Physical Bus Test Device
for PROFIBUS-DP
BT 200

Physical Bus Test Device
for PROFIBUS-DP

Table of Contents

1 DESCRIPTION .................................................. 2

2 COMMISSIONING ........................................... 3

3 NORMAL MODE .............................................. 4

3.1 WIRING TEST .............................................. 5

3.2 ERROR MESSAGES OF THE WIRING TEST ............ 6

4 SPECIALIST MODE ......................................... 8

4.1 OPERATOR CONTROL ..................................... 8

4.2 STATION (RS 485) TEST ............................... 10

4.3 BRANCH TEST ............................................ 11

4.4 DISTANCE ............................................... 12

4.5 REFLECTION TEST ...................................... 13

4.6 SERVICE ................................................ 14

5 MAINTENANCE AND TROUBLE-SHOOTING ........... 15

5.1 CHARGING STATUS OF THE BATTERY ............. 15

5.2 CHANGING THE BATTERY ............................. 15

5.3 SELF-TESTS ........................................... 16

5.4 ERROR CORRECTION TABLE .......................... 17

6 ACCESSORIES AND REPLACEMENT PARTS ............. 18

7 TECHNICAL DATA ......................................... 19
1 Description

Purpose of the BT 200

The BT 200 offers diagnostics for PROFIBUS-DP systems without having to use additional measuring aids (e.g., PC or oscilloscope).

Operator control elements and display

Fig. 1 BT 200 operator control elements and display
1) PROFIBUS-DP connection (9-pin sub D)
2) LC display (2 x 16 characters)
3) ON/OFF button
4) TEST key (start test)
5) CURSOR keys
6) OK key (various functions)
7) ESCAPE key (terminate)
8) Charging contacts
2 Commissioning

Before initial commissioning, check your delivery, and charge the battery.

Scope of delivery

The delivery includes:
- 1 BT 200
- 1 battery
- 1 test plug connector (wiring test)
- 1 test cable, length: 2 m
- 1 user's guide

Charging the battery

- Open the battery compartment (see chapter on changing the battery), and check to determine whether the battery is installed. Install the battery if necessary.
- Charge battery of the BT 200 via charging shell (approx. 4 hours).

⚠️ Attention!
The battery is always delivered uncharged. The charging shell is not included and must be ordered separately.

- Remove the BT 200 from the charging shell. The device is ready for operation.
3 Normal Mode

The BT 200 is turned on with the **ON/OFF** button. Keep the **ON/OFF** button pressed until you see a reaction on the display.

**Standby display**

The following display appears for approx. 3 seconds after the device is turned on.

![Standby display](image)

**Battery display**

The battery capacity display is then shown for approx. 3 seconds.

![Battery display](image)

**Operational display**

After the battery display disappears, the BT 200 assumes normal mode and displays the start screen for the wiring test.

![Operational display](image)

Only the wiring test can be performed in normal mode.

**Energy saver mode**

If no keys are pressed for approx. 3 minutes and no measurements are being performed, the BT 200 goes off automatically.
3.1 Wiring Test

Principle of measuring

The wiring test for a bus segment is performed between the BT 200 and the test plug connector. During the initialization phase, a test can be performed from connector to connector. See figure 2. The test connector is always installed on the one end of the bus segment.

Short circuits can also be determined outside the test path. The bus segment may only be equipped with a terminating resistor at the beginning and at the end.

Performing the test

No stations may be connected to the bus line. The test is started by pressing the TEST key. One of the following two messages is displayed if the test was concluded successfully.

For one terminating resistor (as long as installation has not been completed, only one terminal resistor is present)

After installation has been concluded, two resistors must be inserted.

The test is concluded by pressing the OK key, and a new wiring test can be started. The wiring test can also be concluded or terminated at any time by pressing the ESC key.
3.2 Error Messages of the Wiring Test

Station test

Check to determine whether all plug connectors have been disconnected from the stations.

Wire mix-up

Exchange the cores in the corresponding plug connector.

