



MIG-System

Varistor Testers

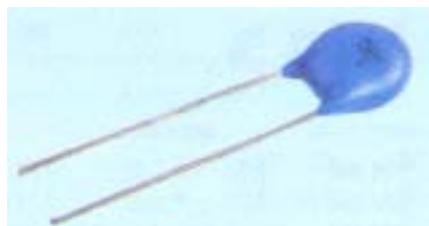
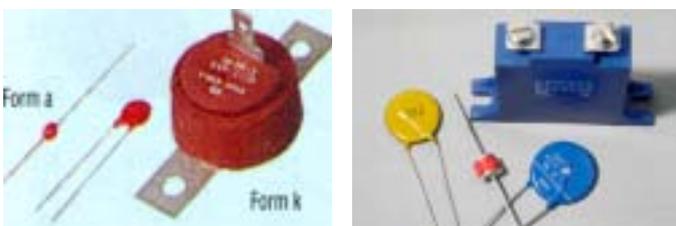


I Clamping Voltage Test 8/20

II Surge Withstand Test 8/20

III Energy Test

IV CWG Test 1.2/50, 8/20



General Information About Varistors and SPD

The Different Electrical Tests

Varistor Voltage V_c

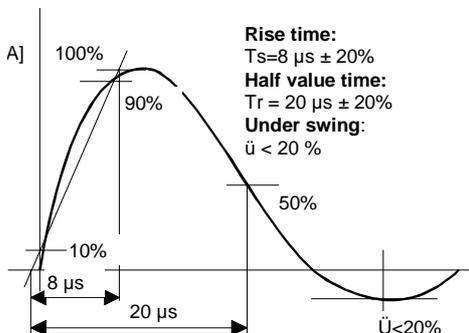
The measured voltage between two terminals when applying specified d.c. current in mA is called V_c . The measurement must be made very fast to avoid heat affection.

Impulse life span of the varistors with 8/20 and 10/1000

The change of V_c is measured after impulses up to 10'000 are applied continuously with an interval of 20 second at 20°C.

Clamping Voltage Test 8/20 μ s

The clamping voltage is the maximum residual voltage V_{peak} across the varistor terminals for a through current I_{peak} . The voltage value gives an indication on the protective function of the varistor. The maximum voltage is determined with the standardized current waveform 8/20 μ s applied. Standardized current waveform:

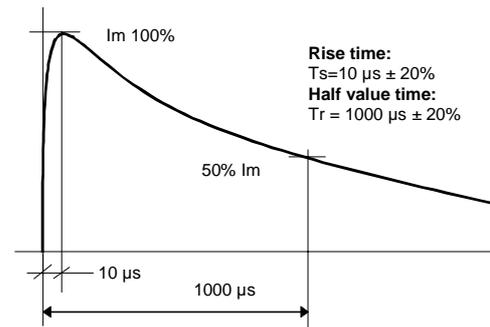


Surge Withstand Test 8/20 μ s

The maximum current within the varistor voltage changes $\pm 10\%$ when one impulse 8/20 μ s is applied. The maximum surge current is approximately proportional to the varistor electrodes (diameters).

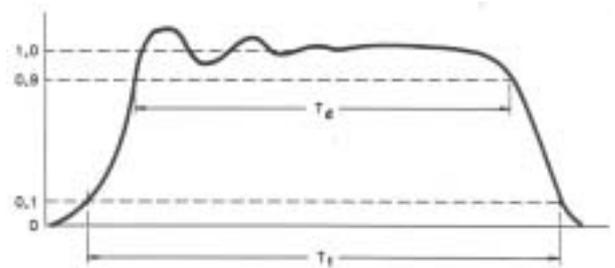
Energy Test 10/1000 μ s

The maximum energy within the varistor voltage changes $\pm 10\%$ when one impulse with a current waveform of 10/1000 μ s is applied.



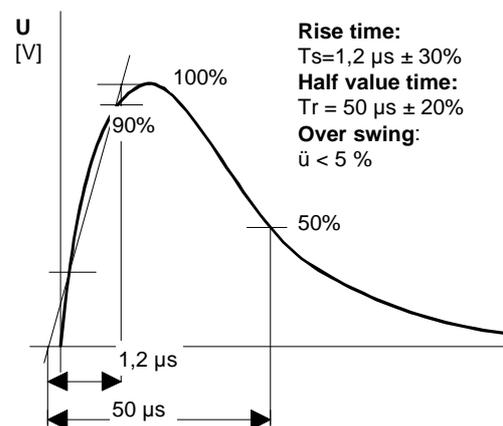
Energy Test 2 ms

The maximum energy within the varistor voltage changes $\pm 10\%$ when one impulse with a rectangular current waveform of 2 ms is applied.



