HaeHong

LIPOWSKY
INDUSTRIE-ELEKTRONIK

User Manual

HARP-5 V4.0

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1 Imprint

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2 Glossary

ADC	Ampere Direct Current. This is the unit of DC current values.
CAN	Controller Area Network
CAN-HS	CAN high speed. Theses are CAN interfaces with high data rates according to ISO-11898.
CAN-LS	CAN low speed. Theses are CAN interfaces with fault tolerant low data rates according to ISO-11519.
CD	Compact Disk
DBC	Database CAN: A file that contains the description of a CAN bus. It contains nearly the same information as a ARXML file.
DLL	Dynamic Link Library. It can be used to execute the DLL functions in custom applications.
ECU	Electronic control unit
EOL	End of line
ESD	Electro static discharge. The sudden flow of electricity between two electrically charged objects caused by e.g. contact.
EU	European Union. The Lipowsky Industrie-Elektronik GmbH resides inside the EU. Therefor shipping within the EU can be done without customs duties. You should definitely check out our worldwide distributors. Check chapter Distributors for more information.
LIN	Local Interconnect Network
LINWorks	Application software suite to configure the Baby-LIN devices.
PC	Personal Computer
PLC	Programmable Logic Controller
PWM	The pulse-width modulation is a modulation technique used to encode a value into a pulsing signal.
RTC	Real-time clock.
SD	Secure Digital Memory Card. This is a type of non-volatile memory cards.
SDF	Session Description File
SID	Service identifier. This number identifies a protocol service.
USB	Universal Serial Bus
VDC	Voltage Direct Current. This is the unit of DC voltage values.

3 Safety instruciotns

3.1 Warning signs

The following warning signs are used for safety precautions:

DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.

WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE NOTICE is used to address practices not related to physical injury.

SAFETY INSTRUCTIONS Safety instructions signs indicate specific safety related instructions or procedures.

The following notice types are used to give you non safety precaution related information, e.g. software or configuration related problems:

Attention
This notice type signals possible problems, you should definitely pay attention to. Ignoring them probably lead to unexpected behaviour or data loss.

Version Incompatibility
This notice type signals possible version incompatibilities and may lead to unexpected behaviour. These incompatibilities can be caused by old or incompatible software or firmware versions as well as missing activation codes.

Warning
This notice type signals possible problems, you should pay attention to. Ignoring them may lead to unexpected behaviour or data loss.

Attention
This notice type should inform you about useful information, that help you understand the Baby- LIN-RM-III better.

Attention
This notice type should give you tips, that help to reduce your expense and time to implement.

3.2 Safety precautions

Despite compliance with the relevant laws and regulations, residual risks can not be excluded. The following safety precautions define the hazards that can occur when operating the HARP-5

DANGER 	Mortal danger by automatic start of connected devices. • Prepare for actions from connected devices. • Study safety precautions of connected devices.
WARNING 	Mortal danger by electric shock. • Operate the HARP-5 only within dry conditions. • Do not touch the HARP-5 if powered. • Do not touch the HARP-5 if damaged.
CAUTION 	• Do not touch the HARP-5 if wet. Injury by damaged battery. • Operate the device only within the defined operating temperature. • Observe the correct polarity when inserting the battery. • Do not touch the battery if damaged. • Do not touch the battery if wet.
NOTICE	Please recycle or dispose the battery safely and properly according to local laws and regulations.

4 Preface

4.1 Updates

4.1.1 Update philosophy

The functionality and features of the HARP-5 are defined by the installed firmware as well as the used versions of the LINWorks and Baby-LIN-DLL.

As we are permanently working on product improvements, the software and firmware are updated periodically. These updates make new features available and solve problems, which have been discovered by our internal tests or have been reported by customers with earlier versions.

All the firmware updates are done in a way, that the updated HARP-5 will continue to work with an already installed, older LINWorks installation. So updating the HARP-5 firmware does not mean, that you necessarily have to update your LINWorks installation as well.

Therefor it is highly recommended to always update
your HARP-5 to the latest available firmware version.

We also recommend to also update your LINWorks software and Baby-LIN-DLL, if new updates get available. Since new versions of the SessionConf may introduce new features to the SDF format, it is possible that older firmware, SimpleMenu or Baby-LIN-DLL versions are not compatible. Therefor you should also update them.

If you update your LINWorks it is highly recommended updating
the firmware of your HARP-5 to the latest available firmware version
as well as distributed the used versions of the Baby-LIN-DLL.

So the sole reason to stay with an older LINWorks version should be, that you use a HARP-5 with outdated firmware version, which you can't upgrade for whatever reason.

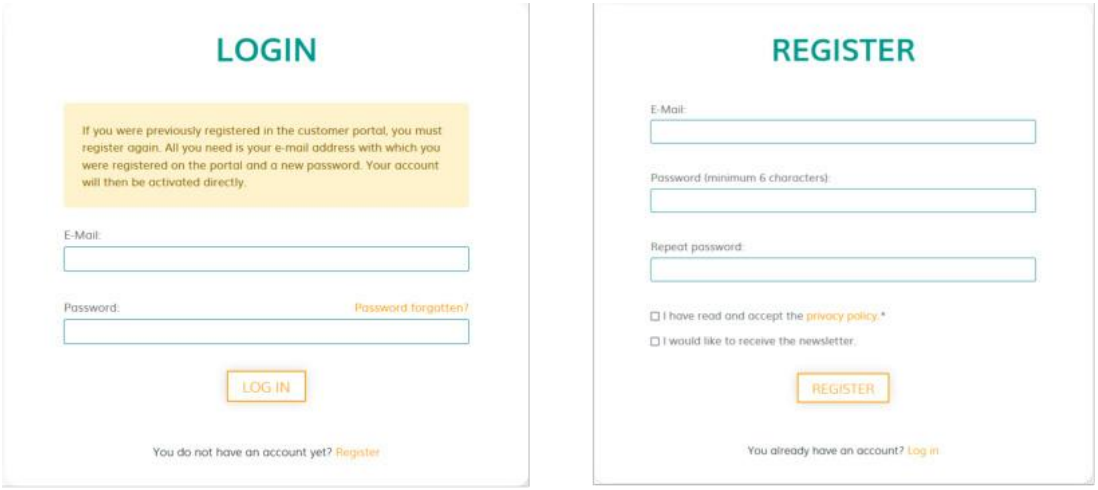
It is highly recommended updating the
Baby-LIN driver to the latest version.

4.1.2 Downloads

The latest version of our software , fimrware and documents can be found in the download area on our website *www.lipowsky.de* .

Advice
The **LINWorks** archive contains not only the **LINWorks** software but also the manuals, datasheets, application notes and examples.
Only the device firmware packages are not included. The firmware is available as separate package.

Documents such as the data sheets or introductions to LIN bus communication are freely available for download. For all other documents and our LINWokrs software you have to log in. If you do not have a customer account yet you can register on our website. After your account has been activated by us you will receive an e-mail and then you have full access to our download offer.



4.1.3 Installation

The LINWorks suite is delivered with a handy setup application. If you already have installed an older version you can simply install the newer versions. The setup application will take care of overwriting the required files. Simply follow these steps:

- Start the "Setup.exe".
- Select the components you want to install.
- Follow the instructions.

Warning
Please stop all running LINWorks applications and disconnect all Baby-LIN devices before starting the setup.

