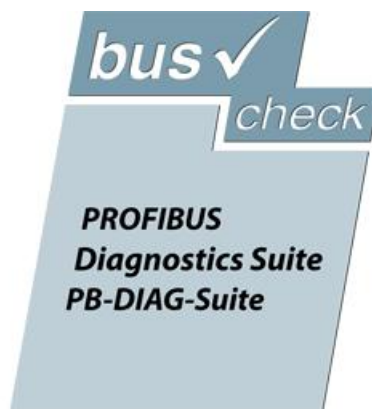


PROFIBUS Diagnostics Suite



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The latest version of this manual is available in the Softing download area at: <http://industrial.softing.com/en/downloads.html>

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1 Introduction

1.1 About PROFIBUS Diagnostics Suite

The PROFIBUS Diagnostics Suite is a universal PC application built around the extensive functionality of Softing's "bus-check" family of test tools. Key features are:

- Wide variety of tests and analyses
- Detail analysis of fieldbus problems
- Easy-to-use test data management
- Creation of test reports

1.2 About this document

1.2.1 Purpose

This document describes how to install and use the PROFIBUS Diagnostics Suite and how to test and interpret test results when working with PROFIBUS Diagnostics Suite.

1.2.2 Target group

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

- Maintenance personnel
- Commissioners
- 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:
 \<product name>\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 previous version
Version 3.00	none - initial publication
Version 3.10	<ul style="list-style-type: none"> Editorial modifications following internal review Order numbers for optional accessories added New device status icons added New cable test note added
Version 3.11	<ul style="list-style-type: none"> New software version 3.11 New firmware for BC-700-PB integrated in software, see also Connect to USB for the first time¹⁶⁾
Version 3.20	<ul style="list-style-type: none"> System requirements⁸⁾ updated New Corporate Identity implemented

1.3 Supported test tools and their functionality

The table below shows which tests can be run with the different PROFIBUS test tools:

Test functions	Operation					Standard tests								Expert tests					
	Battery powered	Graphical color display	Galvanic isolation	Stand-alone operation	Permanent bus status	Cable test	Network status						Trend		Test report	Oscillogram analysis	Frame analysis	Trigger	
							Quick / User-controlled test	Overview bus physics and communication	Protocol analysis	Signal analysis (EIA-485)	Signal analysis (MBP)	Topology	Master simulator	Signal quality				Critical events	Input
PROFIBUS Monitor BC-502-PB						✓		✓					✓	✓		✓			
PROFIBUS Tester 4 BC-600-PB			✓	✓	✓		✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓
PROFIBUS Tester 5 BC-700-PB	✓	✓	✓	✓	✓	✓	✓	✓	✓	optional	✓	✓	✓	✓	✓	✓	✓	✓	✓

The PROFIBUS Monitor acts as a protocol analyzer when connected to the USB interface. Depending on the tool or tool version you are using, different functions are available. You can install the PROFIBUS Diagnostics Suite on any number of systems and use its full functionality for displaying and analyzing stored test results.

*) PROFIBUS Diagnostics Suite Version 2.20 or later will support the current generation of Softing test devices such as Softing BC-600-PB (PROFIBUS-Tester 4) and Softing PROFIBUS Tester BC-700-PB. Supporting test devices of old generations is discontinued. Test devices of old generations are operational without restrictions in conjunction with previous software versions (V2.11 or earlier) of PROFIBUS Diagnostics Suite. Managing or displaying existing test data which has been recorded by test devices belonging to old generations is possible using the current version. This issue applies to the test devices PB-T3, BC-400-PB, BC-450-PB and BC-502-PB.

1.4 Detailed online help

The application software provides an integrated help system in English and German. It contains details on using the software and a description of all available functions and tests.

2 System requirements

Supported operating systems

Windows 7, Windows 8 and Windows 10 (all operating systems for 32 bit and for 64 bit).

Hardware requirements

- RAM \geq 1 GB for Windows 7/8/10 for 32-Bit and \geq 2 GB for Windows 7/8/10 for 64-Bit
- Screen resolution \geq 1024x768 pixels (XGA)
- USB interface 2.0
- For recording baud rates up to 1,5 Mbit/s: Processor \geq 1 GHz
- For recording baud rates of more than 1,5 Mbit/s: Processor \geq 2 GHz

Adobe Reader

For you to be able to read manuals and test reports, you need an installed version of Acrobat Reader. Install it from your product CD or from the official Adobe website (www.adobe.com).



Note

The above system settings are minimum settings. If more than the typical programs and services are loaded during Windows system startup or if they are very CPU intensive, the requirements given above might not be sufficient. .

3 Install software

The installation is mainly identical for all supported Windows operating systems.



Note

Make sure you have administrator rights allowing you to install software on your computer.

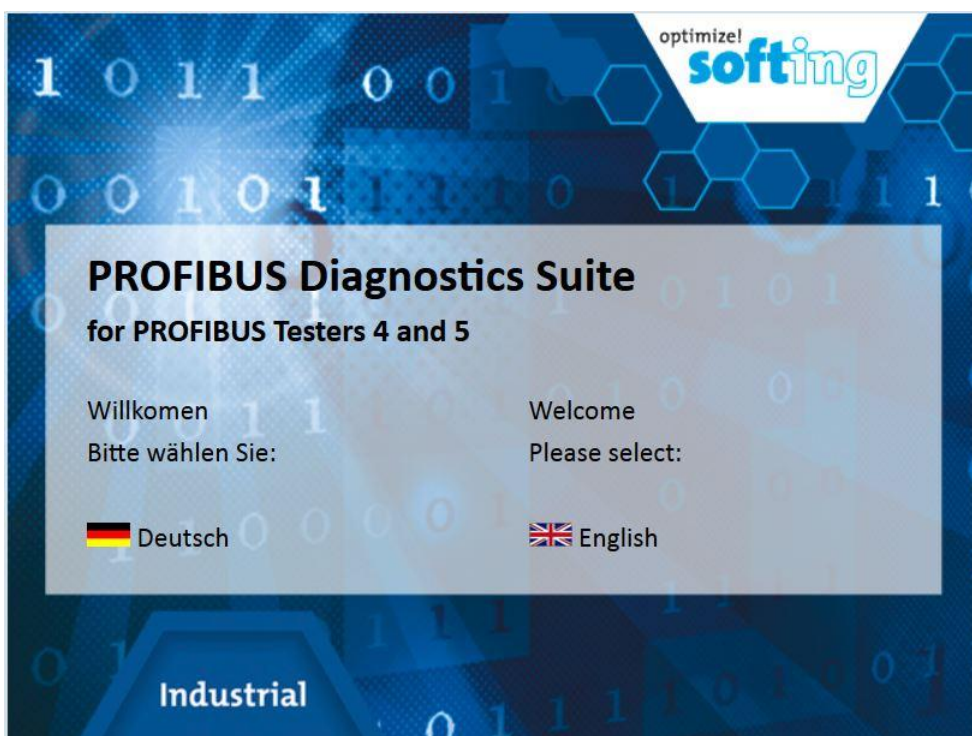


Note

If you install a Softing product for the first time, a window is opened that prompts you to trust the publisher. Activate the option **Always trust software from Softing AG**, if you do not want to be asked in subsequent installations. Then select **[Install]** to start the installation.

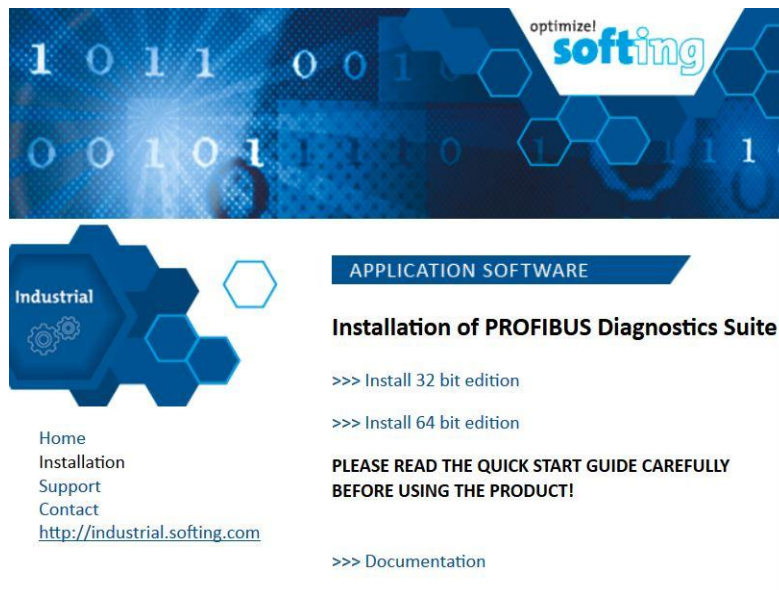
3.1 Installation from the supplied CD-ROM

1. Insert your delivery CD into your CD drive.
2. If Autorun is enabled on your system, the startup page is opened. Select your country flag to start the installation in your language.

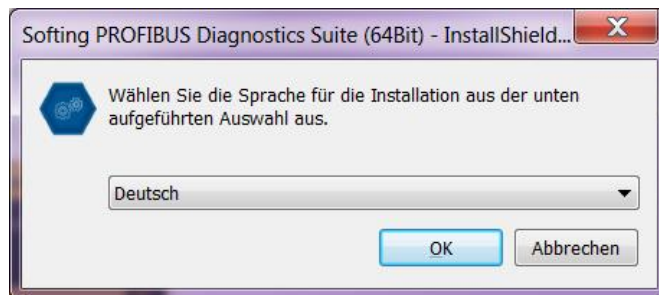


3. If Autorun is disabled, open an Explorer window, select your CD drive and double-click the file *start.exe*.
4. From the following screen select the installation packet that suits your operating system: This will start one of the files *PBDIAGSuiteSetup.exe* or *PBDIAGSuiteSetup64.exe* that are also located on the Product CD in <CD drive>:\software.

Depending on the security settings, your web browser may need to download and save the executable files first. If you have problems, start the executable directly from the above mentioned location on the supplied CD-ROM.

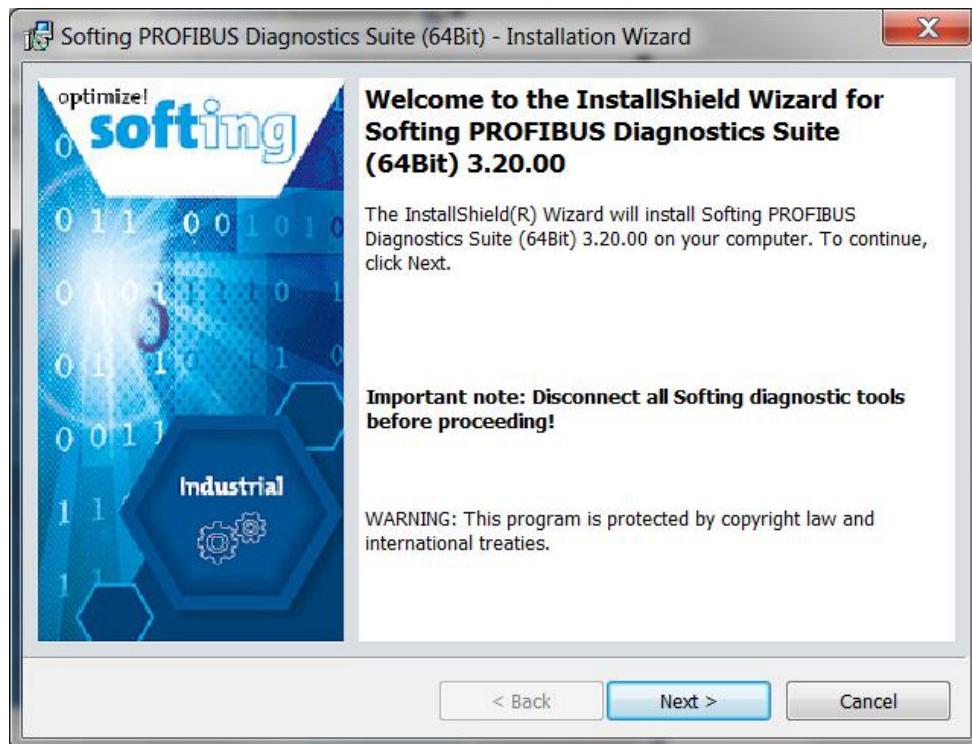


5. The installation wizard requests you to select the language:



6. The system starts searching for previous installed versions of the PROFIBUS Diagnostics Suite. If a previous version is detected, the system asks you to uninstall this version. Confirm with **[OK]** and proceed as described in [Uninstall a previous version](#)¹⁴.

