# SwiftPAT

MI 3302

# Instruction manual

*Ver 1.1, Code no. 20 751 158*

METREL®

*Distributor:*

*Producer:*

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CE Mark on your equipment certifies that this equipment meets the requirements of the EC (European Community) regulations concerning safety and electromagnetic compatibility.

# 1 General description

SwiftPAT MI 3302 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 or earth screening (IT) 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 testing of 110 V appliances.

SwiftPAT MI 3302 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 SwiftPAT, 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!**

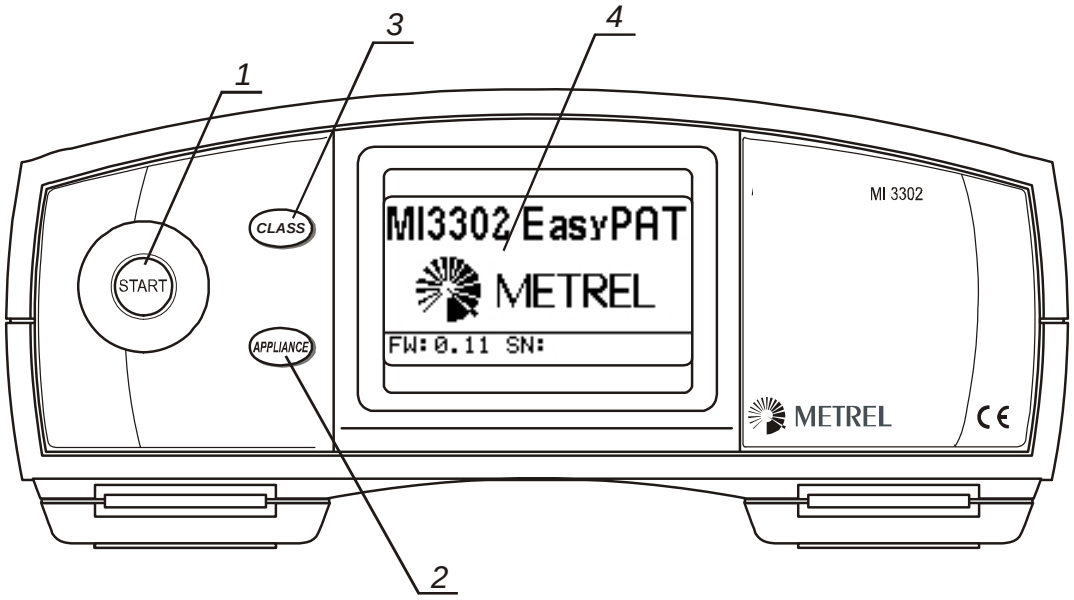
## 1.2 Applied standards

The SwiftPAT MI 3302 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

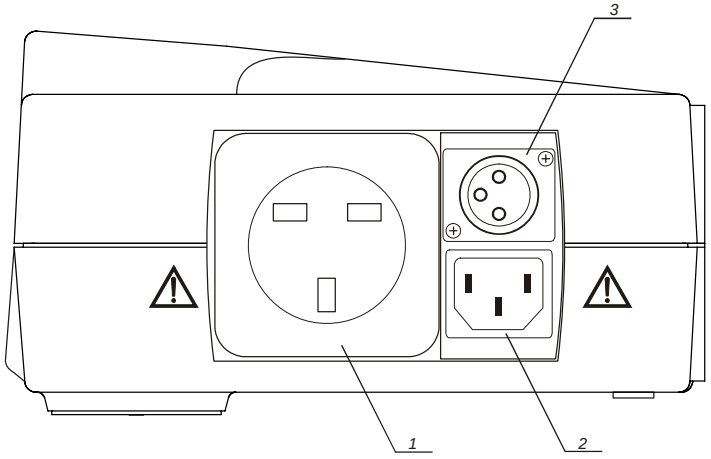



*Front panel*

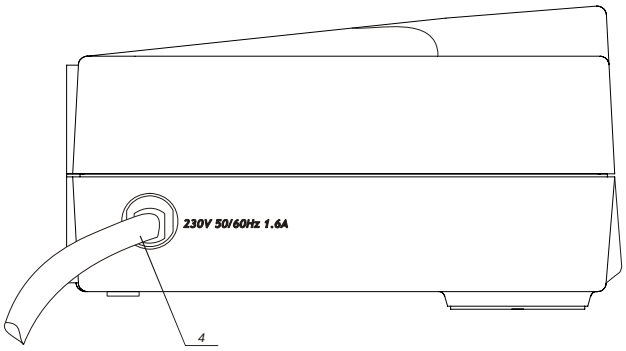
Legend:

1 START/STOP key
2 APPLIANCE selection key
3 Safety CLASS selection key
4 Display

## 2.2 Connector panel




*Connector side*

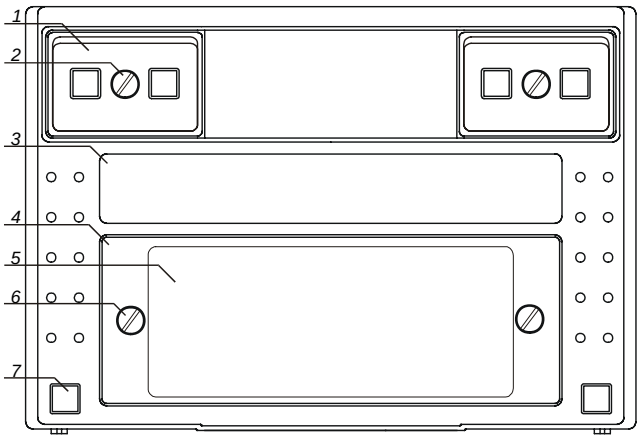



*Mains supply entry*

Legend:

1 Test socket
2 IEC appliance connector
**Warning**! The connector input is for test purposes only; 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

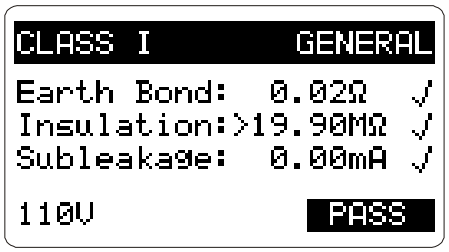



*Bottom side*