Version incompatibility
If you have used the SessionConf and SimpleMenu with version V1.x.x, the new version will be installed parallel to the old ones. Therefor you have to use the new shortcuts to start the new versions.

4.1.4 Check version

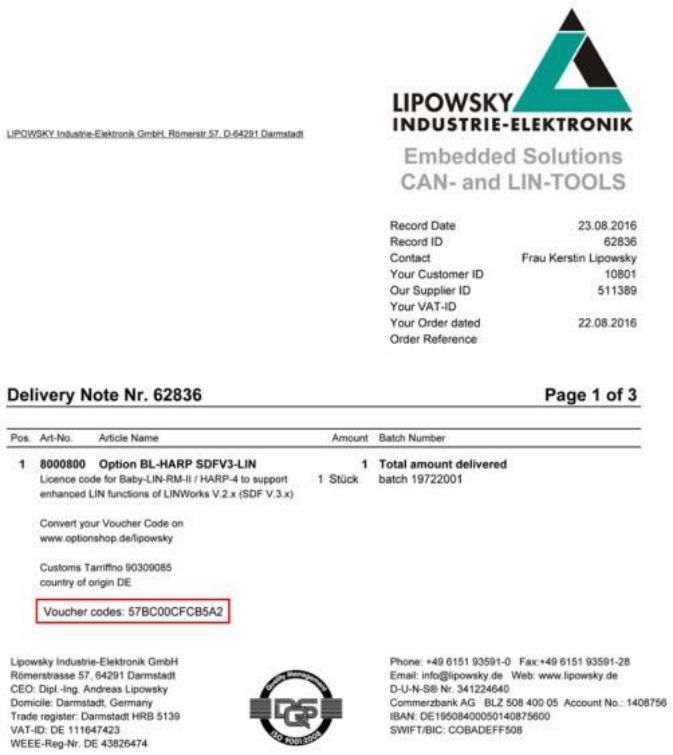
If you want to check the current version of the HARP-5 firmware or a LINWorks component the following table shows you how it is done:

Component	How to check the version
HARP-5 firmnware	Start the SimpleMenu and connect to the HARP-5 . Now the firmware version is visible in the device list.
LINWorks: • LDFEdit • SessionConf • SimpleMenu • LogViewer • MB-Tool	Select the menu option "Help"/"About"/"Info". The info dialog will show the software version.
Baby-LIN-DLL	Call BLC_getVersionString(). The version is returned as string.
Baby-LIN-DLL .NET Wrapper	Call GetWrapperVersion(). The version is returned as string.

Advice
If you need support please always tell us the firmware and software versions you are using.

5 Handle voucher and activation codes

5.1 Convert a voucher code into an activation code



LIPOWSKY Industrie-Elektronik GmbH, Römerstr.57, D-64291 Darmstadt

LIPOWSKY INDUSTRIE-ELEKTRONIK
Embedded Solutions
CAN- and LIN-TOOLS

Record Date	23.08.2016
Record ID	62836
Contact	Frau Kerstin Lipowsky
Your Customer ID	10801
Our Supplier ID	511389
Your VAT-ID	
Your Order dated	22.08.2016
Order Reference	

Delivery Note Nr. 62836 **Page 1 of 3**

Pos.	Art-No.	Article Name	Amount	Batch Number
1	8000800	**Option BL-HARP SDFV3-LIN** Licence code for Baby-LIN-RM-II / HARP-4 to support enhanced LIN functions of LINWorks V.2.x (SDF V.3.x)	1 1 Stück	**Total amount delivered** batch 19722001

Convert your Voucher Code on
www.optionshop.de/lipowsky

Customs Tarriffno 90309085
country of origin DE

Voucher codes: 57BC00CFCB5A2

Lipowsky Industrie-Elektronik GmbH
Römerstrasse 57, 64291 Darmstadt
CEO: Dipl.-Ing. Andreas Lipowsky
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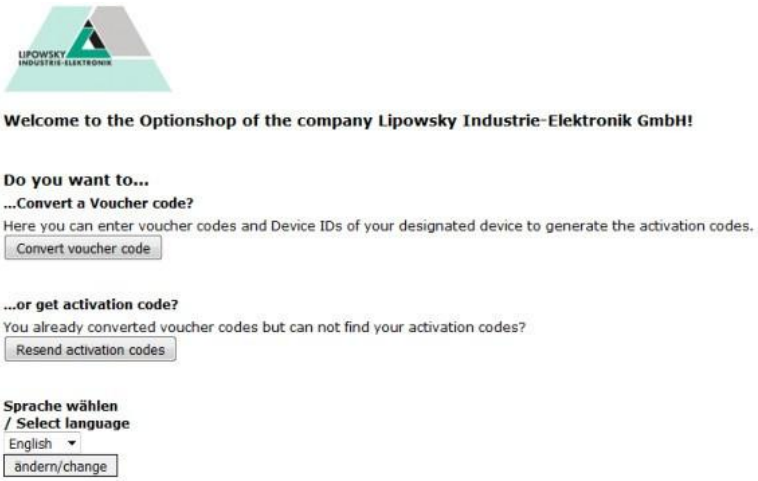
Commerzbank AG BLZ 508 400 05 Account No.: 1408756
IBAN: DE19508400050140875600
SWIFT/BIC: COBADEFF508

These voucher codes have to be converted into activation codes using the target device's serial number. This can be done using the Lipowsky optionshop: *www.optionshop.de/lipowsky* . On this website click on "Convert voucher code".



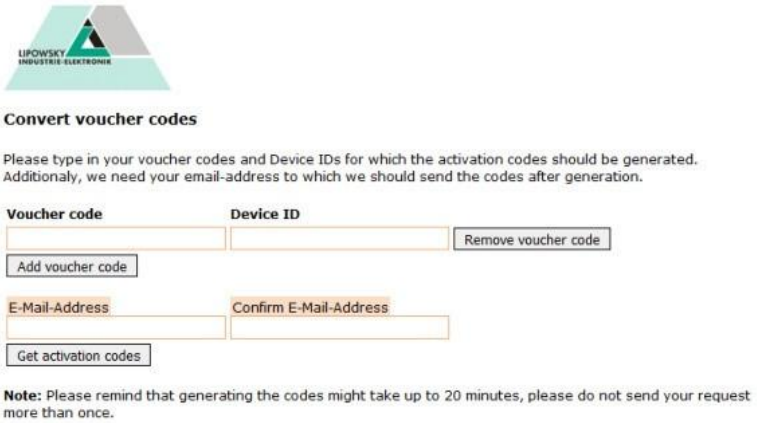
Welcome to the Optionshop of the company Lipowsky Industrie-Elektronik GmbH!

Do you want to...
...Convert a Voucher code?
Here you can enter voucher codes and Device IDs of your designated device to generate the activation codes.
Convert voucher code

...or get activation code?
You already converted voucher codes but can not find your activation codes?
Resend activation codes

Sprache wählen
/ Select language
English
ändern/change

On the next site you have to enter the voucher code and the serial number (sometime referred to as "Device ID") of the device you want the activation code for. Enter your e-mail address and click on "Get activation codes".



A table will display all important information including the created activation code.

Device ID	Voucher code	Option	Part-no	Activation code
1382331	5333DD5EDEDE1	LIN-SDF3.X Support	8000800	EB201 HINRT BK00U OHZ1F 3DSVF IH

Additionally you will receive an e-mail with your activation codes.

