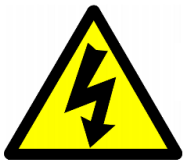
Defence Standard 59-411 issue 2
DCS12 Test Generator
User Manual

Revision History

Issue:	Modification	Date:	Modified By:
1.0	First Issue		N/A

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 connections should be connected prior to applying power to 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 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 to the test generator and EUT should employ 4mm fully shrouded banana plugs. The maximum current for the 600 V and 750 V output is 32A and for the 2500V output is 16A. Operation at these maximum currents should be limited to 30 minutes in any one hour period. continuous operation at up to 50% of the rated maximum current is allowed.

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.

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.

The output ports for 650 V and 750 V share the same primary transformer winding and therefore pulses will appear on both output ports at the same time. It is important to select in software the correct output voltage for the port being used.

Only connect the equipment under test to one output at a time. Equipment under test with multiple power inputs of different voltage test requirements should be tested individually.

Do not operated the Generator if any visible external damage is noted. The Generator should be returned to the manufacturer for repair. To clean the generator, a clean damp cloth should be used with no detergent.

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

DCS12 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 DCS12 Generator meets all applicable Directives, This declaration of conformity is issued under the sole responsibility of the manufacturer:

Signed: 

Date: Thursday, 01 August 2019

Peter Green, Director (The Conformity Assessment Business)

Introduction

The DCS12 generator produces damped oscillatory wave transients that meet the required DCS12 parameters defined in Defence Standard 59-411 issue 2.

The output waveforms are a fixed output level at 600 V, 750 V and 2500 V. Adjustment of these fixed output levels can be made through software should re-alignment of the output be required during any calibration.

This Generator is designed and for use only in testing to test DCS12 of Defence Standard 59-411.

Hardware Overview

Main Power Switch

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

Output Ports

The generator has three pulse output ports, one for each test voltage. These are 4mm shrouded sockets with maximum EUT current capabilities of 32A for the 600 V and 750 V windings and 16 A for the 2500 V winding. Operation at these maximum currents should be limited to 30 minutes in any one-hour period. continuous operation at up to 50% of the rated maximum current is allowed.

The equipment under test should only be connected to the generator for purposes of carrying out the test, it should not be left connected and powered unless active testing is taking place. Under no circumstances should the equipment under test be left connected to the generator and powered whilst the test is not being carried out.

The output ports for 650 V and 750 V share the same primary transformer winding and therefore pulses will appear on both output ports at the same time. It is important to select in software the correct output voltage for the port being used otherwise the equipment will be over-tested.

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.

DCS12 Test Requirements

Test overview

The DCS12 Generator applies damped oscillatory transients direct on to the equipment under test supply line. The supply line is connected in series with the output of the test generator to facilitate this. There are three fixed outputs as required by the standard: 600 V, 750 V and 2500 V.

Pulses can be applied as a singular pulse or in a repetition of ten pulses separated by between one to five seconds as required by the standard. Additional trigger modes include a remote trigger button and a logic trigger input. It should be noted that with all triggering methods there is a minimum of 2 seconds between triggering and the pulse being applied.

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 DCS12 requires that prior to test, a verification of frequency, damping factor and peak amplitude is met. This verification should be made with a 10 Ω load connected to the generator output that is being verified.

For the 600 V winding

- The frequency when measured and averaged over the first three half cycles should be 15.9 kHz ±10 %. That is 14.31 kHz to 17.49 kHz.
- The peak amplitude of the first half cycle should be 600 V ± 10 %. That is 540 V to 660V
- The relative amplitude of the third half cycle should be between 0.6 to 0.8. That is 360 V to 480 V for 600 V.

For the 750 V winding

- The frequency when measured and averaged over the first three half cycles should be 15.9 kHz ±10 %. That is 14.31 kHz to 17.49 kHz.
- The peak amplitude of the first half cycle should be 750 V ± 10 %. That is 675 V to 825 V
- The relative amplitude of the third half cycle should be between 0.6 to 0.8. That is 450 V to 600 V fort 750 V.

