# Defence Standard 59-411 issue 2
# DCS06 Test Generator
# User Manual

## Revision History

| Issue: | Modification | Date: | Modified By: |
|---|---|---|---|
| 1.0 | First Issue | | N/A |
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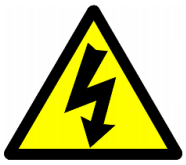
## Safety Precautions

This equipment delivers high voltage, high energy pulses. If misused, could cause serious injury or fatality. All safety instructions should be followed prior to and during use of this Equipment.



The output of this Generator delivers high voltage, high energy pulses. The output connection and test clamp should be connected prior to energising the generator.

During the test application, no personnel should be in contact with the equipment under test or the test clamp. Personnel should maintain a 0.5 metre separation distance between the clamp and equipment under test during pulse application.

This equipment should only be operated by trained personnel that understand the safety implications of Generator misuse. Under no circumstances should the generator be left energised and unattended.

The rear earth terminal should be connected before use. This should be a separate earth connection to the mains i.e. bonded to a ground plane or to a screened room connection point.

Connections from the test generator to the clamp should be in “N” Type co-axial cable. If the clamp supports only 4mm plug connections these should be shrouded

The generator is designed for use with the supplied clamp. If a different clamp is used, the Generator output will not be correct and in certain circumstances the Generator could be damaged.

The applied pulse is a high energy pulse and in certain conditions could cause equipment under test components to explode. It is recommended that eye protection is worn during this test to prevent injury.

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There are no serviceable parts inside the Generator, do not attempt to disassemble or repair the generator. In the event of a failure or damage to the Generator please contact the manufacturer for servicing.

# Contents

## Contact Details

In the event of an equipment failure, repair or any other general enquiry please use the following contact details, quoting the Generator type and serial number:

**The Conformity Assessment Business**

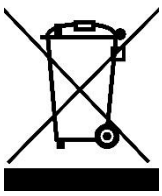
**609 Delta Business Park, Welton Road, Swindon, United Kingdom, SN5 7XF**

**info@conformity-assessment.com**

**+ 44 (0) 1704 821376**

**+ 44 (0) 7943 405145**

## Waste Electrical Equipment (WEE)



The Conformity Assessment Business undertake to accept this Generator at it's end of life for recycling. Please contact us direct to arrange pickup at our cost should the generator be no longer needed or serviceable.

# EU Declaration of Conformity

THE CONFORMITY ASSESSMENT BUSINESS
COMPLIANCE DELIVERED

## Declaration of Conformity

## For

## DCS06 Generator

**Applicable Directives:**

- **Low Voltage Directive: 2014/35/EU**
- **EMC Directive: 2014/30/EU**
- **RHoS Directive: 2011/65/EU**
- **WEE Directive: 2012/19/EU**

Standards used to demonstrate compliance:

EN 61326-1: 2013 Electrical equipment for measurement, control and laboratory use — EMC requirements Part 1: General requirements

EN 61010-1: 2010 Safety requirements for electrical equipment for measurement, control and laboratory use - Part 1: General requirements.

EN 61010-2010: 2014 Safety requirements for electrical equipment for measurement, control and laboratory use - Part 2-2010: Particular requirements for laboratory equipment for the heating of materials.

We:

The Conformity Assessment Business Ltd.

Registered office address:

609 Delta Business Park, Welton Road, Swindon, United Kingdom, SN5 7XF

Declare that the DCS06 Generator meets all applicable Directives, This declaration of conformity is issued under the sole responsibility of the manufacturer:

Signed: 

Date: Thursday, 15 November 2018

Peter Green, Director (The Conformity Assessment Business)

# Introduction

When coupled to its matched test clamp, the Generator produces damped oscillatory wave transients that meet the definition of a type 2 transient waveform from Defence Standard 59-411.

The output waveform is fixed at 100 kHz and has a third half cycle that lies between 25 % and 50 % of the first peak half cycle as per that definition.

