

# SenseCAP All-in-One Weather Station User Guide (V2)

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## 1 Product Introduction

SenseCAP ONE is a series of all-in-one compact weather sensors, including S1000 10-in-1, S800 8-in-1, S700 7-in-1, S500 5-in-1, S200 weather sensors. These weather sensors integrate multiple sensors into this compact device, monitoring up to10 weather parameters: air temperature, air humidity, atmospheric pressure, light intensity, wind speed, wind direction, precipitation, PM 2.5, PM 10,noise and CO2. The sensors use ultrasonic to measure wind speed and wind direction, to achieve high-precision data collection, which is easy maintenance. The equipment is designed with industry standards and can work stably in harsh outdoor environments from -40°C to 85°C. The product supports the Modbus-RTU (RS485) and SDI-12 protocols.

Basic parameters		
Product Model	SenseCAP ONE Series (S200/S500/S700/S800/S1000)	
Power Supply	12V~ 24V (0.42W)	
Heating Power Supply	24V (21W)	
Support Protocols	RS485 (MODBUS-RTU) / SDI-12	
IP Rating	IP66	
Working Temperature	-40 °C ~ + 85°C	
Working Humidity	0 to 100%RH (non-condensing)	

Product Model: S200 (2-in-1)			
Measurement Parameter	Measurement Range	Measurement Accuracy	Resolution
Wind speed	0~60 m/s standard range 0~75m/s extended range Up to 80m/s withstand range	±0.3m/s(≤10m/s); ±3% (10m/s ~ 50m/s) ±5% (>50m/s)	0.1m/s
Direction of the wind	0~360° (@-40℃~60℃)	±3.0°	0.1°
Product Model: S500 (5-in-1)			
Measurement Parameter	Measurement Range	Measurement Accuracy	Resolution
Air temperature	-40~85°C	±0.1℃	0.01°C
Air humidity	0~100%RH	±1.5%RH	0.01%RH
Barometric pressure	300~1250hPa	±50Pa	10 Pa



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Wind speed	0~60 m/s standard range 0~75m/s extended range Up to 80m/s withstand range	±0.3m/s(≤10m/s); ±3% (10m/s ~ 50m/s) ±5% (>50m/s)	0.1m/s
Direction of the wind	0~360° (@-40~60°C)	±3.0°	0.1°
Product Model: S700	(7-in-1)		
Measurement Parameter	Measurement Range	Measurement Accuracy	Resolution
Air temperature	-40~85°C	±0.1℃	0.01°C
Air humidity	0~100%RH	±1.5%RH	0.01%RH
Barometric pressure	300~1250hPa	±50Pa	10 Pa
Wind speed	0~60 m/s standard range 0~75m/s extended range Up to 80m/s withstand range	±0.3m/s(≤10m/s); ±3% (10m/s ~ 50m/s) ±5% (>50m/s)	0.1m/s
Direction of the wind	0~360°(@-40℃~60℃)	±3.0°	0.1°
Light intensity	0~188000 Lux	5% * reading	5Lux
Rain intensity	0~200mm/h	±10%	0.2mm/0.02mm
Product Model: S800	8-in-1)	_	
Measurement Parameter	Measurement Range	Measurement Accuracy	Resolution
Air temperature	-40~85°C	±0.1℃	0.01°C
Air humidity	0~100%RH	±1.5%RH	0.01%RH
Barometric pressure	300~1250hPa	±50Pa	10 Pa
Wind speed	0~60 m/s standard range 0~75m/s extended range Up to 80m/s withstand range	±0.3m/s(≤10m/s); ±3% (10m/s ~ 50m/s) ±5% (>50m/s)	0.1m/s
Direction of the wind	0~360°(@-40℃~60℃)	±3.0°	0.1°
Noise intensity	35~100dB	±1.5dB	0.1dB
PM2.5	0~1000µg/m3	±10%@100~1000µg/m3 ±10µg/m3@0~100µg/m3	1µg/m3
PM10	0~1000µg/m3	±15%@100~1000µg/m3 ±15µg/m3@0~100µg/m3	1µg/m3
Product Model: S1000	) (10-in-1,CO2 series)		

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Measurement Parameter	Measurement Range	Measurement Accuracy	Resolution
Air temperature	-40~85°C	±0.1℃	0.01°C
Air humidity	0~100%RH	±1.5%RH	0.01%RH
Barometric pressure	300~1250hPa	±50Pa	10 Pa
Wind speed	0~60 m/s(@-40℃~60℃)	±0.3m/s, (≤10m/s) ±3% of the measured value (>10m/s)	0.1m/s
Direction of the wind	0~360°(@-40℃~60℃)	(@-40℃~60℃) ±3.0° 0.	
Light intensity	0~188000 Lux 5% * reading		5Lux
Rain intensity	0~200mm/h	0~200mm/h ±10%	
PM2.5	0~1000µg/m3	000µg/m3 ±10%@100~1000µg/m3 ±10µg/m3@0~100µg/m3	
РМ10	0~1000µg/m3	±15%@100~1000µg/m3 ±15µg/m3@0~100µg/m3	1µg/m3
CO2	400-5000ppm;exten ded range up to	$\pm$ (30 ppm +3% of reading) (extended range $\pm$ 10% of	lppm

Note: Multi-in-one meteorological environment sensors with other monitoring elements can be customized. For specific requirements, please contact relevant personnel of the



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## 2 Installation

Before the installation, check the packing list and make sure there are no missing parts.





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## 2.1 Packing List

Number	Parts	
1	SenseCAP ONE All-in-one compact weather sensor	
	M12 8-pin communication cable (default length 3-meter hook-up	
2 wire, and there is a waterproof aviation connector type to choose when working with SenseCAP SensorHub datalogger. If the aviation		1
		1
	connector is not needed, cut it off by yourself)	
3	USB Type-C cable, for configuring devices	
4	Flange plate (purchased separately)	
5	Pole adapter sleeve base (purchased separately)	
6	Pole adapter cross bar (purchased separately)	







### 2.2 Installation

### 2.2.1 Device Interface Introduction



There are two connectors at the bottom of the device.

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- USB Type-C interface allows you to connect your computer with a normal USB Type-C cable to the device for configuration.
- The main data interface can be connected to the M12 8-pin cable, supporting multiple bus protocols



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### 2.2.2 Connect with USB Cable



Note: The white cover (on the side near the label) should be tightened after debugging to prevent water from entering the device!





### 2.2.3 M12 Cable



The device adopts an M12 8-pin connector, the different colored pins provide power and data communication (as shown in the above diagram).

When working with the RS-485, you can connect only 4 wires (not using a heating function),

and the rest can be individually wrapped with tape to prevent short circuit



The holes of the cable and the pins of the device connector must be aligned when the cable is plugged in.







Plugin the cable and tighten it clockwise

Note: the cable is aimed at with the bottom before inserting it into the bottom.

Otherwise, the pins are skewed may cause the communication is abnormal.



When using the device with a heating function, a separate 24V (24V@1A is recommended) power supply is required. Gray wire #5 is connected to the negative of the power supply, and pink wire #6 is connected to the positive pole of the power supply.



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Reminding:

1. When the device needs to add power extension cable, if its length is more than 100 meters, it needs to use 24V/2A for power supply (without heating function);

2. When the heating function is enabled, the power supply of the heating module should be within 3

meters of the SenseCAP ONE. The distance between the power supply of the heating module and

the device is not more than 5m. Please use the 3m / 5m conversion cables sold by our company.

### 2.2.4 Install the device.

There are two major installation methods, either mount on a pole with a sleeve or a platform with a flange plate.







The size of the sleeve is shown below.



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It is recommended that the diameter of the pole should be less than or equal to 75cm.



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The dimension of the flange plate is shown below.



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## 3 Device's Operating Mode

After installation, you can power on the device, configure it and collect data from the device. The device has two operating modes, **configuration mode, and working mode**.

	With a USB cable, you can check or configure the device's
Configuration Mode	parameters, such as device name, version number, and
Configuration Mode	communication protocol configuration. Product firmware can be
	upgraded in this mode.
	Connect the devices and data logger with an M12 data and power
Working Mode	cable, and then the data collected by the device will be sent to the
	host via different communication protocols.



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### 3.1 Configure the device via USB port

There is a waterproof round cover at the bottom of the device. Turn it counterclockwise to remove this cover, and you can see a USB Type-C connector and a configuration button.

Connect the device to your computer with a USB Type-C cable. The computer will automatically install the device driver. After the driver is successfully installed, you can see a serial port in the device's manager.



