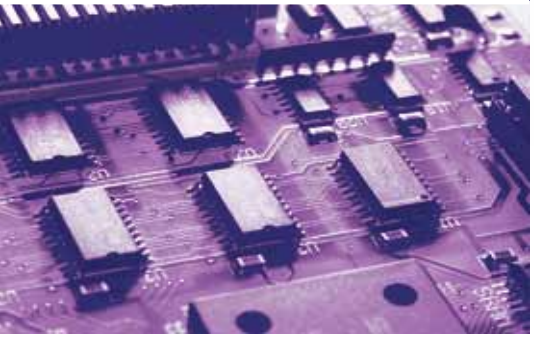
Lightning Tests



EMC - PARTNER

Avionics Test System

Avionics Test System Overview

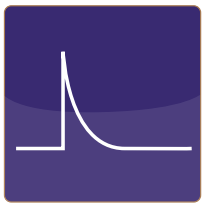
Multi Talented System easily expandable

The requirements of DO-160 Section 22 are encapsulated in the basis system design. Test requirements for OEMs can be easily met by extending the system with additional components. All accomplished at the user premises without any system down time.

MIG0600SS

PN: 103567

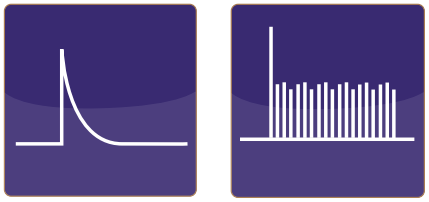
DO-160 WF1, 4, 5A, 5B
PIN injection and Single Stroke waveforms.
PIN injection up to Level 5
Single Stroke Cable Bundle up to Level 3



MIG0600MS

PN: 103509

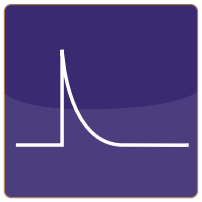
DO-160 WF1, 4, 5A, 5B
PIN injection, Single Stroke and Multiple Stroke waveforms.
PIN injection up to Level 5
Single Stroke Cable Bundle up to Level 3
Multiple Stroke Cable Bundle up to Level 5



MIG0618SS

PN: 103566

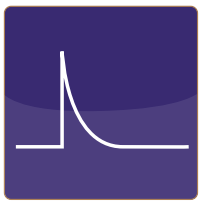
DO-160 WF1, 4, 5A
PIN injection and Single Stroke waveforms.
PIN injection Level 4 and Level 5
Single Stroke Cable Bundle Level 3 to Level 5



MIG3618SS

PN: 103681

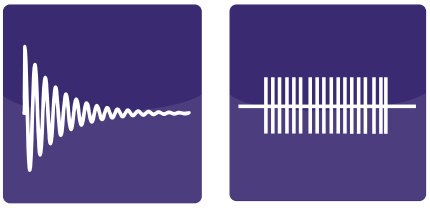
DO-160 WF1
For complete aircraft tests metallic and composite.
Maximum energy 26kJ at 5kA impulse



MIG-OS-MB

230V PN: 103510 115V PN: 103583

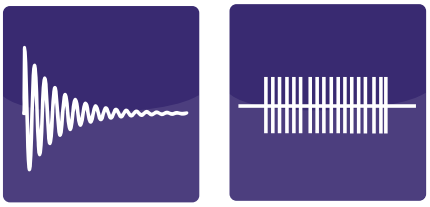
DO-160 WF2, WF3
PIN injection, Single Stroke, Multiple stroke and Multiple Burst waveforms
PIN injection Level 1 to 3
Single Stroke Cable Bundle Level 1 to 3
Multiple Stroke Cable Bundle Level 1 to 3
Multiple Burst Cable Bundle Level 1 to 5



MIG-OS-MB-EXT

230V PN: 103550 115V PN: 103585

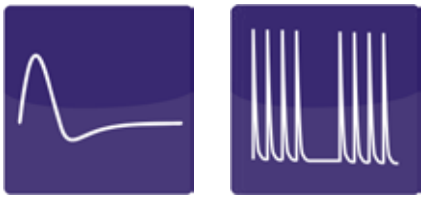
DO-160 WF2, WF3, WF6
PIN injection, Single Stroke, Multiple stroke and Multiple Burst waveforms
PIN injection Level 4 & 5
Single Stroke Cable Bundle Level 4 & 5
Multiple Stroke Cable Bundle Level 4 & 5
Multiple Burst Cable Bundle Level 1 to 5



MIG2000-6

PN: 103519

DO-160 Section 17 & Section 19
Modular System to address the Voltage Spike and Induced Signals requirements.
Refer to MILITARY TEST SYSTEM brochure for further details.



