T&R Test Equipment Ltd

OPERATING AND MAINTENANCE MANUAL

Product: ***High Voltage DC Cable Test Set***

Type: ***PT30-10***

DESIGNED AND MANUFACTURED BY:

T & R Test Equipment Limited

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GENERAL SAFETY STATEMENT

The following safety precautions should be reviewed to avoid injury to the user and damage to the product (and other products connected to it). To avoid potential hazards only use this product as specified.

Only suitably qualified personnel should use this equipment. Servicing of this product should only be carried out by suitably qualified service personnel.

Hazardous voltages and currents are present on the outputs of this unit.

To Avoid Fire Hazards and Personal Injury

Use the correct power supply lead. Only use a suitably rated and approved power supply lead for the country of use.

Ensure that systems that the unit is to be connected to are dead.

Do not connect and disconnect leads whilst outputs are switched on.

Ensure that the product is grounded. To avoid electric shock it is essential that the grounding conductor is connected to the earth ground. If an additional earth terminal is provided on the equipment that may be connected to a local earth. Ensure that the product is properly grounded before making any connections to inputs or outputs.

Terminal ratings must be observed to prevent fire hazards and risk of injury to the operator. Consult the product manual for ratings information before making connections to any terminal.

It is ESSENTIAL to consult the product manual for rating information before making any connection to a terminal or terminal group marked with a warning triangle.

Only use fuses of a type and rating specified for this product.

Do not operate the unit out of its case or with any covers or panels removed.

Do not touch exposed connections and components when power is present.

Do not operate the product if any damage is suspected. Refer the unit to qualified service personnel to be checked.

Do not operate the unit in wet or damp conditions

Do not operate the unit in an explosive atmosphere

If any further queries occur regarding the usage and maintenance of the equipment detailed in this manual, please refer these to the supplier of the equipment in the first case or to:

T & R Test Equipment Limited

CONTENTS

1. DESCRIPTION OF EQUIPMENT

1.1 Electrical Specification

1.2 Output Voltage Control

1.3 Overload Protection

1.4 Metering

1.5 Automatic Earthing

1.6 Manual Earthing Using DP40 Discharge/Earthing Probe

1.7 High Voltage Output Cables

1.8 Construction

1.1 Electrical Specification

1.1.1 The supply voltage for the equipment is 240/220/115V, single phase, 50/60Hz. Each input will tolerate the following voltage variation:

240V +/- 10%
220V +/- 10%
115V +10% and -6%

1.1.2 The maximum power supply requirements will be 750VA.

1.1.3 The output voltages which are continuously obtainable from the equipment are as follows:

a. 30kV DC positive with respect to earth
b. 30kV DC negative with respect to earth
c. 30kV DC positive and negative with respect to earth simultaneously, thus giving 60kV DC between the outputs

1.1.4 The maximum output current obtainable from all outputs as detailed in 1.1.3. above are as follows:

a. 5 milliamperes continuous
b. 10 milliamperes for a duty cycle of 5 minutes ON followed by 15 minutes OFF load

1.1.5 The earthy end of the high voltage output is connected to the earth system of the equipment.

Note: There is a Voltage Dependent Resistor, internal connected between **neutral & chassis.**

1.2 Output Voltage Control

1.2.1 The output from the equipment is controlled from zero by means of a regulating transformer.

1.2.2 The regulating transformer is operated by means of a control knob which is located on the right hand side of the instrument's front panel.

1.2.3 To increase the output voltage turn the control knob in a clockwise direction.

1.2.4 Note: The output can not be energised unless the regulator knob is set to zero, thus operating the zero voltage interlock switch.

1.3 Overload Protection

1.3.1 The instrument is fitted with a fast acting fuse which protects the incoming mains supply to the unit. The rating of the fuse is as follows:

F 5amp for 240V/220V/115V operation

1.3.2 The outputs from the instrument are protected by means of a fast acting magnetic overload relay which in turn controls an output contactor. The overload is set for 12-15 milliamperes.

