



MANUALLY OR AUTOMATED MAGNETIC FIELD OPTIONS MFO 6501 AND MFO 6502

USER MANUAL 601-318B

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FIELD OPTIONS
MFO 6501 AND MFO 6502**

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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 3000 generator 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.



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 and magnetic key cards 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.

The MFO 6501 is a manually driven magnetic field option while the automatic driven MFO 6502 is controlled 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, 702 or 703 (see accessories). It is required for magnetic field testing for fields up to 130 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 excellent 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 involuntarily 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 to 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 multimeter to monitor the generated field, as the field generated in the loop antenna is directly proportional to the current flowing through it:

$$H = C_f \times I$$

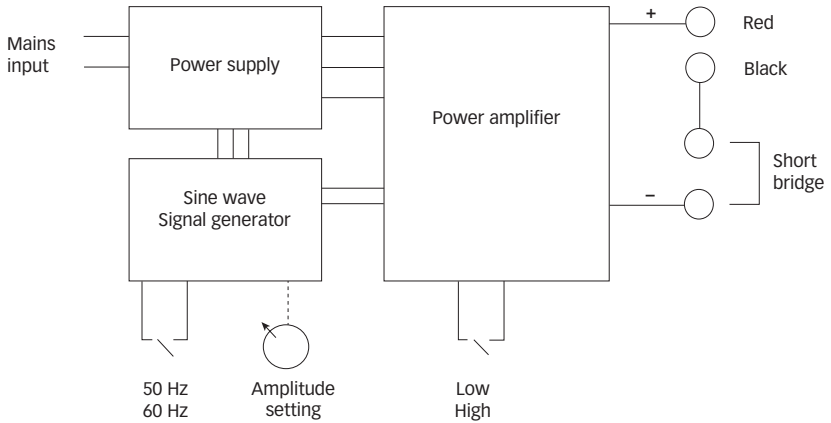
Where **H** is the generated field, **C_f** the coil factor, **I** the current flowing through the loop.

The unit has been designed for use in rugged industrial environments. High 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	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 output
5	Green safety banana sockets	For external multimeter connection
6	Power out – red and black banana sockets	For connection to magnetic field loop antennas INA 701, 702 and 703

3.2.4 Installation



The equipment has to be switched off during installation and interconnection.

1. Connect the MFO 6501 to the loop (INA 701, 702 and 703). In case of use of INA 702 insure that “power” plug is fitted, see description of the accessories.
2. Connect the MFO 6501 to mains
3. Connect external multimeter
4. Switch ON mains power
5. Adjust the required current through the loop using the output control potentiometer

3.2.5 Standard operation – adjustments

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

Standard level	Field in the loop A/m	Current required for loop antenna:		
		INA 701 Cf = 0.89	INA 702 Cf = 9.8	INA 703 Cf = 34
1	1	1.12 A	0.102 A	N/A
2	3	3.37 A	0.306 A	0.088 A
3	10	N/A	1.02 A	0.294 A
4	30	N/A	3.06 A	0.882 A
x	40 (max)	N/A	4.08 A	1.18 A
x	130	N/A	N/A	3.82 A

- Use the external multimeter to adjust the required current
- Typical values; please adjust to effective coil factor (Cf) on calibration certificate of your INA 70x coil.

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 Teseq 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 130 A/m. It fully complies to the requirements of IEC 61000-4-8.

It is fitted with carrying handles as part of its excellent 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.

MFO 6501 and MFO 6502



The MFO 6502's control is fully automatic, driven from the touchscreen user interface of the NSG 3000 generator or the WIN 3000 remote control software. The MFO 6502 is automatically detected. This activates the controls on the touch screen or in the WIN 3000 software. As the voltage to A/m ratio factor of the used loop antenna is available in the user interface or WIN 3000, the user can 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. The two green connectors (by default shorted) serve to connect an external multimeter 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. High quality connectors ensure user safety, additional system protection is provided by a temperature sensor located on the heatsink of the power amplifier.



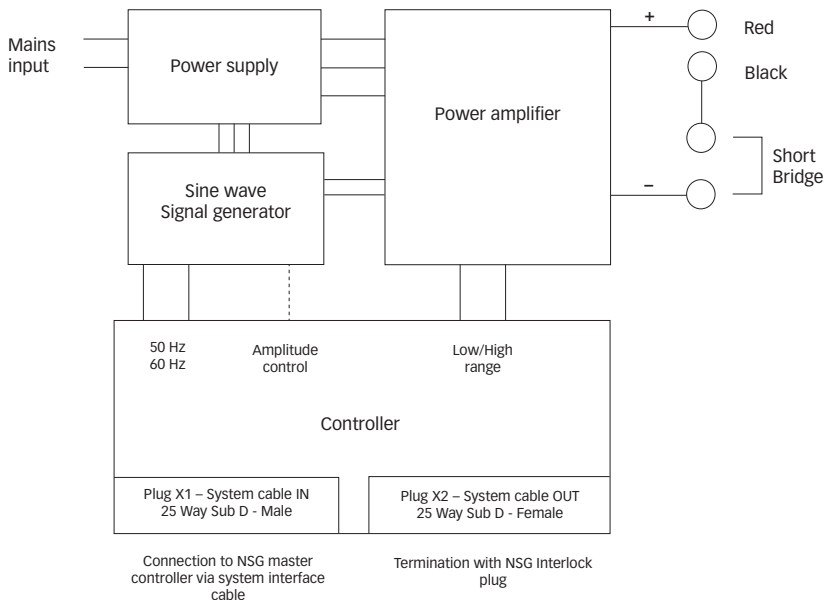
The MFO 6502 is designed to drive **INDUCTIVE LOADS ONLY**, as magnetic field loops. **CONNECTING CAPACITIVE LOADS WILL DESTROY THE INSTRUMENT.**



