

Immunity Tests

EMC -
PARTNER



TRA-System

TRA2000



I EFT

II ESD

III Surge

IV Dips, Variation

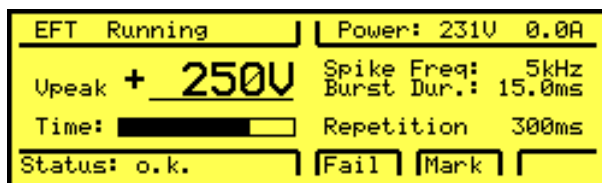


Easy Operation - Transient Testers for all Applications Some Outstanding Features of TRA2000, -IN4, -IN6

Three different transient immunity testers are available from EMC PARTNER:

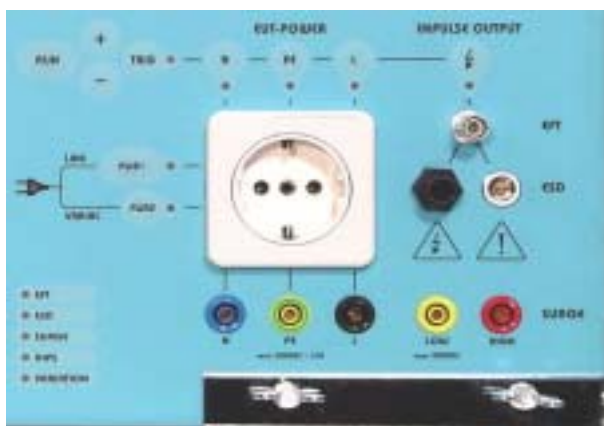
- **TRA2000:** EFT and surge up to 4 kV, ESD up to 15 kV, dips variation 16 A, 260 V,
- **TRA2000IN4:** as TRA2000 plus 10/700 up to 4 kV and ring up to 6 kV,
- **TRA2000IN6:** as TRA2000 plus 10/700 up to 6 kV, ring up to 6 kV and surge up to 6 kV.

All relevant parameters shown in one display



The TRANSIENT-2000 has been designed to operate it as easy as possible. One of the features is the large clear display.

Easy changes during operation



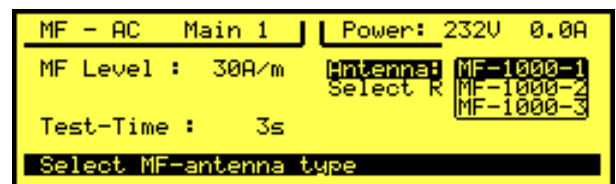
Throughout the operation, parameters can be changed immediately simply by pressing buttons +/- to find any weak points.

What can be varied:

coupling path by pressing the coupling path switches on the front panel, voltage, spike frequency, burst duration, synchro angle and polarity.

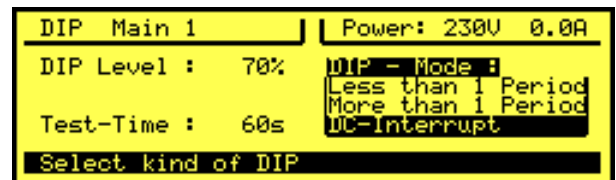
The power supply voltage can also be changed during the operation to simulate power supply tolerances.

Magnetic fields -8, -9 up to full levels



Different magnetic field antennas can be selected in the menu as required by the IEC -8 for continuous and short time tests and part 9 for surge test. The test levels can be directly chosen in A/m. Easy use with "Pull down menu" and a help line for most parameters.

Three different dips menus



With three different menu options to choose from, most dips and interruption tests needed are covered. IEC 61000-4-11 dips and IEC 61000-4-29 d interruption on d.c.

The GENECS Software



The display on the computer monitor screen is the same as on the TRA unit itself. This allows to control the TRANSIENT-2000 from a PC and to prepare tests or programmes on a PC which then can be downloaded to the TRA.