If the driver is not installed automatically, click this link to manually download and install the

#### driver. (The version is CP210x Windows Drivers)

Download for Window	vs 10 Universal (v10.1.9)		
lote: The latest version of the Univers	al Driver can be automatically installed from Window	s Update.	
Platform	Software	Release Notes	
Windows 10 Universal	Download VCP (2.3 MB)	Download VCP Revision History	

There are two methods to configure the device:

- SenseCAP ONE Configuration Tool
- Serial debug tool



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### 3.2 SenseCAP ONE Configuration Tool

SenseCAP ONE Configuration Tool offers a graphical interface for you to configure the device. And you can download the tool from the GitHub link below:

https://github.com/Seeed-Solution/SenseCAP-One-Configuration-Tool/releases

Select the software for the respective operating system, Windows, macOS, or Linux based on your needs.

Source code (zip)		
sensecap_one_cfg_tool_1.0.0_amd64.deb	Linux	53.7 ME
SenseCAP-One-Configuration-Tool-Setup-1.0.0.	exe.blockmap	53 KE
SenseCAP-One-Configuration-Tool-Setup-1.0.0.	exe	48.8 ME
SenseCAP-One-Configuration-Tool-1.0.0.exe	Windows	48.4 MB
SenseCAP-One-Configuration-Tool-1.0.0.dmg.bl	lockmap	88.8 KB
SenseCAP-One-Configuration-Tool-1.0.0.dmg	MacOS	83.2 MB
SenseCAP-One-Configuration-Tool-1.0.0.AppIm	age	84.4 MB
SenseCAP-One-Configuration-Tool-1.0.0-mac.zi	p	80.6 ME
D latest.yml		390 Bytes
D latest-mac.yml		581 Bytes
3 latest-linux.yml		412 Bytes

The next image shows the main interface of the SenseCAP ONE Configuration Tool.

	Mea	asurement Data Area
erial Port /dev/tty.usbserial-14220 >	THPL	Wind
aud Rate 9600	Air Temperature 27.38 °C	Min, Wind Direction 329.4 *
Baud rate for the service port. Device Connection Are	Air Humidity 61.17 %RH	Max. Wind Direction 331.4 *
Disconnect	Air Pressure 100680 Pa	Avg. Wind Direction 330.2 *
Settings	Light Intensity 210 Lux	Min. Wind Speed 2.7 m/s
Firmware Update		Max. Wind Speed 2.9 m/s
Device Setup Area		Avg. Wind Speed 2.9 m/s
evice Information	Precipitation	Misc.
N 119906922012055 ardware Version 0 the of Manufacture 121-03-11 avice Name nnseCAP ONE 1019906922012055	Rain Accumulation         20.8 mm         Rain Duration         1040 s         Rain Intensity         0.0 mm/h         Rain Peak Intensity         0.0 mm/h	Heating Temperature -27.50 °C Tilt Status 0

- 1. Open the software, click on the pull-down box at the serial port, select the corresponding serial port of the device.
- 2. Set the Baud rate to 9600.
- 3. Click connect, if the connection is successful, the sensor data area on the right will show the corresponding measurements.

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• •	SenseCAP One Configurat	ion Tool
Serial Port 1/dev/tty.usbserial-14220 >>	THPL	Wind
Baud Rate 2 9000 V Baud rate for the service port. 3 Disconnect Settings Firmware Update	Air Temperature 27.38 °C Air Humidity 61.17 %RH Air Pressure 100680 Pa Light Intensity 210 Lix	Min. Wind Direction       329.4 *       Max. Wind Direction       331.4 *       Avg. Wind Direction       330.2 *       Min. Wind Speed       2.7 m/s       Max. Wind Speed       2.9 m/s       Avg. Wind Speed       2.1 m/s
Device Information S/N 1019906822012055 Hardware Version 1.0 Software Version 3.0 Date of Manufacture 2021-03-11 Device Name SenseCAP ONE 1019900922012055	Precipitation       Rain Accumulation       20.8 mm       Rain Duration       1040 s       Rain Intensity       0.0 mm/h	Misc. Heating Temperature -27.59 °C Tilt Status 0

Click Settings to enter the device settings, and click "Read From Device" to obtain the Information of the device.

		Configuration Tool - Settings
Device	General	
Application	Main Port Protocol	RS-485 ASCII
		kraft ≪the service cable is unclured, changable for Service Port only. SDI-12
		RS-232 Modbus RTU
	ASCII Protocol Baud Rate	RS-485 Modbus RTU
		RS-422 Modbus RTU
	Modbus Address	RS-232 ASCII
		RS-485 ASCII
	Modbus Baud Rate	RS-422 ASCII
	SDI-12 Address	L. L
	Valid	I range 0-9, A-Z, a-z.
	Device Name	SenseCAP ONE 1019906922012055
	Max	. length 64.
	Factory Reset	Restore Factory Settings
	Data Combination (G0)	
	Output List	T Air Tomporatura
	Load From File	Save To File Read From Device Write To Device Clo

1. Select the communication protocol. In the example here we choose the RS-485 Modbus RTU.



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SENSECAP	User manual/ Technical information	
主通信协议	RS-485 ASCII	
	在脲多用门线螺旋出后生效。	
ASCII协议地址	SDI-12	
ASOUNDERE	RS-232 Modbus RTU	
A O O ULA WITHET W	RS-485 Modbus RTU	
ASCII协议波特率	D0. (20 Markur DTU	
	RS-422 Modbus RTU	
Modbus地址	RS-232 ASCII	
a a construction behalter offer	RS-485 ASCII	
Modbus波特率	RS-422 ASCII	
SDI-12地址	0	

2. Modify the Modbus address: write the address in the Modbus address, and then click "Write to Device".

Device	General	
Application	Main Port Protocol	RS-485 ASCII 🗸
		Apply after the service cable is unplugged, changable for Service Port only.
	ASCII Protocol Address	0
		Valid range 0-9, A-Z, a-z.
	ASCII Protocol Baud Rate	9600
		Apply for both Service Port and Main Port.
	Modbus Address	1
		Valid range [1, 247].
	Modbus Baud Rate	9600 ~
	SDI-12 Address	Ö
		Valid range 0-9, A-Z, a-z.
	Device Name	SenseCAP ONE 1019906922012055
		Max. length 64.
	Factory Reset	Restore Factory Settings
	Data Combination (G0)	

On the configuration page, you can modify the following: device name, data type, and data upload interval. After any modification, you will need to click "Write to Device" for the changes to take effect.

In application settings, you can set the cycle for the tool to read sensor data, with the minimum as 2S, and a dot range for the curve.

•••	SenseCAI	P One Configuration	Tool - Settings			
Device	Data Poll Interval	2 The interval of polling da	seconds	600]		
Application	Plot Deepth	10	f points in each plot, range [10,			
	Language	English	v	100].		
	Version	v1.1.1				
	The	e 21 Page total 50	) Page			
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Click "Firmware Update" to update the device firmware. Please contact sales or technical support at (sensecap@seeed.cc) to get the firmware.

Serial Port	/dev/tty.usbserial-14220	
Baud Rate	9600	
	Baud rate for the service port.	
	Disconnect	
	Settings	]

On the upgrade page, you will need to choose to update the mainboard firmware or the driver board firmware. Select the firmware file at your local repository, click "Update Now". If there is an unexpected power break during the update process, the update won't be executed. You will need to go through the same process to update the firmware.

		Pavorites  Pavorites  Recents	< > III • III	✓ Fireware		Q Search
Target Board	ielect A	🐥 Applicati		sensecap-one-s700-commo	n-v3.1.bin	
-		Documents				
Local File	Master Board @v3.0	Ownloads				
	Slave Board 1 @v3.2	😭 yangbo				
	Slave Board 2	OneDrive				
	Slave Board 3	Desktop	>			
	Slave Board 4	2-Seeed MacBook				
		2019-11				
	Slave Board 5					
	Slave Board 6	iCloud				
	Slave Board 7					
	Update Close	Locations	Options			Cancel
Se	nseCAP One Configuration Tool - Firmware	e Update	Sense	CAP One Configuration 1	Fool - Firmware	Update
Target Board			Sensed Target Board Local File	CAP One Configuration 1 Master Board @v3.0 /Users/yangbo/Desktop/	¥.	Update
Target Board	d Master Board @v3.0 V /Users/yangbo/Desktop/Fireware/senseca		Target Board	Master Board @v3.0	¥.	
Target Board	d Master Board @v3.0 V /Users/yangbo/Desktop/Fireware/senseca		Target Board	Master Board @v3.0	¥.	
Target Board Local File	d Master Board @v3.0 V /Users/yangbo/Desktop/Fireware/senseca		Target Board Local File	Master Board @v3.0	Sireware/senseca	
Target Board Local File Flashing the d	d Master Board @v3.0 V /Users/yangbo/Desktop/Fireware/senseca		Target Board Local File	Master Board @v3.0 /Users/yangbo/Desktop/	Sireware/senseca	
Target Board Local File Flashing the d	d Master Board @v3.0 V /Users/yangbo/Desktop/Fireware/senseca		Target Board Local File	Master Board @v3.0 /Users/yangbo/Desktop/	Sireware/senseca	ly.





