Norsat International Inc.

USER MANUAL

OPTIVIA 905 nm Laser Rangefinder
LRFA1500AB

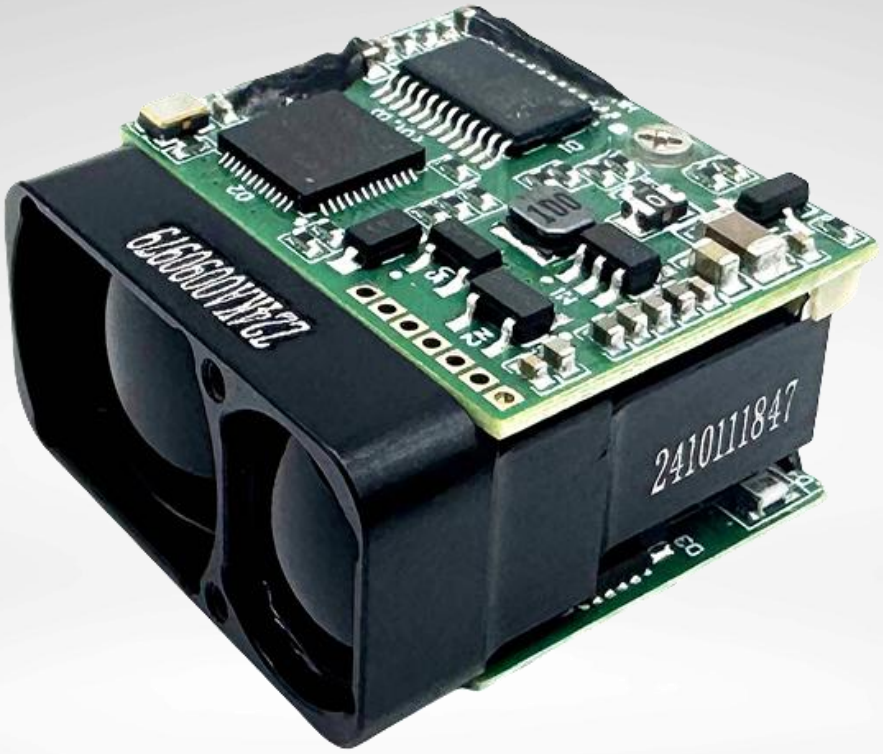

TABLE OF CONTENTS

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Revision History

REVISION	DESCRIPTION
A	Release

1. Disclaimer Notice

This specification mainly provides product reference indicators. If certain indicators are not included in this document, please directly contact Norsat International Inc. to confirm their feasibility. All contents in this manual and the specific specifications of the rangefinder are subject to change without prior notice.

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2. Usage Precautions

WARNING: Avoid direct eye exposure to the rangefinder's laser. If observation is necessary, ensure proper protective equipment is used. Do not look directly into the laser beam. If required, observe only with appropriate professional protective gear to prevent eye injury.

CAUTION: Avoid measuring targets within blind spots, especially highly reflective surfaces (e.g., glass, smooth metal), as measuring such surfaces may cause interference. Avoid operating multiple rangefinder modules facing each other at close range. Prevent high-energy laser sources from directly illuminating the receiving lens. During assembly and debugging, always keep the receiving lens covered to avoid excessive return signals, which may permanently damage the detector.

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CAUTION: Electrostatic Discharge (ESD) Protection: The laser rangefinder's electronic components are sensitive to ESD. Do not touch any electronic parts without proper ESD protection measures.

CAUTION: Do not touch the optical lens directly with fingers or hard objects to prevent scratches or contamination. Avoid using cleaning agents unless absolutely necessary, as they may irreversibly damage the lens coating and compromise product performance. If cleaning is required, use a soft, lint-free cloth or a specialized lens cleaning tool designed for optical surfaces.

CAUTION: Do not operate the product under direct sunlight to prevent overheating and potential performance degradation. The laser rangefinder must not be subjected to severe mechanical shock (vibration, impact, dropping, etc.), as this may misalign optics or damage internal electronics. Rapid thermal shifts (e.g., moving from cold to hot environments too quickly) can cause condensation or material stress, leading to malfunctions.

NOTE: Although the rangefinder incorporates partial moisture resistance, operate in environments below 80% relative humidity to prevent internal condensation and circuit corrosion. Maintain a dust-free and hygienic workspace during operation. Contaminants (sand, oil, etc.) may compromise optical clarity and mechanical components.

CAUTION: Do not attempt to disassemble, modify, or repair any part of the rangefinder. Unauthorized tampering or performance adjustments are strictly prohibited.

