T&R TEST EQUIPMENT

TRUSTED & RELIABLE

OPERATING AND MAINTENANCE MANUAL

Product: ***Cable Impedance Test System***

Type: ***Z-OVR***

Software version 1.04

DESIGNED AND MANUFACTURED BY:

T & R Test Equipment Limited

15-16 Woodbridge Meadows, Guildford, Surrey, GU1 1BJ, United Kingdom

Telephone: 01483 207428 e-mail: sales@trtest.com

Web: www.trtest.com

GENERAL SAFETY STATEMENT

CAUTION

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 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 isolated from the supply and earthed.
- Do not connect and disconnect leads whilst outputs are switched on. Breaking the output circuit with current flowing may cause potentially fatal arcing.
- Ensure that the product is grounded. To avoid electric shock, it is essential that the grounding conductor is connected to the earth ground. An additional earth terminal is provided on the unit that should be connected to a local earth. Ensure that the unit 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.
- Do not operate the unit if there is the possibility of lightning strikes on the line under test or connected lines.

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:

CAUTION/WARNING – Refer to manual

Mains off

Mains on

The following safety symbols appear in this manual:

CAUTION — This action or procedure may be dangerous if not carried out correctly and may cause damage to the equipment or connected equipment.

WARNING — This action or procedure may cause injury or death to the operator or other personnel if not carried out correctly using applicable safety procedures.

Note — This is useful information that may make testing easier, help in interpretation of results or prevent confusion.

CONTENTS

1.	**DESCRIPTION OF EQUIPMENT**	**7**
1.1	**Panel layout and functions**	**8**
1.1.1	Control unit	8
1.1.2	Output unit	10
1.1.3	Display	12
1.1.4	Warning messages	12
1.2	**Installation**	**13**
1.2.1	Environment	13
1.2.2	Supply requirements	13
1.2.3	Cables	14
1.2.4	System connections	17
1.2.5	Overload protection	18
1.3	**Functions**	**18**
1.3.1	Output	18
1.3.2	Metering	19
1.3.5	Result storage	23
2.	**THEORY OF OPERATION**	**26**
2.1	**Kelvin connection**	**26**
2.2	**Impedance testing**	**27**
2.3	**Phase reversal to avoid interference**	**28**
3.	**OPERATION**	**29**
3.1	**Setting up**	**29**
3.1.1	System connections	30
3.1.2	Line connections	30
3.2	**Testing**	**33**
3.3	**After Testing**	**34**
4.	**MAINTENANCE**	**35**

4.1 Output Control Brushes 35

4.2 Removal of the Z-OVR from Case 35

5. STANDARD ACCESSORIES 37

5.1 Spare Fuses Supplied: 37

5.2 Standard Accessories Supplied: 37

6. OVERALL PERFORMANCE SPECIFICATION 39

6.1. Insulation Resistance at 1000V DC 39

6.2. Applied Voltage Test 39

6.3. Accuracy of Instruments 39

6.3.1 Current metering 39

6.3.2 Voltage metering 39

6.3.3 Phase metering 39

7. REVISION 41

1. DESCRIPTION OF EQUIPMENT

The Z-OVR is a line/cable impedance measurement system for high voltage ac systems. The impedance of the line is measured by injecting a current and measuring the magnitude and phase angle of the voltage developed across the line. The resistance and reactance of the line are calculated from these results and displayed. The system uses a 4-wire measurement with a Kelvin connection to the line under test to eliminate measurement errors due to voltage drops in the leads.

The unit has the facility to store test results to a USB memory key.

The system consists of a separate control unit containing all metering and control functions and an output unit that provides the high current output and isolation of measured voltages. All connections to the line are made via the output unit.

The system is supplied with three overhead line Kelvin clamps, one earth Kelvin clamp, one earth lead and all interconnecting and supply leads.

Three outputs are provided on the output unit (75V 80A, 150V 40A and 300V 20A) to allow a wide range of lines to be tested.

.

WARNING

The Z-OVR system must only be used on ‘dead’ systems (i.e. no externally supplied voltages are present on the test object) with safety earths applied. Extreme caution must be applied due to the possibility of induced voltages from other energised circuits. Under no circumstances connect a PCU1 to a live system or lines without earths applied.

WARNING

Under no circumstances use any of the leads supplied with the unit as earthing equipment for high voltage lines or cables. Approved earthing equipment must be used in accordance with accepted working practices before connections can be made between the line and Z-OVR.

1.1 Panel layout and functions

1.1.1 Control unit

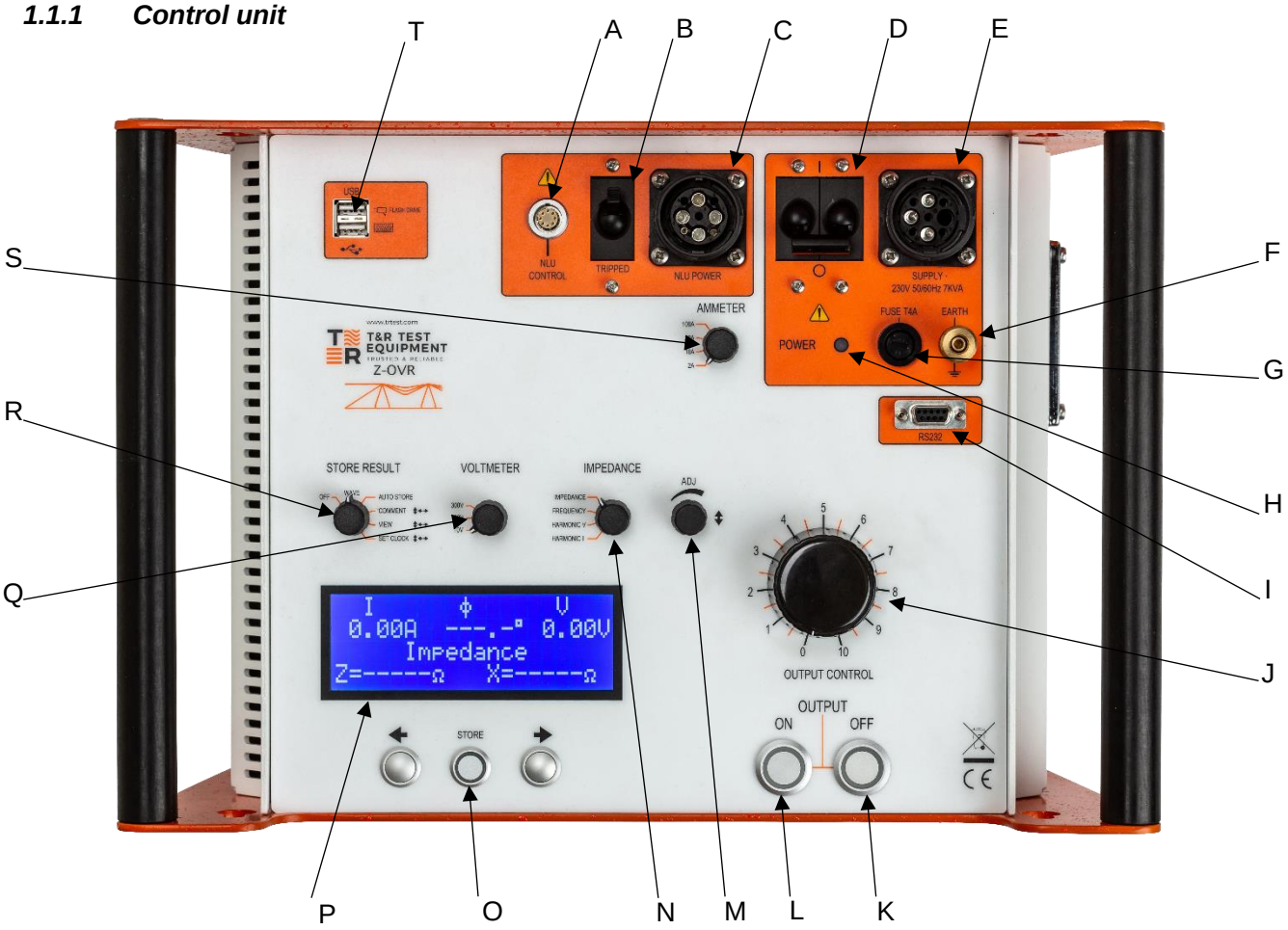


Figure 1.1 Z-OVR front panel

	ITEM	FUNCTION
A	Output unit metering connection	Metering/control connection to output unit
B	Output circuit breaker	Protection for control unit output
C	Output unit power connector	Power supply to output unit
D	Mains input switch/circuit breaker	Supply isolation switch and protection
E	Mains inlet connector	Mains supply connection
F	Earth Terminal	Terminal for optional connection to local earth for enhanced safety
G	Fuse	Fuse for metering and control circuits
H	Power indicator	Supply on indicator
I	RS232 connector	Serial connection for PC/printer connection
J	Main output control	Sets output current
K	Output off button	Switches output off. Illuminates green to show that output is off.
L	Output on pushbutton	Switches output on. Illuminates red to show that output is on.
M	Adj. digital pot	Control to select values for result storage
N	Impedance measurement select	Selects calculated value to display-impedance, frequency, or harmonics
O	Store pushbuttons	Pushbutton switches for store result and selection
P	Liquid crystal display	Shows current, voltage and calculated values
Q	Voltmeter range select	Selects voltage measurement range
R	Store result select	Controls result storage functions
S	Ammeter range select	Selects ammeter range
T	USB sockets	USB sockets for keyboard and memory key

