

Quality is more than a word



Electrochemical Migration Evaluation System (Ion Migration Evaluation System) AMI-U



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

Evaluations of electrochemical migration and insulation resistance are assuming a greater degree of importance as electronic devices are more and more miniaturized and mounted with higher density.

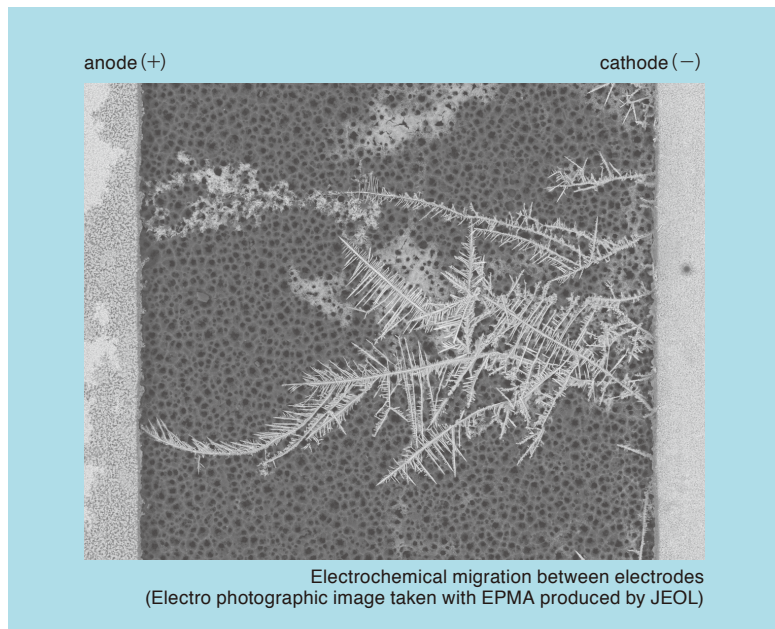
The “Electrochemical Migration Evaluation System” allows these evaluations to be performed continuously with a high degree of accuracy and efficiency.

Environmental testing has been successfully merged with measurements and evaluations.





From Low-voltage to High-voltage Application Tests -Perfect for Stress Evaluation & Resistance Evaluation



● Applicable Tests

- Electrochemical migration evaluation test
- Dielectric breakdown property evaluation test

● Stress Voltage Lineup

- 100V (0, 1 to 100V DC)
- 300V (0, 1 to 300V DC)
- 500V (0, 1 to 500V DC)
- <Custom>
- 1000V (0, 50 to 1000V DC), page 12.
- 2500V (0, 50 to 2500V DC), page 12.

● Main Applications

- PCBs & insulations: Material evaluation of flux, resist, solder, and resin.
- Semiconductor: Material evaluation of conductive adhesive, high-density mounting. Package evaluation of fine-pitch BGA, CSP.
- Capacitors, connectors: Material & parts evaluation.
- High-voltage circuits: Parts evaluation in automobile & energy markets.

● Main Features

- High precision measurement: Measuring instrument made by one of the world's top manufacturer working together with ESPEC's unique scanning technology for voltage measurements.
- Electrochemical migration is identified in micro second.
- Real-time monitor & data editing.
- Using with ESPEC brand environmental test chambers offer better operability and safety.



AMI

Features

Accurate & Flexible Voltage Application

Test Group

Test group consists of 5 or 25 channels and test conditions can be set per test group.

Accurate Voltage Application

Accuracy: $\pm(0.7\%SV^* + 300\text{mV})$

e.g.) In case of 100V application:

$$\pm(0.7\% \times 100\text{V} + 300\text{mV}) = \pm 1.0\text{V}$$

*SV...Setting Voltage

Seamless Application between Stress & Measurement Voltage

Different voltage can be applied to the stress voltage and measurement voltage. The application of measurement voltage from stress voltage transits without pose, thanks to ESPEC unique scanner technology. You can configure the voltage application pose as specimen's discharge time if necessary.

Independent Power Supply

It is designed that each channel is independent, and has its own power supply. This design keeps the influence of short circuit in one channel to minimum. Also, the voltage is monitored per channel, enabling you to confirm whether the right voltage is being applied or not.

