Solar ultraviolet radiation sensor

TBQ-UA Series

TBQ-UA 系列太阳紫外辐射传感器

TBQ-UA series solar ultraviolet radiation sensor

一、产品概述：

Product overview

TBQ-UV 型紫外辐射表被用来测量大气中的太阳紫外辐射（UVAB 波长范围）的精密仪器。该仪器与数据采集器配合使用可提供公众所关心的信息：UV 指数、UV 红斑测量、UV 对人体影响及 UV 特殊的生物学和化学效应。因此备受气象、工业、建筑及医学方面的重视，广泛应用于暴晒引起的红斑剂量、综合环境生态效应、气候变化的研究及紫外线监测和预报。

The TBQ-UV type ultraviolet radiation meter is a precision instrument used to measure solar ultraviolet radiation (UVAB wavelength range) in the atmosphere. When used in conjunction with data collectors, it provides information of public concern: UV index, UV erythema measurement, effects of UV on the human body, and special biological and chemical effects of UV. Therefore, it is highly valued in meteorology, industry, construction, and medicine, and is widely applied in research on redness caused by sun exposure, comprehensive environmental ecological effects, climate change, as well as UV monitoring and forecasting.

二、测量原理：

measuring principle

TBQ-UV 系列紫外辐射表是用来测量大气中的太阳紫外辐射（UVAB/UVA/UVB 波长范围）的精密仪器。TBQ-UV 紫外辐射表广泛应用于暴晒引起的红斑剂量、综合环境生态效应、气候变化的研究及紫外线监测和预报。

TBQ-UV 系列紫外辐射表广泛应用于暴晒引起红斑剂量、紫外光波对植物的影响分析、环境、建筑、材料老化、大气污染、医疗、综合环境生态效应、气候变化的研究及太阳紫外线观测和预报。

TBQ-UV series ultraviolet radiation meter is a precision instrument used to measure the solar ultraviolet radiation (UVAB/UVA/UVB wavelength range) in the atmosphere. TBQ-UV ultraviolet radiation meter is widely used in the study of red spot dose caused by exposure, comprehensive environmental ecological effects, climate change, ultraviolet monitoring and forecast.

The TBQ-UV series of ultraviolet radiation meters are widely used in the study of sunburn dose caused by exposure, the influence of ultraviolet light on plants, environmental, building, material aging, air pollution, medical treatment, comprehensive environmental ecological effects, climate change, and solar ultraviolet observation and forecast.

三、产品特点：

Product features

1、产品遵循 WMO 规范，ISO 9060:2018 国际标准，ISO/IEC 17025 校准标准。

2、防潮防腐蚀，适用于各种恶劣环境，满足客户多种需求。

3、内置温度补偿装置，减少温度对辐射表的影响，特殊工艺镀膜滤光片，余弦响应度高，精确测量。

4、结构简单，安装方便，高承受能力，体积小，优质航空插头，防水线缆。

1.The product complies with WMO specifications, the ISO 9060:2018 international standard, and the ISO/IEC 17025 calibration standard

2. Moisture-proof and corrosion-resistant, suitable for various harsh environments to meet diverse customer needs.

3. Equipped with a built-in temperature compensation device to minimize the impact of temperature on the radiometer, featuring a specially treated coated filter with high cosine response for precise measurement.

4. Simple structure, easy installation, high load capacity, compact size, high-quality aviation connectors, waterproof cables.

四、应用范围：

Application scope

太阳紫外辐射传感器是精准检测太阳紫外线（UV）辐射强度的专业传感设备，核心用于紫外辐射量的定量监测与数据采集，凭借精准的检测性能和环境适应性广泛应用于气象观测、环境监测、光伏电力、农业种植、建筑科研、公共健康等多个领域。

The solar ultraviolet radiation sensor is a professional sensing device that accurately detects the intensity of solar ultraviolet (UV) radiation. Its core is used for quantitative monitoring and data acquisition of UV radiation. With accurate detection performance and environmental adaptability, it is widely used in meteorological observation, environmental monitoring, photovoltaic power, agricultural planting, building research, public health and other fields.