Version incompatibility

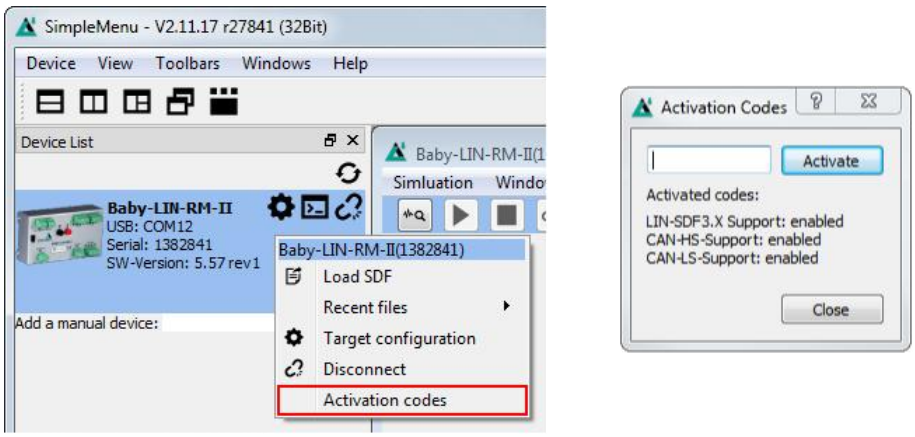
The conversion of voucher codes into an activation codes may take some time. It can take up to 20 minutes until you receive your activation codes via e-mail.

Version incompatibility

If you convert a voucher code into an activation code it will be bound to the device which serial number you entered. Once activated the voucher code can not be used for another device. There is no possibility to export an activation code from a device and regain your voucher code.

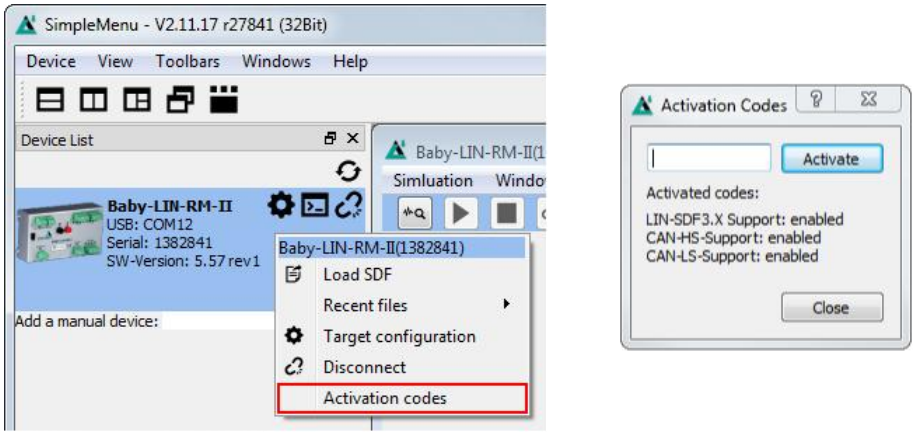
5.2 Redeem an activation code

The SimpleMenu can be used to redeem activation codes. Please connect the HARP-5 with a free USB port on a PC. Now start the SimpleMenu and establish a connection with your HARP-5. Rightclick on the device image in the device list on the left and then choose "Activation codes". Enter your activation code in the new dialog and click on "Activate".



5.3 Check the installed activation codes

The installed activation codes can be displayed using the SimpleMenu. Please connect the HARP-5 with a free USB port on a PC. Now start the SimpleMenu and establish a connection with your HARP-5. Right-click on the device image in the device list on the left and then choose "Activation codes". A dialog will then show you the installed activation codes.



5.4 Support information

In case of any questions you can get technical support by email or phone. We can use TeamViewer to give you direct support and help on your own PC. This way we are able to sort out problems fast and direct. We have sample code and application notes available, which will help you to make your job.

Lipowsky Industrie-Elektronik GmbH realized many successful LIN and CAN related projects and therefor we can draw upon many years of experience in these fields. We also provide turn key solutions for specific applications like EOL (End of Line) testers or programming stations.

Lipowsky Industrie-Elektronik GmbH designs, produces and applies the Baby-LIN products, so you can always expect qualified and fast support.

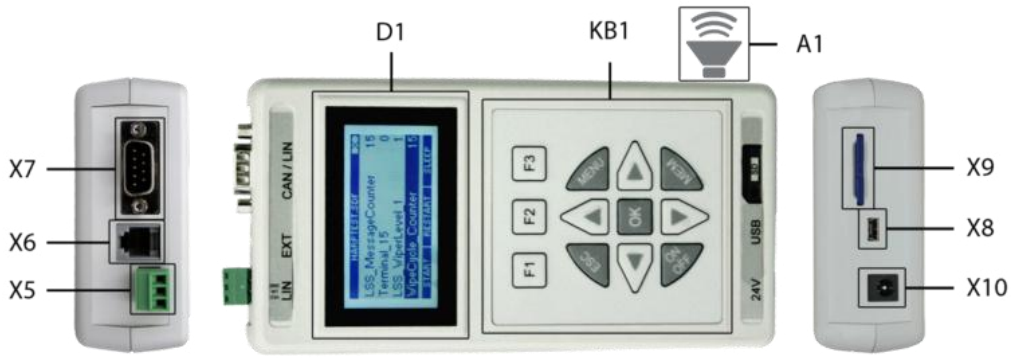
Contact informations	**Lipowsky Industrie-Elektronik GmbH, Römerstr. 57, 64291 Darmstadt**		
Website:	*www.lipowsky.com*	Email:	*info@lipowsky.de*
Telephone:	+49 (0) 6151 / 93591 - 0		

6 Hardware

6.1 Overview

The following images show you what features the HARP-5 has to offer. The following features will be shown:

Abbreviation	Description
X	Connectors to access the different interfaces.
KB	A keyboard to trigger programmable user-defined actions. A keyboard to navigate through the HARP-5 menus.
D	A display to show LIN- and CAN-Bus information and configure the device.
A	An acoustic signal generator that can be triggered by custom events.
SD	A SDHC card slot



Abbreviation	Type	Description
X7	Sub-D-9 male	LIN- and CAN-Bus connector.
X5	Socket for MC 1,5/ 6-ST-3,81 and MCVR 1,5/6-ST-3,81	LIN- and CAN-Bus connector.
X10	NEB 21 R	Logic power and charging supply connector.
X8	USB 2.0 type B-Mini	PC connector
X9	SDHC card slot	SD cards used for storage of SDFs and log data.
KB1	Keyboard with 12 keys	Keyboard for navigating the menus.
D1	Graphical LCD display	Display for showing menus and bus informations.
A1	Acoustic signal generator	An acoustic signal generator that can be triggered by custom events.

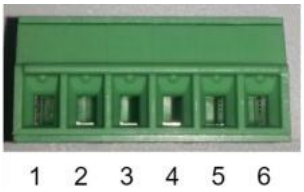
6.2 Connectors

6.2.1 X5 - LIN, CAN and IO

The LIN-Bus interface is available via a MC 1,5/ 3-ST-3,81 connector.

The LIN-Bus interface of the HARP-5 can be operated between voltages of 8-18 VDC.

This CAN-Bus interface is available as fault tolerant low speed interface (CAN-LS) according to ISO-11519.



