MOVE LASER

Molas NL

Coherent Doppler Wind Lidar

User Manual

USER INFORMATION

To ensure that the equipment described in this user guide, as well as all the equipment connected to and used with it, operates satisfactorily and safely, all applicable local and national codes that apply to installing and operating the equipment should be followed. Since codes can vary geographically and can change with time, it is the user's responsibility to identify and comply with the applicable standards and codes. WARNING: Failure to comply with applicable codes and standards can result in damage to equipment and/or serious injury to personnel.

Personnel who are to install and operate the equipment should study this user guide and all referenced documentation prior to installation and/or operation of the equipment.

Published by

MOVELASER

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1. GENERAL INTRODUCTION

Thank you for choosing Nanjing Movelaser Co., Ltd. (hereinafter referred to as Movelaser) Molas NL wind measurement LiDAR products for wind speed measurement activities. This manual is applicable to the Molas NL V6 version LiDAR.

This user guide provides important safety, maintenance, operation, and other information. Therefore, please read this user manual carefully before using the product. To ensure safe operation and normal functioning of the equipment, please comply with the following precautions and warnings as well as other information in this manual, and note the distinction between the 220V version and the 24V version.

1.1 GENERAL SAFETY INSTRUCTIONS

- Molas NL must be installed, commissioned, and operated by personnel who have received professional training from Movelaser (or a Movelaser-designated institution).
- When using Molas NL, operators must comply with applicable national and industry safety regulations, possess all necessary qualifications for operation, and obtain approval from the relevant safety authorities.
- Movelaser shall not be liable for any consequences resulting from failure to follow the instructions in this manual or other improper operation.
- The equipment provided by Movelaser is intended solely for legal and scientific measurement purposes.
- Any malfunctions caused by failure to follow this manual or other improper use are not covered by Movelaser's warranty.
- Do not remove the equipment housing without authorization. Once removed, the equipment will no longer be covered by the warranty.
- Do not modify the equipment's hardware or software without authorization; any malfunctions or losses resulting from such modifications are not covered by the warranty.
- Use of this equipment in a residential area may cause harmful interference, in which case the user will be responsible for eliminating the interference at their own expense. Use of this equipment is subject to the following two conditions:
- This equipment must not cause harmful interference.
- This equipment must accept any interference received, including interference that may cause undesired operation.

1.1.1 ELECTRICAL SAFETY

Failure to comply with the following safety instructions may result in fire, electric shock, or other injury or damage.

- The DU power switch is not a circuit breaker and is not an emergency power cutoff device. In the event of an emergency (such as a fire or flood). Make sure that the power supply cable is unplugged before servicing or moving any part of the system.
- Before installation, ensure that:
  220V: The rated voltage and frequency of the AC power supply for this device match those of the power grid, with an input voltage range of 100 ~ 240VAC and a frequency range of 50 ~ 60Hz.
  24V: This device uses 24V DC power supply, with an input voltage range of 24VDC ±1%.
  Ensure that the input power quality at the main power cable inlet meets the system certification standards.
- To ensure electrical safety, grounding must be performed correctly according to our company's grounding wire installation method.

- Before repairing or moving any system components, disconnect the device's power supply connector.
- To avoid electronic interference, do not route communication cables along medium-high voltage (≥300VAC) cables or surge protector lines.
- The LiDAR system Data unit has an IP65 protection rating. To prevent electrical faults:
  Ensure that matching cable connectors are used for external connections to the system.
  Ensure that all unused external panel connectors on the DU are covered by their fixed covers.

1.1.2 LASER SAFETY

- The laser light source used in the Molas NL complies with the eye safety standards in EN 60825-1. The emitted beam is infrared light that is invisible to the naked eye and is classified as a Class 1M laser product. However, we still recommend following the safety rules below:
- There are no optical components inside the device that can be operated by the customer. Do not attempt to open the device housing to alter the internal optical structure.
- Laser beams passing through optical components or devices may cause eye damage. We strongly recommend placing safety warning signs in prominent locations and informing relevant personnel of the safety guidelines they must follow.
- Do not observe the output laser directly (through the system window and along the laser beam path) or use optical instruments (such as handheld glasses, mirrors, microscopes, binoculars, etc.) to observe while the system is in operation.
- To avoid laser beam reflection, do not use any metal objects to block the laser beam path. Passing through or using any optical instruments for such operations may cause glare and eye damage. It is recommended to set warning signs around the system and remind staff to comply with these safety measures.

1.1.3 INSTALLATION PRECAUTIONS

- All installation operations of Molas NL on wind turbines must be performed by at least two personnel who have received training approved by Movelaser.
- Work at heights may only be performed when weather conditions permit and comply with wind farm regulations. Installation personnel must monitor and be informed of weather conditions in advance.
- In the event of sudden changes in weather conditions that render safe work impossible, immediately cease operations, move any uninstalled equipment from the exterior to the interior of the cabin, and inspect and secure all installed components. During this period, personnel safety must be the top priority.
- Installation personnel must strictly adhere to all relevant safety regulations at the worksite.
- Ensure that fall protection measures are in place throughout the installation process. After installation, use professional tools to check and ensure that all connections are secure.
- Personnel performing work at heights must be equipped with the following safety equipment: safety helmet, safety shoes, safety rope (with fall arrest buffer), safety harness, descender, adjustable safety hook, gloves, and a walkie-talkie. Clothing must be long-sleeved and long-legged, simple, and durable.

1.1.3 HANDLING SAFETY

Optical head

The OH is equipped with two handles and requires two people to move it. When operating the OH, pay attention to the following matters:

- During operation, the window mirror of the OH must be protected from impact with hard objects, as damage or contamination of the window mirror may reduce the usability of the measurement data.
- Damage to the connector may result in water leakage or electrical failure.

Data unit

The weight and design of the DU allow it to be carried by one person. When handling the DU, please note the following:

- Protect the magnets on the bottom when carrying.
- Damage to the connectors may result in water leakage or electrical failure.

1.2 CAUTION LABELS

	The equipment to which this label is affixed contain high-voltage power. Do not disassemble the equipment casing, touch the metal contacts of the connectors directly, or touch the metal contacts with a metal conductor, as this may result in electric shock, fire, or personal injury.
	This system emits an invisible 1M class laser beam during normal scanning operation. Under reasonably foreseeable operating conditions, the system is safe to use, but direct observation through optical instruments may cause harm to the eyes.

