

ENERGY STORAGE

Without vision, even the most
focused passion is a battery
without a device.



KGC

EMPOWERING FUTURE
THROUGH RESEARCH & INNOVATION

INTRODUCTION

Welcome to our 2020 - 2021 edition of Product Catalog. We would like to thank you for your continue support and encouragement. Throughout this challenging time, we have grown and transform our business to be more efficient and effective. This will enable us to offer better service and more competitive pricing to our customers.

Our new edition of catalog comes with a easy reference features where we categorized the products into different usage categories, i.e. Advanced Material, Renewable Energy, Bio-Process, Gauge Calibration, Membrane Technology, 3D scanner and others. This will facilitate the users to quickly access to the equipment specification required, and options available to them in term of measuring range or equipment complexity.

In our new catalog, we have also added the equipment to do research in renewable energy like solar cell, fuel cell, flow cell, lithium ion batteries, and membrane technologies. In synergy with our advanced material equipment, we have also added the equipment for material characterization especially in the area of rare earth research and magnetic properties. In line with the manufacturing industry footsteps, the equipment on 3D scanning and 3D printing also have been added in to expand the tools in the research and development for industry 4.0.

To our current customers, we believed our partnership will be strengthen for the years to come. The new catalog will also create new opportunities to build new relationship with new customers.

Lastly, I would like to thanks our staffs for their dedication and sacrifice in supporting the management for a brighter future.

Patrick Tan

Director

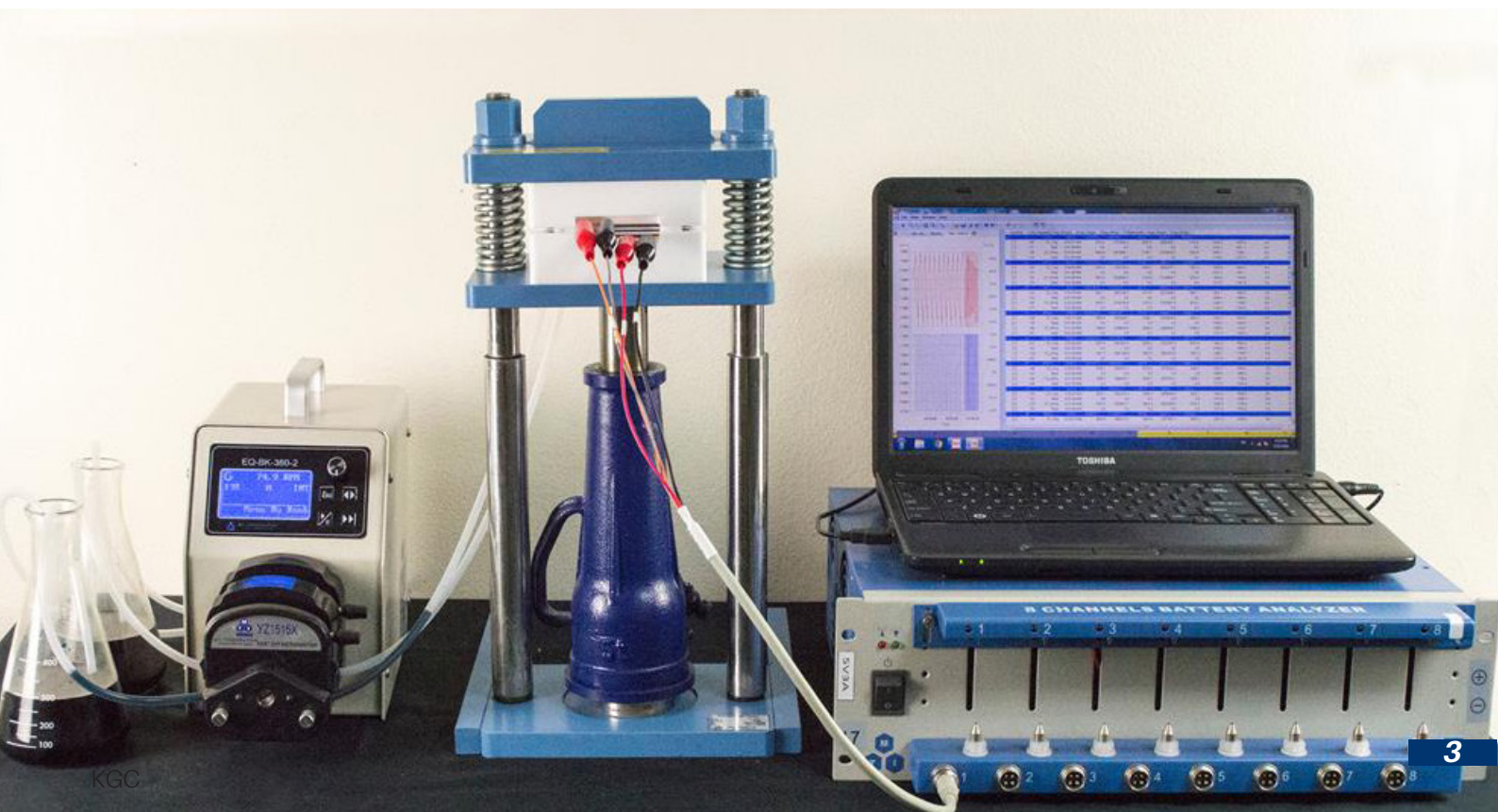
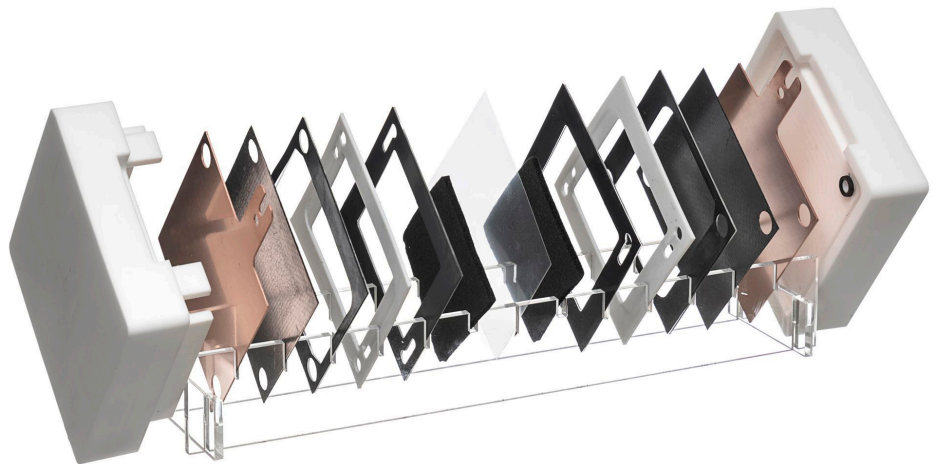
KGC (Group of Companies)