Pin	Signal	Description
X5-1	VBAT	LIN-Bus power supply. This pin is connected with pin X7-9.
X5-2	LIN-1	LIN-Bus signal. This pin is connected with pin X7-8.
X5-3	GND	LIN-Bus ground. This pin is connected with pin X7-3 and X7-6.
X5-4	CAN-LS-H	CAN-High signal of low speed CAN-Bus interface.
X5-5	CAN-LS-L	CAN-Low signal of low speed CAN-Bus interface.
X5-6	DigIO	Adigital I/O

Keep the LIN-Bus voltage within the following range: 8-26 VDC.

- Injury by damaged HARP-5 .
- The HARP-5 may get damaged.

Check LIN-Bus node specifications before using voltages above 18 VDC.

If voltages in excess of 18 VDC are used as LIN-Bus supply voltage, it must be ensured that all connected nodes can cope with this voltage level. It is possible, that some nodes will function incorrectly in voltages exceeding 18 VDC, since the LIN specification states a maximum voltage of 18 VDC.

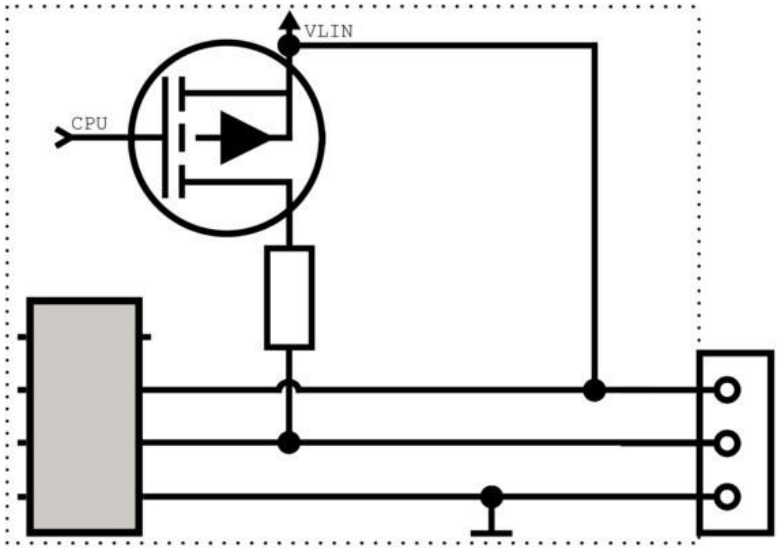
- Injury by damaged HARP-5 .
- The HARP-5 may get damaged.

Advice
The LIN-Bus interface is galvanically isolated from the logic supply, the USB interface.

Warning
The LIN-Bus supply must be provided by an external power supply and must not be interrupted during the LIN communication.

Warning
The LIN-Bus 1 and 2 are connected by default. This allows to use the HARP-5 as a gateway. This behaviour can be switched at runtime by setting the system variable @@SYSDIGOUT37.

6.2.1.1 Equivalent circuit of the LIN-Bus interface:



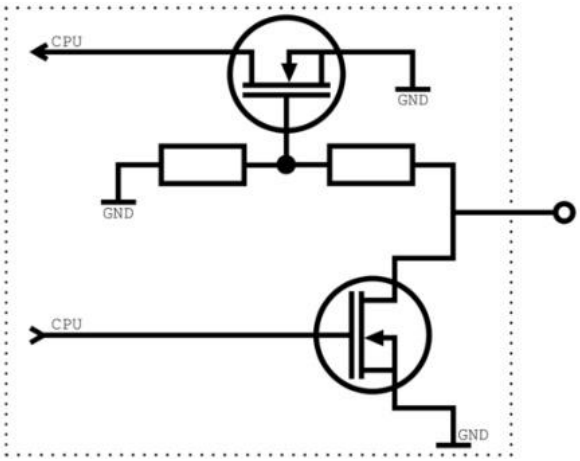
Electrical characteristics	Value	Unit
Maximum operational voltage	26	V
Maximum LIN voltage	32	V
Maximum LIN current	700	mA
Maximum LIN supply voltage	18	V
Maximum LIN supply current	2.5	mA

Electrical characteristics	Voltage threshold for LIN detection	Voltage threshold for LIN transceiver
Minimum	4.3 V	6.8 V

The pull-up resistor of the LIN-Bus driver is switched to 1 kOhm, if the master node is emulated and to 30 kOhm, if only slave nodes are emulated.

6.2.1.2 Equivalent circuit of the digital input of the HARP-5:

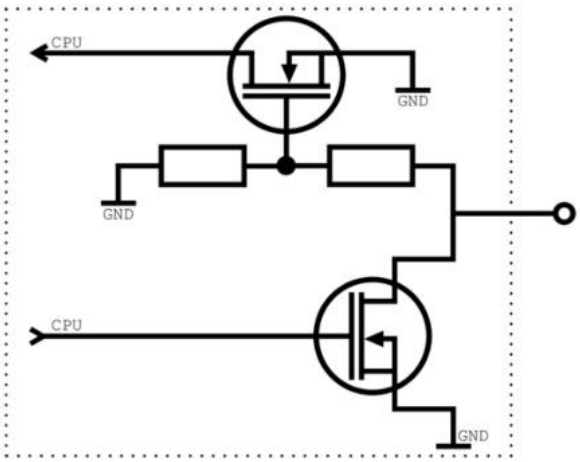
Pins: X5-6



Electrical characteristics	Value	Unit
Maximum voltage for low level	1.2	V
Minimum voltage for high level	5	V
Maximum current	400	µA
Maximum voltage	32	V

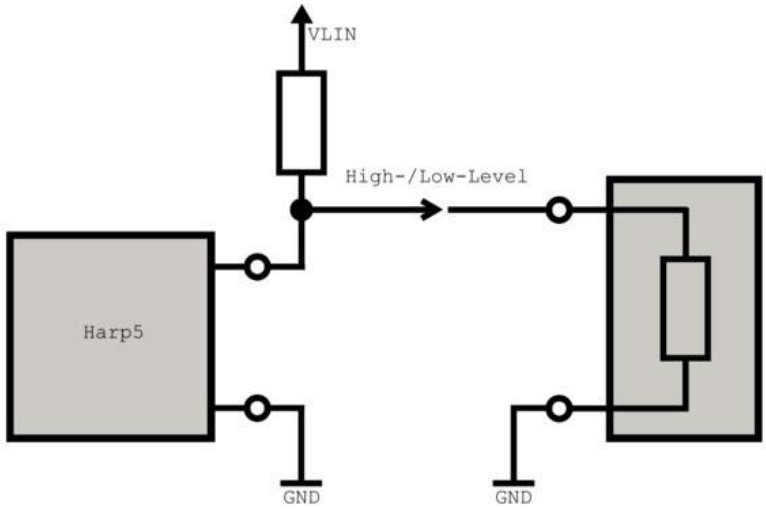
6.2.1.3 Equivalent circuit of the digital output of the HARP-5:

Pins: X5-6, X5-3



Electrical characteristics	Value	Unit
Maximum current for permanent high level	75	mA
Maximum current	0.7	A
Maximum voltage	32	V

6.2.1.4 Connecting an input (e.g. a PLC input) to a digital output of the HARP-5:



The calculation of the pull-up resistor value must meet two criteria:

- The voltage threshold for the digital input of your device must be exceeded.