For the 2500 V winding

- The frequency when measured and averaged over the first three half cycles should be 10.9 kHz ±10 %. That is 9.81 kHz to 11.99 kHz.
- The peak amplitude of the first half cycle should be 2500 V ± 15 %. That is 2125 V to 2875 V
- The relative amplitude of the third half cycle should be between 0.2 to 0.3. That is 500 V to 750 V for 2500 V.

General Voltage and Frequency Measurements

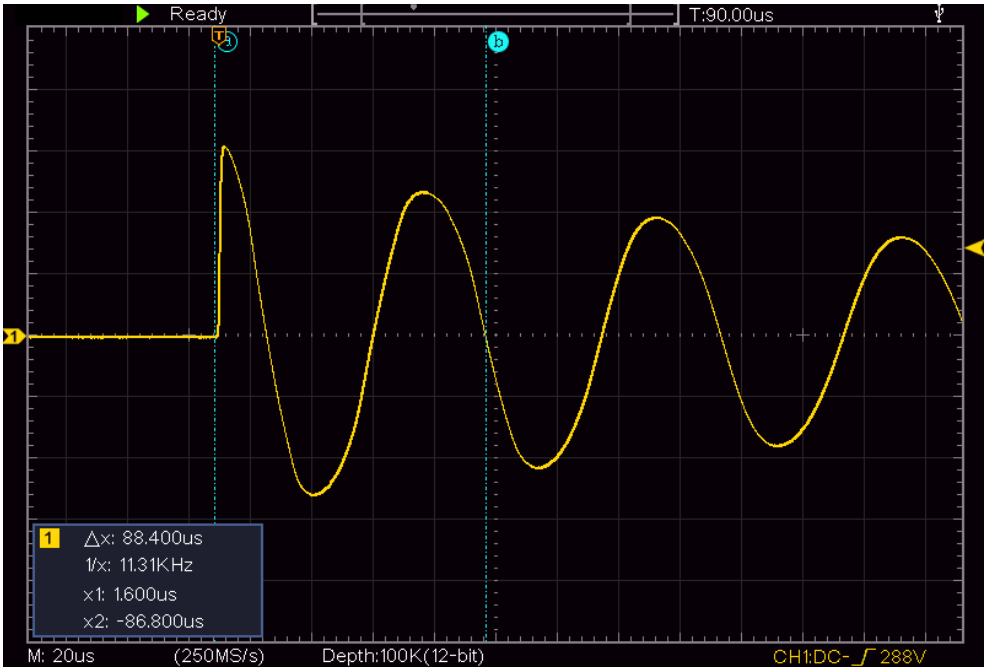
When making voltage and frequency measurements an oscilloscope probe with 100:1 or 1000:1 attenuation should be used. Care should be taken to ensure there are no exposed connections and that the cables used are in good condition.

Frequency Verification

With the output being verified loaded with a 10 Ω resistor, 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.

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.