CWG 1.2/50 μ s

In addition to 8/20 μ s the voltage waveform 1,2/50 μ s is specified. The varistors are tested with superimposed surges on power supply. IEC 61643-1 specifies the performance requirements and testing methods for surge protective devices (SPD) connected to low voltage power distribution systems.



Clamping Voltage Tests: 8/20 μ s up to 200 A and 500 A MIG0603CLV1 and MIG0603CLV2

The MIG0603CLV1 and -2 are generators to test clamping voltages on varistors with a disk size of 5 mm up to 40 mm. The MIG0603CLV include three different source impedances (10,100,1000 Ohm) and up to 11 different measurement ranges to perform varistor clamping voltage tests over the whole range of low voltage (< 1000 V) varistors. The current waveform is within the tolerances over the whole load range.



MIG0603CLV1

MIG0603CLV2	Varistor Characteristics min. to max.			
	Z_{gen} output impedance [Ohm]	I_p [A]	min. rd @ V_{cl} [Ohm]	max. rd @ V_{cl} [Ohm]
1000	1	10	100	500
1000	2.5	10	100	500
100	5	10	100	1300
100	10	5	50	1500
100	25	5	50	2000
10	50	3	30	3000
10	100	1	10	3000
10	200	1	10	1800
5	250	0.2	2	2500
5	500	0.2	2	1500

The MIG0603CLV2 has two additional ranges: 250 and 500 A at Z_{gen} 5 Ohm.

Basic data

Dimensions: 550 x 450 x 190 mm (l x w x h)

Weight: 20 kg

Power supply: 230/115 V selected automatically, power < 400 VA

Control

Impulse counter: 1 up to 29'999

Trigger: auto or manual

Ramps: voltage, polarity

Protocol: peak values, polarity, number of shots, limits on peak current and peak voltage for "passed - failed"

Measuring ranges versus varistors

No.	Name of varistor	Z_{gen}	$V_{cl_{max}}$	I_{peak}	Current / Voltage Monitor
1	< 1000 V; < 2.5 A	1000 Ohm	1000 V	1 A; 2.5 A	10 V = 5.0 A 10 V = 1000 V
2	< 300 V; < 2.5 A	1000 Ohm	300 V	1 A; 2.5 A	10 V = 5.0 A 10 V = 300 V
3	< 100 V; < 2.5 A	1000 Ohm	100 V	1 A; 2.5 A	10 V = 5.0 A 10 V = 100 V
4	< 3000 V; < 25 A	100 Ohm	3000 V	5 A; 10 A; 20 A; 25 A	10 V = 25 A 10 V = 3000 V
5	< 1000 V; < 25 A	100 Ohm	1000 V	5 A; 10 A; 20 A; 25 A	10 V = 25 A 10 V = 1000 V
6	< 300 V; < 25 A	100 Ohm	300 V	5 A; 10 A; 20 A; 25 A	10 V = 25 A 10 V = 300 V
7	< 100 V; < 25 A	100 Ohm	100 V	5 A; 10 A; 20 A; 25 A	10 V = 25 A 10 V = 100 V
8	< 3000 V; < 200 A	10 Ohm	3000 V	50 A; 100 A; 200 A	10 V = 200 A 10 V = 3000 V
9	< 1000 V; < 200 A	10 Ohm	1000 V	50 A; 100 A; 200 A	10 V = 200 A 10 V = 1000 V
10	< 300 V; < 200 A	10 Ohm	300 V	50 A; 100 A; 200 A	10 V = 200 A 10 V = 300 V
11	< 100 V; < 200 A	10 Ohm	100 V	50 A; 100 A; 200 A	10 V = 200 A 10 V = 100 V
12	< 3000 V; < 500 A	5 Ohm	3000 V	250 A; 500 A	10 V = 1000 A 10 V = 3000 V
13	< 1000 V; < 500 A	5 Ohm	1000 V	250 A; 500 A	10 V = 1000 A 10 V = 1000 V
14	< 300 V; < 500 A	5 Ohm	300 V	250 A; 500 A	10 V = 1000 A 10 V = 300 V
15	< 100 V; < 500 A	5 Ohm	100 V	250 A; 500 A	10 V = 1000 A 10 V = 100 V