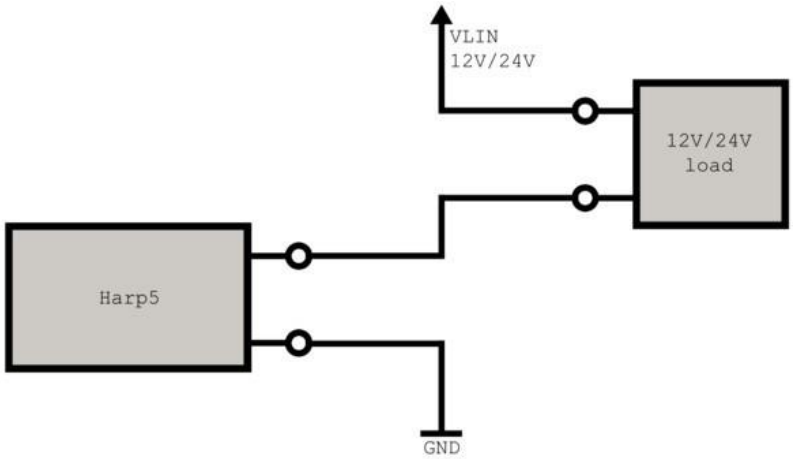
  `VThreshold < VLIN * (RIN / (Rin + RPullUp) )`
- The current through the digital output must be limited.

  `RPullUp > VLIN / 0.5 A`

Hence the pull-up resistor must meet the following inequation:

`VLIN / 0.5 A < RPullUp < RIN * (VLIN / VThreshold - 1)`

6.2.1.5 Connecting a load to a digital output of the HARP-5:



If a load is connected, please make sure the maximum current through the output of the HARP-5 is lower than 200 mA.

6.2.2 X7 - LIN and CAN

The LIN- and CAN-Bus interfaces are available via a Sub-D-9 male connector.

The LIN-Bus interface of the HARP-5 can be operated between voltages of 8-18 VDC.

This CAN-Bus interface is available as high speed interface (CAN-HS) according to ISO-11898.

Pin	Signal	Description
X7-1	VSwitch	A switchable output that can forward the LIN-Supply.
X7-2	CAN-HS-L	CAN-Low signal of high speed CAN-Bus interface.
X7-3	GND	Ground connection for the LIN- and CAN-Bus interfaces. This pin is connected with pin X7-6. This pin is connected with pin X5-3.
X7-4	LIN-2	The second LIN-Bus signal.
X7-5	Supply-Config	A pin to configure whether the HARP-5 is powered by the LIN-Supply pin.
X7-6	GND	Ground connection for the LIN- and CAN-Bus interfaces. This pin is connected with pin X7-6. This pin is connected with pin X5-3.
X7-7	CAN-HS-H	CAN-High signal of high speed CAN-Bus interface.
X7-8	LIN-1	The first LIN-Bus signal. This pin is connected with pin X5-2.
X7-9	VABT	The supply for the LIN-BUS. This pin is connected with pin X5-1

Warning
The LIN-Bus supply must be provided by an external power supply or the integrated 12 V generator and must not be interrupted during the LIN communication..

Warning
The LIN-Bus 1 and 2 are connected by default. This allows to use the HARP-5 as a gateway. This behaviour can be switched at runtime by setting the system variable @@SYSDIGOUT37.

Attention
Do not operate the LIN-Bus supply outside the voltage range of 8-18 VDC.

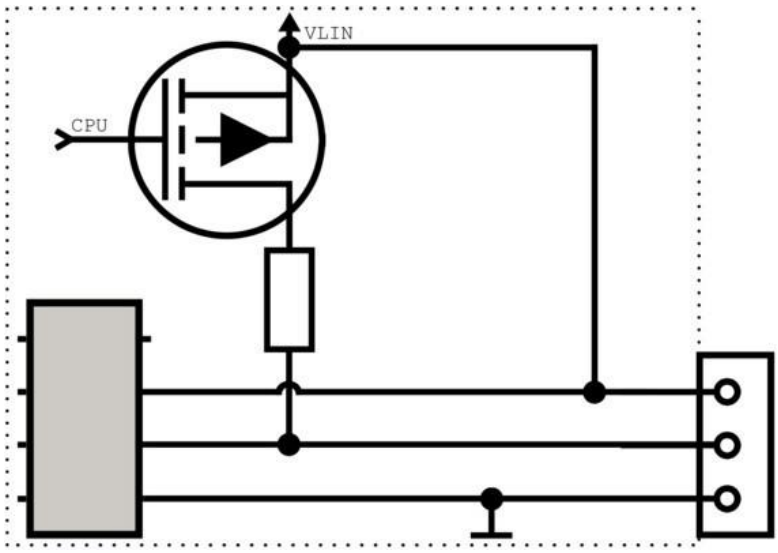
Attention
If voltages in excess of 18 VDC are used as LIN-Bus supply voltage, it must be ensured that all connected nodes can cope with this voltage level. It is possible, that some nodes will function incorrectly in voltages exceeding 18 VDC, since the LIN specification states a maximum voltage of 18 VDC.

Warning
A terminating resistor is not included in the CAN interface and must be connected externally, if not already available in the bus installation. The size of the terminating resistor should be 120 Ohm.

The three pins VSwitch, SupplyConfig and LIN-Supply handle the generation, consumption and output of the LIN-Bus supply. They have the following functions:

<table>
<tr><th>Pin</th><th>Description</th></tr>
<tr><td>LIN-Supply</td><td>This pin can be used for different use cases:
<table>
<tr><th>Use cases for LIN-Supply</th><th>Description</th></tr>
<tr><td>Input</td><td>The LIN-Bus supply is powered by an external source. By default the HARP-5 will also be powered via this pin.</td></tr>
<tr><td>Output</td><td>The HARP-5 creates its own LIN-Bus supply voltage using its integrted 12 V generator. LIN-Bus nodes can then be powered via this pin.</td></tr>
<tr><td>Note used</td><td>If none of the LIN-Bus interfaces are used this pin can be left open.</td></tr>
</table>
Warning
When the LIN-Supply pin is used to output the internally generated LIN-Bus voltage, supplying the HARP-5 from the LIN supply is automatically deactivated independent of the state of the SupplyConfig pin.
Advice
The 12 V generator can be operated by setting the system variable @@SYSDIGOUT35 system variable.
<table>
<tr><th>Variable value</th><th>Description</th></tr>
<tr><td>0</td><td>The 12 V genereto ist off</td></tr>
<tr><td>1 or higher</td><td>The 12 V genereto ist on</td></tr>
</table></td></tr>
<tr><td>SupplyConfig</td><td>This input decides whether the voltage present on LIN-Supply pin can be used to supply the HARP-5 or not. If this pin is open (not connected) the HARP-5 will use the external LIN-Bus voltage as supply. This allows saving battery runtime. If the pin is connected to GND (typically short circuited within the cable) the HARP-5 will never be supplied from the LIN-Supply pin.
Advice
The powering over the LIN-Supply can also be switched off by setting the system variable @@SYSCFG100.
<table>
<tr><th>Variable value</th><th>Description</th></tr>
<tr><td>0</td><td>The device is powered over the LIN-Bus.</td></tr>
<tr><td>1</td><td>The device is not powered over the LIN-Bus.</td></tr>
</table></td></tr>
<tr><td>VSwitch</td><td>This pin is connected to the LIN-Supply pin via an internal switch. If activated, this pin can power external LIN-Bus nodes by the internal or external LIN-Bus supply over the VSwitch pin. This feature works whether the LIN-Bus voltage is supplied by an external source or by the integrated 12V generator.
Advice
This switch can be operated by setting the system variable @@SYSDIGOUT36.
<table>
<tr><th>Variable value</th><th>Description</th></tr>
<tr><td>0</td><td>No voltage available.</td></tr>
<tr><td>1 or higher</td><td>LIN-Bus supply available.</td></tr>
</table></td></tr>
</table>

6.2.3 Equivalent circuit of the LIN-Bus interface:



Electrical characteristics	Value	Unit
Maximum operational voltage	26	V
Maximum LIN voltage	32	V
Maximum LIN current	700	mA
Maximum LIN supply voltage	18	V
Maximum LIN supply current	2.5	mA

Electrical characteristics	Voltage threshold for LIN detection	Voltage threshold for LIN transceiver
Minimum	4.3 V	6.8 V

The pull-up resistor of the LIN-Bus driver is switched to 1 kOhm, if the master node is emulated and to 30 kOhm, if only slave nodes are emulated.

