Ion Migration Evaluation System

AMI

CAT.NO.E94513-V501

Elmatik AS, Türi 9, 11314 Tallinn Estonia tel. +372 650 3875 tel. +372 650 3876 fax +372 655 8019 e-mail: elmatik@elmatik.ee

Analysis and evaluation of ion migration and evaluation of insulation resistance made more accurate, efficient, and easier

Evaluations of ion migration and insulation resistance are assuming a greater degree of importance as electronic devices are miniaturized further and mounted with higher density. The Ion Migration Evaluation System allows these evaluations to be performed continuously with a high degree of accuracy and efficiency.
Environmental testing has been successfully merged with measurements/evaluations.

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AMI (standard model)

AMI (opposite-polarity model)

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MEASUREMENT EVALUATION SYSTEM

CONDUCTOR RESISTANCE EVALUATION SYSTEM

- THROUGH-HOLE CONDUCTOR EVALUATION SYSTEM
- SOLDER-JOINT CONTACT EVALUATION SYSTEM
- BGA, CSP SOLDER JOINT CONTACT EVALUATION SYSTEM
- CONNECTOR CONTACT RESISTANCE EVALUATION SYSTEM
- FPC LIFE EVALUATION SYSTEM
- OTHER INTERCONNECTION MATERIAL CONTACT EVALUATION SYSTEM

ION MIGRATION EVALUATION SYSTEM

INSULATION RESISTANCE EVALUATION SYSTEM

- CAPACITOR INSULATION RESISTANCE EVALUATION SYSTEM
- PCB, PWB INSULATION RESISTANCE EVALUATION SYSTEM
- INSULATION RESISTANCE EVALUATION SYSTEM FOR OTHER INSULATION MATERIAL

LOW-K INSULATION CHARACTERISTIC EVALUATION SYSTEM

LEAK CURRENT MEASUREMENT SYSTEM

- CAPACITOR LEAK CURRENT MEASUREMENT SYSTEM
- FET LEAK CURRENT MEASUREMENT SYSTEM
- SEMICONDUCTOR REVERSE BIAS LEAK CURRENT MEASUREMENT SYSTEM

CAPACITOR TEMPERATURE PROPERTY EVALUATION SYSTEM

INTERCONNECTION MEASUREMENT EVALUATION SYSTEM

- CONNECTOR DISCONNECTION EVALUATION SYSTEM
- SOLDER-JOINT DISCONNECTION EVALUATION SYSTEM
- HARNESS CONTINUITY EVALUATION SYSTEM

OPTICAL COMPONENT ENVIRONMENTAL TEST SYSTEM

ELECTRO-MIGRATION EVALUATION SYSTEM

- LSI ELECTRO-MIGRATION EVALUATION SYSTEM
- GMR HEAD ELECTRO-MIGRATION EVALUATION SYSTEM
- GMR HEAD ELECTRO-MIGRATION RH EVALUATION SYSTEM
- HIGH FREQUENCY ELECTRO-MIGRATION EVALUATION SYSTEM

TDDB EVALUATION SYSTEM

- WAFER LEVEL
- PACKAGE LEVEL

SEMICONDUCTOR PARAMETER AUTOMATIC EVALUATION SYSTEM

- FET(HOT-CARRIER) PROPERTY EVALUATION SYSTEM
- TRANSISTOR PROPERTY EVALUATION SYSTEM

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Detects changes in insulation resistance with high precision

Detects decline of insulation resistance by continuous measurement while applying voltage under high-temperature, high-humidity conditions.

Excels in detection of leak current

The leak-touch detection function detects the occurrence of ion migration in microsecond intervals. It immediately shuts off stress voltage to the channel when leak-touch is detected. You may choose whether to continue testing after detection. (optional)

High-precision measurements implemented (standard model)

Capable of measuring high resistances accurately with use of a solid wire cable (positive side) and a coaxial cable (negative side). The unique low impedance circuitry of the unit suppresses adverse effects of small noise, enabling measurements to be conducted with greater accuracy.