### 3.3 Serial debug tool

The communication settings are as follows:

Select the serial port	You can find port information in your computer's device manager		
Baud rate	9600bps, 8 data bits, 1 stop bits, none parity, none flow contro	ol.	
•••	COMTool V1.7		
K 🕈 🛛		ASCII 🗸	
Serial SettingsPort/dev/cu.usBaudrate9600DataBytes8ParityNoneStopbits1rtsdtrCLOSE			
Receive Settings ASCII HEX Auto Linefeed (ms) Send Settings ASCII HEX Schedulec Send(ms) CRLF>		ClearReceive	
Ready Send(bytes):3			

- In the Serial Debug Assistant, select the corresponding COM port.
- Check the "click Enter to start a new line" check box.
- Set the baud rate to 9,600.
- Send ? in the send area.
- If you receive the corresponding OXA message in the serial receive window, the configuration is successful. If not, please check the COM port and the baud rate.

Please check the detailed ASIIC command in the next chapter.



## **4** Communication Protocols

The device supports the following communication protocols:

	The Modbus protocol is a common language applied to electronic devices.				
	With this protocol, devices can communicate within their network. It has				
	become a universal industry standard, widely used in data loggers, sensor				
Madhua DTU	equipment, and so on. Based on this protocol, devices produced by different				
Modbus-RTU	vendors can communicate with each other for system integration.				
	The Modbus protocol is a master-slave protocol. One node is the host, and				
	the other nodes that use the Modbus protocol to join the communication are				
	the slave. Each slave has a unique address.				
	The ASCII protocol is a query-response or a question-and-answer				
ASCII	communication protocol in which a host PC uses ASCII characters to send				
	commands to a device and then receives responses from that device.				
	Single-bus-based data communication protocol, is an asynchronous serial				
SDI-12	communications protocol for intelligent sensors that monitor environment				
	data.				





### 4.1 Modbus-RTU Protocol

To start Modbus-RTU communication, the M12 data cable of the device needs to be connected to the RS-485 port of one Data Logger, which powers up the device at a voltage of 12V-24V. The following image is a diagram of the wiring:



#### Protocol communication parameters

Data Format	One start bit, 8 Data bits, None parity, one Stop bits.					
Baud Rate	9600bps (d	9600bps (default), which can be modified by configuration.				
	S1000	43(CO2 series)				
Defeult Device Address	S800	46				
Default Device Address (Decimal)	S700	20				
	S500	10				
	S200	44				

### 4.1.1Modbus-RTU Protocol Message Format

Sensor data is stored in the Input Register and is read-only

The device address and the communication baud rate of RS-485 are stored in the Holding Register and can be modified.

Each register is 16bits and takes up 2 bytes.

#### Read the message from the input register.

The message format from by the host					
Slave address	Function code	Register address	Number of registers	CRC check	
1 byte	1 byte	2 bytes (big-endian).	2 Byte (big-endian).	2 bytes	
АА	0x04	RRRR	NNNN	сссс	
Address 0-247	0x04	big endian	big endian	little endian	

The message response from the slave							
Slave	Function code	Number of registers	First Register data	Second register		CRC check	
address				data			

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1 byte	1 byte	1 byte	2 bytes	2 bytes	 2 bytes
АА	0x04	ММ	VV0	VV1	 сссс
Address	0x04	big endian	big endian	big endian	 little-endian
0-247					

#### Read and write the holding register.

The message format from by the host					
Slave address	Function code	Register address	Number of registers	CRC check	
1 byte	1 byte	2 bytes (big-endian).	2 Byte big-endian).	2 bytes	
АА	0x03/0x06	RRRR	NNNN	сссс	
Address 0-247	0x03/06	big endian	big endian	little endian	

The message response from the slave							
Slave	Function code	Number of	First Register	Second register		CRC check	
address		registers	data	data			
1 byte	1 byte	1 byte	2 bytes	2 bytes		2 bytes	
AA	0x03/0x06	ММ	VV0	VV1		сссс	
Address	0x03/0x06	big endian	big endian	big endian		little-endian	
0-247							

### 4.1.2 Register Address Definition

Register type	Addres s	Name	values range	Number of registers	Registe r status	Note
	0x0000	Air temperature	-40000~85000	2	R	
	0x0002	Air humidity	0~100000	2	R	
	0x0004	barometric pressure	30000000~12500000 0	2	R	
	0x0006	Light intensity	0~188000000	2	R	
	0x0008	Minimum wind direction	0~360000	2	R	
Input register	put 0x000A wi	Maximum wind direction	0~360000	2	R	big endian Data format int32 Divide the data value by
	0x000C	Average wind direction	0~360000	2	R	1000 to get the true measurements
	0x000E	Minimum wind speed	0~60000	2	R	
	0x0010	Maximum wind speed	0~60000	2	R	
	0x0012	Average wind speed	0~60000	2	R	
	0x0014	Accumulated	0~8000000	2	R	

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				i/ reenned	intornati	
		rainfall				
		Accumulated				
	0x0016	rainfall	0~200000000	2	R	
		duration				
	0x0018	Rain intensity	0-200000	2	R	
		Maximum				
	0x001A	rainfall	0-60000	2	R	
		intensity				
	0x001C	Heating	-40000~85000	2	R	
		Temperature		2		
			0 or 1000((The			
	0x001E	The dumping	dumping of state is	2	R	
		of state	1000, the vertical of	2		
			state is 0)			
	0x0030	PM2.5	0~1000000	2	R	
	0x0032	РМ10	0~1000000	2	R	
	0x0040	CO2	0-10000	2	R	
	0x0048	Noise intensity	35000~100000	2	R	
	0x1000	Device address		1	R/W	The default address is 1
				·	10,00	Can be set to 1 - 247
						The default is 96, which
						means 9600.
						It can be set to:
						12=1200
						24=2400
	0x1001	Baud rate		1	R/W	48=4800
						96=9600
						192=19200
						384=38400
Holding						576=57600
register						1152=115200
-	0x2000	Set the		1	R/W	Write 1 to set accumulated
		accumulated				rainfall to 0. Read back 1 to
		rainfall to 0				confirm that the setting is
						finished. Read back 0
						indicates that the setting
		Cattha				failed
	0x2001	Set the accumulated		1	R/W	Write 1 to set accumulated
		rainfall duration to 0				rainfall duration to 0. Read
						back I to confirm that the
						setting is finished. Read
						back 0 indicates that the
						setting failed



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### 4.1.3 Modbus-RTU Read

#### Here is an example of the Modbus Poll tool

(download from <a href="https://www.modbustools.com/download.html">https://www.modbustools.com/download.html</a>).



Configuration connection parameters: Baud rate 9600bps, 8 Data bits, None Parity, 1 Stop bits.

🖞 Modbus Poll - Mbpoll1		- 🗆 X
File Edit Connection Setup Functions Display	View Window Help 16 17 22 23 TC ፻ ? ♥?	
Mbpoll1		
Tx = 0: Err = 0: ID = 1: F = 03: SR 1000ms No connection	Connection Setup	×
	Connection Serial Port	OK ^
2 0 3 0	USB-SERIAL CH340 (COM14)    Mode	
4         0           5         0           6         0	8 Data bits         Response T           1000         1000           Delay Betwee         Delay Betwee	[ms]
7 0 8 0	I Stop Bit Advanced      Remote Modbus Server      IP Address or Node Name	[ms]
0 2	127.0.01         Image: Server Port         Connect Timeout         Image: Port           502         3000         [ms]         IPv6	
For Help, press F1.		Port 14: 9600-8-N-1

Read the air temperature register 0x0000 to 0x0001, click Setup, and select Read/Write Definition





) 🖻 🖬 🎒 🗙	Read/Write Definition	F8	2 23 TC 🖳 🎦 🦓 📢	
Mbpoll1	Read/Write Once	F6		
	Read/Write Disabled	Shift+F6		
Tx = 0: Err = 0: ID = No connection	Excel Log	Alt+X		
Name	Excel Logging Off	Alt+Q		
0	Log	Alt+L		
1	Logging Off	Alt+O		
2	Reset Counters	F12		
3	Reset All Counters	Shift+F12		
4	Use as Default			
5	0		1	
6	0			
7	0			
8	0			
9	0			

Set the default slave ID(2-in-1 is 44,5-in-1 is 10, 7-in-1 is 20), function code 04, starting address

