



**Advanced Test Equipment Rentals**  
**www.atecorp.com 800-404-ATEC (2832)**



# **INA 703**

# **MAGNETIC FIELD COIL**

## **USER MANUAL**

# **INA 703 MAGNETIC FIELD COIL**

**USER MANUAL**

# CONTENTS

<b>1</b>	<b>Explanation of symbols</b>	<b>5</b>
<b>2</b>	<b>Introduction</b>	<b>6</b>
2.1	General description	6
2.2	Supply frequency magnetic fields	7
2.3	Pulsed magnetic fields	8
2.4	Oscillatory magnetic fields	9
<b>3</b>	<b>User instructions</b>	<b>10</b>
3.1	General	10
3.2	Unpacking and installation	10
3.3	Positioning	13
3.4	Connection to the generator	14
3.4.1	Connecting to Teseq ProfLine system for IEC 61000-4-8 testing	15
3.4.2	Connecting to Teseq MFO 6501 or MFO 6502 for IEC 61000-4-8 testing	15
3.4.3	Connecting to any other generator for IEC 61000-4-8 testing	16
3.4.4	Connecting to Teseq NSG 3040 or NSG 3060 for IEC 61000-4-9 testing	17
3.4.5	Connecting to Teseq NSG 3040 or NSG 3060 for IEC 61000-4-10 testing	17
3.5	Test execution	17
<b>4</b>	<b>Maintenance and function check</b>	<b>19</b>
4.1	General	19
4.2	Cleaning	19
4.3	Function check	19
4.4	Calibration	20
4.5	Warranty	20
<b>5</b>	<b>Declaration of conformity (CE)</b>	<b>21</b>
<b>6</b>	<b>Options and accessories</b>	<b>22</b>
6.1	INA 703 Stand	22
6.2	INA 703 Coil	22
6.3	INA 3250 interconnection cable	23
6.4	INA 3251 Interconnection cable	23
6.5	Pulse wave shape adapter INA 752	23
6.6	MD 300 surge pulse current probe set	24
<b>7</b>	<b>System description</b>	<b>25</b>
<b>8</b>	<b>Addresses</b>	<b>26</b>



**Lethal danger from high voltages and the risk of radiating illegal electromagnetic interference.**

**This system must be used only for EMC test purposes as specified in these operating instructions.**

**The INA 703 must be installed and used only by authorized and trained EMC specialists.**

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

**When the system is used in conjunction with options, accessories or other equipment the safety instructions concerning those devices must also be observed.**

# 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 non-observation 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 non-observation 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 INTRODUCTION



### 2.1 General description

INA 703 is the top end of a family of magnetic field coils, designed for testing per IEC 61000-4-8 (supply frequency magnetic fields), IEC 61000-4-9 (pulsed magnetic fields), IEC 61000-4-10 (oscillatory magnetic fields).

Thanks to a multi wire - 37 turns – concept, it allows the generation of fields higher than 1000 A/m while using a current source rated for 30 A, so insures the possibility to meet the IEC 61000-4-8 standards requirement of a current THD < 8% which can be met only when using a synthetic current source.

INA 703 has a connection possibility after wire turn 1 and turn 5, which allows to reach great accuracy when generating low amplitude fields.

### INA 703 Magnetic field coil

The tap off after 1 turn is also used for tests per IEC 61000-4-9 and IEC 61000-4-10, which both require a single turn coil.

For tests per IEC 61000-4-8, INA 703 can be used as an accessory to the Teseq proflin system, together with a NSG 1007- 5 kVA source, the INA 2141 impedance box and the WIN 2120 software can generate supply frequency fields (50 and 60 Hz) up to 330 A/m continuously and 1100 A/m short term (3 s).

It can also be used with the MFO 6501 or 6502 current sources and the NSG 3000 series of generators and generate Supply frequency fields (50 and 60 Hz) up to 120 A/m continuously and 120 A/m short term (3 s).

For tests per IEC 61000-4-9, INA 703 can be used together with a classic combined wave generator as available in NSG 3040 or NSG 3060 series plus a pulse wave shape adaptor box INA 752.