Insulation resistances measured over a broad range (standard model)

The unit measures insulation resistances with high accuracy over a wide range from 2×10^{3} to $1\times10^{13}\Omega$ at the tip of the measurement cable (3m). To avoid leakage current on the printed circuit board, direct wiring has been provided in the scanner.
(opposite-polarity model insulation-resistance range: 1×10^{6} to $3\times10^{13}\Omega$)

Capable of evaluating insulation-resistance characteristics

The stress-application voltage and measurement voltage can be set separately. The charge time can also be set for the measurement of values following the application of voltage for a given length of time. This is a highly versatile system with excellent measurement control; it is capable of performing insulation evaluation as well.

standard model

APPLICATIONS

Evaluation of ion migration

Evaluation of insulation deterioration property

- Flux, printed circuit boards, resist, solder, resin, conductive adhesive and other materials related to printed wiring boards and high-density mounting
- BGA, CSP and other fine-pitch pattern IC packages
- PDP
- Capacitors, connectors and other electronic components and materials
- Evaluation of hygroscopic property of insulation materials

MODEL

AMI – □–□–□

Control channel (standard model)
5 : 5-channel control
25 : 25-channel control

SPEC
S : standard model
P : opposite-polarity model

Number of channels
025 : 25 channels
050 : 50 channels
100 : 100 channels
125 : 125 channels (standard model)
150 : 150 channels (standard model)

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AMI

standard model

opposite-polarity model

Teflon coated cable for accurate measurement

Heat-resistant, humidity-resistant, voltage-resistant teflon-coated cable is used for accurate insulation resistance measurement.

Testing also possible in a low-voltage region

As the drive voltages of devices decrease, evaluations of low-voltage ion migration are becoming increasingly important. The unit can precisely measure insulation resistances of $10^{11}\Omega$ or more in low-voltage regions (1V) as well.

Equipped with an opposite-polarity function (opposite-polarity model)

The system has an opposite-polarity function that inverts the polarity of the voltage that is applied in the measurement of resistance, as well as the polarity of the stress-application voltage (IPC-650).

System-integrating environmental testing equipment

By connecting our environmental testing equipment to the system, the system can be controlled in conjunction with the environment. For instance, the stress voltage is cut off when there is a problem with the environmental testing equipment, thereby preventing condensation from influencing the testing. In addition, tests can be started, suspended, or ended in sync with the environmental testing equipment.

Stable voltage application systems

Two different voltage application systems are currently adopted: one with one power-supply circuit per channel (standard model) and one with protective resistance (opposite polarity model). Stress voltages are applied to the specimens. Even if one specimen experiences short-circuiting, the voltages applied to the other specimens remain unaffected. The power supply is equipped with a separate monitoring function, enabling the user to verify that the voltage is being applied correctly.

Absence of no-voltage period

With our unique scanner operation technology, switching of the scanner does not result in a no-voltage period.

Batch charging with shortened measurement period

The measurement period is now shorter due to batch charging. With the contact check function, connections can be confirmed prior to testing, thus eliminating test loss.

Convenient real-time measurement

Temperature/ humidity in the test chamber and insulation resistance value is measured in real time. The multi-task function enable graphic/ data display and file operations to be performed during test. Also, data can be stored in text data format to be analyzed with spreadsheet software.

LAN application software (optional)

Connection to a LAN allows checking the test status and editing data from a remote distance.

Statistical Analysis Possible from Failure Data (optional)

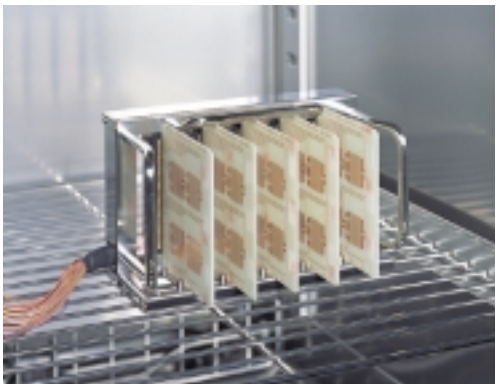
Data-processing software (with a statistical processing function) enables the plotting of Weibull probability, logarithmic-normal probability, and normal probability from failure data, which is useful for data analysis.

