# model:Solar photovoltaic-GTBD1700

## Solar Photovoltaic Power Generation Training System

## 1. Features

1) Various experiments are possible by combining sensor with application circuit and actuator.
2) Trace type solar actuator is designed to maximize the output of solar cell by tracking the case of the maximum amount of solar radiation and to make the power generation efficiency of photovoltaic energy to the optimal state.
3) Tracking method The solar power generation system should be able to be experimented with, and the necessary power, tracking sensor converter, and 2 axis motor driver are built in.
4) Includes tracking system, virtual solar light generation system, DC - DC boost chopper system, standalone inverter system and instrument.
5) Stand alone inverter has built in power circuit protection device.
6) Modular case is box type case with slot and groove for aluminum extrusion cover
7) Insulation effect is increased by sliding the front panel instead of bolt fixing method.

## 2. System configuration

## 3. Spec

**1) Working Board**

(1) Easy to attach and detach with tracking system structure on aluminum profile working board.
(2) Board size: 1100 (W) × 600 (D) mm or more
① Board Material: Aluminum Profile
② Board groove spacing: 1 side 25mm, 2 side 30mm (replaceable structure)
③ Install storage space at the bottom of training board
④ Bottom frame of the main body: 30× 60mm Aluminum Profile frame structure, equipped with movable wheels.
(3) Working frame
(1) Installed at the bottom of working board
* Type: Aluminum Profile
* Size: 40 (D) × 20 (H) mm or less

**2) Azimuth / Altitude Angle Tracking Sensor**
(1) Integrated detection sensor and judgment circuit for recognizing azimuth and altitude
(2) The tracking sensor recognizes azimuth and altitude angles according to the sun's orbit even over 30,000 lux and scattered light.
(3) Magnetic control method to wait below 0.5 lux
(4) Specification
① Voltage: DC 8V ~ 15V
② Power consumption: 15mA (when rated 12VDC)
③ weather
* Normal operation (less than 30,000 lux)
* stopping in bad weather and fog (below 30,000 lux)
* Atmospheric magnetic force control function at sunset (less than 0.5 lux)
④ Azimuth splitting ability: about 2 °
⑤ Drive speed: 2rpm MAX
⑥ Water drop, anti fog and dustproof and UV resistant
⑦ Installation angle: 90 ~ 120 °

**3) Solar cell**
(1) Solar cell module is made of monocrystalline silicon or polycrystalline silicon
(2) The frame of the solar cell module is sealed by using lightweight cold rolled steel plate or light metal special aluminum material to prevent moisture penetration.
(3) By pass diode must be attached inside the solar cell module
(4) Connector
① Solar cell connection terminal
② Jack with connecting hole for Φ4
(5) Solar radiation meter
① Insolation sensor attached
② Experiment of solar cell characteristics according to solar radiation
③ Communication method: 1 wire

**4) Position Detection Sensor**
(1) Upper and lower limit switches: min 6
(2) Mechanically create upper and lower limits
① Connection terminal: 3 terminal configuration (1COM)
② Insulated jack for connecting hole Φ4: 9
(3) Self upper limit, lower limit circuit configuration

**5) Tracking system**
(1) Azimuth controller motor
① Small longitudinal gear motor: 500: 1 (DC24V)
② Spur Gears: 2: 1
③ East West Control Range: 115 ° Controllable
(2) Elevation controller motor
① Small flat shaft gear motor: 1000: 1 (DC24V)
② Spur Gears: 2: 1
③ South North Control Range: 30 ° (20 ~ 50 °) Controllable

**6) Azimuth, Altitude Control Terminal**
(1) Virtual Solar Source System
(2) Changing azimuth and elevation angle
(3) Small flat shaft gear motor: 500: 1 (DC24V)
(4) East West control range: 105 ° variable control
(5) South North Control Range: 25 ° (20 ~ 50 °) Manual Variable
(6) Light source movement using timing belt
(7) Light source
① 100W 220V variable control function
② It turns off automatically at sunset and automatically turns on at sunrise
(8) Virtual solar light east west control terminal: Insulated jack for connecting hole
(9) Upper and lower limit switches
① Mechanically create upper and lower limits
② Input contact: 3 terminal configuration (1COM)

**7) DC DC boosting system**
(1) Input voltage DC 0 ~ 30V higher, MAX DC 35V or higher
(2) Capacity: 200W or more
(3) Magnification: 10 times of input
(4) I / O connector
① Connection hole consists of insulated jack for

**8) Inverter**
(1) Apply PWM method to DC voltage

(2) Capacity: 200W or more
(3) Stack components
① Main circuit stack (4 FET circuits)
② Analog gate circuit composition
③ 50HZ synchronous sine wave oscillation circuit
④ carrier frequency generating circuit
(4) DC input 2 terminal
(5) AC output 2 terminal
(6) Lamp Load