1.3 STANDARD COMPLIANCE

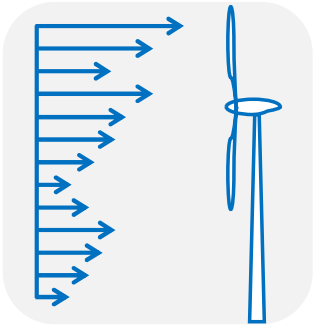
CE regulation	
EMC	IEC 61326-1
Electrical safety	IEC 61010-1
LASER safety	IEC 60825-1
Housing classification	IP5 / IP7
Temperature & humidity	ISO 9022-14
Corrosion resistance	ISO C5-M
Radiation resistance	CISPR 11
Salt resistance	
Lightning protection	IEC TR 61400-24
Transport vibration	ISO 780

2. TECHNOLOGY OVERVIEW

2.1 YAW CORRECTION

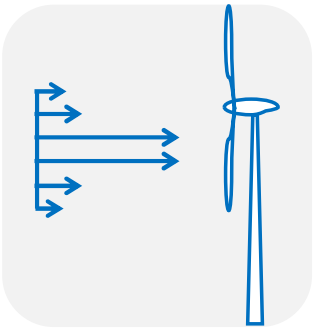
Molas NL provides accurate, forward-looking wind direction measurements that enable precise yaw correction relative to true wind inflow. By continuously minimizing yaw misalignment, the system reduces asymmetric loading on the rotor, lowers long-term structural fatigue, and increases annual energy production (AEP). Compared with traditional nacelle anemometry or older-generation lidar systems, Molas NL offers a more stable and lower-cost solution that requires minimal configuration and maintenance while ensuring optimal wind utilization.

2.2 TURBULENCE DETECTION



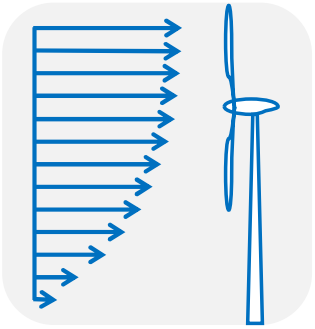
Molas NL provides real-time turbulence detection by measuring the intensity and characteristics of turbulent wind inflows before they reach the turbine rotor. It offers critical data that can be used for subsequent load optimization analysis. The turbulence data collected by Molas NL can be stored for further post-processing and used to refine turbine load management strategies. By analyzing these turbulence events, turbine operators can better understand the impact of turbulence on rotor performance, adjust operational parameters, and ultimately reduce mechanical stresses and extend the life of turbine components.

2.3 GUST DETECTION



By capturing short-term wind speed spikes ahead of the rotor, Molas NL enables the turbine control system to anticipate gust events. This improves transient load handling, supports smoother pitch responses, and protects the turbine from rapid loading cycles that contribute to component wear. Compared with conventional nacelle sensors, Molas NL offers higher sensitivity and earlier warning capability at significantly lower operational cost and complexity than high-frequency met mast instrumentation.

2.4 SHEAR DETECTION



Wind shear frequently occurs when wind speeds at different altitudes exhibit significant variations, causing wind turbine rotor blades to experience markedly different wind speeds. This substantially increases the load on the entire turbine, as well as on the rotor and gearbox.
Molas NL estimates vertical and horizontal wind shear across the measurement volume, allowing the turbine to adapt its control strategy to inflow gradients that influence rotor-effective wind speed and loading. Accurate shear characterization supports both AEP optimization and fatigue management. The system's measurement approach avoids the need for extensive external infrastructure, offering a more flexible, field-deployable, and maintenance-friendly alternative to traditional meteorological masts or multi-lidar arrays.

3. PRODUCT INTRODUCTION

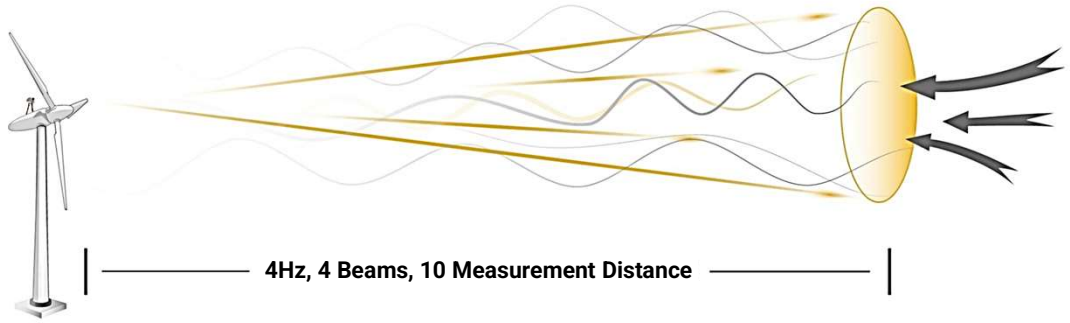
3.1 PACKING LIST

NO.	ITEM DESCRIPTION	SPECIFICATION	QUALITY
1	Optical head	Molas NL6	1
2	Data unit	Molas NL6	1
3	ODC cable assembly	15 m	1
4	Terminal power cable	NL6.3-DU-02	1
5	Network cable	10 m	1
6	Braided grounding wire (DU)	2m, OT10-6& OT10-10	1
7	Yellow-green grounding wire (OH)	3 m	1
8	Hexagon socket screw	M10×45	7
9	Flat washer	M10	13
10	Nut	M10	13
11	Rubber grommet	NL5-A1.1	1
12	Fall arrest rope (optional)*	1.5 m	-
13	Bow shackle (optional)	G2130 5/16	-
14	Commissioning power cable (optional)	-	-
15	PROFIBUS cable assembly (optional)	-	-
16	CANOPEN cable assembly (optional)	-	
17	Test report	-	1
18	User guide	-	1
19	Certificate of conformity	-	1

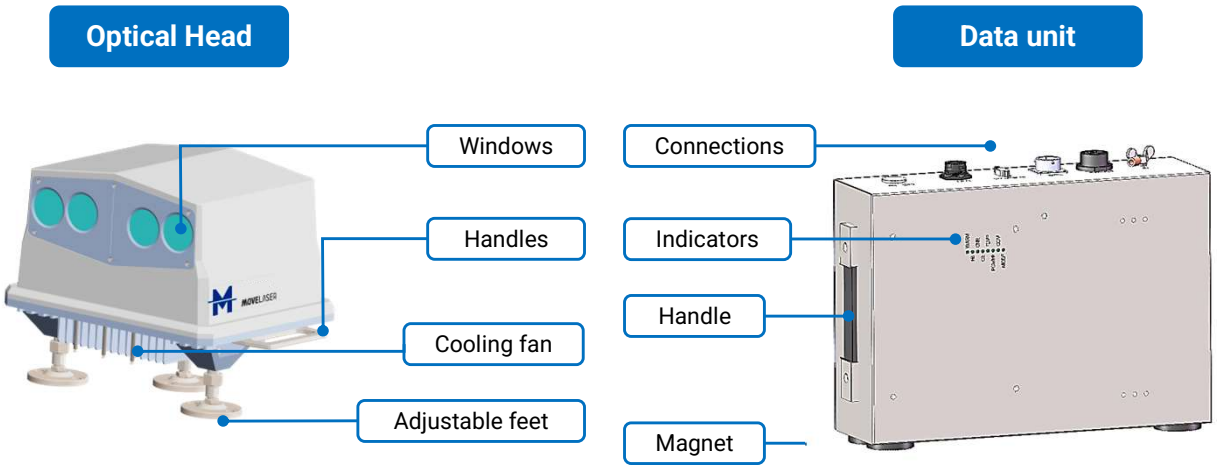
(Optional*:The default system does not include items marked as “optional.” Such items must be requested prior to purchase.)