Features a SIR test coupon type IPC-B-24 and test board rack (standard model, optional)

SIR test coupon type IPC-B-24 and test board rack conforming to IPC-B-24 as stipulated in ISO 9455-17 for efficient SIR testing. The test board rack holds up to five PCBs, and allows measurement of up to 20 channels.

Connection unit (standard model)

Connection unit (opposite-polarity model)



SIR test coupon type IPC-B-24 and test board rack type A (standard model, optional)

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System rack (standard model)

Formation of migration

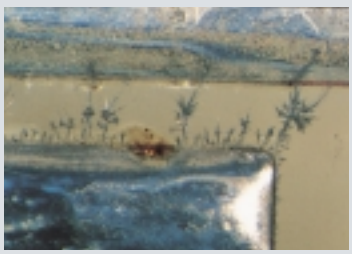
• Formation of ion migration

When electric stress is applied between the electrode, the ionized metal, which is reduced by minus electrode and impurities, is deposited.

• Characteristics of ion migration

- Occurs in short period of time
- When short circuited and generate Joule's heat, ion migration is melted and instantly disappears.

Copper ion migration



Solder ion migration

Control in units of 5 and 25 channels also possible (standard model)

Two types capable of independent control of tests in units of 5 and 25 channels are available, enabling more effective use of channels.

Can be combined with other testing equipment and measurement systems

Depending on the contents of tests and evaluations, the system can be combined with various types of testing equipment. It can be also combined with the environmental testing equipment or measurement system that you are currently using.

Specimen holder (optional)

We provide various fixtures convenient for connection to the cable.

Smaller installation space (standard model)

Compared to the previous model, the installation space is reduced by 15%.

Improved ease of use

The measurement cables can be easily connected through the use of a connection unit. Depending on the installation environment, the connection unit can be attached at a convenient location either on the front, the right side, or the left side of the rack. Other improvements have also been made, such as operation switches on the front of the rack.

Consideration of global environmental problems

Components (except for purchased items such as PCs and measuring instruments) are mounted by lead-free soldering. In addition, power consumption is reduced by 24% (in comparison with the previous model) in consideration of global environmental problems.

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MEASUREMENT PROCEDURES AND EVALUATION EXAMPLE

Measurement procedures

Insulation resistance changes due to ion migration is measured by combining two systems.

①Accurate measurement of insulation resistance value at pre-set interval
<with ultrahigh resistance meter>
Measures insulation resistance value of each channel by scanning the channel at set interval (6 min. at minimum), and preserves the data. Measurement voltage charge time can be set accordingly.
Incorporates batch charge system.

*Batch charge system
Charging 25 or 5 channels (control unit) at once for one minute drastically saves measurement time.

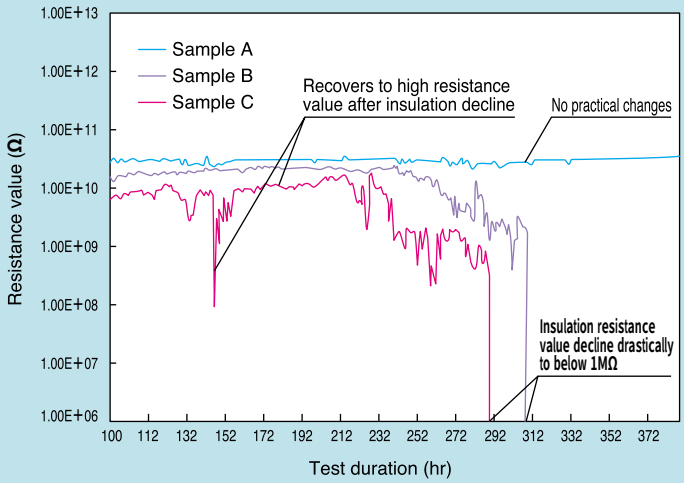
②Leak touch detection by high-speed continuous monitoring
<measurement at leak detector>
After process ①, stress voltage is applied to the specimens. Leak current is continuously monitored at leak detector. When value exceeds the pre-set limit, test duration data during malfunction is preserved and voltage supply on that channel is shut off.
(Leak behavior mode. (optional))
Leak detection speed is μsec order regardless of number of channels.

