# BT 200

## Physical Bus Test Device for PROFIBUS-DP

## Table of Contents

# 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).

**BT 200 - version 2**

Version 2 of the BT 200 offers additional functions.

- Log function
- 6-language user interface
- Test of the PROFIBUS-DP master interface
- Indication of the master's address
- Wiring test with stations connected
- New, reasonably-priced compact charging device

**Operator control elements and display**

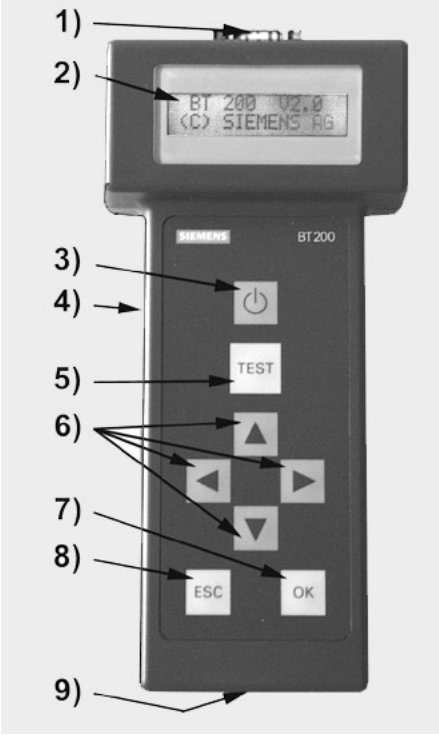



Fig. 1 BT 200 operator control elements and display

1) PROFIBUS-DP connection (9-pin sub D)
2) LC display (2 x 16 characters)
3) ON/OFF button
4) Charging socket for plug connector/charging device
5) TEST key (start test)
6) CURSOR keys
7) OK key (various functions)
8) ESCAPE key (terminate)
9) Charging contacts for charging device

# 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 (station test)
- 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).

**Y Attention!**

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

- Measuring cannot be performed during the charging procedure.

# 3 Normal Mode

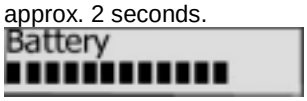
The BT 200 is turned on with the **ON/OFF** button.
Keep the **ON/OFF** button pressed until you see a reaction on the display.

**Standby display**

The following display appears for approx. 2 seconds after the device is turned on.


**Battery display**

The battery capacity display is then shown for approx. 2 seconds.




**Operational display**

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


Only the wiring test can be performed in normal mode.
When the BT 200 is in log mode (the cursor looks different), an extra screen appears after each test.


**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 installation 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.

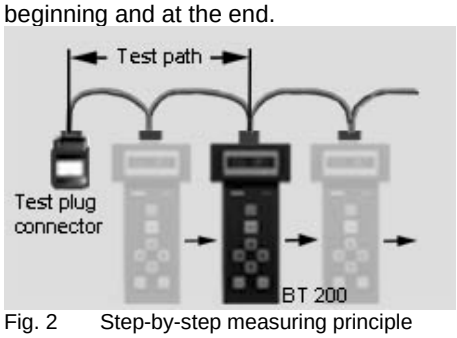
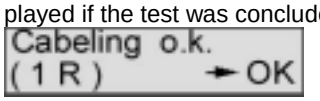


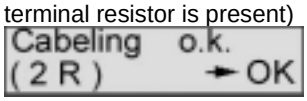

Fig. 2 Step-by-step measuring principle

**Performing the test**

The test can be performed with or without stations connected.
The test is started by pressing the **TEST** key.
One of the following two messages is displayed if the test was concluded successfully.



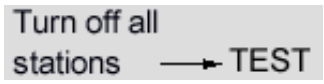

For one terminating resistor (as long as installation has not been completed, only one terminal resistor is present)




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**



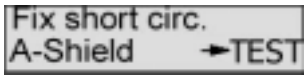

Check to determine whether the power supply has been turned off for all stations and power components.

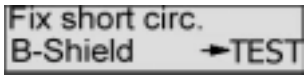
**Wire mix-up**


Exchange the cores in the corresponding plug connector.

