



MIG-System

Varistor Testers

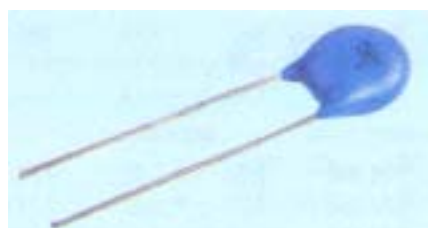
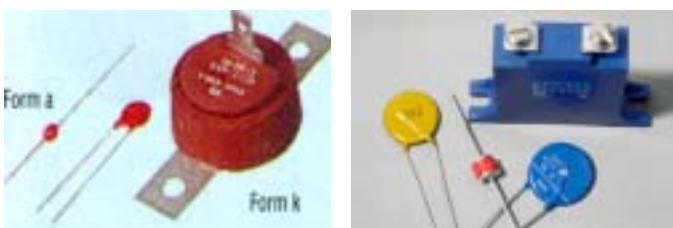


I Clamping Voltage Test 8/20

II Energy Test

III Surge Withstand Test 8/20

IV CWG Test 1.2/50, 8/20



General Information About Varistors and SPD's The Different Electrical Tests

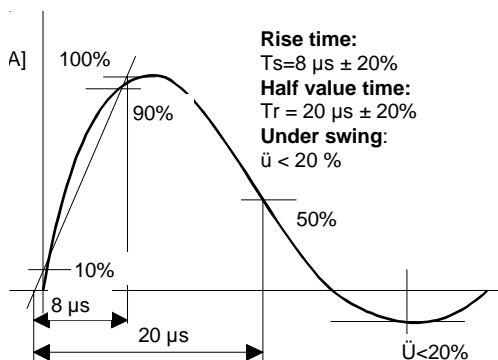
Varistor Voltage V_c

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

I Clamping Voltage Test 8/20

The clamping voltage is the maximum residual voltage V_p across the varistor terminals for a through current I_p . 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 μs applied.

Standardized current waveform:

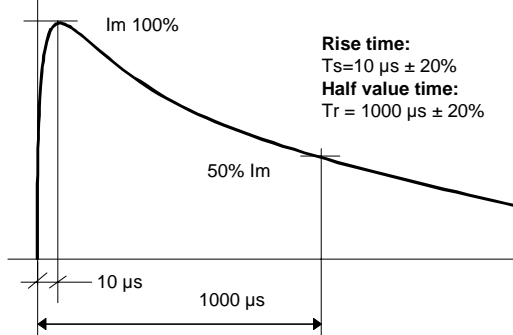


Impulse life span of the varistors with 8/20 and 10/1000

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.

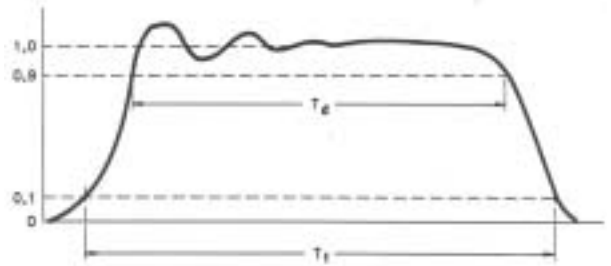
II Energy Test 10/1000 μs

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



II Energy Test 2ms

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

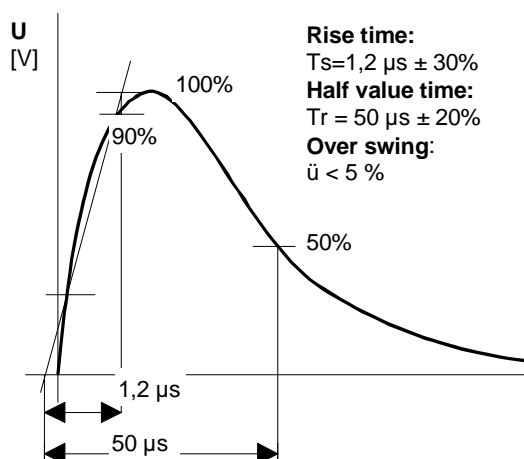


III Surge Withstand Test 8/20

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

IV CWG 1.2/50 μs

In addition to 8/20 μs the voltage waveform 1,2/50 μs is specified. The varistors are tested with superimposed Surges on power supply. IEC 61643-1 specify the performance requirements and testing methods for SPD Surge Protective Devices connected to low voltage power distribution system.