3.2 THEORY OF OPERATION

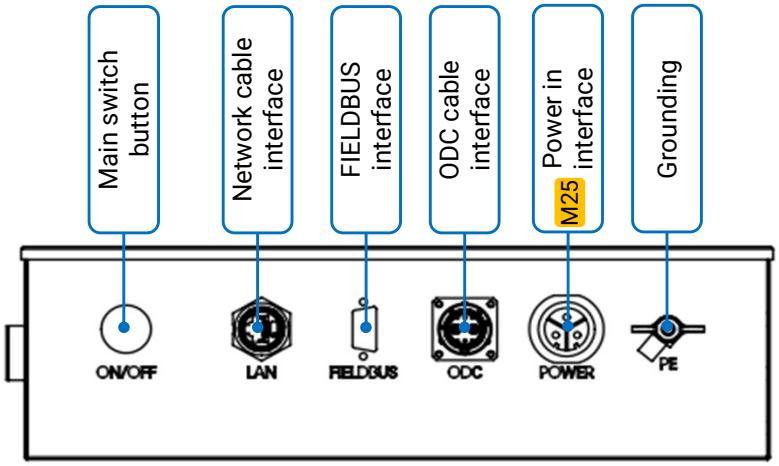
- Molas NL uses the principle of fully coherent Doppler detection to measure wind fields. The LiDAR emits laser pulses into the atmosphere, scanning in a cone angle to sequentially emit four laser beams in four basic directions. These laser pulses interact with aerosol particles (such as dust and water droplets) in the atmosphere during propagation, generating backscattered signals containing wind speed information.
- The optical antenna of the LiDAR system receives these backscattered light signals. The collected backscattered light is used to calculate the Doppler frequency shift, which is then beat-frequency modulated with the internal local oscillator light, converting the frequency changes into electrical signals. The signals are subsequently amplified and digitized by an analog-to-digital converter (A/D), then transmitted to the system processor.
- The processor employs specialized signal processing algorithms to analyze echoes from different directions and range gates (up to 10), calculating the radial wind speed of each laser beam at different distances. By comprehensively solving the data from multiple radial wind speed beams and combining it with a wind field reconstruction model, the vector components of wind speed within the target area are obtained, further deriving key parameters such as wind speed, wind direction, turbulence intensity, and wind shear.
- The Molas NL offers high precision, high resolution, and multi-layer measurement capabilities, providing reliable data support for wind farm site selection assessments, wind turbine operation optimization, and wind resource monitoring.



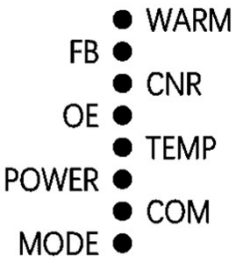
3.3.1 PRODUCT DESCRIPTION



3.3.2 TRAPDOOR CONNECTIONS



3.3.3 STATUS INDICATOR LIGHTS

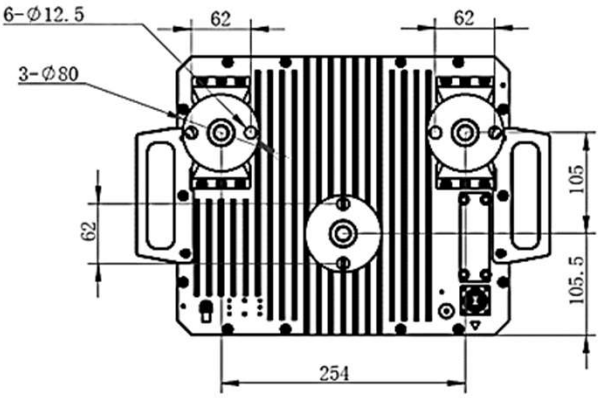


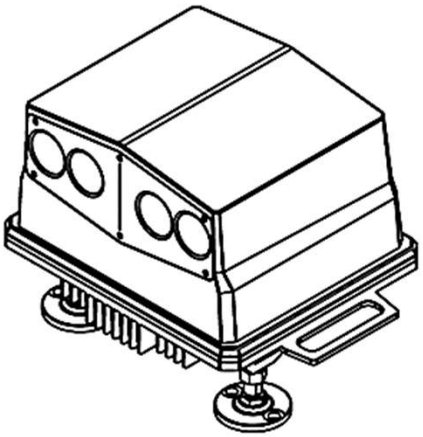
The Data unit of Molas NL is equipped with status indicator lights that provide real-time feedback on the operating status of the device. The operating status of Molas NL can be observed based on the status indicator lights, and a preliminary diagnosis of the cause of failure can be made based on the indicator lights. The meanings of the indicator lights are shown in the table below.

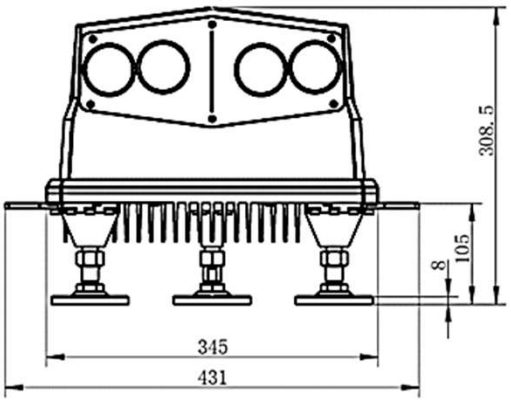
3.3.4 INDICATOR DESCRIPTION

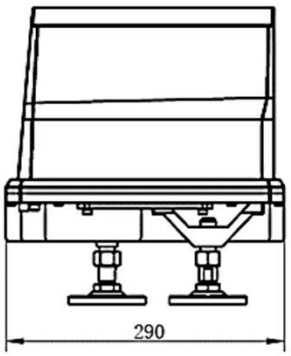
Indicator label	Indicator name	Status and Description
Warm	Power indicator	- Solid green: Power supply normal - Solid red: Power supply reversed
FB	Fieldbus indicator	- Solid green: IPC-STM32 communication and external communication are both normal - Solid yellow: IPC-STM32 communication abnormal - Yellow flashing: External communication abnormal - Red flashing: Both IPC-STM32 communication and external communication abnormal
CNR	Signal indicator	- Solid red: 10 doors with low SNR - Solid yellow: 10 doors with partial abnormalities - Solid green: 10 doors with high SNR
OE	Laser status	- Green flashing: LD not fully emitting light - Solid green: LD fully emitting light
Temp	Temperature indicator light	- Solid yellow: Mainboard HDC1080 temperature too high (>85°C) - Green flashing: Environmental control TEC cold surface temperature abnormal (temperature zone 1 (<10°C>42°C)) - Solid green: All temperatures are normal
Power	Power supply status indicator	- Solid red: OH current abnormal - Solid yellow: OH voltage abnormal - Solid green: Power supply normal - Red flashing: Both voltage and current abnormal (highest priority)
COM	Communication indicator light	- Solid yellow: IPC and DUCT communication abnormal - Solid green: IPC and DUCT communication normal
Mode	System mode light	- Solid red: OH fault mode - Solid yellow: OH temperature protection - Solid green: OH normal mode - Green flashing: OH debugging mode

