

MINI2

User Manual

OTDR

Please read this manual before operating the device.
Please keep this manual together with the device.

MINI2

User Manual

Important: INNO Instrument strongly recommends all users to read this manual before operating MINI2.

This manual is valid for the following software version:

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Preface

Safety symbols

To prevent personal injury and property damage from the misuse of the device, **INNO Instrument** uses the following safety symbols to show relevant information. Before using the device, make sure that you understand the meaning of these symbols. All symbols may not be found on this device. There could be safety symbols not marked in this manual.

Safety symbols used in this manual:

Dangerous  this symbol shows that this is a very dangerous operation and improper operation can lead to serious injury, even death.

Warning  this symbol shows that this is a relative dangerous operation and improper operation can lead to serious injury, even death.

Caution  This symbol shows that this a relatively dangerous operation, or has a certain harm. Improper operation can result in mild or serious injury and property loss.

Safety signs used in the manual and device:

The following safety signs are marked on the device, near the operation position, or in the manual to offer relevant safety. Before use, be sure that you have grasped all the meanings and take necessary precautionary measures.

 This sign shows a forbidden operation. This slash circle is labeled in the operation position or around it.

 This sign means that you must be careful when doing a certain operation. This circle sign is labeled in the operation position or around it.

 This sign means a warning and to be careful. Relevant content appears inside the triangle or near it.

 This sign shows an explanation. Relevant content is listed in the box.

 These signs mean the labeled items should be recycled.



Laser Safety Label

Electrical safety

To reduce harm to the user and device, we put forward the following warning tips:

- Do not use if the machine or the charger were damaged or ruptured.
- Only the external adapter offered by our company can be used. For other adapters, we cannot guarantee its safety factor or performance index.
- Do not use the power adapter outdoors or in an area with excessive moisture.
- Be sure that the external input voltage conforms to a permissible range.

Tips to be careful

Replace internal storage battery:

This machine uses a lithium battery for power. If it exceeds its service life and needs to be replaced, please contact a technician for replacement.

External storage:

The USB is used to save data to the external storage of this device.

Overview

1

Introduction

Through adopting high-powered hardware and convenient software, MINI2 OTDR shortens installation time, debugging and fiber distance maintenance. This chapter will describe the features and basic operations of the MINI2 OTDR test unit.

Basic function

The main function of MINI2 is for fiber fault diagnosis, especially aiming at FTTH applications. Besides basic OTDR functions, optical power meter and light source function for fiber evaluation is also internally installed. MINI2 also has a visual light source (VFL) option function. Through the visual light source, it can do visualization inspection of fiber bends and fiber ruptures in dead zone.

OTDR test

According to Rayleigh scattering and Fresnel Reflection principle, OTDR mode provides relevant measurements of optical fiber link. It can also do distance measurements for fiber connection losses and fault locations. It can determine the arbitrary point loss on the optical fiber. OTDR auto analysis functions can also perform automatic analysis on measurement traces to find events on the fiber. For example, the reflection loss or melting point beyond the forecast loss threshold. It can also list the detected data on the event table.



VFL/Light source module

Visual fault locator which uses a $650 \pm 20\text{nm}$ light source or visual light source can provide a visualization method for fiber fault detection. The red light given out by the visual light source can be seen by human eyes. This allows for the finding of direct fault locations in fiber test dead zones or to perform fiber core calibration in multi-fiber cables.



Light source: MINI2 can provide 2 types of optical source, i.e. 1310/1550. Multiple signal modes in-built in MINI2 are able to satisfy demands in actual applications.



Light source

Fiber end inspection tester module (Fiber microscope)

Connecting the external fiber inspection device to the USB port can detect the grind quality and cleanliness of the optical connector.



Basic configuration

- Color TFT LCD
- AC adapter / charger, power line
- Chargeable lithium battery
- Basic menu operation
- Shoulder belt
- Operation manual

Power supply

- External DC power supply: 19V input voltage; input current $\geq 3A$;
- Lithium battery supply: 11.1V, 7.8Ah, about 3h of fully charging time

Size and weight

- Size: 115H x 173W x 64D mm
- Weight: 0.9Kg (with battery)

Environment condition

- Operating environment: Altitude: 0 to 5000m, Temperature: -20°C to 50°C, Relative humidity: 0% ~ 95%, Max. wind velocity: 15m/s
- Storage environment: temperature: -10°C to 60°C, Relative humidity: 0% ~ 95%, Temperature of battery storage for a long time: -20°C to 30°C

Safety warning and precautionary measures

MINI2 is designed for fiber optical testing and not for any other purpose. Since OTDR is a high precision device, it should be carefully handled. Strictly comply with the following safety rules and general specifications when using and transporting the device. Any violation of the warnings and cautions in this manual will cause deviation from the standard requirements for the OTDR design, manufacturing, and use. Consequences due to violations of the warnings will be assumed by the user.

Operation warnings

- DO NOT operate OTDR in a flammable or explosive environment.
- DO NOT disassemble or modify any component of the OTDR without approval. Component replacement and internal adjustments must be performed by authorized technicians or engineers.
- Please be careful when connecting battery adapter cable. Do not pull the cable when removing it from the outlet. Grasp the cable by its plug. Please make sure the cables are in good condition to avoid the risk of fire or electric shock.
- Please not expose OTDR to fire, electric shock, rain, or humid environments.
- When the following cases occur, turn off OTDR and remove the adapter immediately, otherwise it may lead to serious consequences, such as the abnormal function of the OTDR or damage beyond repair.
 - Fumes, peculiar smell, or abnormal sound.
 - Liquid or foreign matters enter the inner workings of OTDR.
 - OTDR suffers from strong vibration or impact.