For tests per IEC 61000-4-10, INA 703 can be connected to an adequate slow oscillatory waves generator.

Thanks to the multi wire concept and to the professional mechanical design, like U shape base on rolls which allows convenient approach and positioning to the test table, INA 703 is the ideal accessory for magnetic field testing.

## **2.2 Supply frequency magnetic fields**

Supply frequency magnetic field tests, simulate the magnetic fields typically generated by the current flow in power supply cables as specified in IEC/EN 61000-4-8. Such magnetic fields can affect the operation of items of equipment that are sensitive to them.

For testing to IEC 61000-4-8, the INA 703 needs to be supplied by a regulated 50 or 60 Hz current (THD<8%) of maximum 10 A continuously and 35 A short term (<5 s).

Single turn, 5 turns , and 37 turns can be selected in order to reach high fields with low currents, but maintaining good resolution for lower fields testing.

8 The Teseq ProfLine system comprising an NSG 1007- 5 kVA source, an INA 2141 impedance box and WIN 2120 software is ideally suited for this application. For this setup the interconnection cable INA 3250 is required.

The system can generate supply frequency fields (50 and 60 Hz) up to 330 A/m continuously and 1100 A/m short term (3 s).

For more information please consult ProfLine 2100 series user documentation.

The INA 703 can also be used with the Teseq MFO 6501 or 6502 current sources and the NSG 3000 series of generators to generate supply frequency fields (50 and 60 Hz) up to 120 A/m continuously and 120 A/m short term (3 s). For this setup the interconnection cable INA 3251 is required.

For more information please consult MFO 6501/2 or NSG 3040 series user manuals.

### **2.3 Pulsed magnetic field**

Pulsed magnetic fields tests, simulate the type of interference produced by surge pulses as a result of lightning strikes to buildings or other metallic structures such as free standing masts, ground conductors, grounding networks, etc. as specified in IEC/EN 61000-4-9. Magnetic fields of this type can upset the operation of installations that find themselves within such fields.

For testing to IEC 61000-4-9, the INA 703 can be used together with a classic combination wave generator such as the NSG 3040 or NSG 3060 series.

For this test a single loop ( 1 turn) will be used.

In order to meet the pulse waveform required by IEC 61000-4-9, the waveshape adapter INA 752 needs to be used.

## **INA 703 Magnetic field coil**

## 2.4 Oscillatory magnetic fields

Oscillatory magnetic fields tests, simulate the type of interference produced by the switching of medium and high voltage switchgears, as specified in IEC/EN 61000-4-10.

Magnetic fields of this type can upset the operation of installations that find themselves within such fields.

For testing to IEC 61000-4-10, the INA 703 can be connected to an appropriate slow oscillatory wave generator.

For this test a single loop (1 turn) will be used.

## 3 USER INSTRUCTIONS



### **WARNING - Improper or careless operation can be fatal!**

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 organisations can accept any liability for personal, material or consequential injury, loss or damage that may result from improper use of equipment and accessories.

### **3.1 General**

The INA 703 together with the adequate generator must be operated only by authorized and trained specialists. The generator with the coil 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 or human beings. The test system itself does produce EM radiation up to 1100 A/m .



### **WARNING - Personnel fitted with a heart pacemaker must neither operate the instrument nor approach the test setup while a test is being executed.**

Only approved accessories, connectors, adapters, etc. are to be used to ensure safe operation.

### **3.2 Unpacking and installation**

Check the packaging for signs of damage in transit. Any damage should be reported immediately to the transportation company.

INA 703 is delivered dismantled, safely packed in a solid wooden box.

11

Identify the upper side of the box and remove cover after having removed the screws.

The contents of the package will look like:



Unpack carefully the various parts. Check the parts for signs of transport damage. Any damage should be reported to the transportation company immediately.

Screw the vertical bars to the rolling base.



12

Lift (2 persons) the coil (red part) over the base, slide the black fixtures into the vertical bars.



Secure the coil by fastening the fixtures to the bar.