Test Example

Resistance evaluation of flux insulation

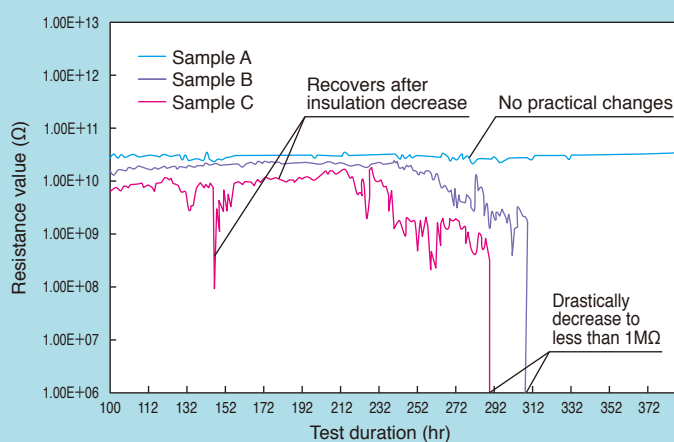
Test conditions

Temperature and humidity condition : 40°C, 90%rh

Stress voltage : 50 V DC

Measurement voltage : 50 V DC

Measurement intervals : 0.5h



Failure threshold : 1MΩ

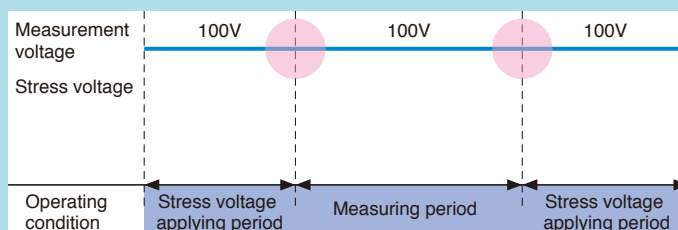
"Leak touch" detection: sample A at 291.2 hours, sample B at 311.8 hours.

*This graph is created in Excel.

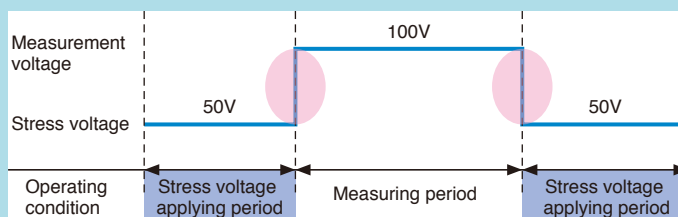
Seamless Application between Stress & Measurement Voltage

Stress voltage (100V), measurement voltage (100V)

In the measuring mode of continuously applied stress voltage



Stress voltage (50V), measurement voltage (100V)



— Voltage that is actually applied onto the specimen

■ Accumulated stress voltage applying time (test time)

Features

Measurement Technology for Accurate and Compatible Data



Tektronix measuring instrument

● Measurement Accuracy Distribution Chart

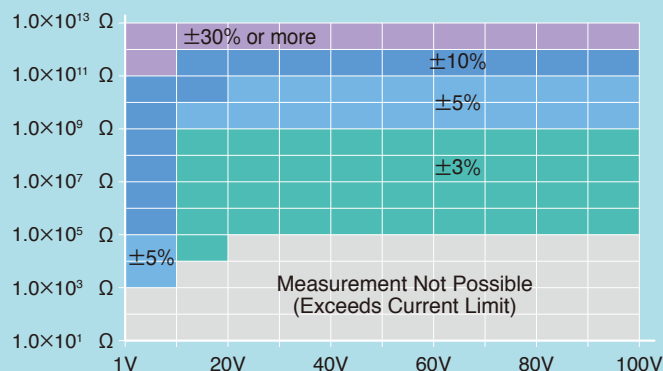
Distribution of measurement accuracy at end of measurement cable

Outside temperature: Room temperature

Measurement range: AUTO

Measurement mode: Long

Number of averaging measurements: 4



- Values on boundary lines are either lower accuracy measurements or accuracy measurements that cannot be measured.
- The above measurement results are provided for the purposes of example. You may not be able to obtain the above measurement accuracy results depending on your system installation environment.
- In such a small range (100fA to 5pA), interferences might appear during measurement.

● Measuring Instrument

Tektronix measuring instrument is renowned for its quality and expertise. After-sales support that includes calibration is also their strength, and available in many countries around the world.

● NPLC Setting- Noise Cancelling

By setting the NPLC (Number of Power Line Cycles), measuring instrument processes data canceling electric noise.

● Wide Measurement Range

100V application: 2×10^5 to $1 \times 10^{13} \Omega$
 300V application: 6×10^5 to $3 \times 10^{13} \Omega$
 500V application: 1×10^6 to $5 \times 10^{13} \Omega$

● IPC Compliant

Scanning method used in AMI complies to IPC standards.

● Current Leak Detection by Comparator

Electrochemical migration slowly grows over long period of time. Under the normal measurement conditions, measured data is recorded in ≥ 6 -min intervals. However, a comparator circuit on each channel continuously monitors the instant current leak. Once the leak exceeding the threshold is detected, the channel's current is recorded in ≥ 1 -min intervals.

● Real-time lower insulation resistance judgement

All channels are continuously judging the failure and detecting lower insulation resistance immediately.

