

Product: ***Micro Cross Arm Tester***

Type: ***MCAT+***



MANUFACTURED BY:

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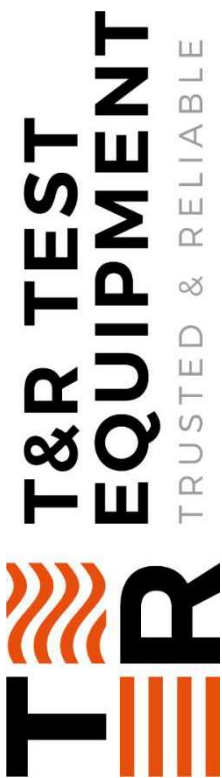
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19 REVISION

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1 IMPORTANT NOTES

Ensure the Probe is only connected to the lowest point on the Cross Arm or the lowest point of bonded steelwork.

Should the Voltage on the Cross Arm exceed 2.7kV the unit will detect this and inhibit the Leakage Current / Prospective Short Circuit Current (ISC) Testing.

The Phase Tests can still be carried out as normal to determine the phase insulator that has excessive leakage current (low resistance insulator).

The Steelwork Test can also be carried out as normal to determine the voltage on the Cross Arm.

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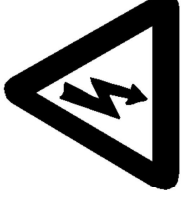
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ALL WARRANTIES IMPLIED BY LAW ARE HEREBY LIMITED TO A PERIOD OF TWELVE MONTHS, AND THE PROVISIONS OF THE WARRANTY ARE EXPRESSLY IN LIEU OF ANY OTHER WARRANTIES EXPRESSED OR IMPLIED.

The purchaser agrees to assume all liability for any damages and bodily injury which may result from the use or misuse of the product by the purchaser, his employees, or others, and the remedies provided for in this warranty are expressly in lieu of any other liability T&R Test Equipment Ltd may have including incidental or consequential damages.

T&R Test Equipment Ltd. reserve the right to discontinue models at any time, or change specification, price or design, without notice and without incurring any obligation.

2 SAFETY RULES



- Only personnel who are fully trained and hold the correct authorisation can use this Tester. The systems that it will be used on are powered from high voltages which are dangerous.
- Before use ensure that the Probe and the accessories that are required for use are clean, free from cracks or deep scores, and are **tightly secured together**.
- Ensure that the Tester is rated for the voltage of the system under test.
- Test the operation of the assembled Tester complete with accessories. See section 10 TESTING FOR CROSSARM LEAKAGE.
- Do not allow a live high voltage conductor to come in contact with the Probe at point below the limit mark. See section 6 PROBE for more information.

- The Probe must never be used without the required insulating rods. A minimum of 3.7m is required.
- Safe working distances must always be observed.
- **Do not attempt to open battery compartments or change batteries whilst probe is connected.**
- **Disconnect the Probe from the crossarm once all test have been completed.**
- **Always connect the earth lead clip to a secure earthing point before performing a test. If the earth clip becomes disconnected during a test never handle the earth clip until the Probe is removed from the line under test.**

REMEMBER

SAFETY IS NO ACCIDENT!

THIS TESTER SHOULD ONLY BE USED BY PERSONNEL WITH THE
CORRECT AUTHORISATION.

16 LIMITED WARRANTY

T&R Test Equipment Ltd warrant instruments and test equipment manufactured by them to be free from defective material or factory workmanship and agree to repair or replace such products which, under normal use and service, disclose the defect to be the fault of our manufacturing, with no charge for parts and service. If we are unable to repair or replace the product, we will make a refund of the purchase price. Consult the Instruction Manual for instructions regarding the proper use and servicing of instruments and test equipment. Our obligation under this warranty is limited to repairing, replacing or making refund of any instrument or test equipment which proves to be defective within twelve months from the date of original purchase.

This warranty does not apply to any of our products which have been repaired or altered by unauthorised persons in any way so as, in our sole judgement, to injure their stability or reliability, or which have been subject to misuse, abuse, misapplication, negligence or accident or which have had the serial numbers altered, defaced or removed. Accessories, not of our manufacture used with this product, are not covered by this warranty. To register a claim under the provisions of this warranty, return the instrument or test equipment to

**T&R Test Equipment Ltd,
15-16 Woodbridge Meadows
Guildford, GU1 1BJ, U.K.**

Upon our receipt and inspection of the product we will advise you as to the disposition of your claim.

Table 14 MCAT+ System Spares

Description	Part Number
10m Probe Lead	A257-0001
3m Earth Lead	A257-0002
5m Probe Extension Lead	A257-0003
Earth Stake	G257-0009
60mm Hook (Used with Probe)	DDM5008
40mm Hook (Used with WPC1000TX)	CMH0297
250mm Electrode Extension	DFH5039
Bowthorpe Rod Adaptor	DDC5025
Universal Star Wheel Adaptor	DDC5025
Polymer Cleaning Kit	DDM5003
MCAT+ Probe	257-P
MCAT+ Base Unit	257-U
Wireless Phase Transmitter	WPC1000TX

3 INTRODUCTION

3.1 GENERAL

The microCross Arm Tester MCAT+ has been designed to measure the voltage and to calculate the leakage current on cross arms or metalwork on unearthed wooden pole on overhead line systems up to 11kV (Phase-to-Phase) to determine faulty Phase Insulators.

Can be used outdoors in all weathers.

