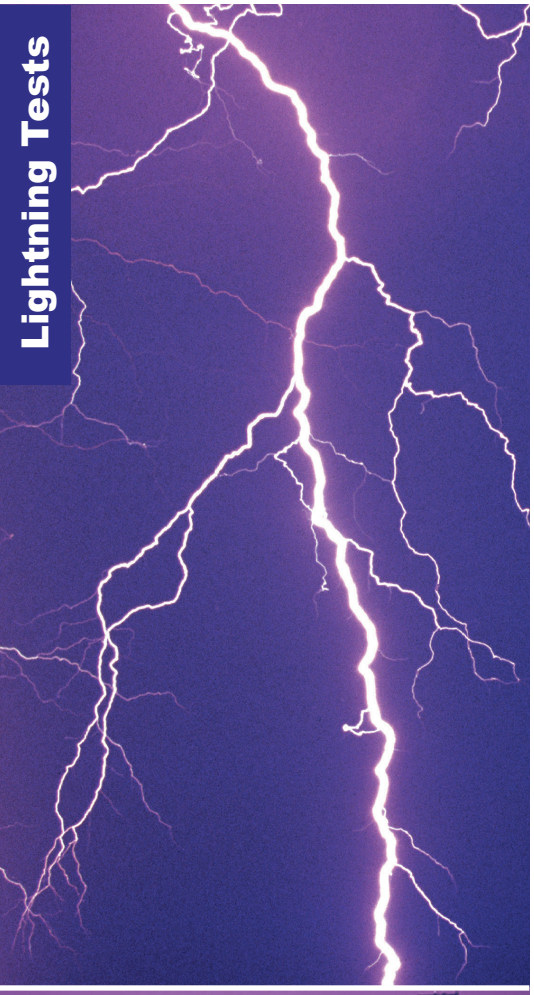


EMC - PARTNER

Telecom Test System

Brief Overview of Phenomena

The most frequent cause of damage to telecommunication and data network equipment is overvoltages or overcurrents, caused by atmospheric discharges such as lightning, direct contact with adjacent power cables or coupling of interference signals from co-located cables. Overvoltages generated by lightning surge currents can disrupt or even destroy computer related products, process control equipment and data communications equipment connected to the telephone line. Apart from interference on data lines, telecom equipment is also subjected to interference through the power interface. These can be surges generated by lightning or switching in the power network. If the interference source is in the same circuit as the electronic equipment, the transfer impedance is low and the impulse takes a current form. If the interference is from some external source, the transfer impedance will be higher and a voltage impulse results.

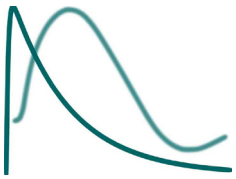
Telecommunications operators aim to maintain a network availability of 99.9%. In order to meet this goal, tests are performed to assess survivability and catastrophic failure of individual equipment. The objective being respectively to check for continued network operation and to ensure that failure does not lead to other equipment in the telephone exchange being damaged or destroyed.

Lightning transients are defined by the cable properties. Telecommunication lines are highly exposed and very long leading to a relatively long voltage impulse being transmitted to electronic interfaces. International telecommunications standards use the 10/700us impulse for telecommunication interfaces, a standard that is being adopted for ethernet and other fast data communication media.

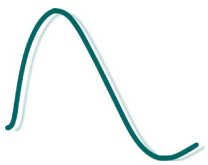
EMC Partner telecom test systems are used to simulate transient (impulses) and also power contact or power induction in the public telephone network.

- **Telecom interface impulses (10/700us, 10/160us & 10/560us)**
  Used to simulate lightning impulses in long telecommunication lines. These impulses are used to test telecom interfaces at the exchange and user premises.

  Application is through specialized Coupling De-coupling Networks (CDNs) that enable continuous traffic while the impulses are applied.

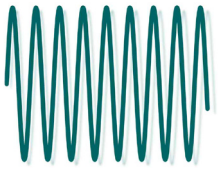


- **Power interface impulses (CWG & 2/10us)**
  A Combination Wave Generator (CWG) delivers voltage impulses (1.2/50us) into an open circuit and current impulses (8/20us) into a short circuit. The 2/10us impulse is defined in FCC part 68 for power interface testing.



- **Lightning Current (8/20)**
  Lightning impulses coupled directly to the telecom line can generate currents with very high amplitudes. Telecom interfaces that do not have primary protection elements, must be tested for impulse current carrying capability.

  These impulses are applied directly to non-active interfaces.



- **Power Contact and Induction**
  Co-located or adjacent power cables are an interference source that can induce voltages into the telecom network. Power contact is direct connection between power lines and telecom lnes, caused by either line falling onto the other. This could occur during storms.

  Typical power frequencies are 16.7 (for railway applications), 50 and 60Hz.