CAUTION: Use the rangefinder strictly in accordance with the specifications in this user manual. Any operational commands beyond the defined parameters in the specifications are prohibited.

3. Safety Instructions

For safe use of the rangefinder, please refer to the safety instructions in the specification sheet. Do not attempt to disassemble or modify any part of the rangefinder, or try to repair it yourself. Do not attempt to tamper with or adjust the performance of the rangefinder.

Proper Usage Conditions

- Pay attention to electrostatic protection; do not touch any electronic components or parts of the rangefinder without professional protective measures.
- Keep an easily accessible copy of the specification sheet manual beside anyone who uses the rangefinder.
- Turn on the rangefinder's power only within the specified voltage and power range.
- Operate the rangefinder in a clean, dry, and electrostatically protected area.
- Do not touch the glass lens with your fingers.
- Avoid exposing the rangefinder to an environment with drastic temperature changes.

Improper Usage Conditions

- Use the rangefinder with the complete machine without confirming that all its functions are intact.
- Use the rangefinder in combination with other equipment without first mastering the content of the product specification sheet and safety instructions.
- Disassemble, alter, or modify the rangefinder without permission.
- Send operating commands to the rangefinder that are not specified in this specification sheet.
- Use or test the rangefinder in a non-conventional application environment.
- Use the rangefinder not in accordance with the instructions in the specification sheet.
- Continue using the rangefinder after performing unreasonable operations.
- Use a rangefinder with obvious faults or defects.
- Conduct testing with the rangefinder within its blind zone.

Risks of Improper Usage

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- Eye injury
- Incorrect results
- Instrument error
- Property damage
- Equipment malfunction

Operator's Responsibilities and Obligations

- Master the basic knowledge of correct rangefinder operation.
- Understand and comply with the rangefinder's usage and maintenance requirements.
- Prevent damage to the rangefinder during storage and transportation.
- Keep the rangefinder clean.
- Store and use the rangefinder in a safe environment.
- Do not expose the rangefinder to strong mechanical impact.
- Do not expose the rangefinder to sudden temperature changes.

Avoiding Ranging Errors

- Be aware of all factors that affect the rangefinder's performance indicators.
- After the laser rangefinder undergoes rough handling (such as vibration, impact, drop, etc.), or before performing critical ranging tasks, it is recommended to verify its performance indicators.

4. Product Overview

The LRFA1500AB Miniature Laser Rangefinder (hereinafter referred to as the rangefinder) is a laser ranging module designed to measure the distance to specific targets and provide target distance information, featuring outstanding performance and simple operation. The laser wavelength of this rangefinder is 905 nm, and the entire system communication is realized through a TTL serial port. A modular design method is adopted to minimize the product weight and volume on the premise of ensuring stable performance.

5. Product Illustration

The product schematic of the laser rangefinder is shown in Figure 1. It mainly consists of the following components:

- Control Board
- Receiver Board
- Power Supply Board
- Receiving Lens
- Transmitting Lens

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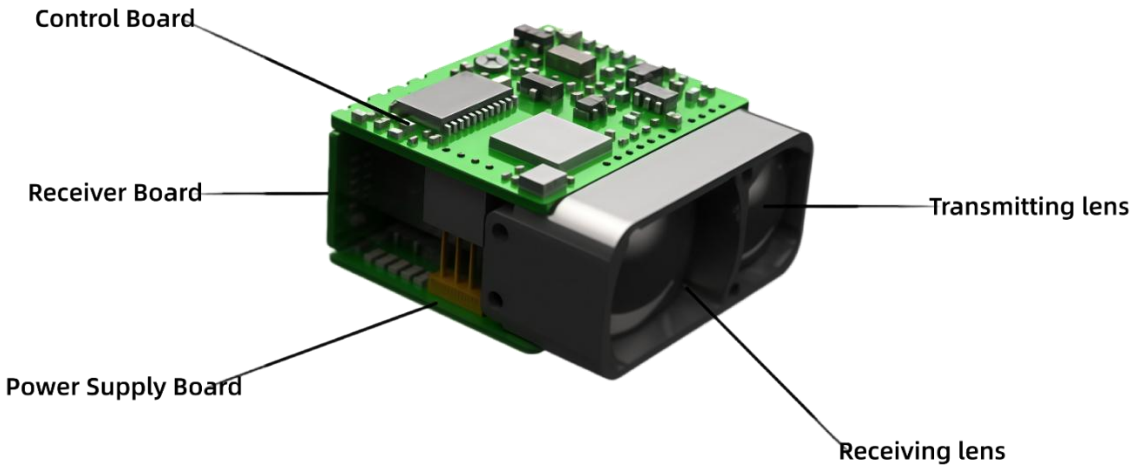

Figure 1 Product Appearance Diagram

6. Product Performance Specifications

6.1 Functions

Main functions are as follows:

Laser ranging and real-time reporting function.

