



Euroopa Liit
Euroopa Sotsiaalfond



Eesti tuleviku heaks



TALLINNA TEHNIKAKÕRGKOO
UNIVERSITY OF APPLIED SCIENCES

Auto andmevõrgu õppevahend

E-õpe oskuste õppimisel ja õpetamisel

Ülevaade ettekandest

- ▶ E-õppe kasutamine teadmiste õppimisel
- ▶ E-õppe kasutamine oskuste õppimisel
- ▶ Loengutunni tutvustus
- ▶ Laboritunni tutvustus
- ▶ Õppevahendi tutvustus

E-õppe kasutamine teadmiste õppimisel

Õppemeetodid

Õppemeetodid teadmiste õppimisel

▶ Õpivahendid

- ▶ Teksti lugemine
- ▶ Piltide vaatamine
- ▶ Video vaatamine ja kuulamine

▶ Õpitegevused

- ▶ Foorum
- ▶ Vestlus teksti kujul
- ▶ Vestlus heli kujul
- ▶ Küsimustik
- ▶ Test



E-õppe raamat

Sisukord



Eesmärk

Ehitus

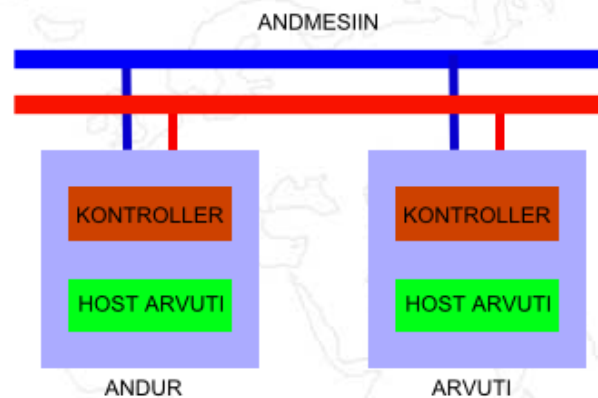
Tööpõhimõte

Hooldus

Remont

Tööpõhimõte

Iga seade CAN andmevahetussüsteemis võib saata ning vastuvõtta sõnumeid, kuid mitte samaaegselt. Sõnu saadetakse järjestikuliselt ühe biti haaval andmesiini ning võetakse vastu iga siiniga ühendatud seadme pool Täpsemalt, ei võta üksi seade, see on, andur või täitur andmevahetusest otseselt osa. Seadme ja siini vahel töötab CAN kontrolleri.



Sõnum koosneb identifitseerivast osast, mis kirjeldab sõnumi tüüpi või sõnumi saatjat ja sisu osast, mis koosneb kuni kaheksast baidist. Kui andmesiin on vaba, siis võib seade hakata sõnumit edastama. Juhul kui kaks seadet hakkavad korraga sõnumit edastama, siis eesõiguse saab seade, millel on suurema prioriteediga identifitseer osa.

Andmeedastuse kiirus võib ulatuda kuni 1Mbit/s.



Allikas [1]

Kordamisküsimustik

Print Blank

All responses- view 19

Kordamisküsimused

Andmevahetusseadmed

- *1 Andmevahetusseadmed on ettenähtud
- Andurite signaalide edastamiseks
 - Täiturite signaalide edastamiseks
 - Nii andurite kui täiturite signaalide edastamiseks

- *2 Andmevahetussüsteem koosneb
- Erinevatest arvutitest, ühendusjuhtmetest
 - Ühest juhtarvutist, ühendusjuhtmetest
 - Juhtarvutist, raadiolainetest

- *3 Andmete edastuse eesõiguse saab seade, millel on
- Väiksem kaugus andmevahetussüsteemi peaarvutist
 - Suurem andmete edastamise maht
 - Sõnumis suurema prioriteediga identifitseeriv osa

Submit questionnaire

Allikas [2]

Kordamisküsimustiku tulemused

[Summary](#)[Delete ALL Responses](#)[View By Response](#)[Return](#)

19 Responses

Kordamisküsimused

Andmevahetusseadmed

1. Andmevahetusseadmed on ettenähtud

Response	Average	Total
Andurite signaalide edastamiseks	21%	4
Täiturite signaalide edastamiseks	11%	2
Nii andurite kui täiturite signaalide edastamiseks	79%	15

2.