- **ESD**
  ESD can result from charging of personnel or equipment. Resultant waveforms and test levels are dependant on location. ESD impulses are used to ensure equipment is not damaged during maintenance procedures.

Applicable Standards

International Electrotechnical Committee (IEC)

IEC 61000-4-5 Ed 2 (2005): Electromagnetic compatibility (EMC) - Testing and measurement techniques - Surge immunity test.

IEC60950-1 (2005): Information technology equipment - safety - Part 1: General requirements

International Telecommunications Union (ITU)

K.44 (2008): Resistibility tests for telecommunications equipment exposed to overvoltages and overcurrents - Basic recommendation

K.20 (2008): Resistibility of telecommunication equipment installed in a telecommunications centre to overvoltages and overcurrents

K.21 (2008): Resistibility of telecommunication equipment installed in customer premises to overvoltages and overcurrents.

K.45 (2008): Resistability of telecommunication equipment installed in the access and trunck networks to overvoltages and overcurrents.

Federal Communnication Commission (FCC)

47 cfr PART 68 (2005): Connection of terminal equipment to the the telephone network.

American National Standards Institute (ANSI)

ANSI / TIA 968-A (2004): Telephone Terminal Equipment - Technical requirements for connection of terminal equipment to the telephone network.

Test System Overview

Test System Features

- ITU basic level tests
- ITU enhanced level tests
- Power contact tests
- Power induction tests
- Application based solutions
- Semiconductor high voltage circuits
- Intuitive user interface
- Telecom couplers up to 8 wires
- Internal program memory
- Electronic polarity change
- Remote control and software upgrade through standard interface
- Full range of accessories
- 2 year warranty

User Benefits

The technical excellence and many unique features of EMC PARTNER telecom test system translate directly into benefits for the user:

- Impulse repeatability eliminates costly re-tests
- Fully reproducible test results between locations
- Simple extension to meet future test needs
- Increase quality of test object
- Save operator time with the automated test routines and test report facility
- Unparalleled reliability and system up-time

Generators

The EMC PARTNER telecom test system comprises a range of instruments to simulate transient and EMC events that occur in the telecom network. EMC PARTNER telecom test system components are available to cover most international applications.

MIG0603IN2 S-T

- **MIG0603IN2 S-T**
  The best solution for IEC, EN and ITU basic testing requirements. Both the combination wave and 10/700us impulses up to 6kV are included. An integrated single phase CDN operates with EUT power up to 280V/16Aac and 110V/16Adc. A direct impulse output enables use of the EMC PARTNER telecom accessories.

MIG0603FCC

- **MIG0603FCC**
  Telecom tester according to FCC part 68. This generator also includes a standard combination wave for IEC, EN and ITU requirements as well as the 10/700us ITU impulse. FCC part 68 waveforms include the 2/10us power line and 10/160us, 10/560us and 9/720us telecom line impulses. An integrated single phase CDN operates with EUT power up to 280V/16Aac and 110V/16Adc. A direct impulse output enables use of the EMC PARTNER telecom accessories.

- **MIG0603EN S-T-I**

  A compact generator with three waveforms and two distinct applications. IEC/EN60950 is an ITE safety standard that requires the 10/700us telecom impulse together with a 1.2/50us voltage impulse. Both these are included in the MIG0603EN. Together with the “classic” combination wave, these impulses can also be applied for telecom testing according to ITU-T K.44, K.20 and K.21. An integrated single phase CDN operates with EUT power up to 280V/16Aac and 110V/16Adc. A direct impulse output enables use of the many EMC PARTNER telecom accessories.

- **MIG1206-1P-T**

  Ideal for ITU-T K.44, K.20 and K.21 basic and enhanced level testing, the MIG1206-1P-T includes a combination wave generator up to 12kV and a 10/700us impulse up to 6kV. An integrated fully automatic CDN operates with EUT power up to 280V phase - neutral/PE and 32A. A direct impulse output enables the many EMC PARTNER telecom accessories such as the CDN-UTP to be used.

- **MIG-1206-3P-T**

  Similar to the MIG1206-1P-T, the MIG1206-3P-T is a three phase version with the same impulse circuits. The fully automatic integrated three phase CDN operates with EUT power up to 480V phase to phase and 280V phase to neutral/PE. The MIG1206-3P-T is mounted in a rack with large wheels for ease of operation in the laboratory environment.

- **MIG1203T T**

  As an extension to the ITU-T K.44 enhanced level requirements, the MIG1203T provides a 10/700us impulse up to 12kV with high voltage outputs on top of the generator protected by a TC-MIG24 test cabinet which is connected to the generator safety circuit. MIG1203T has many options which expand the generator capability to include IEC60950, IEC61000-4-5 and ITU-T K.20, K.21 basic level.

  As options for the MIG1203T, a combination wave, 1.2/50us and 10/1000us voltage impulses up to 12kV are available.