This Generator is designed and for use only in testing to test DCS06 of Defence Standard 59-411.

The Generator is capable of producing transient pulses of over 1000V into an unloaded test clamp, the test waveshape parameters for both loaded (5 Ω) and unloaded amplitude verification are met.

# Hardware Overview

## Main Power Switch

The main power switch is located on the front panel in the bottom left hand corner.

## Output Port

The generator has one pulse output port that is located on the front panel. This is a standard 'N' type connector and should be connected to the clamp using coaxial cable that may be terminated at the clamp with either 4mm shrouded banana plugs or a suitable co-axial connecter. This will depend upon the clamp used and it's input terminal. It is recommended that a maximum coaxial lead length of 3m is used during the testing.

## High Voltage Enable Switch

The high voltage enable switch is located on the front panel. This is a latching push button LED illuminated switch that is recessed (not protruding) to prevent inadvertent operation. This switch works independently of the high voltage interlock on the rear of the Generator and both must be enabled before the high voltage circuit is energised.

Only enable the High Voltage front panel switch when the generator is in active use. In between test programmes and during any down time it is recommended that the switch is in the off position (not illuminated)

## High Voltage interlock

A separate high voltage interlock is located at the rear of the generator. This is normally closed (enabled) by the use of a shorting link. For external control, the jumper can be replaced with any suitable relay switch or, alternatively, taking the red terminal “low” to chassis ground potential.

The high voltage interlock works in conjunction with the front panel High Voltage Enable switch. Both must be enabled before the high voltage circuit is energised.

The interlock terminals are not at a hazardous voltage and are a low voltage high impedance input.

## Touch Screen Display

All the user input and control is via the front 7” touch screen display. The pulse application is also triggered via the display and there are no separate hardware buttons that perform this function. Full control information is covered under the software operating section of this manual.

## Rear “Earth” terminal

This is a secondary safety earth and should be connected at all times when the generator is in use.

# DCS06 Test Requirements

## Test overview

The DCS06 Generator applies Defence Standard 59-411 Type 2 damped oscillatory transients to Equipment Under Test (EUT) using a matched clamp. The cable under test is passed through the clamp and the transients applied up to a set level whereby either the voltage level is met or the injected current is met, whichever comes first.

The Generator software stores the voltage set at the calibration phase of the test and during the test application displays a percentage of the maximum required voltage. Pulses can be applied as a singular pulse or in a repetition of ten pulses separated by one second as required by the standard.

For software operation to set and verify the required levels please see the next section “Software Operation”. This section covers the key Generator verification requirements.

## Generator Calibration and Verification

Defence Standard 59-411 DCS06 requires that four key parameters are met. These are:

- The output frequency – This should be 100 kHz ± 10 kHz when measured at the maximum output level with the test clamp terminated by a 5 Ω load
- The amplitude of the third half cycle – This should be between 50 % and 25 % of the first peak half cycle with the test clamp terminated by a 5 Ω load
- The output amplitude – This should be 700 V when measured into an open circuit
- The waveshape parameters should be met (frequency and decay) when the output level is reduced by a factor of 10

### General Voltage and Frequency Measurements

When making voltage and frequency measurements an oscilloscope probe with 100:1 or 1000:1 attenuation should be used. If the test clamp used has a voltage monitor output port then this can be used, the oscilloscope probe should be connected directly to it. Where no monitor port exists an insulated conductor should be passed through the test clamp and connected at each end to the oscilloscope probe.