Surge Withstand Tests: 8/20 μ s, Current Range 100 A up to 100 kA, Varistor clamping voltage up to 3000 V

EMC PARTNER offers a series of standardized MIG generators for surge withstand tests to cover the broad range of devices under test:

6 kV range

MIG0606: 6 kV, 2 x 3 kA, I_{max} 6 kA

MIG0612: 6 kV, 4 x 3 kA, I_{max} 12 kA

MIG0624: 6 kV, 4 x 6 kA, I_{max} 24 kA

12 kV range

MIG1212: 12 kV, 4 x 3 kA, I_{max} 12 kA

MIG1224: 12 kV, 4 x 6 kA, I_{max} 24 kA

MIG1248: 12 kV, 4 x 12 kA, I_{max} 48 kA



MIG1248



MIG0624

The MIG0624 tester can be equipped additionally with: 10/700, 10/1000 or 10/350 μ s waveforms.

The 6 and 12 kV generators consist of four identical circuits which can be connected in parallel with the following advantages:

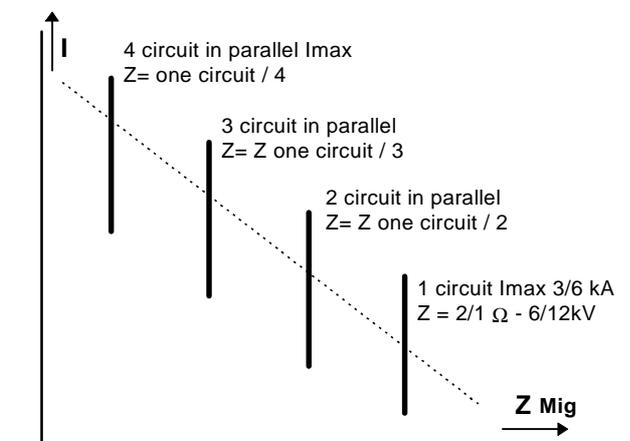
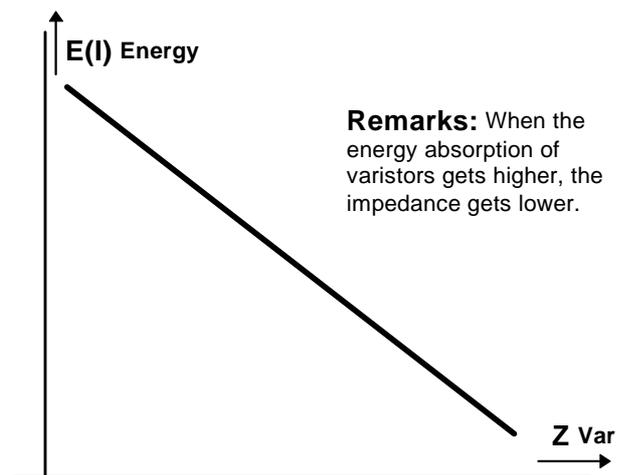
- Current ranges are larger compared with single impulse capacitance circuit (lower current limit).
- Two or four electrode elements can be tested.
- Standard MIG are equipped with polarity

reversal. Tests can be automated.

- Peak voltage and current meter are included in standard unit.
- Because of higher source impedance at lower voltage, bigger ranges of varistors can be tested within tolerances.



The 4 outputs of the MIG0624



With its 4 outputs the generator can be adapted in an optimum way to the DUT (device under test).

Energy Tests: 10/1000 μ s, Current Range 1 A up to 320 A Varistor clamping voltage up to 3000 V

MIG0624LP1

The generator MIG0624LP1 is designed to carry out energy tests in addition to 8/20 μ s surge tests on varistors.

The MIG0624LP1 consists of four impulse circuits and four measurement circuits.

