

## SACE PR010/T test unit instructions



---

# Contents

<b>1. SAFETY NOTES</b> .....	<b>3</b>
<b>2. DEFINITIONS AND ABBREVIATIONS</b> .....	<b>4</b>
<b>3. GENERAL INFORMATION</b> .....	<b>4</b>
3.1. INTRODUCTION .....	4
3.2. PUT IN SERVICE .....	5
3.3. GENERAL DESCRIPTION .....	5
<b>4. FUNCTIONS</b> .....	<b>6</b>
4.1. TEST FUNCTIONS .....	6
4.1.1. Trip test .....	6
4.1.2. Protection functions test .....	6
4.1.3. Communication functions test .....	7
4.2. PROGRAMMING FUNCTION .....	7
4.3. PARAMETER READING FUNCTION .....	8
4.4. PROTECTION UNIT INTERFACE .....	8
4.5. PC INTERFACE .....	8
4.6. TEST REPORT .....	8
4.7. SPECIAL FUNCTIONS .....	10
<b>5. SOFTWARE</b> .....	<b>11</b>
5.1. DESCRIPTION .....	11
5.1.1. Report downloading .....	12
5.1.2. Test unit configuration .....	12
5.1.3. Software updating .....	12
5.2. COMMUNICATION WITH PC .....	13
5.2.1. SW updating procedure .....	13
5.2.2. Test report downloading procedure .....	14
5.2.3. Test report erasing .....	15
5.3. PROTECTION UNIT REFERENCE .....	15
<b>6. TECHNICAL SPECIFICATIONS</b> .....	<b>16</b>
6.1. USER INTERFACE .....	16
6.2. POWER SUPPLY .....	16
6.3. INPUTS/OUTPUTS .....	17
6.4. MECHANICAL SPECIFICATIONS .....	17
6.5. STANDARD EQUIPMENT .....	18
6.6. APPLICABLE STANDARDS .....	18
6.7. ERROR MESSAGES AND TROUBLESHOOTING TABLE .....	19
6.8. NOTES .....	21

---

# 1. Safety notes



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

## **Important!**

Carefully read the entire contents of this handbook. Damage resulting from failure to comply with the instructions given in this handbook 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, since the resultant condensation may 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 may damage the unit's surface.

---

## 2. Definitions and abbreviations

Abbreviation	Description
CB	Circuit breaker (for example: ABB SACE Emax and Isomax circuit breakers).
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 C.B.
TT1	ABB SACE trip test unit for use with some releases.

## 3. General information

### 3.1. Introduction

The SACE PR010/T test unit is designed to Test, Program and Read the parameters of the protection units mounted on ABB SACE circuit breakers (both moulded-case and air circuit breakers). For further information about specific functions, refer to the corresponding protection unit. All functions are executed “onboard” by connecting the SACE PR010/T test unit to the connector present on the front of the protection units. The unit can perform both automatic and manual tests, as well as trip tests.

The test unit’s software may be updated simply by connecting it to a PC (using the diskette supplied by ABB SACE or the software downloaded from our ABB Internet site). 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.

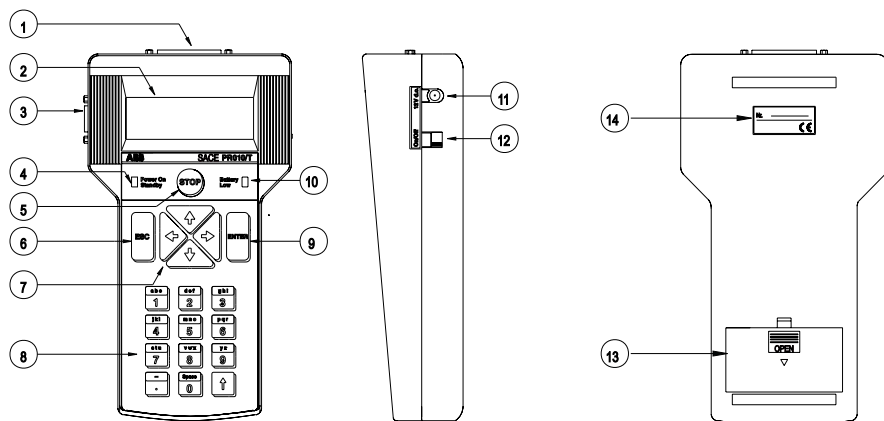
## 3.2. Put in service

To place 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 before connecting the batteries.
- Connect the external power supply to the 12 Vdc outlet (11).