### Frequency Verification

With the clamp connected to a 5 Ω loading jig, the frequency verification is carried out by measuring the first three half cycles and then performing a calculation to establish the

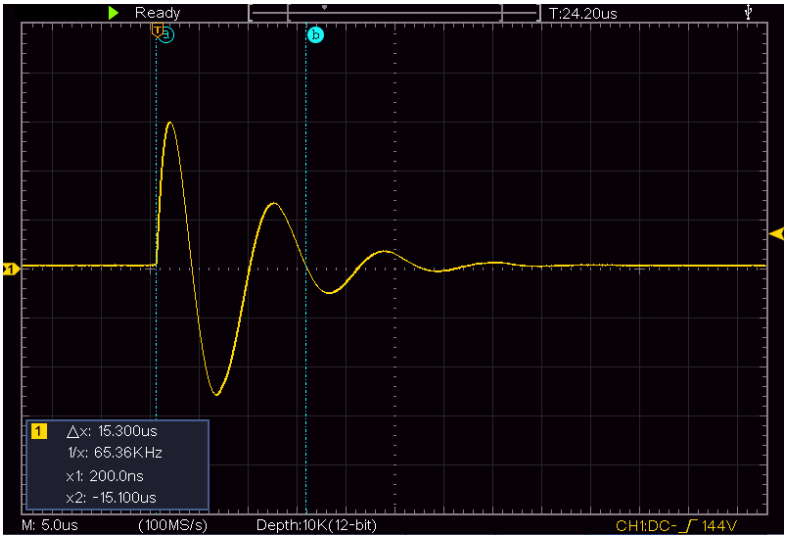
frequency. Due to the damped nature of the waveform being measured it is recommended that cursors are used to measure the frequency and not the built-in automatic measurement that oscilloscopes offer as this yields a more accurate result.

The frequency verification should be carried out at the maximum Generator output which is 700 V when measured into an open circuit, and also with the generator output reduced by a factor of 10.

When measuring with cursors, if a frequency is displayed, it should be noted that as the measurement is across three half cycles that the frequency should be divided by two and multiplied by three to give the correct reading. If the time base is displayed, this should be divided by three and multiplied by two to give the correct time base. The reciprocal of this is the frequency.

Defence Standard 59-411 DCS06 requires that the frequency verification should lie between 90 kHz and 110 kHz (100 kHz ± 10 %).

The following oscillogram shows the cursor placement and oscilloscope settings for measuring the damped oscillatory frequency of the pulse.



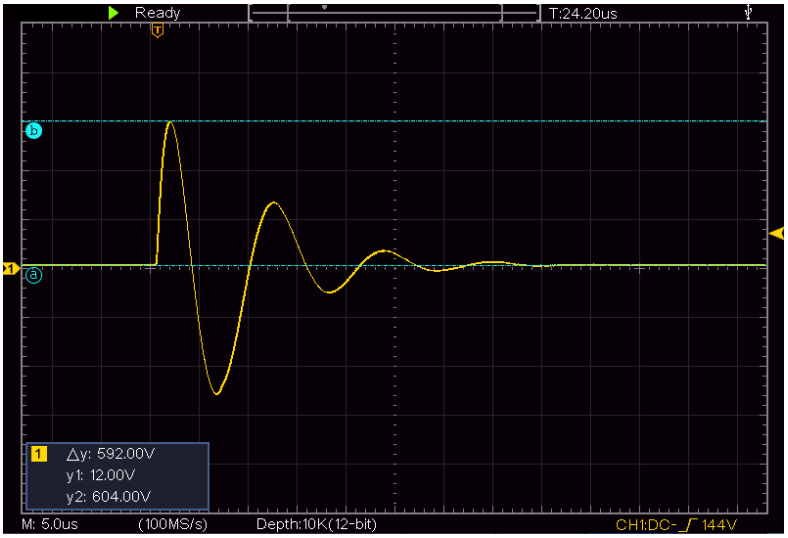

In this example the frequency is:

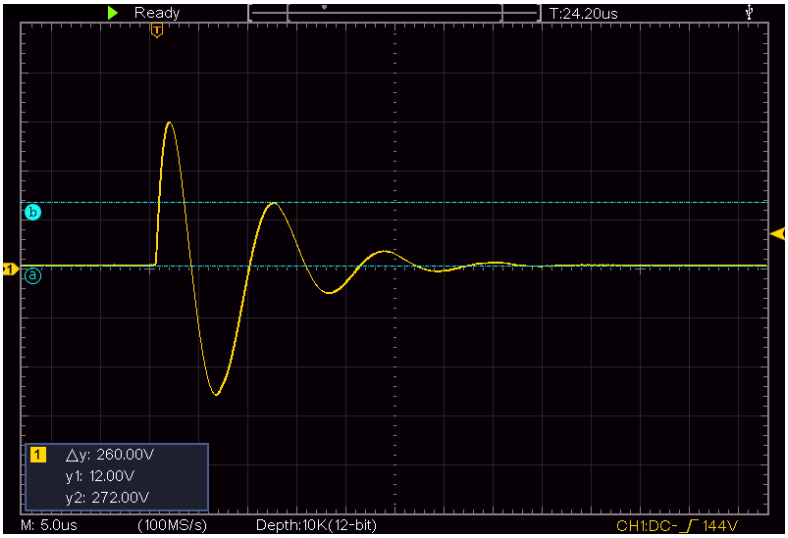
- 1 / (15.3 µs / 3 * 2) = 98.04 kHz
- 65.36 kHz / 2 * 3 = 98.04 kHz

## "Q" Factor Verification

The damping factor of the applied transient is verified with the clamp terminated in a 5 Ω loading jig. The amplitude of the third half cycle should be between 20 % and 50 % of the first half cycle. This verification should be carried out at the maximum Generator output which is 700 V when measured into an open circuit, and also with the generator output reduced by a factor of 10.

The following oscillograms show the damping factor verification, it should be noted that the voltages as shown are the “loaded” voltages, with a set voltage equal to 700 V peak when unloaded.



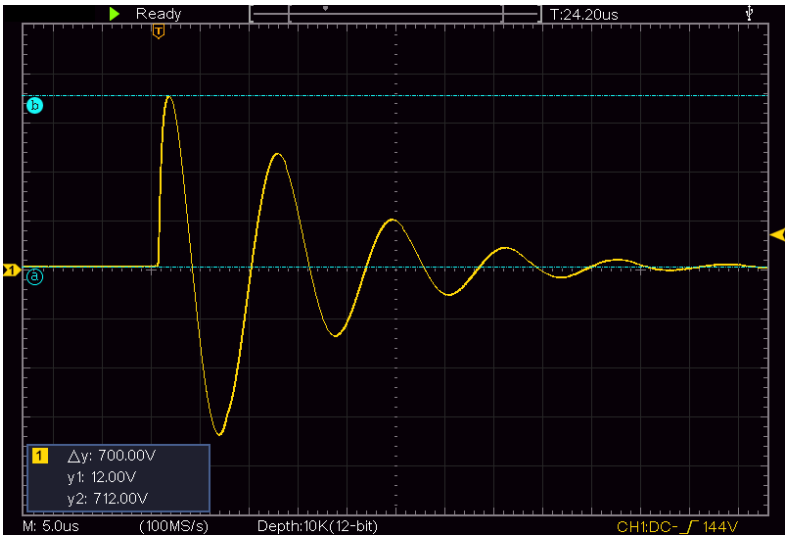




In this example, the third half cycle is 100 / 592 x 260 = 44 % which is within the required 25 % - 50 %.

## Setting the test voltage level

The test voltage and the maximum calibration voltages should be set with the clamp unloaded. The damping factor will not be correct during this measurement as the clamp will be unloaded. The peak level of the first half cycle gives the required level.

The following oscillogram shows the voltage level setting at 700V.