- When stress voltage and measurement voltage is the same, and thus charge time is unnecessary, voltage can be applied continuously during measurement and stress application.
Also, insulation resistance can be measured with 0V stress and voltage application only at time of measurement.

Insulation resistance variation of flux under high temperature/ humidity environment

Measurement condition

- Ultrahigh resistance meter : measurement interval/minimum 6 min.
- Leak-touch detection at leak detector: detection speed/ μsec order (regardless of number of channels)
- High temp/ high humid condition : +40℃ / 90%rh



This example shows leak-touch detection at 291.2hr and 311.8hr.

- Interval of ultrahigh resistance meter : every 30 minutes
- Leak-touch detection level : 50μA (equivalent of $1\times10^6\Omega$)
- Applied voltage, measurement voltage: DC 50V

***Data measured by Ionmigration evaluation system was converted into text data using file convert function, and processed with Commercial spreadsheet software.**

Information on the reliability of technology such as lead-free soldering and ion migration is posted in the form of technology reports at the following site:
http://www.espec.co.jp/english/tech-info/spcial_report/index.html

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SOFTWARE (standard model)

● Main window

- Test conditions are displayed.
- Real time display of resistance value, chamber temperature, error channels, etc.
- Switch to data display window.
- To start, stop, interrupt, restart the test.

(Example shows 3 unit, 75 channel configuration.)

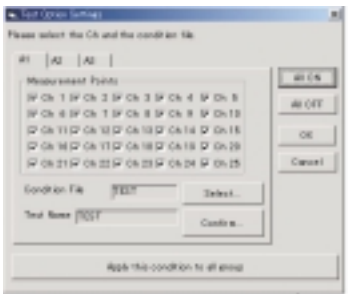
● Test condition registration

Set the test duration, interval, measurement voltage, applied stress voltage, limit value, etc., and register in a file. You may enter several conditions accordingly.

● Test setting

Select and input test module, name of data file, temp/humid of test chamber, output of text data, comments, etc..

● Test details

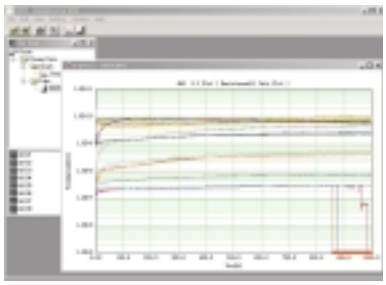


Select test channel and condition. (Select from registered test condition file)

● Test start window

Test setting is complete. Click "Start" to start test.

● Graphic display

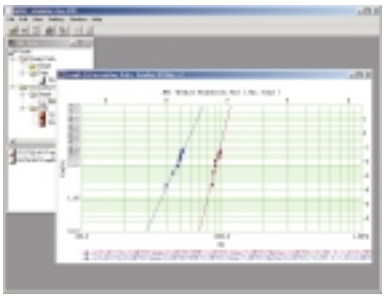


Current test data and previous data are graphically displayed.
Graph can be arranged by selecting the channel, setting display, and cursor display.

● Data display

Displays current test data and previous data.

● Weibull Analysis (optional)



Data-processing software (with a statistical processing function) enables Weibull analysis of test data, as well as the plotting of normal probability and logarithmic-normal probability.

■Some photographs listed in this catalog contain Japanese display.