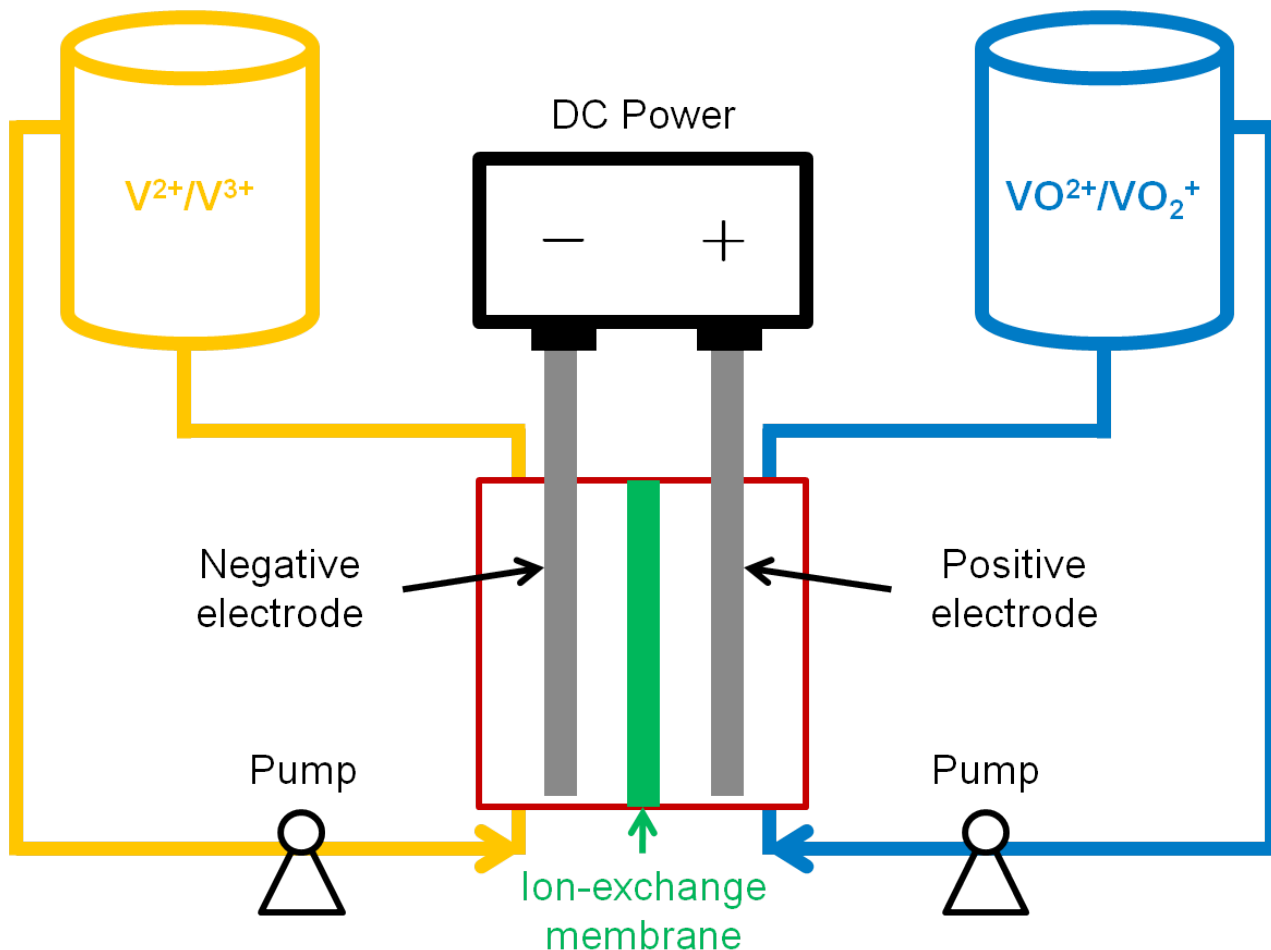
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Vanadium Redox Flow Cell

In vanadium flow batteries, both half-cells are additionally connected to storage tanks and pumps so that very large volumes of the electrolytes can be circulated through the cell.





EQ-VRFB-CTP-LD

Complete Testing Package for Vanadium Redox Flow Battery includes :

A. Vanadium Redox Flow Cell (Single Split Unit) for Battery R&D - EQ-VRB-C-LD

- Single cell voltage range: 1.2V ~ 1.6V
- Cell current density: 40 ~ 100 mA / cm²
- Manifold Blocks are made of anti-corrosive PTFE materials to withstand acids
- Large reactive area provides uniform and reliable test data
- Cathode materials are changable according to the test conditions
- Easy assembly and disassembly
- Reactive Area - Multiple Configurations:
 - 7x7cm
 - 5x5cm
 - 3x3 cm
- All components, Manifold Blocks, Current Plates, Bipolar Plates, Gaskets, Frames, Carbon Felts, Membranes, O-Rings, liquid inlet and outlet ports, are included for immediate use.

B. Dual Channel Precision Peristaltic Pump 0.05- 380ml/min adjustable - EQ-BK-380-2

- Flow rate 0.05 to 380 mL/min adjustable. Flow rate depends on drive rpm and tubing size
- Digital display for information including RPM and flow rates
- Stepper motor drive for high precision, stable transmission
- Stepper motor delivers smooth operation and long service life
- Operating parameters are automatically saved and recalled upon starting up
- Speed ; 1~100 rpm, reversible
- Speed Precision : 0.1 rpm
- Speed Control : Rotary coded switch with keypad

C. 5T Max. Manual Mechanical Press or Compressing Jig - EQ-YLJ-5

D. 500mL Erlenmeyer Flask for Chemical R&D Use

E. 8 Channel Battery Analyzer (6-3000 mA, up to 5V) w/ Cell Holder, Laptop Software & Optional WIFI Control - BST8-3

Current Range: 6.0mA – 3000mA

Accuracy: ±(0.05% of reading + 0.1% of range)

Voltage Range: 0.5 - 5V programmable

Accuracy: ±(0.05% of reading + 0.1% of range)

A vanadium redox battery consists of an assembly of power cells in which the two electrolytes are separated by a proton exchange membrane.

The electrodes in a VRB cell are carbon based; the most common types being carbon felt, carbon paper, carbon cloth, and graphite felt.

Both electrolytes are vanadium-based, the electrolyte in the positive half-cells contains VO^{2+} and VO_2^+ ions, the electrolyte in the negative half-cells, V^{3+} and V^{2+} ions.

The electrolytes may be prepared by any of several processes, including electrolytically dissolving vanadium pentoxide (V_2O_5) in sulfuric acid (H_2SO_4). The solution remains strongly acidic in use.

This circulation of liquid electrolytes is somewhat cumbersome and does restrict the use of vanadium flow batteries in mobile applications, effectively confining them to large fixed installations.

When the vanadium battery is being charged, the VO^{2+} ions in the positive half-cell are converted to VO_2^+ ions when electrons are removed from the positive terminal of the battery. Similarly in the negative half-cell, electrons are introduced converting the V^{3+} ions into V^{2+} . During discharge this process is reversed and results in a typical open-circuit voltage of 1.41 V at 25 °C.

Hydrogen Generator

Generates hydrogen by reforming methanol and water in a membrane reactor, a reactor that purifies the hydrogen through a desne metal membrane as it is generated by methanol reforming



Since the hydrogen is ultra pure, it can be used for braze furnaces, gas chromatographs, electronic production, or to feed PEM fuel cells in dead-end mode.

Me100

- Constant adjustable pressure hydrogen output to 90 psi.
- Pd membrane purified hydrogen for laboratory fuel cell tests, gas chromatography, braze furnaces and electronic chip production.
- Maximum output varies with delivery pressure; stated output is at 1 psig, half this output at 50 psig.
- 17" x 17" x 12", 15 lbs.
- 120 or 240 V operation, less than 1 kW power draw.

The Me100 generates hydrogen by reforming methanol and water in a membrane reactor, a reactor that purifies the hydrogen through a desne metal membrane as it is generated by methanol reforming. Plug the Me100 into a 120 V or 240 V outlet, fill with 60-70% (by volume) methanol and turn on. A pump compresses the methanol-water mixture and sends it through the boiler and into the membrane reactor.

The membrane reactor extracts pure hydrogen as it is produced, saving energy and enhancing the extent of reaction. The hydrogen produced is free of water vapor unlike electrolysis hydrogen. Waste gases are mostly CO₂; waste liquid can be recycled (this is done automatically in the Me100-2).