Note: Please contact the maintenance center if the above cases occur. If timely steps are not taken, this can result in electric shock, fire, bodily harm, device damage, and even death.

- Please just use the exclusive MINI2 AC adapter. Inappropriate alternating of the current power supply may lead to fumes, electric shock, property damage, fire, bodily harm, and even death.
- Please use the exclusive AC power cord. Heavy items should not be placed on the power cord. Do not let power cord become heated or change the power cord. An inappropriate or damaged power cord may lead to fumes, electric shock, property damage, fire, bodily harm, and even death.

Transportation and storage

- When transporting OTDR to a warm area from a cold area, try to gradually warm the device, otherwise condensation can be produced in the interior of the device, leading to adverse effects.
- Please pack the device when not in use.
- Keep OTDR clean and dry.
- OTDR has been precisely calibrated and adjusted. Place it in a carrying case to protect it from being damaged or polluted. A proper buffer box with shock protection should be used during long-distance transportation.
- Please avoid direct sunlight or overheated environments.
- Keep the minimum humidity when stored. Relative humidity should be less than 95%.

Appearance overview



Front panel

Descriptions for keys	
Power	Switch (on / off)
MENU	Back to main menu interface
START	Start/Stop measuring
ESC	Back to previous menu

The upper connect panel



Port description	
DC power connector	Connect the adapter.
SMF port	MINI2 testing interface, applied in OTDR and light source modules of MINI2.
VFL port	Visual light source port
USB port	Connect USB storage device with fiber end probe

Back panel



Charging method



Remaining electric capacity can be checked in the following battery state when MINI2 is powered on.



Test port

The test port lies on the upper panel of the host. There will be one or two test ports depending on the type of OTDR. The test port connected by optical fiber depends on the testing application and measured wavelength. MINI2 can have a visual light source (VFL) installed.

The following are changeable universal connectors used in MINI2 (FC/SC):



Procedures for cleaning universal connector:

- Open the lid of the measurement port which needs to be cleaned.
- Take down the universal connector.
- Blow compressed air toward the top of connecting bar.
- Use a special cleaning belt or dust-free belt dipped in alcohol to clean the top of connecting bar.
- Use compressed air to blow-dry the top of the connecting bar.
- Options: Turn off MINI2. Observe the top of connecting bar by microscope or magnifying lens.



Top of the contaminated connecting bar



Top of the cleaned connecting bar

Connection test

Connect the test fiber

Testing ports are used to connect the tested fiber of OTDR / OPM / OLS.

The process to connect tested fiber to the testing ports:

- Clean the bridge fiber (fiber connector) and connect it to the testing port.
- Clean the fibers to be tested.
- Connect the bridge fiber with the tested fiber.

Connect VFL

The 2.5mm general connect adapter is configured to the Visual Light Source (VFL) and it can be connected with multiple optical fiber connectors.

Notice: Visual Light Source (VFL) is optional. Some devices do not have it installed.

The process to turn on the Visual Light Source:

- Open the cover of Visual Light Source.
- Insert the bridge fiber to the connector of VFL port.

Connect the optical fiber end inspection

Connect with external fiber end inspection tester through the USB interface. The following are the process to connect the visual light source:

- Open the cover of USB port.
- Insert USB connector of optical fiber end inspection tester to USB port.



Basic Operation

3

Power on/off

Press power key until indicating light turns on. Boot animation of INNO Instrument will appear on MINI2 screen. Then the following main menu will appear.

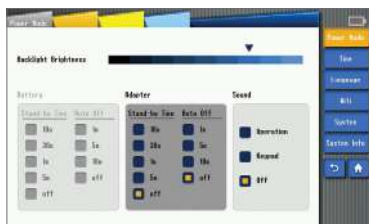


Power off: Press and hold the power key until the screen and indicating light turn off.

Notice: In any situation can you hold down the power key for more than ten seconds to force shutdown.

Adjust the backlight brightness

Click the icon of Backlight Brightness to switch the background lightness. Different color icons represent different levels of the brightness. MINI2 series supports eight levels of brightness.

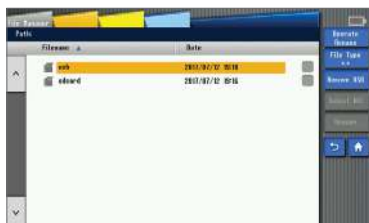


Software upgrading

Please refer to section system maintenance for detailed information.

File copy

As the following picture shows, after inserting external storage, you can check the path of the external storage device in the file management interface, and then execute operations like copy, paste, etc.



OTDR Test

4



- | | |
|--|----------------------------|
| 1. Move trace key | 11. Trace information key |
| 2. Partial amplification key | 12. Start/Stop key |
| 3. "1:1" trace recovery key | 13. Save/Open key |
| 4. Shortcut key for trace horizontal amplification | 14. OTDR set key |
| 5. Shortcut key for trace horizontal shrink | 15. Identify key |
| 6. Full screen display key | 16. Create report key |
| 7. Parameter setting key | 17. Move trace key |
| 8. OTDR key | 18. Main menu key |
| 9. Event key | 19. Return key |
| 10. Measurement key | 20. Display screenshot key |

Move trace key

Click the "Move Trace" key. You can move the trace by touching the screen and dragging left and right.

