RTCA DO160 Section 19.3.5

Spikes induced into interconnecting cables (Chattering relay simulation)

Revision History

Issue:	Modification	Date:	Modified By:
1.0	First Issue	29 April 2025	N/A

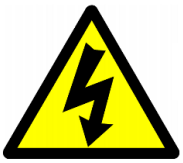
Safety Precautions

Indicates a potential electric shock hazard

Indicates a caution

This equipment delivers high voltage pulses. The energy content is low and as such the potential for electric shock is minimal. However, all normal electrical safety precautions should be maintained during use.

This generator produces high voltage pulses. All setup equipment and the Equipment Under Test should be setup and wiring complete before energising the generator.



During the test application, no personnel should be in contact with the equipment under test during application of the impulses.

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 front earth terminal should be connected before use to the reference ground plane.

Connections from the test Generator should use shrouded connections and the wire used to wrap the EUT cable loom should be rated for 1 kV isolation. Ensure that the wire is not damaged and the insulation is intact prior to test.

Use of this Generator in a manner not specified within this manual could cause damage to the Generator, the Equipment Under Test or cause operator 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.

Do not operate 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

Battersea House, Battersea Road, Stockport, England, SK4 3EA

info@conformity-assessment.com

+ 44 (0) 1704 821376

+ 44 (0) 7943 405145

Sales Partner:

ABSOLUTE EMC

ABSOLUTE EMC Llc.
Covering sales in North America
United States, Mexico, & Canada

absolute-emc.com
Phone:703-774-7505
info@absolute-emc.com

Waste Electrical Equipment (WEEE)

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.

FCC Compliance

This device is classed as commercial test equipment and as such is exempted from the requirements of FCC part 15 compliance as per CFR47 part 15.103(c). However, this device has been tested and found to comply with the requirements of a class B digital device for Conducted Emissions Only.

This device does not meet the radiated emissions requirements of FCC part 15. Specifically, it is designed to generate interfering noise that will radiate at frequencies that are controlled by FCC CFR 47 part 15. As such operation should be in a screened chamber specifically designed for EMC testing.

The following statement for a class B digital device should be noted as relevant to the conducted emissions from the power line:

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.

- Increase the separation between the equipment and receiver.

- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

- Consult the dealer or an experienced radio/TV technician for help.

In addition, due to the exemption for commercial test equipment under FCC CFR47 Part 15103(c) there is no requirement to label the device with the FCC warning. However, this is given below for completeness:

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Introduction

This Generator is designed to simulate the pulse train associated with bounce and arcing on relay contacts. The output pulse train and amplitude meets the requirements of RTCA DO160 Section 19.3.5 and Boeing D6-16050-4 Section 7.5.2.

Hardware Overview

Main Power Switch

The main power switch is located on the rear of the Generator above the IEC mains power inlet.

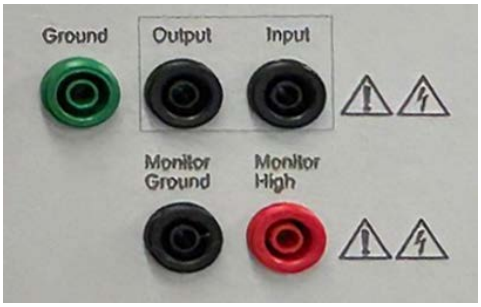
Output Ports

The Generator has three connection ports located on the rear panel.

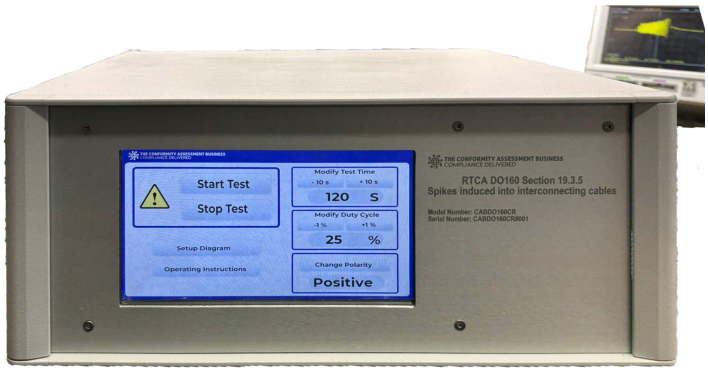
[1] Black Output Connector – This is a shrouded 4mm banana connection and should be connected to one end of the wire wrap.

[2] Black Output Connector – This is a shrouded 4mm banana connection and should be connected to one end of the wire wrap.

[3] Green Earth Connector – This shall be connected to the reference ground plane



There are two monitor outputs on the Generator. These should be connected to the oscilloscope for monitoring the applied pulse. Connection to the oscilloscope should use a 100:1 probe with a minimum voltage rating of 1000 V. The monitor outputs are directly connected to the main outputs.