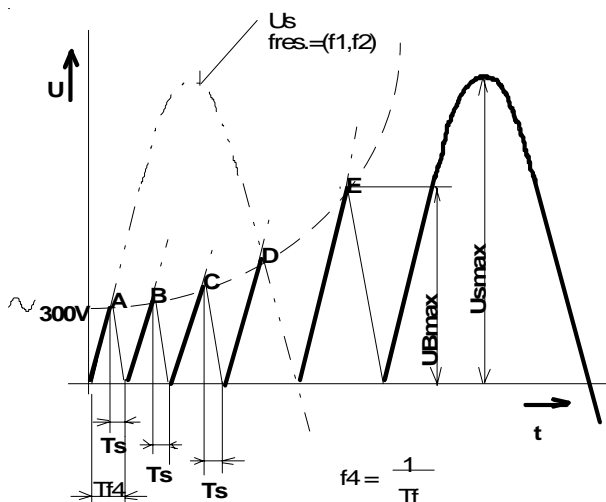
Dialogue line language can be chosen



EFT Electrical Fast Transient, IEC 61000-4-4 TRA2000, TRA2000IN4, TRA2000IN6

Source of interference

Industrial measurement and control equipment practically always operate in conjunction with conventional control units (relays, contactors). Fluorescent lamp ballast units, insufficiently suppressed coffee grinders, vacuum cleaners, drilling machines, hair dryers, universal motors, etc. can be found everywhere in the power supply system. All these primarily inductive loads produce interference when switched on and off. A wide range of switching transients, also called bursts, are produced, with the following waveform.



Technical data

- Voltage range: 0,22 up to 4,4 kV
- Source impedance: 50 Ohm
- Front time at 50 Ohm: 5 ns
- Pulse duration at 50 Ohm: 50 ns
- Spike rep. frequency: up to 1 MHz
- Duration of 50 to 150 ns on 1000 Ohm independent of load
- Direct output for external coupling network
- Internal coupling network for power line 16 A, L-N or PE max. 280 V
- Ramp functions: V_{peak} , spike frequencies, burst duration, synchronisation on power supply
- Random spike distribution to shorten the test time

EFT Main 1		Power: 236V 0.0A	
U-peak	: 250V	Spike Freq:	5kHz
Polarity	: pos	Burst Dur.:	15.0ms
Test-Time	: 15s	Syncro Deg:	90°
		Repetition:	300ms
SETUP	TEST	MAIN	RAMP
		Menu	More

Outstanding features

- Spike frequency up to 1 MHz
- Test setup can be prepared for data and power lines. Programmable switching between data and power line.
- Burst duration ramp for testing immunity on analogue circuit with increasing energy per burst
- Random Mode:
 - randomly distributed spikes
 - faster immunity tests on digital circuits
- Complete test sequence with surge, ESD, EFT, dips possible

Application

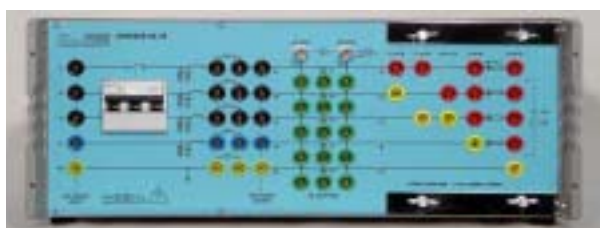
Two methods of burst coupling can be distinguished :

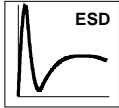
- coupling in data lines,
- coupling in power lines.

The capacitive coupling clamp (length: 1 m) for data lines has sufficient coupling capacity (approx. 100 pf) for the frequencies contained in the burst and forms a parallel line subject to interference.



The coupling network for power lines contains a coupling capacitor C_k (33 nf) for each line and a filter for decoupling from the power system e.g. CDN2000-06-25 or CDN2000-06-32.





ESD Electro Static Discharge, IEC 61000-4-2 TRA2000, TRA2000IN4, TRA2000IN6

Source of interference

What causes electrostatic discharges?

A person becomes electro-statically charged by walking over an insulating floor surface. The capacity of the body can be charged to several kilovolts. This capacity is discharged when contact is made with an electronic unit or system. The discharge is visible with a spark in many cases and can be felt by the person concerned, who gets a "shock". The discharges are harmless to humans, but not to sensitive, modern electronic equipment. The resulting current causes interference in the units or make entire systems "crash".

