

## DO-160 & MIL-STD-461G Indirect Lightning Test System AVI3000



This document has been optimized for electronic media



Smart navigation through technical specifications. Click the green links.



#### Accredited Calibration

Quality at EMC PARTNER is based on an ISO 9001 management system. This is the foundation for an ISO 17025 accreditation verified by the Swiss Calibration Service (SCS). SCS No. 146 is the accreditation number of EMC PARTNER AG. Locally accredited but recognized worldwide through affiliation with the ILAC organisation



#### WHEN GETTING RESULTS MATTERS

## THERE IS ONLY ONE CHOICE

Military and avionic testing is all about quality and precision. AVI3000 brilliantly fulfills these requirements.

A flexible solution that includes:

- > MIL-STD-461: CS117, Level 1 (internal equipment)
- > RTCA DO-160: SECTION 22, Level 3
- > EUROCAE ED-14: SECTION 22, Level 3

Ease of use, compact size and large aperture coupler makes AVI3000 the most efficient and technically advanced instrument in this category.

## MULTI TALENTED SOLUTION

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



#### AVI3000 Test System

• AVI3000 compact unit

#### **Test Accessories**

• CN-BT7

Only one couplter for all 5 waveforms. No change of the EUT cable. Aperture (55x80mm)

#### CN-GI-CI-V

Voltage coupler for WF4 cable bundle testing. Aperture (60x120mm)

Included Benefits		
Stable	Pulse reproducibility during test cycle	
Precise	Repeatable test results over long time	
Fast	Minimum setup and calibration time	
Flexible	User selectable MS and MB timing	
Polarity	Maintain test integrity by electronic switching	
Automated	Save and repeat test routines.	

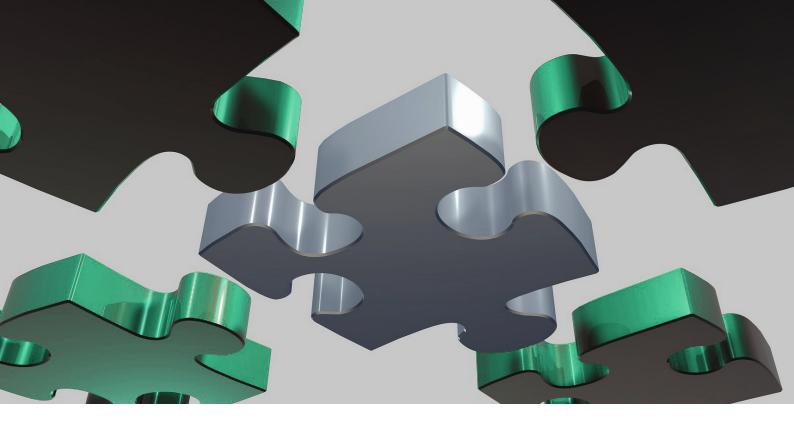
Pre-programmed Multiple Stroke (MS) and Multiple Burst (MB) functions

## AVAILABLE CIRCUITS

AVI3000 is a compact unit that includes all waveforms for RTCA DO-160: Section 22 and MIL-STD-461G: CS117 testing. All event types are available: PIN Injection, Cable Injection and Ground Injection

