



AutoPAT MI 2143 User Manual

Ver 1.0, Code no. 20 750 779



Distributor:

Producer:

Metrel d.d.
Ljubljanska cesta 77
SI-1354 Horjul

E-mail: metrel@metrel.si
<http://www.metrel.si>

© 2003 Metrel



Mark on your equipment certifies that this equipment meets the requirements of the EU (European Union) concerning safety and interference causing equipment regulations

No part of this publication may be reproduced or utilized in any form or by any means without permission in writing from METREL.

Table of contents

1	General description.....	4
1.1	Warnings.....	4
1.2	Applied standards	4
2	Instrument description.....	5
2.1	Front panel.....	5
2.2	Connector panels.....	5
2.3	Bottom	6
2.4	Indicator panel	7
2.4.1	Warning indications.....	7
3	Instrument operation and application	8
3.1	General	8
3.2	Measurement limit values	9
3.3	Test setup	10
3.4	Test procedure.....	12
4	Technical specifications	13
5	Maintenance	15
5.1	Periodic calibration.....	15
5.2	Fuse.....	15
5.3	Service.....	16
5.4	Cleaning.....	16
6	Instrument set and accessory	16

1 General description

AutoPAT MI 2143 is a portable test instrument intended for automatic verification of the electrical safety of portable electrical equipment. The instrument is designed for testing the following product groups:

- ❑ Class I and Class II equipment;
- ❑ General and information technology (IT) equipment;
- ❑ Power supply cords.

This instrument covers the following test functions:

- ❑ Earth bond resistance,
- ❑ Insulation resistance,
- ❑ Substitute leakage current, and
- ❑ IEC cord polarity test.

The instrument also executes fuse pre-test to assure proper connection of tested appliance.

Simple manipulation offers fast selection of desired test. The unique indication of test results enables fast decision on tested product condition.

The instrument is designed for testing 230 V appliances but a special test adapter enables to make tests of 110 V appliances.

AutoPAT MI 2143 is Class II product and ensures safe work with tested equipment. Tested equipment is separated from mains supply.

1.1 Warnings

In order to reach high operator safety while carrying out tests using AutoPAT, as well as to keep the test equipment undamaged, it is necessary to consider the following warnings:

- ❑ **If the test equipment is used in a manner not specified in this user manual, the protection provided by the equipment may be impaired!**
- ❑ **Read this user manual carefully, otherwise use of the instrument may be dangerous for the operator, for the instrument or for equipment under test!**
- ❑ **Do not use the instrument and accessories if any damage is noticed!**
- ❑ **In case a fuse has blown follow the instructions in this user manual to replace it!**
- ❑ **Service intervention or calibration procedure is allowed to be carried out only by a competent authorized person!**
- ❑ **Use only standard or optional test accessory supplied by your distributor!**

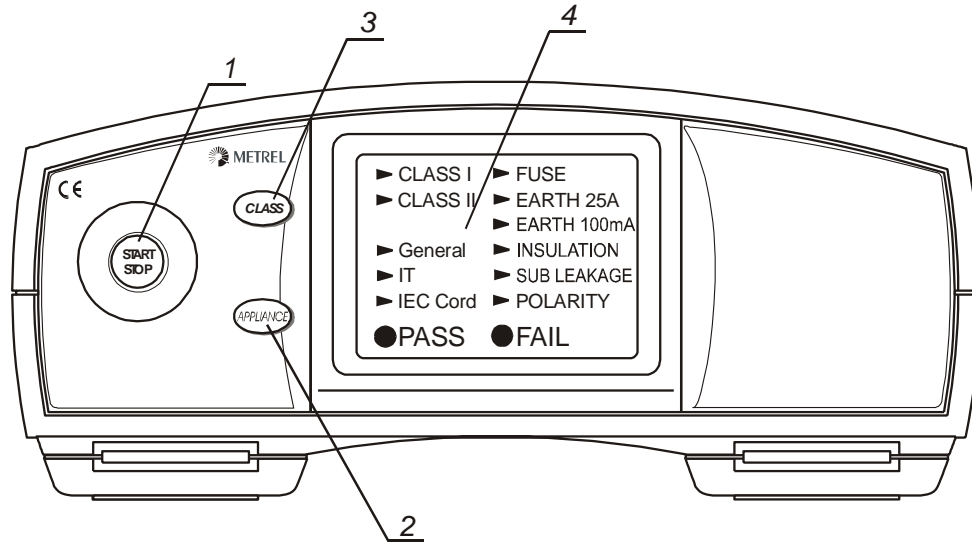
1.2 Applied standards

The AutoPAT MI 2143 instrument has been manufactured and tested in accordance with the following standards:

Safety	EN 61010-1
Electromagnetic compatibility	IEC 61326
Measurements	BS89

2 Instrument description

2.1 Front panel

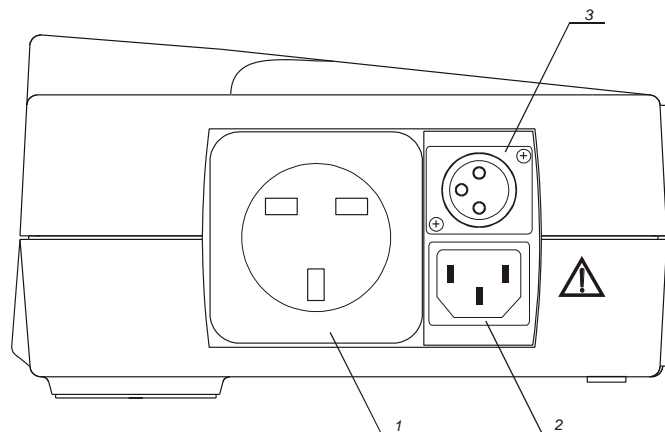


Front panel

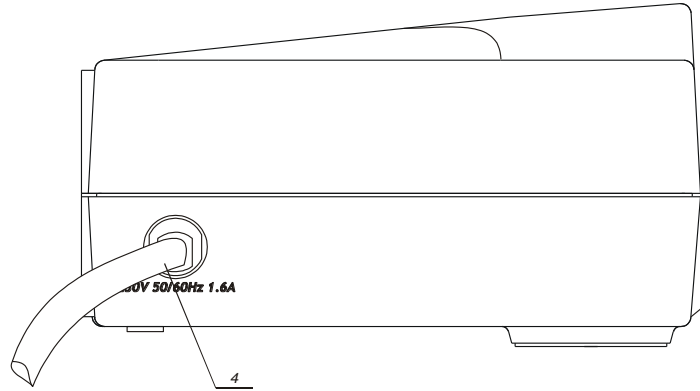
Legend:

- 1..... START/STOP key
- 2..... APPLIANCE selection key
- 3..... Safety CLASS selection key
- 4..... Indicator panel

2.2 Connector panels



Connector side



Mains supply entry

Legend:

1..... Test socket

2..... IEC lead connector

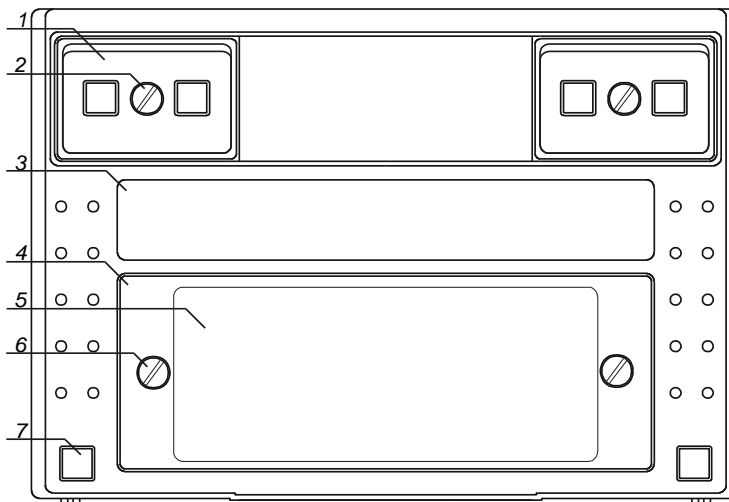
Warning! The connector input is only for test purposes; do not connect it to mains supply!

3..... Earth bond connector, also used as an input for class II measurement of insulation

Note: During IEC cord testing the earth bond clip need not be connected into earth bond connector.

4..... Mains supply cord

2.3 Bottom



Bottom side

Legend:

1..... Plastic cover with rubber foot, for inclined position

2..... Screw.

