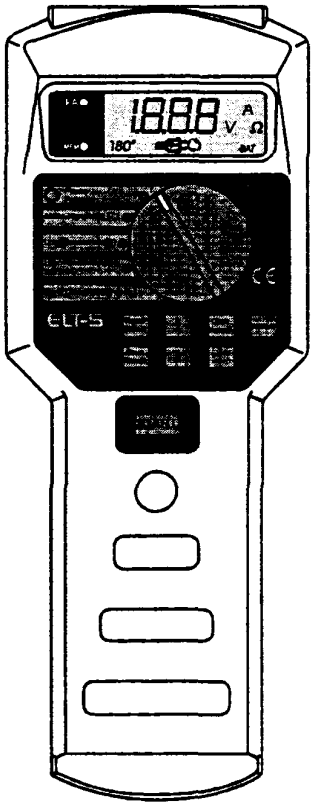
ELT-S
EARTH LINE / LOOP IMPEDANCE TESTER

OPERATING INSTRUCTIONS



SEAWARD

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Safety

Read instructions before use

Due to the potential hazard associated with any electrical circuit it is important that a user is familiar with the instructions covering the capabilities and operation of this instrument. The user should ensure that all reasonable safety precautions are followed and if any doubt exists should seek advice before proceeding.
This product is designed for use by suitable trained competent personnel.

In this user manual, the following four marking conventions are used to focus attention on certain subjects or actions.

TIP:
gives you suggestions and advice to perform certain tasks easier or handier.

ATTENTION:
a remark with additional information; draws your attention to possible problems.

CAUTION:
the machine may be damaged, if you do not carefully execute the procedures.

WARNING FOR DANGER:
you can (seriously) hurt yourself or seriously damage the product, if you do not carefully execute the procedures.

- this document is described with the words manual or user manual;
- the test equipment is described with the words tester, instrument or test device;
- values or displayed data is placed between inverted commas for example "230 V";
- keys or switch positions are placed between brackets for example [start] key.

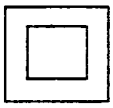
Warranty

SEAWARD Electronic Limited guarantees the tester for a period of 1 year. The period of warranty will be effective at the day of delivery.

Warning pictograms on the tester

There are a number of pictograms on the tester, which are used to warn the user of remaining risks that may be present in spite of the safe design.

Table 1: Pictograms on the tester

Pictogram	Description	Location on the tester
	Warning: Danger read the instructions carefully before use.	At the back side of the tester on the instruction label.
	Warning: Danger for direct contact with live parts.	At the back side of the tester on the instruction label and under the battery cover.
	Marking: Equipment protected throughout by double or reinforced insulation.	At thc back sidc f the tester on the instruction label.
	Marking: Marks the KEMA certification of the tester.	KEMA keur is placed on the front side of the tester.
	CE-mark: Declares the conformity with the European Directives.	CE-mark is placed on the front side of the tester.

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1. GENERAL SAFETY REGULATIONS

	***Read this user manual carefully before you perform any action in connection with the tester.*** ***SEAWARD Electronic Limited is not liable for injuries, (financial) damage and/or excessive wear resulting from incorrectly performed maintenance, incorrect use of or modifications to the instrument.***
	***It is not allowed to change or remove the case or protections of the tester during normal use and without written consent from SEAWARD Electronic Limited. Method of measurement and range are indicated on the back side of the instrument.***
	***It's forbidden to place and/or use the instrument in a room where is a risk of explosion.***
	***If the tester is used by a third party, you being the owner are responsible, unless otherwise specifically defined.***
	***Repair can only be done by SEAWARD Electronic Limited.***
	***Provide a clean and save workplace which has sufficient lightning.***

2. *INTRODUCTION*

2.1 *GENERAL*

2.1.1 The intended use

The impedance tester is intended to be used for judgement of the safety of electrical installations.

The tester is intended for execution of line (L-N or L-N) as well as loop (L-PE) impedance measurements on one or three phase systems. Using this instrument one can test also loop resistance between neutral and protective conductors without causing RCCB trip out. The tester can also be used to determine phase rotation. If the instrument is used in manner not specified in this user manual, the protection provided by the instrument may be impaired and the supplier is excluded from any responsibility.

2.1.2 Target group

The target group to which this user manual is related to is that of qualified persons and technically skilled persons.

By qualified persons we mean persons who:
- have a knowledge level due to previous education/training and who;
- have a certain level of experience required to work with the tester.

By technically skilled persons we mean persons who:
- are qualified and who;
- have a technical knowledge level due to previous education/training and who;
- are familiar with the applied technology in the instrument and perceive the possible dangers.

	***Repair can only be done by SEAWARD Electronic Limited.***

By operating we mean:
- setting up the instrument, working with the tester and cleaning the tester;
- processing the test results.

2.1.3 Working principle

Structure

The ELT-S is a professional instrument intended for execution of line (L-N or L-L) as well as loop (L-PE) impedance measurements on one or three phase systems. Using this instrument one can test also loop resistance between neutral and protective conductors without causing RCCB trip out. Select the test by means of the rotary switch. The test results are clearly displayed on the LCD.

Connecting

The instrument is powered by four alkaline batteries (4 x 1.5 V IEC), what enables autonomous operating for a long time without changing the batteries. The tester is provided with a On/Off switch and after powering up the instrument can be used at once. Test leads or data transfer connectors are situated at the upper side of the tester.

Measuring

Each test has it's specific circuit diagram which is given in the appendix.
The measurements executable by the instrument:

1. Three phase rotation.
2. Line impedance between line and neutral conductors.
3. Line impedance between two line conductors and three phase system.
4. Line impedance between line and protective conductors.
5. Prospective short-circuit current.
6. Prospective short circuit current.
7. Loop resistance between neutral and protective conductors without causing RCCB trip out.
8. Mains voltage.
9. Mains frequency.

