





# 2019 rel.1

# The Company in Brief



**TESEO S.p.A.**, based into Italy's most advanced technology district, has been founded in 1978 by a group of researchers and engineers, as a spin-off of one of the major Italian Telecom Companies, who brought to the new company vast experience in the design of electronic equipment, signal processing and measurements. Their skills were soon employed in the development of fibre optics based equipment for EMC testing.

**TESEO S.p.A.**, nowadays part of Clemessy Group, is located in Turin (Italy) and in 2018 has achieved an outstanding 40 years hands-on experience as system integrator, electronics manufacturer and a specialized technology solution provider.

Quality is naturally a key competitive factor and is reflected in the ISO9001:2015, ISO9100:2016 and ISO17025:2005 certifications, in addition to several customer qualifications obtained.

**TESEO S.p.A.**, aside the compliance with several Quality Standards, is actively part of CEI Committees, has an Accredited EMC Laboratory and is a Notified Body for CE marking.

Today **TESEO S.p.A.** acts as Clemessy centre of expertise for radiofrequency, fibre optics and electronics applications. Structured into three business units, Teseo is recognised as a highly qualified system integrator specialising in providing test solutions to a wide range of industries from aerospace & defense to automotive and transportation, from telecommunications to medical and from electronics to energy.

Structured into three business units, **TESEO S.p.A.** is recognised as a highly qualified system integrator specialising in providing test solutions to a wide range of industries from aerospace & defense to automotive and transportation, from telecommunications to medical and from electronics to energy.

**Teseo RF-EMC-EMI solutions and products**, including fibre optic links and amplifiers **Teseo Systems**, for test equipment and world class manufacturing tools, and embedded systems and RF/telemetry applications **Teseo Services** which range from RF-EMC testing to preventive and corrective maintenance and calibration

# **Certifications**



ISO 9001:2015 – Quality Management System

UNI EN 9100:2016 - International Aerospace Quality Certification



EMC Testing Lab - EN ISO/IEC 17025:2005 LAB 1531

Calibration Lab – EN ISO/IEC 17025:2005 LAT 103



LabView Developer – National Instrument Alliance Member

Calibration Lab - National Instrument Approved Calibration Center



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# Modular optical communication system



**MOCS** is the new modular generation of analog fiber optic based system developed by TESEO for EMC applications. The MOCS system is an innovative development of the AFOM system, which has been unrivalled in the worldwide marketplace for over ten years.

MOCS has embedded improved modularity, leverages on AFOM accumulated experience and the development of enhanced functionalities and features. Nonetheless several AFOM modules are still MOCS compatible in order to protect customer's past investment.

The system overall performance and the design has been improved and optimised in order to have greater features at a cost which is less the AFOM system.

# APPLICATIONS

**MOCS** is designed to acquire analog signals from, and transmit analog stimulus commands to a DUT located in an electrically hostile environment, such as the typical electromagnetic field encountered in an EMC immunity test, high voltage test areas, or wherever the electrical isolation function offered by a fiber optic cable is required.

The modular open architecture design offers the capability to address a large number of fiber optic applications, ensuring the necessary flexibility that a laboratory requires.

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# MainFrame Controllers – MOCS Serie

# CONFIGURATION

**TESEO** 

EIFFAGE

### A typical MOCS configuration includes:

Modular Mainframe (MOCS-MF) control unit houses one or more plug-in modules.

There are two types of generic plug-in modules. An (OAM) Optical Acquisition Module receives analog data from a DUT via an EMC shielded Optical Acquisition Satellite transceiver, and an (OSM) Optical Stimulus Module sends analog stimulus signals to a DUT via an EMC shielded Optical Stimulus Satellite transceiver.

The acquired data and the stimulus commands are sent via FA, FB, FC type fiber optic cables. The MOCS-MF would be placed in a benign EMC area such an instrument control room, whereas the satellites would be in the electrical hostile area near the DUT.

A plug-in module plus a satellite comprise an optical link (one or more channels, depending on the link).

The MOCS-MF can accommodate different types of links (acquisition or stimulus) to perform application specific functions. Each link type is described in a separate datasheet.

The MOCS-MF is the common component of every MOCS and is described in further detail below.

Complex applications can be accommodated by daisy chaining more than one MOCS-MF via the GPIB-RS232 bus.

# **MAIN FEATURES**

### The main characteristics of the MOCS are:

- OAM and OSM satellites shielded against high E- field levels over a very broad frequency range.
- Data exchanged between satellites and plug-ins over fiber optic cables which have an intrinsic immunity to EM coupling via radiated fields.
- Can mix OAM and OSM plug-ins as well as satellites for maximum system flexibility
- The modular MOCS-MF mainframe can hold up to 12 plug-ins.
- Up to 4 MOCS-MF mainframes can be connected in daisy chain.











MainFrame Controllers – MOCS Serie

# MOCS-MF/MFD/MFR MODULAR MAINFRAME

The MOCS-MF is the central unit and the heart of the any MOCS system. It is intended to be operated in a control room attended by the test operator and thus, it does not require electrical shielding. It can hold up to twelve plug-in modules and comes in a 19", 3 U high, rack mountable chassis with handles.

### Three different types of mainframe are available:

MOCS-MF	12 Channels, without display
MOCS-MFD	12 channels, with display
MOCS-MFR	6 channels without display and GBIP-RS232 bus interface

# **MOCS-MF DESCRIPTION**

The Mainframe is connected to the AC mains and can power up to twelve plug-in modules, compared to the maximum four plug-ins of the previous system.

Power is applied via a back panel Power-on switch and an LED on the front panel confirms that the mainframe is in power-on mode.

The back panel contains GPIB-RS-232 connectors to facilitate interfacing to a personal computer as well as daisy-chaining, as needed, up to four mainframes.

A DIP switch on the back panel sets the GPIBRS232 address of the mainframe.

The RS-232 bus was selected since very little bus traffic exists between the MOCS and the PC and because it is a standard PC's I/O equipment.

All manual controls and status indicators on the front panel of the plug-in modules can be accessed remotely via the GPIB-RS232 bus.

Another key changes since the previous systems, the computing and the intelligence has been moved from the mainframe to the plug-in modules.

Microprocessors installed in every plug-in constitute a distributed intelligence approach that dramatically enhanced the signal processing capabilities of the system.



MOCS-MF / MFD Rear

### **MOCS COMPONENTS**

MOCS-MF/MFD/MFR Optical Modular Mainframe, 120 VAC, 60 Hz US or 230 VAC 50 Hz

European

OAM/OSMs

Optical Acquisition/Stimulus Satellites - Application dependent, see individual specifications

Each OAM/OSM plug-in module is connected via fiber-optic cables to the associated OAM/OSM satellite.



# MainFrame Controllers – MOCS Serie

# MODULES COMPATIBILITY

	NUMBER OF		MOCS-MFD		мос	S-MF	MOCS-MFR	DESCRIPTION
MODULE	SLOT	LOCAL	REMOTE	MANUAL	REMOTE	MANUAL	MANUAL	DESCRIPTION
OAM301P	1	×	×	×	×	×	×	DC ÷ 1MHz Acquisition
OAM302P	2	×	×	×	×	×	×	10kHz ÷ 1GHz Acquisition
OAM303P	1	×	×	×	×	✓	×	DC ÷ 100kHz Acquisition
OAM305P	1	x	×	×	×	×	×	6Hz ÷ 15MHz Acquisition
OSM303P	2	×	×	×	✓	×	×	Relay and actuator commands
OSM304P	2	×	×	×	✓	×	×	Relay and actuator commands
OSM306P	1	×	×	×	✓	×	×	DC ÷ 500kHz Stimulus
ODVM301P	1	×	×	×	×	×	×	Digital DC Voltmeter
OTM301P	1	×	*	×	✓	×	×	RF Power Meter
OBM31553P	1	×	×	1	×	1	×	1553 Bus Monitor
OBE31553P	1	×	×	×	×	×	✓	1553 Bus Extender
OVCM302P	2	×	x	1	×	1	×	Video Rx/Control Module
OALM302P	1	×	×	*	×	1	*	Audio Link

# MOCS-MF/MFD/MFR TECHNICAL CHARACTERISTICS

#### Number of plug-ins Acquisition 12 (MOCS-MF/MFD) OAM301 DC ÷ 1MHz OAM302 10kHz ÷ 1GHz 6 (MOCS-MFR) OAM303 DC ÷ 100kHz Number of units (daisy 4 OAM305 6Hz ÷ 15MHz chain mode) Remote control interface RS232 and GPIB Stimulus (only MOCS-MF/MFD) OSM303/04 Relay and actuator 2 x DB9 Connectors commands 1 x GPIB Connectors OSM306 DC ÷ 500kHz Power supply 120 VAC, 60 Hz (supplied Other modules ODVM301 Digital Voltmeter with US power cord) or OTM301 Telemetry 230 VAC, 50Hz (supplied OBM31553 1553 Bus monitor with an European power OBE31553 1553 Bus Extender cord) OVCM302 Video Rx/Control Module **Power consumption** OALM302 Audio link 100VA max Fuse 0.5A (230V), 1A (115V) Dedicated MOCS modules can be rapidly Size customised or developed upon request MOCS-MF/MFD Chassis 19" 3U, 370 Depth MOCS-MFR Chassis 1/219" 3U, 370 Depth Weight 4 Kg Operating temperature 10° to 40°

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# MOCS MODULES ON CATALOGUE



**Optical Analog Acquisition ans Stimulus Links – OAM301** 

# Optical acquisition module DC ÷ 1MHz



**TESEO** DC and low frequency plug-in modules and remote satellites are fiber optic communication links for the transmission of analog signals, including DC, in hostile environments subjected to electromagnetic interferences, noises, or characterized by the presence of high voltages.

A plug-in system consists of a two channels base module fitting in TESEO mainframes, one or two dual fiber optic cables for signal and control, one or two battery powered, shielded transmitters, and one or two battery chargers. Each plug-in system holds two independent optical channels.

It provides researchers and engineers with an integrated technology solution to the problem of monitoring equipmentunder-test functionality in safety conditions in environments characterized by high levels of electromagnetic field or very high voltages.

# SYSTEM CHARACTERISTICS

- Two channels plug-in for MOCS-MF mainframe (up to eight independent channels per mainframe)
- DC to 1 MHz operating frequency range
- 1 MOhm input
- 1 to 500 Vpp full scale input in 9 selectable ranges
- ± 500mV (1Vpp) full scale output on 50 OhmSignal-to-noise ratio better than 50 dB
- Shielded to >200 V/m EM fields, 10 kHz to 18 GHz

### **BASE UNIT PLUG-IN**

OAM301 plug-in system will receive an analog signal in the range DC to 1 MHz up to a distance of 1 km via fiber optic link.

OAM301P base unit plug-in is a two optically and electrically independent channels receiver; you can connect to it one or two OAM301S satellite units.

MOCS-MF mainframe can house up to six OAM301P base unit plug-ins for a total of twelve independent optical channels.

System setup and status are shown on the mainframe LCD graphic display; all functions are available and manageable by means of MOCS keyboard or built-in GPIB-RS232 interface.

During startup OAM301 automatically performs a complete calibration in order to compensate possible gain variation due, for instance, to the joining/disjoining of optical connectors.

Furthermore you can perform a calibration using the zero and reference level selectable on the output.

The information relative to the battery status is also available.

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# **Optical Analog Acquisition ans Stimulus Links – OAM301**

# SATELLITE UNIT

EIFFAGE

The small sized battery powered OAM301S satellite unit can be located close to the signal monitoring points, also in hard to reach zones (e.g. engines, industrial equipment).It can be switched on or off from the mainframe, and you can select nine input ranges, from 1 Vpp to 500 Vpp full scale.

Input is 1 MOhm and coupling can be both AC and DC; the source can be switched from the signal input to zero and reference levels to perform the calibration of the measure setup or to battery to check the remaining charge.

OAM301S withstands more than 200 V/m electromagnetic field level from 10 kHz to 18 GHz and is designed to operate over an exceptionally wide environmental range without significant change in performance.

It can operate continuously for over eight hours and can be recharged in short time by means of the associated battery charger. The ruggedness of this satellite makes it the ideal choice also for the acquisition of signals from remote transducers placed in extremely hard environments.

# **APPLICATIONS**

- General purpose signal monitoring
- Equipment under test functional monitoring
- . Acquisition from remote transducers
- . EMC/EMI
- High voltage floating and safe measurements

### SYSTEM PARTS

- OAM3 two channels plug-in for MOCS-MF
  - 01P battery powered satellite unit
- OAM3 dedicated battery charger
- 01S duplex zip cord fiber optic cable for signal
- CB1 and control lines (mmm = length in meters)
- ST fiber optic cable feedthrough (OPTION) FBm
- тт fiber optic cable reeling frame (OPTION) FOBC
- ST
- FORF

# **TECHNICAL SPECIFICATIONS**

### Frequency

- Bandwidth (- 3 dB)
- DC to 1 MHz
- Max harmonic level - 34 dBc
- S/N [20\*Log (Vmaxpp/Vrms): > 50 dB
  - Flatness ± 2dB max, ±1.5dB typ

#### Amplitude

- 1 MOhm • Input impedance
- Input ranges
- ±0.5/1/2.5/5/10/25/50/100/250 V full scale
  - Output impedance 50 Ohm
    - Output level ±1 V full scale (Hi-Z)
      - $\pm 0.5$  V full scale (50 $\Omega$ )
  - ±(10% + 10mV) max Accuracy:
    - ±(5% + 5mV) typ, full range

### Features and controlled functions

- satellite unit stand-by
- range selection
- coupling (AC/DC) •
- source (input, zero, reference, battery)

#### calibration

### **Mechanical and environmental**

### **Satellite Unit**

- battery operating time continuous > 8 hours
  - switch-off > 1000 hours

108 x 69 x 59 mm

- battery recharging time 2 hours
- battery charger connector LEMO 5 poles
  - circular BNC
- electrical input connector fiber optic connectors
  - signal: ST control: ST
- dimensions
  - operating temperature -10°/ +70°C
- storage temperature - 20° - +80°C
- **Base unit** 
  - electrical output connector BNC •
    - fiber optic connectors signal: ST
  - dimensions
    - plug-in for MOCS-MF operating temperature +0°/ +50°C
    - -20° +70°C storage temperature

control: ST

**OPTIONS** 

The fiber optic cable is available in any length up to 1 Km. A rugged reeling frame (up to eight fibers in one cable) can also be supplied.

Feedthroughs for the fiber optic cables can be supplied too.

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**Optical Analog Acquisition ans Stimulus Links – OAM303** 

# **Optical acquisition module – DC ÷ 100kHz**

OAM303



**TESEO** DC and low frequency plug-in systems and remote satellites are fiber optic communication links for the transmission of analog signals, including DC, in hostile environments subjected to electromagnetic interferences, noises, or characterized by the presence of high voltages.

The OAM03 system consists of a two channels base module fitting in a MOCS mainframe, two single fiber optic cables for signal acquisition, two battery powered, shielded transmitters, and one or two battery chargers.

Each plug-in system holds two independent optical channels.

It provides researchers and engineers with an integrated technology solution to the problem of monitoring equipment under-test functionality in safety conditions in environments characterized by high levels of electromagnetic field or very high voltages.

### BASE UNIT PLUG-IN

OAM303 plug-in system will receive an analog signal in the range DC to 100 kHz up to a distance of 1 km via fiber optic link.

OAM303P base unit plug-in is a two channel optically and electrically independent receivers to be connected up to two OAM303S satellite units.

MOCS mainframes can house up to twelve OAM303P base unit plug-.ins (MOCS-MF or MOCS-MFD) or up to six OAM303P base unit plug-ins (MOCS-MFR) for a total of 24 and 12 independent channels respectively.

When installed in MOCS-MF or MOCS-MFD, system status is available by means of RS232GPIB interfaces or displayed on the LCD of MOCS-MFD; it provides information on linkdown (no carrier on the fiber optical cable) and input voltage over-range.

# SYSTEM CHARACTERISTICS

- Two channels plug-in for MOCS mainframe (up to twenty four independent channels per MOCS-MF or MOCS-MFD and up to twelve independent channels for MOCS-MFR)
- DC to 100 kHz operating frequency range
- 1 MOhm differential input
- $\pm 1$  to  $\pm 50$  V full scale input in 5 selectable ranges
- ±1 V full scale output on 50 Ohm
- Signal-to-noise ratio better than 50 dB
- Shielded to >200 V/m EM fields, 10 kHz to 18 GHz

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# Optical Analog Acquisition ans Stimulus Links – OAM303

### SATELLITE

The very small sized battery powered OAM303S satellite unit can be located close to the signal monitoring points, also in hard to reach zones (e.g. engines, industrial equipment). It can be locally switched on or off, and you can select five input ranges, from 1 Vpp to 100 Vpp full scale.

Input is 1 MOhm differential and can use resistive cables in order not to perturbate the equipment under test and not to pick-up electromagnetic field, in a few words to perform a noninvasive measurement.

Resistive cables are available upon request in different lengths and with different terminations; OAM303S withstands more than 200 V/m electromagnetic field strengths from 10 kHz to 18 GHz and is designed to operate over an exceptionally wide environmental range without significant change in performance.

It can operate continuously for over eight hours and can be recharged in short time by means of the associated battery charger. The ruggedness of this satellite makes it the ideal choice also for the acquisition of signals from remote transducers placed in extremely hard environments.

### SYSTEM PARTS

- OAM303P two channels plug-in for MOCS mainframes
- OAM303S battery powered satellite unit
- CB4 dedicated battery charger
- FCmmm fiber optic cable (mmm = length in meters
- FOBC ST ST fiber optic cable feedthrough (OPTION)
- FORF fiber optic cable reeling frame (OPTION)
- RCcc resistive cable (OPTION)

(cc = length in centimeters, max 30 cm)

### ACCESSORIES

In addition to the base unit and satellite unit, each plug-in system is supplied with a dedicated battery charger leading to very short charge times.

The fiber optic cable is supplied in a duplex zip cord cable, any length is available up to 1 Km.

Alternatively, it can be supplied with a rugged reeling frame (up to eight fibers in one cable); Feed throughs for the fiber optic cables can be supplied too.

### APPLICATIONS

- General purpose signal monitoring
- Equipment under test functional signals monitorina
- Acquisition from remote transducers
- EMC/EMI
- High voltage floating and safe measurements

### **TECHNICAL SPECIFICATIONS**

#### Frequency

- Bandwidth (3 dB)
- Max harmonic level
- S/N [20\*Log (Vmaxpp/Vrms)]
- Flatness

#### Amplitude

- Input type
  - Input impedance
  - Input ranges
  - Ranges selection
  - Max input voltage
  - Output impedance
  - Output
  - Accuracy
  - CMRR

#### Mechanical and environmental

#### Satellite Unit

- battery operating time •
- battery recharge time
- battery charger connector
- electrical input connector
- fiber optic connector
- dimensions
- operating temperature
- storage temperature

### Base unit

- electrical output connector BNC
- fiber optic connector ST plug-in for MOCS
- dimensions
- mainframes operating temperature  $0^{\circ} \div +50^{\circ}C$ 
  - storage temperature -20° ÷ +70°C

### Accessories (available by request)

- resistive cables with different lengths and terminations
- resistive cables with dividers

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- 30 dBc > 50 dB ± 1,5 dB

DC to 100 kHz

differential 1 MOhm ±0.5/1.5/5/15/50 V full scale local with on/off switch ± 50 Vrms 50 Ohm ±1 V full scale 5% typ, 10% max

min 40 dB @ 1 kHz

continuous > 8 hours

LEMO 5 poles circ

125 x 79 x 29 mm

-10° ÷ +70°C

-20° ÷ +80°C

HIROSE 4 poles circ

16 hours

ST

switch-off > 1000 hours





**Optical Analog Acquisition ans Stimulus Links – OAM305** 

# Optical acquisition module 6 Hz ÷ 15 MHz OAM305







**TESEO** plug-in systems and remote satellites are fiber optic communication links for the transmission of analog signals, in hostile environments subjected to electromagnetic interferences, noises, or characterized by the presence of high voltages.

The OAM305 system consists of a base module fitting in a MOCS mainframe, one single fiber optic cable for signal acquisition, one battery powered, shielded transmitter, and one battery charger.

Each OAM305 plug-in system holds one optical channel.

It provides researchers and engineers with an integrated technology solution to the problem of monitoring equipment-under-test functionality in safety conditions in environments characterized by high levels of electromagnetic field or very high voltages.

### **BASE UNIT PLUG-IN**

The OAM305 plug-in system will receive an analog signal in the range 6 Hz to 15 MHz up to a distance of 1 km via fiber optic link.

The OAM305P base unit plug-in is a single channel receiver to be connected to one OAM305S satellite unit.

MOCS mainframes can house up to twelve OAM305P base unit plug-ins for a total of twelve independent optical channels.

# SYSTEM CHARACTERISTICS

- Single channel plug-in for MOCS mainframes (up to twelve independent channels per mainframe)
- 6 Hz to 15 MHz operating frequency range
- 1 MOhm input impedance
- 1Vpp to 100Vpp full scale input in 5 selectable ranges
- 1Vpp full scale output on 50 Ohm
- Signal-to-noise ratio better than 50 dB
- Shielded to >200 V/m EM fields, 10 kHz to 18 GHz



# **Optical Analog Acquisition ans Stimulus Links – OAM305**

### SATELLITE UNIT

The very small sized battery powered OAM305S satellite unit can be located close to the signal monitoring points, also in hard to reach zones (e.g. engines, industrial equipment).It can be locally switched on or off, and you can select five input ranges, from 1 Vpp to 100 Vpp full scale. Input impedance is 1 MOhm.

OAM305S withstands more than 200V/m electromagnetic field strengths from 10 kHz to 18 GHz and is designed to operate over an exceptionally wide environmental range without significant change in performance.

It can operate continuously for over eight hours and can be recharged in short time by means of the associated battery charger. The ruggedness of this satellite makes it the ideal choice also for the acquisition of signals from remote transducers placed in extremely hard environments.

