T&R TEST EQUIPMENT
TRUSTED & RELIABLE

OPERATING AND MAINTENANCE MANUAL

Product: ***Transformer Polarity Tester***

Type: ***TPT9000***

DESIGNED AND MANUFACTURED BY:

T & R Test Equipment Limited

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GENERAL SAFETY STATEMENT

 WARNING

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.**

To Avoid Fire Hazards and Personal Injury

- Use the fused leads supplied with the unit.
- Ensure that systems that the unit is to be connected to are dead.
- Do not connect and disconnect leads whilst outputs are switched on. Breaking the output circuit with current flowing may cause arcing.
- 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.

6. REVISION

Product / Type:	Transformer polarity tester / TPT9000
File:	OM0035-2.docx
Author:	G. Bond
Issue / Date:	2 / 04/05/22
Modified By:	G. Bond

Checked By: M. Clancy	Date: 17/06/22

5. STANDARD ACCESSORIES

5.1 Spare fuses supplied

a. 4 off T0.5A 20mm lead fuses.

5.2 Standard accessories supplied

a. Proving unit (part number A249-0001).

b. 1 off 1m Black fused lead (part number S000-0768).

c. 1 off 1m Red fused lead (part number S000-0769).

d. 1 off 1m Blue fused lead (part number S000-0770).

e. 1 off 1m Brown fused lead (part number S000-0771).

f. Operating & Maintenance Manual.

g. Unit carry set case (part number A249-0003).

h. 9V battery (part number CEJ0016).

5.3 Optional accessories/spares

Proving Unit	A249-0001
Complete replacement output lead set	A249-0002
Carry Case	A249-0003

- 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.
- Warnings from cardiac pacemaker manufacturers state that strong magnetic fields may affect operation. The TPT9000 may induce large magnetic fields in transformers and should therefore not be operated by, or in the vicinity of persons fitted with cardiac pacemakers or any other electronic or electrical medical implants.

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 the manufacturer, T & R Test Equipment Limited.

SAFETY TERMS AND SYMBOLS

The following safety symbols appear on the equipment:

WARNING – Refer to manual

Test Button

4. MAINTENANCE

WARNING

Before removing the unit from its case, ensure that the unit is disconnected from any test transformer. Under no circumstances connect the unit to a test transformer whilst it is removed from its case.

4.1 Replacing the Battery

- Remove the test leads form the TPT9000.
- Remove the battery cover from the bottom of the case.
- Remove and disconnect the old battery from the unit.
- Replace the battery with a suitable 9V alkaline battery.
- Refit the battery into the battery compartment.
- Refit the battery cover.

- Connect the S1 low impedance terminal of the test transformer to the Brown P1 terminal of the TPT9000 and the S2 low impedance terminal of the test transformer to the Blue P2 terminal of the TPT9000.
- When you press the TEST button the TPT9000 will inject the test current into the secondary winding of the test transformer.
- Do not touch the test transformer or any of the wires during the test.
- The TPT9000 will display the result of the test.
- The TPT9000 will first test to see if the test transformer has been connected correctly. If the Error led illuminates check if the connections to the test transformer are correct.
- A green Forward led shows that the unknown side has been connected in the same polarity as the known side.
- A red Reverse led shows that the unknown side has been connected in the opposite polarity as the known side.

CONTENTS

1. DESCRIPTION OF EQUIPMENT

The TPT9000 is used for determining the correct polarity of current and voltage transformers. The TPT9000 automatically detects if the transformer has been connected incorrectly. The set also includes a proving unit to check the correct operation of the unit in the field.

The TPT9000 is designed to be used on ‘dead’ systems (i.e., no externally supplied voltages are present on the test object). Do not connect the TPT9000 to a live system. Always check that the power to the device under test is off and the circuit is isolated before making any connections.

