



# Sun Trackers

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## 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 pyr heliometer has a 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 pyr heliometer 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 pyr heliometer and / or shading assembly towards it.

## APPLICATIONS

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

With increasing interest in renewable energy good quality solar radiation data is becoming increasingly important, particularly the direct component, with regard to electricity production (photo-voltaic systems) and thermal energy (solar collectors). Activities include research and development, production quality control, determination of optimal locations, monitoring 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 understanding 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, is a key part of the World Climate Research

Programme, and 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 new SOLYS 2 provides BSRN level performance but is easier to install and operate than any other tracker on the market. It is very efficient and ideal for operation using solar energy sources.

## SYSTEM CONFIGURATIONS

### Typical Solar Monitoring System

Sun Tracker	
Shading Assembly	
Pyr heliometer	direct solar radiation
Pyranometer	global solar radiation
Pyranometer (shaded)	diffuse solar radiation
Data Logger	

### Basic BSRN Station

Sun Tracker	sun sensor recommended
Shading Assembly	
Pyr heliometer 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) and ventilated	downwards infrared radiation
Data Logger	

# SOLYS 2

Sun Tracker



## 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 the only fully automatic sun tracker available that 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 an integrated tripod stand with levelling feet. A side plate with mountings for a Kipp & Zonen pyrliometer is included as standard and a second side plate can be fitted for an additional pyrliometer. A top mounting plate is available for convenient mounting of up to three Kipp & Zonen radiometers. The shading assembly accessory includes the top mounting 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.



# 2AP

Sun Tracker



## 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 Win2AP software and a PC 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 pyrliometer (or two pyrliometers). Two plates are in-cluded with the optional shading assembly, and a rear mounting plate for up to three ventilated Kipp & Zonen radiometers. Adapters are available for unventilated radiometers and absolute cavity pyrliometers.

A unique feature of the 2AP is the positioning capability. When connected to a PC it can perform a sequence of pre-programmed movements to point at a series of targets.



Performance	SOLYS 2		2AP
Pointing accuracy	°	< 0.1	< 0.05
Torque	Nm	20	40
Payload (balanced)	Kg	20	65
Angular velocity	°/s	up to 5	up to 1.8
Angular acceleration	°/s <sup>2</sup>	up to 3.6	up to 3.6
Conditions & Dimensions			
Supply voltage	V	18 to 30 DC and 90 to 264 AC, 50 / 60 Hz	24 VDC only, or 115 / 230 AC (selectable), 50 / 60 Hz only
Power	W	25	50
		125 with standard heater operating (AC only)	150 with optional heater operating
Operating temperature range	°C	- 20 to + 50 (DC power)	0 to + 50 (- 20 to + 50 with optional cold cover)
		- 40 to + 50 (AC power)	- 50 to + 50 with optional heater and cold cover
Weight	kg	23 (tracker), 5 (tripod stand)	30
Dimensions (WxDxH)	cm	50 x 34 x 38 (excluding tripod stand)	42 x 26 x 38
Features			
Transmission		Inverted tooth belts	Worm and bevel gear
Location, time/date info & setup		Automatic by integrated GPS	Manual by Win2AP software and PC
Mounting base		Tripod stand included	Flat base plate (optional heavy duty tripod stand)
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
Communication		Ethernet and web interface	RS 232 and Win2AP software for PC
Indicators		Power, internal temperature and status	N/A
Positioning mode		N/A	By Win2AP software and PC
Maintenance		No scheduled maintenance required	Annual inspection and grease gears
Options			
Sun sensor kit		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
Top mounting plate		3 positions for Kipp & Zonen radiometers (with or without ventilation units)	N/A
Shading ball assembly		Includes 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 shading unventilated radiometers
Radiometer mounting kits		For absolute cavities, pyrheliometers and other instruments	



Go to [www.kippzonen.com](http://www.kippzonen.com) for your local distributor

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