Technical data

Rise time 0 to 100%: 10 μ s

Half value time 0 to 50%: 1000 μ s

Voltage: V_{max} 6 kV

Circuit 1 current range: 6 A to 80 A

Circuit 2 current range: 14 A to 160 A

Circuit 3 current range: 22 A to 240 A

Circuit 4 current range: 30 A to 320 A

Measurement ranges:

10 V equals 80 A, 160 A, 240 A, 320 A



MIG0624LP1

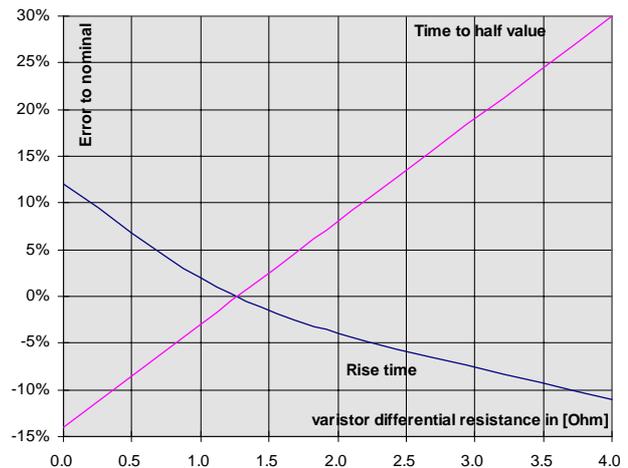
High voltage circuits

Impulse capacitance: 4 x 20 μ F \pm 10 %

Energy at V_{max} : 1500 Joule

Waveform within tolerances:

I_{min} 6 A and I_{max} 320 A \pm 10 %



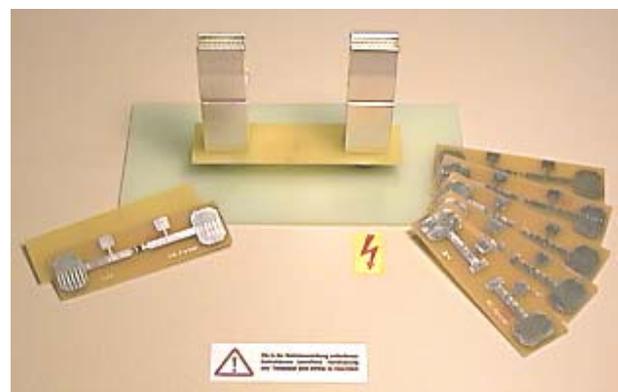
Impulse shape versus varistor differential resistance

Only the MIG0624 can be equipped with the long pulses 10/700, 10/1000 or 10/3500 μ s. The type changes from e.g. MIG0624 to MIG0624LP1 (long pulse 10/1000) or MIG0624LP7 (long pulse 10/700).

MIG0603CLP – SMD varistor tester
The MIG0603CLP includes three different waveforms:

- CWG (1,2/50; 8/20), 6 kV/3 kA,
- energy test (10/1000) up to 360 A,
- 8/20 μ s clamping voltage tests up to 360 A.

With the special SMD adapter shown below the varistors can be properly contacted to the tester.



SMD Adapter

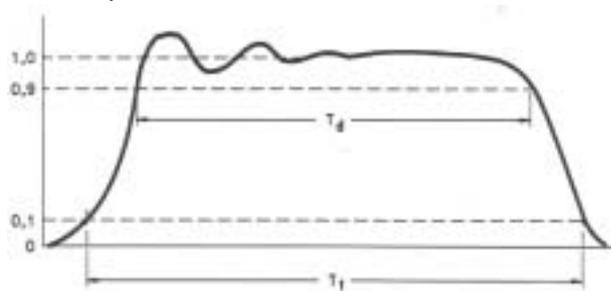
Energy Tests: 2 ms, Energy Range 2 J up to 2000 J Varistor clamping voltage up to 3000 V

The MIG0612EA and the MIG0636EA are generators to test energy absorption on varistors up to 2000 J.

Energy surge rating

Surge currents of relatively long duration are required for testing maximum energy absorption capability. This condition is more representative of the high energy surges usually experienced from inductive discharge of motors and transformers. A rectangular wave of 2 ms according to IEC 60060 is commonly used for this test. The energy absorption in the varistor is the integral of the current flow through and the voltage across the varistor. The 2 ms pulse has – compared with the 10/1000 μ s pulse – the advantage of easy calculation. The energy is with good accuracy the product of the peak current and the clamping voltage multiplied with the pulse duration.

2 ms pulse definition



Duration of the peak of a rectangular impulse current T_d

The duration of the peak of a rectangular impulse current T_d is a virtual parameter defined as the time during which the current is greater than 90 % of its first peak (see figure above).

