NSG 5071 - INDUCTIVE SWITCH TRANSIENT TEST CIRCUIT

USER MANUAL

601-327A

TESEQ

Advanced Test Solutions for EMC

NSG 5071 - INDUCTIVE SWITCH TRANSIENT TEST CIRCUIT

USER MANUAL

CONTENTS

1 EXPLANATION OF THE SYMBOLS USED IN THIS MANUAL

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 failing to observe the warning could lead inconvenience or impairment in performance.

Example:

Please mind the polarity when connecting DUT cables.

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

Caution sign: A situation that may cause damage to the equipment.

Example:

Connect the system only to rated mains power.

Danger sign: Possibly dangerous situation that may cause damage to persons or heavy damage to the test equipment or DUT.

Example:

It is dangerous to fail to observe safety warnings.

2 WARNING SYMBOLS ON THE TEST SYSTEM

This symbol is used on the test system to signify a dangerous condition if misused.

Please read and understand the complete documentation of the NSG 5071 and the applicable standard references before putting the equipment into operation.

3 GENERAL SAFETY

The NSG 5071 system itself contains no dangerous voltages or currents, however, the application requires an external power source and can use up to 30 A for DUT power.

Up to 30 A may be switched using the NSG 5071. Care should be taken in connecting and operating the DUT.

3.1 Overcurrent protection

The NSG 5071 is designed using, and includes, the required Potter & Brumfield KUP-14A15-12 relay. The design can also (with the approval of Ford EMC) be used with other relays. It is important to limit the current in the application so as not to damage the relay that is installed, and in no case exceed 30 A, which is the maximum current limit of the NSG 5071.

The user is responsible to limit the current of the battery voltage source to a level safe for the installed relay (10 A delivered). In case other relays are used, the current should be limited to a value of the installed relay, and not exceeding 30 A.

3.2 Voltage protection

The NSG 5071 does not generate, on its own, dangerous voltages. However, it does contain inductances as part of the test setup that are switched to perform high voltage transient simulations. These transients may be high voltages caused by inductive kickbacks. Care should be used when powering the DUT through the NSG 5071 system. Refer to engineering or product documentation for your specific DUT.

NSG 5071 Inductive switch transient test circuit

Potentially dangerous voltage may be present at the cables leading to and from the DUT. Take care and follow all applicable safety guidelines given for your specific DUT.

Operation of the NSG 5071 without the cover is dangerous and strictly forbidden.

3.3 General warnings

DANGER!
It is imperative that you read the following safety instructions and all safety instructions in the manuals of the connected peripheral systems before installing and starting this test system for the first time.

DANGER!
The electrical and mechanical safety equipment must not be removed, put out of operation or bypassed. Handle all safety equipment with care. If a safety device should be broken or is not working, the system must be put out of operation until the safety device is repaired or exchanged and fully in working order again.

DANGER!
HAZARDOUS AREA! Connectors on the test equipment should not be touched!

The equipment may only be operated within an area that is explicitly declared a "Test Floor" (with appropriate signs) and protected against improper access.

The operating instructions form an integral part of the equipment and must be available to the operating personnel at all times. All the safety instructions and advice notes are to be observed.