In the normal working mode, the rangefinder enters the ready state for receiving commands, which enables:

- Acquisition of distance information.
- Return of the updated sampling result in each sampling cycle, displayed through the upper computer.

6.2 Performance Parameters

Table 1: LRFA1500AB

Item	LRFA1500AB Performance Specification
Operating Wavelength Band	905 nm ± 5 nm
Transmitting Aperture	Φ10 mm
Receiving Aperture	Φ15 mm
Ranging Range	≥1500 m (Target: Large target) ≥700 m (Target: Human or equivalent target) Visibility: ≥10 km, Humidity: ≤60%, Target Reflection Coefficient: 0.3
Ranging Blind Zone	≤5 m
Ranging Accuracy	±0.5 m (≤80 m); ±1 m (≤1000 m); ±(0.2 + 0.0015×D) m (>1000 m)

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Divergence Angle	≤6 mrad
Accuracy Rate	≥98%
False Alarm Rate	≤1%
Ranging Frequency	Single, 1 Hz, 2 Hz, 5 Hz (Ranging range ≥700 m)
Baud Rate	115200 bps
Weight	≤12 g
Overall Dimensions	≤26 mm × 25 mm × 13.5 mm
Electrical Interface	Connector Plug: 0.8WTB-6Y-2 Connector Socket: 0.8WTB-6AWB-01
Power Supply Voltage	DC 3.3 V to 5 V
Standby Power Consumption	≤0.8 W @ 1 Hz
Average Power Consumption	≤1.6 W @ 1 Hz
Operating Temperature	-20°C to +60°C
Storage Temperature	-45°C to +60°C
Function	Laser ranging

NOTE: Note 1: The items marked with * in the table are design values or theoretical calculation values, for reference only.

Note 2: The nominal distance and accuracy are achieved in an environment with visibility not less than 10Km and relative humidity not more than 60%. The ranging capability and accuracy of the rangefinder vary in different environments and for different targets, subject to actual measurement results.

If the rangefinder is used on a stable platform, ensure that the stable platform can achieve stable tracking of the target; otherwise, it will have a certain impact on the ranging range or accuracy of the rangefinder.

6.3 Safety

To ensure the safety of test subjects and operators, the following safety measures are adopted in the design of the OPTIVIA 905 nm Laser Rangefinder LRFA1500AB:

- Safety design and analysis are carried out in accordance with GJB 900A-2012 General Requirements for Equipment Safety Work.
- Non-flammable materials are used, and the mechanical and electrical interfaces are connected stably and reliably.
- Components controlling key systems and functions adopt error-proof design.
- Reasonable design methods are adopted to avoid water vapor accumulation and subsequent short circuit.
- The product operates below the safe voltage for the human body.

7. Interface

7.1 Mechanical and Optical Interfaces

The dimensions of the mechanical and optical interfaces of the laser rangefinder are shown in Figure 2.

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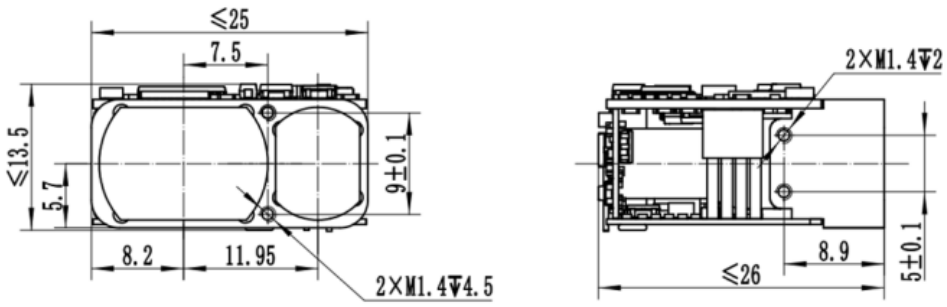

Figure 2 Opto-mechanical Interface Diagram

Technical Requirements:

- Unit: mm
- Unspecified tolerances shall comply with GB/T 1804-2000-m

7.2 Electrical Interface

- Power Supply Voltage: DC 3.3 V to 5 V
- Standby Power Consumption: ≤0.8 W @ 1 Hz
- Average Power Consumption: ≤1.6 W @ 1 Hz
- The upper computer realizes cross-linking test with the rangefinder's 0.8WTB-6AWB-01 connector (Leqing Huabao) through the 0.8WTB-6Y-2 connector. The pin definition of the power supply and communication port on the rangefinder side is shown in the following table 2.

