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MANUALLY OR AUTO- MATED MAGNETIC FIELD OPTIONS MFO 6501 AND MFO 6502

USER MANUAL

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MATED MAGNETIC FIELD
OPTIONS MFO 6501 AND
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1 EXPLANATION OF SYMBOLS



Please take note of the following explanations of the symbols used in order to achieve the optimum benefit from this manual and to ensure safety during operation of the equipment.

The following symbol draws your attention to a circumstance where nonobservation of the warning could lead to inconvenience or impairment in the performance.

Example:



This connection must not be confused with the Equipment under Test (EUT) power input.

The following symbol draws your attention to a circumstance where nonobservation of the warning could lead to component damage or danger to the operating personnel.

Example:



Never connect or disconnect the EUT while the test system is performing a test.

2 SAFETY INSTRUCTIONS



These operating instructions form an essential part of the equipment and must be available to the operator at all times. The user must obey all safety instructions and warnings.

Neither Teseq AG, Luterbach, Switzerland, nor any of its subsidiary sales organizations can accept any liability for personal, material or consequential injury, loss or damage that may result from improper use of equipment and accessories.

2.1 General

The MFO with its NSG and other accessories must be operated only by authorized and trained specialists.

The unit is to be used only for the purpose specified by the manufacturer. The user is directly responsible for ensuring that the test setup does not cause excessive radiated interference which could affect other instrumentation.

The test system itself does not produce any excessive EM radiation. However, the injection of current into a loop results in a radiating electromagnetic field.

To avoid unwanted radiation, the standards organizations recommend that the test setup be operated inside a Faraday cage.



Danger of radiating illegal electromagnetic interference.

The NSG 3040/3060 with its MFO may only be installed and used by authorised and trained EMC specialists.

The NSG 3040/3060 with its MFO must only be used for EMC tests.



Personnel fitted with a heart pacemaker must not operate the instrument and must not be in the vicinity of the test rig while it is in operation.

Please take note of the following explanations of the symbols used in order to achieve the optimum benefit from this manual and to ensure safety during operation of the equipment.



It is recommended for the user to stay away (at least a few meters) from the loop antenna while magnetic field is generated. Also keep away magnetic field sensitive devices such as credit cards – magnetic key cards etc... which might be influenced by the field.

3 MAGNETIC FIELD OPTION MFO 6501 AND MFO 6502



3.1 General description

Mains frequency magnetic fields simulate the kind of stray fields that occur around current carrying power supply lines.

MFO 6501 is a manually driven magnetic field option while the automatic driven MFO 6502 is driven by the NSG 3040 or NSG 3060 generator. Both MFO's fulfill the specification in accordance with the IEC 61000-4-8 standard by inducing a strong current to flow in a magnetic field loop.

3.2 Manual Magnetic Field Option MFO 6501

The manual operated current generator type MFO 6501 is a standard accessory to generate in conjunction with a magnetic loop a magnetic field.



MFO 6501 and MFO 6502

The MFO 6501 provides a convenient means of generating and adjusting the current to flow through one of the magnetic field loops, like INA 701 or INA 702 (see accessories). It is required for magnetic field testing for fields up to 40 A/m. It complies with the requirements of IEC 61000-4-8. It can be used as a stand alone instrument

It is fitted with carrying handles as part of its overall good ergonomic design, which makes for ease of handling. Further, the unit may be used in any of three operating positions; laying or standing on a work bench, or for more permanent applications, it can be wall mounted.



Care has to be taken in case of use in standing position, as the stability is limited, so the cabling connecting MFO 6501 to mains presents a risk of being unvoluntarily caught by the users causing the MFO 6501 to fall down.

The few control elements are readily accessible on the front panel. A rotary hand – wheel to set the necessary current, a 50 – 60 Hz frequency selector and a low – high range selector ensure easy and intuitive operation.

