

SACE PR010/T

test unit instructions



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1. Safety notes



WARNING

This symbol indicates information about procedures or situations that may cause injury to personnel, damage to the unit or financial loss.



WARNING

Carefully read the entire contents of this handbook. Damage resulting from failure to comply with the instructions effectively invalidates the terms of guarantee. The manufacturer declines all liability for damage to the unit caused by incorrect or improper usage.

ABB SACE also declines all liability for any ensuing damage or injury. Do not use the unit in damp or wet environments.

If in doubt about the safety of the unit, take it out of service to prevent inadvertent usage.

The unit's safety may be impaired if:

1. the unit shows visible signs of damage
2. the unit does not work
3. the unit is stored for a long period or has incurred damage during shipment.

Do not switch on the unit immediately after having transferred it from a hot environment to a cold one. Water condensation could damage or destroy the unit. Wait until the unit adapts to the new ambient temperature before switching it on.

Never leave discharged batteries inside the unit since the battery fluid may leak and damage the unit.

Do not use abrasive detergents, petrol or alcohol etc. to clean the unit, since these products may damage the unit's surface.

2. Definitions, abbreviations

Abbreviation	Description
CB	Circuit Breaker (for example: ABB SACE Emax and Isomax)
DUT	Device Under Test
HW	Hardware: the physical and electronic components that make up the device.
Password	Secret password which denies unauthorised access to certain SACE PR010/T functions.
PC	Personal Computer
Release	Protection unit otherwise known as a protection release.
SW	Software: the programs used by the microprocessors to execute a set of programmed functions/tasks.
CT	Current transformer
Trip test	Special test designed to trip the CB
TT1	ABB SACE trip test unit for use with some releases.

3. General information

3.1 Introduction

The SACE PR010/T unit is an instrument capable of performing the functions of testing, programming and reading parameters for the protection units equipping ABB SACE low-voltage circuit-breakers. For the specific functions, refer to the respective protection unit. All of the functions mentioned may be carried out "on board" by connecting the SACE PR010/T unit to the front connector on the protection unit. Two different types of test are available: automatic and manual. It is also possible to perform the trip test through the SACE TT1 unit.

By connecting to a PC (using the disc supplied by ABB SACE, or SW downloaded from the ABB Internet site) it is possible to upgrade the software of the SACE PR010/T unit. The unit can also save important test results, which may then be downloaded to a PC following a request for a test report.

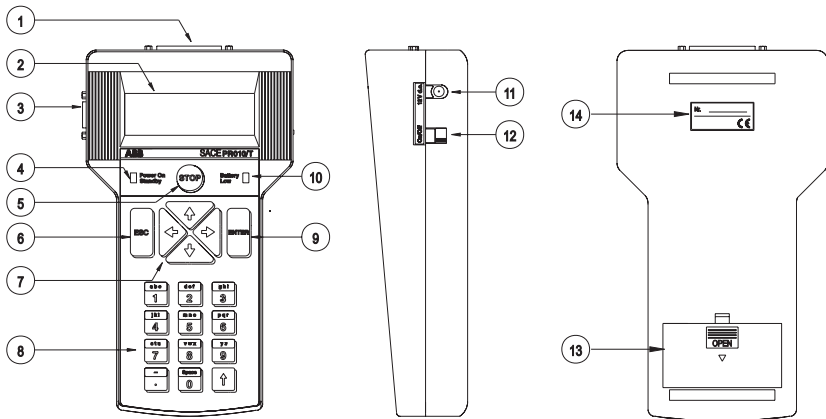
The SACE PR010/T test unit is a portable instrument operated by rechargeable batteries and/or an external power supply.

3.2 Putting into service

To put the SACE PR010/T unit into service, proceed as follows:

- Fit the batteries in the corresponding battery compartment (13), taking care to check the polarity first.
- Connect the external power supply to the 12 Vdc outlet (11).
- Wait for the batteries to charge (when the PR010/T unit is switched off, the battery charge status bar is stationary). Even when the batteries are discharged, the PR010/T unit can still operate if connected to the external power supply.