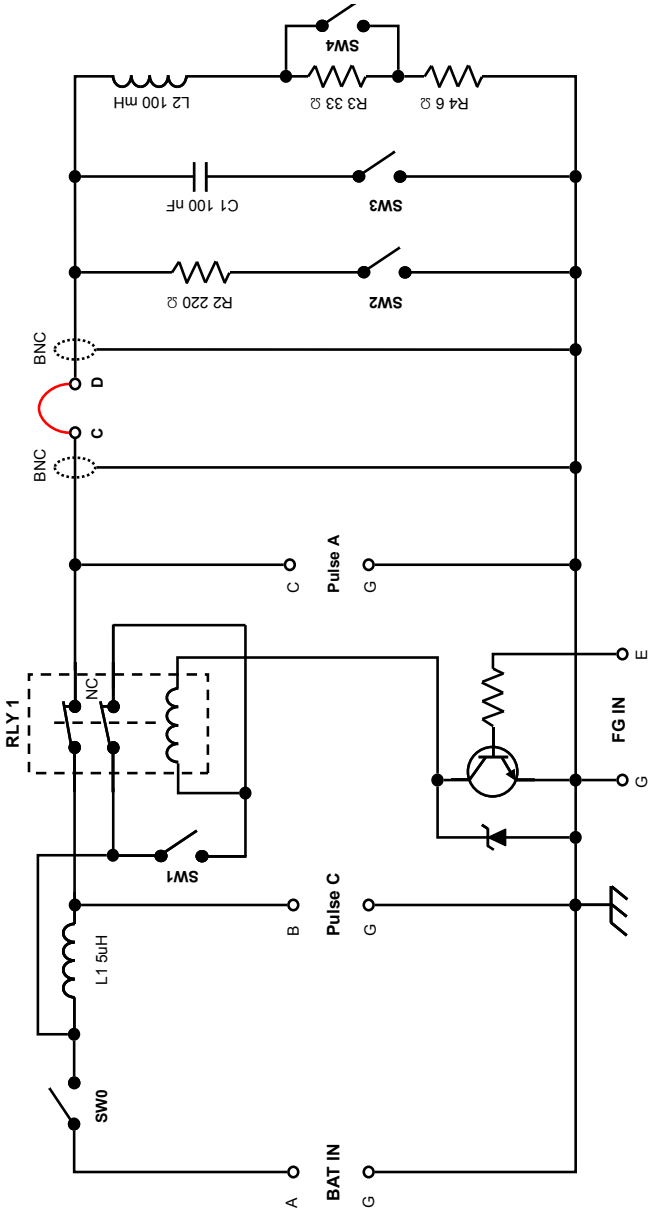
4 INTRODUCTION TO THE NSG 5071

The NSG 5071 is designed exactly in accordance with EMC-CS-2009.1 (hereafter referred to as 'the standard') for test CI 220 pulses A1, A2-1, A2-2, C1, C2 and RI 130 using an inductive/relay transient generator test circuit (hereafter called 'test circuit'). Because the same type of relay is used, CI 260 waveform F is included in this test circuit. This test circuit is defined in annex F for the A, C Pulses and RI 130 and figure 19-10 for CI 260 waveform F.

The basic philosophy of this test circuit is better reproducibility of actual switching transients. The reproducibility of this test circuit comes not from the output characteristics as in traditional conducted automotive immunity tests, but from a fixed design of the generator using several pre-defined components. Many of these components are defined in the standard as "critical" with no substitutions allowed.

Overview of the NSG 5071

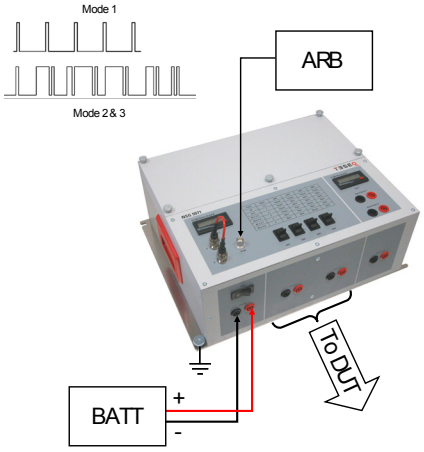
NSG 5071 Inductive switch transient test circuit



Circuit Diagram NSG 5071

5 INSTALLATION OF THE NSG 5071

For RI 220 pulses, the NSG 5071 must be placed on, and connected to the test bench earth using the convenient connections. The ARB signals must be provided as shown in the following diagrams and expanded in the following sections.



Installation for CI 220 pulses

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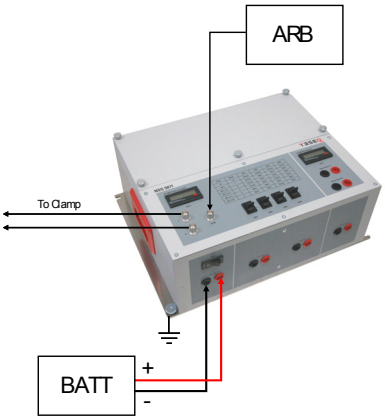
RI 130 contains a similar setup, but the output of the NSG 5071 is connected via two BNC cables to the parallel wire fixture.