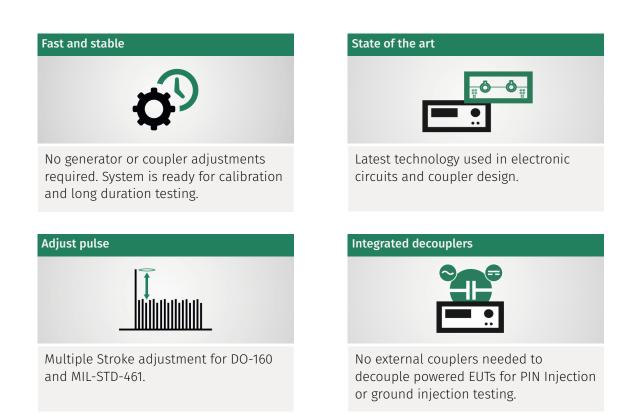
	Waveform 1 (6.4/69µs)	MIL-STD-461 / CS117
	Current Impulse	
	<ul> <li>Cable Bundle Single Stroke</li> </ul>	
	<ul> <li>Cable Bundle Multiple Stroke</li> </ul>	
Ν	Waveform 2 (0.1 and 0.3/6.4µs)	RTCA DO-160 / S.22
	Voltage Impulse	MIL-STD-461 / CS117
	<ul> <li>Cable Bundle Single Stroke</li> </ul>	
	<ul> <li>Cable Bundle Multiple Stroke</li> </ul>	
111100	Waveform 3 (1MHz & 10MHz)	RTCA DO-160 / S.22
	Voltage & Current Impulse	MIL-STD-461 / CS117
	> PIN injection	
	Cable Bundle Single Stroke	
	<ul> <li>Cable Bundle Multiple Stroke</li> <li>Cable Bundle Multiple Burst</li> </ul>	
	Waveform 4 (6.4/69µs)	RTCA DO-160 / S.22
		MIL-STD-461 / CS117
	Voltage Impulse <ul> <li>PIN Injection</li> </ul>	
	<ul> <li>Ground Injection Single Stroke</li> </ul>	
	<ul> <li>Ground Injection Multiple Stroke</li> </ul>	
$\land$	Waveform 5A (40/120µs)	RTCA DO-160 / S.22
	Current Impulse	MIL-STD-461 / CS117
	> PIN Injection	
	<ul> <li>Cable Bundle Single Stroke</li> </ul>	
	Cable Bundle Multiple Stroke	
$\bigwedge$	Waveform 6 (0.25/4µs)	RTCA DO-160 / S.22 MIL-STD-461 / CS117
	Current Impulse	MIL-31D-401/ C311/

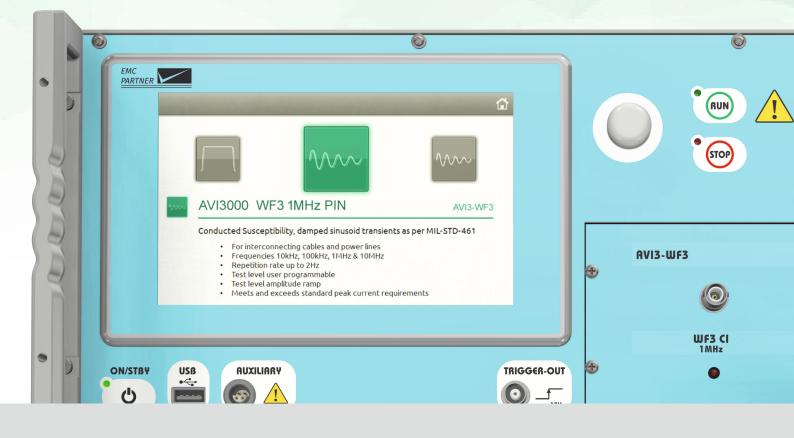
Cable Bundle Multiple Burst >



## UNIQUE FEATURES

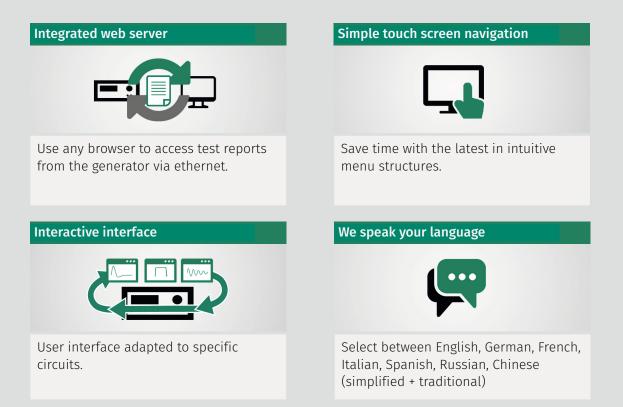
Leading technology - New designs take advantage of latest innovations.





