



User Manual

# PROFIBUS Tester 5 BC-700-PB

Getting Started with PROFIBUS Tester 5 BC-700-PB



**bus ✓**  
check

**PROFIBUS Tester 5  
BC-700-PB**

Version: MMA-NN-006005-EN-1408-1.01

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# 1 Introduction

## 1.1 About PROFIBUS Tester 5 BC-700-PB

The PROFIBUS Tester 5 BC-700-PB is a powerful tool that allows full testing of the bus physics and bus communication on PROFIBUS DP and PROFIBUS PA segments (option). Using the integrated master simulator, you can also test the bus physics if the PLC is currently not in operation, or individually check "suspicious" bus stations. The cable test function examines the cabling in PROFIBUS DP segments, locates unwanted reflections on the line and verifies proper termination of cable segments. The tool is powered either by its built-in battery or through an external AC adapter.

The PROFIBUS Tester 5 BC-700-PB is the first battery-powered tester, which combines the assessment of bus physics and bus communication as well as cable testing in one device. It is therefore the only and truly mobile PROFIBUS diagnostic tool.

## 1.2 About this document



### Read this manual before starting

For damages due to improper connection, implementation or operation Softing refuses any liability according to our existing guarantee obligations.



### CAUTION

Refer also to the safety precautions for battery and battery pack in section [Notes on battery use](#)<sup>53</sup>.

### 1.2.1 Purpose

This document describes PROFIBUS Tester 5 BC-700-PB. It provides information about putting into service and also provides detailed information regarding its safe and correct operation.

### 1.2.2 Target group

This document is addressed to operating staff which is adept in operating PROFIBUS-systems such as:

- Maintenance personnel
- Commissioner
- Application engineers and developers
- Trainers

### 1.2.3 Conventions used

The following conventions are used throughout Softing customer documentation:

Keys, buttons, menu items, commands and other elements involving user interaction are set in bold font and menu sequences are separated by an arrow

Open **Start** → **Control Panel** → **Programs**

Buttons from the user interface are enclosed in brackets and set to bold typeface

Press **[Start]** to start the application

Coding samples, file extracts and screen output is set in Courier font type

MaxDlsapAddressSupported=23

Filenames and directories are written in italic

Device description files are located in C:  
\\StarterKit\\delivery\\software\\Device  
Description files



#### CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.



#### Note

This symbol is used to call attention to notable information that should be followed during installation, use, or servicing of this device.



#### Hint

This symbol is used when providing you with helpful user hints.

### 1.2.4 Document history

Document version	Modifications compared to the previous version
Version 1.00	none - initial document version
Version 1.01	<ul style="list-style-type: none"> <li>▪ Editorial modifications due to internal review</li> <li>▪ Order numbers for optional accessories added</li> <li>▪ New device status symbols added</li> <li>▪ New cable test note added</li> </ul>

## 1.3 Scope of delivery

The PROFIBUS Tester 5 comes in a carrying case comprising:

- Test tool with RS485 interface
- Rechargeable battery pack (internal battery)
- Wide-range power supply with European and US mains power cables
- RS485 D-sub adapter cable BC-600-PB-CB-DSUB-2 "Standard" (cable petrol blue, light connector) for PROFIBUS DP



- USB cable, 3 m
- Terminal block for trigger input/output
- CD-ROM with driver software, PC software and detailed integrated help system in English and German
- PROFIBUS Tester 5 BC-700-PB User Manual and Quick Startup Guide for the PROFIBUS Diagnostics Suite PC software.



Figure 1: PROFIBUS Tester 5 BC-700-PB with carrying case

## 1.4 Optional accessories

### 1.4.1 D-sub adapter cable for testing live systems

This D-sub adapter cable is optimized for reduced influence on live PROFIBUS DP segment operation. Thereby it is most suitable for testing of running plants. The risk of critical influences on bus operation which can cause a plant standstill is significantly reduced.



#### Note

When using this cable it is not possible to use the three active functions master simulator, topology scan and cable testing (see [Master simulator, topology scan and cable test](#)<sup>[27]</sup>).



Figure 2: D-sub adapter cable with reduced influence on bus operation

Softing Order No.: BC-600-PB-CB-DSUB-1

#### 1.4.2 Adapter set for M12 connection technology

Using the M12 adapter set, you can connect the PROFIBUS Tester 5 to field devices with M12 connectors. The set comprises an M12 adapter cable with special pin layout and an M12 terminating resistor that you can screw on, if required.

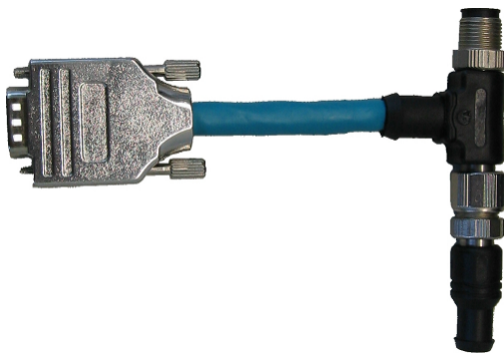


Figure 3: Special adapter set for M12

Softing Order No.: BC-600-PB-CB-M12

#### 1.4.3 Fieldbus shield digital leakage current clamp

When routing PROFIBUS cables in high-interference environments, electromagnetic interference can affect the signal quality. By measuring the shield currents with the digital leakage current clamp, you can locate EMC problem areas and take appropriate countermeasures. The digital leakage current clamp is supplied in a handy case, including measuring cables. There is also an empty compartment for the fieldbus shield digital leakage current clamp in the carrying case of the PROFIBUS Tester 5 BC-700-PB.



Figure 4: Fieldbus shield digital leakage current clamp

Softing Order No.: PB-LSZ-CHB3

#### 1.4.4 Adapter for testing PROFIBUS PA networks

The BC-700-H1 adapter and the supplied test equipment set allows to connect the

PROFIBUS Tester 5 to PROFIBUS PA network segments. It converts the MBP-coded (manchester bus powered) PROFIBUS-PA signal to a format which is appropriate for the RS-485 interface of PROFIBUS Tester 5. The POWER LED indicates if the BC-700-H1 is correctly connected to PROFIBUS-Tester 5. If the PA-STATE LED is lit, the BC-700-H1 adapter is correctly connected to a PROFIBUS-PA network and detects a PROFIBUS-PA DC feeding voltage greater than 9 Volts.



Figure 5: BC-700-H1 Adapter



Figure 6: Supplied test equipment set for connecting to PROFIBUS PA segments

Softing Oder No.: DDL-NL-006010 (Adapter and test equipment)

#### 1.4.5 Spare rechargeable battery

Intensive use of PROFIBUS-Tester 5 during the work day may exhaust the rechargeable battery faster than expected. Plus, charging and discharging will typically wear out the battery pack over the time (refer to [Notes on battery use](#)<sup>53)</sup>). PROFIBUS-Tester 5 contains an energy management. If the measures for energy saving are not sufficient or are perceived as a disturbance it is recommended to operate on the device in conjunction with an external power supply. Alternatively the user may use a spare rechargeable battery.



Figure 7: Rechargeable battery pack

Softing Order No.: ABA-NN-006012

## 1.4.6 Service interfaces for PROFIBUS DP

### 1.4.6.1 Connection type D-sub

The D-sub service interface provides a PROFIBUS access point for testing if the existing D-sub connectors have no service socket or if the bus stations are connected via a terminal block. The service interface can power the terminating resistor of the D-sub connector. You can thus use it as an active bus termination at the beginning or end of the bus.

If the PLC allows dropping and adding bus stations on the live bus, you will need this external bus termination to be able to exchange the first and last bus stations without causing problems on the bus.

The compact unit is rail mounted like a terminal block and powered by an external 24 VDC power supply. The package includes a 90° angled PROFIBUS connector with a switchable terminating resistor.

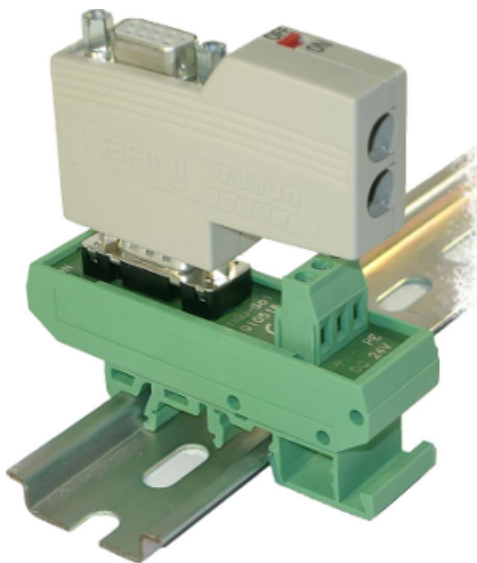


Figure 8: D-sub service interface for testing a live bus

Softing Order No.: BC-PBMB-PB-S

#### 1.4.6.2 Connection type M12

The M12 service interface comprises an IP68 rated T piece, an end cap for the service output of the T piece, and a 1 m PROFIBUS DP cable fitted with a male/female M12 connector on each end.

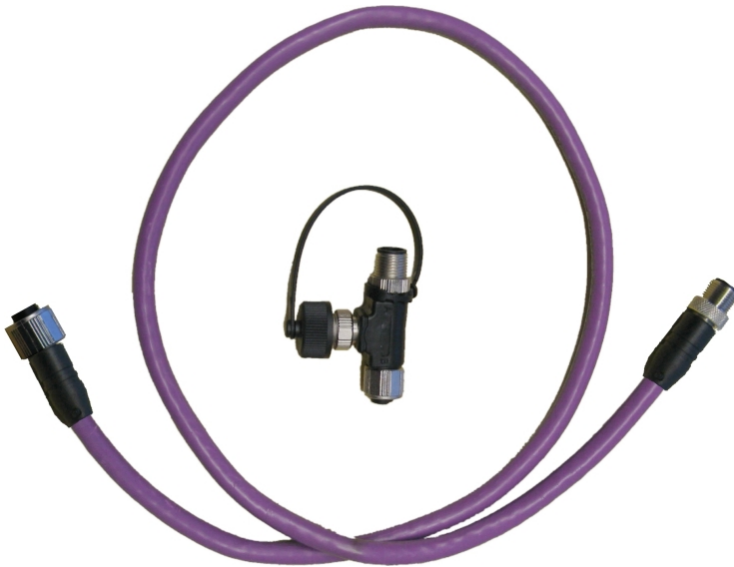


Figure 9: M12 service interface for testing a live bus

Softing Order No.: BC-M12DP-PB

## 1.5 System requirements

### Hardware

- PC
- USB 2.0

### Operating system

- Windows XP (with Microsoft Windows .NET Framework 3.5 installed) or
- Windows 7 (32 bit or 64 bit) or
- Windows 8 and Windows 8.1 (32 bit or 64 bit)

## 1.6 Connectors and controls

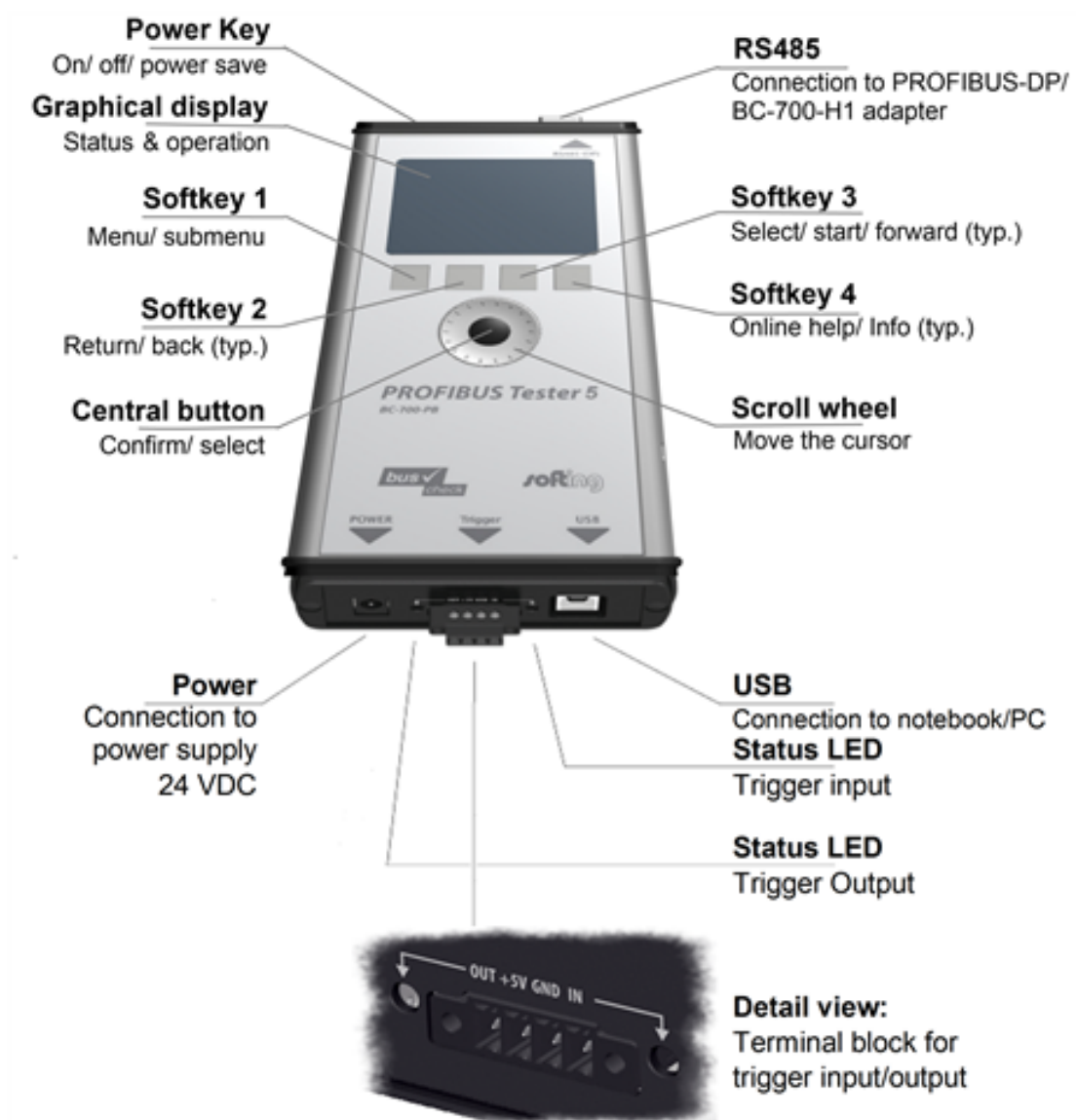


Figure 10: Connectors, buttons and status displays on the PROFIBUS Tester 5 BC-700-PB

