



# 8KVA INJECTION SYSTEM

## 4041 & 4042 DATASHEET



**REDPHASE INSTRUMENTS**

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## **1.0. BRIEF DESCRIPTION & APPLICATION**

The Model 4041 is a high power switch mode voltage source that is used to drive the primary of the Multi Tapped Coupling Transformer, (Model 4042) delivering 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 4042 Coupling Transformer which is inserted into the loop.

Frequencies from 40Hz to 70Hz can be selectively generated by the 4041 to avoid interference with background line frequencies. Voltage drops and current branches generated by the injected current around the earth loop may be measured with a frequency selective 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 on the frequency tuned multimeter. For that reason the 4042 has tap settings for earth loop impedances from 1 Ohms to 80 Ohms which will cover most test situations. When the appropriate tap is chosen the Amplifier on the 4041 Injection unit will see a reflected 8000VA 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.

### **1.1. Where and why it is used**

Our Earth Testing equipment is used in the following areas:

Evaluation of soils at proposed large grounding sites.

Ground systems testing of existing sites such as utility, telecommunication and industrial sites

Site and equipment maintenance.

Earth testing provides important measureable parameters which indicate to engineers the robustness or vulnerability of the soil environment and grounding system 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 8kVA 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 potential and 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. 4041 Power Source**

Input Supply: Three Phase, 4 wire + Earth  
Three Phase, 3 wire + Earth  
300 - 400VAC, line to line 50/60Hz  
Input is protected with a magnetic circuit breaker.

Output Voltage: 0 - 320V, 8000VA Max  
Output Injection frequency: 40Hz to 70Hz

### **2.2. 4041 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. 4041 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. 4042 Interface**

Nominal Primary input voltage: 320V  
User selectable outputs Taps to: 800V  
Reference Voltage set to the 5Ω Tap

### **2.6. 4042 Tap Selection**

OFF.  
80Ω 10A / 800V.  
60Ω 11A / 600V.  
40Ω 14A / 560V.  
30Ω 16A / 490V.  
20Ω 20A / 400V.  
10Ω 28A / 280V.  
5Ω 40A / 200V.  
1Ω 90A / 90V.

## **3.0. SOFTWARE FEATURES**

### **3.1. Enterable Data and Test Parameters**

- Voltage
- Current
- Loop Impedance
- Frequency settings

### **3.1. Software Tap Selection**

The Model 4041 has a set up menu which directly reflects the tap settings of the 4042 above.

If the tap setting entered on the 4041 does not match the manually selected tap on the 4042, 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 4041 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 4041 and the 4042 to allow operation at high temperature and at maximum power.

#### **At 40deg C ambient:**

8000VA continuous operation

#### **At 50deg C ambient:**

4800VA continuous or..  
8000VA continuous for 20 minutes per hour

## **5.0. PROTECTION**

3 phase 16 Amp circuit breaker is used on the 4041 Injection unit.

Both the 4041 and 4042 are also fitted with auto resetting thermal sensors which cut-out or trip to protect the 4042 coupling transformer and 4041 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 8kVA system is designed to shutdown the injection process in less than 100 milliseconds.

## **6.0. ENCLOSURE AND CARRY CASE**

### **6.1. 4041 Injection Unit**

The 4041 is housed in a protective moulded Pelican case. It also comes with a transit case for protection during transportation.

### **6.2. 4042 Coupling Transformer**

The 4042 comes in a custom designed Metal case with heavy duty carry rings on either side. The front panel is covered with a polycarbonate "lexan" label with all functions clearly identified and the terminals colour coded.

The case is well ventilated to exhaust the air..



***Purpose built trailer carrying 8kVA Earth system***

## **7.0. SIZE AND WEIGHT (LxWxH)**

**4041:** In a moulded Pelican case  
600mm X 500mm X 380mm; 42kg

**4042:** Coupling Transformer  
370mm X 350mm X 440mm; 145kg

## **8.0. ACCESORIES**

### **8.1. Supplied**

Interconnection lead between the 4041 Injection unit and the 4042 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 widely. In some cases the operator may need many hundreds of metres of cable depending upon the site layout under test.

### **8.3. Accessory Guide - not supplied**

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

Typically measurement instruments such as the 4025D/E frequency selective Multimeter will require cable types 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 as Potential Drop or Soil Resistivity probes and the 1.2m rods as remote earth stakes often in parallel to reduce impedance. 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.