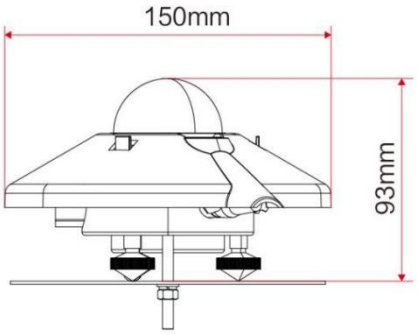
五、技术指标：

Qualification

光谱范围 Spectral coverage	280～400nm(UVAB)，315～400nm(UVA)，280～315nm(UVB)
信号范围 Signal range	0～300W/m^2(UVAB)，0～300W/m^2(UVA)，0～10W/m^2(UVB)
输出信号	0～20mV，RS485

Output signal	
灵 敏 度 Sensitivity	10～500μV/W•m^{-2}
响应时间 Response time	≤10 秒(99%)
内　　阻 Internal resistance	＜30Ω
年稳定度 Annual stability	≤±2%
余弦响应 Cosine response	≤4%(太阳高度角 30° 时)(Sun altitude Angle 30)
非 线 性 Nonlinear	±2%
温度误差 Temperature error	±2%
工作环境温度 Operating ambient temperature	-50℃～+100℃
工作环境湿度 Work environment humidity	0%～100%RH
重　　量 Weight	0.8kg（不含线缆）
产品尺寸 Product dimensions	Φ150×93(mm)
产品清单 Product List	太阳紫外辐射传感器一台 线缆一根 3 米 One solar ultraviolet radiation sensor A 3-meter cable

六、产品尺寸图:
Product size diagram

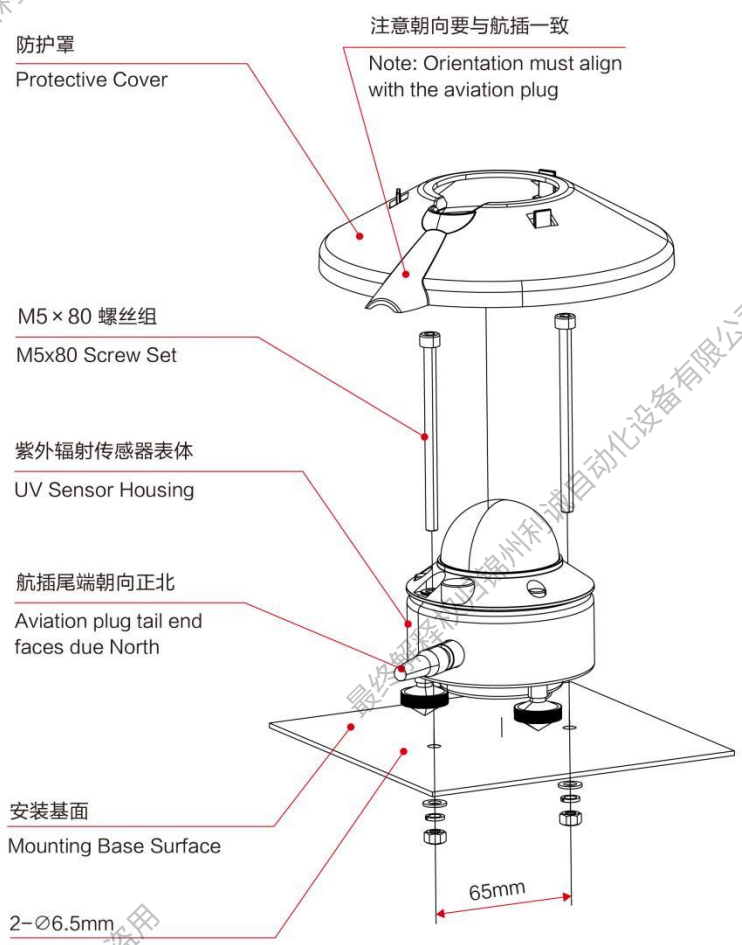


传感器主视图（单位：mm）

Front view of sensor (unit: mm)

七、安装示意图：

Installation diagram



八、传感器安装说明：

Sensor installation instructions:

TBQ-UV 紫外辐射系列传感器通常水平安装，传感器测量的都是入射到与传感器感应面表面平行的平面上的辐射量。

紫外辐射传感器的安装位置应视野开阔，特别是在一年当中日出和日落方位应没有大于 5° 的遮挡物，可选在地面或楼顶平台安装，设置专用的立柱或平台。在台柱上部固定一块比紫外辐射传感器底座稍大的金属板作为安装基面，并与仪器的接触面有良好的隔热。立柱平台离地面约 1.5m，要求牢固，即使受到严重冲击振动(如大风等)，也不改变仪器的水平状态。为了获得更高精度的测量，我们建议用户使用加热通风罩。