The connection to the OAM305P is made via a single fiber optic cable as no control signal is used.

### APPLICATIONS

- General purpose signal monitoring
- Equipment under test functional signals monitoring
- Acquisition from remote transducers
- EMC/EMI
- High voltage floating and safe measurements

# SYSTEM PARTS

- OAM305P single channel plug-in for MOCS mainframes
- OAM305S battery powered satellite unit
- CB1 dedicated battery charger
- **FC***mmm* fiber optic cable (*mmm* = length in meters)
- FOBC ST ST fiber optic cable feedthrough (OPTION)
- FORF fiber optic cable reeling frame (OPTION)

# ACCESSORIES

In addition to the base and satellite units, each plug-in system is supplied with dedicated battery chargers leading to very short charge times.

The fiber optic cable is available in any length up to 1 Km. Alternatively, it can be supplied with a rugged reeling frame (up to eight fibers in one cable).

Feedthroughs for the fiber optic cables can be supplied too.

**TECHNICAL SPECIFICATIONS** 

unbalanced

100 Vrms

50 Ohm

1 MΩ

6 Hz to 15 MHz

- 30 dBc

± 2 dB

1/3/10/30/100 Vpp full scale

+/-(2% + 10mV) typ, full range

+/-(1% + 1mV) typ, ac input @ 60 Hz;

continuous > 8 hours

switch-off > 1000 hours

local with on/off switch

1 Vpp full scale on 5Ω

#### Frequency

- Bandwidth (- 3 dB)
- Max harmonic level S/N [20\*Log (Vmaxpp/Vrms)] > 50 dB
  - Flatness

### Amplitude

- Input type •
- Input impedance
- Input ranges
- Ranges selection
- Max input voltage
  - Output impedance
- Output
- Accuracy:

#### **Mechanical and environmental**

#### Satellite Unit

- battery operating time
- battery recharge time
- battery charger connector
- electrical input connector •
- fiber optic connector
- dimensions
- operating temperature
- storage temperature

### **Base unit**

- electrical output connector
- fiber optic connector
- dimensions
- operating temperature storage temperature

2 hours LEMO 5 poles circular BNC ST 107 x 70 x 47 mm +10° / +50°C -20° - +80°C

BNC ST

plug-in for MOCS mainframes +10° / +50°C -20° - +70°C



**Optical Analog Acquisition ans Stimulus Links – OSM303, OSM304 and OSM305** 

# Optical stimulus modules for switching and actuation

OSM303 / OSM304 and OSM305



# OVERVIEW

The OSM303, OSM304 and OSM305 systems allow to remotely actuate low-power and high-power relays as well as different devices (dc motors, linear actuators, etc.).

An optical stimulus module for switching and linear actuation consists of a two independent optical channels base plug-in fitting into MOCS mainframes, one fiber optic per plug-in channel to send the commands, one or two shielded remote satellites, battery powered, dedicated battery chargers.

OSM series of switching and actuation plug-ins perform fiber optic remote controlled switching of low-power and high-power lines and a variety of different actuations; they provide researchers and engineers with an integrate technology solution to the problem of controlling and remotely managing equipment-under-test functions without perturbing the emission/susceptibility tests; this task is performed in safety conditions in environments characterized by high levels of electromagnetic fields or in very high voltages applications. OSM serie systems offer a wide variety of application.

Some example:

- General purpose low-power and hi-power switching
- General purpose linear and circular actuations
- Simulation of ignition key and accelerator pedal on ground vehicles
- Simulation of continuous and momentary switches and of linear and circular actuations in ship and airplanes EMC testing

# SYSTEM CHARACTERISTICS

- Two channels plug-ins for MOCS mainframe
- Remote management via fiber optic link of low-power relays, high power relays, linear actuators
- Full manual and RS232/GPIB management of all the functions
- Shielded to >200 V/m EM fields, 10 kHz to 18 GHz



**Optical Analog Acquisition ans Stimulus Links – OSM303, OSM304 and OSM305** 

# SATELLITE UNITS

# OSM303S – two-channel low power relays satellite

The small sized battery powered OSM03S satellite can be located close to the points to switch, also in hard to reach zones (e.g. engines, industrial equipment).



It supplies two fiber optic controlled exchange contacts for a maximum load of 1 A, 50 V.

OSM303S withstands more than 200 V/m electromagnetic field strength from 10 kHz to 18 GHz and is designed to operate over an exceptionally wide environmental range without significant changes in performances.

It can work for over 8 hours and can be recharged in about 14 hours by means of the associated battery charger.

### OSM304S - high power relays satellite

OSM304S supplies two fiber optic controlled normally open contacts for a maximum load of 30 A, 50 V.



OSM304S withstands more than 200 V/m electromagnetic field strength from 10 kHz to 18 GHz.

It is designed to operate over an exceptionally wide environmental range without significant changes in performances .

It uses an external power supply like a car battery. **OSM305S - linear actuation satellite** 

OSM305S supplies a fiber optic controlled linear actuator performing a linear shift in the two directions of a pole; the characteristics of the shift are:

- total shift: 150 mm at least
- max force: 10 kg

actuation time: 10 s complete shift

OSM305S withstands more than 200 V/m electromagnetic field strength from 10 kHz to 18 GHz and is designed to operate over an exceptionally wide environmental range without significant changes in performances.

It can work for over 8 hours (0,5 hours of continuous work) and can be recharged in short time by means of the associated battery charger.

BASE UNITS PLUG-IN

Different plug-ins are available, each allowing the control of different satellites.



Common characteristics are:

- two independent optical channels permitting the control of two different satellites with two different actuations
- manual and/or remote actuation via front panel, RS232 or GPIB interface
- fixed/momentary switches for different actuations
- actuations status shown on the plug-in panels
- fiber optic links up to 200 meters.

The **OSM303P** plug-in is a general purpose module, allowing the control of:

- OSM303S satellite containing two 1 A 50 V relays,
- OSM304S satellite containing two 30A 50V relays,
- OSM305S satellite containing a linear actuator
- future OSM actuators series.

The **OSM04P** plug-in is a module dedicated to the control of the ignition (setting in motion, acceleration, deceleration etc.) of a vehicle; so it fully supplies the functions of the ignition key and of the accelerator. Normally it is used with:

• OSM304S and/or OSM305S satellites.

# **CUSTOM ACTUATORS / SWITCHES**

Upon request, more switch and / or actuator units are available:

- Coaxial RF swtiches
- Circular actuators
- High Voltage relays
- Multi-contact relays

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Optical Analog Acquisition ans Stimulus Links – OSM303, OSM304 and OSM305

#### SYSTEM PARTS SYSTEM SPECIFICATION OSM303P two channel general purpose OSM303P - general purpose controller plug-in plug-in for AFOM-MF and IMAGE-MF SlotBus compatible (MOCS mainframes) controls OSM303S, OSM304S, OSM305S OSM304P two channel ignition key and 2 different satellites control pedal dedicated plug-in for AFOM-MF and 2 actuations per satellite (fixed or momentary) **IMAGE-MF** manual or RS232/GPIB control of any function **OSM303S** two exchange low power relays panel display of channels status and remote control satellite optical connector: ST CB4 dedicated battery charger operating temperature: 0° - +50°C OSM304S two normally open high power storage temperature: -20° - +70°C relays satellite OSM304P - ignition key and pedal controller plug-in SlotBus compatible (MOCS mainframes) AL3 external power supply controls OSM303S, OSM304S, OSM305S **OSM305S** linear actuator satellite 2 different satellites control CB2 dedicated battery charger 2 actuations per satellite (fixed or momentary) FCmmm fiber optic cable (mmm = length in manual or RS232/GPIB control of any function panel display of channels status and remote in meters) control FOBC ST ST fiber optic cable feedthrought optical connector: ST (OPTION) operating temperature: 0° - +50°C FORF fiber optic cable reeling frame storage temperature: -20° - +70°C OSM303S - low power relays satellite (OPTION) controllable from OSM303P or OSM304P 2 exchange relays, 1 A 50 V contacts optical connector: ST electrical connectors: 6 x 1pole 2mm miniature sockets battery charger connector: LEMO 5 poles circular battery autonomy: 8 h battery recharge time: 16 hours SWITCH CONFIGURATION operating temperature: 0 ÷ +50 °C storage temperature: -20 ÷ +70 °C OSM303S dimensions: 122 x 79 x 30 mm (case only) weight: 330 g NO O OSM304S - high power relays satellite C A1 controllable from OSM303P or OSM304P 2 normally open relays, 30 A 50 V contacts NC optical connector: ST electrical connector: Type 5 HE301B / MIL C-NO 26482 MOCS C A2 external power connector: LEMO 2 poles MAINFRAME polarized NC operating temperature: 0 ÷ +50 °C OSM303P OPTICAL LINK storage temperature: -20 ÷ +70 °C dimensions: 135 x 79 x 69 (case only) В weight: 860 g **OSM305S** - linear actuation satellite controllable from OSM303P or OSM304P OSM04S total excursion: 150 mm maximum force: 10 kg 0 SLOTBUS total excursion time: 10 s MAINFRAME C end-of-range protections R optical connector: ST OSM04B C battery charger connector: LEMO 5 poles OPTICAL LINK 0 circular в battery autonomy: 8 h (duty 20%) battery recharge time: 2 hours operating temperature: 0 ÷ +50 °C OSM05S storage temperature: -20 ÷ +70 °C

- dimensions: 443 x 113 x 72 (case only)
- weight: 2500 g

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ACTUATOR



2019 rel.1

**Optical Analog Acquisition ans Stimulus Links – OSM306** 

**Optical stimulus module DC ÷ 500kHz** 



### **GENERAL DESCRIPTION**

TESEO stimulus plug-in modules and remote satellites are fiber optic communication links for the transmission of analog signals in hostile environments subjected to electromagnetic interferences, noise, or characterized by the presence of high voltages.

A stimulus link consists of a base module fitting in TESEO mainframes, a fiber optic cable for signal transmission, a battery powered, shielded transmitter, and a battery charger.

Each plug-in module holds two independent optical channels.

OSM series of plug-ins perform signal transmission from the mainframe to the satellites.

They provide researchers and engineers with an integrated technology solution to the problems of simulating various signal sources (e.g. sensors) to assure equipment-under-test functionality, of performing dynamical tests in static conditions and of injecting signals into circuits under test. OSM accomplishes these tests in safety conditions in environments characterized by high levels of electromagnetic fields or very high voltages.

# SYSTEM CHARACTERISTICS

- Two channels plug-in for MOCS-MF mainframe (up to twelve independent channels per mainframe)
- DC to 500 kHz operating frequency range
- 1 MOhm input
- ±5 V full scale
- good impulse response
- Signal-to-noise ratio better than 50 dB
- Shielded to >200 V/m EM fields, 10 kHz to 18 GHz



# **Optical Analog Acquisition ans Stimulus Links – OSM306**

# **BASE UNIT**

OSM306 channels will transmit an analog signal in the range DC to 500 kHz up to a distance of 1 km via fiber optic link.

OSM306P base unit plug-in is a two optical channels transmitter; you can connect to it one or two OSM306S satellite units.

MOCS-MF or MOCS-MFD mainframes can house up to twelve OSM306P base unit plug-ins for a total of twenty-four independent optical channels.

However, as the OSM306S satellite is manually controlled, the OSM306P plug-in module can be housed also in the MOCS-MFR mainframe, for a total of six plug-ins driving up to twelve independent optical channels.

Input is single-ended; input impedance is 1 MOhm; the connector is BNC.

### SATELLITE UNIT

The small sized battery powered OSM036S satellite unit can be located close to the signal injection points, also in hard to reach zones (e.g. engines, industrial equipment). It can be switched on or off from the mainframe.

Output impedance is 50 Ohm and the maximum current available is 5 mA @ full scale output  $\pm$ 5 V; if higher current levels are requested, TESEO can study and develop further expansion devices.

Output is single-ended and the connector is BNC.

OSM306S withstands more than 200 V/m electromagnetic field strengths from 10 kHz to 18 GHz and is designed to operate over an exceptionally wide environmental range without significant change in performance.

It can operate continuously for over eight hours and can be recharged in short time by means of the associated battery charger. The ruggedness of this satellite makes it the ideal choice also for the injection of signals in to equipment placed in extremely harsh environments.

# ACCESSORIES

In addition to the base unit and satellite units, each plug-in system is supplied with dedicated battery chargers leading to very short charge times.

The fiber optic cable is available in any length up to 1Km.

Alternatively, it can be supplied with a rugged reeling frame Feedthroughs for the fiber optic cables can be supplied too.

# **TECHNICAL SPECIFICATIONS**

- Frequency
- Bandwidth: DC to 500 kHz
- Max harmonic level: 34 dBc
- S/N [20\*Log (Vmaxpp/Vrms)]: > 50 dB
- Flatness: ± 1,5 dB
- Amplitude
- Input impedance: 1 MOhm
- Input ranges: ± 5 V full scale
- Output impedance: 50 Ohm
- Output: ± 5 V full scale, or up to 5 mA
- Gain: Unitary
- Accuracy : 5% typ, 10% max
- Controlled functions
- satellite unit stand-by for battery saving

#### Mechanical and environmental all the black

### Satellite Unit

- battery operating time: continuous > 8 hours : switch-off > 1000 hours
- battery charger connector: LEMO 5 poles circular
- battery recharge time: 2 hours
- electrical output connector: BNC
- fiber optic connector: ST
- dimensions: 108 x 69 x 59 mm
- operating temperature: 0° +50°C
- storage temperature: -20° +80°C

### Base unit

- electrical input connector: BNC
- fiber optic connectors: ST
- dimensions: takes 1 slot in MOCS-MF
- operating temperature: 0° +50°C
- storage temperature: -20° +70°C

# SYSTEM PARTS

OSM306P OSM306S channel)	two channels plug-in for MOCS-MF battery powered satellite unit (1
CB1 dedic	cated battery charger
FCmmm (mmi	single fiber optic cable 200/230 $\mu$ m m = length in meters)
FOBCST	ST fiber optic cable feedthrough
(OPT	TION)
FORF fiber	optic cable reeling frame (OPTION)

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Fiber optic video communication system



**TESEO** is now at the third generation of shielded camera systems for EMC applications.

Whether the camera is used to monitor a device under test or control the operations being carried on in an anechoic chamber, the presence of a high level of electromagnetic field requires a well shielded camera and a fiber optic connection to the control room. The higher the field the more stringent the immunity requirement imposed on the equipment.

A superior shielding effectiveness further helps in the radiated emission tests as a poorly shielded camera could contribute to the noise emitted by the device under test. Additionally the typical low illumination conditions encountered in a test chamber request the adoption of a high quality CCD.

TESEO has sold for many years state of the art camera systems based on the best CCD's available on the market coupled with the excellent TESEO video fiber optic link. Field levels in excess of 200 V/m over a broad frequency range

can be easily tolerate **C**.

# **APPLICATIONS**

The most common applications are:

- monitoring of the inside of the chamber by a camera fitted to a wall (or tripod mounted in a corner)
- reading of a LED, CRT or display as part of the immunity test of an electronic device
- pointing at a dashboard or airplane cockpit during radiated susceptibility tests

# **SELECTION CRITERIA**

The technical criteria most often used to select the camera are:

- test field level
- focal distance
- size
- quality of the CCD
- manual or remote command
- battery or mains power
- integration in a complete video, audio, monitoring fiber optic system

Of course also budget constraints are to be considered. TESEO offers a solution to any standard technical configuration requested at the most convenient price.



Optical Audio and Video Systems – IMAGE

The following standard products are in current production:

IMAGE300MC

### IMAGE300MA

Additionally a point to point video link using the same fiber technology is available to remotely connect via a fiber cable an unshielded camera with a monitor or TV.

**IMAGE300MC** is the highest performance system, in use worldwide in many EMC laboratories.

The main features are the capability to remotely command pan, tilt, zoom, focus (iris is automatic), to be immune at high radiated electromagnetic interference from 10 kHz to 40 GHz up to 200 V/m, to live on the battery, with the exclusion of the pan/tilt functionality, in case of mains unavailability.

Tanks to the very high ratio between max and min focal lengths, the camera mounted on a wall can oversee the interior of the chamber for safety reason during the set-up operation and focus on a small display of a device for verification of EUT immunity in the course of radiated test.

The system is formed of:

- MCAF high performances color camera, PAL standard, shielded to 200 V/m from 10 kHz to 40 GHz
- **PTU03** pan/tilt unit, AC powered, with adapter for tripod mount
- AL6 shielded mains power supply 12 VDC, 24 VAC with battery incorporated for CCU03 and PTU02
- **FB010** 10 meter long bifiber optical cable, 200/230 um
- MOCS-MFR chassis housing a max of three plug-in modules
- OVCM302P 2-slot plug-in module for insertion in MOCS MainFrames

The **OVCM302P** module is to be connected to a color monitor, not included in the standard system.

The **OVCM302P** module performs two functions:

- video signal receiver and transducer from optical to electrical
- command generator for pan/tilt via joystick and zoom plus focus via pushbuttons

The options available are:

- 14" color monitor
- any length of the fiber cable up to 500 m
- color standards other than PAL
- AL6/US for 110 VAC, 60 Hz mains
- MOCS-MF/MFD chassis (capable of housing up to 6 2-slot modules)
- other lenses
- dielectric tripod







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# **Optical Audio and Video Systems – IMAGE**

### IMAGE MA

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**TESEO** 

The camera belonging to the system is small and with short focal distance like MCAF, but not provided with remote commands. The manual command of the camera simplifies the configuration of the video link, that is formed of:

- MCMA manual color camera, PAL standard, shielded up to 200 V/m from 10 kHz to 40 GHz
- AL7-HF shielded mains power supply 12 VDC
- FC010, 10 meter long mono fiber cable, 200/230 um
- OVR2 optical receiver

A TV color is to be added to make the above system operate.

The main options are:

- 14" color TV
- Any length of the fiber cable up to 500 m
- Color standards other than PAL
- AL7-HF/US and OVR2/US for 110 VAC, 60 Hz mains
- Shielded battery pack and charged for total independence (10 hours) from the mains (BAT-2)
- Dielectric tripod





MCMA



#### POINT TO POINT OPTICAL VIDEO LINK

The link is formed of:

- OVT2 optical transmitter
- AL8 unshielded 12 VDC supply for OVT2
- FCmmm single fiber cable mmm meter long, 200/230 um
- OVR2 optical video receiver



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# **Optical Audio and Video Systems – IMAGE**

#### **VIDEO LINK**

- Optical length: 500 m max
- Bandwidth: 10 Hz ÷ 15 MHz
- S/N: more than 60 dB

MCAF

- Standard: PAL
- Image device: 1/4"CCD
- Pixels: 752(H) x 582(V)
- Horizontal resolution: 520 TV lines
- Minimum illumination: 0,8 lux @ F = 1.6
- Iris: auto
- Focus / Zoom: remote control
- Focal length: from 4 to 88 mm
- Minimum distance: 30 cm
- Connectors:
  - power supply D 9 poles/male PTU03 commands D 9 poles/female control and signal TV ST (optical fiber)
- Dimensions: 277(L) x 80(W) x 80(H) mm
- Weight: 1.2 Kg
  - Shielding: 200 V/m 10kHz ÷ 40GHz

#### MCMA

- Standard: PAL
- Image device: 1/3"CCD
- Pixels: 752(H) x 582(V)
- Horizontal resolution: 450 TV lines
- Minimum illumination: 1 lux @ F = 1.4
- Iris: auto
- focus / zoom: manual
- Focal length: from 2.8 to 6 mm
- Minimum distance: 30 cm
- Connectors:

#### power supply D 9 poles/male

- signal TV ST (optical fiber)
- Dimensions: 88(L) x 80(W) x 80(H)
- Weight: 0.6 Kg
- Shielding: 200 V/m 10kHz ÷ 18GHz

#### PTU03 PAN/TILT UNIT

- Pan: 0° ÷ 360° motorized
- Tilt: 20° up ÷ 70° down (0° initial position) motorized
- Pan rate: 6°/sec
- Tilt rate: 1.5°/sec
- Connectors: D 9 poles/male
- Maximum load: 10Kg (balanced)
  - Dimensions (H x W x D): 180 x 161 x 144 mm
- Weight: 3.5 Kg
- Tripod mount: 1/4"- 20UNC screw 4.5 mm long max

# **TECHNICAL SPECIFICATIONS**

#### MOCS-MFR

 6-slot chassis, capable of housing up to 3 video control modules

### Supply voltage: 110/220/240 Vac - 50/60 Hz

- OVCM302P PLUG-IN VIDEO AND CONTROL MODULE
  - Video input connector: ST
  - Video output: 1Vpp 75 ohm BNC
  - Control output connector: ST
  - Pan/tilt control: joystick
  - Focus and zoom controls: momentary pushbutton
  - Dimensions: 2-slot MOCS plug-in

### OVR-2

- Input connector: ST
- Video output: 1 Vpp 75 $\Omega$  BNC
- Supply voltage: 110/230/240 Vac 50/60 Hz
- Dimensions: (H x W x D) 70 x 156 x 204 mm

#### OVT-2

- Output connector: ST
  - Power supply connectors: socket 2.5 mm
  - Video input: 1 Vpp 75 $\Omega$  BNC
- Supply voltage: 12 Vdc
- Dimensions: (H x W x D) 30 x 60 x 80 mm

#### AL6 POWER SUPPLY

- Supply voltage: 110/230/240 V 50/60 Hz
- Battery: 12 V, 1.8 Ah, 4 h autonomy (no for motion)
- Output voltages: 24 Vac, 12 Vdc
- Connectors: power supply D 9 poles/female

### AL7-HF POWER SUPPLY

- Supply voltage: 110/230/240 Vac 50/60 Hz
- Output voltages: 12 Vdc
- Connectors: power supply D 9 poles/female

#### AL8 POWER SUPPLY

- Supply voltage: 230/240 Vac 50 Hz
- Output voltages: 12 Vdc
- Connectors: plug 2.5 mm

#### FB010/FC010 FIBER CABLE

- FB010 10 m 200/230 µm bifiber cable, ST connectors
- FC010 10 m 200/230 μm fiber cable, ST connectors

### BAT-2

- Battery: 12V, 5.7Ah
- Dimensions (W x H x D): 165 x 75 x 127 mm
- Weight: 3,2 Kg
- Recharge time: 8h

# **OPTIONAL ACCESSORIES**

#### **COLOR MONITOR CRT/LCD**

Type: CRT 14" to 17" or LCD 15" to 32" PAL color monitor.