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 Display




*Typical display*

| | |
|---|---|
| CLASS I GENERAL | Menu line |
| Earth Bond: 0.02Ω √<br>Insulation:>19.90MΩ √<br>Subleakage: 0.00mA √ | Result field |
| 110V PASS | Message field |

### 2.4.1 Menu line

In the menu line, the selected appliance safety class and type are displayed.

| | |
|---|---|
| CLASS I | Safety class of tested appliance. |
| GENERAL | Type of tested appliance. |

There are the following possibilities:

| **Appliance class** | **Appliance type** |
|---|---|
| Class I | General, IT, IEC |
| Class II | General, IT |

IT: an information technology equipment.
IEC: a cord with IEC appliance coupler.

### 2.4.2 Message field

In the message field, different warnings and messages are displayed.

| | |
|---|---|
| 110V | **Warning!** An adapter for 110 V appliances is connected. |
| FUSE | Conditions on the input terminals shows switched off appliance or failure of its mains fuse. |

### 2.4.3 Result field

| | |
|---|---|
| PASS | All measurement results in the sequence cover predefined limits. |
| FAIL | One or more measurement results do not cover the requirements for selected appliance. |
| ▶ | The measurement is in progress. |
| ✓ | The measurement result is inside pre-set limits. |
| ✘ | Measurement result is out of pre-set limits. |