3.1.3 High Primary Impedance Transformer Testing

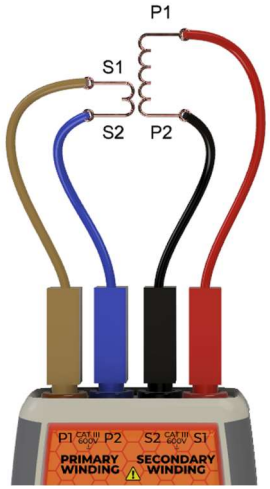

Figure 2.3 TPT9000 connections to a test transformer with a high impedance Primary winding

Some transformers have a very high primary winding impedance. The voltage of the injected current may be too low to energise the transformer. Despite the test transformer being properly connected the Amber ERROR light will show that no return pulse has been detected. If the secondary winding has a much lower impedance, we can still use the TPT9000 to test the transformer.

- Connect the P1 high impedance terminal of the test transformer to the Red S1 terminal of the TPT9000 and the P2 high impedance terminal of the test transformer to the Black S2 terminal of the TPT9000.

- A green Forward led shows that the unknown side has been connected in the same polarity as the known side.
- A red Reverse led shows that the unknown side has been connected in the opposite polarity as the known side.
- If the Error led flashes rapidly the TPT9000 has detected a short circuit between the Primary and Secondary of the test transformer. Check that the connections to the test transformer have been made correctly.
- If the Error led flashes for 1 second, the TPT9000 has not detected any response from the test transformer. Check that the connections to the test transformer have been made correctly. If the connections are ok but the error persists the transformer may have a primary winding with a high impedance. See section 3.1.3.
- In the case of the Primary winding connections being unknown. Connect the Secondary in the correct polarity as shown above. Connect the Red S1 wire from the TPT9000 to the S1 terminal of the test transformer. Connect the Black S2 wire from the TPT9000 to the S2 terminal of the test transformer.
- The test and results will be displayed as before.

1.1 Connections, controls & display

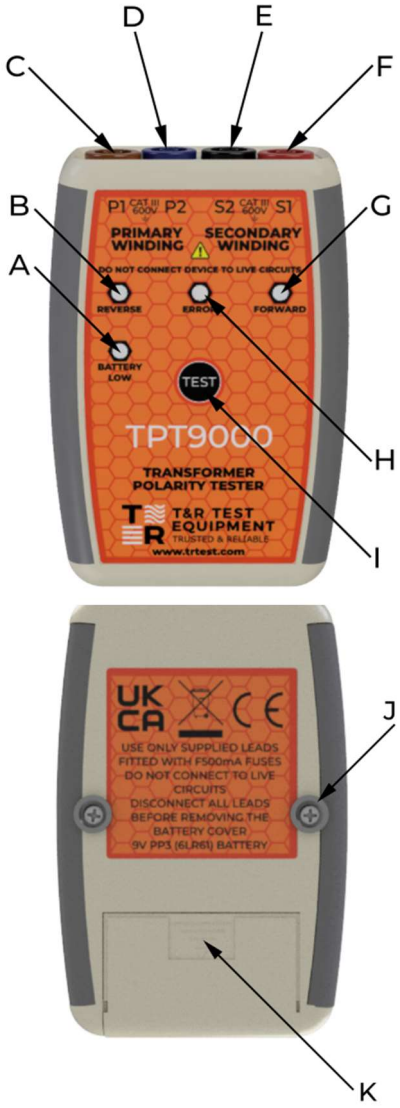

Figure 1.1 TPT9000

Ref	Item	Function
A	Battery Low LED	Indicates if the internal battery voltage has dropped below a useable level
B	Reverse LED	Indicates that the test transformer has one winding connected with reversed polarity to the other
C	Brown terminal	Connect to P1 of the test transformer
D	Blue terminal	Connect to P2 of the test transformer
E	Black terminal	Connect to S2 of the test transformer
F	Red terminal	Connect to S1 of the test transformer
G	Forward LED	Indicates that both windings of the test transformer are connected in the same polarity
H	Error LED	Indicates that the test transformer has not been connected properly
I	Test button	Switches the unit on and starts a test
J	Magnet	For securing the TPT9000 while testing
K	Battery cover	Remove cover to replace the battery

