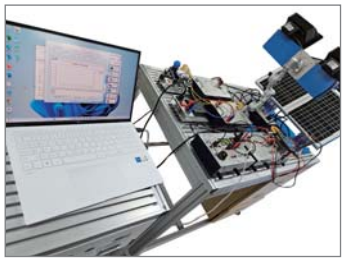
# model:Energy conversion-1000

## Energy conversion laboratory equipment

## Introduction

- Understanding the principles and concepts of renewable energy generation
- Conversion experiment of the generated energy
- Understanding energy processing principles and concepts for generating energy
- Separation of energy production module and energy processing module
- Free attachment and detachment of working board and module
- Light source control using artificial solar light source
- Power processing circuit production and practice

## System configuration



## Components

| | |
|---|---|
| 1) Enhanced Photovoltaic module | 1 ea |
| 2) Data Collect Module | 1 ea |
| 3) Charger Module | 1 ea |
| 4) Step-Up Converter Module | 1 ea |
| 5) Single Phase Inverter module | 1 ea |
| 6) Dimmer Module | 1 ea |
| 7) DC Power Supply Module | 1 ea |
| 8) Battery Module | 1 ea |
| 9) Lamp Module | 1 ea |
| 10) AC Motor Module | 1 ea |
| 11) Charger Assemble Module | 1 ea |
| 12) Step-Up Converter Assemble Module | 1 ea |
| 13) Single Phase Inverter Assemble Module | 1 ea |
| 14) Program CD | 1 ea |
| 15) Manual book | 1 book |

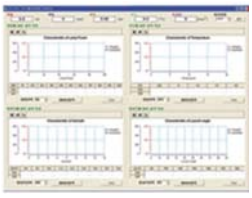
# Training Contents

Part-1, Photoelectric effect simulation
Part-2, Ohm's Law, Voltage / Ammeter Experiment
Part-3, Experiment of solar module characteristics (Isc, Voc, Im, Vm, Fill, Factor)
Part-4, Incidence angle and intensity experiment using external light source
Part-5, Battery Charging Experiment
Part-6, Power conversion experiment using boost module and inverter
Part-7, AC and DC load experiment
Part-8, Charging circuit production and characteristics experiment
Part-9, Boosting circuit production and characteristics experiment
Part-10, Inverter circuit production and characteristics test

# Spec

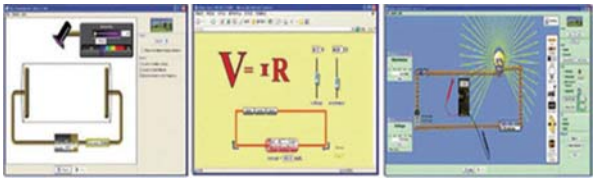
## 1) Software spec

(1) Monitoring S / W



- Output characteristics according to light quantity
- Output characteristics according to temperature
- Output characteristics according to azimuth angle
- Output characteristics according to incident angle

(2) Photovoltaic effect and Simulation method of electric and electronic, low-voltage, ammeter.




## 2) Hardware spec

(1) Enhanced Photovoltaic module

- Azimuth angle and inclination angle variable portion
  - Azimuth : Rotate up to 120 ° with manual knob
  - Angle of incidence : Changeable from 0 to 90 ° (in units of 15 °)
- Artificial light source device
  - 500W halogen lamp : 2ea
  - Angle control using joints
- Solar cell module
  - Maximum output : 10W

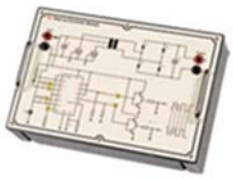
(2) Data Collect Module

- Modules for characterizing solar cell voltage and current
  - Solar cell connection block : output terminals of solar cell 1 and solar cell 2
  - Curve Tracer Block : V-I Characteristic Curves Through an Oscilloscope
  - LCD Display : Displays the voltage, current, and temperature of the solar cell.
  - Load block : 0 ~ 200Ω, 50W class VR
  - PC interface block : Data analysis through dedicated program after connection with PC