### 2.4.4 Other messages

| | |
|---|---|
| MEASUREMENT IS ABORTED! | If the key START is pressed again during execution of appliance test sequence to stop the execution. |
| Voltage on test socket is high! (>15) | External voltage on test socket is detected between L and PE, N and PE on test socket, or earth bond clip and PE; any measurement in progress is stopped to prevent damage of the instrument. |
| Earth bond circuit is overheated! | Internal temperature of 80 °C is reached. In that case earth bond test is skipped until temperature is low enough. |
| L-N resistance is high! Check if appliance is switched on. | The instrument make pre-test if the appliance is switched on and in the case that L-N impedance is high means that it is not switched on. |
| 110 V adapter connected (No fuse test!) | The instrument detected that the adapter for 110 V appliances is connected. This means selection of proper functions and limits for that type of tested appliance. In this case the instrument does not test if appliance is switched on. |

### 2.4.5 Sound warnings

| | |
|---|---|
| Short sound | Confirmation of the pressed key. |
| Two short sounds | Finished test sequence with positive result (PASS). |
| Long sound | Finished test sequence with negative result (FAIL). |
| Long sound, two times | Aborted measurement. |

# 3 Instrument operation and application

## 3.1 General

Automatic appliance testing with SwiftPAT MI 3302 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 the START key again. In this case no test results will be displayed.

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 warning is displayed for 3 seconds. This pre-test does not have any influence on later testing and 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 bond**
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 one limit for this test.

**Earth scr.**
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 resistance of the dielectric between accessible conductive part and L / N is high enough.
**Warning**!
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 SwiftPAT FAILS the first time then 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 Limit values for measurement results

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. SwiftPAT MI 3302 is designed for test conditions and compares results according to the standards mentioned in paragraph ***1.2 Applied standards***.

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

230 V appliances

| **Test function** | **Appliance type** | **Safety class** | **Limit value** | **Test condition** |
|---|---|---|---|---|
| FUSE | General | CLASS I | 30 kΩ | 40 V |
| | | CLASS II | | |
| | Other | CLASS I | | |
| | IT | CLASS I | | |
| | | CLASS II | | |
| Earth bond | General | CLASS I | 0.1 Ω | 25 A |
| | Other | CLASS I | | |
| | IEC cord | CLASS I | | |
| Earth scr. | IT | CLASS I | 0.1 Ω | 100 mA |
| INSULATION | General | CLASS I | 1 MΩ | 500 V |
| | | CLASS II | 2 MΩ | |
| | Other | CLASS I | 1 MΩ | |
| | IT | CLASS I | 1 MΩ | 250 V |
| | | CLASS II | 2 MΩ | 500 V |
| | IEC cord | CLASS I | 1 MΩ | |
| SUB LEAKAGE | General | CLASS I | 0.75 mA | 40 V |
| | Other | CLASS I | 3.5 mA | |
| | IT | CLASS I | 0.75 mA | |
| POLARITY | IEC cord | CLASS I | | <50 V |

110 V appliances

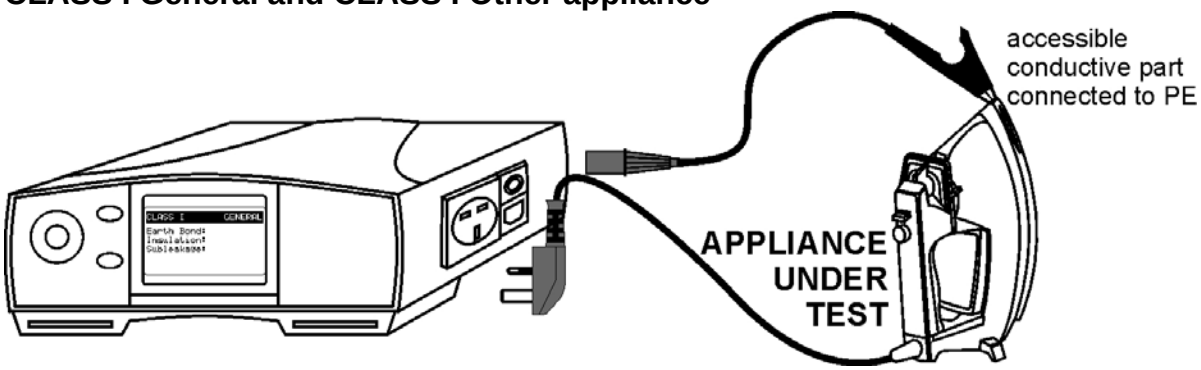
| Test function | Appliance type | Safety class | Limit values | Test condition |
|---|---|---|---|---|
| EARTH 25 A | General | CLASS I | 0.1 Ω | 25 A |
| | Other | CLASS I | | |
| | IEC cord | CLASS I | | |
| EARTH 100 mA | IT | CLASS I | 0.1 Ω | 100 mA |
| INSULATION | General | CLASS I | 1 MΩ | 500 V |
| | | CLASS II | 2 MΩ | |
| | Other | CLASS I | 1 MΩ | |
| | IT | CLASS I | 1 MΩ | 250 V |
| | | CLASS II | 2 MΩ | 500 V |
| | IEC cord | CLASS I | 1 MΩ | |
| SUB LEAKAGE | General | CLASS I | 0.75 mA | 40 V |
| | Other | CLASS I | 3.5 mA | |
| | IT | CLASS I | 0.75 mA | |

