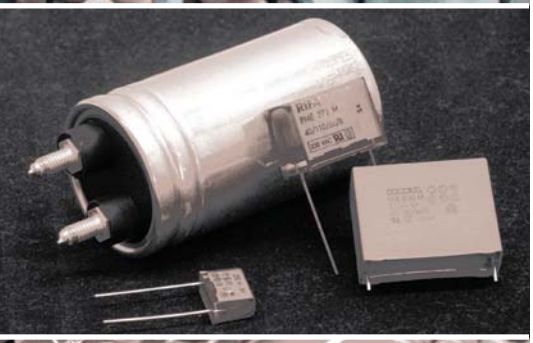
Component Tests



EMC - PARTNER

Capacitor Test System

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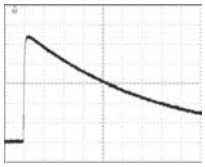
Brief Overview of Phenomena

Long wires to sensors or power supplies are very often connected to the inputs or outputs of industrial electronic equipment. The most frequent cause of damage in industrial electronic systems is overvoltages, caused either by switching actions in the equipment itself or by atmospheric discharges such as lightning. AC capacitors are designed to be used primarily in power frequency applications (50/60Hz) for suppression of switching transients and Radio Frequency Interference (R.F.I). Two types of capacitor can be differentiated for these applications. X capacitors, where a breakdown of the capacitor due to lightning or switching transients would not lead to an electric shock hazard and Y capacitors, used in applications where capacitor breakdown could cause a dangerous situation.

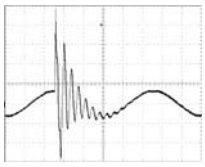
EMC PARTNER capacitor test systems are used to simulate transient (impulse) and active flammability tests on both X and Y capacitor types over a wide range of values.



- **Impulse Voltage Tests**

  This impulse voltage test is used to check the breakdown insulation of capacitors. A normalised voltage impulse of 1,2/50µs as defined in the standard IEC 60060-1 is used as an industry standard for voltage insulation tests. For X and Y capacitors the generator, waveform and test levels are specified in IEC 60384-14: X class capacitors are tested from 0,8 up to 4kV and Y class from 2,5 up to 8kV.

  All X and Y capacitor types must be subjected to impulse tests with the exception of types X3 and Y3.



- **Active flammability Tests — Surge**

  In the standards 60384-14 a passive flammability test is defined. In Amendment 1 of 60384-14 an active flammability test is also defined. The active flammability test must be carried out on X and Y capacitors (except type Y1).

  Each capacitor sample shall be subjected to 20 discharges up to 5kV (depending on capacitor class) from a 3µF tank capacitor. This surge voltage is superimposed onto the AC power supply. Each capacitor is wrapped in cheesecloth which should not ignite when the test voltage is applied. The test usually results in destruction of the capacitor.

Capacitor testing is performed on batches of 24 samples with all values being recorded. Capacitor test systems from EMC PARTNER can easily be extended to include automatic switching between samples and registration of test values.

Applicable Standards

International Electrotechnical Committee (IEC)

IEC 60060-1 (1989). High-voltage test techniques. Part 1: General definitions and test requirements.

IEC 60384-1: (1999). Fixed capacitors for use in electronic equipment - Part 1: Generic specification.

IEC 60384-14: (2005). Fixed capacitors for use in electronic equipment - Part 14: Sectional specification: Fixed capacitors for electromagnetic interference suppression and connection to the supply mains.

Test System Overview

Test System Features

The Capacitor Test System has many unique and outstanding features:

- Up to 8kV impulse voltage levels
- Up to 825V_{RMS} for active flammability tests
- AC voltage adjustment in 1V steps
- Impulse circuits changed to match capacitor load
- All parameters on one screen
- Parameter ramp feature
- Internal program memory
- Backlit LCD display
- Electronic polarity change
- Semiconductor switches
- Compact design
- Fulfils ALL standard requirements
- Remote control and software upgrade through standard interface
- Wide range of accessories
- 2 year warranty

User Benefits

The technical excellence and many unique features of the Capacitor Test System translate directly into benefits for the user:

- Cost effective solution for batch testing
- Increase quality of test object
- Easily transportable
- Save operator time with the automated test routines and test report facility
- Easy integration into a full test suite
- Unparalleled reliability and system up-time

Generators

The Capacitor Test System is available as three separate units (MIG0603CAP, MIG1212CAP and MIG1803CAP).