## 2 Prepare device

### 2.1 Insert battery



#### Switch off device and disconnect charger

Always switch off the device and disconnect the charger before removing or installing the battery.

1. Take a screwdriver (Philipps) and open the head screws on the back side of the device.
2. Remove the back cover.



Figure 11: Removing the back cover of PROFIBUS-Tester 5

3. Make sure that the provided battery is free of damage such as missing insulation of wire leads, puncture or deformation. Insert the provided battery (standard accessory). The connecting plug is protected against polarity reversal. Check that the connecting plug is properly connected.
4. Mount the back cover and fix the screws.

## 2.2 Charge battery

Your battery has been partially charged at the factory. If the PROFIBUS Tester 5 indicates a low charge, do the following:

1. Connect the external AC adapter (standard accessory) to a wall outlet.
2. Connect the external AC adapter to the PROFIBUS Tester 5.
3. The PROFIBUS-Tester 5 will automatically start charging. The power key on top of the PROFIBUS Tester 5 is going to blink equally during the charge process. The graphical display remains switched off. The device is fully charged if the power key flares up very shortly.

Alternatively you may power on the device in order to receive additional information about the charge process. The battery charge level indicator is located at the upper left corner of the screen.



the battery is being charged (white flash symbol).



the PROFIBUS-Tester 5 is fully charged (without mains charger connected)



the PROFIBUS-Tester 5 is fully charged (with mains charger connected)

4. You can disconnect the AC adapter from the device, then from the wall outlet. We recommend switching off the device in order to save energy.



### Hint

You do not need to charge the battery for a specific length of time, and you can use the device while it is charging.



## 3 Startup



### Hint

You can find information on the installation of PROFIBUS Diagnostics Suite and on the corresponding drivers in section [Install software and connect to PC](#)<sup>[20]</sup> and in the PROFIBUS Diagnostics Suite User Manual.

### 3.1 Power-up

1. Acclimate to room temperature

Before being connected to the AC mains power, the PROFIBUS Tester 5 and the AC adapter must be acclimated to room temperature to avoid condensation. This may take up to 60 minutes.

2. Switch on

Switch on the tool by pressing the power key at the upper front edge. Make sure that you have either connected it to a power supply, or that you have inserted the battery. The display lights, performs a self-test and the splash screen is shown.



### Hint

We recommend operating the device solely using the wide-range power supply supplied or using the integrated battery to avoid equalizing currents which can falsify the test results.

The tool is powered by a built-in three cells lithium ion accumulator with 11.1 VDC. Alternatively the tool can be powered by 24 VDC through the external wide-range power supply.

### 3.2 Power-up behaviour without USB connection

If not connected to an USB port, the PROFIBUS Tester 5 starts up in stand-alone mode (see [Display and controls in stand-alone mode](#)<sup>[32]</sup>) and is immediately ready for testing. During program start-up the splash screen is shown for a few seconds and displays "USB NOT CONNECTED":



Figure 12: Splash screen – starting without USB-connection

### 3.3 Power-up behaviour with USB connected



#### Install drivers before connecting

Make sure the required USB drivers are installed before connecting the test tool to the PC or notebook. You can find them on the PROFIBUS Diagnostics Suite PC software CD.

On successful completion of the self-test, the PROFIBUS Tester 5 displays:

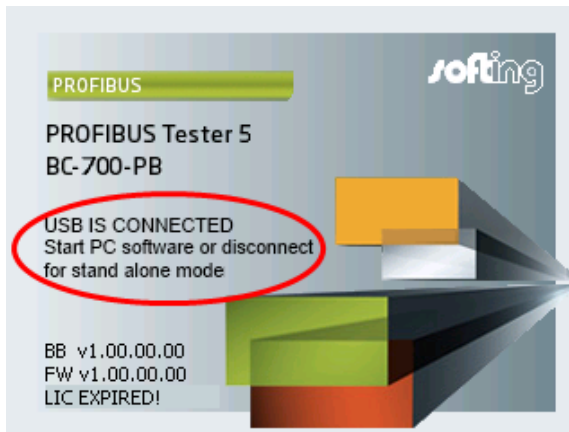


Figure 13: Power-up display when USB connected

When you start the PROFIBUS Diagnostics Suite control and evaluation software on your computer and select the PROFIBUS Tester and a network for testing in its user interface, the test tool switches to PC mode.

At this point, you can also start a firmware update instead of using the control and evaluation software (refer also to [Firmware update](#)<sup>[43]</sup>).

The display shows:

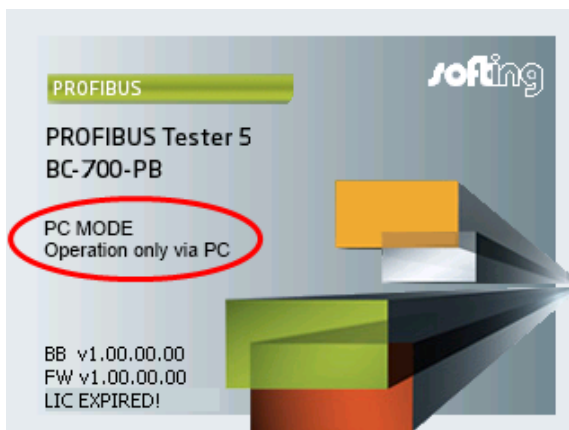


Figure 14: Display at testing with PC software

## 4 Power-off and sleep mode

### Power-off

Press power key for more than three seconds in order to power-off the device. There is no power consumption during the device being powered off. The device can be stored for long a period of time.

### Activate sleep mode

If you want to change manually to sleep mode, actuate shortly the power key. During sleep mode the PROFIBUS-Tester 5 is saving energy and the power key will blink slowly.

If a measurement function is currently active, it is not possible to switch to sleep mode. Depending on the settings in energy management, the PROFIBUS-Tester 5 may automatically change to sleep mode after a predefined period of time.

### Return to normal operation mode

You can recover normal operation very quickly by shortly actuating the power key a second time. The lastly shown menu screen will be displayed which was active before changing to sleep mode.

### Automatic power-off

If the PROFIBUS-Tester 5 is in sleep mode for more than 2 hours, it will automatically power-off.

## 5 Install software and connect to PC

### Installing

Install the software and the required drivers from your PROFIBUS Diagnostics Suite CD-ROM. For detailed installation instructions refer to the supplied Quick Startup Guide.

### Connecting to a PC

Use the included USB cable to connect the tool to a PC or notebook.



#### **Always connect directly to an USB port**

We recommend connecting the unit directly to an USB port (USB 2.0) on the PC or on the notebook. When you use external USB hubs, notebook docking stations or USB 3.0 ports for connection, problems may occur.

## 6 Connection to PROFIBUS

### 6.1 General information

#### 6.1.1 Possible side effects when testing a live bus



##### Test tool side effects

When you connect a test tool, side effects on the system under test are generally unavoidable. If the PROFIBUS is already disturbed to a certain degree or if Simatic Diagnostic Repeaters are used, the operation of the PROFIBUS might nevertheless be affected occasionally. Compliance with the connection notes is mandatory.

#### 6.1.2 Connection types

You can connect a bus station to a PROFIBUS network either

- using connectors such as
  - [D-sub connectors](#)<sup>[25]</sup>, most of which have an integrated terminating resistor and, optionally, an additional service socket
  - [M12 connectors](#)<sup>[13]</sup> for environments requiring increased IP ratings
  - Special vendor-specific hybrid connectors; they are used in combination with special cables to supply power via the bus
- or
- using terminals for direct connection.

Due to the daisy-chain topology, the connection points of the bus stations are the typical points for connecting the test tool.

### 6.1.3 Adapter cable

The PROFIBUS Tester 5 is supplied with the D-sub adapter cable BC 600-PB-CB-DSUB-2 „Standard“ (light connector). For testing on live systems the optional D-sub adapter cable BC-600-PB-CB-DSUB-2 is recommended. An M12 adapter set is optionally available, see [D-sub adapter cable for testing live systems](#)<sup>9)</sup>.



#### Only use original short cables

Only use the original short cables with special pin layout to connect the unit to a PROFIBUS network.

Do not cascade more than two D-sub connectors with service sockets at the same time!

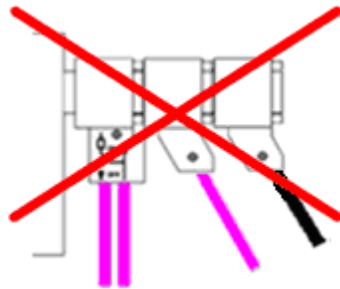


Figure 15: Unallowed cascading of D-sub connectors

### 6.1.4 Strain relief

Use the strain relief supplied with the test tool. Thus you avoid the device from falling down.



Figure 16: Recommended use of retaining strap



### Avoid stress on connectors and bus stations

Avoid stress on connectors and bus stations which might be caused by the device's own weight. Ensure proper strain relief by using suitable supports, cable ties, etc. When this is not possible, you need to select a different connection point to avoid damage.

#### 6.1.5 Using the security lock port

When using trend logging, the PROFIBUS Tester 5 is typically operated in an unattended manner over a prolonged period of time. You can connect a Kensington lock to the security lock port to prevent your device being stolen. The Kensington lock is not part of the product delivery. To use this feature, you have to purchase the Kensington lock additionally. To use the Kensington lock, refer to the product manual. Tie the Kensington lock cable to a fixed object and install the other end of the cable to the security lock port.

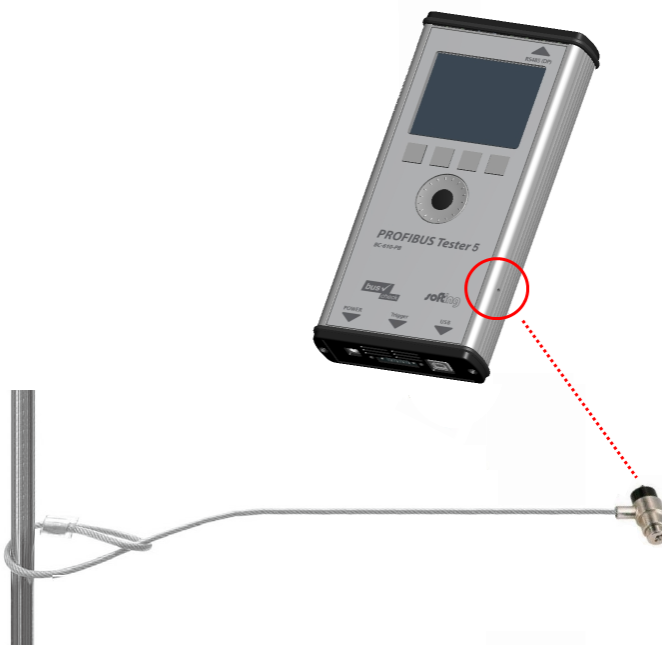


Figure 17: Using a Kensington lock

#### 6.1.6 Test locations

The PROFIBUS Tester 5 can basically carry out tests anywhere on a physical PROFIBUS segment. Note that the use of repeaters creates separate physical segments that each needs to be measured individually. For the best and most informative results, perform the tests at the beginning and at the end of each physical segment. If these test results indicate problems that cannot be clearly classified right away, you should carry out one or more additional tests at the center.