## 3.3 Appliance testing

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

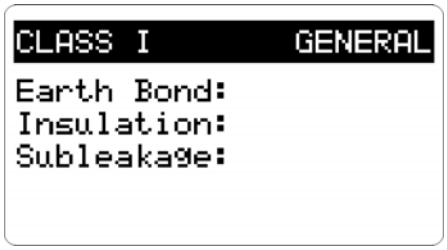
Following figures represent connections for testing appliance.

**CLASS I General and CLASS I Other appliance**

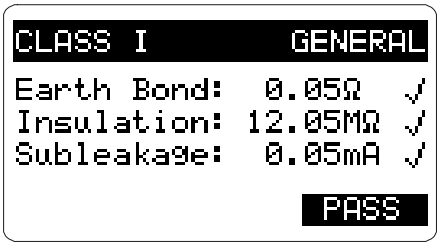



*Connection of the CLASS I appliance*

**Notes:**
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.
CLASS I Other menu has the same principle; it differs only to substitute leakage current limit.

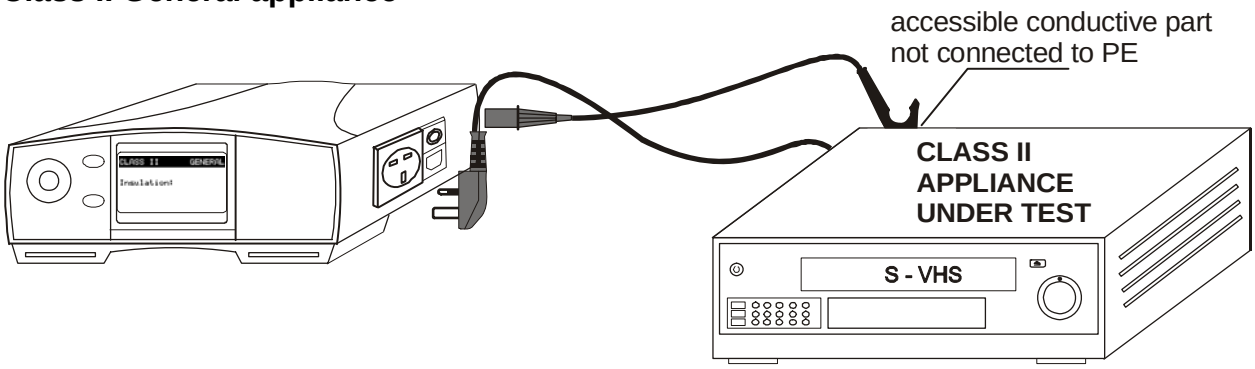



*Initial display*



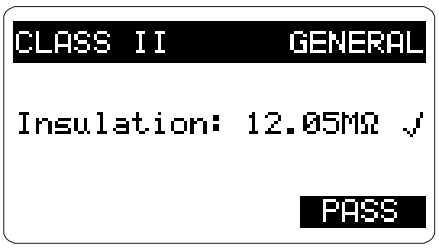

*Result display*