3.3 General description



1. Cable connector for connection to circuit breaker protection unit
2. Backlit LCD display (4 x 20-character lines) to display messages and test results
3. Cable connector for connection to Personal Computer
4. Green/red unit status indicator led (power on - stand-by)
5. Stop test or special functions key
6. Return/cancel key
7. Arrow selection and setting keys
8. Alphanumeric setting and control keyboard
9. Confirm key
10. Red battery charge status indicator led
11. External power supply socket
12. Sliding unit on/off switch
13. Battery compartment
14. SACE PR010/T unit serial number

4. Functions

4.1 Test Functions

The SACE PR010/T test unit tests protection units by monitoring both their HW and SW components. In particular, the unit performs the following tests:

- Trip test: by means of SACE TT1 unit
- Protection functions test
- Communication functions test

4.1.1 Trip test

The trip test tests the operation of the microprocessor, release and opening solenoid chain.

The trip test may also be performed with the circuit breaker on.

This test is performed by means of SACE TT1 unit.



WARNING

For safety reasons, the current flow inside the circuit breaker must be zero during testing.

For this reason, the current flow is automatically monitored before testing and registered as zero if the reading detected is below a preset value.

4.1.2 Protection functions test

The device under test is powered up and the fault condition for the protection function to be tested is simulated. In case of units provided with internal bus, the internal status of the protections (alarm and trip messages etc.) may also be monitored.

In case of certain releases, the type of release and circuit breaker and the rated current of the CTs installed are also automatically identified.



WARNING

For safety reasons, protection function tests must only be performed with the circuit breaker off.

These tests may be performed in both automatic and manual mode.

- **Automatic mode:** releases equipped with internal bus (see electrical diagrams in the Technical Catalogue) are automatically tested. The PR010/T unit is in fact capable of self-learning the protection parameter settings and, based on these parameters, of generating a fault signal for each function in order to test the timing. In the event of an anomaly, the type of error detected is indicated by the corresponding message (threshold or timing error). This sequence is automatically repeated on all protection unit functions. Testing may be interrupted at any time using the STOP button, thereby restoring the original conditions/settings of the

protection unit prior to testing. In the case of releases not equipped with internal bus, the user must preset the protections before testing.

- **Manual mode:** this test may be performed on any type of protection. In this case, the user must set all the protection parameters before testing. During manual testing, the user selects the type of device to be tested from a menu, whereupon device protection functions and thresholds are displayed so that the user can set the required test parameters. If the user selects an intermediate threshold in relation to those actually available, the SACE PR010/T test unit will automatically convert it to the highest one. The fault may be simulated either separately or simultaneously on any combination of phases L1, L2, L3 and NE.

4.1.3 Communication functions test

The SACE PR010/T test unit can also test the serial communication circuits of the protection releases.

4.2 Programming function

Using the SACE PR010/T test unit, the type of releases with internal bus mounted on ABB SACE low voltage circuit breakers can be programmed.

You can also program all the protection function parameters (threshold, curve, interlock parameters etc.). The parameter-programming function does not interrupt the normal operation of the protection unit, although parameters cannot be set if a timing alarm is pending.

The SACE PR010/T test unit will not set parameters outside the permitted range.

A message is displayed at the end of programming to indicate that the parameters have been successfully programmed.

Each operating parameter modified must first be confirmed before it is saved. In the event of a programming error, simply press the ESC key to cancel the last entry/action.

4.3 Parameter reading function

If the SACE PR010/T test unit is connected to releases with internal bus, it is possible to read the main parameters of the protection units.

At the user's express request and, subject to availability, the SACE PR010/T test unit can provide information about the following:

- protection status (thresholds, alarms, trips etc.)
- circuit breaker status (number of operations, contact wear etc.)
- phase, neutral and earth fault current readings
- serial number and SW release (available on the "Information" menu page).

NOTE: The parameter reading function is permanently available, irrespective of the protections and CB status.

4.4 Protection unit interface

The SACE PR010/T test unit can perform all the operations described above without extracting the protection units from the circuit breakers. The test unit (connector 1) is connected to the releases by a cable fitted with a special connector. The SACE PR010/T test unit is connected to the various types of release using the specific cables for each type of release.

4.5 PC interface

The SACE PR010/T test unit is fitted with a connector (3) for connection to a PC (standard RS232 serial port). This interface is used to update the unit's software and download test reports.