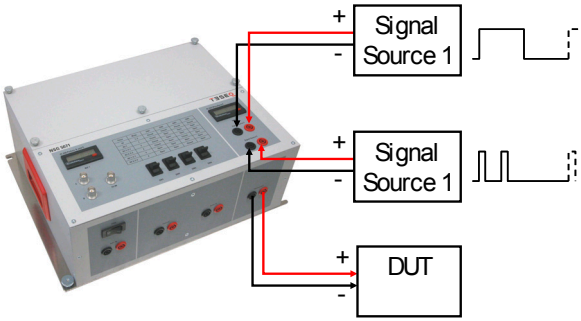


Installation for RI 130 pulses

For CI 220 and RI 130 pulses, the NSG 5071 must be connected to earth using the supplied earth connections.

The earth connection of the NSG 5071

The installation for CI 260 waveform F is somewhat different. In waveform F, there are two signal sources that must be independantly controlled. These two signal sources both power the DUT and control the relay. For detials, see section 7.



Installation for CI 260 waveform F

6 USAGE OF THE NSG 5071 FOR CI 220

6.1 Battery input

The NSG 5071 is used per the guidelines in the standard. As seen in the circuit diagram, SW0 connects and disconnects the battery (| and O respectively) from the entire test circuit and DUT. As the circuit does nothing without battery, SW0 can be thought of as the power switch.

The connectors labeled BAT IN are to be connected to the battery. While a power supply may be used, Ford specified a actual automotive battery during compliance testing and tests without an automotive battery are not considered compliant without specific permission from the standards writer. It is important to use only correct polarity! The negative BAT IN connector is, as defined in the standard, directly connected to chassis ground.

The BAT IN connector and SW0 provides battery to the test circuit and DUT.

The switching condition of RLY1 is dependant upon battery and the status of the FG IN voltage. The NPN transistor will pull activate the relay based on a positive TTL input signal. RLY1 is rated for 10 A.

Failure to observe proper polarity may result in damage to the DUT and NSG 5071!

The supplied relay is exactly that specified in the standard. The standard recognizes the need for occasionally needing more battery current, and other relays may be used with written approval of Ford. In this case, the NSG 5071 has been specifically designed to accept up to 30 A of battery current. However, the supplied relay is specified for only 10 A.

While the NSG 5071 can supply with up to 30 A, the supplied relay is specified 10 A max!

For more information on exchanging the relays, please see the section 8.

6.2 CI 220 DUT output

For all CI 220 testing, the DUT will be connected to either the pulse A or pulse C outputs.

Pulse name	Output connector to use
A1	Pulse A
A2-1	Pulse A
A2-2	Pulse A
C-1	Pulse C
C-2	Pulse C

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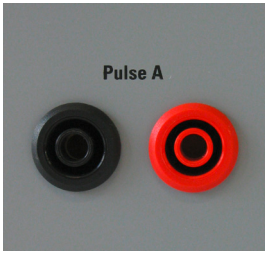
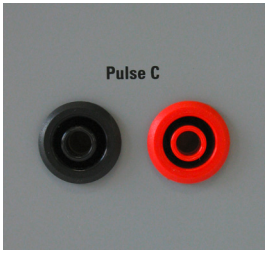


The A1, A2-1 A2-2 DUT output



The C1 and C-2 DUT output

6.3 Selecting the pulse

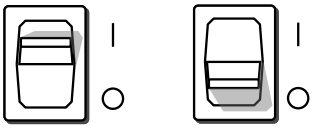
Selecting the pulse is based on the switch positions of SW1 through SW4. Each pulse may be run in several modes, and some must be run in all three modes.

Select the pulse using the handy reference printed on the front of the NSG 5071 and selecting the appropriate switch positions.

Pulse	Mode	SW1	SW2	SW3	SW4
A1	1, 2	Closed	Closed	Closed	Closed
A2-1	1	Closed	Open	Open	Open
A2-1, C-1	2	Closed	Open	Open	Open
A2-2, C-2	2	Closed	Open	Closed	Open
A2-1, C-1	3	Open	Open	Open	Open
A2-2, C-2	3	Open	Open	Closed	Open

The pulse selection table

In all cases, the switch postioins is described below:



During actual testing, it is a simple matter of choosing the correct switch positions and monitoring the DUT. For clarification, the purposes of the SW1 – SW4 are outlined below.

