

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

Hinweis

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

Please read this manual before using the CANcheck.

For more information on our products, FAQ lists and installation tips, please refer to the support section of our website (<http://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. Please 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 k Ω .

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 you require a slotted screwdriver (blade width approx. 5 mm). Please use it to press the plastic spring of the catch together and carefully lift off the cover.

Please note:

- The rechargeable batteries cannot be recharged via the USB connector. Please 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, please check the voltage given by "Settings/Battery voltage". You should 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 the CANcheck by pressing any key for more than 1 second. Then the message "Self-test passed" appears for 1 second. 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.

However, if you wish to switch the CANcheck off immediately select the menu item "Settings" and then the sub-item "Switch off". Please 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. You can switch the background illumination on by selecting the menu item "Settings" and then the sub-item "background illumination". Please then 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.

You can cancel every menu item with the ESC key. You can also cancel every test with the ESC key.

If the pixels of the display are not sufficient, you can move the contents to the left or right with the keys LEFT and RIGHT. With long lists you can also 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 you can change between the virtual keys shown above or below each other. With the keys LEFT and RIGHT you can 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. You can 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 aid of the Y cable you can 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 your selection with the OK key. The selected menu item becomes then the new header.

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

If you erroneously start the test when the CAN network is switched on, you will receive the following error message, 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

Then you return to the system menu with the ESC key. There you can start the next test with the CAN network switched off. Now you receive the test instructions.

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

Summarized tests

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". 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.

Here is the first part of a positive test result. The symbol ▼ in the header means that more lines follow. You can scroll down to them 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 you 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 should 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

This time we will not look at the test result. We can look at the stored test results 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 you have not followed these test instructions, the test result is negative.

Line length	
TEST FAILED	
NEXT	INFO

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

Summarized tests

Line length
Test rejected

To receive an error-free test result, it is now 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.

Please 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.

Now 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 you have connected the CANcheck to the line end, where normally one of the two termination resistors of the CAN network is located.

If the measurement is completed successfully, you receive the message "TEST EXECUTED". The CANcheck has consequently not checked the test result.

Line length
TEST EXECUTED
NEXT INFO

You receive the test result with the virtual key "INFO".

Line length
96 m

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". You can now look at all test results under "Stored results".

Summarized tests

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, you can connect the CANcheck to this socket via the 1-to-1 cable.
- If this is not the case, you can loop in the CANcheck between any CAN node and the CAN network via the Y cable.

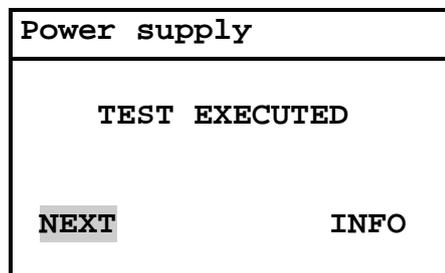
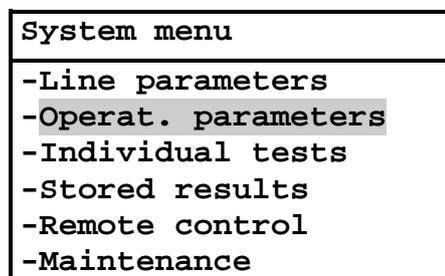
Operating parameters can be measured in two operating modes.

- 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 your 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.



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. There you 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, please 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" you receive an error message.

Baudrate detection
Test rejected

Summarized tests

To receive an error-free test result, it is now 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.

Please acknowledge the result of the measurement of the power supply by pressing the OK key. Now switch the CAN nodes on and ensure that the CAN nodes are sending telegrams.

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

Baudrate detection	
TEST EXECUTED	
NEXT	INFO

You can see the test result via "INFO".

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 there 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, you receive the message "TEST EXECUTED". The CANcheck has consequently not checked the test result.

Bus load	
TEST EXECUTED	
NEXT	INFO

You can see the test result via "INFO". Here is the beginning of the table with minimum value, maximum value and average value. The symbols ▼► in the header mean that there are more lines in the table. You can scroll down the table with the key DOWN. To see the end of a long line, you can 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.

Summarized tests

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.

Please 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 under "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 you repeat the operational tests, 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 means 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.

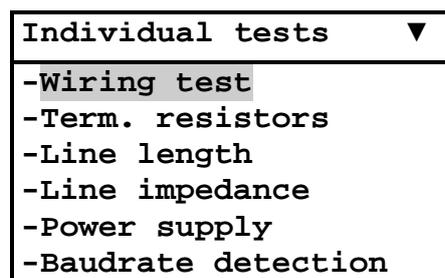
The following resistances are exceptions:

```
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 you can connect the CANcheck to the CAN network at any point. Please switch the CAN network off before the wiring test. In addition, you should 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, however, the resistance of every individual CAN node must then be greater than the "number of CAN nodes" x 1 kΩ.

Please 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 you have followed the test instructions, please start the test with the OK key.

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

Individual tests

```
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

Please note:

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

5.2 Termination resistors

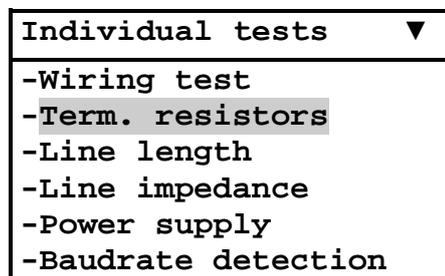
In the test of the termination resistors the CANcheck measures the resistance between CAN_H and CAN_L on the CAN connector. The pin assignment of the CAN connector corresponds to CiA DS-102 (see section 2.1.1).

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.