Table 2: Product Electrical Pin Definition

Pin	Label	Electrical Characteristic	Signal Direction
1	Power-EN	Power Enable Pin	Effective at 3.3 V; ineffective when floating or grounded
2	TTL_RXD	Signal Input Port	Upper Computer to Rangefinder
3	TTL_TXD	Signal Output Port	Rangefinder to Upper Computer
4	NC	—	—
5	Power Positive	—	—
6	GND	—	—

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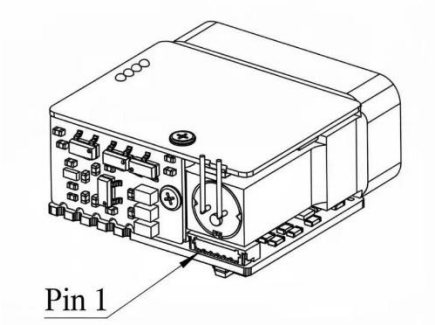

Figure 3 Position of connector pin 1

8. Communication Protocol

8.1 Communication Interface

- Baud Rate: 115200 bps
- Single-byte Transmission Format: 1 start bit, 8 data bits, no parity, 1 stop bit. 8-bit data is transmitted with the low byte first, then the high byte.

8.2 Command 1

8.2.1 Single Ranging Command

NOTE: Transmit Check Code = Byte3 + Byte4 + Byte5 + Byte6 + Byte7

Receive Check Code = Byte1 + Byte2 + Byte3 + Byte4 + Byte5 + Byte6 + Byte7

Sent to the Ranging Module:

Byte	1	2	3	4	5	6	7	8
Description	0x55	0xAA	0x88	0xFF	0xFF	0xFF	0xFF	Check Code

Returned by the Ranging Module:

Byte	1	2	3	4	5	6	7	8
Description	0x55	0xAA	0x88	Status	0xFF	DATA_H	DATA_L	Check Code

• Status = 0: Single ranging failed; DATA_H = 0xFF, DATA_L = 0xFF.

• Status = 1: Single ranging succeeded; DATA_H = high byte of ranging result, DATA_L = low byte of ranging result.

8.2.2 Continuous Ranging Command

NOTE: Transmit Check Code = Byte3 + Byte4 + Byte5 + Byte6 + Byte7

Receive Check Code = Byte1 + Byte2 + Byte3 + Byte4 + Byte5 + Byte6 + Byte7

Sent to the Ranging Module:

Byte	1	2	3	4	5	6	7	8
Description	0x55	0xAA	Freq	0xFF	0xFF	0xFF	0xFF	Check Code

Returned by the Ranging Module:

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Byte	1	2	3	4	5	6	7	8
Description	0x55	0xAA	Freq	Status	0xFF	DATA_H	DATA_L	Check Code

Status = 0: Continuous ranging failed; DATA_H = 0xFF, DATA_L = 0xFF;

Status = 1: Continuous ranging succeeded; DATA_H = high byte of ranging result, DATA_L = low byte of ranging result.

Freq=0x89 for 1Hz ranging; Freq=0xA9 for 2Hz ranging; Freq=0xB9 for

5Hz ranging; Freq=0xF9 for axis calibration mode (returns axis calibration status once after receiving the axis calibration command).

8.3 Stop Ranging Command

Sent to the Ranging Module:

Byte	1	2	3	4	5	6	7	8
Description	0x55	0xAA	0x8E	0xFF	0xFF	0xFF	0xFF	Check Code

Returned by the Ranging Module:

Byte	1	2	3	4	5	6	7	8
Description	0x55	0xAA	0x8E	Status	0xFF	0xFF	0xFF	Check Code

Status = 0: Failure to stop continuous ranging.

Status = 1: Success to stop continuous ranging.

Remarks: Data is returned in hexadecimal; all data results are output by multiplying the actual data by 10.

Example: dist = 2000.3 m → output data = 20003 → hexadecimal 4E23 (Data1 = 0x4E, Data2 = 0x23).

8.4 Command 2

8.4.1 Information

The format of control command information is shown in Table 3.

Table 3: Control Command Information Received by the Rangefinder

Byte	Description	Byte Data (Frame Header / Command Word / Frame Tail)	Remarks
1	Frame Header	0x55	
2	Command Word	0x02	Single ranging
2	Command Word	0x03	1 Hz ranging
2	Command Word	0x06	2 Hz ranging
2	Command Word	0x04	5 Hz ranging
2	Command Word	0x0A	Axis calibration command
2	Command Word	0x00	Stop ranging
3	Frame Tail	0xAA	

8.4.2 Data Returned by the Rangefinder

The data returned by the rangefinder is shown in Table 4.