Y 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**


Possible error causes:

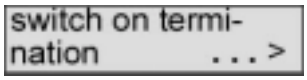
- Interruption of several cores
- Interruption of cores and shield
- Test plug connector not connected



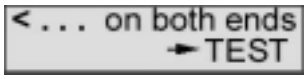

To obtain a correct measuring result for shield break, the shield may not be connected with ground.

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

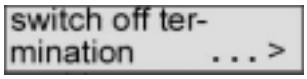
**None or more than two terminating resistors**



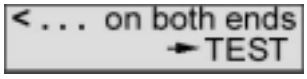

Page with the "→""←" keys.




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.

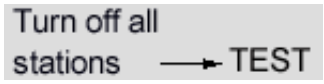
- Wiring test. See normal mode.
- Station test (RS 485 test)
- Branch test
- Distance measurement
- Reflection test
- Service menu

## 4.1 Operator Control

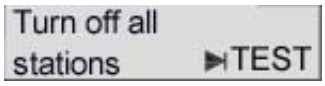
The BT 200 is menu-controlled via the input keys of the sealed keyboard (figure 1).

**Cursor**

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




If the BT200 is in log mode, the cursor position is shown with a modified arrow.



### 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

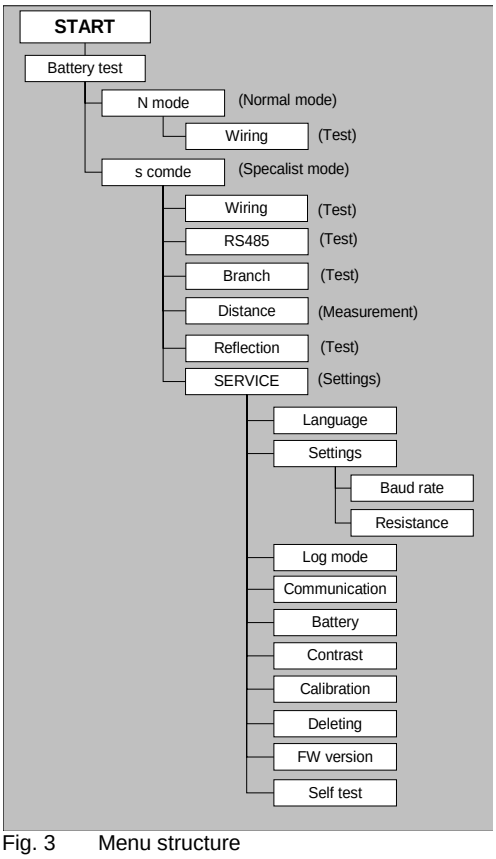



Fig. 3 Menu structure

## 4.2 Station (RS 485) Test

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

**Performing the test**

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

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

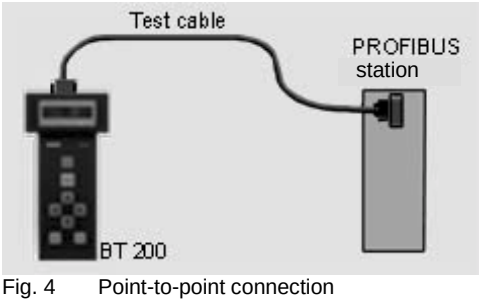



Fig. 4 Point-to-point connection

Turn on the station since the test must be performed with an active station. The master must be in "RUN" mode.
Start station test.
Set address of the station to be tested as shown below.

**Test results**

Possible test results are listed below.

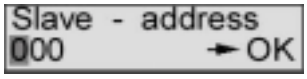
- RS 485 okay (slave okay)
- RS 485 defective. (No continuous signal receipt; repeat test.)
- No response (nothing at all received)
- 5 V : (corresponding measured value)
- RTS signal (YES or NO)

## 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.
Caution: The bus termination must remain ensured.
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.




Confirm with **OK** the address (slave or master) which was detected by the BT 200.