安装时，先把紫外辐射传感器的白色防护罩卸下，再将紫外辐射传感器安装在台上，仪器上插出线端方向朝北，用螺钉将仪器初步定在安装基面上，然后利用仪器上所附的水准泡，调整底座上调节脚，使紫外辐射传感器的感应面处于水平状态，然后固定安装螺钉，最后将白色防护罩装上。TBQ-UV 固定安装注意事项见表 1：

The TBQ-UV series of UV radiation sensors are usually installed horizontally. The sensors measure the amount of radiation incident on a plane parallel to the surface of the sensor's sensing surface.

The installation position of the UV radiation sensor should have an open field of view, especially ensuring that there are no obstructions larger than 5 degrees at sunrise and sunset throughout the year. It can be installed on the ground or a rooftop platform, with a dedicated column or platform set up. A metal plate slightly larger than the base of the UV radiation sensor should be fixed to the top of the column as the mounting surface, ensuring good thermal insulation between it and the instrument. The column platform should be about 1.5 meters above the ground, securely mounted so that even under severe impact vibrations (such as strong winds), the horizontal state of the instrument remains unchanged. To achieve higher measurement accuracy, we recommend users use a heated ventilation hood.

When installing, first remove the white protective cover of the UV radiation sensor, then install the UV radiation transmitter on the platform. The instrument's aviation plug should point north. Use screws to initially secure the instrument to the installation base. Next, use the level bubble attached to the instrument to adjust the adjustment feet on the base, ensuring that the sensing surface of the UV radiation sensor is level. Then fix the mounting screws, and finally reinstall the white protective cover. For TBQ-UV fixed installation precautions, see Table 1:

表 1　TBQ-UV　紫外辐射系列传感器固定安装注意事项

Table 1 Precautions for the fixed installation of TBQ-UV series UV radiation sensors

机械固定 Mechanical fixation	用附件中的螺钉将紫外辐射传感器固定在安装底板上。 Attach the UV radiation sensor to the mounting plate with screws in the attachment.

安装位置 Installation site	应该避免在太阳光入射路径和仪器之间摆放物品，以防止在仪器上产生阴影。 Items should be avoided between the path of sunlight and the instrument to prevent shadows from being created on the instrument.
水平校准 Horizontal alignment	如果是水平固定，使用仪器上的水准泡需要耐心多次调整水平调节脚。 If the level is fixed, it takes patience to adjust the level feet many times when using the bubble on the instrument.
安装方向 Installation direction	接线端朝北。 The wiring terminal faces north.
安装高度 Mounting height	如果是倒置安装的话，WMO 建议安装在离地面不低于 1.5 米的高度。 If installed upside down, the WMO recommends installing it no less than 1.5 meters above the ground.

九、设备使用

Equipment use

为了获得连续的测量数据，TBQ-UV 紫外辐射系列传感器需要连接数据采集系统。

TBQ-UV 紫外辐射系列传感器中 0～20mV 输出设备是一个无源传感器，它不需供电。电缆实际上接收电容噪声，是一个失真信号源。一般说来建议尽可能缩短数据采集器或放大器与传感器之间的距离。

TBQ-UV 紫外辐射系列传感器中 RS485 输出设备是有源传感器，供电电压 9-36V，传感器功耗电流小于 50mA。在使用时，需要按照正确接线供电。

参照表 2 正确连接传感器电缆至数据采集系统:

In order to obtain continuous measurement data, the TBQ-UV UV radiation series sensor needs to be connected to the data acquisition system.

The 0~20mV output device in the TBQ-UV UV radiation series sensor is a passive sensor that does not require power supply. The cable actually receives capacitive noise and is a source of distorted signal. Generally, it is recommended to minimize the distance between the data collector or amplifier and the sensor.

In the TBQ-UV series of UV radiation sensors, the RS485 output device is an active sensor with a power supply voltage of 9-36V and a power consumption current of less than 50mA. When using it, it needs to be connected correctly for power supply.

