



# Military Test System



<b>System Overview . . . . .</b>	<b>. 2</b>
<b>Features &amp; Benefits . . . . .</b>	<b>. 4</b>
<b>Applications . . . . .</b>	<b>. 6</b>
<b>Applicable Standards . . . . .</b>	<b>. 7</b>
<b>Technical Specifications . . . . .</b>	<b>. 8</b>
<b>Accessories . . . . .</b>	<b>10</b>
<b>Special Test Systems . . . . .</b>	<b>12</b>
<b>Software . . . . .</b>	<b>13</b>
<b>EMC PARTNER's Product Range . . . . .</b>	<b>15</b>

# MIG2000-6 - Modular Impulse Tester



## Modular System easily expandable

The easily interchangeable modules quickly adapt MIL2000-6 to the specified circuits of a new application. Each new module fitted to the MIG2000-6 is automatically identified and the corresponding program displayed. A system comprises generator, coupler and verification accessories.

**CS115REC** PN: 103588

**MIL-STD-461 CS115**

Bulk current injection impulse up to 5A.  
Rise & fall time < 2ns pulse duration 30ns



**CS116-10K10M** PN: 103586

**MIL-STD-461 CS116**

Damped sinusoidal transient up to 10A.  
Oscillation frequencies 10kHz, 100kHz, 1MHz, 10MHz.



**CS116-30M100M** PN: 103587

**MIL-STD-461 CS116**

Damped sinusoidal transient up to 10A.  
Oscillation frequencies 30MHz, 100MHz.



**FX-CS106** PN: 103595

**MIL-STD-461 CS106**

Power lead transients up to 400V.  
Rise time 1.5µs pulse duration 5µs, impedance 5Ω.

**FX-MIL1275B** PN: 103591

**MIL-STD-1275**

Imported spikes up to 250V.  
Oscillation frequency 100kHz, rise time < 50ns.

**NATO-FAST-150n** PN: 103615

**SPE-J-00-E CS-EFA-4**

Imported spike impulse up to 850V.  
Spike duration 150ns, impedance 50Ω.

**NATO-SLOW-10u** PN: 103592

**SPE-J-00-E CS-EFA-4**

Imported spike impulse up to 440V.  
Spike duration 10µs, impedance 5Ω.

**FX-DO-160-S17** PN: 103593

**DO-160 SECTION 17**

Voltage spike impulse up to 600V.  
Spike duration > 10µs, impedance 50Ω.

**FX-DO-160-S19** PN: 103589

**DO-160 SECTION 19**

Cable spike test up to 600V.  
Burst duration 50 to 1000µs



**FX-AMD24C1** PN: 105009

**AIRBUS ABD0100.1.8.1**

Voltage spikes up to 2000V.  
Spike duration 10µs, 50µs, 100µs, 200µs, 400µs



# Features



## Easy Operation

- User interface on instrument front panel
- Software control from a computer
- Switching between frequencies
- Electronic Polarity change automation

## Modular System

- Many Impulse Modules
- Easy expansion to meet new requirements
- Automatic module recognition and configuration.



## User Comfort

- Standard DEFAULT values
- QUICK test program with standard default values
- Predefined SOFTWARE for different test standards
- REMOTE control and software upgrade

## Full Feature System

- Amplitude RAMP function
- Electronic POLARITY change
- SYNCHRONISATION to AC power
- Integrated SAFETY CIRCUIT with EMERGENCY STOP

## Data Protection

- Internal memory to save test files
- Software to backup test files on a computer
- Software to store Test Report data
- Calibration data for all waveforms

# Benefits

## The Tester You Need

Lowest operator learning curve  
REAL TIME parameter change,  
EXPANDABLE to include many applications  
Test all levels AUTOMATICALLY

## Upgrade on Site

Upgrade applications as needed  
Low cost and rapid system extension  
New modules can be added at any time.  
No hardware down time