However, CANcheck does not check the number of termination resistors. One termination resistor with 60 Ω or three termination resistors with 180 Ω each would therefore also produce 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 you can connect the CANcheck to the CAN network at any point. Please switch the CAN network off before the test. In addition, you should 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, however, the resistance of every individual CAN node must then be greater than the "number of CAN nodes" x 1 k Ω .

Please 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 you have followed the test instructions, please start the test with the OK key.

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

Term. resistors

-Disconnect all nodes
-Terminate CAN bus
on both ends

OK Start test

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".

Please multiply the adjusted velocity of propagation with the ratio:

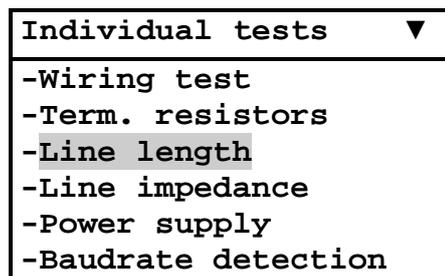
"line length measured manually" / "line length displayed by CANcheck"

and overwrite the adjusted velocity of propagation with the new setting.

For the test of the line length, please remove the two termination resistors of your 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.

Please switch the CAN network off before the test. In addition, you should 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, however, the resistance of every individual CAN node must then be greater than the "number of CAN nodes" x 1 kΩ.

Please 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 you have followed the test instructions, please 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

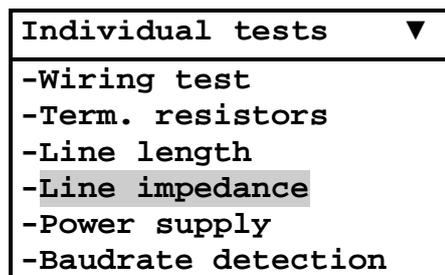
5.4 Line impedance

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.

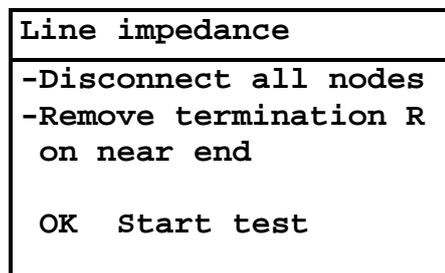
For the test of the line impedance, please remove one of the two termination resistors of your CAN network and connect the CANcheck in its place. Please switch the CAN network off before the test. In addition, you should disconnect all CAN nodes from the network. Switched off CAN nodes with a high resistance between CAN_H, CAN_L and ground can remain connected. As the resistors of all connected CAN nodes are parallel, however, the resistance of each individual CAN node must then be greater than the "number of CAN nodes" x 1 k Ω .

Please select the menu item "Line impedance" 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 6. When you have followed the test instructions, please start the test with the OK key.

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



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.

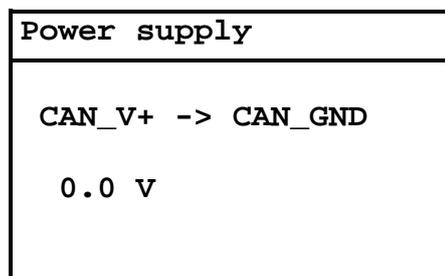
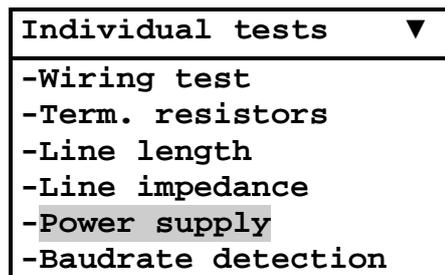
The measurement is not analyzed because the external power supply via CAN_V+ is optional.

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

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

Please put the CAN network into operation before you measure the power supply.

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



Please 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 you connect CAN_V+ and CAN_GND 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.

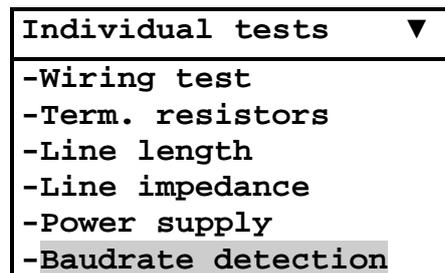
CANcheck checks the polarity of the signal on CAN_H and CAN_L. If the CANcheck detects that CAN_H and CAN_L are not connected in accordance with CiA DS-102, the message: "H-L inverted [ERROR]" appears.

For the measurement of the baudrate, you can connect the CANcheck to the CAN network at any point:

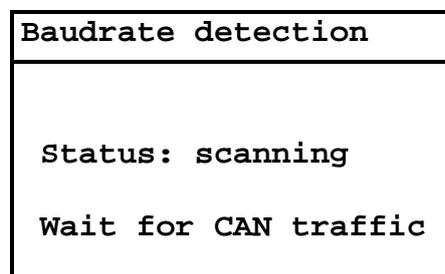
- If there is a free SUB-D9 socket in the CAN network, you can connect the CANcheck to this socket via the 1-to-1 cable.
- If this is not the case, you can loop in the CANcheck between any CAN node and the CAN network via the Y cable.

Please put the CAN network into operation before you start baudrate detection.

Please 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.



Individual tests

Baudrate detection
500 kBit/s

Please note: the test is only correctly ended when a baudrate is detected. If the CANcheck has not completed baudrate detection within a few seconds, you can cancel the test with the ESC key. In this case, please 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 (the default setting is 10 s) the CANcheck generates a list of identifiers and counters that indicate how often the identifiers were recorded.

If the identifiers in your CAN network are repeated with a period longer than 10 s, you must change the scan time. This is done via the menu item "Settings".

The identifiers can be presented in decimal or hexadecimal format. Please select the preferred format via the menu item "Settings".