The INA 703 is now ready to be rolled around to the test setup.



**NOTE!** Do not dispose of packaging materials. All packaging should be retained in the event that the instrument or any of its accessories should need to be returned to a Teseq service center for repair or calibration.

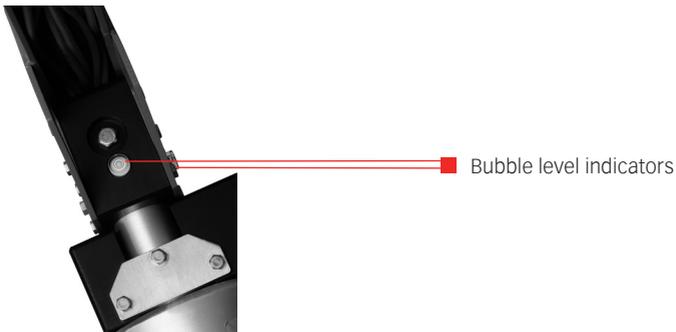
**INA 703 Magnetic field coil**

### 3.3 Positioning

The U-shaped base with castors will allow easy positioning of the INA 703 to the EUT, even if this one is placed on a test table.

The equipment to be tested shall always be positioned in the geometric center of the red coil part

Tests need to be done with the coil in horizontal position and then in vertical position, 2 bubble level indicators as shown in picture below will facilitate the right positioning.



Securing in horizontal and vertical position goes easy thank to the positioning lock:



**NOTE! Standards require only testing for horizontal or vertical position. INA 703 positioning lock has an intermediate position at 45 ° which may be used for investigation purposes.**

### 3.4 Connection to the generator

The INA 703 features a multipole terminal system which insures comfortable and safe connection of various generators suited for various applications



#### **Safety banana plugs: Red and black**

These 2 plugs are mainly used for pulsed and oscillatory magnetic fields testing. The Black banana is the low entry of the coil, the red banana is connected to the end of Turn Nr 1. connecting to these terminals is equivalent to test with a single turn coil.

#### **Round 4 pole connector:**

The pole marked with PE sign is connected together with the black banana to the low entry of the coil.

Pole Nr. 1 is connected together with the red banana to the end of turn Nr. 1

Pole Nr. 2 is connected to the end of turn Nr. 5

Pole Nr. 3 is connected to the end of turn Nr. 37

### **INA 703 Magnetic field coil**

### 3.4.1 Connecting to Teseq ProfLine system for IEC 61000-4-8 testing

An INA 3250 interconnection cable is required. Connect the INA 3250 interconnection cable directly from the 4 pole connector of INA 703 to INA 2141 of ProfLine system.



The setting of the various levels and frequencies of supply frequency magnetic fields is supported comfortably by the WIN 2120 software.

INA 2141 features 3 ranges (red selector on INA 2141 front: Position 0= Off, position 1 = 1 turn, position 2= 5 turns, position 3 = 37 turns) for better accuracy of low level magnetic fields.

For each of the 3 ranges a separate coil factor (the coil factor is available in the INA 703 calibration certificate and is also labelled on INA 703 terminal unit) needs to be used. In the WIN 2120 software configuration file the INA 703 needs to be configured as 3 separate coils.

For more information please consult the ProfLine systems user documentation.

### 3.4.2 Connecting to Teseq MFO 6501 or MFO 6502 for IEC 61000-4-8 testing

An INA 3251 interconnection cable is required. Connect the INA 3251 interconnection cable directly from the 4 pole connector of INA 703 to the output of MFO 6501.



The 3 ranges of the INA 703 are selectable by a respective banana plug (Green/yellow = Low, blue = 1 Turn, Black = 5 Turns, red = 37 Turns) for better accuracy of low level magnetic fields.

For each of the 3 ranges a separate coil factor. (The coil factor is available in the INA 703 calibration certificate and is also labelled on INA 703 terminal unit) needs to be used.

For more information please consult the NSG 3040 systems or MFO 6501/2 user documentation.