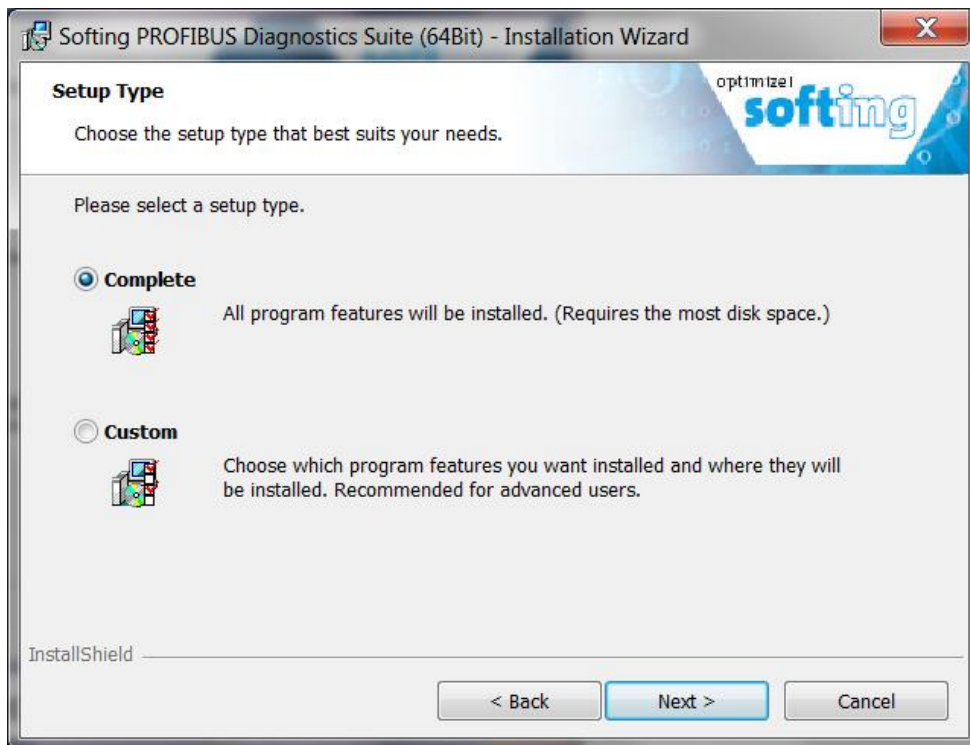
7. Now the system searches for an installed .NET Framework version 3.5. If .NET is not yet installed, you will be prompted to start the installation.
8. If already installed, the actual installation procedure starts with the following window:



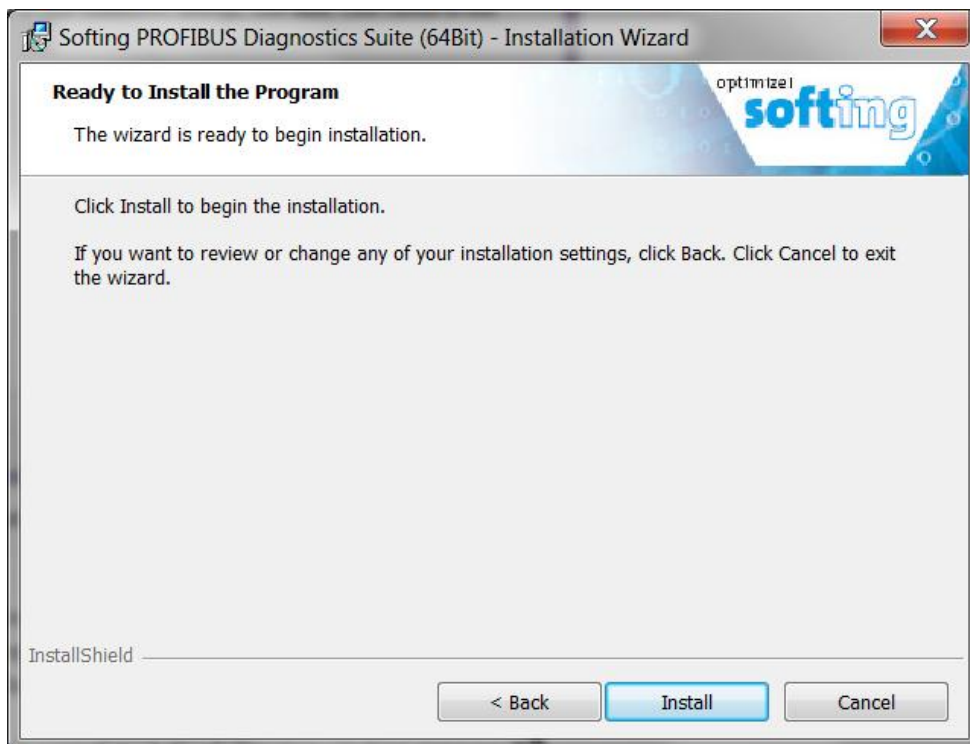
9. Click **[Next]** to open the License Agreement:



10. Accept the terms and click **[Next]** to continue. The **Setup Type** window is opened:



11. Select **Complete** and click **[Next]** to open the Installation window:

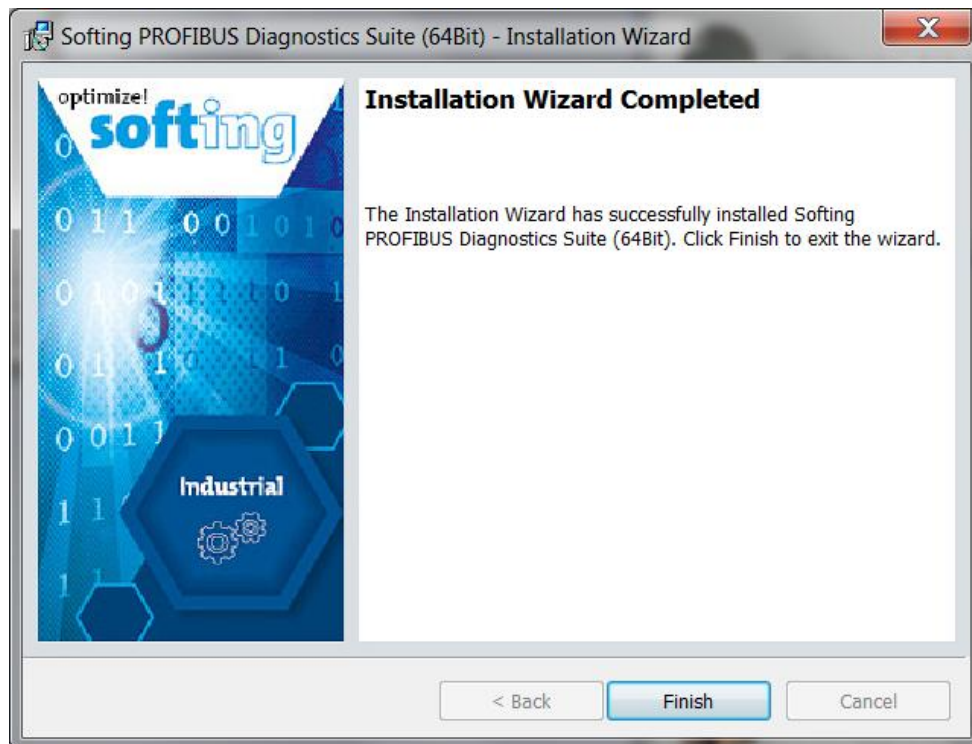


12. Click **[Install]** to start the installation.

**Note**

If you install a Softing product for the first time, a window is opened that prompts you to trust the publisher. Activate the option **Always trust software from Softing AG**, if you do not want to be asked in subsequent installations. Then select **[Install]** to start the installation.

13. When the installation procedure is completed, the following window appears:



14. Click **[Finish]** to complete the installation.

**Note**

When installing the software for the first time you are prompted to restart the computer. Make sure you have closed any other open window and click **[Yes]** to restart.

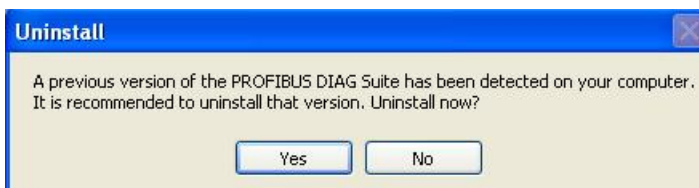
3.2 Update installation from Softing's website

Software updates are provided as required. They give you access to new or improved functionality. All future updates can be downloaded from our web site.

1. Go to <http://company.softing.com/en/startpage.html>.
2. Select **Industrial**, then **Downloads**.
3. In the download center select your **Technology**, the **Product's Category** and the **Product**. Then click **[OK]**.
4. You will be prompted to enter your customer data.
5. Then select **Download** to start your download.
6. After you downloaded the zip file, manually extract it to a temporary directory.
7. Depending on your operating system, run the installation directly from the directory above or as described in [Installation from CD-ROM](#)⁹⁾

3.3 Uninstall a previous version

When the installation of the PROFIBUS Diagnostics Suite starts, the installer looks for previous versions of this software for the PB-T3 or BC 400-PB. If a previous version exists, a pop-up window appears asking you if you want to uninstall it.



3.4 Additional installation notes

.NET Framework version 3.5 missing

Installation under will stop automatically, if the required .NET Framework version 3.5 was not installed before.

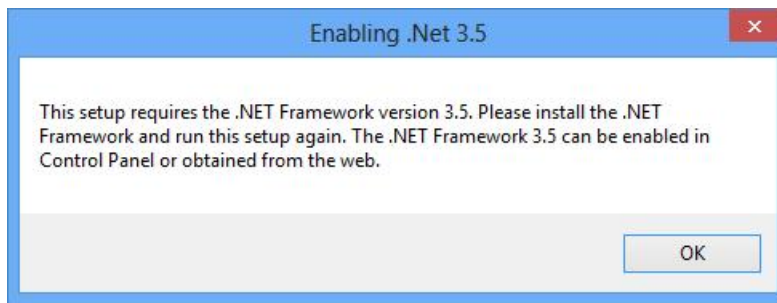


Notes

Higher .NET Frameworks version (such as 4.0 or later) are not downward compatible.

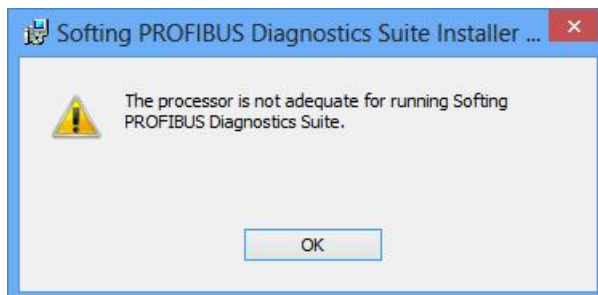
PBDIAGSuiteSetup.exe or PBDIAGSuiteSetup64.exe may require additional setup executables which can be found on your product CD located under <CD drive>:\software\ISSetupPrerequisites. .

Depending on the security settings, your web browser may need to download and save the executable files first. In this case we recommend starting directly the executable from the supplied CD-ROM.



Wrong Setup.exe (32 bit or 64 bit)

There are 32-bit and 64-bit installations. If the wrong installation has been started by mistake, the installation will stop automatically:



4 Connect to USB for the first time



Note

We recommend connecting the unit directly to an USB port on the PC or notebook. If you use external USB hubs or notebook docking stations for connection, problems may occur.



Note

The PROFIBUS Diagnostics Suite PC software also includes the required USB driver. You need to install the driver before connecting the test tool to the PC or notebook.



No battery charge when connecting to USB

When connecting the test tool to a PC via USB, the internal battery is not charged via USB. Use the external AC adapter for charging the battery.

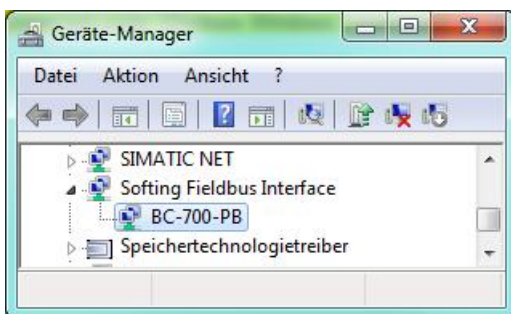
When connecting a test tool to a PC or notebook for the first time, Windows will inform you that it has detected a new device. The hardware detection process differs depending on the Windows operating system you are running but is qualitatively identical for all supported Windows operating systems. The screenshots shown in the following sections have been mainly taken from Windows XP. The hardware device used for the following descriptions is a BC-700-PB .

4.1 Connect to USB under Windows 7, Windows 8 and Windows 10

When connecting a test tool to a USB port for the first time, the message **Installing device driver software** is displayed in a balloon in the Notification Area (System Tray). The driver software will be installed automatically. When the installation is complete, the message **Device driver software was installed successfully** is displayed in a balloon in the Notification Area.