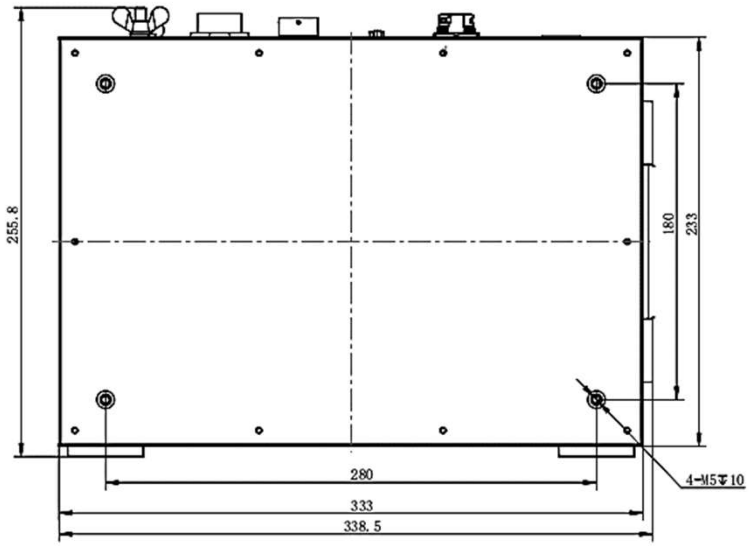
3.3.5 DIMENSIONS

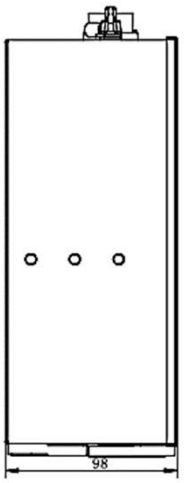












3.3.6 SPECIFICATIONS

Measurements			
Range	NL200	NL400	NL750
	50 - 200 m	50 - 400 m	70 - 750 m
Measuring distances	10 ①		
Data sampling rate	4Hz		
Speed range	-20 ~ 50m/s ②		
Direction range	-180° ~ 180°		
Speed accuracy	0.1m/s		
Direction accuracy	±0.5°		
Beam geometry	NL200	NL400	NL750
	Horizontal Angle: 30° Vertical Angle: 25°	Horizontal Angle: 30° Vertical Angle: 10°	Horizontal Angle: 30° Vertical Angle: 10°
Beam accuracy	±0.1°		

Data	
Output data	4 Hz real time / 10 min averaged (user defined)
Data storage③	32GB / 128GB
Data format	ASCII. and CSV.
Communication④	Profinet/Profibus DP/Modbus TCP/ Modbus RTU/CANOPEN
Time synchronization	NTP

Operation	
Dimensions	OH: 431*290*309 mm (L × W × H) DU: 339*98*256 mm (L × W × H)
Weight	OH: 17.5 Kg. DU: 2.7 Kg.
Input Power Supply	24V DC
Power consumption⑤	65W ~ 200W
Temperature range	-40℃ ~ 65℃
Housing classification	Inside the cabin: IP65 Outside the cabin: IP67
Corrosion resistance	ISO C5-M
Radiation resistance	CISPR 11
Humidity range	0 ~ 100% RH
EMC	IEC61326-1
Electrical safety	IEC61010-1
Laser safety	IEC 60825-1:2007
Compliance	±0.1°

① The specific values for each section can be set by the user via the web client. Please check the set distances when using the LiDAR. Users can adjust the measuring distance settings within the 200m range according to actual needs.
② The wind speed measuring range refers to the wind speed in the line of sight. Negative wind speeds indicate that the wind is away from the LiDAR.
③ The LiDAR periodically clears its memory; please download any data requiring archiving within three months.
④ A single LiDAR supports only one communication protocol.
⑤ When the LiDAR is powered on at an ambient temperature of -40°C to -20°C, the entire LiDAR system undergoes a preheating process, which typically takes around 40 minutes.

4. GENERAL CONDITIONS OF USE

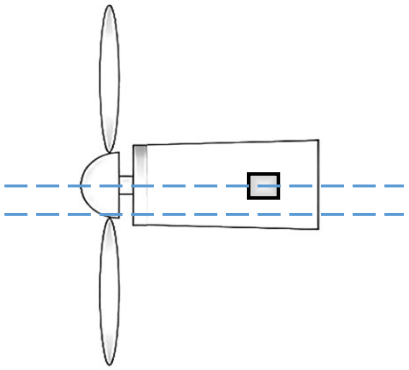
4.1 SYSTEM INTEGRITY

The entire Molas Nacelle Lidar and its components (internal and external parts of the unit), along with all accompanying accessories and external parts (such as communication cables, mounting accessories, interface modules, etc.), must not be disassembled, replaced, or structurally modified in any way without written authorization from MoveLaser.
The nacelle-side power supply system constitutes part of the wind turbine platform. MoveLaser shall not be held liable for any system malfunction or damage resulting from power supply-side non-compliance with product electrical specifications or failure to meet relevant safety standards (including CE electrical reliability and stability requirements).

4.2 SYSTEM ENVIRONMENT

Molas NL has to be installed in an unobstructed environment to ensure a clear measurement field of view for the laser beam. This includes avoiding any forward obstructions, strong electromagnetic interference, or large reflective or diffuse surfaces. System performance is specified under standard nacelle mounting conditions and assumes compliance with wind turbine industry platform design conventions. No object may intrude into the lidar's working beam sector.

The measurement performance of Molas NL is based on the assumption that the wind turbine platform remains within its normal operating attitude range. The system is designed to accommodate nacelle motion during yawing; however, measurement accuracy depends on proper installation and a stable mechanical foundation. As the nacelle is a dynamic environment, attitude variations during wind turbine operation or yawing may introduce measurement deviations. Therefore, Molas NL must be aligned with the nacelle's central axis, and the alignment deviation angle should not exceed 1°. Molas NL can also be installed in a position parallel to the centerline, with measurement results unaffected by the laser scanner's out-of-axis position.

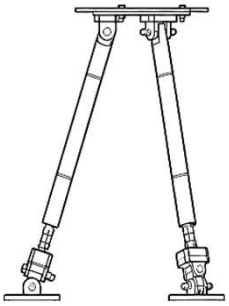


Molas NL is equipped with a high-precision inclinometer. In turbulent or complex flow conditions, particularly in offshore environments, the lidar can automatically correct its pointing angle based on attitude monitoring data, significantly reducing the impact of vibration and volume-averaging effects on sensitivity. Raw attitude data can also be retained for optional post-processing. The attitude monitoring function may be enabled or disabled depending on operational needs.