- **MIG0624TEL**

  Lightning current test requirements in ITU-T K.20 and K.21 specify use of an 8/20us impulse on telecom lines. MIG0624TEL has four independant outputs so if one line is short circuit the current delivered by the generator is limited to the maximum requirement for the standard.

- **MIG0648TEL**

  Similar to the MIG0624TEL, the MIG0648TEL comprises eight independant outputs to enable testing of telecom interfaces up to enhanced level.

- **MIG-ITU-K44**

  Specifically designed for the power induction tests in ITU-T K.44, MIG-ITU-K44 generates a short duration AC output up to 1,500Vac. Both basic and enhanced levels can be reached up to the 10 A^2 s energy requirement. An integrated variac allows easy adjustment of output voltage.

- **MIG0612T-K12**

  A dual output surge current generator designed for testing both two and three electrode gas arresters. This generator includes the 10/1000us, 8/20us and 40/350us (10/350us) current impulses up to 12kA. The TC-MIG24 provides operator safety through the integrated safety circuit.

- **MIG0624T-K12**

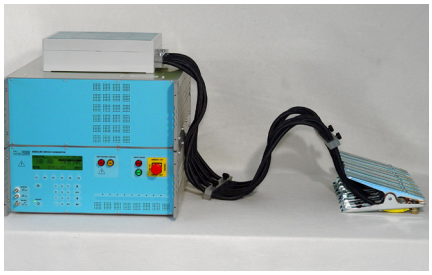
  Similar to the MIG0612T-K12, this generator extends the maximum impulse current capability to 24kA for the 8/20us impulse. TC-MIG24 is a must for this generator.

Remote control of EMC PARTNER telecom test systems is possible using either the EMC PARTNER TEMA or GENECS-MIG software packages.

A wide range of accessories are available to facilitate testing. Four or eight wire coupling devices for active telecom interfaces including Ethernet complete the system.

MIG0603EN S-T-I

MIG1206-1P-T



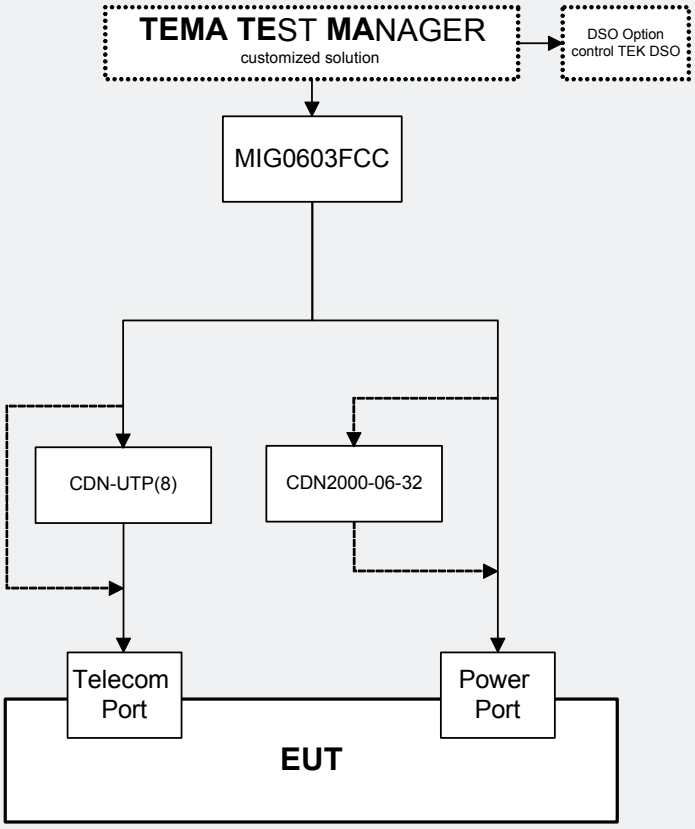
MIG0624TEL

MIG-ITU-K44

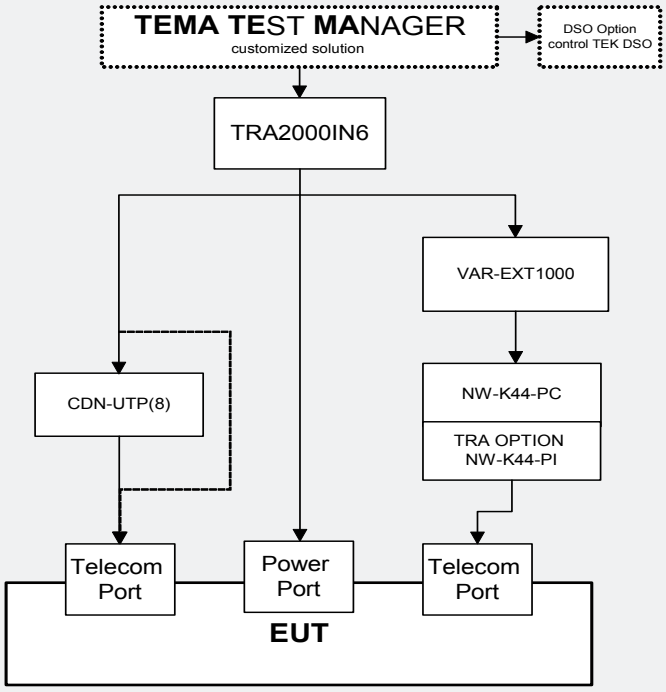
System Flowcharts

The following flowcharts illustrate EMC PARTNER equipment configurations necessary to perform transient, power contact and power induction tests in accordance with telecoms standards.