⚠️ The wiring test must be performed each time a new PROFIBUS plug connector is connected. Otherwise an even number of wire mix-ups will not be recognized.

Short circuit

Locate and correct the short circuit. A frequent cause (e.g., of shield short circuits) is the incorrect application of shield braiding in the plug connectors.
Line or shield break

If several cores or at least one core and the shield are broken or not connected, the BT 200 cannot identify the interruption unambiguously.

To obtain a correct measuring result for shield break, the shield may not be connected with ground.

With all four messages, first check the plug connectors in question. If these are okay, replace the cable.

None or more than two terminating resistors

Page with the "→" "←" keys.

Place a terminating resistor at the beginning and end of the bus segment.

Page with the "→" "←" keys.

Remove or deactivate all terminating resistors except the two at the beginning and end of the bus segment.
4 Specialist Mode

You can switch from normal mode to specialist mode by pressing ESC and OK at the same time.
The following functions are available in specialist mode.
- Wiring test. See normal mode.
- Station test
- Wire mix-up
- Short circuit
- Line or shield break
- None or more than two
- Station test (RS 485 test)
- Branch test
- Distance measurement
- Reflection test
- Service menu

4.1 Operator Control

The BT 200 is menu-controlled via the input keys of the sealed keyboard (figure 1).

Cursor

The current cursor position in the display is shown as a flashing arrow and indicates the function which is being performed.
Menu items

Menu items are selected with the cursor and activated with the **OK key**. The **ESC key** can be used to terminate a running function or to jump back to the higher-level menu item.

Menu structure

![Menu structure diagram](image-url)

Fig. 3 Menu structure
4.2 Station (RS 485) Test

This test is used to test the RS 485 interface of a single slave.

Performing the test

Disconnect bus connector from the slave. Establish point-to-point connection between slave and BT 200. See figure 4.

⚠️ Only the included test cable may be used for this connection.

Fig. 4  Point-to-point connection

Turn on the slave since the test must be performed with an active slave.

Start station test.

Set address of the slave to be tested as shown below.

"←" "→" Change cursor position.

"↑" "↓" Increment/decrement number.

Accept the set three-position number with OK, and start test.

Test results

Possible test results are listed below.

- RS 485 okay (slave okay)
- RS 485 defective. (No continuous signal receipt; repeat test.)
- No response. (Nothing received; wrong slave address may have been set.)
- 5V : (corresponding measured value)
- RTS signal (YES or NO)
4.3 Branch Test

This can be used to check the availability of all slaves on PROFIBUS or to address an individual slave. The branch test can also be performed beyond repeaters/LWL.

Performing the test

Disconnect all masters from the bus (e.g., PG, OP and CP). See figure 5.
Connect BT 200 to the bus.
Set the baud rate configured on the bus on the BT 200.
Set the desired address for individual slave test.
Set address to "000" for the total test.
Start test.

![Measuring principle of the branch test](image)

Test results

During the total branch test, each available slave is indicated in a list of available stations (i.e., LIFE LIST).

- LIFE LIST

For an individual test
- No response. (e.g., No station with this bus address on the bus.)
- Faulty station. (e.g., a slave number has been assigned twice.)
4.4 Distance

The distance can be measured to determine the length of the PROFIBUS cable.

Performing the test

Disconnect all bus stations from the bus. Connect test plug connector to one end of the line and the BT 200 to the other end. (Remove termination for BT 200.) Start distance measurement. After the start, the BT 200 requests three values which must be entered on the keyboard.
- Loop resistance (default = 110 Ω/km)
  The default value can be changed via menu item Service.
- Number of plug connectors with longitudinal inductivity (12 Mbaud connector)
- Resistance value per connector (default = 0.32 Ω)
After entry of the last value and confirmation with OK, measurement is performed.

Measurement results

The following appears on the display.

The following error messages can occur during measurement.
- No resistor inserted.
- Display "0 m" (no plausible length determined)
- More than 1 resistor inserted.

