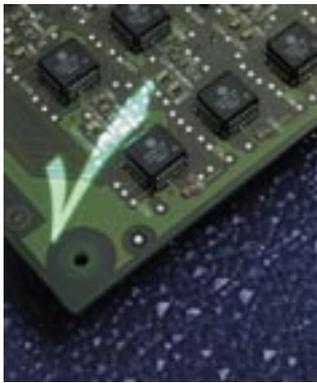


Commonly referred to as "Cleanliness Testing" this test method has, for over 40 years, been acknowledged as an important Quality Assurance and Process Control tool in the manufacture of electronic circuit boards, components and assemblies.

The Contaminometer (CM Series) test systems were originally developed by Protonique, the business of industry guru Brian Ellis. They also featured in the early development programmes of "cleanliness measurement" carried out by the US Department of Defense at China Lake in the 1970s.



Contaminometers are used to measure the amount of ionic contamination, usually referred to as cleanliness level, in accordance with IPC/ANSI-J-STD001D and UK DEF-STD and other international specifications. The instruments are also commonly referred to as ROSE (Resistivity Of Solvent Extracted) or SEC (Solvent Extract Conductivity) testers.

The CM Series of contamination testers are ergonomically designed with the CM11 and CM12 table top models for small size PCBs and components.

The CM60 is a floor standing model, designed to test large PCB panels and assemblies. The CM60 can be equipped with 1 of 2 different sized tanks dependant upon the size of the test pieces.

Ionic Contamination Testing

Ionic contamination testing is required as ionic residues remaining from both the PCB manufacturing process and the soldering process may affect the reliability of a finished assembly.



In a humid environment, ionic contaminants can cause problems such as shorting between conductors by electrolytic dendrite growth, corrosion that erodes the conductors themselves, or loss of insulation resistance. It is therefore important to monitor the level of ionic contamination, giving an indication of the cleanliness and thereby the expected reliability of an assembly.

Ionic contamination is measured by immersing a sample in a test solution of 2-propanol and de-ionised water to dissolve the contaminants. The dissolved ionic substances cause a change in conductivity of the test solution; this

change is precisely measured and converted into a contamination value expressed as $\mu\text{g}/\text{cm}^2$ NaCl equivalence.



Soldering & Cleaning Control

With the increasing use of both no clean and low solids fluxes in controlled atmosphere soldering systems, ionic contamination monitoring has become an essential process control parameter in the production environment. The Contaminometers are exceptional measurement instruments for SPC (Statistical Process Control) of the soldering and cleaning processes. Testing a number of samples per hour or per day, any changes in ionic contamination level will be detected, rapidly alerting the operator to a process variation or fault affecting the contamination level and thus the quality boards produced. The test results are immediately documented by a hard copy with graphical data presentation. Statistical analyses can be made instantly.

Components of the Contaminometer

All components of the CM Series Contaminometers have been carefully chosen to ensure high quality and excellent reliability. The hydraulics of each instrument is thoroughly tested and a special grade polymer is used for both the tanks and the piping in contact with the CM Test Solution. This solution is a mixture of reagent grade 2-propanol and ultra-pure de-ionised water mixed at either 50 or 75% as required by the applicable standard.

ENGINEERING RELIABILITY IN ELECTRONICS

In operation, the solution is re-purified automatically each time a new test is run using a special regeneration or de-ionising cartridge that is easy to exchange. Electronic control is provided by a low voltage system enclosed in a separate, easily accessible cabinet.

The CM Series utilise a solid gold measuring cell, ballistic amplifier and a vigorous pumping system to achieve superior measurement accuracy of less than 0.005 mS/cm even at very low conductivity values.



The CM Systems have also been designed to avoid polarisation effects between electrodes as might occur when using DC test currents. Equally, error signals caused by both DC and AC currents are eliminated and high accuracy is ensured even at low conductivity values.

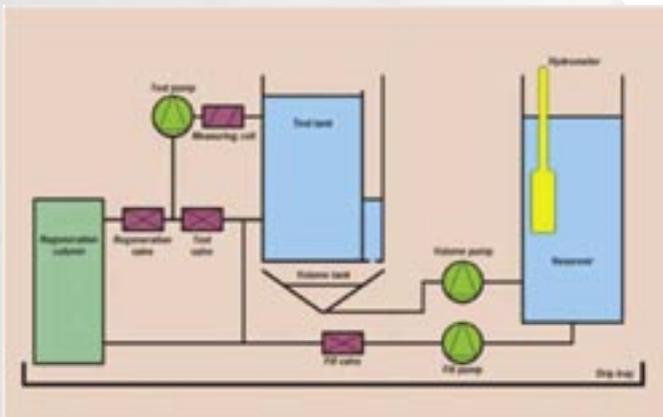
Automatic temperature compensation is incorporated in the electronic control system, the method of temperature measurement being

by a thermistor positioned in the test cell. The Contaminometer software uses a complex algorithm to automatically compensate for ambient temperature, circuit volume and atmospheric absorption of iogenic gases. Temperature is monitored and all measurements are related to the international standard of 20 °C (68 °F).

The CM Series ionic testers are designed to work with Windows® XP operating software.