## Best Performance

Maximum test LEVELS  
Covers all voltage spike requirements  
Automation of test process  
Cost effective solution

## Turn-Key Solution

Wide range of APPLICATIONS  
Test place AUTOMATION  
Ideal for TEST LABS  
2 year warranty

## Software is Key

Graphic User Interface for FASTER programing  
SAVE TIME create tests once only  
Save FAVOURITE tests  
RECALL and Run favourite tests



# Application Options



Airbus ABD0100.1.1 Test System

## Avionics Spike Tests

Both civilian and military avionic standards specify voltage spike testing on power supplies. The various standards all try to achieve the same test, but they do it in different ways. Multiple impedances are specified for the different standards each one requires a new impulse circuit. MIG2000-6 system with its modular architecture enables these diverse requirements to be met with only one system.

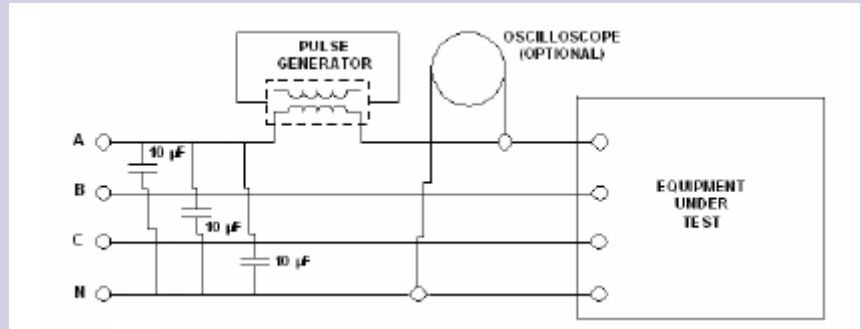
	5Ω	10Ω	50Ω	100Ω
CS106	•			
CS-EFA4 150ns			•	
CS-EFA4 10μs	•			
DO-160 S17			•	
ABD0100.1.8.1	•	•	•	•

The Airbus requirement for 10Ω and 100Ω is met by placing two systems in series. This combination allows extension of an existing system, protecting the investment. Combining two systems in series creates a doubling of the voltage spike up to maximum 2000V. Airbus require testing on 230V equipment to be tested to this higher level with both 10Ω and 100Ω generator impedances.

All voltage spike tests are performed on either AC or DC power lines. It is important to ensure that the power supply used for the EUT has a bypass capacitor fitted across the output terminals. Typically a 10μF capacitor is used. This ensures the impulse energy is diverted into the EUT and not dissipated in the low impedance of the power supply. DC-S17CL provides this bypass function for all voltage spike modules and on DC or single phase and three phase AC power.



DC-S17CL



CN-MIG-BT5

## Large Diameter Cables

Some applications include large cable bundles that cannot be separated to perform serial injection testing with the standard couplers. CN-MIG-BT5 is a coupler designed to accommodate cable bundles up to 8cm in diameter.

# Applicable Standards

## Military Procurement Standards (MIL)

MIL-STD-461 (2007): Requirements for the control of Electromagnetic Interference characteristics of subsystems and equipment.

MIL-STD-883 (18 June 2004): ESD classification testing of devices.

MIL-STD-331 (5 January 2005): Fuse and Fuse components.

MIL-STD-750 (28 February 1995): Test method standard semiconductor devices.

MIL-STD-464 (18 March 1997): Electromagnetic Environmental Effects.

MIL-STD-1541 (30 December 1987): Electromagnetic Compatibility Requirements for space systems.



## Airbus

ABD0100.1.2 and ABD0100.1.8.1: Variable frequency (115V) and dc power supply tests.



## North Atlantic Treaty Organisation

Test Requirement CS-EFA-4 (Imported Transients) of Eurofighter SPE-J-00-E-1000 (1991).



## Radio Technical Commission for Aeronautics (RTCA)

DO-160G Environmental Conditions and Test Procedures for Airborne Equipment. (2010)

Section 17 and Section 19.