4.6 Test report

The SACE PR010/T test unit can save the main test results in order to compile a test report. The unit can store up to five test reports. After the test reports have been downloaded in the PC it is advisable to delete them from the PR010/T so as to have enough free memory available for new reports. The SACE PR010/T test unit saves data even when disconnected from the power supply. Test results are downloaded to a PC when the user requests a test report. The test report contains the following information, which is automatically supplied by the unit or manually entered by the user:

- unit serial number (Sr. Nr.)	
- date and time of test	Manually entered by user
- operator name	
- type of unit tested	Automatically supplied for releases with internal bus only.

The following information is automatically indicated for each protection function tested:

- type of protection
- threshold selected
- curve selected
- phase tested
- test current
- estimated trip time
- measured trip time
- test results.

Test report example:

TEST REPORT WITH SACE PR010/T	
SW Version: 3.2	

Date:	03/05/00
Hour:	13:55
Operator:	Belometti
Relay S.Nr.:	M0047C03B
Relay type:	PR112
Relay version:	LSIG
CB type:	E1B800
CT rated current:	250 A
Neutral:	50%

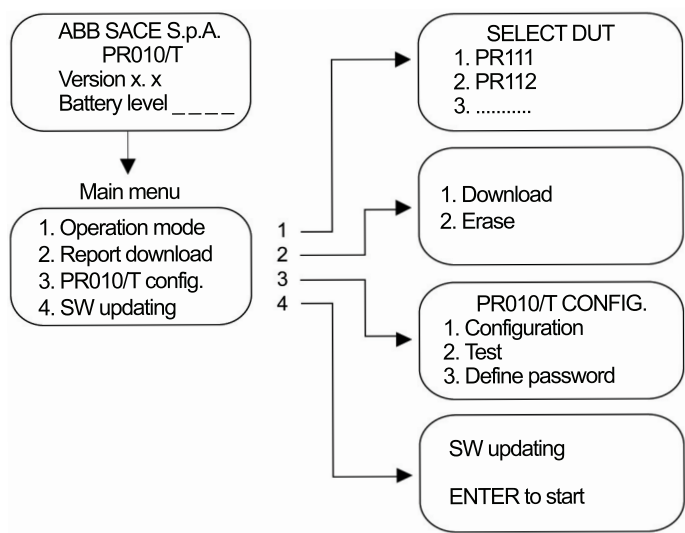
Protection:	L
Threshold [In]:	0.400
Curve [s]:	3.00
Curve type:	$t=k/i^2$
Tested phase(s):	L1
Fault current [In]:	2.40
Expected time [s]:	0.750
Measured time [s]:	0.758
Test result:	OK
Protection:	S
Threshold [In]:	0.800
Curve [s]:	0.35
Curve type:	$t=k/i^2$
Tested phase(s):	L1
Fault current [In]:	1.60
Expected time [s]:	13.668
Measured time [s]:	11.984
Test result:	OK
Protection:	I
Threshold [In]:	4.000
Curve [s]:	inst
Curve type:	$t=k$
Tested phase(s):	L1
Fault current [In]:	8.00
Expected time [s]:	0.060
Measured time [s]:	0.016
Test result:	OK
Protection:	G
Threshold [In]:	0.400
Curve [s]:	0.10
Curve type:	$t=k/i^2$
Tested phase(s):	--
Fault current [In]:	1.00
Expected time [s]:	0.320
Measured time [s]:	0.314
Test result:	OK

4.7 Special functions

- With regard to the setting of the protection parameters it is possible to carry out several tests using different thresholds and curves to identify the optimum program for the circuit breaker/ installation.
- The test unit can memorise a special "frequent use" program for each of the protection units that may be electronically programmed (Define default).
- The manual test function also enables a general current to be introduced into the release in order to test the trip time (a particularly useful function for selectivity studies between two or more circuit breakers).

5. Software

5.1 Description



When the SACE PR010/T test unit is first switched on, it runs an initialisation test. If the test result is successful, the software version and battery charge status are displayed on the screen.

To open one of the sub-menus from the main menu, position the cursor using the

↓ or ↑ keys and press “Enter”.

To return to the main menu, press “ESC”.

The moving ■ sequence indicates that the test unit is busy, so you must wait until it has finished.

Sub-menu 1. "Operation mode" of the main menu is different for each type of protection unit (see "Operation mode menu tree").

Sub-menus 2. "Report download", 3. "PR010/T Config." and 4. "SW updating" are the same for all the protection units.

5.1.1 Report downloading

The SACE PR010/T test unit can download a test report onto a PC which contains all the information indicated under the heading "Test report".

