

CANcheck

Installation Tester for CAN/CANopen Networks

MANUAL
ENGLISH



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Support

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Further international support contacts can be found on our webpage www.ixxat.com

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1 Introduction

1.1 Overview

The CANcheck allows simple testing of CAN networks during commissioning, maintenance and troubleshooting. The battery-operated, portable device is connected to the CAN network to be tested and operated via a clearly structured menu.

The CANcheck measures line parameters – with network switched off¹ – and operating parameters – with network switched on.

Via line parameters it is checked whether the CAN network was correctly installed. Short-circuits, interruptions and incorrect cable properties are quickly detected.

Via operating parameters it is checked whether the nodes in the CAN network are working correctly. Missing identifiers and poor signal levels are quickly detected and can be allocated to the individual CAN nodes.

¹ Generally in the case of tests of line parameters, all CAN nodes should be disconnected from the CAN network. Switched off nodes with a high internal resistance can remain connected.

1.2 Functions and Performance Features

Notice

HMS recommends to calibrate the CANcheck every two years to ensure the accuracy of measurement. For further information please contact HMS.

Tests of the Line Parameters with Network Switched Off

- Resistance measurement between all pins of the CAN connector (assignment in accordance with CiA) and analysis based on pre-defined limit values
- Measurement of the termination resistors
- Determination of the cable length
- Determination of the cable impedance

Tests of the Operating Parameters with Network Switched On

- Measurement of the voltage between CAN_V+ and CAN_GND
- Determination of the baudrate of the tested CAN network (list in accordance with CiA) and test of polarity
- Measurement of the bus load of the tested CAN network and of the proportion of error telegrams
- Operating mode layer 2: determination of all transmitted 11-bit and 29-bit identifiers and display of the frequency of reception
- Operating mode layer 2: absolute and differential signal level listed by identifier
- Operating mode CANopen: frequency of reception and signal level listed by node ID

Other Performance Features

- Summarized tests with test instructions, test result, continued after confirmation
- All test results are stored and can be seen on the display after the test
- Plausibility check of stored test results
- Permanent storage of up to 4 test results
- The test results can be transferred to the PC for printing and filing
- Test instructions and results in German or English
- Power save mode
- Power-on self-test of the device

1.3 Support

Read this manual before using the CANcheck.

For more information on our products, FAQ lists and installation tips, refer to the support section of our website (www.ixxat.com), which also contains information on current product versions and available updates.

If you have any further questions after studying the information on our website and the manuals, please contact our support department. The support section on our website contains the relevant forms for your support request. In order to facilitate our support work and enable a fast response, please provide precise information on the individual points and describe your question or problem in detail.

If you would prefer to contact our support department by phone, please also send a support request via our website first, so that our support department has the relevant information available.

1.4 Returning Hardware

In order to be able to process returns quickly and correctly, please apply for an RMA number before each return. Use our on-line "RMA form" for your application, which you can find on our website in the Support section.

After applying for the RMA number, you will receive a return delivery note from us, which you should enclose with your return delivery. In the case of returns without an RMA number or return delivery note, we reserve the right to return them at your expense.

A detailed description of the RMA procedure can be found on our website in the Support section.

2 Ports

The CANcheck has one CAN connector, one USB connector and a battery compartment. The trigger output is connected to 2 reserved pins of the CAN connector.

2.1 Pin Assignment

2.1.1 CAN Connector

The pin assignment on the CAN connector corresponds to CiA DS-102. The trigger output is connected to 2 pins, which are marked as “reserved” in CiA DS-102. The trigger output is galvanically isolated from the CANcheck ground and has an internal resistance of 1 kΩ.

Pin	Signal	Description
1	-	Reserved
2	CAN_L	CAN bus signal (dominant low)
3	CAN_GND	CAN ground
4	TRIGGER_SHLD	Return wire of the trigger output
5	CAN_SHLD	Optional shield
6	GND	Optional CAN ground
7	CAN_H	CAN bus signal (dominant high)
8	TRIGGER	Trigger output
9	CAN_V+	Optional external power supply Vcc

2.1.2 USB Connector

If the CANcheck and the PC are connected via USB, the device is supplied from the PC. The USB connector is galvanically isolated from the CANcheck ground.

Pin	Signal	Description
1	+5V	Power supply
2	D-	Negative data line
3	D+	Positive data line
4	GND	Ground

2.2 Battery Compartment

The CANcheck is powered by 4 x 1.5 V batteries or 4 x 1.2 V rechargeable batteries Mignon (AA). The battery compartment is on the back of the device. To replace the batteries a slotted screwdriver (blade width approx. 5 mm) is required. Use it to press the plastic spring of the catch together and carefully lift off the cover.

Note:

- The rechargeable batteries cannot be recharged via the USB connector. Remove the rechargeable batteries from the battery compartment and recharge them in a commercial battery charger.
- For rechargeable batteries, the capacity given by “Settings/Battery voltage” is not valid. It is only valid for batteries.
- For rechargeable batteries, check the voltage given by “Settings/Battery voltage”. Recharge the rechargeable batteries when the voltage drops below 4.8 V.

2.3 Trigger Output

When a configurable 11-bit or 29-bit-identifier or an error frame is received, the CANcheck generates a signal pulse on the trigger output. The signal pulse has the following properties:

- positive and negative signal pulse at the end of the telegram
- 10 V peak-peak without load

To use the trigger output, connect the CAN/trigger cable (see section 11.2) to the CANcheck. The SUB-D9 connector with CAN cable and BNC cable belongs to the CANcheck. The SUB-D9 connector with CAN cable belongs to the CAN network.

Usually, an oscilloscope is triggered by the trigger output. The telegram of the configured 11-bit or 29-bit identifier or the error frame is then displayed on the oscilloscope. In this way the level measurements of the CANcheck can be supplemented with measurements with the oscilloscope.

3 Operation

The CANcheck has a display and a keyboard. It is switched on and off via the keyboard.

3.1 Switching On and Off

Switch on the CANcheck by pressing any key for more than 1 second. The message “Self-test passed” appears for 1 second on the display. Then the information on the use of CANcheck is displayed (see chapter 11.4). Confirm this information with the **OK** key. Then the system menu is displayed.

In power save mode (default setting), the CANcheck automatically switches off after 10 minutes without a user input. Generally the CANcheck consumes little power while waiting for a user input.

To switch the CANcheck off immediately select the menu item **Settings** and the sub-item **Switch off**. Confirm the selection with **Off**.

3.2 Display

The CANcheck is equipped with a graphical display with 128 x 64 pixels. The display shows the menu items and the test results.

One header line and up to 6 lines of text are shown on the display. If the space is not sufficient, the content can be moved with the help of the keyboard.

The display has a background illumination. In the default setting the background illumination is switched off. To switch the background illumination on, select the menu item **Settings** and the sub-item **background illumination**. Select **Automatic** and confirm the selection.

In the **Automatic** setting, the backlight switches on every time a key is pressed and off again automatically after 20 seconds.

The background illumination is always switched on when the CANcheck is connected to a PC via a USB cable.

3.3 Keyboard

The CANcheck is operated via a keyboard with 6 membrane switches. Move the selection bar from menu item to menu item with the keys **UP** and **DOWN**. Confirm your selection with the **OK** key. The selected menu item then becomes the new header.

The CANcheck is operated via the system menu and sub-menus. Move from the system menu to the sub-menu with the **OK** key. Move back with the **ESC** key.

Every menu item and test can be cancelled with the **ESC** key.

If the pixels of the display are not sufficient, move the contents to the left or right with the keys **LEFT** and **RIGHT**. With long lists scroll through the text with the

keys **UP** and **DOWN**. The symbols ◀▲▼▶ in the header bar indicate whether moving and scrolling is supported.

In some sub-menus, virtual keys appear on the display. With the keys **UP** and **DOWN** change between the virtual keys shown above or below each other. With the keys **LEFT** and **RIGHT** change between virtual keys shown next to each other. The selected virtual key appears in black with white lettering.

In some sub-menus, numerical values can be entered. Change the values with the keys **UP** and **DOWN** and the decimal place with the keys **LEFT** and **RIGHT**. The selected place appears in black with a white numerical value.

4 Summarized Tests

The summarized tests are intended for the routine execution and repetition of the tests of CAN networks. The user receives test instructions before the test. When the CANcheck has checked the test result, the user receives one of the messages:

- TEST PASSED
- TEST FAILED

With some tests the CANcheck cannot check the test result because there are no generally valid nominal values for it. This applies to the cable length, the power supply, the baudrate and the bus load. After these tests the user receives the message:

- TEST EXECUTED

As soon as the user has acknowledged one of these messages, the test is continued.

Tests with the CAN network switched off are executed with the menu item **Line parameters**. With these tests it is checked whether the CAN network was correctly installed.

Tests with the CAN network switched on are executed with the menu item **Operating parameters**. With these tests it is checked whether the nodes in the CAN network are working correctly.

4.1 Line Parameters

To test the line parameters, connect the CANcheck – if possible – where one of the two termination resistors of the CAN network is located. With the Y cable connect the CANcheck between the CAN network and the termination resistor.

From the system menu, start the tests of the line parameters by selecting the relevant menu item and **OK**. With the keys **UP** and **DOWN**, move the selection bar from menu item to menu item. Confirm the selection with the **OK** key. The selected menu item becomes the new header.

System menu
-Line parameters
-Operat. parameters
-Individual tests
-Stored results
-Remote control
-Maintenance

If the test is started when the CAN network is switched on, the following error message is displayed, because tests of the line parameters are not possible when the CAN network is switched on.

Line parameters
Voltage detected on CAN bus
Test rejected

Return to the system menu with the **ESC** key. Start the next test with the CAN network switched off. The test instructions are displayed.

Wiring test
-Disconnect all nodes -Terminate CAN bus on both ends
OK Start test

The header shows that the wiring is tested first. The test instructions are to be understood as follows: generally for tests of the line parameters, all CAN nodes should be disconnected from the CAN network. Switched off CAN nodes that have a high resistance between CAN_H, CAN_L and ground may remain connected. As the resistors of all connected CAN nodes are parallel, however, the resistance of every individual CAN node must then be greater than the “number of CAN nodes” x 1 kΩ.

If this condition is met, press the **OK** key.

During the measurement a message appears.

Wiring test
Status: scanning

In the case of correct wiring, the message **TEST PASSED** and two virtual keys appear on the display at the end of the test.

```

Wiring test
-----
          TEST PASSED

NEXT          INFO
  
```

Start the next test with the virtual key **NEXT**. To look at the test results with the virtual key **INFO**, change to the virtual key **INFO** with the key **RIGHT**. This appears in black with white lettering. Confirm the selection with **OK**.

Here is the first part of a positive test result. The symbol ▼ in the header means that more lines follow. Scroll down with the key **DOWN**.

```

Wiring test ▼
-----
CAN_H ->
CAN_L   :    65Ω[OK]
CAN_GND : 1.56kΩ[OK]
CAN_SHLD: >1MΩ[OK]
GND     :    >1MΩ[OK]
  
```

Continue the tests of the line parameters by returning to the higher order menu with the **ESC** key. There start the next test with the virtual key **NEXT** and the **OK** key.

Before the measurement of the line impedance, the next test instructions are displayed:

```

Line impedance
-----
-Disconnect all nodes
-Remove termination R
  on near end

OK  Start test
  
```

The test instructions are to be understood as follows: the termination resistor must be removed from the line end to which the CANcheck is connected. The other line end must be terminated.

The line impedance can only be correctly measured if you have connected the CANcheck where normally one of the two termination resistors of the CAN network is located.

In the case of correct line impedance, the message **TEST PASSED** and the virtual keys **NEXT** and **INFO** appear in the display at the end of the test.

Line impedance
TEST PASSED
NEXT INFO

The stored test results can be seen at the end of the test.

Start the next test with the virtual key **NEXT** and the **OK** key. Before the measurement of the line length, the next test instructions are displayed:

Line length
-Disconnect all nodes -Remove termination R on both ends
OK Start test

If test instructions were not followed, the test result is negative.

Line length
TEST FAILED
NEXT INFO

With the virtual key **INFO** an error message is displayed. A more detailed error message is only given with the measurement of the line length as an individual test.