Move trace key



Notice: The previous trace can't be moved. Only the trace that had been amplified can be moved.

Partial amplification key

Click the “Partial Amplification” key and then click the screen up and down to select the area. This area will be amplified and displayed on “trace display small screen interface”.

Partial amplification key



Magnified Area

Trace horizontal amplification key

Click the “Trace Horizontal Amplification” key to amplify the trace;



Trace horizontal shrink key

Click the “Trace Horizontal shrink” key to shrink the trace. Picture 1 is not contracted while Picture 2 is contracted.



Picture 1



Picture 2

“1:1” trace reset key

As shown in the following picture, after performing amplification or shrinking operations to the trace, the trace can be reset by clicking the “1:1” trace reset key.



Full screen display key

Click the “Full Screen Display” key to amplify the testing interface. Picture 1 is not amplified while Picture 2 is amplified.



Picture 1



Picture 2

Parameter setting key

The wavelength, distance range, pulse width, and average time can be set on the measurement setting interface as shown in the following picture:



- Select wavelength
- Select wavelength parameters
- Select parameters

Wavelength can be selected in the wavelength region. One, or both must be selected. The mark "✓" indicates the wavelength selected. The parameters, including distance range, pulse width and average time, can be set in the parameter region. The three parameters, including distance range, pulse length and average time, can be set by clicking on icons or numeric values.

OTDR keys

As shown in the picture, enter the OTDR measurement setting interface by clicking "OTDR".



Measurement

As shown in the picture, enter the measurement interface by clicking the “Measurement” key.



the letter to switch the “Mark line”, which can be moved by pressing the “<”, “>” keys or by touching manually. The loss and location of the Mark line will be displayed under the “Mark Line Information”. Loss, attenuation, reflectivity and ORL (Optical return loss) will be displayed under the “Result”.

Event

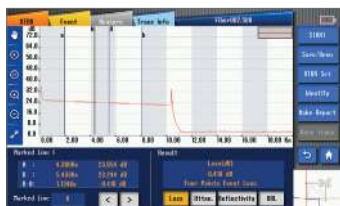
As shown in the picture, enter the event interface by clicking the “Event” key. The information of events such as Type, Number, Location, Loss, Reflectance, Attenuation and Cumulative Loss(Sum) can be shown.

Please refer to section “Loss”.

Please refer to section “Reflectance”.

Please refer to section “Attenuation”.

Cumulative Loss(Sum): It refers to the total loss from port of OTDR to a certain point. Event loss+ Fiber span loss= cumulative loss



ch as “add”, “delete”, “maximize”, “set

Ref”, “delete Ref”, and so on.

- “Add” is used to insert an event point in the selected position on the trace.
- “Delete” is used to delete the inserted event point.
- “Maximize” is used to amplify the event trace.
- “Set Ref” is used to reset a starting point. All the data will be measured through the new set point. (“Reference starting point” can only be set between the original point and event point. If there is no event point after original point, the starting point cannot be set.)
- “Delete Ref” is used to delete the starting point that has been set.

Note: Types of events are shown in the following table.

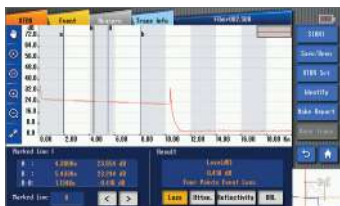
Types of event	Event icons	Descriptions
Start point of fiber cross segment		Start point of fiber span (regarded as the first event point)
End point of fiber cross segment		End point of fiber span (regarded as the last event point)
Short fiber		Used in measuring short fiber
Continuous fiber		Found fiber end continuous with sampling fiber end; insufficient sampling points
Analysis complete		Light is inadequate so that the analysis has to be stopped halfway
Non-reflective event		Events such as “loss”
Reflection event		Reflective event
Gain event		Gain event phenomenon; generally regarded as pseudo gaining.
Light emission level		Show the emitted light intensity.
Fiber span		Fiber without any event appearing.
Reflection events combination		Multiple reflection events appear together.
Echo		Echo or return wave phenomenon appear.
Reflection event (echo possible to occur)		Echo event possible to occur

Event loss(dB): OTDR can measure the degraded signal strength for RBS(Rayleigh backscattering) caused by certain event. Both reflective and non-reflective event can produce event loss.

There are two algorithms on MINI2.

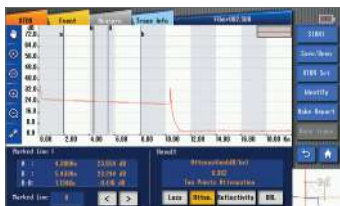
Loss:

- Four points event loss: Event Loss can be computed by LSA. The loss displayed in event lists can be computed by 4 point method. Set the points as a, A, B and b, fitting 2 straight line from the areas of a point to A point and b point to B point, so as to produce event loss result from interception of the 2 lines.
- Two points analysis method(TPA): Difference between these 2 lines on the Y-axis can produce the loss between these 2 lines.(Loss A-loss B)



Attenuation

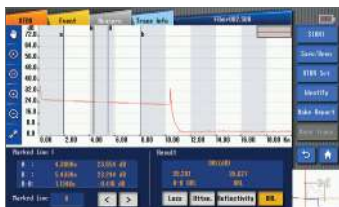
The attenuation, measured in two points, refers to the RBS attenuation given by the distance function between 2 points(as per the fiber standard, labeled as dB/km).