Features

Easy Operation

User interface on instrument front panel
Software control from a computer
Automatically switch between waveforms
Electronic Polarity change automation

Modular System

Easy expansion to meet new requirements
Range of accessories to meet OEM requirements
Specialist accessories for large cable installations
Add non standard waveform 3 frequencies

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 System 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 system components can be added at any time
No hardware down time

Best Performance

Maximum test LEVELS
Includes all waveforms
Automation of test process
Cost effective solution

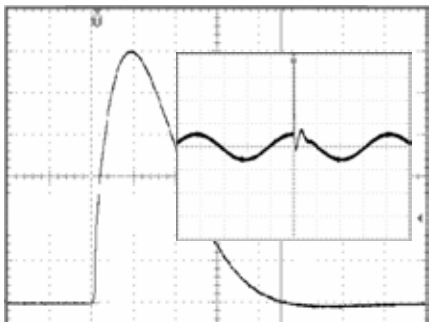
Turn-Key Solution

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

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



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. SYNC-ADAPTER fits to all EMC PARTNER impulse generators, making it fast and easy to synchronise to any phase angle with 1° accuracy.

Airbus Couplers

ABD0100.1.2 requirement for the A350 range specifies tests using fixed system impedances for Waveforms, 2, 3, 4 and 5A. EMC PARTNER has developed a range of couplers, that extend the standard DO-160 test system to meet these requirements. All tests are performed using PIN injection waveforms (voltage and current identical) injected using the cable bundle method. The following waveforms are required:

Waveform 2 up to 1600V 15 ohm and 25 ohm

Waveform 3 up to 3200V 25 ohm

Waveform 5A up to 2000V 1 ohm

Waveform 4 & 5 Voltage Impulse Coupler

DO-160 specifies Waveform 5 as a current waveform with I_T up to 5000A. There are some special cases that require the application of Waveform 5A as a voltage impulse to directly stress the core wires in a cable bundle. In such cases, the V_L (1600V) becomes the test requirement. CN-GI-CI-V was developed at EMc PARTNER to address this need. It can be used to test with the following impulses:

Waveform 4 up to 1600V

Waveform 5A up to 2000V

Waveform 5B up to 300V

Large Diameter Cable Couplers

Some applications use particularly large cable budles that cannot easily be separated out. In such conditions, it is not possible to use the standard DO-160 couplers and turn the EUT cable around the coupler secondary. EMC PARTNER have developed special couplers where the cable bundle is kept in a straight line. They can be used for cables up to 8cm in diameter and reach the following levels:

Waveform 1 up to 3,200A

Waveform 4 up to 1,600V

Waveform 5A up to 5000A

Waveform 5B up to 5000A

Applicable Standards

Radio Technical Commission for Aeronautics (RTCA)

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

- Section 17: Voltage Spike.
- Section 19: Induced Signal Susceptibility.
- Section 22: Lightning Induced Transient Susceptibility.
- Section 25: Electrostatic Discharge (ESD).

European Organisation for Civil Aviation Equipment (EUROCAE)

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

- Section 17: Voltage Spike.
- Section 19: Induced Signal Susceptibility.
- Section 22: Lightning Induced Transient Susceptibility.
- Section 25: Electrostatic Discharge (ESD)