1.1.2 Output unit

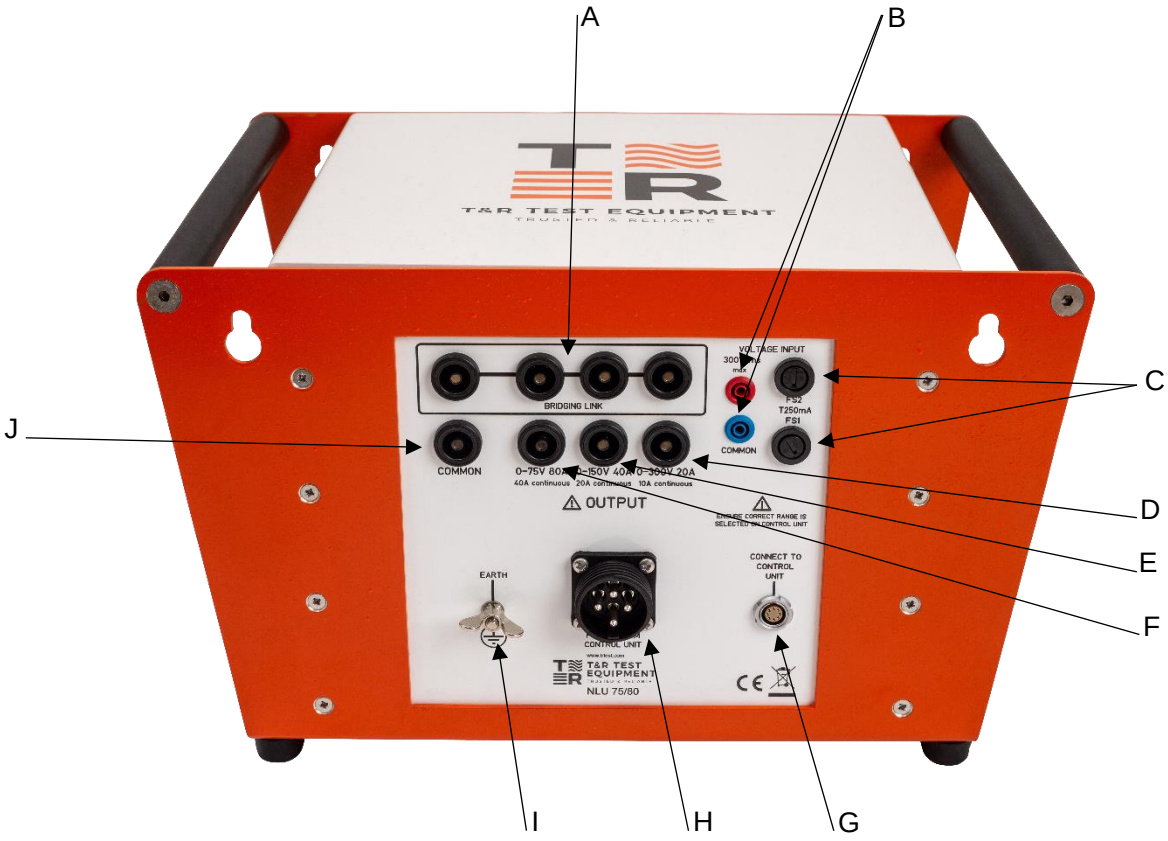


Figure 1.2 Output unit front panel

	ITEM	FUNCTION
A	Output commoning block	Allows three phase cables to be connected together for parallel measurement. All four terminals are connected together. Note: push connector to release before pulling to remove plug from socket.
B	Voltage input sockets	Voltage measurement input
C	Voltage input fuses	Fuses to protect voltage input
D	300V 20A output socket	Highest voltage, lowest current output. Note: push connector to release before pulling to remove plug from socket.
E	150V 40A output socket	Mid range current output. Note: push connector to release before pulling to remove plug from socket.
F	75V 80A output socket	Lowest voltage, highest current output. Note: push connector to release before pulling to remove plug from socket.
G	Z-OVR metering connection	Metering/control connection to control unit
H	Power connector	Power supply from control unit
I	Protective earth terminal	Connect to low impedance local earth
J	Common output socket	Common connector for output current

1.1.3 Display

The Z-OVR display simultaneously shows the injected test current, measured voltage and one of a number of other parameters depending on the position of the IMPEDANCE switch. For full details see section 1.3.4.

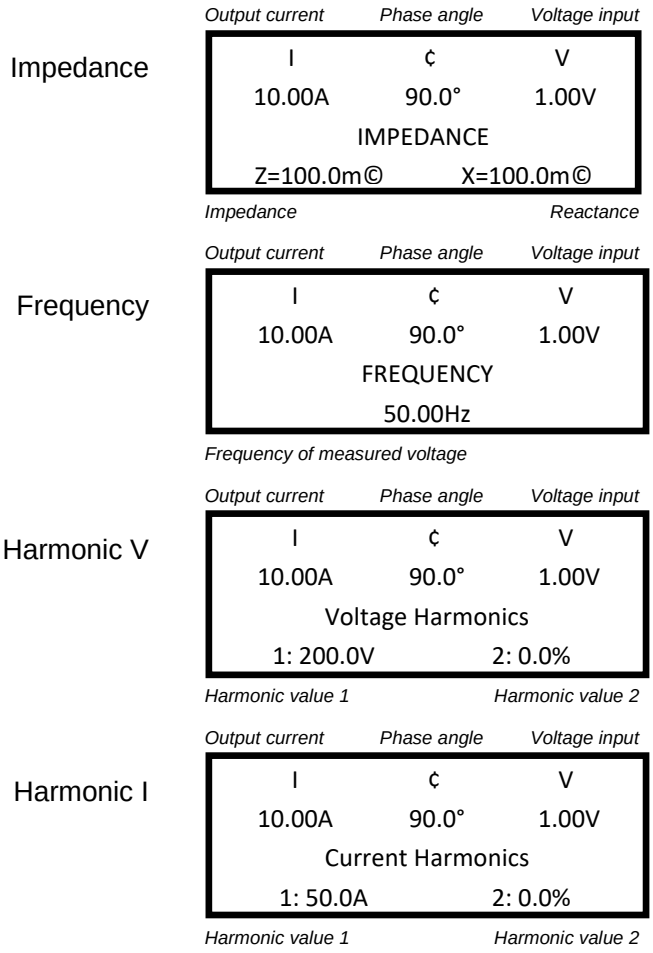


Figure 1.3 Z-OVR metering values

1.1.4 Warning messages

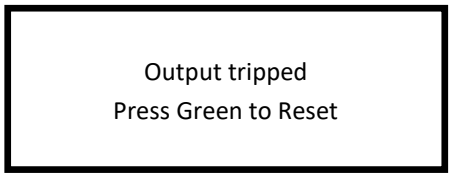


Figure 1.4 Over-current trip warning message

When an over current or duty cycle trip occurs, the green OFF pushbutton must be pressed to clear the trip condition.

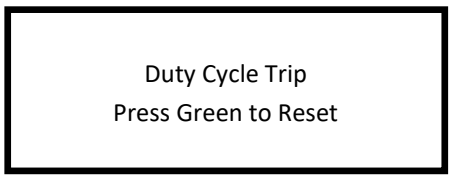


Figure 1.5 Duty cycle trip warning message


Caution

Allow the unit to cool for the rated off time for the main output after a duty cycle trip

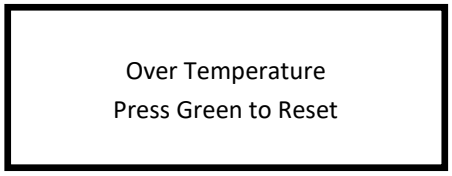


Figure 1.6 Unit over temperature warning message


Caution

After an over temperature trip, the unit will automatically reset when the temperature falls to an acceptable level. If the unit is over temperature, switching the unit off and back on will not clear the message – the unit must be allowed to cool.

1.2 Installation


Caution

The Z-OVR control units and output unit are heavy. Avoid lifting where possible. Ensure that two people are used to lift the units and that appropriate manual handling techniques are used.

1.2.1 Environment

Z-OVR is designed for use in indoor industrial and electrical substation environments.

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

1.2.2 Supply requirements

230V±10% 50/60Hz 1 phase 6.5kVA.

The unit is supplied fitted with a 32A CEE plug. If it is necessary to fit a different plug, the supply cable has the following core colours:

Earth	Green/yellow
Live	Brown
Neutral	Blue

The equipment must be earthed through the mains supply. In addition, the output unit must be earthed using the supplied earth lead to a suitable low impedance local earth (such as the base of a transmission tower).

The earth terminal on the control unit should be connected to a low impedance local earth if the supply earth is suspect.

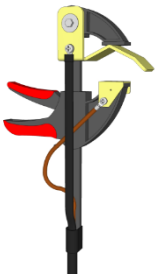
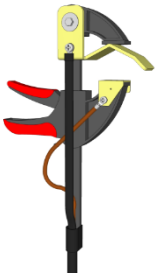
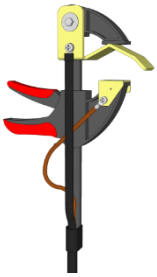

Caution

Ensure that the unit is connected to an appropriate supply by a suitably rated connector and that the system is adequately earthed.

1.2.3 Cables

The following cables are supplied with the Z-OVR system.

Supply/interconnection cables	**Length**	**Purpose**
Mains supply cable	5m	Supply to control unit
Power interconnection cable	5m	Connects output unit to control unit
Metering interconnection cable	5m	Connects output unit to control unit
Earth cable	10m	Connects output unit to safety earth

Output cables	Length	Purpose	Rating
Output cable phase A (red) 12mm² current injection terminated in 6mm connector 6mm² voltage sense terminated in 4mm shrouded plug	10m	Duplex lead fitted with Kelvin clamp for overhead line connection. Max conductor size 80mm diameter. 	80A CAT I 300V* Warning
Output cable phase B (yellow) 12mm² current injection terminated in 6mm connector 6mm² voltage sense terminated in 4mm shrouded plug	10m	Duplex lead fitted with Kelvin clamp for overhead line connection. Max conductor size 80mm diameter. 	80A CAT I 300V* Warning
Output cable phase C (blue) 12mm² current injection terminated in 6mm connector 6mm² voltage sense terminated in 4mm shrouded plug	10m	Duplex lead fitted with Kelvin clamp for overhead line connection. Max conductor size 80mm diameter. 	80A CAT I 300V* Warning
Earth injection lead (green) 12mm² current injection terminated in 6mm connector 6mm² voltage sense terminated in 4mm shrouded plug	10m	Duplex lead fitted with Kelvin clip. Max jaw opening 27mm. 	80A CAT I 300V* Warning

***voltage ratings**

The voltage ratings shown relate to the cable and 4mm/6mm connectors to connect to the output unit. The cables are terminated in **un-insulated** clamps for connection to lines that must **NOT** be handled whilst the output is on.

