical output port, and tighten the flange cap.
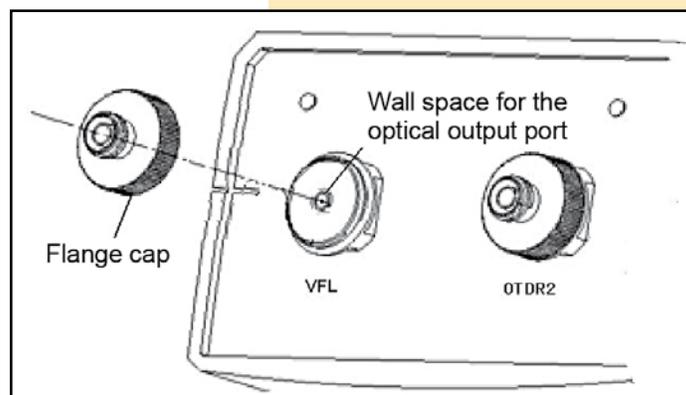
Q Annex B: Technical specifications for various OTDR standard modules

Operating wavelength	Laser wavelength	Dynamic range[2] (dB)	Event dead zone[3] (m)	Attenuation dead zone[4] (m)
Single-mode 1625nm (with built-in filter)	Singlewave length	36	0.5	3
Single-mode 1625nm (with built-in filter)		36		
Multi-mode 850nm		24	0.7	5
Multi-mode 1300nm		36		
Single-mode 1310/1550nm	dualwave length	**32/30**	0.5	3
Single-mode 1310/1550nm		42/40		
Single-mode 1310/1550nm		45/42		
Single-mode 1550/1625nm (with built-in filter)		36/36		
Single-mode 1550/1650nm (with built-in filter)		36/36		
Single-mode 1310/1550nm		50/50		
Multi-mode 850nm/1300nm		26/34	0.7	5

Single-mode 1310/1490/1550nm	Threewave length	37/35/35	0.5	3
Single-mode 1310/1550/1625nm (with built-in filter)		**32/30/28**		
Single-mode 1310/1550/1625nm (with built-in filter)		45/42/42		
Single-mode 1310/1550/1650nm (with built-in filter)		37/35/35		
Single-mode 1310/1550/1650nm (with built-in filter)		45/42/42		
Single-mode 1310/1490/1550/1625nm (with built-in filter)	Fourwave length	45/42/42/42	0.5	3
Single-mode 1310/1490/1550/1650nm (with built-in filter)		45/42/42/42		
Single-mode 1310/1550nm, multi-mode 850/1300nm		**32/30/28/24**	**0.5**	**3**

Notes:

1 Only one standard module can be selected.

2 The environment temperature is 23°C±5°C, with max. test pulse width, average times of more than 500, and SNR=1.

3 The range is ≤ 1.6km, with pulse width of 3ns, optical end face reflection loss of no less than 40dB, and typical values.

4 The range is not ≤ 1.6km, with pulse width of 5ns or less, optical end face reflection loss of ≥50dB 50dB, and typical values.

R   Annex C: Remote control command set

COMMAND TYPE:

No.	FUNCTION	COMMAND
1	Starting measurement	LD
2	Wavelength	WLS
3	Measurement parameters (distance, pulse width and sampling mode)	STP
4	Sampling time	ALA
5	Refractive index	IOR

COMMAND EXPLANATION:

LD

Description	Starting measurement
Command	LD□1 1: Start measurement

WLS

Description	Set wavelength
Command	**WLS□\<Wavelength>1310/1550/1625** **\<Wavelength>: Unit: nm (See the module number in the product manual for wavelength available)**

STP

Description	Set measurement parameters (distance, pulse width and sampling mode)
Command	**STP<Distance mode>, <Distance>, <Pulse width mode>, <Pulse width> and <Sampling mode>** **<Distance mode>:** **0: Manual setting** **<Distance>:** Distance levels: 400: 0.4km 800: 0.8km 1600: 1.6km 3200: 3.2km 8000: 8km 16000: 16km 32000: 32km 64000: 64km 128000: 128km 256000: 256km 512000: 512km **<Pulse width mode>:** **0: Manual setting** **<Pulse width>:** Pulse width level: 3ns, 5ns, 10ns, 30ns, 80ns, 160ns, 320ns, 640ns, 1280ns, 5120ns, 10240ns and 20480ns **<Sampling mode>:** **0:** Speediness **1:** Accuracy

ALA

Description	Set sampling time
Command	**ALA□<Mode>, <Setting>** **<Mode>:** Average mode. **0: Time(s)** **<Setting>:** If the mode is time(s), the range can be set to 1-9999.

IOR

Description	Set the refractive index
Command	**IOR□<Refractive index>** <Refractive index>: The range is 1.300000 – 1.800000.