1.4 Metering

1.4.1 The equipment is fitted with two output kilovoltmeters, which sense both the positive and negative outputs simultaneously. Both instruments have a single range of 0-30 kilovolts. Each division on the instruments represent 1 kilovolt. The individual meters are captioned as follows:

a. Positive kilovoltmeter: + kV DC (In red)
b. Negative kilovoltmeter: - kV DC (In blue)

1.4.2 The equipment is fitted with two output milliammeters, which sense both the positive and negative output currents simultaneously. The individual meters are captioned as follows:

a. Positive milliammeter: + mA DC (In red)
b. Negative milliammeter: - mA DC (In blue)

The output milliammeters are dual range as follows:

Range 1:	0 - 10mA	Each division being 0.5mA
Range 2:	0 - 1.0mA	Each division being 0.05mA

The range change on the milliammeters is achieved by means of an impulse push-button which is coloured white and located on the front panel of the equipment. The rest position is Range 1 and the activated position is Range 2.

1.4.3 The voltage and current monitoring systems for each output are totally independent of each other.

1.5 Automatic Earthing

1.5.1 **AUTOMATIC DISCHARGE/EARTHING**

The automatic discharge system, which is fail safe, will discharge a maximum of 2.5 kilojoules at 30kV DC four times every hour. The contact surfaces of the internal dump switches are made of very hard dissimilar metals to contain contact burning and erosion.

1.5.2 The automatic discharge/earthing switch is controlled by a electro/mechanical device when the HT output is energised the electro/mechanical device will be slightly noisy, the noise will be more pronounced at low mains voltage.

1.6 Manual Earthing Using DP40 Discharge/Earthing Probe

1.6.1 Important:- DP40 Discharge/Earthing Probe

WARNING NOTICE

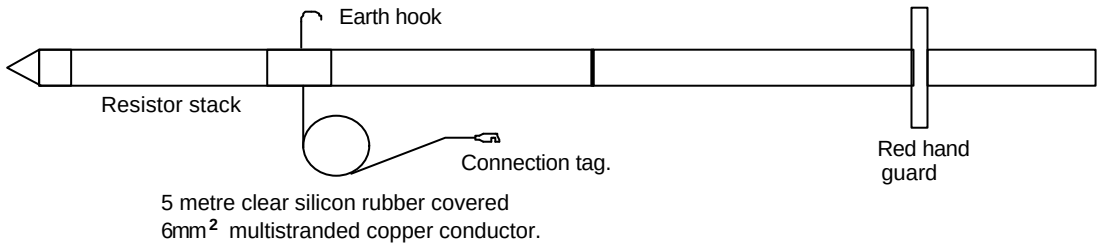
Under no Circumstances Must the Discharge/ Earthing Probe be Used on Energised A.C. Distribution Systems.

Failure to Observe the Above Will Result in Severe Damage to the Discharge Probe and, More Importantly, Possible Fatal Injury to the Operator.

1.6.2 The Spectification for DP40

Max. discharge voltage (kVdc)	40kVdc
Max. discharge capacitance	6µF
Max. discharge energy	7.2kJ
Max. discharges per hour	4

1.6.3 DP40:- two part construction, overall length = 900mm



5 metre clear silicon rubber covered
6mm^2 multistranded copper conductor.

1.6.4 Using DP40 with the PT30-10.

The DP40 is capable of discharging 7.2 kilojoules of stored energy at 30kV four times every hour.

1.7 High Voltage Output Cables

1.7.1. The high voltage output cables provided with the equipment are 5M long and are terminated with a suitable connector allowing a good secure connection to the test object. The cable type used is UR67M with a multi-stranded inner core. The outer screen is connected via the high voltage plug to the ground connection on the PT30-10.

1.7.2. The high voltage plug is protected in transit by a plastic cover. The plastic cover is attached to output cable by means of thick nylon cord.

1.7.3. The high voltage plugs used on the PT30-10 are fully de-mountable, thus allowing for retermination on site should the output cables become damaged.

1.8 Construction

1.6.1. The PT30-10 is housed in a robust case consisting of a rigid frame construction with removable side covers to provide good access and serviceability.

1.6.2. All the controls are located on the equipment's front panel, together with all input and output connections. The instrumentation is mounted on a sub-chassis which, inturn is mounted to the front panel via a shock absorbing system. Also the instrumentation is further protected by means of a polycarbonate cover to prevent damage to the instruments' front faces.

1.6.3. The PT30-10, is housed in a padded bag manfuactured from a waterproof material, for maximum protection during transit. The bag is fitted with carrying handles.

2. OPERATION

2.1. Supply Voltage Selection

2.2. Front Panel Control Functions

2.3. Testing Procedures and Safety Precautions

2.1 Supply Voltage Selection

Disconnect the PT30-10 from the Mains Supply.