Touch Screen Display

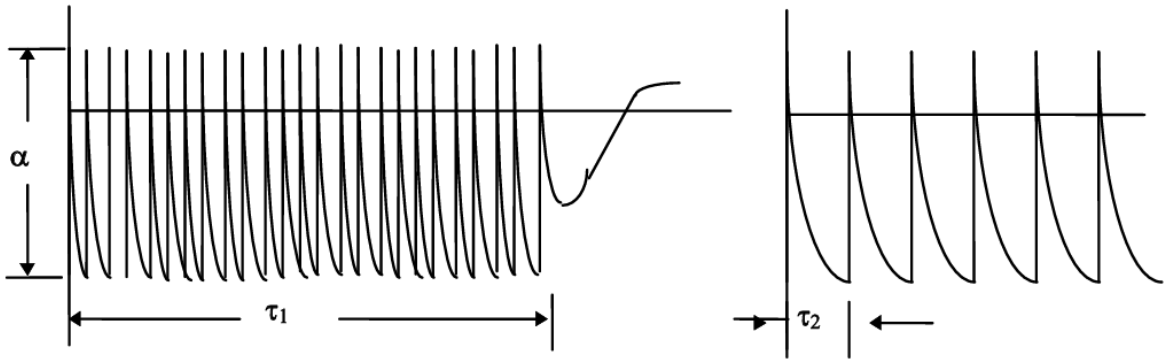
All the user input and control is via the front 7" touch screen display. The pulse application is also triggered via the display and there are no separate hardware buttons that perform this function. Full control information is covered under the software operating section of this manual.

RTCA DO160 Section 19.3.5 Test Requirements

Test overview

The Generator delivers a burst of individual spikes that are in line with test requirements of DO160 section 19.3.5.

These are as follows:

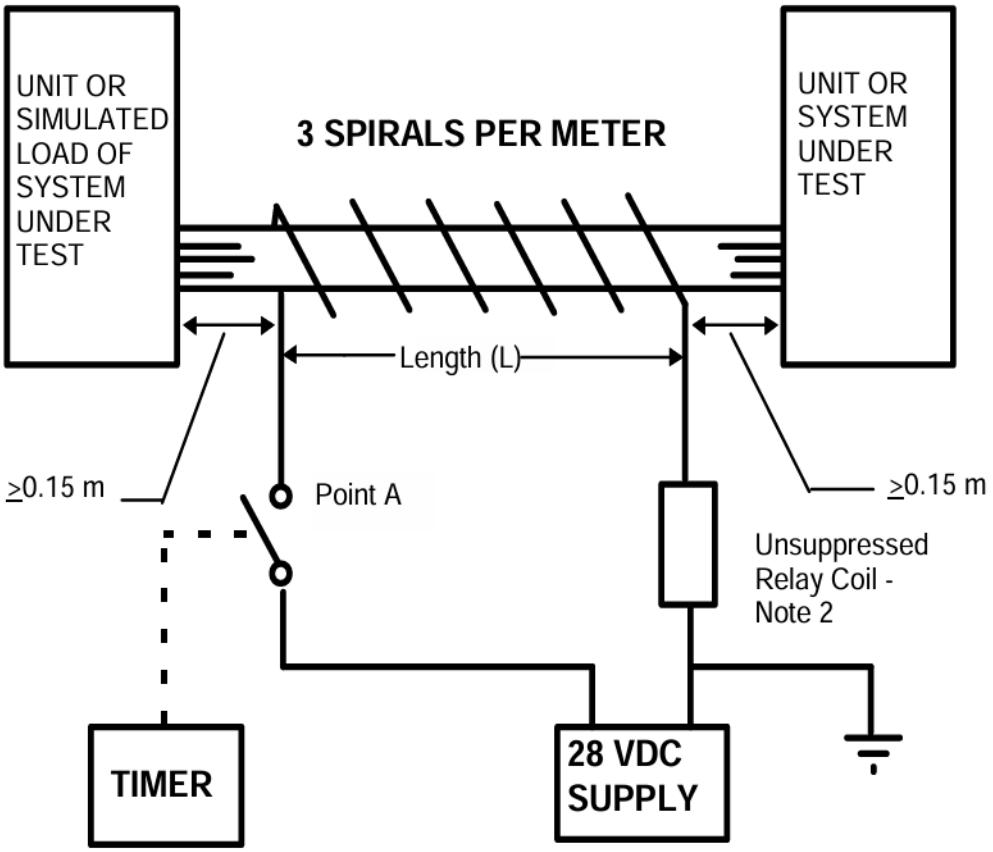


α	Amplitude $\geq$ 600 v p-p
τ_1	Total Duration 50 to 1000 microseconds
τ_2	Repetition Period 0.2 to 10 microseconds

Note: Voltage waveforms measured between Point A of Figure 19-4 and the ground plane. Inherently, the test will produce spikes of variable amplitude within a pulse. Some of the spikes may be less than the 600 V p-p level

Generator Calibration and Verification

In order to calibrate the Generator output, it should be setup and ready for a test programme. The following setup should be used:



The Generator applies the pulse train using a standard relay as the switch. This can exhibit a different pulse train on each switching application. Adjustment to get the best pulse train is made by adjusting the applied duty cycle during operation whilst monitoring the oscilloscope.