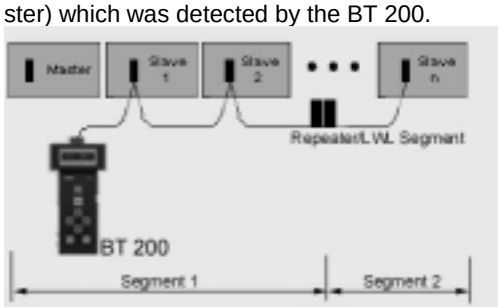
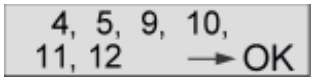



Fig. 5 Measuring principle of the branch test

**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

Distance measurement can only detect lines longer than 15 m. No distance measurement can be performed when repeaters are used.

**Performing the test**

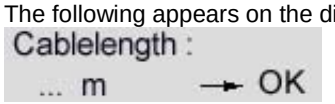
Turn off the power supply of all bus stations.
Connect test plug connector to one end of the line and the BT 200 to the other end. (Turn off resistor for BT 200.)
Start distance measurement.
After the start, the BT 200 requests three values which must be entered on the keyboard.

- Loop resistance (default = 110 Ω/km)
  The default value can be changed via menu item Service.
- Number of 12-Mbaud plug connectors/devices with longitudinal inductivity
- Resistance value per connector/device (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 a faulty location (e.g., short circuit) or to confirm the distance measurement (not via repeater).

Reflections can occur, for example, 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.

**Performing the test**

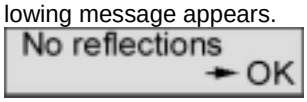
Disconnect master from the bus, and make sure that:

- the bus termination has power
- no bus communication occurs
- no test plug connector is connected.

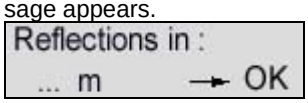
Connect BT 200 to one end of the line.
Start reflection measurement.

**Test results**

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




If a reflection is detected, the following message appears.




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/French/
- Italian/Spanish/Portuguese)
- Loop resistance (50 to 200 Ω/km)
- Baud rate (9600 baud to 12 Mbaud)
- Contrast (↑↓)
- Log mode (on/off)

**Communication**

Activate the interface for data transmission for the log function.

**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.

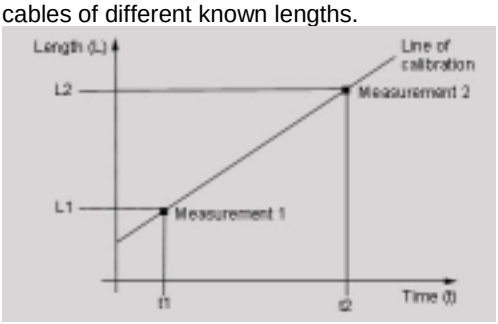



Fig. 6 Principle of calibration

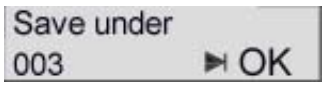
# 5 Log Mode

In log mode, performed tests are stored on the BT 200. Later this information can be transferred over a serial interface to a PC with log SW.
Log mode can be enabled and disabled in the SERVICE menu.
Log mode remains set even when the BT 200 is turned off. This mode remains on until the setting in the SERVICE menu is changed again.
An identifier (X0 ..X999) is assigned to each test to be stored on the BT 200.
The following table shows the maximum number of tests which can be stored and their identifiers.

| Type of Test | ID Letter | Max. Number |
|---|---|---|
| Wiring test | V | 128 |
| Station test | T | 128 |
| Branch test | S | 10 |
| Distance meas. | E | 10 |
| Reflection test | R | 10 |

**Storing the tests**

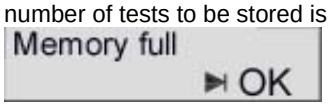
After each test, the following prompt with the next available identifier appears on the display.




The identifier can be changed with the cursor or accepted with OK.
If you manually enter an identifier which has already been assigned, it will be overwritten.

**Memory full**

This display appears when the maximum number of tests to be stored is reached.

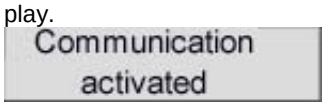



After you confirm with OK, the last selected identifier appears which you can then overwrite.