Me100-2

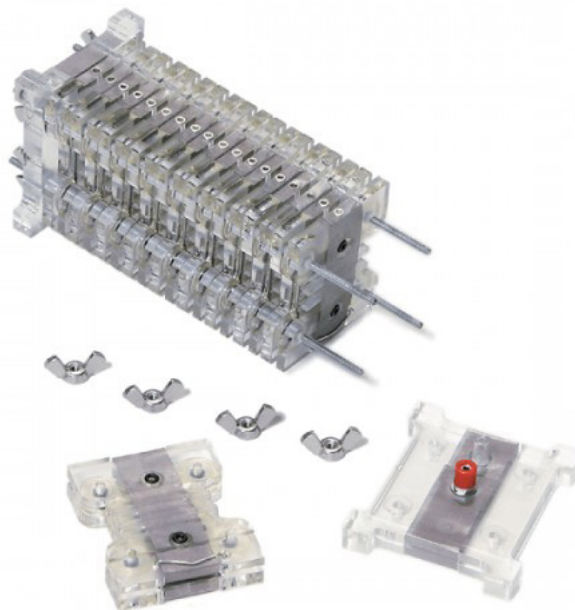
- Outputs to 99.99999% pure hydrogen.
- Pd membrane purified, adjustable constant pressures up to 90 psig.
- Maximum output varies with delivery pressure; stated output at 1 psig, half this output at 50 psig.
- Use ordinary distilled water and methanol.
- Never needs filter replacement. 17" x 17" x 21"; 25 lbs.
- Use for industry, electric cooling, balloons or fuel cell cooling.
- 240 V operation, less than 2.5 kW power draw.

Me150

- Produces 135 cubic feet of 99.99995% pure hydrogen per gallon of 70% (vol) methanol.
- Pd membrane purified.
- Hydrogen delivery to 90 psi.
- 57" x 14" x 29"; 200 lbs.
- 240 V operation.

Proton Exchange Membrane (PEM) Fuel Cell

Equipped with Nickel Based Super Alloy Tube & Flanges
 30 Segments PID Temperature Control with Auto-tune Function
 High Purity Alumina Fiber Insulation



PEMFC KIT

- Power in Hydrogen and Oxygen Mode: 500 mW
- Power in Hydrogen and Air Mode: 180 mW
- Electrode Area: 16 cm²
- Generated Voltage: 0.4 - 0.96 V DC
- Short Circuit Proof
- Dimensions (H x W x D): 3.9" x 3.14" x 3.07"

FUEL CELL H2/O2/AIR

- Operated in two modes: (1) Hydrogen and Oxygen and (2) Hydrogen and Air
- Power in Hydrogen and Oxygen Mode: 900 mW
- Power in Hydrogen and Air Mode: 300 mW
- Electrode Area: 2.9 cm²
- Generated Voltage: 0.45 - 0.96 V DC
- Dimensions (H x W x D): 2.0" x 2.0" x 1.6" (51 x 51 x 41 mm)

DOUBLE FUEL CELL

- H2/O2
- Operated in two modes: (1) Hydrogen and Oxygen and (2) Hydrogen and Air
- Power in Fuel Cell H2/Air Mode: 300mW
- Dimensions (H x W x D): 2.2" x 1.6" x 2" (56 x 42 x 40 mm)
- Weight: 2.1 oz (60 g)

DOUBLE REVERSIBLE FC

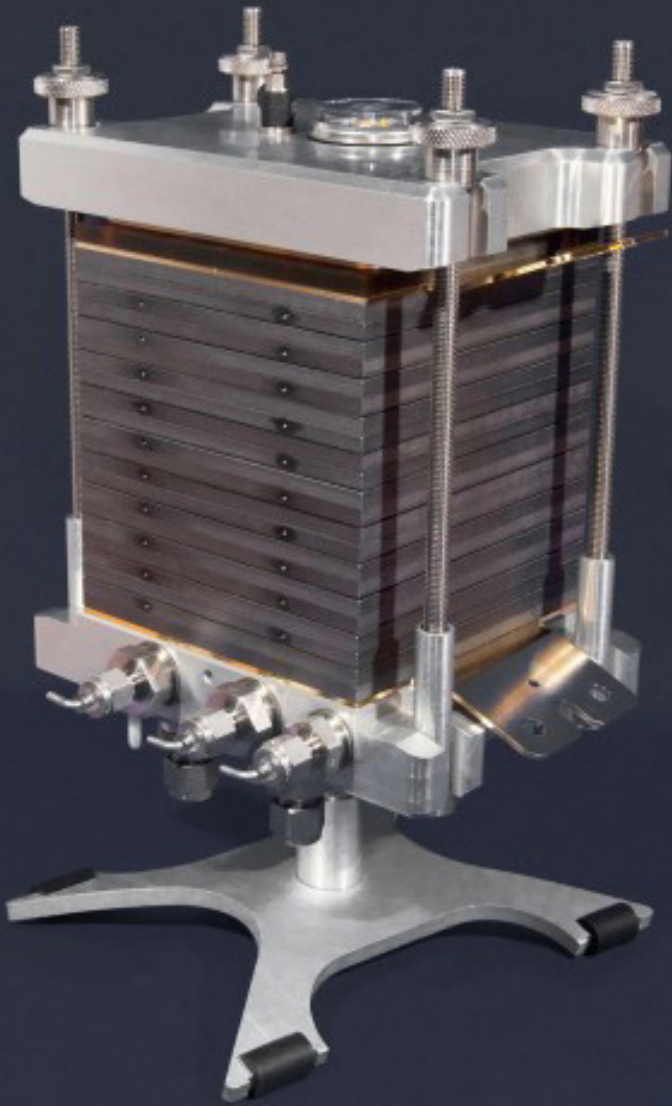
- H2/O2/AIR
- Production of hydrogen and oxygen (electrolyser mode)
- Electrolyser Mode: 10 cm²/min H₂; 5 cm²/min O₂; 2.33 W
- Fuel Cell Mode (O₂): 600 mW
- Fuel Cell Mode (Air): 200 mW

QUATTRO FUEL CELL

- H2/O2/AIR
- Operated in two modes: (1) Hydrogen and Oxygen and (2) Hydrogen and Air
- Power in Fuel Cell H2/O2 Mode: 2 W
- Power in Fuel Cell H2/Air Mode: 600mW
- Dimensions (H x W x D): 2.5" x 2.4" x 2.5" (62 x 60 x 62 mm)

FUEL CELL STACK

- 3/5/10
- Power Per Cell: 200 mW
- Total Power: 3 Cells - 600 mW, 5 Cells - 1W, 10 Cells 2W
- Generated Voltage: 0.4 - 0.96 V per cell
- Electrode Area: 4 cm²per cell
- Dimensions(H x W x D): 2.4" x 3.7" x 2.8" (60 x 178 x 70 mm)
- Weight: 221g, 288g, 430g



Electrically Heated PEM

- Research Cell - 5cm²
- Active Area: 5 cm²
- Number of Cells: 1
- Plate Material: BMC940
- Wetted Materials: Stainless Steel, Aluminum, Silicone, Ultem, Graphite
- Max Operating Temperature: 150°C
- Max Operating Pressure: 50 psi
- FlowFields: Serpentine
- Buss Plates: Copper, Gold plated (not wetted)
- Overall Dimensions: 5" x 5.8" x 6.8" high (127mm x 148mm x 171mm)

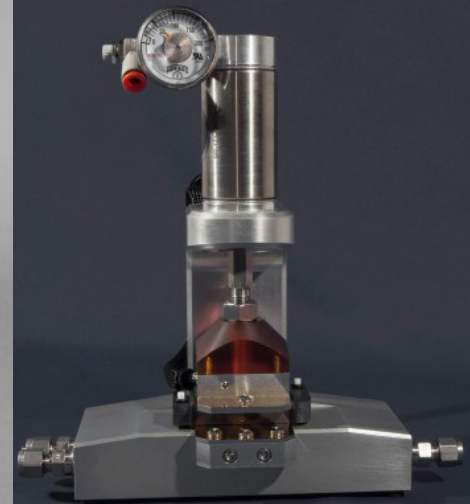
Expandable PEM

- Research Test Cell - 50cm²
- Active Area: 50 cm²
- Number of Cells: 1
- Plate Material: BMC940
- Wetted Materials: Stainless Steel, Aluminum, Silicone, Ultem, Graphite
- Max Operating Temperature: 150°C
- Max Operating Pressure: 50 psig
- FlowFields: Serpentine (others available on request)
- Buss Plates: Copper, Gold plated (not wetted)
- Overall Dimensions: 5" x 5.8" x 6.8" high (127mm x 148mm x 171mm)