FAILURE CRITERIA

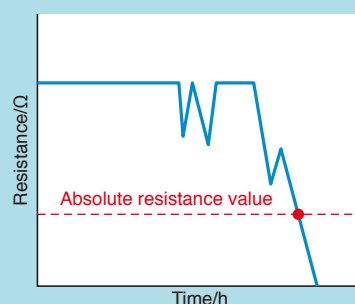
Electrochemical Migration Grows in Hours Criteria by Obtaining Precise Data Efficiently and in Minimized Amounts

Interval Recording

Pass/Fail judgement will be made based on settings below, which are recorded in ≥ 6 min intervals.

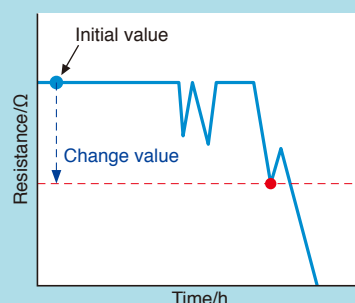
• Absolute resistance value (Ω)

Enter the absolute threshold resistance value.



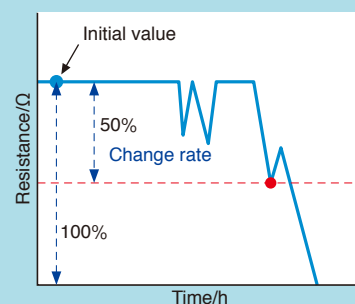
• Change value (Ω)

Enter the change resistance value from the initial resistance as threshold.



• Change rate (%)

Enter the change rate from the initial resistance as threshold. This graph is the case when the change rate is set as 50%.

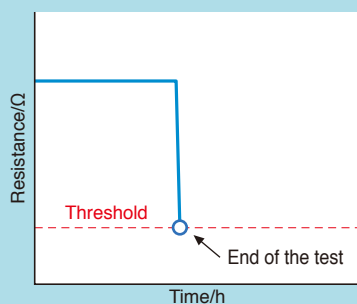


Continuous Monitoring -Immediate Detection

Each channel has a comparator that continuously monitors the instant current leak. Immediately after the leak detection, there are two fail judgement modes.

• One time - failure "Leak Touch"

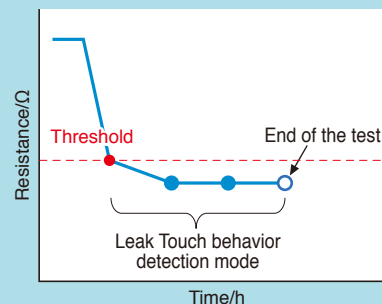
The moment the circuit detects current leak over the threshold, the channel's specimen is judged as failure and the channel's test ends immediately.



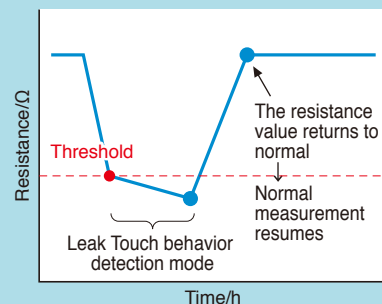
• Multiple times - failure "Leak Touch behavior"

When the circuit detects leak current over the threshold, it starts to measure the leaked channel every $\geq$ one minute. This mode is called "leak touch behavior." You can set check count, check interval and recovery count, before judging it as failure, ending the test.

• Confirmed as failure



• Recovers to normal



Features

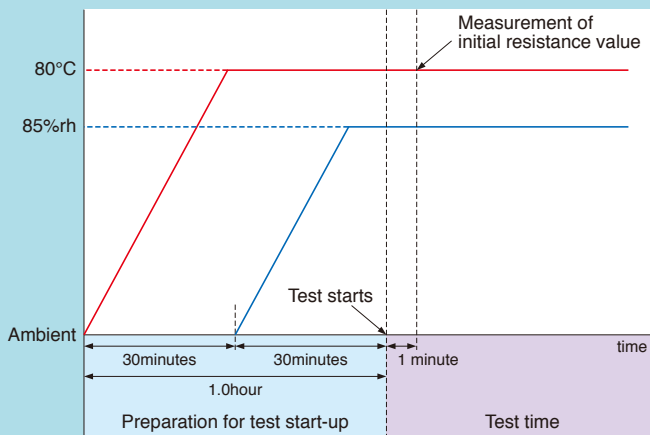
In Synchronization with ESPEC Environmental Test Chambers



Example of AMI Connected with three temp. & humid. chambers

● Prevents Dew Condensation

Set values: 85°C, 85%rh
Temp. increase start: 1.0 hour earlier than the test start
Humid. increase start: 30 minute earlier than the test start
Charge time: 1 minute



● Linked Operation with ESPEC Environmental Test Chambers

One AMI system can be connected to up to three environmental test chambers. Test scheduling (start, pause, and stop) is also available.

● Temp. & Humid. Data

AMI can record temperature and humidity conditions within the chamber, during a test along with measured test data.