3.2 PRINCIPLE OF OPERATION

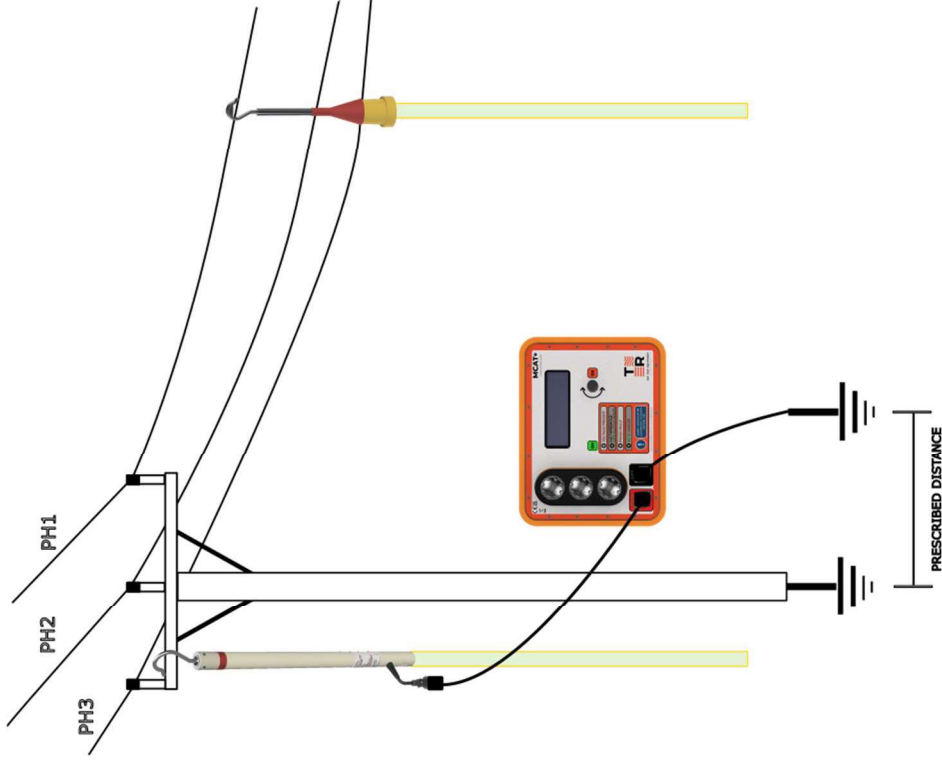


Figure 3-1 Cross Arm Voltage measurement and Phase Measurement

The microCross Arm Tester consists of a High Voltage Probe and a Base Unit. The Probe is hooked onto the Pole Cross Arm and connected to the Base Unit via a special connecting lead. The Base Unit is connected to earth using the Earth Lead with Croc Clip. This ensures a continuous path to Earth from the bonded steelwork via the base unit.

14 CARE AND MAINTENANCE

14.1 STORAGE

The Tester and its accessories should be stored in the proprietary carrying case/bag when not in use, away from damp and changes in temperature.

14.2 TRANSPORTING

When the equipment is in transit it should be stored in its carrying case/bag. Whilst the equipment has been designed for field use it should not be subjected to excessive bumps and shocks.

14.3 CLEANLINESS

Dirt can cause surface tracking on the Probe, and it is therefore necessary to keep the Probe other accessories clean by using the liquid polymer polish provided.

14.4 MECHANICAL DAMAGE

If surface scratches or dents can easily be seen by the naked eye, then the equipment should be returned to the manufacturer for repair since these blemishes act as traps for dirt and moisture. Mechanical damage to screw threads would also necessitate the return of the equipment to the manufacturer.

14.5 RECALIBRATION AND PROOF TESTING

Every twelve months the Tester and its accessories must be rechecked and recalibrated. It is recommended that this be carried out by the manufacturer.

13.4 SAFETY

Table 13 MCAT+ Safety Specifications

EMC	EN IEC 61326-1: 2021(Group 1 Class A) IEC 61000-4-2 IEC 61000-4-3 IEC 61000-4-4 IEC 61000-4-5 IEC 61000-4-6
	FCC CFR 47 Part 15B October 1, 2023
SAFETY	EN 61010-1:2010/A1:2019/AC:2019
RADIO	EN 300 220-2 V3.2.1 (2018-06) ETSI EN 301 489-1 V2.2.3 ETSI EN 301 489-3 V2.1.1

The microCross Arm Tester measures the voltage of the tested object (metal cross arm / bonded steelwork) using resistive chain methods. The Probe contains a resistor chain and a voltage divider is established within the unit; thus, a Earth connection is required for safety and accuracy of the unit.

By measurements from the Cross Arm voltage, the microCross Arm Tester calculates the **Prospective Short Circuit Current (ISC)** in the POLE. It will display it on the LCD, and it will provide warning messages accordingly, with the aid of LEDs, Buzzer and LCD.

The WPC1000TX can then be used in conjunction with the base unit and probe to identify which phase/source is contributing the voltage on the steelwork indicating which insulator is faulty.

3.3 THEORETICAL DIAGRAM

Cross arm leakage detection applies to metal cross arms on three phase, or single phase overhead line systems up to 11kV Phase-to-Phase.

13.3 ENVIRONMENTAL

Table 12 MCAT+ System Environmental Specifications

Operating Temperature	-10°C to +45°C
Relative Humidity	90% non-condensing
Water Ingress	To IEC 529 'wet' testing according to IEC Technical Committee No 78, i.e. all items may be used outdoors in all weathers
Maximum altitude	2000m
Cold Temperature	To IEC 68-2-1
Dry Heat	To IEC 68-2-2
Damp Heat	To IEC 68-2-3

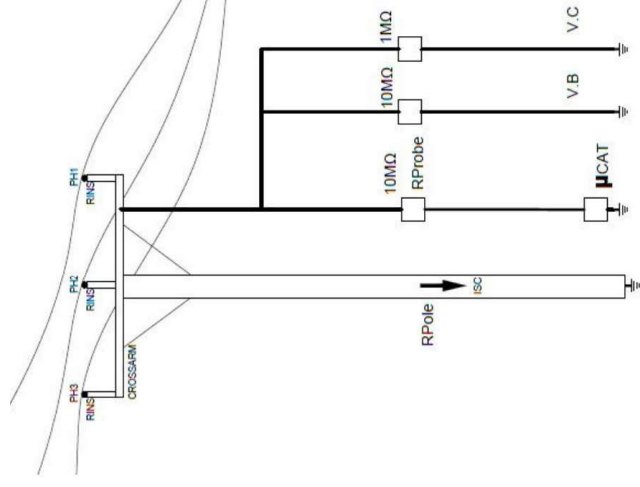


Figure 3-2 Micro Cross Arm Tester Theoretical Operation

Housed within the High voltage Probe are three resistor banks. The various resistor banks are switched in during different tests to determine the value of ISC.

ISC is a calculated value derived from voltage measurements on the bonded steelwork.

When testing for phase contribution with the Transmitter, the HV Probe must remain connected to the bonded steelwork. The waveform from the HV Probe is sampled by the Base unit. When a voltage is detected by the Transmitter, the measured waveform is also sampled and transmitted back to the Base unit. The Base unit compares the HV Probe waveform and the Transmitter waveform to measure the phase angle between the two wave forms.

13.2 MECHANICAL

Table 9 MCAT+ Base Unit Mechanical Specifications

BASE UNIT	
ACRYLIC Panel and ABS Case	Sealed Proprietary Case and Panel
Dimensions	336 x 300 x 148mm
Weight	3.2kg
IP Rating	Case Open / Case Closed IP54 / IP67

Table 10 HV Probe Mechanical Specifications

PROBE	
Length	850mm
Weight	1000gm
Material	Resin bonded fibreglass, Aluminium, ABS

Table 11 WPC1000TX Mechanical Specifications

WPC1000TX	
Length	180mm
Diameter	100mm
Weight	1000gm
Material	ABS

4 EQUIPMENT LIST

- Base Unit (257-U)
- HV Probe (257-P) with 60mm Hook (DDM5008)
- TX Transmitter Unit (WPC1000TX)
- 250mm Electrode Extension (DFH5039) with 40mm Hook (CMH0297)
- HV Probe Connecting Lead (A257-0001)
- Earth Lead (A257-0002)
- HV Probe Connecting Lead 5m Extension (A257-0003)
- Carry Case
- Cleaning kit