It has been known to the electrical industry for over 25 years that electrostatic discharges as encountered every day can have a disastrous effect on electronic equipment. The cost of damage caused by ESD is difficult to assess, but amounts to billions of dollars worldwide.

The areas most affected are:

- manufacturing of integrated circuits (chips),
- the chemical industry e.g. with explosions, fires related to and from sparks of electrostatic discharges,
- malfunctioning of process controllers and electronic equipment.

Technical data

- Contact discharge: up to 10 kV
- Air discharge: up to 15 kV
- Impulse capacitor: 150 pf
- Discharge resistor: 330 Ohm
- Holding time: >5s
- Current rise time: 0,7 to 1 ns
- Maximum current: 30 A
- Single discharges
- Repetitive discharges up to 20 Hz
- Changeable electrode for air and contact discharge

ESD Main 1	Power: 235V 0.0A
U-charge : 8000V	Discharge: Contact
Polarity : pos	Repetition: 1/s
Number of Pulses : 10000	Pulse Counter: Every Pulse
SETUP	TEST
MAIN	RAMP
Menu	More

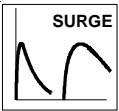
Outstanding features

- Same control as for the other immunity tests (EFT, surge, dips) and therefore automated tests programmable with other immunity tests
- Automated polarity change
- Signalisation of real discharge, only the effective discharges are counted
- Recording of the ESD tests
- Statistical measurements are possible because of the automated control and protocol
- Automated ramp function for voltage and polarity
- "Continuous d.c. voltage"-mode for detecting weak points



Applications

- The TRANSIENT-2000 with the discharge network accessories permits reproducible simulation of electrostatic discharges from a human body to electronic equipment.
- The test object itself determines which test method must be used: contact discharge when metallic parts are present, air discharge where plastic housings with slots exist or indirect discharge at insulation enclosure.
- The TRANSIENT-2000 allows two control methods: manual control, as defined in the IEC61000-4-2 and the new automated control for long term tests and for statistical evaluation of measurements.



Surge CWG, IEC 61000-4-5 TRA2000

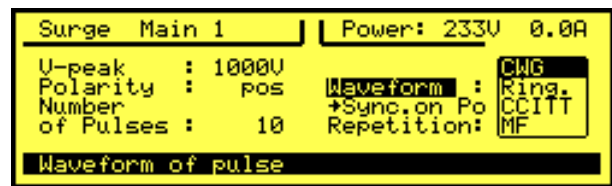
Surge means disturbances with relatively low frequency content but with high energy.

Source of interference

Lightning is a daily event and occurs about 8 million times in approximately 44'000 storm centres throughout the world. That is in the order of 100 discharges per second. Product assembly and finishing, in many industries depend on modern electronics. The most frequent cause of damage is overvoltage, caused either by switching action in the equipment itself or by atmospheric discharge such as lightning. In order that the overvoltages do not destroy the electronic equipment, protection elements and circuits are placed at the inputs and outputs of electronic equipment. Mostly the disturbances are tolerable because of their single event. To protect such equipment from damage protection elements and circuits are installed. Tests must be carried out to determine whether these protective circuits are really effective.

Technical data

- Voltage range: 0,25 up to 4,1 kV,
- Current range: 0,125 kA up to 2,1 kA
- Source impedance: 2 Ohm
- Waveform on no load: 1,2/50 μ s
- Waveform on short circuit: 8/20 μ s
- Repetition frequency: up to 20 impulses per minute
- Synchronisation on power line frequency: 16 Hz up to 400 Hz
- Peak voltage and current measuring unit included
- Direct output for feeding external coupling network
- BNC outputs for voltage and current measurements with an oscilloscope
- BNC output for triggering external measuring equipment