Possible causes of errors:
- Distance < 15 m
- Stub lines, located on the measuring path

Correct the error, and repeat the measurement.
4.5 Reflection Test

The reflection test can be used to determine faults (e.g., short circuits and interruptions) or to confirm the distance measurement.

Reflexions can occur in the following situations:
- Stub lines exist.
- Too many terminating resistors have been inserted, or none have been inserted.
- Change to a wrong type of cable occurs within the measuring path.
- Cable installation is not correct (e.g., luster terminal connection and so on).

Performing the test

Disconnect master from the bus, and make sure that no bus communication occurs. Connect BT 200 to one end of the line. Start reflection measurement.

Test results

If no reflection (i.e., fault) is detected, the following message appears.

![No reflections](image)

If a reflection is detected, the following message appears.

![Reflections in:](image)

The number in the display specifies the distance in meters from the measuring point to the faulty point. If the distance of the reflection measurement corresponds to a previous distance measurement, this distance measurement is confirmed. The wiring of the bus segment which was measured is correct.
4.6 Service

Settings
The following settings can be changed in the Service menu.
- Language (German/English)
- Loop resistance (50 to 200 $\Omega$/km)
- Baud rate (9600 baud to 12 Mbaud)
- Contrast (↑↓)

Default values
If you want to reset all values to their status on delivery, keep both cursor keys pressed for approx. three seconds after turning on the device.

Displays
The Service menu gives you the following information.
- Firmware version
- Battery capacity

Hardware test
This tests the internal hardware.

Calibration
Calibration is not necessary when the standard type-A PROFIBUS cable is used. The accuracy of distance and reflection measurement is achieved by calibration with 2 test cables of different known lengths.

Fig. 6 Principle of calibration
5 Maintenance and Trouble-Shooting

5.1 Charging Status of the Battery
The charging status of the battery is indicated for approximately 3 seconds during startup. This display then disappears. The charging status can also be indicated via the service menu during operation. If the battery goes dead during operation, the charging status begins to flash.

5.2 Changing the Battery

Attention! When changing the battery (2), make absolutely sure that the battery connector (1) with the red cable (light-colored cable) is inserted to the right.

Fig. 7 Changing the battery
5.3 Self-Tests

The BT 200 performs self-tests automatically and on request (hardware test).

- Internal RS 485 driver test
  The test is performed each time the station and branch test is called.

- RAM test
  A cyclic RAM test is performed.

- Flash EPROM test
  A cyclic EPROM test is performed.

- RS 485 driver test

The individual tests (e.g., RAM test, flash EPROM test and display key test) can also be selected from specialist mode via the HW test service menu.

If an error is detected during the self-test, you must proceed as shown in the error correction table.
### 5.4 Error Correction Table

#### Fault during startup

<table>
<thead>
<tr>
<th>Display</th>
<th>Fault</th>
<th>Reason</th>
<th>Effect</th>
<th>Correction</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>No display after switch-on</td>
<td>Battery dead</td>
<td>Hardware does not start up.</td>
<td>Charge battery or install new battery.</td>
</tr>
<tr>
<td>If possible: &quot;internal error&quot; message</td>
<td>After switch-on, &quot;internal error&quot; message appears.</td>
<td>RAM/EPROM error display/keyboard defective</td>
<td>No measuring possible</td>
<td>Replace BT 200.</td>
</tr>
</tbody>
</table>

#### Fault during operation

<table>
<thead>
<tr>
<th>Display</th>
<th>Fault</th>
<th>Reason</th>
<th>Effect</th>
<th>Correction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Battery display flashes before.</td>
<td>Device goes off.</td>
<td>Battery is dead.</td>
<td>No measuring possible</td>
<td>Charge battery/ install new one.</td>
</tr>
<tr>
<td>None</td>
<td>Device goes off.</td>
<td>Time with no user activity was exceeded.</td>
<td>None</td>
<td>Press ON button.</td>
</tr>
<tr>
<td>Internal driver defect</td>
<td>Internal driver is defective.</td>
<td>HW defect</td>
<td>No station/branch test possible</td>
<td>Replace BT 200.</td>
</tr>
</tbody>
</table>
# 6 Accessories and Replacement Parts

The following components can be ordered under their MLFB number.