## European Organisation for Civil Aviation Equipment (EUROCAE)

ED-14G Environmental Conditions and Test Procedures for Airborne Equipment. (2011)

Section 17 and Section 19



# Technical Specifications



## MIG2000-6 (MIL-STD-461 Modules)

### FX-CS106

Voltage range	100V up to 500V
Rise time	1.5 $\mu$ s
Fall time	3.5 $\mu$ s
Duration	5 $\mu$ s
Repetition rate	10Hz (Max)
Coupler	CN-MIG-BT

### CS115REC

Current range into 100ohm	1A up to 10A
Rise time	< 2ns
Fall time	< 2ns
Duration	30ns
Repetition rate	30Hz (Max)

### CS116-10K10M - 10kHz

Current range into 100ohm	0.02A up to 0.2A
Frequency	10kHz
Damping	4th peak 40 to 50%
Repetition rate	2Hz (max)

### CS116-10K10M - 100kHz

Current range into 100ohm	0.2A up to 2A
Frequency	100kHz
Damping	4th peak 40 to 50%
Repetition rate	2Hz (max)

### CS116-10K10M - 1MHz

Current range into 100ohm	1A up to 15A
Frequency	1MHz
Damping	4th peak 40 to 50%
Repetition rate	2Hz (max)

### CS116-10K10M - 10MHz

Current range into 100ohm	2A up to 12A
Frequency	10MHz
Damping	4th peak 40 to 50%
Repetition rate	2Hz (max)

### CS116-10K10M - 30MHz

Current range into 100ohm	2A up to 12A
Frequency	30MHz
Damping	4th peak 40 to 50%
Repetition rate	2Hz (max)

### CS116-10K10M - 100MHz

Current range into 100ohm	1A up to 6A
Frequency	100MHz
Damping	4th peak 40 to 50%
Repetition rate	2Hz (max)



# Technical Specifications

## NATO-FAST-150n

Open circuit voltage	100V up to 1600V
Impulse duration	150ns
Rise time	< 30ns
Source impedance	50 Ohm
Repetition	up to 2 Hz
Coupler	CN-MIG-BT

## NATO-SLOW-10u

Open circuit voltage	100V up to 850V
Impulse duration	10µs
Rise time	< 2µs
Source impedance	5 Ohm
Repetition	up to 2 Hz
Coupler	CN-MIG-BT

## Fx-AMD24C1

Open circuit voltage	50V up to 1200V (Wave shape dependent)
Impulse duration	10µs / 50µs / 100µs / 200µs / 400µs
Rise time	< 2µs
Source impedance	5 Ohm and 50 Ohm
Repetition	up to 2 Hz (Wave shape dependent)
Coupler	CN-MIG-BT4

For full details of the FX-AMD24C1 module refer to the AVIONICS brochure.

## MIG2000-6 Selection Guide

	MIG2000-6 Mainframe	FX-CS106	CS115REC	CS11610K10M	CS11630M100M	FX-MIL1275B	NATO-FAST-150n	NAT-SLOW-10u	FX-DO-160-S17	FX-DO-160-S19	FX-AMD24C1	Accessories	CN-MIG-BT	CN-MIG-BT2	CN-MIG-BT4	CN-MIG-BT5	VERI-MIL2	VERI50	VERI5	SYNC-ADAPTER	DC-S17CL		
MIL-STD-461 CS106	•	•											•			○				•		•	
MIL-STD-461 CS115	•		•											•			•	•					
MIL-STD-461 CS116	•			•	•								•	•			•	•					
MIL-STD-1275	•					•																	
Eurofighter CS-EFA4	•						•	•					•			○					•	•	
Airbus ABD0100.1.8.1	•										•				•				•		•	•	
DO-160 Section 17	•								•				•			○							•
DO-160 Section 19	•									•													

○ = Option instead of CN-MIG-BT



# Accessories and Options



Module for MIG2000-6



CN-MIG-BT4



CN-MIG-BT5



I-PROBE-CS-P8585C

## Plug-in Modules

Enhance MIG2000-6's capability by including additional waveforms. New modules are automatically recognised and controlled by the MIG2000-6 firmware.