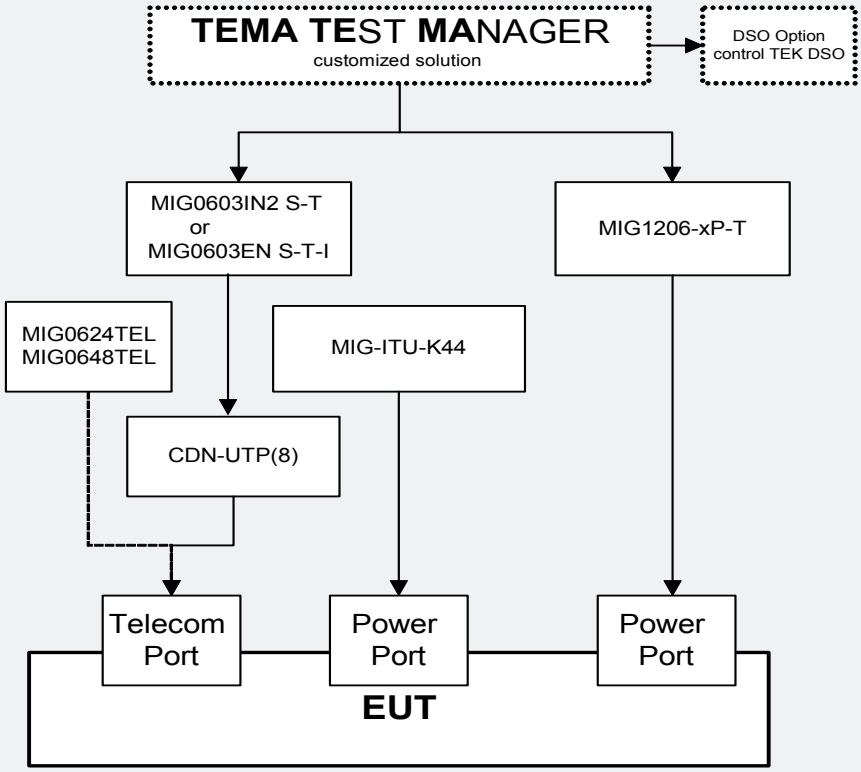
FCC part68



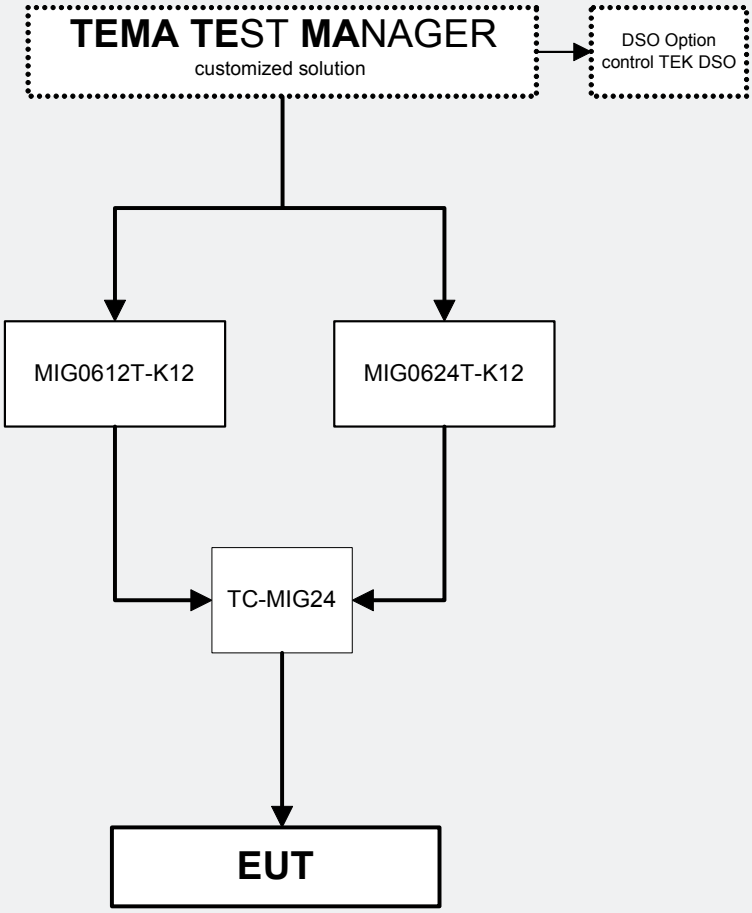
ITU Telecom Basic Level



ITU Telecom Enhanced Level



ITU Telecom Component (Gas Discharge Tubes)