#### Supply voltage: 110/230/240 Vac - 50/60 Hz

#### WALL-MOUNT BRACKETS TRIPODS AND TRIPOD HEADS MULTI-VIEW SURVELANCE SYSTEMS

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**Optical Audio and Video Systems – IMAGE** 

### BRACKETS

### Wall-Mount Standard Bracket

The Standard Bracket is supplied together with the PTU03 as standard accessory.

The bracket is in aluminum, and has a total extension of 132 mm.

Using the dedicated holes, the PTU03 can be mounted on the bracket at a distance of 100 mm from the wall.



### TRIPODS and HEADS Dielectric Tripod



### **Azimuth/Elevation Head**

info@teseo.clemessy.com



- Mounting head made of wood
- Minimum of metal components
- Centre column eligible (wood or synthetic material), standard length 50 cm
- Leg spread at an angle of about 27°
- Feet made of synthetic material cap
- Weight: 3,00 kg = 6.61 lbs.
- Packed length: 82 cm = 32 inches
- Minimum height: 75 cm = 30 inches
- Maximum height: 177 cm = 70 inches
- Load tolerance: 10,00 kg = 22.05 lbs.
- Vibration damping: very good
- Metal free ball head
- Height 75 mm
- Diameter 30 mm
- Load capacity 2kg
- Clamping force 1Nm
- Screw bolt for antenna or camera ¼"
- Screw hole in the bottom 1/4"
- Weight 70gr

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### Wall-Mount Long Bracket

A longer Bracket is available as optional accessory, in case a bigger distance from the wall is needed.

The bracket is in Polyzene (dielectric) material, and has a total extension of 510 mm.

Using the dedicated holes, the PTU03 can be mounted on the bracket at a distance of 500 mm from the wall.

Longer brackets are available upon request.





Optical BUS Extenders – OBE519 and OBE898 Optical CAN/VAN extender

# Optical CAN/VAN OBE519 and OBE898 extenders



### CAN

By OCE we mean a family of fiber optic links for extension of CAN and VAN buses.

The CAN (Controller Area Network) is a bidirectional data stream standardized by ISO specifications.

It is already popular nowadays with the automotive community as it represents the typical connection between on board controllers that exchange data. The need for passing data to and from microprocessor based units on vehicles is growing rapidly and the CAN will get even more popular in the future.

The usage of the bus is also expanding to other application areas requiring relatively high bit rates at a cheap price like industrial automation, intelligent home, etc...

Different speeds are accounted for by different standards.

Low data rates are covered by ISO 11519 part 2 and high data rates by ISO 11898.

OBE519 and OBE898 are TESEO ISO compliant fiber optic extenders.

The differences are confined to the transceivers and, in particular, to few components in the transceiver circuitry.

The reasons for utilizing a CAN bus optical extender in an EMC hostile environment are more than one:

- you may have part of the bus and attached equipment in the chamber being radiated from an antenna and part of same bus and related equipment to be kept out of the high field zone in the control room
- you may need to monitor and/or stimulate the bus during an immunity test from a remote terminal unit outside the anechoic chamber (CAN analyzer)
- you have to isolate a portion of the bus For the above and other possible cases the solution is the extension of the CAN bus by means of the OCE.

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# Optical BUS Extenders – OBE519 and OBE898 Optical CAN/VAN extender

### VAN

The VAN standard is covered by ISO specification 11519 part 3.

The ISO compliant TESEO product is OBE519VAN. Again the differences are confined to the transceivers. The reasons for utilizing a VAN optical extender are the same as those explained above for CAN. Each extender consists of:

- two identical Rx/Tx units. They are shielded and battery powered to be independent from the bus power source, for example the vehicle battery. The part number of each unit is OBE519, OBE519-F (Special version compliant with FIAT standards), OBE898 or OBE519VAN.
- two battery chargers, model CB1, to recharge the OBE internal battery

# **TECHNICAL CHARACTERISTICS**

 a bifiber cable, part number FBxxx, with xxx equal to the length expressed in meters. The standard cable is the 10 meters long FB010
 The connections of the OBE's to the electrical bus are a customer's responsibility.

The use of short twisted shielded wires is recomm3:27 PMended.



OBE898

	OBE898	OBE519	OBE519VAN		
Data rate	1 Mbit/s	1 Mbit/s 125 kbit/s			
Bus interface	ISO11898 compliant	ISO11519 part 2 compliant	ISO11519 part 3 compliant		
Bus terminations	60Ω, O.C., 120Ω sw itch Selectable (OBE898)	<ul> <li>O.C., active termination switch selectable (OBE 519)</li> <li>1kΩ, 2.2kΩ, switch (OBE 519-F)</li> </ul>	none(OBE519VAN)		
Electrical connector	DB9				
Optical connectors	ST				
Power supply	Rechargeable 6V lead battery				
Battery operating time	8 hours				
Battery charging time	2 hours				
Fiber cable type	200 um				
Fiber cable length	10m at max data rate				
Size of OBE	108 x 69 x 59 mm				
Operating temperature	0 to 50 °C				
Shielding	200 V/m up to 18 GHz				

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Optical BUS Extenders – OBE-FD Flexiable Data CAN extender

# Optical Flexible Data CAN extender OBE-FD



# **OVERVIEW**

The CAN (Controller Area Network) is a bidirectional data stream standardized by ISO specifications.

It is already popular nowadays with the automotive community as it represents the typical connection between on board controllers that exchange data. The need for passing data to and from microprocessor based units on vehicles is growing rapidly and the CAN will get even more popular in the future.

The usage of the bus is also expanding to other application areas requiring relatively high bit rates at a cheap price like industrial automation, intelligent home, etc...

Different speeds are accounted for by different standards.

The CAN FD (Flexible Data Rate) has been introduced as "second generation" of ISO 11898 compliant CAN Bus, in order to increase CAN's net throughput up to 5MB/s.

The differences are confined to the transceivers and, in particular, to few components in the transceiver circuitry.

The reasons for utilizing a CAN bus optical extender in an EMC hostile environment are more than one:

you may have part of the bus and attached equipment in the chamber being radiated from an antenna and part of same bus and related equipment to be kept out of the high field zone in the control room

- you may need to monitor and/or stimulate the bus during an immunity test from a remote terminal unit outside the anechoic chamber (CAN analyzer)
- you have to isolate a portion of the bus

The Flexible Data Rate standard is covered by ISO specification 11898-2.

The ISO compliant TESEO product is OBE-FD, an extender over fibre which can reproduce communications both in High-Speed mode (up to 1MB/s) and Flex-Data mode (up to 5MB/s). Each extender system consists of:

• two identical Rx/Tx units. They are

- shielded and battery powered to be independent from the bus power source, for example the vehicle battery. The part number of each unit is OBE-FD,
- two battery chargers, to recharge the OBE rechargeable battery. To be recharged, the battery can be easily removed and recharged apart.
- a bifiber cable, part number FBxxx, with xxx equal to the length expressed in meters. The standard cable is the 10 meters long FB010

The connections of the OBE-FD's to the electrical bus are a customer's responsibility.

The use of short twisted shielded wires is recommended

Optionally, the OBE-FD shielded module can be connected via optic fibre to a transceiver electrically identical, but contained in a plug-in that can be inserted into a standard 19 inch rack, to ease its control by a control room.

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**Optical BUS Extenders – OBE-FD Flexiable Data CAN extender** 

# **QUICK-CHANGE BATTERY**

Thanks to a standard battery cell and a quickchange structure, the battery can be easily removed by the operator and replaced with another one. The battery is a standard cell Lithium rechargeable model, and it can be recharged apart with a standard battery charger.

The battery is retained by a EMC-proof seal metallic cap, than can be easily unscrewed using a screwdriver or a small coin.



# **TECHNICAL CHARACTERISTICS**

Data rate	up to 5 Mbit/s			
Bus interface	ISO11898-1, ISO11898-2 & ISO11898-5 compliant (physical layer)			
Electrical connector	DB9			
Optical connectors	ST			
Powersupply	Rechargeable 3.7V Li-Ion battery (removable) – 18650 type			
Battery operating time	8 hours			
Battery charging time	< 1 hour			
Fiber cable type	200 um glass fiber			
Fiber cable length	10 mt at max data rate *			
Size of OBE	108 x 69 x 59 mm			
Operating temperature	0 to 50 °C			
Shielding	200 V/m up to 18GHz			



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Optical BUS Extenders – OBE-LIN Optical LIN extender

# **OLE Series Optical lin extenders**



**OBE-LIN** 



# OVERVIEW

By **OLE** (Optical Lin Extender), we mean a fiber optic link employed to extend a LIN bus.

LIN is an acronym for Local Interconnect Network, that is a low cost, low speed, serial communication bus for distributed electronic systems on board a vehicle. It is a sort of complement to other buses like CAN that are used for faster or more demanding applications. It is a one-wire bus and typically it connects in a very cost effective way smart sensors and actuators where bandwidth and versatility of CAN connections are not necessary.

The need for a fiber optic extension of LIN may arise mainly for the performance of immunity tests in an anechoic chamber.

In such case the EUT attached to LIN network must be radiated by a transmitting antenna while the LIN analyzer or any other component appended to the LIN (Auxiliary Test equipment) is placed outside of the radiated zone, normally in the control room. The decoupling between EUT and Auxiliary Test Equipment is easily achieved by means of a fiber optic cable inserted between two transceivers that transform the electrical signal into an optic signal and viceversa. As EMC automotive tests require high field levels, at least the transceiver placed in the chamber close to the EUT must be RF shielded.





SEO OBE-LIN

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Optical BUS Extenders – OBE-LIN Optical LIN extender

# **OLE CONFIGURATION**

### An extender consists of:

- Two identical transceivers (RX/TX units) called OBE-LINs. Each unit is shielded and configurable through a manual switch to the LIN master or slave standard. The OBE-LIN does not contain any battery. The OBE-LIN unit that is inside the chamber is supplied by the EUT 12 VDC positive battery node (VBAT, GND). The OBE-LIN unit that is outside the chamber is supplied by a 12VDC dedicated power supply.
- One OBE-LIN-ALIM power supply; 110/230Vac mains supply, 12VDC, 0,5A, to supply the OBE-LIN unit that is outside the chamber. The VBAT, LIN bus and GND pins are available on the DB9 Female connector for user connections.
- A bifiber cable FBxxx, with xxx equal to the length expressed in meter. The standard cable is FB010, 10 meter long. The fiber connectors are ST type and the fiber cable is sized 200/230 um.
- Two DB9 female connectors that the customer may use for its connections. The electrical cable between the EUT and the nearby OBE-LIN is the responsibility of the customer. In the presence of the radiating field the connection is critical and must be short.

TECHNICAL SPEC	IFICATIONS	SYSTEM PARTS			
Data rate	20kbit/s	OBE-LIN	RXTX Transceivers units (x 2)		
Bus interface	Lin spec. Compliant rev. 1.2 Lin spec. Compliant rev. 2.0	OBE-LIN-ALIM	12V power supply for OBE- LIN		
Bus termination	$30k\Omega$ (slave)/1k $\Omega$ (master) selectable	FB010	10mt Bifibre cable		
Electrical connector	DB9 Male	Two DB9 female connectors	May be used to connect OBE-LIN		
Optical connector	ST	Anechoic chamber	VBAT, LIN bus, GND pins		
Power supply	12V from power supply or car battery	VBAT, LIN bus, GND	available on DB9 Female connector for user connections)		
Fiber cable type	200µm - multimode				
Fiber length	Up to 100 meters	DB9 female connector	DB9 female power supply OBE-LIN-ALIM		
Operating temperature	0 to 50°C		- connector		
Dimensions	129 x 79 x 29.5 mm (Lx WxH)	Anechoic chamber	VEAT LINE OND		
Shielding	200V/m up to 18GHz				
ESD Protection	30kV				
OBE-LIN Front view	OBE-LIN Rear view	DB9 female connector	DB9 female connector		
	MASTER VO POW	TER .			



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Optical BUS Extenders – OBE 9141 Optical K-Line extender

# *Optical bus extender according to the ISO-9141 standard*



The OBE9141 system allows the connection, by means of optical fibers, between an Electronic Control Unit (ECU) on a vehicle and a Diagnostic Tester (DT), according to the ISO-9141 standard. The system is composed by an optical transceiver (OBE9141 ECU) interfacing the ECU, placed on the vehicle or near it in the test area and another optical transceiver (OBE9141 DT) interfacing the DT, typically outside the high field test area. The two transducers, both shielded up to 200 V/m over the bandwidth from 10kHz to 18GHz, are connected via three optical fiber cables.

With three optical fibers the system allows all the communication types described by the standard; for some of the height possible configurations only one or two fibers are needed.

The two transducers are similar but not identical.

The OBE9141ECU is powered from the ECU or the vehicle, the OBE9141DT has a dedicated power supply and provides power to the attached DT equipment.

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# THE ISO-9141 STANDARD

The ISO-9141 standard specifies the requirements for setting up the interchange of digital information between an on board ECU and a suitable diagnostic tester. This communication is established in order to facilitate inspection, test, diagnosis and adjustment of vehicles, systems and ECU's.

The ECU shall have one (K) or two (L and K) communication connections.

If lines K or L from one or more ECU's are connected together the resulting system is called a bus system.

Line K is defined as the line which provides information in a serial digital form from the ECU to the diagnostic tester, Line K may also be used bidirectional, in which case it may carry commands or data from the diagnostic tester to the ECU. Moreover line K may be used to initialize the serial communication. Line L is a unidirectional line from the diagnostic tester to the ECU. When it exists it may be used to initialize the serial communication and/or to carry commands and/or data.



Optical BUS Extenders – OBE 9141 Optical K-Line extender

# **POSSIBLE CONFIGURATIONS**



# FULL CONFIGURATION SYSTEM (3 fiber cables)



### **TECHNICAL CHARACTERISTICS**

Battery voltage (nomi	nal)	12V
Input threshold high	2/3 * Vb	o ±10%
Input threshold low	1/3 * Vt	o ±10%
Output resistance "OF	F"	$500\Omega \ \pm 5\%$
Output resistance "Of	۷"	<20Ω
Input resistance "OFF	"	>10KΩ
Baud rate	>100 k	bits
Optical connectors	ST	
Optical fibers cable	200/230	) µm
Electrical interface DE connectors	9 pole f	emale filtered
Power supply connect	t <b>or</b> LEM	O 5 poles circular

(For DT only) circular

# SYSTEM PARTS

**OBE9141ECU** Electronic control unit interface

**OBE9141DT** Diagnostic Tester interface

AL2 (\*) External power supply DC 12V

0.5A 230V-50Hz for OBE9141DT

FBmmm Bifiber optical cable (mmm=length in m)

FCmmm Monofiber optical cable (mmm=length in m) 24V OPTION

OBE9141ECU/24 Electronic control unit 24V

(It replaces OBE9141ECU)

AL2/24 <sup>(\*)</sup>External power supply DC 24V 0.5A 230V -50Hz (For OBE9141DT) NOTE: OBE9141DT and fiber cables are the same for 12V or 24V applications.

(\*) The 110VAC 60Hz version with the US power cord is available and identified by the suffix /US (for example: AL2/24/US)



Measuring Instruments – ODVM301 DC Voltmeter for MOCS Controller

# **Optical Digital Voltmeter Module**



### **GENERAL DESCRIPTION**

TESEO optical digital voltmeter system is a fiber optic communication link for the transmission of accurate DC voltage measurements in hostile environments subjected to electromagnetic interferences, noises, or characterized by the presence of high voltages.

A plug-in system consists of a four channels base module fitting into TESEO mainframes, and up to four battery powered, shielded transmitters, each connected to the base plug-in by means of a single fiber optic cable, and provided with an individual dedicated battery charger.

Each plug-in system holds four independent fiber optic channels.

It provides researchers and engineers with an integrated technology solution to the problem of measuring DC voltages in environments characterized by high levels of electromagnetic field or very high voltages.

### **MAIN FEATURES**

- Four channels plug-in MOCS-MFD mainframe (up to 48 independent channels per mainframe)
- Accurate DC voltage measurement
- Differential, bipolar measurements
- ±32 V full scale with 1 mV resolution
- 1 MOhm input impedance
- Numeric values shown on MOCS-MFD LCD
- Shielded to more than 200V/m EM fields from 10 kHz to 18 GHz

### **APPLICATIONS**

- Power supply precision measurements
- Set point stability measurements
- Sensor output measurements
- General voltages measurements in perturbed environments

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# Measuring Instruments – ODVM301 DC Voltmeter for MOCS Controller

### **BASE UNIT PLUG-IN**

EIFFAGE

**TESEO** 

ODVM301 plug-in system is a digital voltmeter with a  $\pm$ 32 V input range with 1 mV resolution; the measure is sent by the remote satellite over a fiber optic link whose length can easily reach 1 km.

ODVM301P base unit lodges four optically and electrically independent receivers; you can connect to it up to four ODVM301S satellite units.

MOCS-MFD mainframe can house twelve ODVM301P base unit plug-ins for a total of forty-eight independent optical channels.

Each channel measure is shown on the mainframe LCD display, expressed in Volt with three significant decimal digits; furthermore, it's readable on the mainframe built-in IEEE-488 interface. Reading is performed at a rate of two per second.

### SATELLITE UNIT

The small sized battery powered ODVM301S satellites can be located in environments characterized by high electromagnetic field; they withstand more than 200 V/m CW electromagnetic field strengths from 10 kHz to 18 GHz and are designed to operate over an exceptionally wide environmental range without significant changes in performance.

They can operate continuously for over 24 hours and can be recharged by means of the associated battery charger.

On/off switch is local and it provides also a control of the status of the battery.

The input is differential with 1 MOhm impedance; self calibrating techniques and digital filtering assure long-term accuracy and noise rejection.

It's possible to use an input resistive cable in order not to perturbate the equipment under test and not to pickup electromagnetic field, in a few words to perform a non-invasive measurement.

Resistive cables are available upon request in different lengths and with different terminations; they are also available with internal dividers in order to measure high-voltage signals.

### ACCESSORIES

In addition to the base and satellite units, each plug-in system is supplied with a CB4 auto-power-off battery charger CB4.

Fibre optic cable is available in any length up to 1 km. Alternatively, it can be supplied with a rugged reeling frame (up to eight fibers in one cable).

Feedthroughs for the fiber optic cables can be supplied too.

### SYSTEM SPECIFICTIONS

± 32V

1 mV

1 Mohm

4/s

0,5 % (±1mV)

true differential

- Electrical
  - full scale input
  - resolution
  - accuracy
  - input type
  - input impedance
  - measurement rate

### Mechanical and environmental

### Satellite unit

- battery operating time: continuous > 24 hours switch-off > 1000 hours
- battery recharge time: 16 hours
- battery charger connector: LEMO 5 poles circular
- electrical input connector: HIROSE 4 poles circular
- fiber optic connector: ST
- dimensions (H x W x D): 29,5 x 79 x 106 mm
- operating temperature: -10° to +70°C
- storage temperature: -20° to +80°C

### Base unit

- fiber optic connector: ST
- Dimensions: plug-in for MOCS-MFD
- operating temperature: 0° to +50°C
- storage temperature: -20° to +70°C

### Accessories (available by request)

- resistive cables with different lengths and terminations
- resistive cables with dividers

# SYSTEM PARTS

ODVM301P four channels plug-in for MOCS-MFD ODVM301S battery powered satellite unit CB4 dedicated battery charger FCmmm fibre optic cable (mmm = length in meters) OPTIONAL ACCESSORIES FOBC-ST ST fibre optic cable feedthrough

**FORF** fibre optic cable reeling frame **RCcc** resistive cable (cc = length in centimeters)

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Measuring Instruments – OTM301 RF Power Meter for MOCS Controller

# Optical telemetry module RF Power/Volt Meter 10kHz ÷ 1GHz OTM301



**TESEO** optical telemetry system is a fiber optic communication link for the transmission of the measure of a radiofrequency voltage, current or power, in hostile environments subjected to electromagnetic interferences, noises, or characterized by the presence of high voltages.

A plug-in system consists of a two channels base module fitting into TESEO mainframes, one or two fiber optic cables for transmitting the measure values, one or two battery powered, shielded transmitters, and one or two battery chargers.

Each plug-in system holds two independent fiber optic channels.

It provides researchers and engineers with an integrated technology solution to the problem of measuring electrical radiofrequency quantities in environments characterized by high levels of electromagnetic field or very high voltages.

OTM 301 plug-in system is a radiofrequency voltmeter for CW signal in the frequency range 10 kHz to 1 GHz, with a dynamic range of 50 dB (-40 to +10 dBm, about 1 to 750 mV); the measure is sent by the remote satellite over a fiber optic link whose length can easily reach 1 km.

OTM 301P base unit is a dual optically and electrically independent channels receiver; you can connect to it one or two OTM 301S satellite units.

MOCS-MFD mainframe can house up to twelve OTM 301P base unit plug-ins for a total of twenty-four independent optical channels.

Each channel measure, expressed in dBm or mV, is shown on the mainframe LCD graphic display in numerical form, with 3.5 digits; more, it's readable on the mainframe built-in IEEE-488 interface. Reading is performed at a rate of ten per second.

OTM 301P holds also two BNC connectors giving a DC level proportional to the reading for each channel.

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# Measuring Instruments – OTM301 RF Power Meter for MOCS Controller.