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



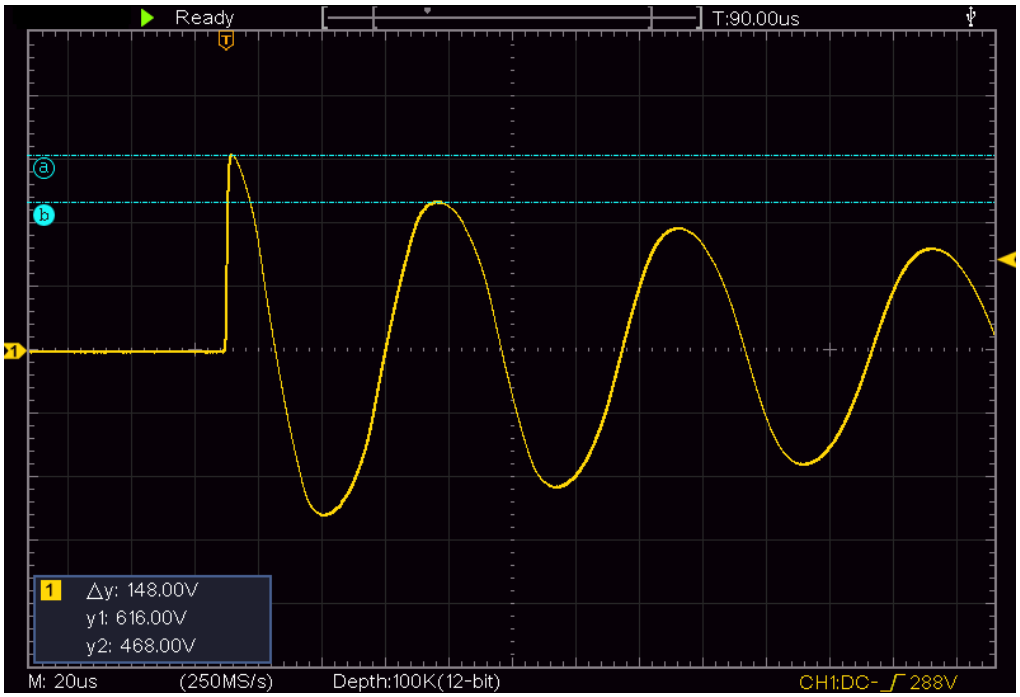
In this example the frequency is:

- 11.31 kHz / 2 * 3 = 16.965 kHz
- 1/ (88.4 µs / 3 x 2) = 16.968 kHz

"Q" Factor Verification

The damping factor of the applied transient is verified when the output is terminated with a 10 Ω load. The amplitude of the third half cycle should be measured and compared to the amplitude of the first peak half cycle.

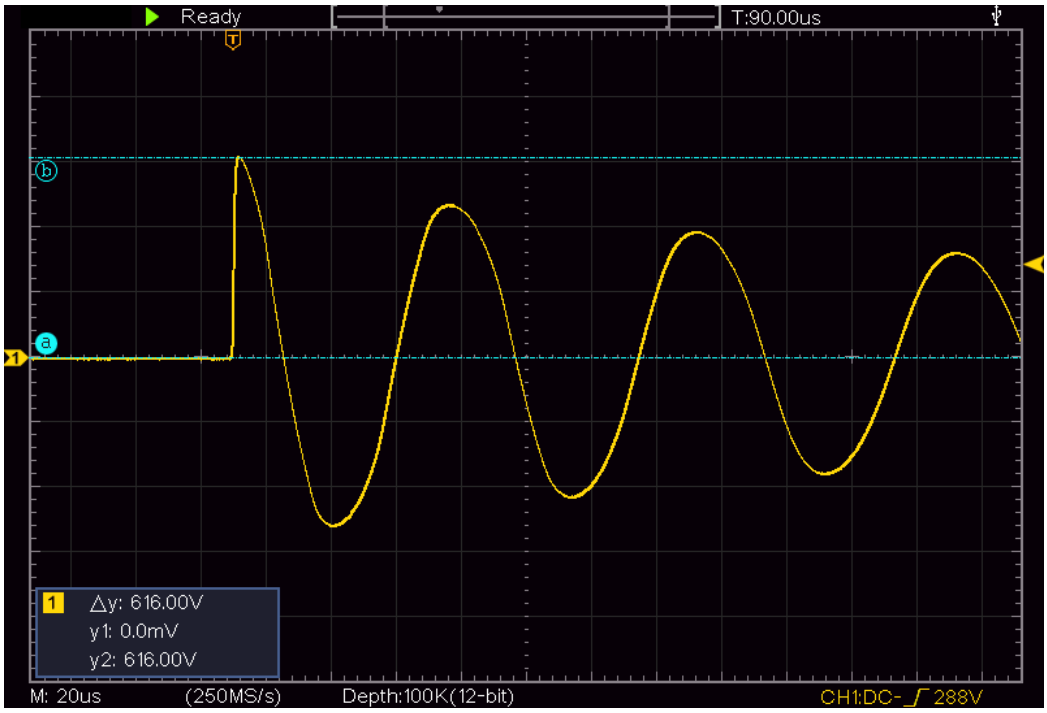
The following oscillograms show the damping factor verification for a 600 V transient.