Generator Specifications

Telecom test system up to 6kV

MIG0603IN2 S-T

Combination Wave 1.2/50us (8/20us)

Voltage range	0.25 up to 6kV
Pulse front time	1.2 µs
Pulse duration	50 µs
Current range	0.125 up to 3kA
Pulse front time	8 µs
Pulse duration	20 µs
Source impedance	4ohm
Coupling path selection	automatic
Coupling paths	L - N (18uF), L - PE (9uF) & N - PE (9uF)
Maximum voltage on CDN	280Vac 50/60Hz
Maximum current	16A

10/700us Telecom wave

Voltage range	0.25 up to 6kV
Risetime	10 µs
Duration	700 µs
Source impedance	15ohms
Damping resistor	25ohms
Current range	12.5 up to 150A

MIG0603FCC

Combination Wave 1.2/50us (8/20us)

Voltage range	0.25 up to 6kV
Pulse front time	1.2 µs
Pulse duration	50 µs
Current range	0.125 up to 3kA
Pulse front time	8 µs
Pulse duration	20 µs
Source impedance	2ohm

Combination wave 2/10us (2/10us)

Voltage range	0.125 up to 3kV
Pulse front time	1.54 µs
Pulse duration	12.5 µs
Current range	0.125 up to 1.2kA
Pulse front time	1.54 µs
Pulse duration	12.5 µs
Source impedance	2.5ohm

Integrated Single Phase CDN

Coupling path selection	automatic
Coupling paths	L - N (18uF), L - PE (9uF) & N - PE (9uF)
Maximum voltage on CDN	280Vac 50/60Hz
Maximum current	16A

9/720us Telecom wave

Voltage range	0.25 up to 6kV
Risetime	9 µs
Duration	720 µs
Source impedance	15ohms
Damping resistor	25ohms
Current range	6.25 up to 157A

10/160us Telecom wave

Voltage range	0.25 up to 2kV
Risetime	7.7 µs
Duration	200 µs
Source impedance	7.5ohms
Current range	33 up to 266A

10/560us Telecom wave

Voltage range	0.25 up to 1kV
Risetime	7.7 µs
Duration	700 µs
Source impedance	8ohms
Current range	31 up to 125A

MIG0603EN S-T-I

Combination Wave 1.2/50us (8/20us)

Voltage range	0.25 up to 6kV
Pulse front time	1.2 µs
Pulse duration	50 µs
Current range	0.125 up to 3kA
Pulse front time	8 µs
Pulse duration	20 µs
Source impedance	2ohm
Coupling path selection	automatic
Coupling paths	L - N (18uF), L - PE (9uF) & N - PE (9uF)
Maximum voltage on CDN	280Vac 50/60Hz
Maximum current	16A

Voltage Impulse 1.2/50us (1uF)

Voltage range	0.25 up to 6kV
Pulse front time	1.2 µs
Pulse duration	50 µs
Pulse Capacitor	1uF
Parallel Resistor	76ohm
Series Resistor	13ohm
Damping Resistor	25ohm

10/700us Telecom wave

Voltage range	0.25 up to 6kV
Risetime	10 µs
Duration	700 µs
Source impedance	15ohms
Damping resistor	25ohms
Current range	12.5 up to 150A

Telecom Test System up to 12kV

MIG1203T T

10/700us Telecom wave

Voltage range	0.5 up to 12kV
Risetime	10 µs
Duration	700 µs
Source impedance	15ohms
Damping resistor	25ohms
Current range	25 up to 300A

OPTIONS TO MIG1203T

1.2-50-1 Voltage Impulse (T-I)	up to 12kV
CWG Combination Wave (T-S)	up to 6kV

MIG1206-1P-T

Combination Wave 1.2/50us (8/20us)

Voltage range	0.5 up to 12kV
Pulse front time	1.2 µs
Pulse duration	50 µs
Current range	0.25 up to 6kA
Pulse front time	8 µs
Pulse duration	20 µs
Source impedance	2ohm
Coupling path selection	automatic
Coupling paths	L - N, L - PE, N - PE
	L + N - PE
Maximum voltage on CDN	280Vac 50/60Hz
Maximum current	32A

10/700us Telecom wave

Voltage range	1 up to 6kV
Risetime	10 µs
Duration	700 µs
Source impedance	15ohms
Damping resistor	25ohms
Maximum Current	400A

MIG1206-3P-T

Combination Wave 1.2/50us (8/20us)