Total duration of a rectangular impulse current T_t

The total duration of a rectangular impulse current T_t is a virtual parameter defined as the time during which the current is greater

than 10% of its first peak. If oscillation are present on the front, a mean curve should be drawn in order to determine the time at which the 10% value is reached.



MIG0612EA

Technical data

MIG0612EA

Waveform 90 to 90%: 2 ms -0%/+20%
 Current range: 5 A up to 150 A
 Varistor clamping voltage ranges:
 100 V, 300 V, 1000 V, 3000 V
 Varistor energy range: 2 J up to 700 J depending on the clamping voltage
 Measurement accuracy: +/-3% for v_{peak} and i_{peak} , +/-10% for energy
 Charging time: maximum 15 seconds

MIG0636EA

Waveform 90 to 90%: 2 ms -0%/+20%
 Current range: 5 A up to 500 A
 Varistor clamping voltage ranges:
 100 V, 300 V, 1000 V, 3000 V
 Varistor energy range: 12 J up to 2100 J depending on the clamping voltage
 Measurement accuracy: +/-3% for v_{peak} and i_{peak} , +/-10% for energy
 Charging time: maximum 30 seconds

Surge Tests on Powered Varistors with CWG Different Generator Impedances

The following generators are hybrid or combination generators with a voltage wave shape at open circuit 1,2/50 μ s and a current wave shape into a short circuit 8/20 μ s. The peak output voltage and current of the MIG are indicated on the front display. The two BNC monitor outputs (v,i) allow monitoring the voltage and current wave shapes by an oscilloscope connected onto.

A coupling and de-coupling network is included to superimpose the surge on a two wire power supply. The varistors are tested with superimposed surges on power supply.

MIG0603UL

This generator complies with:

- UL 1449 August 15. 1996 Table B1.1 "Specification for combinations surge waveforms" with impedance 12 and 2 Ohm
- ANSI / IEEE 62.41: 1991 IEEE Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits



MIG0603UL

Basic data

Dimensions with test cabinet:
450 x 430 x 570 mm (w x h x l)
Weight: approx. 24 kg

High voltage circuits

$v = 1,2/50 \mu$ s; 250 V up to 6600 V
 $i = 8/20 \mu$ s; 500 A at 12 Ohm; 3000 A at 2 Ohm

Coupling filter

Max. allowed voltage between the two lines:
a.c. 400 V r.m.s., d.c. 200 V
Max. allowed current: a.c. 16 A, d.c. 16 A
Coupling: one coupling path

MIG0612

The 0,5 Ohm effective impedance circuit complies with: UL 1449 August 15. 1996.

MIG2412SPD and MIG1206SPD
IEC 61643-1 (1998-02): Surge protective devices connected to low-voltage power distribution systems. Part 1: Performance requirements and testing methods.

Voltage and current range

$v = 1.2/50 \mu$ s and $i = 8/20 \mu$ s
MIG2412SPD: 24 kV / 12 kA
MIG12062SPD: 12 kV / 6 kA



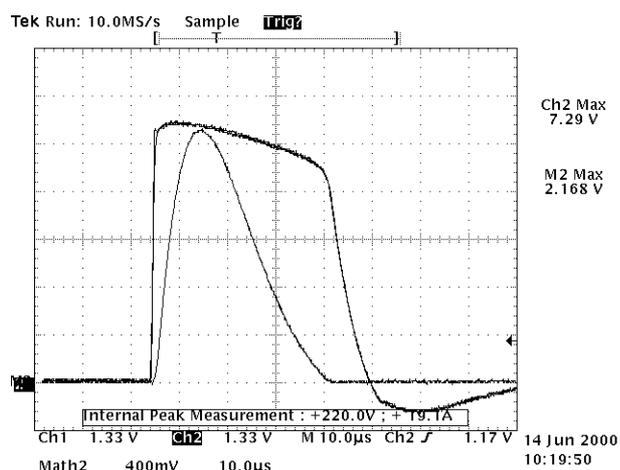
MIG1206SPD

Clamping Voltage Tests on Low Voltage Varistors < 1000V with MIG0603CLV1 and MIG0603CLV2