Andmevahetussüsteem koosneb

Response	Average	Total
Erinevatest arvutitest, ühendusjuhtmetest	58%	11
Ühest juhtarvutist, ühendusjuhtmetest	47%	9

3.

Andmete edastuse eesõiguse saab seade, millel on

Response	Average	Total
Sõnumis suurema prioriteediga identifitseeriv osa	84%	16

[Lae alla tekstiformaadis](#)[Return](#)

E-õppe kasutamine oskuste õppimisel

Õpivahendite ja õpitegevuste vajadus

Vajalikud oskused

- ▶ Komponentide äratundmine ja ülesleidmine
- ▶ Tööparameetrite mõõtmine
- ▶ Töökorrasoleku hindamine ja vajadusel parandamine

Labori ja praktikumi ülesanded

Laboriseade

- ▶ Tutvuda seadme ehitusega
- ▶ Veenduda seadme tööpõhimõttes
- ▶ Oluliste parameetrite kordamine

Näidisauto

- ▶ Minna üle teoorialt praktikale
- ▶ Töösituatsiooni imiteerimine
- ▶ Erilahenduste näitlikustamine

Loengutunni tutvustus

Esitlus

Tööriistad ja testseadmed

Tööriistad ja testseadmed, Andmevahetus ja diagnostikaseadmed
CAN (Controller Area Network)

Süsteemi plokkskeem

Komponentide asukohad

Elektriskeem

Juhtmestik

Sõnum

Protokollide võrdlus

Rikkeotsing

Rikkeotsing

Juhtmestiku remont

Slide Sorter "Concourse" Estonian 100%

Laboritunni tutvustus

Seadmed

Laboritunni metoodika

- ▶ Üliõpilaste arv poolrühmas kuni 15
- ▶ Seadmete ja töökohtade arv vähemalt kolm
- ▶ Tööriistad ja mõõteseadmed sobilikud õppetööks
- ▶ Juhendaja töö läbiviimiseks
- ▶ Tulemuste vormistamine ja analüüs ning järeldus