# SATELLITE UNIT

The small sized battery powered OTM 301S satellites can be located in environments characterized by high electromagnetic field; they withstand more than 200 V/m CW electromagnetic field strengths from 10 kHz to 18 GHz and are designed to operate over an exceptionally wide environmental range without significant changes in performance.

They can operate continuously for over eight hours and can be recharged in short time by means of the associated battery charger.

On/off switch is local and it provides also a control of the status of the battery. Input is 50 Ohm.

### APPLICATIONS

- CW (AM/FM modulated too) power meter (i.e. remote directional couplers)
- CW voltmeter
- CW current meter, with different sets of current probes and equalizers
- **Bulk Current Injection**
- Field Strength measures

# SYSTEM PARTS

- OTM301P two channels plug-in for MOCS-MFD
- battery powered satellite unit OTM301S
- dedicated battery charger CB4
- single fiber optic cable for signal line FC*mmm*
- (mmm = length in meters)FOBC ST ST fiber optic cable feedthrough FORF (OPTION)

fiber optic cable reeling frame (OPTION)

# **OPTIONS – Current Probe and Equalyzer**



When your necessity is to monitor current on bulks, TESEO offers a wide range of current probes and equalizers to cover all the frequency ranges, the sensitivity requirements and the harness sizes. Just request!

# **TECHNICAL SPECIFICATIONS**

#### Electrical

- measure CW power, voltage or current
- frequency range 10 kHz to 1 GHz
- input impedance 50 Ohm
- sensitivity 2,2 mVrms (-40 dBm)
  - up to  $-46 \text{ dBm} (\pm 2 \text{ dB})$ 750 mVrms (+10,4 dBm)
- full scale input •
  - meas overrange
    - 20% 100 mW (+ 20 dBm) max safe input
  - mV or dBm measuring units
    - measuring rate up to 10 Hz
- resolution 3,5 digits
- 4 V full scale monitor output
- ±1dB accuracy

#### **Mechanical and environmental**

### Satellite unit

- battery operating time continuous > 8 hours
- switch-off > 1000 hours
- battery charger connector LEMO 5 poles circular
- battery recharge time 16 hours
- electrical input connector BNC
- fiber optic connector ST
- dimensions 135 x 79 x 29,5 mm
- operating temperature -10° +70°C
- storage temperature -20° +80°C

### Base unit

- monitor connector BNC
- fiber optic connector ST
- dimensions 1-slot plug-in
- operating temperature 0° +50°C
- storage temperature -20° +70°C

#### Accessories (available by request)

### **Bulk Current Monitor set including:**

- probe
- equalizer
- connecting cables

# SYSTEM CHARACTERISTICS

- Two channels plug-in for MOCS-MFD mainframe (up to 24 independent channels per mainframe)
- Measures CW voltage, current and power from 10 kHz to 1 GHz
- 50 dB dynamic range (-40 to +10 dBm)
- 50 Ohm input
- Numeric values shown on MOCS-MFD display
- Shielded to more than 200V/m EM fields from 10 kHz to 18 GHz

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Measuring Instruments – SOVM03 Stand-Alone Optical Voltmeter

# SOVM03 Serial Optical VoltMeter



### **OVERVIEW**

This is the third-generation of EMI shielded and battery powered digital multimeters.

The SOVM03 equipment is a 8-channel digital voltmeter with fiber optic connection to a control PC via a USB Interface.

It is particularly suited for the monitoring of EUT slowly changing voltages in a harsh electromagnetic environment like that encountered during the performance of a radiated immunity test.

The small size of the satellite unit acquiring the channels allows the use of the system not only in an anechoic chamber, but also in smaller EMC enclosures like TEM and GTEM cells, striplines or every application where a rugged voltage monitor is needed.

- Up to 8 simultaneously unbalanced sampled inputs, or 4 simultaneously balanced sampled inputs
- True bipolar DC analog input ranges: ±40 V<sub>DC</sub>.
- AC measurement capability up to 28V<sub>RMS</sub> in the 30-200 Hz frequency range.
- Differential capability using a pair of inputs.

### SYSTEM CAPABILITIES

The system is able to measure:

- unbalanced AC and DC voltage between each input and ground;
- differential voltage between any pair of inputs;
- level of the battery
- (internal) ambient temperature

The PC through the application software allows the reading of the acquired signals and the setting for each channel.

The SOVM03S enclosure is shielded and consequently is not susceptible to the RF field coupled on its external surface.

The connection to the EUT requires particular attention as any signal picked-up by the copper wires adds directly to the voltage level under measurement.



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#### Measuring Instruments – SOVM03 Stand-Alone Optical Voltmeter

### **QUICK-CHANGE BATTERY**

Thanks to a standard battery cell and a quickchange structure, the battery can be easily removed by the operator and replaced with another one. The battery is a standard Lithium cell rechargeable model, and it can be recharged apart with a standard battery charger.

The battery is retained by a EMC-proof seal metallic cap, than can be easily unscrewed using a screwdriver or a small coin.



#### SYSTEM CONFIGURATION

The SOVM03 system is composed by of:

- SOVM-03S satellite unit, battery powered acquisition equipment shielded up to 200 V/m from 10 kHz to 18 GHz;
- SOVM03 GUI software for WINDOWS that allows remote control of the satellite unit;
- USB-IF electro/optical transducer that plugs into the USB port of the PC, and is compatible with USB 2.0 Standard.
- CB12 standard battery charger for two Lithium cells
- FB008 bifibre optical cable 8 meters length, connecting the SOVM03S satellite unit to the USB-IF converter.

Fibre optic cables having different lengths are available upon request.

### OPTIONS

Individual certificate of calibration

- FBxxx: Bifibre optical cable, ST connectors, xxx = length in meters, 200/230  $\mu$ m
- FCxxx: Monofibre optical cable, ST connectors, xxx = length in meters, 200/230 μm NOTE: two FCxxx cables for each SOVM03 system are needed

### SOVM03 GUI SOFTWARE

A software GUI (Graphical User Interface) is delivered together with the system.

It supports Windows  $^{\rm @}$  7 and Windows  $^{\rm @}$  10 Operative systems.



Using this software the User can easily control and manage all the SOVM03 functions.

For User who need to integrate the SOMV03 use into a measurement system, a complete set of lowlevel commands can be found in the User's Guide, in order to allow the development of special or dedicated software routines.



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### Measuring Instruments – SOVM03 Stand-Alone Optical Voltmeter

### **TECHNICAL CHARACTERISTICS**

	SOVM03	
Number of channels	8 (single h	anded); 4 (differential)
Full scale input	$\pm$ 40 V_{DC} (28 V_R/	<sub>MS</sub> )respectto analog ground
AC Bandwidth (-3dB)		30-200 Hz
Max. safe input	±	: 150 Volt DC
Resolution		1 mV
Measuring unit		$V_{DC}$ or $V_{RMS}$
Input impedance		1 MOhm
Amplitude accuracy	$DC\pm0.5\%\pm20\ mV$	$AC\pm2\%\pm20\ mV$
Measurement rate	Standard mode: >10 meas/sec; Str	eaming mode: >1000 meas/sec (No AC function)
Input connector	D-type	e, 15 poles female
Optical connectors		ST type
Fiber cable type	200 µm gla	ss-type fiber multimode
Fiber cable length	Up to 100 mt at max data rate	
Battery type	rechargeable 1 element Li-Ion 18650	
Battery charging time	< 1 hour, using a sta	andard external battery charger
Battery operating time	8 hours in standard mode (full charge) @25°C.	
Communication Protocol	USB 2.0 compatible	
Dimensions & Weight	150 x 50 x 100 mm (W	x H x D) - 630 g (battery included)
Operating temperature	0	°C to +50 °C
Storage temperature	-20	0 °C to +70 °C
EMI/EMC (SOVM03S)	EMI shielde Immune to BCI ESD pr	ed 200V/m up to 18GHz up to 300mA up to 400MHz rotected up to 25kV

Visuals and technical specifications subject to change without notice



Measuring Instruments – SOPM Serie - Stand-Alone Optical RF Power Meter

# Serial optical power meters

SOPM01 or SOPM03 - 3 CHANNELS - 10 kHz - 1 GHz or 10 kHz - 3 GHz



The **SOPM** is the first of a new family of virtual type instruments equipped with fiber optic links that TESEO is developing for inclusion in EMC test benches.

The SOPM is a virtual instrument in that it exploits the cheap computing capability of a PC avoiding the use of an on-board microprocessor and dedicated firmware. To be operative it needs to be connected to a PC but, on the other hand, it can be offered at a very competitive price. Furthermore EMC benches tend to become all automatic with a PC at the center of the system and in the rare cases in which a PC is not permanently available, a portable PC can be utilized for the duration of the test.

The adoption of the optic cable encourages the placement of the power meter in an electromagnetically hostile environment, like the inside of an anechoic chamber. The SOPM series power meters are the only power meters which can be located close to the antenna in the radiated immunity test set-up.

The connection to the RS 232 port of the PC is convenient because of the associated low cost and, technically, because it allows the daisy chaining of up to 8 instruments of the family. A configuration with several instruments, not necessarily identical, can be regarded as an alternative version of the SLOTBUS configuration of different instruments TESEO presented successfully a few years ago with the MOCS system.

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Measuring Instruments – SOPM Serie - Stand-Alone Optical RF Power Meter

### SYSTEM SPECIFICATIONS

**SOPM power meter** is a small shielded box, battery powered, able to withstand high electromagnetic fields.

It connects to the three measurement points via coaxial cables. It converts the measurements from analog to digital and transfers the data to the PC through a fiber optic cable..

The SOPM power meter can be used for ten hours before battery recharge. The status of the battery can be read from the PC together with the three measurements.

The SOPM houses a manual ON/OFF switch.

The SOPM is shielded up to 200 V/m. A special attention is to paid to the coaxial connections because any EM noise picked up by a cables act to the power measurements.

As a precaution the unit is delivered with double shielded cables.



### The main characteristics of the system are:

- three measurement channels
- CW power or voltage or current measurements from 10 kHz to 1 GHz (SOPM01) or 10 kHz to 3 GHz (SOPM03)
- 53dB min dynamic range (power from -40 to +13dBm)
- small size, battery powered sensor unit
- standard 50 Ohm input impedance
- shielding to more than 200 V/m
- RS232 optical interface with PC
- computer based, low cost
- number of SOPM satellite units cascadable in daisy chain: 8 max
- protocol information: SOL (see user's manual)

### SYSTEM DESCRIPTIONS

#### The SOPM System is composed by:

- n° 1 SOPM01S or SOPM03S satellite unit
- $n^\circ$  1  ${\ensuremath{\textbf{SOI}}}$  serial optic interface with 25 to 9 pole adapter type D
- n° 1 FB008 standard 8 meter bifibre cable, ST connectors (other lengths upon request)
- n° 1 CB1 battery charger (power supply 110/220V 50/60Hz)
- n° 1 Win-SOPM Software for Windows™ (CD-ROM)
- n° 3 CAVO223BSM-02 double shield cable with SMA and BNC connectors









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Measuring Instruments – SOPM Serie - Stand-Alone Optical RF Power Meter

### Win-SOPM

The CD-ROM is used to install the software. At the PC terminal the test engineer can read the three channels (voltages or powers) and the status of the battery. Each channel can be acquired at a rate of 10 readings per second; the measuring unit (mV or dBm) can be selected.

The application software is developed for Windows<sup>™</sup> environment and is very easy to work with. No specific training is needed.

For customers willing to write their own software, interface commands and reading formats are provided in the technical manual.



### SOI

The **SOI** is a self powered optical transducer that plugs into a 25-pole D-type RS 232 port of the PC. An adapter for a 9 pin D-type connector is provided. A single SOI can control up to 8 satellites, even of different type, connected in a daisy chain configuration. Each instrument is recognized by the position in the chain.

The transducer operates in both directions in half duplex mode.



### **APPLICATIONS**

The SOPM is intended to be used for the measurement of RF CW signals. In particular in the presence of high electromagnetic fields.

### Typical applications are:

- monitoring of the forward and reverse power in radiated immunity tests like IEC 1000-4-3
- monitoring (and calibration) of the voltage in conducted immunity tests like IEC 1000-4-6
- monitoring of injected currents in Bulk Current Injection tests. In this latter case the three channels are used all at once to measure direct and reverse power plus injected current.

**TESEO** has inserted the SOPM in the automated test benches driven by TESEO software. The SOPM software driver written for this purpose is available for customers willing to upgrade existing systems.



Measuring Instruments – SOPM Serie - Stand-Alone Optical RF Power Meter

### **TECHNICAL CHARACTERISTICS**

### Electrical

• channels

.

measure CW voltage / power

3

- frequency range 10 kHz to 1 GHz or 10 kHz to 3 GHz
- input impedance 50 Ohm
- **sensitivity** 2 mVrms (-40 dBm)
- full scale input 1 Vrms (+13 dBm)
- max safe input 100 mW (+ 20 dBm)
- measuring units mV / dBm
- resolution 0.1 mV
- amplitude accuracy (@ 1MHz) from 2 mV to 800 mVrms ±10% ±1mV
- flatness (@ 0dBm) from 100kHz to 1GHz ±1dB

### **OPTIONS**

- **FOBC ST** ST fiber optic cable feedthrough
- **FBmmm** Bifibre optical cable (mmm = length in meters,up to 500m)
- **FCmmm** Monofiber optical cable (mmm = length in meters)
- ATT20-2 20 dB coaxial attenuator (2 W)

Certificate of calibration ISO 17025 Accredited (Accredia) or ISO9000

Mechanical and environmental

### Satellite unit

- battery operating time continuous > 10 h switch-off > 1000 h
- battery recharge time 2 hours
- electrical input connectors SMA
- fiber optic connector ST
- dimensions 170 x 110 x 55 mm
- operating temperature 0 ÷ +50 °C
- storage temperature -20 ÷ +70 °C

### Serial optical interface

- **baud rate** 9600
- computer connector D-25P or D-9P
- fiber optic connectors ST
- dimensions 60 x 50 x 20 mm
- operating temperature  $0^\circ \div +50^\circ C$
- storage temperature -20° ÷ +70°C

### SYSTEM PARTS

#### SOPM:

**SOPM01S** or **SOPM03S** satellite unit + **SOI** serial optic Interface with 25 to 9 pole adapter type D + **FB008** 8 meter bifibre cable + **CB1** battery charger + **Win-SOPM** software + 3 double shield cables



LISN and EMC Instruments – ANx Serie LISNs

## CISPR16 & MIL STD461 Line impedance stabilization network



### OVERVIEW

**TESEO** offers a family of Line Impedance Stabilization Networks developed for use in conducted emission tests according to the most commonly adopted specifications.

In particular CISPR 16 compliant LISN's are employed for CE marking tests while MIL STD compliant are popular in the military field. An Artificial Hand is included in all models.

The LISN's combine excellent design and manufacturing with a convenient price.

Furthermore they are tested individually and the test reports released with the hardware.



Basic Standard network circuit  $50\Omega / 50\mu H + 5\Omega$ 

#### WHAT IS A LISN FOR?

A LISN is a low pass filter placed between power supply and EUT performing the following function:

- separate the power source from the EUT with respect to the RF noise;
- provide the EUT supply line with a well known and repetitive RF impedance;
- convey the EUT generated noise on the supply lines to a 50 Ohm measuring equipment.



Typical Impedance and Phase curves



### LISN and EMC Instruments – ANx Serie LISNs

#### Important REMARK

Standard LISN's have high capacitance capacitors producing noticeable current leakages. Due to this reason, the LISNs cannot be operated under residual current circuit breakers. The use of an insulation transformer is stronly recommended.

### SINGLE PHASE LISNs

V-Network LISN serie, CISPR 16-1-2 and MIL-STD 461D, E compliant (50  $\mu H$  + 5  $\Omega)$  || 50  $\Omega$  ). Single phase standard plug.

#### AN16A1PH

Compliance	CISPR 16-1-2
Network Impedance	(50μΗ + 5Ω)    50Ω + 250μΗ
Frequency Range	9 kHz – 30 MHz
Lines	2 + PE
Max Line Current	16A (25A for 10 min)
Max Line Voltage	250Vrms, 50/60 Hz
Socket	Shuko socket
RF Output	BNC(f), 50 Ω
Artifical Hand	4mm Banana socket
Transient Limiter	Built-in
Lines switch	Manual rotary switch



AN16A1PH-B		
Compliance	CISPR 16-1-2, MIL-461D, E	
Same Main Features of AN16A1PH		
Additional feature Built-in 10dB attenuator		

### **THREE PHASE LISNs**

V-Network LISN serie, CISPR 16-1-2 and MIL-STD 461D, E compliant (50  $\mu$ H + 5  $\Omega$ ) || 50  $\Omega$ ). Three phase + single phase standard plugs

### AN32A3PH

Compliance	CISPR 16-1-2
Network Impedance	(50μH + 5Ω)    50Ω + 250μH
Frequency Range	9 kHz – 30 MHz
Lines	3ø plug: 3 + N + PE 1ø plug: 2 + PE
Max Line Current	3ø plug: 32A (40A for 10 min) 1ø plug: 16A (25A for 10 min)
Max Line Voltage	3ø plug: 400Vrms, 50/60 Hz 1ø plug: 250Vrms, 50/60 Hz
Socket	3ø plug: CEE socket 1ø plug: Shuko socket
RF Output	BNC(f), 50 Ω
Artifical Hand	4mm Banana socket
Transient Limiter	Built-in
Liines switch	Manual rotary switch



AN32A3PH-B		
Compliance CISPR 16-1-2, MIL-461D, E		
Same Main features of AN32A3PH		
Additional feature Built-in 10dB attenuator		



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LISN and EMC Instruments – LISN1-D Automotive LISN

### CISPR 25 - ISO 11452 - ISO 7637 Line Impedance Stabilization Network & Artificial Network LISN1-D



### LISN AND ARTIFICIAL NETWORK

**TESEO** offers a family of Line Impedance Stabilization Networks developed for use in conducted emission tests according to the most commonly adopted Automotive specifications.

For Immunity test on components or ECU wirings the Automotive Standards require an Artificial Network (AN), to isolate the EUT wired path, where can be present RF interferences, from the Power Supply Lines.

A LISN can be used as AN for the Standard Immunity test.

The only difference between LISN and AN is that the AN may not have the monitor output since it is not required any type of RF readings on it.

Different Standards may require slightly different LISN or AN configuration. In particular CISPR 25 and ISO 11452-2, 4 and 5 require a LISN/AN having a  $1\mu$ F input capacitance on Supply Side, while ISO 7637-2 Standard requires this capacitor removed.

The LISN's and AN's combine excellent design and manufacturing with a convenient price.

Our LISN's and AN's are V-Network type. Furthermore they are tested individually and the test reports released with the hardware.

### WHAT ARE LISN AND AN FOR?

A LISN is a low pass filter placed between power supply and EUT performing the following function:

- separate the power source from the EUT with respect to the RF noise;
- provide the EUT supply line with a well known and repetitive RF impedance;
- convey the EUT generated noise on the supply lines to a 50 Ohm measuring equipment.

The AN is the same of the LISN, but the RF monitor is not used. If present, it shall be closed on 50 ohm termination.

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### LISN and EMC Instruments – LISN1-D Automotive LISN

### **MAIN SPECIFICATIONS**

LISN1-D		LISN1-D-100	
Compliance	CISPR 25, ISO 11452-2/4/5 ISO 7637-2:2011	Compliance	CISPR 25, ISO 11452-2/4/5 ISO 7637-2:2011
Network Impedance	5μH, 0.1μF + 1kΩ	Network Impedance	5μH, 0.1μF + 1kΩ
1µF Input Capacitor	manually selectable	1µF Input Capacitor	manually selectable
Frequency Range	100 kHz – 108 MHz	Frequency Range	100 kHz – 108 MHz
Lines	1	Lines	1
Max Line Current	70A	Max Line Current	100A
Max Line Voltage	60Vdc	Max Line Voltage	60Vdc
Socket	6mm Banana socket	Socket	6mm Banana socket
RF Output	N-type(f), 50 Ω	RF Output	N-type(f), 50 Ω
Dimensions		Dimensions	
Weight		Weight	
Included accessories	Removable 50 $\Omega$ termination, N-Type(m) connector, 1W	Included accessories	Removable 50 $\Omega$ termination, N-Type(m) connector, 1W

### LISN-1D BLOCK DIAGRAM





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### LISN and EMC Instruments – LISN1-D Automotive LISN

### **CISPR 25 CONFIGURATION – LISN APPLICATION**

### LISN for RF Disturbances measurement.



**NOTE:** According to CISPR 25, the LISN1-D shall be mounted directly on the ground plane. For **ENH2** remotely grounded (vehicle power return line longer than 200mm) two LISN1-D networks are required: one for the positive supply line and one for the power return line; for EUT locally grounded (vehicle power return line 200mm or shorter) only one LISN1-D is required for the power line, the power return line is connected to the ground plane.

### **ISO 7637-2 CONFIGURATION – LISN APPLICATION**

### LISN for Transient measurement.





### ISO 11452-2, 4, 5 CONFIGURATION – AN APPLICATION





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LISN and EMC Instruments – LISN2-S Automotive ISO7637 Transient Emission LISN

### **ISO 7637-2 Emission Testing**

Line impedance stabilization network with Slow & Fast Switches LISN2-S



#### **GENERAL DESCRIPTION**

The **LISN2-S** equipment is a device used to perform measurements of conducted voltage emissions according to ISO 7637-2.

The LISN2-S simplified general block diagram is shown below. It consists of two switches, some shunt loads and an artificial network (LISN) as per ISO 7637-2.

During the transient emission tests only one switch shall be actuated at a time. Switch SW1 is a standard automotive relay and is used to measure slow transient emissions (pulses in the millisecond range, with amplitudes over 400V).

Switch SW2 is a solid state electronic switch and is used to measure lower voltage transients (pulses in the nanosecond to microsecond range, with amplitudes less than 400V).

The shunt resistor (selectable from  $120\Omega$ ,  $40\Omega$ ,  $20\Omega$ ,  $10\Omega$ , or external) simulates the DC resistance of other devices which are connected in parallel to the Device Under Test (DUT). It consists of series/parallel combinations of low-inductance resistors.