SW1 – Switch 1 enables (open) or disabled (closed) the Mode 3 “self chattering relay” Mode.

SW2 – Switches 220 Ohms in parallel with L2, effectively shaping the pulse shape.

SW3 – Switches 100 nF capacitor in parallel with L2, effectively shaping the pulse shape.

SW4 – Increases the impedance between L1 and earth.

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6.4 Controlling the input signal

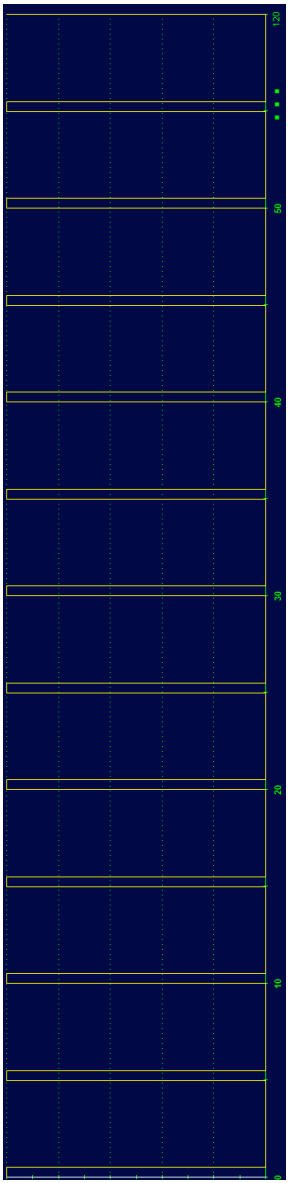
Once the NSG 5071 is connected to a battery voltage source, the relay can be driven with a standard TTL signal. The timings of the control signals can be found in the standard, but are shown below for reference.

Mode 1 pulses are pulses that are triggered at fixed intervals.

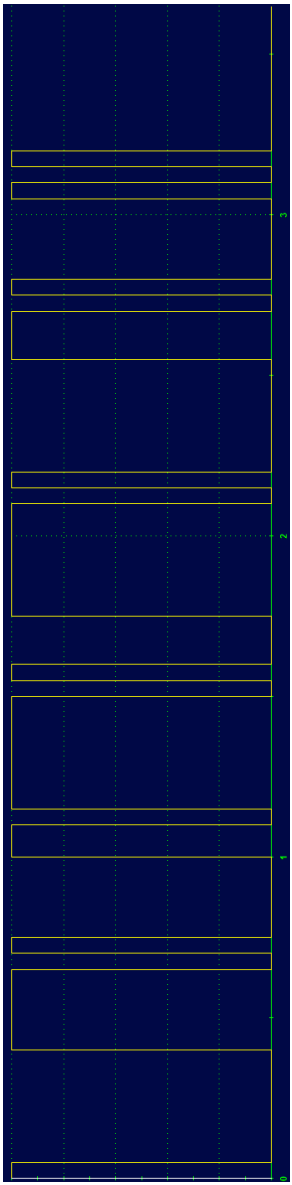
Mode 2 pulses are pulses that occur at defined, pseudorandom intervals.

Mode 3 pulses use the same trigger signal as Mode 2 pulses, but the relay is self chattering during the trigger. Think of Mode 3 pulses as gated self-chattering events.

The user must supply the TTL signals or use an NSG 5600 and the supplied cable.