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

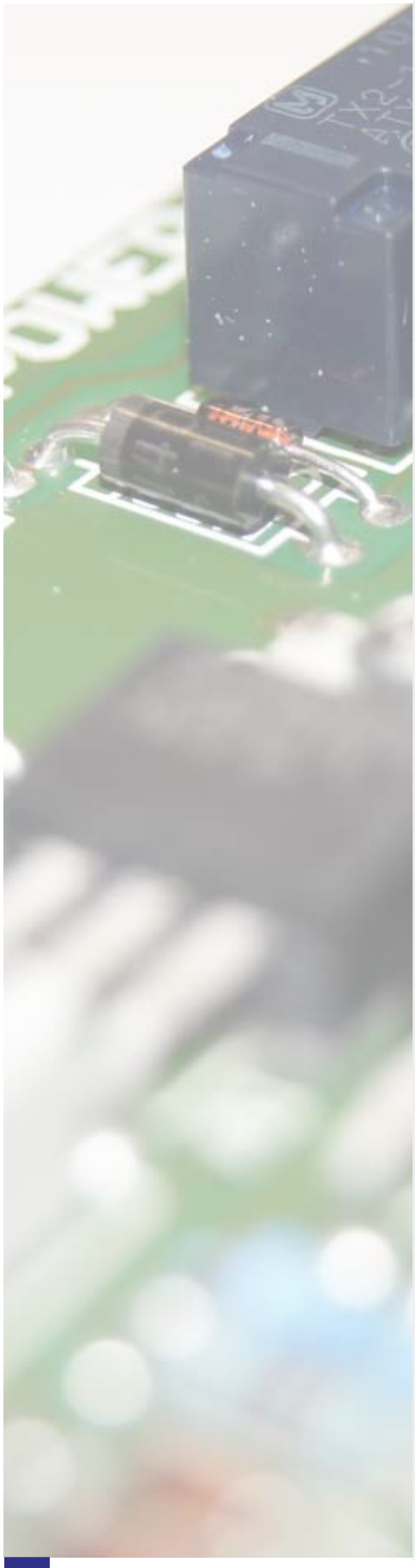
ARP 5415 User's Manual for Certification of Aircraft Electrical/Electronic Systems for the Indirect Effects of Lightning

ARP 5416 Aircraft Lightning Test Methods

Military Procurement Standards (MIL)

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

Generator Specifications



MIG0600SS and MIG0600MS

DO-160 Waveforms	WF1, WF4, WF5A & WF5B
WF1 - 6.4/70µs	20A up to 1800A (3200A)
WF4 - 6.4/70µs PIN Injection	70V up to 1700V / 340A
WF4 - 6.4/70µs Ground injection	65V up to 1700V
WF5A - 40/120µs PIN injection	75V up to 1650V / 1650A
WF5A - 40/120µs Cable bundle	80A up to 3000A (10000A)
WF5B - 50/500µs Cable bundle	75A up to 2000A (5000A)

MIG0600MS only

Multiple Stroke pulse spacing	10ms up to 500ms
Stroke duration	0.01 up to 50s
Repetition	60 up to 999s
Maximum pulses	25 every 10 s
Multiple stroke pattern	DO-160 & User programmable

MIG0618SS (Level 4 and 5 Extension)

DO-160 Waveforms	W1, W4 & W5A
WF1 - 6.4/70µs	250A up to 4000A
WF4 - 6.4/70µs PIN injection	125 up to 3400V / 680A
WF4 - 6.4/70µs Ground injection	125 up to 3400V
WF5A - 40/120µs PIN injection	125 up to 3200V / 3200A
WF5A - 40/120µs Ground injection	400A up to 6000A (10000A)

Figures in brackets represent maximum test level including coupler.

MIG-OS-MB

Single Stroke

DO-160 Waveforms	WF2 & WF3
WF2 - 0.1/6.4us Cable bundle	40V up to 1700V
WF3 - 1MHz PIN injection	80V up to 600V / 24A
WF3 - 1MHz Cable bundle	80V up to 600V
WF3 - 10MHz Cable bundle	80V up to 600V

Multiple Stroke

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 & User programmable

Multiple Burst

Pulse spacing	50µs up to 1000µs
Burst repetition	30 up to 300ms
Burst pattern	1 burst of 20 pulses 3 repetitions

Generator Specifications

MIG-OS-MB-EXT (Level 4 & 5 Extension)

DO-160 Waveforms	WF2, WF3 & WF6
WF2 - 0.1/6.4us	750 up to 5000V
WF3 - 1MHz	1000 up to 5700V
WF3 - 10MHz	1000 up to 4500V
WF6 - 0.25/4us	5 up to 160A

Single Stroke

WF2 - 0.1/6.4us	750 up to 5000V
WF3 - 1MHz	1000 up to 5700V
WF3 - 10MHz	1000 up to 4500V

Multiple Stroke

Pulse spacing	10ms up to 200ms
Duration	0.01 up to 2s
Repetition	2 up to 999s
Maximum pulses	30 every 2s
Stroke pattern	14 pulses

Multiple Burst

Pulse spacing	50µs up to 1000µs
Burst repetition	30 up to 300ms
Burst pattern	1 burst of 20 pulses 3 repetitions

MIG2000-6

DO-160 Section 17

FX-DO160-S17	Voltage Spikes
Amplitude range	100 to 1100V
Source Impedance	50ohm
Coupling	Serial injection using CN-MIG-BT

DO-160 Section 19

Fx-DO160-S19	Induced Signal Susceptibility
Amplitude range	100 to 1000V
Spike duration	4µs
Burst duration	250µs

Please refer to MILITARY Test System brochure for further information.