3..... Label with measurement data.

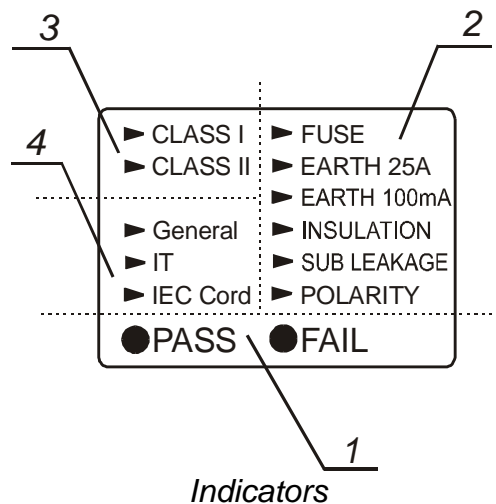
4..... Fuse compartment cover.

5..... Information label.

6..... Fixing screw for fuse compartment cover (see chapter **11.2 Fuses** for instructions on fuse replacement).

7..... Rubber foot.

2.4 Indicator panel



Legend:

- 1..... Final result of tests
- 2..... Particular test function indicator field
- 3..... Indication of selected appliance safety class
- 4..... Tested equipment type

Indicator panel offers all indications which are necessary as support to automatic test procedure.

PASS / FAIL indicators show the final result of executed tests. PASS means that results of all executed tests are within the predefined limits.

Flashing **PASS** indicator means that the result of indicated test function, which is also flashing, is between two limits of that function.

Test function indicator field contains indications of all tests of the instrument. If a test sequence requires particular test, its indicator is turned on when the measurement is performed. After all tests in the test sequence are finished all involved indicators stay illuminated'. **Flashing indicator** means that that test is finished with a result outside the predefined limits.

Fuse indicates only power on or power off state of the tested appliance.

Activity of the instrument is also indicated with buzzer sound.

2.4.1 Warning indications

- A) **Overtemperature protection:** indicators **EARTH 25A** and **Earth 100mA** begin flashing when the internal temperature limit of 80 °C is reached. In that case earth bond test is skipped until temperature is low enough.
- B) **Overvoltage protection:** before each test the instrument checks if external voltage is applied between L and PE, N and PE on test socket, or earth bond clip and PE. The instrument makes sound indication when the voltage is higher than approximately 10 V.

3 Instrument operation and application

3.1 General

Automatic appliance testing with AutoPAT MI 2143 is very simple. It is just necessary to select class and type of appliance and start the test sequence. It is also possible to stop testing before completion by pressing START / STOP key again. In this case all test indicators are cleared.

Only those tests that are required for selected options are executed. Following is a short description of tests.

FUSE

This is pre-test only and is intended to detect if tested appliance is turned on. The instrument measures the impedance between L and N on test socket. If this impedance is too high then fuse indicator starts flashing. This pre-test does not have any influence on final PASS / FAIL decision. The reason is that very low power consumption appliances exist and thus they may have impedance higher than the limit.

EARTH 25A

Continuity test of PE connection is executed between test socket and earth bond clip. Earth bond clip has to be connected to accessible conductive parts that are connected to PE of the appliance supply cord. Test current of 25 A is required for most appliances in safety class I. The instrument contains two limits for this test.

EARTH 100mA

Some information technology (IT) appliances are very sensitive and could be damaged during standard PE continuity test as defined above. For this case the test current is limited to the nominal value of 100 mA.

INSULATION

For the CLASS I appliance the insulation resistance is measured between PE and shorted L and N conductors. The insulation resistance for CLASS II appliance is measured via earth bond clip instead of PE. Test voltage is 500 V nominal, only for CLASS I IT is 250 V. This test shows that the resistivity of the dielectric between accessible conductive part and L / N is high enough.

For safety reason do not touch any accessible conductive parts with capacitance higher than 90 nF during insulation testing.

SUB LEAKAGE

Instead of measurement of leakage current with a real mains supply, this measurement is executed with separated voltage source with output voltage lower than safety limit. The source is connected between PE and shorted L / N conductors. Current into PE is measured and scaled to supply voltage.

POLARITY

This is a special test for detachable supply cords. Polarity in this case means correct connection between the terminals of a plug on one side and a socket on the opposite side.

NOTE!