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Table 4: Data Returned by the Rangefinder

Byte	Description	Byte Value (Hexadecimal)
1	Frame Header	0xAA
2	High byte of integer part of target distance	
3	Low byte of integer part of target distance	
4	Decimal part of target distance	0x00 to 0x63
5	Spare	Spare
6	Frame Tail	0x55

9. Functions and Operations

9.1 Power-on Procedure

- Before Power-on, connect the laser rangefinder, debugging cable, DC power supply and upper computer as shown in Figure 5 in accordance with the interface requirements in 4.2.
- The rangefinder can be started by turning on the power supply.

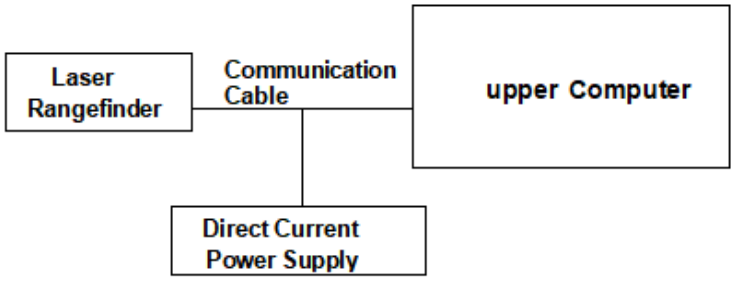

Figure 4 Connection Diagram

9.2 Power-off Operation

- Before powering off, confirm that all work processes and tasks of the product are completed and the program is exited.
- The rangefinder can be shut down normally by disconnecting the power supply after confirmation.

9.3 Function Description

9.3.1 Ranging Function

Operation methods for ranging modes:

1. Send the “Single Ranging” command to the laser rangefinder; the rangefinder executes a single ranging measurement and feeds back the ranging status and distance value.

2. Send the “Continuous Ranging” command to the laser rangefinder; the rangefinder performs continuous ranging measurements and feeds back the ranging status and distance value.

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3. Send the “Stop Ranging” command to terminate ranging.

10. Optical Window Selection and Coating Recommendations

10.1 Material Selection

10.1.1 Optical Window Material

Optical glass H-K9L is recommended as the optical window material. H-K9L is the most common colorless optical glass, applicable to the laser range of 300 nm to 2100 nm, with high cost performance and excellent physical properties.

10.1.2 Processing Recommendations

- The wedge angle tolerance of the optical window shall be as small as possible; a wedge angle tolerance ≤3′ (tolerance grade ≤Grade 7) is recommended.
- The optical surface of the optical window shall be as smooth as possible; an arithmetic mean deviation of the profile (Ra) of 0.012 is recommended.

10.2 Coating Recommendations

It is recommended to coat the optical window of the 905 nm laser rangefinder with an anti-reflection coating for 855 nm to 955 nm, with a transmittance ≥99.5%. According to the specific application environment of the product, the outer surface of the optical window can be additionally coated with other protective films such as hydrophobic film or hard film. The remaining indicators refer to GJB2485-95, with a transmittance ≥97%.

10.3 Optical Window Shape and Usage Recommendations

The effective aperture of the optical window is determined according to different products. Its overall dimension shall ensure that: Outer diameter of optical window - Effective aperture of optical window ≥2mm, Effective aperture of optical window - Outer diameter of rangefinder lens ≥1.5mm. The schematic diagram is shown in the figure. Due to a certain degree of laser absorption by the optical window, the thickness of the optical window itself is recommended to be controlled within 2~4mm according to the overall dimension.

Due to the high transmittance of the optical window, the transmitting optical axis is recommended to be parallel to the normal axis of the optical window, and the air gap between the optical window and the rangefinder shall be less than 0.5mm. The schematic diagram of the position of the optical window and the two lens barrels is shown in the figure 5.

The optical window shall be kept clean and transparent during use, with no stains, fingerprints, dust and other contaminants on the light-passing surface.