Line length
Test rejected

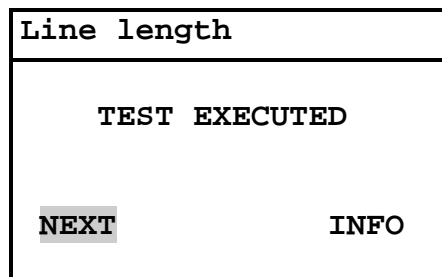
To receive an error-free test result, it is necessary to repeat the tests of the line parameters. Return to the system menu by pressing the **ESC** key twice. Start the tests of the line parameters by pressing the **OK** key.

Confirm the test instructions and the result of the wiring test as well as the test instructions and the result of the measurement of the termination resistors by pressing the **OK** key four times.

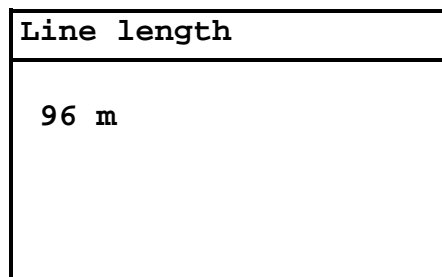
Remove the termination resistors at both ends of the CAN network. If switched off CAN nodes are still connected to the CAN network, the test is only possible if they have a high resistance between CAN_H, CAN_L and ground.

The line length can only be correctly measured if the CANcheck is connected to the line end, where normally one of the two termination resistors of the CAN network is located.

If the measurement is completed successfully, the message **TEST EXECUTED** is displayed. The CANcheck has consequently not checked the test result.



The test result is displayed with the virtual key **INFO**.



Continue the tests of the line parameters by returning to the higher order menu with the **ESC** key. Start the next test with the virtual key **NEXT** and the **OK** key. Now the termination resistor is measured. The test instructions are the same as for the wiring test.

Term. resistors
-Disconnect all nodes -Terminate CAN bus on both ends
OK Start test

In the case of correct termination resistors, the message **TEST PASSED** and two virtual keys appear in the display at the end of the test.

Term. resistors
TEST PASSED
END INFO

End the tests of the line parameters with the virtual key **END**. All test results can be displayed in **Stored results**.

4.2 Operating Parameters

To test the operating parameters, there are two ways to connect the CANcheck to the CAN network:

- If there is a free SUB-D9 socket in the CAN network, the CANcheck can be connected to this socket via the 1-to-1 cable.
- If this is not the case, the CANcheck can be looped in between any CAN node and the CAN network via the Y cable.

Operating parameters can be measured in two operating modes.

- In the operating mode “layer 2”, all 11-bit and 29-bit identifiers are measured. The signal levels are listed by identifier.
- In the operating mode “CANopen”, only those identifiers are measured from which the node ID clearly originates. The signal levels are listed by node ID.

4.2.1 Operating Mode Layer 2

Start the operational tests from the system menu by selecting the relevant menu item and **OK**. Move the selection bar from menu item to menu item with the keys **UP** and **DOWN**. Confirm the selection with the **OK** key. The first test becomes the new header.

First the power supply is measured. If the measurement is completed successfully, the message **TEST EXECUTED** appears in the display at the end of the test. The CANcheck has consequently not checked the test result.

```

System menu
-Line parameters
-Operat. parameters
-Individual tests
-Stored results
-Remote control
-Maintenance
    
```

```

Power supply

TEST EXECUTED

NEXT          INFO
    
```

Start the next test with the virtual key **NEXT**. First, however, we want to look at the test results with the virtual key **INFO**. For this, change to the virtual key **INFO** with the key **RIGHT**. This appears in black with white lettering. Confirm the selection with **OK**.

Power supply
CAN_V+ -> CAN_GND
0.0 V

Continue the operational tests by returning to the higher order menu with the **ESC** key. Start the baudrate detection with the virtual key **NEXT** and the **OK** key. If the display shows the following message, either all CAN nodes are switched off or they are not sending any telegrams.

Baudrate detection
Status: scanning
Wait for CAN traffic

In this case, cancel the test with the **ESC** key. Due to the cancellation, the test result is negative.

Baudrate detection
TEST FAILED
NEXT INFO

Via the virtual key **INFO** an error message is displayed.

Baudrate detection
Test rejected

To receive an error-free test result, it is necessary to repeat the operational tests. Return to the system menu by pressing the **ESC** key twice. Start the operational tests by pressing the **OK** key.

Acknowledge the result of the measurement of the power supply by pressing the **OK** key. Switch the CAN nodes on and ensure that the CAN nodes are sending telegrams.

When the baudrate detection is successfully completed, the message **TEST EXECUTED** is displayed. The CANcheck has consequently not checked the test result.

Baudrate detection	
TEST EXECUTED	
NEXT	INFO

Via **INFO** the test results are displayed.

Baudrate detection
500 kBit/s

If CAN_H and CAN_L are inverted in all nodes in the CAN network – even in this case communication is possible - the CANcheck detects the baudrate but classifies the polarity as erroneous. In this case the following error message appears:

Baudrate detection
H-L inverted [ERROR]
500 kBit/s

Continue the operational tests by returning to the higher order menu with the **ESC** key. Start the next test with the virtual key **NEXT** and the **OK** key.

Now the bus load and the error telegrams are measured. During the scan time (default setting 10 s) the current measured values are displayed every second. In this way changes can be observed.

Busload	
Scan time :	10 s
Bus load :	1 %
Error frames :	0 %

If the measurement is completed successfully, the message **TEST EXECUTED** is displayed. The CANcheck has consequently not checked the test result.

Bus load	
TEST EXECUTED	
NEXT	INFO

The test result are displayed via **INFO**. Here is the beginning of the table with minimum value, maximum value and average value. The symbols ▼► in the header show that there are more lines in the table. Scroll down the table with the key **DOWN**. To see the end of a long line, move the table in the display with the key **RIGHT**.

Busload ▼►		
Scan time : 20 s		
MIN	MAX	AVG
Bus load		

Continue the operational tests by returning to the higher order menu with the **ESC** key. Start the next test with the virtual key **NEXT** and the **OK** key.

In this test the CANcheck records all identifiers that are received during the scan time (default setting 10 s). Then the CANcheck measures the differential and absolute signal level for each identifier.

During the recording of the identifiers, the display shows the relevant header. The header changes as soon as the signal levels are measured.

Identifier scan
Status: scanning

Signal levels per id
Status: measuring

“Identifier scan” always lasts for the set scan time.

“Signal levels per identifier” lasts for the set maximum measuring time at the longest (default setting 60 s).

When the differential and the absolute signal levels of all identifiers have been measured as often as is required for the averaging (default setting 3 times), the measurement is already ended before the set measuring time has elapsed.

Note: it may take several minutes until the measurement is completed if identifiers are transmitted at short intervals one after another (approx. 11 μ s) or the number of identifiers is large (maximum 2048).

In the case of correct signal levels, **TEST PASSED** is displayed. The tolerance ranges for the differential and absolute signal level are given in section 11.1.

Signal levels per id
TEST PASSED
END INFO

End the operational tests with the virtual key **END**. You can now see all test results in **Stored results**.

4.2.2 Operating Mode CANopen

Section 4.2.1 shows the operational tests in the operating mode “layer 2”. This is the default setting.

Switch to operating mode “CANopen” by selecting the menu item **Settings** in the system menu and pressing the **OK** key. Then select the menu item **Operating mode** and press the **OK** key. With the key **DOWN** select “CANopen” and confirm with **OK**. Return to the system menu with the **ESC** key.

If the operational tests are repeated, only the results of the last test differ from section 4.2.1.

The CANcheck records the node IDs and not the message identifiers in the operating mode “CANopen”. According to CANopen standard, the node ID is uniquely contained:

- in the identifier, which the node sends with “Node guarding protocol” or with “Heartbeat protocol”
- in the identifier which the node transmits on access via the first server SDO and which is formed according to the “pre-defined connection set”

Node ID scan
Status: scanning

Signal levels per no
Status: measuring

Signal levels per no
TEST PASSED
END INFO

The operating mode “CANopen” has no effect on the tests of the line parameters.

5 Individual Tests

The summarized tests from section 4 can also be executed individually. In this way, “problematic” tests can be quickly repeated. If the test cannot be executed, a more detailed error message is displayed.

In the system menu, select the menu item **Individual tests** with the key **DOWN** and press the **OK** key. The symbol ▼ in the following header shows that the list of individual tests does not fit in the display. Scroll through the list with the key **DOWN**.

```
System menu
-Line parameters
-Operat. parameters
-Individual tests
-Results
-Remote control
-Maintenance
```

```
Individual tests ▼
-Wiring test
-Term. resistors
-Line length
-Line impedance
-Power supply
-Baudrate detection
```

```
Individual tests ▲▶
-Power supply
-Baudrate detection
-Identifier scan
-Bus load
-Signal levels per id
-Trigger output
```

Now select an individual test with the keys **UP** and **DOWN** and confirm with **OK**.

5.1 Wiring Test

In the wiring test the CANcheck measures the resistance between all line pairs on the CAN connector. The pin assignment of the CAN connector corresponds to CiA DS-102 (see section 2.1.1).

The CANcheck checks whether the resistance between CAN_H and CAN_L corresponds to the termination resistors. The tolerance range for the termination resistors is given in section 11.1.

For all other line pairs, the nominal value is “high resistance”. The tolerance range for “high resistance” is given in 11.1.

The following resistances are exceptions:

CAN_SHLD → CAN_GND

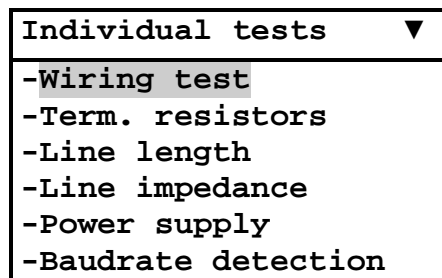
CAN_SHLD → GND

GND → CAN_GND

According to CiA, the lines CAN_SHLD and GND are optional. Therefore there are no nominal values for these resistances.

For the wiring test the CANcheck can be connected to the CAN network at any point. Switch the CAN network off before the wiring test and disconnect all CAN nodes from the network. Switched off CAN nodes with a high resistance between CAN_H, CAN_L and ground can remain connected. As the resistors of all connected CAN nodes are parallel, the resistance of every individual CAN node must then be greater than the “number of CAN nodes” x 1 kΩ.

Select the menu item **Wiring test** with the keys **UP** and **DOWN** and press the **OK** key.



When the CAN network is switched off, the test instructions appear. Error messages are explained in section 6. When the test instructions are executed, start the test with the **OK** key.

During the measurement, a message appears. After the measurement, the test result appears.

```

Wiring test
-----
-Disconnect all nodes
-Terminate CAN bus
  on both ends

OK  Start test
  
```

```

Wiring test
-----

Status: scanning
  
```

```

Wiring test ▼
-----
CAN_H ->
CAN_L   :    65Ω[OK]
CAN_GND : 1.56kΩ[OK]
CAN_SHLD: >1MΩ[OK]
GND     : >1MΩ[OK]
  
```

During the measurement, one line is taken as a reference (measuring point 1) and the resistance is measured against all other lines (measuring point 2).

The test result shows the measuring point 1 in the header. The list of the measuring points 2 follows with the resistance values. This is followed by a blank line.

The symbol ▼ in the header means that not all test results fit on the display. Scroll through the test results with the key **DOWN**.

```

Wiring test ▲▼
-----
CAN_L ->
CAN_GND : 1.54kΩ[OK]
CAN_SHLD: >1MΩ[OK]
GND     : >1MΩ[OK]

CAN_V+ ->
  
```

Wiring test ▲▼	
CAN_V+ ->	
CAN_H :	>1MΩ [OK]
CAN_L :	>1MΩ [OK]
CAN_GND :	>1MΩ [OK]
CAN_SHLD:	>1MΩ [OK]
GND :	>1MΩ [OK]

Wiring test ▲	
CAN_SHLD ->	
CAN_GND :	>1MΩ
GND :	>1MΩ
GND ->	
CAN_GND :	>1MΩ

Note:

With measuring points CAN_SHLD and GND, the result is not analyzed because these lines are optional.