**Class II General appliance**



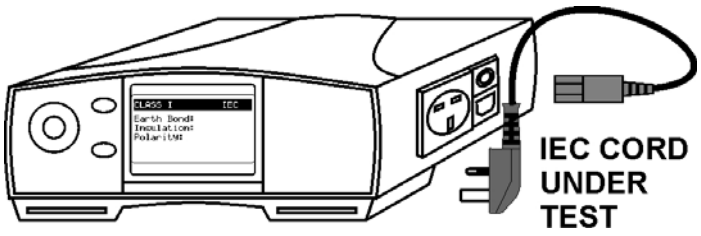

*Connection of the appliance of CLASS II*


*Initial display*

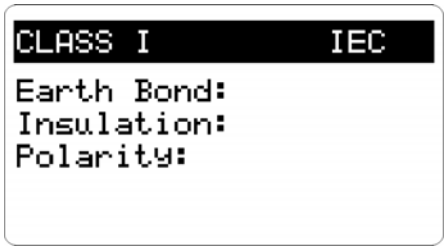



*Result display*

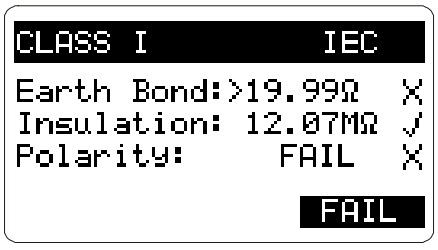
**IEC cord test**




*IEC cord connection*



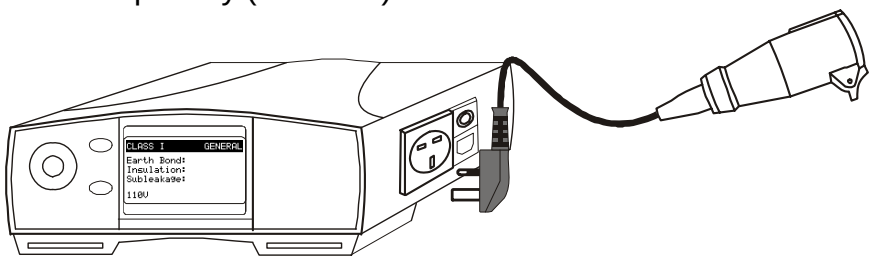

*Initial display*




*Result display*

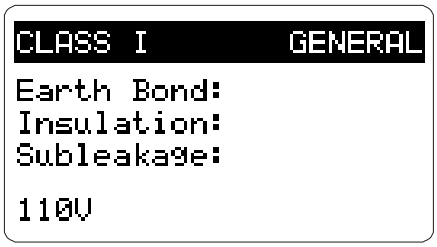
**Connection of 110 V appliances**
Special adapter exists for testing 110 V appliances. The instrument automatically detects this adapter and calculates sub-leakage current to 110 V.