ESD3000

DO-160 Section 25

ESD3000 + DN1	ElectroStatic Discharge
Amplitude range	100 to 30,000V
Discharge Modes	Air and Contact
Holding Time	5 s

Please refer to ESD Test System brochure for further information.

Accessories and Options

Avionic Test System - Selection Guide

	MIG0600MS / SS	MIG0618SS	MIG-OS-MB	MIG-OS-MB-EXT	MIG2000-6	Test Accessories	NW-WF2 FS	NW-WF2 SS	NW-WF3-1M-FS	NW-WF3-1M-SS	NW-WF3-10M-SS	NW-WF3-10M-FS	CN-GI-CI	CN-GI-CI-V	CN-MIG-BT / BT5	CN-MIG-BT3	NW-MS-LEVEL1	Fx-DO-160-S17	FX-DO-160-S19
DO-160 S22 - Level 3 Pin Injection	●		●														●	●	
DO-160 S22 - Level 5 Pin Injection	●	●		●					●						●			●	
DO-160 S22 - Level 3 Single Stroke	●		●										●	O	●		●		
DO-160 S22 - Level 5 Single Stroke		●		●			●		●		●		●	O		●			
DO-160 S22 - Level 3 Multiple Stroke	●		●										●	O	●		●		
DO-160 S22 - Level 5 Multiple Stroke	●			●			●	●	●	●	●	●	●	O		●			
DO-160 S22 - Multiple Burst			●												●				
DO-160 S17 - Voltage Spike					●									O				●	
DO-160 S19 - Induced					●														

O = Option

CN-GI-CI

CN-GI-CI-V

DO-160 Specific Accessories

CN-GI-CI

Current coupling transformer used with WF1, WF5A and WF5B. Application: For cable bundle and ground injection in accordance with DO160 section 22.

CN-GI-CI-V

Voltage coupling transformer used with WF4, WF5A and WF5B. Application: For cable bundle and ground injection in accordance with 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.

OPTION-V to CN-GI-CI

Extends current coupling transformer CN-GI-CI for voltage testing up to level 3 used with WF4 and WF5A. Application: For cable bundle and ground injection in accordance with DO160 section 22.

MIG-OS-MB and EXTENSION

MIG-OS-MB-EXT

This extension enhances MIG-OS-MB's capability by increasing test levels and including additional waveforms. The extension is automatically recognised and controlled by the MIG-OS-MB firmware. The following plug-ins are available for the extension:

MIG-OS-MB-EXT

NW-WF2-FS

Waveform WF2: 0.1/6.4µs extends the MIG-OS-MB to level 5 for single stroke or first stroke testing.

NW-WF2-SS

Waveform WF2: 0.1/6.4µs extends the MIG-OS-MB to level 5 for subsequent stroke testing.

MS definition: 1A 100%, 23D/2 50% within 2 seconds randomly distributed from 50ms up to 110ms. Requires NW-WF2-FS.

NW-WF3-1M-FS

Waveform WF3: 1MHz extends the MIG-OS-MB to level 5 for single stroke and first stroke testing. No burst possible.

NW-WF3-1M-SS

Waveform WF3: 1MHz extends the MIG-OS-MB to level 5 subsequent stroke testing. No burst possible.

MS definition: 1A 100%, 13D/2 50% within 1.5 seconds randomly distributed from 50ms up to 110ms. Requires NW-WF3-1M-FS.

MIG-OS-MB with MIG-OS-MB-EXT

NW-WF3-10M-FS

Waveform WF3: 10MHz extends the MIG-OS-MB for single stroke and first stroke testing. No burst possible.

NW-WF3-10M-SS

Waveform WF3: 10MHz extends the MIG-OS-MB for subsequent stroke tesing. No burst possible.

MS definition: 1A 100%, 13D/2 50% within 1.5 seconds randomly distributed from 50ms up to 110ms. Requires NW-WF3-10M-FS.

NW-WF6H-MB

Waveform 6H: 0.224/4µs impulse.14 pulses multiple burst only.

Custom Networks

In addition to the standard DO-160 waveforms, customer specific networks can be made on request.