5.2 Termination Resistors

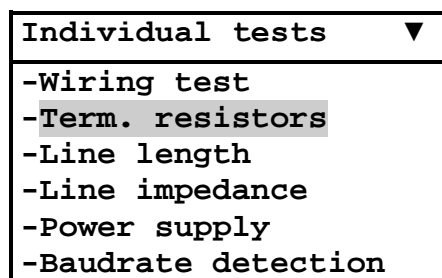
In the test of the termination resistors the CANcheck measures the resistance between CAN_H and CAN_L on the CAN connector. The pin assignment of the CAN connector corresponds to CiA DS-102 (see section 2.1.1).

The CANcheck checks whether the resistance of the parallel circuit of two termination resistors between CAN_H and CAN_L is measured with 120 Ω in each case. The tolerance range for the termination resistors is given in section 11.1.

CANcheck does not check the number of termination resistors. One termination resistor with 60 Ω or three termination resistors with 180 Ω each therefore also produces a positive test result. In these cases, negative test results can be expected in the operational tests in sections 5.9 and 5.10.

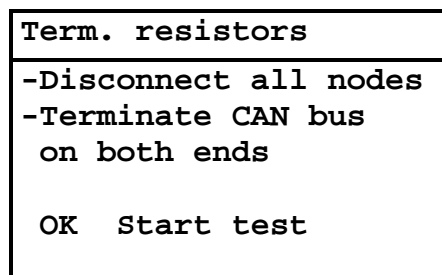
For the test of the termination resistors connect the CANcheck to the CAN network at any point. Switch the CAN network off before the test and disconnect all CAN nodes from the network. Switched off CAN nodes with a high resistance between CAN_H, CAN_L and ground can remain connected. As the resistors of all connected CAN nodes are parallel, the resistance of every individual CAN node must then be greater than the “number of CAN nodes” x 1 k Ω .

Select the menu item **termination resistors** with the keys **UP** and **DOWN** and press the **OK** key.



When the CAN network is switched off, the test instructions appear. Error messages are explained in section 6. When the test instructions are executed, start the test with the **OK** key.

During the measurement, a message appears. After the measurement, the test result appears.



Term. resistors
Status: scanning

Term. resistors
65 Ω [OK]

5.3 Line Length

The CANcheck determines the line length with the aid of the adjusted velocity of propagation on the cable. Stub lines in the CAN network may falsify the test result. The measurement is repeated as often as is required for the averaging (default setting 3 times).

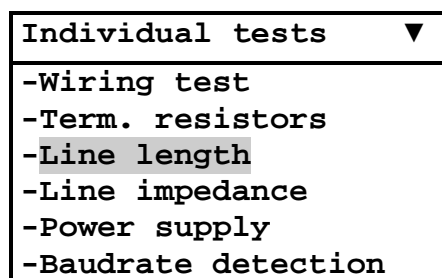
The velocity of propagation is a property of the cable used in your CAN network. The default setting of the velocity of propagation is: $66\% \times c$, with $c = 299792458$ m/s (velocity of light). This corresponds to the specific signal delay of 5.05 ns/m. If the CANcheck displays a line length that does not correspond to the line length that you have measured manually this may be due to an improper adjustment of the velocity of propagation. In that case you must adapt the velocity of propagation. This is done via the menu item **Settings**.

Multiply the adjusted velocity of propagation with the ratio "line length measured manually" / "line length displayed by CANcheck" and overwrite the adjusted velocity of propagation with the new setting.

For the test of the line length, remove the two termination resistors of the CAN network. These are normally located on the line ends. Connect the CANcheck in the place of a termination resistor. The other end remains open.

Switch the CAN network off before the test and disconnect all CAN nodes from the network. Switched off CAN nodes with a high resistance between CAN_H, CAN_L and ground can remain connected. As the resistors of all connected CAN nodes are parallel, the resistance of every individual CAN node must then be greater than the "number of CAN nodes" x 1 k Ω .

Select the menu item **Line length** with the keys **UP** and **DOWN** and press the **OK** key.



When the CAN network is switched off, the test instructions appear. Error messages are explained in section 6. When the test instructions are executed, start the test with the **OK** key.

During the measurement a message appears. After the measurement the test result appears.

Line length
-Disconnect all nodes -Remove termination R on both ends OK Start test

Line length
Status: scanning

Line length
96 m

5.4 Line Impedance

The CANcheck determines the line impedance via a method of approximation. Plug-in connections, stub lines and connected CAN nodes may falsify the test result.

The CANcheck checks whether the line impedance is in the tolerance range. The tolerance range for the line impedance is given in 11.1. The minimum required CAN cable length for a measurement of the cable impedance is 20 m.

For the test of the line impedance, remove one of the two termination resistors of the CAN network and connect the CANcheck in its place. Switch the CAN network off before the test and disconnect all CAN nodes from the network. Switched off CAN nodes with a high resistance between CAN_H, CAN_L and ground can remain connected. As the resistors of all connected CAN nodes are parallel, the resistance of each individual CAN node must then be greater than the “number of CAN nodes” x 1 kΩ.

Select the menu item **Line impedance** with the keys **UP** and **DOWN** and press the **OK** key.

```
Individual tests ▼
-Wiring test
-Term. resistors
-Line length
-Line impedance
-Power supply
-Baudrate detection
```

When the CAN network is switched off, the test instructions appear. Error messages are explained in 6. When you have followed the test instructions, start the test with the **OK** key.

During the measurement, a message appears. After the measurement, the test result appears.

```
Line impedance
-Disconnect all nodes
-Remove termination R
on near end

OK Start test
```


Line impedance
Status: scanning

Line impedance
117 Ω [OK]

5.5 Power Supply

In this test the voltage between CAN_V+ and CAN_GND is measured. The measuring range is given in section 11.1.

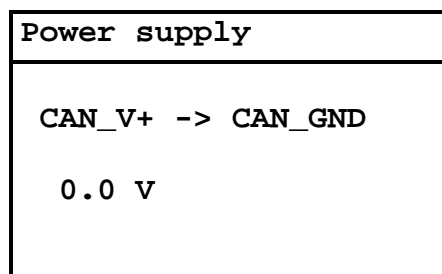
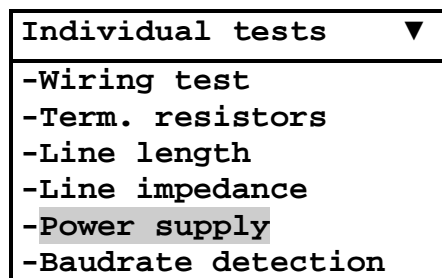
The measurement is not analyzed because the external power supply via CAN_V+ is optional.

For the measurement of the power supply, the CANcheck can be connected to the CAN network at any point.

- If there is a free SUB-D9 socket in the CAN network, the CANcheck can be connected to this socket via the 1-to-1 cable.
- If this is not the case, you the CANcheck can be looped in between any CAN node and the CAN network via the Y cable.

Before measuring the power supply, put the CAN network into operation.

Select the menu item **Power supply** with the keys **UP** and **DOWN** and press the **OK** key. Then the test result is displayed immediately.



Note:

- Voltage levels greater than 0 V can be measured if the line CAN_V+ is included in the cable but not connected. By capacitive coupling, the CAN traffic can generate a voltage that is measured by the CANcheck due to its high input resistance. The voltage is 0 V if CAN_V+ and CAN_GND are connected with a resistor of 10 kΩ or less.

5.6 Baudrate Detection

The CANcheck can automatically detect the baudrate of the CAN network. The CANcheck attempts to receive telegrams from the CAN network with every supported baudrate. As soon as reception is successful, the baudrate is displayed. The list of the supported baudrates is given in section 11.1.

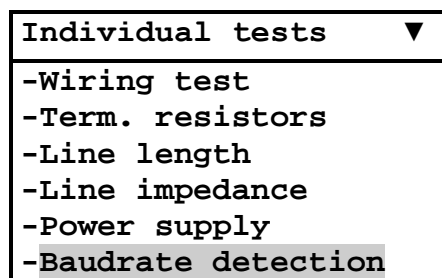
CANcheck checks the polarity of the signal on CAN_H and CAN_L. If the CANcheck detects that CAN_H and CAN_L are not connected in accordance with CiA DS-102, the message: "H-L inverted [ERROR]" appears.

For the measurement of the baudrate, the CANcheck can be connected to the CAN network at any point:

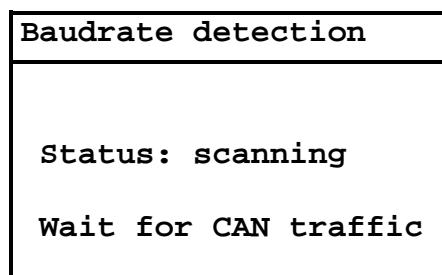
- If there is a free SUB-D9 socket in the CAN network, the CANcheck can be connected to this socket via the 1-to-1 cable.
- If this is not the case, the CANcheck can be looped in between any CAN node and the CAN network via the Y cable.

Before starting baudrate detection put the CAN network into operation.

Select the menu item **Baud rate detection** with the keys **UP** and **DOWN** and press the **OK** key.



During the measurement, a message appears. After the measurement, the test result appears. Error messages are explained in section 6.



Baudrate detection
500 kBit/s

Note: the test is only correctly ended when a baudrate is detected. If the CANcheck has not completed baudrate detection within a few seconds, cancel the test with the **ESC** key and check:

- whether the CAN network is operational
- whether CAN network works with a supported baudrate (see section 11.1)

5.7 Layer 2 – Identifier Scan

In the operating mode “layer 2” (default setting), the CANcheck scans for message identifiers transmitted via the CAN network. During the scan time (default setting 10 s) the CANcheck generates a list of identifiers and counters that indicate how often the identifiers were recorded.

If the identifiers in the CAN network in use are repeated with a period longer than 10 s, change the scan time via the menu item **Settings**.

The identifiers can be presented in decimal or hexadecimal format. Select the preferred format via the menu item **Settings**.

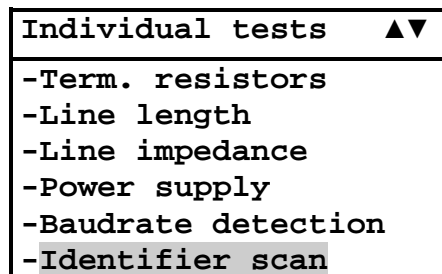
The CANcheck records both 11-bit-identifiers and 29-bit identifiers. The length of the list with identifiers and counters is limited to the value given in section 11.1.

For the identifier scan, the CANcheck can be connected to the CAN network at any point:

- If there is a free SUB-D9 socket in the CAN network, the CANcheck can be connected to this socket via the 1-to-1 cable.
- If this is not the case, you the CANcheck can be looped in between any CAN node and the CAN network via the Y cable.

Before starting the identifier scan put the CAN network into operation.

Select the menu item **Identifier scan** with the keys **UP** and **DOWN** and press the **OK** key.



During the measurement, first the baudrate is detected and the relevant message appears. Then the scan for identifiers is carried out and a further message appears.

After the measurement the test result appears. Only the beginning of the list is shown here. Scroll through the list with the keys **UP** and **DOWN**.

Error messages are explained in section 6.

Baudrate detection
Status: scanning
Wait for CAN traffic

Identifier scan
Status: scanning

Identifier scan ▼
Scan time : 20 s
S : Standard ID
E : Extended ID
ID : Count
S 386 : 83
S 388 : 83

If the hexadecimal format is selected, the following list is displayed. Identifiers in hexadecimal are distinguished by the suffix “h”.

Identifier scan ▼
Scan time : 20 s
S : Standard ID
E : Extended ID
ID : Count
S 182h: 83
S 184h: 83

5.8 CANopen – Node ID Scan

In the operating mode “CANopen” (selected via the menu item **Settings**), the CANcheck scans for CANopen node IDs transmitted via the CAN network. The CANcheck only analyzes the following identifiers:

- Identifier that the node transmits with the “Node guarding protocol” or “Heartbeat protocol”
- Identifier that the node transmits with access via the first server SDO and which is formed according to the “Pre-defined connection set”

Because the node ID is clearly contained in these identifiers. The condition for the recording of node IDs is that the relevant messages are transmitted via the bus. During the scan time (default setting 10 s) the CANcheck generates a list of node IDs and counters that state how often the node IDs are recorded.

If the above-mentioned identifiers are repeated in the CAN network in use with a period of more than 10 s, change the scan time via the menu item **Settings**.