**9) Data Acquisition System Module**

(1) POWER
① Power lamp integrated type POWER S / W
② Multi Display
③ Solar Output Volt (V)
④ Solar Output Current (mA)
⑤ Back temperature (℃)
⑥ Insolation (W / ㎡)
(2) Solar Input, Output Volt Connector
(3) PC Interface Port (RS 232)
(4) Solar cell, solar radiation, temperature connection block
① Connector for solar cell connection: Circular connector connection method for safe laboratory practice
② Connector for solar radiation and temperature: Circular connector connection method for safe laboratory practice
(5) Solar cell load characteristic test function
① Learning of Battery Load Characteristics by Variable VR
(6) Solar cell connection block
① Solar Cell Connector
② Solar cell terminal (more than 2 module terminal)
(7) Solar cell characteristic curve tracer
① Solar cell input terminal
② Built in monitoring system AUTO START PB

**10) Data Acquisition System Measurement Program**

(1) Solar Volt [V], Solar Current [mA], Insolation [ w / ㎡ ]
(2) Temperature of Rear Side of Solar Cell [℃]
(3) I V characteristic curve experiment according to solar radiation
(4) V P characteristic curve experiment according to solar radiation
(5) It should have graph function for each part, and it is designed to draw solar cell characteristic curve and output I V characteristic curve and V P characteristic curve for graph for a certain time.
(6) Data storage function, graph output function

**11) Control Unit**

(1) High performance and high performance by using dedicated MPU chip
(2) Extended application range with various built in functions
① PID loop control with auto tuning (the number of control loops is not limited)
② 1 channel RS 232C interface (dedicated, user defined, MODBUS protocol)
(3) Performance and specification
① Programming Languages: LAD, SCL, FBD
② Programming Software : Latest version of TIA Portal Step 7 Basic Education License, perpetual type
③ Program capacity: 68Kbyte,
④ Operation Mode: RUN, STOP, PAUSE, DEBUG
⑤ Self diagnosis: watchdog timer, memory error detection
⑥ Built in function: PID control, high speed counter
⑦ CPU type: AC /DC/Relay
⑧ Power Supply :AC 200-250 V AC at 50 HZ
⑨ Output Type: 10 Bits 24V DC outputs.
⑩ Digtal Input:14 BITS 24V DC Inputs.
⑪ Analog Input: 2Channels Analog 0-10V DC Input.
⑫ Storage : Program/data memory 100 KB
⑬ communication board for RS232/RS485 (whichever applicable)
(4) DC power supply
① DC 24V 1.5A, Built in power indicator, built in fuse
(5) Unit case
① Box type case with slot and groove for aluminum extrusion cover mounting. It should be light and durable.
② Panel and case are assembled by slide type so there is no bolt on the front, so durability should be excellent
③ The side should be excellent in insulation with plastic injection cover.
④ Color: Silver

**12) Simulation program : PVSYST (Educational and perpetual license)**

(1) Simulation program

① Input PV simulator parameter according to temperature and solar radiation
② Short circuit current: Short circuit current
③ Rated voltage: Rated output voltage
④ Rated current: rated output current
⑤ Rated power: rated output power
⑥ Series: Serial number of solar cell
⑦ Parallel: Parallel number of solar cells
⑧ Module temperature: Solar cell module temperature
⑨ Insolation: Insolation
⑩ temperature coefficient: temperature coefficient
⑪ Open circuit voltage temperature coefficient
⑫ Open circuit voltage coefficient of insolation
⑬ Short circuit current temperature coefficient

(2) Input of solar cell modeling simulator parameter value

① Open circuit voltage (Voc): open voltage
② Shunt resistance (Rsh): Shunt resistance
③ Reference Temperature (Tr): Reference Temperature
④ Band gap for silicon (Eg): band gap of silicon
⑤ Insolation (õ): Insolation
⑥ Series resistance (Rs): Series resistance
⑦ Module Temperature (Tk): Module Temperature
⑧ Ideality factor (A, B): Ideality factor
⑨ Cell saturation current at Tr (Ior): Saturation current
⑩ Short circuit current at 25℃ and 1000W / ㎡ (Isc): Short circuit current at 1000W / ㎡, 25 ℃
⑪ short circuit current temperature coefficient at Isc (Ki): Short circuit current temperature coefficient according to Isc

(3) Solar Array Simulation Output Data

① Solar Array Rated Output: Solar Cell Array Output Value
② Open circuit voltage
③ Short circuit current: Short circuit current
④ Rated power: rated power
⑤ Maximum Operating voltage: Maximum voltage
⑥ Maximum output current

(4) b. Solar cell array simulation graph according to solar radiation

① Pmax (T) graph, Isc (T) graph, Voc (T) graph

(5) Solar Array Simulation Graph According to Temperature

: Pmax (T) graph, Isc (T) graph, Voc (T) graph