Outstanding features

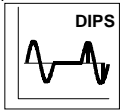
- The repetition rate of the impulses is related to the voltage: A higher voltage causes a lower repetition rate, a lower voltage a higher repetition rate. Therefore the test time is shorter if the EUT allows faster impulse repetition.
- The test setup can be prepared for power and data lines. Programmable switching from power to data line is possible.
- Tests can be linked together with ESD, EFT and dips
- Simultaneous tests with surge and voltage variation can be made.
- Automatic ramp function for voltage, changing polarity and synchronising

Application

CWG indicates that the tester generates a combination of waveforms: on no load a voltage waveform of 1,2/50 μ s and with short circuit a current with a waveform of 8/20 μ s. These two waveforms are chosen because both have been used for a long period for the insulation test or for the energy absorption test.

The type of connection (shielded or unshield-ed) or the mode of connection (common or differential) and the length of the cable define the coupling mode. In practice many different connections exist, therefore a lot of different coupling and decoupling networks are needed to run surge tests.





Dips, Interruption IEC 61000-4-11, IEC 61000-4-29 TRA2000, TRA2000IN4, TRA2000IN6

Dips means a sudden reduction of the voltage at a point in an electrical system followed by voltage recovery after a short period of time from a few cycles to a few seconds.

Source of interference

Voltage failures occur following switching operations, short-circuits, response of fuses and when running up heavy loads.

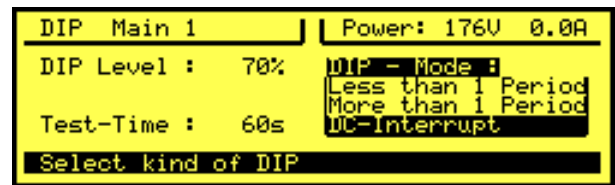
These are man-made faults produced unintentionally, including operation of domestic appliances, electronically controlled machine tools, switching operations in the public lighting system, economy lamps, etc.

The quality of the electrical power supply is increasingly becoming a central topic of discussion. The interference sources in the mains, caused by electronic power control with non-linear components e.g. thyristors are used more frequently in domestic appliances such as hotplates, heating units, washing machines, television sets, economy lamps, PCs and industrial systems with speed-controlled drives.

In order to achieve electro-magnetic compatibility, both the interaction of the electrical equipment connected to the supply and also its noise immunity must be determined.

Technical data

- Voltage range: 0 up to 260 V rms
- Frequency range: d.c. up to 400 Hz with external supply
- Rated current: 16 A for dips 0/100%; 12 A for variation and dips with internal variac and >16 A with external variac
- Inrush current: >500 A
- Interruption between 50 μ s: up to 30 s with preselectable phase angle
- Selectable dips: from 0 to 100 % (IEC: 0%, 40%, 70 %)
- Switching at defined phase angle when turning on and off the EUT power



Outstanding features

- Control port built in for external variac control (rated current of 16 A)
- Test sequences with surge and EFT programmable
- Monitor output for current and voltage measurement
- Automated ramp function for voltage, synchronisation angle and interruption time

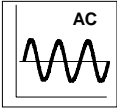


Application

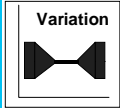
The basis for determining the permissible interaction and the necessary noise immunity is the quality of the supply. The reason why there are still no quality guarantees for the power supply can be attributed to different groups of interests, which are directly opposed:

- 1 the group of operators of noise sensitive equipment, which places emphasis on the highest possible quality of the power supply voltage,
- 2 the group of operators of equipment, from which the feedback impairs the voltage quality and which nevertheless is to be connected and operated, for examples, for energy saving reasons,
- 3 the power supply companies, which have to satisfy both groups of consumers.

If satisfactory operation of electronic equipment is to be assured in the future, all three groups must make a contribution, e.g. the first interest group performs noise immunity tests with the TRANSIENT-2000.



Magnetic Field, V- Variation, Common Mode TRA2000, TRA2000IN4, TRA2000IN6

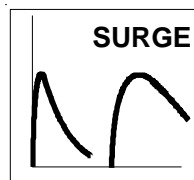
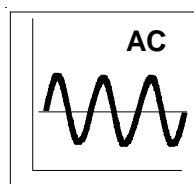


IEC 61000-4-8 a.c. magnetic field
Two types of tests can be configured:

- the current under normal operating conditions which produces a steady magnetic field with a comparatively small magnitude,
- the current under fault condition which can produce comparatively high magnetic fields of short duration until protection devices operate (up to a few seconds).