Voltage range	0.5 up to 12kV
Pulse front time	1.2 µs
Pulse duration	50 µs
Current range	0.25 up to 6kA
Pulse front time	8 µs
Pulse duration	20 µs
Source impedance	2ohm
Coupling path selection	automatic
Coupling paths	Lx - Lx, Lx - N, Lx - PE, N - PE
	L1 + L2 + L3 + N - PE
Maximum voltage on CDN	Lx - Lx 480Vac Lx - N/PE 280Vac 50/60Hz
Maximum current	32A

10/700us Telecom wave

Voltage range	0.25 up to 6kV
Risetime	10 µs
Duration	700 µs
Source impedance	15ohms
Damping resistor	25ohms
Maximum Current	400A

Telecom Component Test System

MIG0624TEL

Current range	1 up to 24kA
Risetime	8us
Duration	20us
Number of Outputs	4
Maximum Current per Output	6kA

MIG0648TEL

Similar to MIG0624TEL with 8 outputs	1 up to 48kA

MIG0612T-K12

8/20us Current Impulse

Current range	0.25 up to 12kA
Risetime	8us
Durationamping	20us
Number of Outputs	2

10/350us Current Impulse

Current range	0.1 up to 4.4kA
Risetime	40us
Duration	350us
Number of Outputs	2

10/1000us Current Impulse

Current range	3 up to 120A
Risetime	10us / 100us
Duration	1000us
Number of outputs	2

MIG0624T-K12

Simialr to MIG0612T-K12 with current	
8/20us	0.5 up to 24kA
10/350us	0.5 up to 8.8kA
10/1000us	5 up to 240A

MIG-ITU-K44

Voltage range	50 up to 1.7kV
Contiuous Power	3.5kVA
Current Limiting Resistors	2 x 200ohm and 2 x 600ohm
Specific Energy	$10A^2$ s

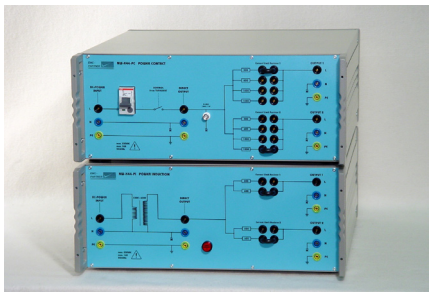
Accessories and Options

NW-K44PC

NW-K44PC

Network for mains power contact according to ITU-T K.44, K.20, K.21. Includes current limiting resistors 2 x 300, 2 x 600, 2 x 1000 and 2 x 1200 ohm. Also features a direct output for use with external limiting resistors such as the PCPI160E.

Requires TRA2000INx with DIP circuit.

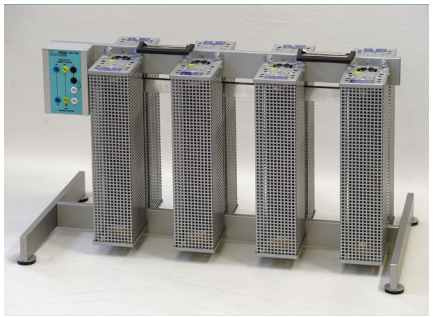


TRA OPTION NW-K44PI

TRA OPTION NW-K44PI

Option to NW-K44PC. Coupling network for power induction tests, basic level, according to ITU-T K.44, K.20, K.21. Includes transformer for 600V output and current limiting resistors 2 x 200 and 2 x 600 ohm. TRA OPTION NW-K44PI can only be used together with the NW-K44PC

Requires TRA2000INx with DIP circuit.



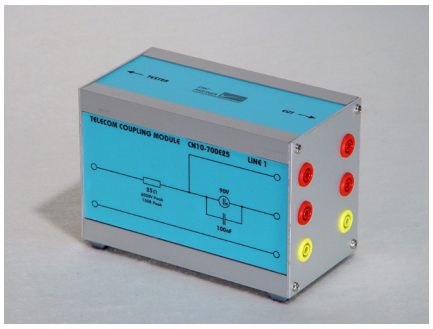
PCPI160E (one unit shown)

PCPI160E

Power contact current limiting resistor network for telecom testing in accordance with ITU-T K.44, K.20, K.21. Resistor values of; 10, 20, 40, 80 and 160 ohm are avaialble.

For use with NW-K44PC

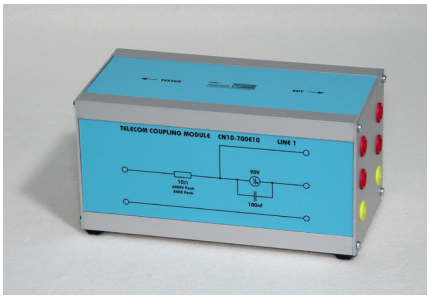
Two PCPI160E units may be required for 4 wire testing.