Disk size	Nominal r.m.s. voltage	Clamping voltage: Vcl @I(class)	Class current I(class)	MIG0603CLV1 10 V – 3000 V 8/20 μs	MIG0603CLV2 10V – 3000V 8/20 μs
5 mm	14 V	43 V	5 A	1 A – 200 A	1 A – 200 A
	130 V	310 V	5 A	1 A – 200 A	1 A – 200 A
	250 V	650 V	5 A	5 A – 200 A	5 A – 200 A
10 mm	14 V	43 V	5 A	1 A – 200 A	1 A – 200 A
	130 V	340 V	25 A	1 A – 200 A	1 A – 200 A
	250 V	650 V	25 A	5 A – 200 A	5 A – 200 A
	510 V	1350 V	25 A	5 A – 200 A	5 A – 200 A
	680 V	1800 V	25 A	5 A – 200 A	5 A – 200 A
20 mm	14 V	43 V	20 A	1 A – 200 A	1 A – 200 A
	130 V	350 V	100 A	1 A – 200 A	1 A – 200 A
	250 V	650 V	100 A	5 A – 200 A	5 A – 200 A
	510 V	1350 V	100 A	5 A – 200 A	5 A – 200 A
	680 V	1800 V	100 A	5 A – 200 A	5 A – 200 A
	1000 V	2700 V	100 A	5 A – 200 A	5 A – 200 A
40 mm	130 V	340 V	300 A		5 A – 500 A
	250 V	650 V	300 A		5 A – 500 A
	510 V	1350 V	300 A		5 A – 500 A
	680 V	1800 V	300 A		5 A – 500 A
	1000 V	2700 V	300 A		5 A – 500 A

Advantages of EMC PARTNER's testers

- Built-in accurate measurement system
- The generator has a short charging time to get efficient testing.
- Before the test starts the class current and the expected clamping voltage can be entered. After the pulse has been released the generator measures and displays the peak current and the clamping voltage.



Voltage and current curves of a 20 mm varistor measured with the CRO monitor outputs of the MIG0603CLV testers

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Main 1          Vcl<1000V; I<25A
I-peak   : 25.0A   U-CRO: 1V= 100V
Polarity : pos    I-CRO: 1V= 2.5A
Number   :         Ucl: 650 V
of Pulses: 10000  Repetition: 10s

Varistor clamping voltage 250..1100V
    
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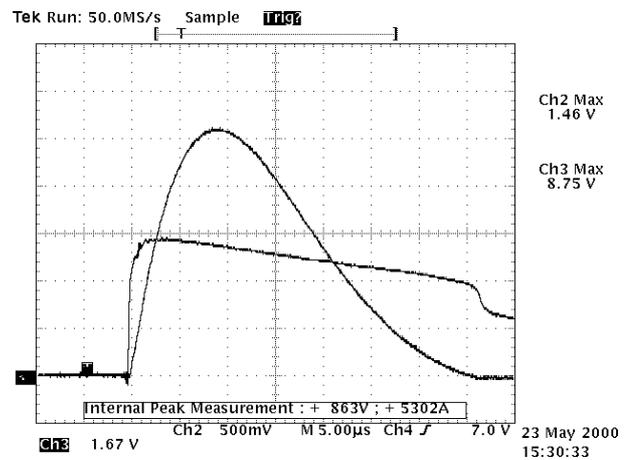
Surge Withstand Tests on Low Voltage Varistors < 1000 V with 6 kV and 12 kV MIG Current Testers