2.1.1 The supply voltage selector is located in the input socket module. The method of selection is as follows:

a. Remove fuse drawer .

b. Remove and rotate fuse carrier until desired supply voltage is seen through the fuse drawer window.

c. The PT30-10 is suitable for 3 different supply voltages as follows: **240V/220V or 115V.**

d. Replace fuse drawer once the desired voltage has been selected.

2.1.2 **IMPORTANT!**

Under no circumstances should the supply voltage selector be altered when the equipment is energised.

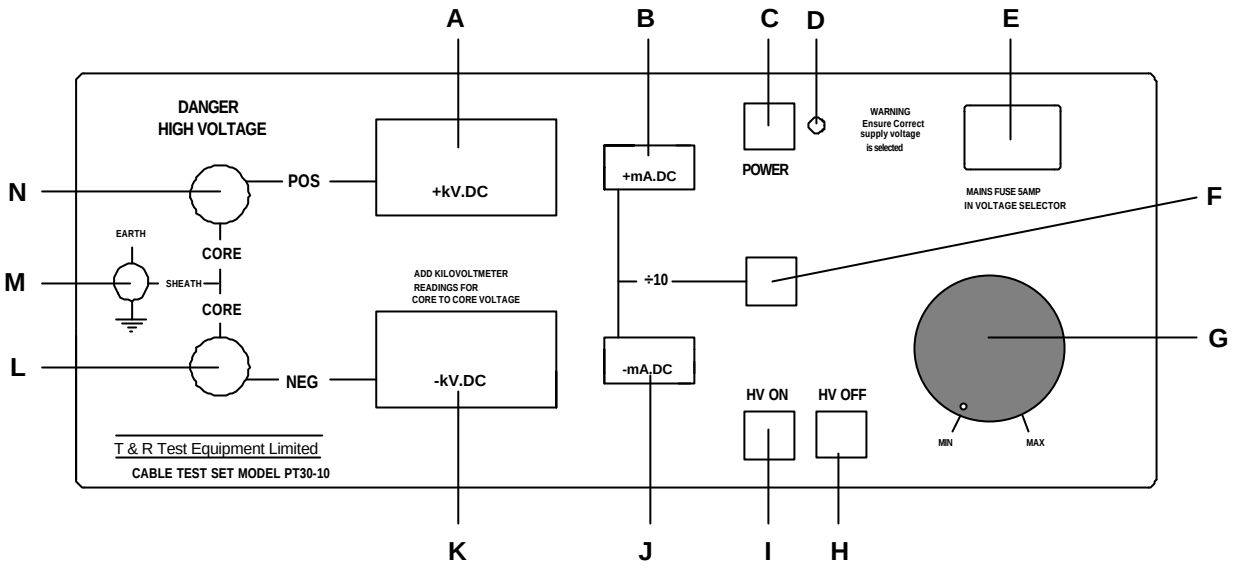
ALWAYS ENSURE THAT THE SUPPLY VOLTAGE SELECTOR IS IN THE CORRECT VOLTAGE POSITION BEFORE ENERGISING THE EQUIPMENT

2.2 Front Panel Control Functions

2.2.1 ITEM FUNCTION

Supply ON/OFF key switch	To isolate both supply leads from the mains supply . Also to prevent unauthorised operation of the equipment when the key is removed
Supply ON lamp (RED)	To indicate that the key switch is closed thus connecting the equipment to the supply. Also indicates that the supply fuse is healthy
Divide by 10 push-button (WHITE)	Selects both output milliammeters low range (0-1mA)
HV OFF illuminated push-button (GREEN)	Indicates HV output is OFF. Switches OFF HV output when pressed
HV ON illuminated push-button (RED)	Indicates HV output is ON. Switches ON HV output when pressed

Front Panel Layout



A. Positive kilovlotmeter

B. Positive milliampmeter

C. Power ON/OFF key switch

D. Power ON lamp

E. Fused mains input module & voltage selector

F. Milliamp meters ÷10 push-button

G. Output voltage control

H. Output OFF push-button

I. Output ON push-button

J. Negative milliampmeter

K. Negative kilovlotmeter

L. Negative output socket

M. Earth terminal

N. Positive output socket

2.3 Testing Procedures and Safety Precautions: For Guidance Only

THE PROCEDURES SET OUT BELOW MUST ONLY BE CARRIED OUT BY AUTHORISED PERSONNEL.

