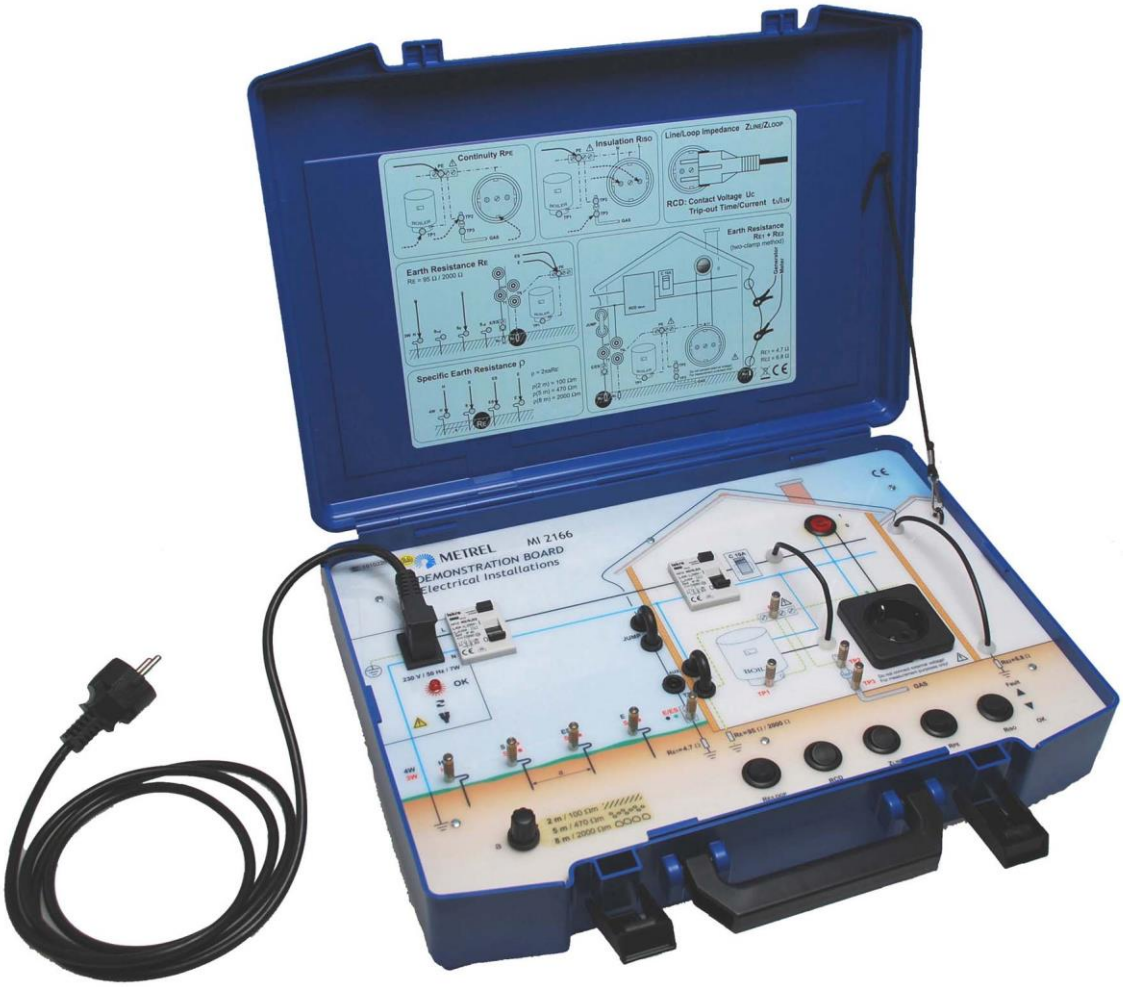

Demonstration board

Electrical installations

MI 2166

User Manual

Version 1.3.6, Code No. 20 750 750

METREL®

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1. Introduction

1.1. General Description

Demonstration board simulates common electrical installation usually met in individual house or apartment. This board is to be used preferably by sales personnel when demonstrating operation of electrical installation test equipment. It is placed into a practical plastic carrying case. Various test methods supported by different test instruments can be presented. Acceptable or faulty parameters can be preset by five »fault« switches. Some real elements of electrical installation are placed on the front panel like RCD protection device, ON/OFF switch with lamp, mains test outlet and connection terminals. Other elements are improvised.

Demonstration board is constructed according to European safety standard EN 61010-1.

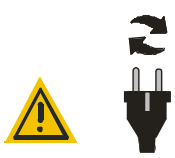
1.2. General warnings

- **If the equipment is not used in a manner specified by manufacturer, the protection provided by equipment may be impared.**
- **Use Demonstration board on TN/TT supply systems only.**
- **Only qualified personnel who are familiar with the board and the measurement instrument may use Demonstration board!**
- **Use of Demonstration board in a way not specified in this User Manual could damage the board.**
- **Do not use Demonstration board in case of any damage noticed!**
- **Only an authorised person may carry out servicing of Demonstration board!**

1.3. Meaning of warning/information symbols on front panel

230 V / 50 Hz / 10 W

OK

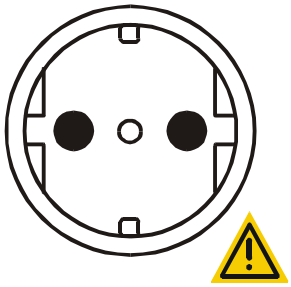


Take care Demonstration board is connected only to mains voltage according to the description under the mains socket! In the opposite case the board can be damaged!

