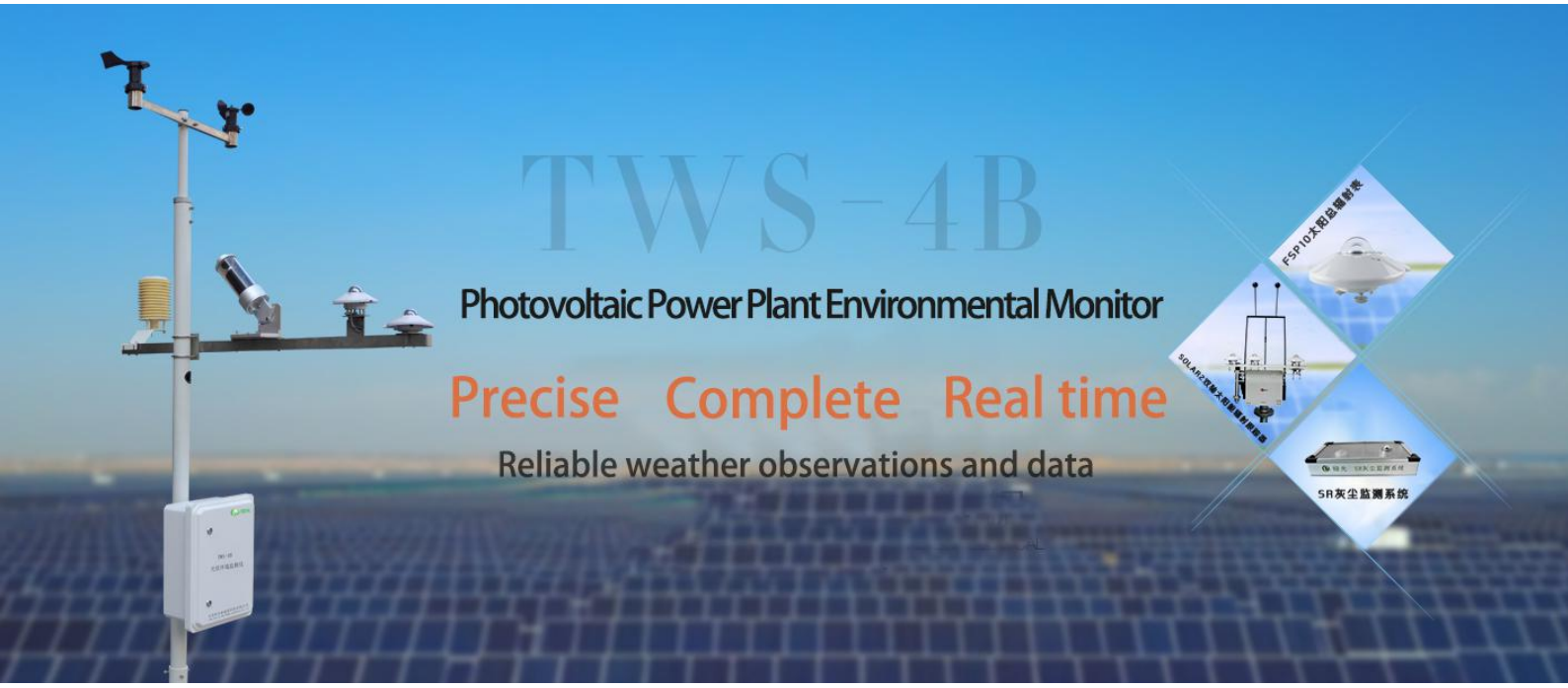
TWS-4B Meteorological Station



Technical Specification

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TWS-4B Meteorological Station

一、System overview 系统概述

Because the weather conditions directly affect the power generation of photovoltaic power station, the core parameters of photovoltaic power station performance evaluation cannot do without accurate meteorological data and solar irradiance data. Meteorological sensors play an important role in the photovoltaic power station monitoring system. Accurate meteorological data is the key to track, evaluate and control the performance parameters of photovoltaic power station. Therefore, each photovoltaic power station monitoring system needs a set of meteorological monitoring sensors and several different types ofpyranometer to calculate the core evaluation index of photovoltaic power station. Therefore, combined with more than ten years of experience in meteorological and solar resource equipment development, MC New Energy has launched TWS-4B Meteorological Station, which is used for photovoltaic power generation site selection, operation and maintenance management, evaluation, scientific research and other tasks, as well as fault warning and other functional purposes.