## EPOS - TOUCH THE FUTURE

EMC PARTNER Operating System (EPOS) is an independant software with free-of-charge updates for lifetime. EPOS is based on a full colour graphic interface and easy to follow onscreen graphics. Pop-up help gives information when needed, directly during the setting process. EPOS is full of features found only in top of the range instrumentation.





## TEMA3000 SOFTWARE SUITE

The best solution for professional EMC Test Labs enables comfortable test setups, easy parameter changes and customizable test reports and DSO integration.



- > Customize & edit your protocols
- > Export to multiple file formats
- > Integrate DSO measurements



- > Minimal learning time
- > Integrated assistant function

#### Manage tests and sequences

►		STANDARD 1
•		STANDARD 2
	-	📒 TEST 1
		🕨 🚞 LEVEL 1
		EVEL 2
		🕨 🚞 LEVEL 3
	•	TEST 2
•		STANDARD 3
•		CTANDADD 4
	-	

- > Predefined test setups
- Save and load own tests and sequences



- > Transfer tests / reports to PC
- > Remote control from computer

## Other systems for indirect lightning PIN injection & Cable bundle tests

DO-160 section 22 MIL-STD-461 CS117 Aircraft OEM specific standards Established worldwide

## www.emc-partner.com



## **Technical Specifications**

## TEST SYSTEM

DO-160 G SECTION 22 LEVEL 3 & MIL-STD-461G CS117 LEVEL 1 (INTERNAL EQUIPMENT)

Test equipment	DO-160G Section 22 level 3	MIL-STD-461G CS117 level 1 (internal equip.)
AVI3000	$\checkmark$	✓
Accessories & coupling devices		
DN-LISN160-32	$\checkmark$	✓
SHUNTOE1	✓	✓
V-PROBE-SI	✓	✓
I-PROBE-MB-P1	✓	✓
CN-BT7	✓	✓
CN-GI-CI-V	optional	✓
Software		
TEMA3000 & Modules	✓	✓

## TEST SYSTEM

#### 1. AVI3000 TEST SYSTEM

#### AVI3000 circuit: WF1 cable induction

Standards	DO-160G S22, MIL-STD-461G CS117, other
Coupling mode	Cable Induction (CI)
Current waveform WF1	6.4 μs ± 20 % / 69 μs ± 20 %
Test level	specified at coupler output
Test level single stroke	25 A - 900 A +20%, -0%
Test level multiple stroke	25 A – 900 A +20%, -0% (first stroke)
	20 A – 300 A +50%, -0% (subsequent stroke)
Pulse repet. single stroke	up to 2 / 1 s @ 25 A, 1 / 7 s @ 900 A
Polarity	positive, negative, alternating
Programmable ramp	current
Requires	CN-BT7



#### AVI3000 circuit: WF2 cable induction

Standards	DO-160G S22, MIL-STD-461G CS117, other
Coupling mode	Cable Induction (CI)
Voltage waveform WF2	rise time: < 100 ns or < 340 ns selectable
	pulse duration: 6.4 µs ± 20 %
Test level	specified at coupler output
Test level single stroke	25 V - 1600 V +20%, -0%
Test level multiple stroke	25 V – 700 V +20%, -0% (first stroke)
	25 V – 350 V +50%, -0% (subsequent stroke)
Pulse repet. single stroke	up to 2 / 1 s @ 25 V, 1 / 1.5 s @ 1600 V
Polarity	positive, negative, alternating
Programmable ramp	voltage
Requires	CN-BT7

#### AVI3000 circuit: WF3, 1 MHz, pin injection

Standards	DO-160G S22, other
Coupling mode	pin injection / direct application
Output impedance	25 Ω
Voltage, current WF3	frequency: 1 MHz ± 20 %
	damping: 25 – 75 % (1st to 5th peak)
Test level	specified at application point
Test level single stroke	100 V - 750 V +10%, -0%
	4 A – 30 A +10%, -0% in short circuit
Pulse repet. single stroke	up to 2 / 1 s @ 100 V – 750 V
Polarity	positive, negative, alternating
Synchronization	automatic on power peak or 0 – 359°, step 1°
Programmable ramp	voltage
EUT max. AC-voltage	230 V