Local Health and Safety Regulations Must Be Observed.

2.3.1 SAFETY PRECAUTIONS:

a. Always ensure by means of a live line tester that the cable about to be tested is not live. This applies both to old and newly installed cables and also to all phases.

b. The test area must be well signed **"" DANGER H.V. TESTING ""**, or similar wording at both ends of the cable.

c. The test area at each end of the cable must be roped off.

d. It is important for the safety of the operator and to protect the equipment that an adequate ground connection be provided. The ground is normally connected to the cable sheath. If the cable sheath is not earthed (this may occur on cables which have just been installed) a temporary earth spike 0.5M long may be used. However, this should be treated with caution, since the soil may have a high resistivity

2.3.2 CONNECTION SEQUENCE:

(See Figure 1.1 for UNI-POLAR and Figure 1.2 for BI-POLAR testing)

a. Connect earth lead between test object earth and PT30-10 earth terminal.

b. Connect discharge/earthing probe to the PT30-10 earth terminal. The earth hook on the probe must now be placed on the test object terminal.

c. Connect the phases not being tested to earth. This means 1 phase for bi-polar test and 2 phases for a unipolar test.

d. For a unipolar test connect the black/negative HV lead to the negative out-put socket on the PT30-10 and the test object. The positive output must be blanked off using the bung provided.

e. For a bipolar test proceed as 2d but connect the red/positive HV lead to the positive output socket on the PT30-10 and the test object.

f. **Ensure The Correct Supply Voltage Is Selected On The PT30-10.**

g. Connect the PT30-10 to mains supply.

h. **Repeat The Procedure And Check That All Connections Are Secure And That All Unauthorised Personnel Are Out Of The Test Area.**

i. Remove the discharge/earthing probe

2.3.3 TESTING SEQUENCE:

a. Switch ON the supply to the PT30-10 using the key provided.

b. The regulator knob must be at zero, press the RED HV ON push-button and increase the output voltage SLOWLY until the desired test level is reached.

c. Hold the test voltage for the normal time.

d. At the end of the test time DO NOT SWITCH OFF THE HV OUTPUT but return the voltage regulator to the zero voltage position.

e. Observe the slow decay in the output voltage which will indicate a healthy cable.

f. After 30 seconds switch off the HV output. The PT30-10 has an auto-earth system which will discharge the cable.

g. Using the discharge/earthing probe tip discharge any remaining charge on the cable, then connect the earthing hook on to the test terminal.