由于天气状况直接影响光伏电站的发电量，所以光伏电站性能评估的核心参数离不开准确的气象数据和太阳辐照度数据。在光伏电站监测系统中气象传感器发挥重要作用，精确的气象实测数据是跟踪、评估和控制光伏电站性能参数的关键，因此每个光伏电站监测系统都需要一组气象监测传感器和几块不同种类的太阳辐射传感以计算光伏电站核心评估指标。因此绿光新能源结合十多年的气象及太阳光资源设备研制的经验，特推出 TWS-4B 气象站，用于光伏电站的选址、运维管理、气象数据监测、科学研究等任务以及故障预警等功能用途。

TWS-4B Meteorological Station is a kind of meteorological observation system which is easy to be installed quickly, with high measurement accuracy, high reliability and maintenance free. Fsp10 pyranometer with high precision and high annual stability, which meet the international standard iso9060, have perfect cosine characteristics, fast response, class B zero offset and wide temperature response performance, And it has the precision and stability of the Kipp&Zonen CMP21 Secondary Standard pyranometer, which reduces the cost of irradiance measurement resources of photovoltaic power station. The monitoring parameters and requirements of the Meteorological Station can be selected according to IEC61724 standard, and the grade meets the requirements of IEC 61724 standard. Meteorological elements and parameters such as Global horizontal irradiance (GHI), in-plane irradiance (POA), Diffuse irradiance (DHI), Albedometers, wind direction sensor, wind direction sensor, ambient temperature, environmental humidity, component temperature sensor, atmospheric pressure sensor, rainfall sensor, Soiling ratio and other meteorological elements and parameters can be selected.

TWS-4B 气象站是一款便于快速安装，测量精度高，可靠性高、免维护集成多项气象要素的气象观测系统。分别采用了高精度，高年稳定性的符合国际标准 ISO9060 相关等级的 FSP10 太阳辐射传感器，具有完美的余弦特性、快速响应、B 类零点偏移和宽温度响应的性能，非常适合太阳能行业的光资源监测需要。而且具有与 Kipp&Zonen CMP21 二等标准总辐射表的精度和稳定性，降低了光伏电站测光资源的成本费用。该气象站监测的测量参数和要求可以根据 IEC61724 标准进行选择，等级符合 IEC61724 标准要求。可以选择水平面太阳总辐射（GHI）、组件阵列平面太阳总辐辐射（POA）、太阳散射辐射（DHI）、反射率计、风向传感器、风向传感器、环境温度、环境

湿度、组件温度传感器、太气压力传感器、雨量传感器、灰尘监测仪等气象要素和参数。

二、Design Basis and Implementation Standards 设计依据及执行标准

1) GB/T33703-2017 Automatic Weather Station Observation Code
2) QXT 520-2019 Code for Surface Meteorological Observation China Meteorological Bureau
3) Q-GDW 1996-2013 Technical Specification for Meteorological Element Monitoring of Photovoltaic Power Prediction
4) QX-T 89-2018 Solar resource assessment methodology
5) Technical Specification for Integrated Technical Monitoring Platform for Leading Base of Photovoltaic Power Generation
6) IEC 61724-1 2017 Photovoltaic system performance –Part 1: Monitoring
7) ISO9060:2018 Solar energy-Specification and clsaafication of instruments for measuring

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hemispherical solar and direct solar radiation

8) Guangdong Provincial Landmark "Technical Specification for Evaluation of Grid-connected Photovoltaic Power Stations" MC New Energy Drafting

9) IEC 61000-4-（2、3、4、5、8）:2014 Electromagnetic compatibility (EMC) - Part 4-5: Testing and measurement techniques

