

T&R Test Equipment Ltd

OPERATING AND MAINTENANCE MANUAL

Product: **High Voltage DC Cable Test Set**
Type: **PT15-10s**



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

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1. DESCRIPTION OF EQUIPMENT

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1.1 Electrical Specification

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

240V \pm 10%
 115V +10% and -6%

1.1.2 The maximum power supply requirements will be 400VA.

1.1.3 The output voltage which is continuously obtainable from the equipment is:

- a. 15kV DC negative with respect to earth
- b. The maximum charging current from the equipment when charging a high capacitance load will be 10 mA
- c. The maximum currents available from the equipment are as the following table:-

V supply	kV DC	mA DC	R load	C load
240V15	0	∞	500pF	
"	"	2.14	7M Ω	0.075 μ F
"	"	5.23	2.86M Ω	0.15 μ F
"	"	8.4*	1.78M Ω	0.15 μ F
"	"	10.00*	1.5M Ω	0.225 μ F
115	"	0	∞	0.225 μ F
"	"	2.12*	7.07M Ω	0.225 μ F
"	11.5	6.00*	1.91M Ω	0.225 μ F
"	10.8	7.2*	1.5M Ω	0.225 μ F

The above currents marked with an * are based on a duty cycle of 5 minutes "ON" then followed by 15 minutes 'OFF' load. The load applied to the equipment is a combination of R load and C load in parallel.

1.1.4 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 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 fast acting fuses which protect the incoming mains supply to the unit. The rating of the fuses is as follows:
 - a. F3.15A for 240V operation
 - b. F5A for 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 High Voltage Output Cable

- 1.4.1. The high voltage output cable 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 PT15-10s.
- 1.4.2. 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.
- 1.4.3. The high voltage plugs used on the PT15-10s are fully de-mountable, thus allowing for re-termination on site should the output cables become damaged.

1.5 Metering

1.5.1 The equipment is fitted with an output kilovolt meter which senses the high voltage from the equipment. The output kilovolt meter has one range which is 0-15 kV dc.

1.5.2 The equipment is fitted with an output milliammeter which senses the output current from the equipment. The output milliammeter has two ranges :-

0-10 milliamps dc

0-1 milliamps dc

The range change on the milliammeters is achieved by means of a non latching push-button which is coloured white and located on the instrument's front panel. The rest position is Range 1 and the activated position is Range 2.

1.6 Automatic Earthing

1.6.1 **AUTOMATIC DISCHARGE/EARTHING**

The automatic discharge system, which is fail safe, will discharge a maximum of 1.25 kilojoules at 15kv 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.

1.6 Manual Earthing Using DP20 Discharge/Earthing Probe

1.6.1 Important:- DP20 Discharge/Earthing Probe

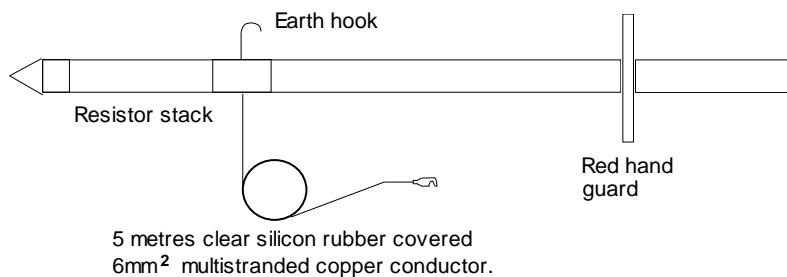
WARNING NOTICE

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 Specification for DP20	Max. discharge voltage (kVdc)	20kVdc
		Max. discharge capacitance	12 μ F
		Max. discharge energy	3.6kJ
		Max. discharges per hour	4

1.6.3 DP20:- overall length = 530mm



1.6.4 Using DP20 with the PT15-10s

The DP20 is capable of discharging 3.6 kilojoules of stored energy at 15kV 4 times every hour.

1.8 Construction

- 1.8.1 The unit is housed in a grounded chassis which is completely screened. This chassis is then housed in the main case which is made from a structurally reinforced plastic.
- 1.8.2 All accessories are housed in a separate carry bag.
- 1.8.3 All the controls for the equipment are located on the front panel together with all the input and output sockets.

