Power Electronics Testings

PV Inverter Test Solution

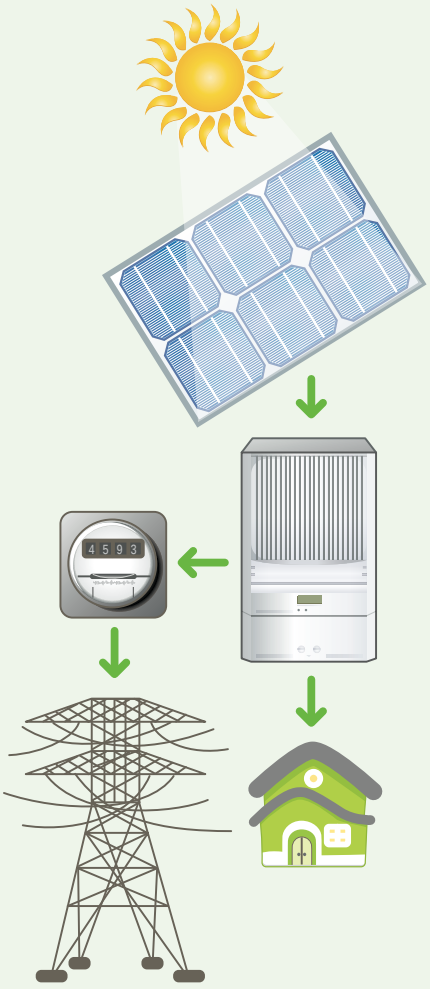
www chromaate com

Chroma

Turnkey Test & Automation Solution Provider

A PV system is an energy system which directly converts energy from the sunlight into electricity. Once light hits the solar cell (array), electricity is generated and the DC is collected at a PV inverter.

PV inverter is a device that changes DC power to AC power and is also a key component in PV systems. There are two main types of PV systems, Grid Connected or Off Grid. Grid connected systems are usually installed on a building and provide electricity directly into the mains supply. Off grid systems are usually used where power is required but access to a mains supply is unavailable.



Chroma provides PV inverter testing solutions based on its twenty-five years of experience in power electronics testing.

These solutions include:

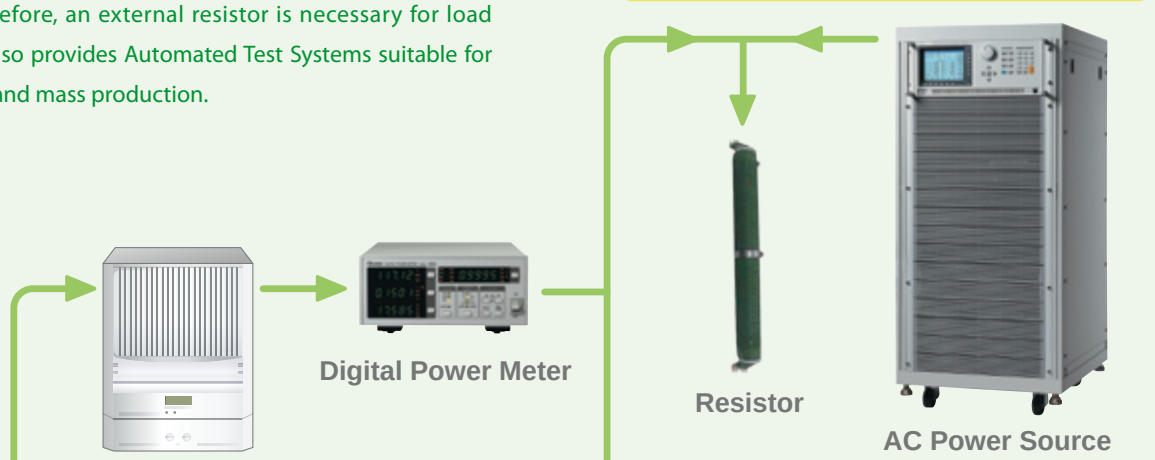
1. DC Power Supply 62000H Series : to simulate output characteristics of the solar array. It also provides a unique feature called solar array simulation function. This function is useful for MPPT performance evaluation on PV inverter devices.