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

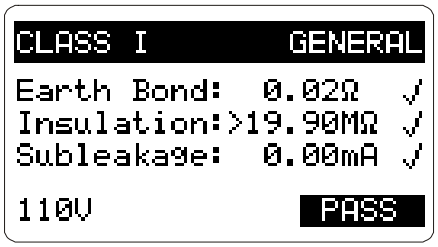



*Connecting 110 V adapter to the instrument*

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



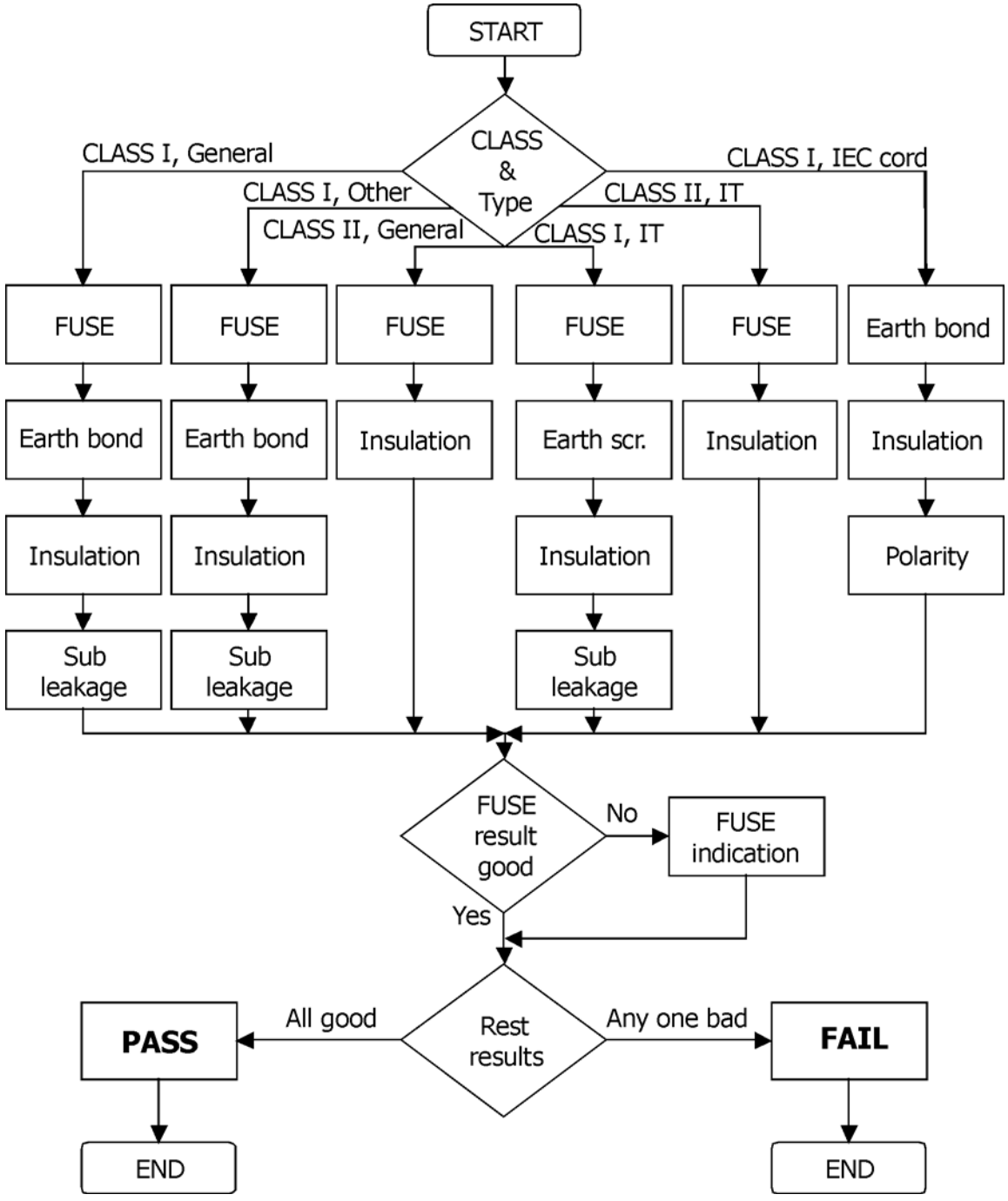