2.2 SPECIFICATIONS

General

Nominal voltage Z LINE	:	100 - 440 Vac (eff)
Nominal voltage Z LOOP	:	100 - 250 Vac (eff)
Nominal frequency	:	45 - 65 Hz
Power supply	:	4 x 1,5 V IEC LR14 alkaline batteries
Max. voltage against ground	:	250 Vac (eff)
Max. input voltage	:	440 Vac (eff)
Battery life time	:	approx. 2000 measurements (1 measurement per 5 minutes)
Display	:	3 digit LCD with additional warnings, view area 60 x 24 mm, character high 19 mm
Quality standard	:	design, development and production according to ISO 9001
Automatic L/N exchange function	:	incorporated
Mass	:	approx. 0,75 kg including batteries and accessories
Dimensions (wxhxd)	:	110 x 65 x 290 mm

Environment and storage

Reference temp. range	:	5°C - 35°C
Operating temp. range	:	0°C - 40°C
Storage temp. range	:	-10°C - 60°C
Max. operating humidity	:	85% RH (0°C - 40°C)
Max. storage humidity	:	80% RH (40°C - 60°C)
		90% RH (-10°C - 40°C)
Degree of protection	:	IP50
Protection classification	:	double insulation
Pollution degree	:	Class II
Overvoltage protection	:	Category II 600 V Category III 300 V

Tests

Measurement of effective (r.m.s.) value of a.c. voltage

Range	:	0 - 440 V
Resolution	:	1 V
Accuracy	:	± (2% reading + 2 digits)

Measurement of frequency

Range	:	25,0 - 199,9 Hz / 200 - 500 Hz
Resolution	:	0,1 Hz / 1 Hz
Accuracy	:	± (0,1% reading + 1 digit)

Line impedance between phase and neutral conductors or between two phase conductors

Range (automatic selection)	:	0 - 19,99 Ω / 20,0 - 199,9 Ω / 200 - 1999 Ω
Resolution	:	0,01 Ω / 0,1 Ω / 1 Ω
Accuracy	:	± (2% reading + 2 digits)
Nominal voltage	:	100 - 440 Vac (eff)
Nominal frequency	:	45 - 65 Hz

Loop impedance measurement between the phase and protective conductors

Range (automatic selection)	:	0 - 19,99 Ω / 20,0 - 199,9 Ω / 200 - 1999 Ω
Resolution	:	0,01 Ω / 0,1 Ω / 1 Ω
Accuracy	:	± (2% reading + 2 digits)
Nominal voltage	:	100 - 250 Vac (Fe)
Nominal frequency	:	45 - 65 Hz

Loop impedance measurement between the neutral and protective conductors

Range (automatic selection)	:	0 - 19,99 Ω / 20,0 - 199,9 Ω / 200 - 1999 Ω
Resolution	:	0,01 Ω / 0,1 Ω / 1 Ω
Accuracy	:	± (2% reading + 2 digits) / ± (2% reading + 2 digits) / 5%
Open circuit test voltage	:	approx. Bat
Test current	:	< 15 Mac , both polarities

Prospective short-circuit current(I_{sc}) standard value (impedance)

Short-circuit current I_K calculation:

$$I_K = \frac{U_{nom}}{Z} \cdot \left(1 + \frac{\delta}{100\%}\right)$$

$$U_{nom} = U_{L-N} \text{ ---------- } 100V < U_{imp} < \frac{U_{L-N} + U_{L-L}}{2}$$

$$U_{nom} = U_{L-L} \text{ ---------- } \frac{U_{L-N} + U_{L-L}}{2} < U_{imp} < 440V$$

U_{L-N} adjustable (230V factory set-up)
U_{L-L} adjustable (400V factory set-up)
δ adjustable (6% factory set-up)

Accuracy of I_K : take into account the accuracy of Z LINE

I_K display range(400 V)	:	0,20 A - 40 kA
I_K display range (230 V)	:	0,11 A - 23 kA

Resolution I_K :

0.01 A	0,06 - 19,99 A
0.1 A	20,0 - 199,9 A
1A	200 - 1999 A
10A	2,00 - 19,99 kA
100A	20,0 - 40,0 kA

Nominal voltage	:	100 - 440 V
Nominal frequency	:	45 - 65 Hz

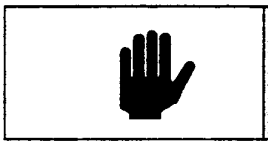
Prospective short-circuit current (I_K) standard value

Short-circuit current I_K calculation:

$$I_K = \frac{U_{nom}}{Z_{LOOP}} \cdot (1 + \frac{\delta}{100\%})$$

$U_{nom} = U_{L-N}$

U_{L-N} adjustable (230V factory set-up)
δ adjustable (6% factory set-up)



Accuracy of I_K : take into account the accuracy of Z LOOP

I_K display range (230 V): 0,11 A - 23 kA

Resolution I_K :

0.01 A	0,06 - 19,99 A
0.1 A	20,0 - 199,9 A
1A	200 - 1999 A
10A	2,00 - 19,99 kA
100A	20,0 - 23,0 kA

Nominal voltage	:	100 - 250 V
Nominal frequency	:	45 - 65 Hz

Transport

The tester is a portable test device which can be handheld or placed down during the tests. Take care of the instrument during transport to avoid mechanical damages.

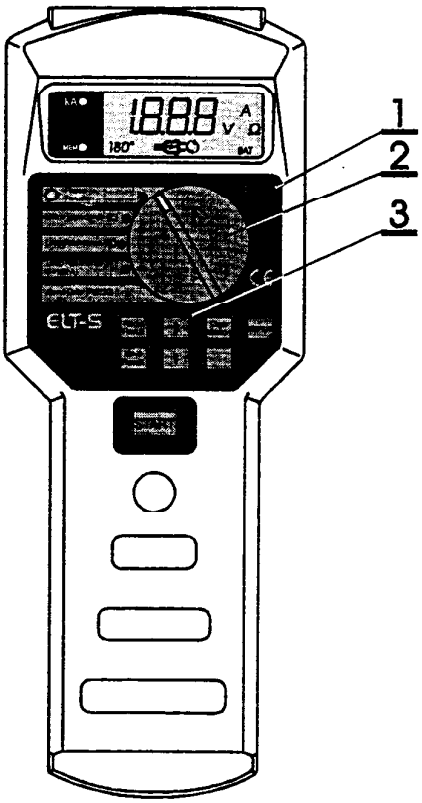
2.3 CERTIFICATION

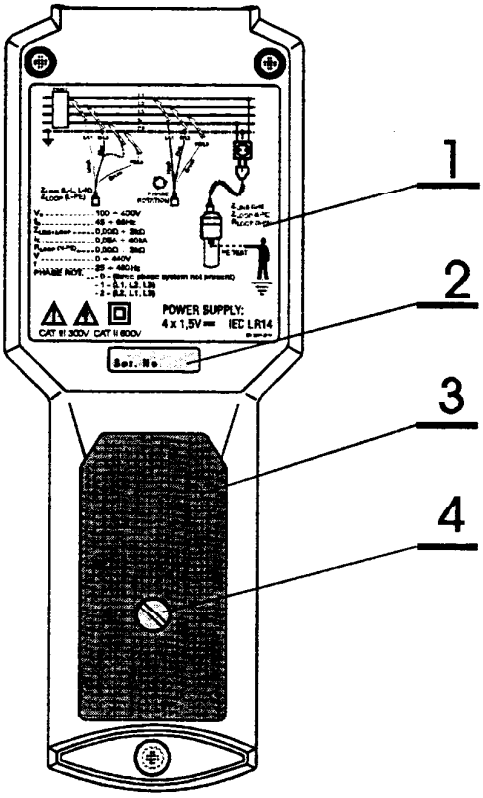
The tester is produced in according to the relevant European Directives.
During design several standards are implemented in the instrument to fulfil the fundamental requirements of the European Directives. The conformation to these requirements is marked with CE Directives and standards.