Only these 2 points would be used for calculating attenuation. There is no need

ORL: Only single mode OTDR can be used to calculate ORL:

- ORL are between marker line A and marker line B.
 - Total ORL are between start point of fiber span and the end point of fiber span.
- ORL, optical return loss, refers to the total effect of multiple reflective events and scattering events in the whole optical fiber system.



Note: in real-time mode, the reflectance may not be always accurate. marker line a should be located prior to the range of linearity befo

Trace information key

As shown in the picture, enter into the trace information interface by clicking "Trace information".



Trace information will show basic information about the measured trace, such as: file name, data, pulse width, average time, reflective index, along with backscattering and loss measurement method.

Start/Stop key

As the following picture shows, the selected trace can be saved by clicking the “Save Trace” icon. If there are 2 traces, you can highlight “Save” icon to save trace that you need.

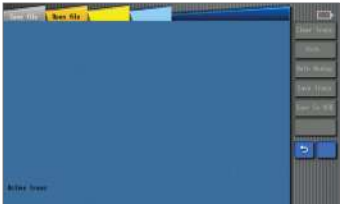


Clear trace

As shown in the following picture, the trace can be cleared by clicking the “Clear trace” icon. Picture 1 shows the display before the trace is cleared, while Picture 2 shows the display after the trace is cleared.



Picture 1



Picture 2

Path

As shown in the picture, you can select the path of trace saved by the create folder option and pressing Enter.



Auto naming

As shown in the picture, you can choose whether to use the auto name function and define its format.



You can manually input the file name after the User-Defined

Open file

As shown in the picture, click "Open file" or click the file directly to load and display the trace. The file can also be read directly by clicking "Open from USB".



As shown in the following picture, click “Save to USB” icon on the screen and then click “Save” to save the file to the USB.



OTDR setup key

As shown in the picture, click the “OTDR set” key to enter the OTDR setup interface. There are “Common set”, “Sample set”, and “Analysis set” options in OTDR settings.



- “Common set” is used to set “Loss measure method”, “Attenuation measure method”, “Application option”, “Display option”, and “Default path of OTDR report creating”. Refer to the following picture.



Introduction to the measuring methods:

LSA (Four points event loss): Event Loss can be computed by LSA. The loss displayed in event lists can be computed by 4 point method. Set the points as a, A, B and b, fitting 2 straight line from the areas of a point to A point and b point to B point, so as to produce event loss result from interception of the 2 lines.

TPA (Two-points Analysis method): Difference between these 2 lines on the Y-axis can produce the loss between these 2 lines. (Loss A-loss B)

Introduction about application option:

- Light check: Before setting the measurement, check the fiber which is being tested for a communication light (other light except the test light source). If a communication light exists, an error message will be shown and the test will be terminated.
- Fiber connector check: Check if the fiber being tested is properly connected to the testing port. If a connection problem exists, an error message will be shown on the screen.
- Auto save: Used to automatically save the measuring information after completing checking.
- Auto amplification: Used to automatically amplify the point which has been selected as the event point in the measurement interface.

Introduction of the display option:

The screenshot displays the OTDR software interface. The main plot shows distance (km) on the x-axis (0.00 to 18.00) and reflectance (dB) on the y-axis (0.0 to 88.0). A red trace shows a sharp drop at approximately 10.00 km, indicating a fault. The interface includes various control buttons and a data table.

OTDR Settings:

- Wavelength: 1310 nm (selected), 1550 nm
- Distance: 200 m
- Pulse: 20 μs, 1 μs, 500 ns, 200 ns, 100 ns
- Time: 180 s, 120 s, 90 s, 60 s

Data Table:

Distance (km)	Reflectance (dB)
0.00	88.0
2.00	72.0
4.00	64.0
6.00	56.0
8.00	48.0
10.00	40.0
12.00	32.0
14.00	24.0
16.00	16.0
18.00	8.0

Screenshot button

- Chapter 4 OTDR test

- Common Sampling Rate (normal): it is a relatively common sampling rate. In this mode, fewer signals are collected, but sampling and analysis are faster in speed.
- High Resolution Sampling Rate(HR): In this mode, more signals are collected and measurement distance is more accurate, but the sampling and analysis are slower in speed.
- Unit Conversion: 3 types of unit are available on MINI2, i.e. Meter, Kilometer, and Mile.
- Fiber Set: To set the IOR, Backscattering (dB), Excess Length (%). Different numerical results can be obtained after analysis according to different settings.

Note: Excess Length (%): in the process of fiber laying, part of optical fiber should be reserved, so in fact the length of fiber is longer.

- IOR: It refers to the Index of Refraction of the trace, i.e. group index. The distance of the trace will be varied depending on this parameter. You can input IOR directly on this device.
- Backscattering (dB): it refers to the RBS of the trace. The reflectance and ORL of the trace will be varied depending on this parameter.
- Excess Length (%): To set the Excess Length of the trace. The distance of the trace will be varied depending on this parameter.

Analysis Set

“Analysis set” is used to set the parameter of analysis trace.