0, quantity (2-in-1 is 12, 5-in-1 is 6, 7-in-1 is 28);

បឹង្ខ Modbus Poll - Mbpoll1	
File Edit Connection Setup Functions Display View	Window Help
🗅 🗃 🔚 🎒 🗙 🛅 🗏 🚊 🕕 05 06 15	16 17 22 23 TC 🔄 🚘 🢡 📢
Mbpoll1           Tx = 0: Err = 0: ID = 1: F = 03: SR = 1000ms           No connection	Read/Write Definition X C X
Name         00000           0         0           1         0           2         0           3         0           4         0           5         0           6         0           7         0           8         0           9         0	Function:       04 Read Input Registers (3x)       Cancel         Address mode       • Dec       Hex         Address:       0       PLC address = 30001         Quentity:       2         Scan Rate:       1000       [ms]         Disable       Read/Write Disabled         Disable on error       Read/Write Once         View       0       20       50       100       Fit to Quantity         Hide Name Columns       PLC Addresses (Base 1)       Address in Cell       Enron/Daniel Mode         Request       RTU       01 04 00 00 00 27 1 CB       ASCII       3A 30 31 30 34 30 30 30 30 30 30 30 32 46 39 0D 0A

Now the computer reads the sensor data every 1 second, and the measurement (line 0 and line 1) is shown in below picture, after dividing the measurement by 1000, it is the true temperature value, 28300/1000 = 28.3 °C

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Modbus Poll - Mbpoll1 File Edit Connection Setup Functions Display View		- □ ×
D 📽 🖬 🚭 🗙 🔁 💆 🛱 🗍 🕮 05 06 15 16 17 22 23   TC	Image: Second	
Tx = 20: Err = 0: ID = 1: F = 04: SR = 1000ms	Ext Cantinue Clear Save Copy Log	Stop on Error Time stamp
Name         000000           0         0           1         28300           2         -           3         -           4         -           5         -           6         -           7         -           8         -           9         -	Tx:000000-01       04       00       00       02       71       CB         Rx:000001-01       04       04       00       00       02       71       CB         Rx:000002-01       04       00       00       02       71       CB         Rx:000002-01       04       00       00       02       71       CB         Rx:000002-01       04       00       00       02       71       CB         Rx:000003-01       04       00       00       02       71       CB         Rx:000005-01       04       00       00       02       71       CB         Rx:000005-01       04       00       00       02       71       CB         Rx:000007-01       04       00       00       02       71       CB         Rx:000007-01       04       00       00       02       71       CB         Rx:000009-01       04       00       00       62       CD       64         Rx:000009-01       04       00       00       62       SC       D6       41	

On the right, you can check the raw sent and received data packages.



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When the temperature is positive:

- 1. Host sends 01 04 00 00 00 02 71 CB
- 2. Slave responses 01 04 04 <mark>00 00 6E 8C</mark> D6 41
- Return temperature data 0x00006E8C (Hex), converted to decimal = 28300, get the corresponding air temperature by dividing through 1000, air temperature = 28300/1000 =

28.3 °C

#### When the temperature is negative:

The temperature needs to be obtained through a complement calculation.

- 1. Host sends 01 04 00 00 00 02 71 CB
- 2. Slave responses 01 04 04 FF FF FC 18 D6 41
- 3. Returned temperature data FFFFFC18H (Hex complement).
- 4. The original code is (FF FF FC 18-1 = FF FF FC 17) = 80 00 03 E8(Hex) = -1000 (Decimal).
- 5. Then the temperature measurement is  $-1000/1000 = -1^{\circ}$



SENSECAP		User manu	ual/Technical int	formation	
(Max wind speed)	<mark>00 00 00 00</mark>	(Avg wind sp	peed) <mark>00 00</mark>	<mark>00 00</mark> (Accum	nulated rainfall) 00
<mark>00 00 00</mark> (Accumul	ated rainfal	l duration )	<mark>00 00 00 00</mark>	( Rain intens	sity) <mark>00 00 00 00</mark>
(Maximum rainfall	intensity )	00 00 6A 7C	( Heating Te	mperature )	<mark>00 00 00 00</mark> (The
dumping of state)	99 09 (Chec	ck code )			

#### S1000 decode:

Read register 0x0000~0x001F and 0x0030~0x0033.

Send command: 2B 04 00 00 00 20 F6 18

Return: 2B 04 40 00 00 70 80 (Temperature) 00 00 95 10 (Humidity) 06 07 94 40 (Air pressure) 00 00 00 00 (Light) 00 00 00 00 (Min wind direction) 00 00 00 00 (Max wind direction) 00 00 00 00 (Avg wind direction) 00 00 00 00 (Min wind speed) 00 00 00 00 (Max wind speed) 00 00 00 00 (Avg wind speed) 00 00 00 00 (Accumulated rainfall) 00 00 00 00 (Accumulated rainfall duration) 00 00 00 00 (Rain intensity) 00 00 00 00 (Maximum rainfall intensity)00 00 6A 7C (Heating Temperature) 00 00 00 00 (The dumping of state) 99 09 (Check code)

PM2.5,PM10 and CO2 need to be read separately:

Send command: 2B 04 00 30 00 04 F6 0C

Return: 2B 04 08 00 00 90 88(PM2.5) 00 00 A4 10(PM10) 13 FA(Check code)

Read register 0x0040~0x0041.

Send command:2B 04 00 40 00 02 77 D5

Return:2B 04 04 00 0C EC 98 (CO2) FD 2F (Check code);





### 4.2 ASCII Protocol

### 4.2.1 Command definition

А	Device address, 0 by default				
ХА	Starter, fixed value				
• •	The separator used to distinguish multiple commands				
•••	A command, represented by different strings				
?	A query term used to query values				
=	Assignment, which is used to set the value				
V	The argument, the specific value of the parameter is set				
m	Sensor measurement				
o	Sensor measurements combine character for getting or setting				
&	multiple measurement parameters				
<cr><lf></lf></cr>	Response terminator				
Terms Explanation					
Command	Represented by different strings, such as BD for Baud rate and CP				
Command	for communication protocol				
	A Data List contains multiple sensor measurement types,				
Data List	represented by an abbreviation of G0.				
	For example, G0 contains several test types:				
	AT;AH;AP;LX;DN;DM;DA;SN;SM;SA;RA;RD;RI;RP;HT;TILT				

### 4.2.2 Query Command Format

Commands come in two formats:

1. A command without = refers to the basic query method.



*Example:* ?<*CR*><*LF*> *indicates query the device's address* 

#### 2. A command with = refers to a query with an argument



Example: 0XA;BD=?<CR><LF> indicates query the device's baud rate

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reserved.



### 4.2.3 Setting Command Format

#### Set a specified parameter, such as setting a baud rate.



Example: 0XA;BD=96<CR><LF> indicates query the device's baud rate

### 4.2.4 Command List

#### Device info queries and related commands settings

Query De	evice address	?					
	Send	? <cr><lf></lf></cr>					
Query	Response	0XA <cr><lf></lf></cr>					
	Description	The default response address is 0					
Query ba	ud rate	BD					
	Send	0XA; BD=? <cr><lf></lf></cr>					
Query	Response	0XA; BD=96 <cr><lf></lf></cr>					
	Description	The baud rate for device 0 is 9,600					
	Send	0XA; BD=[bd] <cr><lf></lf></cr>					
	Response	0XA; BD=[bd] <cr><lf></lf></cr>					
Setting		Return the Baud rate of device 0 is [bd], it could be 96 for 9600; 192 for 19200, 384 for 38400;					
	Description	576 for 57600; and 1152 for 115200.					
		For example, the return value 0XA;BD=96 represents the successful setting of a Baud rate of					
		9,600					
Commur	nication protocol	СР					
	Send	0XA; CP=? <cr><lf></lf></cr>					
	Response	0XA; CP=[cp] <cr><lf></lf></cr>					
		[cp] Represents the code of the communication protocol, the device supports multiple					
		communication protocols.					
		1 SDI-12					
Query	Description	3 RS-485 Modbus-RTU					
		6 RS-485 ASCII					
		Response 0XA;CP=3 <cr><lf> means that the data communication protocol of device 0 is Modbus-RTU protocol based on the RS-485 bus</lf></cr>					
	Send	0XA; CP=[cp] <cr><lf></lf></cr>					
<b>.</b>	Response	0XA; CP=[cp] <cr><lf></lf></cr>					
Setting	Description	Set the communication protocol of device 0 to [cp], if [cp] is 6, the communication protocol is set to ASCII text protocol based on the RS-485 bus					