Two safety banana sockets provide a convenient means to connect the loop antenna, two other ones (shorted by a delivered shunt) to connect an external amp-meter to monitor the generated field, as the field generated in the loop antenna is directly proportional to the current flowing through it:

$$H = C_f \times I$$

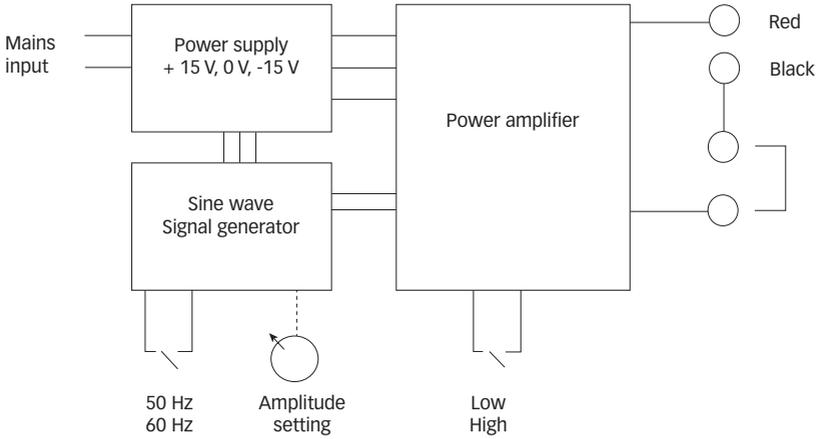
Where **H** is the generated field, **C_f** the coil factor, **I** the current flowing through the loop.

The unit has been designed for use in rugged industrial environments. Professional quality connectors ensure user safety, additional system protection is provided by a temperature sensor located on the heatsink of the power amplifier.

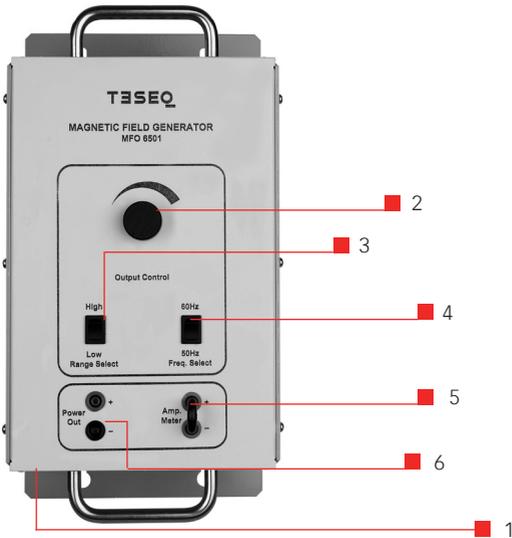


MFO 6501 is designed to drive INDUCTIVE LOADS ONLY, as magnetic field loops. CONNECTING CAPACITIVE LOADS WILL DESTROY THE INSTRUMENT.

3.2.1 Circuit diagram MFO 6501



3.2.2 MFO 6501 description



MFO 6501 and MFO 6502

3.2.3 Parts description

	Parts designation	Function
1	Mains supply in socket	For instrument supply, includes plug, On/Off switch and 3,15 AT fuse
2	2 Output control potentiometer	For output level adjustment
3	Range select switch	To switch from high range to low range – low range allows finer tuning for low amplitude current generation
4	Freq. Select switch	To switch from 50 to 60 Hz
5	Green safety banana sockets	For external amp-meter connection
6	Power out – red and black banana sockets	For connection to magnetic field loop antennas INA 701 or INA 702

3.2.4 Installation



The equipment should be switched off during installation and interconnection.

- Connect MFO 6501 to the lopp (INA 701 or 702). In case of use of INA 702 insure that “power” plug is fitted, see description of the accessories.
- Connect MFO 6501 to mains
- Connect external amp-meter
- Switch ON mains power
- Adjust the required current through the loop using hand-wheel

3.2.5 Standard operation - adjustments

The field generated in the loop antenna is directly proportional to the current flowing through it.