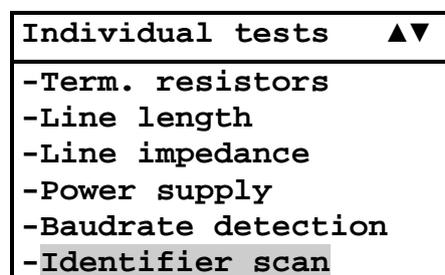
The CANcheck records both 11-bit-identifiers and 29-bit identifiers. The length of the list with identifiers and counters is limited to the value given in section 11.1.

For the identifier scan, you can connect the CANcheck to the CAN network at any point:

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

Please put the CAN network into operation before you start the identifier scan.

Please 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.

Individual tests

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

You will get the following list if you have selected the hexadecimal format. 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 therefore that the relevant messages are transmitted via the bus. During the scan time (the default setting is 10 s) the CANcheck generates a list of node IDs and counters that state how often the node IDs were recorded.

If the above-mentioned identifiers are repeated in your CAN network with a period of more than 10 s, you must change the scan time. This is done via the menu item "Settings".

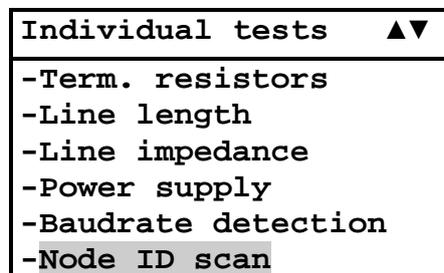
The length of the list with node IDs and counters is limited to the value given in section 11.1.

For the node ID scan, you can connect the CANcheck to the CAN network at any point:

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

Please put the CAN network into operation before you start the node ID scan.

Please 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.

Individual tests

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. The default setting is 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.

If you want to observe the bus load in your CAN network over a longer period, you must change the scan time. This is done via the menu item "Settings".

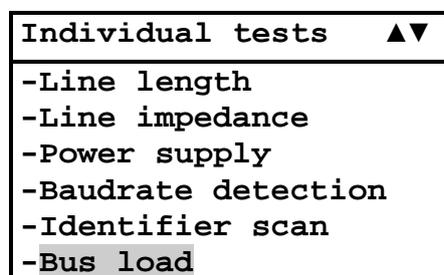
At the end of the scan time the CANcheck provides a table with the bus load and the error telegrams.

For the measurement of the bus load you can connect the CANcheck to the CAN network at any point:

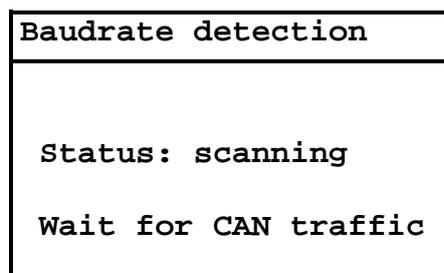
- If there is a free SUB-D9 socket in the CAN network, you can connect the CANcheck to this socket via the 1-to-1 cable.
- If this is not the case, you can loop in the CANcheck between any CAN node and the CAN network via the Y cable.

Please put the CAN network into operation before you measure the bus load.

Please select the menu item "Bus load" 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 bus load is measured and you can view the interim results "online".



Individual tests

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

After the measurement, the test result appears. The symbols ▼► in the header mean 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. First the CANcheck generates a list of identifiers during the scan time (the default setting is 10 s). Then the CANcheck measures the differential and absolute signal level for each recorded identifier separately as often as averaging requires (the default setting is 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 has not been connected the CANcheck will always show the nominal absolute signal level.

If the identifiers in your CAN network are repeated with a period longer than 10 s, you must change the scan time. This is done via the menu item "Settings". You can also change averaging via the menu item "Settings".

The identifiers can be presented in decimal or hexadecimal format. Please 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.

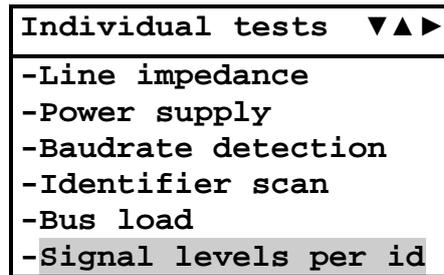
In order to allocate an identifier to a CAN node, however, you require the allocation between identifier and CAN nodes in your CAN network. The CANcheck can only determine the allocation if your CAN network works according to the CANopen standard (see section 5.11).

For the measurement of the signal level you can connect the CANcheck to the CAN network at any point:

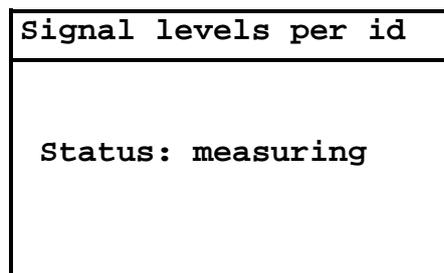
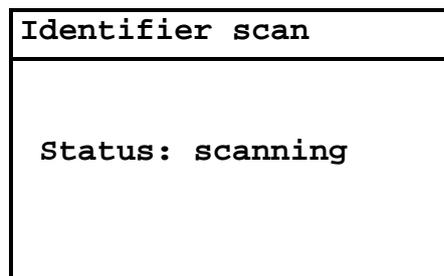
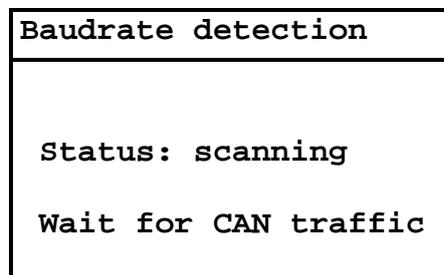
- If there is a free SUB-D9 socket in the CAN network, you can connect the CANcheck to this socket via the 1-to-1 cable.
- If this is not the case, you can loop in the CANcheck between any CAN node and the CAN network via the Y cable.