Wait for the batteries to charge (when the SACE PR010/T unit is switched off, the battery charge status bar is stationary). Even when the batteries are discharged, the 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. 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. 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. This test may also be performed with the circuit breaker closed.

Such test is performed by means of SACE TT1 unit.



**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.



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

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

- **Automatic mode:** releases equipped with internal bus (see electrical diagrams in 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, to generate a fault signal for each function in order to test the delay. In the event of an anomaly, the type of error detected is indicated by the corresponding message (setting or delay error). This sequence is automatically repeated on all 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 settings are displayed so that the user can set the required test parameters. If the user selects an intermediate setting 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 circuit breakers can be programmed.

You can also program all the protection function parameters (setting, 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 protection 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's 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 (settings, alarms, trips etc.)
- circuit breaker status (number of circuit breaker operations, contact wear etc.)
- phase, neutral and earth fault current readings
- serial number and SW release (available on the "Information" menu page).

**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 drawing-out the protection units from the circuit breakers. The test unit is in fact connected to the releases by a set of cables each 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.

The unit also saves test data, even when disconnected from the power supply.

Test results are downloaded to a PC when the user requests a test report.

After a group of test reports is downloaded in the PC it's advisable to delete them from the PR010/T in order to have enough free memory available for new reports.

The test report contains the following information, which is both automatically supplied by the unit and manually entered by the user:

---

ABB SACE		SACE PR010/T	RH0025.002	L0876	8/22
----------	---	--------------	------------	-------	------



- date and time of test
- operator name
- description of circuit breaker
- unit serial number (Sr. Nr.)

Manually entered by user

- type of unit tested

Automatically supplied for electronic releases with internal bus only

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

- type of protection
- setting selected
- curve selected
- phase tested
- test current
- expected trip time
- actual trip time
- test result

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]:	0.761
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]:	10.956
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]:	0.011
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]:	1.50
Expected time [s]:	0.320
Measured time [s]:	0.304
Test result:	OK

#### 4.7. Special functions

With regards to the setting of the protection parameters is possible to carry-out several tests by using different settings and curves to identify the optimum program for the circuit breaker/installation .

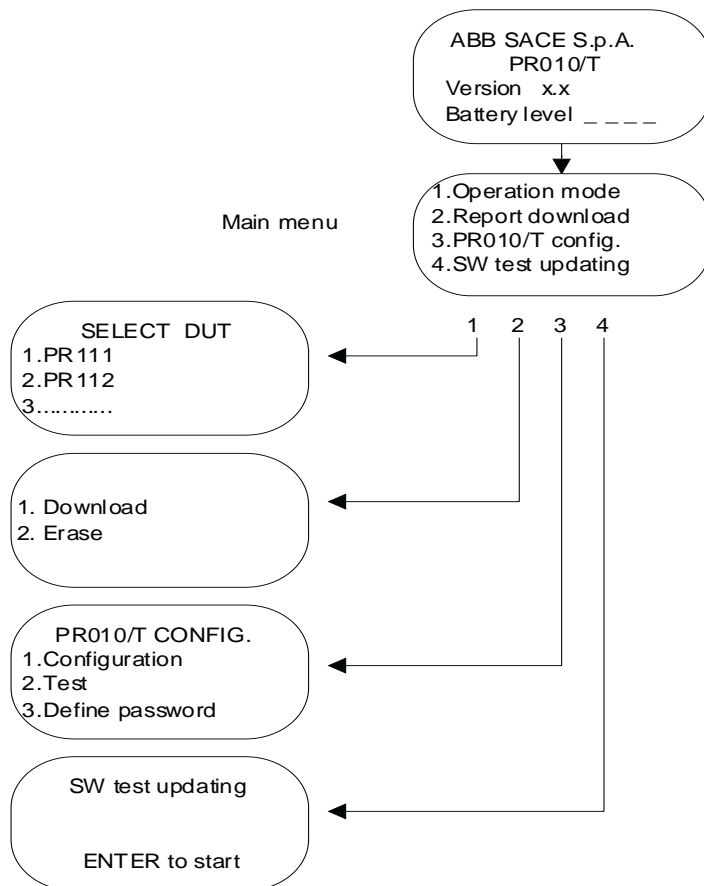
The test unit can memorise a special “frequent use” program for each of the protection units that may be electronically programmed (Define default).