6.2.4 X8 - PC connector

This connector is a USB type B-Mini. It is used to connect the HARP-5 to a PC. To use this interface the Baby-LIN USB driver has to be installed on the PC.

Description
The connector uses the default pin assignment of USB type BMini.

Advice
The USB interface is galvanically isolated from all other connectors.

6.2.5 X9 - SD card slot

This card slot supports SD cards. It is used to store SDFs on the HARP-5 and to write log files to.

Description
This card slot supports SD cards.

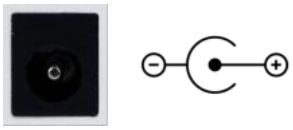
Advice
The following SD card types are supported:

Type	Explicit type description	
SD	SD (SDSC): Secure Digital Standard Capacity	2 GB
SDHC	SDHC: Secure Digital High Capacity	32 GB

Warning
The SD card has to be formatted as FAT16 or FAT32.

6.2.6 X10 - Logic power and charging supply

This connector is a NEB 21 R. It is used to supply the HARP-5 and load its batteries.



Pin	Signal	Description
Outer connection	-	Logic supply ground. Inner
Inner connection	+	Positive logic supply (8-32 VDCV).

Tip
To optimally load the batteries a supply voltage of 24 VDC is required.

Attention
Do not operate the logic supply outside the voltage range of 8-32 VDCV.

6.3 Power supply

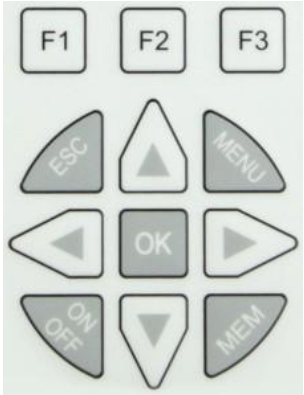
The HARP-5 can be powered by one of the following sources:

- Power supply over supplied power adapter: "X10 - Logic power and charging supply" Supported power supply voltage: 8-32 VDCV
- Power supply over LIN-Supply: "X5 - LIN, CAN and IO" or "X7 - LIN and CAN" Supported power supply voltage: 8-32 VDCV
- Power supply over internal batteries: "Step by step guide: How to change the rechargeable battery"

The HARP-5 has a typical power consumption of 60 mA @ 24 VDCmA.

6.4 KB1 - Keyboard

The keyboard of the HARP-5 features 12 keys to naviagate through the menus and configure the device. The following keys are available:



Keys	Funktion
F1, F2, F3	Theses keys can trigger software defined menu options. Each menu can use up to 3 content dependent options.
Up, Right, Down, Left	These keys are used to navigate through the menus and change values.
ESC	This key is used to exit menus.
MENU	This key is used to open the device settings.
OK	This key is ised to confirm user queries
MEM	This key is used to save changes
ON/OFF	This button is used to swich the HARD-5 on and off

6.5 D1 - Display

The graphical LCD display of the HARP-5 features 128x64 characters and a switchable backlight. It is used to configure the HARP-5 and show LIN- and CAN-Bus information.

The backlight is dimmable and can be switched off automatically after a certain time.

Advice
The LCD backlight can be switched off by setting the system variable @@SYSDIGOUT34.

6.6 Hardware adaptations

6.6.1 Step by step guide: How to change the rechargeable battery

This step by step guide will show you how to change the rechargeable batteries that supply the HARP-5.

NOTICE
Please read this guide completely before you start the installation. Make sure you understood everything and have all the tools and materials required available.

SAFETY INSTRUCTIONS
The HARP-5 could be damaged.

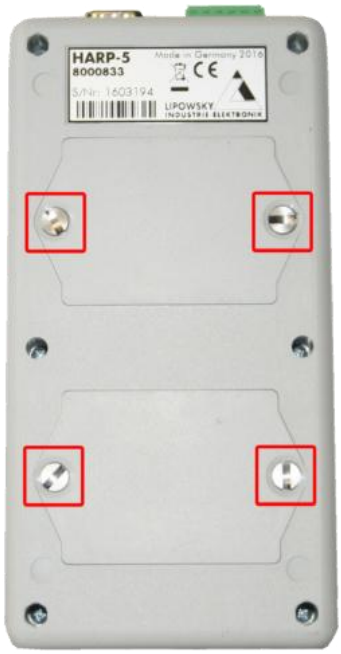
- Please observe ESD measures before modifying the HARP-5, opening the case and touching the circuit boards! Ideally you would use an ESDpad and ESD-wristband.

Please make sure you have the following tools and materials available before starting:

- A matching coin or screw driver.
- A fresh set of 6 rechargeable batteries (2600-2700 mAh 1.2V NiMH AAMignon).

Advice
The rechargeable battery type has to be 2600-2700 mAh 1.2V NiMH AA Mignon. Other capacities are allowed but influence the running and charging time. Additionally the batteries must be able to be charged with a current of 1 A. We recommend you purchase the rechargeable batteries from us, since we tested them.

Place the HARP-5 upside down on the display. Now unscrew the 4 battery cover screws.



Remove the battery covers.

Now you can remove the old batteries and insert six new rechargeable batteries (Check the type above).

Version incompatibility

Please observe the correct polarity when inserting the battery. The polarity is depicted within the battery compartment.

Advice
Please recycle or dispose the battery safely and properly according to local laws and regulations.

Now you can reassemble the HARP-5 by reversing the steps:

- Close the battery compartment with the covers.
- Screw back the 4 battery cover screws.

6.7 Step by step guide: How to change the RTC battery

6.7.1 Introduction

The battery, that powers the RTC of the HARP-5 will usually last over 9Years years. Once its power is used up, the HARP-5 will loose the date and time. Then it is time to replace the RTC battery.

This step by step guide will show you how to change the battery of the real-time clock.

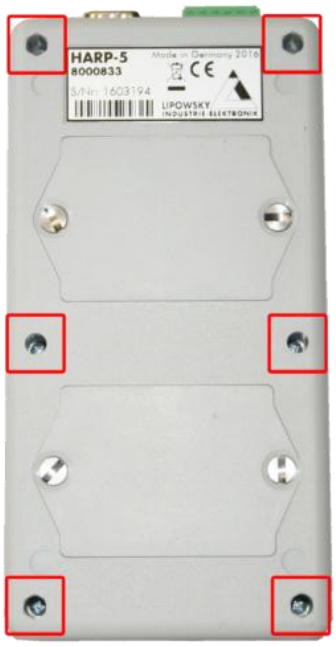
6.7.2 Required tools and materials

Please make sure you have the following tools and materials available before starting:

- A PH1 screw driver
- A fresh 3V CR2430 button cell

6.7.3 Disassembly

Place the HARP-5 upside down on the display. Now unscrew the 6 case screws.