Please put the CAN network into operation before you start measuring the signal level.

Please select the menu item "Signal per identifier" 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 second message appears. Then the signal levels are measured and a third 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.

Individual tests

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]

You will get the following list if you have selected the hexadecimal format. 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]

Please note:

- The identifier scan always lasts for the set scan time.
- The 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 μ s) 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 (the default setting is 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 (the default setting is 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 has not been connected the CANcheck will always show the nominal absolute signal level.

If the above-mentioned identifiers are repeated in your CAN network with a period of more than 10 s, you must change the scan time. This is done via the menu item "Settings". You can also change averaging via the menu item "Settings".

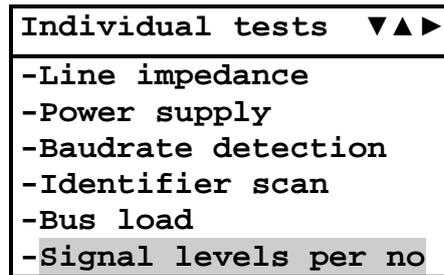
The CANcheck analyzes the signal level for each identifier separately. The limits are given in section 11.1. In this way you can detect identifiers that are transmitted with a weak signal level and may be causes of transmission errors.

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

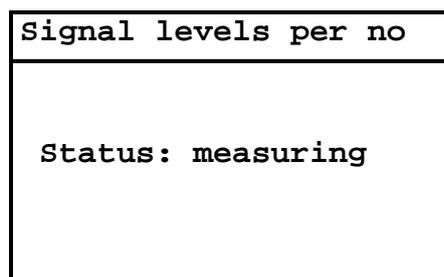
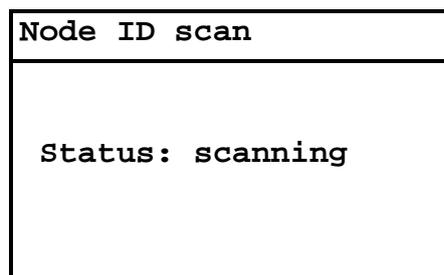
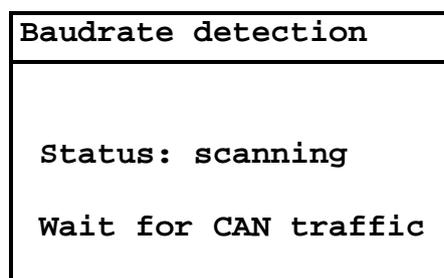
- If there is a free SUB-D9 socket in the CAN network, you can connect the CANcheck to this socket via the 1-to-1 cable.
- If this is not the case, you can loop in the CANcheck between any CAN node and the CAN network via the Y cable.

Please put the CAN network into operation before you start measurement of the signal levels.

Please select the menu item "Signal level per node ID" 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 node IDs is carried out and a second message appears. Then the signal levels are measured and a third 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.

Individual tests

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]

Please note:

- The scan of the node IDs always lasts for the pre-set scan time.
- The 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 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 μ s) 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) you can trigger an oscilloscope. The telegram of the set 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, in order for example to detect signal errors.

The identifier can be entered in decimal or hexadecimal format. Please select the preferred format via the menu item "Settings".

To use the trigger output, you can connect the CANcheck to the CAN network at any point:

- Please 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, you can connect the CANcheck to this socket with the "SUB-D9 connector with CAN cable".
- If this is not the case, you can loop in the Y cable between any CAN node and the CAN network. Connect the CANcheck to the Y cable with the "SUB-D9 connector with CAN cable".

Please put the CAN network into operation before you use the trigger output.

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

Individual tests

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

Then you will see a message. Now you can 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

You will get the following display if you have selected the hexadecimal format. Identifiers in hexadecimal are distinguished by the suffix "h".