Right:

(1)outer diameter of the optical window y1 -Effective aperture of optical window y2≥ 2 mm,

(2)Effective aperture of optical window y2-Outer diameter of rangefinder lens y3≥ 1.5 mm,

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(3)The effective distance d between the optical window and the rangefinder<0.5 mm

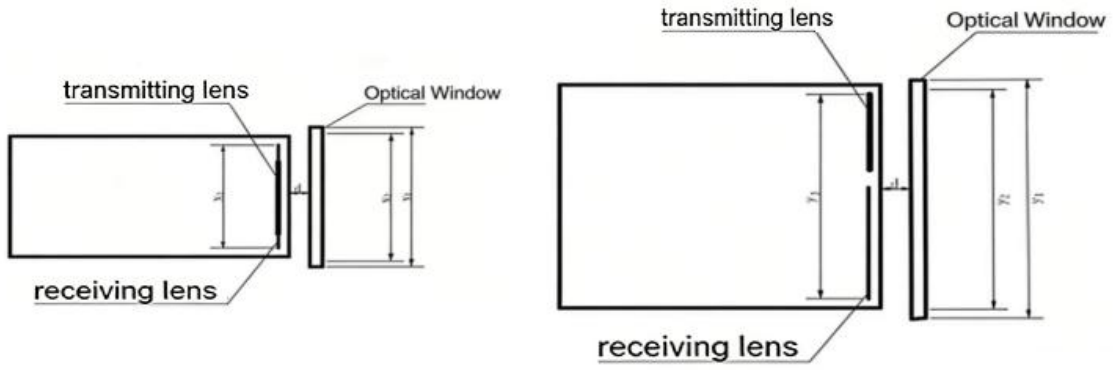

Figure 5: Schematic diagram of the two placement methods and the dimensional outline of the Optical window

Left:

(1)outer diameter of the optical window x1 -Effective aperture of optical window x2≥2 mm,

(2)Effective aperture of optical window x2-Outer diameter of rangefinder lens x3≥ 1.5 mm,

(3)The effective distance d between the optical window and the rangefinder<0.5 mm

11. Maintenance Instructions

11.1 List of Accessories

The accessory list provided with the product is shown in the following table 5 (Optional items may not be included in the list and shall be subject to the actual product).

Table 5: Accessory List

Serial Number	Name	Quantity	Remarks
1	LRFA1500AB Laser Rangefinder	1 Unit	
2	Product Certificate of Conformity	1 Copy	
3	Packaging Box	1 Piece	
4	Connector Plug	1 Piece	

11.2 Cleaning Instructions

11.2.1 Optical Component Cleaning Instructions

- Dust particles shall be blown off with an air blower bulb.
- Fingerprints shall first be removed by gently wiping with degreasing cotton soaked in a minimal amount of alcohol-ether mixture, followed by a final polish using a clean lens cleaning cloth.

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11.2.2 Structural Components and Electronic Device Cleaning

- Under power-off conditions, gently wipe structural components and electronic devices with alcohol and allow them to air-dry naturally before reuse.
- Keep rangefinders, plugs, and cables away from moisture and contaminants as much as possible.
- Ensure thorough drying before equipment packaging.

11.3 Inspection and Maintenance

11.3.1 General Inspection

Visual and power-on inspections shall be performed upon initial product use and after replacement of resource modules. For products under normal operation, only power-on inspection is required prior to use.

Visual Inspection Procedure:

1. Check whether the product's exterior appears normal.
2. Verify cable connections for correctness and ensure they are secure.

Power-On Inspection Procedure:

1. Complete startup operation and verify standby current is correct.
2. Initiate self-test to examine product functionality.
3. Perform shutdown operation after inspection completion.

11.3.2 Periodic Maintenance

Under normal operating conditions, the laser rangefinder requires no maintenance. However, if stored in a dust-free environment for over one year, maintenance shall be performed, including general inspection and power-on inspection.

General inspection of the product shall be performed in a de-energized state. The procedure is as follows:

1. All markings and numbers on the product and test cable connectors must be correct and legible.
2. All screws on the panel must be securely fastened.
3. The optical glass of the product must show no visible defects— such as light spots, pits, water stains, mold, fingerprints, dust particles, or cracks— that could obstruct normal observation.

Perform a comprehensive power-on inspection and maintenance of the laser rangefinder, including the following items:

1. Power on the product sequentially.
2. Complete startup procedure and verify standby current is within specification.
3. Initiate product self-test to validate functionality.
4. Execute proper shutdown sequence.

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11.4 Fault Phenomena Analysis and Troubleshooting Methods

The laser rangefinder is a precision product. In case of failure, the entire module shall be returned to Norsat International Inc. for fault analysis, location, and repair; self-repair is not allowed.

Common fault phenomena and troubleshooting methods are shown in Table 6.