CN10-700E25

CN10-700E25

2 wire telecom coupling module for impulses up to 6kV. For use with 10/700us and 8/20us impulses. Coupling 2 x GDTs (90V) in parallel with 0.1uF capacitor. 2 x 25ohm.



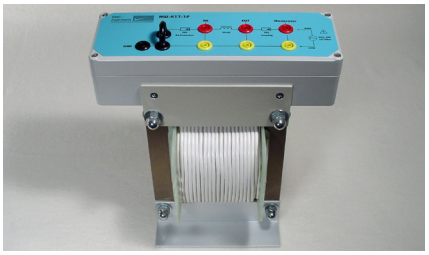
CN10-700E10

CN10-700E10

2 wire telecom coupling module for impulses up to 6kV. For use with 10/700us and 1.2/50us impulses. 2 x 10ohm. For use with CDN-UTP or CDN-UTP8.

NW-K17-1P

2 wire telecom coupling module for impulses up to 6kV. For use with 10/700us and CWG impulses. Coupling 2 x GDTs (90V). 20mH decoupling inductors.



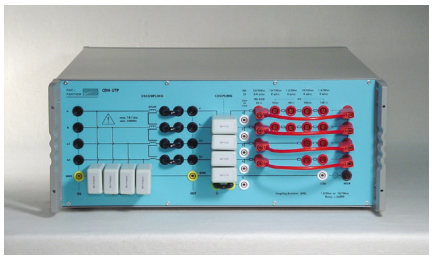
NW-K17-1P

CDN-UTP

The CDN-UTP is a sophisticated coupling and de-coupling network for superimposing surge impulses on balanced communication lines in accordance with IEC 61000-4-5 (Figure 12: unshielded symmetrical interconnection lines), ITU-K20, K21 and FCC part 68.

It is designed for 1.2/50µs and 10/700µs pulses up to 6.6kV.

CDN-UTP is also available with 4 pairs (8 lines) as the CDN-UTP8 version.



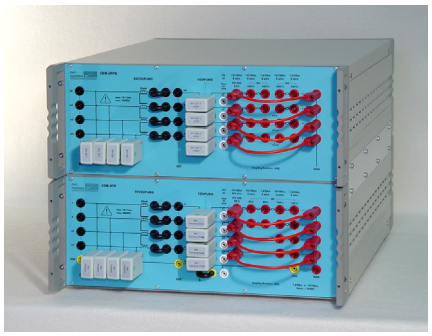
CDN-UTP

CDN-UTP8

The CDN-UTP is a sophisticated coupling and de-coupling network for superimposing surge impulses on balanced communication lines in accordance with IEC 61000-4-5 (Figure 12: unshielded symmetrical interconnection lines), ITU-K20, K21 and FCC part 68.

It is designed for 1.2/50µs and 10/700µs pulses up to 6.6kV.

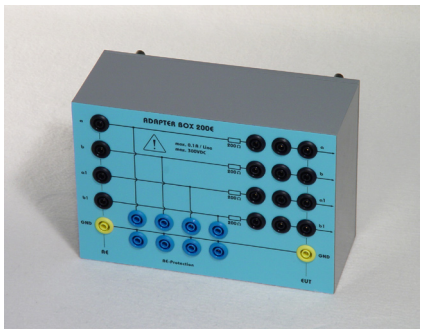
CDN-UTP is also available with 4 pairs (8 lines) as the CDN-UTP8 version.



CDN-UTP8

ADAPTER BOX 200E

The ADAPTER Box 200E can be plugged on the front of the CDN-UTP and CDN-UTP8 as shown in the figure below. The standard banana cables of the CDN-UTP and CDN-UTP8 can be used for EUT and AUX connections..



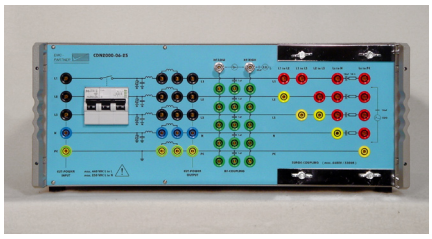
ADAPTER BOX 200E

External Three Phase Couplers

Combination and Ring wave testers can be extended with automatic or manual three-phase coupling networks. The CDN2000-06-25 and CDN2000A-06-32 can also be used for EFT/Burst. Coupling path selection is either from the MIG firmware, from GENECS and TEMA software or manually on the CDN front panel (manual version only). The coupling networks fulfill the requirements laid down in the IEC 61000-4-4, IEC 61000-4-5, IEC 61000-4-12 (ring wave) and ANSI C62.41 standards.