Software operation is self explanatory.

With the test application off:

- The total test duration can be adjusted from ten seconds to ten minutes.
- The Polarity of the pulse can be adjusted

With The test application on:

- Only the duty cycle can be adjusted

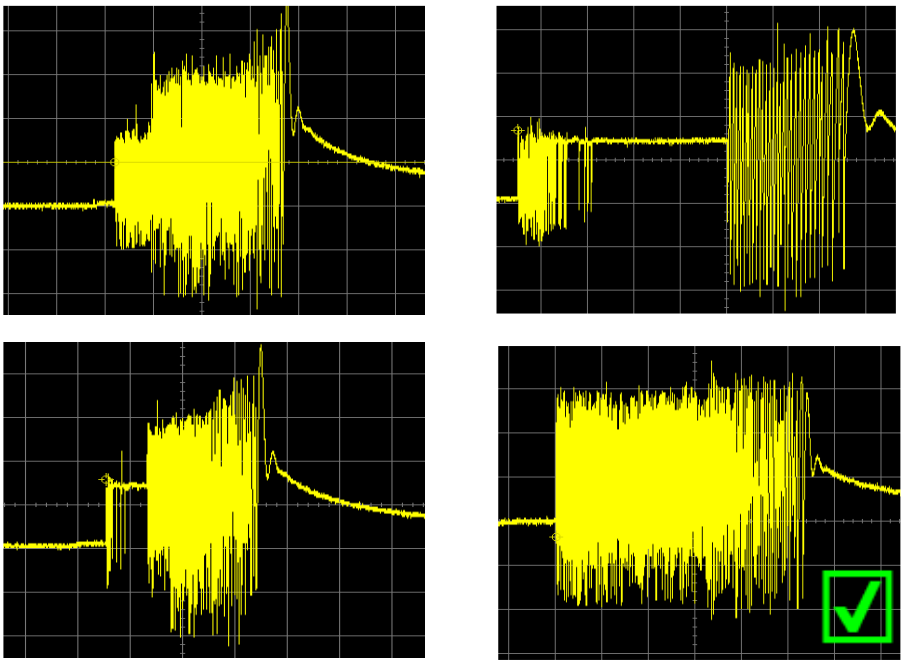
Setting the pulse output

The pulse output can be adjusted during test application to give the best “ideal” response. This is achieved by applying the test and monitoring the subsequent pulse whilst adjusting the duty cycle. The duty cycle changes how hard the relay is switched and subsequently changes the amount of bounce that the relay exhibits.

The oscilloscope should be set up with the following parameters:

- Amplitude: 200 V per division
- Trigger: Normal
- Time Base: 100 us per division
- 100:1 Probe rated at 1000 V minimum
- Oscilloscope and Probe minimum 100 MHz Bandwidth

The duty cycle should be adjusted to yield the following ideal wave shape:



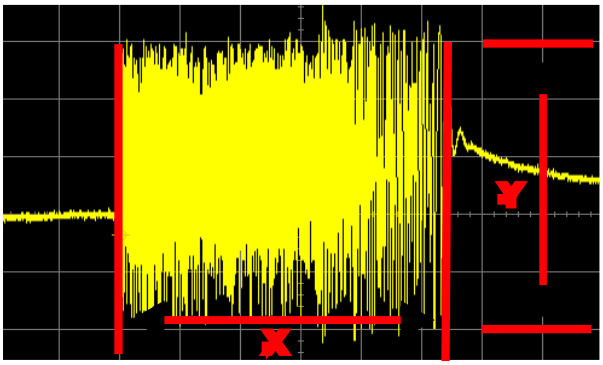
Note: due to the random nature of the applied pulse, not all pulses will look like the ideal pulse identified above. The duty cycle should be adjusted to achieve the best response monitored over a period of a few seconds. All of the above plots meet the test requirement for pulse length and amplitude and therefore meet the minimum requirements of the test standard.