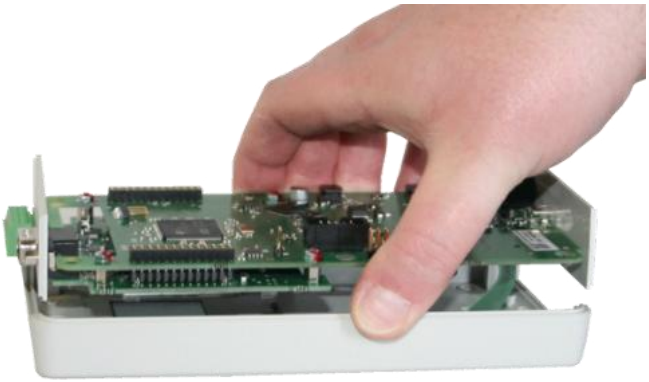


Open the case carefully until you can unplug the ribbon cable. Then place the back side of the case somewhere safe.

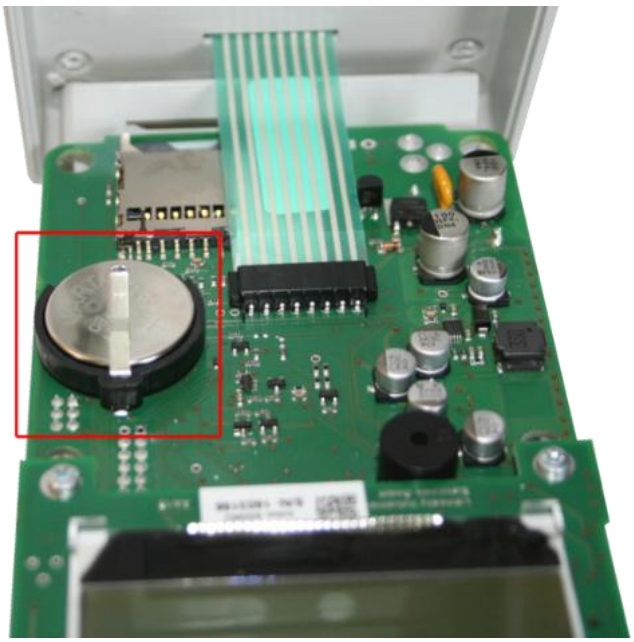
Grab the circuit board on its sides and carefully pull it straight up until it is detached from the case.

Version incompatitbility
Between the circuit board and the front side of the case another cable is present. Therefor do not pull the circuit board to far.

Advice
The top and bottom connector panels are not attached to the circuit board. They may fall off if they are no longer attached to the case.



Lay down the circuit board and hold up the front side of the case.



Now you should be able to see the button cell within the battery holder under the display on the right side.

Advice
If you accidentally unplug the flexible flat cable from the circuit board, you can simply plug it back in. Since that is a bit fiddly, you may consider using pliers. But please be careful not to damage the flexible flat cable.

6.7.4 The battery change

Now you can remove the old button cell and add a fresh 3V CR2430 button cell.

The spring clip needs to contact the + side of the battery.

Please observe the correct polarity when inserting the battery.

Injury by damaged battery.

- Operate the device only within the defined operating temperature.
- Observe the correct polarity when inserting the battery.
- Do not touch the battery if damaged.
- Do not touch the battery if wet.
- Remove the batteries if you do not use the HARP-5 for more than 4 weeks.

Please recycle or dispose the battery safely and properly according to local laws and regulations.

Version incompatitbility
The date and time of the RTC is stored within the processor of the SBC board. It is supplied by the battery of the UPS board. If this supply is interrupted, the RTC is reset. An interruption may have one of the following reasons:
• The SBC board is removed. • The RTC battery is removed from the UPS board.
• The UPS board is removed. • The RTC battery is empty.
If one of these events occur, you have to set the RTC date and time again.

6.7.5 Reassembly

Now you can reassemble the HARP-5 by reversing the steps:

- Grab the circuit board on its sides and push it with the top and bottom connector panels back into the front side of the case.
- Plug the ribbon cable of the back side of the case back into the circuit board.
- Place the back side on the frontside of case.
- Screw back the 6 case screws.

7 Firmware

7.1 Firmware update

7.1.1 Introduction

The firmware is stored in the flash memory of the HARP-5 and can easily be programmed from a PC. The update process uses an ISP (In-system programming) operation and can be executed in the field.

As we are permanently working on product improvements, the firmware is updated periodically. These updates make new features available and solve problems, which have been discovered by our internal tests or have been reported by customers with earlier versions. All the firmware updates are done in a way, that the updated HARP-5 will continue to interwork with an already installed, older LINWorks installation. So updating the Baby-LIN firmware does not mean, that you necessarily have to update your LINWorks installation as well. Therefor it is highly recommended to always update your HARP-5 to the latest available firmware version.

7.1.2 Required software

The following downloads are required to update the firmware of the HARP-5:

Download archive	Description
BabyLinDriverSetup.exe	This setup contains the Baby-LIN driver. It is required to update the firmware.
Firmware update package Baby-LIN / HARP	This package contains the firmware for the HARP-5 as well as the update tool "blprog".

7.1.3 Update the firmware

To update the firmware of the HARP-5 you have to follow these steps:

- Install the drivers for the HARP-5, if you have not already installed them.
- Connect the HARP-5 with your PC.
- Enter the Firmware update mode on the HARP-5:
- Switch on the HARP-5.
- Enter the configuration menu by pressing the "MENU" key.
- Select the option "Firmware update".
- Confirm the firmware update mode by pressing the "OK" key.
- The display switches off.
- Unpack the firmware archive.
- Start the "blprog.exe". A command prompt will be opened and guide you through the process.
- If you have other Baby-LIN products aside the HARP-5 connected with the PC, you will be asked which Baby-LIN product you want to update.

- Press the "y" key to confirm the correct firmware and start the flash process.
- Wait until the flashing finished.
- After the flashing has finished press the "Enter" key to exit the tool.

Tip
If you have other Baby-LIN products aside the HARP-5 connected with the PC you will later be asked to select one. This could easily lead to confusions and flashing the wrong device. Therefor we recommend connecting only one Baby-LIN product during a firmware update.

Tip
If you do not know which virtual COM-Port corresponds to your HARP-5 , you can press "CTRL+C" to stop the firmware update. Now you may disconnect other Baby-LIN products until only your desired HARP-5 is connected. Now you can restart the "blprog.exe".

7.2 PC mode

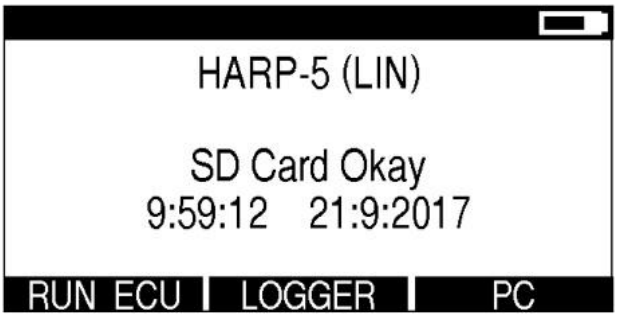
7.2.1 PC mode description

The PC mode enables the HARP-5 to communicate with a PC like other products from the Baby-LIN product family. This means you are able to use the Simple Menu and all of its features as well as writing your own applications using the Baby-LIN-DLL. It is also necessary for updating the firmware.