(3) Charger Module

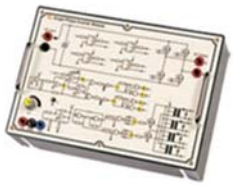
• Module for charging solar battery output to battery
  - Overcharge, overdischarge prevention circuit
  - Solar Cell terminal : Solar cell output input
  - Output terminal : Battery voltage output
  - Battery terminal : Terminal to connect battery
  - Batt Low Set VR : Battery drain setting
  - Batt Low Set VR : Battery drain setting
  - Batt Volt Set VR : Battery charge voltage setting

(4) Step-Up Converter Module



• Module that boosts output of solar cell and battery by commercial AC voltage
  - Input terminal : Charging module output & input
  - Output terminal: boosted voltage output (about 10 times of input)
  - Checkpoint: Oscillation Circuit and FET Gate Waveform

(5) Single Phase Inverter module



• Module that receives DC voltage of boost module and converts it to AC voltage
  - PWM inverter circuit
  - DC Input terminal : Boost module output & input
  - AC Output Terminal : Load Connection for AC Power
  - REF. VR : Output voltage control
  - Checkpoint : Check each part waveform
  - Supplied + 15V, -15V using SMPS module

(6) Dimmer Module

• 500W Halogen lamp Module for adjusting the light quantity of two
  - Built-in fuse 250V 8A

(7) DC Power Supply Module

• Module for supplying + 15V, -15V power to inverter circuit
  - Fuse 250V 8A

(8) Battery Module

• DC 12V, 7AH Battery connected with charging module
  - Fuses 250A, 3A

(9) Lamp Module

• Operating power : 220V, 10W

(10) AC Motor Module

• Operating power : AC 110V, 10W
• Motor drive status display using the rotating plate

(11) Charger Assemble Module

• Modules for students to make charge circuit using breadboard
  - Breadboard for circuit configuration
  - Parts for charging circuit

(12) Step-Up Converter Assemble Module

• Module in which Students use the breadboard to make the logic part of the booster circuit.
  - Breadboard for circuit configuration
  - Main Circuit Power Stack PCB
  - Parts for DC-DC boost circuit

(13) Single Phase Inverter Assemble Module

• Module for the students to make logic part of inverter circuit directly by using breadboard.
  - Breadboard for circuit configuration
  - Main Circuit Power Stack PCB
  - Components for single-phase inverter circuits

(14) Others

• Dimensions : 1218(W)×1533(H)×720(D)mm
• Working Board
  - size : 1100(W)×540(H)mm
• Module storage drawer
  - Size: 350 (W)×600 (H)×500 (D) mm or more, can be negotiated

(15) ESS System protection function

- Protection against temperature
  If any cell of battery temperature < 0°C, stop charging / release at +2°C
  If any cell of battery temperature > +45°C, stop charging / release at +43°C
  If any cell of battery temperature < -20 °C, stop discharging / open MC4 / release at -18 °C
  If any cell of battery temperature >+ 55°C, stop discharging / open MC4 / release at 53°C
  If any cell of battery temperature < +2°C and cell is being charged, turn on cell heating mat release at +4°C
  If any cell of battery temperature > +43°C, turn on cooling fan / release at +40°C
- Protection against voltage
  If any of cell voltage < 8.1V, stop discharging / Stop PCU / release at 13.4V
  If any of cell voltage < 7.0V, System off
  If any cell of battery voltage > 14.25V, open MC and trigger alarm: alarm message:
  “cell short” / release by power reset
- Protection against current
  If battery discharge current > 13.5A, open MC alarm message “over discharge current” /
  release by power reset
- Protection against Short circuit (If pack voltage < 9.5V, open MC)
- Protection fuse (Use slow blow fuse)