- Splice Loss Threshold(dB): To analyze the small non-reflective event on trance.
- Return Loss Threshold(dB): To analyze the small reflective event on trance.

- Fiber End Loss Threshold(dB): To analyze the important even loss on trance.
All these types of loss will affect the signal transmission.

Identification key

“Identify” is used to set identification information of the current trace. As shown in the picture, click “identify” to enter the identification interface.



“Use default” is used to restore all settings.

“Clear” is used to delete all settings that had been identified.

Note: This function can only be used if the trace exists. Otherwise this function cannot be used.

Create report key

As shown in the picture, click the “Create report” key, if a message indicates successfully creation, then a .html file will be generated in the default path.



Note: This function can only be used if the trace exists, otherwise this function cannot be used.

Move trace key

When obtaining two traces while dual-wavelength testing, as shown in the picture, click “Next traces” to switch the trace and its information. Picture 1 is before the switch while Picture 2 is after.



Picture 1



Picture 2

Display screenshot button

As shown in Picture 1, “Display screenshot” can display the complete trace to facilitate macroscopic observation of the trace. Select the “Display screenshot button” in OTDR settings. The screenshot button will be shown on the “Trace display screenshot interface”. Click it to take a screenshot.



Picture 1



Picture 2

Return key

If you want to exit the current operating interface to a different operating interface, click the “Return” key to return to the previous interface.



Main menu key

If you want to return to the main menu interface from different function modules, click the main “Menu” key to return to the main menu interface. Then operate other modules.



SOLA

5

Overview

SOLA is an application for the OTDR, designed to simplify the test process without the need for configuring parameters or analysis while parsing multiple complex OTDR traces. It uses the advanced algorithm, dynamically defines the test parameters, and according to the number of measured traces of the network, determines the most suitable for collection. It can be used with multiple wavelengths of multiple pulse widths to locate and identify faults at the highest resolution. All these functions described above can be performed by pressing one key.

“SOLA” operation

- Click “SOLA” on MINI2 main interface to enter the fault checking interface. Refer to Picture 1.



Picture 1

- Connect the tested fiber that has been cleaned to the testing port.
- Click “Start” to carry out the fault checking test.
- As shown in picture 1, the Link (Line) Loss and Return Loss can be shown on the interface of SOLA after measurement with different wavelength. Link Loss refers to the total loss for the whole measured link. Return Loss refers to the optical return loss for the whole measured link.

Setup

You can set the measuring wavelength selections by selecting the “Setting” interface as shown in Picture 2.



Picture 2

Management

As shown in the picture, you can enable the “Management” function by tapping the “Setup” key to set related measuring parameters such as “Identification (identify)”, “Link definition (line define)”, “Link pass (line pass)”, and “Element pass (item pass)”.



Identification

In this interface, the corresponding records of the files saved after SOLA measurement can be shown.

There are 4 options, including: Cable ID, Fiber ID, Location A, Location B.

The information of cable ID, Fiber ID, Location A and Location B can be recorded and shown.



Line definition (Link info)

You can manually set fiber link definition, including selecting levels of splitting ratio, adjusting related measuring parameters.

IOR: It refers to the Index of Refraction of the trace, i.e. group index. The distance of the trace will vary depending on this parameter. You can input IOR directly on this device.

Backscattering (dB): it refers to the RBS of the trace. The reflectance and ORL of the trace will vary depending on this parameter.



Line Pass

You can modify related numerics, including adjusting the conditions of the measurement link and thresholds of pass / failed.



Element Pass

You can modify the related thresholds to judge whether the element passed or failed.

For example: When you want to modify max splice loss modification, directly click the value in intersection, and then you will see a pop-up box for value input on the screen (Relative message will be shown when the value entered exceeds the limit.) When you select “apply to all wavelengths”, the list of values will be applied in all wavelengths.



[Open file](#)

Open SOLA files which have been saved.



Screenshot

In SOLA, you can click “screenshot” to save the display image



Save File

You can save the SOLA file.



VFL and Light Source

6

Overview

The types of visual light source of MINI2 include visual light source and invisible light source. The visual light source provides a visual method for fiber fault location. It is red and can be seen by human eyes. It can directly locate fault/broken points in the dead zone during an optical fiber test. It can also be used to calibrate the fiber core in multi-optical fibers. There are two types of visual light source which MINI2 can produce: CW continuous light source and 2Hz blink light source. While the invisible light source (1310, 1550nm) can provide the following types of light, including CW light, 1KHZ light, 2KHZ light, 1KHZ blink light, 2KHZ blink light.

Visual light source operation

- Connect the fiber to the port of optical source.



- Tap the light source icon on the main interface to enter the visual light source

interface. Refer to Picture 1.



Picture 1

- Click “CW” or “2Hz” to select and switch the light source. The name that is displayed on the message bar of the interface is the selected light source. (“CW” is the continuous light while “2Hz” is a blinking light)
- Click “Turn off” to turn off the light source.

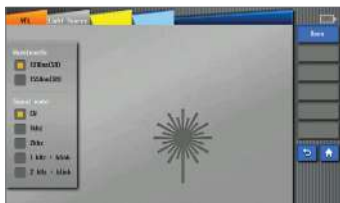
Invisible light source (light source) operation

- Connect the fiber to be tested to the light source(SMF) port.