Trigger output
Use keys to change
Trig ID: 000 h

Please 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" you can check the battery voltage. The batteries must be replaced 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
```

Error messages and indications

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.

In these cases, please cancel the test with the ESC key and switch off the CAN nodes .

Please 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.

In this case, cancel the test with the ESC key and remove both termination resistors. In addition, you should 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, however, the resistance of each individual CAN node must then be greater than the "number of CAN nodes" x 1 k Ω .

6.4 Error message with inverted polarity

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

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

the polarity of the signal between CAN_H and CAN_L is checked. If the polarity is inverted, the above error message is displayed. In this case the dependent tests cannot be carried out.

Error messages and indications

You should then check whether your CAN network generally works with inverted polarity. If this is the case, you should change your CAN network to not inverted polarity. If this is not possible, you can still carry out the dependent tests with the CANcheck with the aid of 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 you do not receive a test result.

In this case, please check:

- whether the CAN network is operational
- whether 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 will be presented.

In this case, please 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]

Error messages and indications

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 will give you 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 will show you 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 you will get a signal level for Vd but not for Va. This case is depicted above.

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

If the identifiers are periodic despite the indication you should 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?	

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

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]

Please note: One-off identifiers can only be measured with the help of 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 will give you an indication of the non-usable bits:

<number> Identifiers BIT?

Error messages and indications

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

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

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

To achieve a result, you should care about 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 will measure 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]

Please 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", you can view the test results, store the test results to a file and check the plausibility of the test results.

Please 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.

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

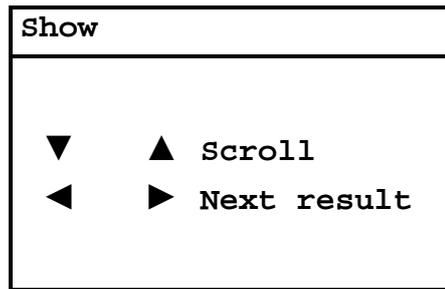
You can choose between "Show" and "Delete" test results with the keys UP and DOWN. It makes no difference whether the test results were achieved via the user interface, via the individual tests or via loading from file.

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

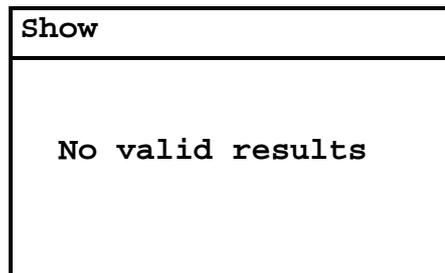
- Scroll through the text with the keys UP and DOWN.
- Change from test result to test result with the keys LEFT and RIGHT.

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

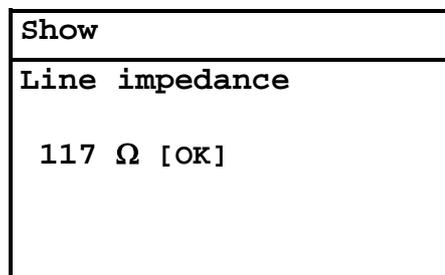
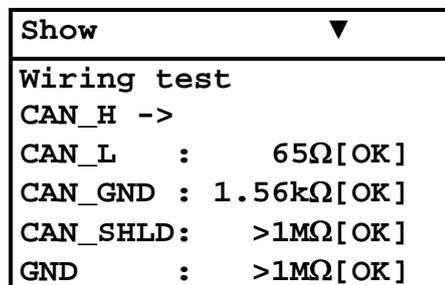
Results



If you select menu items "Results" and "Show" immediately after switching on the CANcheck and press the key LEFT, you receive the result "No valid results".



If you select the menu items "Results" and "Show" after the successful tests of the line parameters and operating parameters, you can view all test results one after the other by pressing the key RIGHT repeatedly.



Show
Line length
96 m

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

Results

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". Please answer the inquiry with OK.

If you then immediately select the menu items "Results" and "Show" and press the key LEFT, you receive the result "No valid results".

Results
-Show -Delete

Delete
OK Yes ESC No

Show
No valid results

Please note:

- If the CANcheck automatically switches off or you switch it off, all results are deleted. If you want to keep the results for more than 10 minutes – for example to transfer the results to your PC – you should 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 will be displayed. Scroll through the directory with the keys UP and DOWN. E. g your directory includes the files "ALFA" and "BETA".

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

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

Now you can enter a file name that is composed of the letters A-Z and the numbers 0-9. Letter "A" is default. 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. Then you will see a message and return to the menu item "Results".

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

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

If you have performed a new measurement and intend to store another test result only one empty space is left now.

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

You have several options now:

- To select an empty space and enter a new file name: Please proceed as described above.
- To overwrite an existing file – no file name change: Please select a file and confirm the following menu item with OK.

Results

- To overwrite an existing file – with file name change: Please select a file, change the file name and confirm with OK.

After you have re-loaded the test results from a file you can view them or transfer them 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 will be 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. Then you will see a message and return to the menu item "Results". Now you can access the test results 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 you should delete test results that you do not need anymore.

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

Upon selection "Delete file", the directory of the CANcheck will be displayed. Scroll through the directory with the keys UP and DOWN.

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

Confirm the selected file with the OK key. Then you will see a message and return to the menu item "Results".

With the next selection "Store to file" you will see that an empty space has replaced the deleted file. The empty space is marked by "----".

```
Delete file
-----
processing ...
```

Results

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

Please note:

- Duplicated file names are not allowed. CANcheck detects duplicated file names upon confirmation and will indicate the problem by a flickering file name.
- The characters of the file name cannot be deleted. If the existing file name is too long you will have to delete the file. Then you can enter a short file name.

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 you got the test results during your most recent measurements or you have loaded them 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 you want to operate the CANcheck by remote control from the PC, the following steps are required:

1. Please connect the CANcheck to the PC with the USB cable provided.
2. Determine which port (COM) was allocated to the CANcheck with the Device Manager on the PC.
3. Start a terminal program on the PC. Select the assigned port there (e.g. COM6) and the settings 115200 baud 8 N 1, no flow control.
4. If the CANcheck is switched off: switch the CANcheck on.
5. Select the menu item "Remote control".

Then you see the message of the remote control server 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 you see:

```

*****
*                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

>_

```

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

If you have switched on the CANcheck, the following appears in the window of the terminal program:

All measurement results:

```

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

```

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

Remote control

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 ***
```

To transfer the test results to the PC, please proceed as follows:

1. Record the transmitted data in the terminal program on the PC. For this, select Transfer/Text recording in the Hyperterminal program. Please 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. Close the file with the recorded data. For this, select Transfer/Text recording/End in the Hyperterminal program.

Then you can edit or print the file with the recorded data.

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 `wt` to start the wiring test. Then the familiar test instructions appear in the window of the terminal program. When you have followed the test instructions, please 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, of course, the character strings `wt` and ENTER must be issued by a program. In addition, the program must accept the messages and the test result. With operation via the terminal program, however, it was shown that the CANcheck supports a serial protocol for the automated wiring test.