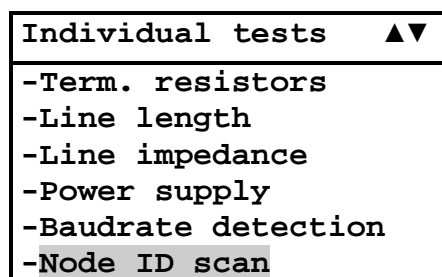
The length of the list with node IDs and counters is limited to the value given in section 11.1.

For the node ID scan, the CANcheck can be connected to the CAN network at any point:

- If there is a free SUB-D9 socket in the CAN network, the CANcheck can be connected to this socket via the 1-to-1 cable.
- If this is not the case, the CANcheck can be looped in between any CAN node and the CAN network via the Y cable.

Before starting the node ID scan put the CAN network into operation.

Select the menu item **Node ID scan** with the keys **UP** and **DOWN** and press the **OK** key.



During the measurement, first the baudrate is detected and the relevant message appears. Then the node ID scan is carried out and a further message appears.

After the measurement, the test result appears. Only the beginning of the list is shown here. Scroll through the list with the keys **UP** and **DOWN**.

Error messages are explained in section 6.

Baudrate detection
Status: scanning Wait for CAN traffic

Node ID scan
Status: scanning

Node ID scan	▼
Scan time : 20 s	
Node ID : Count	
2 : 96	
4 : 95	
7 : 17	
23 : 18	

5.9 Bus Load

The CANcheck determines the bus load by recording all messages on the CAN network during the scan time (default setting 10 s). When determining the bus load the CANcheck takes account of CAN messages and error telegrams received.

During the scan time the CANcheck displays the bus load “online”. In this way a fluctuating bus load can be detected.

To observe the bus load in the CAN network in use over a longer period, change the scan time via the menu item **Settings**.

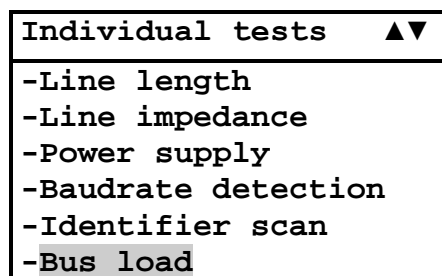
At the end of the scan time the CANcheck provides a table with the bus load and the error telegrams.

For the measurement of the bus load the CANcheck can be connected to the CAN network at any point:

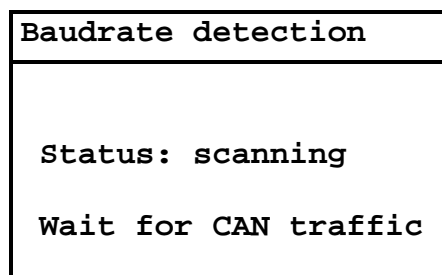
- If there is a free SUB-D9 socket in the CAN network, the CANcheck can be connected to this socket via the 1-to-1 cable.
- If this is not the case, you the CANcheck can be looped in between any CAN node and the CAN network via the Y cable.

Before measuring the bus load put the CAN network into operation.

Select the menu item **Bus load** with the keys **UP** and **DOWN** and press the **OK** key.



During the measurement, the baudrate is detected and the relevant message appears. Then the bus load is measured and the interim results are shown “online”.



Busload	
Scan time :	20 s
Bus load :	1 %
Error frames :	0 %

After the measurement, the test result appears. The symbols ▼► in the header shows that not all test results fit in the display. Scroll through the list with the key **DOWN**.

The table contains the following test results in each case as minimum value, maximum value and average value:

- Bus load Unit: per cent
- All messages Unit: frames per second
- Error telegrams Unit: frames per second
- Ratio of errors to all messages Unit: per cent

Error messages are explained in section 6.

```

Busload ▼►
Scan time : 20 s

MIN    MAX    AVG
Bus load
    
```

```

Busload ▼▲►
Bus load
    1     1     1  %
Total frames
    
```

```

Busload ▼▲►
Total frames
 125   131   127  F/
Error frames
    
```

```

Busload ▼▲►
Error frames
    0     0     0  F/
Error/Total frames
    
```

```

Busload ▲►
    0     0     0  F/
Error/Total frames
    0     0     0  %
    
```

5.10 Layer 2 – Signal Levels per Identifier

In the operating mode “layer 2” (default setting), the CANcheck measures the differential and absolute signal level of all recorded message identifiers. The CANcheck generates a list of identifiers during the scan time (default setting 10 s). Then the CANcheck measures the differential and absolute signal level for each recorded identifier separately as often as averaging requires (default setting 3).

The absolute signal level can only be measured if the CAN_GND line has been connected in your CAN network. If the CAN_GND line is not connected the CANcheck always shows the nominal absolute signal level.

If the identifiers in the CAN network in use are repeated with a period longer than 10 s, change the scan time via the menu item **Settings**. Averaging can also be changed via the menu item **Settings**.

The identifiers can be presented in decimal or hexadecimal format. Select the preferred format via the menu item **Settings**.

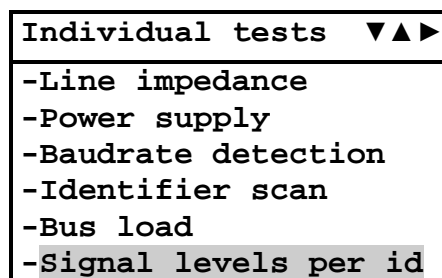
The CANcheck analyzes the signal level for each identifier separately. The limits are given in section 11.1. In this way you can detect identifiers that are transmitted with a weak signal level and may be causes of transmission errors.

To allocate an identifier to a CAN node, the allocation between identifier and CAN nodes in the CAN network is required. The CANcheck can only determine the allocation if the CAN network works according to the CANopen standard (see section 5.11).

For the measurement of the signal level the CANcheck can be connected to the CAN network at any point:

- If there is a free SUB-D9 socket in the CAN network, the CANcheck can be connected to this socket via the 1-to-1 cable.
- If this is not the case, the CANcheck can be looped in between any CAN node and the CAN network via the Y cable.

Before starting measuring the signal level put the CAN network into operation. Select the menu item **Signal per identifier** with the keys **UP** and **DOWN** and press the **OK** key.



During the measurement, the baudrate is detected and the relevant message appears. Then the scan for identifiers is carried out and a second message appears. The signal levels are measured and a third message appears.

```
Baudrate detection
-----
Status: scanning
Wait for CAN traffic
```

```
Identifier scan
-----
Status: scanning
```

```
Signal levels per id
-----
Status: measuring
```

After the measurement the test result appears. Only the beginning of the list is shown here. Scroll through the list with the keys **UP** and **DOWN**.

Error messages are explained in section 6.

```
Signal levels per  ▼
S : Standard ID
E : Extended ID
Vd: CAN_H -> CAN_L
Va: CAN_H -> CAN_GND
17 Identifiers found
17 Identifiers OK
```

Signal levels per ▼▲	
17 Identifiers OK	
0 Identifiers ERROR	
S	386 : 2.0Vd[OK] : 3.5Va[OK]
S	388 : 1.9Vd[OK] : 3.5Va[OK]

The following list is shown if the hexadecimal format is selected. Identifiers in hexadecimal are distinguished by the suffix “h”.

Signal levels per ▼▲	
17 Identifiers OK	
0 Identifiers ERROR	
S	182h: 2.0Vd[OK] : 3.5Va[OK]
S	184h: 1.9Vd[OK] : 3.5Va[OK]

Note:

- Identifier scan always lasts for the set scan time.
- Measurement of the signal level lasts for the set maximum measuring time at the longest.
- When the differential and the absolute signal level of all identifiers have been measured as often as is required for averaging (default setting 3 times), the measurement is already ended before the set measuring time has elapsed.
- If identifiers are transmitted at short intervals one after the other (approx. 11 µs) or in the case of a large number of identifiers (max. 2048), several minutes may elapse before measurement is completed.
- For signal level measurement, the identifiers must appear frequently enough during the set maximum measuring time, i.e. they must be periodic. If the CANcheck utilizes the maximum measurement time, this is an indication of non-periodic identifiers. The signal levels of non-periodic identifiers are not available. They are displayed as follows:
 -.- Vd [PER?] or -.- Va [PER?]. PER is the abbreviation of period.
- For signal level measurement, the CAN message must have the data length code 1 or greater because in general one bit of the first data byte is required. In addition, the bit stream after the identifier must include two dominant bits in a sequence. The signal levels of identifiers that do not meet these requirements are not available. They are displayed as follows:
 -.- Vd [BIT?] or -.- Va [BIT?].

5.11 CANopen – Signal Levels per Node ID

In the operating mode “CANopen” (selected via the menu item **Settings**), the CANcheck measures the differential and the absolute signal levels of all recorded node IDs. First the CANcheck generates a list of node IDs during the scan time (default setting 10 s). This is only possible if the nodes transmit the following identifiers:

- Identifier that the node transmits with “Node guarding protocol” or with “Heartbeat protocol”

- or -

- Identifier that the node transmits with access via the first server SDO and that is formed according to the “Pre-defined connection set”.

Then the CANcheck measures the differential and absolute signal levels for every recorded node ID separately as often as averaging requires (default setting 3).

The absolute signal level can only be measured if the CAN_GND line is connected in the CAN network in use. If the CAN_GND line is not connected the CANcheck always shows the nominal absolute signal level.

If the above-mentioned identifiers are repeated in the CAN network with a period of more than 10 s, t change the scan time via the menu item **Settings**. Averaging can also be changed via the menu item **Settings**.

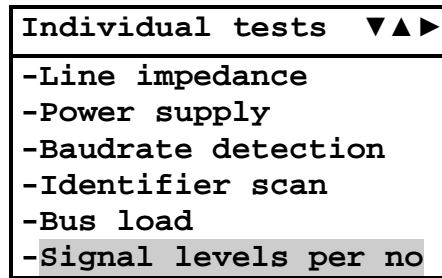
The CANcheck analyzes the signal level for each identifier separately. The limits are given in section 11.1. In this way identifiers can be detected that are transmitted with a weak signal level and may be causes of transmission errors.

For measurement of the signal levels, the CANcheck can be connected to the CAN network at any point.

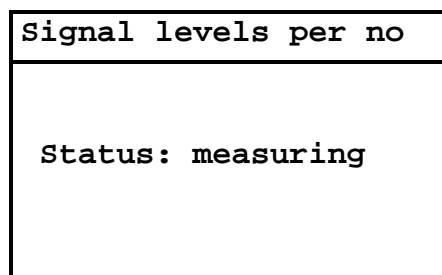
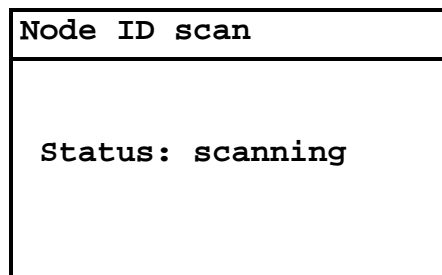
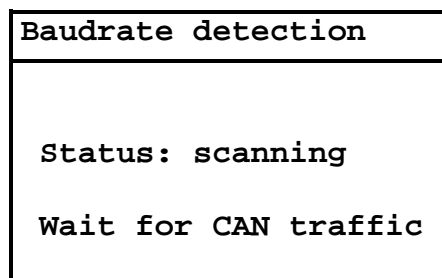
- If there is a free SUB-D9 socket in the CAN network, the CANcheck can be connected to this socket via the 1-to-1 cable.
- If this is not the case, the CANcheck can be looped in between any CAN node and the CAN network via the Y cable.

Before starting the measurement of the signal levels put the CAN network into operation.

Select the menu item **Signal level per node ID** with the keys **UP** and **DOWN** and press the **OK** key.



During the measurement, the baudrate is detected and the relevant message appears. Then the scan for node IDs is carried out and a second message appears. The signal levels are measured and a third message appears.



After the measurement the test result appears. The beginning of the list is shown here. Scroll through the list with the keys **UP** and **DOWN**.

Error messages are explained in section 6.

