



RK320-01 Laser Ceilometer

User Manual

Revision Time	Reviser	Current Version	Remarks
20250815	SUN	V5.0	

1. Overview

1.1 Scope of Use

The primary functions of the RK320-01 laser ceilometer is to measure cloud base height, penetration thickness, and statistically analyze cloud cover, while outputting vertical visibility under obscured sky conditions. It is primarily applied in transportation sectors such as airports and naval vessels, as well as meteorological stations. This laser ceilometer features a simple structure, excellent operational stability, high reliability, low energy consumption, and convenient maintenance.

1.2 Main Functions

- (1) Measurement function: Automatically collect and measure cloud base height, penetration thickness and count cloud amount, up to three layers of clouds can be measured, and vertical visibility is output when the sky is blurred;
- (2) Special function: It can measure tilt angles in two directions and detect the distance to hard-target objects;
- (3) Self checking function: The device has the function of detecting the working status of various important components;
- (4) Automatic protection: Each important component of the equipment has complete protection measures;
- (5) Historical data storage: There is 16M historical data storage space inside the device.

2. Composition and Supporting Facilities

2.1 Composition

RK320-01 laser ceilometer consists of host, bracket, base, data processing terminal, cable and so on.

The outline drawing of RK320-01 laser ceilometer is shown in Figure 1:

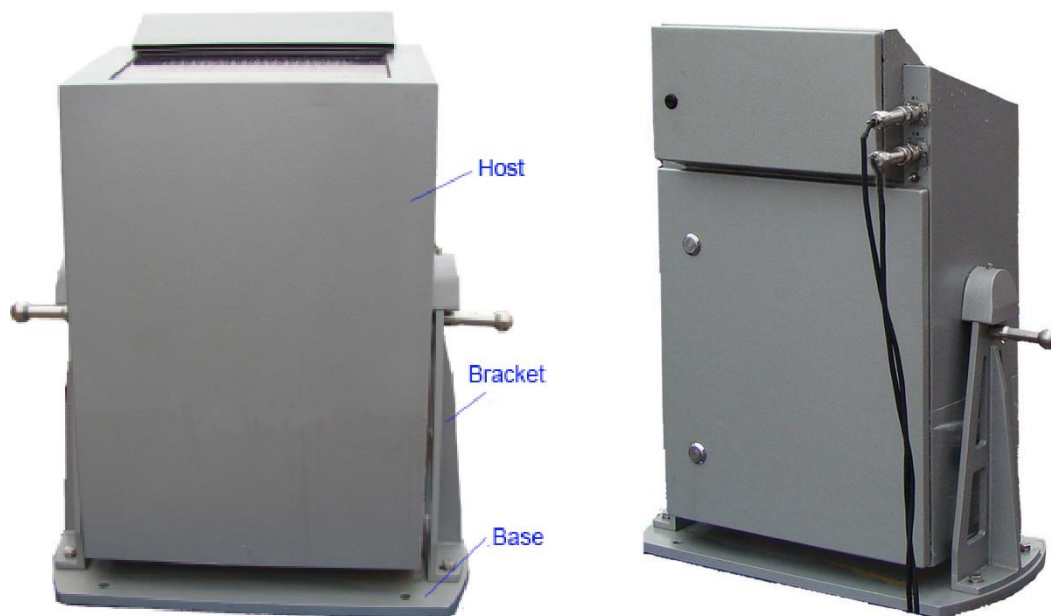


Figure 1 Outline Drawing of RK320-01 Laser Ceilometer

2.2 Supporting Facilities

The supporting equipment for the laser ceilometer is listed in Table 1.

Table 1 List of Complete Sets of Equipment

Serial Number	Name	Quantity	Remark
1	Host	1 set	
2	Base	1 set	
3	Bracket	1 set	
4	Cable	2 roots	Communication cable, power cable (the length is determined according to user requirements)
5	Random document	1 set	Certificate, Manual, etc.