Test System | Accessories & Coupling Devices

EUT max. supply frequency	800 Hz	
EUT max. DC-voltage	± 50 V	

#### AVI3000 circuit: WF3, 1 MHz, cable induction

Standards	DO-160G S22, MIL-STD-461G CS117, other
Coupling mode	Cable Induction (CI)
Voltage, current WF3	frequency: 1 MHz ± 20 %
	damping: 25 – 75 % (1st to 5th peak)
Test level	specified at coupler output
Test level single stroke	50 V - 1900 V +20%, -0%
Test level multiple stroke	50 V – 1900 V +20%, -0% (first stroke)
	50 V – 1000 V +50%,-0% (subseq. stroke)
Test level multiple burst	50 V - 700 V +20%, -0%
Pulse repet. single stroke	up to 2 / 1 s @ 100 V – 750 V
Polarity	positive, negative, alternating
Programmable ramp	voltage
Requires	CN-BT7

#### AVI3000 circuit: WF3, 10 MHz, cable induction

Standards	DO-160G S22, MIL-STD-461G CS117, other
Coupling mode	Cable Induction (CI)
Voltage, current WF3	frequency: 10 MHz ± 20 %
	damping: 25 – 75 % (1st to 5th peak)
Test level	specified at coupler output
Test level single stroke	50 V - 1100 V +20%, -0%
Test level multiple stroke	50 V – 1100 V +20%, -0% (first stroke)
	50 V – 800 V +50%, -0% (subsequent stroke)
Test level multiple burst	50 V - 800 V +20%, -0%
Pulse repet. single stroke	up to 2 / 1 s @ 100 V – 1100 V
Polarity	positive, negative, alternating
Programmable ramp	voltage
Requires	CN-BT7

#### AVI3000 circuit: WF4, pin injection

Standards	DO-160G S22, other
Coupling mode	pin injection / direct application
Output impedance	5 Ω
Voltage, current WF4	6.4 μs ± 20 % / 69 μs ± 20 %
Test level	specified at application point
Test level single stroke	50 V - 500 V +10%, -0%
	10 A – 100 A +10%, -0% in short circuit
Pulse repet. single stroke	up to 2 / 1 s @ 50 V, 1 / 3 s @ 500 V
Polarity	positive, negative, alternating
Synchronization	automatic on power peak
Programmable ramp	voltage
EUT max. AC-voltage	230 V
EUT max. supply frequency	800 Hz
EUT max. DC-voltage	± 50 V

#### AVI3000 circuit: WF4 ground injection

Standards	DO-160G S22	
Coupling mode	Ground Injection (GI)	
Voltage waveform WF4	6.4 μs ± 20 % / 69 μs ± 20 %	
Test level	specified at application point	
Test level single stroke	10 V - 1600 V +20%, -0%	
Test level multiple stroke	10 V – 800 V +20%, -0% (first stroke)	
	10 V – 400 V +50%, -0% (subsequent stroke)	
Pulse repet. single stroke	up to 2 / 1 s @ 50 V, 1 / 9 s @ 1600 V	
Polarity	positive, negative, alternating	
Programmable ramp	voltage	
EUT max. power	230 V / 16 A AC 50 – 800 Hz and DC	

#### AVI3000 circuit: WF4 cable induction

Standards	MIL-STD-461G CS117, other
Coupling mode	Cable Induction (CI)
Voltage waveform WF4	6.4 μs ± 20 % / 69 μs ± 20 %
Test level	specified at coupler output
Test level single stroke	max. 10 V – 600 V +20%, -0%
Test level multiple stroke	max. 10 V – 300 V +20%, -0% (first stroke)
	max. 10 V – 150 V +50%, -0% (subsequent stroke)
Pulse repet. single stroke	up to 1 / 8 s @ 600 V
Polarity	positive, negative, alternating
Programmable ramp	voltage
Requires	CN-GI-CI-V