Figure 4-1 Base Unit



Figure 4-2 HV Probe with 60mm Hook

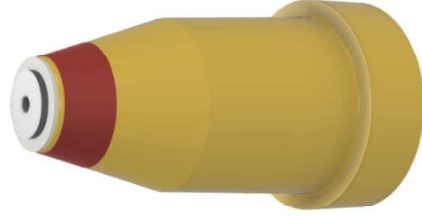


Figure 4-3 TX Transmitter Unit



Figure 4-4 250mm Electrode Extension with 40mm Hook

Phasing Indication	Positive indication for correct phase relationship
IN Phase	When the phase shift angle is (less than or equal to) $\leq 30^\circ$
Out of Phase	when the phase shift angle is (greater than) $> 31^\circ$
Current Consumption	45mA maximum
Battery Low	7.2V nominal (Arming via the testing/arming button is inhibited at this voltage but self-arming from signals is maintained down to 6.8V.)
Battery	9 V manganese alkaline PP3-C IEC 6LF22
Visual Indication	Transmitter— Voltage Present: 2x Red LED's No Voltage Present: No LED's
EMC	Meets BS EN 50081-1 BS EN 50082-2

Audible Indication	Buzzer present when UNSAFE is indicated >65dB at 5 metres
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Table 8 WPC1000TX Transmitter Electrical Specifications

WPC1000TX	
Threshold Voltage	For the 11kV / 33kV voltage comparator the threshold voltage has been set in the range 1.3kV. The threshold may be set to a value agreed with the customer. Accuracy of threshold voltage: $\pm 10\%$ of nominal set level.
Operating Time	Transmitter and Receiver will only operate if the Proving Button is pressed or a voltage above the Threshold is encountered.
Response Time	Less than 1 second.
Spark Protection	The comparators will not be damaged as a result of spark discharge while making contact with the conductor under test.
Bridging Protection	The comparators and their accessories will not cause flashover or breakdown between live parts of the installation or between live parts of the installation and earth.
Range	30m in air (To Be Determined) Along a Network to Be Determined
Operating Frequency	433.9MHz

5 MICRO CROSS ARM TESTER –BASE UNIT

The microCross Arm Tester Base Unit is rated for use on Systems up to 11kV Phase-to-Phase when used with the Provided HV Probe.

The MCAT+ Base unit is the main component in the MCAT+ test system. It houses the batteries for powering the base unit and probe. It also contains the main display for displaying results, LED indicators for displaying results as well as a Buzzer for audible warnings. There are also buttons and an encoder for navigating the various menus of the unit and to begin tests and take measurements.

The HV Probe and Earth Leads also connect to the Base unit. A WPC1000TX Phase comparator can also be paired to the Base unit.

5.1 FRONT PANEL LAYOUT



Figure 5-1 MCAT+ Main Unit Front Panel

Table 1 MCAT+ Main Unit Front Panel Component Functions

Key	Component	Function
1	3x Battery Compartments	6 x 1.5 Volts, IEC LR14 C Cell Alkaline to power the unit
2	LCD Display Screen	Displays information; See Section 5.4 LCD MENUS
3	ON Button	Only used to turn the unit ON
4	Encoder	Used to navigate menus on LCD screen. Turning the encoder clockwise (→) moves the pointer down (↓); turning the encoder counter-clockwise (←) moves

13 TECHNICAL SPECIFICATIONS

13.1 ELECTRICAL

Table 7 MCAT+ Base Unit Electrical Specifications

MCAT+ Base Unit	
System VOLTAGE	For use on 11kV – System Voltages
Frequency	For 50Hz systems
DC Response	Does NOT respond to DC
Max Cross Arm Voltage	2.7kV (above which ISC Test Inhibited)
Resistor Chain Values	2 x 10MΩ (±5%) 1 x 1MΩ(±5%)
Voltage Accuracy to 11kV (Phase-to-Phase)	±1%
Voltage Accuracy over 11kV (Phase-to-Phase).	±5%
Phase Measurement Accuracy	±10°
ISC	Calculated Prospective Short Circuit Current in the unearthed wooden pole
LCD Display	Graphic LCD Display Module 240 x 64
Battery	6 x 1.5 Volts, IEC LR14 C Cell Alkaline
Battery Consumption	Less than 400mA on Max Momentary Load Operation

- Check the WPC1000TX battery.
- Bring the WPC1000TX closer to the base unit.

If the Transmitter and Base unit cannot be paired, the system must be returned to the manufacturer for inspection.

12.6 TURNING UNIT ON

If the Base unit fails to turn on:

- Check the Earth Lead is plugged in and is secure in the Earth Socket.
- Check batteries are present and are the correct polarity.

		the pointer up (^).
5	OK Button	Used to enter sub-menus and start actions
6	Indicator LEDs	The Base Unit has 4x LEDs that will give the following indications: <u>VOLTAGE PRESENT</u> - o SOLID RED for voltage present on steel work - o mA THRESHOLD (indicating safe limits of leakage current at the pole base) - o SOLID GREEN for SAFE - o SOLID AMBER for CAUTION - o SOLID RED for UNSAFE <u>PHASE FAULT</u> - o SOLID AMBER for 'in phase' reading <u>SAFE UNSAFE</u> - o SOLID GREEN for SAFE - o FLASHES RED for UNSAFE See 12 RESULTS / TROUBLESHOOTING for more information.
7	High Voltage Probe Socket	Used to connect to the High Voltage Probe via the Probe Lead. It will not accept the Earth Lead
8	Earth Socket	Used to connect to an Earth connection via the Earth Lead. The Earth lead must be plugged into this socket to turn the unit ON.

5.2 BATTERIES



DO NOT ATTEMPT TO OPEN BATTERY COMPARTMENT OR CHANGE BATTERIES WHILE HV PROBE IS IN CONTACT WITH TEST OBJECT

There are three separate battery banks on the front panel. Each bank consists of two 1.5 Volts, IEC LR14 C Cell Alkaline batteries.



Figure 5-2 Battery Holders

To access the batteries, unscrew the covers by turning the caps counter-clockwise.

With the caps removed, the batteries can be accessed and replaced if necessary. The batteries are inserted with the negative end towards the bottom of the holder. The unit has reverse polarity protection.

If the calculated ISC is above 5mA, then the red mA Threshold LED will light, and the buzzer will sound. The main menu will display a *DANGER* sign.

Only if the ISC value found is bigger than 0.3mA continue to identify the faulty phase.

12.4 PHASE TEST RESULTS

The phase check is only required when an ISC bigger than 0.3mA is obtained or if the Cross Arm Voltage exceeds the limit (2.7kV).

The unit will display the reading taken (phase difference between the voltage on the pole and the voltage connected to the WPC Tx Transmitter) in the same line with the phase selected (in this case, in the same line with *Test Phase 1*).

Repeat the procedure for the remaining two phases.

If a phase difference smaller than 30° is measured, then Phase Fault LED will indicate, and the buzzer will beep.

```
Tx OK
> Test WPC Transmitter
  Test Phase 1    0°
  Test Phase 2   120°
  Test Phase 3  -120°
  Back
```

Figure 12-3 Example Results of Phase Comparison Test

$-30^\circ < \phi < 30^\circ$ indicates that the phase being measured is IN-PHASE with the HV Probe, indicating that the phase measured is a major contributor to the voltage measure don the steelwork.

12.5 WPC PAIRING / TROUBLESHOOTING

If the Transmitter fails to be found by the base unit:

12.2 STEELWORK VOLTAGE RESULTS

If the voltage exceeds 0.3 kV the voltage present LED will turn on (see Table 6 LED and Buzzer overview). The main menu will display a **CAUTION** sign.