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SPECIFICATIONS

Model			AMI	
			standard model	opposite-polarity model
Channel configuration			Standard 25ch. (max. 150ch per rack)	Standard 25ch. (max. 100ch per rack)
Control channel			5ch / 25ch	25ch
Software			Windows® XP	
Insulation resistance measurement range (DC measurement range)			2×10^5 to 1×10^{13}Ω*1 (10pA to 500μA) lower measurement limit 2×10^{3}Ω *2	1×10^6 to 3×10^{13}Ω*1 (3pA to 100μA) lower measurement limit 1×10^{6}Ω
Leak-touch detection range			1 to 500μA	1 to 100μA
Measurement voltage			1 to 100V DC (0.1V step)	3 to 100V DC (0.1V step)
Applied stress voltage range			Not applied/ 1V to 100V DC (1 to 100V DC in 0.1step.Can be set separate from measurement voltage)	Not applied/ ±3V to ±100V DC (3.0 to 9.9V DC in 0.1V steps, 10 to 100V in 1.0V steps. Can be set separate from measurement voltage)
Testing time			Max. 10,000 hours	
Resistance measurement time			Time required for one measurement Standard: approx. 60 sec / 25ch +charge time (set by user,charge time may not be set)	
Leak-touch detection interval			Continuous (except during insulation resistance measurement) Detection speed: measured in μsec order (regardless of number of channels)	
Measure -ment cable	Type	−side	Coaxial cable (single layer shielded structure)	Triaxial cable (double layer shielded structure)
		+side	Single cable	
	Coated material		Thflon (heat resistance of +150℃)	Thflon (heat resistance of +200℃)
	Length		1.5m on both sides of the connection unit	
Connection unit			Single connector	Triaxial connector
Ultrahigh insulation resistance meter			Electrometer 6514 (Keithley Instruments, Inc.)	HP4339B (Agilent Technologies, Inc.)
System rack dimensions (Excluding protrusions)			530W×1750H×940D mm [20.87W×68.9H×37.01D inch]	530W×1800H×1100D mm [20.87W×70.87H×43.31D inch]
Power supply *3			100VAC 1φ 50/60Hz 120VAC 1φ 50/60Hz 220VAC 1φ 50/60Hz 240VAC 1φ 50/60Hz	100VAC 1φ 50/60Hz 120VAC 1φ 50/60Hz 220VAC 1φ 50/60Hz 240VAC 1φ 50/60Hz
Maximum current	100VAC		10.0 A	15.0 A
	120VAC		8.3 A	12.5 A
	220VAC		4.5 A	6.8 A
	240VAC		4.2 A	6.3 A

*1 Measurement condition: Value at end of cable during 100V DC application.

*2 Measurement condition: 1V DC application.

*3 Within ±10% of the rated voltage.

●Please contact us for customized spec requirements.

● Environmental test chamber: Temperature & Humidity Chamber〈sold separately〉

Model	Temperature range	Humidity range	Inside capacity (L)
PR	−20 to +100℃	20 to 98%rh	120, 225, 408, 800
PL	−40 to +100℃		
PSL	−70 to +100℃		306, 800
PH	+10 to +100℃	20 to 98%rh	120, 225, 408, 800

● Environmental test chamber: HAST(Highly Accelerated Stress Test) Chamber〈sold separately〉

Model	Temp/ humid/ pressure range	Inside capacity (L)
EHS-211M	+105 to +142.9℃/ 75 to 100%rh 0.020 to 0.196Mpa (0.2 to 2.0kg/cm^2)	18
EHS-221M		46
EHS-411M	+105 to +162.2℃/ 75 to 100%rh 0.020 to 0.392Mpa (0.2 to 4.0kg/cm^2)	18

●Control mode of unsaturated control, saturated control, wet and dry bulb temperature control.

● Option

- Measurement/ Applied stress voltage
  - High voltage (300V,500V DC)
- Software for checking conduct mode after leak-touch
- LAN application software
- Application software for statistics analysis
- Measurement extension cable (Standard length was changed from 1.5 m to 3 m.)
- Scanner unit connection unit extension cable (Standard length was changed from 1.5 m to 4 m.)
- Holder for applying specimen inside the chamber
- Test board rack Type A (Standard model only)
- SIR Test coupon Type IPC-B-24 (Standard model only)