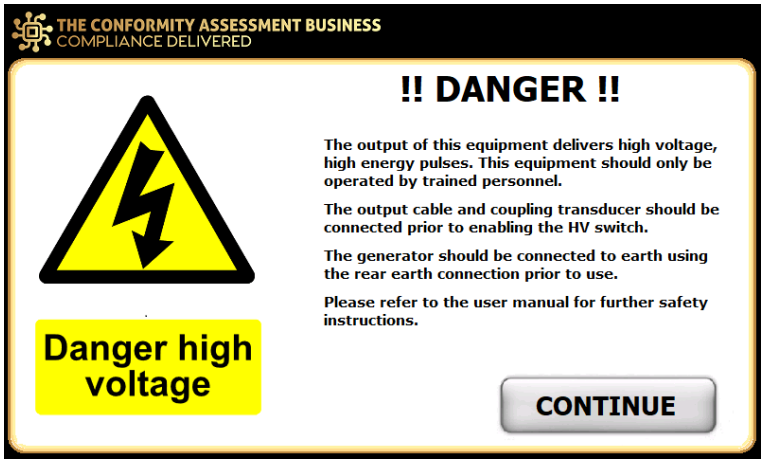
# Software operation

The Generator is controlled by a touch screen display located on the front panel. All operations including manual pulse triggering is carried out by the touch screen interface.

## Initial Switch On

During initial switch on a number of warnings are displayed. These cover high voltage and operational warnings and also the type of test clamp that the generator is designed to work with. DO NOT use the generator with any other clamp otherwise permanent damage could result.

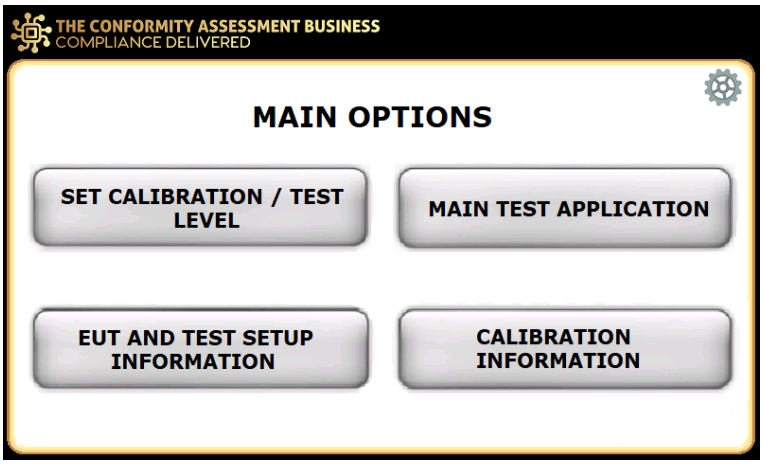
### Initial Start-up Warning




### Clamp and PE warning

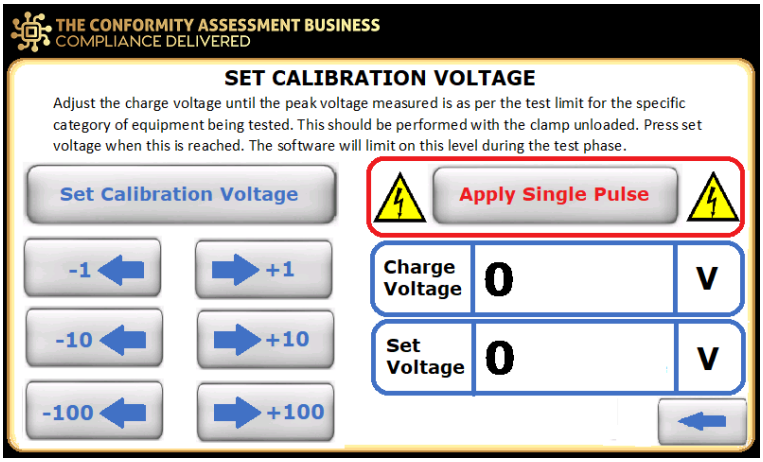
For safety, it is essential that the generator is connected to a secondary earth, This is usually the screened room earth point.

## Main Options




DCS06 requires that a voltage calibration level is recorded with the clamp unloaded. The generator will operate without this calibration level set, however it is recommended that prior to testing the "Set Calibration / Test Level" section is completed, this enables the software to limit the applied pulse to the calibration level and display a percentage of the achieved test level during operation.