Connect the sensor cable to the data acquisition system correctly according to Table 2:

表 2　接线方式

Table 2 Wiring method		
信号 Signal	颜色 Dyestuff	测量系统 Instrumentation system
0-20mV 输出传感器 0-20mV output sensor		
传感器输出+ Sensor output +	红色 Red	电压输入+ Voltage input +
传感器输出- Sensor output-	蓝色 Blue	电压输入-或地 Voltage input-or ground
屏蔽 Shield	屏蔽 Shield	地 Land
RS485 输出接线方式 RS485 output wiring mode		
电源输入+ Power input +	红色 Red	电源输出+ Power output +
电源输入- Power input-	黑色 Black	电源输出-或地 Power output-or ground
RS485-A 信号输出 RS485-A signal output	黄色 Yellow	RS485-A
RS485-B 信号输出 RS485-B signal output	绿色 Green	RS485-B

十、通讯点表

Communication Point Table

Appendix 1: List of communication points

数据地址 Data address	寄存器名称 Register name	特性 Performance	数据类型 Data type	输出范围 Output range
0x0000	辐射值 Radiation value	R		0～300 W/m²
0x0501	Modbus 地址 Modbus Address	R/W		1～255，（0xFF 为广播地址；出厂默认 1） (0xFF is the broadcast address;factory

				default 1)
0x0503	波特率 Baud rate	R/W		1～6（阶梯值代表 4800、9600、19200、38400、57600、115200；出厂默认 2，代表 9600） (Levelofrepresentation4800,9600,19200,38400,57600,115200; the factory default is 2, which represents 9600)

十一、通讯规约

Communication protocol

读指令 read instruction

上位机下发：

The host computer sends

名称 Name	字节 Byte	数据 Data
设备地址 Device address	1	0xXX：传感器地址 Sensor address
功能码 Function code	1	0x03：功能码 Function code
寄存器地址高字节 The high byte of the register address	1	0xXX：地址高字节 Address high byte
寄存器地址低字节 Low byte of the register address	1	0xXX：地址低字节 Address low byte
读取寄存器长度高字节 Read the high byte of the register length	1	0x00：读取寄存器长度高字节 Read the high byte of the register length
读取寄存器长度低字节 Read the low byte of the register length	1	0xXX：读取寄存器长度低字节 Read the low byte of the register length
CRC 校验和 CRC check sum	2	CRC 校验 CRC verification

设备响应：

Device response

名称 Name	字节 Byte	数据 Data
设备地址	1	0xXX：传感器地址

Device address		Sensor address
功能码 Function code	1	0x03：功能码 Function code
数据长度字节数 The number of bytes in the data	1	0xXX：数据长度字节数 The number of bytes in the data
寄存器数据高字节 Register data high byte	1	0xXX：寄存器数据高字节 Register data high byte
寄存器数据低字节 Low byte of register data	1	0xXX：寄存器数据低字节. Low byte of register data
CRC 校验和 CRC check sum	2	CRC 校验 CRC verification

举例：

上位机发送：01 03 00 00 00 01 84 0A　　读取地址为 0x0000 寄存器数据，即读取辐射值

传感器应答：01 03 02 00 94 B9 EB　　辐射值为 0x0094，即 148 W/m²

Example:

The host sends: 01 03 00 00 00 01 84 0A

Read the address of the register 0x0000 to read the radiation value

The sensor responds:01 03 02 00 94 B9 EB

The radiation value is 0x0094, that is, 148 W/m2

设置与上位机通讯地址：

Set the communication address with the host computer:

上位机下发：

Issued by the upper computer

名称 Name	字节 Byte	数据 Data
设备地址 Device address	1	0xXX：传感器表地址 Sensor table address
功能码 Function code	1	0x10：功能码（固定 0x10） Function code (fixed 0x10)
寄存器地址高字节 The high byte of the register address	1	0x05：设置寄存器高字节 Set the high byte of the register
寄存器地址低字节	1	0x01：设置寄存器低字节

Low byte of the register address		Set the low byte of the register
寄存器数量高字节 Register number high byte	1	0x00：寄存器数量高字节 Register number high byte
寄存器数量低字节 Register count low byte	1	0x01：寄存器数量低字节 Register count low byte
数据字节长度 Data byte length	1	0x02：数据字节长度 Data byte length
寄存器数据高字节 Register data high byte	1	0xXX：设备通讯地址 【说明】1～255，（0xFF 为广播地址；出厂默认 1） Device communication address [Description] 1~255, (0xFF is the broadcastaddress; factory default is 1)
寄存器数据低字节 Low byte of register data	1	0x00：寄存器数据低字节 Low byte of register data
CRC 校验和 CRC check sum	2	CRC 校验 CRC verification