Each of the generators is a stand alone instrument that requires only a test cabinet (TC-MIG24 or TC-MIG24F).

To fully comply with IEC60384-14, the serial resistors Rs, the impulse capacitance C_T and the load capacitance C_P are automatically switched when different capacitance ranges are selected.

Verification of the testers are defined with load capacitors: C_X = 0.01µF and C_X = 0.1µF.

The generators have single high voltage outputs, used to test individual capacitor samples. To speed up batch testing, an eight position multiplexer can be added. This fits inside the test cabinet and is linked to the individual generator's safety circuit.

The most significant test parameters can all be programmed as fixed values on the instrument front panel, or using the RAMP function to change parameters during a test. Impulse voltage level, synchronisation angle and polarity can all be programmed using this feature.

- **MIG0603CAP**
  Generates the impulse voltage 1.2/50µs up to 6kV for testing capacitors up to 10µF. Three categories are defined for X capacitors: X1 (2.5 to 4kV), X2 (up to 2.5kV) and X3 (up to 1.2kV). MIG0603CAP is optimized to meet these requirements. The single high voltage output can be extended with a multiplexer to automatically test 8 capacitor samples without the need of operator intervention.

- **MIG1212CAP**
  Generates a 1.2/50µs voltage impulse up to 12kV for testing capacitors up to 10µF. Four categories are defined for Y capacitors, although only three categories require an impulse test (Y3 is exempt): Y4 (2.5kV), Y2 (5kV) and Y1 (8kV). MIG1212CAP is optimized to meet these requirements. The single high voltage output can be extended with a multiplexer to automatically test 8 capacitor samples without the need of operator intervention.

- **MIG1803CAP**
  Active flammability testing determines the ability of a capacitor to burn with a flame as a result of electrical loading. An impulse voltage is applied to the sample which is simultaneously connected to an AC supply. The AC supply is manually adjustable up to 860V. An isolation transformer is included in the generator to block secondary voltages. Because the nature of this test means that capacitors could set fire to a cheese cloth wrapping, the complete assembly must be fire proof.

MIG1212CAP — fully automatic test system

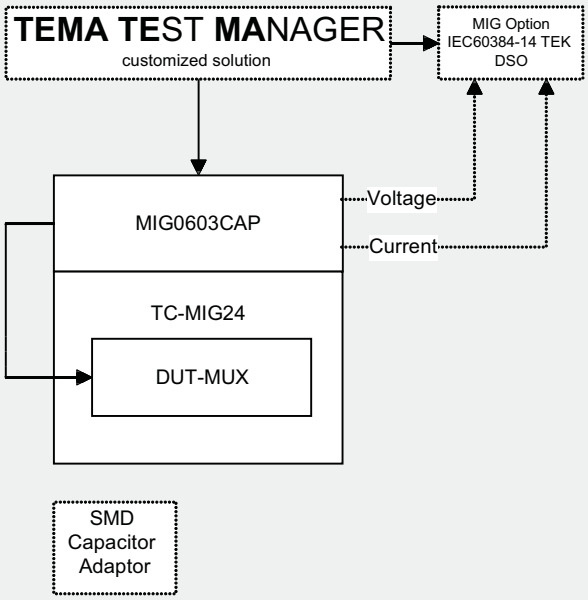
MIG1803CAP with TC-MIG24F on top

MIG0603CAP and MIG1212CAP can be extended to test SMD capacitors using special adapter sets.