### 6.2 Simple connection for tests during system shutdown

If all bus stations provide D-sub connectors with an additional service socket, you can simply plug in the PROFIBUS Tester 5 at that socket (see figure below). If a D-sub

connector does not provide a service socket, you can plug in the D sub adapter cable underneath. Keep in mind that you should never cascade more than two D-sub connectors (see also [Adapter cable](#)<sup>[22]</sup>).

When using M12 connection technology, the M12 adapter cable is "looped" into the bus. It is essential to ensure proper termination at the beginning and at the end of the bus by using the terminating resistor provided with the M12 adapter set.



### Shut down complete installation before connecting

Shut down the PLC and all the devices connected to the PROFIBUS as all these simple connection types will divide the bus.

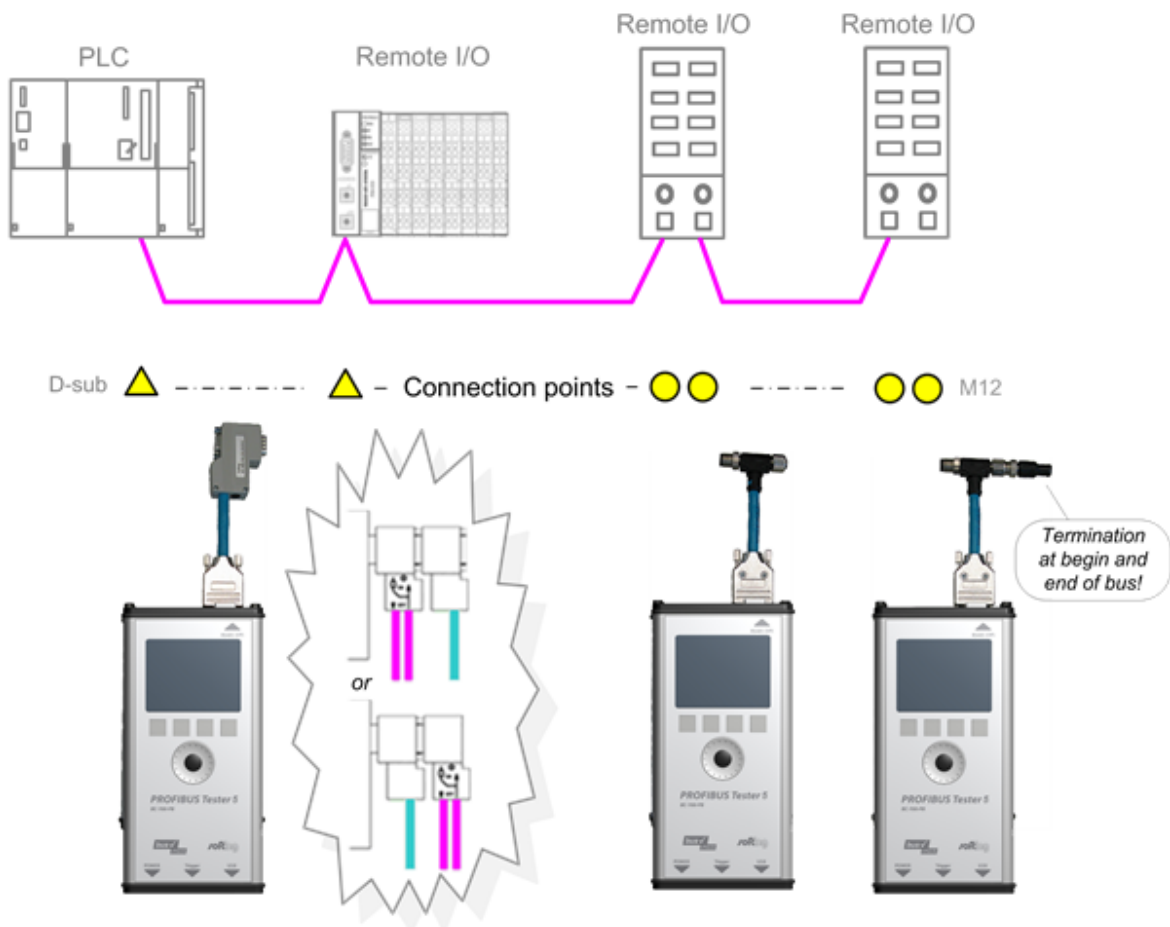


Figure 18: Connection points at system shutdown

## 6.3 Connection for testing a live bus (DP)

To test a live PROFIBUS with the PROFIBUS Tester 5 during operation, appropriate connection possibilities have to be provided. If no suitable connection points are available in the existing installation, it is recommended to install them during system shutdown. This will make future maintenance work much easier.



**Shut down complete installation before connecting**

Shut down the PLC and all the devices connected to the PROFIBUS as all these simple connection types will divide the bus.

**Use D-sub adapter cable BC-600-PB-CB-DSUB-1 for testing on live systems**

For testing on live systems we highly recommend using the optional D-sub adapter cable BC-600-PB-CB-DSUB-1 with reduced influence on bus operation.

### 6.3.1 Connection via D-sub connector with service socket

If all bus stations provide D-sub connectors with an additional service socket, you can simply plug in the PROFIBUS Tester 5 at that socket:

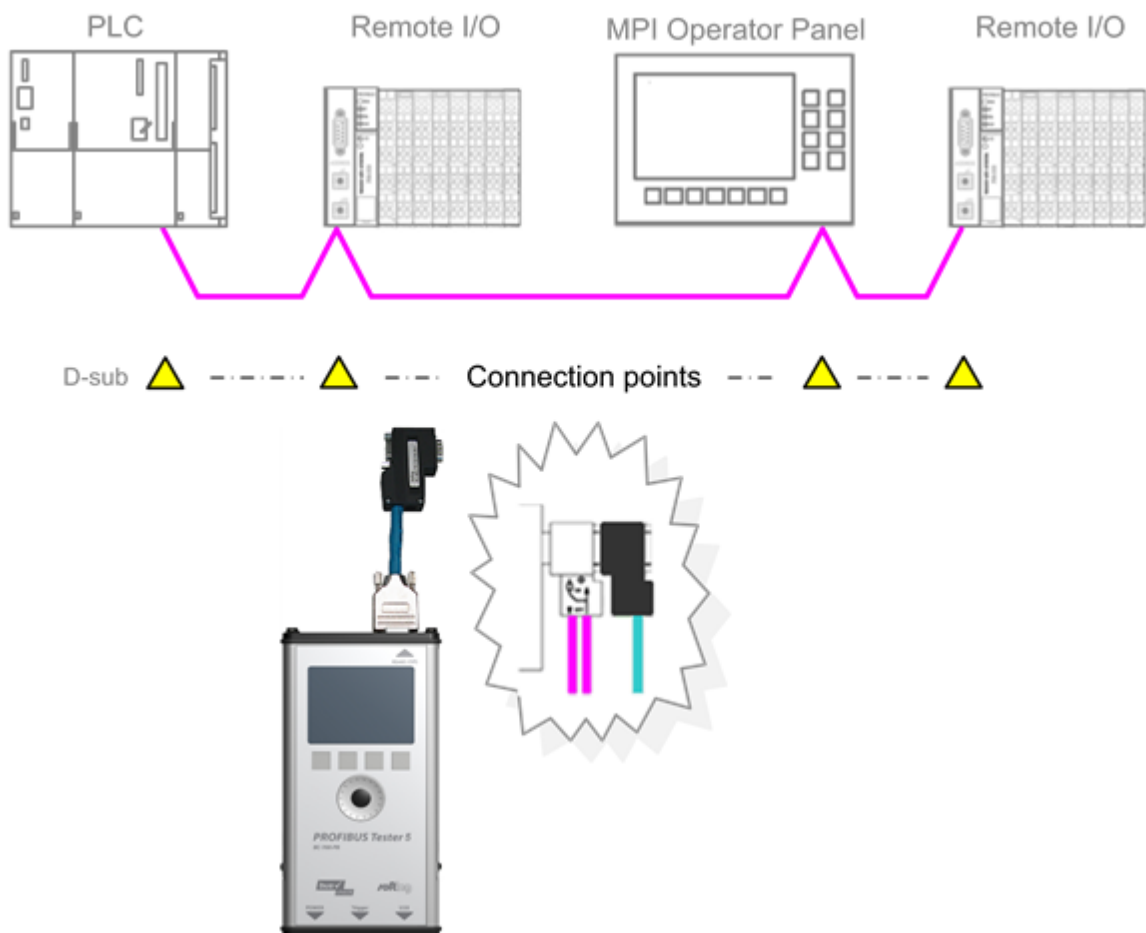


Figure 19: Connection points for the D-sub adapter cable

### 6.3.2 Direct cable connection

To test a live PROFIBUS, you will need additional D-sub service interface of the type BC-PBMB-PB-S (see [Service interfaces for PROFIBUS DP](#) <sup>[12]</sup>).

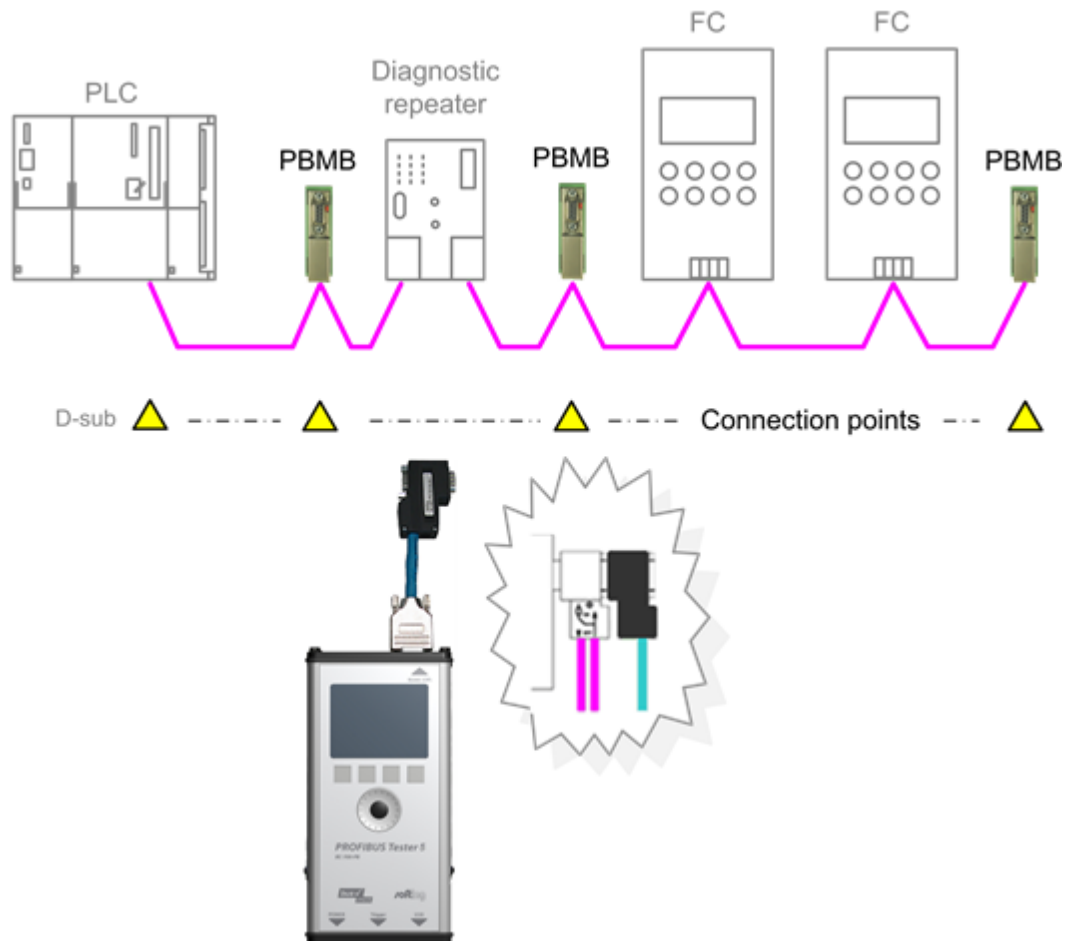


Figure 20: Service interface provide connection points at direct cable connection

### 6.3.3 Connection via M12 connector

To test a live PROFIBUS, you will need additional service interface of the type BC-M12DP-PB (see [Adapter set for M12 connection technology](#) 10)).

Tests on a live PROFIBUS are only allowed on bus segments providing D-sub connection technology. Only D-sub connectors with service socket can be used as connection points for the test tool. For this reason, tests can often only be performed at a bus end.

