



# 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 pyrhelimeter 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 pyrhelimeter 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 pyrhelimeter 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 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

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 |                         |
| Pyrhelimeter          | 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                                     |                              |
| Pyrhelimeter, 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 pyr heliometer is included as standard and a second side plate can be fitted, with a range of mounting kits for an additional pyr heliometer 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 pyr heliometer (or two pyr heliometers). 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<br>< 0.02° active tracking (with optional sun sensor)                     | < 0.1° passive tracking<br>< 0.02° active tracking (with optional sun sensor)   |
| Torque                               | > 20 Nm (at maximum load and angular velocity) *<br>> 23 Nm (when sun tracking) *                 | > 40 Nm (at maximum load and angular velocity)<br>> 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°/s <sup>2</sup>   | up to 3.6°/s <sup>2</sup>   |
| <b>Conditions &amp; Dimensions</b>   |   |   |
| Supply voltage                       | 18 to 30 VDC and<br>90 to 264 VAC, 50 / 60 Hz   | 24 VDC only, or<br>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)<br>-40 °C to +50 °C (AC power)  | 0 °C to +50 °C<br>-20 °C to +50 °C with optional cold cover<br>-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   |
| <b>Features</b>                      |   |   |
| 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 / pyrhelimeter 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  |
| <b>Options</b>                       |   |   |
| 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 / pyrhelimeter mounting  | Large side mounting plate for zenith axis including mountings for two pyrhelimeters   |
| 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, pyrhelimeters, 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.



Go to [www.kippzonen.com](http://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

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