If polarity test with EU version of Autopat FAILS the first time, try to swap L and N terminals of tested IEC cord and repeat the test. If result is »PASS« at least one time, then IEC Cord is OK, otherwise it is not.

3.2 Measurement limit values

Appliances are designed for different purposes and various supply conditions. These ranges of conditions are covered by various general and product standards. A part of the standards are requirements against electric shock with test conditions and limit values. AutoPAT MI 2143 is designed for test conditions and compares results according to the standards mentioned in paragraph **1.3 Applied standards**.

The following limit values are applied for the built-in functions:

230 V appliances

Test function	Appliance type	Safety class	Limit values	Test condition
FUSE	General	CLASS I	30 k Ω	40 V
		CLASS II		
	IT	CLASS I		
		CLASS II		
EARTH 25 A	General	CLASS I	0.1 Ω and 0.5 Ω *	25 A
	IEC cord	CLASS I		
EARTH 100 mA	IT	CLASS I	0.1 Ω and 0.5 Ω *	100 mA
INSULATION	General	CLASS I	1 M Ω	500 V
		CLASS II	2 M Ω	
	IT	CLASS I	1 M Ω	250 V
		CLASS II	2 M Ω	
	IEC cord	CLASS I	1 M Ω	500 V
	SUB LEAKAGE	General	CLASS I	0.75 mA and 3.5 mA*
IT		CLASS I		
POLARITY	IEC cord	CLASS I		<50 V

110 V appliances

Test function	Appliance type	Safety class	Limit values	Test condition
EARTH 25 A	General	CLASS I	0.1 Ω and 0.5 Ω *	25 A
	IEC cord	CLASS I		
EARTH 100 mA	IT	CLASS I	0.1 Ω and 0.5 Ω *	100 mA
INSULATION	General	CLASS I	1 M Ω	500 V
		CLASS II	2 M Ω	
	IT	CLASS I	1 M Ω	250 V
		CLASS II	2 M Ω	
	IEC cord	CLASS I	1 M Ω	500 V
	SUB LEAKAGE	General	CLASS I	0.75 mA and 3.5 mA*
IT		CLASS I		

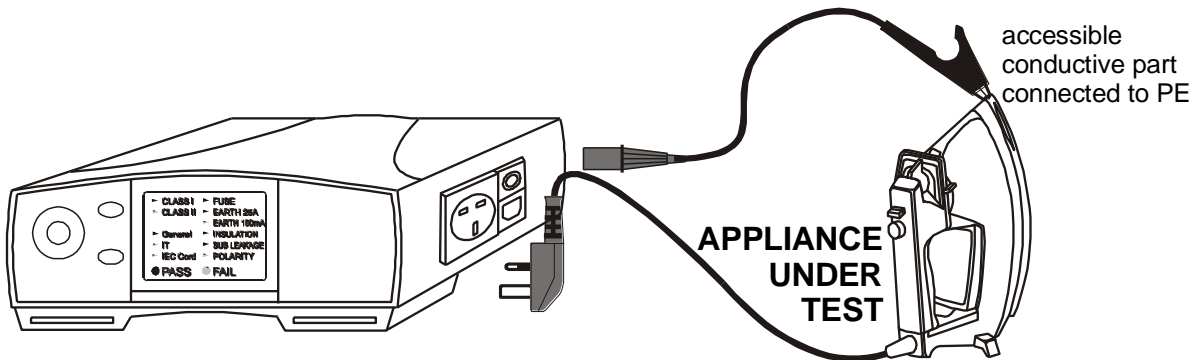
* **Note:** When test result is between two limit values then PASS and appropriate test function indicator are flashing. This is valid only if results of other test are acceptable. If result is out of the worst limit, FAIL indication is activated. In the case of flashing PASS indicator the tested appliance can still be acceptable for known reason, e.g. long mains cord.

In the case that numeric results are required, we recommend to test the appliance with AlphaPAT MI 2142, OmegaPAT MI 2140, or BetaPAT MI 2141.