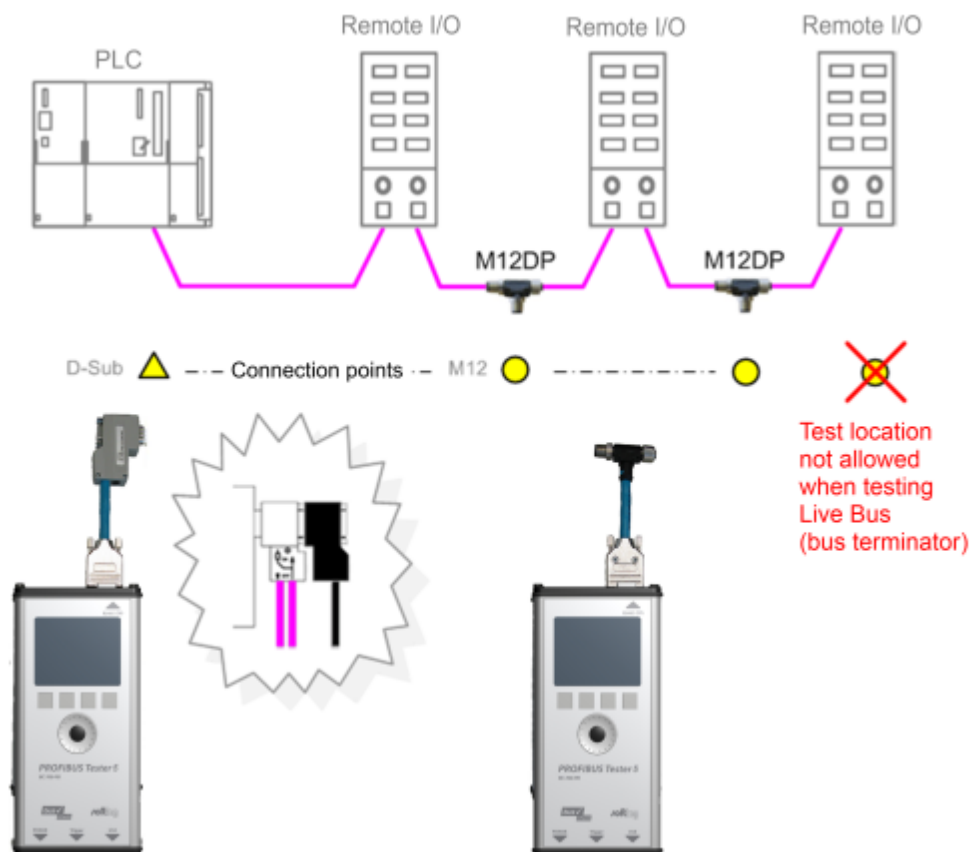


Figure 21: Connection points for the M12 adapter cable



#### Connect T-fitting between existing cable and 1 meter connection cable

Always connect one end of the T-fitting to the already existing cable and the other end to the 1 meter connection cable which is supplied with the service interface.

Do not screw the T-fitting of the M12 service interface directly onto a slave.

## 6.4 Master simulator, topology scan and cable test

### Master simulator

The master simulator allows checking the bus cabling and the station addresses during installation and commissioning, when the PLC (master) is not in operation yet. In addition, you can use this mode to check individual "suspicious" bus stations that have been disconnected from the bus.

## Topology scan

The topology scan determines the sequence and distances of all passive bus stations (slaves). This feature requires correct bus cabling, a very good signal quality, and a connection point located directly at the beginning or end of the bus.

## Cable test

The cable test assesses the wiring and can be used to determine a faulty cable location (e.g. short circuit) by means of reflection test.

All three features can only be used during shutdown of the installation. The D-sub cable BC-600-PB-CB-DSUB-2 which is included in the standard scope of supply must be used. As long as communication is detected on the bus, i.e. at least one device is an active master, the functions are disabled. If necessary, disconnect every single active device (PLC, MPI and, if necessary, diagnostic repeaters) from the power supply or the bus. If an active device is at the end of the bus you want to test, its PROFIBUS connector needs to be unplugged and connected directly to the PROFIBUS Tester 5 BC-700-PB. The bus termination in the device connector will then be powered by the PROFIBUS Tester 5 BC-700-PB.

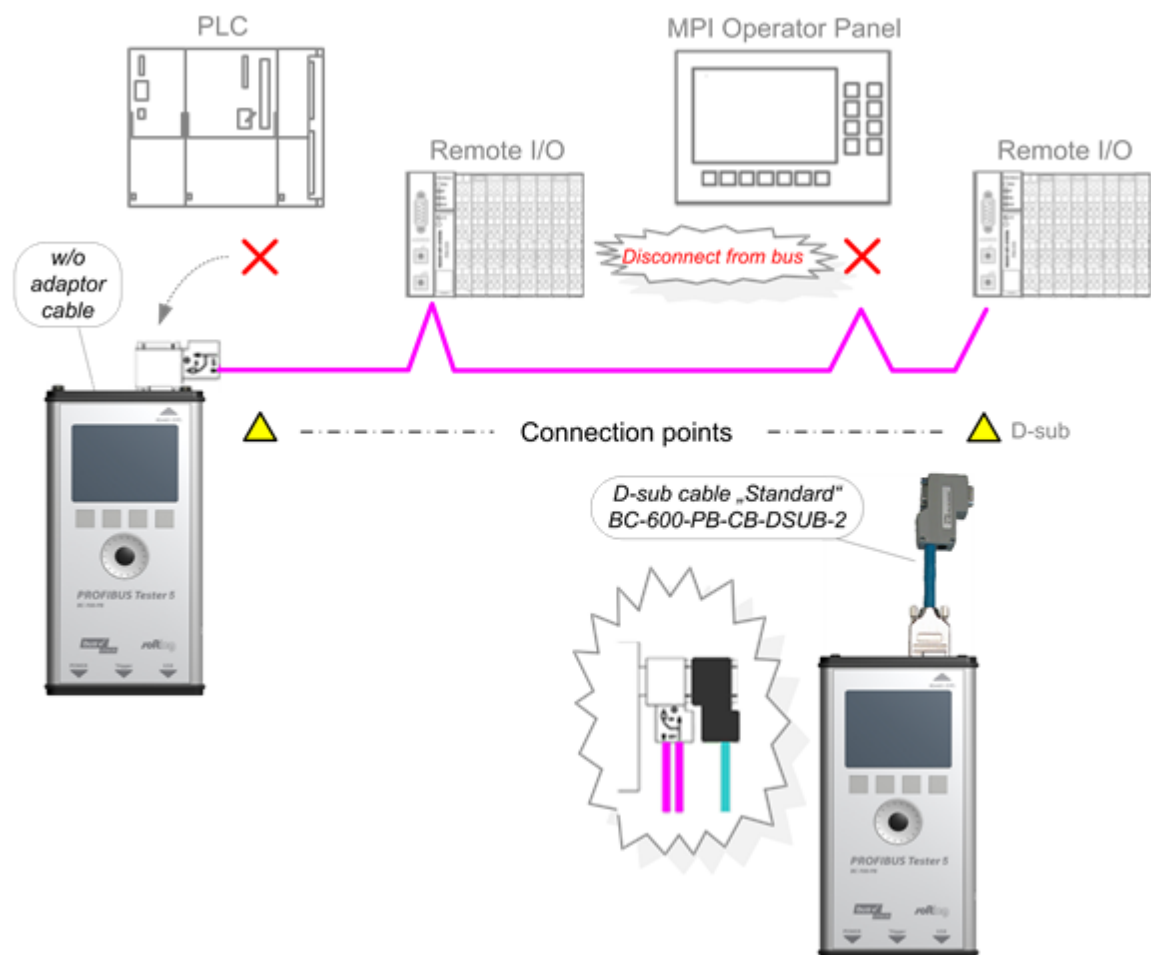


Figure 22: Connection points for topology scan and cable test



Bus stations must only be disconnected from the power supply or the bus during shutdown of the installation



The three functions can be started also when the PROFIBUS Tester 5 BC-700-PB is disconnected from the bus. If you then connect the test device to a live bus, this can cause bus communication problems or a shutdown of the installation.

### Special case: Active devices at both ends of the bus

On the very rare occasion when there is an active device at each end of the bus, do the following:

1. When using D-sub connection:
  - a. Additionally switch on the terminating resistor in the D-sub connector of the last slave.
  - b. Make sure the outgoing cable to the active device at the bus end is connected to the outgoing connector (marked with "OUT", an outgoing arrow, or "A2/B2").

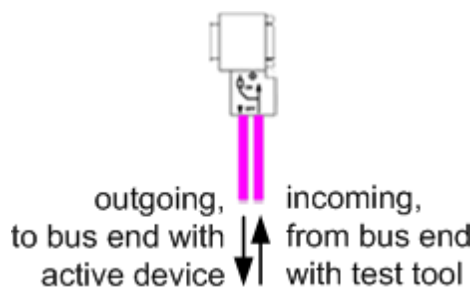


Figure 23: Checking the connection direction at the D-sub connector

2. When using M12 connection:
  - a. Connect the cable from the bus start or test tool to the incoming M12 connector of the last slave.
  - b. A bus termination is required at the outgoing M12 connector of the last slave.

## 6.5 Connecting to PROFIBUS-PA networks

### 6.5.1 Test locations

There are several ways to connect bus stations to PROFIBUS PA:

- Using terminals for direct connection
- Using M12 connectors in the field (unfortunately there is no rule defining on which sides the male and female connectors are to be used)

Field distributors and T pieces are widely used. As opposed to PROFIBUS DP, spur cables are allowed to a limited extent for PROFIBUS PA.

The following types of DP/PA fieldbus couplers are the most common:

- Simatic DP/PA couplers from Siemens, also as part of DP/PA links

- SK1, SK2 and SK3 segment couplers, e.g. from Pepperl+Fuchs (or sometimes under a different label)

Irrespective of the connection types used for the field devices, the fieldbus couplers are usually installed in a control cabinet, and the PA output is connected there via terminals.



**Connection to MBP-IS is not allowed.**

You can use the connection points of bus stations or access points inside the field distributors as connection points. Establishing the electrical connections required for measuring may vary from system to system and might not be possible during operation.

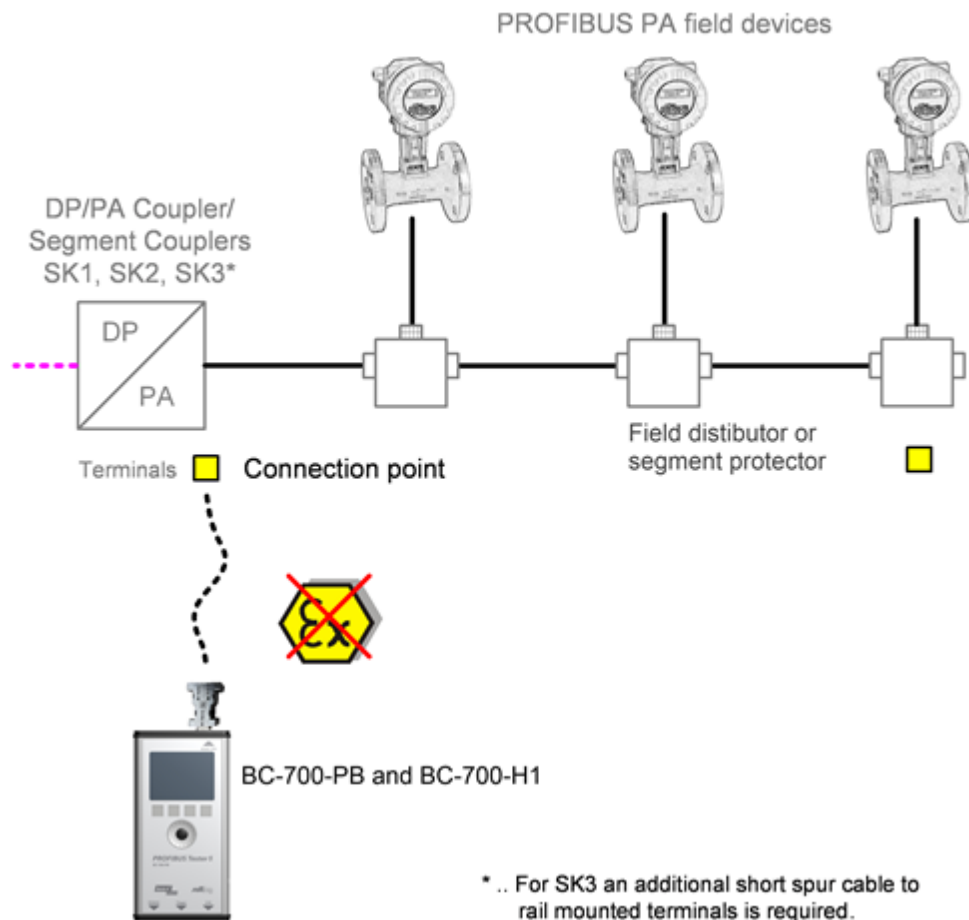


Figure 24: Connection points for PROFIBUS PA



#### Hint

An appropriate connection point is located directly at the DP/PA coupler. At this point, the tool can continue to analyze the bus communication even when lines are interrupted. The measurements are not affected by repeaters or field barriers.