1）GB/T33703-2017 自动气象站观测规范

2）QXT 520-2019 自动气象站

3）Q-GDW 1996-2013 光伏发电功率预测气象要素监测技术规范

4）QX-T 89-2018 太阳能资源评估方法

5）光伏发电领跑基地综合技术监测平台技术规范

6）IEC 61724-1 2017 光伏系统性能 –第 1 部分：监控

7）ISO 9060:2018 太阳能-测量半球形太阳和太阳直接辐射的仪器的规范和分类

8）广东省地标《并网光伏电站评价技术规范》绿光新能源起草主编气象章节

9）IEC 61000-4-（2、3、4、5、8）:2014 电磁兼容性（EMC）第 4 部分：试验和测量技术

三、Functional characteristics 功能特点

1. Appearance and performance 外观及性能:

a. Excellent EMC design and strict environmental adaptability design can be used in harsh environments, with high measurement accuracy, high stability and reliability. The technical specifications of products meet the requirements of meteorological observation specifications；

b. The protection level of double-deck chassis design is IP66, An inner case is a polymer composite, and an outer SUS304 plastic,which can work all day in all kinds of harsh field environment; the protection level of fast waterproof plug is IP68; independent patent technology, patent number: 2015 2 0109223.1。（ (Optional single and double layers)

a.卓越的电磁兼容设计和严格的环境适应性设计,可在恶劣的环境中使用，测量精度高，稳定性可靠，产品技术指标符合气象观测规范要求；

b. 双层机箱设计整机防护级别为 IP66 级，内机箱为高分子复合材料，外为 SUS304 喷塑，可在各类恶劣的野外环境下全天候工作; 快速防水插头防护级别为 IP68; 自主专利技术，专利证号：2015 2 0109223.1。

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C. Real time reliability test: Electromagnetic compatibility (EMC) 可靠性实时性测试：EMC 电磁兼容

Description of Test Item	Standard	Class	Test Method	Rating	NOTE
COLD 低温	GB/T 2423.1	-40℃	-40℃，Test for 72 hours	ClassII	In EMC test, class A indicates that the data is normal during and after the test, and level B indicates that the data has abnormal value during the test
Dry heat 高温	GB/T 2423.2	85℃	+ 85℃，Test for 72 hours	ClsaaIII	
Electrostatic discharge (ESD) 静电放电抗扰度	IEC 61000-4-2	Class 4	8KV	ClassA	
Continuous Radio Frequency Dissturbances 射频辐射抗扰度	IEC 61000-4-3	Class3	10V/M，80MHZ-1000MHZ	ClassA	

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Electrical Fast Transient(EFT) 瞬变脉冲抗扰度	IEC 61000-4-4	Class4	4KV，100KHZRepetition rate，Test for 60S	ClassA	process, but the equipment can automatically recover and the data is normal after the experiment
Surges 浪涌抗扰度	IEC 61000-4-5	Class4	DC + - 2KV	ClassA	
Power frequency magnetic field 工频磁场抗扰度	IEC 61000-4-8	Class5	2KV continuous stable 100A / M test	ClassA	

2.High precision, high reliability, easy to install sensor, high quality, accurate and available measurement data.

2.1 Pyranometer GHI and Pyranometer POA

The MS-802 ISO 9060:2018 Class A (Secondary standard) pyranometer is a reliable reference sensor to measure global broad-band radiation with high precision. It is used as a standard in PV research and climatological studies around the world.

A high quality double-dome construction is adopted to improve the accuracy of the measurement and to minimize unwanted thermal offsets. The ventilation unit of the MS-802F model will reduce the deposition of dust, dew, frost, snow.

The MS-802 pyranometers are manufactured in a consistent way followed by strict quality inspection and performance evaluation. For each sensor the directional response and temperature dependency are measured and validated through a measurement report that comes with the sensor. EKO provides a unique calibration compliant to the international standards defined by ISO9847.。

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ISO 9060:2018	Class A
ISO 9060:1990	(Secondary Standard)
Sub-category "Spectrally flat"	Compliant
Sub-category "Fast response"	Not compliant
Output	Analog (mV)
Response time 95%	< 5 Sec.
Zero off-set a) 200W/m²	< 6 W/m²
Zero off-set b) 5K/hr	+/- 2 W/m²
Non-stability change/1 year	+/- 0.5 %
Non-linearity at 1000W/m²	+/- 0.2 %
Directional response at 1000W/m²	+/- 10 W/m²
Spectral error	+/- 0.23 %
Temperature response -10°C to 40°C	+/- 1 %
Temperature response -20°C to 50°C	+/- 1 %
Tilt response at 1000W/m²	+/- 0.2 %
Sensitivity	Approx. 7 µV/W/m²
Impedance	Approx. 500 Ω
Operating temperature range	-40 - 80 °C
Irradiance range	0 - 4000 W/m²
Wavelength range	285 - 3000 nm (50% points)
Ingress protection IP	67
Cable length	10 m

NOTE：By using one MS802 pyranometer and Shadow Ring，Can measure Diffuse irradiance.
By using two separate MS802 pyranometers with a mounting fixture (plate and rod)，Can measure Albedo.