2. Digital Power Meter/Analyzer 66200/6630 Series : to measure PV inverter output parameters, such as V, I, P, PF, current harmonics & THD.

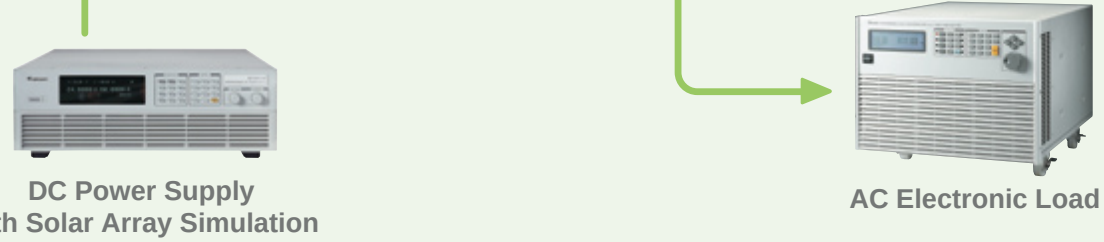
3. AC Power Source 6500/61500/61600 Series : to simulate mains power various scenarios.

4. AC Load 63800 Series : to sink current directly for off grid type PV inverters. The Chroma AC Source provides a voltage level as the reference for the PV inverter output. But the AC source can not sink current (energy); therefore, an external resistor is necessary for load simulation. Chroma also provides Automated Test Systems suitable for R&D, QA qualification and mass production.

Grid Connected Type Testing



Stand Alone (Off Grid) Type Testing



Programmable DC Power Supplies with Solar Array Simulation

150KW Solar Array Simulator

Model 62000H Series

Key Features

- ☑ Voltage range : 0 ~600V & 1000V
- ☑ 3U/15kW high power density module with easy master/slave parallel operation up to 150kW
- ☑ Simulation of multiple solar cell material's I-V characteristic (fill factor)
- ☑ Simulation of dynamic irradiation intensity and temperature level from clear day to cloud cover conditions
- ☑ Shadowed I-V curve output simulation
- ☑ Auto I-V program: 100 I-V curves & Dwell time 1-15,000s
- ☑ Static & dynamic MPPT efficiency test

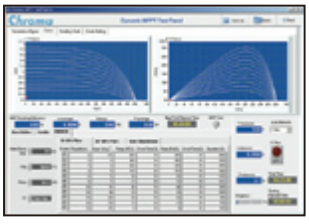
The latest programmable solar array simulator power supply 62150H-600S&1000S released by Chroma provides simulation of Voc (open circuit voltage) up to 1000V and Isc (short circuit current) up to 25A. The 62150H provides an industry leading power density in a small 3U high package. The solar array simulator is highly stable and has a fast transient response design, which are both advantage to MPPT performance evaluation on PV inverter devices.

Model	62100H-600S	62150H-600S/1000S
Output Ratings		
Output Voltage[1]	0~600V	0~600V/0~1000V
Output Current [2]	0~17A	0~25A/15A
Output Power	10KW	15KW

Note 1 : Minimum output voltage is <0.15% of rate voltage at zero output setting.
Note 2 : Minimum output current is <0.2% of rate current at zero output setting when measured with rated load resistance.
* Call for more information on customization of high power system >150kW

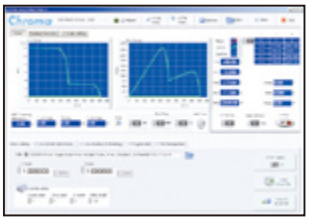
Static & Dynamic MPPT Efficiency Testing

The model 62150H-600S/1000S includes a graphical user Interface software through remote digital interface (USB / GPIB / Ethernet / RS232) control. The user can easily program the I-V curve of the62150H-600S/1000S as well as the I-V & P-V curve for real-time testing. In addition it will display the MPPT status for the PV inverter. Readings and the report function with real-time monitoring using the Softpanel are shown below.



