KIPP & ZONEN
SINCE 1830



Sun Trackers

FOR SOLAR-TRACKING AND PC-BASED POSITIONING OPERATIONS

Accuracy suitable for any requirement
All-weather construction
Unattended operation
Virtually maintenance-free
Wide range of mounting configurations
Ideal for BSRN stations

Introduction

Solar radiation is normally measured using a pyranometer that sees the whole hemisphere above it and responds to radiation from both sun and sky, the 'global' solar radiation. However, it is often necessary to accurately measure the 'direct' radiation coming only from the sun.

A pyrheliometer has a 5° view, slightly larger than the sun and its aureole, and does not see the rest of the sky. To make measurements it must point precisely at the sun and this is achieved using an automatic two-axis sun tracker. A shading assembly blocks the direct solar radiation from reaching a pyranometer mounted on the tracker so that the 'diffuse' solar radiation from the sky can be measured.

The sun tracker provides a stable mounting for the pyrheliometer and moves horizontally (azimuth) and vertically (zenith) to follow the solar arc. Stepping motors controlled by a micro-processor drive through belts or gears to provide movement with the desired torque and accuracy. An on-board programme requires accurate longitude, latitude, altitude, date, and time information for the measurement site. It then calculates the current position of the sun and points the pyrheliometer and shading assembly towards it.

Applications

Sun trackers are widely used in networks of solar monitoring stations that measure direct, diffuse and global radiation, for inputs to weather forecasting and climate models. Other applications include atmospheric chemistry research, pollution forecasting and materials testing.

With growing interest in renewable energy good quality solar radiation data is becoming increasingly important, particularly the direct component, with regard to photovoltaic systems and thermal energy solar collectors. Activities include research and development, production quality control, determination of optimal power plant locations, monitoring the efficiency of installed systems and predicting the output under various sky conditions.

The Baseline Surface Radiation Network (BSRN)

Solar, atmospheric and terrestrial radiation drive almost every dynamic process on the Earth's surface and above, from ocean current circulation to weather, climate and life itself. Small changes can have large and long-lasting effects that are difficult to predict. Accurate data regarding the radiation at the Earth's surface is fundamental to under-standing its climate system, global warming and global dimming.

BSRN comprises a global network of solar monitoring stations using the best equipment and practices currently available and is a key part of the World Climate Research Programme. BSRN is linked to other international climate projects such as WMO-GAW, ARM, GEWEX and GCOS.

Kipp & Zonen sun trackers and radiometers are widely used in all of the above programmes and we can supply complete BSRN compatible solar monitoring systems.

Choice of Sun Tracker

2AP has been in production for many years and is used around the world as the basis of top quality solar monitoring stations for research and in networks, such as BSRN. The high power and rugged design enables operation in extreme conditions, from deserts to Antarctica.

However, not every customer needs these capabilities and for some users 2AP is over-specified. Our SOLYS 2 provides BSRN level performance and is easier to install and operate than any other tracker on the market. It is very efficient and ideal for operation using solar energy power sources.

System Configurations

Typical Solar Monitoring System	
Sun Tracker	
Shading Ball Assembly	
Pyrheliometer	direct solar radiation
Pyranometer	global solar radiation
Pyranometer (shaded)	diffuse solar radiation
Data Logger	

Basic BSRN Station	
Sun Tracker	sun sensor recommended
Shading Ball Assembly	
Pyrheliometer, with temperature sensor	direct solar radiation
Pyranometer, ventilated, with temperature sensor	global solar radiation
Pyranometer (shaded), ventilated, with temperature sensor	diffuse solar radiation
Pyrgeometer (shaded), ventilated	downwards infrared radiation
Data Logger	



The cost-effective and simple sun tracking solution.

- Fully Automatic
- Integrated GPS Receiver
- Easy to Install
- BSRN Level Performance
- Both AC and DC Power Inputs
- Very Low Maintenance

SOLYS 2 is an advance over conventional automatic sun trackers. It does not require a computer and software for installation. The integrated GPS receiver automatically configures location and time data. Multi-colour LEDs indicate the operating status and an Ethernet port allows for software upgrades, testing and fault diagnosis. The high-efficiency belt drive system requires no maintenance.

The tough and distinctive cast aluminium housing has a matching tripod stand with levelling feet. A side plate with mountings for a Kipp & Zonen pyrheliometer is included as standard and a second side plate can be fitted, with a range of mounting kits for an additional pyrheliometer or other instruments. Two top mounting plates are available for convenient horizontal mounting of one, or up to three, Kipp & Zonen radiometers. The shading ball assembly accessory includes the large top mounting plate and a second side plate and allows SOLYS 2 to be configured as a complete solar monitoring station.