4.2 Display the connected test tool

To display the connected test tool, open the **Control Panel**, select **Hardware and Sound**, then **Device manager**:



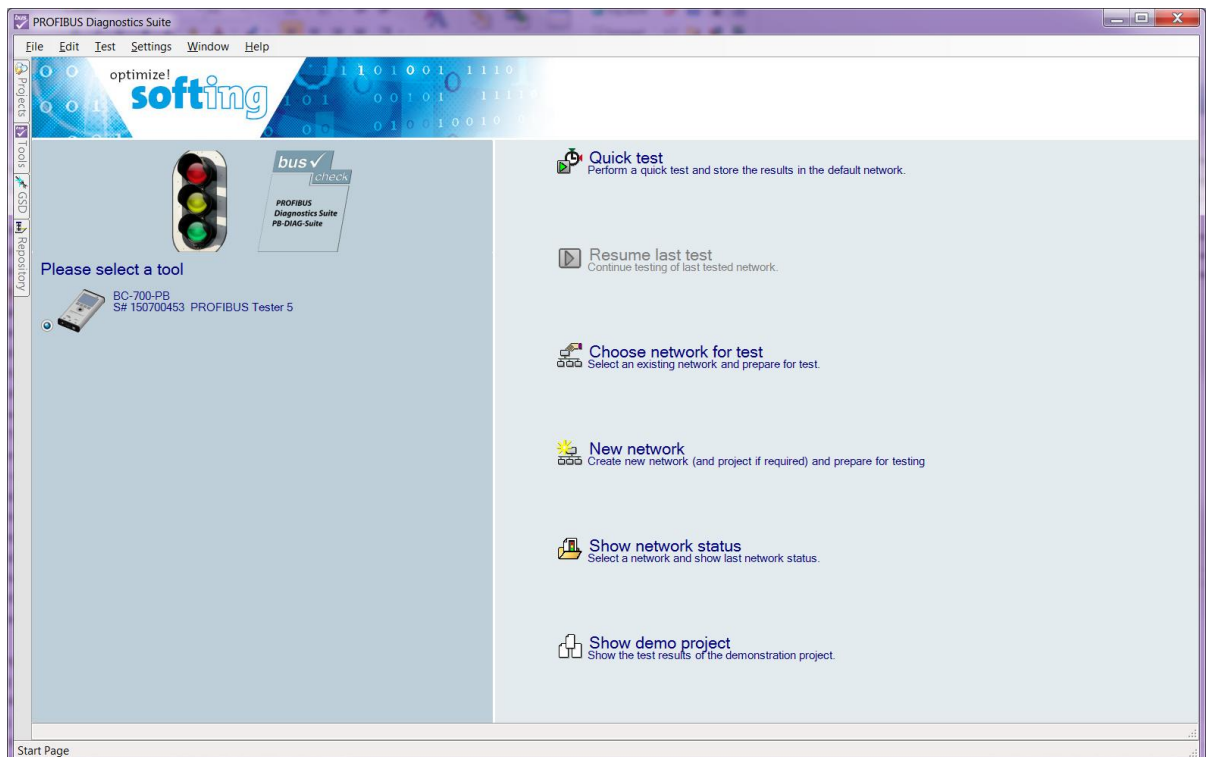
Example of a BC-700-PB connected under Windows 7 (German Windows interface).

5 Use the PROFIBUS Diagnostics Suite

You can start using the PROFIBUS Diagnostics Suite as soon as you have installed the PC software, connected a supported test tool to the USB interface and completed its detection by the Found New Hardware Wizard.

5.1 Open start page

1. Open the start page from the Program menu or using the Desktop Icon.
2. The start page shows the connected test tool on the left side. If you have connected more than one tool, you can choose which one to use.



3. On the right, you can select typical actions or display a demo project with sample test results.

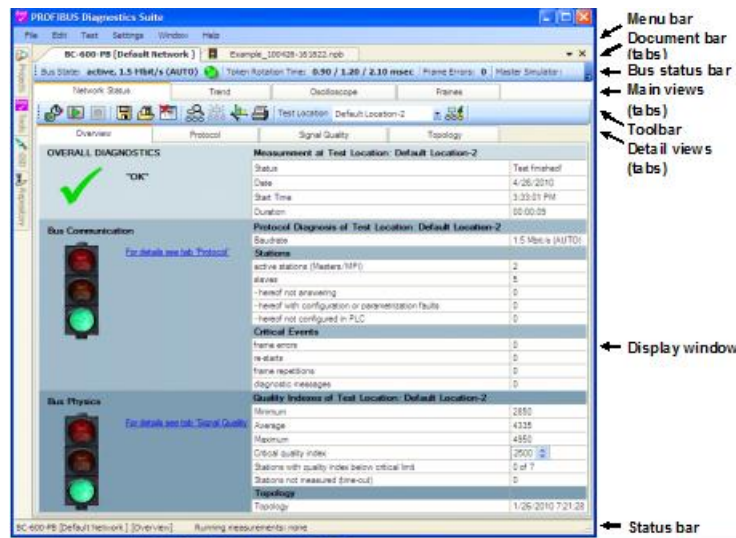
5.2 Use workspace

The appearance of the workspace depends on whether you have selected a connected, ready tool or opened a file with stored test results.

5.2.1 Active, Ready Tool

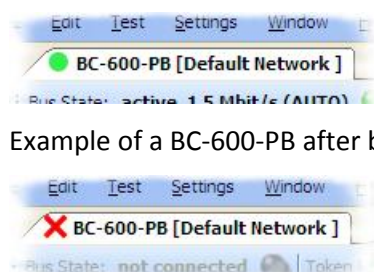
A connected tool selected for testing is displayed on the document bar, which is right underneath the menu bar. If you have selected a BC-600-PB or BC-700-PB, a bus status bar appears below it. At the next level below the status bar, you will find different tabs of the main views that represent the test functions provided by the selected tool (see also [Supported test tools and their functionality](#)^[6]).

An example of an active, ready BC-600-PB looks as follows:

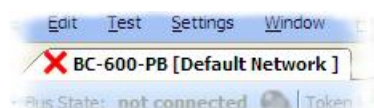


The tab header on the document bar indicates the status of the test by an icon to the left of the tool type.

Example of an active BC-600-PB with at least one started sub-function:



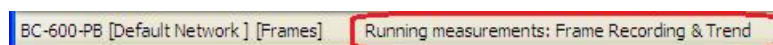
Example of a BC-600-PB after being disconnected from the USB interface:



5.2.2 Use test functions in parallel

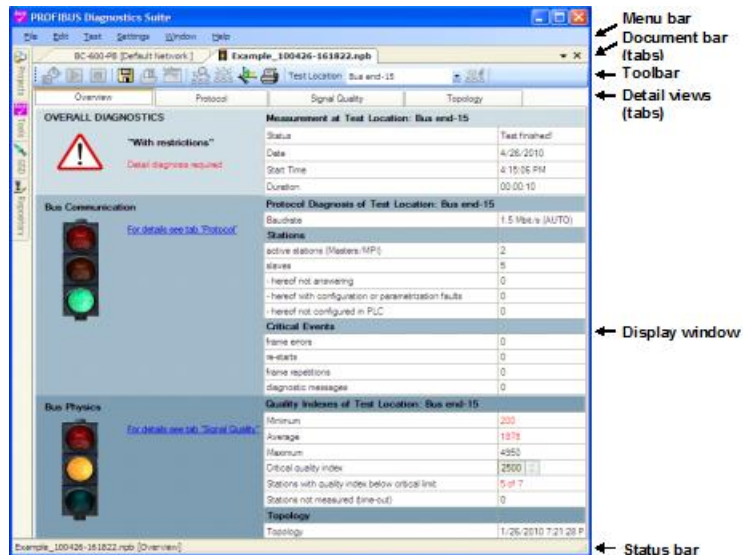
The Network Status, Trend and Oscilloscope test functions can only be started exclusively. In Network Status, you can start either a quick test, a user-controlled test or a topology scan. Starting an exclusive function locks the other functions. Frame recording, however, can always be run in parallel. The status bar at the bottom shows you which test functions are currently running.

Following an example of the Trend and Frame Recording functions running in parallel:



5.2.3 Open file with stored test results

When you open a file with stored test results, the tab header on the document bar indicates the file type by an icon to the left of the file name. An example of an open network status file recorded with the BC-600-PB, with the traffic lights icon in document tab header looks as follows:



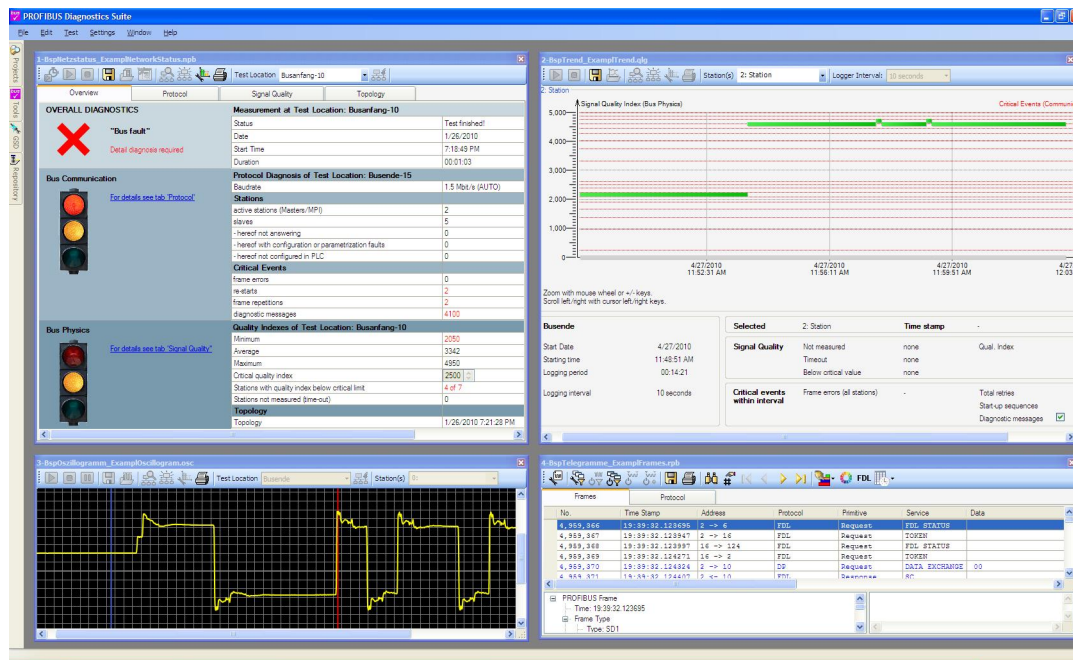
Whereas an active tool is displayed as a document with multiple main views, a file is always shown as a document with one main view. This allows you, for example, to open two different network status files and compare them.

5.2.4 User modes for document views

You can choose between two different user modes for the workspace:

- Advanced mode and
- Standard mode.

Advanced mode is enabled by default. This mode provides both the standard and the expert functions (see [Supported test tools and their functionality](#) ⁶¹). The document tabs can be floated from their normal docked positions on the document bar by double-clicking a tab and dragging it to the desired position on-screen. This gives you a very easy way to compare test results on large-screen monitors. To place a document window back into the document bar, simply double-click its title bar. For example, you could arrange the four documents of the sample project from the start page in the following way:



When you enable Standard mode, the expert functions for analyzing oscillograms and frames are not available. The main views cannot be floated, resized and docked. This mode gives new or less experienced users a clear, easy-to-use user interface with the standard display and control functions. To change the user mode, open **Settings** from the menu bar and select **User Mode**.

6 Test initially on a live PROFIBUS system

6.1 General introduction



Note

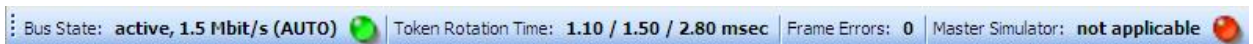
Always follow the information and instructions provided in the tool manual when connecting a test tool to the PROFIBUS.

You can basically perform tests anywhere on a PROFIBUS network. When using the BC-600-PB or BC-700-PB, note that the use of repeaters creates separate physical segments which need to be tested separately with regard to bus physics. For the best and most informative signal quality results, perform the tests at the beginning and end of each physical segment. If these test results indicate problems that cannot be clearly classified immediately, you should carry out one or more additional tests at the center. A topology scan or cable test can only be performed at the beginning or end of the bus.

6.2 Bus status display

If you are using a BC-600-PB or BC-700-PB, a bus status bar is displayed for the active tool. It continually shows the status of the connected PROFIBUS segment, regardless of whether you have started a test or not.

Example of a bus with a running PLC and a baud rate of 1.5 Mbit/s automatically detected:



If no master is active, the open circuit voltage is displayed for the bus status. With correct termination using terminating resistors, the open circuit voltage has to be about 1 V.



Note

The token rotation time will not always correspond to the length of the DP bus cycle that is indicated on the Protocol tab (see [Protocol detail view](#)^[24]) of the Network Status view for all tools except the BC-600-PB.

6.3 Network status

The network status represents the current state of a PROFIBUS network. It is based on the test results of the most important standard functions (see [Supported test tools and their functionality](#)^[6]). When using the BC-600-PB or BC-700-PB, it allows an overall evaluation of the bus health in terms of both bus physics and bus communication.

The possibility to organize test data in projects and networks (see [Projects](#)^[41]) allows you to link important information that can only be tested in specific operating states of the network (complete slave information and topology) with tests you run later. This increases the information value of the network status and makes troubleshooting much easier. The 'last' network status is loaded automatically as soon as you select a network for testing and the associated views have been opened. You basically continue the last test.