Warning

Make all connections to the test object with the supply off (supply switch in the off position) and the cables unplugged from the output unit.

The phase clamp connections supplied with the unit are designed for connection to cylindrical conductors on overhead lines. An optional alternative set of phase leads is available for connection to other types of conductors and terminals using Kelvin clips as on the earth lead.

Phase A Kelvin clip lead part number:
AX136-0007
Phase B Kelvin clip lead part number:
AX136-0008
Phase C Kelvin clip lead part number:
AX136-0009

1.2.4 System connections

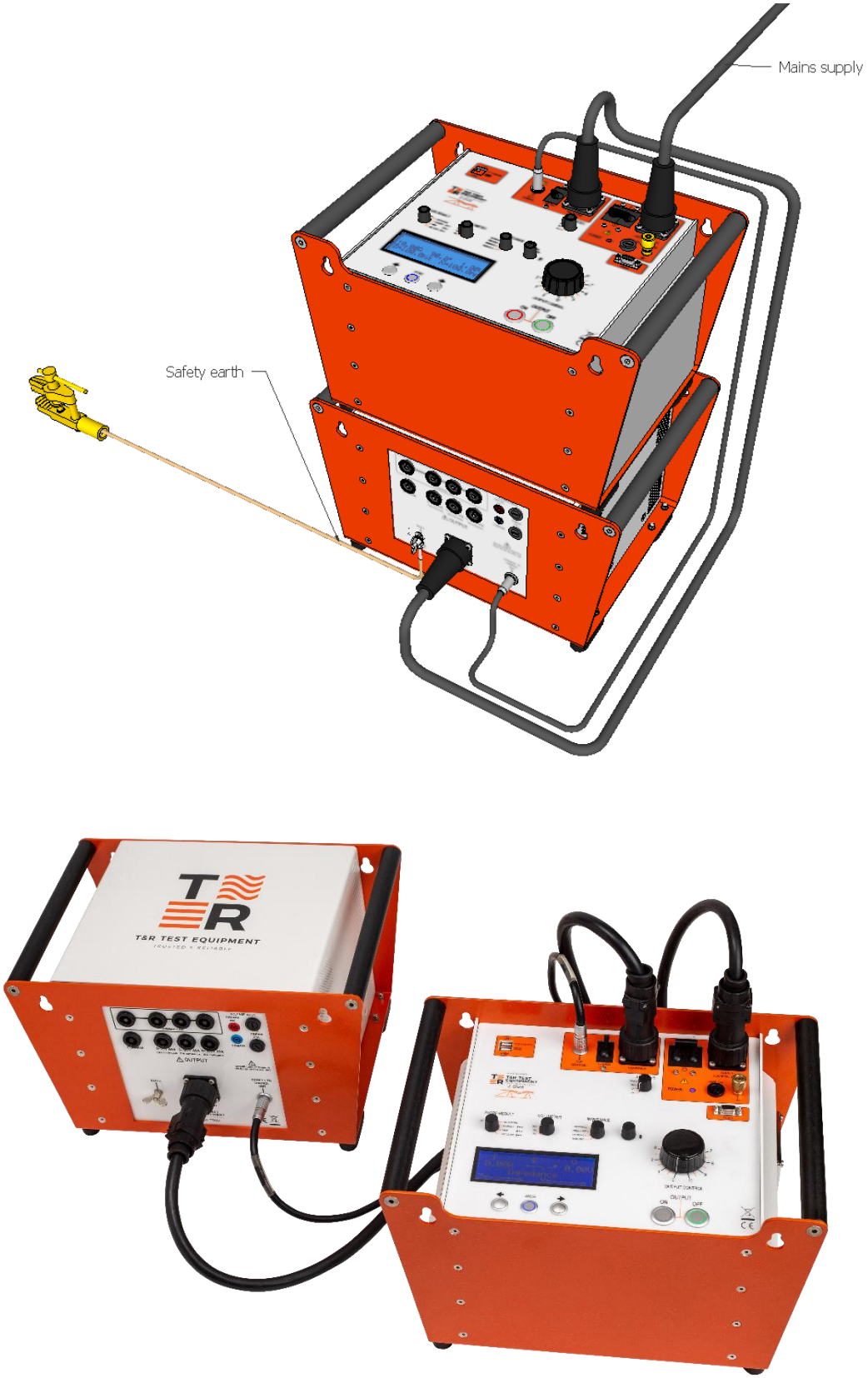


Figure 1.7 System connections

1.2.5 Overload protection

Location	Protection
Mains supply	Hydraulic-magnetic circuit breaker
Control unit output	Hydraulic-magnetic circuit breaker
Control unit control/metering	T4A HRC 32mm fuse
Voltage input	2xT250mA HRC 32mm fuses

1.3 Functions

1.3.1 Output

The output has three ranges. The highest currents are available on the lowest voltage outputs.

When testing, start with the lowest output voltage output. If the required test current cannot be achieved (because the impedance of the line is high) use a higher voltage output.

Output unit	Open Circuit Voltage	Continuous current	Intermittent current	
			5 min on/ 15 min off	Maximum current
NLU75/80	75V	40A	80A	100A*
	150V	20A	40A	40A
	300V	10A	20A	20A

*100A available for short periods

Each output is rated for a continuous current and for higher intermittent currents. The maximum ON time for intermittent currents is enforced by the unit, and the output will be switched off if the rating is exceeded. The display will then show the following message until the green OFF button is pressed to clear the trip condition:

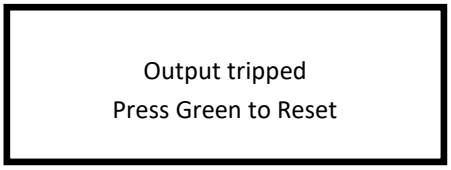


Figure 1.8 Output tripped

NOTE

If the metering cable is not connected between the control unit and the external output unit, the ammeter will not function, and the output will not switch on when the output **ON** push-button is pressed. The metering cable between the control and external output unit acts as an interlock circuit.

1.3.2 Metering

The Z-OVR is fitted with a true rms ammeter and voltmeter with hold facility.

1.3.2.1 Ammeter ranges

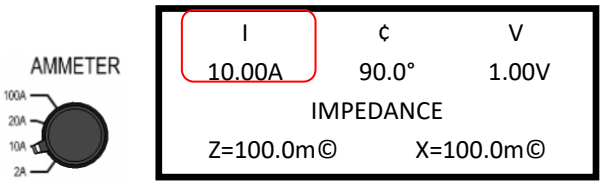


Figure 1.9 Ammeter

Four true rms current metering ranges are provided. The range is selected using the AMMETER switch on the control unit. A current trip is set at 105% of the full scale of the range.

Ammeter range	Metering full scale	Resolution	Accuracy	Trip current
2A	2.000A	0.001A	±1%rdg+5d	2.1A
10A	10.00A	0.01A	±1%rdg+5d	10.5A
20A	20.00A	0.01A	±1%rdg+5d	21A
100A	100.0A	0.1A	±1%rdg+5d	105A

1.3.2.2 Voltmeter ranges

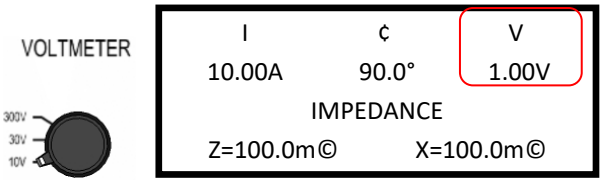


Figure 1.10 Voltmeter

Three true rms voltage metering ranges are provided. The range is set using the VOLTMETER switch on the control unit. The voltage measuring input is isolated by a switched range VT. The VT provides safety isolation from the line under test, but has a relatively low input impedance on the 10V and 30V ranges. Do not use the 10V or 30V range with test currents of less than 5A to maintain accuracy.

Caution

Ensure that the maximum voltage applied to the voltage input does not exceed the range selected. Fuses are provided on the input to protect the VT. If the voltage for the range selected is too high the fuses on the VT input will blow.

Voltmeter range	Resolution	Accuracy	Input impedance
10.00V	0.01V	±1%rdg±5d	~1kΩ
30.00V	0.01V	±1%rdg±5d	~1kΩ
300.0V	0.1V	±1%rdg±5d	~50kΩ

Accuracy note

Always Use the 300V metering range if the test current is less than 5A.

1.3.2.4 Phase angle measurement

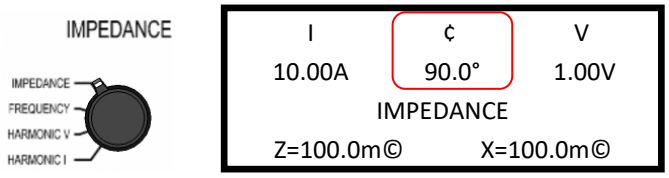


Figure 1.11 Phase angle

The phase angle between the voltage and current is calculated by taking an FFT (Fast Fourier Transform) of both the current and voltage and calculating the phase difference between the fundamental components.