Software Features

The user-friendly software running under Windows® XP gives on-screen instructions to guide the operator through the test cycle. The software can display up to 20 test results in a 2-dimensional or 3-dimensional representation, which can be rotated for ease of analysing the displayed data. The software is further designed to enable easy export of test results into other word processing and SPC software packages.



Data Processing

The analysis of the contamination test data uses a complex curve-fitting routine that gives an accurate indication of the total amount of ionic contamination on the circuit.

The graphical display of test results features auto-ranging of curves in equivalent contamination units of $\mu\text{g}/\text{cm}^2$ NaCl equivalence. Contamination is plotted against time and the curve is automatically extrapolated, producing meaningful data even for a short test.

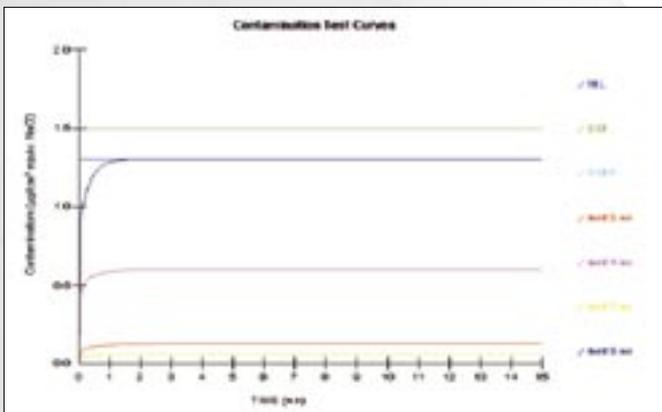
The test data is reviewed graphically including pass/fail analysis. Statistical evaluation of up to 50 test results is incorporated in the Contaminometer software but test results may also be imported into other software packages for further enhancement or appraisal as required. The test data produced meets the requirements of international and military specifications as documented in MIL-P-28809 (obsolete, but still referenced by the industry), DEF standard 00-10/3, IPC-J-STD 001D & IPC-TM-650 and IEC specifications.

Simplicity of Operation

The Contaminometers can be operated by unskilled personnel with a minimum of training. The only manual task is to insert the PCB at the beginning of the test and to remove it at the end. All other test cycle operations are fully automated as follows (see next page):



- The tank fills and the solution is regenerated in preparation for a new test by pumping through a mixed-bed ion exchange column until it reaches an extremely low level of conductivity. The solution is then homogenised.
- The test piece is inserted and a quantity of solution overflows the weir into a calibrated overflow tank. The volume of the overflow is measured with MIL compensation for components, if required. The test can now be started.
- The solution is pumped across the test piece via the measuring cell and the rise in conductivity is monitored. The test ends either when a pre-set time limit (3-15 minutes) is reached or when the conductivity level rises less than 1% of the absolute value over a period of 48 seconds.
- On completion of the test, the results are processed and analysed by the computer and may be viewed on-screen. The results are stored on the hard disk for future use and for comparison purposes.
- The overflow chamber empties and the tank is replenished and regenerated for further tests.



Test Tank Options

To achieve the greatest test accuracy and highest measurement sensitivity, the smallest tank that will accommodate the test sample should be used.

CM60 test tanks are available in 2 different sizes to suit individual applications.

Tank	Maximum PCB Dimensions	Min. PCB Surface Area
1	350 x 250 x 60 mm (13.8 x 9.8 x 2.4-inches)	200cm ²
2	500 x 350 x 60 mm (19.7 x 13.8 x 2.4-inches)	450cm ²
OPTION:	600 x 550 x 60 mm (23.6" x 19.7" x 2.4-inches)	500cm ²

The CM60 contains a built-in test solution reservoir. The software calculates the surface area of the PCB and allows for compensation of the component surface area.

Technical Specifications CM11/12

Machine	CM11	CM12
Max. PCB size	300 x 250 x 30 mm (12 x 10 x 1.2-inches)	240 x 230 x 36 mm (9.5 x 9 x 1.4-inches)
Min. PCB surface area*	100 cm ²	
Measurement Range	0.01 to 30 µg/cm ²	
Sensitivity	< 0.25% of measurement range	
Precision & Repeatability	Better than ±2% of range for max. PCB surface area	
Solution	50 or 75% v/v reagent grade 2-propanol in de-ionised water	
Max. Liquid Volume	3.5 litres	
Power Supply	100 - 240 V AC 50/60 Hz	
Weight	21 kg	

*Note: Testing PCBs with a surface area below the recommended minimum will result in reduced accuracy

Technical Specifications CM60

Measurement range:	0.01 - 30 µg/cm ² NaCl equivalence (auto-ranging)
Sensitivity:	< 0.25% of measurement range
Precision & Repeatability:	Better than ± 2% of range for maximum PCB surface
Solution:	50% or 75% v/v reagent grade 2-propanol in de-ionised water
Maximum liquid volume:	25 litres
Power supply:	100-240 V AC, 47/60 Hz
Weight:	Approx. 75 kg
Computer requirements:	Any suitable PC with Windows® XP
Overall dimensions:	Width x Depth x Height = 650 x 800 x 1100 mm