MIG0603CLV1 Clamping Voltage Tester 8/20 μ s up to 200 A

MIG0603CLV2 Clamping Voltage Tester 8/20 μ s up to 500 A

The MIG0603CLV1 and -CLV2 are generators to test varistor VDR types 05Dx up to and including 20Dx. The MIG0603CLV include three different source impedance 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 over the whole load range within the tolerances.

MIG0603-CLP Zgen Output impedance [Ohm]	Varistor Characteristics min to max. Ip [A]	min rd @ max rd @		
		Vcl [Ohm]	Vcl [Ohm]	max Vcl [V]
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

The MIG0603CLV2 has two additional ranges 250 and 500 A at Zgen 2 Ohm.

The varistor is connected on top of the MIG as shown below.



Measuring ranges versus varistors

	Varistors - Name	Zgen	Vclmax	Ipk	Current / Voltage Monitor
1	<1000V ; <2.5A	1000 Ohm	1000V	1A; 2.5A	10V= 5.0A 10V=1000V
2	<300V ; <2.5A	1000 Ohm	300V	1A; 2.5A	10V= 5.0A 10V= 300V
3	<100V ; <2.5A	1000 Ohm	100V	1A; 2.5A	10V= 5.0A 10V= 100V
4	<3000V ; <25A	100 Ohm	3000V	5A; 10A; 20A; 25A	10V= 25A 10V= 3000V
5	<1000V ; <25A	100 Ohm	1000V	5A; 10A; 20A; 25A	10V= 25A 10V= 1000V
6	<300V ; <25A	100 Ohm	300V	5A; 10A; 20A; 25A	10V= 25A 10V= 300V
7	<100V ; <25A	100 Ohm	100V	5A; 10A; 20A; 25A	10V= 25A 10V= 100V
8	<3000V ; <200A	10 Ohm	3000V	50A; 100A; 200A	10V= 200A 10V= 3000V
9	<1000V ; <200A	10 Ohm	1000V	50A; 100A; 200A	10V= 200A 10V= 1000V
10	<300V ; <200A	10 Ohm	300V	50A; 100A; 200A	10V= 200A 10V= 300V
11	<100V ; <200A	10 Ohm	100V	50A; 100A; 200A	10V= 200A 10V= 100V



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"

Other clamping voltage generators are available on demand.

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, 12 kV, 4 x 12 kA, I_{max}. 48 kA

reversal. Tests can be automated.

- Peak voltage and current meter included in standard unit.
- Higher source impedance at lower voltage, therefore bigger ranges of varistor can be tested within tolerances.



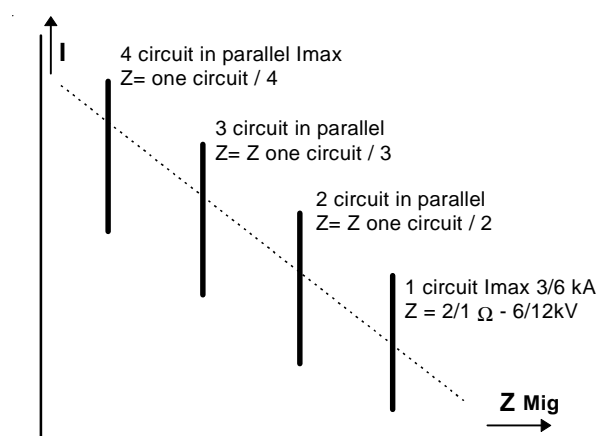
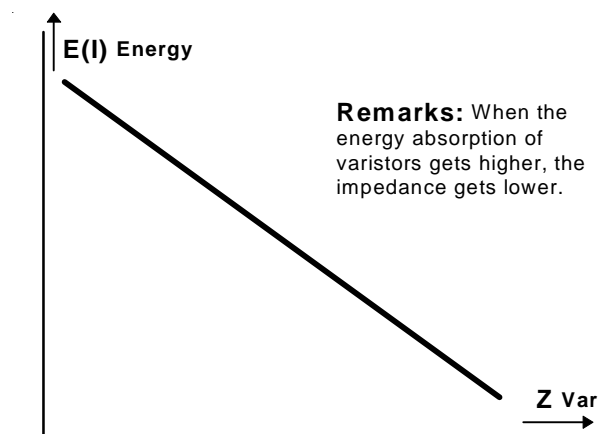
MIG0624