The phase angle of the current is measured relative to the voltage. A phase angle of -90° would signify that the current is lagging the voltage by 90° (an inductive load). A phase angle of +90° would signify that the voltage is leading the current by 90° (a capacitive load).

Range	Resolution	Accuracy
-179.9º - 180.0º	0.1º	±1º

1.3.2.5 *Impedance ranges*

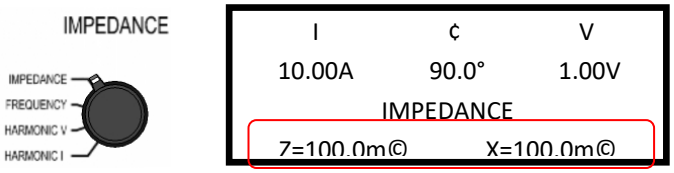
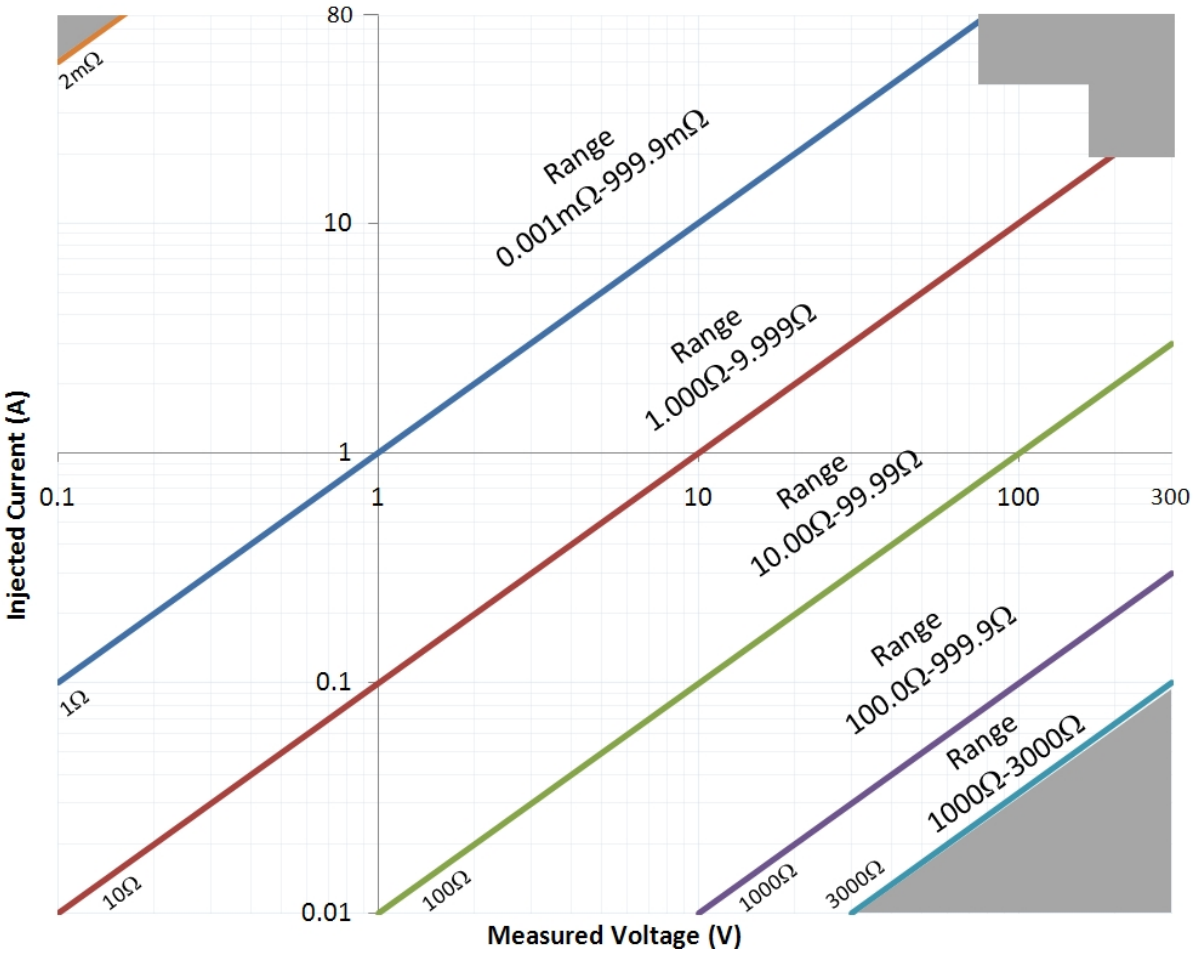


Figure 1.12 Impedance

The impedance of the line under test is calculated from the voltage and current, considering the phase angle between them. The impedance, Z, and reactance, X, are displayed. The Z-OVR can measure impedance in the range 2mΩ to 3000Ω in five ranges.

The impedance range is automatically selected based on the calculated impedance and is always limited to four significant digits.



Note: Grey shaded areas are out of range of the unit

Figure 1.13 Z-OVR impedance ranges

1.3.4.7 Frequency range

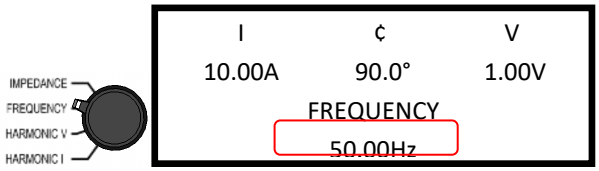


Figure 1.14 Impedance

Range	Resolution	Accuracy
45.00-65.00Hz	0.01Hz	±2d

1.3.4.8 Harmonic ranges

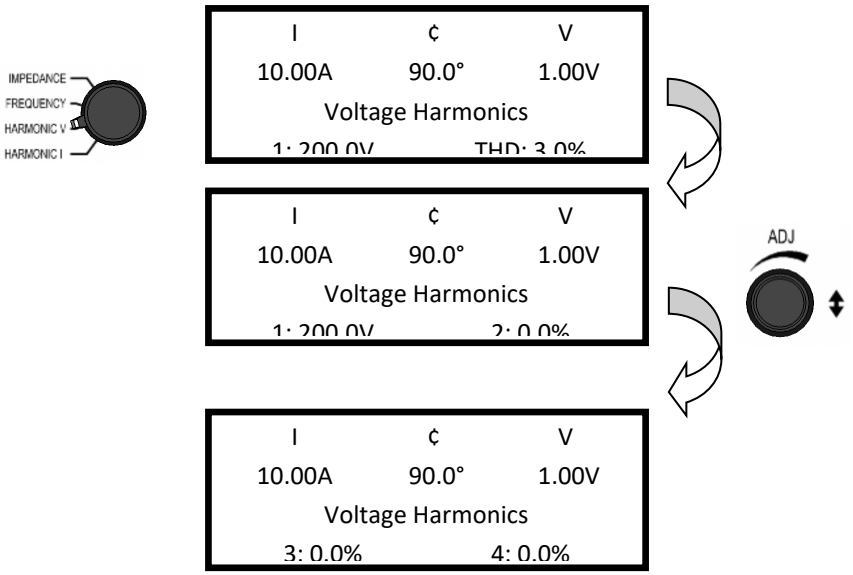


Figure 1.15 Harmonic ranges

The Z-OVR can calculate the harmonic content of the output current and measured voltage. Select the harmonic to be displayed using the ADJ knob. Harmonics may be displayed up to 31st harmonic.

Harmonic ranges are for indication only and are not calibrated.

1.3.5 Result storage

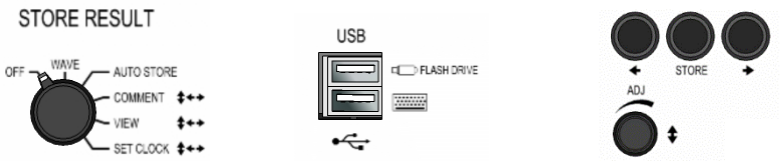


Figure 1.16 Result storage

The Z-OVR can store all displayed results to a standard USB memory key. The unit has a real-time clock and calendar so that all results can be time and date stamped.

There are two stages to storing a result: firstly, typing in a comment, and secondly actually storing results. It is not necessary to type in a comment, but it makes the results easier to understand.

1.3.5.1 Entering a comment

Plug in the keyboard and USB memory key, ensuring that each is plugged into the correct socket.

Set the STORE RESULT switch to COMMENT. Type in your comment using the USB keyboard. When you have finished, press Enter on the keyboard to store the comment. Comments are limited to 19 characters. The comment will now be added to all stored results until the comment is changed or the unit is switched off.

NOTE ! The output cannot be switched on when the unit is in SET COMMENT mode.