3. TESTER COMPOSITION

3.1 GENERAL

The ELT-S is ergonomically shaped made of ABS plastic and it is kept in a plastic case which permits safe transportation and protection against mechanical damage. The display is situated at the front side of the tester. The test results are displayed. The main parts are listed below:





Front:
1. On/off key
2. Selector switch
3. LCD-display

Back:
1. Instruction label
2. Serial number
3. Battery cover
4. Battery cover fastening screw

Figure 2: Main parts

3.2 PRINCIPLE OF MEASUREMENT

3.2.1 Visual inspection

Check the test object or installation before testing for damage. The function of the visual inspection is to ensure the electrically safety of the later parts. Check wires and cables on possible damage. If any damage has been noticed, should not perform any tests, before a technically skilled person has repaired or replaced that specific component or part. The operator does the visual inspection and has the responsibility for it.

3.2.2 Three phase rotation test

This measurement has to be used in order to determine whether there is a left or right hand side phase rotation.

3.2.3 Line or fault loop impedance and prospective short-circuit current measurement

Why to test line or fault loop impedance and prospective short-circuit current?
- to verify correspondence fused fuses (nominal current and breaking current capacity);
- to dimension protection system;
- to verify capability of power source;
- to remove bad contacts (measurement is performed using high current impulse).

Why test impedance instead of resistance?

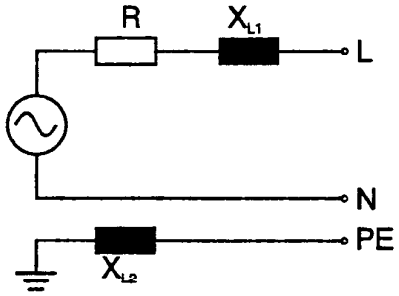


Figure 1: Practical installation

If the measurement is carried out close to power transformer or some inductance is connected in series with power transformer, then inductive part of impedance already has a significant influence to prospective short-circuit current. That is why impedance is the correct parameter for calculation of short-circuit current. Short-circuit current is calculated with respect to a nominal value of mains voltage.

3.2.4 Loop resistance measurement without causing RCCB trip out

Where it is necessary to measure the loop resistance without tripping an RCCB in the supply circuit, the R Loop function should be used. Test current in that function is lower than 15mA which is low enough not to cause RCCB trip out even with a 30mA RCCB..

4. INSTALLATION; START-UP AND ADJUSTING

The tester can only be used if no damages and/or defects are noticed and all components belonging to the originally delivered instrument are mounted

Transportation and handling of the tester should be done carefully to provide mechanical damages.

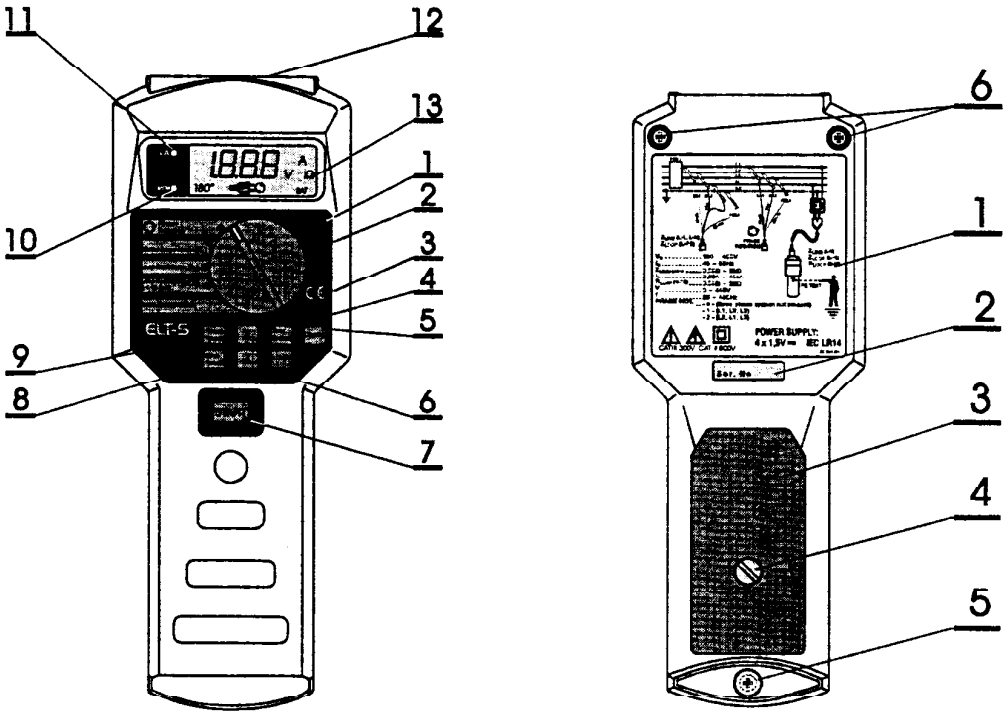
Installation and starting up procedure must be carried out as follows. Installation, starting up and adjusting the instrument may be done by qualified persons.

1. Unpack the instrument.
   Remove the packing materials without causing damage to the environment. Check the tester for damage.
   If damage is noticed, contact SEAWARD Electronic Limited immediately;
2. Put the instrument in a horizontal position, for example on a table in the test room. Keep enough clearance around the instrument to facilitate an easy operation, adjustment and reading of test results, without danger or risks.
3. Insert the batteries into the instrument.
4. Connect the leads according to the circuit diagram.
5. Carry out the selected test.

Find a place to put the manual such that it is within reach during the use of the instrument. We recommend storage within a carry bag.

5. HOW TO USE THE TESTER?

5.1 OPERATING



1. On/off key
2. Rotary mode switch selector
3. Increasing key; memory location
4. Erase key; memory location
5. DISPLAY key
6. Decrease key; memory location
7. START key
8. Store key; to save measuring result
9. Recall key; to recall saved result
10. Memory indication LED
11. kA LED to indicate the unit for short-circuit current, if required
12. Connector part (functional and RS232)
13. LC Display

1. Instruction label
2. Serial number
3. Battery cover
4. Battery cover fastening screw
5. Fixing screw covered by a plastic cover
6. Fixing screw covered by a rubber feet

Figure 3: Operating

Keys
Function key description.