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All



•				
R	5-485 address	MBAD		
	Send	0XA; MBAD=? <cr><lf></lf></cr>		
Query	Response	0XA; MBAD=1 <cr><lf></lf></cr>		
	Description	The RS-485 address of device 0 is 1 (decimal)		
	Send	0XA; MBAD=2 <cr><lf></lf></cr>		
Setting	Response	0XA; MBAD=2 <cr><lf></lf></cr>		
	Description	Set the address of device 0 to 2 (decimal)		
RS	-485 baud rate	MBBD		
	Send	0XA; MBBD=? <cr><lf></lf></cr>		
Query	Response	0XA; MBBD=96 <cr><lf></lf></cr>		
	Description	The RS-485 communication baud rate for device 0 is 9,600		
	Send	0XA; MBBD=[bd] <cr><lf></lf></cr>		
	Response	0XA; MBBD=[bd] <cr><lf></lf></cr>		
e		Return device 0's RS-485 communication baud rate is [bd]: it can be 96 for 9600, 192 for		
Setting		19200, 384 for 38400, 576 for 57600, and 1152 for 115200.		
	Description	For example, the return value is 0XA;MBBD=96 represents the successful setting of the baud		
		rate of 9,600		
Device N	ame	NA		
	Send	0XA; NA=? <cr><lf></lf></cr>		
Query	Response	0XA; NA=SenseCAP ONE S700 <cr><lf></lf></cr>		
	Description	Device name is: SenseCAP ONE S700		
	Send	0XA; NA=[na] <cr><lf></lf></cr>		
Setting	Response	0XA; NA=[na] <cr><lf></lf></cr>		
	Description	Set the new device name to [na], and the character length limitation is 64 bytes		
C	Device model	ТР		
	Send	0XA; TP=? <cr><lf></lf></cr>		
Query	Response	0XA; TP=SenseCAP ONE S700 <cr><lf></lf></cr>		
	Description	The device model is SenseCAP ONE S700		
D	evice version	VE		
	Send	0XA; VE=? <cr><lf></lf></cr>		
	Response	0XA; VE=HW-1.0&SW-2.0&S1-2.2 <cr><lf></lf></cr>		
Query		Device hardware(HW) is v1.0, the software firmware(SW) is v2.0, and the #1 driver board		
	Description	firmware is v2.2		
Devi	ce serial number	S/N		
	Send	0XA; S/N=? <cr><lf></lf></cr>		
Query	Response	0XA; S/N=1019906922012011 <cr><lf></lf></cr>		
	Description	S/N represents the serial number of the device		
Pr	oduction date	MD		
	Send	0XA; MD=? <cr><lf></lf></cr>		
Query	Response	0XA; MD=20201027 <cr><lf></lf></cr>		
	Description	The production date of the return device is October 27, 2020, 20201027		
Resto	pre configuration	RESTORE		
Setting	Send	0XA; RESTORE=1 <cr><lf></lf></cr>		
_				

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	Response	0XA; RESTORE=1 <c< th=""><th>R&gt;<lf></lf></th><th></th></c<>	R> <lf></lf>					
	Description	Return 0XA; RESTO	RE=1 means the setting is successful and return 0XA mea	ans the setting				
	Description	fails.						
Elec	tronic Compass	сс						
	Send	0XA;CC=? <cr><lf></lf></cr>						
	Response	0XA;CC=[cc] <cr><lf></lf></cr>						
Query		[cc] Electronic Compass offset state						
Query	Description	Y	Enable Electronic Compass					
	Description	Ν	Disable Electronic Compass					
		С	Enable Geomagnetic compensation					
	Send	0XA;CC=Y <cr><lf></lf></cr>						
	Response	0XA;CC=Y <cr><lf></lf></cr>						
	Description	Enable Electronic C	Compass					
	Send	0XA;CC=N <cr><lf< td=""><td>&gt;</td><td></td></lf<></cr>	>					
	Response	0XA;CC=N <cr><lf< td=""><td>&gt;</td><td></td></lf<></cr>	>					
Setting	Description	Disable Electronic (	Compass					
	Send	0XA;CC=C <cr><lf></lf></cr>	0XA;CC=C <cr><lf></lf></cr>					
	Response	0XA;CC=C <cr><lf></lf></cr>	·					
	Description	Enable Geomagnetic compensation, it will start the 30s compensation process, during this						
		time, the device should be placed horizontally, and rotate evenly along the Z-axis for 1-2						
		rounds.						
	Tilt Detect	TD						
	Send	0XA;TD=? <cr><lf></lf></cr>						
Query	Response	0XA;TD=Y/N <cr><lf></lf></cr>						
2	Description	Y: Enable tilt detection function						
	2000	N: Disable tile detec	ction function					
	Send	0XA;TD=Y <cr><lf></lf></cr>						
	Response	0XA;TD=Y <cr><lf></lf></cr>						
	Description	Set to enable tilt detection function : TILT=0 means the device is placed vertically, TILT=1						
Setting		means the device is	s placed not placed upright.					
J	Send	0XA;TD=N <cr><lf></lf></cr>	>					
	Response	0XA;TD=N <cr><lf></lf></cr>	>					
	Description	Disable tile detection	on function : the TILT always equals 0 when the device	is placed at any				
	·	position.						
	Heating	НС						
	Send	OXA; HC =? <cr><lf< td=""><td>&gt;</td><td></td></lf<></cr>	>					
Query	Response	OXA; HC =Y/N <cr>&lt;</cr>	:LF>					
	Description	Y: enable heating fu	unction					
	'	N: disable heating f	unction					
	Send	0XA;HC=Y <cr><lf></lf></cr>	·					
Setting	Response	0XA;HC=Y <cr><lf></lf></cr>	, 					
	Description	Turn on the hea	ting function of the device;					
	2 comption	When the air te	emperature is between [5 $^\circ$ C and -25 $^\circ$ C], the dev	vice begins to				

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		heat, and the temperature of the heating plate is the highest, up to 40 $^\circ \!\!\! C$
		When the air temperature is higher than 5 $^\circ$ C, the device stops to heat;
		(Note: If the temperature is lower than -25 $^\circ$ C ,the heating module cannot
		raise the temperature of the device above 0 $^\circ$ C, it may freeze, which will
		affect the detection of wind speed and direction)
	Send	0XA;HC=N <cr><lf></lf></cr>
	Response	0XA;HC=N <cr><lf></lf></cr>
	Description	Set to enable heating function.

#### Command to read sensor data.

For quick reading of all measurements, G0 is the command.

Read all measurements		GO	
	Send	0XA; G0? <cr><lf></lf></cr>	
Query	Response	0XA;AT=23.6;AH=56.4;AP=100819.1;LX=93.0;DN=0.0;DM=0.0;DA=0.0;SN=0.0;SM=0.0;SA=0.0;RA=1	
Query		.4;RD=60.0;RI=0.0;RP=0.0;HT=-38.4;TILT=0.0 <cr><lf></lf></cr>	
	Description	Returns the value of all measurement parameters	

Group Name	Measurement	Name	Unit	
	Contains all combinations of measurement parameters			
	AT	Air temperature	°C (default), °F	
	АН	Air humidity	%RH	
	AP	Barometric pressure	Pa (default), hPa, bar, mmHg, inHg	
	LX	Light intensity	Lux	
	DN	Minimum wind direction	deg	
	Dm	Maximum wind direction	deg	
	DA	Average wind direction	deg	
GO	SN	Minimum wind speed	m/s (default), km/h, mph, knots	
	SM	Maximum wind speed	m/s (default), km/h, mph, knots	
	SA	Average wind speed	m/s (default), km/h, mph, knots	
	RA	Accumulated rainfall	mm (default), in	
	RD	Duration of rainfall	S	
	RI	Rainfall intensity	mm/h (default), in/h	
	Rp	Maximum rainfall intensity	mm/h (default), in/h	
	HT	Heating temperature	°C	
	TILT	Fall detection		

#### Modify the Properties of Measurement Parameters

Properties represent some characteristics of the measured data, such as the unit of output temperature and the interval between data updates.