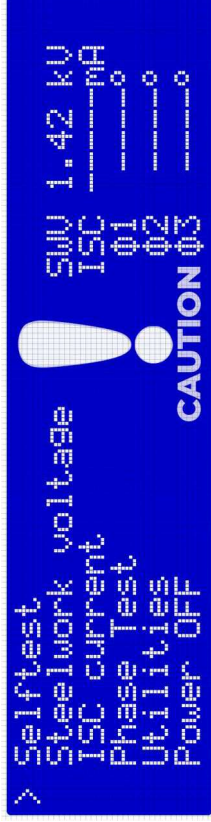


Figure 12-1 Voltage Caution Screen

If the voltage exceeds 2.7 kV, the voltage present LED will turn on, the buzzer will turn on and the ISC test will be prohibited; the phase test can still be carried out normally. The main menu will display a **DANGER** sign.

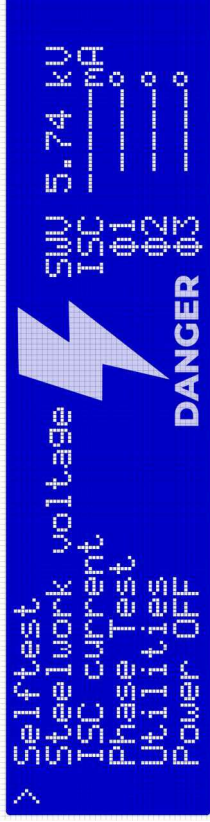


Figure 12-2 Voltage Danger Screen

12.3 ISC CURRENT RESULTS

During the current calculation, the voltage is checked again, if the voltage exceeds 2.7 kV, the current cannot be calculated. The ISC current will be displayed in mA.

If the calculated ISC is between 0.3 mA and 5mA, then the amber mA Threshold LED will light (see Table 6 LED and Buzzer overview). The main menu will display a **CAUTION** sign.

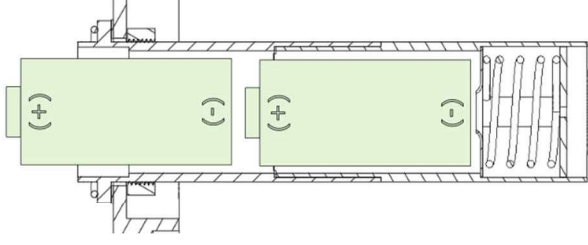


Figure 5-3 Battery orientation

See 5.4.9 BATTERY WARNING for more information about checking the battery levels.

5.3 SOCKETS

The Earth Lead **MUST** be plugged into the Earth Socket for the Base Unit to turn ON.



Figure 5-4 HV Probe and Earth Sockets

There are two user accessible sockets. They are designed such that only the correct supplied lead can be mated to the corresponding socket.

5.4 LCD MENUS

5.4.1 MAIN MENU

Press the ON Button on the Micro Cross Arm Tester.

The LCD will display T&R Logo and unit name, then, the unit will display the *Main Menu*.



Figure 5-5 Main Menu Screen

After tests are performed, the *Main Menu* also displays the results of previous tests.

Table 6 LED and Buzzer overview shows at which thresholds the various LED indicators and Buzzer will indicate on the MCAT+ base unit.

The WPC1000TX Transmitter's LEDs will turn on when they detect a voltage of $>1\text{kV} \pm 10\%$. See Table 3 Transmitter Components.

12.1 SELFTEST RESULTS / TROUBLESHOOTING

Prior to any testing the Selftest needs to be carried out. This test will check the functionality of the buzzer, LEDs and it will check the probe integrity. The unit should be connected as described in section 10 TESTING FOR CROSSARM LEAKAGE (all the leads connected to the base unit, but the HV Probe disconnected from steelwork and the Earth disconnected from Earth electrode).

The functionality of the buzzer and the LEDs must be assessed by the user carrying the Selftest. The functionality of the probe is checked by the Base Unit. Depending on the functionality of the probe, the screen will display PROBE FAULT or PROBE OK.

If PROBE FAULT is displayed:

- Ensure Earth Lead is not connected to Earthing point/electrode.
- Ensure HV Probe electrode is not touching any steelwork.
- Ensure all lead connections between base unit and HV Probe are tight and secure.

If **PROBE FAULT** is continued to be displayed, there is a fault and tests cannot continue. Return the system to the manufacturer for inspection.

If **LEDs** do not light up, return the system to the manufacturer for inspection.

If **Buzzer** does not sound, return the system to the manufacturer for inspection.

12 RESULTS / TROUBLESHOOTING

Table 6 LED and Buzzer overview

Measurements	Lighting Sequence					Audio
	Test	Result	VOLTAGE PRESENT	mA THRESHOLD	PHASE FAULT	SAFE / UNSAFE
Steelwork Voltage (kV)	0.3 to 2.7	SOLID RED	SOLID RED			
Steelwork Voltage (kV)	>2.7	SOLID RED				FLASHES RED
ISC (mA)	<0.3		SOLID GREEN			SOLID GREEN
ISC (mA)	0.3 to 5		SOLID ORANGE			
ISC (mA)	>5		SOLID RED			FLASHES RED
Phase angle (kV>0.1 -30° <φ<30°					SOLID ORANGE	FLASHES RED
						ON

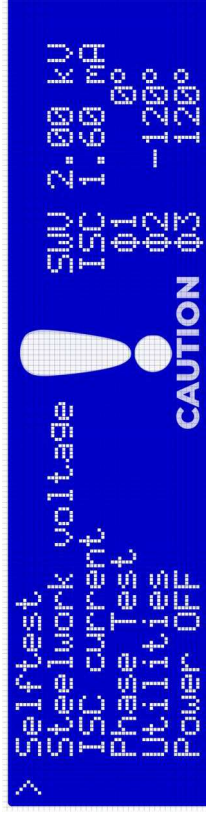


Figure 5-6 Results displayed on Main Menu

5.4.2 SELFTEST MENU

The Selftest menu contains instructions on how to perform the Selftest function. The Selftest Function is also started from within the Selftest menu.



Figure 5-7 Selftest Screen

Results for the Probe obtained during the Selftest are also displayed within the *Selftest* menu. See section 12.1 SELFTEST RESULTS / TROUBLESHOOTING for understanding the results.



Figure 5-8 Selftest Screen showing PROBE FAULT


```

Connect earth lead and probe to the
mCAT. Leave the other ends of the
lead disconnected.
> Start test      PROBE OK
Back

```

Figure 5-9 Selftest showing PROBE OK

Selecting Back exits to the *Main Menu*.

