



2kVA EARTH TESTING CURRENT INJECTION SYSTEM

4046 / 4047 DATASHEET



REDPHASE INSTRUMENTS

Contents

	Section
Brief Description	1
Where and why it is used	1.1
Induced Measureable Parameters	1.2
Hardware features	2
4046 Power Source	2.1
4046 Interactive Interface	2.2
4046 Visual Interface	2.3
Audible Indicators	2.4
4047 Interface	2.5
4047 Tap Selection	2.6
Software Features	3
Software Tap Selection	3.1
Current Ramping	3.2
GPS and Synchronization	3.3
Operating Conditions	4
Operating Temperatures	4.1
Protection	5
Enclosure and Carry Case	6
4046 Injection Unit	6.1
4047 Coupling Transformer	6.2
Size and Weight	7
Accessories	8
Supplied	8.1
Not Supplied	8.2
Accessory Guide	8.3
Warranty	9

1.0. BRIEF DESCRIPTION & APPLICATION

The Model 4046 is a switch mode voltage source that is used to drive the primary of the Multi Tapped Coupling Transformer (Model 4047) to produce either a high current low voltage or high voltage and low current into an earth or passive load loop.

Typically the earth test loop / circuit consists of the earth grid under test connected to a remote earth grid through an earth path in the ground. To complete the loop, a return connecting path isolated from earth, usually an 'out of service' feeder, is also used. The earth test current is driven around the loop by the secondary winding of the Model 4047 Coupling Transformer which is inserted into the loop.

Frequencies from 40Hz to 70Hz can be selectively generated by the 4046 to avoid interference with background line frequency's. Voltage drops generated by the injected current around the earth loop are measured with a tuneable multimeter fixed to the injection frequency.

In most cases the operator will try to inject as much current as possible into the earth loop being tested to achieve the best readable signal possible for the frequency tuned multimeter.

For that reason the 4047 has tap settings for earth loop impedances from 5 Ohms to 400 Ohms which will cover most test situations. When the appropriate tap is chosen the Amplifier on the 4046 Injection unit will see a reflected 2000VA load and provides maximum deliverable power.

For impedances outside this range, the earth loop current will be less than maximum but still sufficient for testing purposes. Optionally the operator may consider our larger and more powerful 8kVA Injection system.

1.1. Where and why it is used

Red Phase Instruments Earth Testing equipment is used in the evaluation of earthing systems at electrical, utility, telecommunication and industrial sites during the commissioning and post maintenance activities of electrical equipment and the site itself.

Earth testing provides important measureable parameters which indicate to engineers the robustness or vulnerability of an earthing grid to withstand some natural or equipment related electrical faults. Also this information will help to ascertain the level of risk to public and site personnel during such a fault event.

1.2. Induced Measureable Parameters

When in use, the 2kVA Red Phase Injection system will induce current flow throughout the site under test. Soil conditions, bonding structures and other equipment on and around the site will develop different voltage potentials at measured points which can assist engineers to develop a comprehensive impedance profile of a site.

The following is typical of the type of measurements undertaken at a grounding site under test.

- Fall Of Potential
- Step Potential
- Touch Potential
- Ground impedance
- Current splits / branching on structures within and external to the site.

2.0. HARWARE FEATURES

2.1. 4046 Power Source

Input Supply: Single Phase, 2 wire + Earth
85 - 264VAC, 50/60Hz

Input is protected with a magnetic circuit breaker.

Output Voltage: 0 - 180V, 2000VA Max

Output Injection frequency: 40Hz to 70Hz

2.2. 4046 Interactive Interface

- Tactile Keypad
- USB Port for Program / Software up-grades
- Emergency Stop push button is located on the front panel to power down the switch-mode source.

2.3. 4046 Visual Interface

A 320 x 240 LED back-lit graphical LCD for menu and parameter listings.

There are also LEDs located on the front panel which display error conditions such as:

- TARGET REACHED: When target output current has been reached.
- DANGER HIGH VOLTAGE: Indicates an active applied source
- ERROR: Indicates high impedance or current limit errors
- OUTPUT DISTORTION: LED due to clipping of output or interference from 50Hz current in the earth loop.

2.4. Audible Indicators

A buzzer on the front panel alerts the operator to a problem or an error condition.