3.3 Test setup

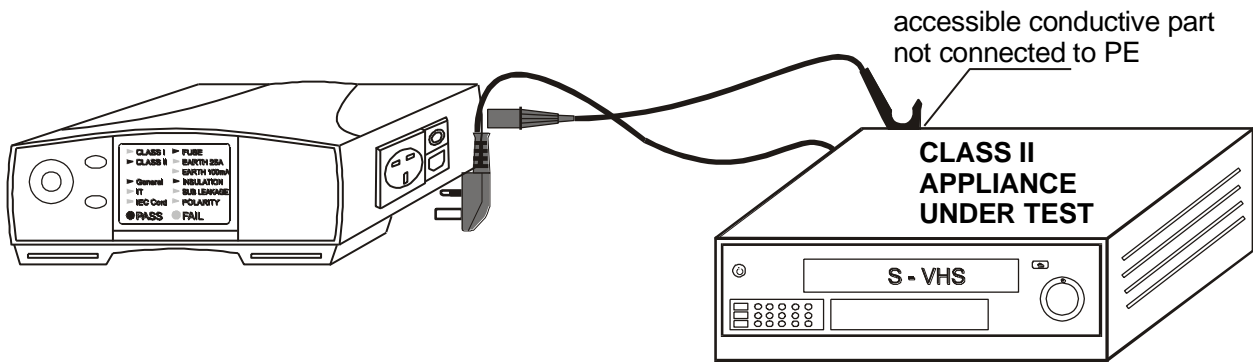
For regular testing it is required to prepare appropriate test setup. This setup must include all connections required for all measurements of particular appliance.

Following figures represent connections for testing appliance.

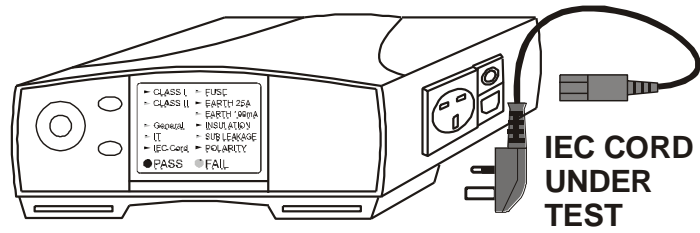


Connection of the CLASS I appliance

Note: If appliance contains accessible conductive parts not connected to PE, then the test has to be repeated as for CLASS II appliance to test the insulation resistance of those parts to L / N.



Connection of the appliance of CLASS II

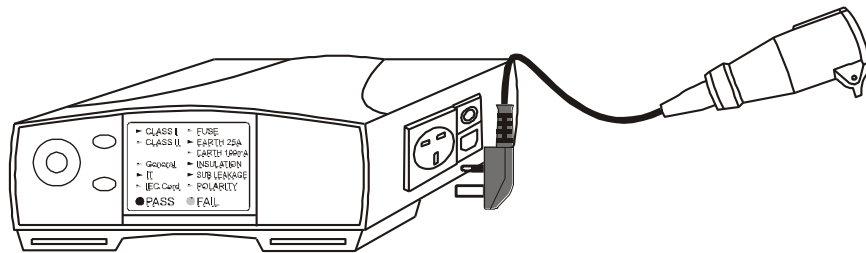


IEC cord connection

Connection of 110 V appliances

Special adapter exists for testing 110 V appliances. The instrument automatically detects this adapter and calculates sub-leakage current to 110 V.

Note: fuse pre-test and polarity (IEC cord) test are disabled.