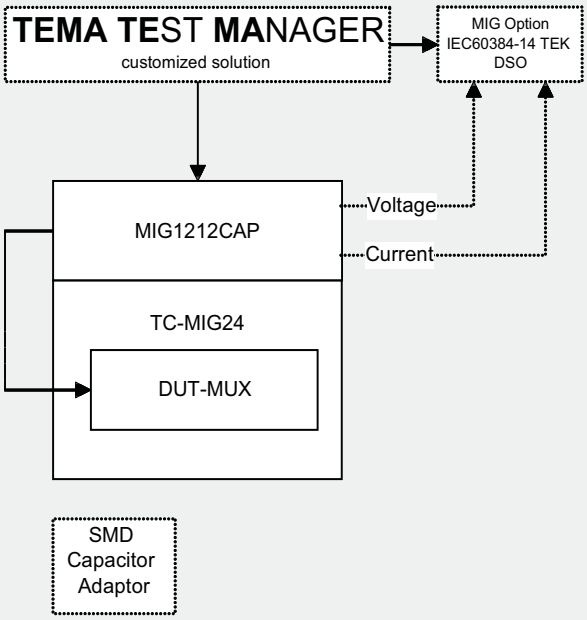
Each of the instruments can be integrated into a complete test package which includes software control of the impulse generators and a measurement oscilloscope. Results are automatically collected and recorded for further analysis. The EMC PARTNER TEMA software is complimented with an additional test module to fulfil these functions (MIG OPTION IEC60384-14).

System Flowcharts

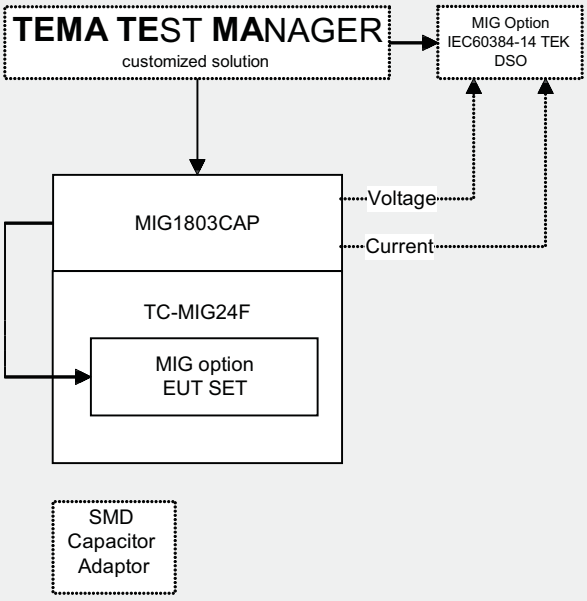
Impulse Voltage Tests - X Class with MIG0603CAP



Impulse Voltage Tests - Y Class with MIG1212CAP



Active Flamability Tests with MIG1803CAP



Generator Specifications

MIG0603CAP

CT = 250nF

Voltage range	0.5 up to 6kV
Voltage increment	1V steps
Impulse capacitor	0.25µF
Energy at 6kV	4.5J
Series resistance	27 to 62ohm
Pulse front time 0 to 27nF	1.2µs
Pulse duration 0 to 27nF	50µs
Overswing	< 5%
Pulse repetition at Vmax	up to 4 per minute
Polarity	positive, negative, alternating
Programmable parameter ramps	voltage, synchronisation, polarity

CT = 20µF

Voltage range	0.5 up to 6kV
Voltage increment	1V steps
Impulse capacitor	20µF
Energy at 6kV	360J
Series resistance	3 to 25ohm
Pulse front time 0 to 120nF	1.2µs
Pulse duration 0 to 120nF	50µs
Overswing	< 10%
Pulse repetition at Vmax	up to 4 per minute
Polarity	positive, negative, alternating
Programmable parameter ramps	voltage, synchronisation, polarity

MIG1212CAP

CT = 250nF

Voltage range	1 up to 12kV
Voltage increment	1V steps
Impulse capacitor	0.25µF
Energy at 12kV	18J
Series resistance	27 to 62ohm
Pulse front time 0 to 27nF	1.2µs
Pulse duration 0 to 27nF	50µs
Overswing	< 5%
Pulse repetition	up to 6 per minute
Polarity	positive, negative, alternating
Programmable parameter ramps	voltage, synchronisation, polarity

CT = 20µF

Voltage range	0.5 up to 12kV
Voltage increment	1V steps
Impulse capacitor	20µF
Energy at 6kV	1440J
Pulse front time 0 to 27nF	1.2µs
Pulse duration 0 to 27nF	50µs
Overswing	< 10%
Pulse repetition	up to 6 per minute
Polarity	positive, negative, alternating
Programmable parameter ramps	voltage, synchronisation, polarity