### 6.5.2 Requirements for analyzing a live bus

When using the PROFIBUS Tester 5 and the BC-700-H1 adapter to carry out measurements on an MBP segment during operation, it is preferable to connect the tool via free bus connection terminals of the DP/PA fieldbus coupler. If the bus begins at the coupler, you can simply use the second terminal block at the DP/PA coupler or at the SK1 or SK2 to sample the bus signal. If the couplers mentioned above are not located at the beginning of the bus or if the bus begins with an SG3 coupler or if you are interested in the PROFIBUS PA signal at another test location, we recommend connecting a short spur cable to rail mounted terminals during system shutdown. This gives you an appropriate connection point and makes future maintenance work much easier.

### 6.5.3 Analyzing during system shutdown

If there is no possibility for connection, you need to improvise in order to pick up the bus signal at an existing terminal block of the fieldbus coupler, the field distributor, segment protector or a field device. For example, you can try a double assignment of bus terminals.



Shut down the system before you divide the bus.  
Disconnect all bus stations from the power supply.

### 6.5.4 Bus connection

The supplied test equipment set allows to easily connect the BC-700-H1 adapter to the PROFIBUS PA segment. Alternatively you can use a short length of PROFIBUS PA standard cable to connect the tool to the bus.

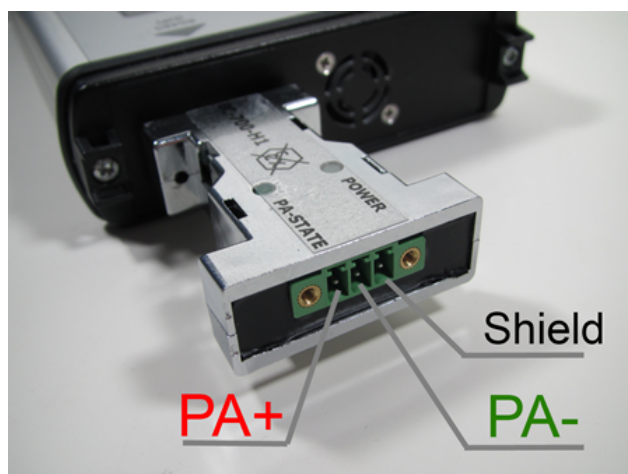


Figure 25: PROFIBUS-PA pin assignment



#### **Do not use in hazardous areas**

The PROFIBUS Tester 5 and BC-700-H1 adapter must not be used in hazardous areas and must not be connected to an intrinsically safe MBP-IS segment (blue terminals of fieldbus coupler; in some cases blue bus cables).

## 7 Display and controls in stand-alone mode

The PROFIBUS Tester 5 always starts in stand-alone mode unless it is USB connected to a PC or notebook. The readings are shown on the graphical display. You can control the tool with the four softkeys, the scroll wheel and the push button in center of the scroll wheel (see [Connectors and controls](#) <sup>[14]</sup>).

When you establish a USB connection during stand-alone mode while a test is running, the test will be aborted and the tool will be reset (restarted). The display briefly shows: "Switching to PC mode".

### 7.1 Main display

The start page is displayed after start-up in stand-alone mode (or when all dialogs or functions have been stopped and you have been returned to the main menu). The main menu is your starting point where you can open any of the test functions or additional administrative functions.

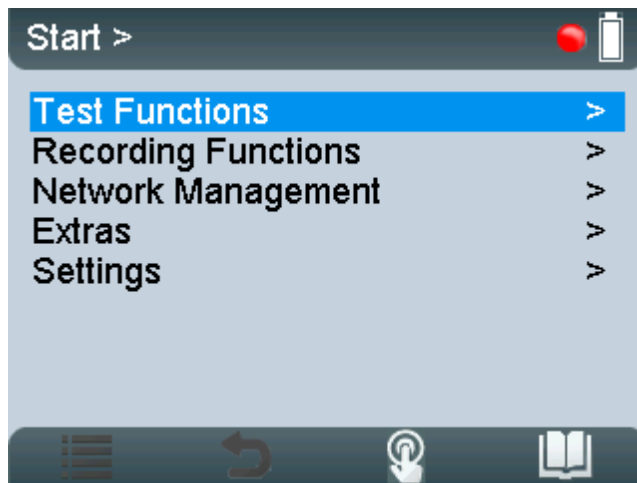


Figure 26: Start menu

### 7.2 User interface

The user interface of PROFIBUS Tester 5 comprises four parts:

- Device Status in the upper right corner, which provides information such as the battery charge level indicator, system load status, memory information, state of master simulator, connected interfaces and adapters,...
- Application Status at the upper edge on the left displays which function or sub-function is currently selected.
- The Workspace in the center of the graphical user interface contains the start page, detail views for the bus analyzes and views for administrative purposes. At a glance the user views the most important information with respect to the selected test function.
- Control information is shown at the lower edge of the user interface. The meaning of the four softkeys is explained in [Operating functions](#) <sup>[34]</sup>.



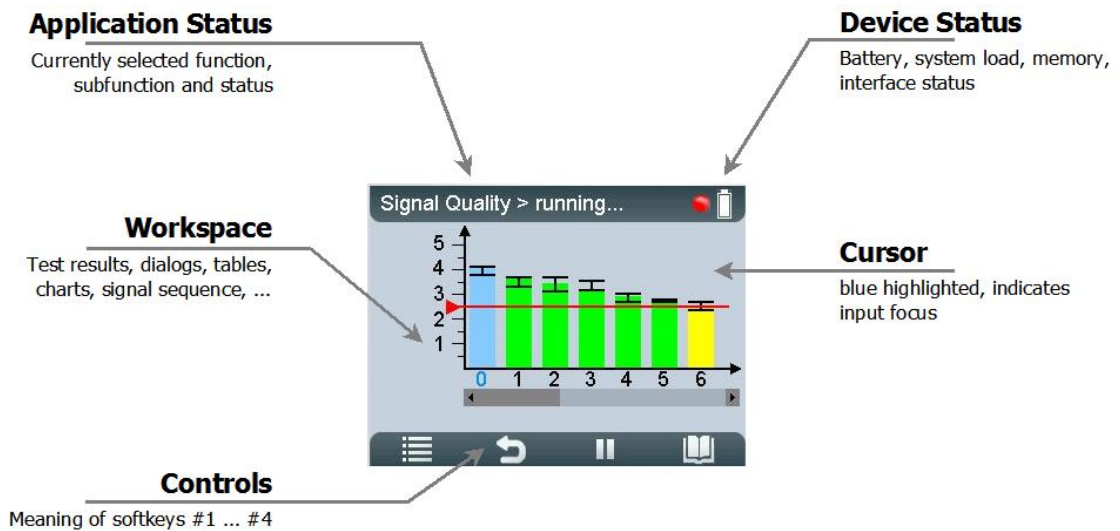


Figure 27: Division of screen areas

The presentation of dialog information comprises four layouts:

- Additional information which is typically less important is shown on user request in Info-dialogs. Access to this read-only function or information is subjected to a sub-menu function or to the [Info]-softkey.
- Other functions may require appropriate user input by means of input dialogs. The colors light blue and blue indicate, which elements are selectable or changeable by means of the input focus (cursor).
- Error messages are displayed in error dialogs.
- The PROFIBUS-Tester 5 contains a context-sensitive online help, which is shown in quick reference dialogs using a smaller font size.

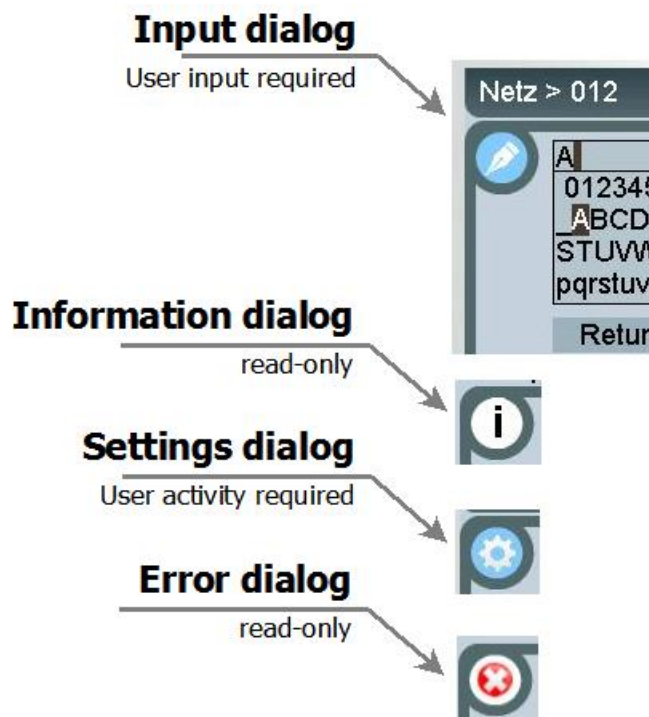


Figure 28: Dialogs in the user interface











### 7.3 Operating functions and softkeys

Use the scroll wheel, in order to move the cursor within lists, tables, dialogs and alphabetic strings. Selected elements are blue highlighted. Press the central button of the scroll wheel or press the Selection- or [Info]-softkey in order to call functions or to request additional information. The appearance of controls will change in a context-sensitive manner. If a softkey is grayed out, the corresponding operating function is disabled:


Symbol	Function
	Open menu/ submenu
	Browse backwards, leave menu function
	Browse tab to the left
	Browse tab to the right
	Confirm/ select (central push button in scroll wheel)
	Start a stopped function
	Stop a running function
	Request details for selected elements (press briefly) or Open context-sensitive reference (press button approx. for 2 seconds)
	Open context-sensitive reference

## 7.4 Device status

The table below indicates the symbols which may be displayed in the device status. Device status information is available and visible at any time of device operation in stand-alone mode.

Symbol	Description
	Battery charge level (approx. 100 %, 66 %, 33 %)
	Critical battery voltage level. PROFIBUS Tester 5 is going to shut down automatically in a couple of minutes. Connect PROFIBUS-Tester 5 to the AC adapter.
	AC adapter connected and battery is charging.
	Battery completely charged - without AC adapter connected.
	Battery completely charged - with AC adapter connected.
	Battery not found or defective. The device runs with external power supply.
	There is activity on the bus. If the LED is green, but no baud rate is detected (e.g. in Bus Status function), the activity on the bus results from disturbances and not from regular frames.
	No bus activity, open circuit voltage within correct range between 0.8 V and 1.4 V. The bus termination is correct, but no frames are transmitted on the bus. To run a test, you have to either switch on the PROFIBUS master or activate the master simulator.
	No bus activity, open circuit voltage below 0.8 V or above 1.4 V. If an open circuit voltage greater than 0 V is displayed in Bus Status function, the bus has not been properly terminated. An open circuit voltage of about 0.5 V to 0.6 V is a sign that no power is supplied to one of the two bus terminations.
	Master simulator is active. You can start the master simulator from the "Extras > Master simulator" menu.

## 7.5 Menu functions

The following table gives a brief overview about the menu functions of PROFIBUS-Tester 5 in stand-alone mode. The online help contains a more detailed description of operating functions (use the -softkey in the corresponding context).

Menu directory	Menu function (> sub menu function)	Short description
Test Functions	Bus Status > Overview	Bus Status function (Overview) assesses bus physics and bus communication and displays the test result in a simplified view.
	Bus Status > Detail view	Bus Status function (Detail view) assesses bus physics and bus communication and displays the test result in table form.
	Signal Quality	The signal quality test determines the signal quality index for each bus station and displays the test result in a bar diagram. The test location is particularly important when you are testing the signal quality. Additional information is available such as Signal/ Noise ratio, edges and numerical values with respect to signal quality testing.
	Signal Quality > Select test location	The test location is particularly important when you are testing the signal quality. It is recommended to make at least two signal quality tests per physical segment (at both ends of the corresponding segment).
	Signal Quality > Settings evaluation	The signal quality evaluation settings contain limit values for the quality index, signal/noise ratio, rise time and timeout.
	Cable Test	The cable test function examines the cabling in PROFIBUS segments. This test detects the cable segment length, scans for unwanted reflections on the line and verifies proper termination of the cable. In case of a fault you will get an error description and a distance indication (if possible) for troubleshooting actions. Tests regarding cabling can only be made from one end of the PROFIBUS line. Active stations (Masters, MPI panel,...) must be disconnected during testing of the respective cable segment. For further information and starting points in order to correctly interpret the fault indication see <a href="#">List of fault indications and remedial measures</a> <sup>[48]</sup> .
	Cable Test > Edit Configuration	In the context of cable testing it is recommended to provide additional information about the corresponding cable segment (physical segment). This is important for proper detection of line length, compliance with maximum allowed segment length as well as for proper documentation of test results. Please give full particulars with respect to the configuration of each cable segment.