2.3 System Principle Block Diagram

Figure 2 is the principle block diagram of the laser ceilometer

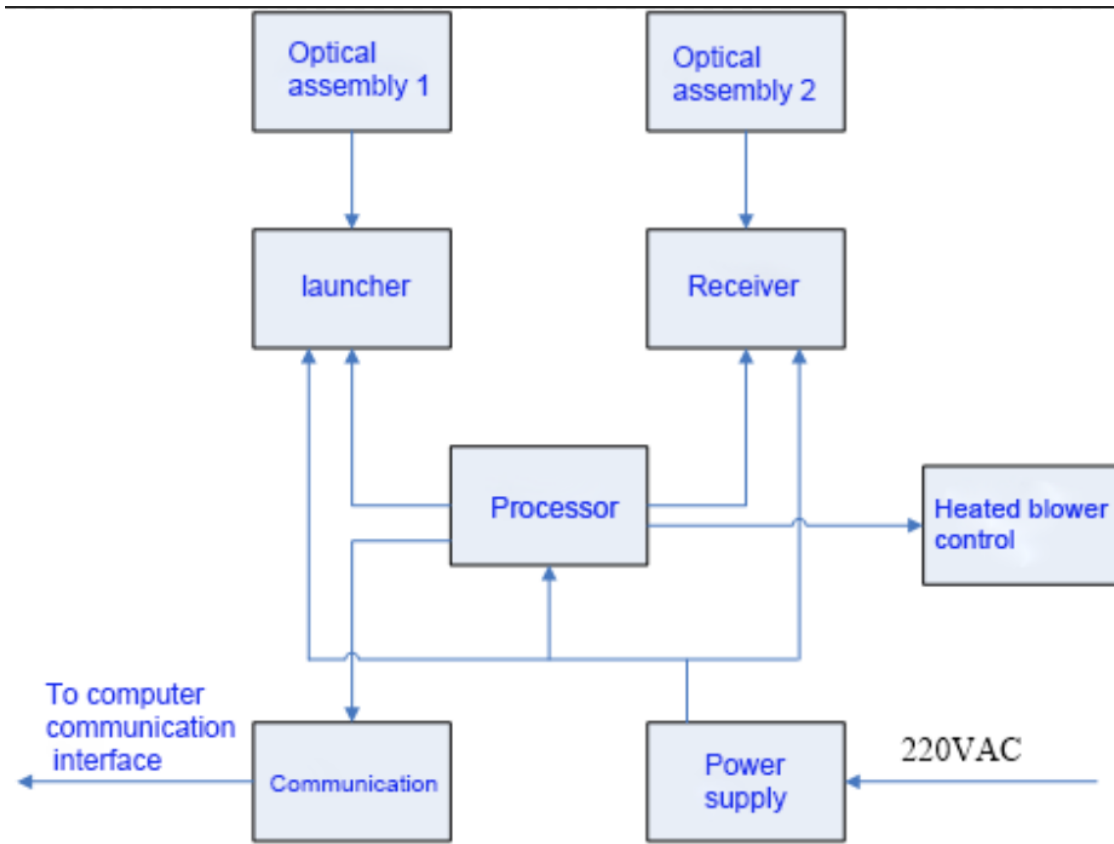


Figure 2 Schematic Diagram of the Laser Ceilometer

The transmitter is mainly composed of a transmission optical system and a transmitter circuit, which are fixed in the inner transmission tube through mechanical devices. The instrument emits periodic infrared pulse laser signals during operation.

The receiver is mainly composed of a receiving optical system and a receiver circuit, which are fixed in the inner receiving cylinder through mechanical devices. The instrument receives atmospheric echo signals during operation.

The processor collects temperature, voltage, current and other detection values of the transmitter board, energy detection board and window detection board through the SPI1 bus, and sends control signals to these boards to provide +12V voltage. Implement data reading and writing with two external EEPROM through SPI3. Collect some detection values of the receiver board through SPI2 and send control signals to the receiver board. Read the signal from the receiver board FIFO through the data bus.

3. Main Technical Indicators

3.1 Measuring Range and Accuracy

- (1) Cloud base height range: 30m - 12km;
- (2) The maximum number of cloud layers that can be measured: 3 layers;
- (3) Resolution: 5m;
- (4) Measurement error of hard objects: $\pm 15\text{m}$.

3.2 The Sampling Period

30 seconds to 300 seconds can be set continuously.

3.3 Way of Working

Long-term uninterrupted work.

3.4 Dimensions and Weight

- (1) Maximum external dimensions (length $\times$ width $\times$ height): $(575\pm 10)\text{mm}\times(300\pm 10)\text{mm}\times(750\pm 10)\text{mm}$;
- (2) Weight: $\leq 60\text{kg}$.

3.5 Power

- (1) Single-phase AC: 198VAC - 242VAC;
- (2) Power: $\leq 100\text{W}$ when not heated; $\leq 700\text{W}$ when heated.