#### AVI3000 circuit: WF5A, pin injection

Standards	DO-160G S22, other
Coupling mode	pin injection / direct application
Output impedance	1 Ω
Voltage, current WF5A	40 µs ± 20 % / 120 µs ± 20 %
Test level	specified at application point
Test level single stroke	50 V - 500 V +10%, -0%
	50 A – 500 A +10%, -0% in short circuit
Pulse repet. single stroke	up to 2 / 1 s @ 50 V, 1 / 5 s @ 500 V
Polarity	positive, negative, alternating
Synchronization	automatic on power peak
Programmable ramp	voltage
EUT max. AC-voltage	230 V
EUT max. supply frequency	800 Hz
EUT max. DC-voltage	± 50 V

#### AVI3000 circuit: WF5A cable induction

Standards	DO-160G S22, MIL-STD-461G CS117, other
Coupling mode	Cable Induction (CI)
Current waveform WF5A	40 μs ± 20 % / 120 μs ± 20 %
Test level	specified at coupler output
Test level single stroke	30 A - 1800 A +20%, -0%
Test level multiple stroke	30 A – 1800 A +20%, -0% (first stroke)
	20 A – 390 A +50%, -0% (subsequent stroke)
Pulse repet. single stroke	up to 2 / 1 s @ 50 A, 1 / 14 s @ 1800 A
Polarity	positive, negative, alternating
Programmable ramp	current
Requires	CN-BT7

#### AVI3000 circuit: WF6 cable induction

Standards	DO-160G S22, MIL-STD-461G CS117, other
Coupling mode	Cable Induction (CI)
Current waveform WF6	0.25 μs ± 20 % / 4 μs ± 20 %
Test level	specified at coupler output
Test level single stroke	2.5 A - 75 A +20%, -0%
Test level multiple burst	2.5 A - 75 A +20%, -0%
Pulse repet. single stroke	up to 2 / 1 s @ 5 A – 75 A
Polarity	positive, negative, alternating
Programmable ramp	current
Requires	CN-BT7

#### AVI3000 control features

Operating system	EPOS proprietary firmware
Languages	8 menu languages, selectable
User interface	7" colour touch display
Connectivity	ethernet, USB, RS485
Programmable patterns	DO-160, multiple stroke, multiple burst, custom
Trigger out	BNC, max. 15 V
Trigger in	auto, manual, external (BNC input)
Synchro. source	EUT Power
Power synchro.	automatic peak synchronisation as per norm
Emergency stop	Emergency button on front panel, safety circ.
Emergency stop	Emergency button on front panel, safety circ.

#### AVI3000 supply, weight, dimensions, climatic conditions

Operating voltage	100 V - 240 V ± 10% (50/60 Hz)
Power consumption	ON < 400 VA, standby < 15 VA
Weight	50 kg
Wxdxh	45 x 60 x 37 cm
Version	19" unit, 8 UH
Temperature range	10 – 35 °C
Humidity	< 80 % non-condensing
Air pressure	86 – 106 kPa
Included articles	
Power cord	with country plug
User manual	with conformity declaration
Calibration certificate	factory calibration

#### AVI3000 accessories

DN-LISN160-32
SHUNT0E1, for WF2 and WF3 short circuit
V-PROBE-SI, common and differential mode
I-PROBE-MB-P1
CN-BT7, for WF 1, 2, 3, 5A, 6
CN-GI-CI-V, for WF4 in MIL-STD-461G, CS117
TEMA3000 and modules