The Mode 1 control signal

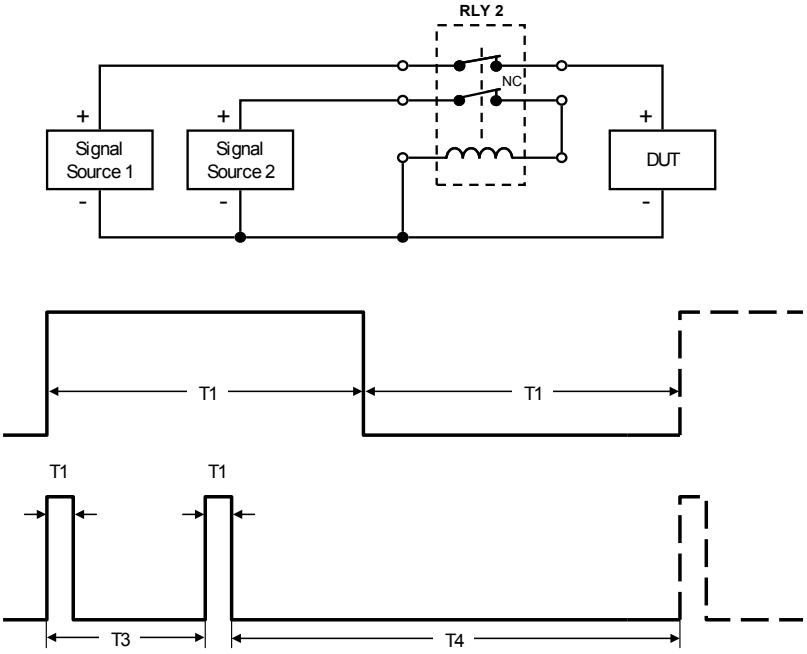


The Mode 2 and 3 control signal

NSG 5071 Inductive switch transient test circuit

7 USAGE OF CI 260 WAVEFORM F

Waveform F is a complex dropout test that depends on two controlled signal sources called “Signal Source 1” and “Signal Source 2” in the standard. As you can see in the following schematic, Signal Source 2 controls primarily the relay switching. When 12 V is supplied by Signal Source 2, the relay RLY2 will chatter. When Signal Source 2 is at 0 V, the DUT will be powered through Signal Source 1, which is also independently controlled.



The control of CI 260 waveform F

8 RELAY MONITORING, USAGE AND RECPLACEMENT

The NSG 5071 is supplied with two Potter & Brumfield KUP-14A15-12 relays. Due to the extreme nature of the test, the relays performance may be degraded over time. Therefore, the relays are recommended by the standard to be replaced after 100 hours of operation. A counter is provided to determine how long the relays are used. Any time the relay is active, the counter will count. The NSG 5071 does not need to be actively switching at the time, but if the relay gets power, from BAT IN (CI 220) or Signal sSurce 1 is set to battery voltage (CI 260) the timer will run.

This is, of course, the most conservative interpretation of “usage”, but represents a compromise to give the users of tracking the relay usage while at the same time having no effect on the pulses applied to the DUT.

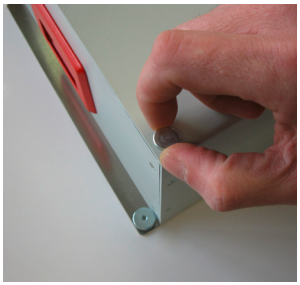
8.1 Resetting the counter

Each counter operates independently for RLY1 and RLY2 for CI 220/RI 130 and CI 260 respectively. Resetting the counter may be performed by pressing the red button on the counter.

Resetting the counter

8.2 Replacing the relays

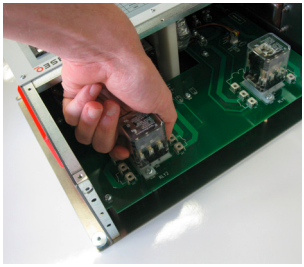
The relays may be replaced by loosening the five thumbscrews on the top of the NSG 5071 and carefully sliding the top cover to the rear. Take care not to damage the copper guide pins or the RF gasket. Everything should be disconnected to the NSG 5071 when exchanging relays.



Loosening the thumbscrews

Removing the cover

Next, the relays can be removed by firmly grasping and lifting the relay and with a slight rocking motion.



Firmly grasping and lifting the relay

Replacing the relay is a simple matter of pressing the relay into the supplied socket and closing the cover. Take care not to damage the copper guide pins and RF gasket.

The copper guides and RF gasket

8.3 Relay usage

The NSG 5071 contains two of the Potter & Brumfield KUP-14A15-12 that are specified in the standard. However, with the authorization of the standards writer, other relays may be used. For this reason, the NSG 5071 is designed for more current than the built-in relay can handle, and it provides connections for other relays.