2.5. 4047 Interface

Nominal Primary input voltage: 180V

User selectable outputs Taps to: 800V

Reference Voltage set to 10Ω Tap

2.6. 4047 Tap Selection

- Off
- 400Ω 2A / 800V
- 200Ω 3.2A / 630V
- 140Ω 3.8A / 530V
- 80Ω 5A / 400V
- 40Ω 7A / 280V
- 20Ω 10A / 200V
- 10Ω 14A / 140V
- 5Ω 20A / 100V

Please note that the 400Ω Tap is voltage limited and will achieve 1.6kVA maximum.

3.0. SOFTWARE FEATURES

3.1. Enterable Data and Test Parameters

- Voltage
- Current
- Loop Impedance
- Frequency settings

3.1. Software Tap Selection

The Model 4046 has a set up menu which directly reflects the tap settings of the 4047 above.

If the tap setting entered on the 4046 does not match the manually selected tap on the 4047, the current and impedance readings will be incorrect.

The software will also prompt the operator to change tap settings if maximum current is not attained.

3.2. Current Ramping

The software enables automatic or manual ramping from zero to maximum current and ramping down to zero again in any tap setting.

3.3. GPS and Synchronization

The 4046 has an additional GPS module which gives accurate position and timing information. A feature of this allows for synchronization with one or more 4025E tuneable multi-meters when performing branch current measurements. The synchronization feature frees the operator from having to use a separate cable to attain the phase synchronization required for these types of measurements.

4.0. OPERATING CONDITIONS

4.1. Operating Temperatures

A fan is fitted to both the 4046 and the 4047 to allow operation at high temperature and at maximum power.

At 25°C ambient

2000VA continuous

At 40°C ambient:

1200VA continuous

2000VA continuous operation at a 50% duty cycle, (i.e On: 30min Off: 30min every hour)

At 50°C ambient:

2000VA continuous operation for 20 minutes per hour

5.0. PROTECTION

15 Amp circuit protection fuse for the 4046. Both the 4046 and 4047 are also fitted with auto resetting thermal sensors which cut-out or trip to protect the 4047 coupling transformer and 4046 drive circuit.

When these sensors trip, the current is ramped down to zero and will only reset once the temperature drops to a safe level.

In the event that the Injection line has been tampered with during operation causing an open circuit condition; the 2kVA system is designed to shutdown the injection process in less than 100 milliseconds.

6.0. ENCLOSURE AND CARRY CASE

6.1. 4046 Injection Unit

The 4046 is housed in a protective moulded Pelican case. It also comes with a foam lined transit case for protection during transportation.



6.2. 4047 Coupling Transformer

The 4047 is housed in a rugged, versatile custom designed flight transit case with heavy duty carry handles on each side. The front panel is covered with a polycarbonate "lexan" label with all functions clearly identified and the terminals colour coded. The case has side vents to exhaust the air



7.0. SIZE AND WEIGHT (LxWxH)

4046: In a moulded Pelican case
570mm X 460mm X 260mm; 25kg
In Transit case with interconnect
640mm X 350mm X 640mm; 35kg

4047: Coupling Transformer
375mm X 320mm X 370mm; 45kg

8.0. ACCESSORIES

8.1. Supplied

Interconnection lead between the 4046 Injection unit and the 4047 coupling Transformer.

8.2. Not Supplied

Cables and accessories required for connection into the earth loop are at the operator's discretion as operational requirements vary from job type to site requirements.

In some cases the operator may need many hundreds of metres of cable depending upon the site layout under test.

8.3. Accessory Guide

Any type of cable can be used provided it has a sufficient current rating.

Typically measurement instruments such as the 4025D Tuneable Multimeter will require cable types which are at least 1.5mm square.

The Injection line cable should be typically 2.5mm square in diameter as a minimum.

Earth Stakes or ground rods as shown below are typically metal electrodes made from Galvanized tube, crooked chisel, angle iron, or copper bars.

Rod sizes may be 0.4m, 0.8m or 1.2m in length. As a general rule the 0.4 and 0.8m lengths are used in Potential Drop or Soil Resistivity tests and 1.2m rods are often used in ground impedance testing.

A rod's radial thickness does not impact largely on overall impedance so is not of concern.



Circular metallic plates of at least 200cm square in area are a common earth plate used in Step potential measurements.



Plate shape is not entirely important and may also be square if desired but the minimum surface area must be maintained.

9.0. WARRANTY

One year limited warranty on parts and labour.