Use outlets with grounded protection terminal only!

There is a protection circuit inside the board.The board will not turn on if connected to outlet without grounded protection terminal.

The lamp will be ON if mains plug is inserted correctly. Otherwise swap L and N terminals!

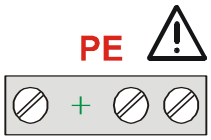


Protection circuit inside Demonstration board cuts mains voltage at input stage of the board if phase line is not applied to appropriate terminal or a voltage difference between neutral line and protective conductor is higher than 30 V.

Use the test outlet on front panel for measurement purposes only!

Do not connect any load, otherwise board may be damaged and the operator exposed to hazardous voltage!

Do not connect external voltage – possible hazardous voltage on accessible parts of board.



PE collector (and all accessible conductive parts) are NOT connected to mains PE but to neutral line.

Note!
If lamp is blinking and you hear noise from relays inside board, disconnect mains plug and check supply socket.

1.4. List of measurements that can be demonstrated

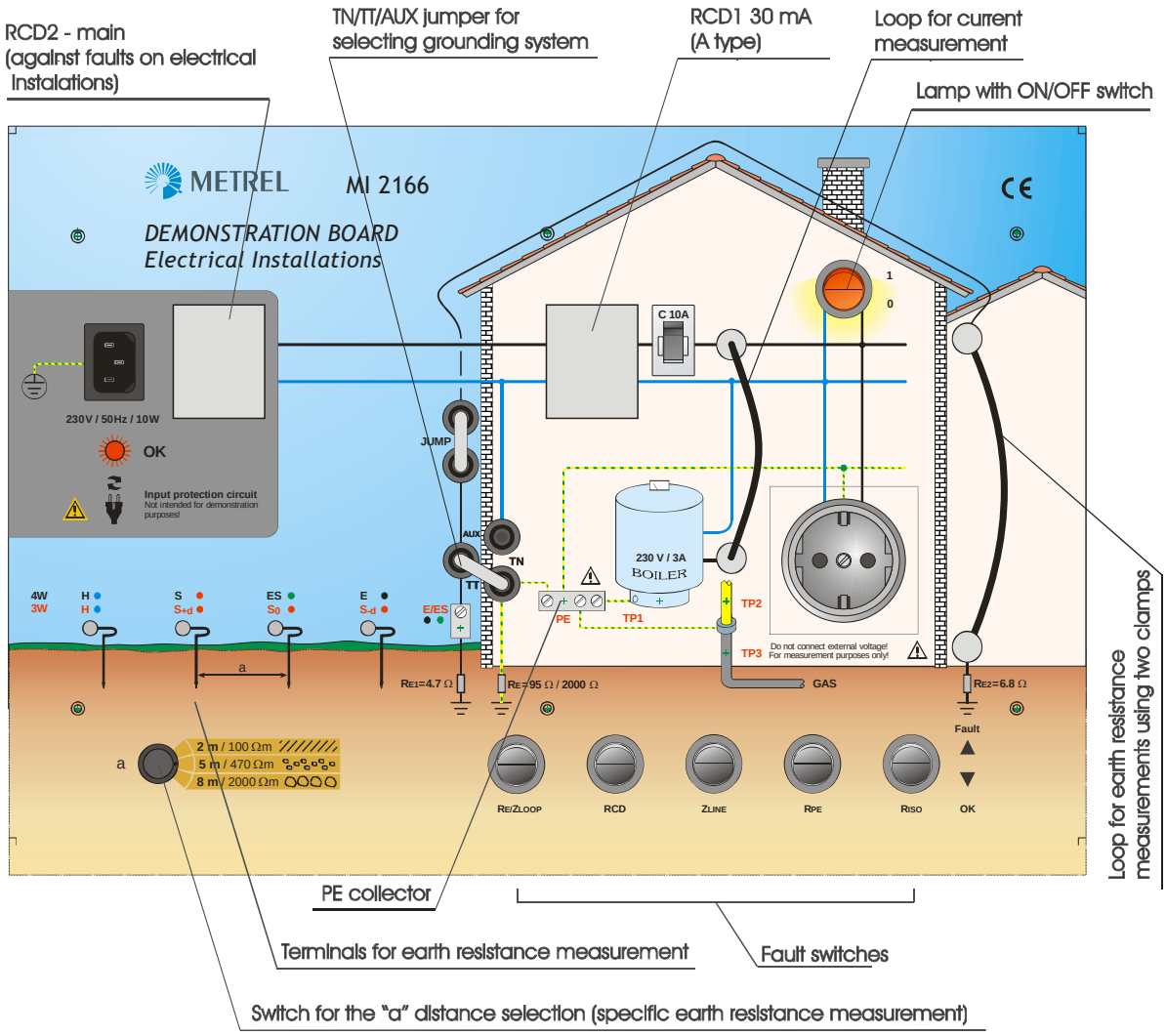
- Continuity of protective conductor,
- Insulation resistance,
- Earth resistance using standard four-lead method,
- Earth resistance using two-clamp method,
- Specific earth resistance at three ground levels,
- Line impedance between the L and N terminals,
- Loop impedance in TT grounding system,
- Loop impedance in TN grounding system,
- Contact voltage without using auxiliary test probe,
- Contact voltage and earth resistance using auxiliary test probe,
- RCD trip-out current,
- RCD trip-out time,
- Current using clamps,
- Other measurements.