3.1.2 Transformer Testing

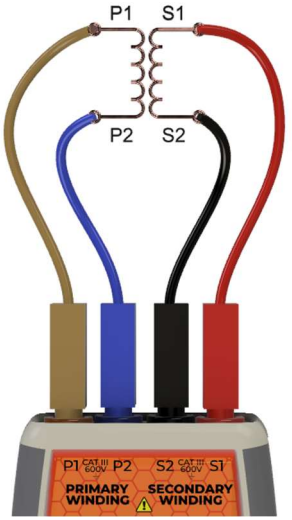

Figure 2.2 TPT9000 connections to a test transformer

- Inspect the test transformer for polarity markings.
- In the case of the Secondary winding connections being unknown. Connect the Primary in the correct polarity as shown above. Connect the Brown P1 wire from the TPT9000 to the P1 terminal of the test transformer. Connect the Blue P2 wire from the TPT9000 to the P2 terminal of the test transformer.
- For the unknown secondary connections connect the Red S1 and the Black S2 wires from the TPT9000 across the secondary winding.
- Do not touch the test transformer or any of the wires during the test.
- Press the TEST button on the TPT9000.
- The TPT9000 will display the result of the test.

direction of current flow is known, pass the brown wire through positive side of the test transformer.

- Pass the wire out of the P2 side of the CT and back to the Blue terminal of the TPT9000.
- If the polarity of the primary of the CT is not known, loop the wire through the central hole in any direction.
- Check the secondary side of the CT for polarity markings.
- Connect the secondary terminal marked S1 to the Red input of the TPT9000 and the secondary terminal marked S2 to the Black input of the TPT9000.
- Do not touch the CT or any of the wires during the test.
- Press the test button on the TPT9000.
- The TPT9000 will first test to see if the test transformer has been connected correctly. If the Error led illuminates check all the connections to the test transformer are correct.
- The TPT9000 will display the polarity of the current connection to the test CT.
- If the Forward LED lights, then the unknown side of the test CT has been connected correctly with respect to the known side of the test CT.
- If the Reverse LED lights, then the unknown side of the test CT has been connected reversed with respect to the known side of the test CT.

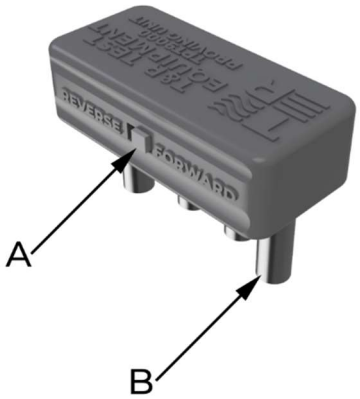

Figure 1.2 Proving Unit

Ref	Item	Function
A	Polarity Switch	Switch test polarity between Forward and Reverse
B	Connectors	Connectors to fit the proving unit into the TPT9000 terminals.

1.1.1 LED messages

Figure 1.3 Green LED 1 second flash

The Green LED will light for 1 second when the transformer under test has been connected with both windings in the same polarity.

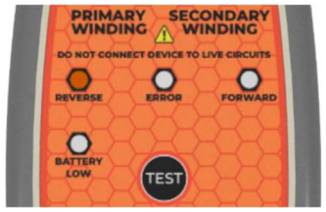

Figure 1.4 Red LED 1 second flash

The Red LED will light for 1 second when the transformer under test has been connected with the windings in a different polarity.

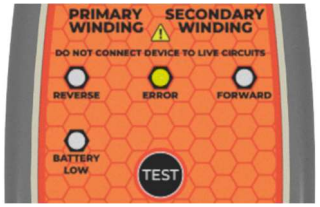

Figure 1.5 Amber LED 1 second flash

The Amber LED light for 1 second when the TPT9000 has carried out a test on the test transformer but no response has been detected on the return connections. This can be caused by poor connections to the transformer windings.