*Initial display*



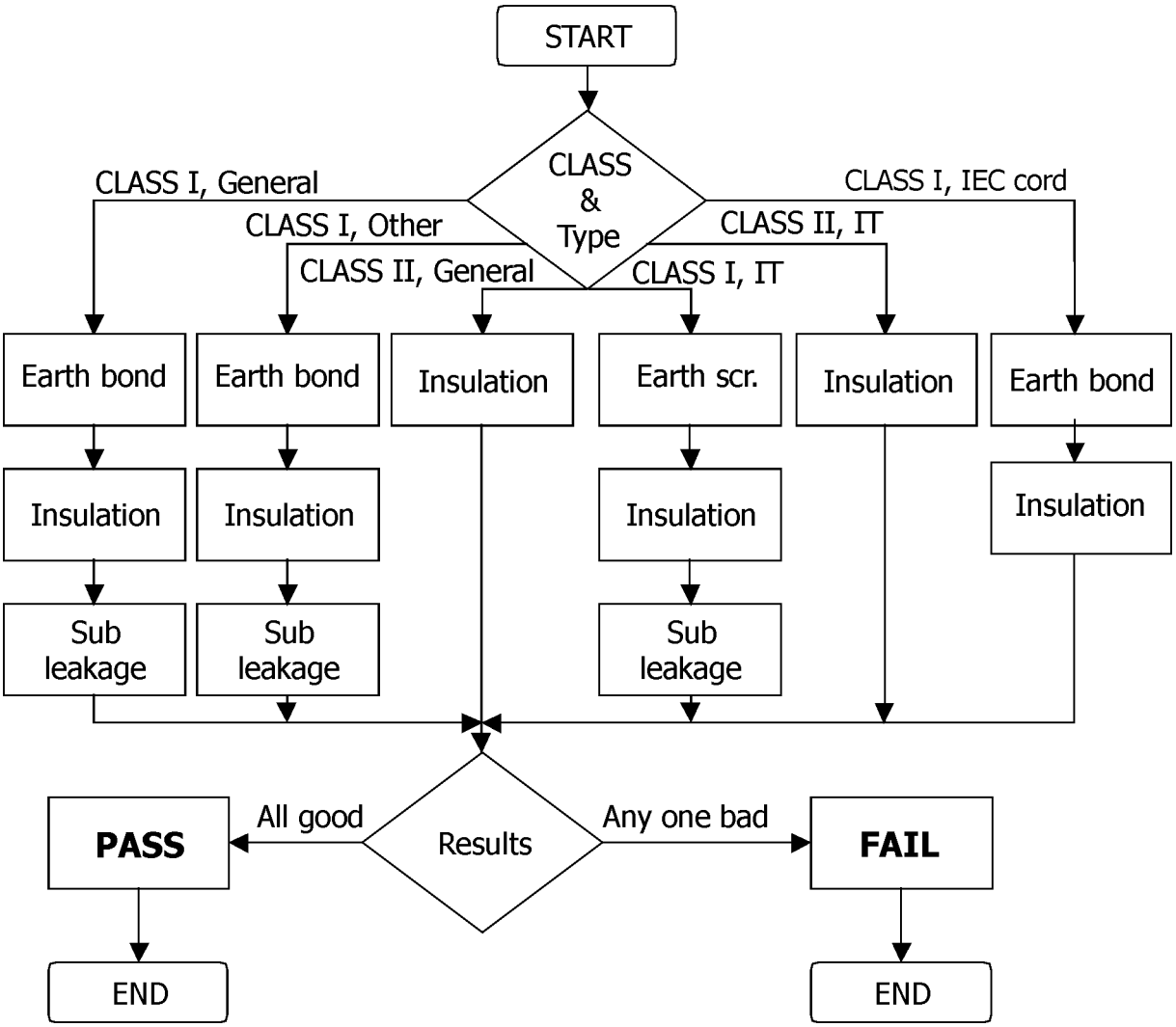

*Result display*

## 3.4 Test procedure

Flowchart for automatic testing of 230 V appliances:



Flowchart for automatic testing of 110 V appliances:



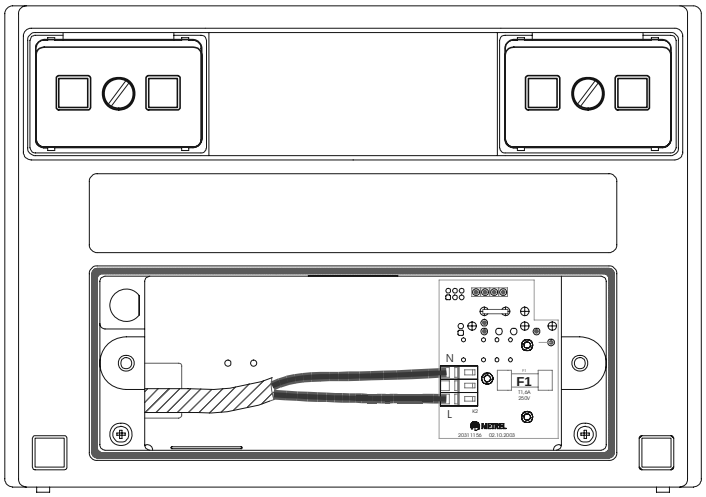
# 4 Maintenance

## 4.1 Periodic calibration

It is essential for all measurement instruments to be regularly calibrated. We recommend calibration once per 12 months. An authorised technical person should do the calibration only. Please contact your dealer for further information.

## 4.2 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.

## 4.3 Service

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

Unauthorized person is not allowed to open the SwiftPAT MI 3302. There are no user replaceable components inside the instrument, except the fuse (refer to chapter ***4.2 Fuse***).

## 4.4 Cleaning

Use soft patch slightly moistened with soap water or alcohol to clean the surface of SwiftPAT MI 3302. 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!

# 5 Technical specifications

**Earth bond**

| Range | Resolution | Accuracy |
|---|---|---|
| 0.00 Ω ÷ 19.99 Ω | 0.01 Ω | ±(5 % of reading + 3 digits) |

| | |
|---|---|
| Limit value | 0.1 Ω |
| 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 scr.**

| Range | Resolution | Accuracy |
|---|---|---|
| 0.00 Ω ÷ 19.99 Ω | 0.01 Ω | ±(5 % of reading + 3 digits) |

| | |
|---|---|
| Limit value | 0.1 Ω |
| Test currents | 100 mA (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 |

**Insulation resistance**

| Range | Resolution | Accuracy |
|---|---|---|
| 0.00 MΩ ÷ 19.99 MΩ | 0.001 MΩ | ±(10 % of reading + 5 digits) |

| | |
|---|---|
| Limit CLASS I | 1 MΩ |
| Limit CLASS II | 2 MΩ |
| Nominal voltage CLASS I IT | 250 V d.c. (+10 %, -0 %; ≥250 kΩ) |
| Nominal voltage rests | 500 V d.c. (+10 %, -0 %; ≥500 kΩ) |
| Test current | >1 mA at 500 kΩ @ 500 V; >1 mA at 250 kΩ @ 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**

| Range | Resolution | Accuracy |
|---|---|---|
| 0.00 mA ÷ 19.99 mA | 0.01 mA | ±(5 % of reading + 5 digits) |

| | |
|---|---|
| Limit value | 0.75 mA |
| Limit CLASS I Other | 3.5 mA |
| 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<br>110 V with the 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 pre-test**

| | |
|---|---|
| Limit | 30 kΩ |
| Accuracy | ± 10 % |
| Test voltage | <50 V a.c. |
| Output | test socket (L to N) |

**General data**

| | |
|---|---|
| Rated supply voltage | 210 V ÷264 V, 50 Hz or 60 Hz |
| Maximum power consumption | 1.3 A |
| Fuse | T 1.6 A / 250 V, 5 × 22 mm |
| Overvoltage category | 300 V CAT II |
| Protection classification | II (double insulation) |
| Pollution degree | 2 |
| Display | Dot-matrix LCD |
| Dimensions (w*h*d) | 26.5 cm × 11 cm × 18.5 cm |
| Weight (without accessories) | 2.76 kg |

**Reference / operating conditions**

| | |
|---|---|
| Temperature range | 0 °C ÷ +40 °C |
| Humidity range | 80 % RH (0 °C ÷ +40 °C), no condensing |
| Reference voltage | 230 V |
| Storage temperature range | -10 °C ÷ +70 °C |
| Maximum relative humidity | 90 %RH (-10 °C ÷ +40 °C)<br>80 %RH (40 °C ÷ 70 °C) |

# 6 Instrument set and accessory

**Standard set**

Instrument SwiftPAT MI 3302
Soft carrying case
Earth bond clip
User manual
Production verification data
110 V test adapter