5.1.2 Test unit configuration

The test unit configuration can be customized.

You can define a password (Define password) to use to access the testing and programming stages, to adjust brightness and contrast, and to select the language of your choice (default password: 00000).

If, after specifying a new password, you want to restore the default setting, you need to zero the password; to do so, select the "Reset password" item and notify ABB SACE of the code displayed (e.g. CODE = 63795).

ABB SACE will provide an unlock code to input on the same page (PLEASE INSERT RESET CODE-----) which enables you to reset the PR010/T with the default password (00000).

N.B. The unlock code can only be used for one password zeroing operation; for any subsequent password zeroing operations, you must go to the "Reset password" page again and notify ABB SACE of the new code it displays (e.g. CODE = 83922) in order to obtain the new unlock code.

You can also perform a test on the unit by selecting the "Test" menu.

The software is self-explanatory; simply follow the instructions that appear on the screen.

5.1.3 Software updating

The software installed on the SACE PR010/T test unit may be upgraded simply by connecting it to a PC and following the procedure described below in the section "Communication with PC".

5.2 Communication with PC

Using the "SD-TU Interface" software provided it is possible to update the SACE PR010/T unit, customizing the list of devices available for the test.

To install the software, just run the application "SD-TU Interface xxx.msi". The steps necessary for updating the test unit software are listed below.

Further explanations on the use of the "SD-TU Interface" software can be found in the software's own on-line help.

5.2.1 SW updating procedure

1. Switch on the SACE PR010/T test unit.
2. Connect the SACE PR010/T test unit (connector 3) to one of the PC's serial ports (COM1... COM4) using the cable supplied.
3. Run the "SD-TU Interface.exe" program.
4. From the list of devices that appears in the "Device selection" window on the left of the screen, use the mouse (holding down the left key) to select the device you want, dragging it into the "Device" window that appears on the right.
5. Repeat the selection operation indicated in point 4 for all the devices you want to insert (when the memory available is exhausted this is indicated with the message "PR010/T memory completely filled!!").
6. Select Program/From configuration on the PR010/T menu.
7. Now go to the PR010/T unit and select the 4.Update SW menu from the main menu. This message will appear:
 'Update SW'
 'ENTER to confirm'
8. Press ENTER on the SACE PR010/T unit to display the following message:
 'Waiting SW update'
9. Before one minute elapses, press OK in the window displayed on the PC. The SACE PR010/T unit will now display the message:
 'SW Updating in progress'
 accompanied by a progressive status bar indicating the download time remaining. The maximum duration of the procedure may be several minutes, depending on the number of devices selected; the "programming status" bar is displayed on the PC monitor in the "Program PR010/T" window, indicating how the updating is proceeding. If the file is successfully downloaded, the SACE PR010/T unit will display the following message:
 "End SW updating"
 "SW Ver. X.X"
 "Press ESC to restart"
 while the PC will display the message:
 "PR010/T successfully programmed"
 Press ESC on the SACE PR010/T unit to restart the unit with the new software version. Close the PC application.
10. If the file is not successfully downloaded, the SACE PR010/T unit will display the following message:
 'WARNING.SW updating failed'
 'Press ESC to restart'
 and the PC will display the message:
 'Time out error: cannot contact PR010/T'
11. Press ESC on the SACE PR010/T unit to return to the screen:
 'Program failed'
 'ENTER for recovery'
12. Select PROGRAM/from CONFIGURATION in the "PR010/T Program" of the PC.

-
13. Proceed as described in point 7 onwards.

5.2.2 Test report downloading procedure

1. Switch on the SACE PR010/T test unit.
2. Using the cable supplied, connect the unit to one of the PC's serial ports
3. Run the "SD-TU Interface" program.
4. On the PR010/T menu select **Get report**
5. On the main menu of the SACE PR010/T unit, select
'2.Report Download',
the following message will be displayed:
'Test report download'
'ENTER to start'
6. Press ENTER on the SACE PR010/T unit to display the following message:
'Waiting for report download'.
Before one minute elapses, press the **Get report** key in the window "get report from PR010/T" displayed on the PC.
7. The SACE PR010/T unit will now display the message:
'Download in progress'
accompanied by a progressive status bar indicating the download time remaining. The maximum transmission duration is about one minute.
8. If the file is not successfully downloaded, the SACE PR010/T unit will display the message:
9. 'END report download'
10. 'Press ESC to restart'
11. while the PC will automatically open the Report window displaying what has been received.
12. Press ESC on the SACE PR010/T unit to return to the main menu.
13. If the file is not successfully downloaded, the SACE PR010/T unit will display the message:
'Download aborted'
'Press ESC to return'
14. The PC will display the message "Timeout error: cannot contact PR010/T"
15. Press ESC and resume as described in point 4 onwards.
16. In the event of problems not described in this section, refer to the "Error messages and troubleshooting table".