### Set Calibration Level




Operating Procedure:

[1] Ensure that the generator is connected to the test clamp and the secondary PE connection is made at the rear of the test generator. The clamp should be out of the calibration jig for this part of the calibration.

[2] Connect an oscilloscope to either the test monitor output port on the clamp or place a single loop within the clamp and connect the oscilloscope directly to the loop. A 100:1 or 1000:1 oscilloscope probe should be used for this connection. Typical oscilloscope settings to capture this waveshape are 5 µs per division time base, 200 V per division amplitude (assuming the probe attenuation is considered by the oscilloscope) and either single or normal trigger mode.

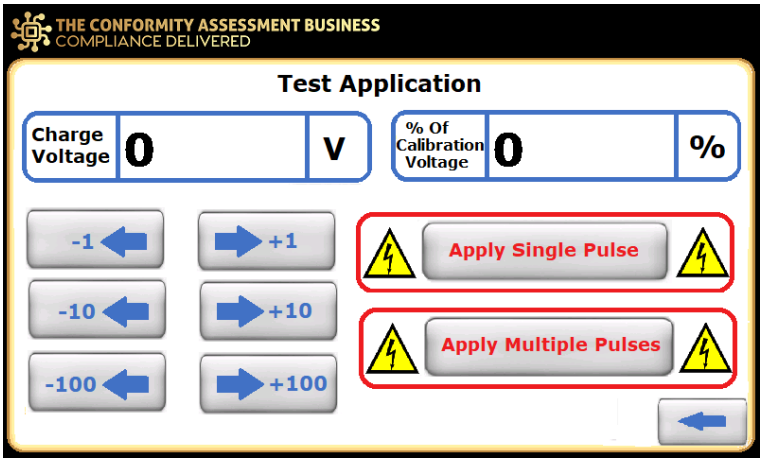
[3] Ensure that the High Voltage Interlock on the rear of the Generator is connected and that the High Voltage Enable button is on (illuminated).

[4] During the application of transients it is essential that personnel do not touch any part of the test setup except the test generator and oscilloscope.

[5] The voltage increase and decrease buttons can now be adjusted until the oscilloscope shows the required test level peak voltage as measured on the first half cycle. A single discharge is triggered by pressing the "Apply Single Pulse" button.

[6] When the correct test level voltage is measured on the oscilloscope, press the "Set Calibration Voltage" button and return to the main menu using the back arrow located in the bottom left hand corner.

