MACCOR
BATTERY & CELL TEST EQUIPMENT WORLD WIDE

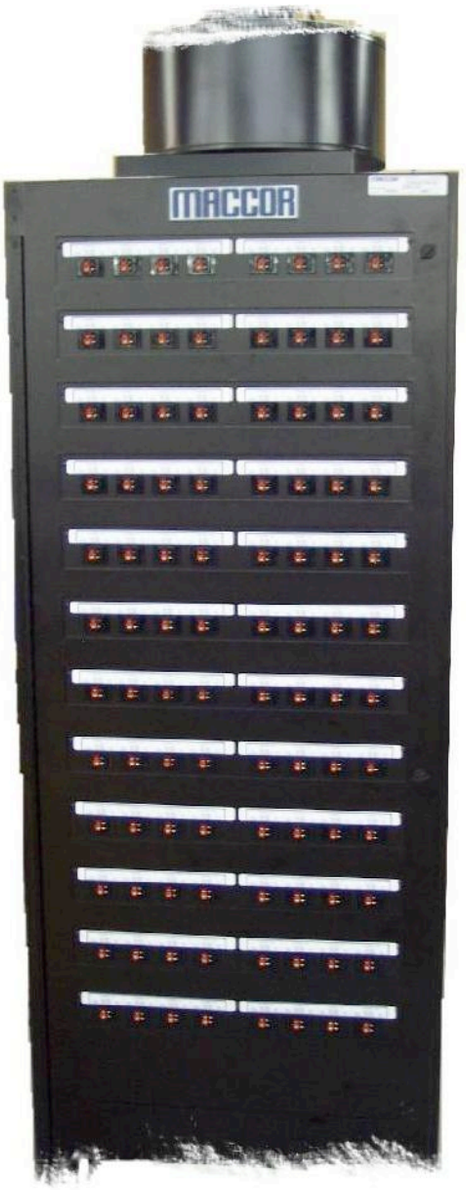
Series 4000 Automated Test System

The multifunction Series 4000 is a range of fully automated, computerized test systems that provide the highest level of specifications and features available in the industry.

From the base system that provides the highest level of accuracy and time resolution, features can be added to allow the Series 4000 system to perform virtually any type of test, with any type of products (i.e. batteries, super-capacitors, fuel cells, etc.) and chemistries.

Each test position:

- Operates independently of the other positions
- Can be user programmed to run a wide range of multi step tests, including pulse tests
- Can be user programmed to operate in steps of fixed current, fixed power, fixed voltage, fixed resistance, and voltage ramp (cyclic voltammetry)
- Can be set up to record data at operator specified intervals of time, voltage, current, etc.
- Is delivered calibrated to NIST traceable standards, and requires calibration only once per year



96 channel Series 4000

The Series 4000 systems are available in sizes from 1 to 192 test positions and are custom manufactured to meet a specific customer's requirements. They can be configured with a wide range of voltage and current ranges and can be fitted with optional hardware to provide a number of additional features and capabilities.

Based on tried and proven technology, the Series 4000 is designed to be readily upgradeable. This allows Maccor to continuously introduce new features that keep up with the ever-changing requirements and level of sophistication demanded by our customers.

Supplied as a complete turnkey system, the Series 4000 consists of a test cabinet, PC computer, tester software, and data analysis software. The test cabinet, with embedded microprocessors, and PC computer are connected via a 10 Base T LAN communications network.

To provide maximum reliability, flexibility, and speed of operation, embedded microprocessor controller boards provide control of the tests and collect data. Each controller supports from one to eight test channels, dependent on the application. In addition, the test cabinet contains the individually controlled programmable loads and power supplies.

Each test channel is operated independently. This allows different tests to be performed on different test channels simultaneously. Once started, tests operate automatically until the appropriately programmed test end condition is reached.

Tests are programmed, by the operator, on the host PC computer using a menu-driven build test program which is extremely user friendly and easy to use. When a test is started, the test program is downloaded to the appropriate channel's embedded controller board. The controller board controls the test and collects the initial data measured by the programmable load. This measured data is then transferred to the PC computer for processing and storage.