SOLYS 2 does not suffer from internal clock drift because time is updated by the GPS receiver. A sun sensor is available for active tracking where the stability of the support platform cannot be guaranteed.







The high-end market leader for all conditions.

- Highest Accuracy Available
- Highest Load and Torque Available
- BSRN Level Performance
- AC and DC Power Versions
- Operates in Extreme Climates
- Positioning Capability

2AP has proven performance in the harshest climates. High power motors and precision gear drives have the torque to break ice and to operate in high winds. The optional cold weather cover and internal heaters enable operation down to -50 °C. After setup using the supplied Win2AP software and a PC (not included) operation is stand-alone with only occasional checks of the internal clock required. Two small side plates are included as standard, but no instrument mountings.

An active tracking sun sensor is available to correct for clock drift or movement of the support platform. The large side mounting plate takes the sun sensor and a Kipp & Zonen pyrheliometer (or two pyrheliometers). The optional shading ball assembly includes two side plates and a rear mounting plate for up to three ventilated Kipp & Zonen radiometers. Adapters are available for unventilated radiometers.

A unique feature of the 2AP is the positioning capability. The Win2AP software can be used to configure a sequence of pre-programmed movements to point at a series of targets.





Specifications	SOLYS 2	2AP
Pointing accuracy	< 0.1° passive tracking < 0.02° active tracking (with optional sun sensor)	< 0.1° passive tracking < 0.02° active tracking (with optional sun sensor)
Torque	> 20 Nm (at maximum load and angular velocity) * > 23 Nm (when sun tracking) *	> 40 Nm (at maximum load and angular velocity) > 40 Nm (when sun tracking)
Payload (balanced)	20 kg	65 kg
Angular velocity	up to 5°/s	up to 1.8°/s
Angular acceleration	up to 3.6°/s²	up to 3.6°/s²
Conditions & Dimensions		
Supply voltage	18 to 30 VDC and 90 to 264 VAC, 50 / 60 Hz	24 VDC only, or 115 / 230 VAC (selectable), 50 / 60 Hz
Power sun tracker	21 W (reduces to 13 W at night)	50 W
Power heater	100 W (heater is standard, AC only)	100 W (heater is optional)
Operating temperature range	-20 °C to +50 °C (DC power) -40 °C to +50 °C (AC power)	0 °C to +50 °C -20 °C to +50 °C with optional cold cover -50 °C to +50 °C with optional cold cover and optional heater
Weight	23 kg (sun tracker), 5 kg (tripod stand)	30 kg
Dimensions (WxDxH)	50 x 34 x 38 cm (excluding tripod stand)	42 x 26 x 38 cm
Features		
Transmission	Inverted tooth belts	Worm and bevel gear
Location, time/date info & setup	Automatic by integrated GPS	Manual by Win2AP software and PC (not included)
Mounting base	Tripod stand included	Flat base plate (optional heavy duty tripod stand and height extension tube)
Zenith axis fittings	One side plate / pyrheliometer mounting kit standard	Two small side plates standard, no mounting kit
Heater for low temperature operation	Standard (AC power only)	Optional (must be used with cold cover)
Communication	Ethernet and web interface	RS 232 and Win2AP software for PC (not included)
Indicators	Power, internal temperature and status	N/A
Positioning mode	Ethernet and web interface	By Win2AP software and PC
Maintenance	No scheduled maintenance required	Annual inspection and grease gears
Options		
Sun sensor kit	For active sun tracking	For active sun tracking
Side mounting plate	For fitting to zenith axis shaft on opposite side to standard side plate / pyrheliometer mounting	Large side mounting plate for zenith axis including mountings for two pyrheliometers
Large top mounting plate	3 positions for Kipp & Zonen radiometers (with or without ventilation units)	N/A
Small top mounting plate	1 position for a Kipp & Zonen radiometer (with or without ventilation unit)	N/A
Shading ball assembly	Includes large top mounting plate, second side mounting plate, 2 shading balls on adjustable rods	Includes rear mounting plate for 3 Kipp & Zonen ventilated radiometers, two large side mounting plates, 3 shading balls on rods
Adapter kit	Not needed	For unventilated radiometers
Radiometer mounting kits	For absolute cavities, pyrheliometers, PGS-100 sun photometer and other instruments	
Note: The performance specifications quoted are worst-case and/or maximum values		

* The standard torque setting is ideal for all normal measurement applications, but it is adjustable in firmware. Torque can be reduced to save power, or increased to a maximum of 30 Nm when sun tracking.

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Go to www.kippzonen.com for your local distributor

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Kipp & Zonen B.V. reserve the right to alter specifications of the equipment described in this documentation without prior notice