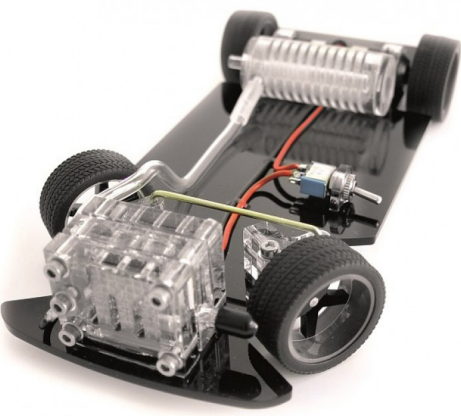
PEM Research Test Cell

- 250cm²
- Single cell stack
- Pneumatic compression system for quick and repeatable assemblies
- Water Cooled
- Operating temperatures up to 150°C
- Standard parallel, micro channels flow fields
- No MEAs included



Flex-Stak Assembled

- Disassemble and reassemble fuel cell stack of individually connected cells with the Flex-Stak Hydrogen Air PEM Fuel Cell.
- MEA Active Area: 3.2 x 3.2cm (10cm²)
- MEA Membrane Area: 5.3 x 5.3cm
- Graphite Plate Overall Dimensions (L x W x D): 6.3 x 6.3 x 0.4 cm
- Comes in a 1-cell, 5-cell, 10-cell, 15-cell and 20-cell stack configuration



Fuel Cell Concept Car and Gas Station

- Model Car
- Fuel Cell Stack Hydrogen and Air (two cells)
- Electrolyzer
- Hydrogen Storage Tank
- 3-Panel Solar Module
- Hydrogen Gas Station Base
- Power Supply
- Instructional Textbook

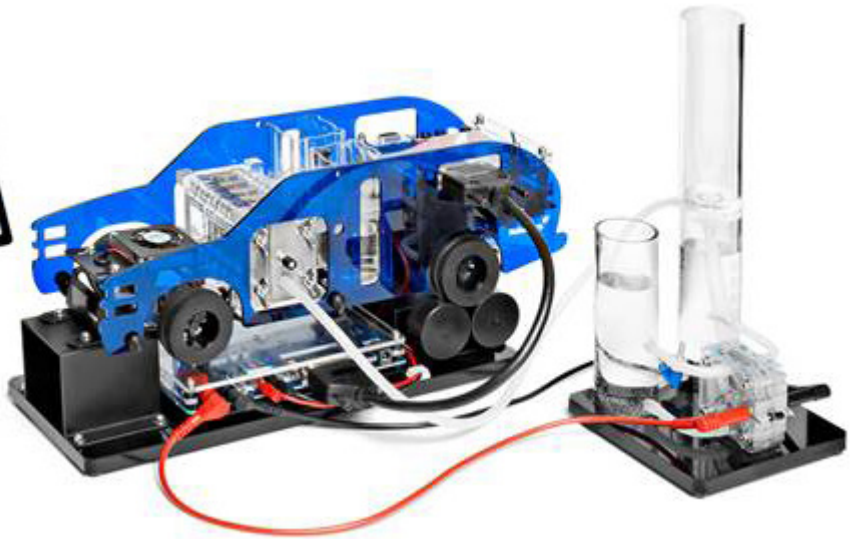


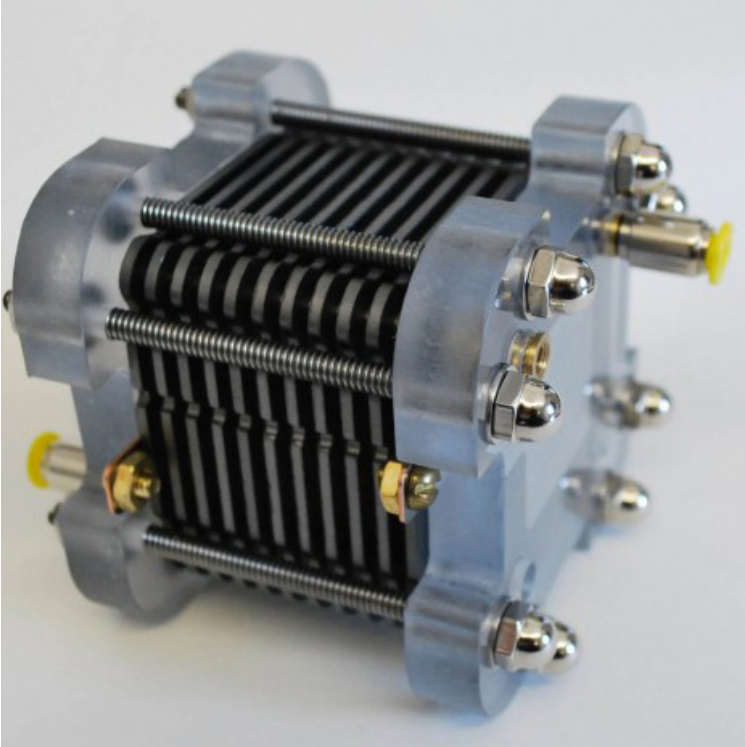
Solar Hydrogen Car & Gas Station

- Car and Gas Station Demo Includes:
- Demo Car
- Fuel Cell Stack (two cells)
- Electrolyzer
- Hydrogen Storage Tank
- 1-Panel Solar Module
- Demo Gas Station
- Instructional Textbook

**Electric Vehicle
Trainer**

- Includes:
- Fuel Cell Stack 5
- x2 Gas Storage 30
- Fan
- Supercapacitor
- Hydrogen Filling Station
- Test Bench Controller
- Energy Management Board
- HyDrive (Assembled)





Direct Methanol Fuel Cell

- The DMFC Flex-Stak comes in a 1-cell, 5-cell, 10-cell, and 20-cell stack configuration
- Power: 0.2 watts per cell (1 watt for 5 cell stack)
- Active Area of Cell: 10 cm²
- Flow Rate: 10 cc/min per cell
- Operates on 3% by mass of methanol-in-distilled water
- Concentration of Methanol to be Used: 1 molar
- Stack Contents Include : Plastic Endplates, Graphite Composite Bipolar/Monopolar Plates, High Performance DMFC MEAs, Expandable Design, Hardware

7-Cell Dismantlable Direct Methanol Fuel Cell Stack

- Ruggedly built and designed for ease of use and assembly and disassembly by researchers
- Comes with seven conditioned DMFC MEAs for immediate use
- 7 Cell Stack
- 7 Membrane Electrode Assemblies conditioned for Direct Methanol use
- Power Output: 50 watts
- Active Area: 50cm²
- Flow Field Pattern: Serpentine
- Gold plated current collectors



Flow Battery Flex-Stak

- Disassemble and reassemble flow battery (Vanadium Redox Battery) stack of individually connected cells with the Flex-Stak.
- Electrode Area: 10 cm²
- Ports: 4
- Flow Rate: 10 to 80 cc/minute at 1 Amp 1 Volt for charging
- For Charging: 1 Amp / 1 Volt
- Liquid is fed into the bottom and out the top.
- Dimensions: 3.25" x 3.25" x 2" (8.26 x 8.26 x 5.1 cm)
- Stack contents Include: Endplates, Felt, wetted PVC and CPVC, Interdigitated Flow Fields, Wetted Vinyl Ester, Hardwar