This result is also displayed on the Main menu once the Selftest menu has been exited.

```

> Selftest  PROBE FAULT  SWU  -----kV
Steelwork voltage      ISC  -----mA
ISC current            01  -----°
Phase Test             02  -----°
Utilities               03  -----°
Power OFF

```

Figure 5-10 Main Menu with PROBE FAULT Warning

5.4.3 STEELWORK VOLTAGE MENU

The *Steelwork voltage* menu contains instructions on how to setup for the Steelwork voltage test. The Steelwork voltage test is also started from within the *Steelwork voltage* menu.

```

Connect earth lead to earth point.
max 50cm from the pole. Connect the
HV probe to the crossarm steelwork.
> Start test      kV
Back

```

Figure 5-11 Earth Lead Instruction Screen

Results obtained are also displayed within the *Steelwork voltage* menu.

2. Assemble system components as described in 8 ASSEMBLING THE SYSTEM.
3. Navigate and enter Phase Test menu.
4. If “Tx not found” is displayed, Pair the Transmitter and Base unit.
5. Raise the WPC Transmitter and connect to live line phase 1 (as shown in Figure 11-1 Testing for Phase Comparison with the MCAT+ and Transmitter).
6. Navigate to Test phase 1 and press OK (see 5.4.5 PHASE TEST MENU and 5.4.6 TEST WPC TRANSMITTER MENU).
7. Remove the WPC Transmitter from phase 1. Raise the WPC Transmitter and connect to live line phase 2.
8. Navigate to Test phase 2 and press OK.
9. Remove the WPC Transmitter from phase 2. Raise the WPC Transmitter and connect to live line phase 3.
10. Navigate to Test phase 3 and press OK.
11. Remove the WPC Transmitter from phase 3.
12. Exit Phase Test menu.
13. Remove HV Probe from steelwork.
14. Navigate to Power OFF and turn unit off.

11 TESTING FOR PHASE COMPARISON

Testing for Phase comparison can only be done after testing for Cross arm leakage (see 10 TESTING FOR CROSSARM LEAKAGE).

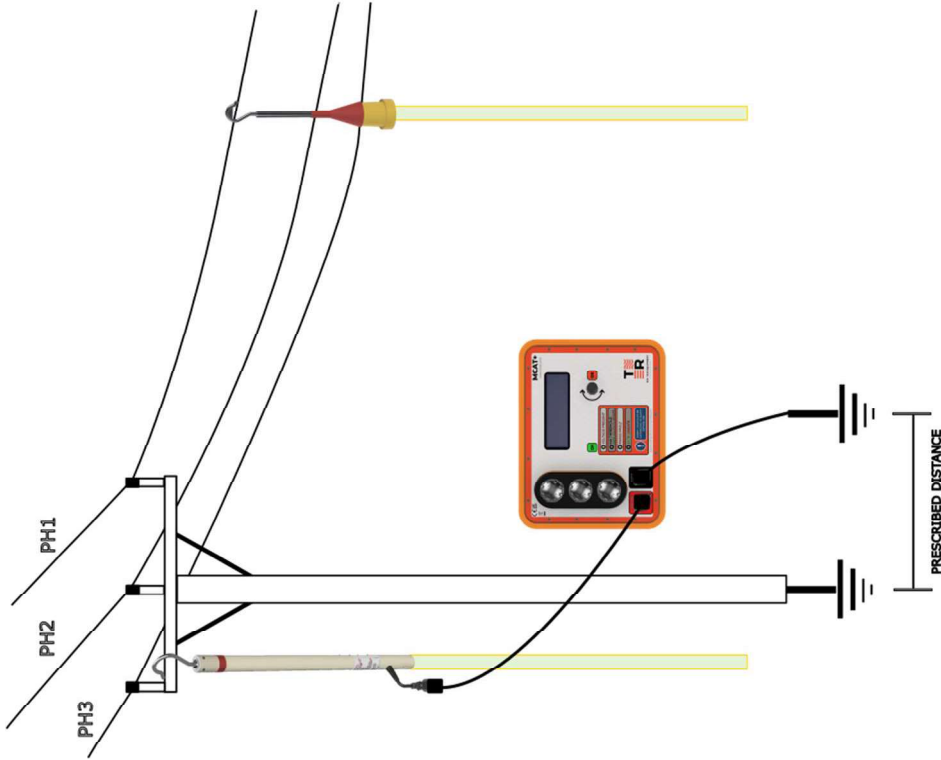


Figure 11-1 Testing for Phase Comparison with the MCA T+ and Transmitter

1. With system set up as described in 10 TESTING FOR CROSSARM LEAKAGE.

```
Connect earth lead to earth point
max 50cm from the pole. Connect the
HV probe to the crossarm steelwork.

> Start test      2.13    kV
Back
```

Figure 5-12 Cross Arm Voltage Measurement

Selecting Back exits to the *Main Menu*.

5.4.4 ISC CURRENT MENU

The *ISC current* menu contains instructions on how to setup for the ISC current test. The ISC current test is also started from within the *ISC current* menu.

```
Connect earth lead to earth point
max 50cm from the pole. Connect the
HV probe to the crossarm steelwork.

> Start test      mA
Back
```

Figure 5-13 ISC Testing Screen

Results obtained are also displayed within the *ISC current* menu.

```
Connect earth lead to earth point
max 50cm from the pole. Connect the
HV probe to the crossarm steelwork.

> Start test      1.24    mA
Back
```

Figure 5-14 ISC Current Results Screen

Selecting Back exits to the *Main Menu*.

5.4.5 PHASE TEST MENU

The *Phase Test* menu contains information regarding testing for phase comparison. It has functions to pair the base unit with the WPC1000TX and to also measure the phase angles between the WPC1000TX and the HV Probe.

```
Tx not found
> Test WPC Transmitter
Test Phase 1  -----°
Test Phase 2  -----°
Test Phase 3  -----°
Back
```

Figure 5-15 *Phase Test menu*

Results obtained are also displayed within the *Phase Test* menu.

```
Tx OK
> Test WPC Transmitter
Test Phase 1    0°
Test Phase 2   120°
Test Phase 3  -120°
Back
```

Figure 5-16 *Example Results of Phase Comparison Test*

Refer to section 12.3 ISC CURRENT RESULTS For more information regarding results.

Selecting Back exits to the *Main Menu*.

4. Turn unit ON.
 5. If connected, **Disconnect EARTH from EARTH Electrode**, ensure the HV Probe is not touching any steelwork and perform Selftest.
 6. **Connect Earth lead to Earth Electrode**.
 7. Connect the test probe to the operating rods.
 8. Raise the electrode to lowest item of steelwork supporting live conductors and hang the probe on the steelwork in preparation for testing.
 9. Navigate to Steelwork voltage menu and press Start test. See 5.4.2 SELFTEST MENU.
- See 12.1 SELFTEST RESULTS / TROUBLESHOOTING for interpretation of results.
10. Exit Steelwork voltage menu.
 11. Enter ISC current Menu.
 12. Press Start test.
 13. Exit ISC current Menu.
 14. If testing for which Phase is contributing, see 11 COMPARISON, otherwise remove HV Probe from steelwork.
 15. Navigate to Power OFF and turn unit off.

5.4.6 TEST WPC TRANSMITTER MENU

This menu is accessed from within the *Phase Test* Menu (see section 5.4.5 PHASE TEST MENU)

It contains information on how to pair the Base Unit with the WPC1000TX as well as the function to begin pairing.