● Prevents Dew Condensation

When the temp. of the chamber rapidly increases, dew condensation could be generated on the surface of the specimen.

In order to avoid dew condensation, resistance test can be set to have a delay start, to wait for specified time after reaching the set values.

● Safety Interactions

If an error occurs in either AMI or the chamber, it automatically shuts the stress voltage immediately to protect specimens. At the same time, the test data will be saved automatically.

Features

Monitor and Process Test Data

Real-time Monitoring

In addition to AMI measured data, temp. and humid. from ESPEC environmental test chamber can also be monitored and recorded on a PC. You can control the test operation via the main window, such as start, stop, pause, and restart.

Weibull Analysis (Option)

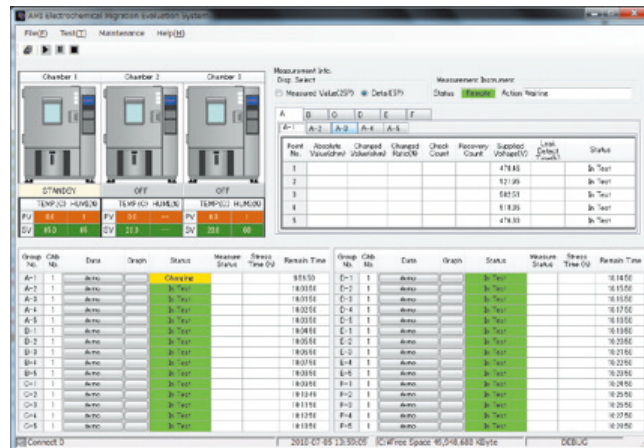
An optional software, "E-graph" displays the Weibull distribution of failed specimen, showing in synchronization with temp., humid. and resistance data.

Remote Monitoring & Data Processing (Option)

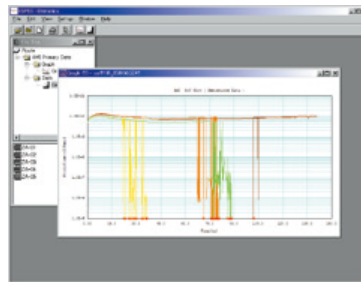
By installing an optional software, AMI and other ESPEC chambers can be connected to LAN network. It enables to monitor and to process data from a remote location.

Main window

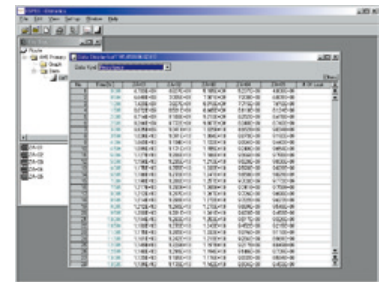
*Image of AMI-150



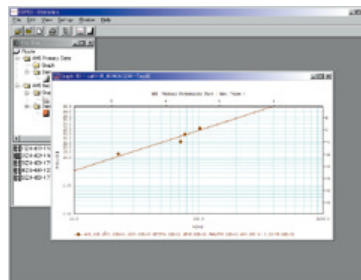
Graphic display



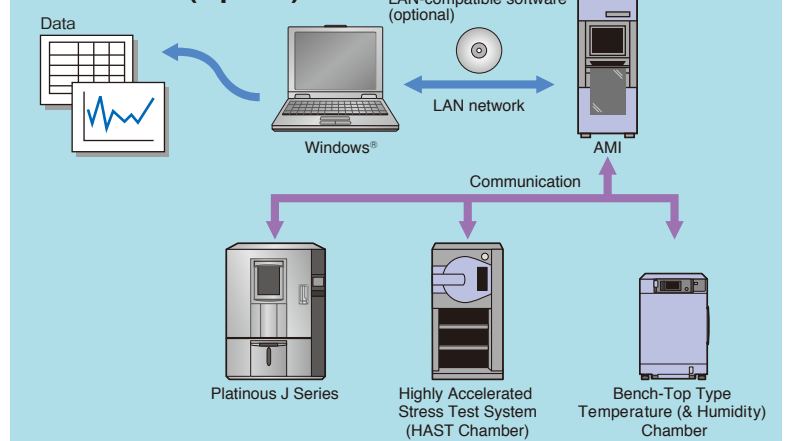
Data display



Weibull Analysis (Option)