Disk size	Nominal r.m.s. voltage	Maximum peak current: 8/20 μ s	MIG0612 2 x 6 kV 300 A – 6 kA 8/20 μ s	MIG0624 4 x 6 kV 300 A – 6 kA 8/20 μ s	MIG1248 4 x 12 kV 600 A – 12 kA 8/20 μ s
5 mm	14 V	100 A	*	*	
	130 V	400 – 800 A	2 x 0.3 – 6 kA	4 x 0.3 – 6 kA	
	250 V	400 – 800 A	2 x 0.3 – 5 kA	4 x 0.3 – 5 kA	
10 mm	14 V	0.5 – 1 kA	2 x 0.3 – 6 kA	4 x 0.3 – 6 kA	4 x 0.6 – 12 kA
	130 V	2.5 – 3.5 kA	2 x 0.3 – 6 kA	4 x 0.3 – 6 kA	4 x 0.6 – 12 kA
	250 V	2.5 – 3.5 kA	2 x 0.3 – 5 kA	4 x 0.3 – 5 kA	4 x 0.6 – 12 kA
	510 V	2.5 – 3.5 kA	2 x 0.3 – 4.5 kA	4 x 0.3 – 4.5 kA	4 x 0.6 – 11 kA
	680 V	2.5 – 3.5 kA	2 x 0.3 – 4 kA	4 x 0.3 – 4 kA	4 x 0.6 – 10 kA
20 mm	14 V	2 kA – 3 kA	2 x 0.3 – 6 kA	4 x 0.3 – 6 kA	4 x 0.6 – 12 kA
	130 V	6 kA – 10 kA	2 x 0.3 – 6 kA	4 x 0.3 – 6 kA	4 x 0.6 – 12 kA
	250 V	6 kA – 10 kA	2 x 0.3 – 5 kA	4 x 0.3 – 5 kA	4x 0.6 – 12 kA
	510 V	6 kA – 10 kA	2 x 0.3 – 4.5 kA	4 x 0.3 – 4.5 kA	4 x 0.6 – 11 kA
	680 V	6 kA – 10 kA	2 x 0.3 – 4 kA	4 x 0.3 – 4 kA	4x 0.6 – 10 kA
	1000 V	6 kA – 10 kA	2 x 0.3 – 3 kA	4 x 0.3 – 3 kA	4 x 0.6 – 9 kA
40 mm	130 V	40 kA			4 x 0.6 – 12 kA
	250 V	40 kA			4 x 0.6 – 12 kA
	510 V	40 kA			4 x 0.6 – 11 kA
	680 V	40 kA			4 x 0.6 – 10 kA
	1000 V	40 kA			4 x 0.6 – 9 kA

* This test can be performed with the MIG0603CLV.

Advantages of EMC PARTNER's testers

- Built-in accurate measurement system
- The generator has a short charging time to get efficient testing.
- With its 4 outputs the generator can be adapted in an optimum way to the DUT.
- As nominal value the desired current can be entered directly together with the expected clamping voltage. After the pulse the generator measures and displays the peak current and the clamping voltage.



Voltage and current curves of a 20 mm varistor measured with the CRO monitor outputs of the MIG0624 testers

Energy Tests on Low Voltage Varistors < 1000 V with MIG0624LP1, MIG0612EA and MIG0626EA

Disk Size	Nominal r.m.s. voltage	Energy surge rating: 2 ms or 10/1000 μ s	MIG0624-LP1 4 x 2 A – 60 A 10/1000 μ s	MIG0612EA 5 A – 180 A 2 ms	MIG0636EA 20 A – 500 A 2 ms
5 mm	14 V	0.4 J – 0.6 J	4 x 0.1 J – 4 J	2 J – 25 J	
	130 V	4 J – 8 J	4 x 0.5 J – 23 J	4 J – 140 J	
	250 V	8 J – 17 J	4 x 1.5 J – 44 J	8 J – 275 J	
10 mm	14 V	2 J – 3 J	4 x 0.1 J – 4 J	2 J – 25 J	6 J – 75 J
	130 V	20 J – 45 J	4 x 0.5 J – 23 J	4 J – 140 J	12 J – 420 J
	250 V	38 J – 70 J	4 x 1.5 J – 44 J	8 J – 275 J	24 J – 825 J
	510 V	55 J – 125 J	4 x 6 J – 71 J	20 J – 490 J	50 J – 1470 J
	680 V	72 J – 155 J	4 x 8 J – 94 J	30 J – 600 J	70 J – 1800 J
20 mm	14 V	12 J – 16 J		2 J – 25 J	6 J – 75 J
	130 V	70 J – 150 J	4 x 0.5 J – 23 J	4 J – 140 J	12 J – 420 J
	250 V	130 J – 300 J	4 x 1.5 J – 44 J	8 J – 275 J	24 J – 825 J
	510 V	190 J – 470 J	4 x 6 J – 71 J	20 J – 490 J	50 J – 1470 J
	680 V	250 J – 620 J	4 x 8 J – 94 J	30 J – 600 J *	70 J – 1800 J
	1000 V	400 J – 860 J	4 x 8 J – 100 J	40 J – 700 J *	100 J – 2100 J *
40 mm	130 V	310 J			12 J – 420 J
	250 V	490 J			24 J – 825 J
	510 V	900 J			50 J – 1470 J
	680 V	1100 J			70 J – 1800 J *
	1000 V	1400 J			100 J – 2100 J *