MIG Generator		**Three Phase CDN**	
Model	Internal CDN	Model	EUT Voltage
MIG0603IN2	Yes	CDN2000-06-32 or CDN2000A-06-32	280V Lx to N/PE 480V Lx - Lx
MIG0603EN	Yes	CDN2000-06-32 or CDN2000A-06-32	280V Lx to N/PE 480V Lx - Lx
MIG0603FCC	Yes	CDN2000-06-32 or CDN2000A-06-32	280V Lx to N/PE 480V Lx - Lx

Note: CDN2000-06-25 can be used for Combination wave, Ring wave and EFT testing. With an EMC PARTNER oscillatory wave tester, power and up to four data lines using the 100kHz and 1MHz oscillatory waves can be tested according to IEC61000-4-18.



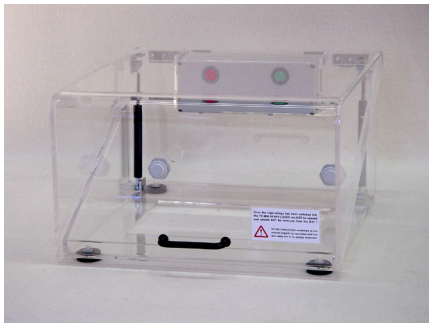
CDN2000-06-32

CDN2000A-06-32

TC-MIG24

A test cabinet for EUT with maximum dimensions 12 x 15 x 28cm. Can be used together with all Telecom Device Testers with the outputs on top. These include MIG0612T-K12 and MIG0624T-K12

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



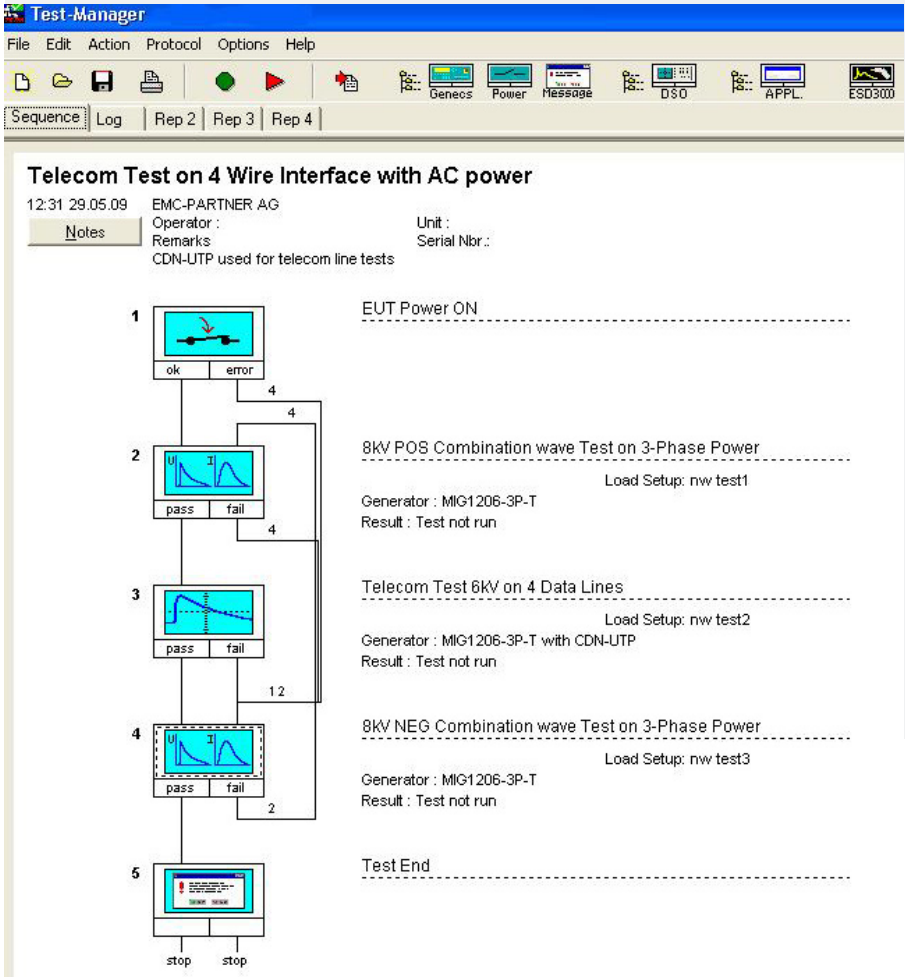
TC-MIG24

Software

For remote control of EMC PARTNER military generators, 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 several generator types to be included in the same test sequence. Generates an enhanced level of test report.

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

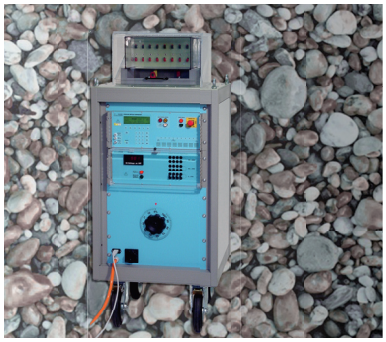
Lightning Tests

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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