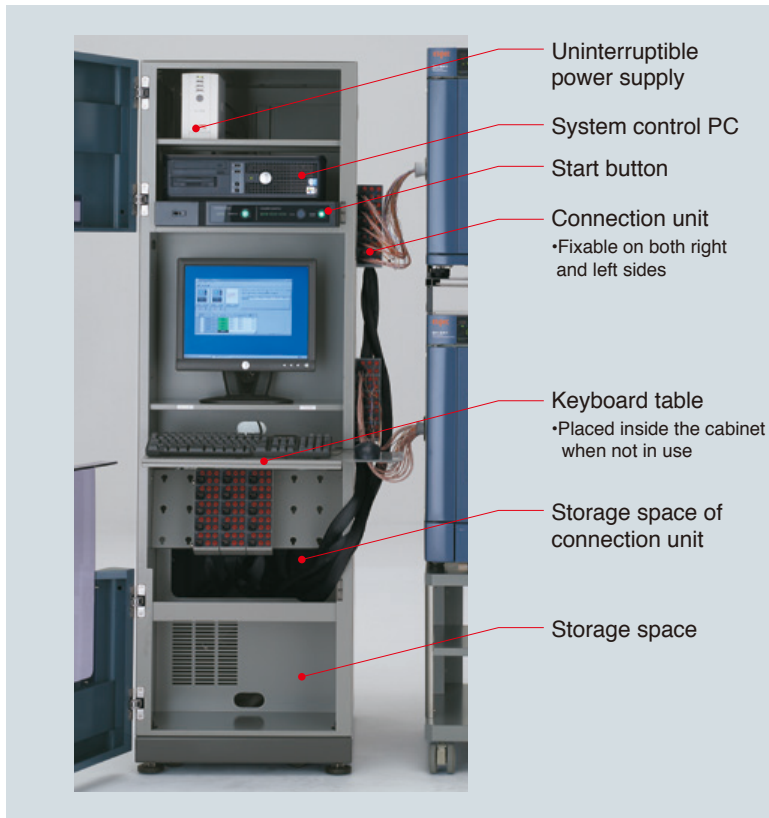
Network (Option)



*The chambers are examples.

Features

System Components & Options



System rack



Connection unit



SIR test coupon type IPC-B-24 and test board rack type A (option)

Flexible Layout

The connection unit facilitates the cable connection work. Its location is selectable from the front, right, or left side of the rack, according to your layout.

Specifically Designed Cables

In order to restrict the influence of micro-noises, AMI employs a single cable on anode side and a co-axial cable on cathode side. Cables are coated with Teflon, which shows superior resistance to heat, humidity, and electric voltage.

IPC-B-24-compliant PCB and Rack (Option)

IPC-B-24-compliant PCB as defined in ISO 9455-17 is available. The dedicated PCB rack can receive up to five PCBs, and allows measurement of up to 20 channels.

Custom Connection Jigs (Option)

We offer connection jigs tailored to customer's specimen. The jig's design allows easy connection, which would lead to more efficient testing.

Scanner Unit with Advanced Wiring

The scanner board for the micro-electric current adopts an advanced wiring technology to minimum the influence of leaked current on printed circuit board.

Earth-friendly Design

In consideration of global environment, components are fixed with lead-free soldering. Furthermore, power consumption has been reduced by 24% compared to the previous model.

SPECIFICATIONS

Type			Stress constant voltage 100 V		Stress constant voltage 300 V (option)		Stress constant voltage 500 V (option)	
Channel configuration			Standard 25ch. (max. 150ch per rack)		Standard 25ch. (max. 150ch per rack)			
Control channel			5ch	25ch	5ch	25ch	5ch	25ch
Soft ware *1			Windows OS		Windows OS			
Measurement	Stress power supply	Stress constant voltage *2	Not applied/ 1 to 100 V DC		Not applied/ 1 to 300 V DC		Not applied/ 1 to 500 V DC	
		Min. set voltage resolution	0.1 V		0.1 V (set at 1 to 200 V) 1.0 V (set at 200 to 300 V)		0.1 V (set at 1 to 200 V) 1.0 V (set at 200 to 500 V)	
		Impressed voltage accuracy	±(0.7% of Setting Voltage + 300mV)		±(0.7% of Setting Voltage + 300mV) *4			
	Resistance evaluation and measurement time	DC measurement range *3	0.001pA to 0.5mA		0.001pA to 0.5mA			
		Resistance measurement range	2 × 10 ⁵ to 1 × 10 ¹³ (when applying 100 V) 2 × 10 ³ to 1 × 10 ¹¹ (when applying 1 V)		6 × 10 ⁵ to 3 × 10 ¹³ (when applying 300 V) 2 × 10 ³ to 1 × 10 ¹¹ (when applying 1 V)		1 × 10 ⁶ to 5 × 10 ¹³ (when applying 500 V) 2 × 10 ³ to 1 × 10 ¹¹ (when applying 1 V)	
		Measurement accuracy *3	±1.015% (20pA range, full scale)		±1.015% (20pA range, full scale)			
		Measurement voltage	1 to 100 V DC (0.1 V step)		1 to 300 V DC (1 to 200 V DC: 0.1 V step) (200 to 300 V DC: 1.0 V step)		1 to 500 V DC (1 to 200 V DC: 0.1 V step) (200 to 500 V DC: 1.0 V step)	
		Measurement time (1 time) *5	15 s + charge time	80 s + charge time	15 s + charge time	80 s + charge time	15 s + charge time	80 s + charge time
Leak Touch detection			Constantly detects with the speed of less than 100μs		Constantly detects with the speed of less than 100μs			
Measurement cable	Type	+ side	Single cable		Heat-resistant single cable			
		— side	Coaxial cable (one-layer shield)		Coaxial cable (one-layer shield)			
	Coating material		Teflon (heat resistance of + 150°C)		Teflon (heat resistance of + 150°C)			
	Length		Between scanner unit and connection unit: 2.5 m From connection unit to the tip: 1.5 m		Between scanner unit and connection unit: 2.5 m From connection unit to the tip: 1.5 m			
Connection unit			25-channel connection Coaxial connector		25-channel connection + side: Metallic outlet — side: Square type coaxial connector			
Measurement Instrument			Tektronix, Inc.		Tektronix, Inc.			
External dimensions *6			W530 × H1750 × D940 mm		W530 × H1750 × D940 mm			
Power supply			100 V AC, 1ϕ, 10.0 A 120 V AC, 1ϕ, 8.3 A 220 V AC, 1ϕ, 4.5 A 240 V AC, 1ϕ, 4.2 A		100 V AC, 1ϕ, 10.0 A 120 V AC, 1ϕ, 8.3 A 220 V AC, 1ϕ, 4.5 A 240 V AC, 1ϕ, 4.2 A			