In addition, the deletion of all results is supported via remote control. Please press the ENTER key on the PC to confirm deletion. Please 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

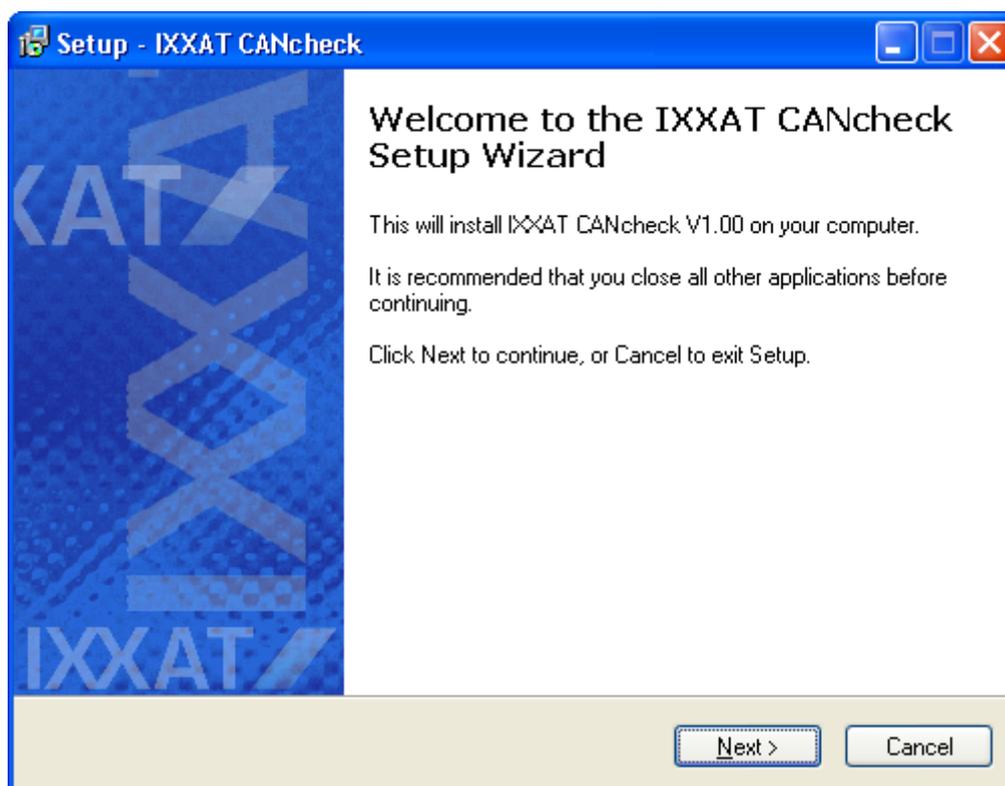
Setting	Options	Description	Chapter
Language	English Deutsch	Selects the language of the menus and test results. The test results on the display and in the terminal window appear in the selected language.	-
Operational mode	Layer 2 CANopen	Layer 2: Evaluates and displays all message identifiers. CANopen: 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	The 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 the 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 that have been measured so far.	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. The test results are not deleted.	-
Version	-	Displays the hardware and software versions of your CANcheck.	-

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, please start the application `CANcheck.exe` on the CD provided. The following welcome window then appears:



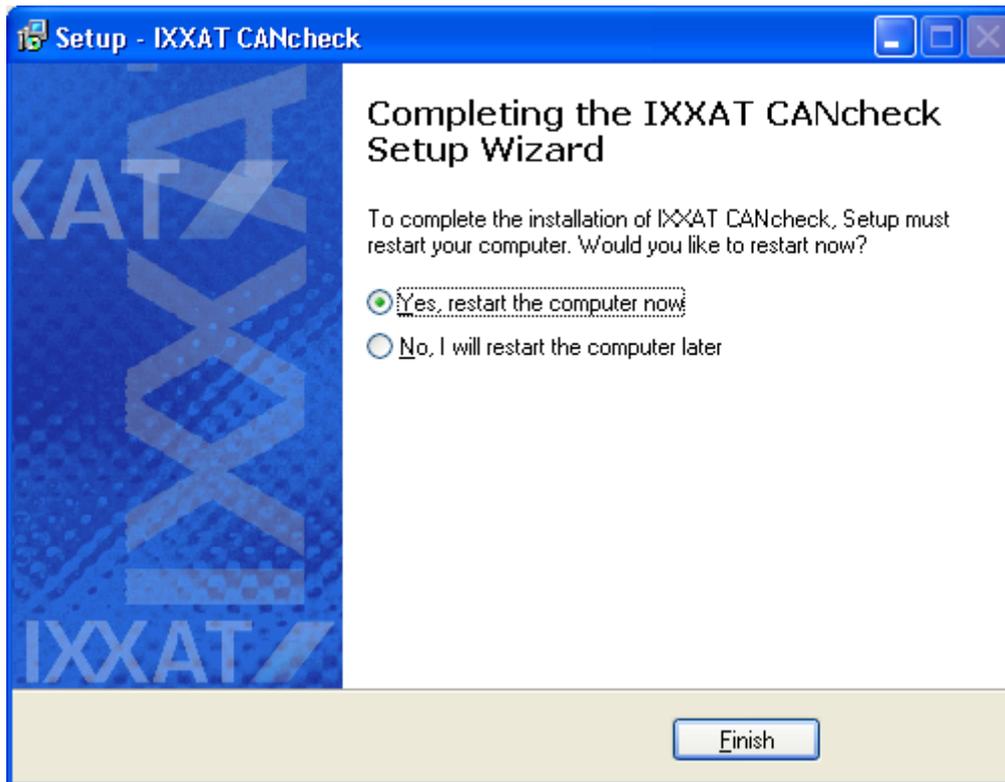
Click on the button "Next" to continue

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

Please 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".