Technical data

- with MF1000-1: range of 1 to 130 A/m
 - with MF1000-2: range of 1 to 110 A/m
 - with MF1000-3: range of 0.3 to 1 kA/m
- The a.c. source and the timing switch is included in the standard TRANSIENT-2000.

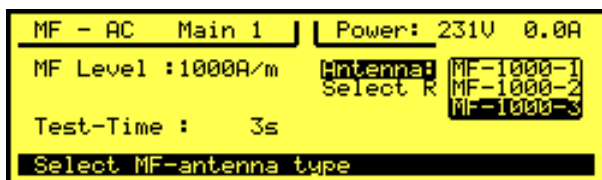


IEC 61000-4-9 surge MF

The CWG tester defined in the IEC 61000-4-5 can be used to perform the surge magnetic field tests. The current waveform at short circuit is 8/20 μ s.

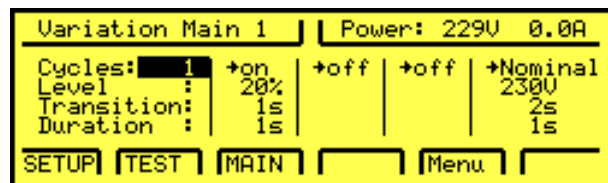
Technical data

- with MF1000-1: range of 0.1 to 1.5 kA/m
- with MF1000-2: range of 0.1 to 1.1 kA/m



IEC 61000-4-11 voltage variation

- Voltage range: 0 up to 260 V rms
- Switching at defined phase angle when turning on and off the EUT power
- Control port built in for external variac control (rated current 16 A)
- rms measuring of current and voltage and displaying of the values
- Monitor output for current and voltage measurement
- Automated ramp function for voltage, synchronisation angle and interruption time



IEC 61000-4-16 Common mode

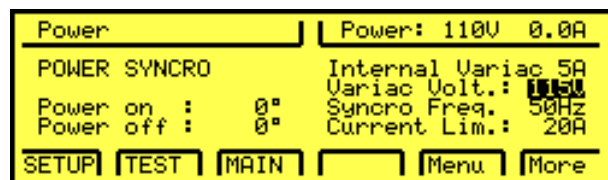
In IEC 61000-4-16 three tests are defined:

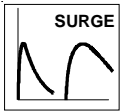
- test with d.c. voltage,
- test with a.c. voltage at 50/60 Hz,
- Sweep voltage test 0 to 150 kHz (not part of the NW16S).

Technical data of NW16S

The a.c. source and timing switch can be used from the standard TRANSIENT-2000.

- a.c and d.c. range:
 - continuous: up to 1 V and up to 30 V
 - short time: 1 s up to 10 and up to 300 V
- coupling network standard and telecom CN16 and CN16T





Surge, Ring Wave and 10/700 μ s TRA2000IN4

Surge means disturbances with relatively low frequency content but with high energy.

Source of interference

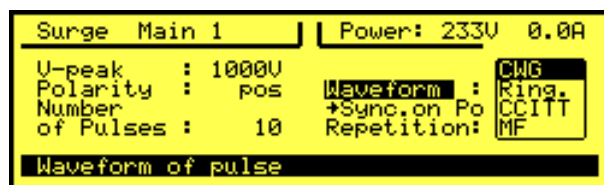
Lightning is a daily event and occurs about 8 million times in approximately 44'000 storm centres throughout the world. That is in the order of 100 discharges per second. Mostly the disturbances are tolerable because of their single event. Tests must be carried out to determine whether these protective circuits are really effective. Different waveshapes are specified for telecom equipment or equipment connected to power supply 50/60 Hz.

