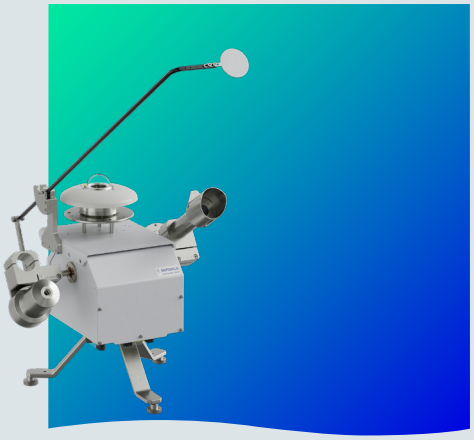
SEMS-2000

Solar Energy Measurement System for automatic monitoring of Direct, Global and Diffuse irradiance using SunTracker-2000



INTRODUCTION

SEMS-2000, for the automatic irradiance monitoring, is based on SunTracker-2000, is a compact 2-axis solar tracker designed for accurate and reliable solar radiation measurement in unattended outdoor installations. Built on an astronomical elevation-azimuth tracking algorithm, it continuously aligns mounted sensors with the Sun to support high-quality measurement of direct, diffuse and global solar radiation.
Designed for long-term operation in remote sites, the system combines precise tracking, robust construction, and optimized power consumption. It is an ideal solution for solar resource assessment, photovoltaic and solar thermal applications, research installations, and advanced meteorological stations.

FEATURES

High tracking accuracy

Two-axis altitude-azimuth tracking ensures accurate Sun positioning throughout the day.

Compact and robust design

The compact mechanical structure simplifies transport and installation while ensuring long-term outdoor reliability.

Optimized for remote operation

Low power consumption makes the system suitable for autonomous and remote installations.

Unattended performance

Designed for long-term operation with minimal human intervention.

Harsh-environment suitability

Built for demanding outdoor conditions, including wide temperature range, high humidity, and strong wind exposure.

Advanced pointing option

An optional Sun sensor enables active tracking for even higher pointing accuracy when required.

CONFIGURATION & MEASUREMENT

Complete solar radiation measurement setup

The system supports measurement of DNI, DHI and GHI using pyrheliometers, pyranometers, and optional shadow disk assemblies mounted on the tracker structure.

Tracker and architecture

The SEMS-2000 system consists of the SunTracker-2000 mechanical structure and a MTD3K control unit data acquisition system, which manages Sun position calculation, power supply, pointing status and communications.

Pointing performance

The tracker provides an alignment accuracy of ±0.1° on both axes. With the optional Sun sensor for active tracking, pointing accuracy can be improved to better than ±0.01°.

Power and operating logic

The system includes smart operating functions such as night standby, reduced holding torque, and critical power management to support reliable autonomous operation.

Remote communication and diagnostics

The SEMS-2000 supports remote configuration, supervision, and alarm handling through available communication options.

Optional data quality monitoring

The optional ADAS-3000 firmware module runs a real time data coherence supervision and generates alarms when inconsistencies are detected.

ULTRA-PRECISE SUN TRACKING
±0.1° pointing accuracy on both axes, improved to better than ±0.01° with optional active Sun sensor.

BUILT FOR REMOTE SOLAR SITES
Optimized for long-term autonomous operation with battery and solar power supply.

INTELLIGENT POWER-SAVING LOGIC
Advanced standby and power-management functions maximize uptime in energy-constrained installations.

REAL-TIME DATA QUALITY ASSURANCE
Optional ADAS-3000 checks solar radiation data coherence and warns users when maintenance is needed.

ALL-IN-ONE MEASUREMENT PLATFORM
Tracker, control, communications and diagnostics combined in one integrated measurement system.