When using the BC-600-PB or BC-700-PB, the signal quality measured at different connection points can be allocated to different test locations. When you use more than one test location, the bus communication test result will always be overwritten by the result for the next test location, so that the reading at the end of the test reflects the result for the last test location in the test.


The network status is always saved automatically when you close an active tool on the document bar or when you select a different network for testing. The next time you test this PROFIBUS network again, the PROFIBUS Diagnostics Suite will automatically load this 'last' network status again. The following data can be saved in the network status, depending on the test functions provided by the selected test tool:

- the last test data acquired for bus physics and bus communication
- the last topology determined for the network, which makes analyzing the signal quality much easier by displaying the bus stations in their actual sequence on the bus
- the last recorded complete diagnostic information from slaves, which is only transmitted during startup or with error messages (see [Protocol detail view](#)^[24])

The last network status that is saved automatically thus serves as a kind of database. Previously collected information that is only available in specific operating states is combined with new test results and thus allows easier and more precise diagnostics.

To document a specific state, e.g. during the acceptance test of the installation, you can store the network status manually as a "snapshot" by selecting **Test → Save Network Status**.

6.4 Quick test


You can start a quick test either from the start page or by clicking the Start Test icon () on the toolbar in the Network Status view of the active test tool. This test gives you a quick overview of the bus physics and/or bus communication, depending on the tool you are using.

The quick test will automatically detect all bus stations when you start it from the start page, when you test a network for the first time after starting the program, or after you have manually cleared the network status using this icon:



If you have set the baud rate to "Auto" under **Test → Set Baud Rate**, the test will be performed at the baud rate detected automatically. When a specific baud rate has been set, that baud rate will be used. If no master is active, the PROFIBUS Diagnostics Suite will ask you if you want to activate the master simulator.

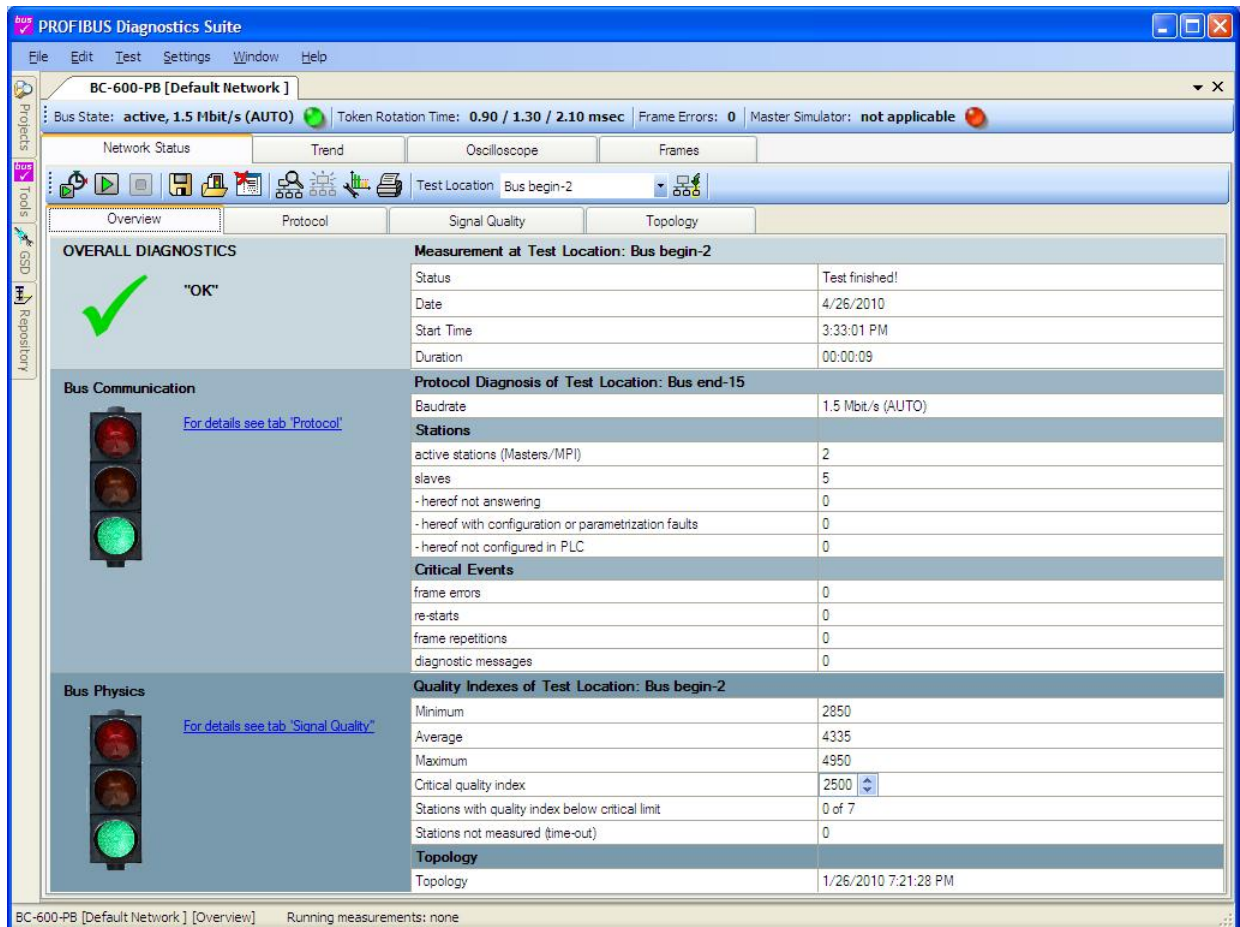
In all other cases, the test will be performed using the last determined station list and the last baud rate that was set manually for this network. If you have set the baud rate to "Auto", the baud rate will be detected separately for each test.

If you have added or dropped bus stations, you can scan the stations again manually at any time by clicking this icon () on the network status toolbar. If the current station list differs from the list stored in the network status, a pop-up window will ask you to manually compare and adjust the lists.

If you start the quick test from the start page, the tool will always write the test data to the default network (see [Projects](#)^[41]). The previously stored network status will be overwritten.

6.4.1 Quick test overview

A quick test with the BC-700-PB provides a full overview of both the bus physics and the bus communication, which is summarized on the Overview tab:



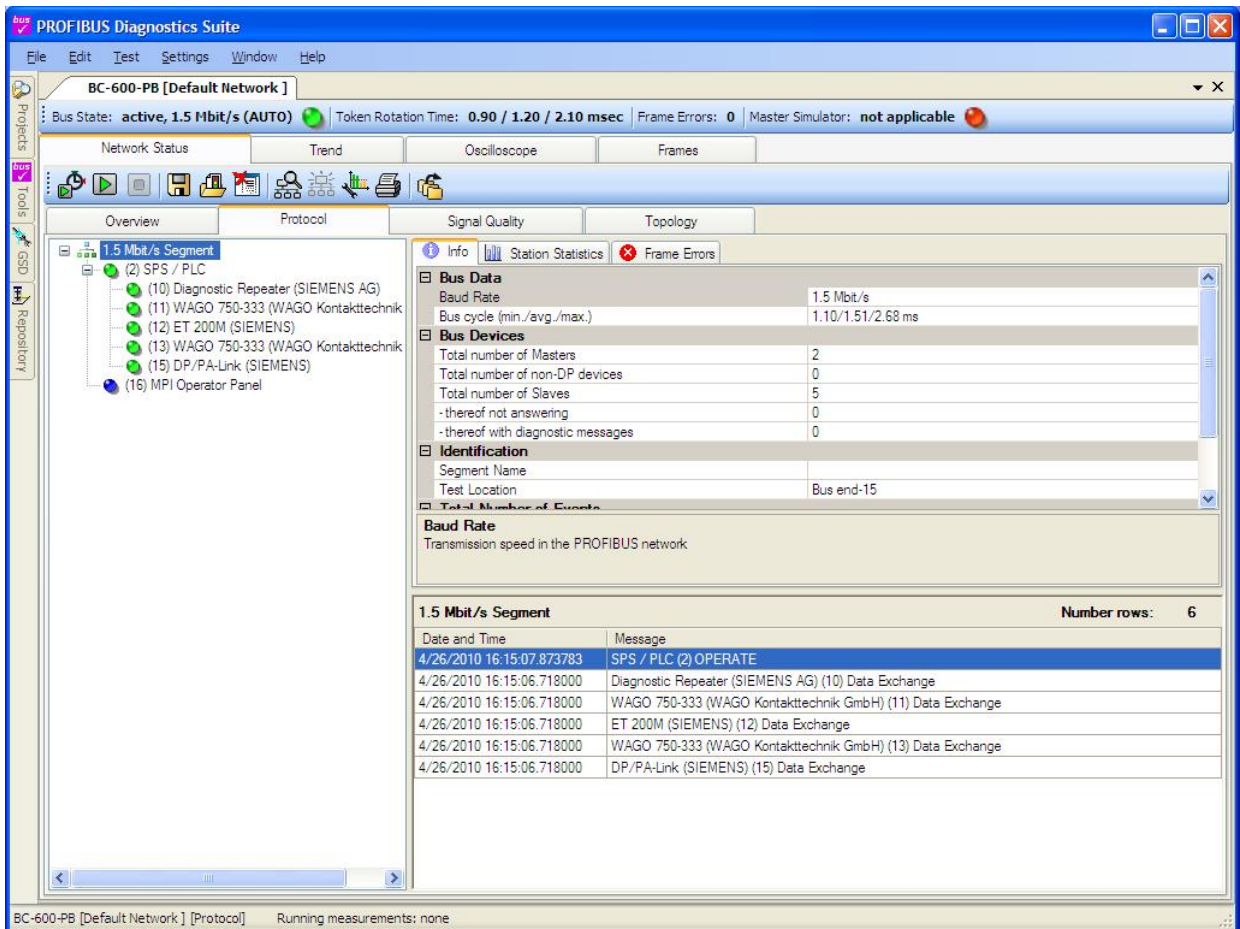
6.4.2 Interpretation of test results on the overview tab

The overall diagnostic result shown at the top left is based on the worst single result for bus physics and bus communication (displayed as traffic light symbols).

The test results that might be useful to identify the problems are shown in red in the right-hand column. For a detailed analysis, select the Protocol or Signal Quality tab. These tabs are described in [Interpret test results](#)^[31].

6.4.3 Protocol detail view

After you have completed a quick test, the **Protocol** tab displays a detailed overview of the bus communication:



The colors in the live list on the left have the following meanings:


Color	Master state	Slave state
● - red	Stop	No response or failure
● - orange	-	parameter or configuration error
● - yellow	Clear	Diagnostic message
● - green	Operate	Correct cyclic operation)
● - blue	(MPI device)	Not configured in the master (PLC

You can access different information at the segment, master and slave levels.

In a PROFIBUS DP network, specific data that is essential for diagnostics is only transmitted when a slave is started up or transmits an error message. This data and the import of the correct GSD file for the device are required for representing error messages (diagnostics) as well as configuration and parameterization as plain text.

For details, refer to the "Startup Monitoring" topic in the integrated help system of the software.

All communication state changes of masters and slaves are displayed in the event log together with time stamp at the bottom right. The time stamp indicates the start of the DP cycle during which the event occurred.

All events are saved in log files which can be accessed by this icon () . The event log makes the burdensome triggering for some special frames redundant. This causes a revolution of troubleshooting.

When you are using a protocol analyzer, the Protocol view will be displayed instead of the Overview page on completion of a quick test.

6.4.4 Interpretation of the protocol analysis results

The live list must not contain any slaves marked in red or orange. If a slave is shown in red, it has been configured in the PLC, but either failed or is non-existent. If the live list contains red and blue slaves at the same time, this could also indicate an incorrect address setting in a slave. A slave can be marked in orange for two reasons: One is that the master has failed to accept its parameterization either because the slave has been configured with an incorrect GSD file or because the wrong device type was installed. The other reason is that the slave configuration stored in the master differs from the slave's actual configuration, for example because modules have not been connected in the configured order.

At segment level, no faults should be reported on the "Frame Errors" tab. If this tab indicates errors, you can check if the error concerns one or more slaves by opening the Statistics tab at slave level. In addition, the "Info" tab at segment level must not contain any restarts/parameterizations. Normally there should be no retries, either. If retries have occurred, you can check if the retries concern one or more slaves by opening the "Station Statistics" tab at segment level. If retries have occurred for multiple slaves, this points to problems with the cabling, connectors, terminations or EMC disturbances. If only one slave is concerned, the cause might be an internal electronics problem, for example. In that case, you can try and disconnect the slave from the bus during system shutdown, test it individually with the master simulator (see [Testing without a ready PLC](#)^[28]) or exchange it if you have a replacement device.

In the case of urgent problems, you can reduce the baud rate of the PLC as a temporary emergency measure. This will make the bus significantly more robust. If this measure is possible for the specific application has to be checked in each individual case. To ensure reliable continuous operation, however, it is essential to correct the actual problem.



Note

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6.4.5 Signal quality detail view

After a quick test with the BC-700-PB, the Signal Quality tab provides an overview of the bus physics by indicating the quality index measured for each bus station. You can display a detail view for individual stations in a separate window at the bottom of the screen. This window is hidden by default and can be opened by double-clicking a station. For a detailed description refer to the integrated help system of the software.