Table 2: Switches

Selector position	Description
ON/OFF	*- on/off key; auto off 10 minutes after last key has been pressed or rotary switch turned;*
Recall result	*- to recall saved results;*
Save result	*- to save measuring result displayed:*
↑ ↓	*- increase/decrease object or measuring place identification number when saving or recalling results;*
	- check other results saved before then displayed one under the same object and measuring place identification number in [Recall Result] function
Clear memory	*- clear all saved results;*
	- clear all saved results under a certain object identification number marked (without dots YYY);
	- clear only saved results under a certain measuring place identification number marked (with dots XXX);
	- clear only the displayed result when in [Recall Result]-function;
	perform RESET of the instrument.
Display	*- select object identification number or measuring place identification number when in [Save Result] or [Recall Result]-function;*
Phase rotation	*- determine phase rotation;*
Line impedance (ZL)	*- line impedance and prospective short-circuit current measurement;*
Loop resistance (RL)	*- loop resistance measurement and prospective short-circuit current;*
Loop resistance (RN)	*- loop resistance measurement without causing RCCB trip out;*
Data transfer (RS232)	*- transfer stored data to printer or PC.*

5.1.1 Starting

Operating the instrument may only be performed by qualified persons.
Never open the instrument during testing.

Check before every test:
**** cables and test leads on possible damages;***
**** tester on possible damages and/or defects.***

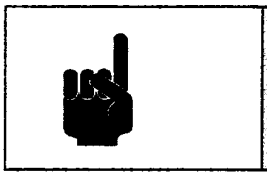
1. Check the instrument for visible damages and/or defects, for example power cord, test leads etc. Don't carry out any test with a damaged or broken instrument.
2. Do not connect the test leads to the instrument and object or installation.
3. The instrument can be used at once.

Test selection

First carry out the visual inspection on the test object or the installation. Connect the tester conform the circuit diagram.

The instrument operates three tests:
Test 1: Three phase rotation test.
Test 2: Line or fault loop impedance and prospective short-circuit current measurement.
Test 3: Loop resistance measurement without causing RCCB trip out.

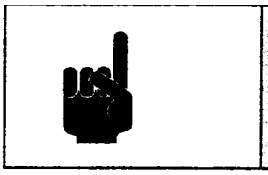
5.2 TESTING



- Avoid testing objects or installations in the vicinity of high electromagnetic and/or electrostatic fields.

In the following paragraph the test methods will be explained. We consider that starting-up is carried out as described in paragraph 5.1.1.

5.2.1 Test 1: Three phase rotation test



- Don't touch the test object nor the installation during measuring;
- Each result can be saved only once.

How to carry out test 1:
1. Connect the test leads to the instrument according to the circuit diagram (see appendix 1).
2. Set rotary switch to [○ Phase rotation].
3. The result is displayed without pushing the [START] key.
4. Read the result save it if required, and note memory codes.
5. Disconnect the test leads and object or carry out another test.

Presentation of result:

- -1- phases according to measuring cable marks
- -2- phases not according to measuring cable marks
- -0- phases do not correspond to 3 phase system or one or two phases fail

5.2.2 *Test 2: Line or fault loop impedance and prospect. short-circuit current measurement*

- After finishing the measurement use the [DISPLAY] key to check the prospective short circuit current and the connection (connection L-L or L-N in Z LINE function only)

- Two polarities of the test current are possible when starting the Z LOOP function in order to avoid a trip out of the RCCB:

- positive ..... use it if the RCCB is sensitive to negative polarity only,
- negative ..... use it the if the RCCB is sensitive to positive polarity only.

- Select the positive polarity by pressing the [START] key once, when starting the measurement, or select the negative polarity by pressing the [START] key twice (in that case 180° is displayed).

- If the rotary switch is set to [Mains Impedance (ZL)] it is possible to check the safety state of the earth connection, at the concerning terminals in the instrument, by means of touching the metal earth potential key

How to carry out test 2:

1. Connect the test cords with the instrument conform the circuit diagram of attachment 2. (2/5 three phase or 3/5 single phase).
2. Set the rotary switch to [Mains impedance (ZL)] or [Loop resistance (RL)]
3. The mains voltage is displayed.
   - For the Z_L function press the metal button.
   - If the mains voltage is displayed, a Loop Resistance measurement can be performed.
   - If the message UPE is displayed there is a voltage >50V on the earth terminal. Disconnect the ELT-S and check the socket.
   - In the R_L function the tester checks continuous the difference between the phase / neutral voltage and the phase / earth voltage.
   - If the mains voltage is displayed the difference is <25V. The measurement can be performed.
   - If the message PEd is displayed the difference is >25V. Disconnect the ELT-S and check the socket.
5. The present mains voltage is displayed.
6. Press the [DISPLAY] key to check the mains frequency.
7. Press the [START] key and read out the result. Save it if required, and note the memory codes when necessary. Both results (impedance and prospective short circuit) will be saved.
8. Disconnect the test object or carry out another test.

5.2.3 Test 3: Loop resistance measurement

- DC test current is pushed into PE - N loop using instrument's battery. In order to reach better results both polarities (positive and negative) are used during the test.

- There must be no voltage between N and PE terminals otherwise the instrument will not carry out the measurement but present voltage will be displayed blinking way.

How to carry out test 3:
1. Connect the test leads according to the circuit diagrams (see appendix 1).
2. Set rotary switch to [Loop resistance] (RN) position.
3. Press [START] key and release it.
4. Read the result. Save it if required and note memory codes.
5. Disconnect the test leads and object or carry out another test.

5.3 MEMORISING OF RESULTS

Each saved result is equipped with an identification code defined by the customer. The code consists of 2 x 3 characters as follows:

X.X.X $\overset{\text{DISPLAY}}{\longleftrightarrow}$ YYY

Where X.X.X presents a code of a certain measuring place inside the tested object, and YYY. presents a code of the tested object.

Each displayed result can be stored as follows:

Pressed key	Comments
[Save Result]	Last changed partial code (X.X.X. of YYY) used for memorising of results is Displayed in order to be changed if necessary.
[↑], [↓]	Insert new code using [↑, ↓] keys if necessary.
[DISPLAY], [↑], [↓]	Check the other part of the code pressing [Display] key and change it using [↑, ↓] keys if necessary.
[Save Result]	Confirm saving using [Save Result] key.

Displayed value is now saved to memory location including sub-result and parameters of the measurement that ca be checked using [DISPLAY] key when in [Recall Result]-function. List of sub-results and parameters which are saved to memory together with main result, see in the following table:

Table 3: Sub-results and parameters.