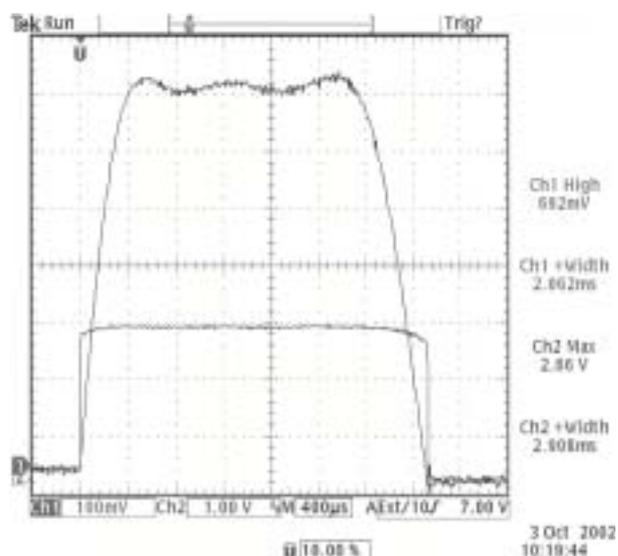
* The maximum absorbed energy is 500 J with the MIG0612EA and 1500 J with the MIG0636EA.

Advantages of EMC PARTNER's testers

- Built-in accurate measurement system
- The generator has a short charging time to get efficient testing.
- As nominal value the desired energy can be entered directly in Joule together with the expected clamping voltage. After the pulse the generator measures and displays the peak current, the clamping voltage and the absorbed energy (only with 2 ms rectangular pulses).

```

Main 1      2ms: Ucl < 1000V
I-peak    :   61A    U-CRO: 1V= 100V
Number    :          I-CRO: 1V=  20A
of Pulses: 10000   Ucl: 650V E: 200 J
                Repetition: 10s
Energy absorbtion in Joule (Ws)
    
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Voltage and current curves of a 10 mm varistor measured with the CRO monitor outputs of the MIG0612EA testers

EMC PARTNER's Product Range

Immunity Tests



The TRA2000 performs all of the following transient tests on electronic equipment that are required for the CE-mark up to full levels: **ESD, EFT, surge, dips, a.c. magnetic field, surge magnetic field and common mode tests**. A large range of accessories for different applications is available: MF antennas, three phase couplers, verification sets, coupling kits, etc. The TRA2000 complies with IEC 61000-4-2, -4, -5, -8, -9, -11, -12p, -16, -29p.



The Modular Impulse Generator (MIG) performs **damped oscillatory tests**: 100 kHz, 1 MHz, voltage and magnetic field tests. The MIG complies with IEC 61000-4-8, -9, -10, -12 as well as with IEC 60255-4, -5, -22.



The HAR1000 with the Immunity software performs the following tests: **harmonics, voltage variation and ripple on d.c.** The HARMONICS-1000 complies with IEC 61000-4-13, -14, -17, -29p.

Lightning Tests

EMC PARTNER offers a wide range of testers in accordance with FCC 68 part D, ITU K.44, ETS 300 046, Bellcore and RTCA DO-160D, etc. for telecom, aircraft and military electronic equipment testing.



Component Tests



EMC PARTNER offers a wide range of modular impulse generators (MIG) for transient component testing on: varistors, arresters, surge protective devices (SPD), capacitors, circuit breakers, watt-hour meters, protection relays, insulation material, suppressor diodes, connectors, chokes, fuses, resistors, emc-gaskets, cables, etc.

EMC PARTNER has the largest range of impulse generators in the range up to 100 kV and 100 kA. Below is an example for an insulation tester up to 24 kV.



Emission Measurements



One unit performs all measurements on the power supplies of electronic equipment and products for the CE-Mark. The HAR1000 includes an amplifier for a clean power source, a line impedance network, the measurement systems Harmonics and Flicker. Accessories: three phase extension, "Immunity" and "ANASIM" software. Complies with IEC 61000-3-2 and -3.

We look forward to working with you

For more detailed information please contact our representative in your area or EMC PARTNER in Switzerland. For information on further products please visit also our website.

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Europe: Austria, Belgium, France, Germany, Great Britain, Hungary, Ireland, Italy, Netherlands, Scandinavia, Spain, ...

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