Menu directory	Menu function (> sub menu function)	Short description
	Cable Test > Cable Segment List	The cable segment list shows all segments which belong to the currently selected network in a tabular overview. Plus, an OK- or error-message is displayed (if available). Particularly in the context of acceptance control the commissioner can get a survey over the cabling of the network.
Recording Functions	Quick Test	The Quick Test allows full testing of bus physics and bus communication. The test data is stored in the tool. It can subsequently be imported by the PROFIBUS Diagnostics Suite software application.  The residual waiting period is displayed during the quick test. After completion of the test, a tabular overview is displayed which informs you about existing and missing quick tests respectively.
	Trend	Trend logging is used for detecting rare or sporadic faults over a prolonged period of time. The function monitors both the bus physics and critical events in the bus communication. The test data is stored in the tool. It can subsequently be imported by the PROFIBUS Diagnostics Suite software application. The tool displays the duration of the running trend test.  After completion of the test, a tabular overview is displayed which informs you about existing and missing trend tests respectively. The Trend Test runs until manually stopped, is aborted automatically when the power supply is interrupted or when the maximum logging time of 99 hours and 59 minutes is reached.
Network Management	Networks	Select network - The PROFIBUS-Tester 5 stores the test results that are associated with a real PROFIBUS network in a separate file folder for that network. Three configurable folder structures exist. The radio button shows which network is currently selected.  Each network contains at least one physical segment and test location.
	Networks > Edit Network	Segment list - The signals of stations located behind a repeater are regenerated and transmitted by the repeater. Therefore, all stations behind the same repeater will have identical quality test results. When using repeaters, you will thus have to test each segment separately.  One test location belongs exclusively to one segment.

Menu directory	Menu function (> sub menu function)	Short description
	Networks > Segment list > Edit Segment	Assign test locations to segments: Those test locations are particularly important which are located within the currently tested physical segment. It is recommended to make at least two signal quality tests per physical segment (at both ends of the corresponding segment).
	Test Locations	Manage test locations: Particularly when testing signal quality, the test location has a major influence on the test result.  To find typical PROFIBUS faults, it is recommended to measure the signal quality at different locations on the bus, at least at both line ends. If a PROFIBUS network comprises multiple segments connected through repeaters, you have to measure each segment separately.
Extras	Master Simulator	Using the master simulator, you can even test the signal quality while you are still setting up a PROFIBUS installation and the actual master is not operational yet.  The master simulator is disabled by default when you switch on the tool. You can only select a baud rate on the display and thus start the master simulator if no other master is active.  If you use the master simulator in a trend test, quick test recording or when running the Bus Status function, the values for the critical events will not be informative because the master simulator does not execute a regular DP protocol.
Settings	Energy Management	The energy management settings have a considerable bearing on battery life of the test device with respect to one battery charge. It is recommended to activate the automatic profile "economy".
	Language	Here you can select the operating language
	Hardware Information	Hardware information is displayed here (version- and serial numbers).
	License	Here you can obtain licensing information

## 7.6 Organize and store test results

PROFIBUS Tester 5 comprises three predefined network folders: a default network folder and two empty folders.

A network folder is a directory containing all the test results assigned to a network. The name of the network folder is the same as the network name displayed during the data import into the PC.

The default network is provided for spontaneous tests and is a fixed component of the project management and cannot be deleted. However, you can rename and edit the default network and start testing using this network. If you are deleting all networks, automatically the default network including a default segment and a default test location will be generated in the network folder.

A network in PROFIBUS Tester 5 comprises one or more segments, and one or more test locations. A minimum network configuration (default network) comprises one segment (default segment) and one test location (default test location).

The test location has a major influence on the test result, particularly when testing signal quality, using the oscilloscope function or using the cable test function. To store all test results within a network in the PROFIBUS Tester 5, you have to set the radio button to the corresponding network in the networks function (see also [User interface](#)<sup>[32]</sup>).

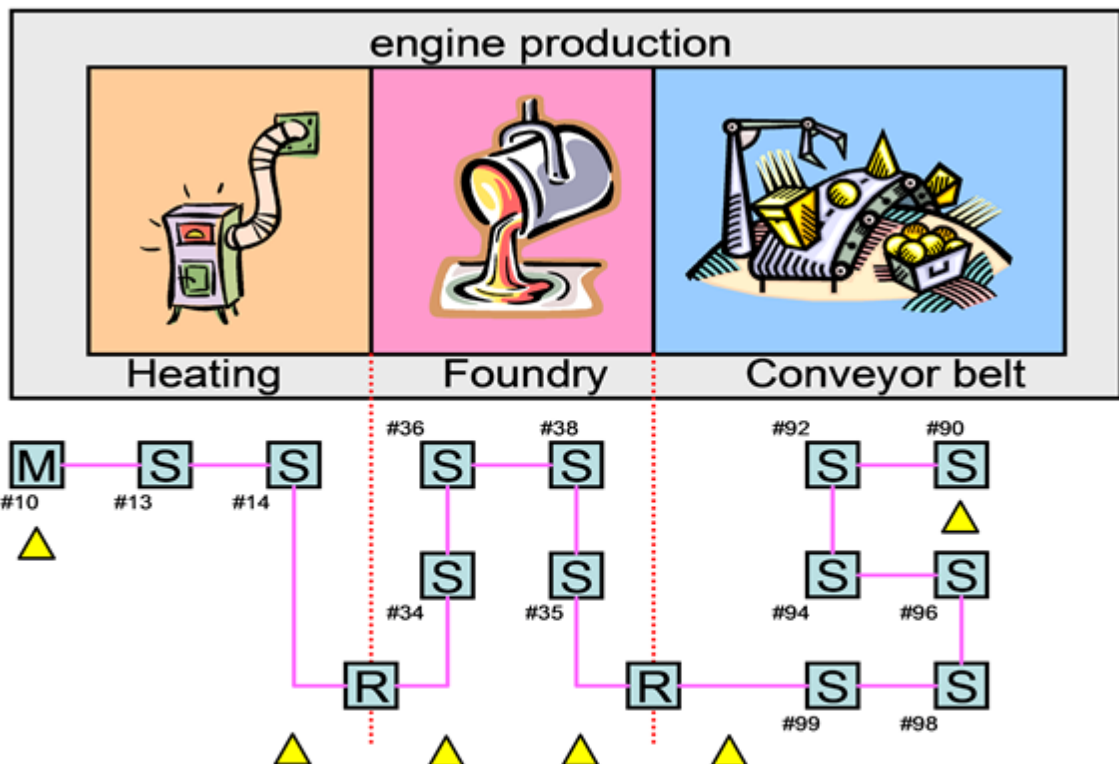


Figure 29: Select Network – the radio button is set to "engine production"

Test results in stand-alone mode are stored under the specified test location in the network you have defined as the storage location. Thus, test results will be organized and stored in PROFIBUS Tester 5 according to their test location. Refer to the figure below to see an example network which could be organized as follows in PROFIBUS Tester 5 (recommendation):

1. Use the **Networks/ select network** function and select an empty network folder. Enter the network name (e.g. "engine production").
2. Use the **Edit network** sub-function and rename the default segment (e.g. to "heating") and add two new segments (e.g. "foundry" and "conveyor belt").
3. Use the **Test locations** function and generate six test locations.

4. Assign test location to segments. You can do this in **Test locations** or in **Networks** → **Edit Network** → **Edit segment-subfunction**.



▲ Connection points / Test locations

Figure 30: Example network comprising three segments, 13 PROFIBUS stations, 2 repeaters and 6 recommended test locations (two per segment)



## 8 Import data into the PC

Quick Tests, cable test results and Trend logs stored in the test tool can be imported into the PC software.

1. To do this, start the PROFIBUS Diagnostics Suite.
2. Connect the PROFIBUS Tester 5 BC-700-PB to the PC via USB. An additional **Import Test Data** dialog box appears automatically showing the test data previously saved:

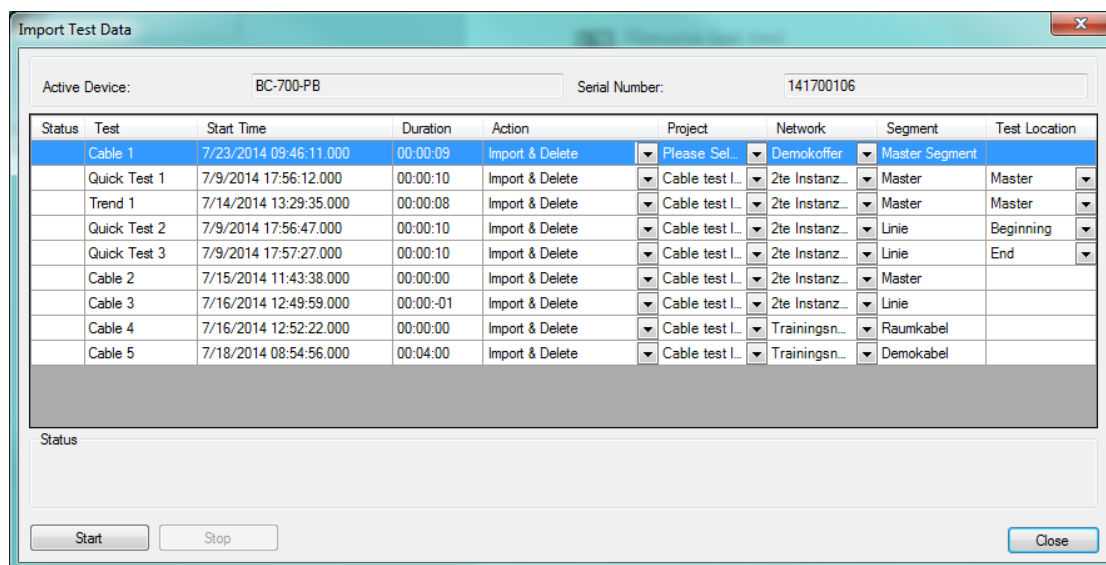


Figure 31: Importing test data

3. The **Import Test Data** dialog box has been completed in advance and contains already the network designations, segment designations and the test location designations, which have been derived from the network management of PROFIBUS Tester 5 BC-700-PB.

For ALL the stored data, you need to fully select the action to be performed, the network/project and the test location to which you want to store the data. The default action **Import & Delete** deletes the test data in the tool after the import is complete. This frees the allocated memory locations for new tests.

The imported Quick Tests, cable test results and Trend logs are fully compatible with the test data that can be acquired using the PC software.

## 9 Licenses

Some main menu functions of PROFIBUS Tester 5 require a license activation or may be blocked respectively. You can view the license activation status in the menu function **License** in the **Settings** directory.

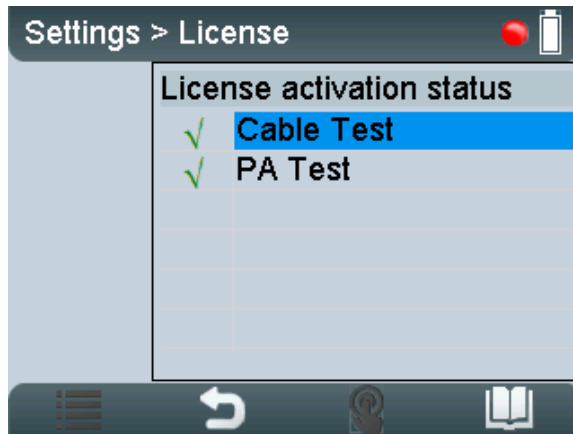


Figure 32: Viewing the license activation status

Disabled functions or functions without a license will be grayed out or are not visible in the main menu in stand-alone mode. In PC mode of operation in conjunction with the PC software PB-DIAG-SUITE the corresponding functions are blocked, too. When USB is connected you can view the license activation status in PC-software PB-DIAG-SUITE, too (**Help** → **Hardware Info**).

## 10 Firmware update

Firmware updates are made available as required. They are provided with the updates to the PC software (see [Install software and connect to PC](#)<sup>[20]</sup>) and allow access to new or improved functionality. How to update the firmware is described in detail in the separate PROFIBUS Diagnostics Suite – Quick Startup Guide.

## 11 Maintenance and service

The PROFIBUS Tester 5 is maintenance-free and does not require calibration. It is recommended to exclude this device from control of measuring and monitoring of devices. Repairs/ service exchange (RMA) may only be carried out by the device manufacturer. All returns must be made without supplied carrying case and accessories (unless otherwise agreed). Please also include a brief fault description and a phone number at which we can contact you should we need further details. In case of returns within the warranty period, please also enclose a copy of the invoice or delivery note.

The built-in battery is subjected to normal wear and tear. The battery capacity decreases in the course of years; this is typical for specified normal operation. Exhaustive discharge and overcharge or exhaustive operation of the device in conjunction with very high or low temperatures will accelerate the battery ageing process (refer to [Notes on battery use](#))<sup>53</sup>.