10 TESTING FOR CROSSARM LEAKAGE

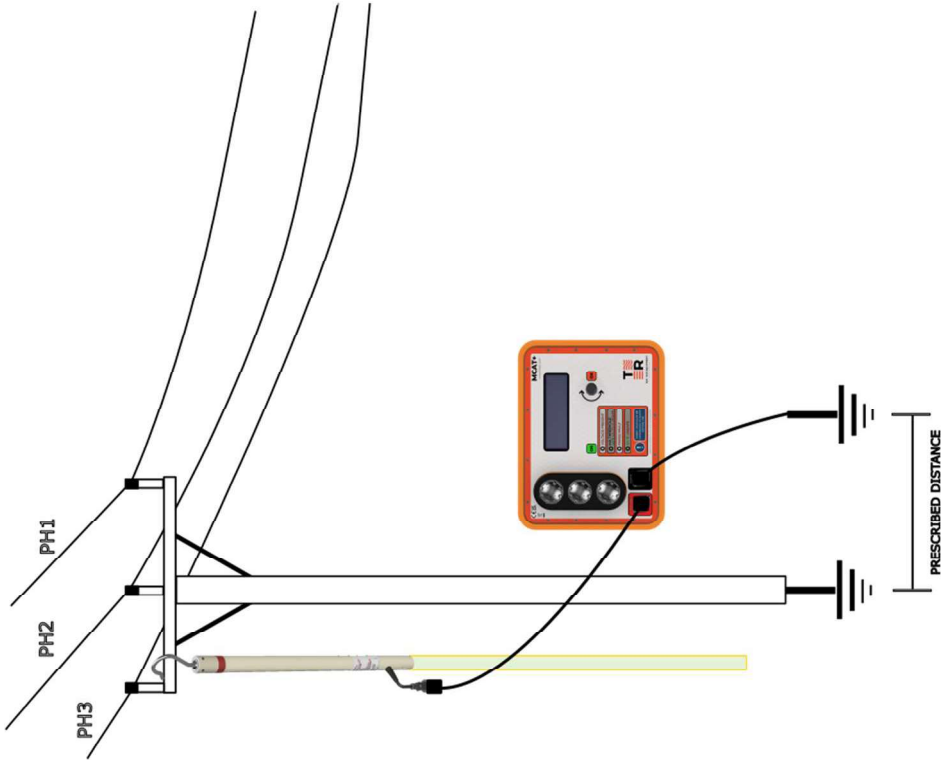


Figure 10-1 Testing for Crossarm Leakage with the MCAAT+

1. Inspect device components are suitable for use.
2. Assemble system components as described in 8 ASSEMBLING THE SYSTEM.
3. Select a position for the earth electrode no more than 50 cm from the pole and insert the earth electrode 150mm into the ground. See Figure 10-1 Testing for Crossarm Leakage with the MCAAT+.



Figure 5-17 Test WPC Transmitter menu

Selecting Back exits to the Phase Test menu.

Refer to section 8.4 PAIRING THE TRANSMITTER AND BASE UNIT for more information about proving communication.

5.4.7 UTILITIES MENU

The *Utilities* menu contains information about the Base unit and Probe.

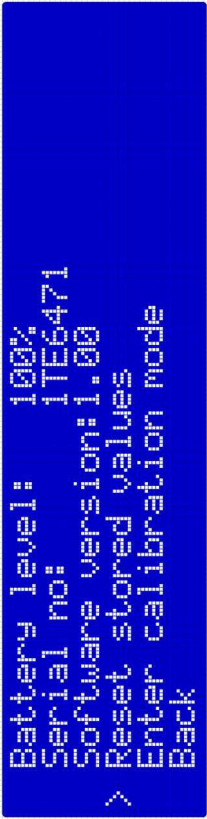


Figure 5-18 Utilities Menu

Table 2 Utilities Menu Information

Key	Function
Battery level	Displays the current battery level of the base unit. See 5.4.9 BATTERY WARNING for more information. Also see 5.2 BATTERIES for more information about the batteries used.
Serial no	This is the serial number of the Base unit. It can be adjusted in Calibration Mode

Software version	Displays the current software version of the base unit. It can only be updated with new software.
Reset stored values	Figure 5-6 Results displayed on Main Menu shows how results from previous tests are saved onto the main menu. Selecting Reset Stored values clears all results on the Main menu. This will also clear all LEDs and warnings.
Enter calibration mode	Selecting this enters a password protected screen. Only to be used by authorised personnel. If accidentally entered, press OK until you are returned to the <i>Utilities</i> menu.
Back	Exits to the <i>Main Menu</i> .

5.4.8 POWER OFF

The unit can be turned off by selecting *Power OFF* in the *Main Menu*.

The unit also has an auto power off function that will turn the unit off if it has been more than 5 minutes from the last user input.

The unit will also turn off if the battery gets to 0% level (6.3V).

5.4.9 BATTERY WARNING

If there is a battery warning in the top right of the screen, the unit will automatically shut down; change the batteries before proceeding. See 5.2 BATTERIES.

9 OVERVIEW OF TESTING / FLOW CHART

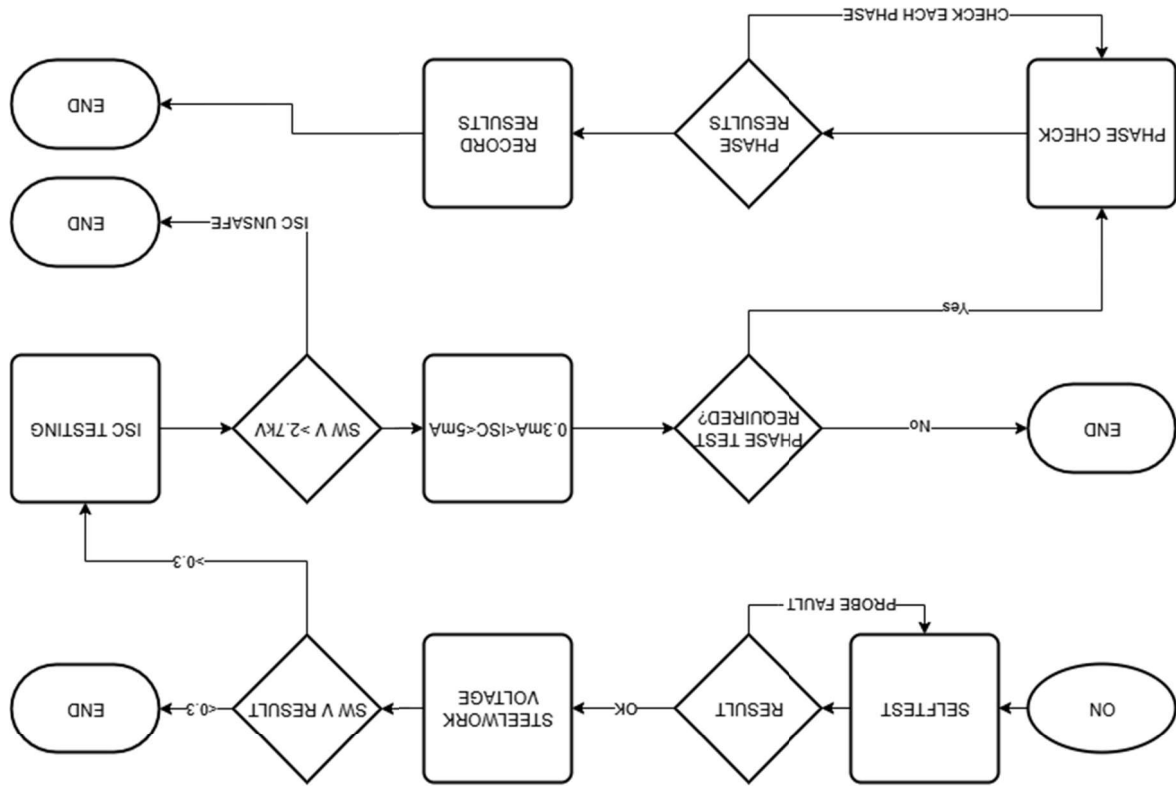


Figure 9-1 Overview of Steelwork and Phase testing.