The shunt resistor (selectable from  $120\Omega$ ,  $40\Omega$ ,  $20\Omega$ ,  $10\Omega$ , or external) simulates the DC resistance of other devices which are connected in parallel to the Device Under Test (DUT). It consists of series/parallel combinations of low-inductance resistors.

The artificial network is compliant with standard ISO 7637. Its typical impedance |ZPB|, is measured between terminals P and B, with switch SW2 open, switch SW1 closed and terminals A, B short-circuited. Therefore impedance calibration shall be performed at internal points P and B, keeping switch SW2 in the open state.



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### LISN and EMC Instruments – LISN2-S Automotive ISO7637 Transient Emission LISN

A monitor signal, obtained through a 100:1 voltage divider and made available on a BNC connector of the front panel of the equipment, allows to evaluate the voltage transients generated by the DUT during switching on/off processes.

Selection of the switch to be used in conjunction with the LISN is performed by the operator.

Approximately 5 µsec before generation of the disconnection pulse, a BNC connector, located on the front panel of the equipment, provides a SYNC OUT trigger pulse that can be used to synchronize an external oscilloscope. In any case the voltage transient can be observed/synchronized using the voltage probe MONITOR OUT connector. To be noted that while the return of the SYNC OUT signal is always connected to equipment chassis, the MONITOR OUT return, that is instead connected to the battery return line, may not (on the rear panel of the equipment a GROUND socket is available for connection of the battery return to CHASSIS GROUND).

The equipment is capable of delivering a current of 50 A at 60 V battery voltage and is protected against permanent load short-circuits by a thermal switch (not shown in the simplified block diagram), that is located upstream of switch SW1.

There is a second protection mechanism (not shown in the simplified bloc diagram) that operates when the equipment internal temperature has increased up to 110 °C, because of the heat dissipated by the shunt load. This could happen when the lowest shunt load  $(10\Omega)$  is selected and the highest battery voltage is applied (60V). When this situation arises, the shunt load is immediately disconnected and an internal fan is switched on. At the same time an alarm warning illuminates on the equipment front panel for the operator.

The temperature warning extinguishes and the shunt load is reconnected to the battery power line as soon as the internal temperature of the equipment lowers below 70 °C.

#### **ARTIFICIAL NETWORK**

The artificial network is a standard ISO 7637-2 5uH,  $50\Omega$  LISN, having the following circuit diagram:



MAIN SPECIFICATIONS

#### General

- Test Voltage: up to 60 Vdc @ 50A max
- Operating temperature: 23°C ±5%
- Physical Dimensions: Rack 19" 6U x 400mm depth
- Load short circuit protection: By thermal switch
- Shunt load (max rated power @10Ω): 800W (series/parallel combination of 16 resistors)
- Temperature sensor: NTC on shunt load heat-sink
- Overtemperature protection: ≥110°C (load=off - fan=on)

### Artificial Network (LISN)

- Inductance: 5 uH
- Inductor resistance:  $<5 \text{ m}\Omega$ -
- Capacitor: C=0.1 µF, 200Vac, 1500Vdc
- Impedance: As per ISO 7637-2:2004, (±10%)

#### **Slow Pulse Switch**

- Type: Automotive relay, with coil transient suppression
- Contact rating: I=70A (max), no suppression across contact
- Contact material: high purity silver
- Voltage rating: over 400V

#### **Fast Pulse Switch**

- Type: Electronic switch
- Maximum voltage:400V (limited to 600V)
- Maximum current: 50A
- Voltage drop: 1V Max at 25A
- Switching time: <300 ns ±20% Measured during power disconnection on 400V max drop with test load: R=0.6Ω, L=50µH (1kHz), at 13.5V and 27V battery test voltages.

#### Shunt resistor

RS=10, 20, 40, 120  $\Omega$  or external, selectable

#### **Equipment configurations**

- Slow pulse switch and LISN
- LISN and fast pulse switch

#### **Power disconnection**

- Pulse Time Duration: 3msec to 800msec, selectable
  - Pulse Trigger: Automatic, fixed PRF= 1Hz
    - Manual, by pushbutton External, TTL high-to-low transition

#### Connectors

- Sync out/Monitor out/Trigger in: BNC Female -
- Output: 6mm Safety Banana



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EMC Accessories – BCI-T and ESDT-10605, Standard BCI & ESD Tables

BCI-T Standard BCI Table, compliant to ISO 11452-4 ESDT-10605 Standard ESD Table, compliant to ISO 10605



### **GENERAL DESCRIPTION**

The BCI-T is a standard table for BCI test, in conformance to the ISO 11452 part 4 Standard.

The EDST-10605 is a standard table for ESD measurements applications, in conformance to the ISO 10605 Standard.

The main structure is made in high quality wood for a perfect dielectric support.

The table has on its top a HCP (Horizontal Coupling Plane) in copper or brass consisting of a 1mm metallic foil, fixed to the bench top.

Optionally, for application in rooms having a nonmetallic floor, is possible to add an aluminum standard GRP (Ground Reference Plane) underneath the table, having standard dimensions.

### **MECHANICAL CHARACTERISTICS**

 Table dimensions: 1000 x 2000 x 900 m (L x W x H). T
 Other dimensions available upon request

### **BCI-T STANDARD REFERENCES**

The BCI-T follows these Standard indications:

- Standard: ISO 11452-4:2005
- Top ground Plane: as per ISO 11542-4:2005 par 7.1
- Underneath-table ground plane: as per ISO 11542-4:2005 par 7.1
- Table Height and dimensions: as per ISO 11542-4:2005 par 7.1

### **STANDARD REFERENCES**

The ESDT-10605 follow these Standard indications:

- Standard: ISO 10605:2008
- HCP: as per ISO10605:2008 par 6.4
- GRP: as per ISO10605:2008 par 6.4
- Table Height and dimension: as per ISO10605:2008 par 6.4

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### EMC Accessories – BCI-T and ESDT-10605, Standard BCI & ESD Tables

### SYSTEM PARTS

**ESDT-10605** Standard Table **Cable**  $1M\Omega$  1.2m reference cable

### **OPTIONS**

### **GRP - GROUND REFERENCE PLANE**

If the table must be used in a chamber or room having a non-metallic floor, it needs to be placed on a Ground Plane assuring the ground reference.

The GRP is in aluminum and has a dimension of at least 200mm larger (and wider) than the table dimension.

### SWEVEL CASTER

As option, the standard table can be equipped with four wheels for an easier handling.

The wheels are provided of individual brake and swevel movement.

The total height of the table with wheels will not change and will be compliant to the Standard.



### **GROUNDING GRIP**

The standard table is provided of one grounding spot connector , placed in one of the corners.

In case this is not enough, as option can be ordered a movable multi-spot grounding grip unit.

The grip is secured to the table by means of a double gripping vise.



The standard grounding grip is provided by six standard 4 mm banana jack connectors.

Grounding grips with different numbers of banana jacks are available upon request.





### **OPTIONAL FIXTURES**

#### POSITIONNING TEST FIXTURE

As per ISO standards, the EUT harness and injection/monitor probes shall be arrangd in well defined positions.

A set of dielectric fixtures to harness layout and probe holders can be ordered. Form factors will depend of models of probes/coupler/power sensors used. Please ref to the relevant datasheet for additional details

### **ISO 10605 ANNEX F TEST FIXTURE**

The Fixture for indirect discharges test as per ISO 10605 ANNEX F is also.

Please ref to the relevant datasheet for additional details

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EMC Accessories – ESDT-10605-CP-ANNEXF, Indirect Discharge Fixture

# ESD Indirect Discharges Islands Compliant to ISO 10605 Annex F

ESDT-10605-CP-ANNEXF



### **GENERAL DESCRIPTION**

The ISO 10605, in its Annex F describes an additional approach to ESD test for powered-up devices, in order to grant a better correlation between ESD test and the real world.

In order to do this, the Standard introduces a special fixture allowing to produce direct or indirect discharges on the EUT.

While direct discharges are applied directly to the EUT, indirect discharges are applied through "discharge islands" placed at fixed distances and by conductive metal strips.

Dimensions and form factor of the fixture is defined by the Standard for a reliable test repeatability.

### **STANDARD REFERENCES**

The ESDT-10605-CP-ANNEXF follows these Standard indications:

Standard: ISO 10605:2008 Annex F

### **MECHANICAL CHARACTERISTICS**

- Total length: abt. 1900 mm
- Discharge Island distance: 500 mm
- Coupling Plane dimensions: 160x350 mm
- Coupling support material (coupling plane, strip, islands): Copper

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EMC Accessories – RC20 – RC20BNC Resistive Cables

### **Resistive Cables** RC20 – RC20BNC



### **PURPOSES**

High input impedance, low frequency, fiber optic links used to transmit analog signals in harsh electromagnetic environments, i.e. in anechoic chambers, suffer very often from the criticality of the terminal connection to the device under test.

Optical transceivers are usually shielded and not sensitive to the impinging field. Fiber cables are immune by definition.

The electrical cable connecting the EUT to the transceivers is typically not immune.

During CW (with/without AM modulation) radiated immunity tests the high field level generates a common mode conducted disturbance that enters the EUT via the cables.

Due to common to differential mode conversion first and the presence then of spurious non linear functions in the circuitry a DC or low frequency disturbance adds to the wanted signal, with no change to distinguish between them.

The consequent deformation of the useful signal is wrongly misinterpreted as a susceptibility of the fiber optic link.

Very often the most obvious solution, i.e. the insertion of a filter in the transceiver, is not viable because it affects adversely the in-band performance that must be maximized. In this case the resistive cable is of help and more often than not definitively solves the problem.

### IMPLEMENTATION

The electrical connection for OAM303 channels is implemented by means of a short pair of thin resistive wires. The resistance attenuates the field induced disturbance to a level that is normally tolerable.

The standard cable offered by TESEO is called RC20, where "RC" stands for resistive cable and "20" for the length expressed in centimeters. The connection must be short. A long connection collects more noise and makes the accuracy of the analog channels poor as the resistance grows linearly with the length and becomes comparable with the high input impedance of the electronic circuitry. On the other end a too short connection causes a coupling between the satellite box and the device under test. Very often 20 cm is a good compromise but of course other lengths can be provided following specific customer's requirements.

The wires are as thin as possible, the limiting factor being the fragility of a too thin conductor. Each wire ends in a crimped metallic tip (terminal) to be put in contact or soldered to a printed circuit board track or component lead. A red or black sleeve identifies easily the hot or cold side of the connection.

Other terminations like fast-on connectors for automotive applications or probes for penetrating wire sheaths or lead clips can be provided.

### 

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### EMC Accessories – RC20 – RC20BNC Resistive Cables

At the other end a HIROSE 4-pole circular male connector is adopted to match the corresponding connector fitted to the TESEO satellite OAM303S. The wires are made of a carbon filled silicone material with the following characteristics:

- resistance of about 15 kOhm per linear meter
- diameter of 2 mm., including plastic sheath
- operating temperature range in excess of -20 to 100°C.

### **OTHER APPLICATIONS**

The same RC20 cables can be used together with the **ODVM301** DC voltmeter.

The usage of resistive cables with high frequency channels like the 1 MHz **OAM301** is possible only when the full bandwidth is not needed. The resistance of the cable, coupled with the input capacitance of the channel turns the high-Z cable into a low pass R-C type filter with a significant band reduction.

As the OAM301S connector is a BNC, the two wire cable is called RC20BNC.

The cable can instead be used properly with the low frequency **SOVM02** monitoring equipment. In this case the cable is formed of 9 wires with a DB9 connector.

Eight wires are resistive, one conductive for ground connections.

Labels are used to identify the wires. The part number is RC20DB9.

The same DB9 cable can also be used together with ADAC system

### HANDLING

The material that is used now in the high resistance cable is less flexible than the previous one. The plastic sheath further contributes to make it more rigid. However the cable must be handled with care, in particular it must not be stretched.

After handling it, the recommendation is to repeat the calibration of the channel to account for possible changes of resistance.



**STANDARD PRODUCT** 

- RC20 2- wire resistive cable for OAM303 and ODVM301
  - RC20DB9 9-wire resistive cable for SOVM02 and ADAC
  - **RC20BNC** 2-wire resistive cable for OAM301

### **OPTIONS**

RCxx, y xx = length in cm. y = void, DB9, BNC

quotation on request



### 2019 rel.1

TEM Cells and Shielded Boxes – DTEM, Shielded Effectiveness Measurement Cell

### Dual TEM Cell for Shielding Effectiveness Measurements up to 1GHz

DTEM



### **FEATURES**

- Electromagnetic, electric and magnetic shielding effectiveness measurement
- Frequency up to 1 GHz
- Dynamics up to 80 dB

### **GENERAL INFORMATIONS**

The TEM cell consists of a section of rectangular coaxial transmission line (RCTL) with two tapered sections at each ends. The taper is used as a transition to match the RCTL to standard coaxial cable characteristic impedance connectors at the two ports of the cell.

The center inner conductor, consisting of a tin metallic septum, is fixed by two dielectrical supports.

The cell is used as a broadband amplitude and phase linear transducer of RF signals into field strengths.

The field inside the cell is uniform and so it is a good approximation to simulate a plane wave in open space (far field).

Since the TEM cell operates in bi-directional mode it is assumed that two cells coupled through a common aperture may be used as a radiated field measurement system.

The coupling between cells through their common aperture yields the basic result which the dual-cell correct operation relies on.

Providing the upper side of the TEM cell with an aperture, the generated field, which is known and uniform, couples into a second similar above-standing cell.

When mounting the shielding material sample on the aperture, the coupling between the source cell and the transducing one is reduced.

The amount of this coupling reduction is a direct measure of the shielding effectiveness of the sample material under test.

### **MEASUREMENT SYSTEM**

The measurement system is made-up with:

- A dual TEM cell
- A signal generator
- A receiving unit

Both cells are terminated on their characteristic impedance to ensure a low VSWR level and to allow for the TEM mode propagation only.

An automated PC-based control system handles both exchanging transmissions between instruments and data collection.

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TEM Cells and Shielded Boxes – DTEM, Shielded Effectiveness Measurement Cell

### SHIELDING EFFECTIVENESS DEFINITION

### **TECHNICAL CHARACTERISTICS**

### **DTEM S.W.R. measurement**

The measurement has a substituting approach and therefore is performed through two phases:

in the first phase, called calibration phase, the transduced signal power level is measured in a free aperture condition;

in the second phase the same measurement is accomplished by mounting the sample on the aperture.

The shielding effectiveness (SE) is so defined as: SE = 10 Log

where:

A = signal power level measured without the test sample

**B** = signal power level measured with the test sample mounted

### **MEASUREMENT SET-UP**





DTEM dynamic range [dB] measured with 0 dBm input, 1 kHz RES BW



### **MECHANICAL CHARACTERISTICS**

- Dimensions: 400 x 220 x 260 mm (L x W x H)
- Weight: approximated 15 kg

### SYSTEM PARTS

 
 DTEM
 Dual TEM cell

 HJ
 Hybrid Junction (OPTION)

 MDSC
 Set of two matched double-shielded BNC-BNC coaxial cables (OPTION)

 DSC
 Double shielded BNC coaxial cable (OPTION)

 PT2
 Set of two 50-Ohm resistive loads (OPTION)

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TEM Cells and Shielded Boxes – RLTC Series, Radio Link Test Cells

### Radio Link Test Cell

**RLTC Series** 



### DESCRIPTION

The RLTC shielded anechoic box family has been conceived to test small RX/TX and wireless devices operating in the various frequency bands from some hundreds of MegaHertz up to several GigaHertz.

The RLTC family cells are made of aluminum to provide a shielding effectiveness of 50 dB (minimum of 40 dB) while offering a low weight and excellent handling as facilitated by two transport handles.

The minimum size is  $60 \times 30 \times 30$  cm. All dimensions can be incremented in steps of 10 cm.

The inside of the cell is lined with ferrite tiles and / or with absorbers, depending on the range of frequencies to be covered.

These cells are not TEM: however a certain field uniformity is achieved through the use of the anechoic material lining. A +/- 6 dB uniformity over a cube of 16 cm of side can be obtained. The cell is provided by a door. Dimensions can be trimmed to fulfil particular requirements. An extractable drawer contains fibre optic feedthroughs and filtered connectors for connecting electrically the DUT can be also installed to allow the accessing and positioning of the DUT. A dedicated mechanical mounting fixture for each DUT shape can be provided as an option.

Gasket and locking mechanism ensure that the door or drawer is kept in place with no electromagnetic leakage. Normally the action on the door and drawer is manual, but for production testing a pneumatic actuation is offered as an option.

As option, inside the cell can be placed a broad band antenna whose polarization can be changed by extracting and rotating 90 degrees its support.

The antenna is connected to the outside instrumentation via a coaxial connector fitted to a lateral panel of the box.



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TEM Cells and Shielded Boxes – RLTC Series, Radio Link Test Cells

SOME EXAMPLES

















SW Simulation



TEM Cells and Shielded Boxes – RLTC Series, Radio Link Test Cells

### ADVANTAGES

#### The cell offers:

- isolation from the external electromagnetic environment
- controllable and repetitive propagation conditions
- test volume with reasonable field uniformity
- reproducible attenuation between antennas for TX/RX combination tests
- high volume acceptance test by optional pneumatic actuation of drawer insertion

### FUNCTIONALITY

The cells can be used to test separately a transmitter or a receiver by connecting the antenna respectively to a spectrum analyzer and a signal generator. The typical measurements are radiated power of the transmitter and sensitivity of the receiver. The cell can be calibrated experimentally by comparison with a high quality anechoic chamber.

However there are cases in which transmitter and receiver are to be tested together: two cells are connected by an external variable attenuator that simulates the air interface between transmitting and receiving antennas (see figure below).



RLTC-01 up to 1GHz

### **CUSTOMIZATION**

RLTC Series Cells can be customized on Customer's needs.

TESEO Engineers are at disposal to design cells based on custom EUT type and dimensions, as well frequency band.





TEM Cells and Shielded Boxes – TRIPLATE01

### **TRIPLATE01** SAE J1113-25 Test Cell



The triplate is an OPEN TEM cell of widespread use by the automotive community. The reference specification , SAE J1113-25 of September 1995, revised in March 1999, gives the instructions on how to build and test the device.

The scope of the triplate is to radiate for a susceptibility test at high field levels a device over a broad frequency band with a power budget much smaller than that required by transmitting antennas in the anechoic chamber.

The TEM propagation is well known and controllable. The open structure of the cell avoids the reflections of the wall typical of the standard (closed) TEM cell. The size of the triplate is such that a pure TEM propagation mode cannot be extended as such at high frequencies. However with a careful initial calibration the cell can be used up to 1 GHz.

The usual rule of a DUT not higher than one third of the distance between the driven element and the outer ground planes of the triplate applies.

Therefore large objects with limited height can be accommodated, typically car on-board controllers with connecting cables. The lack of sides facilitates the access of the cables that would be difficult in a standard cell and also their routing.

Caution: the cell is of the open type and with high field levels, the field propagates also outside the cell. The cell must be used in a Faraday cage and, to prevent the field from resonating in the enclosure, the most suitable test set-up is with the triplate in a shielded room lined with absorbing material.

The high voltages and field generated in and by the triplate may be dangerous to the personnel and for safety reasons nobody should be allowed to stay in the chamber during the performance of the tests.



### TEM Cells and Shielded Boxes – TRIPLATE01

### TRIPLATE01

EIFFAGE

**TESEO** 

TRIPLATE01 is the TESEO implementation of the requirements laid down in the mentioned SAE specification. TESEO has collected in the past a fair experience with design, fabrication and test of TEM cells and striplines. TRIPLATE01 is the complement to the ISO compliant OTEM and STRIPLINE TESEO products already in use by many customers in the car industry.

### **TECHNICAL SPECIFICATIONS**

Frequency range	10 KHz to 1000 MHz
Nominal impedance	50 Ohm
RF connectors	N type, female
Dimensions	620 x 620 x 3030 mm (closed) 1240 x 620 x 3030 mm (open)
Weight	150 Kg

### **HOW TO USE TRIPLATE01**

The cell must be connected to the output of the RF amplifier on one side and to an RF load on the other. The field level generated in the cell is determined by the formula "field" versus "power" contained in the SAE specification. The characteristic effective impedance parameter included in the formula is calculated from data collected in the calibration phase

### CALIBRATION

Calibration is to provide at each frequency point the value of the effective impedance. This parameter is calculated from the measurements of forward, reverse and output power as well as the electric field level in 5 points on the central axis of the triplate. A three channel RF power meter and an isotropic probe are utilized in the applicable frequency bandwidth.

### SYSTEM CONFIGURATION

The TRIPLATE01 is only one item. The code to order is: **TRIPLATE01** 

#### **Documentation:**

The product is delivered with the user's guide that includes calibration data.

### **OPTIONS**

The available options are:

- Wooden table
- Radiated immunity software
- RF loads for various power levels
- SOPM 3-channel fiber optic RF power meter
- Isotropic electric field probe
- RF dual directional coupler
- RF power amplifier



### **Products and Services Catalog** 2019 rel.1 Special Application Equipment - ADAC Analog / Digital Acquisition System

# Modular Shielded Environments for Data Security





### SHIELD OR NOT TO SHIELD

The cornerstone of a physical protection is shielding against EMI interferences including solar storms, RF menaces (HEMP/HPEM) and RF leakages.

Electromagnetic radiation, RF and EMI shielding server rooms and chambers for data centers such as airport radar towers, infrastructure control centers, secure tempest communication.

Where we can help in design, implement and maintain your:

- Data centers and server rooms
- . Banking transactions
- Double cooling floor .
- WikiLeaks
- . Conference rooms
- Hacker safety
- . Intruder prevention
- 19" shielded racks .
- Government databases .
- Secret service .
- Embassy
- Military communication
- Cryptographic systems .