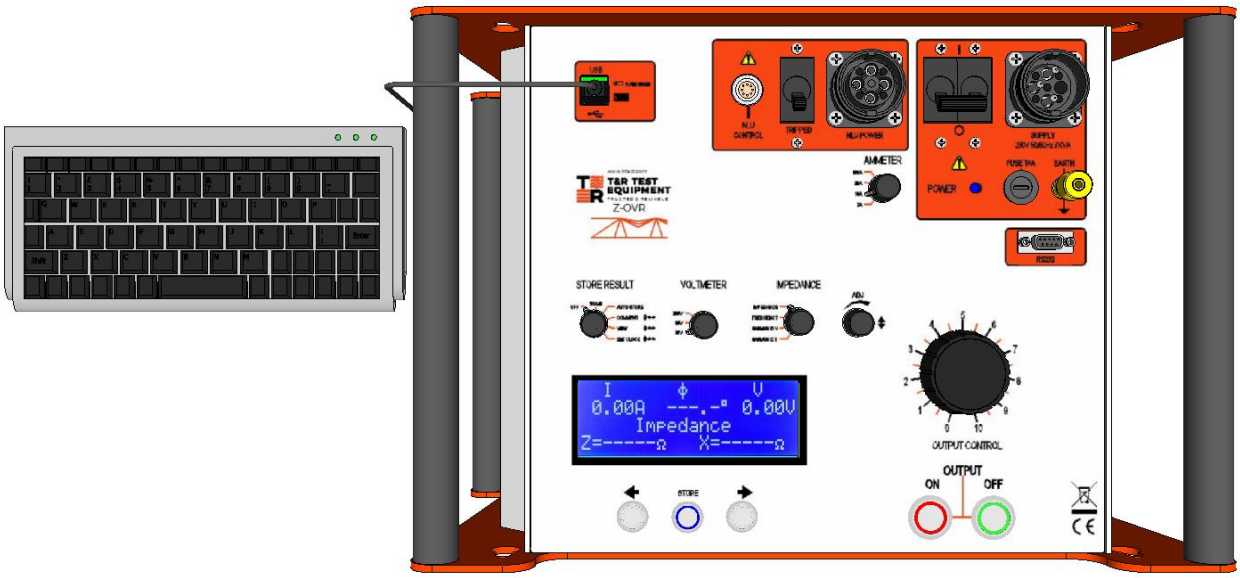


Figure 1.17 Keyboard and memory stick connected to Z-OVR (connections to output unit not shown for clarity)

1.3.5.2 Storing a result

Figure 1.18 Store buttons

Set the STORE RESULT switch to AUTO STORE. The unit will now store a result every time the STORE pushbutton is pressed.

If the output is on when STORE is pressed, the result will be stored internally until the output is switched off. An “S” symbol is shown on the display when results are stored and waiting to be written to the memory key. When the output is switched off, the stored results are written to the memory key.

If the output is off when STORE is pressed, the values currently held on the display are written to the memory key. Pressing STORE again will have no effect until the output is switched on again (this is because there are no new results to write to the memory key).

1.3.5.3 Result file format

The results are stored to the USB memory key in a CSV (comma separated value) format. This can be opened by all common spreadsheet programs (including Microsoft Excel and OpenOffice Calc).

The data is of the following format:

```
"Z-OVR","V0.01","C01","P1","A1"
"Time","Date","Amps","Volts","Phase","Freq   Hz","Z   mOhms","X   mOhms","Comment"
"11:49:23","23/02/10","10.00","1.00","90.0","50.00","100.0","100.0","Comment"
"11:49:23","23/02/10","10.00","1.00","90.0","50.00","100.0","100.0","Comment"
```

1.3.5.4 Folder structure

The Z-OVR creates a folder on the memory key called TRTEST. Within this folder, a new folder is created for each day on which testing is carried out using the date as the folder name in the form DD-MM-YY (e.g. 20-02-10).

A new file is created using the start time of the testing each time the USB stick is removed, or the unit is switched off and on. The file name is of the form HHMMSS.csv (e.g 141500 for 14:15).

1.3.5.5 Viewing results

Results stored on the memory key can be viewed on the same day on the unit. Results from previous days must be viewed on a computer.

To view today’s results, select VIEW on the STORE RESULT selector. The results files available can then be scrolled through using the ADJ knob.

NOTE

! If there are no results stored for the current date, the unit will display NO RESULTS FOUND. This does not mean that there are no results on the USB key, just none for the current date.

To select a results file to view, press ➔.

The results in the file may then be scrolled through using the ADJ knob.

1.3.5.6 Storing waveforms

Figure 1.19 Store switch

When WAVE is selected on the STORE RESULT switch, the voltage and current waveforms are written to the USB memory key in a CSV file when the output is switched off.

The file is in the form of two columns of data giving sampled current and voltage values at 60µs intervals. The file covers a time period of 62ms. The “0.06” in the 7th column of the 1st row gives the time between samples in ms.

```
"11:49:06","23/02/10","","","","Sample Time(ms)","0.06"
"Current","Voltage"
"-0.001","0.03"
"-0.001","0.04"
"-0.001","0.02"
"0.002","0.04"
"0.004","0.04"
"0.001","0.03"
"0.004","0.04"
…
…
…
1023 sample lines
```

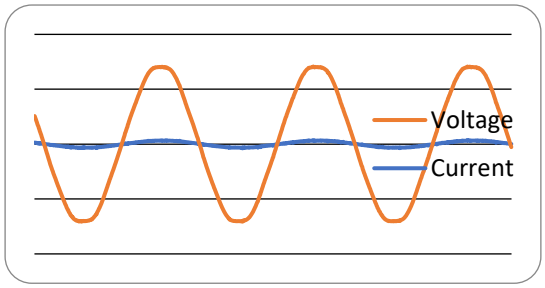


Figure 1.20 Waveform plot

1.3.5.7 Setting the clock

Figure 1.21 Store controls

Select SET CLOCK on the STORE RESULT switch to set the real time clock. Use the ← and → to set the digit to change and use the ADJ control to change a digit. To save the new value, change back to any other position of the STORE RESULT switch.

2. THEORY OF OPERATION

2.1 Kelvin connection

The Z-OVR uses a Kelvin connection to remove the impedance of the current injection cables from the measured reading. Current is injected through a 12mm² core in the output cables and measured using a thinner core in the output cable.

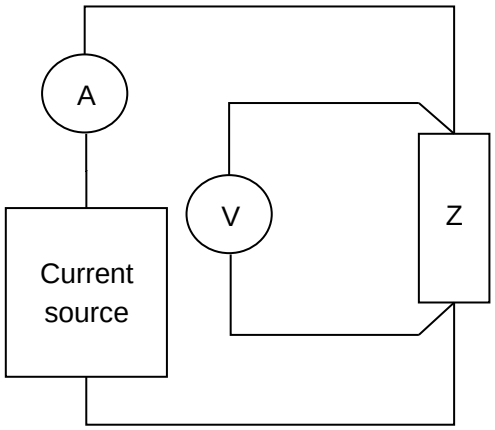
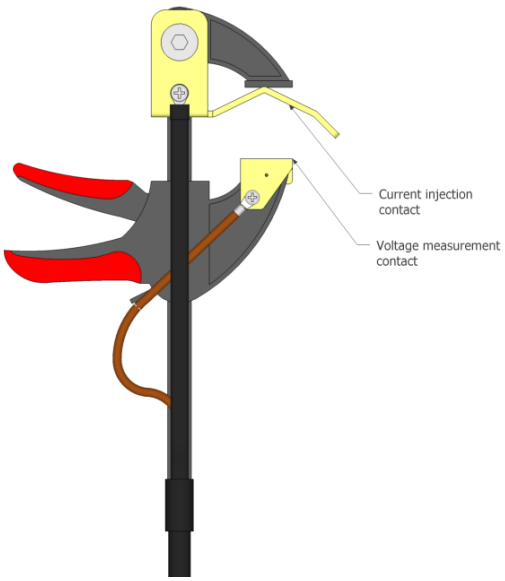


Figure 2.1 Kelvin measurement

All the connection clamps have a separate current injection contact and voltage measurement contact.



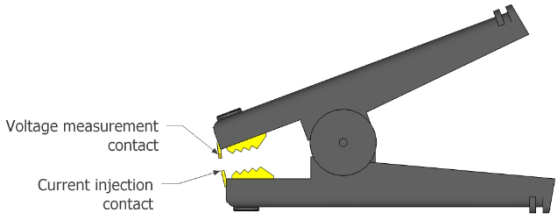


Figure 2.2 Kelvin clamps

2.2 Impedance testing

Four separate impedance tests are carried out to characterise the impedance of a line or cable:

1. Phase A to phase B
2. Phase B to phase C
3. Phase C to phase A
4. Phase A, B and C connected in parallel to earth.

Each test is carried out with an earthed short fitted at the far end of the line to be tested.

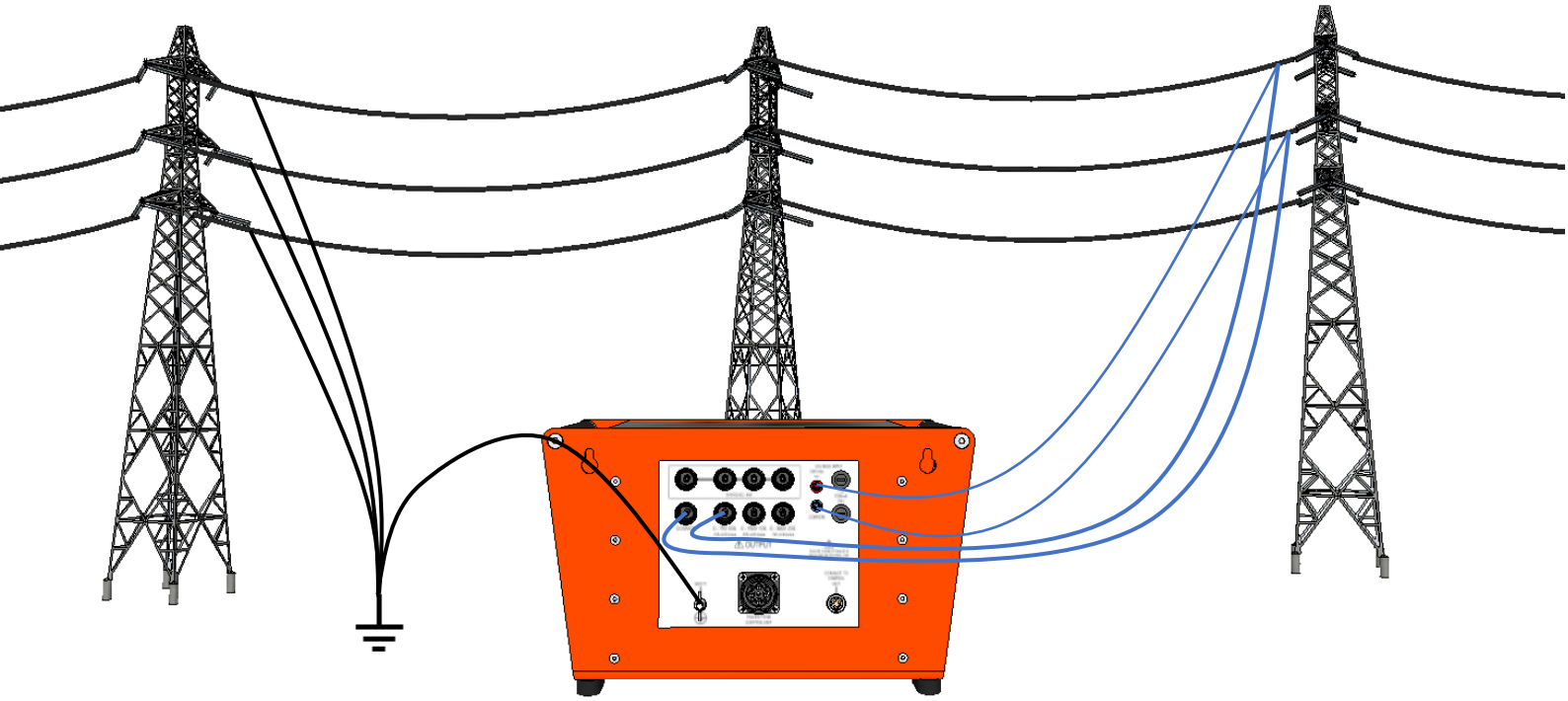


Figure 2.3 Phase to phase test (connections to control unit omitted for clarity)

