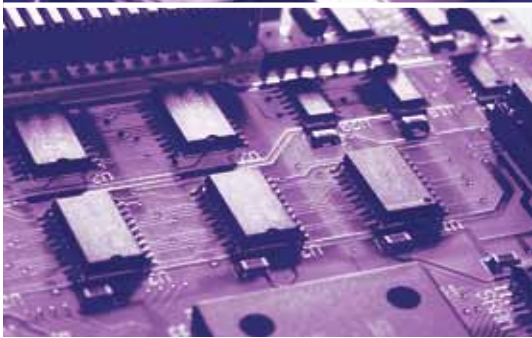


Lightning Tests



# AVI3000 Test System



**AVI3000 Test System Overview . . . . . 2**

**Features & Benefits . . . . . 4**

**Applications of AVI3000 . . . . . 6**

**Applicable Standards . . . . . 7**

**Generator Specifications . . . . . 8**

**Test & Verification Accessories . . . . . 9**

**TEMA3000 Software . . . . . 10**

**EMC PARTNER's Product Range . . . . . 11**

# AVI3000 Test System Overview



## Multi Talented System “All in One”

The first System to fully integrate all waveforms from DO-160 and MIL-STD-461G. Combined with a single coupler where the EUT cable passes only once, AVI3000 is a compact and resourceful solution to indirect lightning testing needs.

## Waveform 1 (6.4/69 $\mu$ s)

### Current Impulse

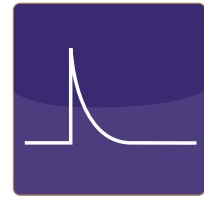
Cable Bundle Single Stroke  
Cable Bundle Multiple Stroke



## Waveform 2 (0.1/6.4 $\mu$ s)

### Voltage Impulse

Cable Bundle Single Stroke  
Cable Bundle Multiple Stroke



## Waveform 3 (1MHz & 10MHz)

### Voltage & Current Impulse

PIN injection  
Cable Bundle Single Stroke  
Cable Bundle Multiple Stroke  
Cable Bundle Multiple Burst



## Waveform 4 (6.4/69 $\mu$ s)

### Voltage Impulse

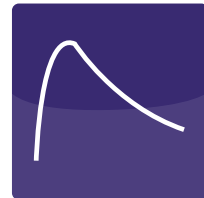
PIN Injection  
Ground Injection Single Stroke  
Ground Injection Multiple Stroke



## Waveform 5A (40/120 $\mu$ s)

### Current Impulse

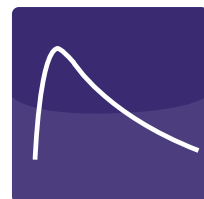
PIN Injection  
Cable Bundle Single Stroke  
Cable Bundle Multiple Stroke



## Waveform 6 (0.25/4 $\mu$ s)

### Current Impulse

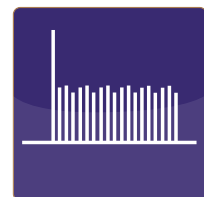
Cable Bundle Multiple Burst



## Single/Multiple Stroke & Multiple Burst

### DO-160 Event Timing

Standard DO-160 random spacing  
User programmable spacing  
User programmable event duration



# Features



## Latest Technology

- Colour touch panel user interface
- High tech material used in coupler design
- Latest technology high voltage circuits
- Enhanced interface with graphics and contextual help

## Integrated System

- Includes all waveforms for DO-160 section 22
- PIN injection, Single/Multiple Stroke & Multiple Burst
- Dedicated coupler CN-BT7 for all waveforms
- PIN Injection decoupler integrated up to 230V/800Hz

## Multiple Applications

- Fully compliant to DO-160 section 22
- Reach level 3 under any test condition
- Fully compliant to MIL-STD-461G CS117
- Test to Internal levels with all waveforms

## Automatic Polarity

- No disturbance of EUT cables
- Less user intervention
- Coupler need not be turned
- Significant time saving

## Phase Sync

- Powered PIN direct sync through high voltage connections
- Peak sync 90° positive polarity 270° negative polarity
- Separate sync input for additional plug-in modules
- Sync up to 800Hz



# Benefits

## Best Performance

- Easier operation, front panel or via software
- Small coupler easier to place in setup
- Large aperture coupler for cable bundle tests
- Single turn coupler reduces setup complexity