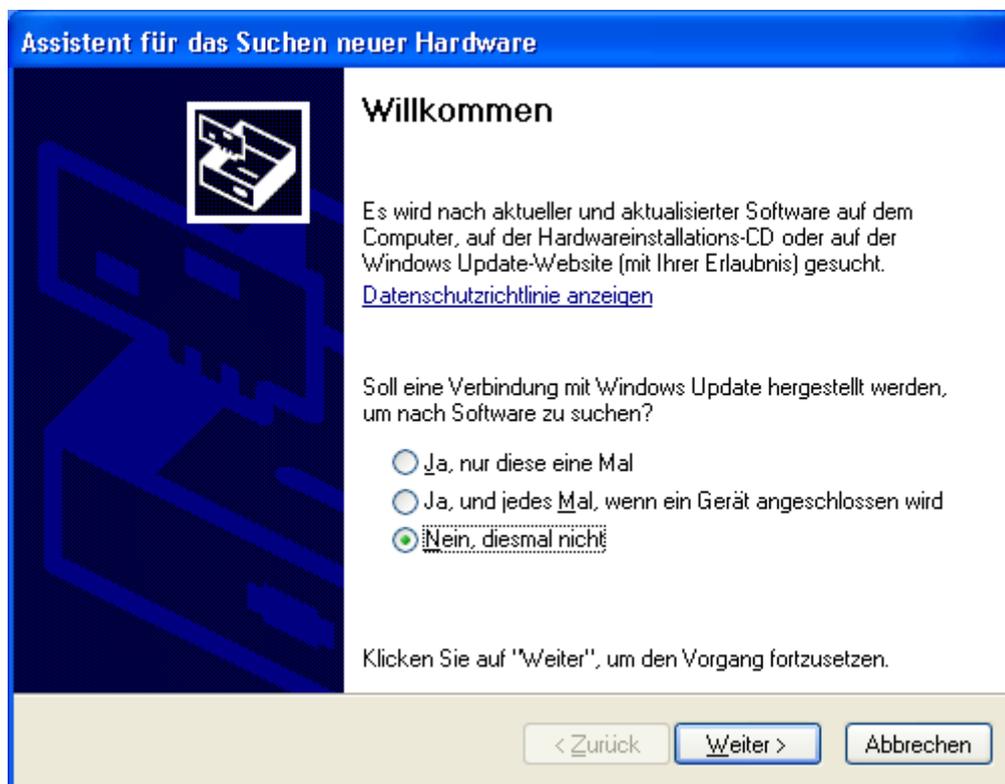
To complete the installation, the following window appears:



Please 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:



Please select "No, not this time" and click on the button "Next" to continue.

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

Please 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:

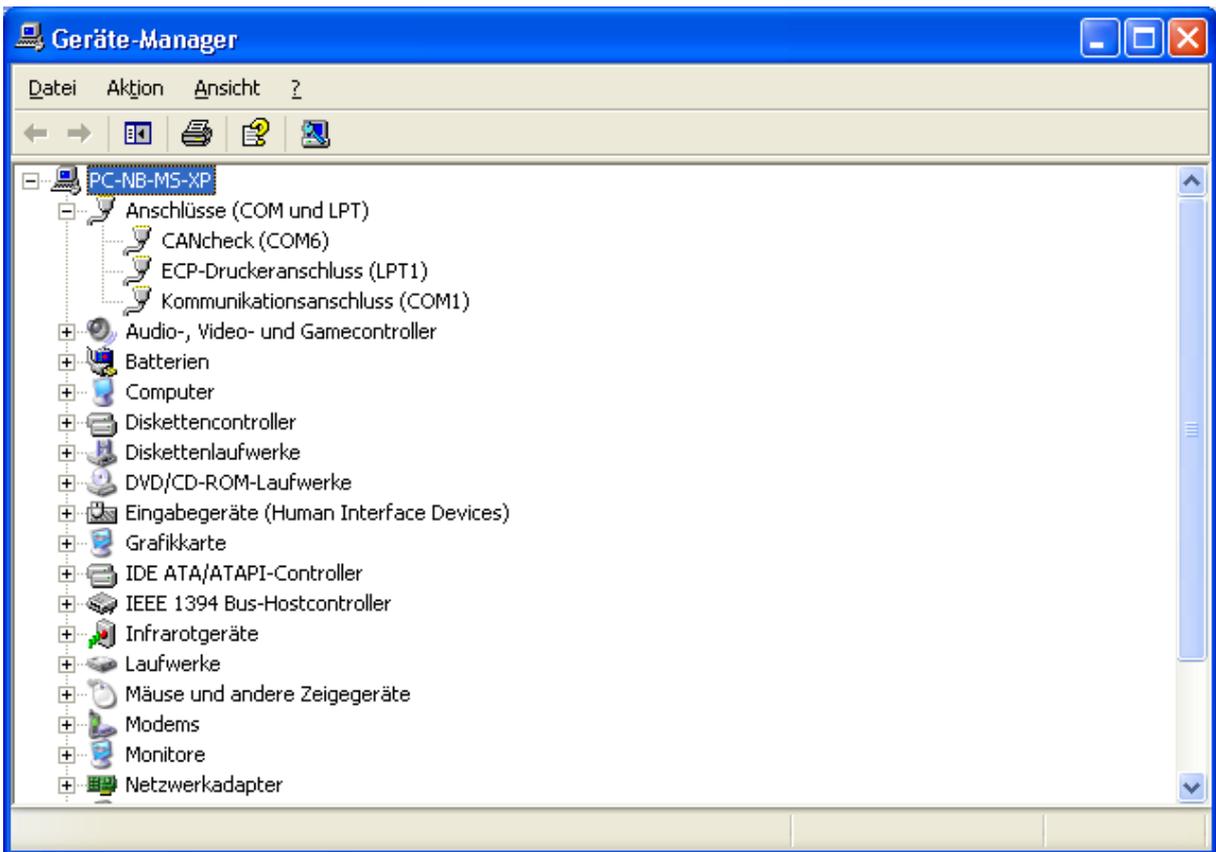


Please click on the button "Finish" to complete the installation.