Table 6: Common Fault Phenomena and Troubleshooting Methods

Problem	Possible Fault Cause	Troubleshooting Method	Judgment Basis	Solution
Rangefinder fails to communicate or has abnormal communication	Power supply issue	Check if the power supply causes hardware or software lockups; verify voltage setting is correct; ensure protection current is correct; try replacing the power supply.	If the rangefinder operates normally after changing the voltage or power supply, the problem is determined to be related to the power supply.	Set the correct voltage and current, or replace the power supply.
	Connection cable issue	Check if the connections are secure, or replace the test cable (TTL communication test cables should not be excessively long).	If the rangefinder can communicate normally after re-connecting or replacing the test cable, the problem is determined to be related to the connection cable.	Re-connect the cable or replace the test cable.
		Check if the wiring matches the interface definition.	If the rangefinder operates normally after the wiring is aligned with the definition, the problem is determined to be related to incorrect wiring.	Re-wire according to the correct interface definition.
	Incorrect baud rate setting	1. Check if the rangefinder status and baud rate setting are consistent with the communication protocol. 2. If the rangefinder supports baud rate adjustment, change to the required baud rate and attempt communication again.	If the rangefinder communicates normally after the baud rate setting matches the communication protocol, the problem is determined to be an incorrect baud rate setting.	Set the baud rate on the upper computer to match the communication protocol.
	Incorrect communication command	Check if the rangefinder status and the sent commands are consistent with the communication protocol, and confirm if the	If the rangefinder communicates normally after the sent commands match the communication protocol, the problem is	Send the correct commands to the rangefinder.

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		commands are in hexadecimal format.	determined to be incorrect communication commands.	
	Main control program issue	If communication fails during debugging with the main controller, check if standalone communication is normal.	If standalone communication is normal, the problem is likely related to the main control program.	It is recommended to check the entire machine program for issues (e.g., verify if the check bits are correct, and if the upper computer can correctly identify and display data).
	Other causes	Contact Norsat International Inc. for service and repair.	Contact Norsat International Inc. for diagnosis.	Contact Norsat International Inc. for service and repair.
Rangefinder returns no valid value	Operational issue	Check if the receiving or emitting lens is blocked (by window glass, wall corner, etc.), and verify if the rangefinder is aligned with the target.	If the rangefinder returns to normal after removing the obstruction, the problem is an obstruction.	Remove the obstruction.
		Re-align the rangefinder and try measuring again.	If the rangefinder returns valid measurements after re-alignment, the problem is determined to be misalignment between the rangefinder and the target axis.	Re-align the rangefinder with the target.
	Other causes	Contact Norsat International Inc. for service and repair.	Contact Norsat International Inc. for diagnosis.	Contact Norsat International Inc. for service and repair.
Rangefinder has erroneous readings	Electrical noise interference	1. Point the rangefinder's receiving lens at an empty area or the sky (away from the sun) and test if the erroneous readings persist. If no erroneous readings occur, the problem is identified as optical noise interference (caused by factors such as external light sources, incorrect tilt angle of the optical system, small aperture of the window, or excessive light transmission). 2. Power on the rangefinder separately from the whole machine and test if erroneous readings persist. If no erroneous readings occur, the problem is identified as electrical or communication noise interference. 3. Power on the rangefinder separately from the whole machine and test if erroneous readings persist. If no erroneous readings occur, the problem is identified as power supply noise interference.		Suggest dealing with power supply noise; Series common mode filtering with multiple large points; Replace the grounding capacitor with 10nF; increase the threshold (which will reduce the capability)
	Communication noise interference			Suggest dealing with communication noise; Wrap a shielding magnetic ring or increase the threshold (which will reduce the ability)
	Power supply noise interference			Suggest dealing with light noise (optical window and testing angle); Raise

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		4. Power on the rangefinder separately from the communication module and test if erroneous readings persist. If no erroneous readings occur, the problem is identified as communication noise interference. 5. If erroneous readings still exist after the above steps, test the rangefinder in standalone mode (taken out of the whole machine, powered on and communicated with separately). If erroneous readings still exist, the problem is identified as an issue with the rangefinder itself or its power supply adapter.		the threshold (which will lower the ability)
Rangefinder has erroneous readings	Other causes	Contact Norsat International Inc. for service and repair.	Contact Norsat International Inc. for diagnosis.	Contact Norsat International Inc. for service and repair.
Insufficient ranging capability of the rangefinder	Weather conditions	Determine if the weather is rainy, foggy, sandy, or dusty; if atmospheric visibility is too low; if humidity is too high; or if the test area has large temperature differences or local turbulence, which may cause environmental errors.	If the ranging capability meets the indicators when visibility is higher than the indicator requirements, the problem is identified as weather conditions.	Test the ranging capability under weather conditions that meet the specifications.
	Optical window issues	Check the whole machine to see if the optical window transmittance is too low, the coating is defective, the window aperture is too small, the inclination angle is too large, etc. Test the ranging capability with the optical window removed, and observe if the capability decreases. Observe if the lens of the ranging camera is too dirty.	If the ranging capability meets the indicators after removing the optical window, the problem is identified as insufficient light transmission through the upper window. If the ranging capability meets the indicators after wiping the lens, the problem is identified as insufficient transmittance of the upper lens.	Replace the optical window per model selection and installation requirements, or use a rangefinder model with higher capability.
	Target size too small or reflectivity too low	Replace the target, and it is recommended to select heavy targets such as buildings on the optical axis, avoiding empty targets as much as possible.	If the ranging capability meets the indicators when replacing with a larger or higher-reflectivity target, the problem is identified as unsuitable target selection.	Replace the target, or use a rangefinder model with higher capability.