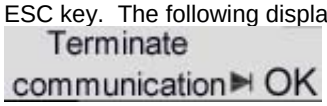

This identifier cannot be changed. The last test result is overwritten.

**Transferring tests to a PC**

The test data are stored in non-volatile memory (i.e., they can be transferred to the PC even after the BT 200 is turned off).
Before starting the transmission to the PC, connect the included "log" cable to a COM interface of the PC and to the 9-pin sub D socket of the BT 200.
The transmission is activated with the SERVICE menu and indicated on the display.




Communication can be terminated with the ESC key. The following display appears.




OK terminates communication.
ESC terminates "termination" of communication.

**Deleting the test data**

The test data can be deleted with the SERIVCE menu.

# 6 Sample Applications

**Testing the complete PROFIBUS-DP**

- No master may be connected to the bus.
- The "life list" can also be generated with a repeater and optical paths.
- Parts of the system can be tested in advance without the master for their bus functionality.

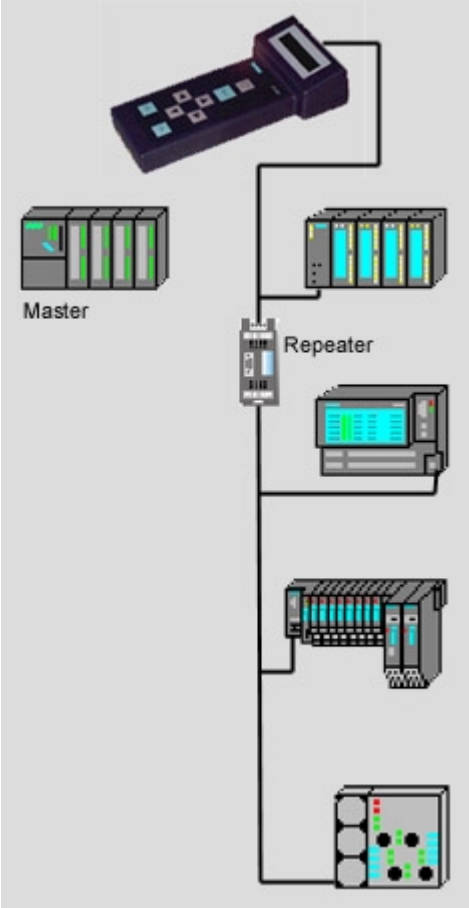



Fig. 7 Sample test 1

**Wiring test for connected stations**

- Stations no longer need to be removed from the bus.
  (Stations must be powered down!)
  (Measurement not possible over repeater)