EN50530 & Sandia Dynamic MPPT Test

Static MPPT Test



Shadowed I-V Curve Simulation

High Precision Power Measurement Digital Power Meters/Power Analyzers

Model 66200/6630 Series

Key Features

- ☑ Voltage : Vrms, Vpeak+, Vpeak-
- ☑ Current : Irms, Ipeak+, Ipeak-
- ☑ Power : Watts, Power Factor, VA, VAR
- ☑ Other : Current Harmonics & THD

66200 Softpanel

66200 Softpanel

IEC 61000-3-2 Current Harmonic Test

Power Efficiency Test Softpanel

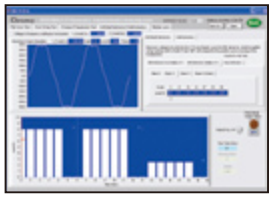
Model	66202	6630
Parameters	V, Vpk, I, Ipk, Is, W, VA, VAR, PF, CF_I, F, THD_V, THD_I, Energy	V, Vpk, I, Ipk, Is, W, VA, PF, CF_I, F, THD, Harmonic, Energy
AC Voltage	150/300/500Vrms (CF = 1.6)	2000/600/200/60/20/6Vpeak, 600Vrms continuous
AC Current	SHUNT H : 0.2/2/8/20Arms (CF=2@0.2/2/8A, CF = 4@ 20A) SHUNT L : 0.01/0.1/0.4/2Arms (CF=4)	300/100/30/10/3/1/0.3/0.1Apeak, 20Arms continuous
Power	47Hz ~ 63Hz : 0.1% of rdg + 0.1% of rng 15Hz ~ 1KHz : (0.1+ 0.2/PF*KHz)% of rdg + 0.18% of rng 300V x 0.01A Range : 0.2% of rdg + 7mW	0.4% of rdg + 0.1% of rng

Advance AC Power Sources

Model 61500/6500 Series

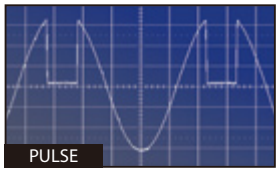
Key Features

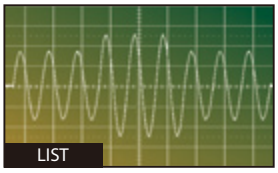
- ☑ Output : 500VA~90KVA/0~300VAC/424VDC, 1or 3 phase
- ☑ Turn on, turn off phase angle control
- ☑ Programmable voltage and frequency slew rate
- ☑ Power line disturbance simulation LIST, PULSE, STEP modes
- ☑ Distortion waveform editor SYNTH and INTERHAR modes
- ☑ Measurement for RMS Voltage, Current, Power, PF, VA, VAR, Crest factor, peak and inrush current.
- ☑ Standard AC source for IEC61000-3-2 testing

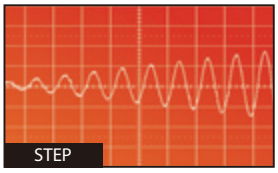


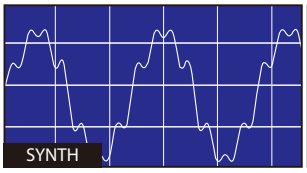
Voltage Harmonic & Interharmonics Test

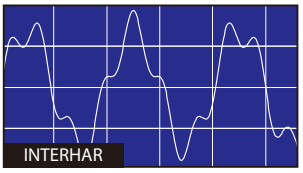
Voltage DIP, Short, Variation Regulation Test











Model	6560	6590	61511	61512
Output Phase	1	1 or 3	1 or 3	1 or 3
Power	6KVA	9KVA	12KVA	18KVA
Voltage	150V/300V/500V	150V/300V	150V/300V	150V/300V
Max. Current	60A/30A/15A	90A/45A	96A/48A	144A/72A
Frequency	45 ~ 1KHz	45 ~ 1KHz	DC, 15 ~ 1.5KHz	DC, 15 ~ 1.5KHz

Programmable AC&DC Electronic Loads

Model 63800 Series

The 63800 Series AC&DC Electronic Loads are designed for testing Off-Grid Inverters. The 63800's state of the art design uses DSP technology to simulate non-linear rectified loads with it's unique RLC operating mode.