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	Operating beyond the temperature range of the rangefinder	When the ranging capability decreases, send a self-test command to check the current operating temperature of the rangefinder. After the temperature returns to normal, re-test the ranging capability and observe if the capability is insufficient.	If the ranging capability does not meet the requirements when operating at the working temperature, but returns to normal after the temperature recovers, the problem is identified as insufficient capability due to temperature exceeding the range.	Use the device within the required operating temperature range.
	Other causes	Contact Norsat International Inc. for service and repair.	Contact Norsat International Inc. for diagnosis.	Contact Norsat International Inc. for service and repair.
Rangefinder accuracy out of tolerance	Excessive deviation in target reflectivity	Confirm whether the test target is high-reflectivity and judge whether data jitter is large or accuracy is poor.	If data jitter decreases and accuracy returns to normal after replacing the target, the problem is excessive deviation in target reflectivity.	Replace the target; it is not recommended to use high-reflectivity test targets.
	Test operation issue	Judge whether the target is accurately aimed.	If accuracy returns to normal after accurately aiming at the target, the problem is a test operation issue.	Re-aim at the target accurately.
	instrument issue	Confirm the accuracy of the calibration instrument (it may not be calibrated).	If the number of readings returns to normal after replacing or re-calibrating the calibration instrument, the problem is identified as an issue with the test instrument.	Re-calibrate the calibration instrument.
	Low transmittance of the optical window	Judge whether the number of rangefinder returns is too small.	If the number of readings returns to normal after removing the optical window, the problem is identified as an issue with the optical window.	Replace the optical window according to the model selection and installation requirements.

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11.5 Packaging, Transportation, and Storage Requirements

11.5.1 Packaging

For products that have been unsealed and need to be restocked, they should be repackaged according to the original packaging specifications. When products require return to the factory, the original packaging should be used whenever possible. If alternative packaging is used, it must not cause any degradation or damage to the product's performance.

11.5.2 Transportation

Repackaged products may be transported by road (truck), rail (train), air (aircraft), or sea (ship). During transit, the packaged goods must be securely fastened to the transport vehicle to prevent impacts, rough handling, and exposure to rain or snow. The road transportation and railway transportation environments shall refer to GJB 150.16A-2009.

11.5.3 Storage Requirements

Products shall not be stored outdoors or exposed to open-air conditions. The recommended storage environment is a warehouse meeting the following specifications:

- Temperature: 0°C to 30°C
- Relative Humidity: ≤70% RH

Environmental Conditions:

- Free from corrosive substances
- Absence of strong mechanical vibration or impact
- No strong magnetic fields

12. After-Sales Service

In the event of product failure requiring full-unit return for fault diagnosis and repair, the following service terms apply:

12.1 Service Coverage

Warranty Period: 1 year from the date of product delivery.

Technical Support: Lifetime service.

Repairable items include but are not limited to the following:

- Optical System
- Laser Emission Module
- Laser Reception Module
- Circuit Components

12.2 Warranty Service

Covered Repairs: Free replacement or repair for defects caused by product quality issues, including:

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- Material defects
- Manufacturing flaws
- Design-related failures

Non-Covered Repairs: Damages caused by improper use, unauthorized modifications, or other user-related factors. Repair and replacement parts will be charged at cost.

Since the laser rangefinder is classified as a precision optical instrument, please take care to protect the product during use. If you have any other questions regarding usage and maintenance, you may communicate with Norsat International Inc.

12.3 Service Process

Warranty claims require valid proof of purchase.

Non-warranty repairs will be billed based on actual costs.

All repairs performed by certified technicians using genuine parts.

13. Contact Information

Norsat International Inc.

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support@norsat.com

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