2. Before connecting demonstration board to mains supply

Before connecting Demonstration board to mains voltage the operator has to verify:

- Wall mains outlet has to be equipped with PE terminal and there are no mechanical damages noticed on the outlet!
- There are no damages on Demonstration board and on mains cord!
- Mains outlet has to be protected with RCD protection device $I_{\Delta N}$ = 30 mA (recommended).

3. Front panel description



4. Faults simulation

The following faults on electrical installation can be simulated:

Switch	Parameter	Approx. parameter value without fault	Approx. parameter value with fault
RE/ZLOOP	Earth resistance RE	RE = 95 Ω	RE = 2000 Ω
RCD1	RCD trip-out	tΔ < 300 ms	No trip-out
ZLINE	Line impedance between L and N terminals of mains socket	ZLINE = Zx* + 0.2 Ω	ZLINE = Zx* + 2.4 Ω
RPE	Resistance of protective conductor between PE collector and boiler's PE terminal	RPE = 0.0 Ω	RPE = 4.7 Ω
RISO	Insulation resistance between L terminal of mains socket and PE collector	RISO > 200 MΩ	RISO = 0.44 MΩ

*Input impedance (at wall socket)

5. Measurements

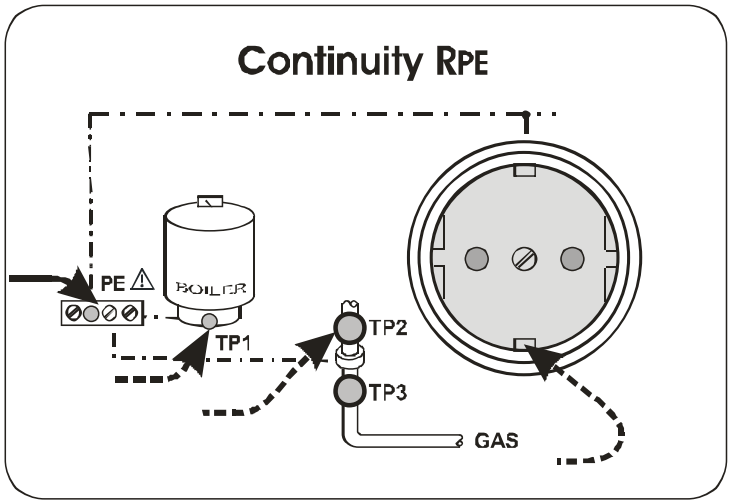
5.1. Continuity of protective conductor

Warning:

Disconnect mains plug and switch off the RCD1 (protection device)!

Start conditions:

- All »fault« switches in OK position!



Measurement location	Nominal value
PE collector – PE terminal of mains outlet	0.1 Ω
PE collector – PE terminal of boiler housing (TP1) (RPE switch in OK position)	0.1 Ω
PE collector – PE terminal of boiler housing (TP1) (RPE switch in fault position)	4.7 Ω
PE collector – internal gas installation (TP2)	0.4 Ω

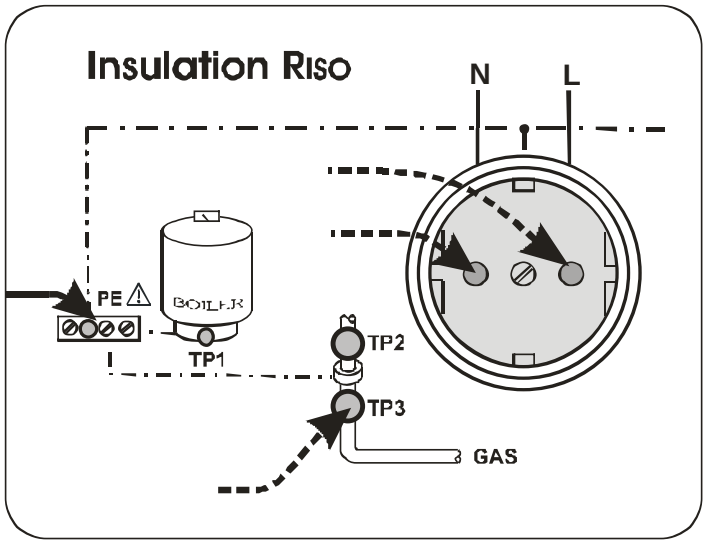
5.2. Insulation Resistance

Warning:

Disconnect mains plug and switch off the RCD1 (protection device)!

Start conditions:

- Switch off the lamp!
- All »fault« switches in OK position!