Key Features

- ☑ Phase : 1 or 3 (parallel)
- ☑ Power : 1.8KW, 3.6KW, 4.5KW
- ☑ Frequency : 45Hz ~ 440Hz
- ☑ Voltage : 50 ~ 350Vrms
- ☑ Power Factor : 0 ~ 1 lead or lag
- ☑ Crest Factor : 1.414 ~ 5
- ☑ Mode : CC, CR, CP, RLC

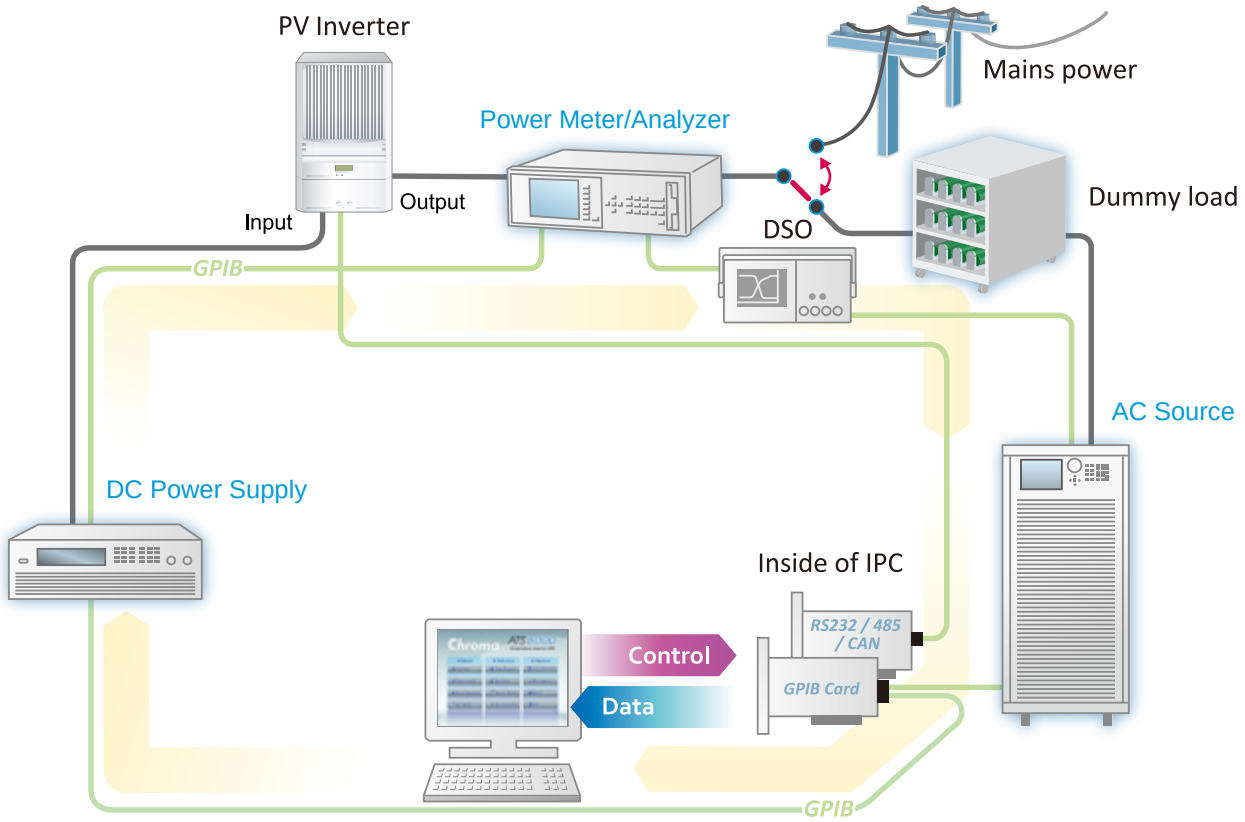
Model	63802	63803	63804
Power	1800W	3600W	4500W
Current	0 ~ 18Arms (54 Apeak, continue)	0 ~ 36Arms (108 Apeak, continue)	0 ~ 45Arms (135 Apeak, continue)
Voltage	50 ~ 350Vrms (500 Vpeak)	50 ~ 350Vrms (500 Vpeak)	50 ~ 350Vrms (500 Vpeak)
Frequency	45 ~ 440Hz, DC	45 ~ 440Hz, DC	45 ~ 440Hz, DC