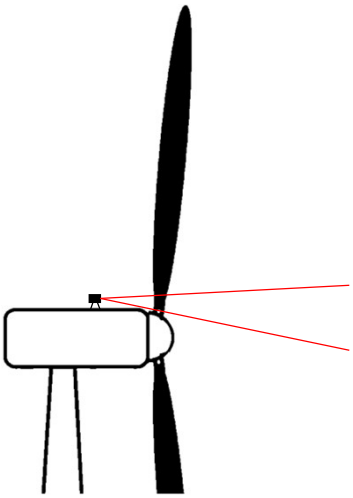
4.3 INSTALLATION

Before installing the nacelle-mounted LiDAR on the wind turbine, the final design of the mounting bracket and installation position of the Molas NL must be determined based on the specific wind turbine model, nacelle dimensions, and structural constraints. When designing the bracket and defining the installation location, the following factors should be taken into account:

- **The Optical Head (OH) should not be mounted directly on the nacelle.** A dedicated mounting bracket is required to provide sufficient elevation and mechanical support. As shown in the example, the default design uses a tripod-style bracket, though the exact structure may vary depending on the product version and wind turbine model.
- **The Bracket height needs to be optimized.** A bracket that is too low increases the percentage of time during which the laser beam is blocked by the rotating blades, reducing data availability. Conversely, an excessively tall bracket may create installation difficulties and compromise structural stability. A balanced height should therefore be selected.



- The laser beams emitted by the Molas NL should be unobstructed. The installation location should ensure that the beam path is free from blockage by the nacelle cover or any other fixed structure, as illustrated in the diagram.



- **The bracket should allow for OH orientation adjustment.** After installation, the optical head should be adjustable so that its pointing direction can be aligned parallel to the wind turbine's main rotational axis.
- **The OH and bracket assembly needs to provide adequate mechanical stability.** Structural loads on the LiDAR, bracket, and nacelle cover must be evaluated under survival wind speed conditions (70 m/s). The design must ensure reliable stability and resistance to vibration.
- **The bracket is required to incorporate lightning protection.** A lightning rod should be integrated into the bracket, and the system must be properly bonded to the wind turbine's lightning protection system.
- **The bracket–nacelle connection must distribute loads over a sufficiently large contact area.** This prevents stress concentration that could damage the nacelle cover or reduce structural integrity.
- **The installation area on the nacelle roof should be as level as possible.** Small deviations in OH inclination can be corrected using the bracket and the OH's adjustable base, but excessive surface unevenness should be avoided.
- **The installation position should minimize interference with other instrumentation.** The LiDAR and its bracket should be placed such that they do not obstruct or negatively influence other sensors or measurement systems on the wind turbine.

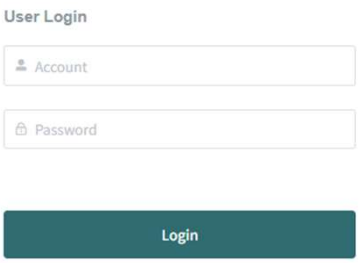
5. MOLAS WEB CLIENT

5.1 INTRODUCTION

The Molas Web Client is a browser-based interface designed for remote monitoring and management of the Molas NL lidar system. This client requires no installation of additional software, ensuring a quick access. The web client is built with security and reliability in mind, providing a secure, user-friendly platform for accessing real-time Lidar data. Through the Molas Web Client, users can efficiently monitor the operational status of the Molas NL lidar system, including key performance indicators (KPIs) and system health metrics. The client also allows for the downloading of interaction data, enabling easy access to critical data logs and diagnostics for further analysis.

5.2 USER INTERFACE DESCRIPTION

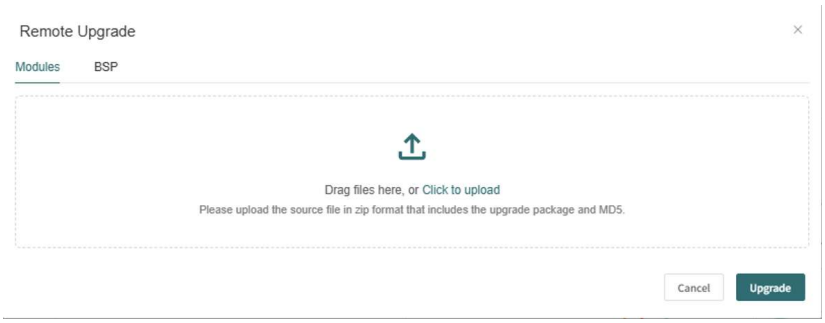
- Please refer to the <Installation Guide> for detailed instructions on connection methods and login credentials.
- Once on the login page, you can switch the display language between Chinese and English by clicking the 中 or En button at the top right corner.
- Enter the username and password in the respective fields, then click "Login" to access the main interface of the client.



- The icons in the top-right corner of the main screen correspond to the following functions, as shown below.

En / 中 Click this button to toggle the display language between Chinese and English.

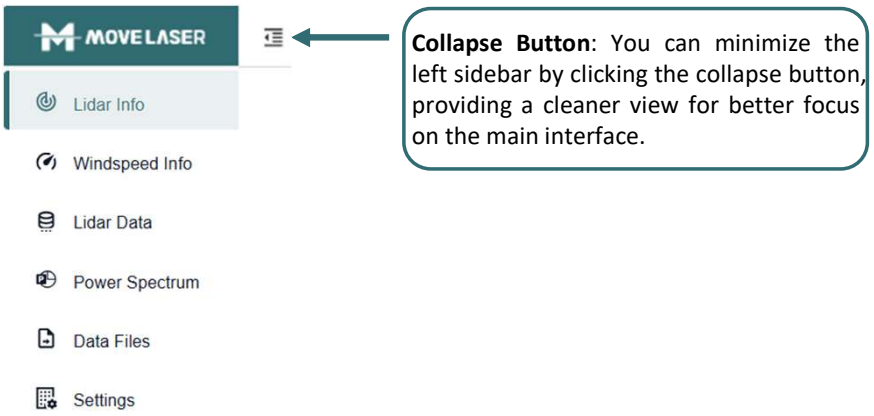
Click the Remote Upgrade button to open a popup window. Be sure to select the correct upgrade option - Modules or BSP. After choosing the required option, upload the correct upgrade package and click Upgrade.



Click this button to toggle the interface between full-screen mode or zoomed view.

Click this button to log out from the client.

- The left sidebar of the main interface serves as a navigation panel, allowing direct access to various functional sections.



- Lidar Info Page

Once connected to the LiDAR, the following information will be displayed:

- Lidar Number
- Time Synchronization Mode
- Lidar Time
- Geographic Location (Longitude and Latitude)
- Storage Capacity
- Firmware and Hardware Module Versions

This information allows users to verify the system status during installation and confirm key details.

If the storage is near full, users should download and save historical data, then click Clean Disk to clear the data.