Standard level	Field in the loop A/m	Current required for INA 701 Cf = 0,89	Loop antenna 702; Cf 9,8
1	1	1,12 A	0,102 A
2	3	3,37 A	0,306 A
3	10	N/A	1,02 A
4	30	N/A	3,06 A
x	40 (max)	N/A	4,08 A

- Use the external amp-meter to adjust the required current

3.3 Automatic Magnetic Field Option 6502

3.3.1 Introduction

The automatic type MFO 6502 (Magnetic Field Option) is a standard accessory for the Tesseq NSG 3000 generator series. It provides a convenient means of generating and regulating the current to flow through one of the magnetic field loops. It is required for magnetic field testing for fields up to 40 A/m. It complies to the requirements of IEC 61000-4-8.

It is fitted with carrying handles as part of its overall good ergonomic design, which makes for ease of handling. Further, the unit may be used in any of two operating positions; laying on a work bench, or for more permanent applications, it can be wall mounted.



Its control is fully automatic, driven from NSG 3040 or NSG 3060 or WIN 3000. Once detected, the functions offered by MFO 6502 are available in the user interface or in the WIN 3000 software. As the voltage to A/m ration factor of the used loop antenna is available in the user interface or WIN 3000, the user will setup his tests directly in A/m, the software makes the calculation and drives the MFO 6502 to generate the right current through the loop antenna.

Two safety banana sockets (red and black) provide a convenient means to connect the loop antenna, Two other ones (Gree – shorted by a delivered shunt) to connect an external amp-meter to verify (or to calibrate) the generated current, as the field generated in the loop antenna is directly proportional to the current flowing through it:

$$H = C_f \times I$$

Where **H** is the generated field, **C_f** the coil factor, **I** the current flowing through the loop.

The unit has been designed for use in rugged industrial environments. Professional quality connectors ensure user safety, additional system protection is provided by a temperature sensor located on the heatsink of the power amplifier.



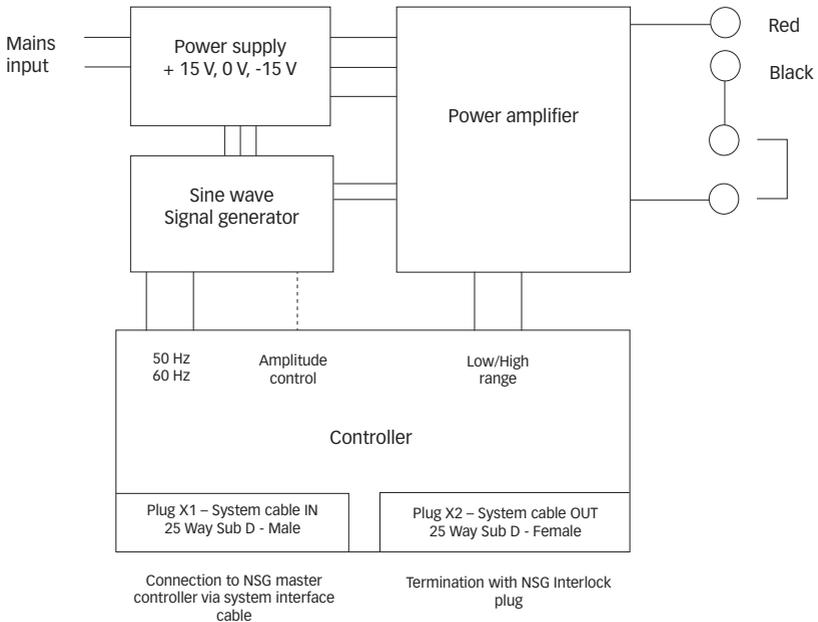
MFO 6502 is designed to drive INDUCTIVE LOADS ONLY, as magnetic field loops. CONNECTING CAPACITIVE LOADS WILL DESTROY THE INSTRUMENT.