Technical specifications SunTracker-2000

Communication with control unit	RS485, 9600 baud, half-duplex, command/status interface
Controllers	High-resolution programmable motor control, 64 positions/step, 0.0003° accuracy, 1 s position refresh
Resolution	12,800 micro-steps/360°, equal to 0.00058° per axis
Protection	EMI and ESD type 2/3 protection; overcurrent, surge, voltage peak and noise protection; 4000 V galvanic isolation
Structure material	Machined aluminium structure, with AISI 316 stainless steel mechanical parts and bronze gear
Finish	UV-protected paint, anodized and electro-galvanized surfaces
Mounting	Adjustable tripod support with spirit levels for alignment
Sensors mounting	Standard brackets for two pyrheliometers and one pyranometer; optional shadow disk for diffuse radiation measurement
Drive	Two stepper motors, 18.8 °/s speed and 12 Nm torque
Transmission	48:1 machined worm gear transmission, providing 0.00058°/micro-step sensitivity
Alignment accuracy	±0.1° on both axes; better than ±0.01° with optional Sun sensor active tracking
Repeatability	±0.1° on both axes
Leveling	Leveling by bubble level sensors and tripod base adjustment
Weight	8 Kg
Size	H x W x D =300 mm x 370 mm x 290 mm

Technical specifications SEMS-2000

Remote operation	MTD3K-based positioning and alignment control, with GSM/GPRS/3G/Wi-Fi/WiMax remote supervision
Power	12 V, 18 Ah battery supply, rechargeable by 75 W solar panel; no mains required
Consumption	2.8 W tracker only; 3.7 W complete system
Protection	4000 V isolated power switching, SMS alarms, EMI and ESD protection
Environment	-30 °C to +60 °C, 0–100% RH, wind up to 30 m/s without positioning error
Maintenance	Automatic unattended operation after installation

Ordering code

SEMS-2000	Complete package including: Solar tracker, MTD3K Solar Tracker Control Unit, VT display module and keypad, external GPS receiver, SDK-2000 Shadow Disk Kit, Modbus communication interface, internal batteries.
SA-2000	Solar tracker only, for implementation in case there is already an MTD3K in the field.

Pyranometers, pyrheliometers, and accessories must be ordered separately; sensors should be selected with an mV output:

- LPPYRHE16 - Class B Pyrheliometer*
- LPS100P0 - Class A Pyranometer
- LPS020P0 - Class B Pyranometer (alternative)

*For a class A pyrheliometer; please contact our sales office.

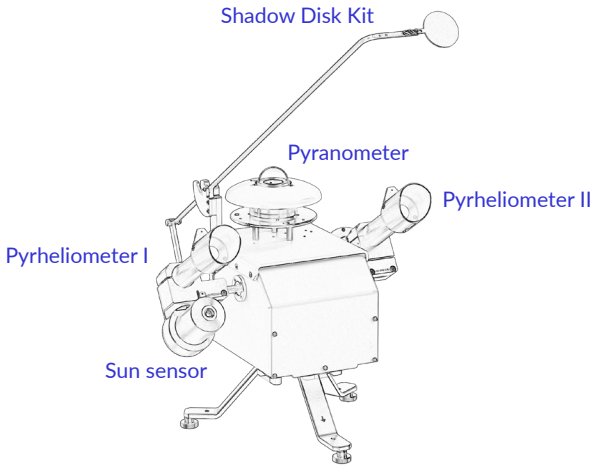
Technical specifications MTD3K Control Unit

Function	External control unit supplying power, control and communication to the SunTracker-2000
Power	12 VDC battery, rechargeable by mains supply or 50–75 W solar panel
Sun position control	NREL algorithm with 0.01° accuracy, updating elevation and azimuth every second
Energy saving	Automatic power management, night standby, ultra-low-power mode and torque reduction during holding
Communication	RS485 half-duplex, opto-coupled power control output, and remote access via GSM/GPRS/3G/Wi-Fi/WiMax
Options	GPS connection for automatic position and time data
Diagnostics	16-bit tracker status word for communication, tracking, reset, position, StallGuard and calibration alarms
Critical power mode	Detects low battery or solar panel failure, limits tracking and can send SMS alarms

Sensor Configuration

The SunTracker-2000 supports a flexible sensor setup for solar radiation measurements, including:

Pyrheliometer I	Direct normal irradiance (DNI) measurement
Pyrheliometer II	Additional or calibration pyrheliometer
Pyranometer	Global horizontal irradiance (GHI) measurement
Shadow disk kit (optional)	Diffuse horizontal irradiance (DHI) measurement
Sun sensor (optional)	Active tracking with accuracy better than ±0.01°
Spectral sensors (optional)	Spectral solar radiation measurement



vs1.0

Senseca Spain, S.A.U
Calle Electrónica 51
28923 Alcorcón - Madrid - Spain
www.senseca.com - info.madrid@senseca.com