## 12 Troubleshooting

Problem	Causes and remedies
The display of the PROFIBUS Tester 5 remains blank.	<p>Possible cause:</p> <ul style="list-style-type: none"> <li>• The PROFIBUS Tester 5 either needs an external power supply or you have to install the built-in battery.</li> </ul> <p>Remedy:</p> <ul style="list-style-type: none"> <li>• Use the supplied external AC adapter to connect the tool to the mains power supply.</li> <li>• Charge the built-in battery</li> </ul> <p>Alternative cause:</p> <ul style="list-style-type: none"> <li>• The tool is defective.</li> <li>• The rechargeable battery is defective</li> </ul> <p>Remedy:</p> <ul style="list-style-type: none"> <li>• Return the tool to the manufacturer.</li> <li>• Replace the rechargeable battery</li> </ul>
The display shows the following error message: "USB ERROR - Refer to manual or disconn. for stand-alone mode".	<p>Possible cause:</p> <ul style="list-style-type: none"> <li>• This error message can be caused by poor physical connection via USB ("loose" contact).</li> </ul> <p>Remedy:</p> <ul style="list-style-type: none"> <li>• Check the USB cable and connector.</li> </ul> <p>Alternative cause:</p> <ul style="list-style-type: none"> <li>• The device may be connected via external USB hub, notebook docking stations or USB 3.0 port which could evoke problems during driver installation</li> </ul> <p>Remedy:</p> <ul style="list-style-type: none"> <li>• It is recommended to connect the unit directly to a USB 2.0 port</li> </ul>
The baud rate is not detected automatically on a live PROFIBUS.	<p>Possible cause:</p> <ul style="list-style-type: none"> <li>• Massive disturbances in the bus physics.</li> </ul> <p>Remedy:</p> <ul style="list-style-type: none"> <li>• Manually set the baud rate and repeat the test.</li> </ul>
A main menu function is grayed out or is not visible respectively	<p>Possible cause:</p> <ul style="list-style-type: none"> <li>• Missing license</li> <li>• Out-dated firmware version is in use</li> </ul> <p>Remedy:</p> <ul style="list-style-type: none"> <li>• Please check your bill of delivery if the license is included in your order.</li> <li>• Please download the latest firmware version</li> </ul>

Problem	Causes and remedies
It is not possible to activate the sleep mode for energy saving	<p>Possible cause:</p> <ul style="list-style-type: none"> <li>• Test function is currently active</li> </ul> <p>Remedy:</p> <ul style="list-style-type: none"> <li>• Stop running test functions before activating the sleep mode</li> </ul>
After some minutes the display becomes dark.	<p>Possible cause:</p> <ul style="list-style-type: none"> <li>• Backlight was switched off automatically in the context of energy saving settings</li> </ul> <p>Remedy:</p> <ul style="list-style-type: none"> <li>• Actuate any push button or scroll wheel</li> </ul> <p>Alternative cause:</p> <ul style="list-style-type: none"> <li>• The tool automatically entered the sleep mode/ powered off in the context of energy saving settings</li> </ul> <p>Remedy:</p> <ul style="list-style-type: none"> <li>• Actuate the power key in order to power up the device</li> </ul>
The device is running but does not react to any user input.	<p>Possible cause:</p> <ul style="list-style-type: none"> <li>• The program has crashed</li> </ul> <p>Remedy:</p> <ul style="list-style-type: none"> <li>• Actuate power key for at least three seconds in order to power off the device</li> <li>• Switch off the power supply. As the case may be, open head screws on the back of the device and remove the connecting plug of the rechargeable battery</li> </ul>
After switching on the device, the splash screen persists and shows "Selftest failed! System halted"	<p>Possible cause:</p> <ul style="list-style-type: none"> <li>• Self-testing has identified faulty device components</li> </ul> <p>Remedy:</p> <ul style="list-style-type: none"> <li>• Return the tool to the manufacturer</li> <li>• Optional: Press the key combination [Softkey 1] + [Softkey 4] during switch-on of the device. Detailed information about self-testing is shown.</li> </ul>

You can find support contact data on the cover sheet's back side of this document.

## 13 Tips and tricks for cable testing



### Perform cable test without mains adapter

When using the cable test function we recommend removing the mains adapter and operating on the PROFIBUS-Tester 5 by means of the built-in battery in stand-alone operation mode.

### 13.1 Assessment criteria

The cable test function examines the cabling in PROFIBUS DP segments and summarizes the test result in a single statement ("Ok" or "Error"). Amongst technical criteria with respect to the cabling the overall assessment incorporates additional criteria with respect to the workflow and to plant planning. Under certain conditions a user may not be able to successfully finish cable testing in a dedicated segment (e.g. at a very early installation phase of a facility, when there is no possibility to power the bus terminators). In such a case it is recommended, to add a comment to the corresponding test report which clarifies the circumstances that lead to the negative cable test result. Not all errors will inevitably lead to downtimes or represent under the specific circumstances a severe error. At last, the commissioner or maintenance personnel decides, if a PROFIBUS-network is functioning properly or not. The corresponding person gets necessary information and recommendations by means of using appropriate PROFIBUS diagnostic tools. The table below contains assessment criteria which must be fulfilled in order to successfully complete the cable testing function. The table describes also, under which conditions the cable test will result in an error or failure.

<b>Failed, if at least one of the following criteria is fulfilled</b>	<b>Passed, if all of the following criteria are fulfilled</b>
Substantial troubleshooting effort was carried out unsuccessfully and there are still errors on the cabling	All cabling errors have been successfully eliminated
The corresponding PROFIBUS DP segment is still affected by reflections on the cable	The corresponding PROFIBUS DP cable segment is free of reflections
The user did not run through the three steps of cable testing	The user has run through each of the three steps of cable testing successfully
Detection of the cable segment length fails	The cable segment length has been successfully detected
Bus termination is not as expected	The terminators at both ends of the cable segment are switched on and properly powered
The detected cable segment length exceeds the limit value specified by PI (PROFIBUS PROFINET International)	The baudrate (entered by user) and the detected cable segment length fit together according to PI recommendation (PROFIBUS PROFINET International)

## 13.2 List of fault indications and remedial measures

The classifying text messages in the graphical user interface of PROFIBUS Tester 5 which describe the cabling errors are kept concisely. The table below lists possible cabling error messages and provides a detailed description of the discovered fault indications. The column on the right contains "remedial measures" and further starting points in order to correctly interpret and to repair the indicated fault.

The PROFIBUS Tester 5 uses amongst other methods impulse reflectometry for assessing the cabling and classifying and locating errors on the cable. Multiple cable errors, which exist simultaneously on the cable may result in an imprecise cable test result. Please bear in mind, the more the corrective repair of the cable is proceeding, the more precise the cable test results in the corresponding PROFIBUS cable segment will be.

Electromagnetic interferences may influence PROFIBUS cable testing in a negative manner because cable conductors may act like an antenna. Please bear this in mind during cable testing and take care of proper functional earthing of your plant respectively. Existing high frequency noise voltage may negatively influence the PROFIBUS Tester 5 if operated by means of the external power supply. We recommend operating on the PROFIBUS-Tester 5 by means of the built-in battery under the above mentioned prevailing conditions.

Cable testing error message from graphical user interface of PROFIBUS-Tester 5	Remedial measures - starting points for correctly interpreting and repairing the indicated fault
Break on line A	The green signal line of the PROFIBUS-cable is broken. Please search for damage on the cable in the vicinity of the indicated error location. Possibly the error could come from a fatigue breakage or a faultily assembled PROFIBUS-connector. The green signal line typically is connected to Pin 8 of the PROFIBUS Sub-D type connector.
Break on line B	The red signal line of the PROFIBUS-cable is broken. Please search for damage on the cable in the vicinity of the indicated error location. Possibly the error could come from a fatigue breakage or a faultily assembled PROFIBUS-connector. The red signal line typically is connected to Pin 3 of the PROFIBUS Sub-D type connector.
Break on shield	<p>The shielding conductor is broken in the tested cable segment. Alternatively electromagnetic shielding is not applied for in a continuous manner. Please search for damage on the cable in the vicinity of the indicated error location. Possibly the error could come from a fatigue breakage or a faultily assembled PROFIBUS-connector.</p> <p>In rare cases electromagnetic shielding may be disrupted intentionally in order to avoid electromagnetic interferences. Please check this issue with the planning personnel of the PROFIBUS-facility.</p>



Cable testing error message from graphical user interface of PROFIBUS-Tester 5	Remedial measures - starting points for correctly interpreting and repairing the indicated fault
Short circuit between A and B	<p>There is an unusual low ohmic or capacitive resistance between signal lines A and B. Please search for damage on the cable in the vicinity of the indicated error location. Possibly the error could come from a severe crush of the cable or multiple unpowered bus terminators.</p> <p>Plus, be on the lookout for illegal spur lines and check, if moisture penetrated the cabling or if the cabling is heavily soiled.</p>
Short circuit between A and shield Short circuit between B and shield Short circuit between A, B and shield	<p>There is an unusual low ohmic or capacitive resistance between the mentioned signal lines and conductors. Possibly the error could come from a severe crush of the cable or a faultily assembled PROFIBUS-connector.</p> <p>Plus, be on the lookout for illegal spur lines and check, if moisture penetrated the cabling or if the cabling is heavily soiled.</p>
Capacitive Load / Spur Line	<p>There is an unusual capacitive load between signal lines A and B and the shield conductor. Possibly the error could come from an illegal spur line or from interference-suppression capacitors. This is common usage with "over-compensated" or defective PROFIBUS-devices.</p> <p>Disconnect the devices in the vicinity of the indicated error location and repeat cable testing in order to encircle the error.</p>
Unknown error	<p>The cable is still affected by unwanted reflections. Though it is not possible to classify the fault indication. Please search for damage on the cable in the vicinity of the indicated error location and check if the PROFIBUS-connector has been properly assembled.</p> <p>Unwanted reflections may emerge from transitions between media and signal conductors which have different impedance values (e.g. two different cable types).</p>
Sending pulse could not be detected. The cable is either too short or not connected.	Please do not fall below the minimum cable length of 3 meters. The intended use of cable testing requires a cable with adequate length.
(Near-end) terminator switched on No reflections could be detected. Please remove terminators.	<p>During the first of the three steps of cable testing the PROFIBUS Tester requires an open cable on both sides. However, the tester detected an ohmic resistance between the signal wires and the resistance value is in the range of bus terminators. Please make sure, that every bus terminator on every PROFIBUS-connector is switched off or is deactivated.</p> <p>Please take into consideration, that dip-switches for switching on/off bus terminators may be defective.</p>

Cable testing error message from graphical user interface of PROFIBUS-Tester 5	Remedial measures - starting points for correctly interpreting and repairing the indicated fault
Idle voltage too high	<p>The ideal idle voltage between signal wires A and B of a cable segment, which is properly terminated on both sides is approximately 1.1 Volts. However, the PROFIBUS-Tester detected voltage values higher than 3 Volts between the signal wires A-B; A-Shield and/or B-Shield. These unwanted potential differences obstruct the cable testing function and the test results will become void. Plus, running leakage currents may damage the PROFIBUS-Tester.</p> <p>Please take care of proper functional earthing of your plant. We recommend to remove the mains adapter and to operate on the PROFIBUS-Tester 5 by means of the built-in battery if you are receiving this error message. This will avoid damage caused by leakage currents.</p> <p>Please take also into consideration that the error cause could be a defective RS-485 driver of a PROFIBUS-device. Troubleshooting EMC and earthing issues are a highly complex field of activity. Therefore it is recommended to ask service providers which are primarily specialized in troubleshooting the above mentioned issues.</p>
Far-end / Near-end terminator not powered	<p>The corresponding bus terminator has been switched on, but the terminator is improperly powered by 5 V supply voltage, yet. During the cable testing the PROFIBUS Tester requires a properly terminated cable at the far end (2nd test step) or on both sides of the cable segment (3rd test step). A properly terminated cable segment consists of activated and powered bus terminators on both sides of the cable.</p> <p>Please make sure that the corresponding PROFIBUS-device at the corresponding end of the cable segment is powered. Plus, the activated bus terminator is properly plugged to a powered PROFIBUS-device.</p>
No terminator detected	<p>There is neither an unpowered bus terminator nor there was detected a bus terminator at all in the respective cable segment.</p> <p>During the cable testing the PROFIBUS Tester requires a properly terminated cable at the far end (2nd test step) or on both sides of the cable segment (3rd test step).</p> <p>When using D-sub connection, activated bus terminators are only effective at the incoming connector of PROFIBUS-connectors. The incoming connector is marked with "IN", an incoming arrow or "A1/B1". Please be also on the lookout for PROFIBUS-cables which have been connected by mistake to the outgoing connector.</p>

Cable testing error message from graphical user interface of PROFIBUS-Tester 5	Remedial measures - starting points for correctly interpreting and repairing the indicated fault
Far-end / Near-end terminator wrong or not adapted	<p>The PROFIBUS Tester detects an ohmic resistance between the signal wires A and B, but the resistance value is not as expected in the range of a bus terminator.</p> <p>Please make sure, that the bus terminator is properly powered and the PROFIBUS-connector has been properly powered. Take into consideration that multiple bus terminators may be switched on and that dip-switches for switching on/off bus terminators may be defective (due to aging and soiling).</p>
Line A and B interchanged	<p>The green and the red signal line are interchanged. Possible cause might be a PROFIBUS connector which is assembled improperly. Please bear in mind that after having two times interchanged line A and B, this error cannot be recognized anymore. Only when interchanging both lines for a third time, you may recognize the error.</p> <p>Typically, the tester will not return a measured distance. In order to localize the fault location we recommend shortening the respective cable segment step by step by switching on bus terminators within the cable segment.</p> <p>Repeat the cable test after each shortening procedure until the error is no longer reported.</p> <p>The last active bus terminator is the faulty one.</p>
Near end terminator was powered by internal 5 V power supply	<p>This message is a note and not an error message. The cable test has been passed successfully. The bus terminating resistor has been switched on at the test location but is not powered via a PROFIBUS station. Possible causes: The related cable end is not connected to an activated PROFIBUS station or the 5 V power supply of the related PROFIBUS station is defective. The PROFIBUS tester was able to supply the bus terminating resistor with its tester-internal 5 V power supply.</p>

### 13.3 Metering the cable segment length correctly

Directly after starting the cable test function you will see the actual segment configuration. In the context of cable testing it is recommended to provide the number of connectors and connected devices in the respective cable segment. The provided number of these elements should be as precise as possible in order to correctly detect cable segment length or the distance to the error. This chapter illustrates, how connectors and devices influence the detection of the cable length.