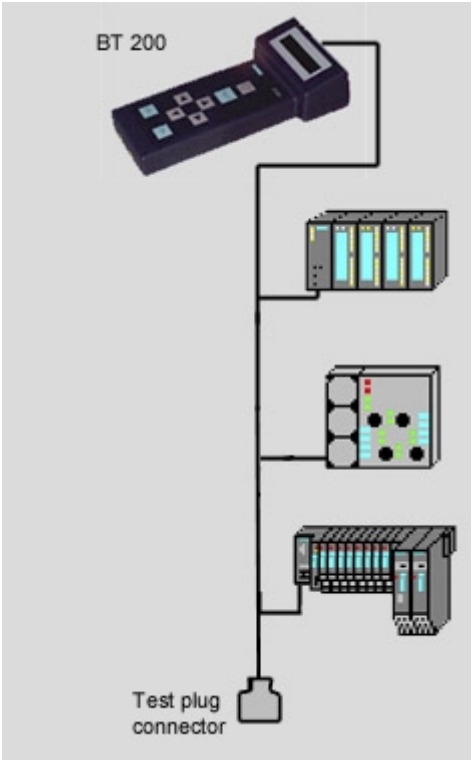



Fig. 8 Sample test 2

**Wiring test of a segment via PG socket on the repeater**

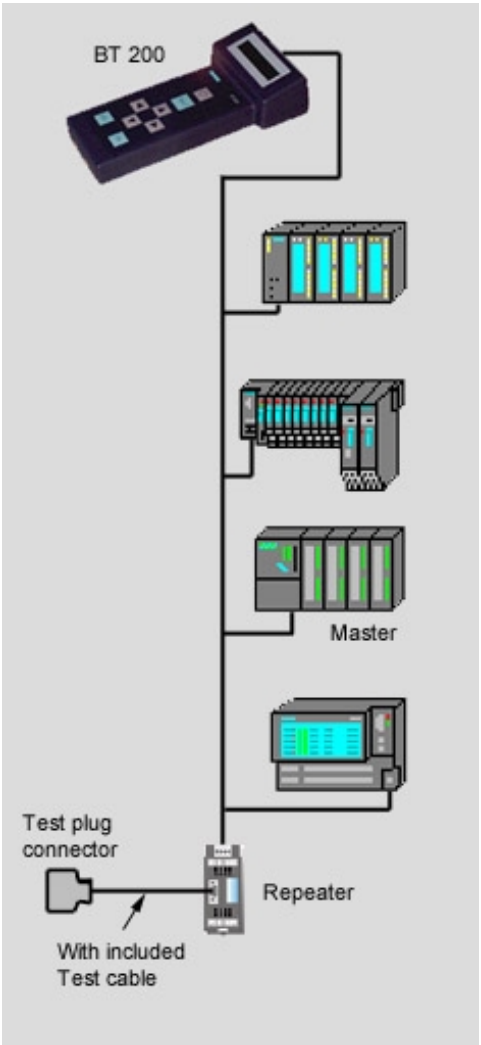



Fig. 9 Sample test 3

**Wiring test of a segment behind a repeater and with terminator**

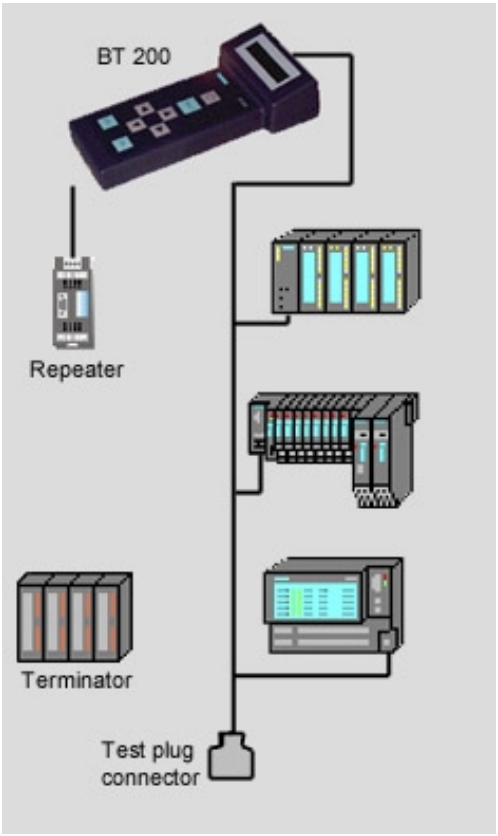



Fig. 10 Sample test 4

# 7 Maintenance and Trou ble-Shooting

## 7.1 Charging Status of the B attery

The charging status of the battery is indicated for approximately 2 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.

**Standard values**

If you want to reset all values to their status on delivery, keep **both cursor** keys pressed for approx. three seconds after switch-on.

## 7.2 Changing the Battery

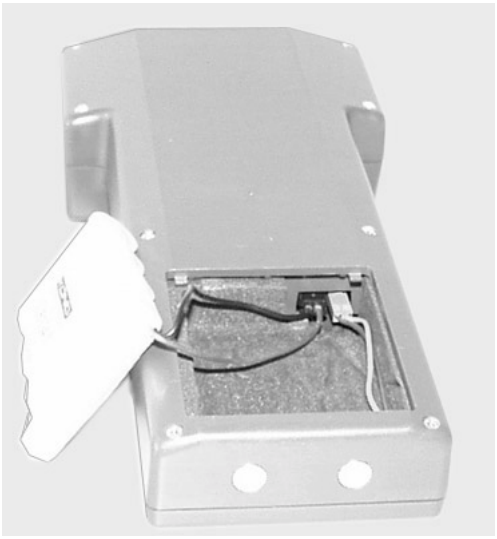


Fig. 11 Changing the battery

## 7.3 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 in specialist mode via service menu - HW test.

If an error is detected during the self-test, you must proceed as shown in the **error correction table**.