All modules are independent and can be ordered at any time.

Detailed technical specifications for each module indicate the matching accessories.

## Couplers

### CN-MIG-BT

Injection probe for f-range 10kHz up to 10MHz, application for MIL-STD-461 CS116 and DO-160 Section 17.

### CN-MIG-BT2

Injection probe for frequency range 10MHz up to 100MHz, application for MIL-STD-461 CS115 and CS116.

### CN-MIG-BT4

Coupler to Fx-AMD24C or Fx-AMD24C1. The waveforms are guaranteed at secondary output. The coupler can be used for single and three phase applications up to 800Hz.

### CN-MIG-BT5

Injection probe for frequency range 10kHz up to 10MHz, application for MIL 461 CS116 and DO-160 W2, W3 (1 and 10MHz) up to level 3 (600V).

Dimensions of aperture: 8 x 7.2 cm

## Test Accessories

### 20dB Attenuator

Used to reduce output from CS116 module when the EUT is very sensitive.

### I-PROBE-CS-P8585C

Current monitor probe used during CS115 and CS116 testing to ensure the anticipated test level is not exceeded.

Measurement bandwidth up to 200MHz.

## Verification Accessories

### VERI5

Coaxial high voltage termination and integrated divider with 5ohm for Voltage Spikes calibration in accordance with ABD0100.1.8.1, MIL-STD-461 CS106 and SPE-J-00-E-100 NATO slow.



VERI50

### VERI50

Coaxial high voltage termination and integrated divider with 50ohm for CS115 and CS116 calibration. Two units are required for use with VERI-MIL2.



VERI-MIL2

### VERI-MIL2

Coaxial calibration fixture for use with CS115 and CS116 waveforms. Needs two 50ohm terminations with dividers (VERI50).

### CAL-LOOP-2T BT4

Special calibration loop required when two MIG2000-6 systems with two CN-MIG-BT4 are connected in series to achieve the 2000V test level required by Airbus for 230V equipment mounted on the A350 aircraft.

## Application Accessories

### SYNC-ADAPTER

Power line synchronisation box for superimposing transients on 50Hz, 60Hz and 400Hz supplies. Used with NATO-SLOW and NATO-FAST modules to synchronise in 90° steps on the AC.



SYNC-ADAPTER

### DC-S17CL

Set of 4 boxes for Voltage Spikes Testing according to DO-160-S17 and MIL-STD-461 CS106, consisting of:

- two decoupling boxes "PARALLEL INJECTION". Can be used separately for 230V, 50/60Hz, 10A or connected in parallel for max. 115V, 400Hz, max. 10A
- two decoupling boxes "SERIAL INJECTION" with 2x 10µF for use max. 230V, 50Hz or 115V, 60Hz, 400Hz.



DC-S17CL

# Special Test Systems



MIG1212EMP



DN-MIG12-16

## MIG1212EMP

Testing military installations against the conducted effects of EMP energy requires an impulse generator with fast risetime combined with high energy content.

Designed to fulfill the German defence standard TA 7.490.801-02, MIG1212EMP is a combined impulse generator and Coupling/Decoupling Network (CDN).

Two voltage impulse ranges and two current impulse ranges are included in the generator.

Control is through a microprocessor with LCD user interface or the TEMA software from a computer.

## Technical Specifications

### 0.5/250 $\mu$ s

Voltage Range Common mode	1 up to 12kV
Risetime	500ns
Duration	ca. 250 $\mu$ s
Current Range Common mode	100 up to 1.2kA
Risetime	500ns
Duration	ca. 155 $\mu$ s

### 0.5/50 $\mu$ s

Voltage Range Differential mode	1 up to 12kV
Risetime	500ns
Duration	ca. 50 $\mu$ s
Current Range Differential mode	100 up to 1.2kA
Risetime	500ns
Duration	ca. 155 $\mu$ s

## Application Accessories

### DN-MIG12-16

De-coupling network. Single phase up to 230V/3kVA and three phase 440V/10kVA.