Lidar Number	9156	TimeSyn Mode	NTP Timing
WEB Version	1.2.1.9	BSP Version	1.1.1.1
AMP Version	1.2.6.2	IPC Version	1.21.1.1
DFB Version	5	EYDFA2 Version	0
Lidar Type	NL200	DU	0
Longitude	10	Latitude	20

Lidar Time	2025-11-20 15:43:44	Number Of Beams	4
DUCT Version	1.1.14.1	JSON Version	0.1.1.1
NLMB Version	2.6.1.9	FPGA Version	1.1.3.1
Time Zone	GMT+8	SN	
Tilt Sensor	0.00°	Roll Sensor	0.00°
Altitude	30	Free Disk Space	65% Clean Disk

■ Wind speed chart

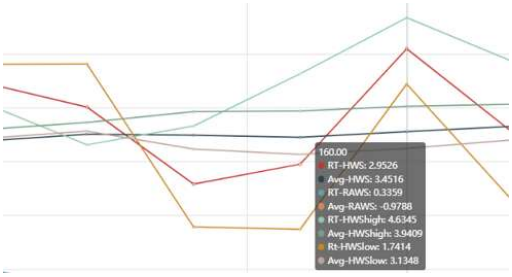
The Wind Speed Chart displays horizontal wind speed data at different distances within the measurement range. The user can select which data to monitor:

- HWS Series: Combined horizontal wind speed
- RAW Series: Combined radial wind speed
- HWShigh Series: Horizontal wind speed at the lidar's upper plane
- HWSlow Series: Horizontal wind speed at the lidar's lower plane

Unchecking boxes will hide corresponding data in the chart.

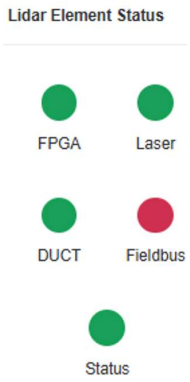
By checking the "**10 min Average**" box, the user can switch between real-time (4Hz) data and data are averaged over 10 minutes.

Hover the mouse on a dot to get more information:



■ Lidar Element Status

The Lidar Element Status indicators use **GREEN** for normal status and **RED** for abnormal status, allowing users to easily identify and diagnose any issues.



■ Wind Speed and Direction Info Pages

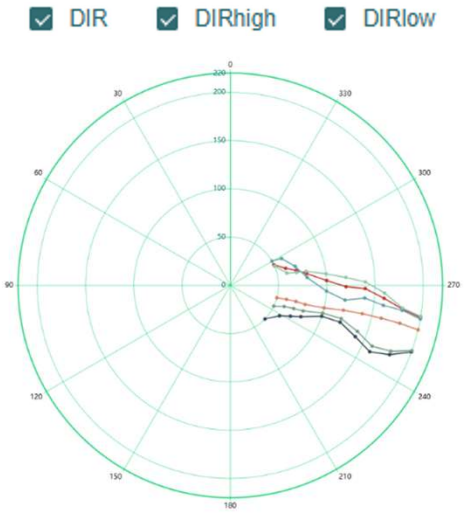
- In this page, users will see the following charts:
- **RWS Chart**: Displays radial wind speed at different distances for each of the four laser channels (RWS1-RWS4).

  RWS1-RWS4 correspond to the four laser beams.

  By checking **"10 min Average"**, users can toggle between real-time and 10-minute average data. Hovering over the chart shows the specific value at the cursor's position.

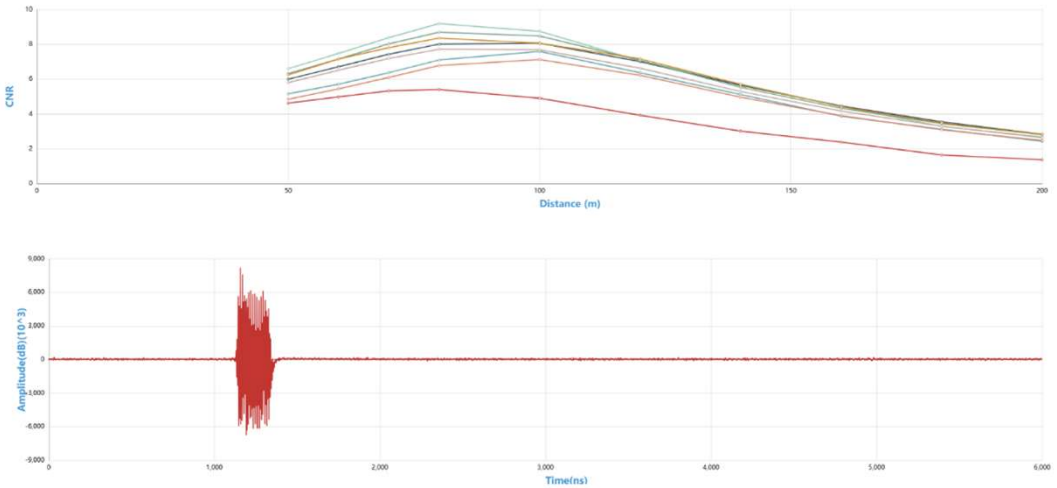
- **Direction Chart**: Displays wind direction at various azimuth angles over different distances.
  DIR: Wind direction
  DIRhigh: Wind direction from the upper plane of the lidar
  DIRlow: Wind direction from the lower plane of the lidar
  The **"10 min Average"** option allows users to switch between real-time and data are averaged over 10 minutes.
  Unchecking boxes will hide corresponding data in the chart.
  Hover the mouse on a dot to get more information.



Lidar Data Page

In the **Lidar Data Page**, users can view:

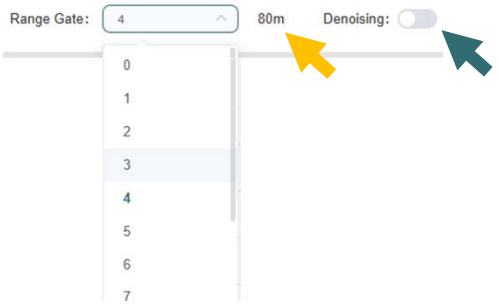
- **CNR Chart**: Displays the Carrier-to-Noise Ratio over distance.
- **Time-Domain Echo Signal Chart**: Shows the echo signal amplitude as it varies over time.



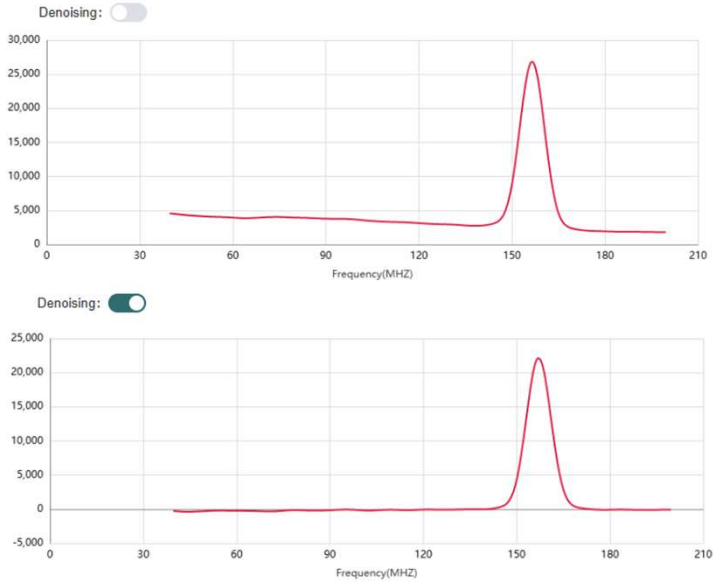
Power Spectrum Page

This page shows the power spectrum for each of the 4 laser channels.