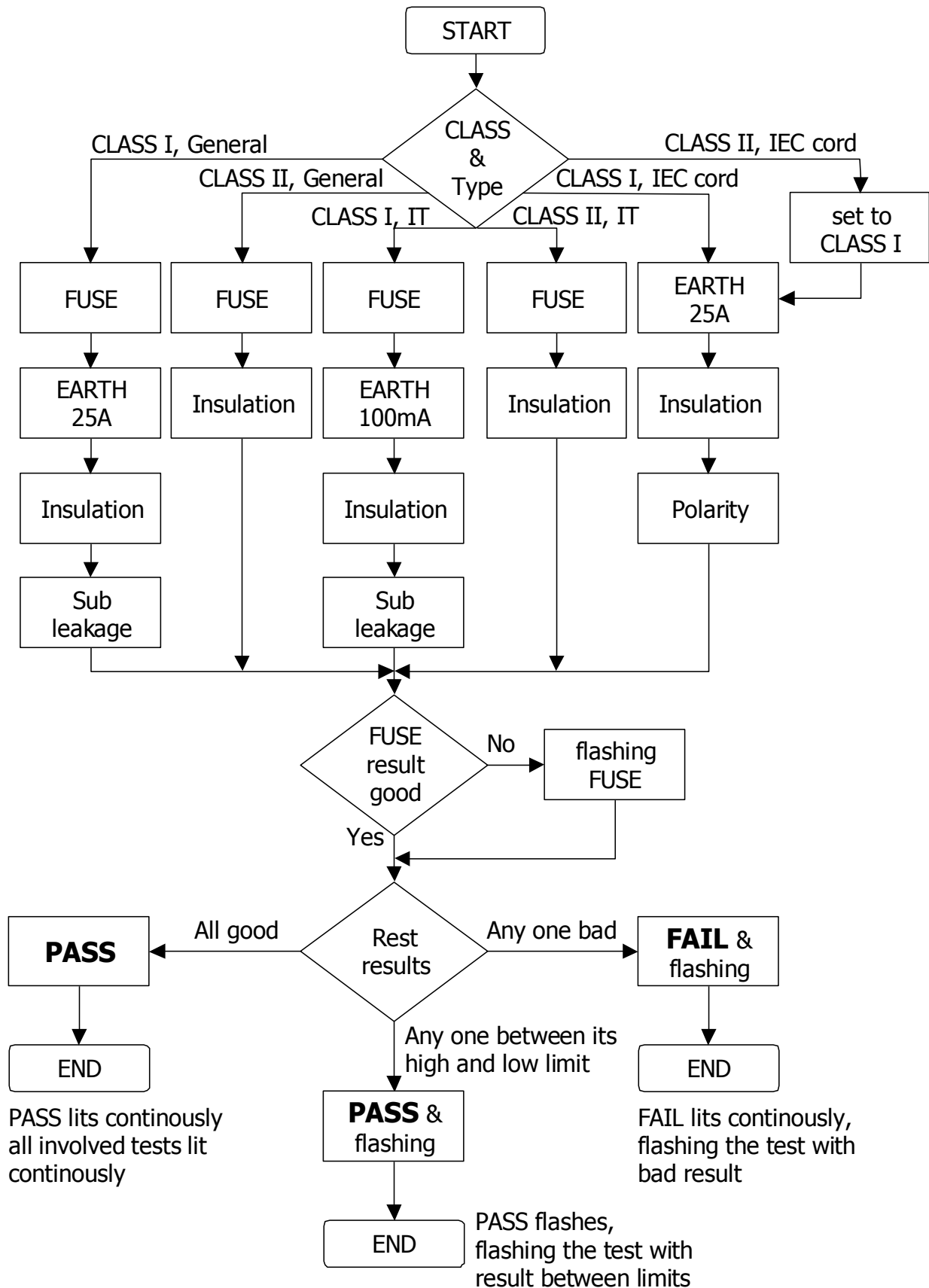


Connecting 110 V adapter to the instrument

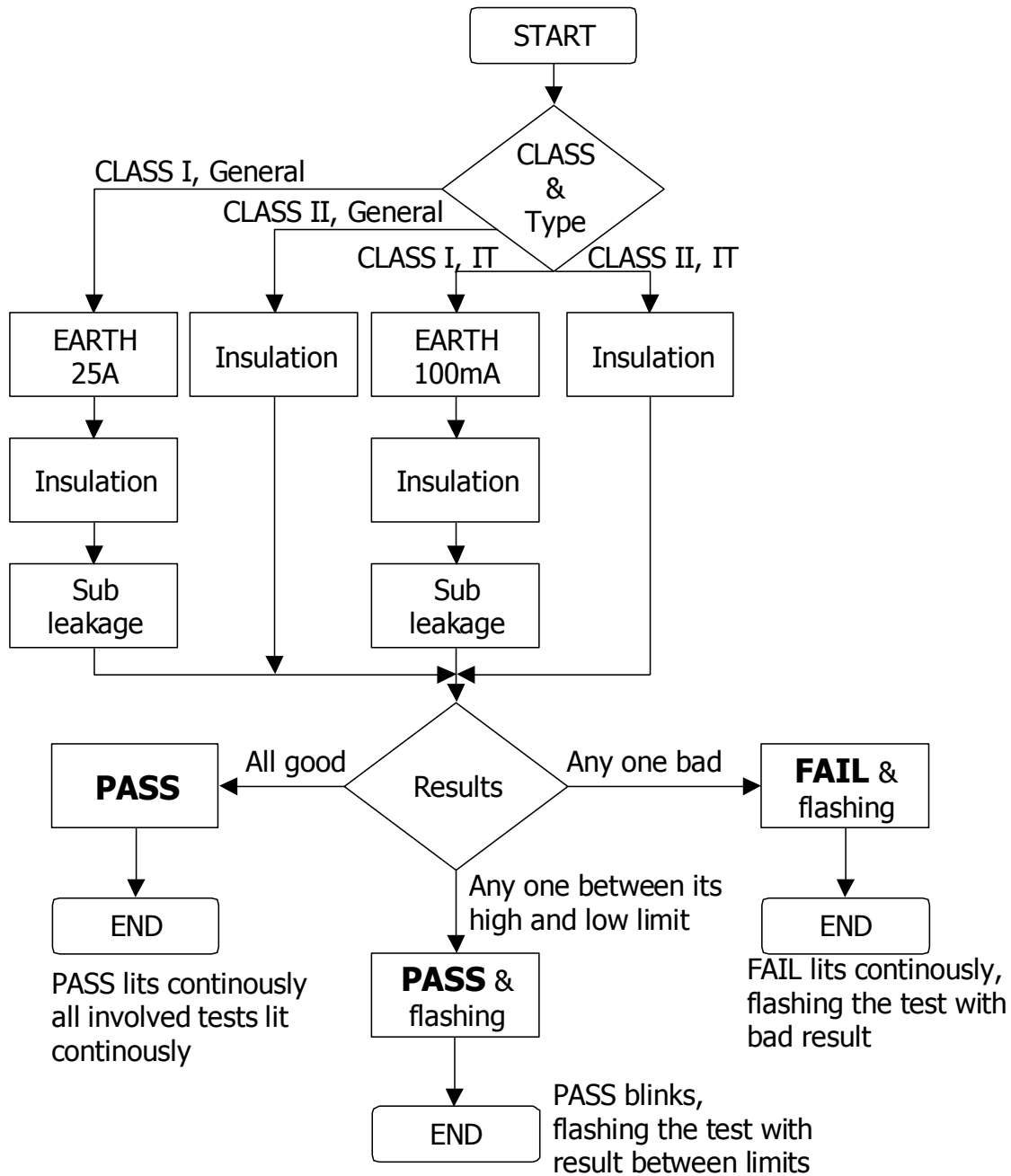
Measurement connections of tested 110 V appliances with this adapter are the same as mentioned above.

3.4 Test procedure

Flowchart for automatic testing of 230 V appliances:



Flowchart for automatic testing of 110 V appliances:



4 Technical specifications

Earth 25 A

Limit1	0.1 Ω ± 0.03 Ω
Limit2	0.5 Ω ± 10 %
Test current.....	25 A (100 mΩ, mains supply voltage: 230 V a.c., ambient temperature: 25 °C)
Open circuit voltage	<6 V a.c. (mains supply voltage: 230 V a.c.)
Test duration.....	5 s
Output.....	test socket (PE) to earth bond clip

Earth 100 mA

Limit1	0.1 $\Omega \pm 0.03 \Omega$
Limit2	0.5 $\Omega \pm 10 \%$
Test currents.....	100 mA (100 m Ω , mains supply voltage: 230 V a.c., ambient temperature: 25 °C)
Open circuit voltage	<6 V a.c. (mains supply voltage: 230 V a.c.)
Test duration.....	5 s
Output.....	test socket (PE) to earth bond clip

Insulation resistance

Limit CLASS I	1 M Ω
Limit CLASS II	2 M Ω
Accuracy	$\pm 10 \%$
Nominal voltage CLASS I IT	250 V d.c. (+10 %, -0 %; ≥ 250 k Ω)
Nominal voltage rests	500 V d.c. (+10 %, -0 %; ≥ 500 k Ω)
Test current.....	> 1 mA at 500 k Ω @ 500 V; > 1 mA at 250 k Ω @ 250 V
Short circuit current.....	1.3 mA
Test duration.....	5 s
Output.....	CLASS I: test socket (L+N to PE); CLASS II: test socket (L+N) to earth bond clip
Auto discharging after test. ...	Yes