Õppevahendi tutvustus

Arvutijuhitav laboratoorne töö

Laboritöökoht üliõpilastele

Arvuti, tarkvara ning universaalne laboriseade

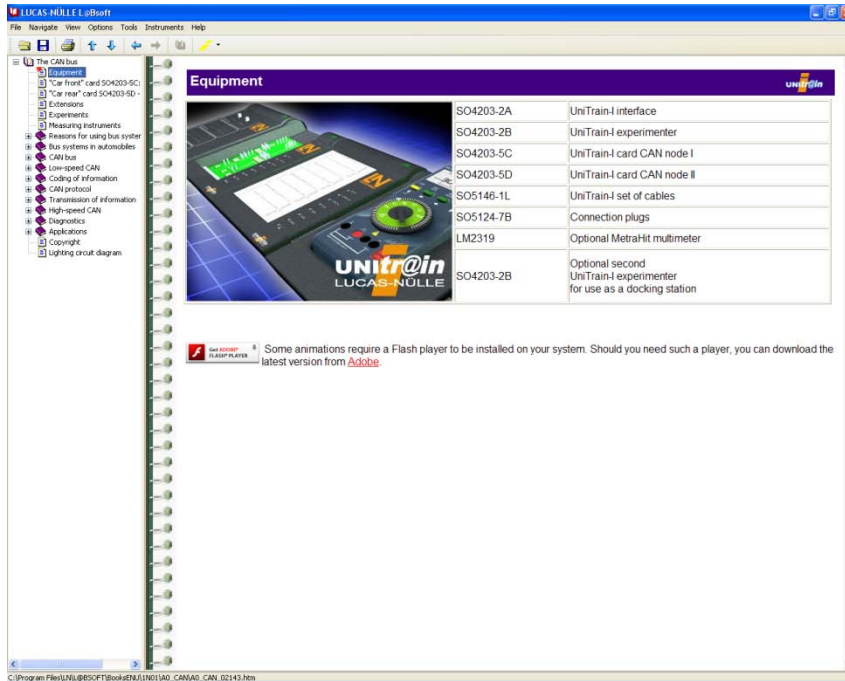


Laborikursuse esileht ja tagaleht

The screenshot shows the 'The CAN bus' course introduction page. The title bar reads 'LUCAS-NÜLLE LabSoft'. The left sidebar contains a tree view with categories like 'Equipment', 'Extensions', 'Experiments', 'Measuring instruments', 'Reasons for using bus system', 'Bus systems in automobiles', 'CAN bus', 'Low-speed CAN', 'Coding of information', 'CAN protocol', 'Transmission of information', 'High-speed CAN', 'Diagnostics', 'Applications', 'Copyright', and 'Lighting circuit diagram'. The main content area features a purple header with 'The CAN bus' and the UniTrain logo. Below this, it says 'UniTrain-I course "Automotive engineering 10 - CAN bus"'. A 3D rendering of a blue car is shown with various components highlighted in green and red. Below the car, the text reads: 'Course number: SO4204-7K, Version 2.1', 'Author: Martin Burgmer, Kai-Christian Tonnsen', and 'Lucas-Nülle GmbH | Siemensstraße 2 | D-50170 Kerpen (Sindorf) | Tel.: +49 2273 567-0'. At the bottom, there are two website URLs: www.lucas-nulle.com and www.unitrain-i.com. The footer contains 'Copyright © 2007 LUCAS-NÜLLE GmbH. All rights reserved.' and the file path 'C:\Program Files\NL\BESOFF\BookEN\I101\10_CAN\AO_CAN_Start.htm'.

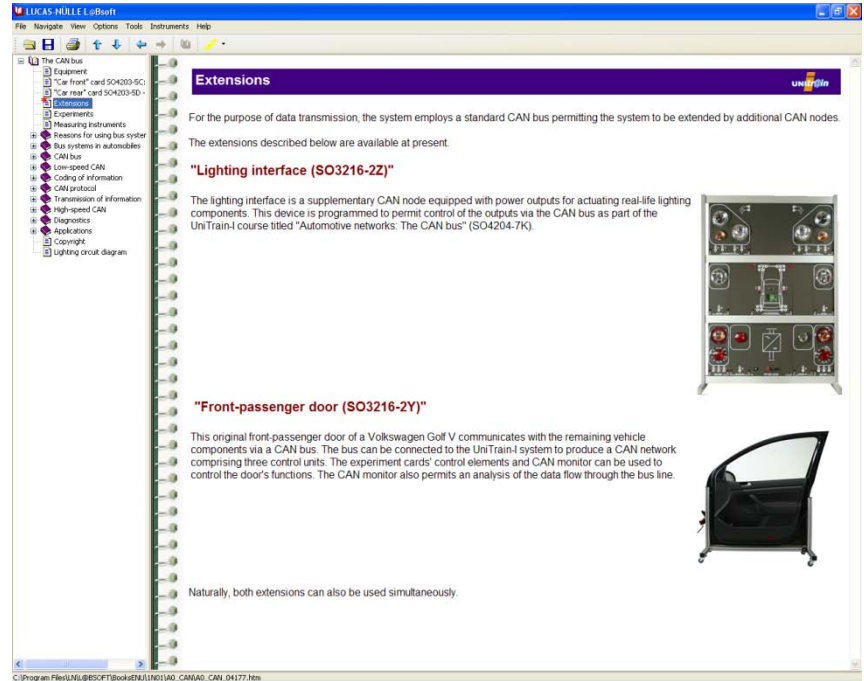
The screenshot shows the 'Automotive 10: CAN bus' course completion page. The title bar reads 'LUCAS-NÜLLE LabSoft'. The left sidebar contains a tree view with categories like 'The CAN bus', 'Equipment', 'Extensions', 'Experiments', 'Measuring instruments', 'Reasons for using bus system', 'Bus systems in automobiles', 'CAN bus', 'Low-speed CAN', 'Voltage levels on low-speed', 'Negative logic', 'Voltage levels', 'Differential voltages', 'Transmission rates', 'Experiment: Bit durations', 'Test', 'Coding of information', 'CAN protocol', 'Transmission of information', 'High-speed CAN', 'Diagnostics', 'Applications', 'Copyright', and 'Lighting circuit diagram'. The main content area features a purple header with 'Copyright © 2002-2008 LUCAS-NÜLLE GmbH' and the UniTrain logo. Below this, it says 'Congratulations!' and 'This is the last page. You have completed the course "Automotive 10: CAN bus"'. A photograph shows a person sitting on a beach with a laptop open. Below the photo, the text reads: 'Copyright © 2008 LUCAS-NÜLLE GmbH.', 'This course "Automotive 10: CAN bus" is protected by copyright. All rights pertaining thereto are reserved. Any reproduction of the document as a file or in written form be it photocopy, microfilm or any other method or conversion into a machine-compatible language, in particular for data processing systems, without the expressed written approval of the LUCAS-NÜLLE GmbH is strictly forbidden.', 'The software as described above is made available on the basis of a general licensing agreement or in the form of a single license. The use or reproduction of the software is only permitted in strict compliance with the contractual terms stated therein.', and 'If changes have been performed in a manner which was not strictly authorised by the LUCAS-NÜLLE GmbH, any product liability or warranty claims pertaining thereto are null and void.' The footer contains 'Copyright © 2007 LUCAS-NÜLLE GmbH. All rights reserved.' and the file path 'C:\Program Files\NL\BESOFF\BookEN\I101\10_CAN\AO_CAN_02146.htm'.