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. Following the successful conclusion of this test, the software version and battery charge status are displayed on the unit's screen.



---

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

ò or ñ arrow keys and press “**Enter**”.

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

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

Sub-menu 1. “Operation mode” 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 test updating” are instead 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’s 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 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 cable supplied, connect the SACE PR010/T test unit to a PC and proceed as described below:

### 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. Insert the software update diskette in the corresponding PC drive and run the 010\_PCI.EXE program.
4. In the OPTIONS menu, select TRANSMISSION PORT, then the required COM port and press OK.
5. In the FILE menu, select NEW PROGRAM FILE\_NAME, then file PR010T\_x.Hex (x=version) and press OK. The software update window will now open.
6. From the main menu of the SACE PR010/T test unit, select `4.SW test updating`. The following message will now be displayed:  
`SW test updating`  
Press `ENTER to start`
7. Press ENTER on the SACE PR010/T unit to display the following message:  
`Waiting update`
8. Before one minute elapses, press OK in the window displayed on the PC. The SACE PR010/T unit will now display the following message: `Updating in progress`  
accompanied by a progressive status bar indicating the download time remaining. This process takes just a few minutes.
9. 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`  
The PC will instead display the message:  
`OK, END OF FILE`.  
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`

---

The PC will instead display the message:  
'TOO MANY ERRORS, PROGRAM ABORTED' .

11. Press ESC on the SACE PR010/T unit to return to the screen:  
'Program failed'  
'ENTER for recovery'
12. In the PC's UNIT menu, select START UPDATE PROGRAM.
13. Proceed as described in point 7 onwards.

### 5.2.2. Test report downloading procedure

At the end of each test sequence the PR010/T allows to store the data for a test report. The procedure for downloading a test report is the following:

1. Switch on the SACE PR010T test unit.
2. Using the cable supplied, connect the unit to one of the PC's serial ports (COM1...COM4).
3. Insert the software update diskette in the corresponding PC drive and run the 010\_PCI.EXE program.
4. In the FILE menu, select NEW REPORT FILE NAME, name the file and path extension and press OK. The software DOWNLOAD window will now open.
5. From the main menu of the SACE PR010/T unit, select

'2.Report download'

The following message will now be displayed:

'REPORT'

'1. Download'

'2. Erase'

Select:

'1. Download'

The following message will now be displayed:

'Report download'

Press 'ENTER to return'

Press ENTER on the SACE PR010/T unit to display the following message:

'Waiting for report download'

Before one minute elapses, press OK in the window displayed on the PC.

The SACE PR010/T unit will now display the message: 'Download in progress' accompanied by a progressive status bar indicating the download time remaining. This process takes about one minute.

6. If the file is successfully downloaded, the SACE PR010/T unit will display the message:

'END report download'

Press 'ESC to return'

The PC will automatically open a window (e.g.: in NOTEPAD) displaying the downloaded test report.