- Tap the light source icon on the main interface to enter the Light Source

interface. Refer to picture 2.



Picture 2

- Select the wavelength of light source (1310 / 1550nm) by tapping on the upper left side of the screen. Select emitting light source modes (CW / 1KHZ / 2KHZ / 1KHZ+blink / 2KHZ+blink) by tapping on the lower left side of the screen. Tap the "Open" key to open the invisible light source.



- Turn off "light source": tap the "close" key on the right side.

Warning: Do not directly look at the MINI2 light source or the fiber end connected to light source. This may cause damage to the eyes.

Fiber Microscope

7

Overview

The grind quality and cleanliness of the fiber connecting end face can be inspected with the aid of the magnified surface view displayed on the screen of MINI2.

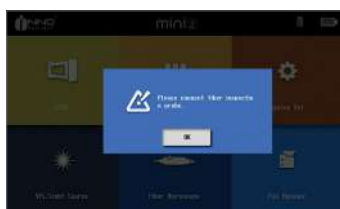
Start fiber end inspection

After connecting the fiber inspection tester, click "Fiber Microscope" on the MINI2 main interface to enter the inspection interface. Refer to Picture 1.



Picture 1

Notice: If you have not connected the fiber inspection probe before entry into the end face inspection interface, it will show the message: "Please insert fiber end inspection tester". Refer to Picture 2.



Picture 2

The function of fiber microscope

There are three functions of the fiber inspection probe (fiber microscope), “Screenshot / Real time(video)”, “Open”, “Save”, “Align Center”, “Zoom”, “Save Report”, and “Identification”.

- “Screenshot / Real time (video)” function is used to “Save”. After successfully connecting the device, you cannot enable the “Save” function until the “Screenshot / Real time” soft key changes to “Real time”.



- “Open” function is used to open saved files.



- “Save” function is used to save the measured information. It is not selected by default, so after you have selected “Screenshot / Real time” you can save.



- “Align Center” function is used to place the image in the middle of the screen.



- “Zoom” function is used to amplify the active displayed image. (Note: you cannot tap “Screenshot” when the amplification function is executed.)



- “Save Report” function is used to save an analysis report of file.



- “Result” function is used to analyze the active image and show the results in the

form of tables.

Layer	Criteria (a)	Threshold	Result	Criteria (b)	Threshold	Result
B: Core (10-15)	\$Size<=	0	1	\$Size<=	1	0
	\$Size<=	100	1	\$Size<=	100	1
B: Cladding (15-18)	\$Size<=	0	1	\$Size<=	1	0
	\$Size<=	100	1	\$Size<=	100	1
C: Buffer (18-20)	---	---	---	---	---	---
D: Jacket (20-250)	\$Size<=	100	1	\$Size<=	100	1
	\$Size<=	100	1	\$Size<=	100	1

- “Identify” function is used to set related information displayed, the contents of which are user-definable.

Identification	File name
Task ID	☐
Client	☐
Channel	☐
Mode	☐
Location 1	☐
Location 2	☐
Color ID	☐
Fiber ID	☐
Connector ID	☐

Check the preserved image

- Click “Files” on the main interface.
- Select the image saved path (Path saved for MINI2 is set to: sdcard\Fibe_Microscope). Refer to Picture 3.



Picture 3

File Management

Overview

“File management” is used to view saved data and carry out operations like “Copy”, “Delete”, “Rename”, and “Create folder”. All the file operations should be carried out in directories of the internal storage and USB storage (The set directories of MINI2 are SD card and USB).

Start file management

Click “File manager” on main interface of MINI2 to enter the file viewing interface. Refer to Picture 1.



Picture 1

File manager function

There are 2 functions in file management interface: Operate, Operation and File type.

“Operate” function

There are functions of “delete”, “copy”, “rename” and “create folder” and “send” included in operation interface. Click “Operate” to display the above functions. Refer to Picture 2.



Picture 2

- **DELETE key**
It can delete the files or subdirectories in the directory.
Operation steps: Click FILE TYPE to select the file type to be deleted → click and access to the root directory (sdcard / usb) → Select the folder or files to
- **COPY key**
It can copy subdirectories or files.
Operation steps: Click FILE TYPE to select the file type to be copied click and access to the root directory (sdcard / usb) → click PASTE after selecting subdirectory or file (PASTE cannot be executed if no subdirectory or file is selected) → select the target directory needed to be copied → click PASTE. However, PASTE cannot be executed under the same directory. The notice “You can’t copy a file to the same directory!” will appear on the screen.
- **RENAME key**
It can rename folder, file format, and file format.
Operation steps: Click FILE TYPE to select the file type to be renamed → select folder or file to RENAME, access to the input interface, press “ENTER”
- **CREATE FOLDER key**
It can create a subfolder under the current folder.
Operation steps: Click and access to the root directory (sdcard / USB directory) click CREATE FOLDER to enter the input interface → Input the folder name then press ENTER to create a folder successfully.
- **SEND key**
Connect the software between host computer and slave computer by WIFI to send files → click files to be sent

“File type”

Overview

The system setup function of MINI2 can let the user modify the system parameters as required.

Start system setup

Click “System set” on the main interface of MINI2 to enter the “System setup” interface. Refer to Picture 1.



Picture 1

Functions of system settings

There are functions such as “Standby and brightness”, “Time”, “Language”, “System maintain”, “WIFI”, and “System Info” in the MINI2 system set interface.