^{*1} Windows operating system version requirements are subject to change based on version changes in Windows.

Please ask for current supported operating system version.

^{*2} It is able to set different value from the measurement voltage.

^{*3} The measurement accuracy and the DC measurement range are only applicable to the measuring instrument.

For the measurement accuracy in the whole system, please refer to the Measurement Accuracy Distribution Chart on page 5.

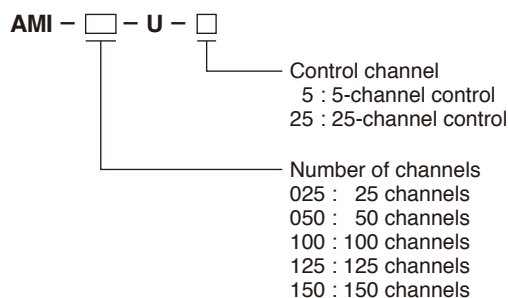
^{*4} The connection unit for applied high voltage is equipped with 1 k Ω resistors in series on the positive side of the applied voltage.

A slight voltage drop may occur depending on the current flow through specimens. This voltage drop is not included in the applied voltage accuracy.

^{*5} The charge time will be zero in the stress voltage full-time measurement mode.

^{*6} Excludes protrusions.

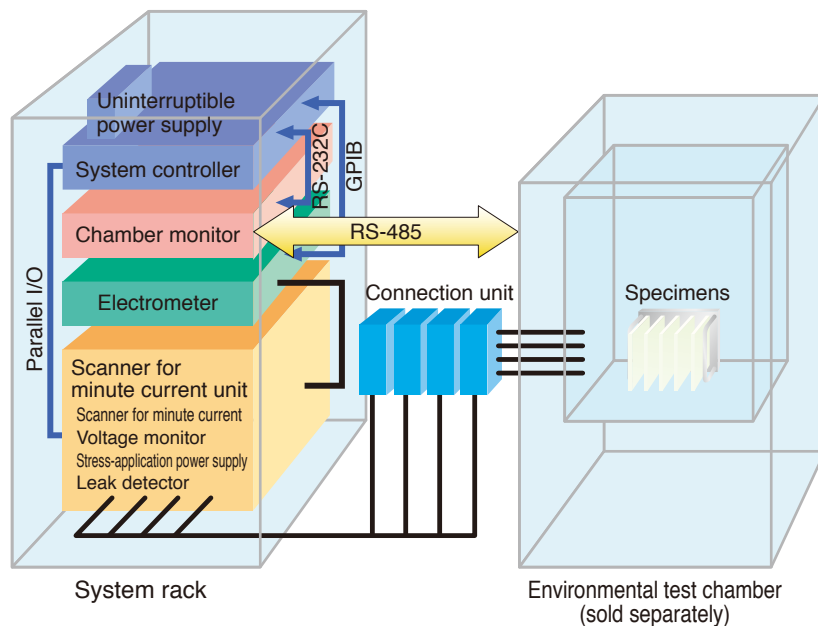
MODEL



ACCESSORIES

- Measurement cable
- Communication cable (RS-485)
- Setup CD
- User's manual

SYSTEM CONFIGURATION DIAGRAM



OPTION

Additional channel (25 channel basis)

The channels can be added according to the capacity of the system (150 channels at maximum on 25 channels basis).

Additional Scanner Box

Required when adding a total of 100 additional channels or more.