High Performance Hardware Devices and Software Architecture
PV Inverter Automated Test Systems

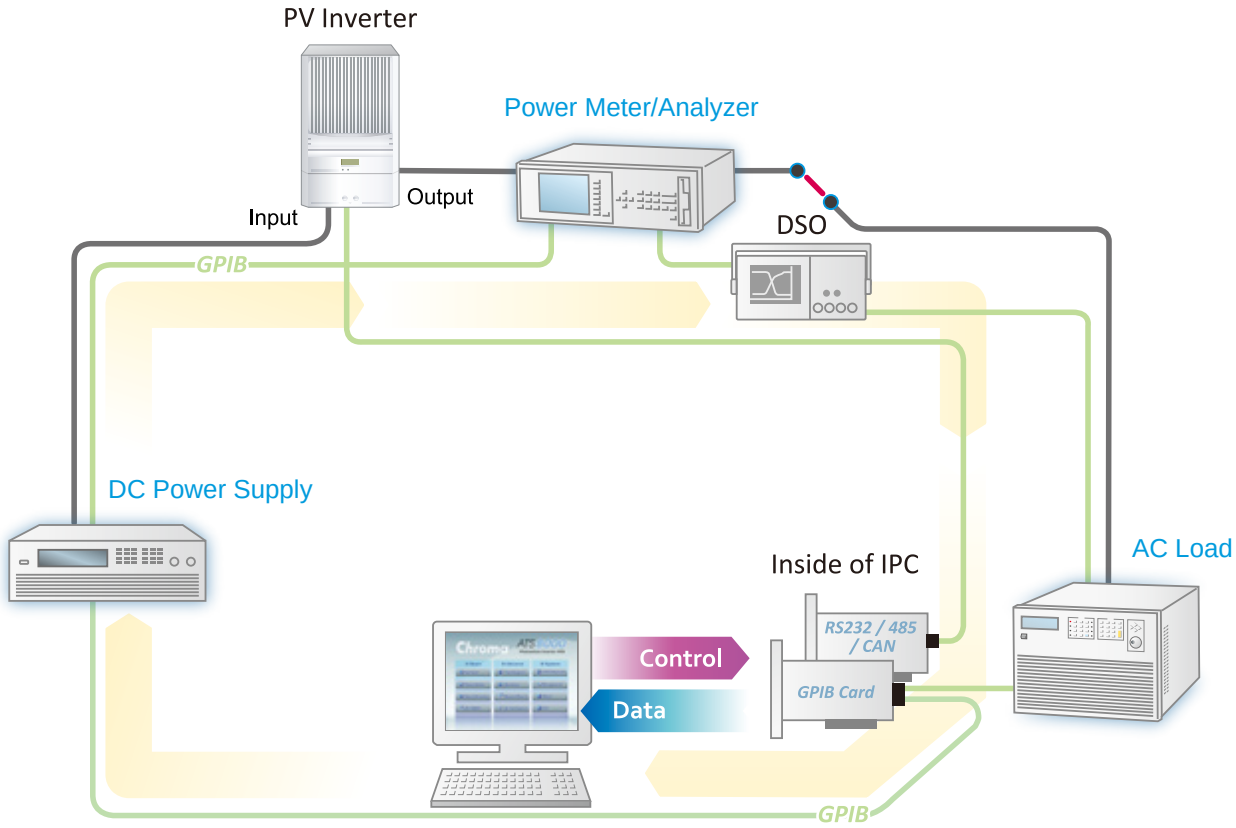
Model 8000

1. **Dummy Load & Controller**
2. **Monitor**
3. **AC Source :** Chroma 6500/61500/61600 series
4. **System Controller :** Industrial PC
5. **Digital Storage Oscillate scope :** TEK DPO/TDS series
6. **Digital Power Meter/Analyzer :** Chroma 66200/6630 series
7. **System Power Panel**
8. **Connecting Panel**
9. **DC Power Supply :** 62000H series