Electrochemical Cell Stack

- Disassemble and reassemble fuel cell stack of individually connected cells with the Flex-Stak Electrochemical Cell
- MEA Active Area: 3.2 x 3.2cm (10cm²)
- MEA Membrane Area: 5.3 x 5.3cm
- Fittings: 4 x 1/8" Push-to-connect (2 per reactant side)
- Graphite Plate Overall Dimensions (L x W x D): 6.3 x 6.3 x 0.4 cm
- Stacks contents include: Plastic Endplates, Anode configuration on both sides of the bipolar plate, Expandable Design, No MEAs are included with this flex-stak, Hardware

Lithium-ion Cylindrical Cells



SAMSUNG 18650/21700 Li-ion Battery Series- Capacity 1500 / 2000 / 2600 / 2900 / 3000 / 3500 mAh

- Capacity 1500mAh
- Rated Voltage: 3.7 V
- Charging Voltage End: 4.2V
- Discharging Voltage End: 2.5V

LG 18650/21700 Li-ion Battery Series-Capacity 3200/3350/3500mAh

- Rated Voltage: 3.7 V
- Charging Voltage End: 4.2V
- Discharging Voltage End: 2.5V

Panasonic 18650 / 20700 Li-ion Battery Series- Capacity 2900 / 3200 / 3450mAh

- Rated Voltage: 3.6 V
- Charging Voltage End: 4.2V
- Discharging Voltage End: 2.5 V

SANYO 18650 Li-ion Battery Series-Capacity 2200/ 3500mAh

- Rated Voltage: 3.6 V
- Charging Voltage End: 4.2 V
- Discharging Voltage End: 2.75 V

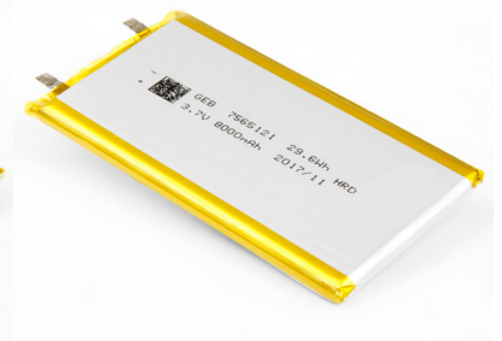
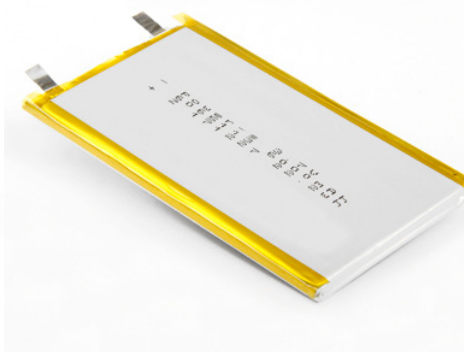
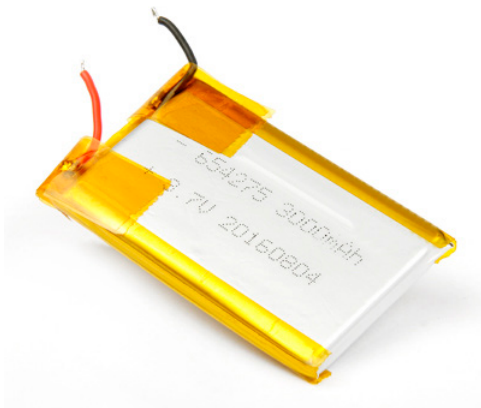
GreatPower 18650 Li-ion Battery Series-Capacity 2200/2500/2600mAh

- Rated Voltage: 3.7 V
- Charging Voltage End: 4.2V
- Discharging Voltage End: 2.5V

FST 18650 Li-ion Battery Series-Capacity 2000/2500/2600mAh

- Rated Voltage: 3.7 V
- Charging Voltage End: 4.2 V
- Discharging Voltage End: 2.5 V

Lithium-ion Pouch Cells



15 - 1,000 mAh Lipo Battery

- Small capacity range (3.7V, 15-1,000mAh) Li-polymer cells are used to power portable devices and equipments like wearables and or provide back up power.
- Cells can be combined and assembled in series to increase voltage or parallel to increase capacity by using several identical cells.
- Thermistors or thermal fuses and gas gauging can be added if necessary, but Printed Circuit Module (PCM) is highly recommended for safety protection.
- Connection can be tabs soldering directly, stripped lead wires and or with a specified genuine connector.

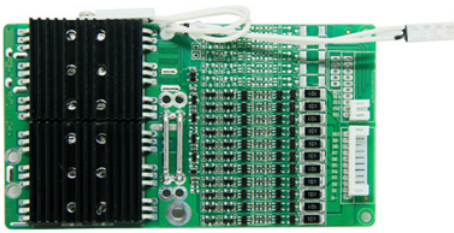
1,000 - 5,000 mAh Lipo Battery

- Medium capacity range (3.7V, 1,000 to 5,000mAh) Li-polymer cells are often used to power larger portable consuming devices, industrial or medical applications that requires more power output and longer operation.
- Cells can be combined and assembled in series to increase voltage or parallel to increase capacity by using several identical cells.
- Thermistors or thermal fuses and gas gauging can be added if necessary, but Printed Circuit Module (PCM) is highly recommended for safety protection.
- Connection can be tabs soldering directly, stripped lead wires and or with a specified genuine connector.

5,000 - 10,000 mAh Lipo Battery

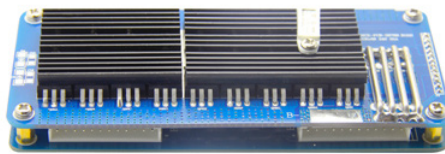
- Large capacity range (3.7V, 5,000-10,000mAh) Li-polymer cells are used to power those applications requiring more higher energy levels. Cells can be combined and assembled in series to increase voltage or parallel to increase capacity by using several identical cells.
- Cells can be combined and assembled in series to increase voltage or parallel to increase capacity by using several identical cells.
- Connection can be tabs soldering directly, stripped lead wires and or with a specified genuine connector.

Battery Management System



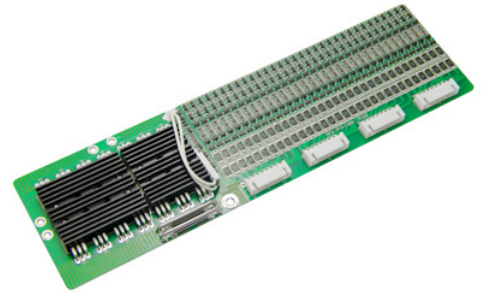
BMS D167 for 29.6V 8S Li-ion/ Li-Polymer Battery Packs (35A Charge, 35A Discharge)

- Battery management circuit board for 29.6V 8S Li-ion and Li-polymer battery pack
- BMS/PCB/PCM applies for 8 cells Li-ion/Li-polymer battery pack
- To prevent the battery packs from overcharge, overdischarge, over current, over temperature, short circuit
- The Maximal working current: 35A
- Compatible with both Li-ion and Li-Polymer cells



BMS D276 for 88.8V 24S Li-ion/ Li-Polymer Battery Packs (55A Charge, 55A Discharge)

- Battery management circuit board for 88.8V 24S Li-ion and Li-polymer battery pack
- BMS/PCB/PCM applies for 24 cells Li-ion/Li-polymer battery pack
- To prevent the battery packs from overcharge, overdischarge, over current, over temperature, short circuit
- The Maximal working current: 55A
- Compatible with both Li-ion and Li-Polymer cells



BMS D268 for 88.8V 24S Li-ion/ Li-Polymer Battery Packs (35A Charge, 35A Discharge)