Temperature and Humidity		IB
Data Update Interval		
	Send	0XA;IB=? <cr><lf></lf></cr>
Query	Response	0XA;IB=1 <cr><lf></lf></cr>
	Description	The default data updates every 1 second

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	Send	0XA;IB=2 <cr><lf></lf></cr>	
Cattle a	Response	0XA;IB=2 <cr><lf></lf></cr>	
Setting	<b>D</b>	Set the data update interval to 2 seconds, you can choose a value between 1 to 3600	
	Description	seconds.	
Air Temperature Unit		UT	
	Send	0XA; UT=? <cr><lf></lf></cr>	
Query	Return	0XA; UT=C <cr><lf></lf></cr>	
	Description	The temperature unit is Celsius	
	Send	0XA; UT=F <cr><lf></lf></cr>	
Set up	Response	0XA; UT=F <cr><lf></lf></cr>	
Secup	Description	Set the air temperature unit to Fahrenheit.	
	Description	C=°C, F=°F	
Barometric Pr	essure Unit	UP	
	Send	0XA; UP=? <cr><lf></lf></cr>	
Query	Response	0XA; UP=P <cr><lf></lf></cr>	
	Description	The unit is Pa.	
	Send	0XA; UP=H <cr><lf></lf></cr>	
Set up	Response	0XA; UP=H <cr><lf></lf></cr>	
Secup	Description	Set the unit to hPa.	
	Description	P = Pa, H = hPa, B = bar, M = mmHg, I=inHg	
Wind Speed &	Direction Data	IW	
Update Interva	al		
	Send	0XA; IW=? <cr><lf></lf></cr>	
Query	Response	0XA; IW=1 <cr><lf></lf></cr>	
	Description	The default data updates every 1 second.	
	Send	0XA; IW=2 <cr><lf></lf></cr>	
Set up	Response	0XA; IW=2 <cr><lf></lf></cr>	
Set up			
	Description	Set the data update interval to 2 seconds, you can choose a value between 1 to 3600	
	Description	Set the data update interval to 2 seconds, you can choose a value between 1 to 3600 seconds.	
Wind speed &	-	seconds.	
Wind speed & average time v	direction		
	direction	seconds.	
average time	direction window	seconds.	
	direction window Send Response	seconds.           AW           0XA; AW=? <cr><lf></lf></cr>	
average time	direction window Send	seconds.          AW         0XA; AW=? <cr><lf>         0XA; AW=5<cr><lf></lf></cr></lf></cr>	
average time	direction window Send Response	seconds.         AW         0XA; AW=? <cr><lf>         0XA; AW=5<cr><lf>         The default average update interval for wind speed &amp; direction data is 5 seconds.</lf></cr></lf></cr>	
average time v	direction window Send Response Description	seconds.         AW         0XA; AW=? <cr><lf>         0XA; AW=5<cr><lf>         The default average update interval for wind speed &amp; direction data is 5 seconds.         The default average update interval for wind speed &amp; direction data is 5 seconds.         The device collects wind speed &amp; direction in 5s intervals and then averages the value.</lf></cr></lf></cr>	
average time	direction window Send Response Description Send Response	seconds.         AW         OXA; AW=? <cr><lf>         OXA; AW=5<cr><lf>         The default average update interval for wind speed &amp; direction data is 5 seconds.         The device collects wind speed &amp; direction in 5s intervals and then averages the value.         OXA; AW=10<cr><lf></lf></cr></lf></cr></lf></cr>	
average time v	direction window Send Response Description Send	seconds.         AW         0XA; AW=? <cr><lf>         0XA; AW=5<cr><lf>         The default average update interval for wind speed &amp; direction data is 5 seconds.         The device collects wind speed &amp; direction in 5s intervals and then averages the value.         0XA; AW=10<cr><lf>         0XA; AW=10<cr><lf></lf></cr></lf></cr></lf></cr></lf></cr>	
average time v	direction window Send Response Description Send Response Description	seconds.         AW         OXA; AW=? <cr><lf>         OXA; AW=5<cr><lf>         The default average update interval for wind speed &amp; direction data is 5 seconds.         The default average update interval for wind speed &amp; direction data is 5 seconds.         The device collects wind speed &amp; direction in 5s intervals and then averages the value.         OXA; AW=10<cr><lf>         OXA; AW=10<cr><lf>         Set the data update interval to 10 seconds, you can choose a value between 1 to 3600</lf></cr></lf></cr></lf></cr></lf></cr>	
average time v Query Setting	direction window Send Response Description Send Response Description	seconds.         AW         0XA; AW=? <cr><lf>         0XA; AW=5<cr><lf>         The default average update interval for wind speed &amp; direction data is 5 seconds.         The device collects wind speed &amp; direction in 5s intervals and then averages the value.         0XA; AW=10<cr><lf>         0XA; AW=10<cr><lf>         Set the data update interval to 10 seconds, you can choose a value between 1 to 3600 seconds</lf></cr></lf></cr></lf></cr></lf></cr>	
average time v Query Setting	direction window Send Response Description Send Response Description nit	seconds.         AW         0XA; AW=? <cr><lf>         0XA; AW=5<cr><lf>         The default average update interval for wind speed &amp; direction data is 5 seconds.         The device collects wind speed &amp; direction in 5s intervals and then averages the value.         0XA; AW=10<cr><lf>         0XA; AW=10<cr><lf>         Set the data update interval to 10 seconds, you can choose a value between 1 to 3600 seconds         US</lf></cr></lf></cr></lf></cr></lf></cr>	

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	Send	0XA; US=K <cr><lf></lf></cr>			
Setting	Response	0XA; US=K <cr><lf></lf></cr>			
Setting	Description	Set unit to km/h			
	Beschption	M = m/s, K = km/h, S = mph, N = knots			
The wind direction offset		DO			
correction val	ue				
Send		0XA;DO=? <cr><lf></lf></cr>			
Query	Response	0XA; DO=0 <cr><lf></lf></cr>			
	Description	The default correction angle for the wind direction is 0.			
	Send	0XA; DO=1 <cr><lf></lf></cr>			
	Response	0XA; DO=1 <cr><lf></lf></cr>			
Setting		Set the wind direction offset to +10°, if the current wind direction is 280°, the corrected wind			
	Description	direction is 290 degrees.			
		The wind correction range is -180° to 180°			
Rainfall Data U	Jpdate Interval	IR			
	Send	0XA;IR=? <cr><lf></lf></cr>			
Query	Response	0XA;IR=10 <cr><lf></lf></cr>			
	Description	The default rain data update interval is 10 seconds.			
	Send	0XA;IR=60 <cr><lf></lf></cr>			
Setting	Response	0XA;IR=60 <cr><lf></lf></cr>			
Setting	Description	Set the data update interval to 60seconds.			
	Description	The interval range is 10 to 3600 seconds.			
Rainfall Unit		UR			
	Send	0XA; UR=? <cr><lf></lf></cr>			
Query	Response	0XA; UR=M <cr><lf></lf></cr>			
	Description	The default rainfall unit is mm			
	Send	0XA; UR=I <cr><lf></lf></cr>			
Setting	Response	0XA; UR=I <cr><lf></lf></cr>			
Setting	Description	Set the units of rainfall to inches			
	Description	M = mm, I = inch.			
Rainfall Count	er Reset Mode	CR			
	Send	0XA; CR=? <cr><lf></lf></cr>			
		0XA; CR=M <cr><lf></lf></cr>			
Query	Response	0XA; CR=M <cr><lf></lf></cr>			
Query	Response Description	0XA; CR=M <cr><lf> Rain counter reset mode is by manual M</lf></cr>			
Query					
Query	Description	Rain counter reset mode is by manual M			
Query	Description Send	Rain counter reset mode is by manual M     0XA; CR=L <cr><lf></lf></cr>			
Query	Description Send	Rain counter reset mode is by manual M         0XA; CR=L <cr><lf>         0XA; CR=L<cr><lf></lf></cr></lf></cr>			
Query Setting	Description Send	Rain counter reset mode is by manual M         0XA; CR=L <cr><lf>         0XA; CR=L<cr><lf>         Set the counter reset mode to overflow reset, and you can select the modes as:</lf></cr></lf></cr>			
	Description Send	Rain counter reset mode is by manual M         OXA; CR=L <cr><lf>         OXA; CR=L<cr><lf>         Set the counter reset mode to overflow reset, and you can select the modes as:         M: Manual reset, reset immediately after sending the reset command (the reset command is</lf></cr></lf></cr>			
	Description Send Response	Rain counter reset mode is by manual M         OXA; CR=L <cr><lf>         OXA; CR=L<cr><lf>         Set the counter reset mode to overflow reset, and you can select the modes as:         M: Manual reset, reset immediately after sending the reset command (the reset command is available under all three communication protocols, as detailed in the different protocol</lf></cr></lf></cr>			
	Description Send Response	Rain counter reset mode is by manual M         OXA; CR=L <cr><lf>         OXA; CR=L<cr><lf>         Set the counter reset mode to overflow reset, and you can select the modes as:         M: Manual reset, reset immediately after sending the reset command (the reset command is available under all three communication protocols, as detailed in the different protocol sections).</lf></cr></lf></cr>			