## 7.4 Error Correction Table

**Fault during startup**

| Display | Fault | Reason | Effect | Correction |
|---|---|---|---|---|
| None | No display after switch-on | Battery dead | Hardware does not start up. | Charge battery or install new battery. |
| If possible: "internal error" message | After switch-on, "internal error" message appears. | RAM/ EPROM error display/ keyboard defective | No measuring possible | Replace BT 200. |

**Fault during operation**

| Display | Fault | Reason | Effect | Correction |
|---|---|---|---|---|
| Battery display flashes before. | Device goes off. | Battery is dead. | No measuring possible | Charge battery/ install new one. |
| None | Device goes off. | Time with no user activity was exceeded. | None | Press ON/ OFF button. |
| Internal driver defect | Internal driver is defective. | HW defect | No station/ branch test possible | Replace BT 200. |

# 8 Accessories and Replacement Parts

The following components can be ordered under their MLFB number.

| Designation/Picture | MLFB Number |
|---|---|
| Test connector  | 6EP8106-0AC20 |
| Log kit<br>for Win95/98/NT4<br>• CD-ROM in Ger/Eng/French<br>• Cable | 6ES7193-8MA00-0AA0 |
|  <br>Plug-in charger w. power pack for: 230 V AC<br>110 V AC | <br><br>6ES7193-8LA00-0AA0<br>6ES7193-8LB00-0AA0 |
| Battery with connection cable | 6EP8106-HA01 |
| Test-cable station test<br>9-pin sub D on<br>9-pin sub D (1 to 1) | 6EP8106-OHC01 |

# 9 Technical Data

| | |
|---|---|
| **General** | |
| Dimensions | 210 * 100 * 55 mm |
| Weight | 400 g |
| Battery capacity | ≥ 720 mAh |
| Life | ≥ 8 h |
| Voltage supply | NiCd, 4.8 V battery |
| Display | LCD, 2 * 16 characters |
| Baud rate | 9600 Bd to 12 MBd |
| Protection class | IP 20 |
| Measuring accuracy | Length measurement (+/-3m) |
| | |
| **Environmental Requirements** | |
| Operating temperature | + 5°C to +45°C |
| Storage temperature | -20°C to +60°C |
| Relative humidity | Maximal 95% / 24°C<br>Middle 75% / 17°C<br>(without condensation) |
| Air pressure<br>operation<br>storage | <br>795 to 1080 hPa<br>660 to 1080 hPa |
| | |
| **EMC guidelines** | |
| CE labeling | DIN EN 61326-1: 1998<br>EN 50 081-1<br>EN 50 082-2 |
| | |
| **Physical Requirements** | |
| Vibration during operation | IEC 1131-2 |
| Shock stress during operation | IEC 1131-2 |
| Free fall | IEC 1131-2/68-2-32 |
| | |
| Certifications | |
| UL | |
| CSA | |
| **Order number** | 6ES7 181-0AA01-0AA0 |

**Abbreviations**

| | |
|---|---|
| **Bd** | Baud (1 Bd = 1 character (bit/second) |
| **BT** | Physical bus test device |
| **CP** | Communications processor |
| **EMC** | Electromagnetic compatibility |
| **MBd** | 1 MBd = $10^6$ baud |
| **NiCd** | Nickel cadmium |
| **NN** | Miles above sea level |
| **OP** | Operator panel |
| **PG** | Programmer |
| **RTS** | Request to send |

## Info Info Info Info Info Info Info

This document can be downloaded free of charge from the Internet under the following URL:

http://www.ad.siemens.de/simatic-cs

Continuous current information on SIMATIC products is available on the Internet under:

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