In this example 468 / 616 = 0.759

Measuring the first peak amplitude

The following oscillogram shows the measurement of the first peak half cycle of a 600V transient using cursor placement.



In this example the first peak is: 616 V

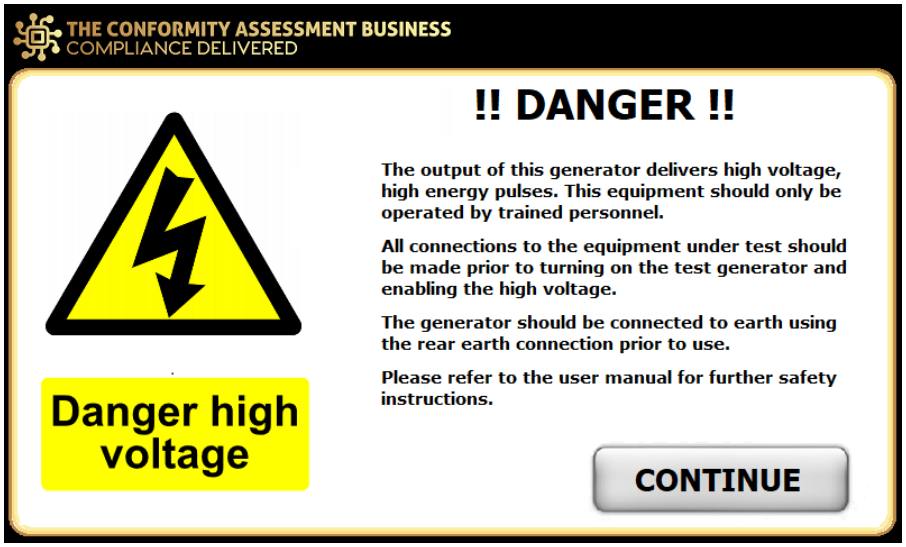
Software operation

The Generator is controlled by a touch screen display located on the front panel. All operations with the exception of remote pulse and hardware trigger in are carried out with 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.

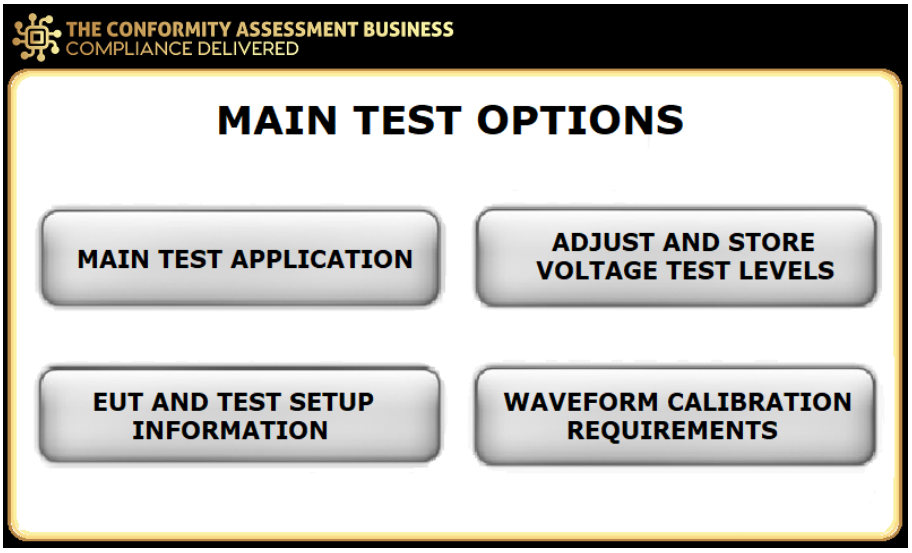
Initial Start-up Warning



EUT 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.