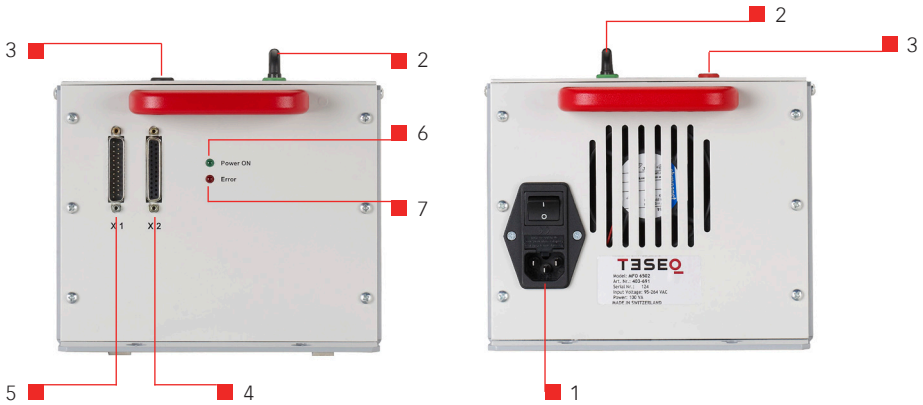
For proper operation of the plug and play detection mechanisms it is strongly recommended to first power on the MFO 6502 accessory and only after the NSG 3000 generator main frame.

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 multimeter connection
3 Power Out – red and black banana sockets	For connection to magnetic field loop antennas INA 701, 702 and 703
4 Plug X2	NSG system interface OUT – to be terminated by NSG 3000 interlock plug or linked to another accessory, to X1 plug
5 Plug X1	NSG system Interface IN – to be connected to NSG 3000 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



The equipment should be switched off during installation and interconnection.

1. Connect instrument power IN to mains
2. Remove 25 way Sub D plug at rear of NSG Master Controller
3. Connect this connector to X2 of MFO 6502
4. Connect 25 way output to MFO 6502 X1 plug, using the system interface cable delivered with MFO 6502
5. Connect MFO 6502 to loop antenna INA 701, 702 and 703
6. In case of INA 702, verify that “Power” plug is fitted
7. Power On MFO 6502
8. 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	4.2 kg
Connections	Mains supply In Socket	
	Sockets for DVM	
	Power out safety banana sockets	
	n.a.	Plug X1, 25 way sub D connected to NSG 3000
	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 3000
Supply voltage	90 to 240 VAC	
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 0,89³	Loop antenna INA 702; Cf 9,8³	Loop antenna INA 703; Cf 34³
Range low ^{1,2}	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	80 to 400 mA into INA 703 allows 2.7 to 13.6 A/m
Range high ^{1,2}	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	200 mA to 4,1 A into INA 703 allows 6.8 to 130 A/m

¹ Current adjustment through customer provided multimeter for MFO 6501.

² Current adjustment – software driven for MFO 6502

³ Typical values; please adjust to effective coil factor (Cf) on calibration certificate of your INA 70x coil.

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

For tests with mains frequency magnetic fields, Teseq provides three different magnetic field loops, INA 701, 702 and 703. 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.



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 up to 40 A/m for mains frequency fields 50 or 60 Hz when used with the MFO 6501 or MFO 6502 current sources.



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).

4.1.3 Multi-turn magnetic field loop INA 703

The INA 703 was conceived for tests at stronger power frequency magnetic fields according to IEC 61000-4-8.

A multi-turn concept (37 turns) allows the INA 703 to generate fields higher than 1000 A/m while using a programmable AC source rated for just 30 A. This enables testing to the IEC 61000-4-8 standards requirement of a current THD < 8%, which can be met only with a programmable AC source.

The INA 703 has taps at turns 1 and 5, providing increased accuracy when generating low amplitude fields.

For testing to IEC 61000-4-8, the INA 703 can be used as an accessory to a TESEQ Profline system comprising an NSG 1007 source, an INA 2141 impedance box and the the WIN 2120 software.

The INA 703 can also be used with the MFO 6501 or 6502 current sources and the NSG 3000 series of generators to generate supply frequency fields (50 and 60 Hz) over 130 A/m continuously.

With its multi-turn concept and professional mechanical design features, such as the U-shaped caster base for convenient positioning at the test table, the INA 703 is the ideal accessory for magnetic field testing.



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 add a small amount of a mild, non-foaming household cleanser.

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 of an unauthorized 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.

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