Komponendid ja lisavõimalused



Code	Description
SO4203-2A	UniTrain-I interface
SO4203-2B	UniTrain-I experimenter
SO4203-5C	UniTrain-I card CAN node I
SO4203-5D	UniTrain-I card CAN node II
SO5146-1L	UniTrain-I set of cables
SO5124-7B	Connection plugs
LM2319	Optional MetraHit multimeter
SO4203-2B	Optional second UniTrain-I experimenter for use as a docking station


Some animations require a Flash player to be installed on your system. Should you need such a player, you can download the latest version from [Adobe](#).



For the purpose of data transmission, the system employs a standard CAN bus permitting the system to be extended by additional CAN nodes. The extensions described below are available at present.


"Lighting interface (SO3216-2Z)"

The lighting interface is a supplementary CAN node equipped with power outputs for actuating real-life lighting components. This device is programmed to permit control of the outputs via the CAN bus as part of the UniTrain-I course titled "Automotive networks: The CAN bus" (SO4204-7K).



"Front-passenger door (SO3216-2Y)"

This original front-passenger door of a Volkswagen Golf V communicates with the remaining vehicle components via a CAN bus. The bus can be connected to the UniTrain-I system to produce a CAN network comprising three control units. The experiment cards' control elements and CAN monitor can be used to control the door's functions. The CAN monitor also permits an analysis of the data flow through the bus line.



Naturally, both extensions can also be used simultaneously.

Kohandatatav laboriseade

Lucas-Mülle LabSoft

Technical data:

Input voltage:

- +15 V_{DC}

Function groups:

- Buttons / switches for controlling various functions in a vehicle
- LEDs for simulating the lighting system and fuel gauge
- DIP switches for setting a node's base address
- Eight integrated fault simulations

Dimensions:

- 160 x 100 mm (width x height)

Weight:

- 0.3 kg

Description of the SO4203-5C

The card depicts the front of a car as an independent CAN node as seen in modern vehicles. The controls represent the following functions:

- Right/left indicator lights
- Low beam
- High beam
- Brake lights
- Hazard lights
- Simulated opening of car doors
- Interior lighting
- Central locking - locked/unlocked

Every time a control is operated, a CAN message is generated which triggers suitable actions at this node or other connected CAN nodes. The card can be connected to the "CAN node I" card (SO4203-5D) by means of 2-mm sockets on the right-hand side, and to other CAN nodes via sub-D9 sockets at the top. In this case, the card's IDs can be adjusted by means of the relevant DIP switches at the bottom right. The fault simulation feature produces specific errors in the circuit for demonstrating the effect of interference on the CAN bus.

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Lucas-Mülle LabSoft

"Car rear" card SO4203-5D - CAN node II

The UniTrain-I experiment card "CAN node II" is a supplement to the "CAN node I" card (SO4203-5C) depicting the rear of a car with CAN bus control.