Measurement location	Nominal value
L terminal of mains outlet – N terminal of mains outlet	> 200 MΩ
L terminal of mains outlet – PE collector (RISO switch in OK position)	> 200 MΩ
L terminal of mains outlet – PE collector (RISO switch in fault position)	0.44 MΩ
N terminal of mains outlet – PE collector	> 200 MΩ
PE collector – external gas installation (TP3)	0.68 MΩ

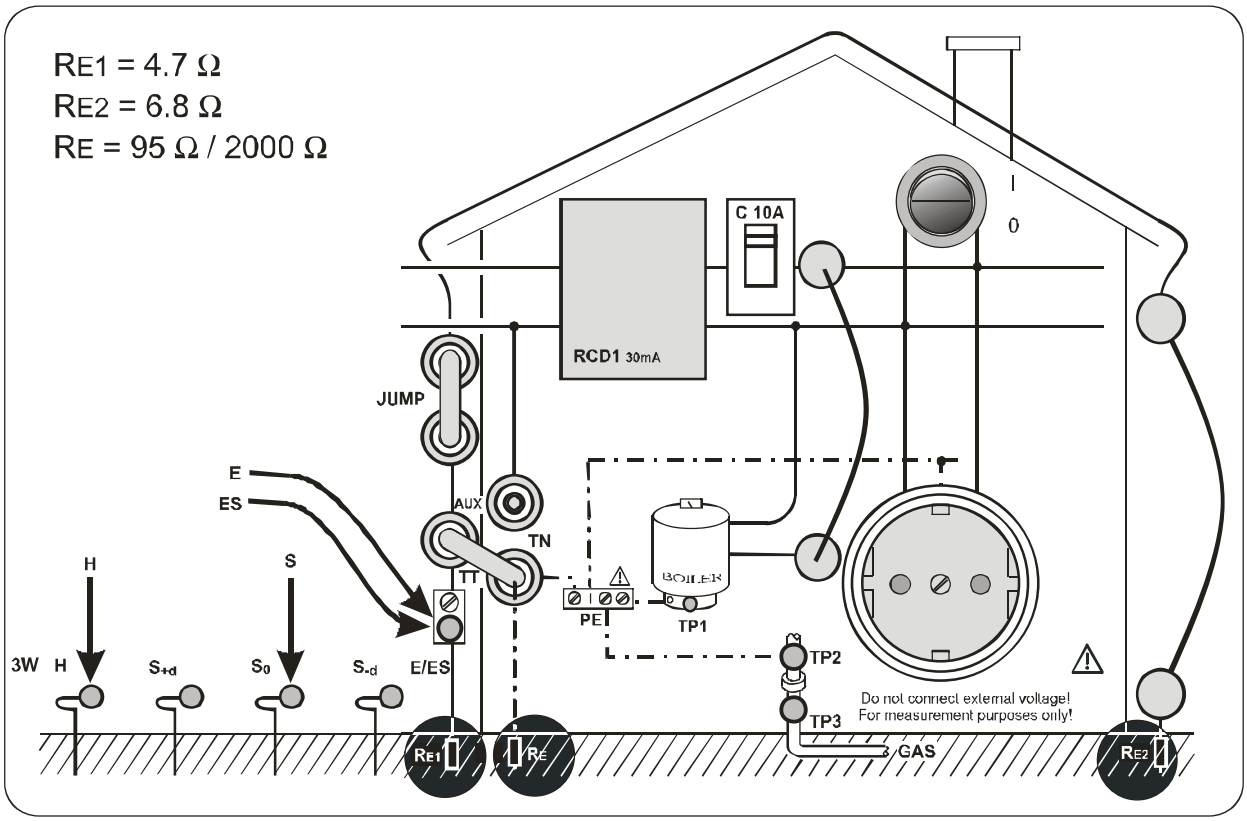
5.3. Earth resistance

Warning:

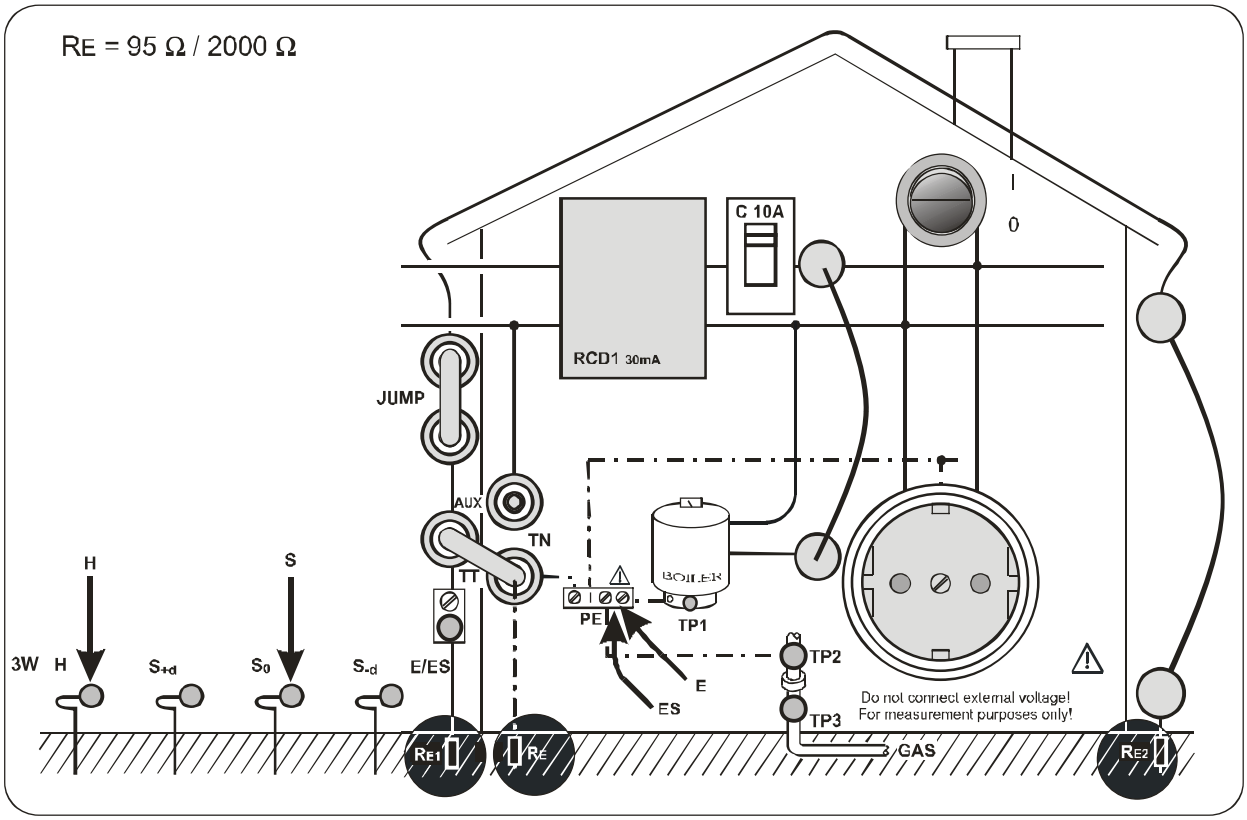
Disconnect mains plug and switch off the RCD1 (protection device)!