### PROTECT YOUR DATA

The protection of data and IT infrastructures is not any longer related to large corporations or military organizations. It is rapidly and increasingly affecting small and medium-sized companies and their operational resilience.

Keywords like Tempest, compromising radiation or VanEck-Phreaking, show that menaces are growing worldwide threat for company's IT and data.

Data Centers represent today the heart of the business ecosystem and contain the excellence in technical, scientific and electronic data processing technologies. They need protection techniques with demanding specifications.

Almost 80% of companies needing data protection were not able to define and implement adequate data protection policies over the last three years. From smaller Data Center to large server farm, TESEO tailors protection based on requirements

Special Application Equipment - ADAC Analog / Digital Acquisition System



EIFFAGE

**TESEO** 

### **FIX & MOBILE INSTALLATIONS**

Aside modular building solutions, more flexible systems can be considered for achieving field deployable fully protected.

Based on requirements TESEO can propose shielded shelters or shielded tents where shielding requirements are not so demanding and a lighter solution delivers an affordable cost saving.

Shielded tents with load-bearing structure, or RF shielding materials to be applied directly on the walls with upholstery techniques may be the adequate solution for light RF shielding.

### MAINTAIN EFFECTIVENESS

Post-installation validation and preventive maintenance include RF tests to validate the real efficiency of a shielded structure. **TESEO** can perform Shielding Effectiveness test according Standards EN 50147-1, NSA 65-6, IEEE-STD 299 (MIL-STD 285), from low frequency up to 40 GHz.





### SECURITY SYSTEMS

Cyber Security and protection against data leakages can be complemented adopting some selected analogue equipment and fibre optic transmission techniques. TESEO optical audio, video analogue and digital links are the most effective solution for Data Centres, TEMPEST areas and radar sites.



TESEO audio and video surveillance systems shielded up to 200V/m and data transmission over fibre grants an high level security against leakages.

### **NATO/BSI STANDARDS**

System-tested according to EN 50147-1, NSA 65-6, IEEE-STD 299 (MIL-STD 285) and compliance with requirements with NATO standard, Tempest, NSA 65-2, including:

- EMSEC (for Emissions Security). •
- NATO SDIP-27 (Level A-B-C)
- NATO SDIP-29
- NATO AMSG 799B
- ASMG 720B, AMSG 788A, AMSG 784 •
- VBV 32000 (B)



Special Application Equipment - ADAC Analog / Digital Acquisition System

# **Analog / Digital Acquisition System**

ADAC



### FEATURES

- 4 analog channels
- 8 digital ON/OFF channels
- high input impedance
- analog range remotely selectable
- shielded against EM fields up to 200V/m from 10 kHz to 18 GHz
- small size, battery operated
- low cost

### **GENERAL DESCRIPTION**

TESEO ADAC analog/digital acquisition system is a fiber optic based tool for monitoring the performance of equipment subjected to high electromagnetic field.

Typical application is the for pass/fail examination of EUT's during the performance of radiated immunity tests in GTEM's, TEM cells where the cost of the test equipment is not compatible with other more sophisticated fiber optic links. Obviously ADAC can be also employed in large EMC chambers.

Use of shielded enclosure, filtered electrical inputs, fiber cables, carbon fiber pigtails allow ADAC to pick up the true signal generated by the EUT completely neglecting the presence of a disturbing EM environment, whereas copper wire connections to the analysis instrument, i.e. scope, logic analyzer, would not permit to take any meaningful measurement due to the effect of the field.

The analog to digital conversion (8 bits) and the consequent digital transmission over the fiber cable give higher stability and accuracy of full-scale than with traditional analog modulation methods.

### The basic system is composed by:

- ADAS Satellite unit
- ADAR Receiver and command unit
- **FBmmm** Bifibre optical cable
- FCmmm Monofiber optical cable
- **CB1** Battery charger
- AL5-A Power supply for ADAR

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### Special Application Equipment - ADAC Analog / Digital Acquisition System

### ADAS

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**TESEO** 

ADAS is a small dimension satellite unit intended to be used close to the EUT inside the test cell or enclosure. It connects to the EUT via short electrical connections, possibly resistive cables, acquires analog and discrete information by multiplexing, digitizing the input analog signals and converting them into optical signals. The acquisition rate is 200 kilosamples/sec for each channel.

In the other direction ADAS processes the analog inputs range commands: the selectable ranges are  $\pm 1, 3, 10$ , 30 volt.

The satellite is battery powered to avoid electrical connections to external power supplies.

The battery status is monitored by means of a LED.

### ADAR

Similarly to the satellite, ADAR performs tasks in the two direction: it reconverts the multiplexed optical signal into electrical and releases the analog and discrete lines to the output connectors for use by standard laboratory test equipment like an oscilloscope or a multimeter and it delivers the range commands to the satellite.

It is a stand-alone box with 4 range manual selectors one per analog channel, and 8 LED's to show the status of the digital ON/OFF's.

It is powered from an external power supply. The analog signals at the BNC connectors have a range of ±1volt, the digital signals are TTL compatible. For cost reasons no computer interface (IEEE-488 or RS232) is provided.

#### FBmmm - FCmmm

The optical cable consists of one bifibre cable for clock and data, and one single fiber cable for control.

CB1

The satellite is battery powered. The battery is rechargeable in two hours by means of the battery charger.

### **APPLICATIONS**

The most typical application is the monitoring of EUT performance in high EM field conditions.

#### TECHNICAL SPECIFICATIONS

#### Electrical

- analog channels 4
  - **ON/OFF** channels
    - 8 analog signals input ranges  $\pm 1,3,10,30$
- volt discrete in/out levels TTL compatible
- A/D conversion 8 bit
- sampling rate 200 ksamples/sec
- analog channels input type differential
- analog channels output type unbalanced
- accuracy of analog channels2% ± 16 mV x Range
- input impedance 1 MOhm
- max input voltage ± 50 volt
- output impedance 50 Ohm
- analog signals output range ± 1 volt
- range selection manual, remote
- input signal resolution ± 8mV @ ± 1V range ± 24mV @ ± 3V range
  - ± 80mV @ ± 10V range
    - ± 240mV @ ±30V range
- Mechanical, optical and environmental
  - analog input connector D type
  - analog output connector BNC
  - digital in / out connector D type
    - optical channels 3 (clock,data, control
  - fiber optic connectors ST
  - ADAS dimension 110w x 55h x 210d
    - ADAR dimension 156w x 86h x 204d
    - 5 h
  - battery operating time battery recharge time 2 h

  - operating temperature range 0 to +50 °C
    - storage temperature range -20 to +70 °C

### **TECHNICAL SPECIFICATIONS**

- ADAS Satellite unit
- ADAR Receiver and command unit
- CB1 Battery charger
- AL5-A Power supply for ADAR
- FBmmm Bifibre optical cable
- Monofiber optical cable (mmm = **FC**mmm length in meters)

### **OPTIONS**

- FOBC ST
- ST fiber optic cable RCcc Resistive cable (cc = length in cm)

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2019 rel.1

Special Application Equipment – PWS02 Optical Phonic Wheel Simulator

# PWS02 Optical Phonic Wheel Simulator



### **OVERVIEW**

- Full antiskid system simulation via fiber optic link
- Up to eight independent channels
- Battery powered satellites shielded to > 200 V/m,
- 10 kHz to 18 GHz
- Internal (antiskid) or external (arbitrary) waveform
- simulation
- All functions manageable via IEEE-488 interface or locally (mainframe front panel)

### **GENERAL DESCRIPTION**

PWS02 is an electro-optic system which performs, using proper couplers, the remote stimulation of magnetic sensors used in antiskid automotive applications (phonic wheel pick-ups).

The use of fiber optic links provides an extremely high degree of protection against electromagnetic fields.

PWS02 mainframe lodges two OSM02B plug-ins; they each hold four independent electro-optic channels which can be connected via fiber optic cable to a maximum of four OSM02S satellites, for a total of eight independent channels.

The first plug-ins is standard, the second optional.

The whole set of functions available is completely controllable both locally and remotely by means of the built-in IEEE-488 interface.

Each OSM02S satellite unit is powered by an internal rechargeable battery, providing eight hours and more of autonomy; the proper SCU series sensor coupling unit, connected to the satellite, performs the pick-up stimulation.

Satellites are controllable (on/off and output level) from the PWS02 mainframe

### **TECHNICAL INFORMATION**

The signal generated by PWS02 and used for the stimulation is a sinusoidal waveform whose frequency can change from a selectable upper value (corresponding to high rotation speed on the phonic also selectable lower wheel) to an value (corresponding to low rotation speed) and vice versa for the programmed number of times; the time during which the frequency assumes the lower value, the time in which it remains at the upper value, and both the frequency decrease and increase slopes (corresponding to deceleration and acceleration) are selectable too. Each channel can be set to follow the above pattern or a signal of fixed frequency (upper value is used). The figure below shows the general behavior of the frequency versus time.

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2019 rel.1

OSM02B

OSM02S

CB1(/US)

SCU01

SCU02

FCmmm

FOBC ST

BCcc

sensors.

to 200 m.

### Special Application Equipment – PWS02 Optical Phonic Wheel Simulator

### **PWS02 CYCLE SPECIFICATIONS**

- A = cycle start
- B = cycle stop
- 1 = deceleration slope
- 2 = low speed
- 3 = acceleration slope
- 4 = high speed
- 5 = frequency corresponding to high speed
- 6 = frequency corresponding to low speed



SYSTEM PARTS

PWS02(/US) mainframe (inclusive of one OSM02B plug-in)

230V dedicated battery charger

ACCESSORIES

**PWS02** shall be supplied with the proper **SCU** series sensor coupling units suitable to stimulate the pick-up

In addition, dedicated battery chargers, with very

The fiber optic cables are available in any length up

Accessories: SCU01 – Piezo Effect Sensor

short charge times, are supplied too.

4 channels tx plug-in 10Hz ÷ 50kHz (OPTION)

single channel battery powered satellite unit

Piezo Effect sensor coupling unit (OPTION)

Hall Effect sensor coupling unit (OPTION) BNC-BNC cable (cc = length in centimeters)

fiber optic cable (mmm = length in meters)

ST fiber optic cable feedthrough (OPTION)

### **TECHNICAL SPECIFICATIONS**

	Mainframe: PWS0	02 & OSM02B
•	high frequency	selectable from 100 Hz to 2 kHz
•	low frequency	selectable from 10 Hz to 2 kHz
•	deceleration slope	selectable from 1 to 9999 Hz/s
•	acceleration slope	selectable from 1 to 9999 Hz/s
•	low frequency time	selectable from 0 to 9999 ms
•	high frequency time	selectable from 0 to 99 s
•	cycle repetition	selectable from 01 to 99
		(00 = continuous repeat)
•	output level control	selectable from 0 to 99%
•	frequency monitor outp	ut 5 mV/Hz, BNC
•	signal monitor output	2 Vpp full scale, BNC
•	external inputs	n° 2 x 2 Vpp full scale, BNC
•	fiber optic connectors	ST
•	power supply	230 Vac 50 Hz (*)
•	dimensions	rack 19" 3U 365 mm depth with
		handles
•	operating temperature	0 ÷ +50°C
•	storage temperature	-20 ÷ +70°C
	Satellites: OSM02	2S
•	full scale output	4 Vpp (Open Circuit)
•	electrical out connector	BNC
•	fiber optic connector	ST
•	EM fields shielding	200 V/m 10 kHz to 18 GHz
•	battery operating time	continuous > 8 hours
		switch-off > 1000 hours
•	battery charger connect	tor LEMO 5 poles circular
•	battery recharge time	2 hours
•	dimensions	108 x 69 x 59 mm
•	operating temperature	-10 ÷ +70°C
•	storage temperature	-20 ÷ +70°C
(*) The /US version is available for the U.S. market		

### **APPLICATIONS**

- **ANTISKID** simulation in environments characterized by high levels of EM fields
- General phonic wheels simulation
- General arbitrary waveform injection (with external generators)

	•	pick-up hole depth	32 mm
		Accessories: SC	CU02 – Hall Effect Sensor
	•	input impedance	20 ohm +/- 10%
	•	connector	BNC female, 50 ohm
	•	frequency range	10Hz-2kHz (single sensors)
			50-600Hz (differential sensors
1	•	input signal	Sine/square wave up to 4Vpp
	•	dimensions	80 x 60 x 50 mm (L x W x H)
			<ul> <li>pick-up hole depth</li> <li>Accessories: SC</li> <li>input impedance</li> <li>connector</li> <li>frequency range</li> <li>input signal</li> <li>dimensions</li> </ul>

output adjustment range

pick-up hole diameter

input resistance

input inductance input connector

dimensions

- weiaht operating temperature
- 0 ohm gle sensors) erential sensors) ave up to 4Vpp m (L x W x H) abt 350 gr -0 ÷ +50°C with mounting adapter.

50 to 500 Ohm 16 mH

50 (diameter) x 46,6 mm

BNC

16 dB

19 mm

sensor mounting List of supported sensors type available upon request



Special Application Equipment – SW18-2-4, DC-18GHz Coaxial RF Switch for MOCS

### Coaxial RF Switch Module DC - 18 GHz SW18-2-4



**GENERAL DESCRIPTION** 

The Coaxial RF Switch Module is a double 4-way RF switch unit, capable of operating from DC to 18 GHz, 50  $\Omega$  impedance, with power levels greater than 50 W per RF path, as shown in the module electrical characteristics.

The module shall be housed inside a MOCS mainframe, where three slot-positions shall be reserved. It can be locally controlled in manual mode by the operator or, remotely, through a GPIB parallel interface or an RS232 serial interface, by a dedicated PC.

The module front panel is fitted with two 4-way switches, for manual control use, and two groups of four LED's, one group for one RF switch, to show the RF way being selected.

All the module controls and indicators are located on the unit front panel, while the RF connections are available on the unit rear panel, by means of 50  $\Omega$  SMA-F connectors.

A single MOCS-MF or MOCS-MFD mainframe can host up to four Coaxial Switch units, and a maximum of four MOCS unit can be dasychained, in order to compose a switch matric with up to sixteen switches.





Typical application of these switches is the automated management of power generation and power monitoring in EMC or Radiofrequency laboratories, where a single power source needs to be switched on multiple amplifier's inputs, or where a power monitoring through a power head must be done on multiple power sources.

Also Aerospatial industries may need RF switch matrix for automatic test equipment.

Complex matrix can be built-up using single switches wired together using our high quality coaxial semirigid jumpers, and driven with dedicated softwares.



### 2019 rel.1

Special Application Equipment – SW18-2-4, DC-18GHz Coaxial RF Switch for MOCS

TECHNICAL SPECIFICATIONS - ELECTRICAL				
Frequency	DC-18 GHz			
Number of ways	4			
Impedance	50Ω			
VSWR	1.2 1.3 1.4 1.5	(0 – 3 GHz) (3 – 8 GHz) (8 – 12.4 GHz) (12.4 – 18 GHz)		
Insertion Loss	0.2 dB 0.3 dB 0.4 dB 0.5 dB	(0 – 3 GHz) (3 – 8 GHz) (8 – 12.4 GHz) (12.4 – 18 GHz)		
Isolation	80 dB 70 dB 60 dB 60 dB	(0 – 3 GHz) (3 – 8 GHz) (8 – 12.4 GHz) (12.4 – 18 GHz)		
Average Power[W] @ 25 °C per RF path	120 Watt CW 80 Watt CW 60 Watt CW 50 Watt CW	(0 – 3 GHz) (3 – 8 GHz) (8 – 12.4 GHz) (12.4 – 18 GHz)		

TECHNICAL SPECIFICATIONS - MECHANICAL		
Connectors	SMA female	
Life Cycles per position	5.000.000 cycles	

### **TECHNICAL SPECIFICATIONS - ENVIRONMENTAL**

Operating Temperature	-40 to +85 °C
Storage Temperature	-55 to +85 °C
SW1	SW2

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Test Systems - PTG8A, Magnetic Field Generator System

### BCI400 – BCI400D - Bulk Current Injection Standard Systems Serie

ISO 11451-4 ISO 11452-4 RTCA DO160G Sect. 20 Generic Bulk Current Standards

### **OVERVIEW**

Bulk Current Injection Standards for Automotive and Avionic applications require a complex system composed by several parts, which must be adequately selected and matched one to each other.

Ancillary equipment are also important to complete the system and allow closed loop and substitution method tests, as well the calibration of the injection probe.

The BCI400 family systems are the turn-key solution for Bulk Current Injection tests, and include all the needed accessories and facilities to carry on a complete test.



### **BCI400 SYSTEMS SERIE**

The BCI400 family systems are composed by a main Rack Unit containing the generation and power monitoring instruments set.

A 4-Unit height drawer contains all the probes set, power sensors and directional coupler.

An additional 8-Units height auxiliary drawer is provided to contain cables, calibration fixture and attenuators, and User's additional accessories as well.

The system is completed by a wooden table with horizontal coupling plane and a ground plane to be laid beneath the table, to be compliant to most of the Bulk Current Standards.



Test Systems - PTG8A, Magnetic Field Generator System





### SYSTEM PARTS OVERVIEW

#### **RACK MAIN UNIT**

The 27U (about 1.40m including wheels) height rack main unit containing all the generation and monitoring instrumentation, is composed by:

- A Power Distribution Panel with breakers and safety emergency pushbutton.
- **A RF Generator** with AM, FM and pulse modulation capabilities.
- A RF Amplifier with hardware safety Interlock with direct access from the back of the rack.
- A Three-channel RF power meter controlling three remote power probes via fibre optic.

The rack is self-powered and self-cooled by an internal cooling system. Four swevel wheels with individual brake make easy to move the rack around.

On the back, one TCP/IP Ethernet and one USB ports allow the remote control of the instrumentation.

### **PROBES/SENSORS DRAWER**

A 4-Unit drawer with shaped foam contains the three fibre-optic power sensors, the Injection probe, the Monitoring probe and the Dual Directional Coupler.

### AUXILIARY DRAWER

Underneath the probe/sensors drawer, an additional 8-Unit drawer allows to store all the remaining accessories and cables for an orderly system configuration.


### Test Systems - PTG8A, Magnetic Field Generator System

### WOODEN TABLE











A dielectric table made in high quality wood with standard dimensions is available to complete the system.

Minimum dimensions for the table are  $1000 \times 2000 \times 800 \text{ mm}$  (L x W x H). Wider or longer tables are available, upon request.

**Wheels.** At User's convenience, the table can be provided by four swevel wheels with brake, for an easy handling.

The total height of the table with wheels will not change and will be compliant to the Standard.

**Vise.** The standard table is provided by one grounding spot connector , placed in one of the corners.

In case this is not enough, as option can be ordered a movable multi-spot grounding grip unit.

The grip is secured to the table by means of a double gripping vise.

The standard grounding grip is provided by six standard 4 mm banana jack connectors.

Grounding grips with different numbers of banana jacks are available upon request.

**GRP.** An aluminum ground plane can be added beneath the table when the installation location is not provided by a floor with metallic ground plate.

**INJECTION PROBE CALIBRATION.** In accordance to the test to be performed, a complete set of accessories is available for calibration and verification of the Injection Probe (i.e. as per ISO 11452-4 ANNEX A or other Standards). The set is composed by:

- One Injection Probe Calibration Fixture suitable for the supplied Injection probe.
- One 30 dB High power Attenuator.
- One High power coaxial load.
- One RF Cables and adapters bundle set.

Test Systems - PTG8A, Magnetic Field Generator System

### **CONTROL SOFTWARE**

EIFFAGE

**TESEO** 

The hardware system is completed by a EMC test management software, able to perform and configure Bulk Current Injection test as per different International Standards.

The software can control all the instrumentation via LAN TCP/IP and/or USB for a complete Conducted Immunity Test management.



### **MODULARITY AND FLEXIBILITY**

The great advantage of BCI400 family system is to get a turn-key system for Bulk Current Test with modular structure, therefore highly configurable and customizable.

Further than customizing the amplifier power and the number and type of accessories, the standard basic systems can be enhanced with additional functions, such as Automotive BUS extenders, video and audio units, acquisition and/or stimulus modules, to be installed into the ten MOCS-MFD available slots, aside the power meters.



### STANDARD MODELS MAIN SPECIFICATIONS

	BCI400	BCI400D			
Standards	ISO 11451-4 ISO 11452-4	Standards	RTCA DO160G Section 20 – Cat. Y		
Frequency Range	1MHz – 400 MHz (usable down to 100kHz)	Frequency Range	9kHz – 400 MHz		
Output RF Power	150W CW minimum 200 W CW typical	Output RF Power	200 W CW minimum 250 W CW typical		
Interlock	Hardware, D-sub 15 pins Located on the rear	Interlock	Hardware, D-sub 15 pins Located on the rear		
Fibre Optic Length	5 meters (standard) Other lengths upon request	Fibre Optic Length	5 meters (standard) Other lengths upon request		
RF Cables Length	5 meters (standard) Other lengths upon request	RF Cables Length	5 meters (standard) Other lengths upon request		
Remote Interfaces	Ethernet LAN USB 2.0	Remote Interfaces	Ethernet LAN USB 2.0		
Software minimum requirements	Microsoft <sup>™</sup> Windows <sup>™</sup> Vista, 7, 8, 10	Software minimum requirements	Microsoft <sup>™</sup> Windows <sup>™</sup> Vista, 7, 8, 10		
Temperature	Operating: 0° to 45° Storage: -10° to 55°	Temperature	Operating: 0° to 45° Storage: -10° to 55°		
Dimensions (WxDxH)	575 x 740 x 1440 mm	Dimensions (WxDxH)	575 x 740 x 1440 mm		
Weight	Approx. 170kg	Weight	Approx. 170kg		

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### 

### Products and Services Catalog 2019 rel.1

### Test Systems - PTG8A, Magnetic Field Generator System

Here the parts composing the basic systems and the optional accessories

### **BASIC SYSTEMS PARTS**

BCI400	BCI400D
Rack chassis unit, 19" standard, 27U height	Rack chassis unit, 19" standard, 27U height
RF generator 10kHz-3GHz with AM modulation	RF generator 10kHz-3GHz with AM modulation
RF Power Amplifier, 100kHz-400MHz, 150W minimum	RF Power Amplifier, 10kHz-400MHz, 200W minimum
Digital Controller with power meter	Digital Controller with power meter
3 pcs Power sensors, battery powered	3 pcs Power sensors, battery powered
3 pcs battery chargers for power sensors	3 pcs battery chargers for power sensors
Injection probe	Injection probe
Current Monitor Probe	Current Monitor Probe
Dual Directional Coupler	Dual Directional Coupler
Calibration Fixture for Injection Probe	Calibration Fixture for Injection Probe
High power termination	High power termination
High power Attenuator	High power Attenuator
Adapters and RF Jumper cables Set	Adapters and RF Jumper cables Set
Fibre Optic Cables set (5 meters length)	Fibre Optic Cables set (5 meters length)
RF Coaxial Cables set (1 pc 5 meters; 2 pcs 1 meter length)	RF Coaxial Cables set (1 pc 5 meters; 2 pcs 1 meter length)
Measurement Software	Measurement Software

MAIN OPTIONS				
BCI-T	Wooden table for BCI Standard with HCP (Horizontal Coupling Plane fixed on the top of the table,			
BCI-GP	Ground Plane in aluminum, to be laid underneath the table. Necessary when the table is not positioned on a conductive floor.			
BCI-T-C	Wooden table for BCI Standard with HCP (Horizontal Coupling Plane fixed on the top of the table. Table is provided by wheels with individual brake			
GRIP-VISE	Grounding Grip Vise, with 6 standard banana connectors			



Test Systems - PTG8A, Magnetic Field Generator System

### Magnetic Field Generator for IEC EN 61000-4-8 PTG8A



### **GENERAL DESCRIPTION**

PTG8A is the TESEO power generator that in combination with a loop allows the performance of the magnetic field immunity test in accordance with IEC EN 61000-4-8.