Standby and brightness

- Background brightness: Set the background brightness for the screen.
- Battery and adapter: Set the stand-by time and auto power-off time when using the battery or adapter.
- Sound: Set the measurement warning sound and key warning sound.
- Skin: Set the skin of the operation interface.

Time

As shown in Picture 2, you can use the “Time” function to set the time displayed on the device.



Language

Picture 2

As shown in Picture 3, the “Language” function is used to set the language displayed on the screen.



Picture 3

WI-FI

As shown on Picture 4, the “Wi-Fi” function can be used to connect the device to a local area network with wireless internet. Under this function, along with upper computer, wireless file transmission can be implemented. (Please refer to the Wi-fi Instruction for the usage in detail.) The remote control function can be implemented when both Wi-fi and Cloud Server are available.



Picture 4

System maintenance

There are two functions in “System maintain”, which are “Software Upgrade” and “Factory reset”. Refer to Picture 5.



Picture 5

- “Software upgrade” can be used to upgrade or downgrade software.
Operation steps:
 - Insert the USB with the update file and power adapter to the respective MINI2 ports.
 - Click “System maintain” on the system setup interface.
 - Click “Upgrade”. It will show an upgrade notice. Then click “Confirm” to carry out the upgrade operation.

Note: If the adapter has not been inserted, the screen will show “Ensure that

electric quality is more than 50% to upgrade!"

- "Factory reset" is used to restore the system parameters to the original.

System Information

10

System information

As shown in Picture 1, this interface displays information about the product and manufacturer.



Picture 1

Appendix

Structure requirement

- Display screen: 5inch (800 x 480)
- Indicator light (2 pieces)

Indicator light	State	Function
Charge light (Red)	Long-time onlight	Full charged
	2Hz blink	Adapter power supply
	1Hz blink	Battery charge
	off	Take out the adapter, battery power supply.
Power light (Green)	Long-time on light	Starting up operation
	Blink	Low electric quantity
	off	Power off

- Keys (4)

Names of keys	Quantity
Enter	1
ESC	1
Power	1
Menu	1

- Operating time>8h, charging time<4h

Hardware interface requirement

- DC INPUT: Power port
- USB port : Save data and connect the fiber microscope
- Mini B port: Internally installed, programming
- Serial port: internally installed, software debugging
- Optical interface: interchangeable port (FC, SC),
place 1550nm / 1310nm light source
- VFL port: Visual optical light port, 2.5mm universal interface
- SD card slot: Internally installed, SD card start, place the program.

Software interface requirement

- Interface mode: button input or touch screen input
- Operating platform: Linux 2.6

Operating environment requirement

- Temperature requirement:
Working temperature: 10℃ ~ 50℃
Storage temperature: -20℃ ~ 60℃
- Humidity requirement: (general standard)
Operating humidity: 0% ~ 45%, non moisture condensation
Storage humidity: 0% ~ 95%, non moisture condensation

Performance requirement

Module	Technical index	Value
OTDR Module	Dynamic range	1310/1550 $\pm$ 20nm, 32dB/30dB
	Event dead zone	0.8m
	Attenuation dead zone	4m
	Sampling point	110,000
	Sampling resolution ratio	0.04m ~ 10.25m
	Loss threshold value	0.01dB
	Real time refresh rate	1s
Fiber end inspection module	Interchangeable port	(FC,SC) / PC (FC,SC) / APC
VFL module	Operating wavelength	650 $\pm$ 20nm
	Output Power	20mW
Optical Source	Detector type	InGaAs / GeGeX
	Wavelength	1310/1550 $\pm$ 20nm
	Output Power	Max. Output power: -5dBm
	Output Signal Mode	CW/1KHZ/2KHZ/1KHZ+blink/ 2KHZ+blink
	Stability (Optical source)	0.04@20°C@15min dB

Algorithm

Loss

Equation: (least squares)

Where

$$y = a_0 + a_1 x$$

$$a_0 = (\sum y_i) / n - a_1 (\sum x_i) / n$$

$$a_1 = (\sum x_i y_i - \frac{\sum x_i \sum y_i}{n}) / [\sum x_i^2 - (\sum x_i)^2 / n]$$

Loss:

- Four-point event loss: Event Loss can be computed by LSA. The loss displayed in event lists can be computed by 4-point method. Set the points as a, A, B and b, fitting 2 straight lines from the areas of a point to A point and b point to B point, so as to produce event loss result from interception of the 2 lines.
- Two points method: Difference between these 2 lines on the Y-axis can produce the loss between these 2 lines. (Loss A-loss B)

Reflectance

Reflectance refers to the value indicating the magnitude of the reflectance caused by changes of refractive index. Reflected light power P1/incident light P0. As shown in the following equation by software algorithm.

Rayleigh scattering intensity:

Relay = BackScattering + $10 * \lg((\text{HighSampleRating} / \text{CurrentSampleRating}) * i\text{Blind})$;

Reflectance:

Reflect = Relay + $10 * \lg(\text{pow}(10, \text{Delta} / 5) - 1)$;

Where: Relay refers to Rayleigh scattering intensity of a pulse, BackScattering refers to scattering coefficient, HighSampleRating refers to maximum sampling rate, Current Sample Rating refers to current sampling rate, iBlind refers to current theory pulse width of dead zone, and Delta refers to the difference between Max. and Min. values within the area selected.