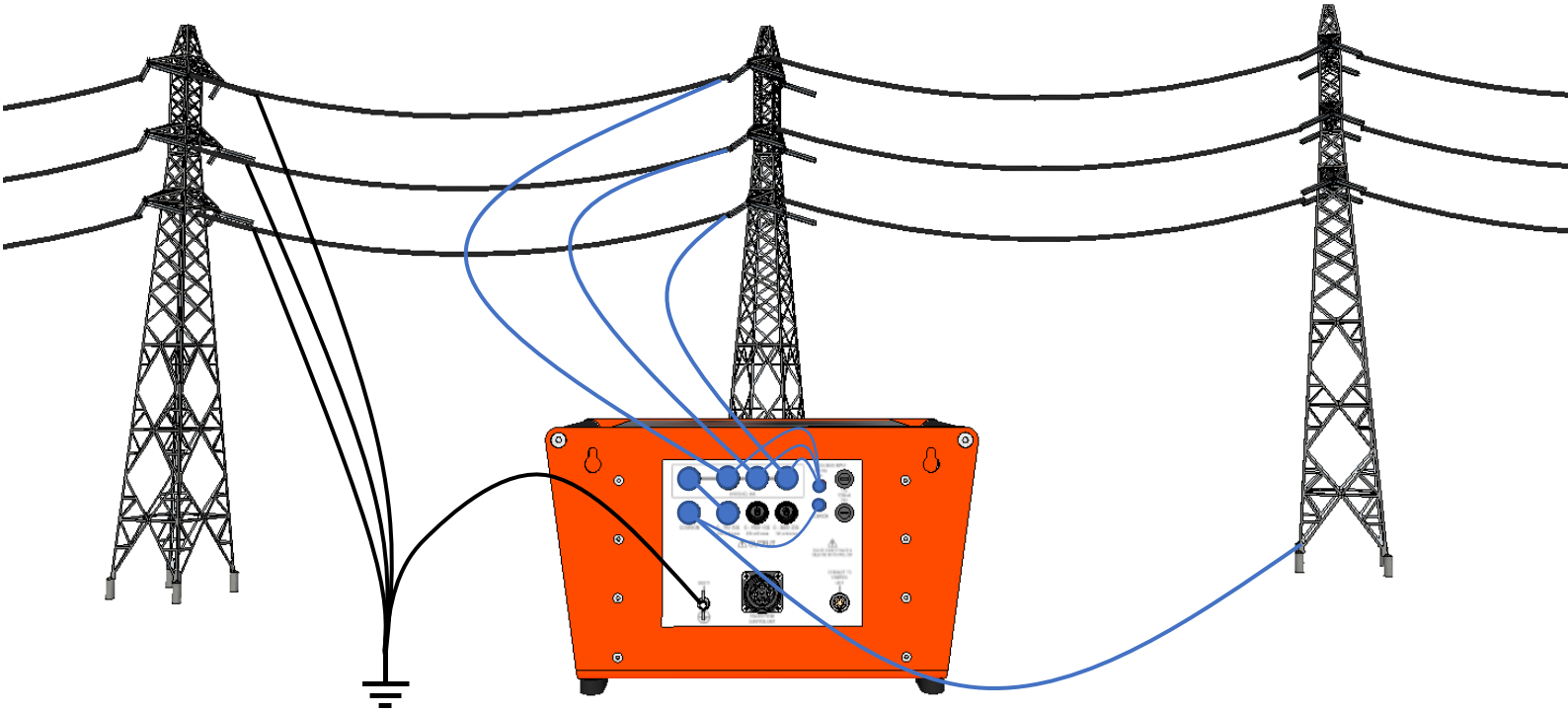


Figure 2.4 All phases parallel test (connections to control unit omitted for clarity)

In each case a current in injected and voltage phase and magnitude is measured. The impedance, Z, is calculated from the rms current and voltage:

$Z=V/I$

The reactance, X, is calculated from the reactive power (Q) and the current. Q is in turn calculated from the real power (P) and VA (|S|). The real power is calculated on a sample by sample basis from the voltage and current.

$Q=\sqrt{(VA^2-P^2)}$

$X=Q/I^2$

This method of calculation gives accurate results for impedance regardless of wave shape.

The sequence components of the impedance can then be calculated from these results.

2.3 Phase reversal to avoid interference

If interference from a nearby powered circuit is suspected, it is possible to check the level of this interference. First carry out a test as above and note the results. Reverse the connections to the output unit (reverse the high current connections and also the voltage input connections) and take a second reading.

If the readings are the same, the interference is not affecting the result. If the readings are different when reversed, take the average of the forward and reverse results to remove the effect of the interference.

In general, tests conducted at a higher current will be affected less by external interference.

3. OPERATION

3.1 Setting up

Warning

Make sure that all necessary safety procedures are followed to ensure that the line is dead and earthing equipment is installed. Leave earthing equipment connected at the point of current injection until all connections have been made. Ensure that the line is earthed at the correct point during the test using suitably rated earthing equipment. This equipment must only be connected and used by suitable competent personnel.

Warning

Never make or touch the connections to the line under test without first switching off the supply to the unit – hazardous voltages are present on the output and the output clamps are not insulated.
Never break the high current output circuit when the output is switched on – this may cause arcing.

The output unit output from the Z-OVR control unit is ONLY for connection to a T&R Test Equipment NLU75/80 output unit. Do not attempt to connect PCU1-SP loading units. The output unit provides isolation between the control unit and the line under test.

Carefully move the control unit and output unit into position near the base of the line to be tested. The control unit can either be stood on top of the output unit or in a convenient position if the output unit is to be mounted closer to the tower.

3.1.1 System connections

First connect the safety earth between the earth connection on the output unit and a suitable local earth. This should be a low impedance earth such as a substation earth bonding point or the base of the tower. A screw clamp is provided to make this connection.

Connect the supply and metering leads between the control unit and the output unit. Note that the connectors are polarised – look at the keys on the connectors, and do not try to force them in if they do not fit easily.

Connect the supply lead to the mains supply, but do not switch the unit on. This grounds the control unit.

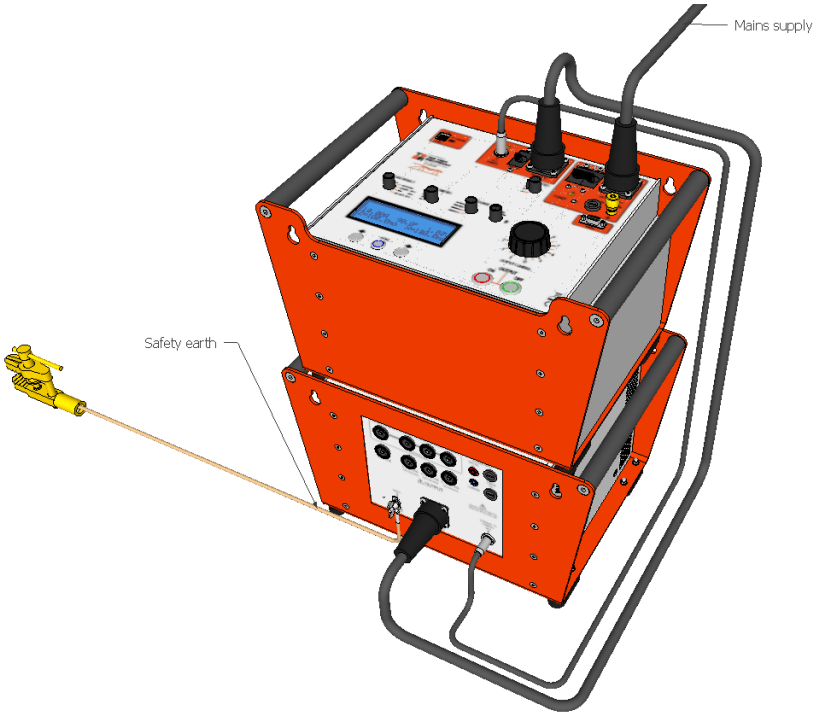


Figure 3.1 Connection between control unit and output unit

3.1.2 Line connections

Connect all three phase connection clamps to the phases of the line under test and connect the earth injection lead to the base of the tower if testing overhead lines (or suitable earth point for cables). The earth connection is used for measuring the parallel impedance of all three phases to earth.

Connect the phase A lead to the 75V 80A terminal.

Connect the phase A sense plug to the red VOLTAGE INPUT socket.