Substitute leakage current

Limit	0.75 mA, 3.5 mA
Accuracy	$\pm 10 \%$
Open circuit voltage	<50 V a.c. (mains supply voltage of 230 V a.c.)
Short circuit current.....	<40 mA
Test duration.....	2 s
Output.....	test socket (L+N to PE)
Current scaled to	230 V 110 V with 110 V appliance adapter

Polarity test

Test voltage	up to 80 V d.c. / < 1 mA
Detects.....	Pass, L-open, N-open, PE-open, L-N crossed, L-PE crossed, N-PE crossed, L-N shorted, L-PE shorted, N-PE shorted, multiple faults
Output.....	test socket and IEC cord

Fuse pretest

Limit	30 k Ω
Accuracy	$\pm 10 \%$
Test voltage	<50 V a.c.
Output.....	test socket (L to N)

General data

Rated supply voltage210 V ÷ 264 V, 50 Hz or 60 Hz

Max. power consumption 1.3 A

Fuse..... T 1.6 A / 250 V, 5 × 22 mm

Overtoltage category300 V CAT II

Protection classification II (double insulation)

Pollution degree2

DisplayLED indicators

Dimensions (w*h*d)26.5 cm × 11 cm × 18.5 cm

Weight (without accessories) 2.76 kg

Storage temperature range...-10 °C ÷ +70 °C

Reference / operating conditions

Temperature range0 °C ÷ +40 °C

Humidity range.....80 % RH (0 °C ÷ +40 °C), no condensing

Reference voltage.....230 V

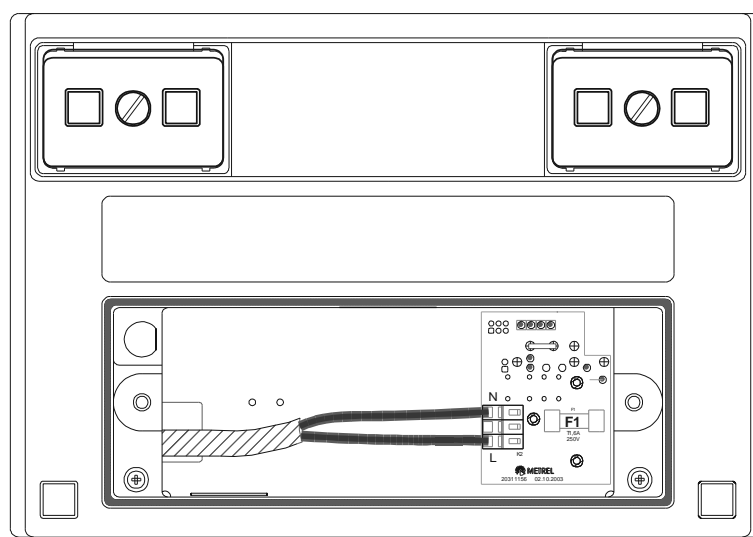
5 Maintenance

5.1 Periodic calibration

It is essential for all measurement instruments to be regularly calibrated. We recommend calibration once per 12 months.

5.2 Fuse

The instrument contains a mains fuse T 1,6 A / 250 V, 20 x 5 mm. It is located under fuse cover.



Mains fuse

To change the fuse:

- ❑ Disconnect the instrument mains cord and all test leads before removing fuse cover!
- ❑ Unscrew screws on fuse cover (pos 6 of bottom part) and remove cover
- ❑ Replace blown fuse with the same type as mentioned above
- ❑ Close fuse compartment and fix the fuse cover.
- ❑ Check the instrument.

5.3 Service

For repairs under or out of warranty please contact your distributor for further information.

Unauthorized person is not allowed to open the AutoPAT MI 2143. There are no user replaceable components inside the instrument, except the fuse (refer to chapter **5.2 Fuse**).

5.4 Cleaning

Use soft patch slightly moistened with soap water or alcohol to clean the surface of AutoPAT MI 2143. Leave the instrument to dry totally before using it.

Notes:

- ❑ Do not use liquids based on petrol or hydrocarbons!
- ❑ Do not spill cleaning liquid over the instrument!

6 Instrument set and accessory

Standard set

Instrument AutoPAT MI 2143
Soft carrying case
Earth bond clip
User manual
Production verification data
Conformity declaration

Optional accessory

110 V test adapter