### **3.4.3 Connecting to any other generator for IEC 61000-4-8 testing**

An INA 3251 interconnection cable is required. Connect the INA 3251 interconnection cable directly from the 4 pole connector of INA 703 to the output of the generator.

The 3 ranges of the INA 703 are selectable by a respective banana plug (Green/yellow = Low, blue = 1 Turn, Black = 5 Turns, red = 37 Turns) for better accuracy of low level magnetic fields.

For each of the 3 ranges a separate coil factor. (The coil factor is available in the INA 703 calibration certificate and is also labelled on INA 703 terminal unit) needs to be used.



**Make sure that the maximum ratings of INA 703 are not exceeded – risk of fire.**



**For Standard compliance testing the generator shall have a THD<8%, this is not permanently guaranteed when solutions based on variacs and step down transformers powered from mains supply are used.**

### 3.4.4 Connecting to Teseq NSG 3040 or NSG 3060 for IEC 61000-4-9 testing

The INA 752 pulse wave shape adapter is required.



INA 752 has at one end the right plugs fitting into the surge out terminals of NSG 3040 and 3060 series, and at the other end the right safety banana plugs to fit in the INA 703 terminals.

For more information please consult the NSG 3040 or NSG 3060 systems user documentation, section about magnetic fields testing

### 3.4.5 Connecting to Teseq NSG 3040 or NSG 3060 for IEC 61000-4-10 testing

The required connection cable is delivered together with the NSG 3040- MOW generator series.

For more information please consult the NSG 3040 or NSG 3060 systems user documentation, section about magnetic fields testing.

## 3.5 Test execution

The user must observe safety instruction for all the instruments and associated equipment involved in the test setup.

Test setup configuration is to be strictly in compliance with the methods described in the relevant standard to ensure that the test is executed in a compliant manner



**WARNING - Users must be aware of the following dangers that can occur during testing:**

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

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

Field strength (A/m)  $H = C_f \times I$

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

The use and setting of the generator and associated software is given in the generator user documentation.

## 4 MAINTENANCE AND FUNCTION CHECK



### 4.1 General

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

### 4.2 Cleaning

In general a moist cloth is sufficient for cleaning the outer housing!. If necessary add a small amount of a mild, non-foaming household cleanser.

No chemicals (acid, etc) 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.

### 4.3 Function check



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

Functional check of the whole system (generator plus INA 703) can be made by monitoring the current flowing through the INA 703.

This current, multiplied by the coil factor, will give the generated magnetic field.

Supply frequency current may be measured by a RMS ampmeter.

Pulsed and oscillatory currents can be observed with an oscilloscope.



**Do not connect the oscilloscope directly in order not to exceed its max. input voltage.**

**Teseq recommends the use of an oscilloscope together with MD 300 current probe (see paragraph: accessories).**

#### **4.4 Calibration**

The calibration of a Magnetic field loop is explained in IEC 61000-4-8. The same calibration is valid for testing per IEC 61000-4-9 and -10.

A magnetic field meter is placed in the center of the loop and a reference supply frequency current is generated through the loop. The ratio between the measured magnetic field and the reference current gives the coil factor.

Teseq has a worldwide network of accredited test laboratories specialised in EMC calibrations. **Visit [www.teseq.com](http://www.teseq.com).**

#### **4.5 Warranty**

Teseq grants a warranty of 2 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 have to be returned in their original packaging.

Teseq accept no responsibility for damage in transit.

# 5 DECLARATION OF CONFORMITY (CE)



## Declaration of conformity



Manufacturer: Teseq AG  
Address: Nordstrasse 11F, 4542 Luterbach, Switzerland  
declares that the following product  
Product: INA 703 / Magnetic Field Coil  
Options: all  
conforms to the following Directives and Regulations  
EMC Directive 2004/108/EEC  
LVD Directive 2006/95/EEC  
Generic standards: EN61326-1, 2005  
EN61326-2-1, 2005  
EN61010-1, 2001  
The relevant technical file is available for inspection:  
Technical file: N° EMC\_INA703\_2012/ LVD\_INA703\_2012  
Teseq AG  
CH - 4542 Luterbach

The purpose of this instrument is the generation of defined interference signals for EMI immunity testing. Depending on the arrangement of the test rig, the configuration, the cabling and the properties of the EUT itself, a significant amount of electromagnetic radiation may result that could also affect other equipment and systems. The user himself or herself is ultimately responsible for the correct and controlled operation of the rig. In case of doubt, the tests should be carried out in a Faraday cage.