Application: Superimposing NEMP impulses onto power supply lines.

### NW-EUT-V

Reference load used to verify MIG1212EMP voltage impulse. 6nF capacitor from each phase to PE.

# Software

## OPTICAL LINK

For remote control of MIG2000-6 or MIG1212EMP. Optical link provides up to 10m separation between the control computer and test generator and 100% galvanic isolation providing the computer full protection against disturbance signals.



OPTICAL LINK

## USB-RS232 ADAPTER

Most modern Desktop and Laptop computers are fitted with USB connections in preference to the largely outdated RS232 serial interface. This adapter converts the MIG2000-6 or MIG1212EMP RS232 serial interface for use with USB equipped computers.



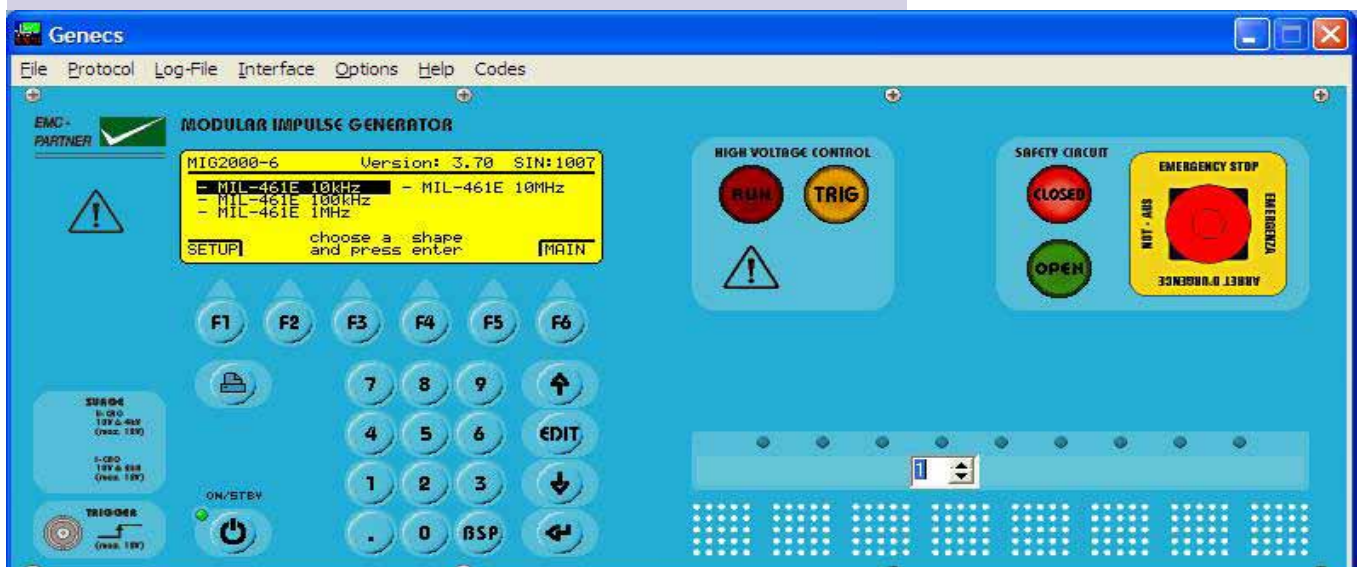
USB-RS232 ADAPTER

## GENECS-MIG Software

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.

Tests programmed in MIG2000-6 or MIG1212EMP can be saved on the computer and simply recalled for later use.

GENECS-MIG can be used with MIG2000-6 and MIG1212EMP generators.