5.2.3 Test report erasing

The following procedure entirely erases the test reports stored in the PR010/T:

- 1. Switch on the SACE PR010/T test unit.
- 2. On the main menu of the SACE PR010/T unit, select:
 '2.Report Download'
 '2.Erase'

The following message will be displayed:

'Report erasing'
'ENTER to proceed'
'ESC to return'

Select ENTER to erase the report.

5.3 Protection unit

See annex RH0029002.

6. Technical specifications

6.1 User interface

The user interface comprises an alphanumeric display, membrane keyboard and indicator led.

Each time a key is pressed, an acoustic signal is emitted. The back-lit LCD display features 4 lines each containing up to 20 characters.

The display's back-lighting automatically switches off when the keyboard is idle, unless connected to the external power supply.

If no key is pressed for at least 5 minutes the display switches off automatically to minimise electrical consumption.

6.2 Power supply

The SACE PR010/T test unit is a portable instrument operated by 6 rechargeable batteries and/or an external power supply.

When installing the rechargeable batteries in the PR010/T unit, pay attention to the polarity indications in the space provided for the batteries.

The **specifications of the external power supply** supplied are as follows:

Vin	= 100...240 Vac (47...63 Hz)
Vout	= 12 Vdc $\pm$ 5%
Max output current	= 2.7A

The **specifications of the rechargeable batteries** supplied are as follows:

Size	AA
Type	NiMH
Voltage	1.2V
Capacity	1300 mA/h

The operating autonomy of the batteries during testing depends on the type of release tested, the type of tests performed, the different release versions and the operations performed by the user. When testing, for example, a PR112/P unit the batteries operate for about 2 hours under test conditions and 6 hours in stand-by mode.

The battery recharge time is about four hours with unit switched off.

The batteries recharge automatically when the SACE PR010/T test unit is connected to the external power supply.

The rechargeable batteries are supplied discharged. The batteries must therefore be charged before using the PR010/T test unit for the first time.

The test unit may also be connected to the external power supply.

6.3 Inputs/Outputs

The SACE PR010/T test unit uses a set of signals to perform its various testing, programming and reading functions. The main characteristics of these signals are as follows:

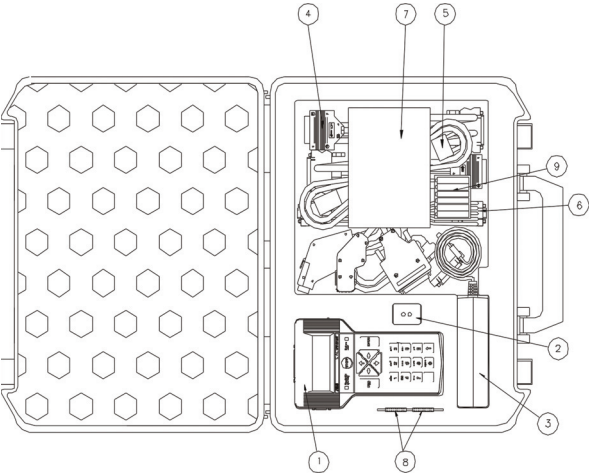
Output voltage range:	- 5 ... +12 Vdc
Maximum output current:	1A constant
Input voltage range:	0 ... +15 Vdc
Minimum input impedance:	1 Mohm

6.4 Mechanical specifications

Plastic enclosure		
Front panel protected against electrostatic discharges		
Dimensions:	Length	= 210 mm
	Max. width	= 120 mm
	Max. depth	= 60 mm
Protection class:	IP30	
Weight (complete with rechargeable batteries):	600 g	
Operating temperature range:	0 °C ... +50 °C	
Storage temperature range:	-20 °C ... +70 °C	
Maximum relative humidity:	90%, (non-condensing)	
MTBF:	15 years @ 30°C	

6.5 Standard equipment

The SACE PR010/T test unit is supplied in a special case, complete with the following accessories:



1. SACE PR010/T test unit complete with rechargeable batteries
2. SACE TT1 TRIP TEST unit
3. External power supply
4. 1m length cables with connectors suited for several types of electronic releases.
5. External power supply connection cable
6. PC connection cable
7. User manual and application software
8. Set of adapters for different types of releases
9. Batteries

6.6 Applicable standards

The SACE PR010/T test unit bears the CE quality mark and fully complies with all major international standards on electromagnetic compatibility (EMC).