Main result	Sub-results and parameters
○ PHASE ROTATION	- No sub-results and parameters
LINE impedance	- Short-circuit current - Connection (L-L or L-N)
LOOP impedance	- Short-circuit current - Polarity of measuring current
LOOP resistance	- No sub-results and parameters

- If one wishes to abandon current procedure (memorising), rotary switch must be turned.
- For all measuring results, numbers from 001 up to including 999 are available (for object and for measuring place).
- If one does not care for numeration of objects, then all the results can be saved under the same object code only the measuring place code is to be changed from test to test.
- If one does not care for numeration of objects as well as measuring places, then all the results can be saved under the same object and measuring place code, simply omitting steps 2 and 3 of upper demonstration.

5.4 RECALLING OF MEMORISED RESULTS.

Each memorised result is equipped with eventual sub-result and parameters of the measurement as well as with identification number for each function (1 to 3, see figure below) enabling the user to identify which result belongs to. Identification number is displayed for a while only before displaying of recalled result.

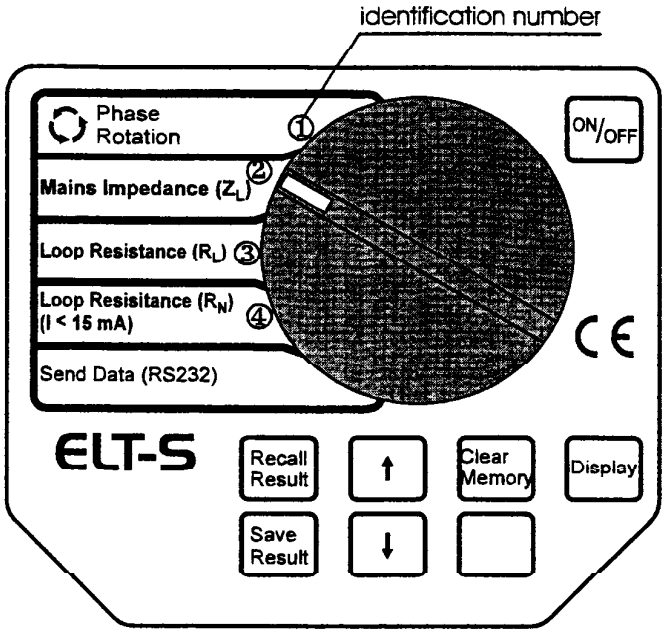


Figure 4: Identification number of each function

Procedure how to recall memorised results:

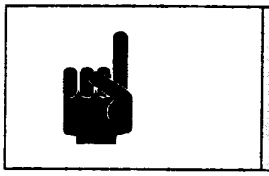
Pressed key	Comments
Recall Result	Last changed partial code (X.X.X of YYY) used for recalling of results is displayed.
↑, ↓	Insert desired code using [↑, ↓] key if necessary.
DISPLAY, ↑, ↓	Insert desired code using [↑, ↓] key if necessary.
Recall Result	Confirm recalling pressing [Recall Result] key again.

Identification number of a function is displayed for a while and then the main result.

↑, ↓	Check the other results saved under the same object and measuring place code using [↑, ↓] keys.

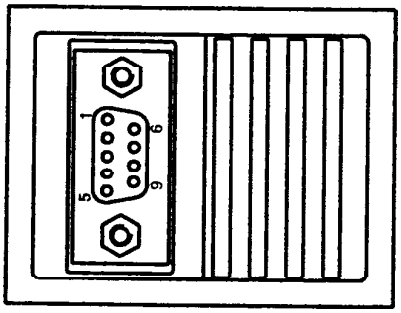
Form of memory locations under a certain code X.X.X, YYY:

Result 1 + sub-result;
Result 2 + sub-result;
...
...
Result n + sub-result



- If one wishes to abandon current procedure (recalling), rotary switch must be turned.
- Use [DISPLAY] key to check also sub-results when in recall function.

5.5 RS232 COMMUNICATION



2.....Rx
3.....Tx
5.....GND

Figure 5: RS232 connector

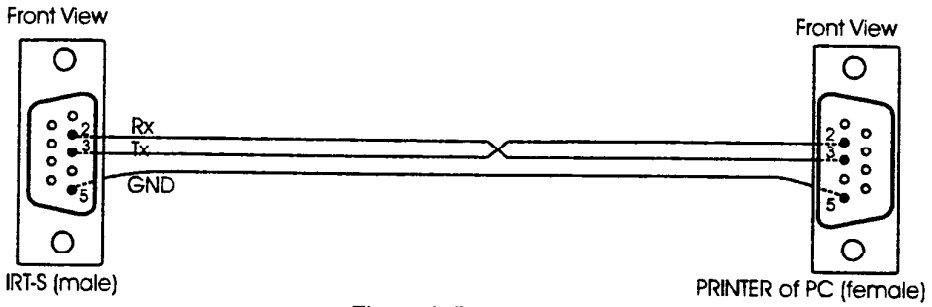


Figure 6: RS232 cable

- connect printer or PC to ELT-S using RS232 cable, supplied with the SEAWARD'S Administration Software;
- set all communication parameters at PC using SEAWARD'S Administration Software that can be supplied by upon separate order;
- set rotary switch of ERT-S to RS232-position, " PrE " is displayed;
- press [START] key in order to transfer stored data to PC or printer;

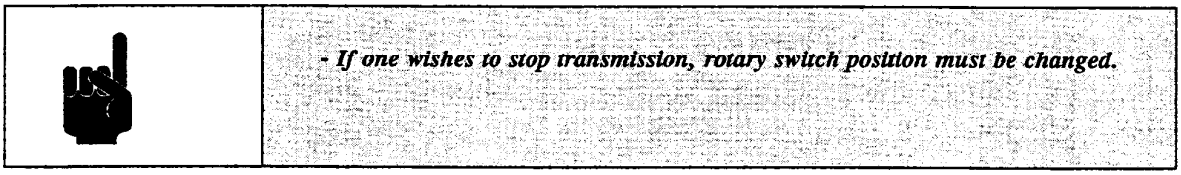
RS232 parameters

- baud rate 4800 Baud;
- format: 1 start bit, 8 data bits, 1 stop bit, no parity;
- protocol: X_{ON}/X_{OFF}.

```
Seaward Electronic LTD.
Type Tester
Serial. Nr.        9621002
------------------------------
Date: --------------------
Operator: ----------------
Place: ---------------------
Note: ---------------------

Object: 001    Place: 001
--------------------------------
Test 1
Test result
```

Figure 7: An example of print out



5.6 ERASING OF RESULTS

In order to avoid confusion, it is advisable to erase all stored results before starting new family of measurements. Sometimes only results stored under a certain object number are to be erased or only results stored under a certain measuring place of the object are to be erased, or even only displayed result recalled is to be erased, that is why appropriate erasing procedure must be followed.

