IMPULSE IMPEDANCE TESTER

4051 DATASHEET

REDPHASE INSTRUMENTS

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<u>Description</u>

When lightning strikes a structure like a HV Tower or Pylon, a voltage will develop across the impedance between the tower footings and the surrounding earth due to The impulse current passing through it.

Knowledge of this impedance under impulse current conditions such as a lightning strike is very important. It highlights the potential level of hazard to people, nearby structures and their contents as well as the electrical installations themselves. Knowledge of this impedance also assists installers to profile lightning risk and to determine the most effective protection measures required for a site.

The Model 4051 is a field portable, battery operated product designed to provide a practical method of measuring impulse impedance by simulating lightning flash conditions of varying impulse shapes in accordance with elements of IEC 602305-1.

1.0. Application

The 4051 produces high voltage and current impulse profiles which mimic that of a lightning strike.

The 4051 is used to apply an impulse to an earthed structure such as a pylon footing.
The impact of this impulse on an area between the pylon footing and a point of interest away from the pylon is measured in terms of voltage, current and impedance at the peak of the measured impulse.

The 4051 can test for:
- Point to point ground path impulse impedance
- Impulse effects on remote objects
- Electrode grid impulse impedance

Performing a number of impulse tests will provide the operator with a comprehensive impedance profile of a pylon or electrode's footing and its surroundings when struck by a high voltage or high current impulse.

The 4051 offers the operator two impulse wave shapes to choose from and two test types to choose from.

The results provided from the impulse tests are dependent on soil resistivity, distance between test electrodes, earth stake to soil impedance and the impulse profile chosen.

Please note that a high current / voltage impulse test is not intended as a replacement for low frequency earth testing of electrodes such as HV pylons.

It should be used as a valuable supplement test to an existing low frequency grid impedance and potential profiling tests.

2.0. Main Features

The 4051 has four terminals for generating and measuring lightning impulse signals.

Two terminals are used to apply the impulse signal and the other two are used to sense the impulse between the points of interest.

The unit has a graphic user interface and key pad for easy navigation to the different test and results menus.

The 4051 is battery operated and has the capacity for 4 to 5 hours of field operation.
It can be re-charged with a 18Vdc plug pack which is supplied with the unit.

Two USB ports are available:
Type A - For downloading saved test records to a USB flash drive.
Type B - For uploading new firmware when required.

The operator can select from two different impulse types:
- 8/20μS
- 10/350μS

Up to 5 impulse
types are available however for the majority of tests the two impulse types available here have been found to give the most practical and consistently reliable results.

There are two types of test menus and test set-ups available to the operator:
- **Direct Impedance test—Stage 1**
  The impedance between two points of interest, say the pylon footing and an object some distance from the footing.
- **Electrode Impedance test—Stage 2**
  Where the impulse impedance of the pylon footing is measured at a point between the pylon footing and a remote earth point acting as the return path.
  The set up for this test is analogous to a low frequency grid impedance set up

For more information please contact
Red Phase Instruments at: info@redphase.com.au

3.0. Connections and Processes

3.1 Interface

The 4051 has two dedicated HV connections, designated as black and red which are used to deliver a high voltage or high current impulse to an earthed electrode.

There is also a pair of +ve and −ve terminals designated as white and blue which are used to capture the impulse signal across the two points of interest.

3.2 Processing

The 4051 has two processing platforms for performing all necessary visual and testing functions.

The two platforms are:

- A dedicated display and parameter input and output processor
- Digital Signal Processor used to perform the testing, including discharge profiling, impulse capture and measurements

3.3 Impulse discharge and capture

Depending upon the soil conditions the 4051 makes a general determination of the soil's impedance prior to the actual discharge test by applying the chosen impulse profile at a peak of around 90V between the two points of Injection.

Once the general impedance is determined the 4051 then calculates and discharges the maximum allowable impulse current across the same injection path with the selected profile.

The captured impulse across the injection path is then measured at its peak voltage and current and a proper impulse impedance measurement is determined from this.

3.4 Impulse ratings

The 4051 can charge to a maximum 800V.
The voltage across the load is measured in two ranges: 100V and 1000V

The maximum discharge current is a little more than 32 Amps and the 4051 will in each case attempt to discharge the maximum current possible across the measured load.
The current in the load is measured in two ranges: 10A and 30A

4.0. Limitations

The Model 4051 generates impulses which mimic lightning strikes.

The impulse levels are not of course at the level of that imposed by an actual lightning strike and the operator must be aware that other lightning impact phenomena such as dielectric breakdown of soil surfaces and resultant soil impedance breakdowns cannot be achieved at the levels of discharge generated by the 4051.

Another limitation is one that is imposed by the fast rising impulse fronts which bounds the test range to a maximum of 50 metres.
Field tests within this range have returned reliable results analogous to a low frequency earth test setup, albeit with consistently higher impedance readings, which are the result of the high frequency components of the discharged impulse.

5.0. Accessories

- Operating manual

- 5 x 1mm^2 cables with 4mm banana plugs Length 25 metres each.

- Plug Pack:- 85V to 265V AC input
                    18V DC output

- Foam lined transit case for safe and easy transport.

6.0 General Specification

Supply	
Operating voltage	12V - 2.2Ah Internal Battery
Charger / Power Supply	18V DC Plug Pack
Charge current	500mA
Charge Time	6 to 8 hours typical
Maximum power consumption	15 Watts peak, 7 Watts standby
LCD Backlight Power consumption	0.7W
Input Ranges	
Impedance Measurement Range	0.5 Ω to 300Ω without oscillation Theoretically no upper limit but oscillation limits clear signal capture and measurement.
Output Impulse Profile	2 types as below
Impulse type 1	8 / 20us
Impulse type 2	10 / 350us
Output Range	
Maximum Pulse Output Voltage	800V, Impedance dependent
Current Range	
Pulse Output Current	1 Amp to 32A
4051 chassis and user interface isolation	
From Voltage Input	1000Vdc or 1000Vac min
Environmental	
Operating Temperature	0 to 45°C Degrees
Relative Humidity (RH)	90%
Size	
Instrument (including moulded case)	345 x 300 x 150 mm. Weight 5.5 kg approx.