Examples of some custom networks already made:

- Waveform 3 Single Stroke, 1.5MHz
- Waveform 3 Multiple Stroke, 3MHz
- Waveform 3 Multiple Stroke, 4.3MHz
- Waveform 3 Multiple Stroke and Multiple Burst, 5MHz

Example of a plug-in

CN-MIG-BT

CN-MIG-BT

Coupling transformer for cable bundles up to 3.5 x 6cm.

Application: For WF2 and WF3 up to level 3 in accordance with DO160 section 22.

CN-MIG-BT3

CN-MIG-BT3

Coupling transformer for cable bundles up to 8cm diameter.

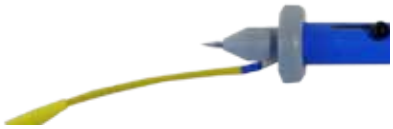
Application: For WF2 and WF3 1MHz and 10MHz up to level 5 in accordance with DO160 section 22.

CN-MIG-BT5

CN-MIG-BT5

Coupling transformer for cable bundles up to 8cm diameter.

Application: For WF2 and WF3 1MHz and 10MHz up to level 5 in accordance with DO160 section 22.



CN-MIG-TT

CN-MIG-TT

Coaxial test tip for PIN injection. Set includes verification equipment and measurement adapter. Decoupling of powered pins requires AC-DC Decoupler 2.

Application: For use with MIG-OS-MB (WF2 & WF3) in accordance with DO160 section 22.

AC-DC Decoupler 2

AC-DC Decoupler 2

Decoupler for powered pin testing. Use with MIG-OS-MB and CN-MIG-TT.

Application: PIN injection testing up to level 3 using WF3 1MHz in accordance with DO160 section 22.

SHUNT 0E1

SHUNT 0E1

0.1ohm measuring shunt for use with CN-MIG-BT3.

AC-DC Decoupler Level 4 & 5

AC-DC Decoupler Level 4 & 5

Decoupler for use with MIG-OS-MB-EXT.

Application: PIN injection testing at level 4 and 5 using WF3 1MHz in accordance with DO160 section 22.

Airbus Specific Accessories

NW-WF3-1M-FS-A350

ABD0100.1.2 G Lightning test requirement. Single Stroke or First Stroke of a multiple stroke sequence. Output at coupler up to 1500V/60A. Source impedance 25ohm.

NW-WF3-1M-FS-A350

NW-WF3-1M-SS-A350

ABD0100.1.2 G Lightning test requirement. Subsequent Stroke of a multiple stroke sequence. Output at coupler up to 750V/30A. Source impedance 25ohm.

NW-WF3-1M-SS-A350

WF2-FS-A350

ABD0100.1.2 G Lightning test requirement. Single Stroke testing. Output at coupler up to 1600V/107A. Source impedance 15ohm and 25ohm.

WF2-FS-A350

CN-WF5A1500

ABD0100.1.2 G Lightning test requirement. Waveform 5A coupler for use with MIG0600MS. Single Stroke or Multiple Stroke testing. Output at coupler up to 1500V/1500A. Source impedance 1ohm

CN-WF5A2000

ABD0100.1.2 G Lightning test requirement. Waveform 5A coupler for use with MIG0600MS. Single Stroke or Multiple Stroke testing. Output at coupler up to 2000V/2000A. Source impedance 1ohm

CN-WF5A1500
CN-WF5A2000

RES10-400M

RES10-400M

10ohm resistor for lightning voltage damage tests with WF2.

Application: PIN injection testing according to M00RP0400435.

RES20-400M

RES20-400M

20ohm resistor for lightning voltage damage tests with WF2.

Application: PIN injection testing according to M00RP0400435.

NW-PIN5A-MS

NW-PIN5A-MS

Resistor network for use with MIG0600MS impulse generator.

Application: Waveform 5A PIN injection

Resistor values; 2, 3, 13, 5 and 25ohm.

Usable up to 1600V Single Stroke and 320V Multiple Stroke

NW-PIN5A-SS

NW-PIN5A-SS

Resistor network for use with MIG0618SS impulse generator.

Application: Waveform 5A PIN injection

Resistor value; 100ohm.

Usable up to 3000V Single Stroke.

Special Couplers for Large Cables

CN-CI-I1

Current coupling transformer for cable induced tests, applicable for the following waveforms: WF1, WF5A, WF5B

Single and Multiple Stroke up to 5000A

EUT cable straight through coupler

Aperture 6 x15 cm

CN-CI-I1

CN-CI-V1

Voltage coupling transformer for waveforms: WF4 and WF5A

Single Stroke and Multiple Stroke up to 300V

EUT cable straight through coupler

Aperture 6 x15 cm

CN-CI-VI

CN-CI-VI (2x)

Voltage coupling transformer for voltage waveform WF4, WF5A and WF5B.