GENECS-MIG

## TEMA Software

Start testing faster with pre-loaded standard routines. Supervise the test process using loop, continue or stop functions linked into EUT responses. Customise the test report format and content automatically generating a document for export to Word® or Excel®

In addition to the basic TEMA software, an enhanced package is available which enables control of a Tektronix oscilloscope. This feature means that measurements and waveforms can be captured on the oscilloscope and imported into the test report.

**Test-Manager - <milcs116.seq>**

File Edit Action Protocol Options Help

Sequence Log Rep 1 Rep 2 Rep 3 Rep 4

### MIL-STD-461F, CS116 10kHz to 100MHz

12:12 13.05.2008 EMC-PARTNER AG, 4242 Laufen, Switzerland

Operator : J. Bloggs Unit : Black Box  
Remarks Serial Nbr : 001  
Test Equipment MIG2000-6

**Notes**

- CS116 10kHz test 0.1A  
Load Setup: CS11610k  
Generator : MIG2000-6 3.54  
Result : Test not run
- CS116 100kHz test 1.0A  
Load Setup: CS116100k
- 
- 
- Operator Action before Continuing with Test
- CS116 30MHz test 10.0A  
Load Setup: CS11630M

**MIG2000-6**  
Abort Block Abort Sequence Show Protocol

EMC-PARTNER **MODULAR IMPULSE GENERATOR**

Running | MIL-461E 10kHz100%  
Ipeak + .10A  
Time: 225s Rep. : 1.00s  
Status: o.k. | Fail | Mark

F1 F2 F3 F4 F5 F6

**RUN**  
**TRIG**

# EMC PARTNER's Product Range

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

## Immunity Tests

Transient Test Systems for all EMC tests on electronic equipment. ESD, EFT, surge, AC dips, AC magnetic field, surge magnetic field, common mode, damped oscillatory and DC dips. According to IEC and EN 61000-4-2, -4, -5, -8, -9, -10, -11, -12, -16, -18, -19, -29.

## Lightning Tests

Impulse test equipment and accessories for aircraft, military and telecom applications. Complete solutions for RTCA / DO-160 and EUROCAE / ED-14 for indirect lightning on aircraft systems, MIL-STD-461 tests CS106, CS115, CS116 and Telecom, ITU-T .K44 basic and enhanced tests for impulse, power contact and power induction.

## Component Tests

Impulse generators for testing; varistors, gas discharge tubes (GDT), surge protective devices (SPDs), X / Y capacitors, circuit breakers, watt-hour meters, protection relays, insulation material, suppressor diodes, connectors, chokes, fuses, resistors, emc-gaskets, cables, etc.

## Emission Measurements

Measurement of Harmonics and Flicker in 1-phase and 3-phase electrical and electronic products according to IEC /EN 61000-3-2 and 61000-3-3 . HARCS Immunity software adds interharmonic tests, voltage variation and ripple on DC tests according to IEC/EN 61000-4-13, -4-14, -4-17.

## System Automation

A full range of accessories enhance the test systems. Test cabinets, test pistols, adapters and remote control software, simplify interfacing with the EUT.

Programmable PSU, EMC hardened for frequencies from 16.7Hz to 400Hz. Frequency PS3-SOFT-EXT complies with IEC / EN 61000-4-14 and -4-28.

## Service

Our commitment starts with a quality management system backing up our ISO 17025 accreditation. With the SCS number 129, EMC PARTNER provide accredited calibration and repairs. Our customer support team are at your service!



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:

**[www.emc-partner.com](http://www.emc-partner.com)**

### **The Headquarters in Switzerland**

EMC PARTNER AG  
Baselstrasse 160  
CH - 4242 Laufen  
Switzerland

Phone: +41 61 775 20 30  
Fax: +41 61 775 20 59  
Email: [sales@emc-partner.ch](mailto:sales@emc-partner.ch)  
Web-Site: [www.emc-partner.com](http://www.emc-partner.com)

### **Your local representative**