Signal levels per ▼
N= Node ID
Vd: CAN_H -> CAN_L
Va: CAN_H -> CAN_GND
7 Node IDs found
7 Node IDs OK
0 Node IDs ERROR

Signal levels per ▼▲
N 2: 1.9Vd[OK] : 3.5Va[OK]
N 4: 1.9Vd[OK] : 3.5Va[OK]
N 7: 1.8Vd[OK] : 3.7Va[OK]

Note:

- Scan of the node IDs always lasts for the pre-set scan time.
- Measurement of the signal levels lasts for the set maximum measuring time at the longest.
- When the differential and the absolute signal levels of all identifiers are measured as often as is required for averaging (default setting 3), the measurement is already ended before the set measuring time has elapsed.
- If identifiers are transmitted at short intervals one after the other (approx. 11 µs) or in the case of a large number of node IDs (max. 127), several minutes may elapse before measurement is completed.
- For signal level measurement, the node IDs must appear frequently enough during set maximum measuring time, i. e. they must be periodic. If the CANcheck utilizes the maximum measuring time, this is an indication of non-periodic node IDs. The signal levels of non-periodic node IDs are not available. They are displayed as follows:
 -.- Vd [PER?] or -.- Va [PER?]. PER is the abbreviation of period.
- For signal level measurement, the CAN message must have the data length code 1 or greater because in general one bit of the first data byte is required. In addition, the bit stream after the node ID must include two dominant bits in a sequence. The signal levels of node IDs that do not meet these requirements are not available. They are displayed as follows:
 -.- Vd [BIT?] or -.- Va [BIT?].

5.12 Trigger Output

This test generates a trigger pulse if a pre-set 11-bit or 29-bit identifier or an error frame appears on the CAN network. With the trigger pulse (for properties, see section 2.3) an oscilloscope can be triggered. The telegram of the set 11-bit or 29-bit identifier or the error frame is displayed on the oscilloscope. In this way the level measurements of the CANcheck can be supplemented with measurements with the oscilloscope, for example to detect signal errors.

The identifier can be entered in decimal or hexadecimal format. Select the preferred format via the menu item **Settings**.

To use the trigger output, the CANcheck can be connected to the CAN network at any point:

- Connect the CAN/trigger cable (see section 11.2) to the CANcheck. The SUB-D9 connector with CAN cable and BNC cable belongs to the CANcheck. The SUB-D9 connector with CAN cable belongs to the CAN network.
- If there is a free SUB-D9 socket in the CAN network, the CANcheck can be connected to this socket with the SUB-D9 connector with CAN cable.
- If this is not the case, in the Y cable can be looped between any CAN node and the CAN network. Connect the CANcheck to the Y cable with the SUB-D9 connector with CAN cable.

Before using the trigger output, put the CAN network into operation.

Select the menu item **Trigger output** with the keys **UP** and **DOWN** and press the **OK** key.

```
Individual tests
- Power supply
- Baudrate detection
- Identifier scan
- Bus load
- Signal levels per id
- Trigger output
```

Select either 11-bit identifier or 29-bit identifier or error frame with the keys **UP** and **DOWN** and press the **OK** key.

```
Trigger output
- 11 Bit ID
- 29 Bit ID
- Error Frame
```

If 11-bit or 29-bit identifier is selected the identifier must be set. Select the place in the identifier with the keys **LEFT** and **RIGHT**. Change the value with the keys **UP** and **DOWN**. Confirm the selection with the **OK** key.

A message is displayed. Now it is possible to measure the trigger signal on the BNC connector of the CAN/trigger cable.

Trigger output
Use keys to change Trig ID: 0000

Trigger output
Status: triggering

The following text is displayed if the hexadecimal format is selected. Identifiers in hexadecimal are distinguished by the suffix "h".

Trigger output
Use keys to change Trig ID: 000 h

Note:

- The selected 11-bit or 29-bit identifier must be present on the CAN network.

6 Error Messages and Indications

6.1 Error Message after Switching On

```
Self test
failed
Error 1
```

```
FAIL
-Settings
```

The CANcheck executes a self-test, when it is switched on. If the self-test fails, the message “Self test failed Error <no.>” appears for approx. 2 seconds. Then **FAIL** appears in the header. The only supported menu item is **Settings**.

Error number 1 means that the battery voltage is too low. With the menu item **Settings** check the battery voltage. Replace batteries if the battery voltage is less than 4.0 V.

6.2 Error Messages when CAN Nodes Are Not Switched Off

```
Wiring test

Voltage detected
on CAN bus

Test rejected
```

Term. resistors
Voltage detected on CAN bus
Test rejected

Line length
Voltage detected on CAN bus
Test rejected

Line impedance
Voltage detected on CAN bus
Test rejected

If the CAN nodes are not switched off, the CANcheck detects voltage (e.g. the recessive level) on the CAN bus. With tests that require a switched off CAN node, one of the above error messages appears.

Cancel the test with the **ESC** key and switch off the CAN nodes.

Note: only switched off nodes with a high resistance between CAN_H, CAN_L and ground can remain connected (see section 6.3).

6.3 Error Message with Low-Impedance Resistance

Line length
Term. resistors lower than 1k Ω
Test rejected

Before measurement of the line length, the resistance between CAN_H and CAN_L is measured. If this is not high resistance, the above error message is displayed.

Cancel the test with the **ESC** key, remove both termination resistors and disconnect all CAN nodes from the network. Switched off CAN nodes with a high resistance between CAN_H, CAN_L and ground can remain connected. As the resistors of all connected CAN nodes are parallel, the resistance off each individual CAN node must be greater than the “number of CAN nodes” x 1 kΩ.

6.4 Error Message with Inverted Polarity

Baudrate detection
H-L inverted [ERROR]
500 kBit/s

The polarity of the signal between CAN_H and CAN_L is checked with baudrate detection and the dependent tests:

- Identifier scan
- Node ID scan
- Bus load
- Signal level per identifier
- Signal level per node ID
- Trigger output

If the polarity is inverted, the above error message is displayed. In this case the dependent tests cannot be carried out.

Check whether the CAN network in use generally works with inverted polarity. If this is the case, change the CAN network to not inverted polarity. If this is not possible, carry out the dependent tests with the CANcheck with a special adapter that exchanges CAN_H and CAN_L.

The adapter must be connected between CANcheck and CAN network. It consists of one SUB-D9-socket and one SUB-D9-connector. Pins 1, 3, 4, 5, 6, 8, 9 of socket and connector are connected 1-to-1. Pin 2 of the socket is connected to Pin 7 of the connector. Pin 7 of the socket is connected to Pin 2 of the connector.

6.5 Error Message after Cancelling a Test

Baudrate detection
Test rejected

If the tests dependent on the baudrate detection (see section 6.4) are canceled with the **ESC** key during baudrate detection, the above error message appears. In this case the baudrate detection has failed and no test result is displayed.

In this case, check whether:

- the CAN network is operational
- the CAN network works with a supported baudrate (see section 11.1)

6.6 Error Message with Missing Results

Plausibility check
Not possible Missing results: Baudrate detection Signal level per ID

Plausibility check
Not possible Missing results: Line length Term. resistors

The preconditions for the plausibility check are:

- Either: Results of the summarized tests of the line parameters and the operating parameters
- Or: Results of the individual tests:
 - Termination resistors
 - Line length
 - Signal levels per identifier (includes baudrate detection)

The plausibility check is not possible if one result or more are missing. Then an error message and the list of the missing tests is presented.

In this case, execute the missing tests and repeat the plausibility check.

6.7 Indication of a Non-Periodic Identifier

```

Signal levels per ▼
S : Standard ID
E : Extended ID
Vd: CAN_H -> CAN_L
Va: CAN_H -> CAN_GND
17 Identifiers found
15 Identifiers OK
    
```

```

Signal levels per ▼▲
15 Identifiers OK
 2 Identifiers PER?
 0 Identifiers ERROR
S 386 : 2.0Vd[OK]
      : 3.5Va[OK]
S 388 : 1.9Vd[OK]
    
```

```

Signal levels per ▲
S 1824 : 2.0Vd[OK]
        : -.-Va[PER?]
S 1840 : 2.3Vd[OK]
        : -.-Va[PER?]
S 1919 : 2.5Vd[OK]
        : 3.9Va[OK]
    
```

For the signal level per identifier measurement, the identifiers must appear frequently enough² during the maximum measurement time, i.e. they must be periodic. If the CANcheck utilizes the maximum measurement time, this is an indication of non-periodic identifiers. Then, the following line gives an indication of the non-periodic identifiers:

<number> Identifiers PER? PER is the abbreviation of period.

The signal levels of these identifiers are not available. The list with the signal levels shows the affected identifiers as follows:

```

<identifier> : -.- Vd [PER?]
              : -.- Va [PER?]
    
```

It is possible, that the identifier was present during the Vd measurement but absent during the Va measurement. Then a signal level for Vd is shown but not for Va. This case is depicted above.

The PER? indication is not an error message but it means that the CANcheck is not able to check one or more signal levels. The CAN network may be perfect.

² Every identifier must be measured averaging factor x 2 times. Averaging factor 3 is default.

If the identifiers are periodic despite the indication increment the maximum measurement time using the menu item **Settings**.

In operating mode “CANopen” the PER? indication is presented as follows.

```
Signal levels per ▼
N= Node ID
Vd: CAN_H -> CAN_L
Va: CAN_H -> CAN_GND
7 Node IDs found
5 Node IDs OK
2 Node IDs PER?
```

```
Signal levels per ▼▲
N 32: 2.3Vd[OK]
      : --Va[PER?]
N 48: 2.3Vd[OK]
      : --Va[PER?]
N 127: 2.5Vd[OK]
      : 3.9Va[OK]
```

Note: One-off identifiers can only be measured with the trigger output and an oscilloscope (see section 5.12).

6.8 Indication of an Identifier without Usable Bits

```
Signal levels per ▼
S : Standard ID
E : Extended ID
Vd: CAN_H -> CAN_L
Va: CAN_H -> CAN_GND
17 Identifiers found
16 Identifiers OK
```

```
Signal levels per ▼▲
16 Identifiers OK
1 Identifiers BIT?
0 Identifiers ERROR
S 386 : 2.0Vd[OK]
      : 3.5Va[OK]
S 388 : 1.9Vd[OK]
```

Signal levels per ▲	
S 1840	: 2.3Vd[OK] : 3.7Va[OK]
S 1911	: -.-Vd[BIT?] : -.-Va[BIT?]
S 1919	: 2.5Vd[OK] : 3.9Va[OK]

For signal level measurement, the CAN message must have the data length code 1 or greater because in general one bit of the first data byte is required. In addition, the bit stream after the identifier must include two dominant bits in a sequence. If these conditions are not met the following line gives an indication of the non-usable bits:

<number> Identifiers BIT?

The signal levels of these identifiers are not available. The list with the signal levels shows the affected identifiers as follows:

<identifier> : -.- Vd [BIT?]
: -.- Va [BIT?]

The BIT? indication is not an error message but it shows that the CANcheck is not able to check one or more signal levels. The CAN network may be perfect.

To achieve a result, make sure that dominant bits in the first data byte. If the bits in the first data byte are random anyway it is sufficient to repeat the test once or more often. One of these tests measures a bit stream with two dominant bits in a sequence.

In operating mode “CANopen” the BIT? indication is presented as follows.

Signal levels per ▼	
N=	Node ID
Vd:	CAN_H -> CAN_L
Va:	CAN_H -> CAN_GND
7 Node IDs found	
6 Node IDs OK	
1 Node IDs BIT?	

Signal levels per ▼▲	
N 48	: 2.3Vd[OK] : 3.7Va[OK]
N 119	: -.-Vd[BIT?] : -.-Va[BIT?]
N 127	: 2.5Vd[OK] : 3.9Va[OK]

Note: The signal level measurement is not possible if the CAN message has the data length code 0, i.e. if no data byte is included.

7 Results

Via the menu item **Results**, it is possible to view the test results, to store the test results to a file and to check the plausibility of the test results.

Select the menu item **Results** with the keys **UP** and **DOWN** and press the **OK** key. Now you select the test result handling with the keys **UP** and **DOWN** and confirm with **OK** key.

```
System menu
-----
-Line parameters
-Operat. parameters
-Individual tests
-Results
-Remote control
-Maintenance
```

```
Results
-----
-Show
-Delete
-Store to file
-Load from file
-Delete file
-Plausibility check
```

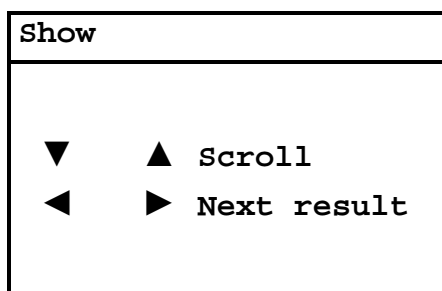
7.1 Show and Delete

You can choose between **Show** and **Delete** test results with the keys **UP** and **DOWN**. It makes no difference whether the test results were achieved via the user interface, via the individual tests or via loading from file.