设备响应：

Device response

名称 Name	字节 Byte	数据 Data
设备地址 Device address	1	0xXX：传感器地址 Sensor address
功能码 Function code	1	0x10：功能码 Function code
设置寄存器高字节 Set the high byte of the register	1	0x05：设置寄存器高字节 Set the high byte of the register
设置寄存器低字节 Set the low byte of the register	1	0x01：设置寄存器低字节 Set the low byte of the register
寄存器数量高字节 Register number high byte	1	0x00：寄存器数量高字节 Register number high byte
寄存器数量低字节 Register count low byte	1	0x01：寄存器数量低字节 Register count low byte
CRC 校验和 CRC check sum	2	CRC 校验 CRC verification

举例：

上位机发送：01 10 05 01 00 01 02 02 00 F3 E1　　将传感器的通讯地址设置为 0x02

传感器应答：01 10 05 01 00 01 50 C5　　传感器应答完毕后，会将通讯地址更改为新设置的地址

Example:

The host sends: 01 10 05 01 00 01 02 02 00 F3 E1

Set the communication address of the sensor to 0x02

The sensor responds: 01 10 05 01 00 01 50 C5

After the sensor responds, it changes the communication address to the newly set address

设置与上位机通讯波特率：

Set the communication baud rate with the host computer:

上位机下发：

Issued by the host computer

名称 Name	字节 Byte	数据 Data
设备地址 Device address	1	0xXX：传感器地址 Sensor address
功能码 Function code	1	0x10：功能码（固定 0x10） Function code (fixed 0x10)
寄存器地址高字节 The high byte of the register address	1	0x05：设置寄存器高字节 Set the high byte of the register
寄存器地址低字节 Low byte of the register address	1	0x03：设置寄存器低字节 Set the low byte of the register
寄存器数量高字节 Register number high byte	1	0x00：寄存器数量高字节 Register number high byte
寄存器数量低字节 Register count low byte	1	0x01：寄存器数量低字节 Register count low byte
数据字节长度 Data byte length	1	0x02：数据字节长度 Data byte length
寄存器数据高字节 Register data high byte	1	0xXX：通讯波特率 Communication baud rate 【说明】0x01：4800 explain 0x02：9600（出厂默认） (Default at factory) 0x03：19200

		0x04：38400 0x05：57600 0x06：115200
寄存器数据低字节 Low byte of register data	1	0x00：寄存器数据低字节 Low byte of register data
CRC 校验和 CRC check sum	2	CRC 校验 CRC verification

设备响应：

Device response

名称 Name	字节 Byte	数据 Data
设备地址 Device address	1	0xXX：传感器地址 Sensor address
功能码 Function code	1	0x10：功能码 Function code
设置寄存器高字节 Set the high byte of the register	1	0x05：设置寄存器高字节 Set the high byte of the register
设置寄存器低字节 Set the low byte of the register	1	0x03：设置寄存器低字节 Set the low byte of the register
寄存器数量高字节 Register number high byte	1	0x00：寄存器数量高字节 Register number high byte
寄存器数量低字节 Register count low byte	1	0x01：寄存器数量低字节 Register count low byte
CRC 校验和 CRC check sum	2	CRC 校验 CRC verification

举例：

上位机发送：01 10 05 03 00 01 02 03 00 F3 93　　将传感器的通讯波特率设置为 19200

传感器应答：01 10 05 03 00 01 F1 05　　传感器应答完毕后，会将通讯波特率更改为新设置的波特率

Example:

The upper computer sends: 01 10 05 03 00 01 02 03 00 F3 93

Set the communication baud rate of the sensor to 19200

The sensor responds：01 10 05 03 00 01 F1 05

After the sensor responds, it changes the communication baud rate to the new set baud rate

十二、注意事项：

(Matters need attention)

1、滤光片应保持清洁，要经常用软布或毛皮擦拭。

2、滤光片不可拆卸或松动，以免影响测量精度。

3、应定期更换干燥剂，以防表体内结水。

1、The filter should be kept clean and should be frequently wiped with a soft cloth or fur.

2、The filter should not be removed or loosened to avoid affecting the measurement accuracy.

3、The desiccant should be replaced regularly to prevent water from forming on the surface.