The convenient screen on the circuit board defines the various connections. Take care with the connections and the overall current limit of the system when using relays other than the KUP-14A15-12.

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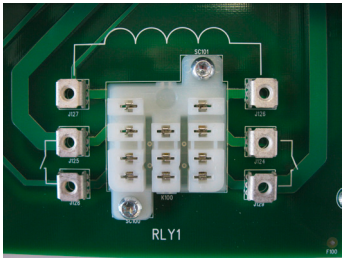
The user is responsible to limit the current of the battery voltage source to a level safe for the installed relay (10 A delivered). In case other relays are used, the current should be limited to a value of the installed relay, and not exceeding 30 A.



The connections provided for other relays

It is important to remove the KUP-14A15-12 before using any other type of relay.

9 MAINTENANCE

The only user replaceable parts are the relays RLY1 and RLY2. No other user serviceable parts are inside.

The KUP-14A15-12 should be regularly checked. In some cases, it may wear out in much less than 100 hours. This is relay considered a consumable item in the NSG 5071.

9.1 Cleaning

Clean only with a clean, dry cloth. No cleaners are recommended.

9.2 Batteries

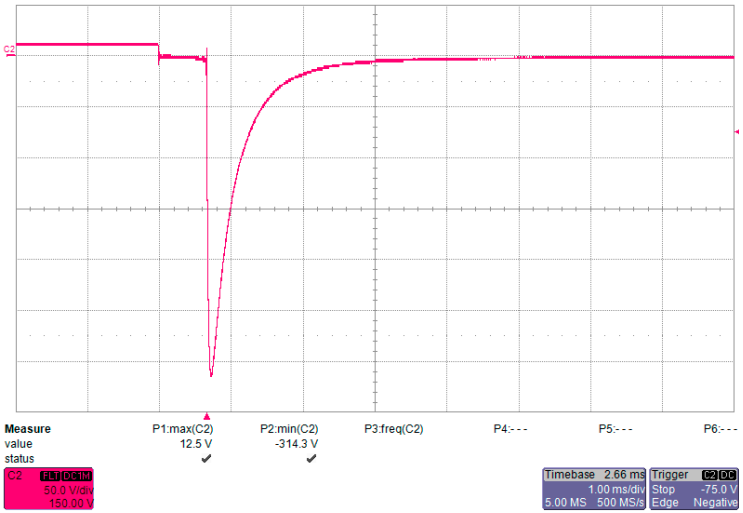
The clock has an internal, non-replaceable battery. This battery is rated for 10 years. Contact your Teseq representative for replacements.

9.3 Calibration

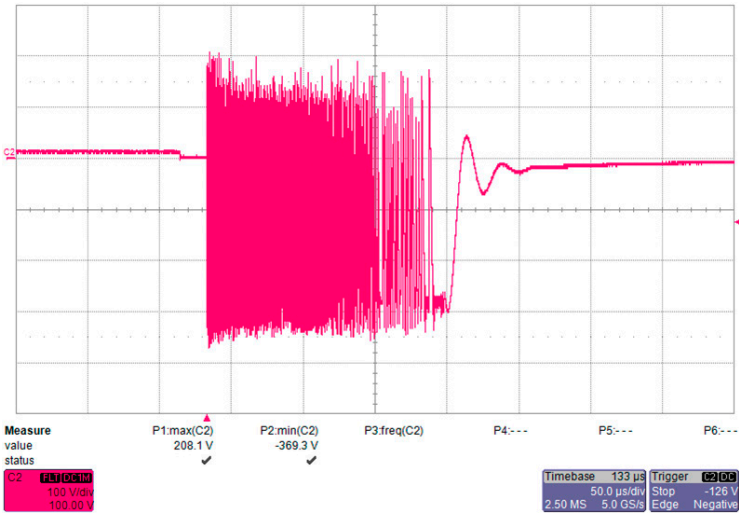
No calibration is required. You should periodically check your NSG 5071 to ensure that the output can be compared to the example plots in the standard, and in this document.