Measurement of pulse parameters

Pulse Train

For pulse train duration the following oscilloscope settings should be used:

- Amplitude: 200 V per division
- Trigger: Normal
- Time Base: 100 us per division
- 100:1 Probe rated at 1000 V minimum
- Oscilloscope and Probe minimum 100 MHz Bandwidth



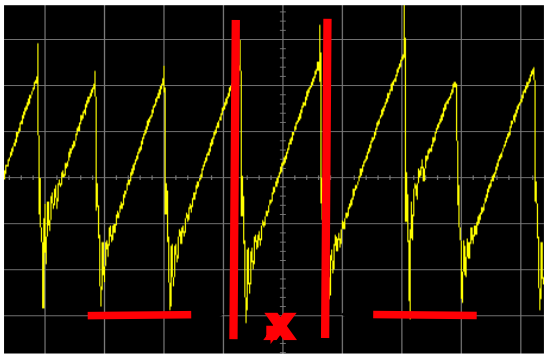
Pulse train duration (X) should be between 50 and 1000 microseconds

Pulse train Amplitude (Y) should be 600 V – Not all pulses are required to meet this amplitude requirement.

Pulse Detail

For pulse detail the following oscilloscope settings should be used:

- Amplitude: 200 V per division
- Trigger: Normal
- Time Base: 2 us per division
- 100:1 Probe rated at 1000 V minimum
- Oscilloscope and Probe minimum 100 MHz Bandwidth

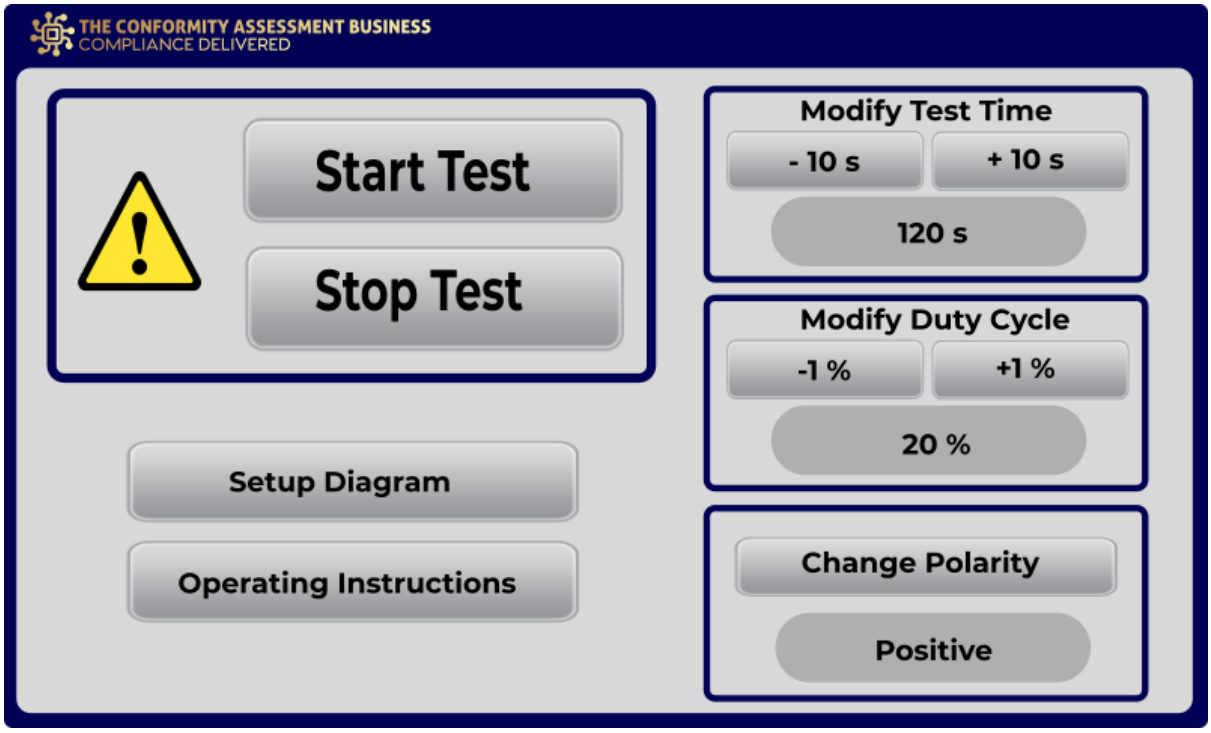


Pulse duration (X) should be between 0.2 and 10 microseconds

Generator Operation

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

Main Test Screen:



Operation:

[1] Test time and polarity can only be changed with the test stopped

[2] Duty Cycle can be changed with the test stopped or operating the test

[3] Start // Stop test will run the test applying pulses at a rate of 9 Hz for the duration specified.

Electrical and Mechanical Specifications

Supply Voltage and Frequency: **110 V AC**

Maximum current draw = 1A

IP Rating: IP3X

For indoor use only

Overvoltage category II

Pollution Degree II

Operating conditions:

Maximum operating altitude: 2000 m

Maximum operating humidity 55% RH during operation and storage

Operating temperature range: 10 – 40 °C