All results are to be erased

Rotary switch is in any position but RS232.

Pressed key	Comments
Clear Memory	CLr is blinking.
Clear Memory	Confirmation.

All results are erased.

Only results of a certain object (YYY) are to be erased.

Rotary switch is in any position but RS232.

Pressed key	Comments
Recall Result	Last changed partial code (X.X.X of YYY) used for recalling of results is displayed.
DISPLAY	Use [DISPLAY] key to select object code (without dots) if necessary.
↑, ↓	Insert desired code using [↑, ↓] key if necessary.
Clear Memory	"CLr" is blinking.
Clear Memory	Confirmation.

Only results of a certain measuring place (X.X.X) of the object are to be erased.
Rotary switch is in any position but RS232.

Pressed key	Comments
[Recall Result]	Last changed partial code (X.X.X of YYY) used for recalling of results is displayed.
[↑], [↓]	Insert desired object / measuring place code using [↑, ↓] keys.
[DISPLAY]	Use [DISPLAY] key to select measuring place / object code.
[↑], [↓]	Insert desired object / measuring place code using [↑, ↓] keys if necessary.
[DISPLAY]	Use [DISPLAY] key to select already inserted measuring place code (with dots) if not already selected.
[Clear Memory]	" CL r " is blinking.
[Clear Memory]	Confirmation.

Only results of a certain measuring place of the object are erased.

Only recalled result displayed is to be erased
Rotary switch is in any position but RS232.

1. Recall the result under a certain measuring place and object code - follow the procedure under paragraph 5.6.
2. Use [↑, ↓] key to select the result to be erased (N for example).
3. Press [Clear memory] key, " CL r " is blinking.
4. Press [Clear memory] key again to confirm erasing.

Only the recalled result under a certain measuring place of the object is now erased. The next result saved under the same measuring place and object code is displayed (N-1 for example).

- If one wishes to abandon current procedure (recalling / clearing), rotary switch position must be changed.

5.7 RESET OF THE INSTRUMENT

After inserting batteries or if there is a malfunction noticed, it is advisable to carry out reset of the instrument as follows:-

1. Switch off the instrument.
2. Press [Clear memory] key and keep it pressed while switching on the instrument.
3. rES is displayed for a while meaning the reset function has been effected.

- All memory locations will be erased performing reset function.

Parameters of all functions will be set to it's default values as follows:
- measuring place identification number is set to 0.0.1;
- object identification number is set to 001.

5.8 TROUBLESHOOTING

Table 4 describes different displayed fault messages of the tester. For each fault an explanation and cause is given. Faults which demand technically skilled persons are marked with a star (*).

When performing various tests, various warnings could be displayed having the following meanings:

Table 4: General faults and warnings

Display	Cause
o.r.	The test result is out of reach, see paragraph "Specifications"
0 V	Input voltage is out of nominal range. (flashing)
Fr	Frequency of mains voltage is out of nominal range
hot	The instrument is overheated → wait. (flashing)
	Mains voltage present, phase voltage an L input.
	Mains voltage present, phse reversed (phase voltage an N input)
BAT	Battery voltage is lower than 4.3V → replace the batteries.
mem no	All memory locations are empty.
toP	All memory locations are used
Prt	Send Data function is selected
Clr	Clear function is active
rES	The instrument has been reset or new batteries are inserted
001	Measuring place identification number
001	Object identification number
180°	Negative polarity of test current. In ZLOOP function only
PEd	Voltage between phase and neutral is 25V higher then the voltage between phase and PE
UPE	The voltage on the PE is higher then 50V
L-n	The measurement was done between L and N terminals. In ZLINE function only
L-L	The measurement was done between two phase terminals. In ZLINE function only
FuS	The fuse of the R_N function is defect

5.9 CALIBRATION AND REPAIR

Technical specifications are warranted only if the instrument is calibrated at least once a year by a competent service department. In case of any instrument malfunction or if some damage is noticed at the instrument or test leads, the instrument must be serviced by a competent service department. Contact SEAWARD Electronic Limited for detailed information. There are no user replaceable parts in the instrument!

Calibration and/or service is done by:

SEAWARD Electronic Limited
Bracken Hill, South West Industrial Estate,
Peterlee, Co. Durham SR8 2SW. England
Tel: 0191 586 3511 Fax: 0191 586 0227

6. MAINTENANCE

	***Don't replace parts yourself. Contact SEAWARD Electronic Limited (see paragraph 2.1.2).***

6.1 BATTERY REPLACEMENT

	***If the "BAT" mark appears on the display, that means the battery voltage is lower than 4.3 V, then remove the old batteries and insert new ones.*** ***Exchange all four batteries. If there are memorised results in the instrument then transfer them to a printer or PC as soon as possible.***

	***Disconnect all cables before removing battery cover.*** ***Caution, possible live parts under the battery cover.***

Battery replacement procedure:

1. Disconnect all cables and remove the battery cover.
2. Exchange batteries within 1 minute.
3. Place battery cover back and switch on the instrument.

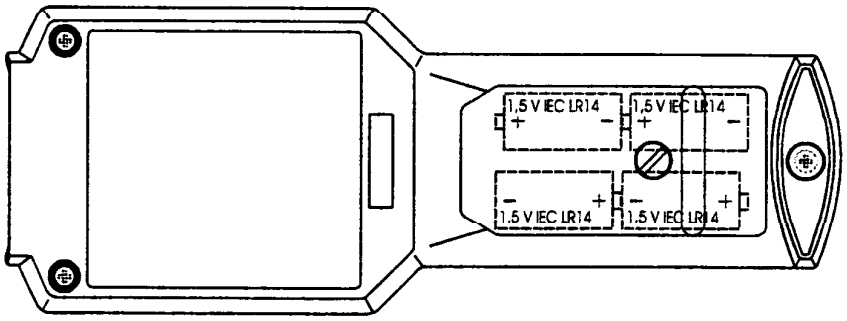
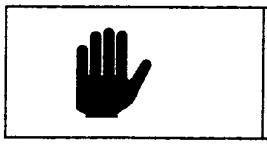


Figure 8: Batteries inserted



Use only the batteries declared in technical specification.

If there is no chance to transfer the results (printer or PC not available), then follow the next procedure when changing batteries in order not to loose stored data:

1. Switch off the instrument.
2. Remove battery cover.
3. Exchange the batteries within one minute.
4. Place battery cover back and switch on the instrument
5. CLr should not be displayed after switching it on meaning memorised results has not been erased.