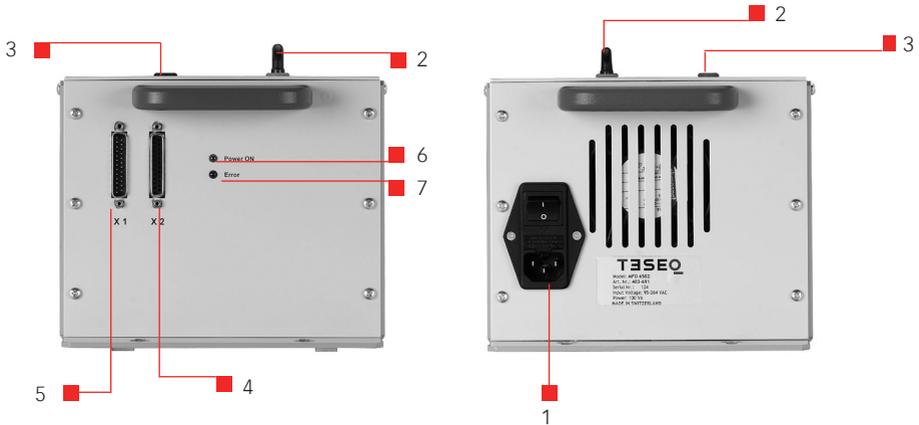
For proper operation of the plug and play detection mechanisms it is strongly recommended to power on first the MFO 6502 accessory and then the NSG generator main frame.

Powering on the NSG main frame before the accessories may result in a non detection of the accessories.

3.3.2 Circuit diagram MFO 6502



3.3.3 MFO 6502



3.3.4 Parts description

Part designation	Function
1 Mains supply In socket	For instrument supply, includes plug, On/Off switch and 3,15 AT fuse
2 Green safety banana sockets	For external amp-meter connection
3 Power Out – red and black banana sockets	For connection to magnetic field loop antennas INA 701 or INA 702
4 Plug X2	NSG system interface OUT – to be terminated by Modula Interlock plug or linked to another accessory, to X1 plug
5 Plug X1	NSG system Interface IN – to be connected to Modula Master Controller or to another accessory, to X2 plug
6 Power LED	Shows if instrument is powered up
7 Error LED	ERROR LED off: No problem – accessory is ready to run
	ERROR LED blinking: Problem able to be solved by user. Ex:

Interlock is activated – emergency button is pressed – overtemperature (for MFO 6502)

ERROR LED On:

Problem which needs module repair – please contact your nearest Teseq customer support center or sales representative.

3.3.5 Installation - connection to NSG



The equipment should be switched off during installation and interconnection.

- Connect instrument power IN to mains
- Remove 25 way Sub D plug at rear of NSG Master Controller
- Connect this connector to X2 of MFO 6502
- Connect 25 way output to MFO 6502 X1 plug, using system interface cable delivered with MFO 6502
- Connect MFO 6502 to loop antenna INA 701 or 702
- In case of INA 702, verify that “Power” plug is fitted
- Power On MFO 6502
- Power On NSG main frame

3.3.6 Technical specifications

Parameter	MFO 6501	MFO 6502
Magnetic field adjustment	Manually via potentiometer	Software driven via user interface or WIN 3000
Dimensions	195 x 180 x 380 mm	
Weight	4 kg approx.	4,2 kg approx.
Connections	Mains supply In Socket	
	Sockets for DVM	
	Power out safety banana sockets	
	n.a.	Plug X1, 25 way sub D connected to NSG
	n.a.	Plug X2, 25 way sub D termination plug
Control cable	n.a.	2 meters – 25 way sub D – twisted pair – shielded (incl. in delivery) to connect to NSG
Supply voltage	90 to 240 V	
Power consumption	< 150 W	
Operating temperature	5° – 40° C	
Overload protection	By temperature sensor on power stage	
Total harmonic distortion (THD)¹	< 8% (nominal <3,5 % at full range)	
Frequency	Selectable 50 and 60 Hz +/- 3%	

Range selection	Loop antenna INA 701; Cf 0,89	Loop antenna 702; Cf 9,8
Range low ²	80 to 400 mA into INA 701 allows 0,08 to 0,36 A/m	80 to 400 mA into INA 702 allows 0,8 to 4 A/m
Range high ^{2,3}	200 mA to 4,1 A into INA 701 allows 0,18 to 3,6 A/m	200 mA to 4,1 A into INA 702 allows 2 to 40 A/m

¹ Typical, for the full range from standard level 1 (lowest standard level) to full range (level X)

² Current adjustment through customer provided amp-meter for MFO 6501.