Connect the phase B lead to the COM terminal.

Connect the phase B sense plug to the blue VOLTAGE INPUT socket.

Set the VOLTMETER switch on the control unit to 300V and the AMMETER switch to the most suitable range for the desired test current.

Note: The phase order shown on the tower is for illustration purposes only.

The following diagrams show the configuration required for each test.

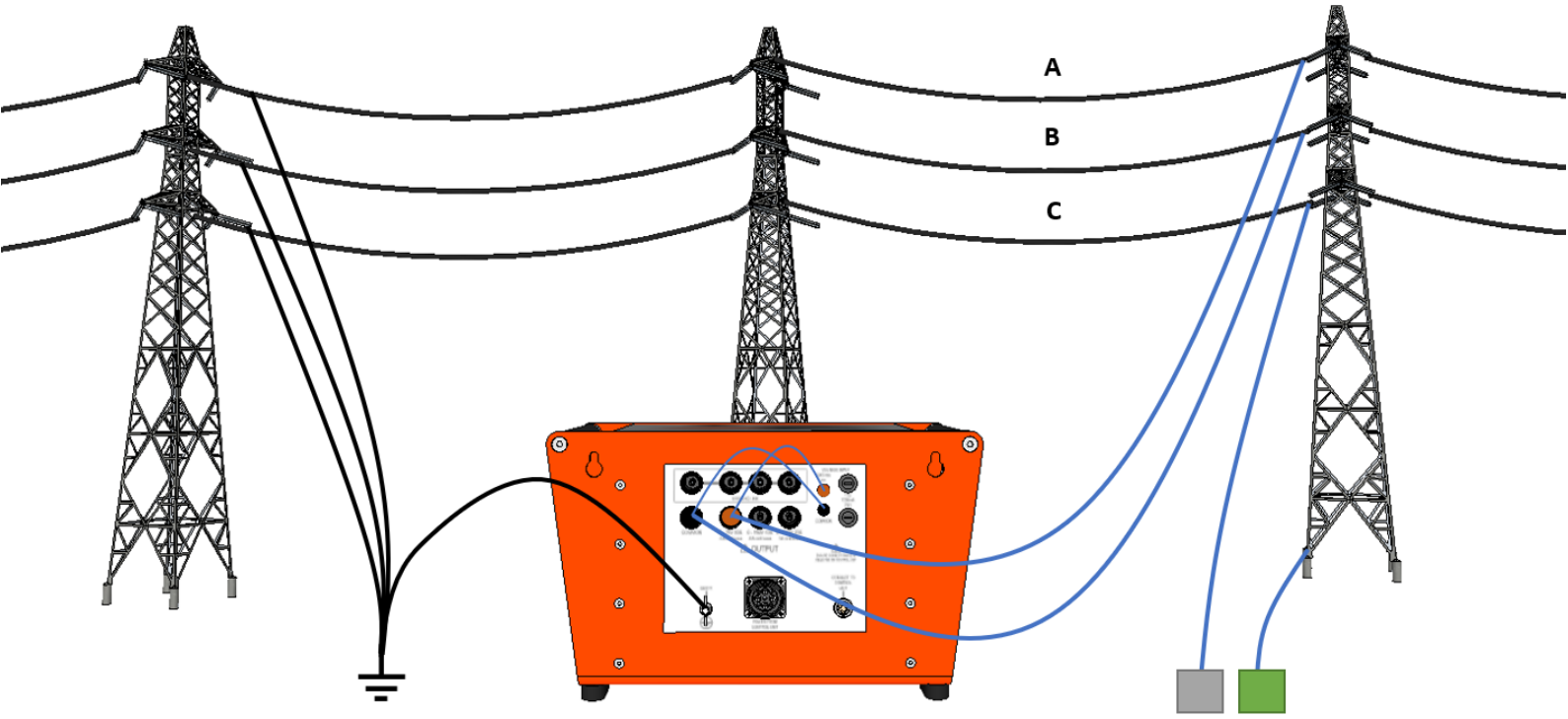


Figure 3.2 Phase A-B test

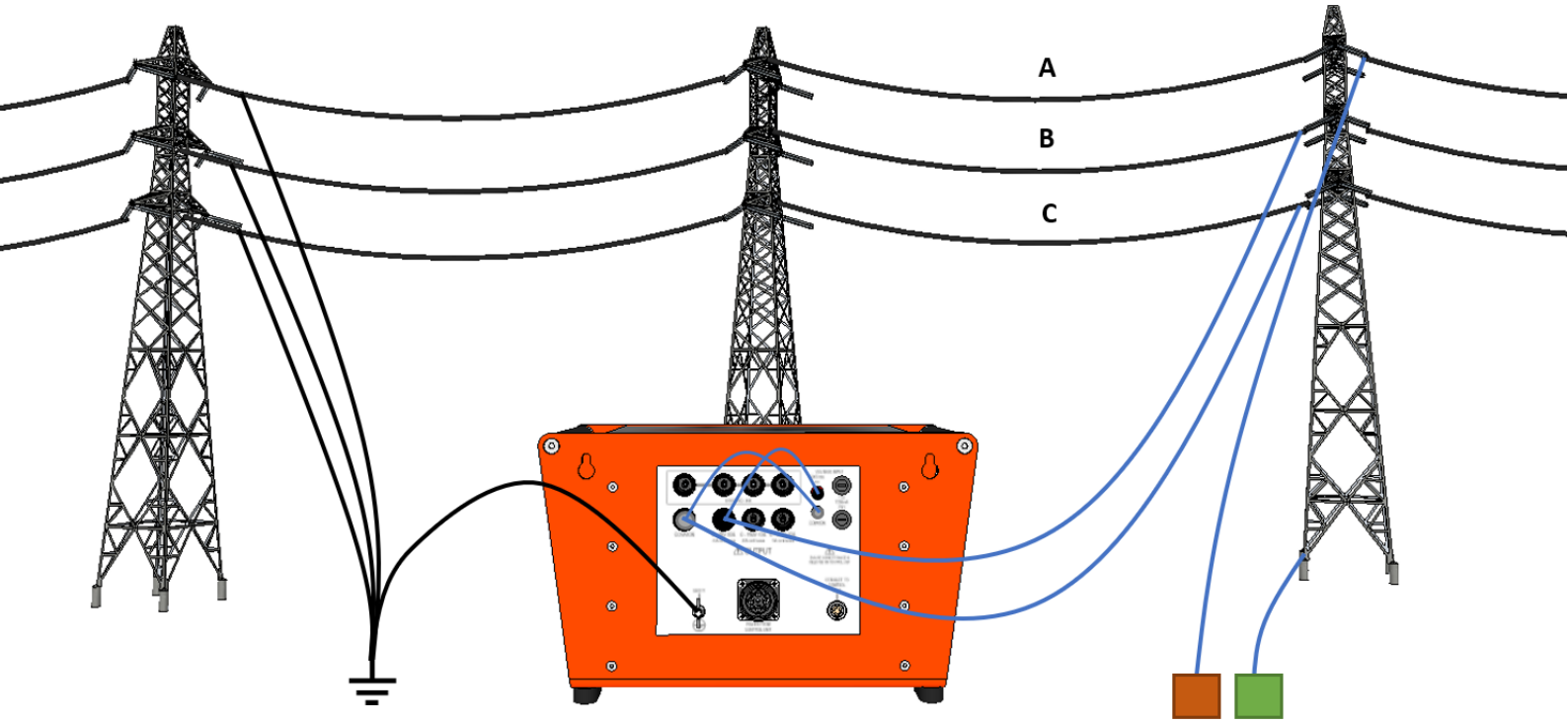


Figure 3.3 Phase B-C test

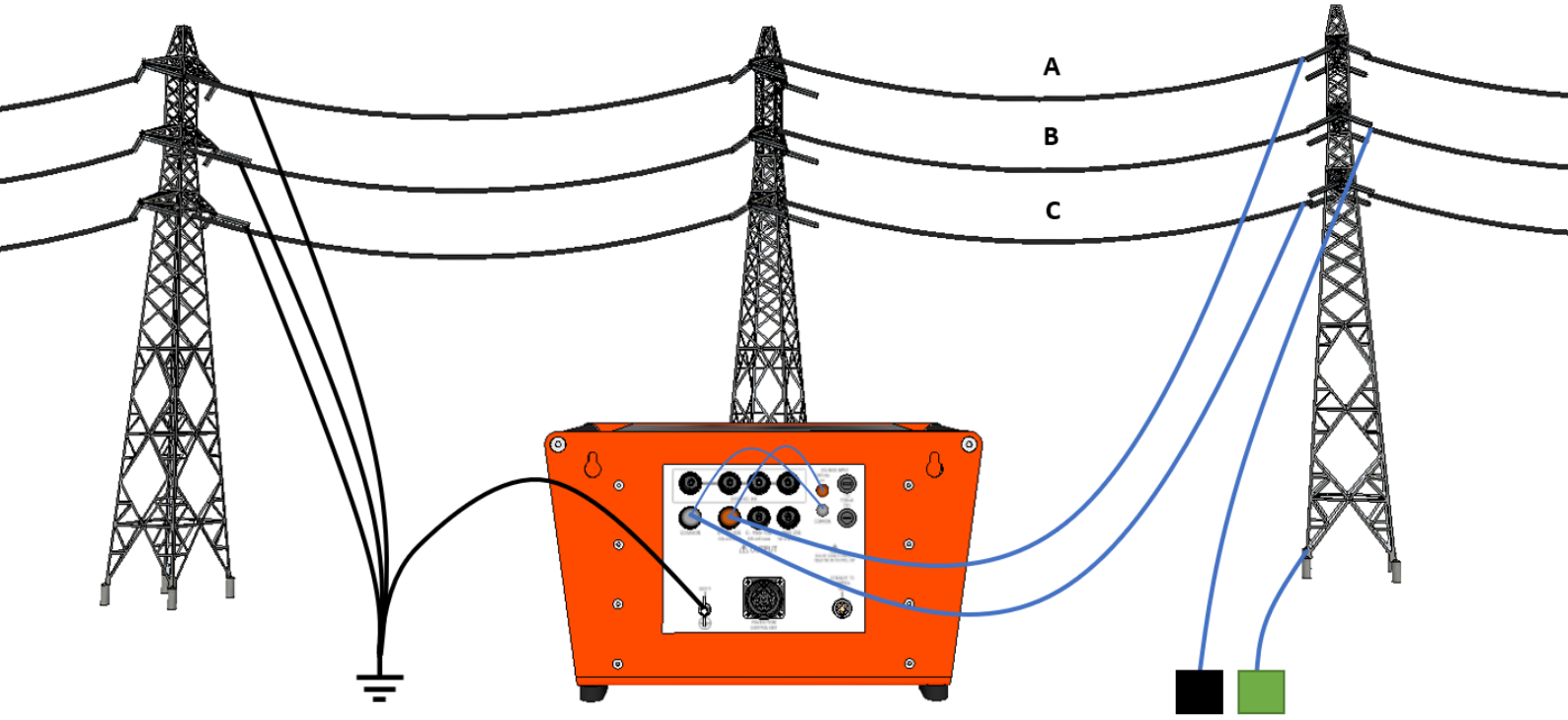


Figure 3.4 Phase C-A test

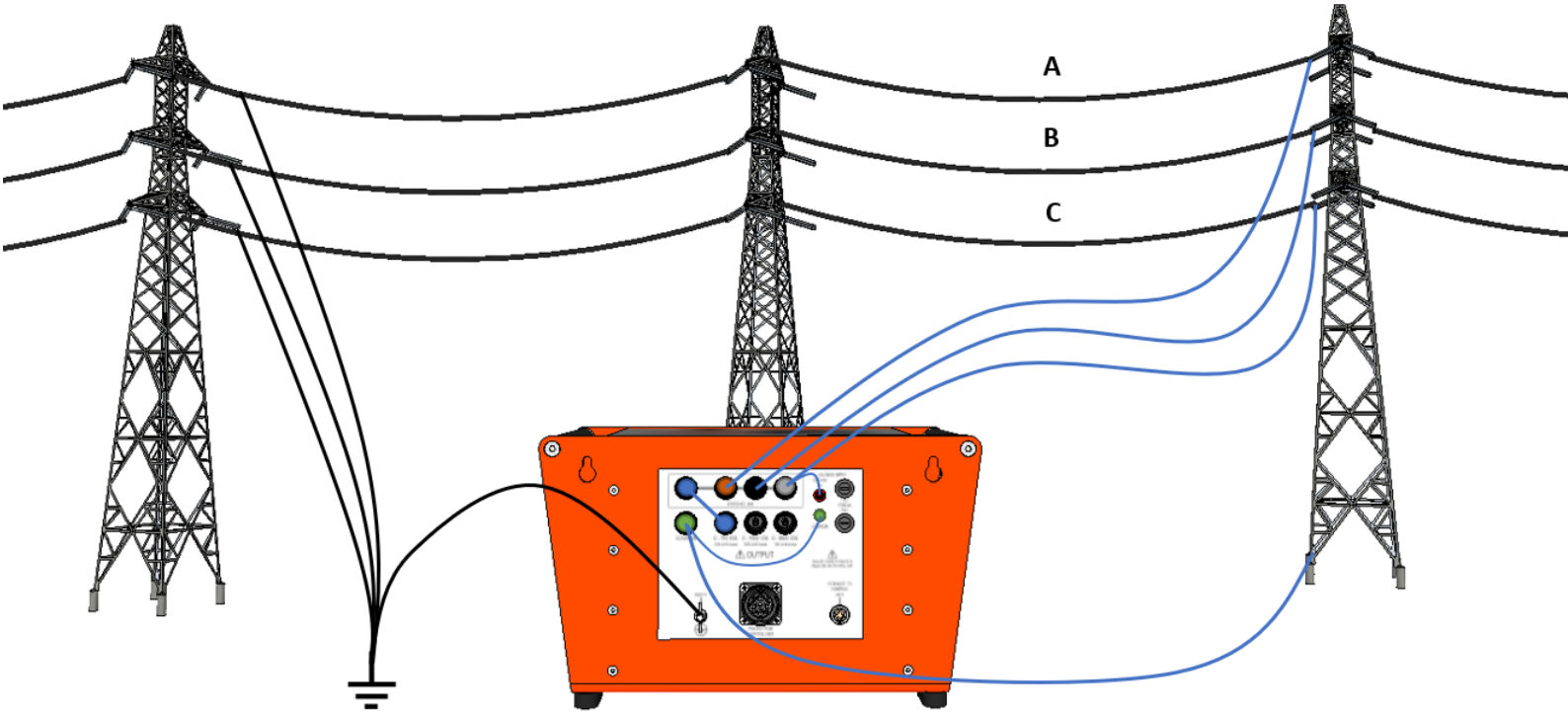


Figure 3.5 Parallel test to earth

The table below gives the connections required for each test.

Test / Lead	Phase A to phase B	Phase B to phase C	Phase C to phase A	Parallel to earth
Phase A high current lead	75V/150V/ 300V	Not connected	COM	Commoning block
Phase A voltage lead	RED	Not connected	Blue	RED
Phase B high current lead	COM	75V/150V/ 300V	Not connected	Commoning block
Phase B voltage lead	BLUE	RED	Not connected	RED
Phase C high current lead	Not connected	COM	75V/150V/ 300V	Commoning block
Phase C voltage lead	Not connected	BLUE	RED	RED
Earth injection lead	Not connected	Not connected	Not connected	COM
Earth injection voltage lead	Not connected	Not connected	Not connected	BLUE
Note				Connect 75V/150V/ 300V to Commoning block

3.2 Testing

Always switch on the output with the output control at zero. This ensures that a very high current is not unintentionally injected, and that a voltage too high for the currently selected voltage range is not applied.

Ensure that all personnel are clear of the cable. Turn the output control to zero and press the ON pushbutton. Increase the test current to the desired level, watching the voltage to ensure that it does not exceed the voltage range selected. If the line has a low impedance and the measured voltage is less that 10V or 30V, switch to a lower voltage range. More accurate results will be obtained by using the lowest voltage and current metering ranges which can accommodate the test current and measured voltage.

Always start with the lowest voltage output range (75V 80A). If a suitable test current cannot be achieved change to the 150V 40A output, and if the impedance is still too high to achieve a high enough test current change to the 300V 20A output. Longer lines with higher impedances will require use of the higher voltage outputs.

3.3 After Testing

On completion of the test, switch off the output using the OFF pushbutton. Return the output control to zero and switch off the supply. Before disconnecting the test-object, ensure the mains supply switch is in the OFF position.