Attenuation Loss

If the parameter of the fiber structure is uniform axially, then attenuation coefficient between point x1 and point x2 can produced by the following equitation:

$$\alpha = 5 \lg \left(\frac{P_{x1}}{P_{x2}} \right) / (x2 - x1).$$

- Attenuation of area between 2 points: the attenuation coefficient between 2 points can be calculated. The difference value of power(dB) / The distance between 2 points (km)
- A-B LSA: Refers to least square approximation. Linearly fit the backscattering data between A and B to measure attenuation coefficient between the 2 points, producing straight slope which can be converted between m and km. The attenuation between point A and point B can be produced.

Accumulation loss

Refers to the total loss from port of OTDR to a certain point.

Event loss+ fiber span loss= accumulative loss

Term list

This term list gives explanations about fiber and related devices.

B

- Backscattering: The scattered light which opposes the previous direction of propagation.
- Bandwidth: The function size transmitted by waveguide drop 3db below the zero frequency. The lowest frequency bandwidth is the function of waveguide length, but it is not in direct proportion to the length.

C

- Coating layer: A kind of material coated on the optical fiber in wire drawing process to prevent fiber damaged from environment or improper operation.
- Cladding: Insulating materials coated on the fiber cores.
- Cable pipelines: The pipeline for cable to pave or from where the pipe can be pulled.
- Cable bending radius: Cable bending radius refers to the stress load that the cable suffered. Free bend refers to the admissible diameter when it lies under an unburdened state.
- Cable module: The kind of cable installed by connectors on one end or both ends. This kind of cable is often used as the interconnection in cable systems and optoelectronic devices. If there is only one end installed by the connector, this is called "Tail end fiber". If both ends are installed, this is called "bridging cable or wire jumper".

D

- Decibel (dB): Standard unit used to describe the optical power gain or loss.
- Dielectric: It belongs to nonmetal type, so it is non-conducting, glass optical fiber is deemed as a kind of dielectric. Medium cable contains no metal parts.

F

- Fiber core: The central area where light propagates through it. Fiber core eccentricity ratio: The core center displacement measurement relative to the cladding center.
- Fiber core ellipticity: The deflected measurement for aspheric fiber core and

perfect circle.

I

- Insertion loss: Attenuation resulting from the insertion of optical module (the connector or coupler in optical transmission system).

M

- Material dispersion: The dispersion from material refractive index or the correlation with light speed and wavelength in this material.
- Module (1): Used to describe the terms about the independent light path which penetrates the fibers, such as multimode and single mode.
- Module (2): Scattered light wave can be transmitted in optical waveguide. The differential equation eigenvalue featured in waveguide. There is only one module which can transmit in single mode optical fiber called "Basic mode". But there are hundreds of modules in multimode fibers. They are different in graph and propagation speed, the upper limit of module quantity determined by fiber core diameter, and waveguide value.
- Monochrome: Composed by single wavelength, radiation is not the ideal monochrome. The best situation is to display wavelength in narrow-band range.
- Multi optical fiber and cable: The cable contains two or more pieces of optical fiber.
- Multimode fiber: A kind of optical waveguide. Through it, light can be transmitted by multimode. Typical fiber core or covering size is measured in micrometers. (62.5 / 125).

N

- Nanometer: A kind of measurement unit, equal to nm, often used to describe wavelength, such as 1300nm.

O

- OTDR: OTDR transmits impulse to fiber to measure backscattering. Through analysis, the track can determine the event.
- Optical Time Domain Reflectometer (OTDR): A kind of device used to measure the optical features in optical pulse transmission and make measurements of

the backscattering light and reflected light as the time function. This device can also be used as the function relationship to estimate damping coefficient and distance, determine the flaws and other part loss.

- Optical fiber: A kind of threadlet or fiber made by any derivative light dielectric.
- Optical fiber link: Optical fiber transmission channel designed to connect either terminals or tandem with other channels.
- Optical cable: The module constituted by the materials which can protect the optical fiber and resist to machine or environment damage.

P

- Plug-in board: Network devices in the bracket, such as OTDR or the switches.
- Photoelectric device: A device that can response to fiber power, send or adjust optical radiation, or used in internal work. It can also be used as any device in photoelectric conversion.
- Port: Located at the port of the plug-in device to connect the wire jumper or the fiber.
- Peak wavelength: The wavelength when the source optical power meter maximizing.

S

- Single mode optical fiber: A fiber with small size core diameter called "single mode optical fiber". Usually 9 μ m. Among them, only the single mode and basic mode can transmit on this kind of fiber. This kind of optical fiber is particularly applied to long-distance bandwidth transmission, for the bandwidth is only restricted by dispersion.

T

- Transmitter: A kind of driver can switch electric signal to optical signal.
- Transmission loss: Total loss in system when transmission happens.
- Telecom cabinet (TC): It is an enclosure space placed by cross-linked fiber terminal and telecom settings. Equipment cabinet is regarded as a cross-link by main wiring and horizontal wiring.

W

- WDM: Transmit several signals in optical waveguide with different wavelengths at the same time.

Maintain and technical support

Any operation, such as calibration, maintenance or repair of the device can only be carried out by qualified maintenance technicians. Please contact the engineers of [INNO Instrument](#). You can also consult any question through the following website.

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We DESIGN

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