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# **RK400-14 Laser Snow Deep Sensor**

## **User Manual**

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## 1.Overview

The laser snow depth sensor is our company's latest product, with a large measurement range, a maximum distance of 200m, and high accuracy. It also has rich industrial data interfaces (RS232, 485, 422, 0-10V, 0-5V, 4-20mA, etc.), strong anti-interference ability, and is widely used in various industrial control and field monitoring and testing sites such as steel industry, metallurgical industry, automotive industry, printing industry, food industry, etc.

## 2. Performance index

- (1) Light source: Laser (capable of measuring snow covered surfaces)
- (2) Laser characteristics: laser diode
- (3) Wavelength: 640nm.
- (4) Spot type: Point spot
- (5) Laser level: class 2
- (6) Laser sensor lifespan: 5 years
- (7) Working temperature: -40 ° C to+50 ° C
- (8) Working humidity: 0-100% RH
- (9) Measurement range: 0-10m<sup>①</sup>
- (10) Measurement accuracy:  $\leq \pm 3\text{mm}$  (temperature -40 degrees to+50 degrees, angle 0 degrees to 50 degrees)
- (11) Sampling frequency:  $\geq 10\text{Hz}$
- (12) Display and output resolution: 1mm
- (13) Measurement angle: 0 degrees to 50 degrees
- (14) Power: About 10W (including heating) Less than 0.8W (excluding heating)
- (15) Power supply voltage: DC 12V
- (16) Protection level: waterproof and dustproof, IP68

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(17) Wiring instructions (Includes 10 m with lines of different colors or cable length upon request):

Pin	Define
1	Red12VDC
2	Black GND
3	Green 485A
4	Blue 485B
5	Black SDI-12

①The sensor has a 10cm measurement blind spot

(18) Mounting: include accessories of mounting to mast vertical of 4 inches of diameter.

### 3.Usage and precautions

Equipment usage method:

1. When using, first install the equipment and connect the corresponding cables, with an installation angle between 0 and 50 degrees (factory default angle of 50 degrees).
2. After turning on the power, the device will perform the initial data collection, and the laser will be continuously fired several times until the collection is completed (the yellow light goes out).
3. Send commands (see the list in the communication protocol description) to initialize the snow depth, set the actual installation angle, and the device will perform data collection again.
4. Send measurement commands to obtain measurement values, check if the data is normal (default automatic collection interval is 10 minutes), and refer to section 5.4 for the format of the reply data.



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## 4.Maintenance and upkeep:

- 1.Do not touch the lens with your fingers.
2. Only use clean soft cloth for wiping, and if necessary, use alcohol or water adhesive damp cloth for wiping.
3. If not used for a long time, please turn off the power to avoid affecting the lifespan.

## 5.Communication protocol description

### 5.1 SDI-12 protocol:

The default address of the device is 0, with a baud rate of 9600, data bit 8, check bit N, and stop bit 1.

The snow depth sensor supports the commands listed in the following table according to the SDI-12 V1.4 protocol:

command	reply	illustrate
a!	a	Confirm Active
a!	allccccccmmmmmvvxx...x	Get Identity String
aAb!	b	Change the address to b
?!	a	Query Address
aM!	attn	Start Measurement
aMC!	attn	Start measuring and use CRC for response data
aD0! – aD9!	a<values> a<values><CRC>	Obtain measurement values If the measurement command specifies CRC, reply to CRC
aM1! – aM9! aMC1! – aMC9!	attn	Additional measurement function
aC!	attnn	Start concurrent measurement

aCC!	attnn	Start concurrent measurement and use CRC for response data
aC1! – aC9! aCC1! – aCC9!	attnn	Additional concurrent measurement function
aR0! – aR9! aRC0! – aRC9!	a<values> a<values><CRC>	Query real-time data
aZC! aZC=g...g!	aOK aF0	Snow depth initialization (reset) g : 1-8 characters, floating point number, angle between laser and upright pole (°), If no angle is specified, follow the angle specified during the previous reset Reply: OK means starting the reset operation, F0 indicates that the sensor is clearing to zero
aST=on! aST=off!	aOK aF0	Turn on or off the laser tracking function Reply: OK indicates the start of the corresponding operation, F0 indicates that the sensor is already performing the corresponding operation
aACI=i...i!	aOK	Automatic collection interval i : 1-5 character automatic collection interval value (minutes), Turn off the sensor timing collection function when the interval value is 0
aGAC!	ai...i	Obtain automatic collection interval value
aTH=t...t! <sup>①</sup>	aOK	Set the upper limit of heating temperature t: 1-5 characters, floating point number, unit °C
aTT=t...t! <sup>②</sup>	aOK	Set heating start temperature t: 1-5 characters, floating point number, unit °C

①② Do not modify the starting and stopping heating temperatures

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unless necessary, to avoid product damage caused by incorrect settings.