1.9 Storage

- 1.9.1. The PT15-10S when not in use must be stored in a dry environment, corrosion damage may occur to the HV components if stored in damp environment.
- 1.9.2. **Important:**
If the unit is moved from a cold area to a warmer area condensation could form on the HV components, this would greatly reduce the internal breakdown voltage.
If it is suspected that condensation may have formed the PT15-10S should not be used until its temperature has stabilised and any condensation evaporated, this may take many hours.

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 PT15-10s 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 PT15-10s is suitable for 2 different supply voltages as follows:
240V or 115V.
- d. Replace fuse drawer once the desired voltage has been selected.

2.1.2 **IMPORTANT!**

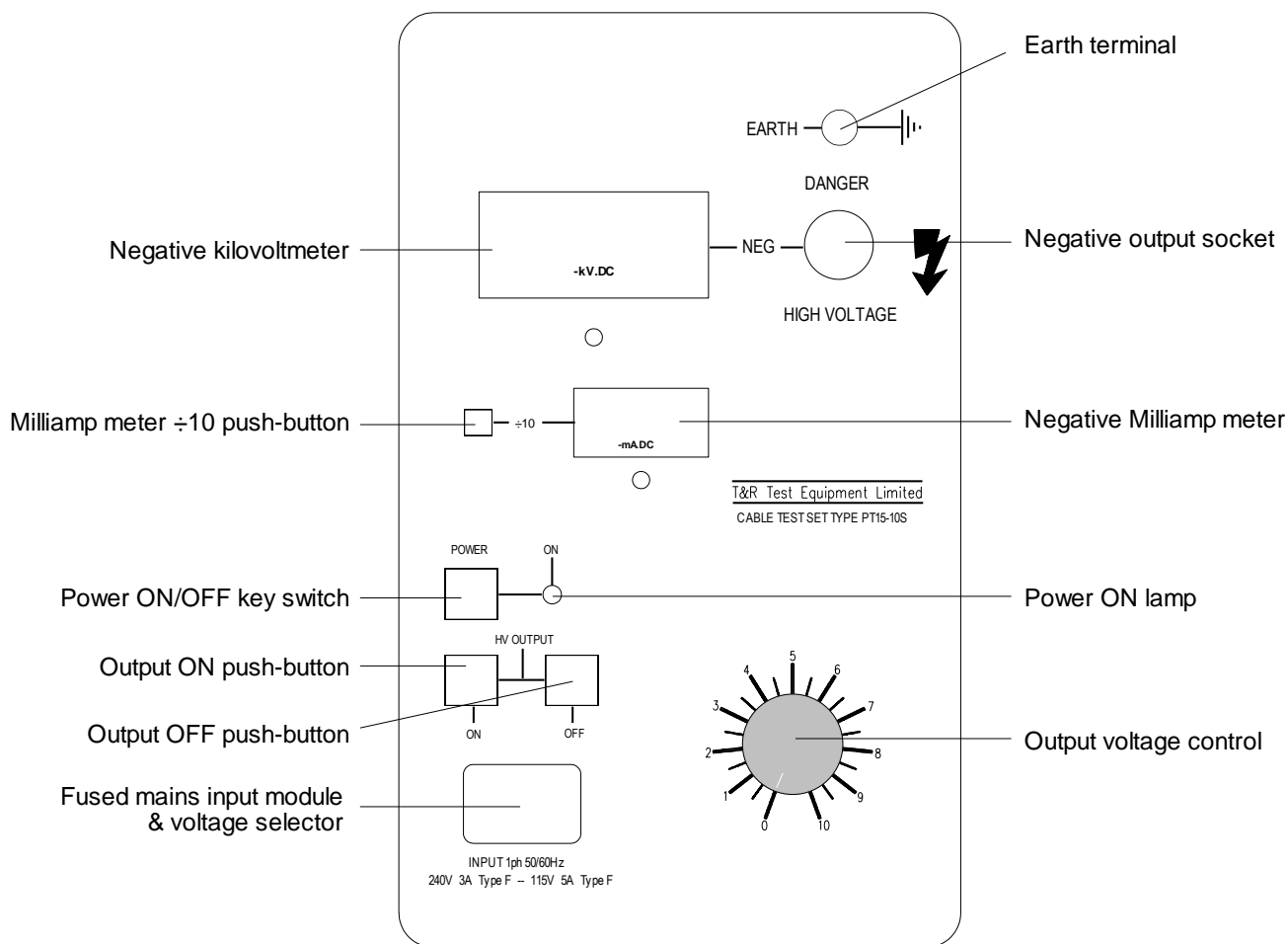
Under no circumstances should the supply voltage selector be altered when the equipment is energised.