4. MAINTENANCE

Warning

The following actions should only be taken by suitably qualified and competent service personnel. Before removing the unit from its case, ensure that the unit is disconnected from the mains. Under no circumstances connect the unit to the mains whilst it is removed from its case.

4.1 Output Control Brushes

The output control brushes should be examined and replaced if necessary. The interval between inspection and renewal of the brushes will depend upon the amount of usage (particularly at very high currents). However, it should be remembered that damage to the output control can result if the brushes are allowed to wear away to such an extent that a loss of brush pressure occurs.

4.2 Removal of the Z-OVR from Case

To remove the instrument from its case, the following procedure should be used: -

a. Remove the 14 socket head screws securing each of the side panels to the unit (each side has 4 screws to the rear, 4 screws to the front and 6 to each side).

b. Loosen the handles using socket head screws on front of unit.

c. Remove the side panels, being careful to disconnect the in-line plug and socket to the cooling fan.

d. Lift the unit out of the U section case.

5. STANDARD ACCESSORIES

5.1 Spare Fuses Supplied:

a. 1 off 32mm T4A HRC

b. 10 off 32mm T250mA HRC

5.2 Standard Accessories Supplied:

a. 5m supply cable fitted with 32A CEE plug.

b. 5m power interconnecting lead.

c. 5m metering & control lead.

d. Cable case to hold above leads.

e. 10m safety earth lead.

f. 3 x 10m output leads terminated in Kelvin line connection clamps.

g. 1 x 10m earth output lead terminated in Kelvin clip.

h. USB keyboard.

i. USB memory key.

j. User manual.

6. OVERALL PERFORMANCE SPECIFICATION

6.1. Insulation Resistance at 1000V DC

The insulation resistance will not be less than 10MΩ between mains input to frame and all isolated outputs, and all combinations of isolated output to isolated output.

6.2. Applied Voltage Test

Mains input to frame and all isolated outputs 2kVrms.

All isolated inputs/outputs 3kVrms.

6.3. Accuracy of Instruments

6.3.1 Current metering

Metering range	Metering full scale	Resolution	Accuracy
2A	2.000A	0.001A	±1%rdg+5d
10A	10.00A	0.01A	±1%rdg+5d
20A	20.00A	0.01A	±1%rdg+5d
100A	100.0A	0.1A	±1%rdg+5d

6.3.2 Voltage metering

Voltmeter range	Resolution	Accuracy
10.00V	0.01V	±1%rdg±5d
30.00V	0.01V	±1%rdg±5d
300.0V	0.1V	±1%rdg±5d

6.3.3 Phase metering

Range	Resolution	Accuracy
-179.9º - 180.0º	0.1º	±1º

7. REVISION

Product / Type: Z-OVR impedance system
File: OM0032.docx
Author: M. Clancy

Issue / Date: 2 / 02.01.19

Checked By: MC	Date: 09.09.20

Drawings Required

A3/001778 latest issue (Z-OVR)

A3/001770 latest issue (NLU75/80)