6.5 User-controlled test



As opposed to a quick test, a user-controlled test does not stop automatically. This test mode provides more accurate results than a quick test because it allows a more reliable detection of signal quality fluctuations and bus communication problems.



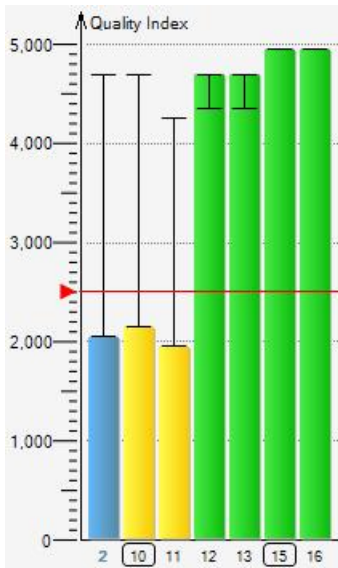
The test will automatically detect all bus stations when you test a network for the first time after starting the program or after you have manually cleared the network status. If you have set the baud rate to "Auto" under TEST – SET BAUD RATE, the test will be performed at the baud rate detected automatically. When a specific baud rate has been set, that baud rate will be used. If no master is active, the PROFIBUS Diagnostics Suite will ask you if you want to activate the master simulator.

In all other cases, the test will be performed using the last determined station list and the last baud rate that was set manually for this network. If you have set the baud rate to "Auto", the baud rate will be detected separately for each test.



When you have added or dropped bus stations, you can scan the stations again manually at any time by clicking the icon on the network status toolbar. If the current station list differs from the list stored in the network status, a pop-up window will ask you to manually compare and adjust the lists.

The test results are represented in the same way as for the quick test (for a description, refer to [Quick test](#)^[22]). In this test mode, the signal quality results additionally indicate deviations in the quality index.



6.6 Active test functions for BC-600-PB and BC-700-PB

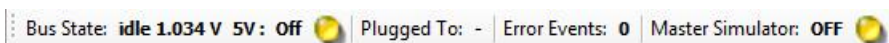
These functions can only be used for slaves during shutdown of the installation. As long as communication is detected on the bus, i.e. at least one master is active, the functions are disabled. If necessary, disconnect every single active device (PLC, MPI panel) from the power supply or the bus.



Note

Strictly follow the connection and safety instructions given in the respective test tool manual for the three active test functions described in the next sections.

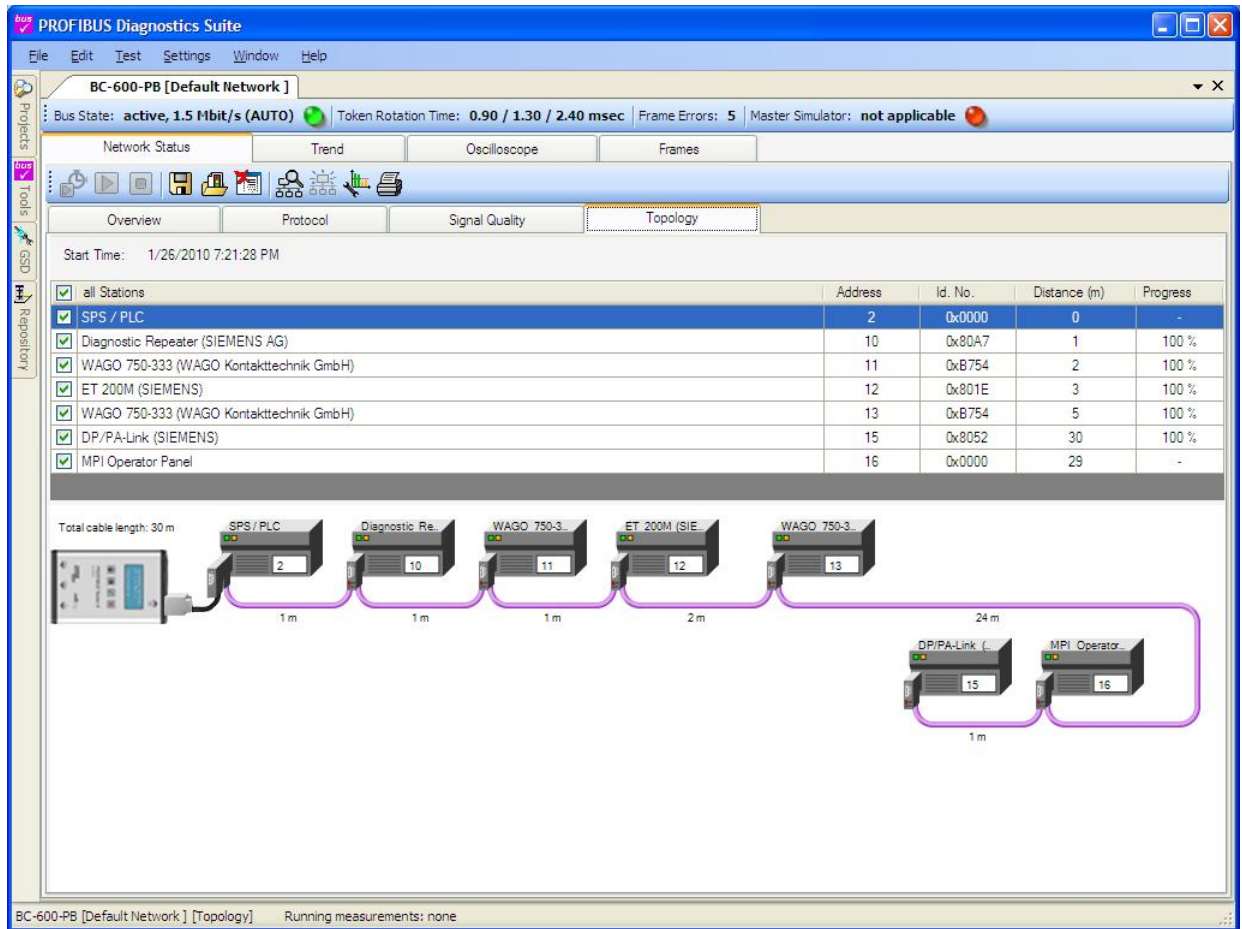
The bus status bar shows you when a function is ready to use. The field on the far right has to indicate "Master Simulator: OFF".



6.6.1 Topology scan

The topology scan determines the sequence and distances of all passive bus stations, i.e. slaves. This feature requires correct bus cabling with a minimum distance of one meter between each individual bus station, a good signal quality, and a test location directly at the beginning or end of the bus.

The relative distance of each master from the test location has to be manually entered after the topology scan. You can use the distances measured for nearby slaves for orientation.



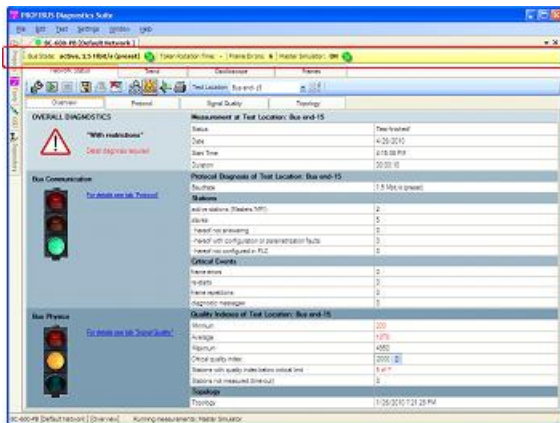
You can check the plausibility of the test results by running another topology scan from the other end of the bus. If the results of the two tests are largely comparable, the test results can be expected to be correct.

6.6.2 Testing without a ready PLC



The master simulator allows checking the bus cabling and the station addresses during installation and commissioning, when the master (in most cases a PLC) is not in operation yet. In addition, you can use this mode to check individual "suspicious" subsegments (see [Signal quality detail view](#)^[26]) or individual bus stations that have been disconnected from the bus. For the network status, the Master Simulator mode records the complete slave information that is relevant to diagnostics and normally can only be monitored when the bus is started up.

When the master simulator is active, the bus status bar is highlighted in yellow:



Note

Tests with the master simulator are only useful for analyzing the signal quality. When testing with the BC-600-PB or BC-700-PB, the test results shown on the Protocol tab have no significance for a test report.

If the network status already contains a station list with active devices, these devices are automatically excluded from the test when the master simulator is active.

6.6.3 Cable test (BC-700-PB only)



Note

Cable test is available when you are working with the BC-700-PB in stand-alone mode. Follow the connection and safety instructions given in the BC-700 User Manual.

This function examines the cabling in PROFIBUS segments. It 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.

You can import cable test results to the PROFIBUS Diagnostics Suite. By means of the [integrated explorer](#)^[40] it is possible to display the imported cable test results in the PROFIBUS Diagnostics Suite.

6.7 Trend test

The trend test is used for finding rare or sporadic faults over a prolonged period of time. Depending on the test tool you are using (see [Supported test tools and their functionality](#)^[6]), you can use this test to monitor the quality of the bus physics and/or bus communication. To analyze the bus physics, the quality index is determined cyclically.

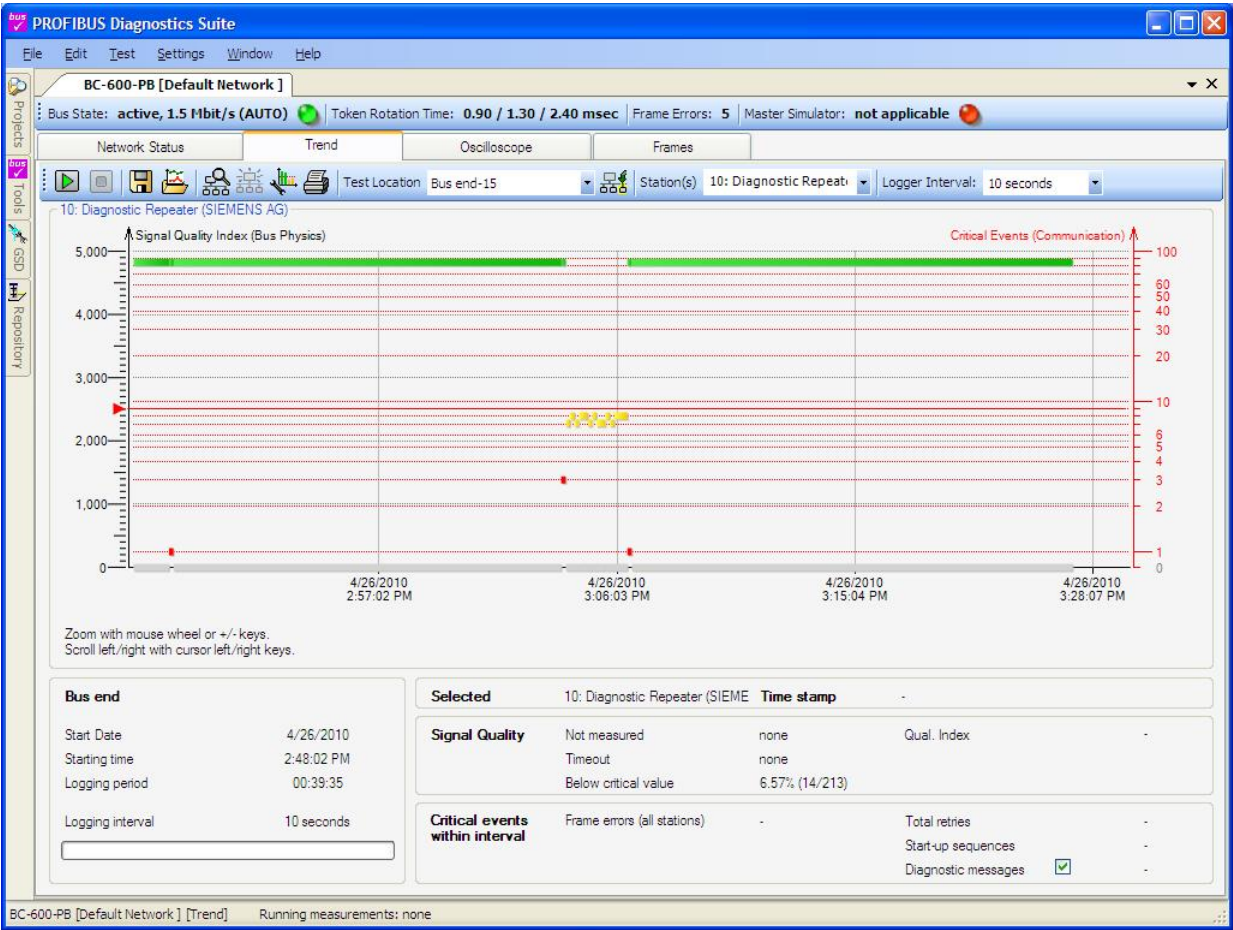


Note

The logging interval must be selected according to the transfer rate and number of stations on the bus to ensure that all stations can be fully tested and no timeouts occur.