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 Switch ON/OFF	To isolate both supply leads from the set.
Supply on Lamp	To indicate supply is connected to the set and that supply fuse is healthy.
÷ 10 push-button	Selects range for output milliammeter.
HV OFF illuminated push-button (Green)	Indicates HV output off when lit. Switches off HV output when pressed.
HV ON illuminated push-button (Red)	Indicates HV output on when lit. Switches on HV output when pressed.
Input module	Selects either 240/115V supply voltages houses mains fuse.

Figure 1 Front Panel Layout - PT15-10s



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 2

- a. Connect earth lead between test object earth and PT15-10s earth terminal.
- b. Connect discharge/earthing probe to the PT15-10s 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.
- d. Connect the HV lead to the negative output socket on the PT15-10s and to the test object.
- e. **Ensure The Correct Supply Voltage Is Selected On The PT15-10s.**
- f. Connect the PT15-10s to mains supply.
- g. **Repeat The Procedure And Check That All Connections Are Secure And That All Unauthorised Personnel Are Out Of The Test Area.**
- h. Remove the discharge/earthing probe

2.3.3 TESTING SEQUENCE:

- a. Switch ON the supply to the PT15-10s 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 PT15-10s 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.

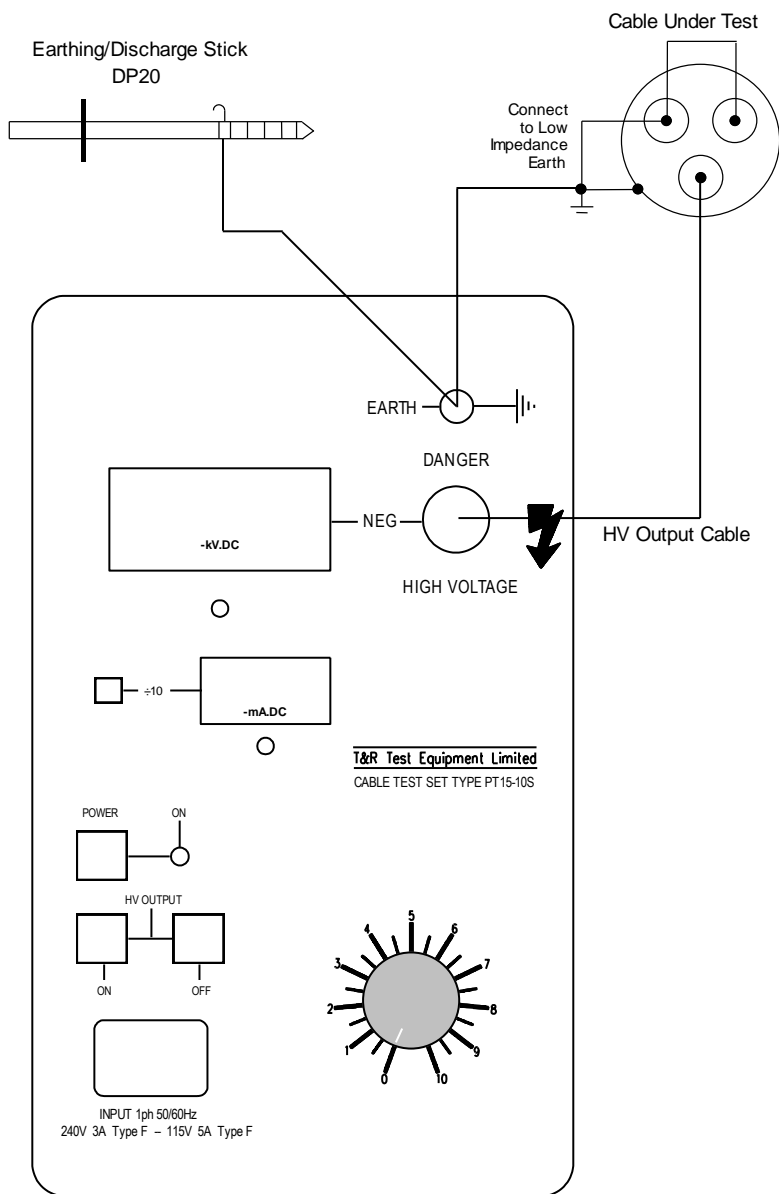
2.3.4 DISCONNECTION SEQUENCE:

- 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.