Connectors: Please specify, how many 12 MBit/s PROFIBUS-connectors exist in the respective cable segment and enter the number in the segment configuration. The series inductance within the 12 MBit/s PROFIBUS-connectors act like a delay element on the cable with respect to impulse reflectometry. Every connector corresponds to approx. 50 cm cable length.

Devices: Please specify, how many PROFIBUS devices are connected to the respective cable segment (Master, Slave, repeater; typ. not more than 32). The RS485-driver unit of each PROFIBUS-station acts like a RC-circuit (delay element) on the cable. In the context of impulse reflectometry this corresponds to additional 20 cm cable length per device.

Consequently, the combination consisting of connector plus device corresponds to approx. 70 cm cable length.

Example: A cable segment has approx. 50 m effective cable length and contains 20 PROFIBUS devices, which are connected to the line by means of 12 MBit/s Sub-D type connectors. Without indicating the number of connectors and devices the PROFIBUS Tester 5 BC-700-PB will detect a total cable segment length of 64 meters, which corresponds to a systematic error of measurement of approx. 28 %. The more precise you will enter the number of connectors and devices into the segment configuration, the more precise the length indication will be (cable segment length or distance to error).

The cable length detection is optimized for standard PROFIBUS cable type A. The detected cable segment length will show a methodical error in measurement, if you are using a fieldbus cable with deviating impedance value.

## 14 Notes on battery use

### 14.1 Lithium backup battery

**CAUTION**

This product contains a lithium-metal backup battery!

The lithium content is not more than 1 g. The battery has been successfully tested by the manufacturer in accordance with the UN Manual of Test and Criteria (test procedures of Part III, Sub-Section 38.3).

Improper handling of lithium batteries can cause the batteries to ignite or explode and pose a burn hazard to users. If the product is properly handled, this battery does not need to be replaced during the lifetime of the product. Therefore, opening the product is unnecessary and not permitted. The product must only be operated within the specified temperature range. Do not expose to heat above this temperature range and keep away from open fire. Store in a dry place.

### 14.2 Rechargeable battery pack

#### 14.2.1 Guidelines and warnings on battery use

**Read and understand these safety instructions and warnings before using or charging your rechargeable battery pack**

Failure to read and follow the below instructions may result in fire, personal injury and damage to property if charged or used improperly.

**CAUTION**

The rechargeable battery pack contains < 2 g Lithium.

- Softing Industrial Automation GmbH, its distributors or retailers assume no liability for failures to comply with these warnings and safety guidelines.
- By purchasing this battery, the buyer assumes all risks associated with lithium batteries. If you do not agree with these conditions, return the battery immediately before use.
- Never charge batteries unattended. When charging the battery pack you should always remain in constant observation to monitor the charging process and react to potential problems that may occur.
- We recommend, to charge the Lithium-ion battery inside the device via the external AC adaptor.
- If at any time you witness a battery starting to “balloon” or swell up, discontinue charging process immediately, disconnect the battery and observe it in a safe place for approximately 15 minutes. This may cause the battery to leak, and the reaction with air may cause the chemicals to ignite, resulting in fire.

- Since delayed chemical reaction can occur, it is best to observe the battery as a safety precaution. Battery observation should occur in a safe area outside of any building or vehicle and away from any combustible material.
- You must not short circuit the wire leads! Never place the cells on a conductive surface.
- Wire lead shorts can cause fire! If you accidentally short the wires, the battery must be placed in a safe area for observation for approximately 15 minutes. Additionally, if a short occurs and contact is made with metal (such as rings on your hand), severe injuries may occur due to conductivity of electric current.
- A battery can still ignite even after 10 minutes.
- In the event of a crash, you must remove battery for observation and place in a safe open area away from any combustible material for approximately 30 minutes.
- Never store or charge battery pack inside your car in extreme temperatures, since extreme temperatures could ignite fire. Keep in mind the maximum allowed storage temperature. Refer to [Storage and Transportation](#)<sup>[55]</sup> for more information.
- Use caution to avoid puncture of the cell. Puncture of cells may cause fire.
- You must not pull the wire leads when you carry or remove the battery from the device.
- In case of cells being damaged, do not use the battery anymore!
- You must not open the cells. Oxygen and lithium will heavily react with each other!
- If the electrolyte may get in contact with your skin or with our eyes, please give a wash by using plenty of water and soap and call on a doctor.
- Defective lithium ion batteries may evaporate substances which are harmful to health! You must not inhale!
- Please return old battery packs to a recycling center or hand over to us for proper disposal. You must not ship battery packs which are clearly damaged. Please contact our support department.
- You must not throw battery packs on the fire.

### 14.2.2 Charging

- Use only the wide-range power supply (AC adapter) provided with the tool (see [Scope of delivery](#)<sup>[8]</sup>) in order to charge the battery. Set voltage and current correctly (failure to do so can cause fire).
- Never charge batteries unattended.
- Charge in an isolated area, away from other flammable materials.
- For operating temperatures while charging refer to [Specifications](#)<sup>[56]</sup> (operating temperature).

### 14.2.3 Discharging

The energy management of the device complies with the following recommendations for discharging lithium ion batteries:

- You may not discharge the battery more than 80 % of nominal capacity.
- Do not discharge battery to a level below 3.3 V per cell under load. Deep discharge below 3.3 V per cell can deteriorate battery performance and without load not less than 3.5 V.

Operating Temperatures Discharge, refer to [Specifications](#)<sup>[56]</sup> (operating temperature).

### 14.2.4 Storage and transportation

- Store battery at room temperature between 12°C/53F and 18°C/65F for best results. (This corresponds to a battery charge level of 33%, refer to [Device status](#)<sup>[35]</sup>).
- Do not expose battery pack to direct sunlight (heat) for extended periods
- When transporting or temporarily storing in a vehicle, temperature range should be greater than 7°C/20F, but no more than 66°C/150F.
- Storing battery at temperatures greater than 77°C/170F for extended periods of time (more than 2 hours) may cause damage to battery and possible fire.

### 14.2.5 Battery life

Charging and discharging will typically wear out the battery pack over the time. Due to this aging the usable battery capacity will decrease accordingly. Higher current loads and deep discharge processes will considerably increase the aging process.

You will have best results with respect to battery life, if you

- avoid deep discharging
- charge the battery properly
- store the battery at recommended temperatures
- avoid overloading
- switch off the device when not being used for a longer period of time.

### 14.2.6 Battery warranty

Product warranty is limited to original defects in material and workmanship. Warranty does not cover collateral damage. Due to the nature and use of this product there is no term warranty. Misuse, abuse, incorrect charging and other inappropriate use of this product are not covered under warranty.

If you do not agree with these conditions, return the lithium polymer battery immediately and before any use.

## 15 Technical data

Power Supply / battery	<p>Via external AC adapter 100 V .. 240 VAC 50/60 Hz (galvanically isolated) or built-in three cells lithium ion accumulator with 11.1 VDC</p> <p>Rechargeable battery has a run-time of up to 5 hours (run-time depends on the executed test functions and rate of wear of the rechargeable battery)</p> <p>Battery is charged via external AC adapter.</p>
RS485 (DP)	<p>PROFIBUS D-sub connector (female), 9-pin, switchable power supply for ext. bus termination</p> <p>Protocol and frame analysis: PROFIBUS DP and DPV1, automatic baud rate detection 9.6 kbit/s .. 12 Mbit/s</p> <p>Signal analysis: PROFIBUS DP, DPV1, FMS and MPI</p> <p>Signal quality index 0 .. 5000 determined from signal waveform as well as signal/noise ratio and rise time</p> <p>Signal sampling with 8/16 samples per bit</p> <p>Oscillogram display: test range <math>\pm 5V</math> at 10mV resolution (differential), 0V...15V at 15mV resolution (A or B to DGND)</p> <p>Sampling rate: up to 384 MSamples/s, for signal details: 2,400 sampled points, for oscillogram analysis: 8,192 sampled points</p> <p>Topology scan: active, maximum distance 230 m, accuracy <math>\pm 2</math> m</p> <p>Cable test: active, permitted cable segment length 5 m ... 1500 m, accuracy 5%</p>
USB	V 2.0, high speed 480 Mbit/s, galvanically isolated
Trigger	<p>IN : L=0 .. 0.8 V; H=2.4 .. 24 V; pulse &gt; 10 <math>\mu</math>s, active high</p> <p>OUT: approx. 5 V, active low (connection to storage oscilloscope)</p>
Internal memory capacity	<p>3 network directories for storing Quick Tests and Trend logs</p> <p>Trend logging: max. 99 hours</p>
Dimensions	HxWxD: 35 x 220 x 110 mm
Weight	<p>Test tool without cable: approx. 0.75 kg</p> <p>Complete tool with carrying case, without accessories: approx. 4.2 kg</p>
Protection class	IP 20
Permissible ambient conditions	<p>Operating temperature 0 .. 50 °C</p> <p>Storage temperature -20 .. 70 °C,</p> <p>Air humidity 10 .. 90% without condensation</p>
Conformity	CE, FCC, VCCI



Operation	Via graphical color display, four function keys and scroll wheel including central push-button or via PC/notebook. Localization of the display texts: English and German
PC operating software	PROFIBUS Diagnostic Suite, see separate documentation

## 16 Declarations by the manufacturer

This device complies to the EU product directive 2004/108/EC according to the following directives:

- EN 61000-6-4:2007+A1:2011 Electromagnetic compatibility (EMC) – Part 6-4: Generic standards – Emission standard for industrial environments
- EN 55022:2010 - Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement - Class A product
- EN 61000-6-2:2005 - Electromagnetic compatibility (EMC) -- Part 6-2: Generic standards - Immunity for industrial environments
- EN 61326-1:2013



A Declaration of Conformity in compliance with the above standards has been made and can be requested from Softing Industrial Automation GmbH.



### Note

To fulfill the EMC requirements, the other components (AC adapter, PROFIBUS stations, etc.) also have to meet the EMC requirements. A shielded cable must be used. In addition, the cable shield must be grounded properly.



### Note

Additional tests have been performed successfully proving compatibility with the requirements set forth by FCC and VCCI.

## 17 Recycling

This symbol is required in accordance with the Waste Electrical and Electronic Equipment (WEEE) Directive of the European Union. The presence of this marking on the product indicates:

1. The device was put on the European Market after August 13, 2005
2. The device is not to be disposed of via the municipal waste collection system of any member state of the European Union.



\*\*This appliance is labeled in accordance with European Directive 2002/96/EC concerning waste electrical and electronic equipment (WEEE). The Directive determines the framework for the return and recycling of used appliances as applicable throughout the European Union. This label is applied to various products to indicate that the product is not to be thrown away, but rather reclaimed upon end of life per this Directive.

\*\*It is very important that customers understand and follow all laws regarding the proper decontamination and safe disposal of electrical equipment. For Softing products bearing this label please contact your dealer or local Softing office for details on the take back program that will facilitate the proper collection, treatment, recovery, recycling and safe disposal of device.

## **Related Documents**

### **PROFIBUS Diagnostics Suite**

- User Manual "Getting Started"
- PB-DIAG-SUITE online help

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