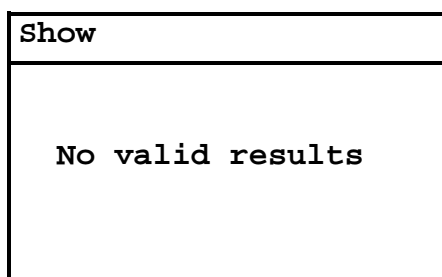
If **Show** is selected, the new function of the keys is shown:

- Scroll through the text with the keys **UP** and **DOWN**.
- Change from test result to test result with the keys **LEFT** and **RIGHT**.

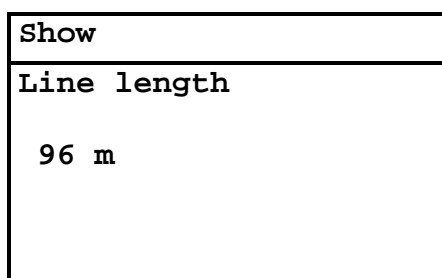
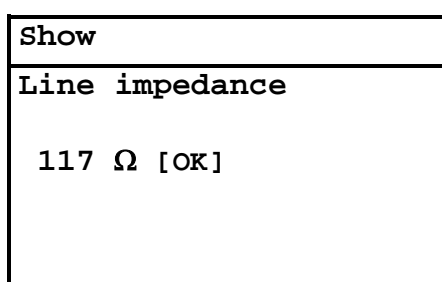
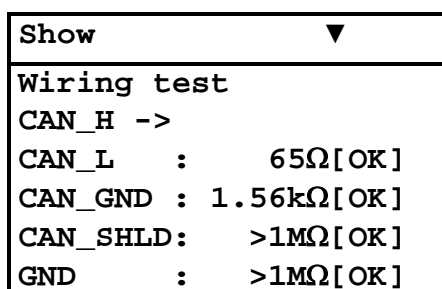
```
Results
-----
-Show
-Delete
-Store to file
-Load from file
-Delete file
-Plausibility check
```



If menu items **Results** and **Show** are selected immediately after switching on the CANcheck and the key **LEFT** is pressed, the result **No valid results** is shown.



If the menu items **Results** and **Show** are selected after the successful tests of the line parameters and operating parameters, all test results can be shown one after the other by pressing the key **RIGHT** repeatedly.



```
Show
-----
Term. resistors

65 Ω [OK]
```

```
Show
-----
Power supply

CAN_V+ -> CAN_GND

0.0 V
```

```
Show
-----
Baudrate detection

500 kBit/s
```

```
Show          ▼►
-----
Bus load
Scan time : 20 s

MIN    MAX    AVG
```

```
Show          ▼
-----
Identifier scan
Scan time : 20 s
S : Standard ID
E : Extended ID
ID   : Count
S 386 : 83
```

```

Show ▼►
Signal levels per id.
S : Standard ID
E : Extended ID
Vd: CAN_H -> CAN_L
Va: CAN_H -> CAN_GND
17 Identifiers found
    
```

Delete the test results via the menu items **Results** and **Delete**. Answer the inquiry with **OK**.

If then immediately the menu items **Results** and **Show** are selected and the key **LEFT** is pressed, the result **No valid results** is displayed.

```

Results
-Show
-Delete
    
```

```

Delete

OK  Yes

ESC No
    
```

```

Show

No valid results
    
```

Note:

- If the CANcheck automatically switches off or is switched off, all results are deleted. To keep the results for more than 10 minutes – for example to transfer the results to the PC – store the results to a file on the CANcheck.

7.2 Store to File, Load from File, Delete File

Test results can be stored to a file on the CANcheck or loaded from a file. In addition, a file on the CANcheck can be deleted. Select the action with the keys **UP** and **DOWN**.

Results
-Show
-Delete
-Store to file
-Load from file
-Delete file
-Plausibility check

Upon selection **Store to file**, the directory of the CANcheck is displayed. Scroll through the directory with the keys **UP** and **DOWN**. For example the directory includes the files "ALFA" and "BETA".

Store to file
-ALFA
-BETA

Select an empty space that is marked by "----" and confirm with **OK**.

Enter a file name that is composed of the letters A-Z and the numbers 0-9 (default setting "A"). One to four characters are supported. Select the place in the name with the keys **LEFT** and **RIGHT**. Change the character with the keys **UP** and **DOWN**.

Store to file
Use keys to change file name
[A]

Store to file
Use keys to change file name
[CAN1]

Confirm the file name with the **OK** key. A message is displayed and then again the menu item **Results**.

```
Store to file
-----
processing ...
```

```
Results
-----
-Show
-Delete
-Store to file
-Load from file
-Delete file
-Plausibility check
```

To store another test result after a new measurement only one empty space is left now.

```
Store to file
-----
-ALFA
-BETA
-CAN1
-----
```

There are several options:

- Select an empty space and enter a new file name (see above).
- To overwrite an existing file – no file name change: select a file and confirm the following menu item with **OK**.
- To overwrite an existing file – with file name change: select a file, change the file name and confirm with **OK**.

After reloading the test results from a file they can be viewed or transferred to the PC.


```
Results
-----
-Show
-Delete
-Store to file
-Load from file
-Delete file
-Plausibility check
```

Upon selection **Load from file**, the directory of the CANcheck is displayed. Scroll through the directory with the keys **UP** and **DOWN**.

```
Load from file
-----
-ALFA
-BETA
-CAN1
-----
```

Confirm the selected file with the **OK** key. A message is displayed and the menu item **Results**. The test results can be accessed via the menu items **Show** or **Remote control**.

```
Load from file
-----
processing ...
```

```
Results
-----
-Show
-Delete
-Store to file
-Load from file
-Delete file
-Plausibility check
```

For reasons of clarity delete test results that are not needed anymore.

```
Results
-Show
-Delete
-Store to file
-Load from file
-Delete file
-Plausibility check
```

Upon selection **Delete file**, the directory of the CANcheck is displayed. Scroll through the directory with the keys **UP** and **DOWN**.

```
Delete file
-ALFA
-BETA
-CAN1
-----
```

Confirm the selected file with the **OK** key. A message is displayed and the menu item **Results**.

With the next selection **Store to file** an empty space replaces the deleted file. The empty space is marked by "----".

```
Delete file

processing ...
```

```
Results
-Show
-Delete
-Store to file
-Load from file
-Delete file
-Plausibility check
```

Note:

- Duplicated file names are not allowed. CANcheck detects duplicated file names upon confirmation and indicates the problem by a flickering file name.
- The characters of the file name cannot be deleted. If the existing file name is too long the file must be deleted. Then a short file name can be entered.

7.3 Plausibility Check

The CANcheck classifies the measurements of the termination resistors and the differential signal levels by comparison to fixed limits. The limits are given in chapter 11.1. The CANcheck does not classify the line length and the baudrate. However, the CANcheck can check the plausibility of measurements by the following calculations:

- Line length and termination resistors: Resistance of a line with the measured length
- Line length and baud rate: Acceptable line length according to CiA DSP 301
- Line length and signal levels: Voltage drop across a line with the measured length

The criteria are given in chapter 11.2.

Results
-Show
-Delete
-Store to file
-Load from file
-Delete file
-Plausibility check

Upon selection **Plausibility check**, the CANcheck checks the plausibility of the test results that are displayed via the menu item **Show**. Either the results are from the most recent measurements or are loaded from a file. The result of the plausibility check is displayed in a list.

Plausibility check ▼
Line length 92 m
Term. resistors 64 Ω
-> Plausible
Baudrate 500 kBit/s

Plausibility check ▲
Baudrate 500 kBit/s
-> Plausible
Signal level 1.9Vd
-> Plausible

8 Remote Control

The CANcheck can be operated by remote control from the PC. The most important application of this is the transmission of test results to the PC. Another application is integration of the CANcheck in automated test processes.

The condition for remote control is the one-off installation of the USB driver and a one-off test of the connection between the CANcheck and the PC (see section 9).

Every time the CANcheck is operated by remote control from the PC, the following steps are required:

1. Connect the CANcheck to the PC with the USB cable provided.
2. Determine which port (COM) is allocated to the CANcheck with the Device Manager on the PC.
3. Start a terminal program on the PC. Select the assigned port (e.g. COM6) and the settings 115200 baud 8 N 1, no flow control.
4. Make sure, that CANcheck is switched on.
5. Select the menu item **Remote control**.

The message of the remote control server is displayed on the CANcheck display.

```
System menu
-Line parameters
-Operat. parameters
-Individual tests
-Stored results
-Remote control
-Maintenance
```

```
Remote control
Use 115200 Baud 8 N 1

Remote control server
started
```

In the window of the terminal program on the PC the following is shown:

```

CANcheck3 - HyperTerminal
Datei Bearbeiten Ansicht Anrufen Übertragung ?
*****
*          CAN Installation Tester          *
*          (C) 2007 IXXAT                  *
*****

Remote control server started

Commands:

wt          - Wiring test
tr          - Termination resistors
ll          - Line length
li          - Line impedance
ps          - Power supply
rsho       - Results -> Show
rdel       - Results -> Delete
rtofile <AAAA..9999> - Results -> Save to file
rfromfile <AAAA..9999> - Results -> Load from file
rdelfile <AAAA..9999> - Results -> Delete file
slan <deutsch | english> - Settings -> Language
sidform <hex | dec> - Settings -> ID format
sstim <1..200> - Settings -> Scan time
smtim <10..2000> - Settings -> Maximum measurement time
sbat       - Settings -> Battery voltage
stest     - Settings -> Self test
sver      - Settings -> Version
stop      - Stop remote server

>_
  
```

Verbunden 00:00:17 Auto-Erkenn. 115200 8-N-1 RF GROSS NUM Aufzeichnen Druckerecho

At the prompt `>` in the terminal program, enter the character string `rsho` to view all stored results.

If the CANcheck is recently switched on, the following appears in the window of the terminal program:

All measurement results:

```

|
|   No valid results
|
|-- *** END ***
  
```

However, if successful tests of the line parameters has been carried out and the CANcheck has not been switched off since then, the test results are shown in the following format (The results of the tests of the operating parameters are shown in a similar format.):

All measurement results:

-- Wiring test:

```
CAN_H    -> CAN_L    :    65 Ohm[OK]
CAN_H    -> CAN_GND   :   >1MOhm[OK]
CAN_H    -> CAN_SHLD  :   >1MOhm[OK]
CAN_H    -> GND       :   >1MOhm[OK]
```

```
CAN_L    -> CAN_GND   :   >1MOhm[OK]
CAN_L    -> CAN_SHLD  :   >1MOhm[OK]
CAN_L    -> GND       :   >1MOhm[OK]
```

```
CAN_V+   -> CAN_H    :   >1MOhm[OK]
CAN_V+   -> CAN_L    :   >1MOhm[OK]
CAN_V+   -> CAN_GND   :   >1MOhm[OK]
CAN_V+   -> CAN_SHLD  :   >1MOhm[OK]
CAN_V+   -> GND       :   >1MOhm[OK]
```

```
CAN_SHLD -> CAN_GND   :   >1MOhm
CAN_SHLD -> GND       :   >1MOhm
```

```
GND      -> CAN_GND   :   >1MOhm
```

-- Line impedance:

```
109 Ohm [OK]
```

-- Line length:

```
97 m
```

-- Term. resistors:

```
65 Ohm [OK]
```

```
-- *** END ***
```

Transferring the test results to the PC:

1. To record the transmitted data in the terminal program on the PC, select Transfer/Text recording in the Hyperterminal program. Enter a meaningful path and name for the file and press the **Start** button.
2. At the prompt **>** in the terminal program, enter the character string **rsho** to view all stored results.
3. To lose the file with the recorded data, select Transfer/Text recording/End in the Hyperterminal program.

Then the file with the recorded data can be edited or printed.

To integrate the CANcheck in automated test runs, individual tests must be started from the PC. At the moment the remote control of following tests is implemented:

- Wiring test
- Termination resistors
- Line length
- Line impedance

At the prompt **>** in the terminal program, enter the character string **w_t** to start the wiring test. Then the familiar test instructions appear in the window of the terminal program. After executing test instructions, press the **ENTER** key on the PC.