## Reduced Learning Curve

- Reduced Setup only one generator and one coupler
- Set-up diagrams integrated into generator
- Create and Save Tests in generator
- Predefined test included as standard

## Cost Effective

- Meets multiple requirements
- Switch simply between waveforms
- Less complexity due to clever hardware integration
- Lowest cost for full compliant solution

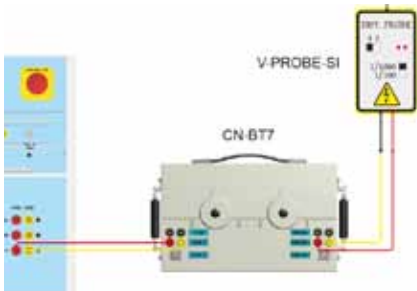
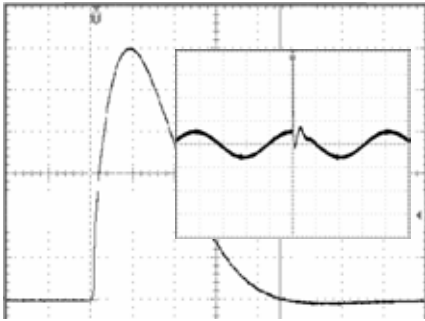
## Reproducibility

- Integrated AC decoupler for Power PIN testing
- Reliability through solid state switching
- High impulse fidelity
- Test level and limit waveforms comply to standard

## Full Compliance

- DO-160 PIN injection test
- DO-160 Single Stroke tests
- DO-160 & MIL-STD-461G Multiple Stroke tests
- DO-160 & MIL-STD-461G Multiple Burst tests

# Applications for AVI3000



## Active AC Power PIN Synchronisation

DO-160 specifies that impulses should be synchronized to the peak of the AC waveform. This requires a phase detection circuit and high voltage switches with sufficient accuracy for meaningful synchronization. AVI3000 includes active synchronization making it fast and easy to synchronize with 1° accuracy on supplies up to 800Hz.

## Current and voltage coupler in one

Latest material technology enables only one coupler for all waveforms in DO-160 section 22 and MIL-STD-461G CS117.

Current Waveforms 1, 3, 5A and 6

Voltage Waveforms 2, 3

can all be applied with the CN-BT7 coupler.

Integrated monitor loop for easy waveform verification using direct connection with high voltage probes or current shunts.

## Single turn coupler

Clever design means no turns on the transformer secondary.

Existing steel and ferrite coupling transformers saturate under high energy conditions, necessitating large couplers with more material to delay saturation. CN-BT7 uses a revolutionary material with extreme energy handling capabilities.

Impulse amplitudes can easily be achieved without multiple winding of the EUT cable.



## Large Diameter and short Cables

Some applications use particularly large cable bundles that cannot easily be separated out. In such conditions, it is not possible to use conventional DO-160 couplers and turn the EUT cable around the coupler secondary. CN-BT7 with an aperture of 6 x 9cm is designed with AVI3000 to allow the cable bundle to be kept in a straight line.

With a total length of 30cm, Short cable lengths are also no problem for CN-BT7.



## WF4 Ground Injection & Cable Bundle

Integrated into AVI3000 direct connection for Ground Injection testing including fuse to protect against EUT overcurrent.

Application of WF4 as cable Bundle test is possible using the CN-GI-CI-V coupler up to 600V, exceeding the level 3 requirement (300V).

# Applicable Standards

## Radio Technical Commission for Aeronautics (RTCA)

DO-160 : Environmental Conditions and Test Procedures for Airborne Equipment.

- Section 22: Lightning Induced Transient Susceptibility.



## European Organisation for Civil Aviation Equipment (EUROCAE)

EUROCAE / ED-14: Environmental Conditions and Test Procedures for Airborne Equipment.

- Section 22: Lightning Induced Transient Susceptibility.



## US Department of Transportation, Federal Aviation Authority (FAA)

Advisory Circular 20-136 (1990): Protection of Aircraft Electrical/Electronic Systems against the indirect effects of lightning.



## Society of Aerospace Engineers (SAE)

ARP 5412 Aircraft Lightning Environment and Related Test Waveforms

ARP 5414 Aircraft Lightning Zoning

ARP 5415 User's Manual for Certification of Aircraft Electrical/Electronic Systems for the Indirect Effects of Lightning

ARP 5416 Aircraft Lightning Test Methods



## Military Procurement Standards (MIL)

MIL-STD-461G Requirements for the control of Electromagnetic Interference characteristics of subsystems and equipment.