- Users can select a specific **Range Gate** to view the corresponding distance, which is displayed next to the gate number.



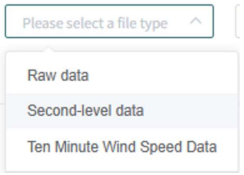
- The Denoising button activates noise reduction for the displayed results.



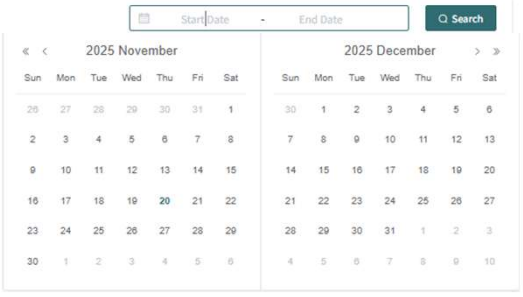
Lidar Data PageData File Page

In the **Data File Page**, users can search for and download historical data.

- To select the data type, choose from the dropdown list.

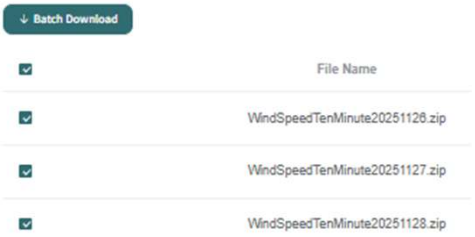


- After selecting the desired data type, click on the date input box and choose the start and end dates from the calendar.



- Once the time range is selected, click Search to retrieve the data.
- Users can download the data by clicking on the Download button next to the progress bar.

- For bulk downloads, users can select multiple files by checking the boxes on the left of the filenames, then click ↓ Batch Download at the top to download the selected data.



LIDAR PARAMETER CONFIG

In the **Setting Page**, users can configure the **Range Gate** settings:
Click Config and a success message will appear at the top of the page when the configuration is complete.

Hub Height and Lidar Height

Hub Height: The height from the ground to the wind turbine hub (rotor center). Input the appropriate value based on users' turbine model.
Lidar Height: The height from the ground to the LiDAR itself. This is crucial for ensuring accurate alignment with wind speed measurements.

Fieldbus Address

If using Fieldbus communication, input the **Fieldbus Address** for system integration.

T1, T2, T3

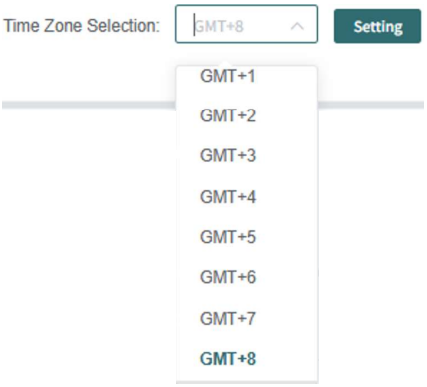
These parameters represent the average time and status judgment threshold percentage for wind speed and direction. It is recommended to use the default values unless there are specific needs, as these values are optimized for typical operations. **Do not change the threshold percentages unless necessary.**

Min Avg-TI (Turbulence Intensity)

This parameter defines **turbulence intensity**. Enter the value based on the actual operating environment to ensure accurate measurements.

- Time Zone and Modbus Configuration

Time Zone Selection: Set the time zone based on the LiDAR system's geographical location. Click Setting to adjust.



Modbus-Tcp ID: This ID is used to define communication with Modbus systems. If Modbus-Tcp is used, input the appropriate ID for SCADA integration.

- Geographic Information Config

In this section, users can configure the **Longitude**, **Latitude**, and **Altitude** for each LiDAR system.

- Time Sync Mode & FTP Settings

Time Sync Mode: Select between Internal Timing (using the system clock) or NTP (Network Time Protocol).
NTP Server: If NTP is selected, input the server details to synchronize the system time.
FTP Settings: Configure the FTP upload options, including upload periods (e.g., 10 min, 30 min), and FTP server address.

- Network Configuration

IP Address, **Subnet Mask**, **Default Gateway**: Configure the network settings for the LiDAR system to communicate within your local network. Ensure these settings are correct for proper system operation.
Broadcast Option: Toggle this button to control whether the LiDAR broadcasts data to the network.

- Cloud Platform Configuration

ODC Valid Bit: Enable or disable the cloud connection for the LiDAR system.
Broker, **Port**, **Username**, **Password**: Configure access to cloud data storage and communication services. Enter the required credentials if using a cloud platform.

- Session Information

The **Session** section displays the current status of the LiDAR system's parameters, including initialization times and session logs. Any operations performed on the page will be recorded here.

6. DATA FILE DESCRIPTION

6.1 REAL-TIME DATA FILE DESCRIPTION

File name is time stamped as describe below:
WindSpeedYYYYMMDD.csv

- **WindSpeed:** File name
- YYYY: Year when the file was created and measurements start
- MM: month of data
- DD: day of data

For example, the file named WindSpeed20250413 was created the 13th of April 2025.

File Header DESCRIPTION

Data	No.	Description	Format/unit	Max.	Min.	Invalid
Timestamp	1	Measure timestamp	Yyyy/mm/dd hh: mm: ss: fff	-	-	-
Los	2	Beam number	-	4	1	-
Distance	3	X-axis measurement distance	M	200	50	-
Hubheight	4	The height from the ground to the wind turbine hub	M	-	0	-
Lidarheight	5	The height from the ground to the lidar itself	M	-	0	-
Roll	6	Rotation around the x-axis (left-right axis)	°	30	-30	-
Tilt	7	Rotation around the y-axis (front-back axis)	°	30	-30	-
Cnr	8	Carrier to noise ratio for the corresponding beam	Db	-	-	-
Rws	9	Radial wind speed	M/s	75	-50	Nan
Drws	10	Radial wind speed standard deviation	°	-	0	Nan
Rwsstatus	11	Radial wind speed status identification (0 indicates invalid data, 1 indicates valid data; same applies below)	-	1	0	-
Raws	12	Axial projected wind speed	M/s	75	-50	Nan
Rawsstatus	13	Axial projected wind speed status identification	-	1	0	-
Hws(hub)	14	Inverted horizontal wind speed	M/s	75	0	Nan
Hws(hub)status	15	Inverted horizontal wind speed status identification	-	1	0	-
Dir(hub)	16	Inverted wind direction	°	180	-180	Nan
Dir(hub)status	17	Inverted wind direction status identification	-	1	0	-
Veer	18	Vertical wind direction change rate	°/M	-	-	-
Vshear	19	Vertical wind shear	-	-	0	Nan
Hshear	20	Horizontal wind shear	-	-	0	Nan

Ti	21	Turbulence intensity	-	-	0	Nan
Tistatus	22	Turbulence intensity status identification	-	1	0	-
Hwshigh	23	Inverted horizontal wind speed at the upper plane	M/s	75	0	Nan
Hwshigh status	24	Inverted horizontal wind speed status identification at the upper plane	-	1	0	-
Hwslow	25	Inverted horizontal wind speed at the lower plane	M/s	75	0	Nan
Hwslow status	26	Inverted horizontal wind speed status identification at the lower plane	-	1	0	-
Dirhigh	27	Wind direction at the upper plane	°	180	-180	Nan
Dirhigh status	28	Wind direction status identification at the upper plane	-	1	0	-
Dirlow	29	Wind direction at the lower plane	°	180	-180	Nan
Dirlow status	30	Wind direction status identification at the lower plane	-	1	0	-

6.2 STATISTICAL AVERAGE DATA FILE DESCRIPTION

File name is time stamped as describe below:
WindSpeedTenMinuteYYYYMMDD

- **WindSpeedTenMinute:** File name
- **YYYY**: Year when the file was created and measurements start
- **MM**: month of data
- **DD**: day of data

For example, the file named WindSpeedTenMinute20250413 was created the 13th of April 2025.