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Accumulated rainfall		AL	
overflow value	9		
	Send	0XA; AL=? <cr><lf></lf></cr>	
	Response	0XA; AL=80000 <cr><lf></lf></cr>	
Query		The default accumulated rainfall overflow value is 80000, which is measured in the current	
Query	Description	rainfall unit.	
		This overflow value takes effect only if the CR rainfall counter reset mode is set to ${\sf L}$ overflow	
		reset.	
	Send	0XA; AL=1000 <cr><lf></lf></cr>	
Catting	Response	0XA; AL=1000 <cr><lf></lf></cr>	
Setting	Description	When the rainfall is set to 1000 (current unit), the accumulated rainfall will be reset to 0.	
	Description	The overflow value range is 10-80000 (current unit).	
Accumulated	rainfall		
duration overf	low value	DL	
	Send	0XA; DL=? <cr><lf></lf></cr>	
	Response	0XA; DL=2000000 <cr><lf></lf></cr>	
Query		The default rainfall duration overflow value is 2,000,000, the unit is second.	
	Description	This overflow value will only take effect when the CR rainfall counter reset mode is ${\sf L}$ overflow	
		reset.	
	Send	0XA; DL=3600 <cr><lf></lf></cr>	
	Response	0XA; DL=3600 <cr><lf></lf></cr>	
Setting		Set the rainfall duration overflow value to 3600 seconds.	
	Description	It ranges between 100 – 2000000 seconds.	
Clear the accu	mulated		
rainfall		CRA	
	Send	0XA; CRA=1 <cr><lf></lf></cr>	
Setting	Response	0XA; CRA=1 <cr><lf></lf></cr>	
	Description	Clear the accumulated rainfall.	
Clear accumul	ated rainfall		
Duration		CRD	
	Send	0XA; CRD=1 <cr><lf></lf></cr>	
Setting	Response	0XA; CRD=1 <cr><lf></lf></cr>	
	Description	Clear the accumulated rainfall duration.	
		Once the device is powered ,the accumulated value will be calculated and saved. When the	
	Accumulated	accumulated value reaches 80,000 mm, it will be automatically cleared and enter the	
	rainfal	recalculation stage (it will still be saved after power off).	
	Accumulated	Once the device is powered ,the accumulated value will be calculated and saved. When the	
Interpretatio	rainfall	accumulated value reaches 2000000s, it will be automatically cleared and enter the	
n .	duration	recalculation stage (it will still be saved after power off).	
	Rainfall		
	intensity	The accumulated rainfall in the past hour, during which the accumulated value is updated	
	(hourly	every 10s until the accumulated time reaches 1 hour	
	rainfall)		
raintall)			

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Maximum	
rainfall	Maximum rainfall per minute in the past hour *60 minutes
intensity	



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## 4.3 SDI-12

SDI-12 communication adopts three wires, two of which are sensor power supply wires and the other is SDI-12 signal wire.

Each sensor on the SDI-12 bus has a unique address, which can be set to '0', '1' ~ '9', 'A' ~ 'Z', 'A' ~ 'Z'. The SDI-12 address of the SenseCAP ONE defaults to '0'. The instructions supported by this sensor are shown in the next chapter, where each instruction conforms to the SDI-12 v1.4.

The sensor is powered by a DC power supply of 3.6~16V. After the sensor is powered on, it will go into sleep mode immediately and wait for the data acquisition equipment to give instructions. SDI-12 uses baud rate 1200bps, 1 start bit (high level), 7 data bits (high 0 and low 1, anti-logic), 1 even parity bit, and 1 stop bit.

The sequence of each byte sent is shown in the following figure:



### 4.3.1 SDI-12 command and response

#### Command format

- Start with device address 'a', it is 'O'in the following sample.
- End with '!'as a terminator
- The response command end with the <CR><LF>

Query the device	?!
address	
Send	?!
Response	0 <cr><lf></lf></cr>
Description	The sensor at address '0' responded to the query
Query the device	0!
status	
Send	0!
Response	0 <cr><lf></lf></cr>
Description	Address '0' of device online
Query the device	0!!
information	
Send	0!!
Response	014SenseCAPONE3.01019906922104001 <cr><lf></lf></cr>
Description	Response the device information

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	acccccccmmmvv	vxxxxxxxxxxxxx <cr><lf></lf></cr>			
	а	Device address: 0			
	14	SDI-12 protocol version :v1.4			
	сссссссс	Product: SenseCAP			
	mmm	Device series: ONE			
		Software version: 3.0			
	*****	Device serial number: 1019906922104001			
	×				
Modify device	0Ab!	•			
address					
Send	0A1!				
Response	1 <cr><lf></lf></cr>				
Description	Device address 0 is	s changed to 1. The address range is 0-9、A-Z、a	-Z.		
Start Measurement	ом!				
Send	OM!				
	Immediately respo	onse: 00024 <cr><lf></lf></cr>			
Response	After 2s, the respor	nse device's address, means finishing the measu	irement.; 0 <cr><lf></lf></cr>		
	This command is	to start THPL measurement, in order: air ter	mperature, air humidity,		
	atmospheric press	ure, illuminance, but the sensor will not reply to	o the measurement data		
	immediately after receiving this command, but the time required to reply the				
	measurement data and the number of measurements. To obtain measurement data, you				
	must wait until the measurement is completed, and then use the send data command				
	"ODO!" to obtain it.				
	After using this command, the sensor will enter a sleep mode after the measurement to				
Description	save power consumption. After using "continuous measurement command ORO!OR9!", it				
	will exit the low power consumption state.				
	The response form	at is defined as follows:			
	atttn <cr><lf></lf></cr>				
	a	Device address:0			
	ttt -	The time expense to measure data, the unit is			
		seconds.			
	n -	The number of measurements			
Extended	ОМ1!ОМ9!				
Measurement					
Send	0Mn! (n ranges 0~	9)			
	Immediately response: 00024 <cr><lf></lf></cr>				
Response	After 2s, the response device's address, means finishing the measurement.: 0 <cr><lf></lf></cr>				
	0M1!: Start Wind m	easurement: minimum wind direction, maximu	ım wind direction,		
	average wind direction, minimum wind speed, maximum wind speed, average wind				
	speed.				
Description					
	0M2!: Start Rain me	easurement: accumulated rainfall, accumulated	l rainfall time, rainfall		
	intensity, maximum rainfall intensity.				
		-			

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	0M3!: Start Dust	measurement: PM2.5, PM10.	
	0M9!: Start other	measurements: heating temperature, tilt status.	
	0M4!0M8!: rese	rved.	
	After using this command, the sensor will enter a sleep mode after the measurement to save power consumption. After using "continuous measurement command ORO!OR9!", it will exit the low power consumption state.		
	For the definition of reply, please refer to "Start measurement command OM!"		
Read	0D0!0D9!		
measurement			
value			
Send	0D0!		
Response	0+27.65+65.81+10	0+27.65+65.81+100000+5000 <cr><lf></lf></cr>	
Description	responds with th in 0D0!, you ca received.	is used to obtain a set of measurement data in the sensor. The sense ne measurement data. If all the desired measurement data is not return n continue to send OD1!, OD2!, etc., until all the measurement data mat is defined as follows: LF> Device address:0 This the real measurement value. pd.d p is the polarity symbol. the first d is the number before the decimal point. the second d is the data after the decimal point. Note that the decimal point is not necessary. In this example, "+27.65" is the first measurement data, "+65.81" is the second measurement data, "+100000" is the third measurement data, and "+5000" is the fourth measurement data.	ed
Continuous	0R0!0R9!		
measurement			
command			
Send	ORO!		
Response	0+27.65+65.81+10	0000+5000 <cr><lf></lf></cr>	
Description	returned direct measurement p	rom "start measurement command OM!", the measurement value can ly. Each "continuous measurement command" is an independe rocess, for example, ORO! and ORI! are not required before OR2!. inuous THPL measurement: air temperature, air humidity, atmosphe tensity.	ent