6.2 CLEANING

Do not use liquids based on petrol!
Do not spill cleaning liquid over the instrument.

Use a soft cloth moistened with water or alcohol and leave the instrument to dry totally after cleaning.

7. STANDARD UNIT AND ACCESSORIES

Standard set:

- one ELT-S instrument;
- one test main cable, curly type, 2 m;
- one English user manual.

Check all the supplied items (casing of the instrument as well as the accessories) and if there is some damage present which may cause dangerous manipulation (hazardous voltage) send the device back to the supplier to be exchanged or serviced.

Accessories:	Order No.
- Single unit soft carry bag	71G071
- Multi unit hard carry case	71G072
- SEAWARD'S Administration Software	278A920
- Data download lead	278A921
- Mains lead	278A004
- Three fase lead	278A005
- Wander lead	278A006

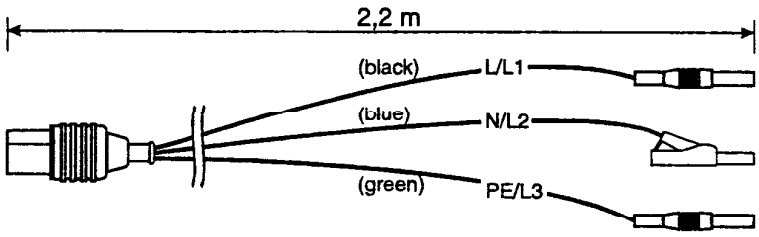


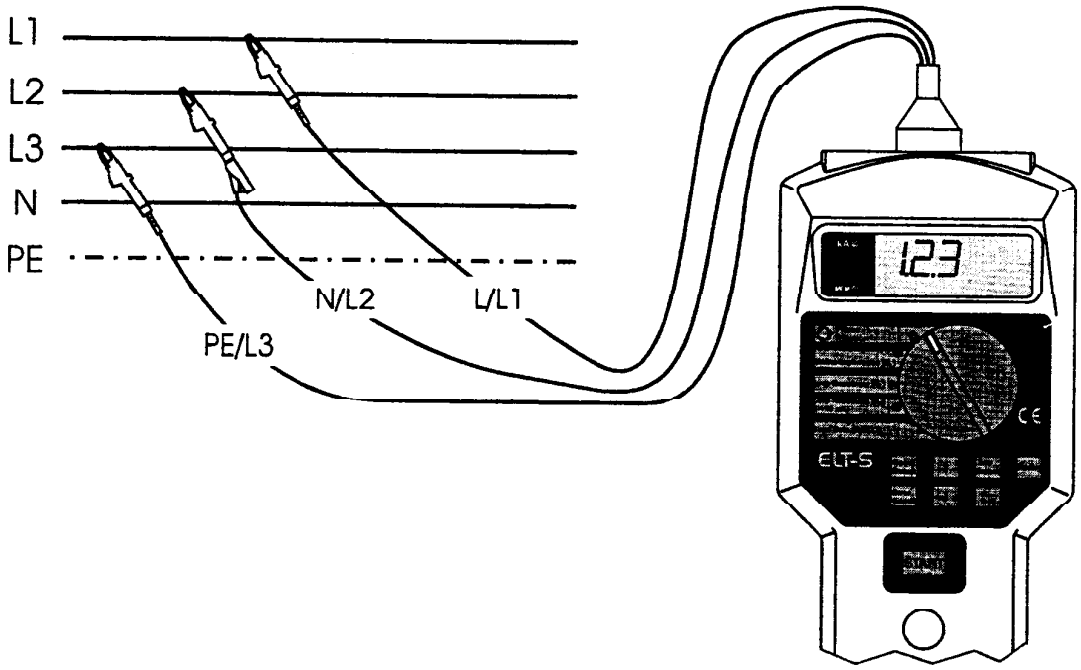
Figure 9: Test lead

Appendix 1 1/5

Circuit diagrams

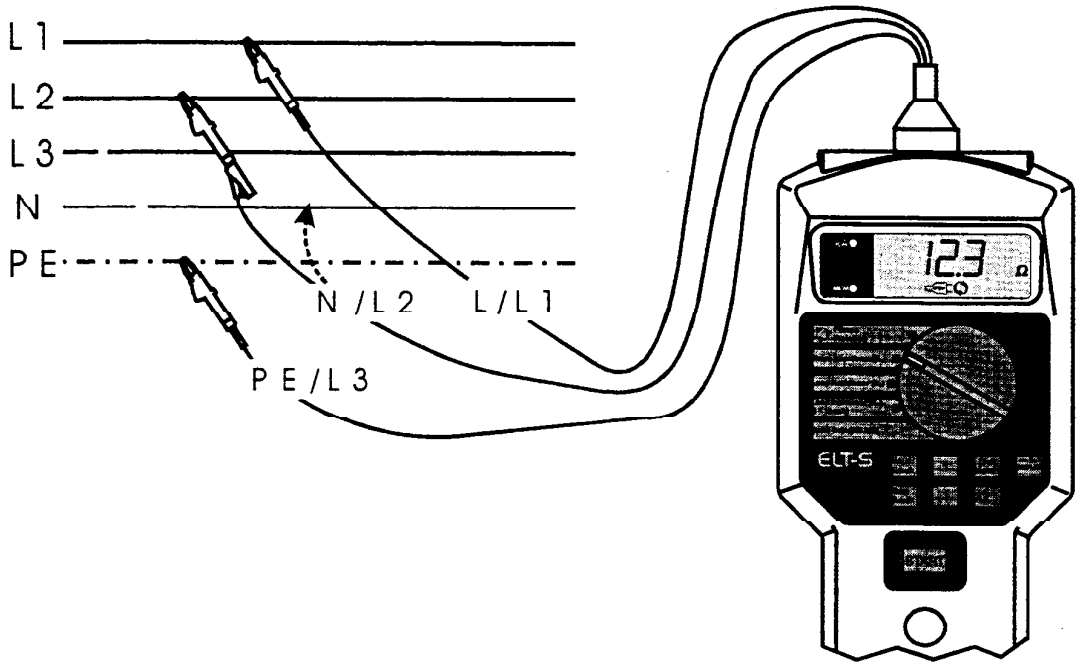
- *Three phase rotation test*

Connect the instrument to test object or installation according to the circuit diagram.