Extended cable that connects the scanner unit and the connection unit

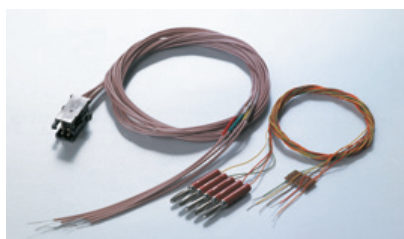
Cables can be lengthened from the standard 2.5 m.

- 4m

Measurement cable for 25 channel (standard type 1.5m)

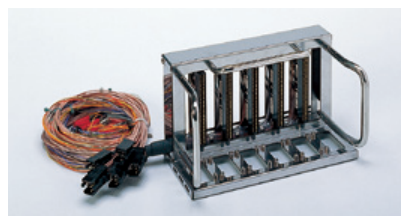
We offer both positive and negative measurement cables in addition to the standard accessories.

- 1.5m
- 3m



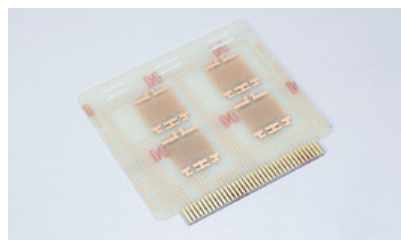
Test board rack type A

Test board rack for SIR test coupon type IPC-B-24.



SIR test coupon type IPC-B-24

Printed circuit boards that comply with IPC-B-24 specified in ISO 9455-17.



Board holder

We offer a variety of jigs for securing samples such as boards. (Connection terminal: screw-type)

LAN-compatible software

LAN-compatible software enables remote test checking and data processing, such as from a distant office.

* License for multiple PC monitoring requires an additional cost.

Data processing software (with statistical processing software)

Weibull analysis is installed in addition to the standard statistical processing software.

Emergency stop switch

Stops the system immediately.

Custom Specification

High-voltage Electrochemical Migration Evaluation System

Stress voltage application	Stress Voltage Range	50 to 1000V DC/ 50 to 2500V DC* *Please inquire for more than 2500V specifications.
	Channel configuration	25ch as standard (max. 150ch per rack)
	Control channel	5ch / 25ch
Resistance measurement	Resistance range	1 × 10 ⁵ to 1 × 10 ¹³ Ω (100V stressing) 1 × 10 ⁶ to 1 × 10 ¹⁴ Ω (1000V stressing) 2.5 × 10 ⁶ to 2.5 × 10 ¹⁴ Ω (2500V stressing)
	Voltage	50 to 1000V DC / 50 to 2500V DC (50 to 200V: 0.1V steps, 200 to 2500V: 1V steps)
	System	Tektronix, Inc.
External dimentions	Cabinet rack	W530×H1750×D940mm
	Connection unit	25 or 50ch: W500×H1705×D600mm 75 or 100ch: W500×H1705×D600mm x 2 sets 125 or 150ch: W500×H1705×D600mm x 3 sets

VARIOUS SAFETY FUNCTIONS

High-voltage Indicator Lamp

It calls operator's attention not to get electric shock. Illumination begins at the start of testing and remains untill the voltage drops when the test if interrupted and test ends.

Safe Volatage Increasing

Stress voltage increase stops for $\geq 1s$ on every 100V step, while decreases instantly.

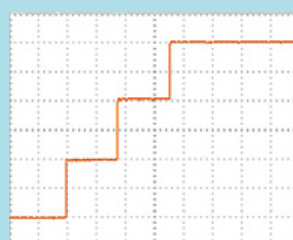
Current Limit Circuit

Every channel has a circuit limited up to 1mA. It protects specimen and prevents voltage dropping.

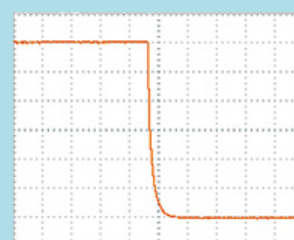
Door Interlock (Option)

High-voltage testing (1000V and above) can be dangerous to the operator. The door interlock would prevent the operator from accidentally starting a test while the chamber door being opened.

Safe Voltage Increasing



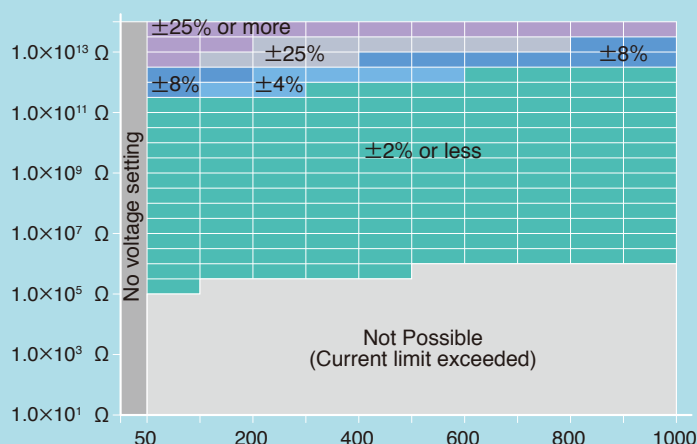
Voltage increase



Voltage decrease

Superior Measurement Accuracy

Ambient condition: 23°C±5°C, ≤60%
Applied voltage: 1000V
N=50 Averaged values



*The voltage (horizontal axis) does not reflect application voltage error.
Please inquire for the measurement accuracy when voltage more than 1000V is applied.