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	0R1!: Start Wind	continuous measurement: minimum wind di	rection, maximum wind	
	direction, averag	e wind direction, minimum wind speed, maxim	um wind speed, average	
	wind speed.			
	0R2!: Start Rain	measurement: accumulated rainfall, accumula	ted rainfall time, rainfall	
	intensity, maxim	um rainfall intensity.		
	0R3!: Start Dust c	continuous measurement: PM2.5, PM10.		
	0R9!: Start anoth	0R9!: Start another Continuous measurement: heating temperature, dumping status.		
	0R4!0R8!: reserved.			
	If the sensor was in a low-power working state before, after using this command, the			
	sensor will exit th	sensor will exit the low-power working state.		
Start Measurement	aMC!,aMC1!aM0	C9!,aRC0!aRC9!		
with CRC				
Send	ORCO!			
Response	0+26.52+67.73+10	0280+35JKy		
	To enhance the e	error detection capability of the SDI-12 protocol, "s	start measurement	
	command 0M!", '	'extended measurement command 0M1!0M9!" a	nd "continuous	
	measurement command 0R0!0R9!" can add 16-bit cyclic redundancy check. Add the			
Description	character C after the command character M or R of these commands to form a new			
	command: aMC!,aMC1!aMC9!,aRC0!aRC9!.			
	For the calculation	on of CRC-16, please refer to the SDI-12 protocol v1	.4 document.	
Clear accumulated	0XCRA!			
rainfall command				
Send	0XCRA!			
Response	01 <cr><lf></lf></cr>			
	aN <cr><lf></lf></cr>			
Description	а	Device address:0		
Description	N	Clear success: 1		
		Clear failed: 0		
Clear accumulated	0XCRD!			
rainfall duration				
Send	0XCRD!			
Response	01 <cr><lf></lf></cr>			
	aN <cr><lf></lf></cr>			
	а	Device address:0		
Description	N	Clear success: 1		
		Clear failed: 0		
			1	

## 4.3.2 SDI-12 Read

Wiring the SDI-12



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Seeed





#### Use USB to SDI-12 debugger to communicate with the device



#### The communication settings:

Format	1 start bits, 7 data bits, Even parity, 1 stop bits	
Baud rate	1200bps	
Device address	0x00	

Connect the green wire (GND Data) and yellow wire (SDI-12 Data) to the **USB to SDI-12** debugger.

And connect the red wire (Vin+ power positive) and brown wire (Vin- power ground) to the 12V power supply.

Download the serial port debugging assistant: <u>https://github.com/Neutree/COMTool</u>, and

then open the serial port debugging tool.

- Choose the correct port number
- Set the baud rate to the baud rate of the USB to SDI-12 debugger (note that it is not the baud rate of the SDI-12 protocol)
- Check the "CRLF"
- Click to open the serial port.
- Send the query device address command "?!", if you can see the response "0", it means the connection is OK.



All

rights



COMTool V1.7		– 🗆 X
K 🕈 🕜		ascii 🗸 🔀
Serial Settings	0	
Port COM54 USB 🗸		
Baudrate 9600 🗸		
DataBytes 8		
Parity None 🗸		
Stopbits 1		
rts dtr		
CLOSE		
Receive Settings		
🔵 ASCII 🛛 🔘 HEX	?!	ClearReceive
Auto Linefeed 200 (ms)		
Send Settings		
🔵 ASCII 🕘 HEX		
Scheduled 300		Send
CRLF>	21	
Ready Send(bytes):2	Receive(bytes):3	

#### Start Measurement

Read air temperature, air humidity, barometric pressure, light intensity

Send the "start measurement command OM!", the sensor first responds with "00024", which means that the "OM!" command takes 2 seconds to measure and returns 4 measured values. After 2 seconds, the sensor responds with its own address "0", indicating that the measurement has been completed.

COMTool V1.7	- 0
< 👕 🔞	ascii 🗸 🔀
Serial Settings 00024 0	
Port COM54 U	
Baudrate 9600 🗸	
DataBytes 8	
Parity None 🗸	
Stopbits 1	
rts dtr	
CLOSE	
CLOSE	
Receive Settings	ClearReceive
Receive Settings	CearReceive
Receive Settings ACCII ARX Auto Linefeed 200 (ms) Send Settings	ClearReceive
Receive Settings ASCII HEX Auto (ms) Send Settings ASCII HEX	
Receive Settings ACCII ARX Auto Linefeed 200 (ms) Send Settings	ClearReceive
Receive Settings ACCII HEX Auto Linefeed 200 (ms) Send Settings ACCII HEX Scheduled con	

Then send "Read measurement value command ODO!" to get the 4 measured values of this measurement, which are air temperature +27.01°C, air humidity 64.74%, barometric pressure 100720Pa, and light intensity 10Lux.







- COMTool V1.7		– 🗆 X
< 🕈 🕐		ascii 🗸 🔀
Serial Settings	00024	
Port COM54 U	0+27.01+64.74+100720+10	
Baudrate 9600	3	
DataBytes 8	2	
Parity None	2	
Stopbits 1		
rts dtr		
CLOSE	]	
Receive Settings		
ASCII HEX Auto Linefeed 200 (ms)		ClearReceive
Send Settings		
ASCII HEX		Send
Send(ms) 300		
	000!	

Use extended measurement command 0M1! to read minimum wind direction, maximum wind direction, average wind direction, minimum wind speed, maximum wind speed, average wind speed. The device responds with "00056", which means that the "0M1!" command takes 5 seconds to measure and returns 6 measured values. After 5 seconds, the device responds with its own address "0", indicating that the measurement has been completed.

COMTool V1.7	- 0
< 🕈 🕐 🔄	ascii 🗸
Serial Settings 00056	
Port COM54 U	
Baudrate 9600 🗸	
DataBytes 8	
Parity None 🗸	
Stopbits 1	
rts dtr	
CLOSE	
Receive Settings	
ASCII HEX CMI! Auto (ms) 200	ClearReceive
Auto Linefeed 200 (ms) Send Settings	ClearReceive
Auto Linefeed 200 (ms)	ClearReceive
Auto Linefeed 200 (ms) Send Settings ASCII HEX Scheduled acc	

Then send "Read measurement value command 0D0!" to get the 6 measured values of this measurement, which are minimum wind direction 345.9 degrees, maximum wind direction 347.5 degrees, average wind direction 346.3 degrees, minimum wind speed 2.8m/s, and maximum wind speed 2.8m./s, average wind speed 2.8m/s.





COMTool V	/1.7		- D >
< 👕	?		ascii 🗸 🔀
Serial Sett	ings	00056	
Port	COM54 U 🗸	0+345.9+347.5+346.3+2.8+2.8+2.8	
Baudrate	9600		
DataBytes	8 🗸		
Parity	None 🗸		
Stopbits	1		
rts	dtr		
C	LOSE		
Receive Set	0.160-01		
ASCII Auto Linefee (ms)	• HEX ed 200	000!	ClearReceive
Send Settin			
ASCII Schedul Send(ms	• HEX ed 300		Send
CRLF>		000!	×
		Receive(bytes):43	

Then send "continuous measurement command OR2!, the device returns 4 measured values: cumulative rainfall 1.2mm, cumulative rainfall duration 20 seconds, rainfall intensity 1.2mm/h, maximum rainfall intensity 72.0mm/h.

- COMTool V1.7		- 🗆 X
K 🕈 🛛		ascii 🗸 🖌
Serial Settings	0+1.2+20+1.2+72.0	
Port COM54 U		
Baudrate 9600		
DataBytes 8		
Parity None		
Stopbits 1		
rts dtr		
CLOSE		
Receive Settings		
ASCII HEX	OR2!	ClearReceive
Linefeed 200 (ms)		
Send Settings		
🔵 ASCII 🕚 HEX		
Scheduled Send(ms) 300		Send
CRLF>	0R2!	$\checkmark$
Ready Send(bytes):4	Receive(bytes):15	





# 5 Error code

## 5.1 Modbus error code

Error code	Description	Response instance
0x01	Device do not response	01 84 01 82 C0
0x04	Sensor probe exception	01 84 04 42 C3

## 5.2 ASCII error code

Error code	Description	Response instance
0	Command do not exist	OXA;=#0
1	Device do not response	OXA;AT=#1
3	The command length exceeds the limit,	OXA;=#3
	it needs to be reduced	
4	Sensor probe exception	OXA;AT=#4

## 5.3 SDI-12 error code

Error code	Description	Response instance
2001001	Device do not response	0+2001001+2001001+2001001+2001001 <cr><lf></lf></cr>
2001004	Sensor probe exception	0+2001004+2001004+2001004+2001004 <cr><lf></lf></cr>





# 6 Trouble Shooting

# 6.1 How is the average wind speed and direction calculated?

The default average time window is 5s. Within this window, the device will collect wind speed and direction data five times and return an average value.

## 6.2 Support

Support is provided Monday to Friday, from 09:00 to 18:00 GMT+8. Due to different time zones, we cannot offer live support. However, your questions will be answered as soon as possible in the before-mentioned schedule.

Provide as much information as possible regarding your enquiry (product SKU, accurately describe your problem and steps to replicate it etc.) and send a mail to: <a href="mailto:support@sensecapmx.com">support@sensecapmx.com</a>

Version	Date	Description	Editor
V1.0	7/4/2023	First edition	Jenkin Lu
V1.1	25/4/2023	Add new product Introduction	Xinan Rao
V1.2	8/6/2023	Add trouble shooting	Andrea Ouyang
V1.3	8/12/2023	Modify Document error	Yvonne Meng

## 6.3 Document Version