Currents of 100 A continuous or 1000 A for a few seconds at mains frequency can be injected into a square loop of 1 to 2 meter side as requested by the above specification.

The generator comprises a current range selector, a timer for the high current range (0.5 to 4 seconds), a current adjustment knob and a current display.

A front panel LED illuminates when the equipment is switched on with low/medium current selected or when a high current is active after pressing a START pushbutton. the generator is provided with a cable for connection to a wooden bench.

The bench is a function of the devices to be tested. It can be a platform for floor standing equipment or

a bench for table top equipment.

The bench version has a square loop of 1 meter with two positions, horizontal and vertical, the third axis being obtained by rotation of the EUT.

Interlock switches enable the current only in the correct position.

The platform version can be provided with square loops of 1 or 1.5 meter, two positions, or a single rectangular loop,  $2.5 \times 1.5$  meter for testing electronic cabinets.

The wooden plane supports a metal ground plane that enlarges the test volume when the loop is vertical.

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### Test Systems - PTG8A, Magnetic Field Generator System

### FEATURES

- □ Complying with EN61000-4-8 (IEC1000-4-8):
- Dever frequency magnetic field immunity test
- Test level up to 100 A/m for continuous field generation
- Test level up to 1000 A/m for short duration field generation
- Three induction coils available to test normal or special size equipment
- Two axis, equivalent to three axis testing
- □ Induction coil integrated with test bench
- High level of safety operation

### SYSTEM ACCESSORIES

### MFGA / MFGAL

The MFGA induction coil family is composed of four coils in order to have the capability to test objects having different dimension.

The first two coils, MFGA and MFGAL are totally integrated with their measurement bench in order to allow an easy EUT positioning.

The bench is made of wood. It constitutes the EUT support plan, includes the ground plane and supports the induction coil that can be positioned in vertical or horizontal manner. It is so possible to execute the test in the three main orthogonal directions (the third is obtained rotating the EUT), according to the general criteria.

The coil positioning is manually done. The coil is free to rotate and can be locked in the two main positions.

An interlock circuit enables the current flowing only when the coil is well locked in one of the two positions.

The immersion method defined in the standard state that objects having dimensions up to 0,6x0,6x0,5(h) meters can be tested in single square coils, 1 meter side.

TESEO MFGA is the right solution. If the EUT has large size, MFGAL induction coil may test object having dimensions up to 0,9x0,9x1,5(h).



info@teseo.clemessy.com

#### MFGAXL

The third TESEO induction coil, MFGAXL, is referred in the standard as coil for floor-standing equipment. Its dimensions are 1,5mx2,5(h)m.

It is equipped with a ground plane, a wood insulating support and a vertical coil capable to generate the requested field on an EUT having dimensions of 0.9x0.75x2(h).

Due to the structural dimension, the coil is fixed to its ground plane and is not able to rotate.



### MAGNETIC FIELD SENSOR

TESEO delivers the system together with its calibration chart in order to give to the operator the current/field relation.

An electromagnetic field radiation tester can be ordered as option, in order to directly measure the generated magnetic field.

Specifications upon request



# Products and Services Catalog

### 2019 rel.1

Test Systems - PTG8A, Magnetic Field Generator System

### **TECHNICAL SPECIFICATIONS**

### PTG8A

- Magnetic field: 100A/m continuous 1000Alm short period
- Current range: low, medium, high (corresponding to about 10 A, 100A, 1000 A). Max current about 2000 A depending on size of connected loop
- Current adjustment: continuous within the range selected
- Test duration: low, medium current undetermined, high current 0.5, 1, 1.5, 2,2.5, 3, 3.5, 4 seconds
- Current display:4 digits, floating point
- Frequency: 50, 60 Hz
- LED indicator: current on
- Operating temperature: 0 to 50 "C
- Test bench: platform or bench
- Loops: please see the MFGA specs
- Dimension depending on type and size of loop
- Weight depending on type and size of loop

### **INDUCTION COIL: MFGA**

- coil dimension: 1m x 1m
- EUT dimension: 0,6m x 0,6m x 0,5(h)m
- coil material: copper
- bench material: wood
- ground plane dimensions: 1.5m x 1m
- ground plane material: aluminum
- Positions: two with locking system

### INDUCTION COIL: MFGAL

- coil dimension: 1,5m x 1,5m
- EUT dimension: 0,9m x 0.9m x 0,75(h)m
- coil material: copper
- bench material: wood
- ground plane dimension: 1,8m x 1m
- ground plane material: aluminum
- Positions: two with locking system

### INDUCTION COIL: MFGAXL

- coil dimension: 1,5m x 2,5m
- EUT dimension: 0,9m x 0,75m r 1,5(h)m
- coil material: copper
- ground plane dimension: 1,8m x 1m
- ground plane material: aluminum
- Positions: one fixed



Test Systems – SATB, Servo Actuator Test Bench

# Servo actuator test bench



TESEO Servo Actuator Test Bench (SATB) is the standard test bench platform which serves R&D and product end of line test of :

Linear servo-actuators for aircraft FLAPS

Rotary servo-actuators for aircraft

- Leading Edge Flap Actuation System (LEFAS)
- Trailing Edge Flap Actuation System (TEFAS)

Linear Main and Tail Rotors servo-actuators



### LEAN MANUFACTURING IN AEROSPACE AND DEFENSE

TESEO has been retained as supplier of choice for the programs :

Fix Wing: CESSNA, M346, Eurofigther

Rotary Wing: Light Utility Helicopter (LUH) and Advanced Light Helicopter (ALH)



Test Systems – SATB, Servo Actuator Test Bench

### **TECHNICAL DATA**

TYPE OF FEATURES	HELICOPTER ACTUATORS Serves already over 5 linear	AIRCRAFT ACTUATORS Serves already over 19 linear and 4 rotary
Physical Data	Size         3100x1400x1700 mm           Weight         1200 Kg           Power         380VAC-32A	Size         2500x1350x1800           Weight         900 Kg           Power         380VAC-40A
Technical features	Linear input axe with position control according to selected wave profile (sinus, triangle, trapezius, square) and with frequency up to 15Hz. Reaction load control with PID up to 30KN. Hydraulic control with PID up to 300 Bars.	Two rotative axes with speed and torque control. Reaction load control with PID up to 50KN.
Aquisition System	National Instruments Real-Time	National Instruments Real-Time
Functional test	Common Features • Stall Load & Synchronization • Linearity • Hysteresis • Frequency Response • Threshold Verification • Internal Leakage	Common Features • Run-In • Efficiency • Backlash • Irreversibility FLAP • Force Limiter in extension and retraction • Stroke Check LEFAS/TEFAS Rotary Actuator • Torque Limiter
Options	Servo-Actuators fixture Custom test	Twin test station Servo-Actuators fixture Custom test

### **KEY FIGURES**

- Lean Manufacturing embedded design
- Real-Time for deterministic control
- Real-Time Ethercat for I/O management, Sensors and Actuations, with rugged synchronization (jitter lower than microsecond)
- Maximum accuracy in displacement measurement of 0,005mm.
- Maximum accuracy in load and torque measurement: up to 0,005Nm in Torque and up to 0,05% FS in Load.

- Calibration procedure embedded
- Automated detection of Servo-Actuator type
- User friendly Human Machine Interface that requires limited training for use and maintenance
- Linear maximum speed 160mm/sec on Input axe
- Linear maximum speed 30 mm/sec on reaction axe
- Rotary axe maximum speed 5.000 RPM.



# ESD System ISO 10605 and EN/IEC 61000-4-2

**Products and Services Catalog** 

2019 rel.1

Complete System for ESD Test and ESD Set-Up Verification



### **NOISEKEN – NOISE LABORATORY**

NOISEKEN is a Japanese Company Specialist in pulsed EMI simulation.

For over 30 years from its foundation in 1975, Noise Laboratory has been focusing on immunity test equipment and related solutions. Now their product lines include various types of immunity test equipment ranging from those conforming to IEC 61000-4 series standards, other international or national immunity standards and even to customer's in-house test standards.





Spark phenomena which may be generated when taking a sweater off and touching onto a door knob of a vehicle in dry condition are called "Electrostatic discharge (ESD)". In our ordinary lives, 30kV electricity can be easily generated only with putting shoes on and walking on a carpet.

TESEO, in collaboration with Partners offers ESD simulators systems that can reproduce and simulate the ESD from a charged human body intentionally for testing whether electronic equipment become malfunctioned or work correctly with the ESD influence, and the simulators conform to IEC61000-4-2 and Automotive ISO 10605 Standards.

Beside ESD equipment for testing laboratories, TESEO also has a complete set of equipment and accessories for ESD guns calibration and verification, to completely fulfill the International Standards requirements.

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Test Systems – ESD Systems.

ESD BASIC GENERATOR

### **ESD SMART GENERATOR**



Cost-oriented basic model ESD Simulator the light weight discharge gun attachable.

The output voltage can be selected either max. 30kV (B3011A) or max. 16kV (L1611A) and compliant to both EN/IEC61000-4-2 Standard (both B3011A and L1611A) and ISO10605 Standard (only B3011A, used with  $2k\Omega$  discharge network).

- Pre-checking function for quick gun verification.
- CR constant checking function (No indicator) to check the correct unit attachment.
- Discharge Detecting Function to check the airdischarge ready-to use gun.
- White spotlight LED to facilitate the visualization of the discharging area.
- Easy exchange of gun head and CR unit.

The ESD system employing the generator basic model is designed for those laboratories which need to have a ESD system at very affordable cost, but with the confidence to be compliant to the main International Standards, such as EN/IEC61000-4-2 or ISO 10605 Automotive requirements.

This generator may be equipped with most of the additional accessories, in order to build-up a complete system with all the needed expectancies.



Basic Generator front Panel



Advanced ESD simulator for EMC test equipment with smart built-in functions.

This can be available for evaluating malfunctions or functions declines of electronic equipment against the ESD.

Programmable simulator to ease some complex tests. The output voltage is up to 30kV to comply IEC61000-4-2 & ISO 10605 Standards.

- 3 pre-checking functions for quick gun verification.
- CR constant indicator to to check the correct unit attachment.
- Discharge Detecting Function to check the airdischarge ready-to use gun.
- White spotlight LED to facilitate the visualization of the discharging area.
- Easy exchange of gun head and CR unit.
- Ten-key & Rotary knob for a easy setting.
- Infra-red Remote Controller to allow to remotely set the generator.
- Lightest-weight discharge gun in the market
- Control Software for test result reporting and control via Personal Computer.



Smart Generator LCD Display Menu

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### Test Systems – ESD Systems

### ESD GUNS

All the ESD Generators can be matched with ESD guns performing the International Standards.

An easy-to-use configuration is the main features of these guns.

The tips, gun heads and CR discharge units can be replaced and configured easily by the operator in a while, without complex assembly/disassembly operations.

The gun is equipped with a LED spot light to easily identificate the discharging point.

EN/IEC61000-4-2 and ISO 10605 compliant discharge modules available.





The Gun main body can be equipped by different Gun Heads, RC discharge Networks and Gun Tips, to fulfill the needed International Standards





### **ESD GUNS MODELS AND CONFIGURATIONS**

Components	GT-30RA IEC 61000-4-2	GT-30R2KA ISO 10605	GT-30R3320KA IEC 61000-4-2 and ISO 10605
Conical Tip	$\bigotimes$	$\bigotimes$	<b>V</b>
Round Tip	<b>V</b>	<b>V</b>	Ŵ
Spherical Tip	Ø	$\bigotimes$	$\checkmark$
CR Unit 150pF-330Ω	$\checkmark$	8	$\bigotimes$
CR Unit 330pF-330Ω	Ø	8	$\checkmark$
CR Unit 150pF-2kΩ	Ø	$\bigotimes$	$\bigotimes$
CR Unit 330pF-2KΩ	X	$\checkmark$	$\checkmark$

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### Test Systems – ESD Systems.

### **ESD GENERATORS TECHNICAL SPECIFICATIONS**

Parameter	ESS-L1611A ESS-B3011A Basic Generator Basic Generator		ESS-S3011A Smart Generator			
Output Voltage	0.20kV-16kV ±5% 0.20kV-30kV ±5%		0.20kV-30kV ±5% -10.0kV: 0.01kV -30.0kV: 0.1kV step			
Polarity		Posit	tive / Negative			
Repetition Cylcle	0.05s-9.99s ±1 Steps: 0.0	0% / Manual 1s step	0.05s-600s ±10%, / Manual Steps: 0.01s (0.05-9.99s), 0.10s (10.0-600.0s)			
No. of discharges	1-999 times, 1 time step	or continous preset	1-60000 times, 1 step or continous preset			
Discharge mode		Contac	t / Air Discharge			
Trigger mode	Gun trigger / Ma	anual trigger	Gun trigger / Manual trigger / external trigger			
Operation Panel	Display: 5x7 Do Operation: via	t matrix LED pushbuttons	Display: Color LCD Operation: via pushbuttons			
Radion Mode Select Switch		Extra / Norr	nal switching built-in			
Discharge Detection	B	uilt-in Discharge detection	on function for air-discharge mode			
Pre-checking Function	High voltage out	put checking	<ol> <li>High voltage output checkng</li> <li>Withstanding voltage checking</li> <li>Discharge relay operation checking</li> </ol>			
CR & GUN head checking	CR typ	e and gun type matching	g check (to prevent wrong combinations)			
IEC LEVEL Test mode	Contact discharge m	ode: 2kV, 4kV, 6kV, 8kV	/ step; Air discharge mode: 2kV, 4kV, 8kV, 15kV step			
MANUAL test mode	Not Avaliable		Contact/air discharge mode arbitrary setting in the range 0.2kV-30.0kV. Sweeping function built-in. Recordable up to 99 units			
SEQUENCE test mode	Not Avaliable		Allows MANUAL mode use in continously operation. Max 22 steps / 1 program Up to 20 recordable programs			
Warning Lamp	Lighting at	voltage output from the	generator; Blinking at electrostatic discharge			
Charge capacitor / resistor	150	oF±10%,330Ω±10% (bu	ilt-in unit for discharge gun GT-30RA)			
Generator Charge resistor			10ΜΩ			
AUX connector	Not Avaliable		D-SUB 15 pins female connector (to connect patolight, automatic ESD suppressor, external interlock input, external trigger input			
Optical communication	Not Ava	liable	Optical connector (serial interface) for PC connection			
Power Supply consumption	AC100V - AC240V ±10	% 50Hz-/60Hz 62VA	AC100V - AC240V ±10% 50Hz-/60Hz 75VA			
Generator Dimensions	(W)270mm x (H)263	mm x (D)200mm	(W)392mm x (H)312mm x (D)295.3mm			
Discharge gun Dimensions		Discharge gun: (W)83.3	mm x (H)217.2mm x (D)229.3mm			
Generator Weigth	Approx.	4.8kg	Approx. 7.5kg			
Discharge gun Weigth		Approx 800g exclu	ding cables and connectors			

### **CR UNITS TECHNICAL SPECIFICATIONS**

CR Unit	1 <sup>st</sup> discharge peak current	t <sub>1</sub> Current	t <sub>2</sub> Current
150pF/330Ω	3.75A/kV±10%	2A/kV±30% (t <sub>1</sub> =30ns)	1A/kV±30% (t <sub>2</sub> =60ns)
330pF/330Ω	3.75A/kV±10%	2A/kV±30% (t <sub>1</sub> =65ns)	1A/kV±30% (t <sub>2</sub> =130ns)
150pF/2kΩ	3.75A/kV +30%-0%	0.275A/kV±30% (t <sub>1</sub> =180ns)	0.15A/kV±50% (t <sub>2</sub> =360ns)
330pF/2kΩ	3.75A/kV+30%-0%	0.275A/kV±30% (t <sub>1</sub> =400ns)	0.15A/kV±50% (t <sub>2</sub> =800ns)

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### Test Systems – ESD Systems

### ESD TESTING ACCESSORIES

#### Standard ESD table with HCP (Horizontal Coupling Plane) and GRP (Ground Plane to be placed beneath the table)

Standard table for ESD measurements applications, in conformance to the ISO 10605 Standard.

The main structure is made in high quality wood for a perfect dielectric support.

Table dimensions: 1000 x 2000 x 800 mm (LxWxH)

Other dimensions are available upon request Including:

One 1.2 meters shorting cable

One 1.2 meters load cable  $(2 \times 470 k\Omega)$ 

Optional:

Swevel caster

### **Grounding Grip**

The standard table is provided of one grounding spot connector, placed in one of the corners. In case this is not enough, as option can be Ordered a movable multi-spot grounding grip unit. The grip is secured to the table by means of a double gripping vise.

### Gun Stand

Gun stand used to support the discharge gun (Out of ISO Standard)

- Including the adapter for discharge gun GT-30R series.
  - Height: 300mm
  - Pedestal diameter: 160mm
  - Weight: Approx. 1.6kg

#### Hand-free Gun Stand

Allows to move discharge gun vertically and horizontally to arbitrary desirable discharging point. (Out of ISO Standard)

#### **Gun Holder**

Handly holder for discharge gun during the test. Also used as pre-checking fixture in combination with ESS-S3011A and GT-30R series.



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### Test Systems – ESD Systems

### **ESD TESTING ACCESSORIES**

#### ESD Mat

Mat to be laid out between DUT and HCP for the ESD susceptibility test in the packaging and handling. Surface resistance  $10^{7} \sim 10^{9} \Omega$ , as per Standard Dimensions: W1000mm × D500mm × thickness 2mm

#### Infrared Remote Controller

Remote controller for an easy remote management of the ESD generator. The remote controller function is available for ESS-S3011 model only.



#### ESD Suppression Brush

A dedicated brush to eliminate the electrification of EUT / DUT before starting the ESD test.

#### ESD Indirect Discharges Islands Compliant to ISO 10605 Annex F

The ISO 10605, in its Annex F describes an additional approach to ESD test for poweredup devices, in order to grant a better correlation between ESD test and the real world.

In order to do this, the Standard introduces a special fixture allowing to produce direct or indirect discharges on the EUT.

While direct discharges are applied directly to the EUT, indirect discharges are applied through "discharge islands" placed at fixed distances and by conductive metal strips.

Dimensions and form factor of the fixture is defined by the Standard for a reliable test repeatability.

- Standard: ISO 10605 Annex F
- Total length: abt. 1900 mm
- Discharge Island distance: 500 mm
- Coupling Plane dimensions: 160x350
   mm
- Coupling support material (coupling plane, strip, islands): Copper





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Test Systems – ESD Systems

### ESD SET-UP VERIFICATION ACCESSORIES

#### **ESD Current Target**

Load resistor to measure, verify and calibrate ESD current waveform defined in IEC61000-4-2 Standard and ISO 10605 Ed.2 Standard

- **Frequency Specifications:** 
  - > 300kHz-1GHz: ±0.5dB
  - $\triangleright$ 1GHz-4GHz: ±1.2dB
- Conversion ratio: 2V/1A (50Ω termination)
- Weight: Approx. 400g

Remark: The ESD Target shall be mounted on a metallic plate for testing. Different plates and Faraday cages are available and shown in the next page.





A complete set to calibrate the ESD target in conformance with IEC61000-4-2 Ed.2.0 (2008).

The Set is contained into a transportation case

Remark: The ESD Target shall be mounted on a metallic plate for testing.

Different plates and Faraday cages are available and shown in the next page.



Set with

carrying case

Coupling Adapter



Adapter coupled with ESD target

#### **High-Impedance High-Voltage Meter**

High performance and cost effective high-impedance high-voltage meter. It features significantly high input impedance ( $\geq$  100 G Ohm ), high accuracy and high resolution measurement, and a wide measurement range (Measurement range ± 1V ~ 100 kV).