Combination Wave (Inductance Tests)

Voltage range	0.5 up to 12kV
Voltage increment	1V steps
Impulse capacitor	20µF
Energy at 12kV	1,440J
Source impedance	4ohm
Pulse front time	1.2µs
Pulse duration	50µs (variable with load inductance)
Overswing	< 5%
Pulse repetition	up to 6 per minute
Polarity	positive, negative, alternating
Programmable parameter ramps	voltage, synchronisation, polarity

MIG1803CAP

Impulse Tester (Active Flammability)

Voltage range	0.75 up to 18kV
Vmin at 4 to 10µF load	4kV
Vmax at 4µF load	6kV
Impulse capacitor	3µF
Energy at 18kV	486J
Pulse repetition Cx < 4µF	up to 12 per minute
Pulse repetition Cx 4 to 10µF	up to 6 per minute
Polarity	positive, negative, alternating
Load capacitor Cx > 1µF	serial resistor 5ohm
Load capacitor 0.22µF < Cx < 1µF	serial resistor 10ohm
Load capacitor 0.068µF < Cx > 0.22µF	serial resistor 40ohm
Load capacitor Cx < 0.068µF	serial resistor 100ohm
Programmable parameter ramps	voltage, synchronisation, polarity

Voltage Control (Coupling / de-coupling)

Voltage range	50 to 800V
AC power ranges	0 to 275V
	275 to 550V
	550 to 825V
EUT current	16A

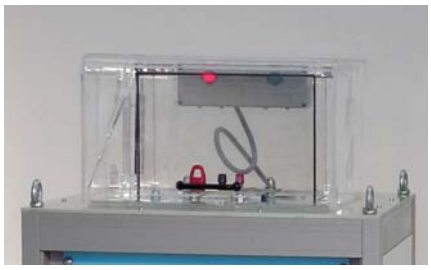
Accessories and Options

TC-MIG24

TC-MIG24

A test cabinet for EUT with maximum dimensions 12 x 15 x 28cm. Can be used together with MIG0603CAP and MIG1212CAP. MIG OPTION DUT MUX can be fitted inside the test cabinet.

TC-MIG24 is linked to the MIG0603CAP and MIG1212CAP safety circuit. Opening the test cabinet disables test voltages. Safety circuit status is indicated by red and green lamps in the test cabinet.

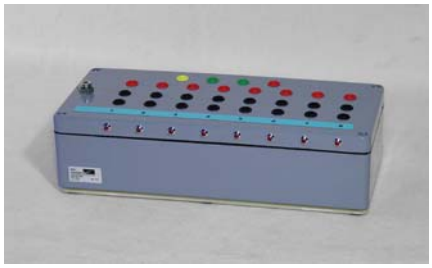


TC-MIG24F

TC-MIG24F

A test cabinet for EUT with maximum dimensions 12 x 15 x 28cm. Can be used together with MIG OPTION EUT SET and MIG1803CAP. The test cabinet includes a glass cover to contain flames, should the capacitors start to burn.

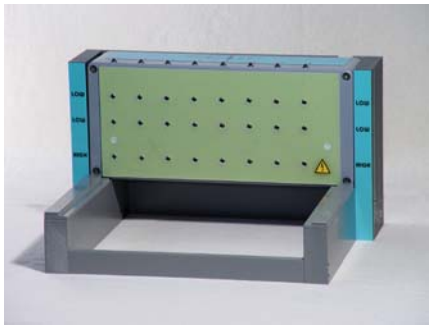
TC-MIG24F is linked to the MIG1803CAP safety circuit. Opening the test cabinet, disables test voltages. Safety circuit status is indicated by red and green lamps in the test cabinet.



MIG CAP DUT-MUX

MIG-CAP DUT-MUX

An eight channel multiplexer that can be used together with the MIG0603CAP and MIG1212CAP. The multiplexer connects directly to the MIG generator for high voltage and also control signals. Requires TC-MIG24 for personnel protection.