To analyze the bus communication, critical protocol events (frame errors, retries, restarts after drop-out and diagnostics) are continuously recorded and added up for the selected logging period. Diagnostic messages that are considered normal for particular installations can be optionally excluded from the total count.

Example of a combined trend for bus physics and bus communication, tested using the BC-600-PB:



Whenever the PROFIBUS Diagnostics Suite stores a trend test, it saves a link to the file containing the trend test results for each test location in the network status. In other words, the network status "remembers" the last trend test for each test location.

As the "last" network status is always stored automatically, it consequently always contains up-to-date links to the most recent trend files. If you store a network status manually as an interim status, the links refer to the trend tests performed until you stored the interim status.

When you manually clear the network status in a network, all links to trend results will be deleted. Starting a quick test from the start page also clears the network status in the default network so that the trend links stored there will also be lost in that case.

7 Interpret test results

7.1 General test result interpretation

As the quality index depends on the station type and the overall length of the segment, there is no limit value that could be applied universally. When the overall length is relatively short and the bus has been newly installed, all quality indexes should be at least slightly below 4,000.

If the segment is relatively long, the quality index will decrease with increasing distance. This is normal provided that the same behavior occurs if you test the bus from the other end and the baud-rate dependent maximum cable length has not been exceeded.

If quality indexes drop below the default limit of 2,500, this is always a sign of defective cabling/connectors or incorrect terminations.

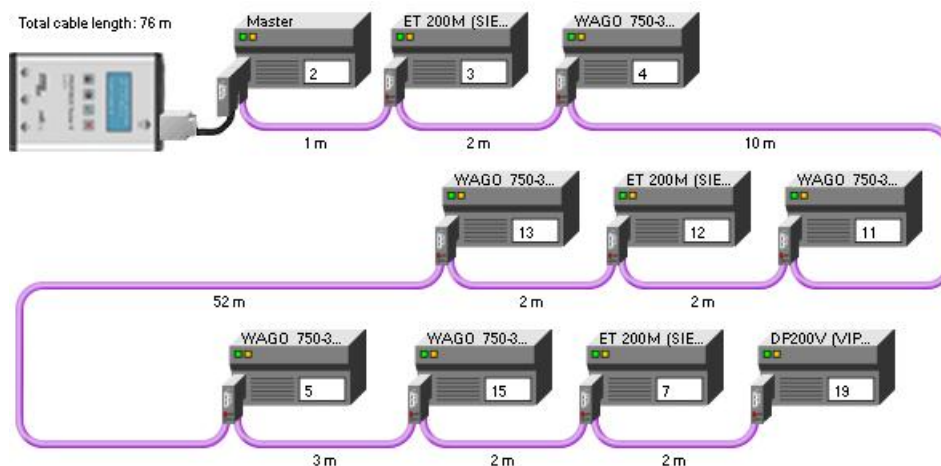
Even a bus with quality indexes below 1,000 might still be running. The noise immunity will be very low, however, so there is bound to be at least sporadic faults.

If you have trouble finding the cause of the problem, it is a good practice to divide the bus into smaller segments and test them using the master simulator (see [Testing without a ready PLC](#)^[28]). You can only test the bus step by step this way, but it is a reliable way to locate physical problems.

7.2 Interpret typical physical problems

7.2.1 Test setup

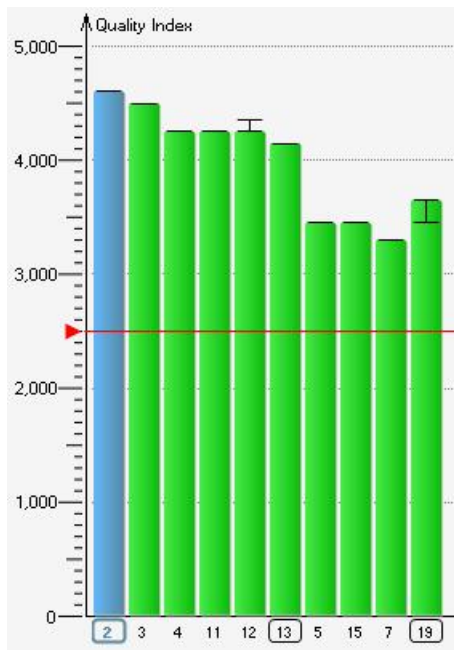
All test examples illustrated here are based on the following PROFIBUS network:



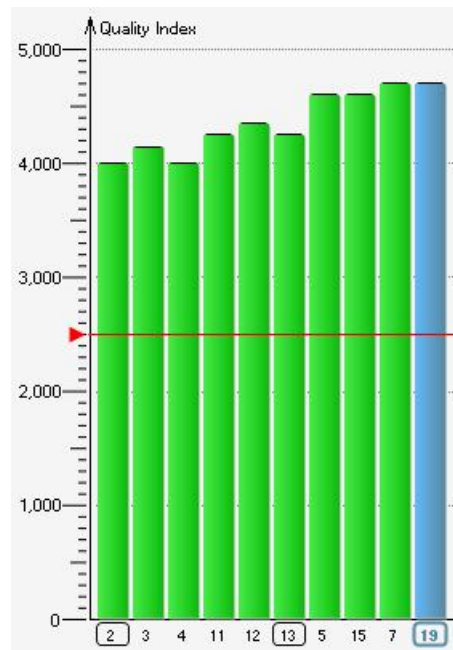
The test results and problems determined in practice may differ from those described in this section as they depend, above all, on the baud rate and line length used.

To rapidly pinpoint physical problems, it is very useful to know the bus topology, i.e. the sequence and distances of all bus stations, and the bus length. This information has to be gathered previously while the system is error free. See also [Topology scan](#)^[27].

7.2.2 Good operational state

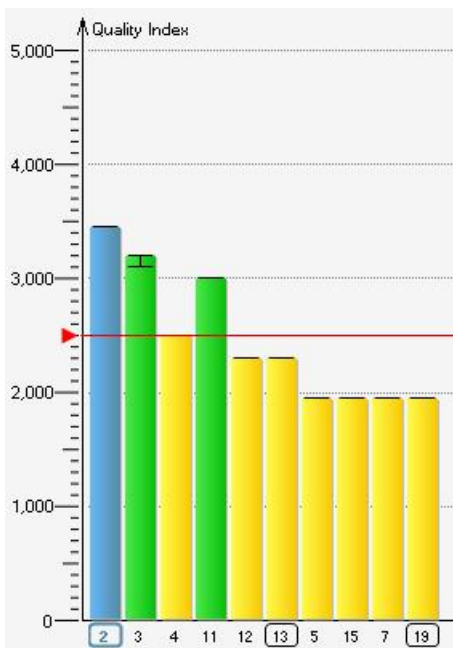


Test at beginning of bus (addr. 2) at 1.5 Mbit/s



Test at end of bus (addr. 19) at 1.5 Mbit/s

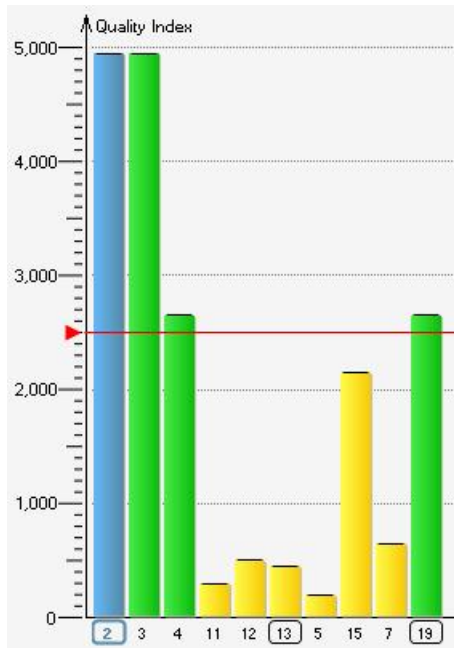
The further away a station is from the test location, the worse is its quality index. This effect is normal and due to the line length. The quality index is also negatively affected by increased baud rates:



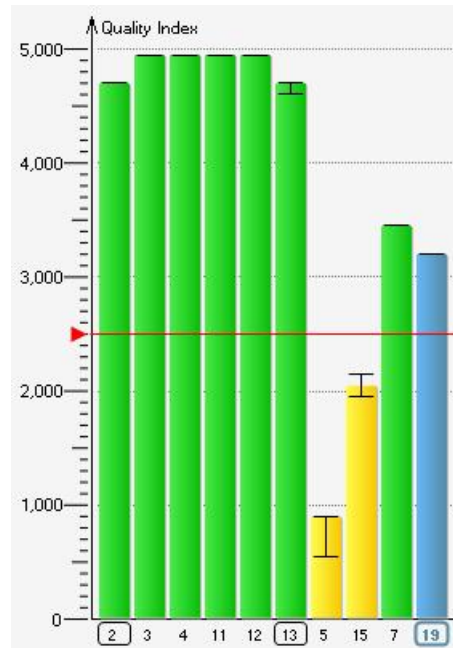
Test at beginning of bus (addr. 2) at 12 Mbit/s

While the bus might be running stable, the noise immunity is reduced. Conclusion: Decreasing the baud rate (if allowed by the application) generally helps to increase the noise immunity of the PROFIBUS

7.2.3 Problems related to missing terminating resistors



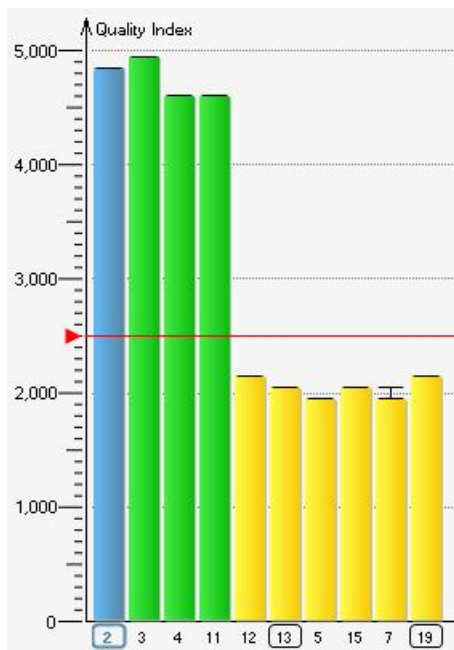
Test at beginning of bus (addr. 2)



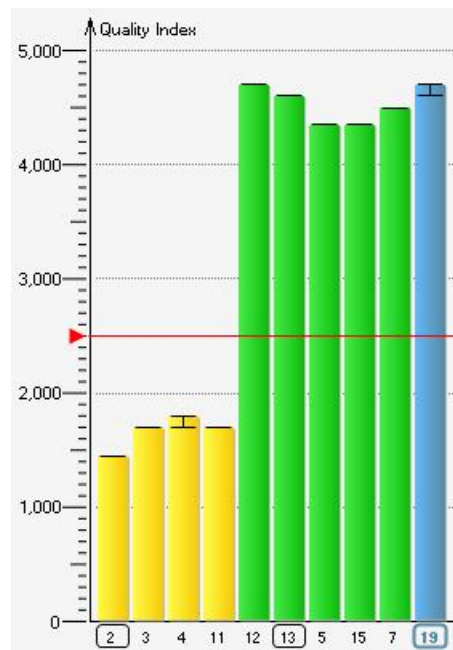
Test at end of bus (addr. 19)

In this example, the terminating resistor is missing at the beginning of the bus. The closer the test location is to the fault, the worse the overall results.

7.2.4 Problems related to contact resistance/unallowed cable length



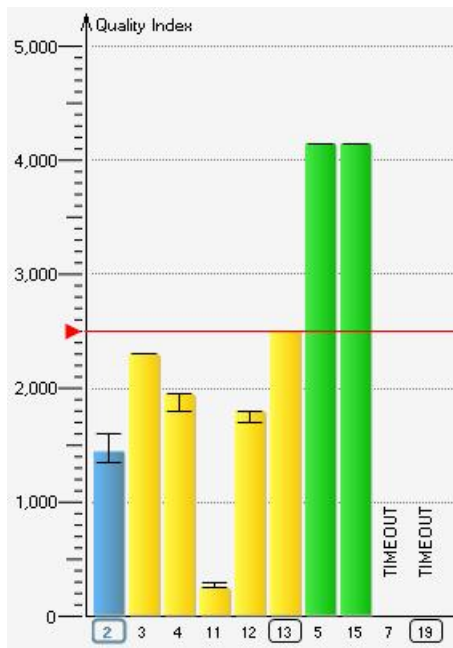
Test at beginning of bus (addr. 2)



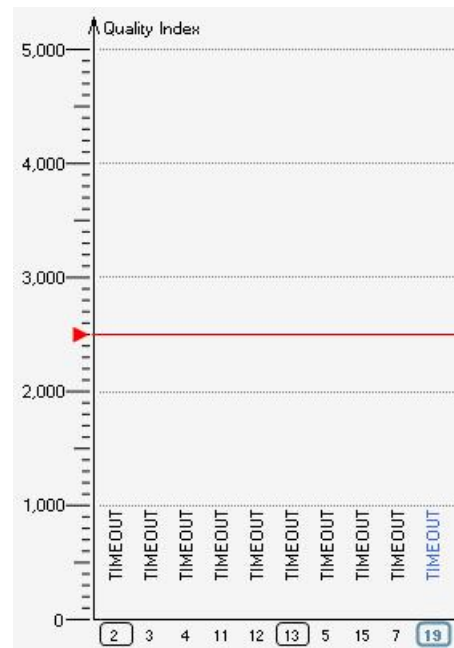
Test at end of bus (addr. 19)

In this example, there is a very high contact resistance between two stations, which considerably reduces the quality indexes of the subsequent stations. In this case, the problem is located between stations 11 and 12. If the allowed bus length is exceeded step by step over multiple stations, the change in the quality index will be less abrupt.