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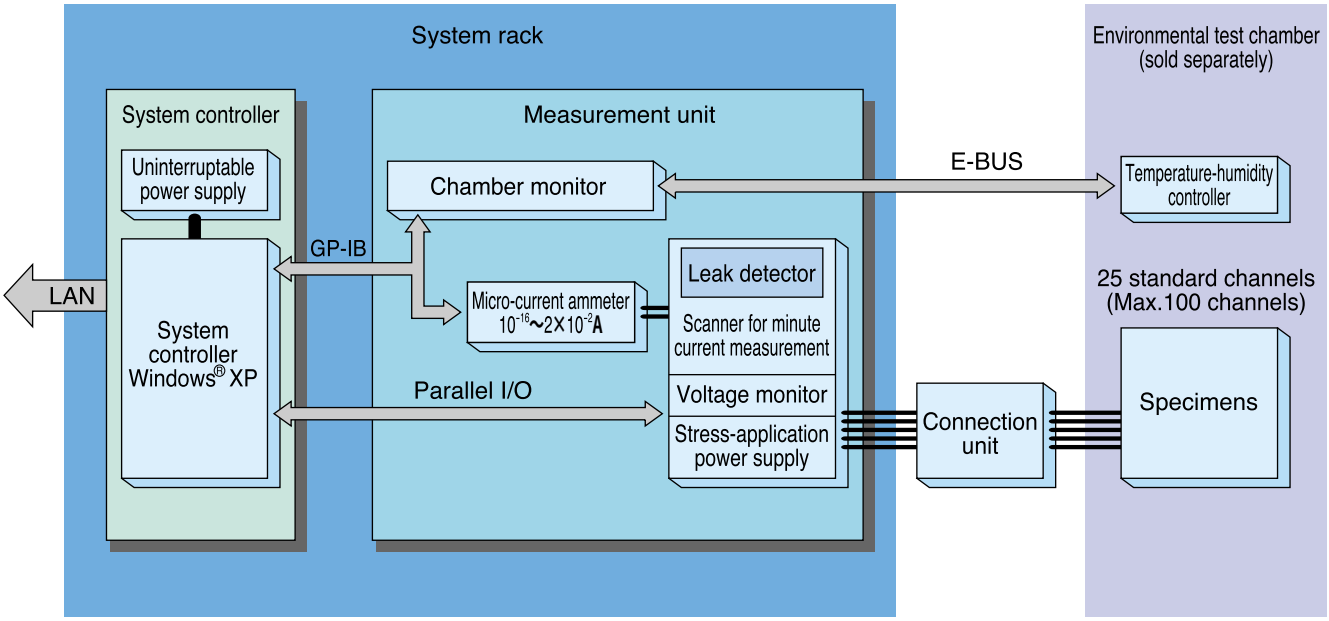
SYSTEM BLOCK DIAGRAM (standard model)



System controller

- System controller :

  System-control PC and LCD monitor
  Performs measurement, data processing, and control of testing equipment.

- Uninterruptable power supply :

  Backup power supply for system controller
  (reset manually when power restored)

- Printer space :

  Can be stored inside the system rack
  (storable dimensions: 450W×260H×270D mm)

Measurement unit

- Stress-application power supply :

  DC voltage is applied between specimen poles as electric stress.
  A power supply is provided for each channel.

- Voltage monitor :

  The output of each stress-application power supply is monitored.

- Micro-current ammeter :

  The insulation resistance of a specimen is measured at set intervals.
  (Equipped with electrometer 6514 made by Keithley Instruments, Inc.)

- Scanner for minute current :

  Measurement of standard 25 channels at resistance value $10^{3}\Omega$ to $10^{13}\Omega$.

- Leak detector :

  Constantly monitors leak current against pre-set limit under applied stress voltage between electrode.