2.3.4 DISCONNECTION SEQUENCE:

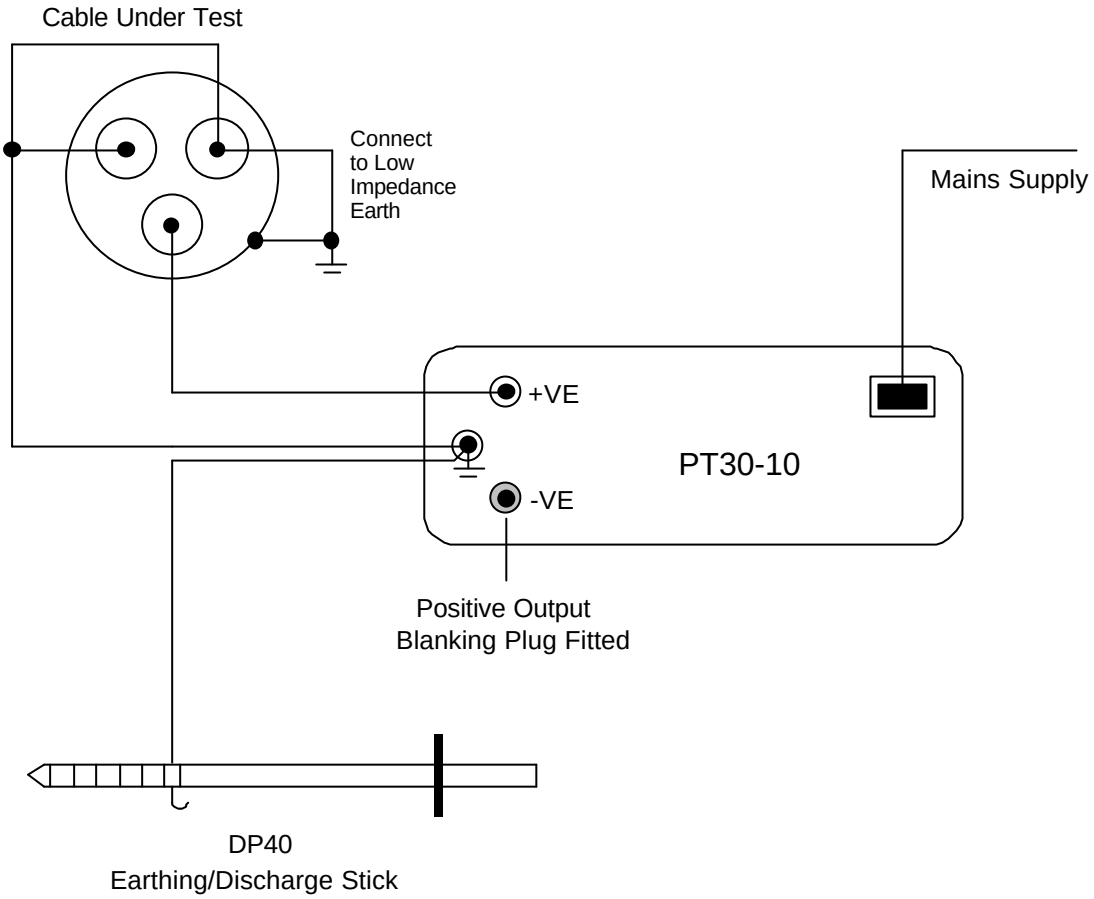
a. To disconnect repeat the connection sequence in the reverse order.

REMEMBER!

ALWAYS CHECK EACH POINT ABOVE AND REFER TO THE EQUIPMENT'S MANUAL IF IN DOUBT.

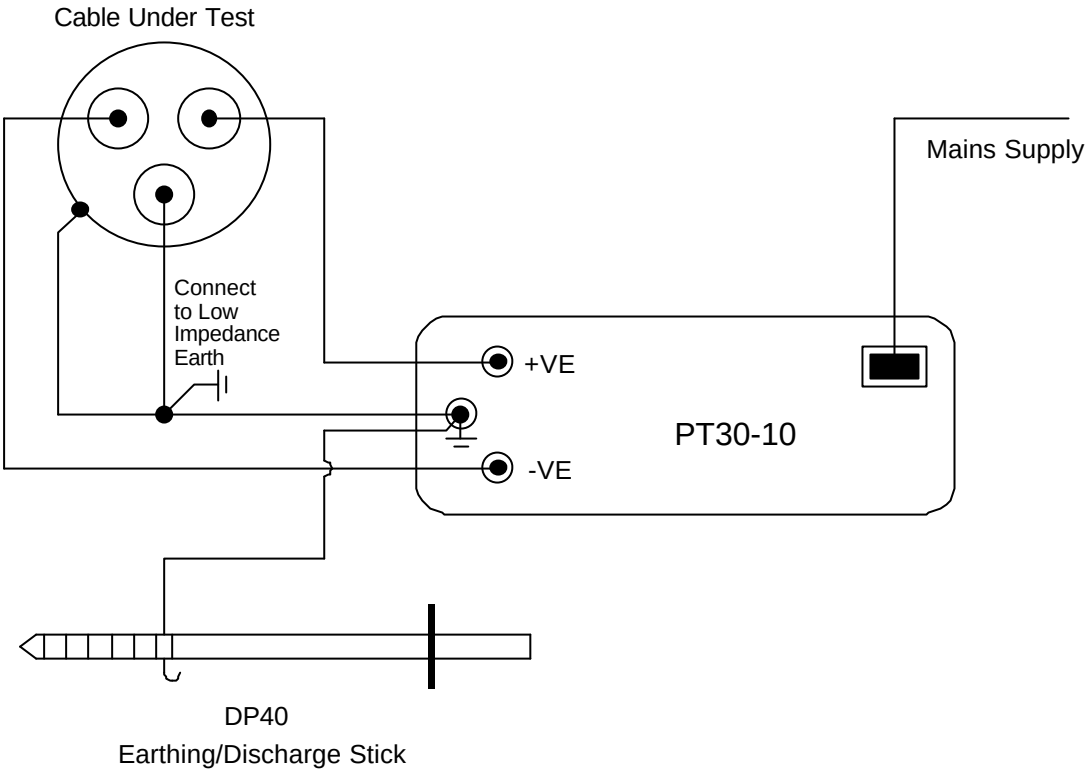
External Connections for PT30-10 HV Cable Test Set

Figure 1.1 Uni-Polar Test



External Connections for PT30-10 HV Cable Test Set

Figure 1.2 Bi-Polar Test



3. MAINTENANCE

Disconnect the PT30-10 from the Mains Supply.