- Battery management circuit board for 88.8V 24S Li-ion and Li-polymer battery pack
- BMS/PCB/PCM applies for 24 cells Li-ion/Li-polymer battery pack
- To prevent the battery packs from overcharge, overdischarge, over current, over temperature, short circuit
- The Maximal working current: 35A
- Compatible with both Li-ion and Li-Polymer cells

BMS D596V1 for 33.3V 9S Li-ion/ Li-Polymer Battery Packs (70A Charge, 70A Discharge)

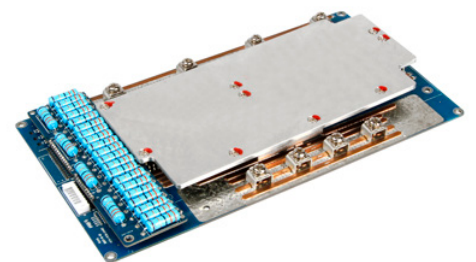
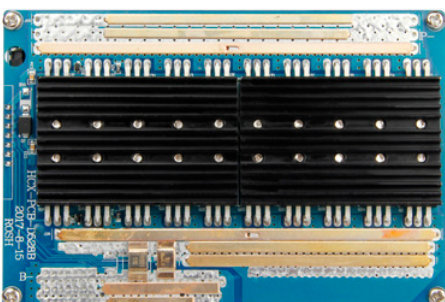
- Protection Circuit Board for 33.3V 9S Li-ion and Li-Polymer battery pack
- PCM applies for 9 cells Li-ion/Li-Polymer battery pack with E-Switch integrated, E-Switch can totally turn off the output
- With cell balance/equilibrium function
- After battery pack is fully charged. PCM will detect each cell's voltage and trim higher voltage down until other cells reach the same voltage level.
- PCM comes with all the voltage detection wires and connectors

MS D425V1 for 66.6V 18S Li-ion/ Li-Polymer Battery Packs (50A Charge, 50A Discharge)

- Battery management circuit board for 66.6V 18S Li-ion and Li-polymer battery pack
- BMS/PCB/PCM applies for 18 cells Li-ion/Li-polymer battery pack
- To prevent the battery packs from overcharge, overdischarge, over current, over temperature, short circuit
- The Maximal working current: 50A
- Compatible with both Li-ion and Li-Polymer cells

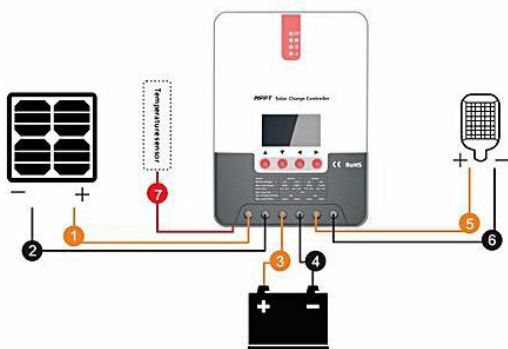
BMS D575 for 118.4V 32S Li-ion/ Li-Polymer Battery Packs (120A Charge, 120A Discharge)

- Battery management circuit board for 118.4V 32S Li-ion and Li-polymer battery pack
- BMS/PCB/PCM applies for 32 cells Li-ion/Li-polymer battery pack
- To prevent the battery packs from overcharge, overdischarge, over current, over temperature, short circuit
- The Maximal working current: 120A
- Compatible with both Li-ion and Li-Polymer cells



Solar Charge Controller

Prevents overcharging and can protect against overvoltage, which can reduce battery performance or lifespan and may pose a safety risk.



1. Solar panel "+" interface
2. Solar panel "-" interface
3. Battery "+" interface
4. Battery "-" interface
5. Load "+" interface
6. Load "-" interface
7. External temperature sampling interface

SOLAR CHARGE CONTROLLER (ML24XX)

- With the advanced dual-peak or multi-peak tracking technology, when the solar panel is shadowed or part of the panel fails resulting in multiple peaks on the I-V curve, the controller is still able to accurately track the maximum power point.
- A built-in maximum power point tracking algorithm can significantly improve the energy utilization efficiency of photovoltaic systems, and raise the charging efficiency by 15% to 20% compared with the conventional PWM method.
- A combination of multiple tracking algorithms enables accurate tracking of the optimum working point on the I-V curve in an extremely short time.
- The product boasts an optimum MPPT tracking efficiency of up to 99.9%.
- Advanced digital power supply technologies raise the circuit's energy conversion efficiency to as high as 98%.
- Automatic recognition of battery voltage is supported.
- LED fault indicators and an LCD screen which can display abnormality information help users to quickly identify system faults.
- Historical data storage function is available, and data can be stored for up to a year
- Charging program options are available for different types of batteries including gel batteries, sealed batteries, open batteries, lithium batteries, etc

SOLAR CHARGE CONTROLLER (SRDMXXX)

- True MPPT functions, applicable to monocrystalline, polycrystalline and amorphous silicon solar panels serially connected in various numbers, significantly improving the solar panels' energy utilization ratio.
- MPPT solar charging technology, the maximum solar input voltage $V_{oc} \leq 60V$.
- The load is stepping up and constant current output which can support maximum 18pcs of LED beads connected in series
- Adopts an improved charging algorithm that supports 12 V and 24 V lead-acid batteries and lithium batteries, and the user can set the operating modes for lead-acid batteries or lithium batteries accordingly.
- Boasts a load triple-stage brightness adjustment and morning on design, with an operating duration adjustable from 0 to 15 hours and a power settable from 0 to 100%.
- Features a system status log function, able to record a maximum of 7 days of system status, comprehensively and effectively monitoring the system's conditions.
- Data communication adopts a multi-time two-way handshake protocol and a data compression algorithm, realizing precise and fast data transmission.
- Features an intelligent power mode which can extend the battery life to its top limit by adjusting the load power automatically according to the remaining battery capacity.
- With an infrared remote control function, operations including setting parameters, reading status and viewing historical data can be conducted.
- Features of "U" series:
 - Boasts a wireless Internet communication function, able to conduct remote monitoring and real-time management on street lights via the solar power street light management system.

Solar Simulator

All Abet solar simulators are completely self-contained. The source, arc lamp power supply, control electronics, shutter, lamp, and optical compartment are housed in a single compact enclosure. A digital shutter timer allows internal or external control of the shutter.



MODEL 11002

- Abet Technologies' model 11002 SunLite™ Solar Simulators set a new standard for 50x50 mm field solar simulators using only a 100 W Xe arc lamp. A wide range of reproducible irradiance settings is made possible by the available attenuation option. Highly stable long term and short term output allows for reproducible metrology.
- Features:
 - 1) Gen III Optics for High Efficiency Illumination
 - 2) Infinitely Adjustable Irradiance, Reproducibly Settable
 - 3) Class A AM1.5G Spectral Match
 - 4) ASTM Class A stability
 - 5) 50x50 mm Class B uniformity
 - 6) Manual Shutter Included, Electronic Shutter Optional
 - 7) Uninterrupted testing with the prealigned lamps
 - 8) HEPA filtered air cooling

MODEL 10500

- Abet Technologies model 10500 is a low cost solar simulator providing an attractive alternative to more fully featured and expensive solar simulators for applications that do not require a large area illuminated field.
- The optical system of the 10500 produces a collimated 25 mm beam. Focus or defocus it for higher irradiance or larger solar cells. One sun output is achievable up to a 35 mm diameter illuminated field
- The 10500 utilizes a fast F/1 optical system and rear reflector to collect radiation from the lamp allowing over 3 suns output over smaller fields.
- The beam can be collimated at 25 mm diameter or defocused to illuminate larger cells.
- Focus, lateral, and rear reflector adjustments allow for optimizing beam size and uniformity.
- One sun performance for up to a 35 mm diameter illuminated field with uniformity of +/- 20% can be achieved with careful alignment.
- Smaller areas within the illuminated field will provide higher levels of uniformity if required.