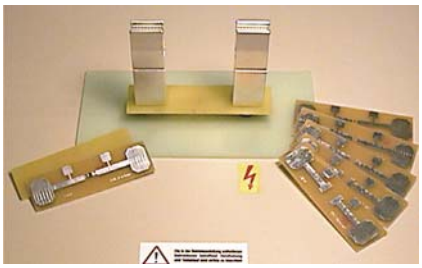
MIG EUT-SET

MIG EUT-SET

An eight channel multiplexer that can be used together with the MIG1803CAP. Special construction ensures the MIG OPTION EUT SET does not burn during active flammability tests. The multiplexer connects directly with the MIG generator for high voltage and also control signals. Requires TC-MIG24F for personnel protection.

CN-MIG-SMD

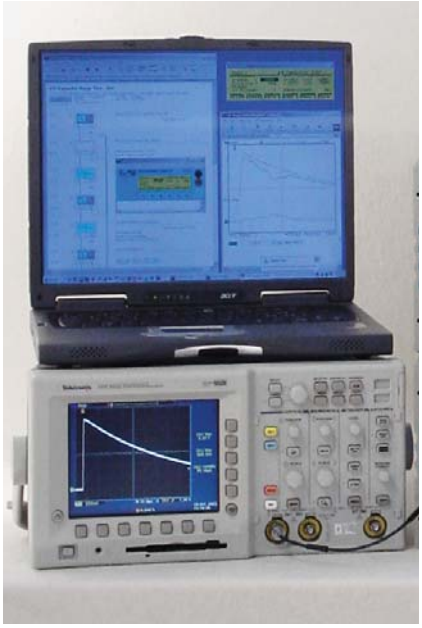
Adapter with PCB panel to fit Surface Mount Device (SMD) capacitors of different sizes. Can be used with MIG0603CAP, MIG1212CAP and MIG1803CAP.



CN-MIG-SMD

SOFTW IEC60384-14

This is a complete package to fully automate X and Y capacitor testing. It includes a PC with TEMA and the module “Insulation test on X and Y capacitors” pre-loaded, a two channel Digital Storage Oscilloscope (DSO) and all connections necessary to perform measurement and testing.