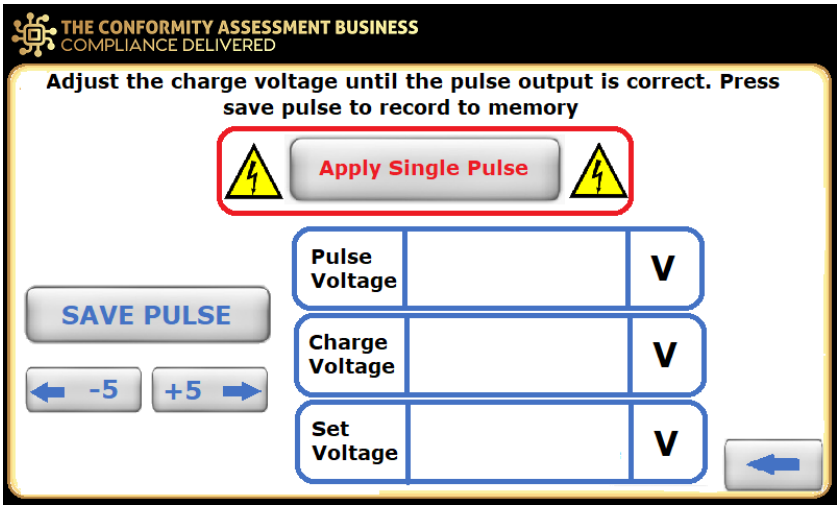
Main Options



Referring to the above menu:

- The main test application takes the user to a screen where individual pulses, multiple pulses and remote operation can be selected.
- Adjust and store voltage levels allows the user to set the output voltage within certain limits of adjustment. This should only be used if the generator output has been found to drift in amplitude over time. Levels are recorded in firmware and should not need frequent maintenance.
- EUT setup and Waveform calibration are informative screens that guide the user through test application and calibration measurements.

Set and Adjust Test Levels



Operating Procedure:

[1] Ensure that the PE connection is made at the rear of the test generator. A non-inductive 10 Ω load should be connected across the output terminals of the pulse being set. This should be rated to cope with the pulse being measured.

[2] Connect an oscilloscope to either the output being set. A 100:1 or 1000:1 oscilloscope probe should be used for this connection. Typical oscilloscope settings to capture this waveshape are 10 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.

When the set voltage button is pressed, the value is written to non-volatile memory and will be retained for future testing.

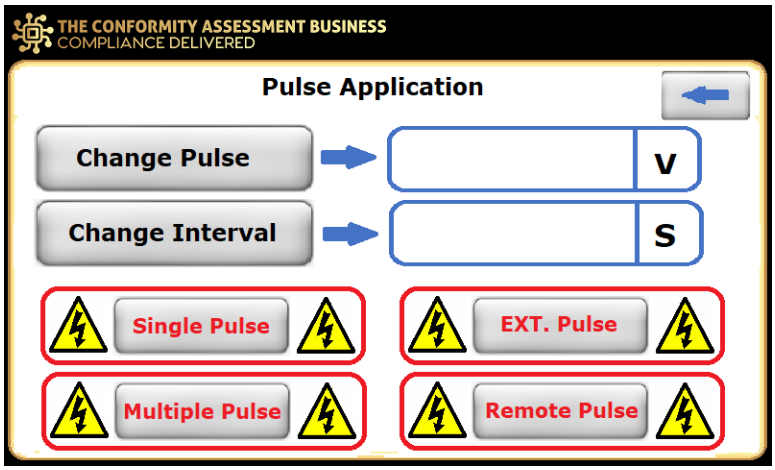
The charge voltage required can only be set within software limits. Charge voltages to achieve correct outputs are approximately:

1750 V for the 600 V output

1000 V for the 750 V output

960 V for the 2500 V output

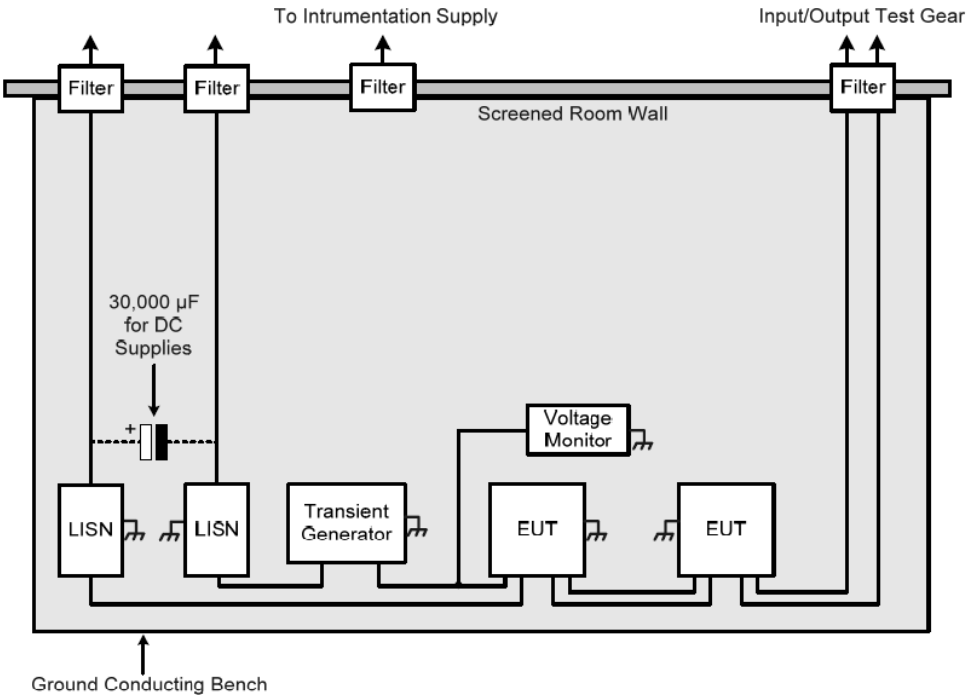
Test Application



Operating Procedure:

[1] Set the test generator and equipment under test up as per the requirements of Defence Standard 59-411 issue 2 DCS12 – Diagrams Below:

General Layout:



[1] The indicated voltage will determine which pulse output to connect the EUT to. This will be either 600 V, 750 V or 2500V.

The output ports for 650 V and 750 V share the same primary transformer winding and therefore pulses will appear on both output ports at the same time irrespective of the 600 V or 750 V pulse being selected. It is important to select in software the correct output voltage for the port being used otherwise the equipment will be over-tested.

[3] Pulses can now be applied in various ways:

- Single Pulse Button: Pressing this will trigger a pulse that will be present 2 seconds after pressing the button
- Multiple Pulse Button: Pressing this will trigger ten pulses with a delay that is defined in the “interval box” this is 2, 3, 4 or 5 seconds.
- Remote Trigger: This should be selected if using the remote trigger button (supplied).
- External Trigger: This will trigger a pulse on a logic transition from low to high, 0 V to 5 V. When using this function, it should be noted there is a two second delay after the trigger point to allow for capacitor charging. It is recommended that a 100ms pulse is applied with a minimum of 2s repeat. This is the minimum repetition and is to allow 2s for capacitor charging prior to the pulse aopplication.

Electrical and Mechanical Specifications

Supply Voltage and Frequency: 230 V 50 Hz supply **only**

Maximum current draw = 2A

IP Rating: IP2X

For indoor use only