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## **John Chubb Instrumentation**

Unit 30, Lansdown Industrial Estate, Gloucester Road,  
Cheltenham, GL51 8PL, UK. Tel: +44 (0)1242 573347  
Fax: +44 (0)1242 251388 email: jchubb@jci.co.uk

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## **USER MANUAL FOR JCI 148 ELECTROSTATIC VOLTMETER**

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# USER MANUAL FOR JCI 148 ELECTROSTATIC VOLTMETER

## 1. INTRODUCTION.

*The JCI 148 Electrostatic Voltmeter provides an accurate electrostatic voltmeter with linear response and polarity indication for voltages from 0 to 20 kV.*

The JCI 148 Electrostatic Voltmeter comprises a shielding enclosure in which an electrode, connected to the input, is supported by high quality insulation in a well defined and stable geometric arrangement relative to the sensing aperture of a JCI 140 Static Monitor. The geometry is such that the numbers shown on the display correspond directly to the applied voltage in kilovolts. The design, mounting and insulation of the high voltage electrode ensures low charge leakage even at the maximum operating voltage. The design also ensures there is negligible influence by any charge retained on the insulator surfaces.

The attraction of an electrostatic voltmeter based on the use of a 'field mill' type fieldmeter is the near zero current drain (limited only by insulation leakage,  $10^{14}$  ohms or more up to 20kV), the high sensitivity (1V resolution up to 2kV), the low internal capacitance (about 7 pF), the infinite input time constant and the linearity of response. The frequency response is -3dB at 30Hz when using the standard JCI 140. The JCI 140F option provides a faster response, -3dB at 400Hz.

The JCI 140 Static Monitor is easily removable from the mechanical arrangement and can be used in its own right for other measurement purposes. All the normal features of JCI 140 and JCI 140F instruments are available for use - for example for external power supply input and for output to remote display and recording of observations.

## 2. USE OF ELECTROSTATIC VOLTMETER UNIT

### 2.1 JCI 140 mounting:

The JCI 140 is mounted into the unit by holding it between the fingers, on either side, and placing it with its sensing aperture end uppermost, obliquely into the channel between the two side plates so its top plate rests against the inside back surface. The JCI 140 is pressed up into position by two spring loaded fingers which may be pressed down either by a finger at the front or by lifting the lever at the back against the upper fixed stop. The bottom of the JCI 140 must be latched over the spring fingers and the lever is gently released. Check that the spigot around the sensing aperture of the JCI 140 is properly engaged into the hole in the baseplate of the Voltmeter unit and sits fully up into the mounting hole.

The JCI 140 may be easily removed from the unit by depressing the spring supporting fingers either at the front or by the lever extension at the back.

### 2.2 Connections:

The first connection to make to the unit is bonding to a reliable earth point from the earthing terminal on the backplate. If voltages over 20kV may occur it is wise to 'earth' directly to a good earth bonding point (for example a metal water pipe) and not via other instrumentation. If a spark breakdown occurs the discharge current may be quite large and will contain very high frequency transient signals. These could cause damage or interference. After earth bonding the high voltage connector may be inserted and connected to whatever source is to be tested.

Care needs to be taken about the selection and routing of the high voltage lead. The lead

should have a suitably low leakage dielectric covering and have sufficient dielectric strength to avoid electrical breakdown to the highest voltages which may occur. None the less it is wise to route the lead away from other equipment, instruments and earthy surfaces. It is also desirable to avoid any rubbing of the cable against surfaces and to minimise any flexing. These actions are liable to generate static charges on the outside of the cable and this can couple into the connecting lead and degrade the quality of observations.

JCI 140 and JCI 140F instruments may be used with an external power supply for long term continuous monitoring observations. The power supply required is 12V isolated from earth. Power may be supplied to the instrument either via the 8w mini DIN connector or via the 2.1mm d.c. power connector in the back cover. A 12V 250mA regulated supply e.g. from an isolated supply 'wall cube' (with center positive) will be suitable. (A suitable 12V 'wall cube' unit, such as the 'Mascot' Type 9583, is available from JCI).