Start conditions:

- All »fault« switches in OK position!



Measurement location	Nominal value
H terminal – S0 / S+d / S-d+ – E/ES (jumper TN/TT/AUX in TT position, jumper JUMP inserted)	2.7 Ω
H terminal – S0 / S+d / S-d – E/ES (jumper TN/TT/AUX removed, jumper JUMP inserted)	2.8 Ω
H terminal – S0 / S+d / S-d – E/ES (jumper TN/TT/AUX removed, jumper JUMP removed)	4.7 Ω



Measurement location	Nominal value
PE collector – S0 / S+d / S-d – E/ES (jumper TN/TT/AUX removed, RE/ZLOOP switch in OK position)	95.2 Ω
PE collector – S0 / S+d / S-d – E/ES (jumper TN/TT/AUX removed, RE/ZLOOP switch in fault position)	2000 Ω

Notes!

3W – 3-wire measurement: E and ES leads are connected together.

In 3-wire measurement the instrument should show the same earth resistance value regardless of connection point (S0, S+d, S-d).

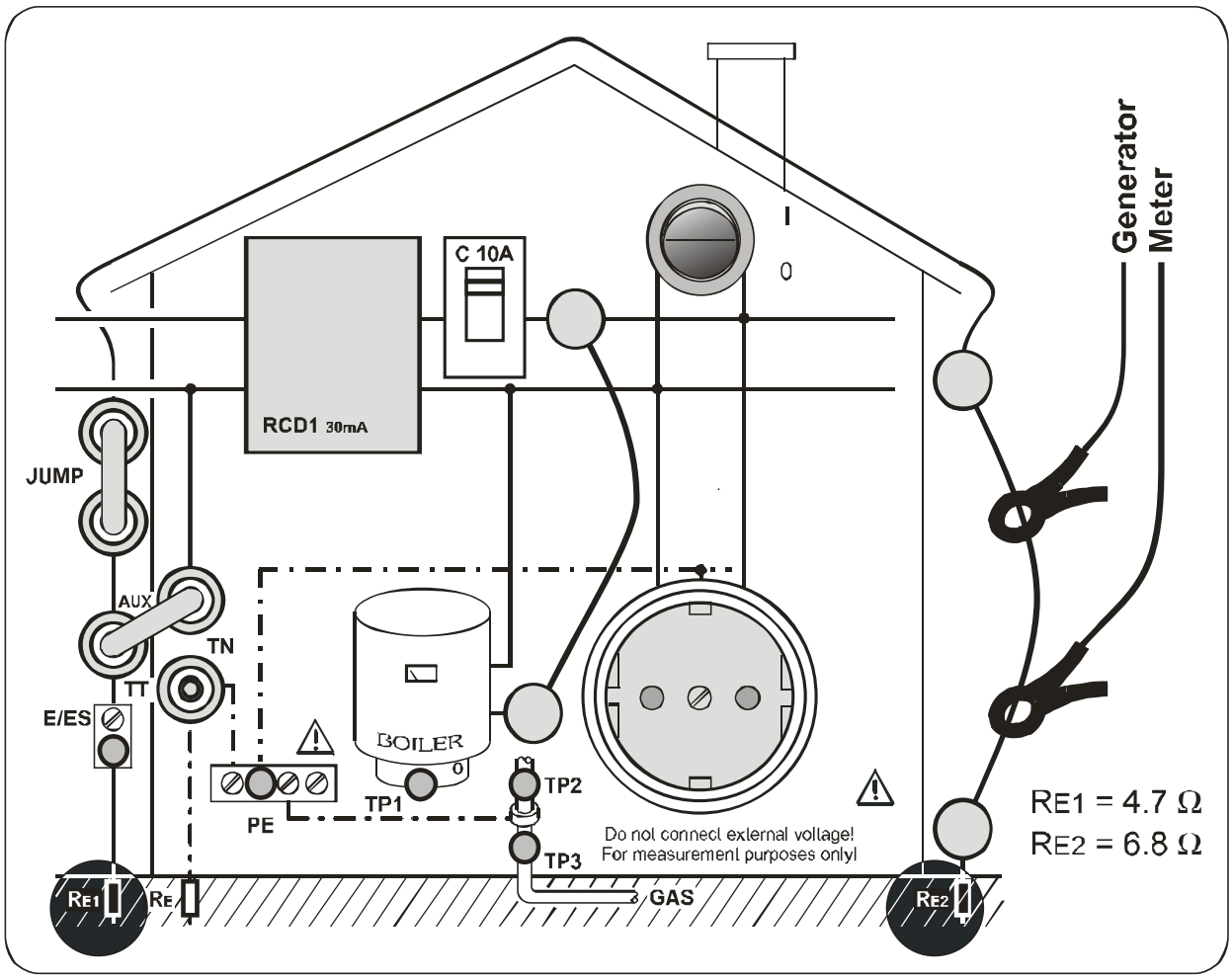
5.4. Earth resistance using two-clamp method