File Header DESCRIPTION

Average data	No.	Description	Format/unit	Maximum	Minimum	Invalid value
Dateandtime	1	Timestamp is relative to the end of the 10 minutes averaging intervals	Yyyy/mm/dd hh: mm	-	-	-
Distance	2	X-axis measurement distance	M	200	50	-
Roll	3	Rotation around the x-axis (left-right axis)	°	30	-30	-
Tilt	4	Rotation around the y-axis (front-back axis)	°	30	-30	-
Rws1	5	Beam 1-line-of-sight wind speed	M/s	75	-50	Nan
Rws1avl	6	Beam 1-line-of-sight wind speed availability percentage	%	100	0	-

Rws2	7	Beam 2-line-of-sight wind speed	M/s	75	-50	Nan
Rws2avl	8	Beam 2-line-of-sight wind speed availability percentage	%	100	0	-
Rws3	9	Beam 3-line-of-sight wind speed	M/s	75	-50	Nan
Rws3avl	10	Beam 3-line-of-sight wind speed availability percentage	%	100	0	-
Rws4	11	Beam 4-line-of-sight wind speed	M/s	75	-50	Nan
Rws4avl	12	Beam 4-line-of-sight wind speed availability percentage	%	100	0	-
Raws	13	Axial projected wind speed	M/s	75	-50	Nan
Rawsavl	14	Axial projected wind speed availability percentage	%	100	0	-
Hws(hub)	15	Inverted horizontal wind speed	M/s	75	0	Nan
Hws(hub)avl	16	Inverted horizontal wind speed availability percentage	%	100	0	-
Dir(hub)	17	Inverted wind direction	°	180	-180	Nan
Veer	18	Vertical wind direction change rate	°/M	-	-	Nan
Dir(hub)avl	19	Inverted wind direction availability percentage	%	100	0	-
Vshear	20	Vertical wind shear	-	-	0	Nan
Hshear	21	Horizontal wind shear	-	-	0	Nan
Shearavl	22	Wind shear availability percentage	%	100	0	-
Ti1	23	Beam 1-turbulence intensity	-	-	-	Nan
Ti1avl	24	Beam 1-turbulence intensity availability percentage	%	100	0	-
Ti2	25	Beam 2-turbulence intensity	-	-	-	Nan
Ti2avl	26	Beam 2-turbulence intensity availability percentage	%	100	0	-
Ti3	27	Beam 3-turbulence intensity	-	-	-	Nan
Ti3avl	28	Beam 3-turbulence intensity availability percentage	%	100	0	-
Ti4	29	Beam 4-turbulence intensity	-	-	-	Nan
Ti4avl	30	Beam 4-turbulence intensity availability percentage	%	100	0	-
Hwshigh	31	Inverted horizontal wind speed at the upper plane	M/s	75	0	Nan
Hwshighavl	32	Inverted horizontal wind speed availability percentage at the upper plane	%	100	0	-
Hwslow	33	Inverted horizontal wind speed at the lower plane	M/s	75	0	Nan
Hwslowavl	34	Inverted horizontal wind speed availability percentage at the lower plane	%	100	0	-
Dirhigh	35	Inverted wind direction at the upper plane	°	180	-180	Nan
Dirhighavl	36	Inverted wind direction availability percentage at the upper plane	%	100	0	-
Dirlow	37	Inverted wind direction at the lower plane	°	180	-180	Nan

Dirlowavl	38	Inverted wind direction at the lower plane	%	100	0	-
Cnr1(db)	39	Carrier-to-noise ratio for the beam 1	Db	-	0	-
Cnr2(db)	40	Carrier-to-noise ratio for the beam 2	Db	-	0	-
Cnr3(db)	41	Carrier-to-noise ratio for the beam 3	Db	-	0	-
Cnr4(db)	42	Carrier-to-noise ratio for the beam 4	Db	-	0	-

6.3 FTP FILE

Users can transmit data via FTP to receive real-time data from Molas NL. The FTP-transmitted data contains real-time data and statistical average data.

■ REAL-TIME DATA

File name is time stamped as describe below:
RT-MolasNL-XXXX-TTmin-YYYYMMDD-tttttt
- **RT-MolasNL:** File name
- **XXXX:** Lidar number
- **TTmin:** Data transmission cycle
- **YYYY**: Year when the file was created and measurements start
- **MM**: month of data
- **DD**: day of data
- **tttttt:** time of the first data registered in file

For example, the file named RT-MolasNL-1892-05min-20250413-121521 created the 13th of April 2025, at 12h15min21sec by the MolasNL-1892 with a 5-minute data transmission cycle.

■ STATISTICAL AVERAGE DATA

File name is time stamped as describe below:
Avg-MolasNL-XXXX- YYYYMMDD
- **Avg-MolasNL:** File name
- **XXXX:** Lidar number
- **TTmin:** Data transmission cycle
- **YYYY**: Year when the file was created and measurements start
- **MM**: month of data
- **DD**: day of data

For example, the file named Avg-MolasNL-1892-20250413 was created the 13th of April 2025, by the Molas-1892.

7. CUSTOMER SERVICE

Movelaser users receive support whenever assistance is needed, covering system operation or maintenance-related matters.

Professional software, optoelectronics, and lidar engineers provide technical support Monday through Friday.

Email: xzzhou@movelaser.com

Returns are accepted only for products that remain unmodified and in their original packaging. Non-capital items are not covered under warranty, and any associated costs shall be borne by the owner.

The warranty does not cover replacement and/or repair resulting from:

- Cosmetic wear, aging, or tearing of instrument components;
- Degradation, damage, or malfunction caused by negligence or failure to follow the operating instructions provided with this document;
- Lack of proper supervision, maintenance, or inventory management;
- Operation or use of the instrument in a manner inconsistent with Movelaser or manufacturer specifications.

This warranty does not include the right to download updated versions of the system software. It only covers replacement of the software version that is identical to the one supplied at the time of purchase.
This warranty does not constitute a maintenance agreement. A separate maintenance contract must be purchased if required.

MOVE LASER