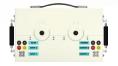
## COUPLING DEVICES

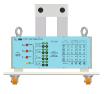
#### CN-BT7

Application	coupling device for AVI3000 / cable induction
Suitable for waveforms	WF1, WF2, WF3, WF5A, WF6
Turn ratio	1:1
EUT voltage max.	500 V AC or DC
EUT current max.	16 A / 800 Hz (when testing WF2)
	32 A / 400 Hz (when testing WF2)
	32 A / 800 Hz (when testing all other WFs)
	426 A / 50-60 Hz (when testing all other WFs)
Aperture	5.5 x 8 cm
Dimensions	34 x 18 x 21 cm
Weight	18 kg
For generator	AVI3000



Standards	MIL-STD-461G CS117, DO-160G S22, other
Application	injection probe for WF4, WF5A (voltage) in
	cable induction mode
Test level WF4 (CI)	max. 600 V with AVI3000
Test level WF5A (CI)	max. 600 V with AVI3000
EUT supply	max. 130 A @ 50-60 Hz with AVI3000
	max. 20 A @ 400 Hz with AVI3000
	max. 10 A @ 400 Hz with AVI3000
Aperture	6 x 12 cm
Dimensions	53 x 65 x 50 cm
Weight	190 kg
For generators	AVI3000, MIG0600MS, MIG0618SS
Included	connection cables





## ACCESSORIES

#### SHUNT0E1

Application	calibration of WF2, WF3 short circuit current
Impedance	0.1 Ω ± 2 %
Output	100 mV/A
Maximum setting AVI3000	WF2: 1600 V, WF3: 1900 V
Weight	0.15 kg
Dimensions	12 x 2.5 x 2.5 cm
Requires	AVI3000, CN-BT7

#### V-PROBE-SI

Standards	DO-160G S22, MIL-STD-461G CS117, other
Type of probe	differential (can measure CM as well)
Input voltage	max. 7 kV DC + peak, max. 2.5 kV r.m.s.
Waveforms	all AVI3000 waveforms and voltage test levels
Bandwidth	DC – 70 MHz (-3 dB)
Accuracy	± 2 %
Input impedance	10 MΩ    10 pF
Attenuation ratio	1:100 or 1:1000
Power supply	4 x AA batteries and/or mains adapter
Weight	1.5 kg (packed)
Dimensions	29 x 34 x 8 cm (packed)
For generator	AVI3000
Included	carrying case, mains adapter, AA batteries





#### I-PROBE-MB-P1

DO-160G S22, MIL-STD-461G CS117, other
measurement of SC current / clamp on probe
50 Ω (BNC connector)
max. 100 A r.m.s., max. 5 kA impulse
all AVI3000 current waveforms
5 Hz – 15 MHz
0.1 V/A into 1 MΩ
+ 1 / - 0 %
0.5 As
3.5 A/Hz
25 ns
1 ΜΩ ΑC
1.68 kg
12 x 13 x 4 cm (inner diameter 5 cm)
AVI3000, MIG-OS-MB, other
carrying case



Test System | Accessories & Coupling Devices

#### **DN-LISN160-32**

Standards	DO-160G S22, MIL-STD-461G CS117, other
Application	Line Impedance Stabilization Network (5 µH)
Inductance	5 $\mu$ H per line (for both AC and DC lines)
Capacitance	10 $\mu$ F included, 33000 $\mu$ F included
	LISN is calibrated with capacitors connected
Number of lines	2 AC lines (L, N or L1, L2), 2 DC lines (+ / -)
AC voltage max.	L-N: 480 V @50/60 Hz, L-PE: 280 V @50/60 Hz
	L-N: 150 V @ 400 Hz, L-PE: 85 V @ 400 Hz
AC current max.	32 A
DC voltage max.	50 V
DC current max.	32 A
EUT protection	yes, at 275 V
Weight	13 kg
Dimensions	45 x 57 x 19 cm, 19" unit, 4 UH
For generators	AVI3000,MIG0600MS,MIG0618 SS,MIG-OS-MB
Requirements	for 3-phase EUTs, two pieces are required



### SOFTWARE

#### **TEMA3000**

Suitable for generator	AVI3000
Type of license	modular:
	TEMA3000 basic license (remote control)
	TEMA3000 REPORT (automatic test report)
	TEMA3000 DSO (DSO control, supports most
	current oscilloscopes on Ethernet)
	TEMA3000 LIBRARY (pre-programmed
	test levels according to standards)
Operating system required	Windows, latest
Communication port	ethernet
Updates	lifetime updates at no additional cost
Latest version	available on EMC PARTNER website

## NOTES

Test System | Accessories & Coupling Devices

# **Tradition meets** Technology

Over 20 years devoted to combining latest technologies into the best products.