Warning:

Disconnect mains plug and switch off the RCD1 (protection device)!

Start conditions:

- All »fault« switches in OK position!



RE1 + RE2

Measurement location	**Nominal value**
Earth Current loop (jumper TN/TT/AUX removed, Jumper JUMP inserted)	11.5 Ω

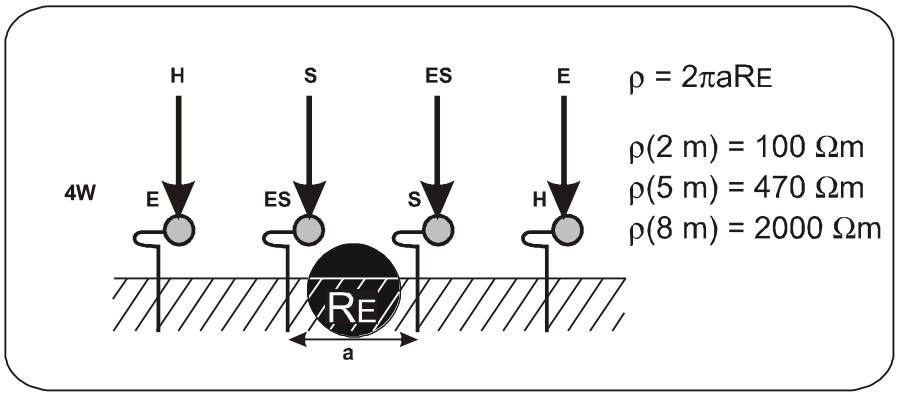
≈ RE2 (RE1 is practically shorted with low external earth resistance of power transformer)

Measurement location	**Nominal value**
Earth Current loop (jumper TN/TT/AUX in AUX position, jumper JUMP inserted)	7.1 Ω

5.5. Specific earth resistance

Warning:

Disconnect mains plug and switch off the RCD1 (protection device)!



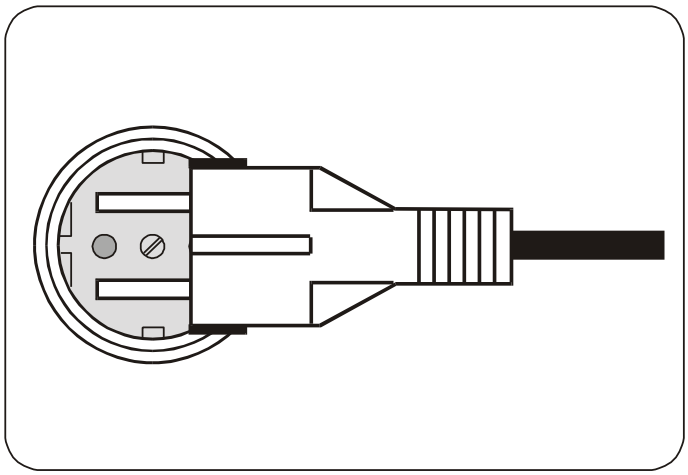
Measurement location	Nominal value
E – ES – S – H (“a” switch in 2 m position)	103 Ωm
E – ES – S – H (“a” switch in 5 m position)	471 Ωm
E – ES – S – H (“a” switch in 8 m position)	1960 Ωm

Note!
Take care the same distance »a« is selected on measurement instrument as on Demonstration board.

5.6. Line impedance

Start conditions:

- Connect mains plug and switch on the RCD1 (protection device)!
- All »fault« switches in OK position!