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 following advantages:

- Larger current ranges compared with only one impulse capacitance circuit (lower current limit)
- Two or four electrode elements can be tested
- Standard MIG are equipped with Polarity

With the 4 outputs, the generator can be adapted on an optimum way to the DUT.



Other surge withstand generators are available on demand.

Energy Tester 10/1000 μs , Current Range 1 A up to 750 A Varistor clamping voltage up to 3000 V

The generator MIG0624LP1 is designed to carry out energy tests in addition to surge tests 8/20 μs on varistors VDR
The MIG0624LP1 consists of four impulse circuits and four measurement circuits.

Technical data

Rise time 10 to 100%: 10 μs

Half value time 0 to 50%: 1000 μs

Voltage: Vmax. 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 equal 80 A, 160 A, 240 A, 320 A



MIG0624LP1

High voltage circuits

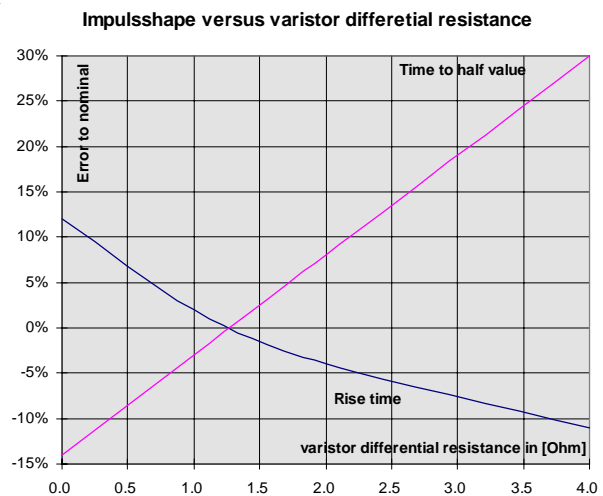
Impulse capacitance: $8 \times 10 \mu\text{F} \pm 10 \%$

Energy at Vmax. : 1'500 Joule

Waveform within tolerances:

Imin 6 A and Imax 320 A $\pm 10 \%$

Weight: approx. 45 kg



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

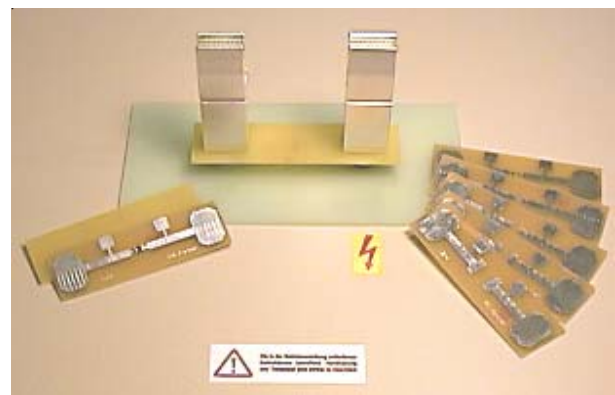
MIG0603CLP SMD varistor tester
The MIG0603CLP include three different wave forms like:

CWG (1,2/50; 8/20), 6 kV/3 kA;

energy test (10/1000) up to 360 A

8/20 μs clamping voltage tests three range up to 360 A.