During the measurement, a message appears in the window of the terminal program. After the measurement the test result appears in the window of the terminal program.

In an automated test run the character strings **w_t** and **ENTER** must be issued by a program. In addition, the program must accept the messages and the test result. The operation via the terminal program shows that the CANcheck supports a serial protocol for the automated wiring test.

In addition, the deletion of all results is supported via remote control. Press the **ENTER** key on the PC to confirm deletion. Enter the character **** to cancel.

The settings **Language** and **Scan time** can also be carried out by remote control.

At the prompt **>** in the terminal program, enter the character string **stop** to end the remote control server.

Then the system menu appears again in the display of the CANcheck.

9 Settings

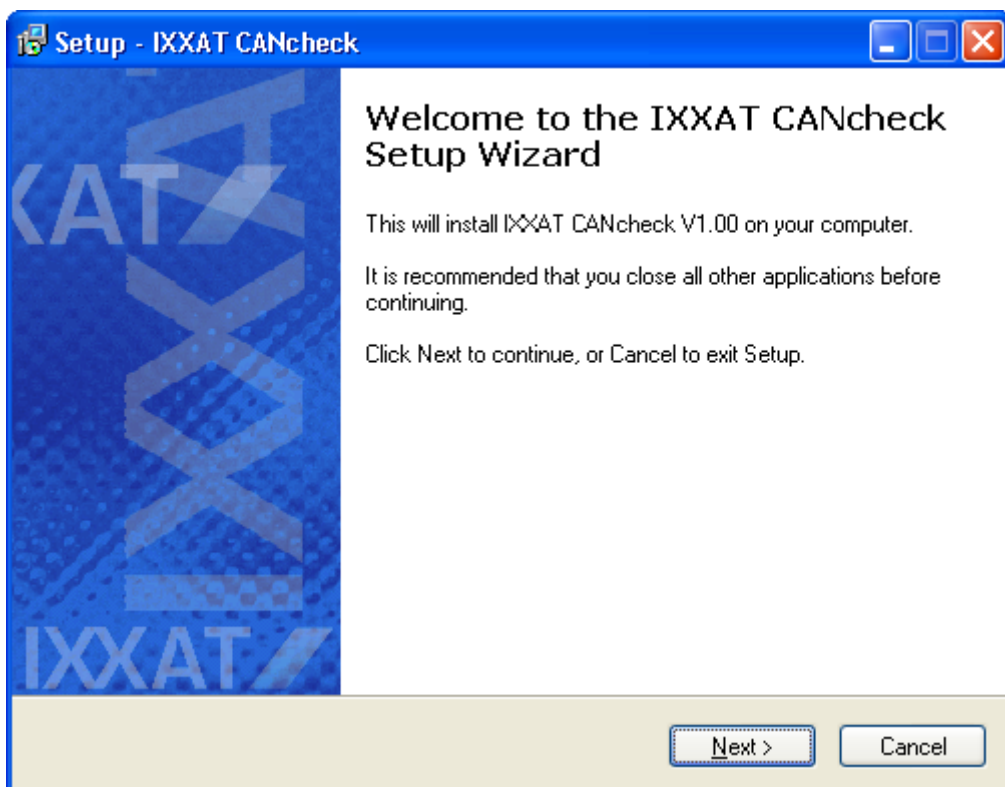
Setting	Options	Description	Chapter
Language	English Deutsch	Selects the language of the menus and test results. The test results on the display and in the terminal window appear in the selected language.	-
Operational mode	Layer 2 CANopen	Layer 2: Evaluates and displays all message identifiers. CANopen: Evaluates certain CANopen identifiers and displays node IDs.	4.2.1, 4.2.2, 5.7, 5.8, 5.10, 5.11
ID format	hex dec	Identifiers appear in hexadecimal format respectively decimal format.	5.7, 5.10, 5.12
Power off	Off Abort	Switches the CANcheck off immediately.	3.1
Power save mode	enable disable	In power save mode, the CANcheck automatically switches off after 10 minutes without a user input.	3.1
Background illumination	automatic disable	In the "automatic" setting, the backlight switches on every time a key is pressed and off again automatically after 20 seconds.	3.2
Battery voltage	-	Displays voltage and capacity of the battery of the CANcheck.	2.2, 6.1
Self-test	-	Repeats the self-test. The self-test is always executed upon power-on.	-
Scan time	1 .. 200 s	During scan time the CANcheck generates a list of identifiers respectively node IDs.	4.2.1, 5.7, 5.8, 5.9, 5.10, 5.11
Max. measurement time	10 .. 2000 s	CANcheck aborts the measurement after max. measurement time and displays the signal levels so far measured.	4.2.1, 5.10, 5.11
Averaging	1 .. 10	Certain measurements are repeated as often as is required for the averaging.	4.2.1, 5.3, 5.10, 5.11
Line data/ Velocity of propagation	50 .. 85 %	Velocity of propagation on the line as percentage of the velocity of light.	5.3
Factory defaults	Reset Abort	Re-establishes the settings at the time of delivery. Test results are not deleted.	-
Version	-	Displays hardware and software version of CANcheck in use.	-

10 USB Driver

To transfer the test results to the PC, the CANcheck and the PC must be connected via a USB cable. In addition, the appropriate USB driver must be installed (included in the scope of supply).

10.1 Installation of the USB Driver

To install the USB driver, start the application **CANcheck.exe** on the CD provided. The following welcome window appears:



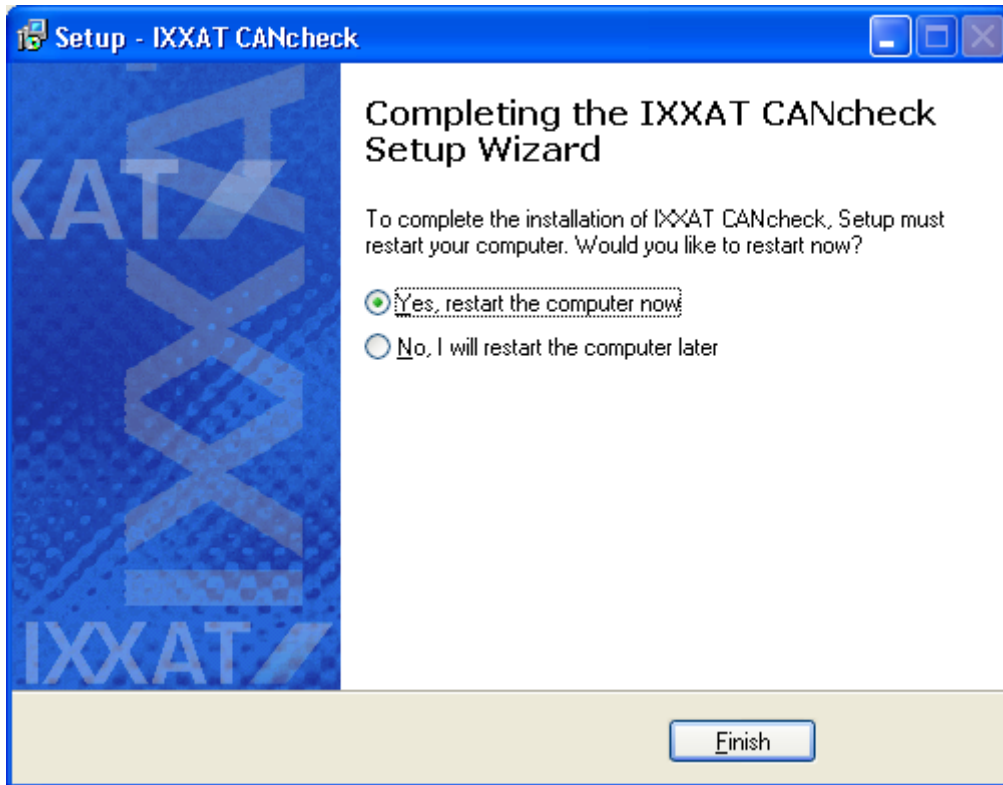
Click on the button **Next** to continue

Read the license agreement in the next window and select "I accept the agreement" before clicking on the **Next** button to continue.

Confirm selection of the installation folder in the next window with **Next**.

In the next window, start the installation by clicking on the button **Install**.

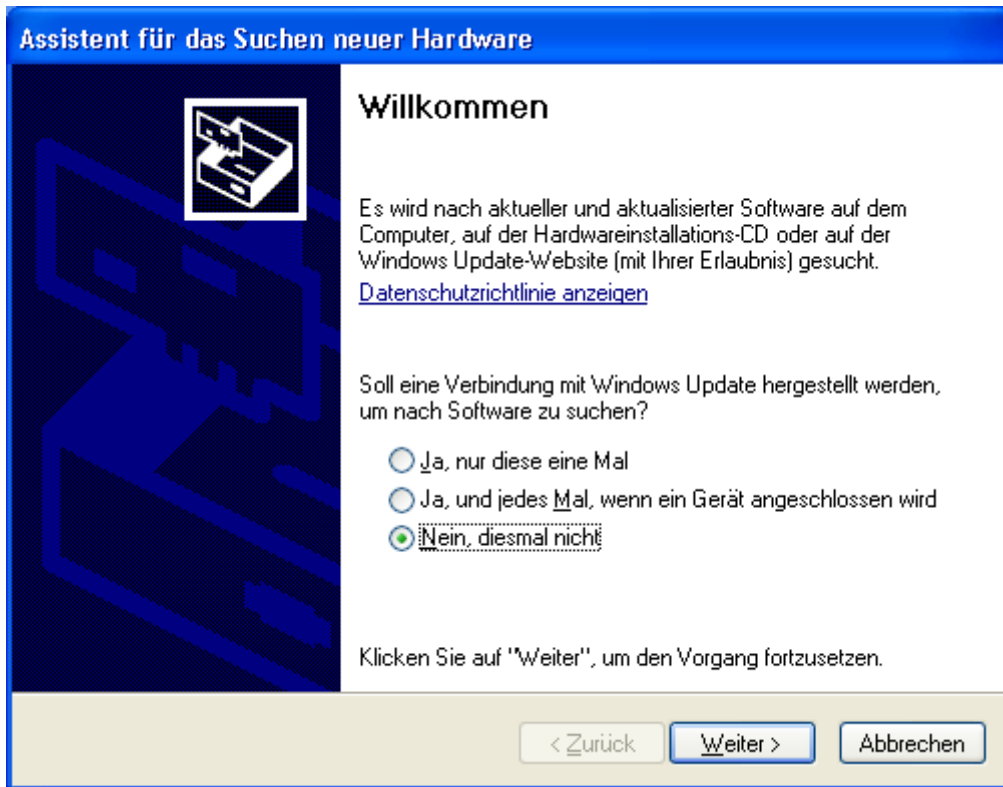
To complete the installation, the following window appears:



Select “Yes, restart the computer now” and click on the button **Finish** to complete the installation.

10.2 Initial Connection of CANcheck and PC

Connect the CANcheck and the PC via a USB cable. When you connect the CANcheck and the PC for the first time via a USB cable, the window of the assistant for detecting new hardware appears:



Select “No, not this time” and click on the button **Next** to continue.

In the next window, select “Install software automatically (recommended)” and click on the **Next** button to continue.

Ignore the warning in the next window and start the installation by clicking on the button **Continue installation**.