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.

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



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

In the terminal program, please 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

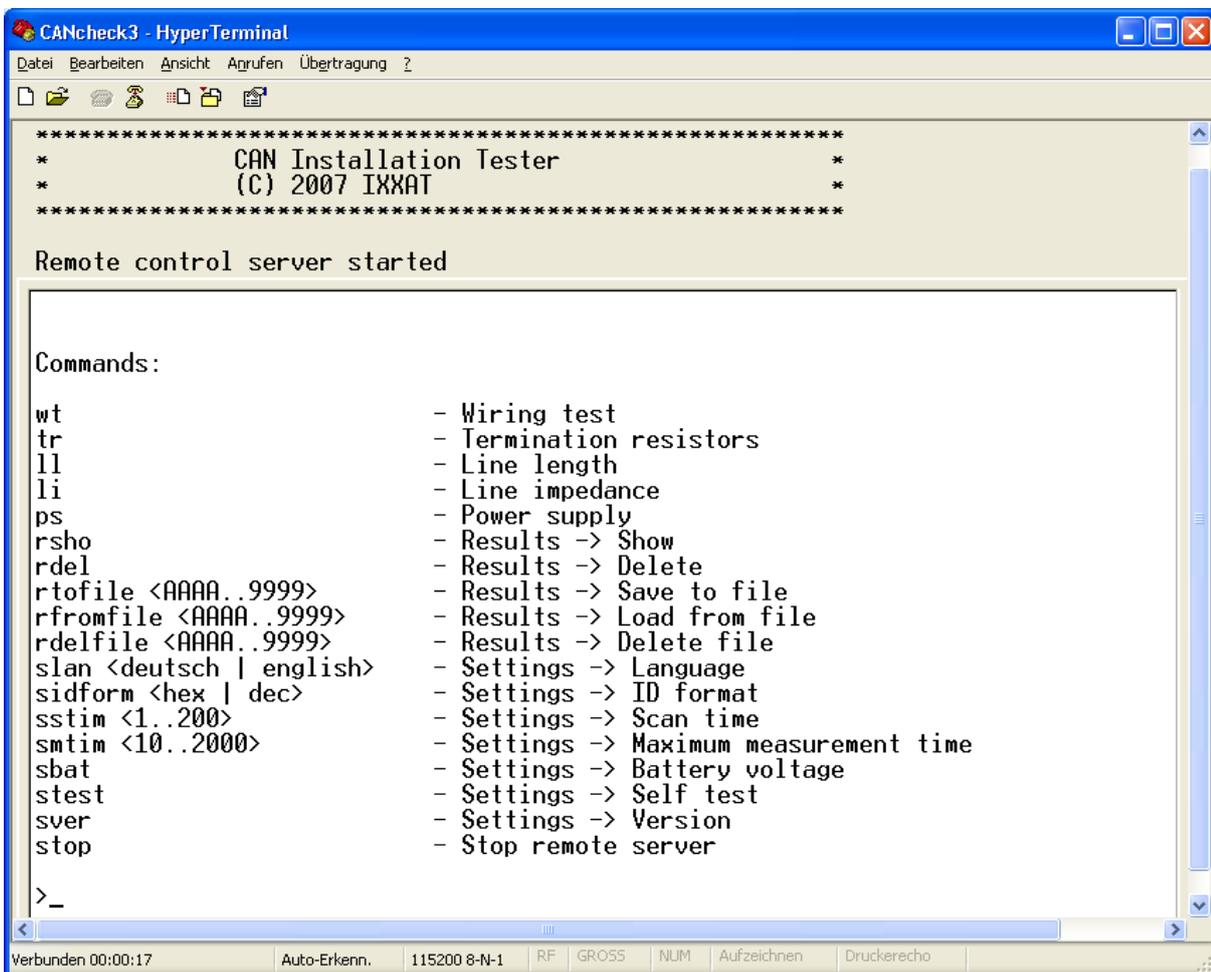
USB driver

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:



The test of the connection is now completed.

11 Appendix

11.1 Technical specifications

Dimensions:	165 mm x 105 mm 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 Ω to 200 Ω ± 5 % 0 Ω to 20 Ω ± 20 % 200 Ω to 1 MΩ ± 20 %
Termination resistors:	54 Ω 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 kΩ is classified as OK
Cable length measurement:	20 m to 30 m ± 3 m 30 m to 500 m ± 10 % The measurement is based on the adjusted velocity of propagation.
Line impedance:	120 Ω ± 20 % is classified as OK
CAN_V+ supply:	0 V 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 V to +5 V ± 0.1 V -10 V to +10 V ± 0.4 V
Differential signal level:	1.5 V ≤ (CAN_H → CAN_L) ≤ 3 V is classified as OK
Absolute signal level:	(CAN_H → CAN_GND) ≤ 7 V with (CAN_L → CAN_GND) ≥ -2 V is classified as OK
Scan time:	Adjustable from 1 s to 200 s
Measuring time:	Adjustable from 10 s 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 1kΩ.
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.

Please 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 radiointerference 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

HMS Technology Center Ravensburg GmbH declares that the product:

	CAN Installation Tester
model:	CANcheck
with the article number:	1.01.0097.00000

do comply with the EC directives 2004/108/EC.

Applied harmonized standards in particular:

EN 55022:2006 + A1:2007

EN 61000-6-2:2005

EN 55024:1998 + A1:2001 + A2:2003

23.08.2011, Dipl.-Ing. Christian Schlegel , Managing Director



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