10 EXAMPLE PLOTS

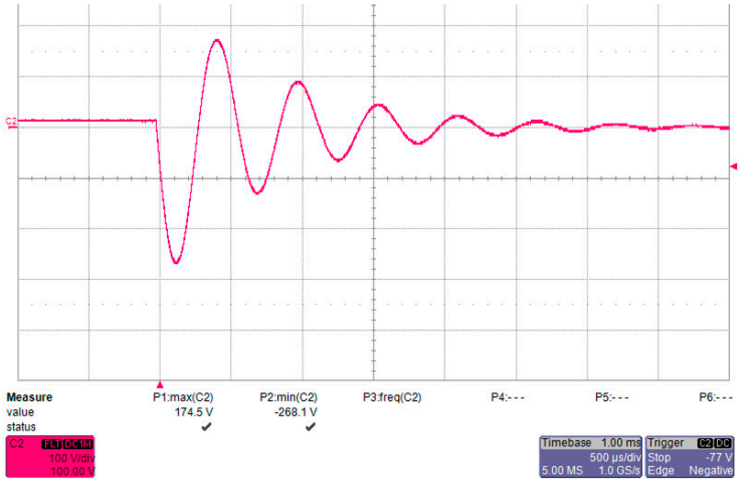
Your NSG 5071 should have plots that are representative of the plots seen here, and in the standard. Please note that these pulses are “pseudo-random” and every pulse will usually not appear exactly as shown. Additionally, it if often necessary to trigger on current – see the standard for more details.



Pulse A1



Pulse A2-1 Detail



Pulse A2-2 Contact break

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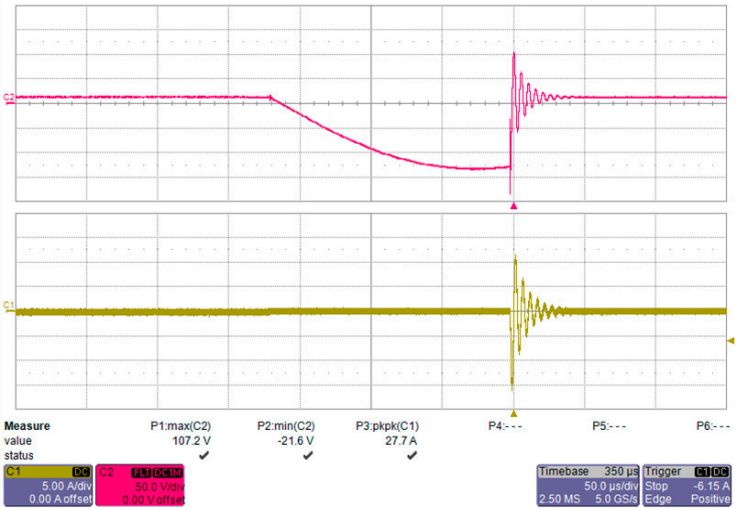
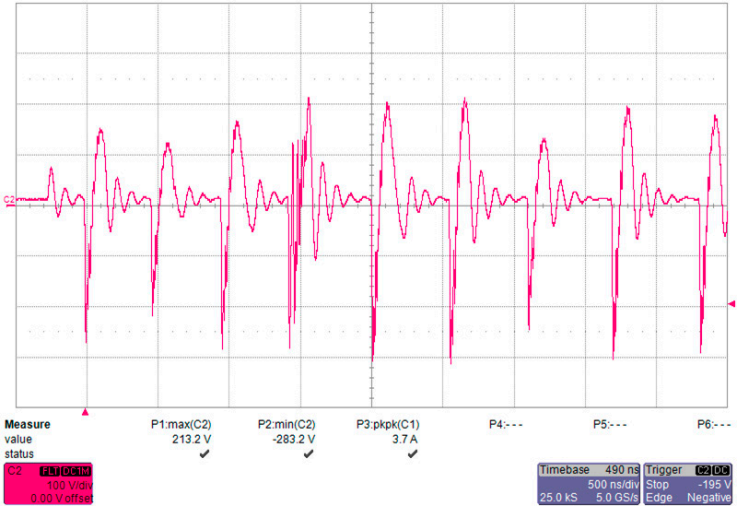
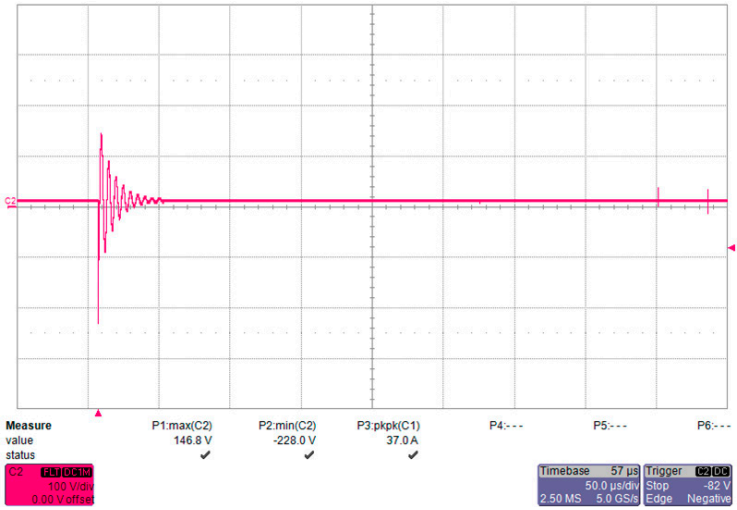