Technical data:

Input voltage:

- +12 V_{DC}

Function groups:

- Switches for electric window control
- Potentiometer for fuel gauge simulation
- LEDs for simulating the lighting system: central locking and electric windows
- DIP switches for setting a node's base address

Dimensions:

- 160 x 100 mm (width x height)

Weight:

- 0.3 kg

Description of the SO4203-5D

The toggle switches simulate the operation of electric window controls. The movement of the windows is simulated by LEDs. The potentiometer is for simulating the fuel tank's contents. Voltage in this case is **not** supplied from the UniTrain-I experimenter, but via 2-mm cables from the "CAN node I" card. The power is fed in via 2-mm sockets on the card's left-hand side. These also serve for connecting the bus to the first CAN node.

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Elektrooniline labor

Experiments

Read the following instructions carefully before starting an experiment. Instructions for the various virtual instruments can be found [here](#).

Connecting the experiment system to the computer

These instructions are valid for **all** experiments.

The prerequisites mentioned below must be fulfilled for the experiment system to communicate with a computer.

- The USB driver for the system must be installed (included on the program CD).
- The Unitrain-I interface SO4203-2A should be connected to the computer by means of the supplied USB cable.
- The Unitrain-I interface SO4203-2A must be connected to the SO4203-2B experimenters.
- Both CAN cards must be slotted into the experimenters.

- The software should not be running in simulation mode (selected when the program is first launched).

Basic settings

These settings are valid for all experiments **except** fault simulation experiments. For fault simulation, **other conditions** apply.

- All experiments should be conducted in "low speed" mode. This is selected via the "MODE" field of the CAN monitor.
- Whenever there are exceptions, the required mode is specified.
- The oscilloscope should always be used in XT mode.
- Whenever the oscilloscope is to be triggered, use the following settings:
 - Trigger from channel A
 - Trigger on rising edge
 - "SINGLE" and "STOP" buttons are not needed

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Basic settings

These settings are valid for all experiments **except** fault simulation experiments. For fault simulation, **other conditions** apply.

- All experiments should be conducted in "low speed" mode. This is selected via the "MODE" field of the CAN monitor.
- Whenever there are exceptions, the required mode is specified.
- The oscilloscope should always be used in XT mode.
- Whenever the oscilloscope is to be triggered, use the following settings:
 - Trigger from channel A
 - Trigger on rising edge
 - "SINGLE" and "STOP" buttons are not needed
 - Pre-trigger should be set to "0%"

Evaluation

Every experiment yields a set of results. Almost all these results can be checked to see whether the answers are correct (except for the fault simulations). For this purpose, click on "Check answers". Before using this facility, make sure you have completed **all** entries. Every entry field is then marked by one of the following symbols:

Symbol	Meaning
✓	Correct. Carry on.
!	Wrong. Please review this section.
?	Entry is missing. Please fill.

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Raamat ja küsimustik

Bus topology

CAN buses employed in automation technology serve, for instance, to network widely scattered parts of an industrial plant. Use is made here of a linear topology in which all CAN nodes are linked to a main line via short stubs:

1: Bus line 2: Stub 3: Station 4: Station 2 5: Station 3 6: Station 4

This type of network is also defined by the CAN standard.

Because the distances between CAN nodes in vehicles are much shorter, automobile manufacturers can install hybrid topologies which, for instance, connect several star points to a line. Though such hybrid topologies negatively influence signal quality on the bus lines, interference is minimized by the short transmission distances in the vehicle.

Click here for [general information](#) on other topologies and networks.

Test

Test your knowledge:

“CAN” stands for

- Controller Aided Norm
- Compatible Automatic Nodes
- Controller Area Network

Please select an answer.

Check answer

Which standard defines transmission parameters and protocols for the CAN bus?

- VDE 0100
- SAE 1543
- ISO 11898
- DIN A3

Correct.

Check answer

The CAN bus in automation technology always has a linear topology. Which type of topology typifies the CAN bus in an automobile?

- The CAN bus in an automobile has a ring topology.
- Due to the short transmission paths in an automobile, a linear topology is not absolutely necessary.
- A motor vehicle's network can be furnished with nodes at which several lines converge.
- A motor vehicle can employ several network types resulting in a hybrid topology.