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## 5.2 Real time measurement data

The measurement data obtained using the M MC C CC R0 RC0 command is real-time data automatically collected by the sensor. The sensor automatically measures at set time intervals, and the data requested by the command is only the data content of the last measurement.

The sensor automatically starts a laser measurement 10 seconds after the power supply starts. The snow depth and distance data obtained before the laser acquisition is completed are all 0 (invalid data). It is recommended to reserve the sensor acquisition time after the sensor is powered on before obtaining the data, and determine the validity of the data based on whether it is 0.

## 5.3 Synchronous measurement data

Use the M1 MC1 C1 CC1 command to control the sensor to immediately perform a measurement. Due to the need for temperature control, laser sensor initialization, continuous acquisition, and other operations on the sensor, the estimated measurement time for response is usually very long (5 minutes or more).

## 5.4 data format

The data obtained by the M MC C CC R0 RC0 M1 MC1 C1 CC1 command is in the same data format. The command response example is as follows:

Address+snow depth (mm)+distance (mm)+ambient temperature (°C)+voltage (V)

Example: 0+0+1019+20.8+12.7

## 5.5 Snow depth initialization

The actual snow depth is calculated based on the difference between the current measured distance and the initial measured distance. Therefore, an initial measurement is required during initial installation and changes in installation status for subsequent snow depth calculations.

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Snow depth sensors are usually not installed perpendicular to the ground, so the sensor needs to correct the snow depth value based on the angle between the laser and the ground.

The angle value of the reset command is the angle between the sensor laser beam and the vertical pole, which can also be calculated by subtracting the angle between the laser beam and the horizontal plane by 90 °.

If the measured ground changes after long-term use, it is also necessary to perform a snow depth initialization operation. When the installation angle does not change, the angle value can be left unspecified, and the angle value input from the last specified angle reset operation can be used to simplify the angle measurement operation.

### **5.6 laser tracking**

When on-site installation requires confirmation of installation position or calculation of installation angle based on measurement distance, the laser can be continuously turned on to facilitate confirmation of laser position and real-time acquisition of measurement distance.

When laser tracking is turned on, the M MC C CC R0 RC0 command can be used to obtain real-time updated distance values. As it is only used for debugging, the snow depth value will not be updated.

The laser tracking function is only used for debugging and is not recommended to be turned on for a long time. Therefore, if the function is not turned off within 10 minutes after being turned on, the sensor will automatically turn off the laser tracking function to prevent damage to the sensor after being turned on for a long time.

### **5.7 Automatic collection**

By default, the sensor uses an internal collection process to regularly measure distance, and the collector uses the M MC C CC R0 RC0 command to obtain snow depth data. This method can greatly improve the response speed of the sensor and be compatible with various collector data acquisition processes, adapting to the sensor with minimal collector compatibility



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modifications (for special collection needs, additional collection commands can be used for simultaneous data measurement).

The automatic collection function is mainly controlled based on the automatic collection interval value. The automatic collection interval value is the data maintained during power failure, and there is no need to repeat the setting every time power is turned on after successful setting.

The interval parameters need to be set according to the actual usage environment, for example, when using solar power and the ambient temperature is low, the acquisition interval can be appropriately extended to reduce sensor power consumption.

### **5.8 Command Example**

The following example defaults to address 0

1. Confirm Active

0! Reply: 0

2. Query Address

?! Reply: 0

3. Get Identity String

0! Reply: 014JZSSMeterDpSnow1.0+Equipment number

4. Change address to1

0A1! Reply: 1

5. Using measurement data with CRC calibration

0MC! Reply: 00104

Measurement completion reply: 0

0D0! Reply: 0+0+1019+20.8+12.7ND`

6. Using synchronous measurement data with CRC verification

0MC1! Reply: 03004

Measurement completion reply: 0

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0D0! Reply: 0+871+148+21.3+12.8AJm

7. Snow depth reset (angle between laser and pole 30 °)

0ZC=30! Reply: 0OK

8. Snow depth reset (angle between laser and pole 30.12 °)

0ZC=32.12! Reply: 0OK

9. Default snow depth reset (angle between laser and pole 0 °)

0ZC! Reply: 0OK

10. Enable laser tracking

0ST=on! Reply: 0OK

11. Turn off laser tracking

0ST=off! Reply: 0OK

12. Disable automatic collection function

0ACI=0! Reply: 0OK

13. Set the automatic collection interval to 60 minutes

0ACI=60! Reply: 0OK

14. Obtain automatic collection interval

0GACI! Reply: 060

**Attachment: Instructions for indicator lights:**

- Green light: Work indicator light, strobe represents work.
- Yellow light: When the light is on, it indicates that snow depth data is being collected.
- Red light: When the light is on, it indicates that the sensor probe is heating up.