2.2 .PY-FS01 Wind Speed Sensor

Applied for the wind speed monitor in engineering machinery leasing, hoist, factory, electric power, port machinery, mine industry, photovoltaic fields.

Major functions and features:

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• Adopt contactless magnetic sensing principle, excellent anti-interference ability, high reliability
• Wide operating voltage, low threshold, wide meausrement range
• The shaft of cup adpots three phase protection structure design, the IP rate reaches 65
• Multi-level surge protection design
• Sensor adopts fault-tolerant design, sensor will not be damaged even wrong wiring
• Module design for wind cup, PCB, easy installation, free of debug, applicable for various conditions.

Operating voltage	DC12V-DC30V	Operating voltage	<35mA
Threshold	≤0.5m/s	Wind load	>70 m/s
Measurement range	0.5~60m/s(Can be customized)	Resolution	0.1m/s
Surge protection	4kV/2kA	ESD protection	15kV
Accuracy:±0.3m/s（2m/s）			
Operating temperature	-40℃~+70℃	Humidity	0%~95%(No coagulation)
Body material	PC+ABS	IP rate	IP65
Cup material	PC+ABS	Bearing material	Stainless steel440C
Weight	200g		

2.3 .PY-FX01 Wind direction sensor

Applied for the wind speed monitor in engineering machinery leasing, hoist, factory, electric power, port machinery, mine industry, photovoltaic fields.

Major functions and features ：

• Adopt contactless magnetic sensing principle, excellent anti-interference ability, high reliability

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- Wide operating voltage DC18V-DC30V, low threshold, wide meausrement range
- The shaft of cup adpots three phase protection structure design, the IP rate reaches 65
- Multi-level surge protection design
- Sensor adopts fault-tolerant design, sensor will not be damaged even wrong wiring
- Module design for wind vane, PCB, easy installation, free of debug, applicable for various conditions.

Operating voltage	DC12V-DC30V	Operating voltage	<35mA
Threshold	≤0.5m/s	Wind load	>70 m/s
Measurement range	0~360°	Resolution	0.35°
Accuracy	±2°		
Surge protection	4kV/2kA	ESD protection	15kV
Operating temperature	-40℃~+70℃	Humidity	0%~95%(No coagulation)
Body material	PC+ABS	IP rate	IP65
Cup material	PC+ABS	Bearing material	Stainless steel440C
Weight	230g		

2.4. PTWD-2AF temperature sensor

The PT100 platinum resistance temperature sensor uses the characteristic of metal platinum to change its temperature when the temperature changes. The display instrument will indicate the temperature value corresponding to the resistance value of platinum resistance. It has high accuracy and good stability. High reliability, long product life and wide application temperature range. It is the most commonly used temperature detector in the low and medium temperature range (-200 ～ 650 ℃). It is not only widely used in industrial temperature measurement, but also made into various standards. Thermometers (covering national and world reference temperatures) are used for metering and calibration.



Range	–40 to 105℃

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Accuracy	0.1°C @20-50°C
Response time	2s

2.5 PTWS-3 Relative Humidity Sensor

PTWS-3 is an excellent temperature and relative humidity sensor. Provide customers with accurate and reliable measurement methods. The linearly amplified voltage output allows the sensor to be connected to the controller. Resistant to strong chemical corrosion, no need to avoid light, no anti-static, short recovery time after high humidity

PTWS-3 humidity can be widely used in meteorological observation and forecasting, road environmental monitoring, civil aviation, industrial testing and other fields. In order to make the sensor more accurate measurement by eliminating the environmental impact and have a longer service life, we recommend that you equip it with a radiation shield or install it in a louver.

Range	0-100%
Accuracy	±1.5%RH@0~80℃
Response time	4s

2.6 .MC600 Six Elements Integrated Micro Meteorological Station （All in one)

Micro weather station is also called weather intelligent integrated sensor or Internet of things sensor, using ultrasonic and radar measurement principle. It is a compact, high precision, high reliability and maintenance free multi factor integrated sensor.MC600 adopts IP66 anodized aluminum alloy shell or polymer plastic shell, MC600 adopts 8-24V DC power supply, and Military grade aluminum alloy, high corrosion resistant connector, which is convenient for quick installation.Including Temperature and Relative Humidity Probe、Wind speed Sensor、 Wind direction Sensor、Barometric Pressure Sensor and Rainfall.