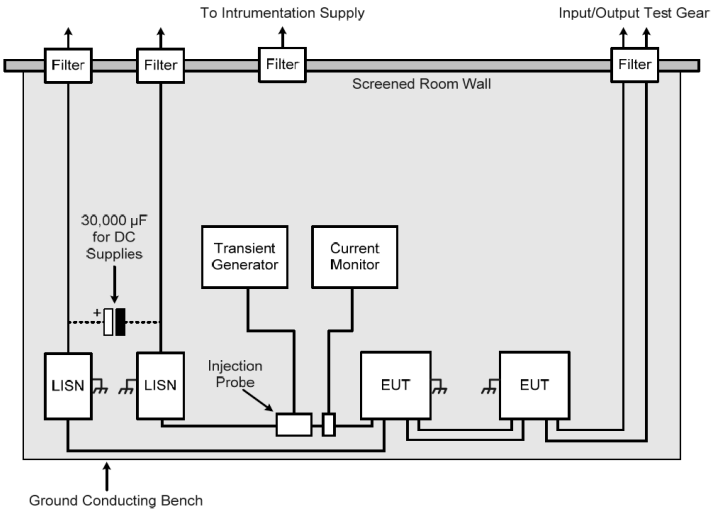
## Test Application



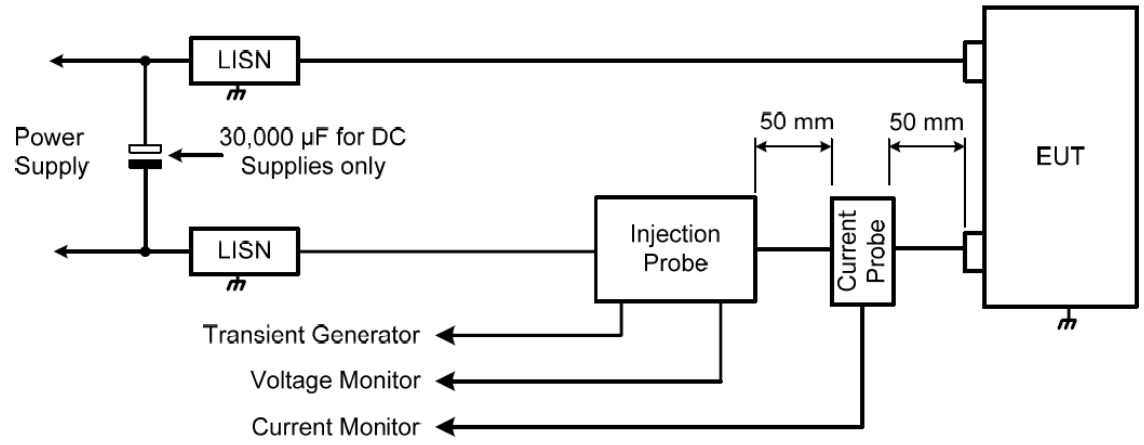

Operating Procedure:

[1] Set the test generator and equipment under test up as per the requirements of Defence Standard 59-411 issue 2 DCS06 – Diagrams Below:

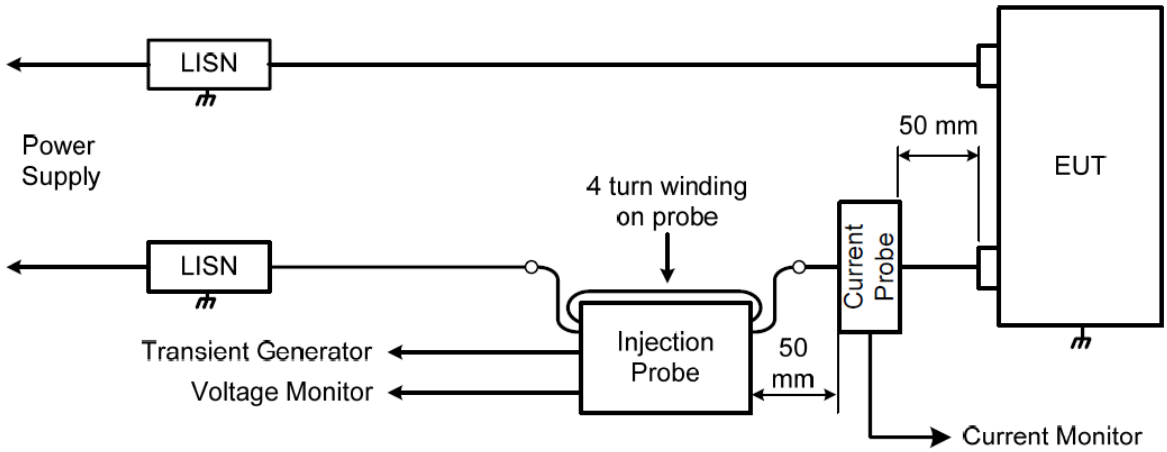
**General Layout:**



**Setup for DC Supplies**




**Setup for AC Supplies**




[2] Using the "Apply single Pulse" button, increase the charge voltage until either 100% of the calibration voltage is reached or the required current limit is met as measured using the current probe and current monitor.

[3] Apply 10 pulses at the required test level with a 1 second interval– The "apply multiple pulses" button will apply 10 pulses with a 1 second interval between pulses as per the requirements of the standard.

[4] Reverse the test clamp on the cable under test and repeat step [3]