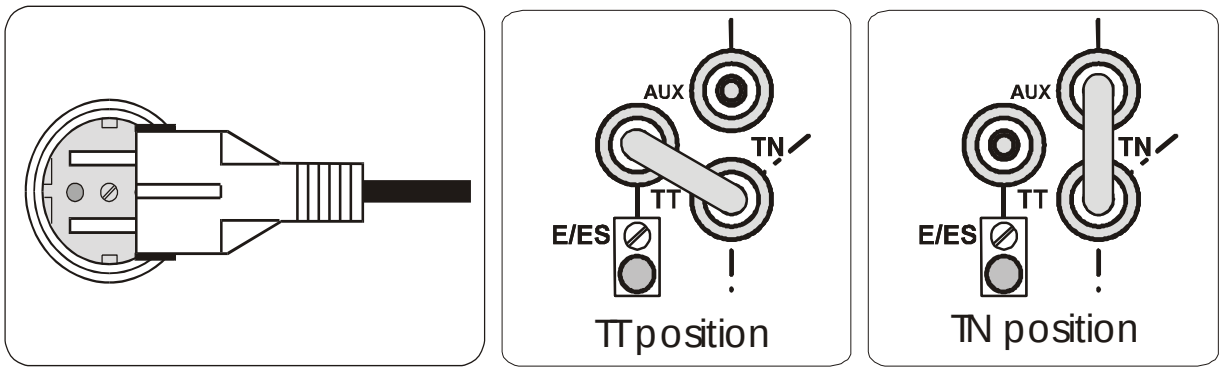
Measurement location	Nominal value
Line impedance at mains outlet (ZLINE switch in OK position)	Zx + 0.2 Ω
Line impedance at mains outlet (ZLINE switch in fault position)	Zx + 2.4 Ω

Zx = line impedance at the input, i.e. wall outlet.

5.7. Loop impedance

Start conditions:

- Connect mains plug and switch on the RCD1 (protection device)!
- All »fault« switches in OK position!



Note!
The measurement of loop resistance will cause the RCD1 on front panel to trip if test current is higher or equal than declared nominal one, i.e. 30 mA.
Check test instrument User manual for selection of the best measurement method in order to reach as good test results as possible!

Loop impedance (L - PE) in TT grounding system

Measurement location	**Nominal value**
Mains outlet (RE/ZLOOP switch in OK position, ZLINE switch in OK position, jumper TN/TT/AUX removed)	Zx + 95.2 Ω
Mains outlet (RE/ZLOOP switch in fault position, ZLINE switch in OK position, jumper TN/TT/AUX removed)	Zx + 2000 Ω
Mains outlet (RE/ZLOOP switch in OK position, ZLINE switch in OK position, jumper TN/TT/AUX in TT position, jumper JUMP inserted)	Zx + 2.7 Ω

Zx = Line impedance at the input i.e. wall outlet.

Loop impedance (L – PE) in TN grounding system

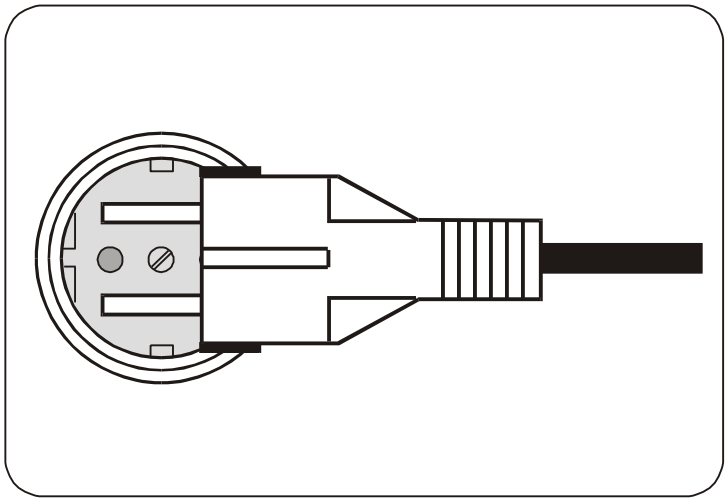
Measurement location	**Nominal value**
RLOOP at mains outlet (RE/ZLOOP switch in fault position, ZLINE switch in OK position, jumper TN/TT/AUX in TN position)	Zx + 0.34 Ω

Zx = Line impedance at the input i.e. wall outlet.

5.8. Contact voltage and trip-out time / Current of RCD1 protection device

Start conditions:

- Connect mains plug and switch on the RCD1 (protection device)!
- All »fault« switches in OK position!



Contact voltage

$I_{\Delta N}$ = 30 mA

Measurement location	**Nominal value**
Mains outlet (RE/ZLOOP switch in OK position, jumper TN/TT/AUX removed)	2.86 V
Mains outlet (RE/ZLOOP switch in fault position, jumper TN/TT/AUX removed)	60 V

Trip-out time

$I_{\Delta N}$ = 30 mA

Measurement location	**Nominal value**
Mains outlet (RCD1 switch in OK position)	< 300 ms
Mains outlet (RCD1 switch in fault position)	No trip

Trip-out current

$I_{\Delta N}$ = 30 mA

Measurement location	**Nominal value**
Mains outlet (RCD1 switch in OK position)	15 mA ÷ 30 mA
Mains outlet (RCD1 switch in fault position)	No trip