3.6 Communication

- (1) Interface type: RS232/RS485;
- (2) Baud rate: 9600, 19200, 38400, 57600;
- (3) Maximum wired transmission distance: not less than 300m.

3.7 Working Environment Conditions

- (1) Ambient temperature: -40°C - 50°C ;
- (2) Relative humidity: 95%RH (30°C).

3.8 Storage and Transportation Conditions

- (1) Ambient temperature: -55°C - 60°C ;
- (2) Relative humidity: 95%RH (35°C).

3.9 Reliability and Maintainability

- (1) Mean time between failures: $\text{MTBF} \geq 500\text{h}$.

(2) Average repair time: MTTR≤0.5h.

4. Specifications

4.1 Installation Plan

Before starting to install the ceilometer, an installation plan should be developed to ensure a smooth installation process.

- (1) Wiring planning: Determine the wiring plan and cable types for power lines, grounding lines, and communication lines;
- (2) Foundation: Prepare the foundation for installation;
- (3) Connecting cables: Connect the power line, communication line, and grounding wire of the site to the power port, communication port, and grounding port of the equipment respectively, and connect the communication line to the serial port of the backend computer.

4.2 Positioning and Orientation

Install the on the working foundation. When measuring hard objects, place it horizontally, and when measuring cloud layers, place it vertically. When fixing the foundation, it is necessary to ensure that the sun does not directly shine on the ceilometer lens to avoid burning out equipment components. For this reason, the placement of the ceilometer should be in accordance with the following: the window in the northern hemisphere should be placed to the north, and the window in the southern hemisphere should be placed to the south (this placement is only effective for north latitude or above 30 ° south latitude). Figure 3 shows the placement direction of the ceilometer in the northern hemisphere. Adjust the placement direction in a timely manner according to seasonal changes to avoid direct sunlight.

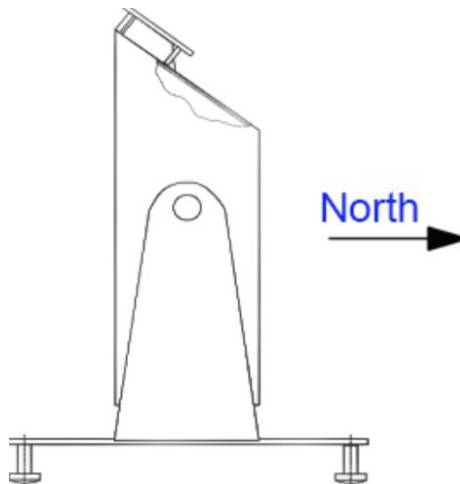


Figure 3 Orientation of Ceilometer in Northern Hemisphere

4.3 Grounding

The grounding is used to protect the electronic components inside the ceilometer from lightning strikes and radio frequency interference (RFI).The grounding of the ceilometer is achieved through the grounding cable.

The grounding cable consists of a conductor with a cross-sectional area greater than 10mm² (yellow/green dual-color), which connects to the grounding terminal on the base to ensure proper instrument grounding. This not only enhances equipment safety but also protects the ceilometer from the effects of lightning surges.

5. Equipment Maintenance Methods

- (1) The window protective glass of the laser ceilometer should be kept clean to obtain accurate measurement results. When the window becomes dirty, the measured energy will decrease. Usually, window glass needs to be cleaned every 2-3 days, but some windy and dusty areas should be cleaned more frequently.
- (2) Wipe the window glass with a soft, lint free cotton cloth or degreased cotton dipped in pure water, taking care not to scratch the surface of the glass during wiping.
- (3) If there are fallen leaves, snow, or other situations, the device will automatically detect and blow air to clear them.

6. Precautions

- (1) The maintenance of instruments must be carried out by qualified personnel recognized by the manufacturer;
- (2) Do not plug or unplug the internal wiring of the equipment when it is powered on;
- (3) The instrument has a dangerous voltage of 220VAC, please pay attention to safety;
- (4) The laser emitted by the equipment poses a certain level of harm to the human eye. Please do not look directly at the emission window;
- (5) It is strictly prohibited for direct sunlight to shine on the ceilometer lens. Please adjust the placement direction in a timely manner according to seasonal changes.