Emissions:	IEN55022 class B
Electrostatic discharge:	IEC/EN 61000-4-2
Radiated immunity:	IEC/EN 61000-4-3
Conducted immunity:	IEC/EN 61000-4-6 (1kV)

6.7 Error messages and troubleshooting table

UPDATE ERROR	
"SW updating failed" "Press ESC to restart"	This message indicates a software updating error. To rectify, repeat the operation, after first checking the PC-PR010/T connection and the name of the loaded file.
COMMUNICATION ERROR	
"Communication error" "Press ESC to return"	This message indicates that the SACE PR010/T's internal bus is unable to establish a connection with the device under test.
INVALID DIGITAL VOLTAGE	
"DUT internal voltage not valid" "Press ESC to return"	This message indicates an internal DUT voltage reading that is outside the accepted range.
INVALID PROGRAM	
"Program failed" "Press ENTER for recovery"	If this message is displayed when the SACE PR010/T test unit is powered up, it means that the program stored in the SACE PR010/T's memory is incorrect due to the failure of a previous software updating sequence. In this situation, the SACE PR010/T test unit cannot work and must therefore be reloaded with the updated software.

INVALID WATCH DOG

"Control signal not valid"
"Press ESC to return"

This message indicates that the internal control signal is outside the established range. Check the connection between the SACE PR010/T test unit and device under test.

The following error messages are displayed on the SACE PR010/T unit:

Troubleshooting guide			
No.	Faults	Causes and errors	Checks and remedies
1	The POWER-ON led is not lit	The external power supply is disconnected	Power up the unit with the power supply provided by ABB SACE
		The external power supply is not connected to the mains power supply	Connect the power supply to a 220V power mains
		No batteries fitted	Fit batteries like the ones specified under the heading "Power supply"
		The batteries are flat	Recharge the batteries by connecting the unit to the external power supply
2	The message display is not clear	The contrast and/or brightness setting(s) are incorrectly adjusted	Adjust as described under the heading "Test unit configuration"
3	The display language is incorrect	The language setting is incorrectly programmed	Switch on the unit and 10" later select: 3. ENTER ENTER ENTER Select the correct language with UP and DOWN.

Troubleshooting guide

4 Problems updating the software installed on the PR010/T unit	Wrong connection cable used to connect the PC to the PR010/T test unit	Replace with the cable supplied and repeat the operation
	The serial cable is not properly connected	Make sure the cable connectors are properly inserted
	The PR010/T unit is not ready for Sw updating	Proceed as described under the heading "Sw updating procedures"
	The PR010/T's time-out elapses before the software starts downloading from the PC	Make sure the PR010/T unit displays the message "Waiting for update" at the start of the file transfer procedure
	The update file is not selected	Select the required software version and repeat the update procedure
	The wrong type of file is selected	Select file type PR010t_x.Hex
5 Problems downloading the test report to the PC	Wrong connection cable used to connect the PC to the PR010/T test unit	Replace with the cable supplied and repeat the operation
	The serial cable is not properly connected	Make sure the cable connectors are properly inserted
6 Problems connecting the cable to the device under test	The PR111-type release is fitted with the wrong adapter	Fit the correct PR111 adapter
	The PR111 adapter is damaged	Replace with the spare one supplied
	A cable for the Isomax series is connected to an Emax circuit breaker, or vice versa	Use the correct cable for the circuit breaker

6.8 Notes

In view of ongoing revisions to Standards and the latest developments in technology and materials, the characteristics (mechanical, electrical and electronic) and overall dimensions indicated in this handbook are only deemed legally binding subject to confirmation by ABB SACE.

The test unit does not need recalibrating.



WARNING

If necessary, the device may be operated by standard AA-type batteries (non-rechargeable), provided the unit is not simultaneously connected to the external power supply.