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It has the following characteristics:

1). Professional intelligent weather sensor with digital interface.

2). There are no mechanical parts in the design of ultrasonic wind speed and direction sensor.

3). High integration, high precision, high reliability, maintenance-free intelligent measurement sensor.

4). * * the rainfall is measured by 24GHz Doppler radar, and the data acquisition adopts 1msps, 16 bit ADC, with high precision and fast speed, which ensures the accuracy of later data processing and improves the resolution of rainfall collection data and the accuracy of rainfall.

5) * *high performance ARM + FPGA integrated SOC architecture is adopted to improve the resolution of wind speed data collection and the accuracy of rainfall the firmware supports remote wireless upgrade.

SIZE 尺寸	Ø 118mm * 198mm(H)；weight：0.8kg
IP Class 防护等级	P66，Body material：Anodized aluminium alloy or engineering plastics IP66，主体材质：阳极氧化铝合金或工程塑料
Air Temperature Sensor 环境温度传感器	Range：–40 to 105℃ Resolution：0.01℃ Accuracy：0.1°C @20-50°C Response time：2s
Relative Humidity Sensor 相对湿度传感器	Range：0-100% Accuracy：±1.5%RH@0~80℃ resolution：0.01% Response time：4s
Wind speed Sensor 风速传感器	Range：0～70m/s Resolution：0. 1m/s Accuracy：±0.2m/s @0-10m/s、±2% @>10m/s Type:ultrasonic measurement principle 超声波原理
Wind direction sensor 风向传感器	Sensor range ：0～360° Accuracy ：1° resolution：±1° Type:ultrasonic measurement principle 超声波原理
Barometric Pressure Sensor 气压传感器	Range:450~ 1100 hPa（Extended :10-1200hpa) Accuracy:±0.3hPa Resolution : 0.012hpa Long term stability:±1（hpar/yr)
Rainfall 雨量传感器	Resolution of liquid precipitation:0 .1 / 0.2 / 0.5 / 1.0 mm Droplet diameter: 0.3-5.0 mm Type:Doppler radar measurement principle 多普勒雷达原理
Rain intensity 雨强	Range：0.1...200mm/h rThe falling speed of particulate matter ：0.9... 15.5m/s Accuracy: ± 10% (typical value of simulating 0.5mm diameter raindrop)

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2.7 Surface Temperature Sensors

The PT100 platinum resistance temperature sensor uses the characteristic of metal platinum to change its temperature when the temperature changes. The display instrument will indicate the temperature value corresponding to the resistance value of platinum resistance. It has high accuracy and good stability. High reliability, long product life and wide application temperature range. It is the most commonly used temperature detector in the low and medium temperature range (-200 ～ 650 ℃). It is not only widely used in industrial temperature measurement, but also made into various standards.Thermometers (covering national and world reference temperatures) are used for metering and calibration.

Range	-30～+135℃
Accuracy	±0.2℃

2.8 CR1000X Data Loggers

The CR1000X is a low-powered device designed to measure sensors, drive direct communication and telecommunications, analyze data, control external devices, and store data and programs in on-board, non-volatile storage. The electronics are RF-shielded and glitch-protected by a unique sealed, stainless-steel canister. A battery-backed clock assures accurate timekeeping. The on-board, BASIC-like programming language—common to all Campbell Scientific data loggers—supports data processing and analysis routines.

The CR1000X wiring panel includes two switchable 12 V terminals, analog grounds dispersed among 16 analog terminals, and unpluggable terminal blocks for quick deployment.