IEC 61000-4-5: surge and 10/700

IEC 61000-4-12: ring wave

ANSI/IEEE: surge and ring wave

ITU-T K.44: surge and 10/700 μ s



Technical data

Surge, CWG

- Voltage (oc): 1.2/50 μ s
- Current (cs): 8/20 μ s
- Repetition rate maximum: 10/min
- Source Impedance: 2 Ohm \pm 10%
- Source energy: 84 Joule at 4.1 kV
- V_{peak} : 0.25 up to 4.1 kV \pm 10%
- I_{peak} : 0.125 up to 2.1 kA \pm 10%
- Measurement accuracy: \pm 3% (v,i)
- Single-phase CDN: L-N(PE) 280 V, 16 A
- Coupling path: L to N, 18 μ F
- Coupling path: L-PE, 9 μ F and 10 Ohm
- Repetition frequency: up to 20 pulses/min
- Synchronisation on power line frequency: 16 Hz up to 400 Hz

Ring Wave 100 kHz

- Rise time: 500 ns \pm 30 %
- Frequencies: 100 kHz \pm 10%
- Repetition rate maximum: 10/min
- Decaying: 60% first to second peak
- Impedance: 12, 30 Ohm
- V_{peak} : 0.25 up to 6 kV \pm 10%
- I_{peak} : 20 up to 500 A \pm 10%
- Measurement accuracy: \pm 3%
- Single-phase CDN: L-N(PE) 280 V, 16 A
- Coupling path: 12 Ohm, 10 μ F
- Coupling path: 30 Ohm, 3 μ F
- Repetition frequency: up to 20 pulses/min
- Synchronisation on power line frequency: 16 Hz up to 400 Hz

10/700 μ s

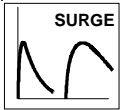
- Voltage (oc): 10/700 μ s
- Current (cs): 4/300 μ s, 40 Ohm
- Repetition rate maximum: 4/min
- Impulse capacitance: 20 μ F
- Source energy: 160 Joule at 6 kV
- V_{peak} : 0.25 up to 4 kV \pm 10%
- I_{peak} : 16.6 up to 267 A \pm 10%
- Measurement accuracy: \pm 3%
- Damping resistor: 25 Ohm
- Serial resistor: 15 Ohm

Control

- Peak voltage and current measuring unit included
- Direct output for feeding external coupling networks
- BNC outputs for voltage and current measurements with an oscilloscope
- BNC output for triggering external measuring equipment

Accessories

Detailed information about accessories can be found in the brochure "Accessories". For information about surge coupling on power supply and I/O lines see page 10 of this brochure.



Surge, Ring Wave and 10/700 μ s TRA2000IN6

Technical data

Surge, CWG

- Voltage (oc): 1.2/50 μ s
- Current (cs): 8/20 μ s
- Repetition rate maximum: 10/min
- Source Impedance: 2 Ohm \pm 10%
- Source energy: 220 Joule at 6 kV
- V_{peak} : 0.25 up to 6 kV \pm 10%
- I_{peak} : 0.125 up to 3 kA \pm 10%
- Measurement accuracy: \pm 3% (v,i)
- Single-phase CDN: L-N(PE) 280 V, 16 A
- Coupling path: L to N, 18 μ F
- Coupling path: L-PE, 9 μ F and 10 Ohm
- Repetition frequency: up to 20 pulses/min
- Synchronisation on power line frequency: 16 Hz up to 400 Hz

Ring Wave 100 kHz

- Rise time: 500 ns \pm 30 %
- Frequencies: 100 kHz \pm 10%
- Repetition rate maximum: 10/min
- Decaying: 60% first to second peak
- Impedance: 12, 30 Ohm
- V_{peak} : 0.25 up to 6 kV \pm 10%
- I_{peak} : 20 up to 500 A \pm 10%
- Measurement accuracy: \pm 3%
- Single-phase CDN: L-N(PE) 280 V, 16 A
- Coupling path: 12 Ohm, 10 μ F
- Coupling path: 30 Ohm, 3 μ F
- Repetition frequency: up to 20 pulses/min
- Synchronisation on power line frequency: 16 Hz up to 400 Hz