- CS117



# Generator Specifications



## DO-160 PIN Injection

Waveforms	WF3, WF4 & WF5A
WF3 - 1MHz	100V up to 750V / 30A (25Ω)
WF4 - 6.4/69μs	50V up to 500V / 100A (5Ω)
WF5A - 40/120μs	50V up to 500V / 500A (1Ω)

## DO-160 Single Stroke

Waveforms	WF1, WF2, WF3, WF4 & WF5A
WF1 - 6.4/69μs	25A up to 900A
WF2 - 0.1/6.4μs	25V up to 1600V
WF3 - 1MHz	50V up to 1900V
WF3 - 10MHz	50V up to 1100V
WF4 - 6.4/69μs	10V up to 1600V
WF5A - 40/120μs	30A up to 1800A

## DO-160 & MIL-STD-461G Multiple Stroke

Waveforms	WF1, WF2, WF3, WF4 & WF5A
WF1 - 6.4/69μs	25A up to 900A
WF2 - 0.1/6.4us	25V up to 600V
WF3 - 1MHz	50V up to 1900V
WF3 - 10MHz	50V up to 1100V
WF4 - 6.4/69μs	10V up to 800V
WF5A - 40/120μs	30A up to 1800A
Subsequent Stroke Level	3% up to 100% (depending on first stroke amplitude)
Pulse spacing	10ms up to 500ms
Duration	0.01 up to 2s
Repetition	2 up to 999s
Maximum pulses	30 every 2s
Multiple stroke pattern	DO-160 Random & User programmable

### User Programmable Pattern

Pulse spacing	10ms up to 400ms
Duration	20ms up to 1000ms
Maximum pulses per event	30

## DO-160 & MIL-STD-461G Multiple Burst

Waveforms	WF3 & WF6
WF3 - 1MHz	50V up to 700V
WF3 - 10MHz	50V up to 800V
WF6 - 0.25/4μs	2.5A up to 75A
Burst pattern DO-160	1 burst of 20 pulses 3 repetitions
Pulse spacing	50μs up to 1000μs
Burst repetition	30ms up to 300ms

### User Programmable Pattern

Pulse spacing	50μs up to 50000μs
Burst Length	1ms up to 3000ms
WF3 spikes per 2s period	500
WF6 spikes per 2s period	60



# Test & Verification Accessories

## Test Accessories

### CN-BT7

Coupling transformer used with WF1, WF2, WF3, WF5A, WF6. Aperture 6 x 9cm. Application: For Cable Bundle testing.

### CN-GI-CI-V

Voltage coupling transformer used with WF4. Application: For Cable Bundle testing only. Ground Injection is fully integrated into AVI3000.

### DN-LISN160-32

Line Impedance Stabilization Network for cable bundle and ground injection tests. For AC and DC up to 32A. Three phase power systems require two units.

Application: To provide a defined system impedance for impulse tests according to DO160 section 22.

### I-PROBE-MS

High bandwidth current transducer. Clamp-on type with large opening. Application measurement of current amplitudes for WF1, WF5A and WF5B in the EUT cables in accordance with the DO160 section 22.

### I-PROBE-MB-P1

High bandwidth current waveform transducer. Opens to cause minimum disruption to the circuit under test.

Application: To measure the current waveform and amplitude for WF2 and WF3 in the EUT cable in accordance with DO160 section 22.

### V-PROBE-SI

V-PROBE-SI. Differential voltage measurement probe. AC/DC rating up to 7000V. Transient rating up to 7000V.

Probe factor x 1000. Bandwidth 70MHz

### SHUNT 0E1

0.1  $\Omega$  shunt with SHV-BNC connector for direct measurement of current impulses on AVI3000 and CN-BT7.

## MIL3000 System

Additional DO-160 tests can be performed with the MIL3000 system. This modular instrument can be fitted with plug-in modules for:

- DO-160 section 17 voltage spike
- DO-160 section 19 induced spike

Refer to the MIL3000 brochure for further information and technical specifications.



