

# JCI 178 Charge Measurement Unit

*for general measurement of small quantities of charge and measurement of charge transfer in static discharges.*

## INTRODUCTION

The JCI 178 is a compact and easy to use instrument for the sensitive measurement of charge in the range 10pC to 200nC. Higher and lower sensitivity ranges can be provided. The 3½ digit liquid crystal display shows directly the quantity of charge transfer measured in nano-coulombs (nC). An analogue output is provided for remote display and recording of readings and there is opportunity for remote zeroing.

For measurement of charge transfer in electrostatic discharges the unit can be fitted with a JCI 179 shielded probe. This ensures that observations can be interpreted with confidence [1,2] and valid judgements made on the risk of ignition presented in relation to quantities of charge transferred.

## PRACTICAL DESIGN FEATURES

The charge measurement unit has many of the same physical design features as the JCI 140 Static Monitor instrument. It is thus easy to handle, to control and to read the values from observations.

The unit is based on a 'virtual earth' charge measurement circuit. As this ensures the input remains essentially at earth potential insulation leakage problems are minimised. Circuit design features (such as guarding) minimise zero drift and droop of readings.

Two ranges of sensitivity are available. These are selected by the 3 position slide switch in the back cover of the instrument. This provides selection as: OFF/ON(20nC FSD)/ON(200nC FSD). A small push button is provided in the back cover for zeroing readings before observations. No zero setting adjustment is provided so it is necessary (and always wise) to take note of the 'zero' reading after the



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zeroing button has been released and just before charge is received. Note that with sensitive charge measurements it is desirable to hold the unit in the 'zeroing' state until just before measurements are made. This will reduce the influence of any zero drift.

The back cover also includes a combination 'Durable Dot'/'4mm bayonet pin' earth bonding connector, an 8w min DIN connector and a 2.1mm 12V external power supply input connection. The 8w miniature DIN connector provides for analogue output of observations, input of external power supply and opportunity for zeroing with a remote push button. The instrument must be bonded to earth for meaningful measurements.

An audio alarm is included with a user settable threshold level. This may help recognition of untoward charge generation situations and identification of hazardous discharges in practical testing.

## ELECTROSTATIC DISCHARGE PROBE

Charge transfer measurements in spark type electrostatic discharges need to be made using a shielded probe, such as the JCI 179[1,2]. The JCI 179 probe is a general purpose shielded probe, and this can be mounted directly on the input BNC connector of the JCI 178. The input for the virtual earth amplifier is buffered with a capacitor to earth and an input feed resistor to the charge measurement amplifier to avoid overloading its output drive capability. The circuits of the JCI 178 are not specially fast so they will not resolve any fast steps in the rising edge of a charge transfer but they will show correctly the overall quantity of charge transferred. Observations may usefully be recorded using a digital storage oscilloscope – for instance a Picoscope.

## CALIBRATION

The sensitivity of charge measurement may be calibrated by charging a calibrated quality capacitor to a calibrated voltage and discharging

this to the instrument input. Because the input is to a virtual earth preamplifier all the charge ( $Q = C V$ ) will be transferred and used as a basis for instrument calibration. For example, a 10nF 1% polystyrene capacitor charged to 1.0V is a convenient arrangement for providing 10nC of charge. (See also Calibration section on JCI Website).

## References:

- [1] J. N. Chubb; G. J. Butterworth “*Charge transfer and current flow measurements in electrostatic discharges*” J. Electrostatics 13 1982 p209
- [2] J. N. Chubb “*Measurement of charge transfer in electrostatic discharges*” J. Electrostatics 64 (5) 2006 p301-305.



The business of JCI Ltd is the design, development, manufacture and marketing of high quality instruments for electrostatic measurements. JCI Ltd also carries out electrostatic testing of materials, consultancy and calibration of JCI instruments to BS 7506: Part 2: 1996.

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Instrumentation