Grid Connected PV Inverter Test Block Diagram



Off Grid PV Inverter Test Block Diagram



Optimized Equipment & Test Items

The Chroma 8000 ATS is equipped with optimized standard test items for PV inverters (the Unit Under Test), It meets IEEE1547, 1547.1, UL1741, GB/T 19939, CGC/GF001 preliminary test requirements. The user is only required to define the test conditions and specifications for the standard test items to perform the test.

The optimized test item covers 5 types of power supply test requirements. The OUTPUT PERFORMANCE test verifies the output characteristics of the UUT. The INPUT CHARACTERISTIC test checks the UUT input parameters. TIMING & TRANSIENT tests the timing and transient states during protection. The PROTECTION TESTS trigger and test the protection circuit, the SPECIAL TEST provides means to test the most sophisticated UUT when unique test routines are needed.

Output Performances

1. Output Voltage
2. Output Current
3. Output Power
4. Output Power Factor
5. EFF (CEC/European/Conversion/Max)
6. DC injection Current
7. THD
8. Current Harmonic Test
9. Night Time Power Consumption

Input Characteristics

10. Input Voltage
11. Input MPPT Voltage
12. Input Current
13. Input Power
14. Input MPPT Power

Timing & Transient

15. OVP/UVP Trip Time
16. OFP/UFP Trip Time
17. Anti-Islanding Trip Time*
18. Re On-Grid Time

Protection Tests

19. OV/UV Protection
20. OF/UF Protection
21. Anti-Islanding*

Special Tests

22. MPPT Efficiency
23. MPPT Time
24. MPPT Record
25. RS232/485/CAN communication

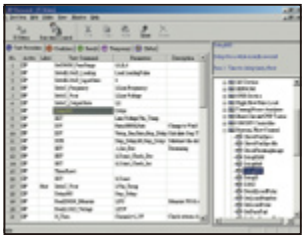
* Simulate loss of utility only

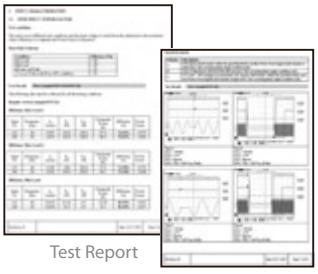
Software Platform of ATS

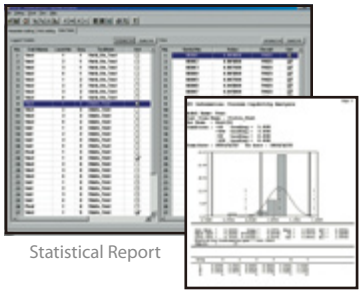
The Model 8000 Test Systems include the industries most sophisticated power supply testing software platform, PowerPro III. PowerPro III provides users with an open software architecture suited for a wide range of applications and devices.

Power Pro III is a Windows 98/NT/2000/XP environment, which provides necessary computer peripherals.

Software Main Screen


Test Item Editing


Test Report


Statistical Report

Ordering Information

Programmable DC Power Supplies

62000H : Programmable DC Power Supply

Digital Power Meters

66202 : Digital Power Meter (20A)(1 ϕ)
A662006 : External CT 50Arms for Model 66202
A662007 : External CT 100Arms for Model 66202

Power Analyzers

6630 : Power Analyzer (1 ϕ or 3 ϕ)

Programmable AC Power Sources

6500 : Programmable AC Source
61500 : Programmable AC Source
61600 : Programmable AC Source

Programmable AC&DC Electronic Loads

63800 : Programmable AC&DC Electronic Load

PV Inverter Automatic Test Systems

8000 : PV Inverter ATS
A800066 : PV Inverter ATS Software

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