7.2.5 Problems related to cable breaks



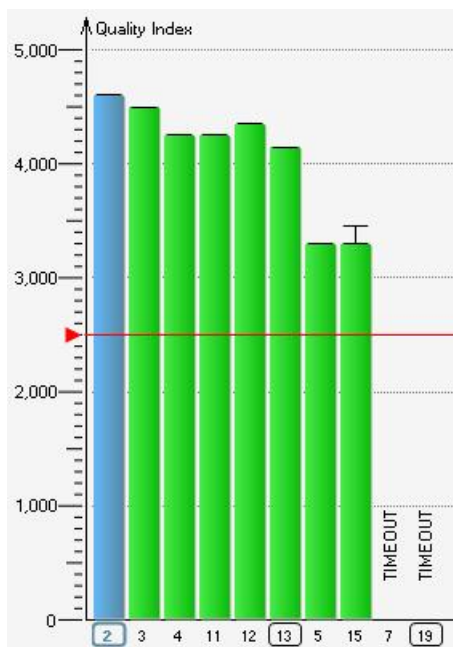
Test at beginning of bus (addr. 2)



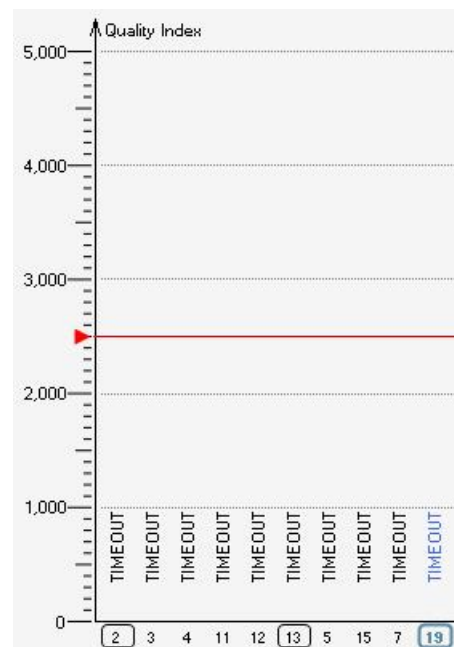
Test at end of bus (addr. 19)

Because of a cable break between stations 15 and 7, no quality indexes can be determined for the subsequent stations. When testing at the end of the bus, no quality indexes can be determined at all. As a result of the open, not-terminated line end, the quality indexes of other stations are also negatively affected.

7.2.6 Problems related to termination at middle of bus

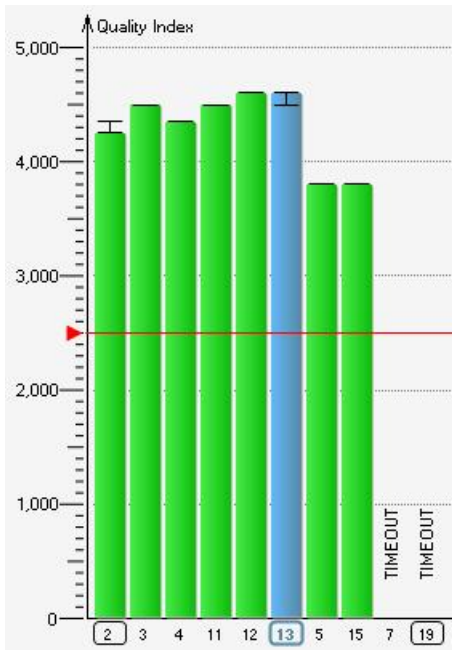


Test at beginning of bus (addr. 2)



Test at end of bus (addr. 19)

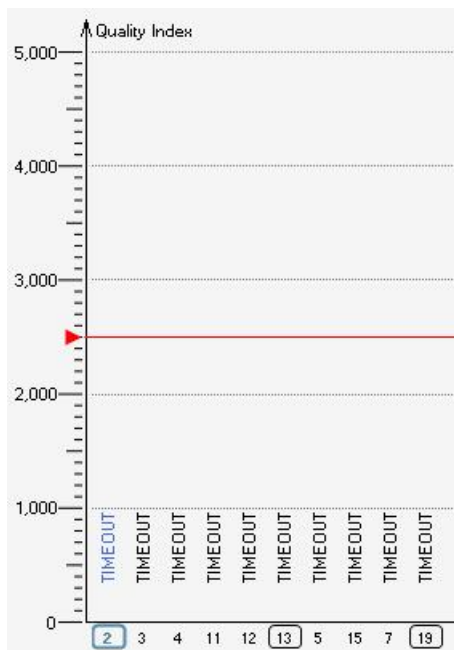
This problem looks almost like a cable break at first glance. But the quality indexes on the whole appear better. In this case, an additional test performed at the middle of the bus provides greater certainty:



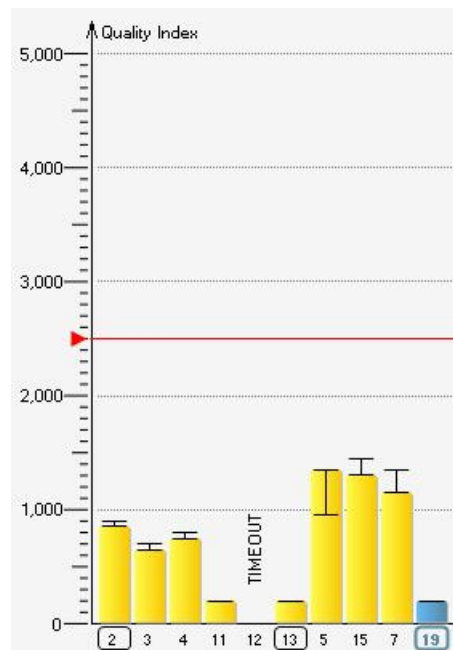
Additional test at middle of bus (addr. 13)

The good quality indexes at the beginning and at the middle of the bus clearly indicate a correct termination. In this example, the terminating resistor has been switched wrongly on at the station 15.

7.2.7 Problems related to shield short

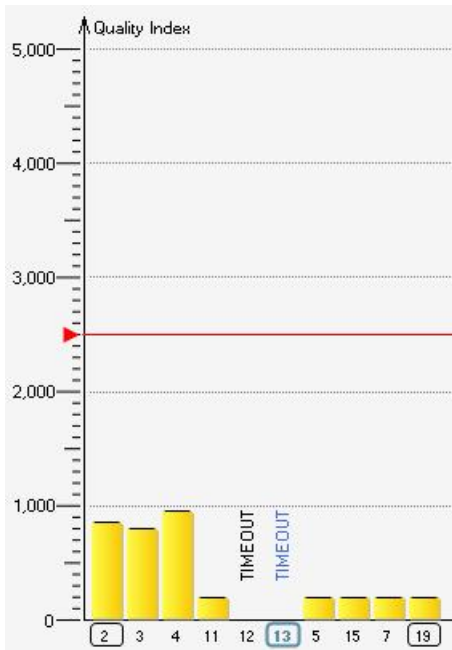


Test at beginning of bus (addr. 2)



Test at end of bus (addr. 19)

When testing at the beginning of the bus, no quality index can be determined at all. The quality results obtained when testing at the end of the bus are very bad. Bus operation is very unstable at best. An additional test performed at the middle of the bus does not provide any new insights.



Test at middle of bus (addr. 13)

In this case, divide the bus into segments. Then use the master simulator to test the individual segments with the PLC switched off (see [Testing without a ready PLC^{\[28\]}](#)). This way you can narrow down step by step where the problem is.

7.2.8 Notes on further analysis of unclear problem causes

In most cases, the overall results, i.e. the average of all quality indexes, will grow worse the closer you get to the fault location.

If the cause of a problem is unclear, make at least one more test at the middle of the bus after you have tested the beginning and end of the bus.

If the cause is still unclear, turn off the PLC and divide the bus into segments. Then test the individual segments separately by using the master simulator (see also [Testing without a ready PLC^{\[28\]}](#)). This allows you to narrow down and eventually pinpoint basically all physical problems on the bus.



Note

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7.3 Interpret trend test results

If fluctuations occur during the course of the day, or quality fall-offs at certain times of the day, this indicates external influences that have to do with periodic procedures taking place in the environment of the PROFIBUS network.

Examples would be:

- Electromagnetic disturbances caused by machines and systems that are operated only temporarily
- Electromagnetic disturbances during the startup of machinery (shift change)
- Voltage fluctuations in the course of the day or week
- Climatic changes (e.g. temperature, condensation) in the course of the day

When you are testing with the BC-600-PB or with BC-700-PB and logging intervals with poor quality indexes coincide with an increase in the number of frame errors or retries, as shown in the example, then the physical disturbances have already started to negatively affect the correct operation of the bus.

**Note**

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8 Document test results


8.1 Network status test report

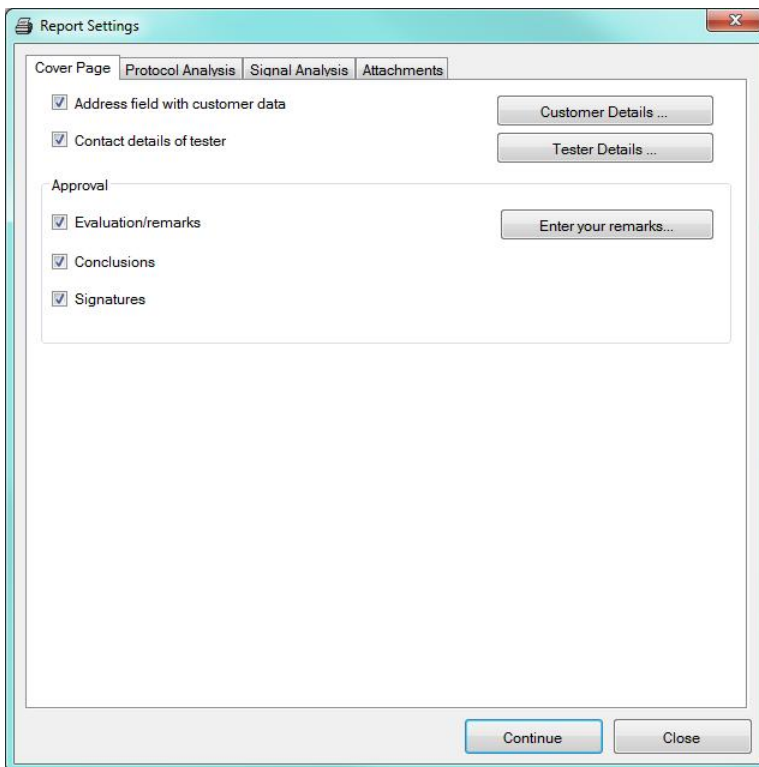
Based on the network status, you can create a detailed test report for an active test tool or for an open file.



Note

Test reports should never be based on quick tests, but on user-controlled tests with a test duration of at least 10 minutes.

Click the printer icon () to open the Test Report Settings dialog box. Here you can make very detailed settings for the cover page and the scope of the report. You can configure in detail which test results you want to include for the bus physics and the bus communication. In addition, you can append attachments to the test report such as trend logs, oscillograms and imported cable test results.



You can then print the completed test report or export it to a PDF or Excel file.

The report shows a Softing logo at the top right of the header. You can replace it with any other logo you want to use. To do this, replace the *Company-Logo.png* file with the new logo file in the following default directory.

C:\ProgramData\Softing\PROFIBUS\Diag Suite\images

8.2 Trends



You can print the trends shown on screen or export it to a PDF or Excel file. Alternatively you can append trends to a network status test report (see [Network status test report](#))^[38].

If the relevant links exist in the network status, you can optionally document the last trend of each test location in the test report (see [Trend test](#)^[29]).

8.3 Oscilloscope



You can print the oscillogram shown on screen or export it to a PDF or Excel file. Alternatively you can append oscillograms to a network status test report.

8.4 Frame record files

You can print any section of the individual frames saved in a frame recording or export the selected section to a PDF or Excel file.

8.5 Cable test results



You can print the cable test results shown on screen or export them to a PDF or Excel file. Alternatively you can append cable test results to a network status test report.