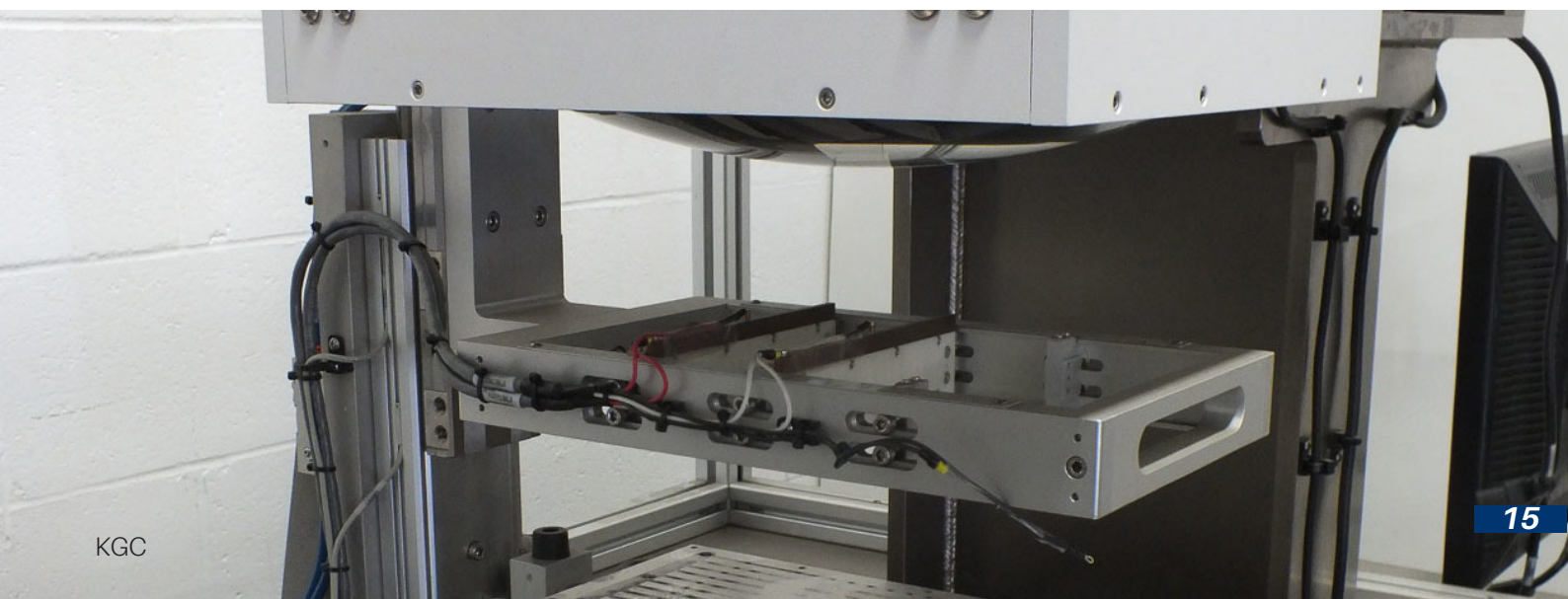
SUN 3000 CLASS AAA

- The Abet Gen II optical design, patent pending, dramatically increases the percentage of photons reaching the work plane.
- All electronics are packaged in the lamp house - no clutter of high power cables to deal with
- Photofeedback and digital shutter timer are included.
- Standard maintenance, lamp or filter replacement, does not require any tools.
- Locking indicator dials on all the system controls provide for a reproducible and stable setup.
- A built-in beam imaging accessory assists in system alignment.
- Any dust or dirt particles introduced into an optical system can degrade system performance and shorten the life of critical optical components.
- Sun 3000 sources utilize a HEPA filtered cooling fan to extend the life of the delicate optical components.
- Abet Technologies offers a number of spectral and field size options to match your application.
- The Sun 3000 family standard offerings range from 50×50 mm to 400×400 mm 1 sun or more uniformly illuminated field versions for Photovoltaic and UV applications.
- Beyond the standard AM 1.5 and AM 0 filters many other filters are offered to fine tune the spectral characteristics of the source for your particular application.
- A low profile optical alignment system leaves the space below the system wide open for any material positioning equipment or large samples.
- Unit mounting options allow suspension from above leaving space below totally free if needed.
- Up-pointing and horizontal output direction models are also available.
- Long working distances allow easy interface to vacuum boxes.



SUN 2000 CLASS AAA

- The Abet Gen II optical design, patent pending, dramatically increases the percentage of photons reaching the work plane.
- All electronics are packaged in the lamp house - no clutter of high power cables to deal with. A digital shutter timer allowing both manual and external control is included with every unit.
- Standard maintenance, lamp or filter replacement, does not require any tools.
- Locking indicator dials on all the system controls provide for a reproducible and stable setup.
- Any dust or dirt particles introduced into an optical system can degrade system performance and shorten the life of critical optical components. Sun 2000 sources utilize a HEPA filtered cooling fan to extend the life of the delicate optical components.
- Abet Technologies offers a number of spectral and field size options to match your application. The Sun 2000 family standard offerings range from 50×50 mm to 3500×3500mm 1sun or more uniformly illuminated field versions for Photovoltaic and UV applications.
- The compact design of the systems, combined with the long working distance optics, leaves the space below these instruments wide open for any sample positioning or testing equipment. Unit mounting options allow suspension from above leaving the space below totally free if needed.
- Up-pointing and horizontal output direction models are also available. Long working distances allow easy interface to vacuum boxes.
- Beyond the standard AM 1.5 and AM 0 filters many other filters are offered to fine tune the spectral characteristics of the source for your particular application.
- A low profile optical alignment system leaves the space below the system wide open for any material positioning equipment or large samples.
- Unit mounting options allow suspension from above leaving space below totally free if needed.
- Up-pointing and horizontal output direction models are also available. Long working distances allow easy interface to vacuum boxes.



Probe Station & Reference Cells

All solar simulators are subject to output variations with time due to component aging. Reference cells need to be used to allow both the initial system setting and later the maintenance of irradiance levels.



NREL Calibrated Cell Used for Calibration Transfer

- Solar reference cell is a precision instrument for the determination of solar simulator irradiance levels.
- The sensor is a mono-crystalline silicon solar cell having an area of 2x2cm (4cm).
- The back of the solar cell is attached to the device in such a way that a good heat transfer to the device housing is guaranteed.
- Below the solar cell a Pt100 RTD temperature sensor is mounted to allow monitoring of device temperature.
- The device is not shunted allowing the whole IV-curve to be measured. The solar cell is protected by a high quality fused silica window, assuring spectral sensitivity over a 320 - 1100 nm range.
- Each reference solar cell is delivered with a calibration report showing the IV-curve plot and the following parameters: I_{sc} , V_{oc} , I_p , V_{mp} , Fill Factor and Efficiency.