European representative: Teseq AG, Nordstrasse 11F, 4542 Luterbach, Switzerland

Place and Date: Luterbach, March, 7, 2012



Johannes Schmid  
President

## 6 OPTIONS AND ACCESSORIES



### 6.1 INA 703 stand



### 6.2 INA 703 coil



INA 703 Magnetic field coil

### 6.3 INA 3250 Interconnection cable

To interconnect INA 703 with Teseq ProfLine system for IEC 61000-4-8 testing.



### 6.4 INA 3251 Interconnection cable

To interconnect INA 703 with Teseq MFO 6501 or MFO 6502 for IEC 61000-4-8 testing.



### 6.5 Pulse wave shape adapter INA 752

The pulse waveshape adapter INA 752 is a standard accessory for the Teseq NSG 3000 series. It provides a convenient means for interconnecting the NSG 3040 or NSG 3060 surge generator with the loop antennas INA 701, 702 or 703 and insures that the generated pulsed magnetic field has the waveshape as specified in the application standard.

The combination NSG 3040 with CWM 3450 – INA 752 – INA 701 (or 702 or 703) is required for magnetic field testing for pulsed fields up to 1200 A/m. It complies to the requirements of IEC 61000-4-9.



### 6.6 MD 300 surge pulse current probe

The MD 300 probe has been specially designed to verify surge current pulses as specified in IEC/EN 61000-4-5, ANSI C62.41 and their derivatives.

The main advantage of the MD 300 current probe is, that the measuring system is physically isolated from the circuit under test.

The MD 300 current probe is ready to use as coming along with pre-mounted coaxial cable. The BNC-end plug needs to be connected to the high-impedance input or 50  $\Omega$  input of an ordinary memory oscilloscope. The conductor carrying the surge current to be measured is passed through the hole in the current probe. The resulting voltage wave shape on the oscilloscope will then be an authentically reproduction of the actual current wave shape within the given accuracy.



## 7 SYSTEM DESCRIPTION



### Technical specifications

Coil size:	1 x 1 m
Homegen field volume:	60 x 60 x 50 cm
Base:	Strong aluminum with rolls
Max vertical positioning Height:	130 cm
Turns:	1, 5, 37
Max supply frequency current cont:	10 A
Max supply frequency current short (3 s):	35 A
Max supply frequency field strength cont:	330 A/m
Max supply frequency field strength short (3 s):	1100 A/m
Max pulsed current:	1500 A
Max pulsed field strength:	1200 A/m
Weight:	25 kg

### Accessories

Connection cable for INA 2141:	INA 3250
Connection cable for MFO 6501 or 6502:	INA 3251
Pulse waveshape adapter for IEC 61000-4-9 testing:	INA 752
Current probe:	MD 300
Manual current source (4 A):	MFO 6501
Automatic current source (4 A):	MFO 6502
Automatic current source (37 A):	NSG 1007 - 5 kVA (ProfLine 2105)

### Other coil models

INA 701 – single turn coil
INA 702 – multi turn (1 turn, 11 turns) coil

## Headquarters

### Teseq AG

4542 Luterbach, Switzerland

T +41 32 681 40 40

F +41 32 681 40 48

sales@teseq.com

[www.teseq.com](http://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

© March 2012 Teseq®

Specifications subject to change without notice. Teseq® is an ISO-registered company. Its products are designed and manufactured under the strict quality and environmental requirements of the ISO 9001. This document has been carefully checked. However, Teseq® does not assume any liability for errors or inaccuracies.

To find your local partner within Teseq®'s global network, please go to [www.teseq.com](http://www.teseq.com)