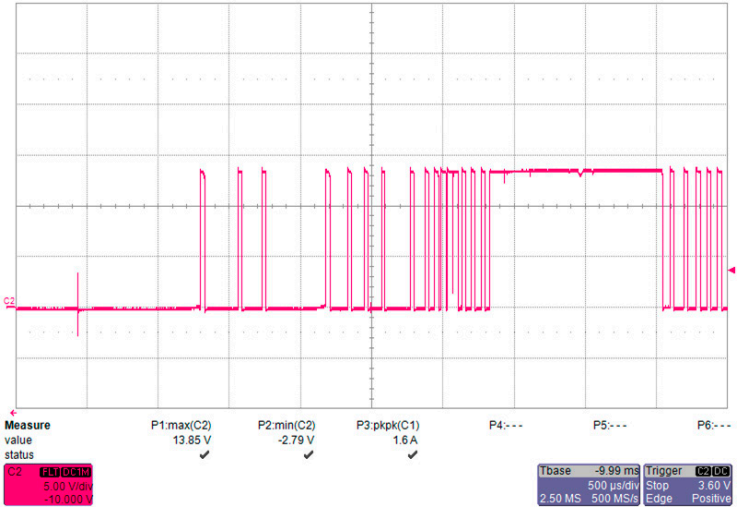
Pulse A2-2 Contact make and break



Pulse C1



Pulse C2



CI 260 Waveform F

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11 DIMENSIONS AND WEIGHT

Dimensions (LxWxH)	353 x 270 x 126 mm (13.9 x 10.6 x 5 inch)
Weight	8.65 kg (19 lbs)

12 SPECIFICATIONS

Maximum input voltage (Umax) Signal Source 1, Signal Source 2 BAT IN	15 V
Maximum DUT current (Imax) Signal Source 1, Signal Source 2, BAT IN	10 A (Installed KUP-14A15-12 relay 30 A (Other relay)
TTL control signal	TTL low: 0-0.4 V TTL high: 2.63 - 5 V

NSG 5071 Inductive switch transient test circuit

13 ENVIRONMENTAL CONDITIONS

Temperature range	
Operation at:	+10 to +40° C
Storage at:	-10 to +60° C
Humidity:	30 to 78% (non condensing)
Air pressure:	860 to 1060 hPa

14 DECLARATION OF CONFORMITY

TESEQ
Advanced Test Solutions for EMC

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Declaration of conformity

CE

Manufacturer:	Teseq AG
Address:	Nordstrasse 11F, 4542 Luterbach, Switzerland
	declares that the following product
Product:	NSG 5071 - Ford Transient Generator
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_NSG 5071_2010 / LVD_NSG 5071_2010 Teseq AG CH - 4542 Luterbach

The purpose of this instrument is the generation of pseudo random 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.

Place and Date: Luterbach, May 20th, 2010

Johannes Schmid
President

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