MEASUREMENT SYSTEMS

Conductor Resistance Evaluation System **AMR**

Accurately detects minute cracks in semiconductor packages and electronic component junctions. Automatic measurement and chamber integration allow improved efficiency in test schedule management.

■ Evaluation Targets

- Printed circuit boards
- Semiconductor underfill



Semiconductor Parametric Test System **AMM**

Supports cutting-edge device evaluation and offers highly-reliable data acquisition, collection, and analysis over a wide range of evaluation conditions from reliability evaluations to test/characteristic evaluations.

■ Evaluation Targets

- Semiconductor transistors



Electromigration Evaluation System **AEM**

Space-saving all-in-one system, the AEM is the only product of its kind in the industry to offer electromigration evaluation of 1 μ A at 400°C.

■ Evaluation Targets

- Semiconductor wiring patterns
- Solder bumps



Flash Memory Endurance Cycling System **RBM-LCT**

A Monitored Burn-in System for evaluation testing of non-volatile memory, such as Flash memory or FeRAM. This testing/evaluation equipment is suited to a variety of uses from R&D to mass production.

■ Evaluation Targets

- Flash memory (FeRAM and MRAM)



VARIOUS ENVIRONMENTAL TEST CHAMBERS (SOLD SEPARATELY)



Environmental Stress Chamber

Model	Temperature range	Temp.change rate	Inside capacity (L)
ARL	−45 to +180°C	4.0K/min to 6.3K/min	680,1100
ARS	−75 to +180°C		220,390,680,1100
ARU	−45 to +180°C		680,1100
ARG	−75 to +180°C		220,390,680,1100
ARSF	−70 to +180°C	10K/min to 18K/min	249,398,784
ARGF			

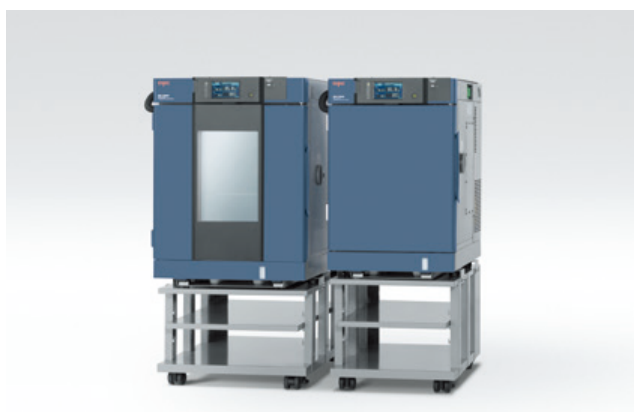
Humidity range : 10 to 98%rh (ARL/ARS/ARSF)



Temperature & Humidity Chamber Platinous J Series

Model	Temperature range	Humidity range	Inside capacity (L)
PR	−20 to +100°C	20 to 98%rh	120,225,408,800
PL	−40 to +100°C		306,800
PSL	−70 to +100°C		
PHP	ambient temp. +10 to +100°C	40 to 98%rh	219,398,784

Temp change rate : 1K/min to 5K/min



Bench-Top Type Temperature & Humidity Chamber

Model	Temperature range	Humidity range	Inside capacity (L)
SH-222	−20 to +150°C	30 to 95%rh	22.5
SH-242	−40 to +150°C		
SH-262	−60 to +150°C		
SH-642	−40 to +150°C		
SH-662	−60 to +150°C		64



Highly Accelerated Stress Test System (HAST Chamber)

Model	Temp./ humid./ pressure range	Inside capacity (L)
EHS-212(M)	+105 to +142.9°C / 75 to 100%rh	21
EHS-222(M)	0.020 to 0.196Mpa	51
EHS-412(M)	+105 to +162.2°C / 75 to 100%rh	21
	0.020 to 0.392Mpa	

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

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ISO 9001/JIS Q 9001

Quality Management System Assessed and Registered

ESPEC CORP. has been assessed by and registered in the Quality Management System based on the International Standard ISO 9001:2015 (JIS Q 9001:2015) through the Japanese Standards Association (JSA).

* Registration : ESPEC CORP.
(Overseas subsidiaries not included)



ISO 14001 (JIS Q 14001)

Environmental Management System Assessed and Registered

ESPEC CORP.
(Overseas subsidiaries not included)