communication between them, then Tx not found would be displayed on the screen (Fig. 4.2.a).

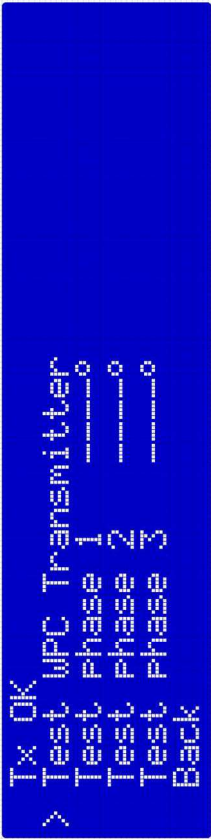


Figure 8-6 WPC Link Established

After the Tx has been proven once, all the phase tests can be carried without proving the Tx again. The Tx will have to be proven again once the unit is power cycled or the user has left the Phase test menu.

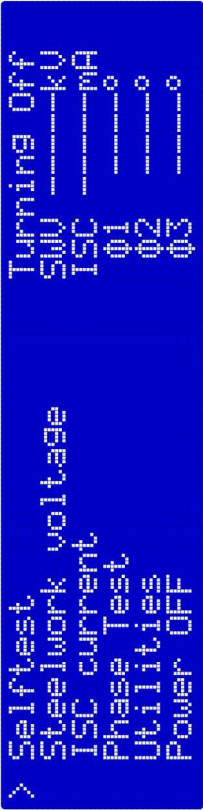


Figure 5-19 0% Battery Turning Off Warning

The battery level can also be checked at any time in the Utilities menu.

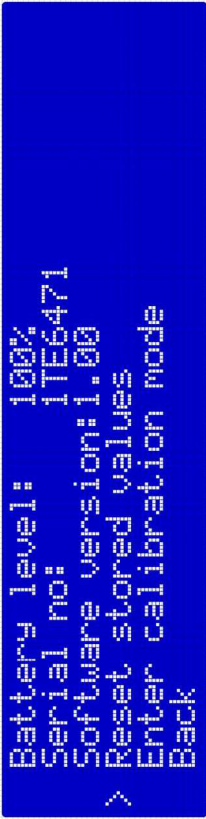


Figure 5-20 Utilities Menu with 100% Battery level

In the utilities menu the battery level is displayed in percentage. The percent could drop down to 0%. **The 0% does not imply that the batteries are totally drained (0V) but implies that the MCAT+ should not and cannot perform the functions it is supposed to.**

The unit will display on the Main menu Low battery when the battery gets to 20% (7.2V out of 9V)

8.4 PAIRING THE TRANSMITTER AND BASE UNIT

It is recommended to prove the communication between the Tx and the Base Unit anytime the unit is turned on. By doing this, the unit will be ready to perform a phase test right after the voltage or the current exceed the stated limits.

The Tx Transmitter communication must be checked before a phase test is carried out. If the communication between the Tx Transmitter and the base unit has not been proven, then the unit will prohibit the user to carry out a phase test.

Note: The MCAT+ will display *Tx not found* in the *Phase Test* menu by default. Only after the WPC communication has been proven, the message will change to *Tx OK*.

Select *Phase Test* from the main menu. In *Phase Test* menu select *Test WPC Transmitter*:

```
Tx not found
> Test WPC Transmitter
Test Phase 1  -----o
Test Phase 2  -----o
Test Phase 3  -----o
Back
```

Figure 8-4 Test WPC Transmitter

Press and hold the WPC Tx button. While pressing the Tx button select *Start WPC pairing* on the microCross Arm Tester.

```
Press and hold the WPC button.
Press WPC pairing option.
> Start WPC pairing
Back
```

Figure 8-5 Pair WPC TX to Base Unit

If the Tx communicates with the microCross Arm Tester, then Tx OK (Fig. 4.2.c). will be displayed on the screen. If there is no

flash for approximately 5 seconds, after which time both RED LED's will remain continuously lit, and the Transmitter will send a signal to the receiver in the Base Unit.

Select a contact electrode to suit the application (40mm hooks are supplied as standard) and screw it to the comparator. If the straight or "Y" electrode is selected it may be necessary to use a 100mm or 250mm contact electrode extension so that the contact electrode can be seen more easily from ground level. This short extension is screwed to the comparator and the contact electrode screwed to it. Attach the required number of extension poles to the comparator using an adaptor or handle. If tests are to be carried out on system voltages in areas where interference fields could affect the indications, then a contact electrode extension should be used.



Figure 8-2 WPC Assembly with accessories

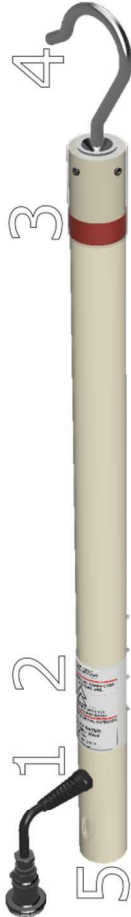


Figure 8-3 WPC Assembly with extension and electrodes

The **Comparator Transmitter** is supplied with two types of Pole adaptors and a 40mm Hook as standard, other accessories can be supplied on request.

6 PROBE

The probe is rated for use on Systems up to 11kV Phase-to-Phase.



Key	Component	Function
1	HV Probe Flying Lead	The probe is connected to the base unit via the HV Probe lead. A 5m Extension can be used to increase the overall HV Probe length. The leads and probe connections are designed such that they can only be made one way; do not force connections.
2	Label	Contains information including model number and serial number.
3	Limit Mark	55mm from the contact end of the Probe there is a red band which is the limit mark. This mark indicates the physical limit to which these items may be inserted between live components or may touch them.
4	60mm Hook	The HV Probe is used with a 60mm Hook. It has an M8 fitting. Other electrodes can be supplied.
5	Handle	Designed in such a way that Bowthorpe style poles can be inserted and used to lift the HV Probe to the appropriate height.

The probe is made out of insulated materials. The probe contains resistor chains and switching relays for switching in different resistor chains. **The internal components are sensitive; care must be taken to not drop the probe.**

8 ASSEMBLING THE SYSTEM

8.1 BASE UNIT

Inspect the Base unit for any signs of cracking or water ingress.