8.6 Expert functions

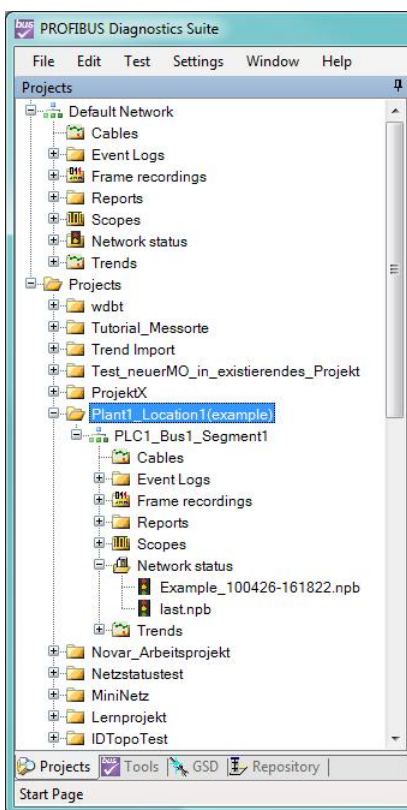
The Advanced user mode offers you two expert functions for analyzing oscillograms and frames. Whether these two functions are available depends on the functionality of your test tool (see [Supported test tools and their functionality](#)^[6]). For details, please see the integrated help system supplied with the PC software.

9 Integrated Explorer






The integrated Explorer is provided on the left-hand side of the workspace. It is hidden behind the four vertical tabs when you start the application for the first time. To display the Explorer window in full:



- move the mouse pointer over one of the four tabs (when you move the mouse out of the Explorer window, the window is hidden again automatically)
- or
- click one of the four tabs (in this case, the Explorer window will only be hidden again when you click the workspace outside the window).

To display the Explorer window permanently, click the  icon at the top right. This will reduce the workspace, however, so that leaving the Explorer window open only makes sense if you are using a high screen resolution. The icon changes to . To hide the Explorer window again, click this icon and then click the workspace outside the Explorer window. Example of the integrated Explorer opened in the Project view:



The following file types are available:

-  Cable test result (*.cpb); cpb-files have to be imported; cable testing is available solely during stand-alone operation of BC-700-PB
-  Event logs in which the complete event history from the protocol analysis of the network status is stored separately because of the data volume (*.log)
-  Frame recording (PROFIBUS DP: *.rpb, PA: *.rpa)
-  Network status test report (*.pdf or *.xls)
-  Oscillogram (*.osc)

-  Network status (*.npb); the "last.npb" file is a special file that exists once for each network (see [Network status](#)^[21])
-  Trend recording (*.qlg)

9.1 Projects

The Project Explorer offers you an easy way to manage your tests. The tree structure shows the default network and all currently open projects. Each project consists of one or more networks that belong to the same PROFIBUS installation.

The Default Network is shown at the top of the Project Explorer. All tests that are not part of a specific project are stored there. When you start a quick test from the start page, the network status stored previously in the default network is deleted.

The Projects tab provides access to the test results of different PROFIBUS networks and allows you to organize the folder structure to suit your needs. Projects and all the files they contain are stored in the following default locations:

- Under Windows XP:
C:\Documents and Settings\All Users\Application Data\Softing\PROFIBUS\Diag Suite\projects
- Under Windows 7 and Windows 8:
C:\ProgramData\Softing\PROFIBUS\Diag Suite\projects

You can create new projects at the default location or any other location you prefer. To move a project, you have to close it first so that it is no longer displayed in the Project Explorer. You can then move the project to a different storage location in the Windows Explorer and then open it again in the Project Explorer.

9.2 Tools

The Tool Explorer shows you which tools are currently connected via USB. If you have connected more than one tool, the tools are grouped by type and sorted by serial number.

When you have selected a tool, you can right-click it to open the context menu and

- assign the tool, i.e. its test results, to a network,
- open a single function/main view or all the functions/main views available for this test tool (see [Supported test tools and their functionality](#)^[6]) as an active tool,
- manually set the baud rate if supported by the test tool.

9.3 GSD

This tab shows you which GSD files have been imported (for displaying error messages as well as configuration and parameterization information as plain text in the **Network Status** → **Protocol** view). To add more GSD files, select **File** → **Import GSD**.

9.4 Repository

This tab displays the stored filter and trigger settings and the search conditions for the expert analysis of frame recordings.

10 Firmware update for BC-700-PB

The updates for the PROFIBUS Diagnostics Suite also provide the latest firmware updates in the "Firmware" folder of the program directory. The default path is: *C:\Program Files\Softing\PROFIBUS\DIAG SUITE\Firmware*.

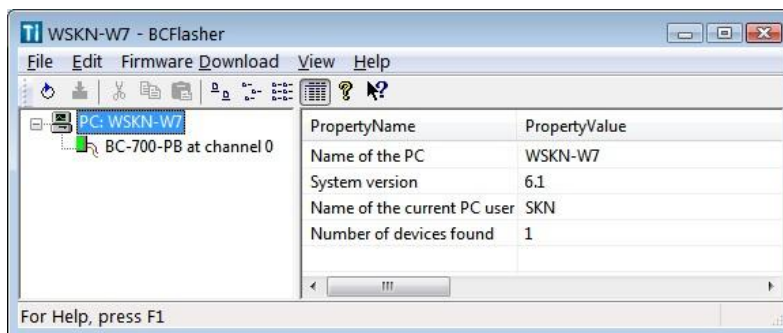


Note

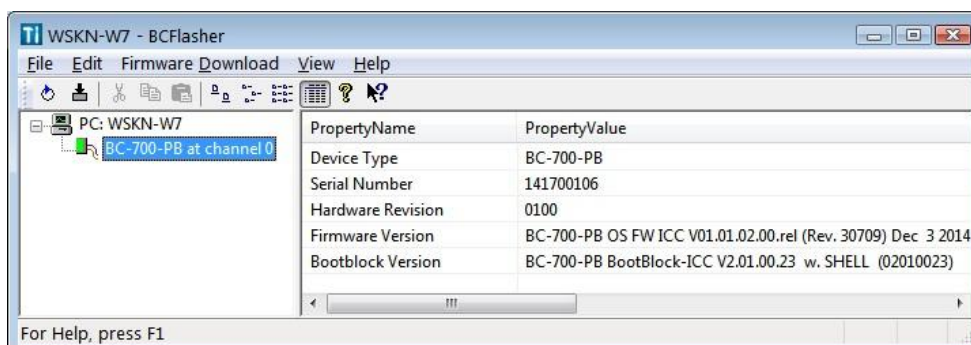
If you manually download the firmware updates from the Softing web site, you have to store them on a local drive of your computer before continuing with the steps described below.

The BCFlasher tool, which is installed with the PROFIBUS Diagnostics Suite, allows you to update the firmware of the test tools (except PROFIBUS Inspektor). Before you start a firmware update, the test tool to be updated has to be connected to the PC via USB and the PROFIBUS Diagnostics Suite has to be closed. Administrator rights are not required.

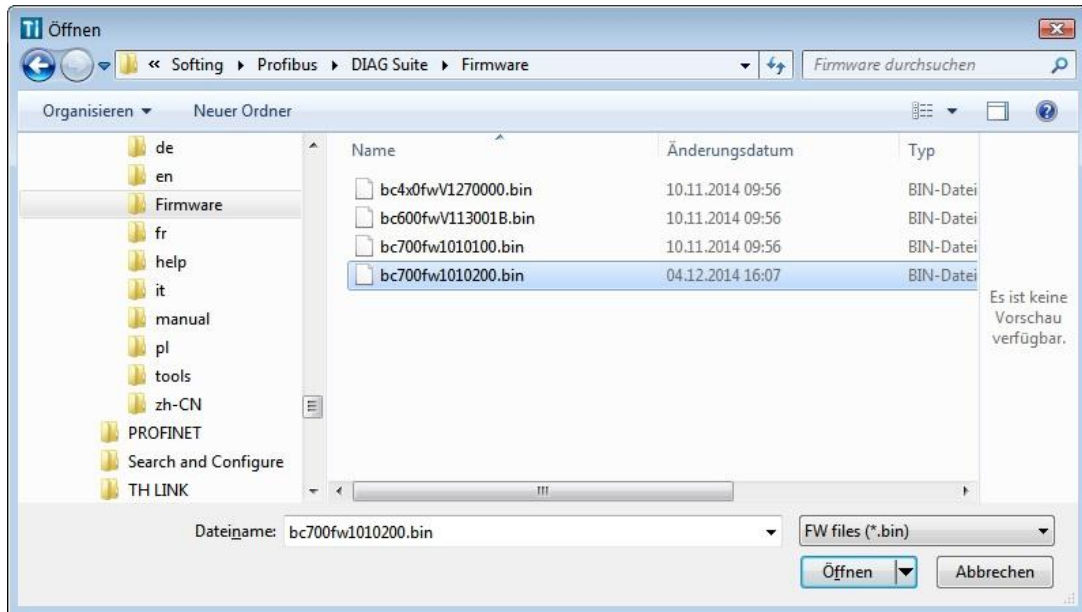
1. Click **Start → All Programs → Softing PB Diag Suite → BCFlasher**.
2. BCFlasher automatically detects all connected tools. Do not remove a tool while the application is running.
3. Expand the tree view to show all detected tools:



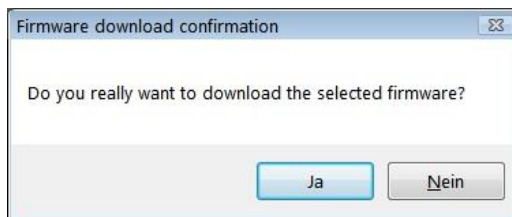
4. If no tool has been detected, select **File → Scan for Devices** from the menu bar or click the scan icon (🔍). To select a tool for the firmware update, click it with the mouse. The right part of the window shows the version information for the selected tool.



5. Select **Firmware → Download → Download Firmware** or click the download icon (📄) to display the dialog box for opening the new firmware file.
6. Specify the path, then choose the correct firmware file for the test tool:



7. The names of firmware files start with "bcxxxfwV" followed by a six-digit version number. "xxx" stands for the tool type, for example: "600" stands for the BC-600-PB. The file name extension is ".bin".
8. Click **[Open]**. A confirmation dialog appears:



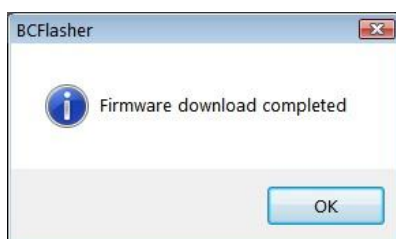
9. Click **[Yes]** to start the update. The update process will take about one minute, depending on the tool.



Note

Do not unplug the USB connection during the firmware update. If the tool is externally powered, do not interrupt the power supply.

10. A message appears when the update has been successfully completed:



11. If required, select **File → Scan** for Devices from the menu bar or click the scan icon (🔍) to check the firmware version.

11 Troubleshooting

Problem	Causes and remedies
A test tool is not detected by the PROFIBUS Diagnostics Suite (at Start Page or at Tool Explorer).	<p>Possible causes:</p> <ul style="list-style-type: none"> ▪ The tool was connected to the PC before installing the software. The Windows hardware wizard was terminated with an error message. As a result, the tool is displayed as defective in the Device Manager, under Softing Fieldbus Interface, which you can access by selecting Control Panel → System → Device Manager. ▪ After a previous SW downgrade the tool is displayed as defective in the Device Manager – see above. <p>Remedy:</p> <ul style="list-style-type: none"> ▪ Open the Windows Control Panel, select System, change to the Hardware tab and start the Device Manager. Under the Softing Fieldbus Interface entry, right-click the connected test tool which is marked as defective and click "Uninstall Driver". Then briefly disconnect from USB and reconnect again. Now the test tool will be detected as a new device – see also Connect to USB for the first time^[16]. <p>Alternative cause:</p> <ul style="list-style-type: none"> ▪ USB problem <p>Remedy:</p> <ul style="list-style-type: none"> ▪ Replace the USB cable, use the USB port directly on the PC or notebook (no hubs, etc.).
The baud rate is not detected automatically on a live PROFIBUS.	<p>Possible cause:</p> <ul style="list-style-type: none"> ▪ Massive disturbances in the bus physics. <p>Remedy:</p> <ul style="list-style-type: none"> ▪ Manually set the baud rate in the PC software and repeat the test.
When using BC-600-PB, there are differences between the live list on the Protocol tab and the station list for signal quality analysis.	<p>Possible cause:</p> <ul style="list-style-type: none"> ▪ Stations either failed or were configured in the master, but not connected to the bus. <p>Remedy:</p> <ul style="list-style-type: none"> ▪ Check the bus stations and the PLC program; replace/modify if required.
The Protocol and Topology tabs of the Network Status view do not display the concrete type designations for some or all slaves.	<p>Possible cause:</p> <ul style="list-style-type: none"> ▪ During the tests performed so far, no startup of all stations on the bus (e.g. during startup of the PLC) has been monitored or there have been no diagnostic messages from individual stations. <p>Remedy:</p> <ul style="list-style-type: none"> ▪ Refer to Protocol detail view^[24]

If you need to contact Softing's support team, you can send us an email to support.automation@softing.com or call us with +49 89 45656-326. Please send us the relevant test files or screenshots of the relevant error messages, as applicable.

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