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-NOTE-	Additional specifications are listed in the CR1000X Specifications Sheet.
Operating Temperature Range	-40° to +70°C (standard) -55° to +85°C (extended) Non-condensing environment
Maximum Scan Rate	1000 Hz
Case Material	Anodized aluminum
Analog Inputs	16 single-ended or 8 differential (individually configured) Two analog inputs can measure 4 to 20 mA or 0 to 20 mA natively. Four analog inputs can provide pulse/digital I/O functions.
Pulse Counters	10 (P1 to P2 and C1 to C8)
Voltage Excitation Terminals	4 (VX1 to VX4)
Maximum Source/Sink Current	±40 mA (voltage excitation) 50 mA (switched regulated)
Communications Ports	Ethernet USB Micro B CS I/O RS-232 RS-422 CPI RS-485
Data Storage Ports	microSD
Switched 12 Volt	2 terminals
Digital I/O	8 terminals (C1 to C8) configurable for digital input and output. Includes status high/low, pulse width modulation, external interrupt, edge timing, switch closure pulse counting, high-frequency pulse counting, UART, RS-232, RS-485, SDM, SDI-12, I2C, and SPI function. Terminals are configurable in pairs for 5 V or 3.3 V logic for some functions.
Input Limits	±5 V
Analog Voltage Accuracy	Accuracy specifications do not include sensor or measurement noise.

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	±(0.04% of measurement + offset) at 0° to 40°C ±(0.06% of measurement + offset) at -40° to +70°C ±(0.08% of measurement + offset) at -55° to +85°C (extended temperature range)
ADC	24-bit
Power Requirements	10 to 18 Vdc input
Real-Time Clock Accuracy	±3 min. per year (Optional GPS correction to ±10 µs)
Internet Protocols	Ethernet, PPP, CS I/O IP, RNDIS, ICMP/Ping, Auto-IP(APIPA), IPv4, IPv6, UDP, TCP, TLS (v1.2), DNS, DHCP, SLAAC, SNMPv3, NTP, Telnet, HTTP(S), FTP(S), SMTP/TLS, POP3/TLS
Communication Protocols	CPI, PakBus, SDM, SDI-12, Modbus, TCP, DNP3, UDP, NTCIP, NMEA 0183, I2C, SPI, and others
Battery-backed SRAM for CPU Usage & Final Storage	4 MB
Data Storage	4 MB SRAM + 72 MB flash (Storage expansion of up to 16 GB with removable microSD flash memory card.)
Idle Current Drain, Average	< 1 mA (@ 12 Vdc)
Active Current Drain, Average	1 mA (1 Hz scan @ 12 Vdc) 55 mA (20 Hz scan @ 12 Vdc)

2.9 SR Dust Soiling Measurement System （Soiling Ratio）

By using the principle of all-band optical pollution measurement (BOSM) technology, the SR value of dust is measured and calculating the SR value of dust, from 1 (completely clean) to 0 (completely blurred). The cleanliness has been reduced from 100% to 0%. It can make investors find a balance between power generation efficiency and cleaning cost. The operation and maintenance personnel of the power station can choose the best cleaning scheme scientifically and accurately without experience and visual inspection, thus avoiding the loss of power generation efficiency and the waste of cleaning cost. It can effectively improve the income of the power station and the return on investment of investors.

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It has the following characteristics:

1）By using the principle of all-band optical pollution measurement (BOSM) technology，Coincidence cell absorption spectrum.

2）Accurately know when and where to clean and reduce costs.

3）Small in size, simple to install.

4）Small panels use solar industry standard materials

5）No maintenance is required, just clean the PV module in the same way.

6）Patent technology,low power consumption, ModbusRS-485 digital communication

Soiling Ratio (SR) range	Dual sensor value:50-100% measurement accuracy 5% Sensor accuracy:5%
Soiling Ratio accuracy	90 to 100 %：± 1 % 80 to 90 %：± 2 % 50 to 80 % ：± 5 %
Communication	RS485 Modbus 0r voltage Or LORA
working temperature	-40℃-+70℃
Working humidity	5%-100%

三、Measured parameters and requirements for each Meteorological Element

Table 1 lists measured parameters defined by this document and a summary of measurement requirements. The purpose of each monitoring parameter is listed in Table 1 in order to guide the user.

A check mark (√) in Table 1 indicates a required parameter to be measured on site, qualified by specific notes where included.

Table 1 lists the minimum number of on-site sensors, in many cases by reference to Table 2.Where no number is given, only one sensor is required, although redundant sensors are typically advisable. When

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multiple sensors are required, they shall be distributed throughout the PV plant, or placed at monitoring points indicated in the table. If the plant includes multiple sections that have different PV technology types or substantially different local geography, then at least one sensor shall be placed in each section.

The symbol “E” in Table 1 indicates a parameter that may be estimated based on local or regional meteorological data or satellite data, rather than measured on site.

Empty cells in Table 1 indicate optional parameters that may be chosen for specific system requirements or to meet project specifications.