With the special SMD adapter as showed below, the varistors can be properly contacted to the tester.



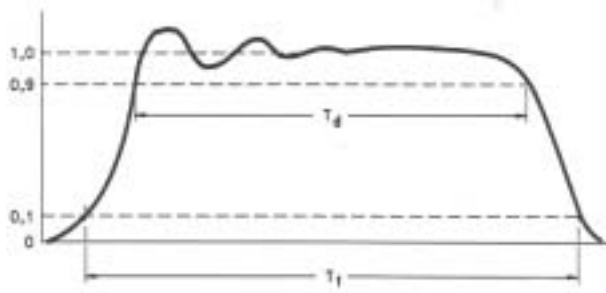
Other energy generators are available on demand.

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

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 2ms according to IEC60060 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 2ms pulse has compared to the 10/1000us pulse the advantage of easy calculation. The energy is with good accuracy the product of peak current and clamping voltage multiplied with the pulse duration.

2ms Pulse definition



Duration of 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

Basic data

Dimensions with test cabinet:
450 x 430 x 570 mm (w x h x l)
Weight: approximately 38 kg

Technical Data

MIG0612EA

Waveform 90 to 90%: 2ms -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% v,i peak, energy +/- 10%
Charging time: maximum 15 seconds

MIG0636EA

Waveform 90 to 90%: 2ms -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: 12 J up to 2100 J depending on the clamping voltage
Measurement accuracy: +/-3% v,i peak, energy +/- 10%
Charging time: maximum 30 seconds

SURGE Tests on Powered Varistors with CWG Different Generator Impedances

The MIG0603UL is hybrid or combination generators with a voltage wave shape at open circuit (oc) 1,2/50 μ s and a current wave shape into a short circuit (sc) 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 W.

ANSI / IEEE 62.41: 1991 IEEE Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits

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 6'600 V
 $i = 8/20 \mu$ s;
500 A at 12 Ohm ; 3000 A at 2 Ohm

Coupling filter

Maximum allowed voltage between the two lines, ac 400 V rms, dc 200 V
Maximum allowed current, ac 16 A, dc 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



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

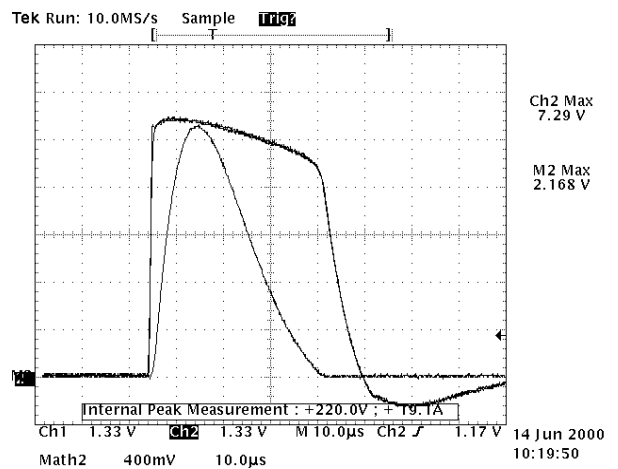
Disk Size	Nominal r.m.s. voltage	Clamping voltage: Vcl @I(class)	Class Current I(class)	MIG0603CLV1	MIG0603CLV2
				10V up to 3000V 8/20us	10V up to 3000V 8/20us
5mm	14V	43V	5A	1A..200A	1A..200A
	130V	310V	5A	1A..200A	1A..200A
	250V	650V	5A	5A..200A	5A..200A
10mm	14V	43V	5A	1A..200A	1A..200A
	130V	340V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