³ Current adjustment – software driven for MFO 6502

Indicated max values reachable for environmental temperatures below 30°C. For higher environment temperatures internal temperature sensor might trip after a few minutes.

4 ACCESSORIES



4.1 Magnetic field loops

When tests with mains frequency and/or pulsed magnetic fields need to be performed, Teseq provides two different magnetic field loops. These are rectangular loops measuring 1 x 1 m and are suitable for test objects with dimensions up to 0.6 x 0.6 x 0.5 m. Two types of loop can be supplied, INA 701 and INA 702.



4.1.1 Single-turn magnetic field loop INA 701

The INA 701 is a 1 x 1 m loop – single turn - with a coil factor of 0.89. It enables the generation of field strengths of up to 3,6 A/m for mains frequency fields 50 or 60 Hz when used with the MFO 6501 or MFO 6502 current sources and 1200 A/m for pulsed magnetic fields (IEC 61000-4-9), where the current is generated by a 4400 V surge generator.

4.1.2 Multi-turn magnetic field loop INA 702

The INA 702 is a 1 x 1 m loop - 11 turns – coil factor 9,8 - when fitted with the **POWER** plug. It enables the generation of field strengths of up to 40 A/m for mains frequency fields 50 or 60 Hz when used with the MFO 6501 or MFO 6502 current sources.



INA 702 becomes a single turn loop when fitted with the **PULSE** plug, which allows the generation of pulsed field strengths up to 1200 A/m, where the current is generated by a 4400 V surge generator.

The tests are carried out using the so-called immersion method, i.e. the item under test is placed in the center of the loop. The test is performed in accordance with the IEC 61000-4-8 (mains frequency) or IEC 61000-4-9 (pulsed) standards for magnetic fields.

In order to meet the pulse waveform required by IEC 61000-4-9, the waveshape adapter INA 752 needs to be used with NSG 3040 and the INA 701 or 702 loop antennas.

4.2 Pulse wave shape adapter INA 752/INA 753

4.2.1 Introduction

The pulse wave shape adapter INA 752 is a standard accessory for the Teseq NSG 3040 generator, resp. INA 753 for NSG 3060. It provides a convenient means of interconnecting the surge generator pulse output with the loop antennas INA

701 or 702 and insures that the generated pulsed has the wavshape as specified in the application standard IEC 61000-4-9.

4.2.2 Generator setting

Generally surge generators get setted by voltage, the current they deliver will depend from the load impedance. In this case the load consists in the loop antenna plus the waveshape adapter which is fix and stable. So there is a direct relationship between the generator voltage setting and the current delivered to the load.

As there is also a direct relationship between current in the loop antenna and the generated field (coil factor), there will be a direct relationship between the surge generator setted voltage and the generated field.

The coilfactor is given by the loop antenna manufacturer. It consists in the value englobing the factor of the coil plus the factor of the pulse waveshape adapter. This global factor is labelled on the INA 752 or INA 753 pulse waveshape adapter.

In case of use with Teseq INA 702 loop antenna, insure that termination plug labelled PULSE is fitted on antenna.

To make the use easy, Teseq provides directly the Volts to A/m ratio. This one is indicated on the top panel of the INA 752/753. This ratio has to be entered in the user interaface screen or WIN 3000 in order to generate the right field. The user will then always enter his settings in Amps / meter.

Volts to A/m ratio: This factor has to be entered in the software in the field "coilfactor".



In case a INA 702 loop antenna is used, the termination plug labelled "Pulse" needs to be used.

5 MAINTENANCE AND FUNCTION CHECK



5.1 General

Inside the test system there are no adjustable elements accessible to the user for either calibration or maintenance purposes.

The housing of the test system must not be opened. Should any maintenance or adjustment become necessary, the whole test system, together with an order or fault report, should be sent in to a Teseq service center.

Maintenance by the user is restricted to cleaning the outer housing, performing a function check and verification of the pulse parameters.

5.2 Cleaning

In general a moist cloth is sufficient for cleaning the outer housing. In stubborn cases use a small amount of a mild, non-foaming household cleanser as well.