3. APPLICATIONS

This chapter describes how to use the TPT9000 to test different types of transformers.

3.1 Transformer Testing

3.1.1 CT Testing

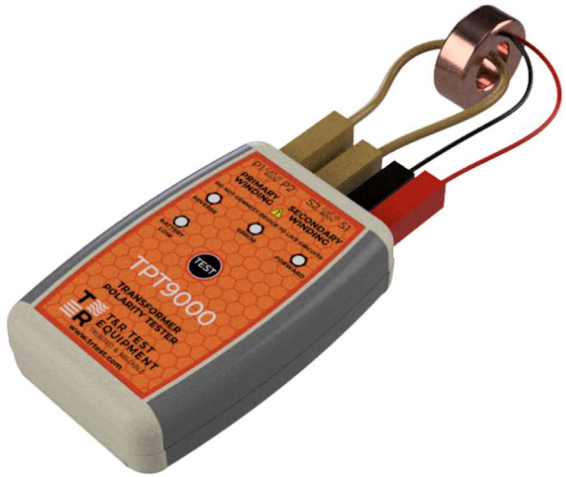

Figure 2.1 TPT9000 connections to a test CT

- Check the CT for Primary polarity markings. If the CT has been marked P1 and P2 or the direction of the current through the CT is known, this should be observed when connecting the TPT9000.
- The Brown output wire from the TPT9000 must be looped through the central hole of the CT. Pass the wire in through the P1 side and out of the P2 side. If the CT does not have its polarity marked but the

2.2 Proving Unit

The function of the TPT9000 can be checked using the included proving unit.

Fit the proving unit into the output terminals of the TPT9000. The switch on the front of the proving unit can be set so that it appears as either a forward or reverse connected transformer.

Select forward or reverse and then press the test button. The corresponding forward or reverse LED will light.

Warning:

The TPT9000 is designed to test transformers that have been disconnected from all power supplies. Do not apply any power to the terminals of the unit.

Figure 1.6 Rapid flashing Amber LED

The Amber LED will rapidly flash for 1 second when the TPT9000 detects that either the transformer under test has a voltage present or that there is a connection between the Primary and Secondary windings. Note that the TPT9000 cannot test auto transformers.

Figure 1.7 Amber LED 1 second flash

The Battery Low LED will light for 1 second when the TPT9000 detects that the internal 9V battery voltage has dropped below a usable level.

1.2 Installation

1.2.1 Environment

The TPT9000 is designed for use in industrial and electrical substation environments.

Category Rating:	CATIII
Maximum altitude:	2000m
Temperature:	0°C to 45°C operating
	-20°C to 60°C storage
Relative humidity:	90% non-condensing
Protection rating:	IP20 in use

1.2.2 Supply requirements

The TPT9000 requires a single PP3 9V battery to operate. The battery level is automatically monitored, the device will not perform a test if the battery voltage has dropped below a useable level.

1.2.3 Connection cable ratings

Test Leads	600V CAT IV fused test leads terminated in shrouded 4mm connectors.

1.2.3 Overload protection

Each of the test leads must be fitted with a F500mA HBC fuse. This must be replaced with a fuse of the same type.

2 Theory of Operation

2.1 Main current output

The TPT9000 first checks that there is no connection between the Primary and Secondary windings. **Note, the TPT9000 cannot test auto transformers.**

If a connection between the windings is detected the test will be stopped and the Amber ERROR LED will flash rapidly.

If no connection is detected between the two windings the TPT9000 will inject a small pulse of current into the Primary winding.

The unit then waits for a resulting pulse on the Secondary winding.

If the detected pulse is in the same polarity to the injected pulse the transformer under test has been connected with Forward polarity. The Green FORWARD LED will light for 1 second.

If the detected pulse is in the opposite polarity to the injected pulse the transformer under test has been connected with Revered polarity. The Red REVERSE LED will light for 1 second.

If a return pulse is not detected the Amber ERROR LED will light for 1 second. Check the connections to the test object.