Connect the Earth lead to the Earth Connection. The Base unit can only be turned on if the Earth Lead has been inserted into the Earth Socket.

Connect the HV Probe Lead to the HV Socket on the Front Panel.

8.2 PROBE

Inspect the Probe for any cracks.

Inspect the Probe for any water damage.

Select a contact electrode to suit the application (a 60mm hook is supplied as standard) and screw it to the probe.



Figure 8-1 Attach the hook to the HV Probe

Attach the required number of extension poles to the probe using an adaptor or handle. A minimum of 3.7m is required.

Connect the HV Lead to the flying lead that extends from the base of the probe. Use 5m Extension Lead if required.

8.3 TRANSMITTER

Inspect the Transmitter for any signs of cracking.

Press the Proving button to check the function of the internal circuitry and the condition of the battery. The 2x RED LEDS will

FIXED	(860mm)		
-------	---------	--	--

Note: Items marked * come as standard in MCA T+ kit.

7 WPC1000TX TRANSMITTER

The WPC1000TX Transmitter is rated for use on Systems up to 33kV Phase-to-Phase.



Figure 7-1 WPC1000TX Transmitter



Figure 7-2 WPC1000TX Transmitter components

Table 3 Transmitter Components

Key	Component	Function
1	Limit Mark	By definition the limit mark indicates the physical limit to which the comparator may be inserted between live components or may touch them. However, when the comparator is used with a contact electrode extension the shroud of the extension covers the limit mark. In some models the shroud is clear, and the limit mark is still visible but in others it is coloured red and the shroud itself constitutes the limit mark.
2	Thread	Used for attaching pole adapters. See Table 5 WPC1000TX Accessories for information about which accessories can be used with the WPC1000TX.

ELECTRODE			
HOOK CONTACT ELECTRODE	100mm	DDM 5010	ALL
PROVING UNIT		HVP 03	
POLE ADAPTOR	BOWTHORPE	DDC 5025	ALL
POLE ADAPTOR	UNIVERSAL STAR WHEEL	DDC 5054	ALL
POLE ADAPTOR	KARL PFISTERER	DDC 5039	ALL
POLE ADAPTOR	CHANGE	DDC 5055	ALL
ADAPTORS FOR OTHER POLE SYSTEMS AVAILABLE TO ORDER			
EXTENSION POLES			
TOP BOWTHORPE	1200mm	CMH 5045	USED IN COMBINATIONS
INTERMEDIATE BOWTHORPE	1200mm	CMH 5046	WORKING DISTANCES BEING OBSERVED
BOTTOM BOWTHORPE	1200mm	CMH 5047	
(FOAM FILLED) BOWTHORPE	1200mm	CMH 5051	FOR ALL VOLTAGES,
HANDLE - FIXED - (FOAM FILLED)	1200mm (860mm)	DDM5013	UP TO 33kV (1)
HANDLE -	1200mm	DDM5018	UP TO 33kV (2)

7.4 TRANSMITTER ACCESSORIES

Table 5 WPC1000TX Accessories

NAME	DESCRIPTION	PART No	USED ON SYSTEM VOLTAGES
CONTACT ELECTRODE EXTENSION	100mm RED SHROUD	DFH 5053	ALL
*CONTACT ELECTRODE EXTENSION	250mm RED SHROUD	DFH 5039	ALL
CONTACT ELECTRODE EXTENSION	650mm RED SHROUD	DFH 5054	UP TO 33kV
CONTACT ELECTRODE EXTENSION	1000mm RED SHROUD	DFH 5034	UP TO 33kV
STRAIGHT CONTACT ELECTRODE		CMH 0110	ALL
"Y" CONTACT ELECTRODE		CMH 0111	ALL
*HOOK CONTACT ELECTRODE	40mm	DDM 5009	ALL
HOOK CONTACT	60mm	DDM 5008	ALL

3	Button	Used for proving the Indicator lamps and for pairing the Transmitter to the Base unit. See 8.4 PAIRING THE TRANSMITTER AND BASE UNIT for more information about pairing.
4	Battery Compartment	Houses the battery for the Transmitter. 9 V manganese alkaline PP3-C IEC 6LF22.
5	Indicating Lamps	When the Transmitter is presented to a Live Line, if the voltage on the Line is greater than the set Threshold voltage (1kV $\pm$ 10%), both RED LEDs on the Transmitter will Flash for approx. 5 seconds then come on continuously. At this time the Transmitter sends a radio signal to the Receiver regarding the condition of the line.

The WPC1000 range of capacitive high voltage wireless comparators have been designed to meet the requirements of IEC standard 61481. They may be used indoors and outdoors in all weathers.

The comparators are intended for use on high voltage systems but not in switchgear.

The function of the comparator is to determine whether a conductor is energised or de-energised and to detect and indicate the correct phase relationship between bonded steelwork measured by the HV Probe and an energised line, using a Transmitter and the Base Unit as a Receiver.

7.1 WPC1000TX PRINCIPLE OF OPERATION

A cone shaped plastic moulding house the Transmitter comparator. The inner wall of the cone has a metallic screen coating to which the earthy parts of the circuit are connected. This screen coating is capacitively coupled to the earth of the electric field and acts as a voltage divider with an internal sensing capacitor. In this manner, high voltage appearing at the electrode is divided down and the voltage across the sensing capacitor is proportional to the voltage at the electrode with respect to earth.

This proportional signal voltage is fed to the electronic circuitry whose output communicates to the MCAT+ Base unit.

The Transmitter unit must be used in conjunction with an insulating stick of the minimal insulating length, as required for the system voltage being used on.

Adaptors can be supplied to connect the Transmitter units to various types of insulating sticks.

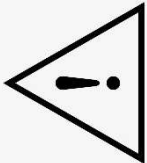
7.2 SELF ARMING MODE

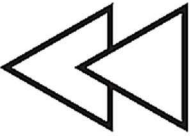
In this mode of operation, the Comparator automatically switches, on when an A.C. voltage greater than the set threshold voltage (1kV±10%) is applied to the contact electrode.

7.3 LABELLING

The information shown is as follows:

Table 4 Information on a WPC Label

	Read and understand the instruction manual before using the Comparators.
---	--

	Suitable for Live Working Designed and manufactured to meet the requirements of IEC 61481 phase comparators for voltages of 1kV to 36Kv A.C
	Meets EMC standards BS EN 50081-1 and BS EN 50082-2 (Tx).
WPC TYPE XXXX	A unique identification for each model
VOLTAGE XX/XXXkV	Indicates the system voltage or range been that the comparators can be used on
FREQUENCY 50/60Hz	The comparator will operate over the frequency range 50Hz/60Hz
SERIAL No. XXXXXXX	The year/month of production and a number are shown which gives traceability of features and threshold voltage
CLIMATIC CLASS	Normal The comparators will perform correctly over the temperature range -25°C to +55°C and in 20% to 96% humidity. Outdoor The comparators are suitable for use either indoor or outdoor and in wet conditions.
	Identifies the type of battery that is recommended for use with the comparator.