The flexibility of the Series 4000 allows it to be used for a wide range of applications such as Materials Research, Portable Electronic Devices, Quality Control in Manufacturing, Research & Development, Battery Pack Assembly, Super-Capacitor Testing, Fuel Cell Testing, Thermal Battery Testing, Qualification Testing, and much much more.

Specifications

Multi-Current Range

Range 1	150 µA Full Scale ±0.03 µA
Range 2	5 mA Full Scale ±1.0 µA
Range 3	150 mA Full Scale ±30.0 µA
Range 4	5000 mA Full Scale ±1.0 mA
Current Control Range	300 ηAmps to 5 Amps

Voltage (multi-current range channels)

Measurement Range	-2V to +8 Volts or 0V to +10 Volts
Accuracy	±0.02% Full Scale Range
Resolution	16 bit

Single-Current Range

Current Range	Per Your Specifications, currents up to 2000A available
Current Accuracy	±0.05% Full Scale

Dual-Current Range

Current Range	Any combination of two single-current ranges
Current Accuracy	±0.05% Full Scale Range

Voltage (single-current range and dual- current range channels)

Measurement Range	Per Your Specifications, voltages up to 180V available
Accuracy	±0.02% Full Scale
Resolution	16 bit

Modes of Operation

Fixed (Constant) Current	Fixed (Constant) Power
Fixed (Constant) Resistance	Fixed (Constant) Voltage
1kHz AC Impedance Measurement	
Voltage Ramp (Cyclic Voltammetry)	
Functions – functions can be used as set points, end conditions, or set as variables. The function is entered in the function field and valid mathematical functions, measured values, and custom values are selected and added from the valid key words.	
Waveform – allows the streaming of an external test file (i.e. FUDS drive cycle test) to the test system.	

Time

Minimum Step Time	10 mS†
Control, Measurement, and Adjustment	every 10 mS
† Optional 5mS and 1mS minimum step times available	

Options

Multiplexer	Allows impedance analyzers from Princeton Applied Research or Solartron Analytical to be integrated for EIS experiments
Telecom Pulsing	GSM, CDMA, GPRS, Multi-Level, Multi-Slot, plus others
High-Speed Data Acquisition	Up to 1kHz in burst mode
Reference Electrode Inputs	High impedance, range ±5V
Thermocouple Inputs	Type “T”, “K”, or “J”
Thermistor Inputs	Various types
RTD Inputs	PT100 or PT1000
Pressure Inputs	Various ranges, for use with 0 to 100mV transducers
Auxiliary Voltage Inputs	±5V, ±10V, ±20V, etc.
PH Inputs	Various ranges, for use with probes with > 10kΩ input impedance
LED Status Indicators	Indicates active channel
External Charge Controllers	Rated from 5A to 200A, for use with external Battery chargers
External Load Controllers	Rated from 5A to 200A, for use with External loads
Smart Battery Packs	SMB communications for testing of smart battery packs
Environmental Chamber Control	Automatic control of supported environmental Chambers via RS232/485/IEE 488 interface
Cell Holders	
Molded True 4-Wire Kelvin Cell Holders	AAA, AA, C, D, 9V, and 18650 Adjustable Cylindrical Cell Holders Spring Loaded Binding Posts
Digital Inputs	For reading of TTL based inputs which can control the flow of the test procedure
Digital Outputs	Allows for the setting of TTL based outputs which can be used to trigger an event or simply display status lights
Cables	Contact Maccor’s Sales Department for Length and Terminations
Appropriately Sized Uninterruptible Power Supply	
Calibration and Maintenance Service	

AC Power Input

For each system, two separate AC inputs are required, one to power the electronics and one for the charge power.

Power for Electronics

110 or 220/240 VAC Single-Phase
50/60 Hertz

Power for Charge

186 to 265 VAC Single-Phase or
186 to 265 VAC Three-Phase
50/60 Hertz

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