7. Communication Protocol (MODBUS-ASCLL)

Parameter	Value
Data Bits	8 bits
Check Bit	None
Stop Bit	1 bit
Baud Rate	57600 bps
Slave Address	0x05 (Factory Default)

7.1 Data Information

The ceilometer automatically uploads a measurement result per measurement period (default 1 minute) according to the set accumulation time. The format of the measurement result is as follows:

YYYY-MM-DD HH:MM:SS CYY 00 0 ///// ///// ///// ///// ///// L00 M00 H00 T00 01234567 XXXX

YYYY-MM-DD 4 digits for year, 2 digits for month, 2 digits for day;

HH:MM:SS 2 hours, 2 minutes, 2 seconds;

CYY is the equipment label;

00 is the device ID number, 00~99;

0 is the sky state: 0 means no cloud is detected, 1, 2, 3 means that 1, 2, and 3 layers of clouds are detected respectively, 4 and 7 means vertical visibility, and 5 means the data is unqualified;

///// ///// ///// ///// ///// When the corresponding sky state is 1, 2, and 3, it means the 1st, 2nd, and 3rd layers of clouds respectively The cloud base height and penetration thickness of , in m, if the sky state is 4, the first ///// represents the vertical visibility, the value range is 00000~99999, in m. When the stratum cloud is not detected or the data format is unqualified, it is indicated by /////.

For example, if two layers of clouds are detected, they are 1200m with a penetration thickness of 50m, and 4300m with a penetration thickness of 80m, which are expressed as:

YYYY-MM-DD HH:MM:SS CYY 00 2 01200 00050 04300 00080 ///// ///// L00 M00 H00 T00 01234567 XXXX

For example: if no cloud is detected, it means:

YYYY-MM-DD HH:MM:SS CYY 00 0 ///// ///// ///// ///// ///// L00 M00 H00 T00 01234567 XXXX

For example: the output is vertical visibility 600m, then it is expressed as:

YYYY-MM-DD HH:MM:SS CYY 00 4 00600 ///// ///// ///// ///// L00 M00 H00 T00 01234567 XXXX

L00 represents low cloud cover, an integer ranging from 0 to 10.

M00 represents the cloud cover of medium clouds, which is an integer ranging from 0 to 10.

H00 represents high cloud cover, an integer ranging from 0 to 10.

T00 represents the total cloud cover, an integer ranging from 0 to 10.

01234567 indicates the device status, the value range is 00000000~FFFFFFFF (hexadecimal), the status code description is shown in Table 2.

XXXX means check, the range is 0000~FFFF. crc16 checksum for all characters (before the checksum, excluding spaces).

Table 2 Status Code Description

Serial Number	Device Status	Output Status Code
1	All status is normal	00000000
2	Ceilometer power failure	00000001
3	Ceilometer laser launch board failed	00000002
4	Ceilometer laser temperature failure	00000004
5	Ceilometer laser energy failure	00000008
6	Ceilometer laser energy plate failed	00000010
7	Ceilometer receiver APD board failed	00000020
8	Ceilometer receiver temperature failed	00000040
9	Ceilometer receiver status failed	00000080
10	Ceilometer fan failed	00000100
11	Ceilometer observation window pollution	00000200
12	Ceilometer observation window contamination detection board failed	00000800
13	Ceilometer calibration constants and calibration failed	00002000
14	Ceilometer enable failed	00004000
15	Ceilometer self-check failed	00008000
Note: If the above multiple states fail at the same time, it is the accumulation of the corresponding state values.		

7.2 Set The Address (Send in ASCII format)

Sent

(ASCII) ID,1\r\n

Response

(ASCII) T\r\n

7.3 Set The Serial Port Configuration (Send in ASCII format)

Sent

(ASCII) SETCOM,9600 8,N,1\r\n

Response

(ASCII) T\r\n

Note:"\r\n" is the carriage return line feed.

8. Trouble Shooting

8.1 Equipment Not Working

- (1) Check if the power supply is functioning properly;
- (2) Check if the lightning arrester has been damaged.

8.2 The Main Computer and Equipment Cannot Communicate

- (1) Check if the software settings (baud rate, address, COM port) are correct;
- (2) Check if the communication cable connection is normal;
- (3) Check if the ceilometer is powered on properly;
- (4) Please contact the manufacturer.

8.3 Clearly Have Clouds within the Measurement Range but No Cloud Signal

- (1) The device is not aimed at the cloud layer;
- (2) Check the working status of the ceilometer;
- (3) Please contact the manufacturer.

9. Warranty Terms

This product comes with a one-year warranty, starting from the date of delivery. Within twelve months, the Company shall be responsible for free repair or replacement of any failure caused by sensor quality issues (non-human damage). Fees will be charged for repairs or replacements after the warranty period expires.

 Complies with applicable CE directives.

Manual subject to change without notice.