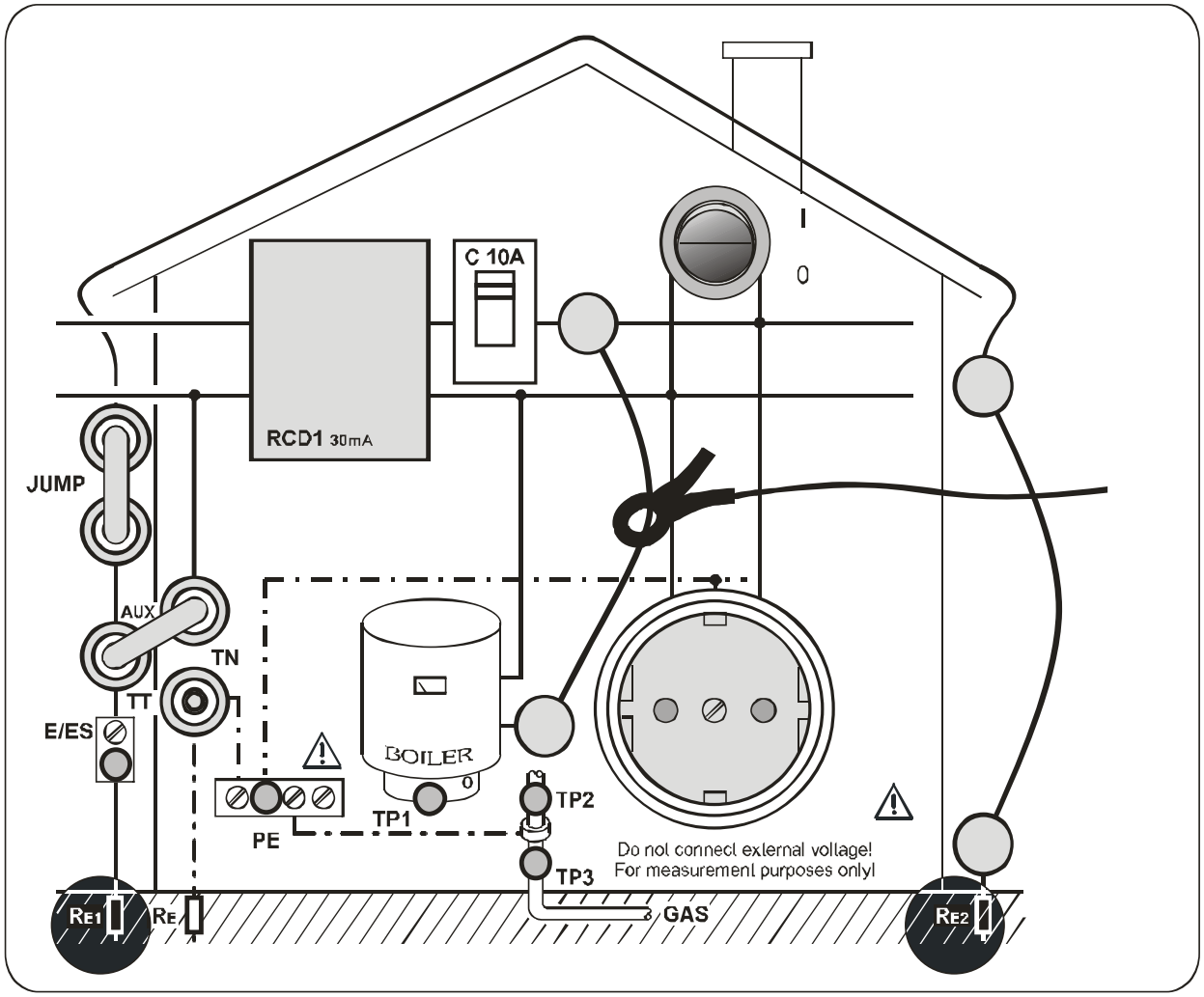
Note!

Nominal values in the table are valid for RCD1 measurements type AC.

5.9. Current measurement using clamps

Start conditions:

- Connect mains plug and switch on the RCD1 (protection device)!



Measurement location	**Nominal value**
Current Loop (RCD1 switch in OK position)	~ 3 A

6. Technical data

Nominal mains voltage	230 V / 50 Hz
Power consuption	10 W
Mains cord	single-phase
Dimensions (width × length × height)	450 × 330 × 110 mm
Weight	3.56 kg
Protection class	I (protective earth conductor)
Over current category	CAT II 300 V
Pollution degree	2
RCD (protection device)	30 mA/type A

Reference conditions

Reference temperature range	10 °C ÷ 30 °C
Reference humidity range	40 %RH ÷ 70 %RH

Operation conditions

Working temperature range	0 °C ÷ 40 °C
Maximum relative humidity	95 %RH (0 °C ÷ 40 °C), non-condensing

7. Maintenance

7.1. Cleaning

Use a soft cloth slightly moistened with soapy water or alcohol to clean the surface of the board and then leave the board to dry totally before use.

Do not use liquids based on petrol!
Do not spill liquids over the board!

7.2. Service

In case of unusual response of Demonstration board or if there is any damage noticed, the product has to be taken to an authorised service. Consult the producer or your dealer for further information.
The product has no internal user serviceable parts (fuses, etc).

Producer's address:

METREL d.d.
Ljubljanska 77
1354 Horjul
Slovenia

Tel.: +386 (0)1 7558 200
Fax.: +386 (0)1 7549 095 or +386 (0)1 7549 226

8. Standard set

Upon receipt of Demonstration board it is advisable to check the content of the delivery. The following items have to be included:

- Demonstration board.
- Two jumpers.
- Mains cable.
- Instruction manual.