CN-BT7



CN-GI-CI-V



DN-LISN160-32



V-PROBE-SI



# TEMA3000 Software

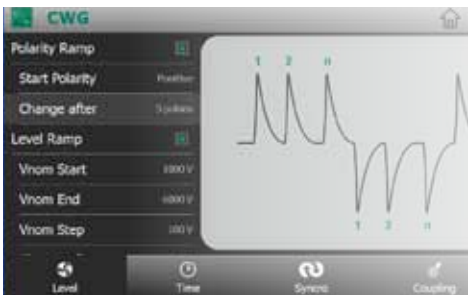


TEMA3000 is a modern software running under Windows7 and higher operating systems.

The heart of a complex test system, TEMA3000 includes the functions:

- Generator control from a PC
- Linking of test to form a complex sequence
- Library of predefined tests for DO-160 & MIL-STD-461
- Integration of DSOs
- Test report generation

## Generator control from a PC



Connected using the Ethernet cable to AVI3000, TEMA3000 opens a window which emulates the EPOS in AVI3000. All parameters are input exactly as on the AVI3000 front panel. Any generator connected to TEMA3000 will be simultaneously programmed over the Ethernet cable. Conversely, parameters entered on AVI3000 are changed in TEMA3000.

## Linking tests to form a sequence



Individual tests stored on the PC or in AVI3000 can be combined to form a complex test sequence. This feature enables multiple tests to be linked and run in a continuous sequence. Apart from tests, other applications can be started, an oscilloscope can be integrated or a message box opened. As a LIBRARY module, pre-defined test routines are available from EMC PARTNER. These cover DO-160 and MIL-STD-461.

## Control of a DSO



A DSO module is available to extend the basic TEMA3000 software package. DSOs with Ethernet and USB interfaces can be controlled from TEMA3000 software. Apart from setting timebase and amplitude, measurement features in the DSO can also be accessed and measurement results added to the test report. Tektronix, Keysight, Lecroy and Rohde & Schwarz models are supported as standard.

## Test Report Generation

TEMA3000 basic module generates a HTML format test report. The basic software can be extended with the PROTOCOL module which enables transfer of report data as .csv files for import into EXCEL®, odt. files for export into WORD, custom report formatting and final reports generated as Adobe® .pdf files.

## Web Server



Use any PC with any operating system and internet browser to connect to the internal web server. This enables access to test report and service data either directly on a PC internet browser or using the USB memory stick. Customize the test report by uploading company logo and test information from the USB memory stick. Conversely, test report and service information can be saved directly to the USB memory stick. Communication with a PC is by Ethernet, which again reduces dependency on obsolete or expensive interfaces.

Remote control from a PC is best achieved with the OPTICAL LINK and the TEMA3000 software package.

# 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, -13, -14, -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.

## 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:

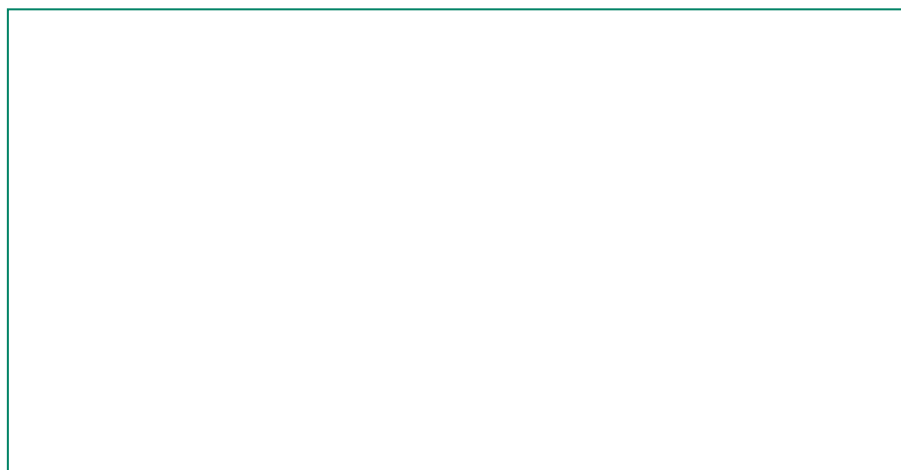
**[www.emc-partner.com](http://www.emc-partner.com)**

### **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**



Information and specifications in this document are an indication of capability only. Technical performance is given in the EMC PARTNER AG Technical specification for the corresponding instruments. Version 02.2016. Subject to change without notice. .