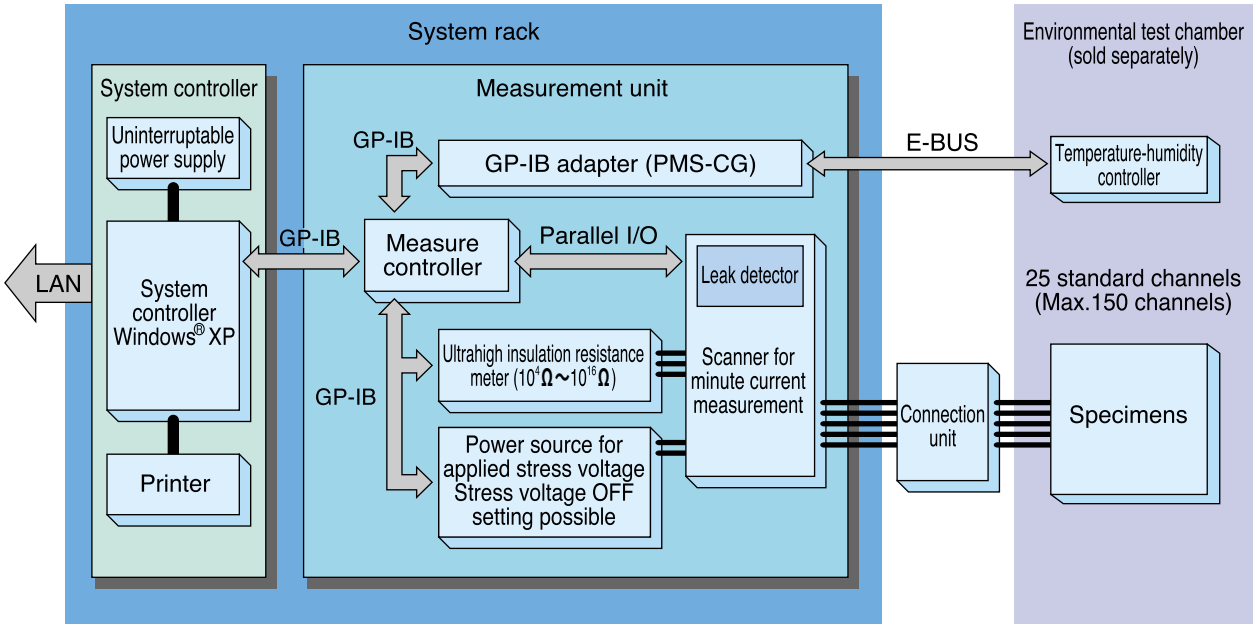
- Chamber monitor :

  Allows temperature control, monitoring, alarm control of chamber from system controller.

- Connection unit :

  Relays the measurement cable.

SYSTEM BLOCK DIAGRAM (opposite-polarity model)



System controller

- System controller :

  System-control PC and LCD monitor
  Registration of test conditions, confirmation of operation status, data processing.

- Uninterruptable power supply :

  Backup power supply for system controller (reset manually when power restored)

Measurement unit

- Measure controller :

  Designated to measurment.
  Shuts off voltage application to the detected channel during stress voltage application and measurement, leakage detection, and leak-touch detection.

- Power source for stress application :

  DC voltage stress is applied between electrodes of specimen.

- Ultra high insulation resistance meter :

  Measures insulation resistance in pre-set interval.
  Ultrahigh insulation resistance measurement range indicated in the diagram implies performance of meter.
  (Equipped with HP4339B made by Agilent Technologies)

- Scanner for minute current :

  Measurement of standard 25 channels at resistance value $10^{6}\Omega$ to $10^{13}\Omega$.

- Leak detector :

  Constantly monitors leak current against pre-set limit under applied stress voltage between electrode.

- GP-IB adapter :

  Allows temperature control, monitoring, alarm control of chamber from system controller.

- Connection unit :

  Relays the measurement cable.

ESPEC CORP. http://www.espec.co.jp/english

Head Office
3-5-6, Tenjinbashi, Kita-ku, Osaka 530-8550, Japan
Tel:81-6-6358-4741 Fax:81-6-6358-5500
Europe Office
Tel:49-6196-77-99980 Fax:49-6196-77-99985

ESPEC NORTH AMERICA, INC.
Tel:1-616-896-6100 Fax:1-616-896-6150

ESPEC EVALUATION & TEST SYSTEMS, INC.
Tel:1-408-433-2295 Fax:1-408-433-2296

ESPEC ENVIRONMENTAL EQUIPMENT (SHANGHAI) CO., LTD.
Head Office
Tel:86-21-58303322 Fax:86-21-58661781
BEIJING Rep. Office
Tel:86-10-64627025 Fax:86-10-64627036
GUANGZHOU Rep. Office
Tel:86-20-83317826 Fax:86-20-83317825
SHENZHEN Rep. Office
Tel:86-755-83674422 Fax:86-755-83674228
SUZHOU Rep. Office
Tel:86-512-68664007 Fax:86-512-68601994

ESPEC TEST TECHNOLOGY (SHANGHAI) CO., LTD.
Tel:86-21-68798008 Fax:86-21-68798088

ESPEC (MALAYSIA) SDN. BHD.
Tel:60-3-89451377 Fax:60-3-89451287

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EC99J2046

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ISO 14001 (JIS Q 14001)
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