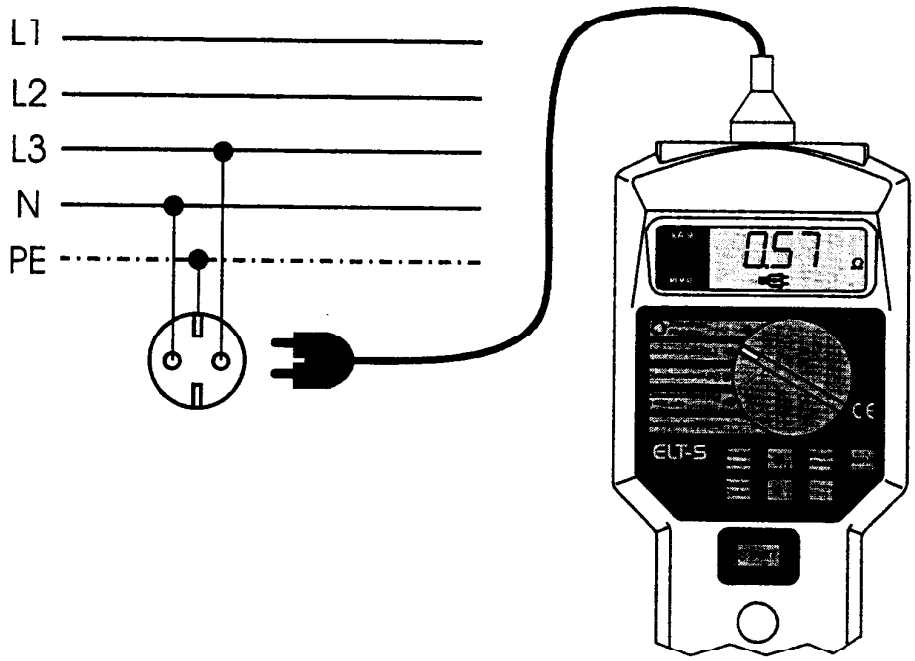
- *Line impedance and prospective short-circuit current measurement*

Connect the instrument to test object or installation according to the circuit diagram.



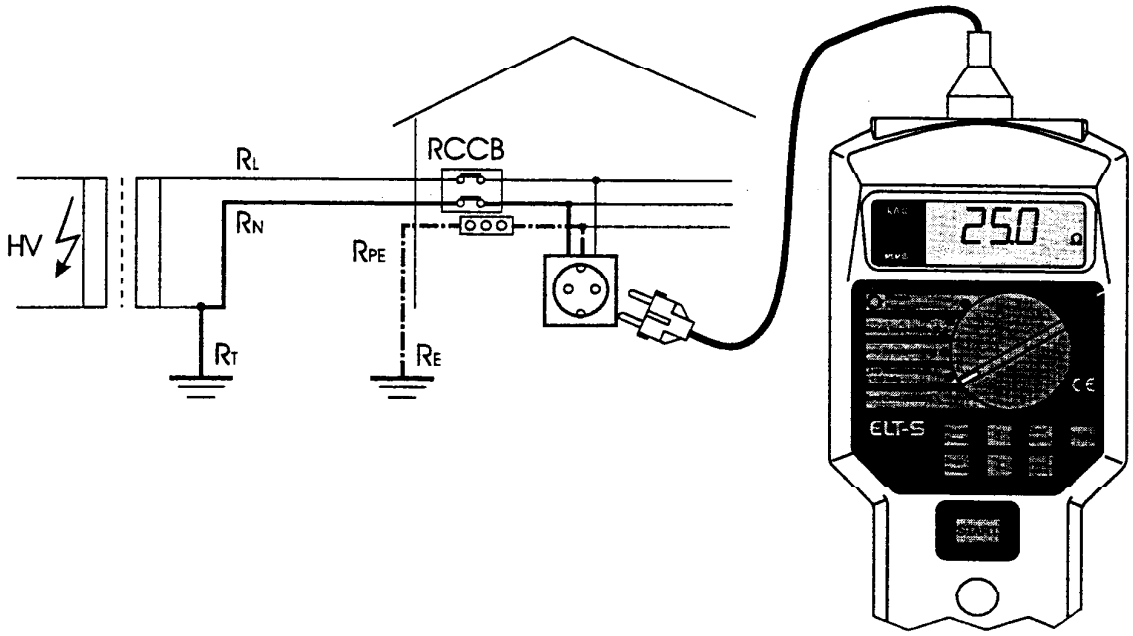
- *Fault loop impedance and prospective short-circuit current measurement*

Connect the instrument to test object or installation according to the circuit diagram.



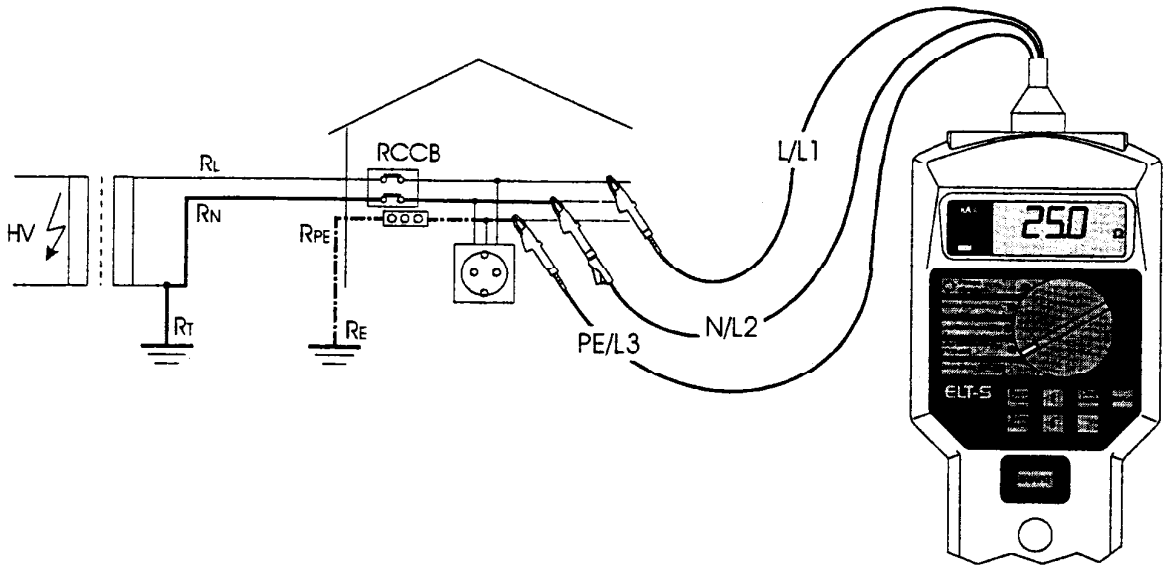
- *Loop resistance measurement without causing RCCB trip out*

Connect the instrument to test object or installation according to the circuit diagram.



- *Loop resistance measurement without causing RCCB trip out (using separate test leads)*

Connect the instrument to test object or installation according to the circuit diagram.



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