3.1 The PT30-10 requires very little maintenance. However, as with all high voltage equipment, it is essential that the unit and its accessories be kept clean.

3.2 On a regular basis it is advisable to check the voltage regulator carbon brush condition. This is achieved by removing the unit from the padded bag and then removing both of the unit's side panels. Access is now gained to all the unit's major components.

3.3 Rotate the regulator until the carbon brush can be seen. Ensure no excessive wear has taken place and that there is adequate brush pressure. If badly worn replace immediately with a new brush.

3.4 When checking the brush condition as detailed above also check for signs of erosion on the regulator track. Wipe clean with an alcohol moistened cloth. If the track is badly eroded it should be cleaned with very fine sandpaper ensuring a flat surface is restored. Remove particles with a fine brush and finally cleanse with an alcohol moistened cloth or brush.

3.5 Ensure the high voltage leads are carefully stored and that the exposed ends are kept clean. Always ensure that the protective plastic cover is fitted over the connector.

3.6 Always ensure that the output sockets' protective bungs are fitted when the equipment is not in use.

3.7 The earthing cable and the earth cable on the discharge/earthing probe are both made from a very flexible copper conductor which is then covered in a transparent silicon rubber sleeve. This enables the operator to physically check the condition of the cable and connecting tags.

4. STANDARD ACCESSORIES

4.1 Spare fuses supplied

a. 1 off **F5A** 1¼ inch

4.2 The following items are provided with the equipment:

a. Mains input lead.
b. 2 keys (for mains ON/OFF switch).
c. 5 metre earth lead fitted with clip and tag.
d. 5 metre high voltage output cable fitted with HT plug & clip, colour coded red.
e. 5 metre high voltage output cable fitted with HT plug & clip, colour coded black.
f. DP40 discharge/earthing probe.
g. Operating & Maintenance Manual.
H. Carry bag with pocket for above items.

5. PERFORMANCE SPECIFICATION

5.1. **Insulation resistance at 1000V DC:**

Not less than 10 megohms between mains input to frame

5.2. **Applied voltage test**:

2.0kV rms for 1 minute between mains input and frame

5.3. **Induced voltage test:**

± 35kV DC for 5 minutes

5.4. **Flashover test:**

6 flashovers at 30kV DC on each output direct to earth

5.5. **Normal voltage test:**

± 30kV DC on no load for 30 minutes

5.6. **Accuracy of instruments:**

Output kV meters ± 1.5% at full scale

Output mA meters ± 2.5% at full scale on each range

6. CALIBRATION RESULTS

6.1. PT30-10 Serial Number:.....

6.2 Calibration results:

Equipment's Positive KV meter	Standard KV meter
+10kV	
+20kV	
+30kV	

Equipment's Negative KV meter	Standard KV meter
-10kV	
-20kV	
-30kV	

Equipment's Positive mA meter		Standard mA meter
+10mA	x1 Range	
+5mA	“”	
+2mA	“”	
+1.0mA	÷10 Range	

Equipment's Negative mA meter		Standard mA meter
-10mA	x1 Range	
-5mA	“”	
-2mA	“”	
-1.0mA	÷10 Range	

7. TEST CERTIFICATE

PRODUCT TYPE: ***PT30-10 DC Cable Test Set***

PRODUCT SERIAL NUMBER:

TEST PROCEDURE: As routine test sheet:- PT30-10 rts.doc

TESTED BY: .....

PASSED BY: .....

DATE: .....

8. REVISION

Product/Type: High Voltage DC Cable Test Set/PT30-10
File: PT30-10 manual v7.doc
Author: D. Buckle

Issue/Date: 7 / 12-06-2001
Modified By: D. Buckle

Checked By: I. D. W. Lake	Date: 12-06-2001

Drawings Required

A2/000151 latest issue