Unfortunately your answer is wrong.

Check answer

Eksperimenteerimine ja mõõteriistad

1.

Procedure

1. Turn on the low beam.
2. Disconnect the "car rear" card from the bus by removing the CAN-H and CAN-L leads from the sockets on the card.
3. Turn off the low beam and observe the rear lights.
4. Investigate the indicators, fuel gauge and window controls in the same way.
5. Record the relevant results by filling in the gaps in the exercise text below.

Experiment results

If a subscriber is removed from the bus, this [leaves] all the connected actuators [unchanged] ✓. This results in two mutually independent ✓ CAN bus segments. Every segment [remains enabled] ✓. If the segments are connected together again, [the bus behaves as before the interruption] ✓.

Check result

Measuring instruments

The system features two measuring channels. These are located on the "ANALOG IN" panel of the UniTrain-I interface. Voltages, currents and signals input here via the accompanying 2-mm leads can be displayed by the following virtual instruments on a PC, for instance:

Virtual voltmeter

The virtual voltmeter is modelled on a real one. Because a voltmeter usually only has one input, this system offers a separate voltmeter for each channel. The voltmeters are opened via the menu path "Instruments" -> "Measuring Devices" -> "Voltmeter A" or "Voltmeter B" from the menu bar at the top of the screen. If the results of a measurement are to be recorded in an experiment's evaluation, they can be copied easily into the relevant fields of the page using drag and drop. This eliminates the need for manual typing of the results. More details on how to use the virtual voltmeter can be found under the menu "Help" -> "Contents".

Virtual oscilloscope

The virtual oscilloscope emulates a dual-channel storage scope. It is used almost exactly like a real oscilloscope. Because two input channels can be displayed simultaneously here, the training system only provides a single virtual oscilloscope. The oscilloscope is opened via the menu path "Instruments" -> "Measuring Devices" -> "Oscilloscope" from the menu bar at the top of the screen. If an experiment evaluation requires oscilloscope traces, these can easily be copied to the relevant fields on the page using drag and drop. Only parameters such as time-base and voltage resolution are entered manually. More details on how to use the virtual oscilloscope can be found under the menu "Help" -> "Contents".

Note that the virtual voltmeters and the virtual oscilloscope **cannot be used at the same time**.

CAN monitor

The CAN monitor displays messages communicated on the training system's bus. It resembles a logic analyser as used in modern diagnostic systems for the CAN bus. The CAN monitor is directly connected to the two cards via the plug-in strip on the UniTrain experimenter. It is therefore not necessary to connect cables via ANALOG IN. The CAN monitor is opened via the menu path "Instruments" -> "Measuring Devices" -> "CAN monitor" from the menu bar at the top of the screen. More details on how to use the CAN monitor can be found under the menu "Help" -> "Contents".

Mõõtmiseks valmistumine

• Lighting interface (S03216-ZZ). As required
 • Front-passenger door (S03216-2Y). No

Information on using the extensions is provided [here](#).

1. Connect the following terminals with the accompanying experiment cables:

"Car front" module	"Car rear" module
CAN-H	CAN-H
CAN-L	CAN-L
+12V	+12V
Earth	Earth

"Interface S04203-2A" module	"Car front" module
A+	CAN-H
A-	Earth
B+	CAN-L
B-	Earth

Procedure

1. Open the CAN monitor via the menu path "Instruments" > "CAN monitor" and perform the following settings in the "OPTIONS" menu:

Periodic messages			Baud rate	
ID 6	ID 7	ID 15	Low speed	High speed
Active	Inactive	Inactive	125 k	Any

2. Confirm your selection by clicking on the "OK" button.
3. Close the CAN monitor.
4. Open the virtual oscilloscope via the menu path "Instruments" > "Measuring devices" > "Oscilloscope".