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.

```

Main 1          Vcl<1000V; I<25A
I-peak   : 25.0A   U-CRO: 1V= 100V
Polarity : pos    I-CRO: 1V= 2.5A
Number   :         Ucl: 650V
of Pulses: 10000  Repetition: 10s
Varistor clamping voltage 250..1100V
    
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Voltage and current curves of a 20 mm Varistors measured with the CRO monitors outputs of the MIG0603CLV testers

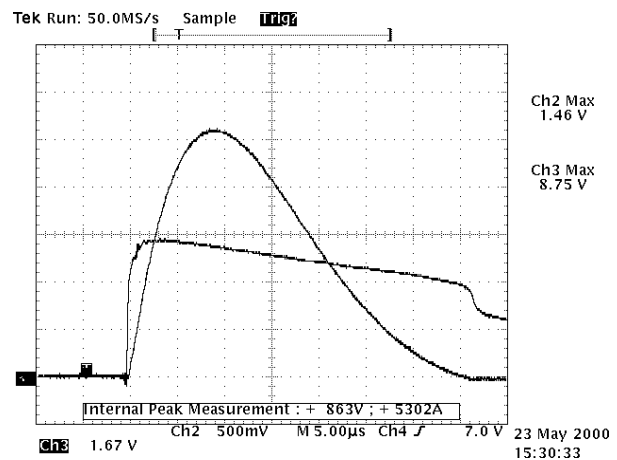
Surge Withstand Tests on Low Voltage Varistors < 1000 V with 6 kV and 12 kV MIG Current Testers

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

Notes: (*2) : Test can be performed with MIG0603CLV

Advantages of EMC PARTNER's testers

- Built-in accurate measurement system
- The generator has a short charging time to get efficient testing.
- four independent outputs which each 1ohm allow ideal adaptation to the varistor impedance
- 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 40 mm Varistors measured with the CRO monitors outputs of the MIG0603CLV testers

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

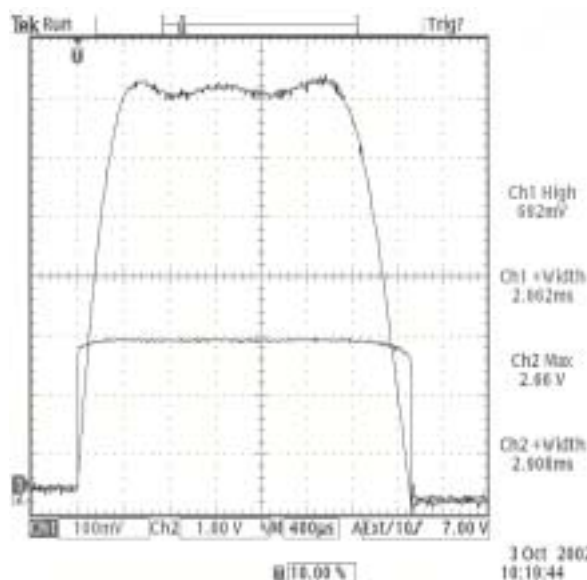
Disk Size	Nominal r.m.s. voltage	Energy surge rating: 2ms or 10/1000	MIG0624-LP1	MIG0612EA	MIG0636EA
			4x 2A..60A 10/1000us	5A..150A 2ms	20A..500A 2ms
5mm	14V	0.4J..0.6J	4x 0.1J..4J	2J..25J	
	130V	4J..8J	4x 0.5J..23J	4J..140J	
	250V	8J..17J	4x 1.5J..44J	8J..275J	
10mm	14V	2J..3J	4x 0.1J..4J	2J..25J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

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: 1U= 100U
Number    :          I-CRO: 1U= 20A
of Pulses: 10000   Ucl: 650V E: 200 J
                Repetition: 10s
Energy absorbtion in Joule (Ws)
    
```



Voltage and current curves of a 10 mm Varistors measured with the CRO monitors outputs of the MIG0603CLV 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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We have representatives in:

America: Canada, Mexico, USA, ...

Asia: China, Hong Kong, Israel, Japan, Malaysia, South Korea, Taiwan, ...

Australia: Australia, New Zealand

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

You will find contact information for all representatives at EMC PARTNER's website www.emc-partner.com.

Your local representative:

EMC PARTNER offers the largest range of impulse test equipment up to 100 kA and 100 kV in the areas of:

Immunity Tests

Lightning Tests

Component Tests

Emission Measurements