Figure 2

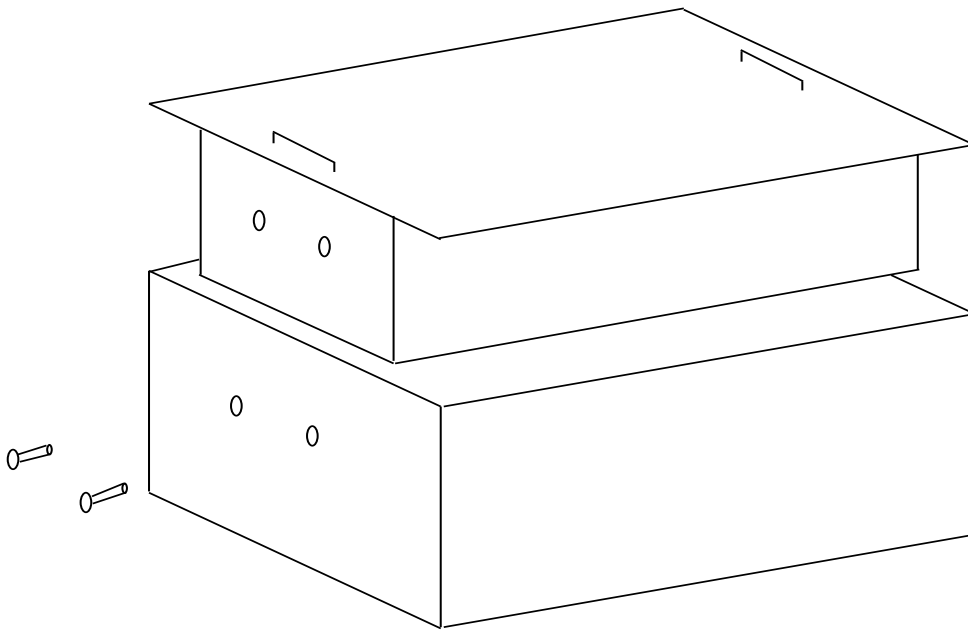


2.3 MAINTENANCE

Disconnect the PT15-10s from the Mains Supply.

- 3.1 The PT15-10s 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 case refer to figure 3 for the procedure for removing the unit from the case. 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 lead is 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 socket' protective bung is 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.

Figure 3 Removing Equipment From Its Housing.



1. Remove the 4 fixing screws that hold the carrying strap to the unit's case.
2. The unit can now be lifted from the case.
3. To gain access to the internal components remove the aluminium screening panel from the chassis.

4. STANDARD ACCESSORIES

4.1 Spare fuses supplied

- a. 1 off **F3.15A** 1¼ inch
- b. 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. DP20 discharge/earthing probe.
- e. 5 metre HT output cable with clip and HT plug.
- f. Separate accessories bag
- g. Operating & Maintenance Manual.

5. OVERALL PERFORMANCE SPECIFICATION

5.1 Insulation Resistance at 1000V DC

The Insulation Resistance will not be less than 10 Megohms between Mains Input to Frame.

5.2 Applied Voltage Test.

Mains input to frame
2 kV RMS for 1 minute.

5.3 Flashover test:

5 flashovers at 15kV DC direct to earth.

5.4 Normal voltage test:

15kV DC on no load for 30 minutes

5.5 Accuracy of Instruments

Output Kilovoltmeter $\pm 1\frac{1}{2}\%$ of FSD.
Output milliammeter $\pm 2\frac{1}{2}\%$ of FSD.

6. REVISION

Product / Type: High Voltage DC Cable Test Set / PT15-10s
File: OM0028.docx
Author: D. Buckle

Issue / Date: 10 / 28/02/17
Modified By: K. Mupotsa

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Drawings Required

A2/000438 latest issue