WF4 Single Stroke up 1600V, Multiple Stroke up to 375V

WF5A Single Stroke up to 1600V, Multiple Stroke up to 300V

WF5B Single Stroke up to 125V

EUT cable straight through coupler

Aperture 6 x15 cm

2x CN-CI-V1

CN-CI-VI (2x) + CN-CI-I1

Voltage coupling transformer for voltage waveform WF4, WF5A and WF5B.

WF4 Multiple Stroke up to 375V

WF5A Single Stroke up to 1600V, Multiple Stroke up to 640V

WF5B Single Stroke up to 300V

EUT cable straight through coupler

Aperture 6 x15 cm

2x CN-CI-V1 + CN-CI-I1

General Accessories

DN-LISN160-32

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.

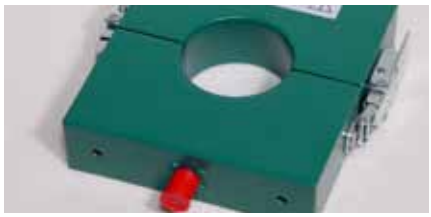
Application: To provide a defined system impedance for impulse tests according to DO160 section 22.

CDN-BDBC

CDN-BDBC

Blocking device (BD) and bypass circuitry (BC).

Application: For power pin testing in accordance with DO160 section 22.



I-PROBE-MB-P1

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-PHV

V-PROBE-PHV

V-PROBE PHV1000. AC/DC rating up to 1000V. Transient rating up to 4000V.

Probe factor x 100.

Bandwidth 400MHz

OPTICAL LINK

OPTICAL-LINK

Serial optical connection between remote control PC and EMC PARTNER impulse generator. Length 20m

USB-RS232 ADAPTER

USB-RS232 ADAPTER

RS232 to USB adapter for remote control of EMC PARTNER generators from a PC with USB interface.

SYNC-ADAPTER

SYNC ADAPTER

External synchronisation of Impulses. Galvanically de-coupled.

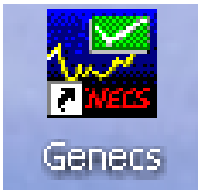
For use with synchronisation signals up to 240V and 400Hz.

Software

For remote control of EMC PARTNER avionics 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

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.

TEMA EXT MEASURE

As extension of the TEMA software, a DSO control package is available. Connected to the remote control computer and programmed directly from TEMA, an oscilloscope can be used for the following additional automated functions:

- EUT failure detection based on parameter windows. 4 measurements avaialble.

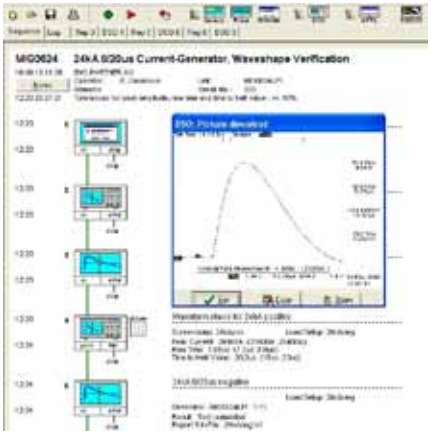
- wave shape verification and inclusion in the test report.

The DSO CONTROL icon is included in a sequence using drag-and-drop then programmed directly from the TEMA window.

- As soon as the DSO has been set into the desired mode, the setting record of the complete DSO can be transferred into a file using the TEMA DSO Upload function in the DSO dialogue.

TEMA EXT MEASURE is used as part of special application packages such as the SOFTW IEC60384-14. For further information, please refer to the CAPACITOR TEST SYSTEM brochure.

MIG1212CAP with TEMA and DSO



Sequence with DSO screenshot

DSO models Supported in TEMA EXT MEASURE

Tektronix TDS Models from series:

200, 500, 600 & 3000,

Both 2 and 4 channel oscilloscopes are supported

The computer must include a separate remote control interface for the DSO. Usually this is GPIB.

CN-MIG-BT with three turn calibration loop

MIG2000-6 only

CN-MIG-BT with three turn calibration loop

Coupling transformer for cable bundles up to 3.5 x 6cm.

Application: Voltage spike tests in accordance with DO160 Section 17.

For further accessories, please refer to the Military Test System brochure.

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 lighting 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 form 16.7Hz to 400Hz. Frequency 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 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:

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