Low Cost Reference Cell

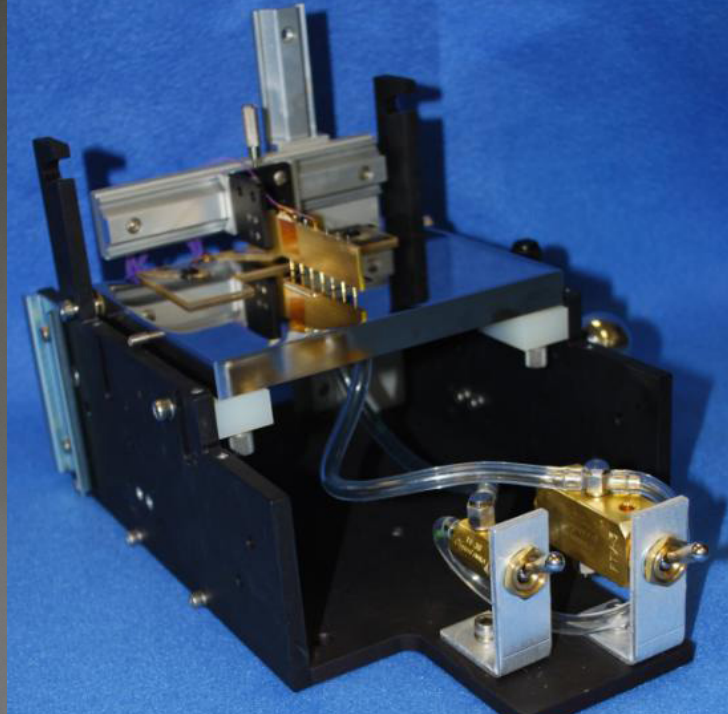
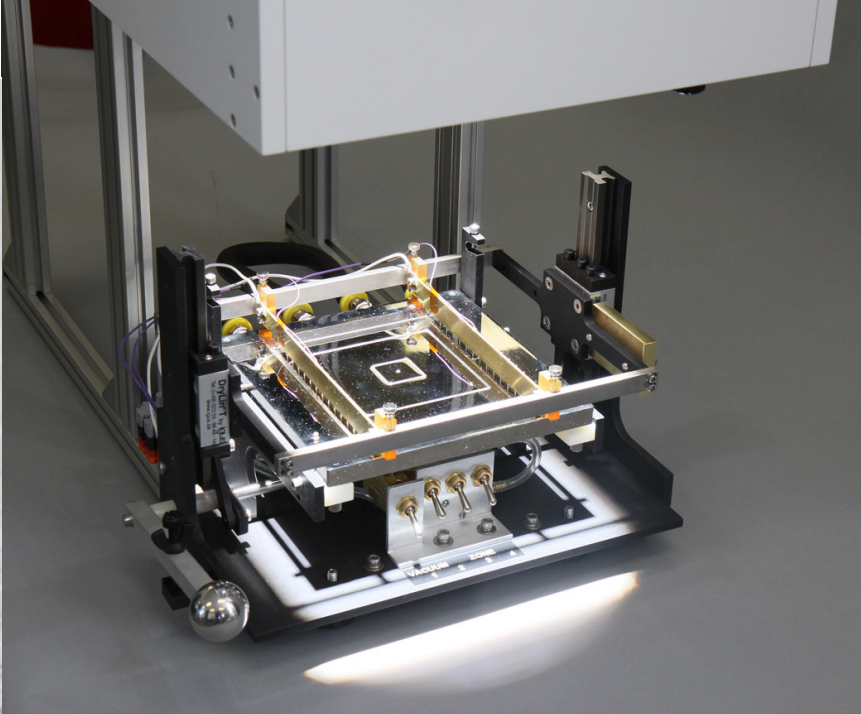
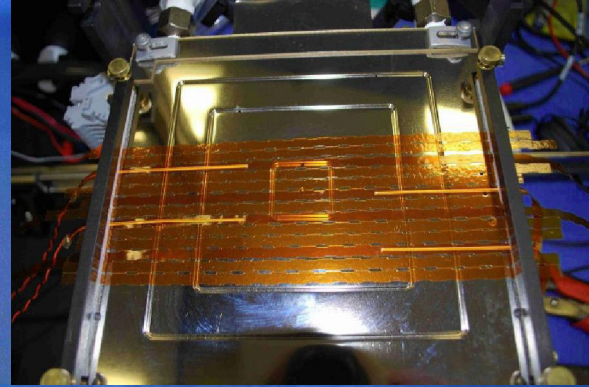
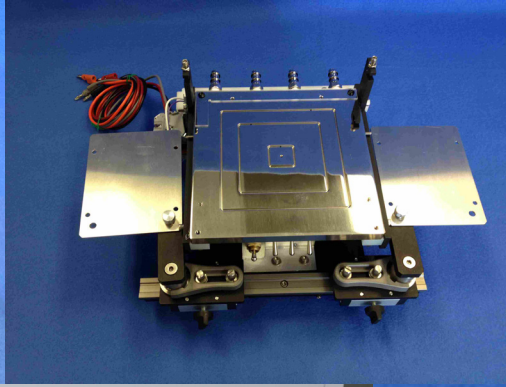
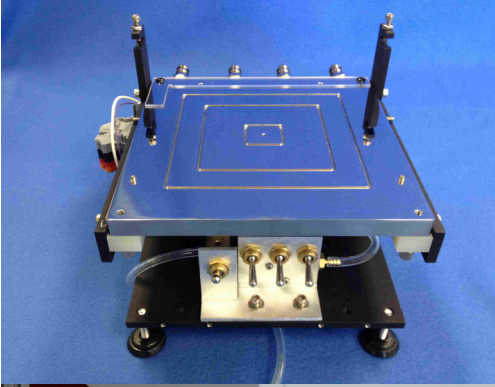
- Model 15151 reference cells offer an entry level means for calibrated solar cell metrology.
- Each 10x10 mm cell comes calibrated to deliver 100mV output at one AM1.5G sun which can easily be read with any voltmeter.
- Calibration accuracy is 6% at the time of shipment.
- Enclosure size is 55x36x7 mm.
- Model 15151-KG5 cells add a KG5 window to more closely match the spectral response of organic and amorphous silicon solar cells.
- The calibration accuracy is 8% at the time of shipment.

Multi-Junction Reference Cell

- Multi-Junction solar cell metrology is more complicated than that of a single junction one.
- As these cells are made of multiple layers, a multi-source/LED solar simulator is usually employed to allow adjustment of band to band irradiance ratios.
- Our triple junction reference cells can be used to set the correct irradiance for each single junction.

Calibrated Readout

- Model 15159 Calibrated Readout can be calibrated for a particular
- Model 15150 reference cell to display 100.0 when the cell is exposed to one AM1.5G sun irradiance.
- It can also be shipped calibrated to offer 0.1 Ohm input impedance and then be usable with a number of different cells displaying their calibrated I_{sc} at one sun irradiance conditions.



Back Contact Option

- The back contact option consists of insulating strips and dual conductor strips.
- The dual conductor strips, wider conductor used for output and narrower for sense signal are mostly insulating except for a small section where the gold plated conductors are exposed so that they can contact the back pads.
- The ends of the conductive strips are also exposed for bringing the signals out.

Micromanipulator Base Option

- The micromanipulator base option provides two magnetic platforms for micromanipulators.
- The bases are fully adjustable so that micromanipulators can contact anywhere on a cell.

Probe Bar and Actuator Option

- The probe bar and actuator option is for bus bar metalized cells.
- Probe bars have a series of spring loaded pins to contact a cell bus bar.
- Each probe bar has an isolated center voltage sense pin.
- Probe bars are independently adjustable to match cell bus bar separation.
- The number of probe bars and the number of pins on each probe bar depends on the option ordered.

Multi-Zone Vacuum Chucks

- Abet Multi-Zone Vacuum chucks are available in four standard sizes, 50 x 50 mm, 156 x 156 mm, 210 x 210 mm and 300 x 300 mm.
- Cells from 3 x 3 mm to the chuck maximum size can be accommodated
- A set of cell locators is included with each chuck to allow for reproducible positioning of the devices.
- A locating bracket correctly positions the chuck with respect to an Abet Solar Simulator.
- For use with other solar simulators custom locating brackets can be ordered.
- Each station has a calibrated temperature sensor to facilitate STC correction.
- Simple connection to a recirculating cooler provides temperature control from dew point to 70 degrees C for standard chucks.
- Higher temperature capable chucks are available on special order.
- Three different cell contact options are available affording the most flexible probe stations available.
- All of the options can easily be installed in the field if cell contact geometries change in the future.

KGC

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THROUGH RESEARCH & INNOVATION

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