No chemicals should be used for cleaning purposes.

Before beginning to clean the test system ensure that it is switched off and the mains power cable is unplugged from the supply.

5.3 Function check



The safety measures described previously must be strictly observed while carrying out a function check.

As soon as the test system is switched on the Power-LED should light up. If this is not the case then please check the mains power connection to the test system as well as the fuses, voltage selector and any other cabling.

The instrument automatically carries out a diagnostic routine once it has been successfully switched on.

The generator cannot perform any test while the Interlock circuit is open.

5.4 Calibration

The combination of high voltages and high frequencies in a single pulse makes the calibration of EMC pulse generators particularly demanding and difficult. Teseq has one of the few accredited test laboratories in Europe that is in the position to undertake calibrations in this specialized field.

5.5 Warranty

Teseq grants a warranty of two years on this test system, effective from the date of purchase.

During this period, any defective components part will be repaired or replaced free of charge or, if necessary, the test system will be replaced by another of equivalent value. The decision regarding the method of reinstating the functional capability is at the sole discretion of Teseq.

Excluded from the warranty is damage or consequential damage caused through negligent operation or use as well as the replacement of parts subject to degradation.

The warranty is rendered invalid by any intervention on the part of the customer or a third party.

The faulty items are to be returned in their original packaging or other equivalent packaging suitable for the purpose of the foreseen means of transportation.

Teseq can accept no responsibility for damage in transit.

6 CE CONFORMITY



The equipment is CE-certificated. The following standards apply:

Type of standard	Standard nr.	Remark
Product family standard	EN 61010	Safety requirements for electrical equipment for use in measurement, control, regulation and laboratory applications.
Generic standard	EN 61000-6-3	Electromagnetic compatibility (EMC); generic standard for interference radiation; Part 6.3 for residential, business and trade applications as well as small businesses.
Generic standard	EN 61000-6-4	Electromagnetic compatibility (EMC); generic standard for interference radiation; Part 6.4 industrial applications.
Generic standard	EN 61000-6-1	Electromagnetic compatibility (EMC); generic standard for interference immunity; Part 6.1 for residential, business and trade applications as well as small businesses.
Generic standard	EN 61000-6-2	Electromagnetic compatibility (EMC); generic standard for interference immunity; Part 6.2 for industrial applications.
Product family standard	EN 60326-1	Electrical equipment for measurements, control and laboratory use.

The requirements cannot be fulfilled in some cases. (The true purpose of an interference generator is to produce interference signals. Emission limitations can therefore only be complied with if the equipment is operated inside a faraday cage).

Deviations from the requirements are stated and explained in the appendix to the conformity declaration.

Headquarters

Teseq AG

4542 Luterbach, Switzerland

T +41 32 681 40 40

F +41 32 681 40 48

sales@teseq.com

www.teseq.com

Manufacturer

Teseq AG

4542 Luterbach, Switzerland

T +41 32 681 40 40

F +41 32 681 40 48

sales@teseq.com

China

Teseq Company Limited

T +86 10 8460 8080

F +86 10 8460 8078

chinasales@teseq.com

France

Teseq Sarl

T +33 1 39 47 42 21

F +33 1 39 47 40 92

francesales@teseq.com

Germany

Teseq GmbH

T +49 30 5659 8835

F +49 30 5659 8834

desales@teseq.com

Japan

Teseq K.K.

T +81 3 5725 9460

F +81 3 5725 9461

japansales@teseq.com

Singapore

Teseq Pte Ltd.

T +65 6846 2488

F +65 6841 4282

singaporesales@teseq.com

Switzerland

Teseq AG

T +41 32 681 40 50

F +41 32 681 40 48

sales@teseq.com

Taiwan

Teseq Ltd.

T +886 2 2917 8080

F +886 2 2917 2626

taiwansales@teseq.com

UK

Teseq Ltd.

T +44 845 074 0660

F +44 845 074 0656

uksales@teseq.com

USA

Teseq Inc.

T +1 732 417 0501

F +1 732 417 0511

Toll free +1 888 417 0501

usasales@teseq.com

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