<table>
<thead>
<tr>
<th>Designation/Picture</th>
<th>MLFB Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test connector</td>
<td>6EP8106-0AC20</td>
</tr>
<tr>
<td>Charging shell w. power pack for:</td>
<td></td>
</tr>
<tr>
<td>- 230 V AC</td>
<td>6GT2003-1AA00</td>
</tr>
<tr>
<td>- 110 V AC</td>
<td>6EP8106-0HB01</td>
</tr>
<tr>
<td>Battery with connection cable</td>
<td>6EP8106-HA01</td>
</tr>
<tr>
<td>Test cable 9-pin sub D on 9-pin sub D (1 to 1)</td>
<td>6EP8106-OHC01</td>
</tr>
</tbody>
</table>
# 7 Technical Data

## General

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions</td>
<td>210 * 100 * 55 mm²</td>
</tr>
<tr>
<td>Weight</td>
<td>400 g</td>
</tr>
<tr>
<td>Battery capacity</td>
<td>≥ 720 mAh</td>
</tr>
<tr>
<td>Life</td>
<td>≥ 8 h</td>
</tr>
<tr>
<td>Voltage supply</td>
<td>NiCd, 4.8 V battery</td>
</tr>
<tr>
<td>Display</td>
<td>LCD, 2 * 16 characters</td>
</tr>
<tr>
<td>Baud rate</td>
<td>9600 Bd to 12 MBd</td>
</tr>
<tr>
<td>Protection class</td>
<td>IP 30</td>
</tr>
<tr>
<td>Measuring accuracy</td>
<td>Length measurement (+/-3m)</td>
</tr>
</tbody>
</table>

## Environmental Requirements

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating temperature</td>
<td>+ 5°C to +45°C</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>-20°C to +60°C</td>
</tr>
<tr>
<td>Relative humidity</td>
<td>Maximal 95% / 24°C Middle 75% / 17°C (without condensation)</td>
</tr>
<tr>
<td>Air pressure</td>
<td></td>
</tr>
<tr>
<td>operation</td>
<td></td>
</tr>
<tr>
<td>storage</td>
<td></td>
</tr>
<tr>
<td>operation</td>
<td>795 to 1080 hPa</td>
</tr>
<tr>
<td>storage</td>
<td>660 to 1080 hPa</td>
</tr>
</tbody>
</table>

## EMC guidelines

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>CE labelling</td>
<td>DIN EN 61326-1: 1998 EN 50 081-1 EN 50 082-2</td>
</tr>
</tbody>
</table>

## Physical Requirements

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Vibration during operation</td>
<td>IEC 1131-2</td>
</tr>
<tr>
<td>Shock stress during operation</td>
<td>IEC 1131-2</td>
</tr>
<tr>
<td>Free fall</td>
<td>IEC 1131-2/68-2-32</td>
</tr>
</tbody>
</table>
Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bd</td>
<td>Baud (1 Bd = 1 character (bit/second))</td>
</tr>
<tr>
<td>BT</td>
<td>Physical bus test device</td>
</tr>
<tr>
<td>CP</td>
<td>Communications processor</td>
</tr>
<tr>
<td>EMC</td>
<td>Electromagnetic compatibility</td>
</tr>
<tr>
<td>MBd</td>
<td>1 MBd = 10^6 baud</td>
</tr>
<tr>
<td>NiCd</td>
<td>Nickel cadmium</td>
</tr>
<tr>
<td>NN</td>
<td>Miles above sea level</td>
</tr>
<tr>
<td>OP</td>
<td>Operator panel</td>
</tr>
<tr>
<td>PG</td>
<td>Programmer</td>
</tr>
<tr>
<td>RTS</td>
<td>Request to send</td>
</tr>
</tbody>
</table>

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