PC based digital data recording arrangements show great advantages for viewing and storing electrostatic observations with JCI 140 Static Monitor instruments. With such systems observations can be made to the full fast response capability of JCI 140F instruments and the data logging capability provides opportunity for detailed monitoring of long term observations. Compact and low cost units, with both digital storage oscilloscope and datalogging facilities, are available from, for example, Picotechnology. The software is Windows compatible.

### **2.3 Checking performance:**

PTFE is used as the insulation mounting the high voltage electrode to provide good quality mechanical and electrical characteristics. If there is any doubt about the quality of the electrical insulation (for example if the adaptor may have been exposed to dust and dirt) this may easily be tested by placing some charge on the high voltage electrode and observing on the JCI 140 how quickly this leaks away. This may be done with just the unit itself with the high voltage lead removed or for the whole test assembly. Measurements should be made at voltages close to the maximum likely to arise in practice so that possible losses by corona can be checked.

### **2.4 Cleaning:**

To keep the adaptor compact the unit has been designed so that at it's maximum operating voltage internal electrical stresses approaches the breakdown strength of air - but with a reasonable margin. Dust and dirt within the adaptor may degrade the performance at the highest voltages by promoting corona or spark type discharges. If particulate matter may have entered the adaptor it will be best to separate the top plate assembly from the baseplate so the inside may be cleaned. This can be achieved by undoing the top or bottom four M2x4 countersunk screws holding the cylindrical wall to the end plates. The inside should be carefully cleaned using a link free cloth with suitable solvent before reassembly. Care should be taken to avoid risk of rotation of the central electrode as this will change the adaptor calibration.

### **2.5 Calibration:**

The sensitivity may be checked at any time, up to 1 kV, by comparing the readings with those of a calibrated digital multimeter. Adjustment of sensitivity may be made by loosening the lock nut around the threaded portion of the high voltage bayonet connection pin and then adjusting the position of the central stem before relocking. Formal calibration requires

comparison of readings against a suitably stable and smooth high voltage supply that has been formally calibrated to National Standards.

### 3. RoHS and WEEE Directives

JCI electrostatic measuring instruments are not required to conform to the RoHS Directive because they come within Category 9 exemption.

To comply with the requirements of the EC WEEE (Waste Electrical & Electronic Equipment) Directive all JCI instruments at the end of their useful life should either be returned to JCI or otherwise disposed of or recycled in an environmentally appropriate manner.

### 4. JCI 148 SPECIFICATION FEATURES:

<i>Sensitivity ranges:</i>	+1.999 and $\pm 19.99$ kV FSD
<i>Accuracy and linearity:</i>	within $\pm 2\%$ FSD on JCI 140 display and analogue output signal.
<i>High voltage connection:</i>	special JCI HV protective connector
<i>Maximum safe voltage:</i>	+30kV
<i>Internal capacitance:</i>	about 7pF
<i>Earth connection:</i>	an earth connection terminal is provided on the unit sideplate.
<i>Dimensions:</i>	- 180x180 mm baseplate 330 mm high without connector - total weight (with JCI 140) about 3 kg
<i>JCI 140 controls:</i>	- 3 position slide switch in back plate: OFF: ON 2kV: ON 20kV - multiturn potentiometer zero set adjustment.
<i>JCI 140 Display:</i>	3½ digit liquid crystal display with polarity and low battery indication. Display shows JCI 148 voltage directly in kV.
<i>JCI 140 power supply:</i>	replaceable PP3 battery or external 12V floating power supply via connections to 8w mini DIN connector or via 2.1mm d.c. power connector.
<i>Calibration:</i>	JCI 140/JCI 148 Electrostatic Voltmeter can be calibrated at JCI to BS 7506: Part 2: 1996 Annex using measurements whose accuracy can be traced to National Standards.



*Figure 1: JCI 148 Electrostatic Voltmeter with JCI 140 and HV connection lead*