Option 10/700 μ s

- Voltage (oc): 10/700 μ s
- Current (cs): 4/300 μ s, 40 Ohm
- Repetition rate maximum: 4/min
- Impulse capacitance: 20 μ F
- Source energy: 360 Joule at 6 kV
- V_{peak} : 0.25 up to 6 kV \pm 10%
- I_{peak} : 16.6 up to 400 A \pm 10%
- Measurement accuracy: \pm 3%
- Damping resistor: 25 Ohm
- Serial resistor: 15 Ohm



Option EXTERNAL CDN COUPLING

The TRA2000IN6 will be extended with outputs for connecting an external three-phase CDN in accordance with ANSI C62.45. This option allows a common mode coupling as defined in the ANSI document.

Option DIAGNOSTIC 1P

The TRA2000IN6 will be extended with coupling paths on the internal coupling filter for diagnostic tests in accordance with ANSI C62.45. This option cannot be added together with the option "EXTERNAL CDN COUPLING".

Control

- Peak voltage and current measuring unit included
- Direct output for feeding external coupling networks
- BNC outputs for voltage and current measurements with an oscilloscope
- BNC output for triggering external measuring equipment

Accessories

Detailed information about accessories can be found in the brochure "Accessories". For information about surge coupling on power supply and I/O lines see page 10 of this brochure.

Surge Coupling Accessories to TRA2000, TRA2000IN4, TRA2000IN6

Surge and EFT coupling onto power supply

The below listed coupling and de-coupling networks (CDN) can be used together with the TRA2000 testers. The coupling path selection needs to be made manually on CDN2000-06-32 and CDN2000-06-25. The combination TRA2000 testers and CDN2000A-06-32 allows the programming of the coupling paths for surge and EFT.

Generator data		CDN data	
Type	Maximum AC-Voltage	Type	Three-phase coupling
TRA2000	280 V L/N- PE L to N 280 V	+ CDN2000A-06-32 or + CDN2000-06-25 or + CDN2000-06-32	280 V Lx/N to PE 415 V Lx - LX/N
TRA2000	280 V L/N- PE L to N 280 V	+ CDN2000A-06-32 Option 480 V	280 V Lx/N to PE 480 V Lx - LX/N
TRA2000IN4	280 V L/N- PE L to N 280 V	+ CDN2000A-06-32 or + CDN2000-06-25 or + CDN2000-06-32	280 V Lx/N to PE 415 V Lx - LX/N
TRA2000IN4	280 V L/N- PE L to N 280 V	+ CDN2000A-06-32 Option 480 V	280 V Lx/N to PE 480 V Lx - LX/N
TRA2000IN6	280 V L/N- PE L to N 280 V	+ CDN2000A-06-32 or + CDN2000-06-25 or + CDN2000-06-32	280 V Lx/N to PE 415 V Lx - LX/N
TRA2000IN6	280 V L/N- PE L to N 280 V	+ CDN2000A-06-32 Option 480 V	280 V Lx/N to PE 480 V Lx - LX/N
TRA2000-IN6 Option EXTERNAL CDN COUPLING extends the TRA for L1+L2+L3+N to PE (ANSI C62.45)	280 V L/N- PE L to N 280 V	+ CDN2000A-06-32 or + CDN2000-06-25 or + CDN2000-06-32	280 V Lx/N to PE 415 V Lx - LX/N
TRA2000-IN6 Option EXTERNAL CDN COUPLING extends the TRA for L1+L2+L3+N to PE (ANSI C62.45)	280 V L/N- PE L to N 280 V	+ CDN2000A-06-32 Option 480 V	280 V Lx/N to PE 480 V Lx - LX/N L1+L2+L3+N to PE 480 V

Surge coupling on I/O lines

In practice many different connections exist, therefore a lot of different coupling and de-coupling networks are needed to run surge tests. EMCP offers two different standard kits:

- CDNKIT1000 for RS232, TTL, d.c. etc. for maximum 4 lines,
- CDNKIT1000T for ISDN balanced lines for maximum 4 balanced lines.

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