Channel	On/off	Voltage division	Coupling	Inverse display	Time base	Trigger channel	Edge	Pre-Trigger	Trigger level	Display mode	
A	ON	2V/DIV	DC	OFF	50	µs	A	Rising	0%	Approx. 3 V	X/T
B	OFF	-	-	-	-	-	-	-	-	-	-

5. Trigger the oscilloscope until a satisfactory image appears on the screen.
6. Make sure that none of the switches (e.g. indicator) on the experimenters is actuated.
7. The first recessive signal level (voltage at CAN-H = 0 V, voltage at CAN-L = 5 V) is exactly one bit long. Set the time division so that this bit can be clearly read and then determine its duration.
8. Calculate the resultant transmission rate in the evaluation section.

Experiment evaluation

Reading the bit duration:

Time base: 50 µs / DIV
 Channel A:
 Amplitude factor: 2 V / DIV
 Coupling: AC DC

Laboritöö tulemus

Procedure

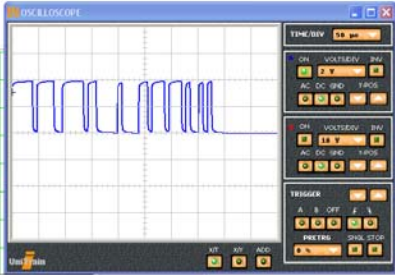
- Open the CAN monitor via the menu path "Instruments" > "CAN monitor" and perform the following settings in the "OPTIONS menu":

Periodic messages			Baud rate	
ID 6	ID 7	ID 15	Low speed	High speed
Active	Inactive	Inactive	125 k	Any
- Confirm your selection by clicking on the "OK" button.
- Close the CAN monitor.
- Open the virtual oscilloscope via the menu path "Instruments" > "Measuring devices" > "Oscilloscope".

Channel	On/off	Voltage division	Coupling	Inverse display	Time base	Trigger channel	Edge	Pre-Trigger	Trigger level	Display mode	
A	ON	2V/DIV	DC	OFF	50	A	Rising	0%	Approx.	3 V	X/T
B	OFF	-	-	-	-	-	-	-	-	-	-
- Trigger the oscilloscope until a satisfactory image appears on the screen.
- Make sure that none of the switches (e.g. indicator) on the experimenters is actuated.
- The first recessive signal level (voltage at CAN-H = 0 V, voltage at CAN-L = 5 V) is exactly one bit long. Set the time division so that this bit can be clearly read and then determine its duration.
- Calculate the resultant transmission rate in the evaluation section.

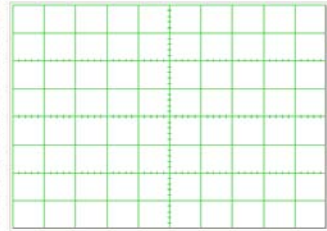
Experiment evaluation

Reading the bit duration:



Experiment evaluation

Reading the bit duration:



Time base: 50 ns / DIV
Channel A: 2 V / DIV
Coupling: AC = DC

Calculation of the transmission rate:

$$\begin{aligned} \text{Transmission rate} &= 1 \text{ bit} / \text{bit duration} \\ &= 1 \text{ bit} / 8 \mu\text{s} \\ &= 0.125 \text{ Bit} / \mu\text{s} \\ &= 125000 \text{ Bit} / \text{s} \\ &= 125 \text{ kBit} / \text{s} \end{aligned}$$

Experiment result

The bit duration on the bus is 8 μs .
The transmission rate on the bus is 125 kBit / s.

Check results

Kasutatud kirjandus

1. Tallinna Tehnikakõrgkooli e-õppe keskkond. Auto elektriseadmed. Andmevahetusseadmed. CAN andmevahetussüsteem. [WWW]
<http://ekool.ttkk.ee/mod/book/view.php?id=2318&chapterid=17> (20.04.2010)
2. Tallinna Tehnikakõrgkooli e-õppe keskkond. Auto elektriseadmed. Andmevahetusseadmed. Kordamisküsimused. [WWW]
<http://ekool.ttkk.ee/mod/questionnaire/view.php?id=2324> (20.04.2010)
3. Tallinna Tehnikakõrgkooli e-õppe keskkond. Auto elektriseadmed. Andmevahetusseadmed. Kordamisküsimused. [WWW]
<http://ekool.ttkk.ee/mod/questionnaire/report.php?instance=2&sid=2&qact=vresp>
(20.04.2010)

Täna tähelepanu eest!