- 
7. Press ESC on the SACE PR010/T unit to return to the main menu.
  8. If the file is not successfully downloaded, the SACE PR010/T unit will display the following message:  
`Download aborted`  
Press `ESC to return`  
The PC will instead display the message:  
`UPLOAD FAILED: TIMEOUT WAS RECEIVED` .  
Press ESC and resume as described in point 4 onwards.
- 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 erases entirely the test reports stored in the PR010/T:

1. Switch on the SACE PR010/T test unit.
2. From the main menu of the unit, select:

`2. Report Download`  
`2. Erase`

The following message will now be displayed:

`Report erasing`  
`ENTER to proceed`  
`ESC to return`

Select ENTER to erase the reports.

## 5.3 Protection unit reference

See annex n.RH0029.002

---

## 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 = 1300mA/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 recharged 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

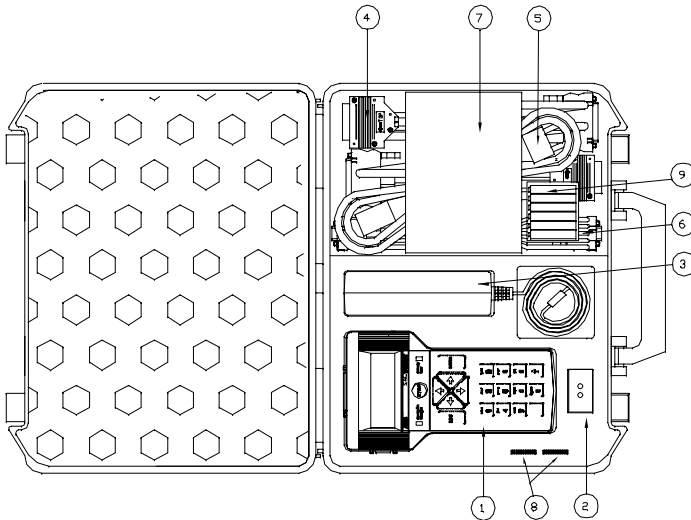
### 6.4. Mechanical specifications

- Plastic enclosure
- Front panel protected against electro-static discharges
- Dimensions:      Length                                = 210 mm  
                              Max. width    = 120 mm  
                              Max. depth    = 60 mm
- Protection class: IP30
- Weight (complete with rechargeable batteries): 600g
- 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 handbook 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 electro-magnetic compatibility (EMC).

- Emissions: EN55022, Class B
- Electro-static discharge: IEC/EN 61000-4-2
- Radiated immunity: IEC/EN 61000-4-3
- Conducted immunity: IEC/EN 61000-4-6 (1 kV)

---

## 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 exit”

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**

“Monitoring signal not valid”

Press “ESC to exit”

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:

<b>Troubleshooting guide</b>			
<b>Nr.</b>	<b>Faults</b>	<b>Causes and errors</b>	<b>Checks and remedies</b>
1	The POW ER-ON led is Light-off	The external power supply is disconnected	Power up the unit with the power supply provided by ABB SACE
		The external power supply is disconnected from the mains power supply	Connect the power supply to a 220V power network
		The ON/OFF switch is set to OFF	Set the ON/OFF switch to ON
		No batteries fitted	Fit batteries like the ones specified under the heading "Power supply"
		The batteries are discharged	Recharge the batteries by connecting the unit to the external power supply
2	The mes sage display is not clear	The contrast and/or brightness setting(s) are in correctly adjusted	Adjust as described under the heading "Test unit configuration"
3	The display language is incorrect	The language setting is in correctly programmed	Switch on the unit and 10" later select: 3. ENT ER ENT ER ENT ER Select the correct language with UP and DOWN.
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 PR010T unit is not ready for Sw updating	Proceed as described under the heading "Sw updating procedures"
		The PR010T'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
		An Isomax cable is connected to an Emax circuit breaker, or vice versa	Use the correct cable for the circuit breaker in question
		The cable is connected the wrong way round	Correctly insert the connector, taking care to check the connector polarity.

---

## 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.



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.**

---

ABB SACE



SACE PR010/T

RH0025.002

L0876

22/22