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Table 1 – Description of meteorological elements

Parameters	Symbol	Unit	Monitoring purposes	Required		Number of sensors
				A High-precision	B Medium accuracy	
in-plane irradiance (POA)	*Gi*	W /m^{-2}	Solar energy resources	√	√ or E	Table 2 column 1
Global horizontal irradiance	*GHI*	W/ m^{-2}	Solar energy resources	√	√ or E	Table 2 column 1
Direct normal irradiance	*DNI*	W/ m^{-2}	Solar resource, concentrator	√ for CPV	√ or E	Table 2 column 1
Sunshine hours		h	Solar resource, concentrator	Computing	√ or E	Table 2 column 1
Diffuse irradiance	*DHI*	W/ m^{-2}	Solar resource, concentrator	√ for Type of power station with double sided components	√ or E	Table 2 column 1
Two-axis solar radiation tracker			Solar energy resources, Gi can be installed GHI, DNI, Gd radiation	√ for CPV		Matching with the number of solar radiation sensors
Tracking Oblique irradiance	*Gi*	W/ m^{-2}	Solar Energy Resources with Different Module Arrays	√ forTracking PV support station type		According to the statistics, the number of installation modes of adjustable components in the power station yard area is determined
Photosynthetic active radiation	*G*	μmols-1m-2	Assessment of the effect of photosynthetic active radiation on crops at stations	√		Agro-Optical Complementary Photovoltaic Power Station
Albedometers		%	Solar resource, concentrator	√ for Type of power station with double		Table 2 column 1

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				sided components		
ambient temperature	T_{amb}	°C	Measuring the correlation between ambient temperature and historical data and estimating PV temperature	√	√ or E	Table 2 column 1
ambient humidity	*RH*	%	Estimation of spectral variations	√	√ or E	Table 2 column 1
wind speed		m s^{-1}	Estimation of PV temperatures	√	√ or E	Table 2 column 1
wind direction		degrees		√	√ or E	Table 2 column 1
rainfall		mm	Estimation of soiling losses	√		Table 2 column 1
PV module temperature	T_{mod}	°C	Measurement of temperature-related loss	√	√ or E	Table 2 column 2
Soiling ratio	*SR*	%	Determining soiling-related losses	√ ,If conditions permit, match first, so as to facilitate operation and maintenance		Table 2 column 1

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Table 2 – Relation between system size (AC) and number of sensors for specific sensors referenced in Table 1

System size (AC)	Number of sensors	
	line1	line2
< 5 MW	1	6
≥ 5 MW to < 40 MW	2	12
≥ 40 MW to < 100 MW	3	18
≥ 100 MW to < 200 MW	4	24
≥ 200 MW to < 300 MW	5	30
≥ 300 MW to < 500 MW	6	36
≥ 500 MW to < 750 MW	7	42
≥ 750 MW	8	48

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四、Configuration list (Each set of Meteorological stations)

No	ITEM DESCRIPTION	TYPE	UNIT	Q'ty
1	temperature sensor	PTWD-2AF	SET	1
2	Pyranometer GHI	MS802	SET	1
3	Pyranometer POA	MS802	SET	1
4	Wind Speed Sensor	PY-FS01	SET	1
5	Wind direction sensor	PY-FX01	SET	1
6	Surface Temperature Sensors	PTWD-3F	SET	6
7	Datalogger	MC1000	SET	1
8	silicon-based radiation sensor	Si-RS485TC-T-MB	SET	2
9	Mast with Base, Guy Cables, and Grounding Kit	TWS-FG3	SET	1
10	Communication system	RS485	SET	1
11	lightning conductor	standard	SET	1
12	smoke proof	standard	SET	1
13	transport	standard	PCS	1

NOTE:

1. According to the instructions of the Table 1–Description of meteorological elements, you can choose the meteorological elements to meet the needs of customers.

根据表 1 气象要素说明，选择气象要素满足客户需求。

2. Optical power prediction power station needs to be equipped with solar direct radiation（DHI) and solar scattering radiation sensors(DNI) to meet customer needs.

光功率预测电站，需要另外选配太阳直接辐射和太阳散射辐射传感器，满足客户需求。

3. The power station with double-sided assembly needs to be equipped with solar reflectivity sensor to meet customer needs.

采用双面组件的电站，需要另外选配太阳反射率传感器，满足客户需求。

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