Compliant to requirement of ISO 10605 Annex A, Par. A.2.2

- Measurement range ± 1V~100 kV (Auto ranging 1~19,999 V and 10~100,000V)
- Measurement Resolution 1V for low range and 10 V for high range
- Measurement Accuracy ± 1% ± 2 counts •
- Input Impedance ≥ 100 G Ohm
- Display 4 1/2 Digit LCD
- Power AC 100-240 V or 9V Battery •
- Working Temperature 32 to 122°F (0 to +50°C)
- Working Humidity 0 to 70% RH
- Dimension 0x15x50 cm (7.85x5.91x19.68 inch) •
- Weight 2 kg (4.41 lb)

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### Test Systems – ESD Systems

### **ESD SET-UP VERIFICATION ACCESSORIES**

#### **ESD Target Mounting Board**

Metallic board for ESD system verification. The board allows to fix the load resistor (ESD target) for measuring the discharge current waveform defined in IEC61000-4-2. Standard and ISO 10605 Ed.2 Standard Two available models:

- - 0.6m x 0.6m dimension
    1.2m x 1.2m dimension
- 1.2m x 1.2m dimension

The ESD target is not included



#### ESD Target Faraday Cage Mounting Box

Faraday Cage for ESD system verification. The Cage has a metallic plate with an ESD target (included) and a shielded box on the back to host an oscilloscope. The box has fans for forced cooling. As option, a wooden support with metallic ground

plane on the top is available.

### Dimensions:

Faraday Cage Front Plate: 160 x 160 cm Back shielded box: 65 x 65 x 50H cm Wooden support: 100 x 100 x 80H cm Other dimensions upon request





Front view



Dimensions







Shielded box on the back



Services – Accreditied Calibration Centre

# **Calibration Laboratory**



### **ELECTRICAL AND ELECTRONIC EQUIPMENT**

On-site or in our Laboratory, our specialized technicians perform calibrations and verifications of a wide range of electrical and electronic equipment, form DC to 40 GHz.

R&D Test Benches Manufacturing Test Benches Manufacturing Lines

### **CALIBRATION CAPABILITY**

Oscillators and frequency counters Oscilloscopes RF power generators RF power sensors RF power meters Electromagnetic field meters and antennas Low frequency meters and generators (< 10 kHz) Test equipments for electrical safety Spectrum analyzers Receivers and emitters for EMC tests, EMI included (Electromagnetic Immunity) High voltage pulses and fast transients generators Pulse Generators Thermometric chains Testing Laboratories General Purposes Equipment Automotive/Aerospace/medical equipment





### Services – Accreditied Calibration Centre

### **OUR SERVICES**

EIFFAGE

TESEO

Booking of the calibration in order to reduce the turnaround time

Fast Calibrations (24H) on demand

Auto-recall: we will remind you the expiry calibration date of your equipment when in our database

Yearly and multi-yearly framework contracts: optimization of our relative administrative costs

Maintenance and repair quotations

Consultancy about the metrological confirmation of your equipment

Professional training on measurement methods and uncertainty of measurement evaluation

Turk-Key Management of calibration, Repair and Maintenance.With a long years experience in the Services Management, TESEO is able to manage all the instruments of a laboratory, even taking care of their repairs, technical support and maintenance To achieve this goal, TESEO cooperates with others qualified Repair & Calibration Centres for all activities that is not able to perform directly, offering to the customer the advantage of having a single contact for all services.

### NATIONAL INSTRUMENTS OFFICIAL PARTNER

For years partner of National Instruments as Alliance Member, TESEO extends the services on NI products with calibration and adjustment of boards and measurement - acquisition systems.

TESEO Calibration Laboratory, using the NI Calibration Executive software, performs calibrations according to National Instruments recommendations, using standards traceable to the national and international SI units.



#### **ACCREDIA CALIBRATION CENTRE LAT N° 103**









Services – Accreditied Calibration Centre

### **ISO 17025 ACCREDITED CALIBRATIONS**

TESEO, in his Accredited Lab In Duento (Turin) can perform the following Accredited Calibrations

### ACCREDIA Accredited Calibrations UNI CEI EN ISO/IEC 17025:2005

QUANT	ΙΤΥ	MEASURING RANGE	
1	Frequency	Generable: from 1 Hz to 18 GHz Measurable: from 1 Hz to 2.7 GHz	
1	Power AF	Generable : 10 kHz ÷ 100 kHz Generable : 100 kHz ÷ 18 GHz Measurable : 10 kHz ÷ 18 GHz Measurable : 10 MHz ÷ 18 GHz Measurable : 100 kHz ÷ 4 GHz	from 10 nW a 5 mW from 1 nW to 5 mW from 10 nW to 100 mW from 1 nW to 100 mW from 10 nW to 100 W
1	Electric Field Strenght (Field Probes)	10 kHz ÷ 200 MHz 200 MHz ÷ 3 GHz	from 1 to 200 V/m from 1 to 60 V/m
-	Magnetic Field Strengh (Field Probes)	t 10 kHz ÷ 200 MHz	from 2.65 to 530 mA/m

Further than Accredited Calibration performed in his Accredited Calibration Laboratory, TESEO offers a wide range of Accredited Calibrations covering almost all the Electric and Electronic Quantities, thanks to collaboration with National and International Partners.

Collaboration with **Dare!! Calibration** (RvA Accredited – The Netherlands) Collaboration with **Seibersdorf Laboratories** (ÖKD Accredited – Austria)



Services – Accreditied Calibration Centre

### **UNI EN ISO 9001 CALIBRATIONS – Permanent Laboratory**

Beside the Accredited Calibration TESEO, in his Metrological Lab In Duento (Turin) can perform Calibrations at ISO 9001 level, for the following quantities:

### Calibrations according to the UNI EN ISO 9001:2015 quality system

QUANTITY	APPLICABLE TO	MEASURING RANGE
Voltage	DC 0 ÷ 1020V AC 1mV ÷ 1020V	10 Hz ÷ 500 kHz
Current	DC 0 ÷ 11A AC 0.01μA ÷ 11A	10 Hz ÷ 10 kHz
Current for	AC 0.01µA ÷ 1000A	10 Hz ÷ 50 Hz
Current clamps	AC 0.01µA ÷ 600A	10 Hz ÷ 1 kHz
Resistance	Short ÷ 330 $M\Omega$	
Capacitance	330pF ÷ 1100μF	
Temperature (Thermocouples)	-210℃ ÷ 1370℃	
Temperature (Thermom. chains)	) -40°C ∻ 180°C	
Attenuation	0dB ÷ 60dB	10 kHz-18 GHz
Frequency	Generable : 1 Hz-20 GHz	Measurable : 1 Hz-18 GHz
RF Power	Generable : 10 kHz÷200 MHz Generable : 200 MHz÷1 GHz Generable : 1 GHz÷3 GHz Generable : 3 GHz÷8 GHz Generable : 8 GHz÷18 GHz Measurable : 10 kHz÷1 GHz Measurable : 1 GHz÷18 GHz	$+52 dBm \div -60 dBm$ +50 dBm ÷ -60 dBm +44 dBm ÷ -60 dBm +30 dBm ÷ -60 dBm +10 dBm ÷ -60 dBm +57 dBm ÷ -60 dBm +50 dBm ÷ -60 dBm
VSWR	10 kHz ÷ 18 GHz	
High Frequency Impedance	10 kHz ÷ 18 GHz	
Electric field Strenght (Antennas and Field Probes)	10 Hz ÷ 10 kHz 50 ÷ 400 Hz 10 kHz ÷ 200 MHz 200 MHz ÷ 3 GHz 3 GHz ÷ 18 GHz	from 1 V/m to 1000 V/m from 1 V/m to 10kV/m from 1 to 300 V/m from 1 to 60 V/m from 1 to 10 V/m
Magnetic field Strenght (Antennas and Field Probes)	10 Hz ÷ 10 kHz 50 to 400 Hz 10 kHz ÷ 200 MHz 200 MHz ÷ 3 GHz	from 200 mA/m to 80 A/m from 200 mA/m to 400 A/m from 2.65 to 800 mA/m from 2.65 to 160 m/Am
Electromagnetic Power Flux Density	10 kHz ÷ 200 MHz 200 MHz ÷ 3 GHz	from 265 nW/cm <sup>2</sup> to 24 mW/cm <sup>2</sup> from 265 nW/cm2 to 955 $\mu$ W/cm
Pulses and High Voltage transients	DC ÷ 2 GHz (min 500ps rise-time)	from 0 to 20 kV



### Services – Accreditied Calibration Centre

### UNI EN ISO 9001 CALIBRATIONS – On-Site Calibrations

Thanks to a Second-Line Standards equipment, TESEO can perform calibrations directly at Customer's facility: Calibrations according to the UNI EN ISO 9001:2015 quality system

QUANTITY	MEASURING RANGE	APPLICABLE TO
Voltage	DC 0 ÷ 1020V AC 1mV ÷ 1020V	10 Hz ÷ 500 kHz
Current	DC 0 ÷ 11A AC 0.01μA ÷ 11A	10 Hz ÷ 10 kHz
Current for Current Clamps	AC 0.01μA ÷ 1000A AC 0.01μA ÷ 600A	10 Hz ÷ 50 Hz 10 Hz ÷ 1 kHz
Resistance	Short $\div$ 330M $\Omega$	
Capacitance	330pF ÷ 1100μF	
Temperature (thermocouples)	-210℃ ÷ 1370℃	
Attenuation	0dB ÷ 60dB	10 kHz-18 GHz
Frequency	Generable: 1 Hz-20 GHz	Misurable : 1 Hz-18 GHz
RF Power	Generable: 10 kHz÷200 MHz Generable: 200 MHz÷1 GHz Generable: 1 GHz÷3 GHz Generable: 3 GHz÷8 GHz Generable: 8 GHz÷18 GHz Measurable: 10 kHz÷1 GHz Measurable: 1 GHz÷18 GHz	$+52dBm \div -60dBm$ + $50dBm \div -60dBm$ + $44dBm \div -60dBm$ + $30dBm \div -60dBm$ + $10dBm \div -60dBm$ + $57dBm \div -60dBm$ + $50dBm \div -60dBm$
VSWR	10 kHz ÷ 18 GHz	
High Frequency Impedance	10 kHz ÷ 18 GHz	
Pulses and High Voltage transients	DC ÷ 2 GHz (min 500ps rise-time)	da 0 a 20kV



### Services – Accreditied EMC Laboratory

## EMC Laboratories Radio Frequency and Electromagnetic Compatibility





### **CE MARKING- HOMOLOGATIONS – VALIDATION - TESTS**

Our engineers are used with all the tests and measurements in RF and EMC fields which are necessary to obtain the homologation or the validation for your equipment or installations.

In our laboratories or on customer site, we answer to the requirements of many regulations and standards; covering the following markets : automotive, marine, railroads, defense, telecommunication, electronics, ...

### **CE MARKING**

We carry all of the measurements and tests necessary to obtain the declaration of conformity of your products, machines (test benches, ...) and production lines.

Our immunity tests include:

Emission and immunity tests, either conducted and radiated

Electrostatic Discharges

Electrical Fast Transient / Burst and Surges

Voltage dips, short interruptions and voltage variations

Harmonics and flickers

Exposure to E and H fields and stress measurements





### Services – Accreditied EMC Laboratory









### **AUTOMOTIVE COMPONENTS**

To meet regulatory standards or manufacturers requirements, we carry out the approval tests of many components: Bulk Current Injection (BCI) ISO pulses SITE VALIDATION Resistance to power and / or to load failure

### SITE VALIDATION

For maintenance or validation of anechoic and semi anechoic rooms and outdoor test sites, we manage following validations:

NSA (Normalized Site Attenuation) with network analyzer

FSNSA (Free Space Normalized Site Attenuation) with network analyzer

SVSWR (Site Voltage Standing Wave Ratio) with network analyzer Field Uniformity

Shielding Effectiveness

### EXTREMELY LOW FREQUENCIES (ELF)

Measurements under extreme solicitation at Low Frequencies, fields beyond 10kV/m and 300 A/m at frequencies from 50 to 5000 Hz; Parallel plates Helmholtz coil

### RADIOFREQUENCY

Our measurements cover both broadband (up to 40 GHz) and narrowband (up to 18 GHz) and can respond to all types of civil or military antennas (TV, radio, telephone, radar surveillance).

Our experts are able to advise and train you on the rules and methods of measurement.

### MORE MEASUREMENT CAPABILITIES

IFR MEASUREMENTS OF RADOME PANELS UP TO 18 GHz

SCATTERING PARAMETERS MEASUREMENT UP TO 18 GHz



Services – Accreditied EMC Laboratory



TESEO EMC Accredited Testing laboratory can perform EMC tests according to:

- EN 55015:2013 + A1:2015;
- EN 61547:2009

#### We can help our customers:

- reaching CE marking
- performing EMC tests
- measuring LUX during tests
- giving consultancy





TESEO EMC Accredited Testing laboratory can perform EMC tests according to: EN 60601-1-2:2007

#### We can help our customers:

- reaching CE marking
- performing EMC tests
- Obtaining standard compliance
- giving consultancy



Services – Accreditied EMC Laboratory





TESEO EMC Accredited Testing laboratory can perform EMC tests according to: • UNECE Regulation n. 10 rev. 5

#### We can help our customers:

- reaching E homologation
- performing EMC tests
- obtaining standard compliance
- giving consultancy

### **TESEO EMC LAB ACCREDITATIONS AND ACKNOWLEDGEMENT**

Since the inception of our EMC Laboratory, we have tested more than 5.000 devices for over 1.000 different customers.

Our engineers are used with all the tests and measurements in RF and EMC fields which are necessary to obtain the homologation or the validation for your equipment and installations.

Vehicle Certification Agency (VCA)



Accredited by:



EN ISO/IEC 17025:2005 LAB 1531





Services – Maintenance & Repair Laboratory

# TESEO Maintenance & Repairs Service LABORATORY



**EMC INSTRUMENTS REPAIR - A 360° SERVICE CAPABILITY** 

TESEO Service and Calibration team handles the expertise gained from a large number of projects, the thorough expertise of turn key EMC Testing Laboratories design, commissioning and maintenance; turn-tables and Automotive Testing, and the sound knowledge of on-site support at EMC Testing Facilities.

TESEO is a uniquely accredited company in delivering highly professional repair services. Over 30 years of experience and 60.000 original manufacturers technical repair manuals enables to extend your instruments life-cycle.

### **IN-HOUSE SERVICE**

TESEO maintains, repairs and calibrates RF, analog, fibre optic and digital equipment in its fully equipped Service laboratories.

High-skilled technicians perform repairs and general maintenance on amplifiers, radiofrequency signal generators and receivers, electronic instruments, optical links, turn tables and antenna masts from all the major manufacturers.



### **ON-SITE SERVICE**

Larger equipments, such as turn tables, anechoic chambers, high-power amplifiers and antennas are serviced directly on-site in France and Italy.

A reliable and fast service ensures the fastest turn-round time possible.



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Services – Maintenance & Repair Laboratory

### AVIONIC AND AEROSPACE EQUIPMENT – AGE – GPU

Beside EMC test facilities, TESEO maintains and re-qualifies electric and hydraulic benches for avionic test, aeronautic production lines and flight lines.

On selected items, avionic repairs are performed in TESEO facility.



### **CORRECTIVE MAINTENANCE GLOBAL CONTRACTS**

The Global Maintenance Services Contract grants a fully corrective maintenance and repair.

One stop-shop for Customer's tailored solutions in terms of reaction time and repair levels. A unique point of contact for maintain all your equipment and systems.

Global Contracts cover from general purposes instrument such as network analysers, to EMC dedicated equipment, spanning from antennas to anechoic and shielded chambers. from turn tables to antenna positioning equipment.



### SYSTEMS AND EQUIPMENT MAINTAINED

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	_	-								

Hydraulic GPU **GEPU Equipment** Air Conditionning systems Electric GPU **RF** Amplfiers **Fire Detection systems Fibre Optic Links** Exaust gas extraction systems STTE **Test Benches** Antennae and Field Meters **Mechatronic Components** AGE Anechoic Chambers Rotary systems Shielded and Anechoic rooms Avionics **Turntables and Bench Rollers** SCOE **EMC** Equipment and accessories Antenna Masts

#### **EQUIPMENT BY BRAND**

#### FULL REPAIR SERVICE FOR:

**BONN & BHE** 

TEKTRONIX

TESEO

#### 1<sup>st</sup> AND 2<sup>nd</sup> LEVEL MAINTENANCE FOR: **AGILENT & KEYSIGHT 3C TEST** NOISEKEN AMPLIFIER RESEARCH AH SYSTEM **RF SPIN** CETC 41 SCHWARZBECK **INN-CO SYSTEM** ETM SEIBERSDORF LABS **RHODE & SCHWARZ** FSA SIEPEL GERAC SPIZENBERGER SPIES TEGAM

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LAPLACE



# **TESEO Preventive Maintenance** & Calibrations – Global Service



### **PREVENTIVE MAINTENANCE: A VALUABLE ASSET**

Periodically scheduled Preventive Maintenance ensures that your equipment and systems are always at their best operating performance capability and delivers to your operations: Minimised your down-time with planned activities Increased your MTBF and reduce unpredicted unavailability Optimised your total cost of ownership

### **Preventive Maintenance**

Anechoic chambers and EMC Laboratories General Purposes systems Electric and electronic instruments

#### **Functional Verification & Accredited Calibrations**

Our ISO17025 ACCREDIA LAT 103 Accredited Laboratory performs Functional Verification and Calibrations for all electric quantities, including RF Power, Frequency and Field Strength. Then as NI Managed Independent Partner, the laboratory performs National Instruments calibrations, including on-site activities. Our mobile Calibration unit performs ISO9001 calibrations everywhere needed.

Worried about calibration intervals and down-time? Planned calibrations are made with a 24 hours turnaround time, our back-office operations remind and plan instruments pick-up, all your certificates are dematerialised and accessible via cloud.

#### Resident

If your laboratory is too big even for planned operations, we selecyively provide highly specialised and trained technicians on-site for periods or full-time.



### Services – Global Service Formula

### **PREVENTIVE MAINTENANCE & CONTRACTS**

- Periodically scheduled maintenance, planned in accordance with Customer's operations.
- In-House or on-Site recurring test campaigns.
- Yearly or multi-year contracts granting fix price and the most effective preventive maintenance service.

### **FUNCTIONAL VERIFICATION & CALIBRATION**

- ACCREDIA Accredited ISO17025 calibrations
- ISO17025 Compliant Calibrations
- ISO 9001 calibrations
- Choose between On-Site and Instrument Care Service (from pick up to return, all managed by TESEO).

### ANECHOIC CHAMBERS AND SITE VALIDATIONS

Instrument log (preventive maintenance, calibrations, repiars)

check planning and management,

#### Site Validation (ISO 9001 or ISO 17025)

- Shielding Effectiveness (SE)
- Normalized Site Attenuation (NSA)
- Field Uniformity (FU)

ASSET MANAGEMENT

instrument recall.

Period

.

Instrument Asset Database

Site VSWR (sVSWR)



#### Technical documentation and files management accessible from Cloud.

### **EVOLUTIVE MAINTENANCE, TRAINING, CONSULTING**

- Evolutive Maintenace, including enhancements or obsolescence management.
- RF & EMC consulting and traning, including EMC testing standards

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including









Services – Turn-Key System Design and Integration

# **Turn-Key RF & EMC Laboratories**



### **TURN-KEY SYSTEMS: A SOLUTION AT YOUR FINGERTIPS**

### Turn-key RF test laboratories, including:

- EMC compliance test facilities, including fully equipped anechoic chamber and test systems, for conducted and radiated EMC measurements compliant with any CISPR, FCC, RTCA, MIL and EN standards
- Antenna and PIM Testing
- Reverberating Chambers
- Satellite and Radar Testing
- HIRF/HERO Testing
- RF Hardware-In-the-Loop testing
- MIMO Testing
- Target Simulation and Radar Cross-section
- NEMP and HPM Testing
- Lightening Testing
- MRI Equipment Testing
- Customisable software for automated measurements
- Software for automated control of turn tables and antenna mast
- Antennas and RF probes for CW and Pulsed measurements
- E/H Generators
- RF/MW solid state and TWT Amplifiers for CW and pulsed applications
- Turntables and Roller benches
- Automated antenna mast
- Conducted Immunity instruments
- ESD and Pulse instruments

We are considered the largest independent integrator in Europe

- Track record in all RF
- applications
- Over 300kW of power delivered

### **KEY STANDARDS**

- CISPR 16
- IEC 61000-4-3
- IEC 61000-4-21
- CISPR 25
- ISO 11451
- RTCA DO160G
- MIL STD 461G
- TEMPEST
- IEEE STD 149

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### **Products and Services Catalog**

2019 rel.1

Services – Turn-Key System Design and Integration

### Anechoic, Semi-anechoic, Shielded Chambers

- Anechoic, Semi-Anechoic and Reverberating Chambers
- Shielded Rooms

**TESEO** 

EIFFAGE

- Tempest and DataCenters shielding
- Antenna Test Range and High Power Absorbers

### Turn Tables, Antenna Mast and Accessories

- Turn Tables and Antenna Mast
- Roller Benches
- Exhaust Gas extraction, Fire Detection
- XYZ and Special Positionning Systems

### **RF/MW Amplifiers, Antennas, Probes and Instrumentation**

- RF/MW amplifiers, DC to 40GHz, CW and Pulsed
- Antennas and E/H RF Field Probes, DC to 40 GHz, CW and Pulsed
- RF Generators, RF Power meters, EMI Receivers, Optical Links
- RF Switch Matrix, Interlock Systems, RF Cables, LISNs, CDN, RF Probes

### **Automated Measurement Software**

- Radiated Immunity and Emission Test
- Conducted Immunity and Emissions Test
- Pulse and ESD Test
- Report Generation

### Installation, Validation, Calibration, Training

- Laboratory Integration and Installation
- Site Validation (SE, FU, NSA, sVSWR)
- ISO 17025 Accredited and ISO 9001 Calibrations
- Software, Hardware, EMC Standards Trainings

### Maintenance & Support over the lifecycle

- Preventive Maintenance & Calibrations
- Corrective Maintenance & Repairs (Instruments & Chambers)
- Evolutive Maintenance and overhaul
- Global Maintenance Contracts















TESEO, thanks to Network of trusted Partners, Distributes and integrates a wide range of RF and EMC equipment, Services, Software and Accessories.