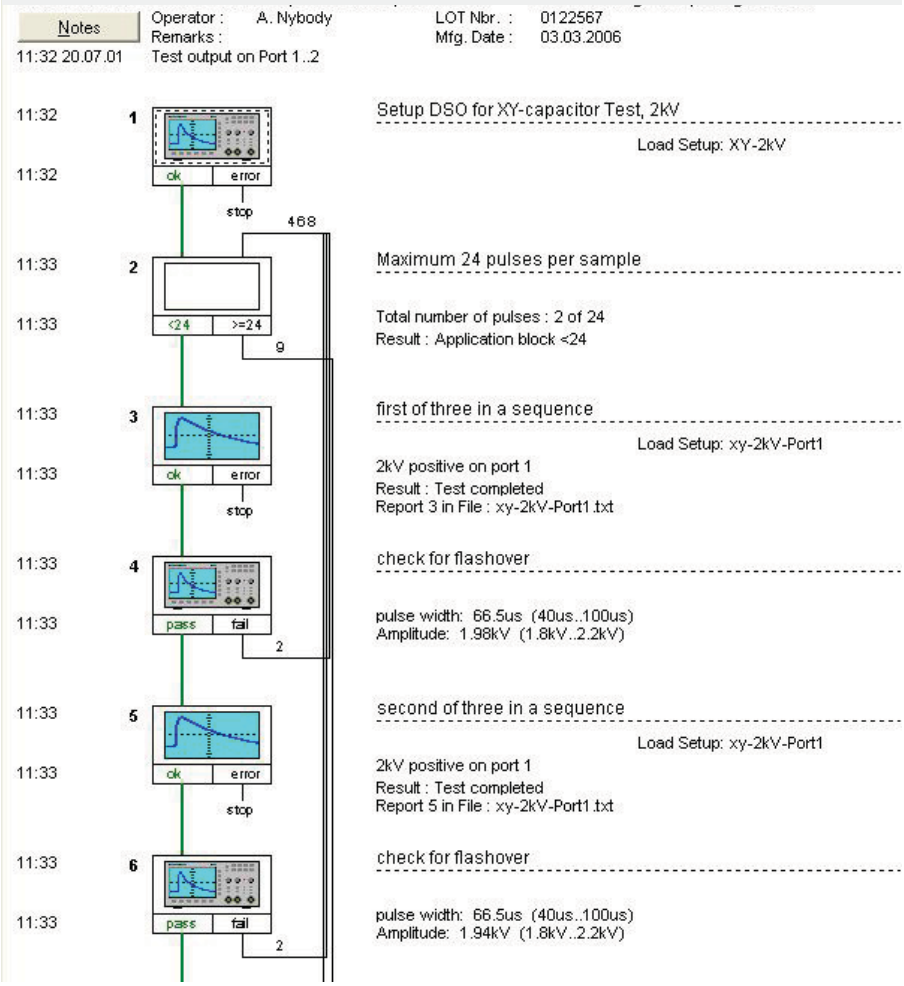
SOFTW IEC60384-14

Software

For remote control of Capacitor Test systems, an OPTICAL LINK and one of the following software packages is needed:

- GENECS-MIG: This is a relatively simple program that reproduces generator front panel functions on a PC. In addition to remote programming and control of the generators, test report information is available to word processing or other evaluation programs such as EXCEL.
- TEMA Software: Comfortable control of EMC PARTNER generators from a PC. Enables up to four generator types to be included in the same test sequence. Generates an enhanced test report.
- SOFTW IEC60384-14: This is a special module for the TEMA software specially written for automatic testing of X and Y capacitors using the MIG-CAP DUT-MUX or the MIG EUT-SET.

Predefined Test Routines



EMC PARTNER's Product Range

The Largest Range of Impulse Test Equipment up to 100kA and 100kV.

Immunity Tests

Transient Test System can be used to performs all EMC tests on electronic equipment. ESD, EFT, surge, AC dips, AC magnetic field, surge magnetic field, common mode, damped oscillatory and DC dips tests are available as stand-alone or combined test instruments. A large range of accessories for different applications is available: three phase couplers up to 690V/100A, telecom and data line couplers, verification sets, magnetic field coils. Immunity test systems fulfills IEC and EN 61000-4-2, -4, -5, -8, -9, -11, -12, -16, -18, -29.

TRA3000 and ESD3000 ideal for CE testing
Easily extended to meet other applications

Lightning Tests

A range of test equipment and accessories for aircraft, military and telecom applications. Complete solutions including all hardware and software to meet the requirements of RTCA / EUROCAE DO160 / ED14 for indirect lighting on aircraft systems, MIL-STD-461 tests CS106, CS115, CS116, for military vehicles, ITU-T .K44 basic and enhanced tests for impulse, power contact and power induction, FCC part 68 for telecom equipment testing.

MIG2000-6 – a flexible solution for military and avionic applications

Component Tests

Modular impulse generators (MIG) for transient component testing on: varistors, gas discharge tubes (GDT), surge protective devices (SPD), X Y capacitors, circuit breakers, watt-hour meters, protection relays, insulation material, suppressor diodes, connectors, chokes, fuses, resistors, emc-gaskets, cables, etc. Manual or fully automated solutions are available up to 100kA (8/20us) and 144kV (1.2/50us).

MIG1212CAP – an automatic 8 bank capacitor test system

Emission Measurements

One unit performs all measurements on the power supplies of electronic equipment and products for the CE-Mark. HAR1000 uses a novel techniques to deliver clean power source for the EUT in a compact and lightweight form. The system includes all hardware and software including line impedance networks, control and evaluation software. A basic 1-phase system can be easily extended to 3-phase by adding 2 further phases . HARCS Immunity software further expands the system by addidng interharmonic tests, voltage variation and ripple on DC tests. Complies with IEC / EN 61000-3-2, -3 IEC / EN 61000-4-13, -14,

HAR1000-3P and HARCS software a complete test system

System Automation

As addition to the basic generators, a range of accessories are available to enhance capability. Test cabinets, test pistols, adapters and software, simplify interfacing with the EUT.

PS3 programmable source is an EMC hardened supply for frequencies form 16.7Hz to 400Hz. Frequency variation tests can be made using the PS3-SOFT-EXT. Complies with IEC / EN 61000-4-28

PS3 - programmable source ideal for EMC applications

For further information please do not hesitate to contact EMC PARTNER's representative in your region. You will find a complete list of our representatives and a lot of other useful information on our website:

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