100% Swiss made products



# Specific EMC test requirements ?

Search & find your required test equipment with our powerful **QUICK SELECTOR** tool at

www.emc-partner.com

MC NRTNER				Q search	
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Search pro	ard: IEC, ITU, MIL-STD,	EN, DO-160, Airbus &		□ MIL-STD-461 / CS117	Search Product by - Standard - Application
□ ABD0100.1.8.1 □ ANSI / IEEE 62.45 □ ANSI C37.90	<ul> <li>IEC 60335-1</li> <li>IEC 60384-14</li> <li>IEC 60571</li> </ul>	□ IEC 61000-4-4 □ IEC 61000-4-5 □ IEC 61000-4-8	□ ISO 10605 □ ITU-T K.20 □ ITU-T K.21	MIL-STD-461 / CS118     MIL-STD-883     NMI M6 Section A.219	- Impulse - Keyword
ANSI C62.41 ANSI C63.16 DC 10614 EN 50121-3-2	□ IEC 60664-1 □ IEC 60950-1 □ IEC 61000-3-2 □ IEC 61000-3-3	□ IEC 61000-4-9 □ IEC 61008-1 □ IEC 61009-1 □ IEC 61010-1	□ ITU-T K.22 □ ITU-T K.44 □ ITU-T K.45 □ JASO D 001-94	Renault 32-10-001/D     Renault 32-10-035/A     RTCA D0-160 - Section 17     RTCA D0-160 - Section 19	or send us your concrete inquiry directly via website
EN 50121-4 EN 50155 EUROCAE/ED-14	<ul> <li>IEC 61000-4-10</li> <li>IEC 61000-4-11</li> <li>IEC 61000-4-12</li> </ul>	☐ IEC 61051-1 ☐ IEC 61180-1 ☐ IEC 61180-2 ☐ IEC 61340-3-1	JESD22-A114-B     JESD22-A115-A     MIL-DTL-23659D     MIL-STD-1512	TTCA D0-160 - Section 22     TTCA D0-160 - Section 25     SAE J551-15     STANAG 4239	
□ FAA AC 20 -136 □ IEC 60060-1	□ IEC 61000-4-16 □ IEC 61000-4-18 □ IEC 61000-4-19	□ IEC 61340-3-1 □ IEC 61340-3-2 □ IEC 61439	MIL-STD-1541     MIL-STD-331     MIL-STD-461 / CS106	□ UL 1414 □ UL1449 □ VDE 0675 Teil 6	

## THE EMC PARTNER PRODUCT RANGE

Find further brochures on our website emc-partner.com/brochures or contact your local representative for a hardcopy.

#### **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 EURO-CAE / ED-14 for indirect lighting on aircraft systems, MIL-STD-461 tests CS106, CS115, CS116, CS117, CS118 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, electricity 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 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. PS3-SOFT-EXT complies with IEC / EN 61000-4-14 and -4-28.

#### SERVICE

Our committment starts with a quality management system backing up our ISO 17025 accreditation. With the SCS number 146, EMC PARTNER provides accredited calibration and repairs. Our customer support team is at your service!













For further information please do not hesitate to contact your local EMC PARTNER AG representative Visit our website for more information and contact details.

## www.emc-partner.com

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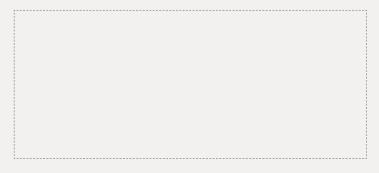
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#### Your local representative



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