To complete the installation, the following window appears:

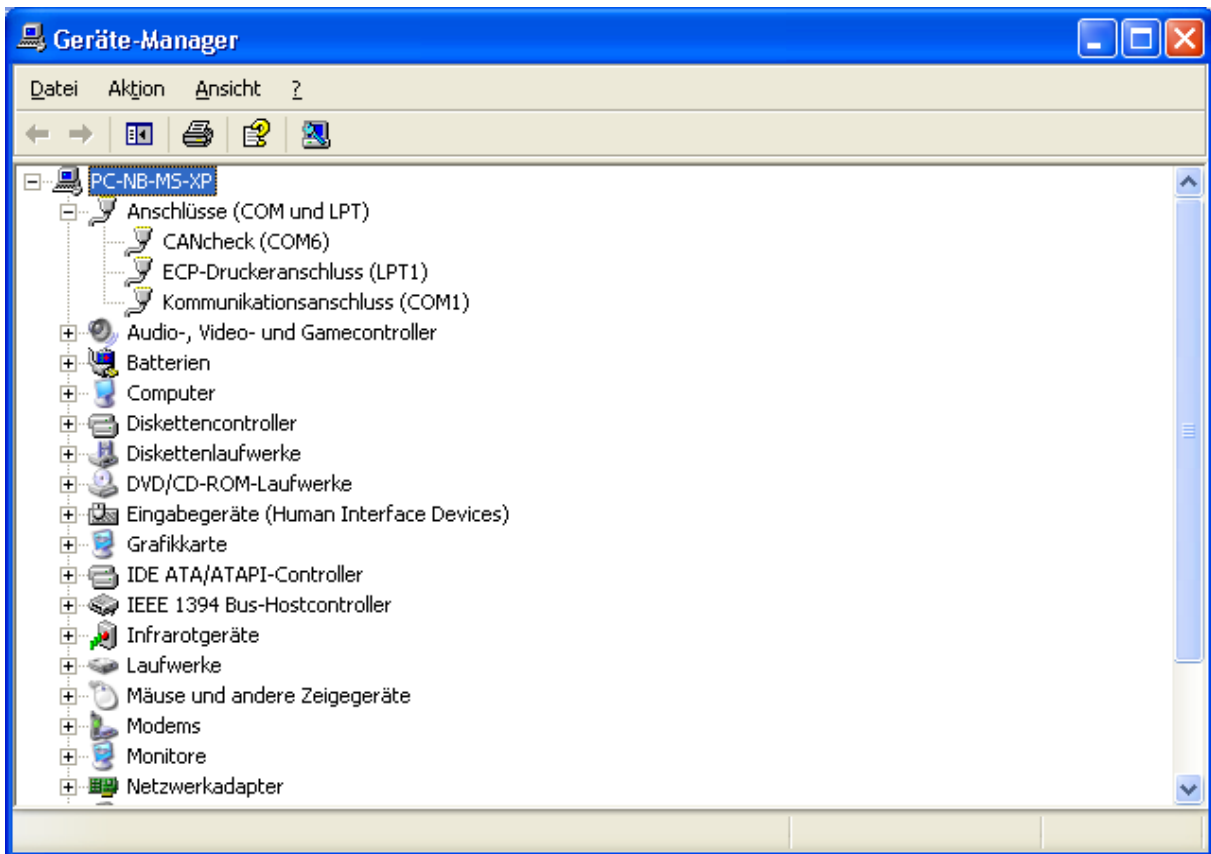


Click on the button **Finish** to complete the installation.

To make a connection to the CANcheck, you must know the assigned port (COM). This is displayed in the **Device Manager**. To open the Device Manager, click on **Start**, and then click on **Control Panel**. Double-click on **System**. Click on **Device Manager** on the index card **Hardware**.

Click on the plus symbol (+) next to "Ports" in order to view the ports. In the following example the CANcheck was assigned the port COM6.

Note: The window of the assistant for detecting new hardware only appears when the CANcheck and the PC is connected via a USB cable for the first time. After this the CANcheck always appears with the known port (COM), provided that the same USB port is used.



To **test** the connection between the CANcheck and the PC, start a terminal program (e.g. Hyperterminal) on your PC.

In the terminal program, select the assigned port (e.g. COM6) and the settings: 115200 Baud 8 N 1, no flow control.

To test the connection, switch the CANcheck on by pressing any key for more than 1 second. End the subsequent test screen by pressing a key again. Then select the menu item **Remote control** and press the **OK** key.

System menu
-Line parameters
-Operat. parameters
-Individual tests
-Stored results
-Remote control
-Maintenance

Then the following appears on the CANcheck display:

```
Remote control
Use 115200 Baud 8 N 1

Remote control server
started
```

In the window of the terminal program on the PC, the following appears:

```
CANcheck3 - HyperTerminal
Datei Bearbeiten Ansicht Aufrufen Übertragung ?
Remote control server started

Commands:
wt           - Wiring test
tr           - Termination resistors
ll           - Line length
li           - Line impedance
ps           - Power supply
rsho        - Results -> Show
rdel        - Results -> Delete
rtofile <AAAA..9999> - Results -> Save to file
rfromfile <AAAA..9999> - Results -> Load from file
rdelfile <AAAA..9999> - Results -> Delete file
slan <deutsch | english> - Settings -> Language
sidform <hex | dec> - Settings -> ID format
sstim <1..200> - Settings -> Scan time
smtim <10..2000> - Settings -> Maximum measurement time
sbat        - Settings -> Battery voltage
stest       - Settings -> Self test
sver        - Settings -> Version
stop        - Stop remote server

>_
Verbunden 00:00:17 Auto-Erkenn. 115200 8-N-1 RF GROSS NUM Aufzeichnen Druckerecho
```

The test of the connection is now completed.

11 Appendix

11.1 Technical Specifications

Dimensions:	165 x 105 x 32 mm (L x W x H)
Weight:	Approx. 500 g
Protection class:	IP30
Housing material:	Aluminum
Display:	128 x 64 pixels
Background illumination:	Automatic or switched off
Keyboard:	Keyboard with 6 membrane switches
Languages:	German or English
Operating modes:	CAN layer 2 or CANopen
Operating temperature range:	0 °C to +50 °C
Storage temperature range:	-20 °C to +70 °C
Power supply:	4 x 1.5 V batteries or 4 x 1.2 V rechargeable Mignon (AA) or USB
Power save mode:	Can be switched on and off
Operating period:	Approx. 24 hours with a battery capacity of 2850 mAh
USB port:	USB 2.0 Full speed USB port galvanically isolated from device ground
CAN port:	ISO 11898-2 High speed medium access unit
Resistance measurement:	20 to 200 Ω \pm 5 % 0 to 20 Ω \pm 20 % 200 to 1 M Ω \pm 20 %
Termination resistors:	54 to 77.5 Ω is classified as OK The value 77.5 Ω takes into account the resistance of 500 m of cable.
High resistance:	> 1 k Ω is classified as OK
Cable length measurement:	20 to 30 m \pm 3 m 30 to 500 m \pm 10 % The measurement is based on the adjusted velocity of propagation.
Line impedance:	120 Ω \pm 20 % is classified as OK Minimum cable length: 20 m Measured by evaluating the change in voltage of the test voltage, edge steepness of test voltage: 150 ns (0 to 6,66 MHz)
CAN_V+ supply:	0 to +29 V
Baud rate detection:	5 kBit/s; 10 kBit/s; 20 kBit/s; 50 kBit/s; 62.5 kBit/s; 83.3 kBit/s; 100 kBit/s; 125 kBit/s; 200 kBit/s; 250 kBit/s; 500 kBit/s; 800 kBit/s; 1 MBit/s
Identifier recording:	max. 2048 11-bit identifiers max. 2048 29-bit identifiers max. 2048 11-bit- / 29-bit-Identifier
Bus load and error telegrams:	Display in messages / seconds and in per cent
CAN signal level:	0 to +5 V \pm 0.1 V -10 to +10 V \pm 0.4 V
Differential signal level:	1.5 V \leq (CAN_H \rightarrow CAN_L) \leq 3 V is classified as OK
Absolute signal level:	(CAN_H \rightarrow CAN_GND) \leq 7 V with (CAN_L \rightarrow CAN_GND) \geq -2 V is classified as OK
Scan time:	Adjustable from 1 to 200 s
Measuring time:	Adjustable from 10 to 2000 s
Averaging:	Adjustable from 1 to 10
Trigger output:	On reception of an adjustable 11-bit or 29-bit identifier or an error frame, a voltage pulse is generated on the trigger output. Trigger output galvanically isolated from device ground. Internal resistance 1 k Ω .
Non-volatile memory:	All settings are stored in the non-volatile memory. Factory settings can be restored by command. Up to 4 test results can be stored in the non-volatile memory.

11.2 Criteria for Plausibility Check

11.2.1 Line Length and Termination Resistors

If:

measured resistance $> 1.05 \times [120 \Omega \parallel (120 \Omega + 2 \times \text{length} \times 70 \text{ m}\Omega/\text{m})]$

-> NOT plausible

Else:

-> Plausible

The plausibility check shows ERROR if the termination resistors have been classified as ERROR.

11.2.2 Line Length and Baudrate

If:

measured line length $> 1.1 \times$ accepted line length for the measured baudrate

-> NOT plausible

Else:

-> Plausible

Baudrate	Accepted line length
1 Mbit/s	25 m
800 kbit/s	50 m
500 kbit/s	100 m
250 kbit/s	250 m
200 kbit/s*	250 m
125 kbit/s	500 m
100 kbit/s*	500 m
62.5 kbit/s*	500 m
83.3 kbit/s*	500 m
50 kbit/s	1000 m
20 kbit/s	2500 m
10 kbit/s	5000 m
5 kbit/s*	5000 m

* No CiA baudrate. The criterion for the next higher baudrate applies.

11.2.3 Line Length and Signal Levels

Search measurement for minimum differential signal level.

If:

signal level $< 2 \text{ V} \times [120 \Omega / (120 \Omega + 2 \times \text{length} \times 70 \text{ m}\Omega/\text{m})] - 0.1 \text{ V}$

-> NOT plausible

Else:

-> Plausible

The plausibility check shows ERROR if the termination resistors have been classified as ERROR.

11.3 Accessories

Port	Description	Article no.
USB	USB cable with A connector and B connector; length: 2 m	2.09.0000.01605
CAN	CAN cable (1-to-1 cable) with SUB-D9 socket and SUB-D9 connector; length 2 m	1.04.0076.00180
CAN	CAN cable (Y cable) with 2 x SUB-D9 socket and 1 x SUB-D9 connector; length 2 m	1.04.0076.00002
Trigger output	CAN / trigger cable with SUB-D9-socket and SUB-D9 connector; trigger output routed out from the SUB-D9 socket onto a BNC connector; length 1 m	1.04.0076.00003

11.4 Information on the Use of CANcheck

CANcheck may cause fault or destruction of CAN nodes and systems controlled by them. HMS is not liable for consequential damages!

The CANcheck does not participate actively in the CAN traffic. But it has an effect on your CAN network as a passive device. Check the compatibility of CANcheck and your CAN network before you connect the CANcheck to your CAN network.

Check the compatibility based on the additional line length:

- CANcheck and CAN cable (Y cable) correspond to approx. 7 m additional line length. Due to its input capacitance, CANcheck is equivalent to 3 m cable. The CAN cable accounts for 4 m.

11.5 Information on Disposal of Waste Equipment

This product is subject to the Electrical and Electronic Equipment Act (ElektroG) and is to be disposed of separately in accordance with the ElektroG. The products of HMS that are subject to the ElektroG are devices for exclusive commercial use and are marked with the symbol of a waste bin with a cross through it.



In accordance with the B2B regulation, disposal is governed separately according to § 10 para. 2 clause 3 Electrical and Electronic Equipment Act (ElektroG) in the edition of March 16 2005 in the General Terms and Conditions of Business of HMS and its supplements.

Accordingly, when the products supplied by HMS are no longer used, customers are obliged to dispose of these products at their own expense. It is to be noted that in contrast to privately used equipment (B2C), they may not be disposed of at the state-owned collection centers of disposal organizations (e.g. municipal recycling centers). The statutory regulations for disposal are to be observed.

If delivered products are passed on to third parties, customers are obliged to take back the delivered products when no longer used at their own expense and dispose of them correctly in accordance with the statutory regulations or to impose these obligations on third parties.

The General Terms and Conditions of Business and their supplements as well as further information on disposal of waste electrical and electronic equipment can be downloaded at www.ixxat.com.

11.6 Information on EMC

The CANcheck is a class A device. This means that it has been constructed for industrial use and that it meets the EMC requirements for industrial devices.

If the CANcheck is used in office or home environment radio interference can occur under extreme conditions.

To ensure faultless operation of the CANcheck, the following instructions must be followed due to technical requirements of EMC:

- use only the included accessories and cables
- the CAN cable must be shielded
- the shield of the CAN interface must be connected at the 9-pin D-Sub connector and at the subscriber

If problems arise during operation of the CANcheck despite the instructions above, the distance between potential sources or drains of interference (e. g. motors, frequency inverters) and the device should be incremented.

11.7 Declaration of Conformity

The product is in compliance with the Electromagnetic Compatibility Directive. More information and the Declaration of Conformity is found at www.ixxat.com.