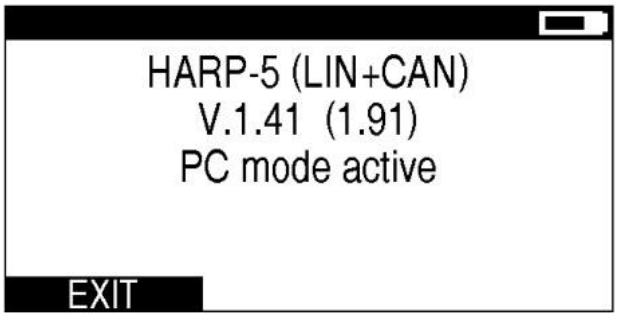
7.2.2 Enable the PC mode

To enable the PC mode of the HARP-5 make sure it is switched on. If you are not in the main menu press ESC repeatedly until you are in the main menu. Then press "F3" to enter the PC mode.

Main menu



View when the PC mode is enabled



If the PC mode is currently enabled, simply press the "F1" key to exit the PC mode again.

7.3 Stand-alone mode and autostart

7.3.1 Enable the stand-alone mode

The HARP-5 is able to operate stand-alone without a PC, PLC or operator. To enable this mode several requirements need to be met:

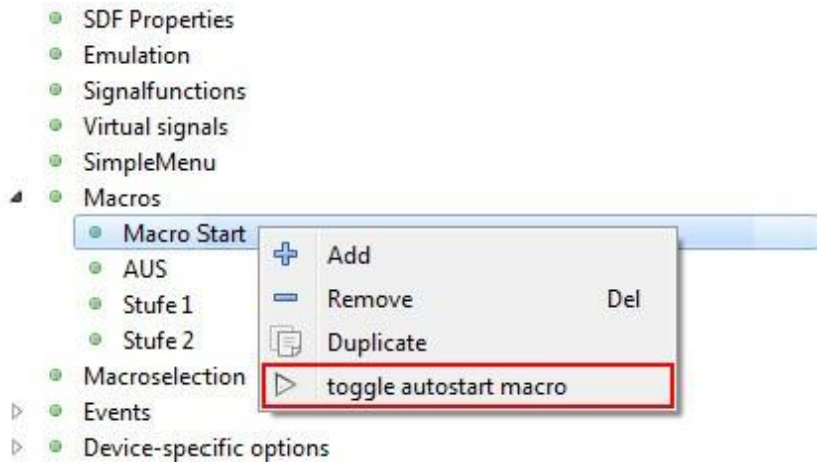
- You need a SDF with a macro that is marked as "autostart" macro.
- The device needs to be configured to automatically start the autostart macro of a persistently stored SDF when powered up.

7.3.2 Configure the autostart macro

You can mark a macro in a SDF as autostart macro. This means that this macro is started automatically when the SDF is loaded. Usually this macro will start the LIN- or CAN-Bus communication and perform necessary initialisations.

To mark a macro as autostart macro the following steps are necessary.

- Open your SDF using the SessionConf.
- If this SDF does not already have a macro that you want to use as autostart macro please create one.
- Right click on the macro and select "toggle autostart macro". The macro will now have the "[autostart]" marker.



Advice
Please note that only one macro can be marked as autostart macro.

Tip
You probably want to start the LIN- or CAN-Bus within the macro since it is not automatically started by loading the SDF.

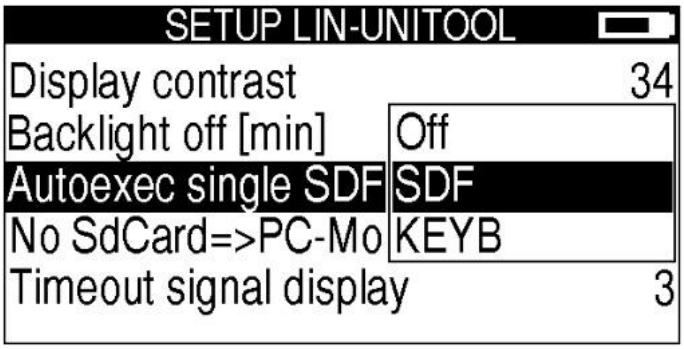
7.3.3 Store a SDF persistently

All SDFs stored on the SDHC card of the HARP-5 are stored persistently. There is no need to configure the device or SDF in a special way. The option "Store SDF in device persistently" has no effect for the HARP-5.

7.3.4 Configure the device to automatically load a SDF and start a macro

Before you can configure the device to automatically load a SDF and start a macro you have to make sure, that only one SDF is stored on the SDHC card. This SDF requires a macro marked as autostart macro.

To enable the autostart feature switch on the HARP-5. Then press the "MENU" key and scroll down to the option "Autoexec single SDF". Press the "OK" key and select "SDF" to start in the SDF menu or "KEYB" to start in the keyboard menu.



Press "ESC" to exit the menu and press "MEM" to save the changes. If you now switch the HARP-5 off and then on again the autostart macro should be executed and the SDF or Keyboard menu will be shown.

Warning
If you have more than one SDF stored on the SDHC card no SDF will be loaded automatically.
the setup.

Warning
A macro is only started automatically if a macro is marked as autostart macro.
the setup.

7.4 Logging

7.4.1 Introduction

The HARP-5 supports the logging of the frames on the LIN- and CAN-Bus. The following possibilities to log the bus data are available:

- The bus data can be logged using the SimpleMenu if the HARP-5 is connected to a PC. The logging using the SimpleMenu is described here: Check chapter "SimpleMenu" for more information.
- The log data can be written to the SD card or transmitted through the CAN-HS interface without a PC.
- The log data can be send through a USB connection to a custom application on a PC.

7.4.2 Configure and activate the logging

The configuration of the logging feature depends on the mode the HARP-5 is using.

Configuration	SDFile mode	Monitor mode
Start, stop or pause the logging	Set the following system variable: "@@SYSLOGCONTROL"	Start logging without loading a SDFile. Select Logger from the main menu, configure the logger and press start.
Source channel of the log data	The source channel is selected indirectly: The logging system variables exist individually for a section. If a section configure and start a logger, the channel this section is mapped to, will be the source channel. Check chapter "Channels and sections" for more information.	Within the Logger menu: Choose an option for Source
Format of the log data	Set the following system variable: "@@SYSLOGFORMAT"	Within the Logger menu: Choose an option for Format
Target of the log data	Set the following system variable: "@@SYSLOGTARGET"	Within the Logger menu: Choose an option for the Target
Resolution of the logged timestamps	Set the following system variable: "@@SYSLOGTIMEBASE"	The resolution of the logged timestamps is always in us.
Maximum log file size	Set the following system variable: "@@SYSLOGFILESIZE"	The maximum log file size is always 4096 MB.

The logger menu allows to configure one logger for each source channel and offers the following options:

Option	Values	Description
Source	LIN1	The first LIN channel will be the source of the logger.
	LIN2	The second LIN channel will be the source of the logger.
	CAN1	The first CAN channel will be the source of the logger.
	CAN2	The second CAN channel will be the source of the logger.
Target	USB	Check chapter "USB connection" for more information.
	SDCard	Check chapter "SD card" for more information.
	CAN1	Check chapter "CAN-HS interface" for more information.
Format	Binary	Check chapter "Binary format" for more information.
	text	Check chapter "ASCII format" for more information.
Mixed	No	This option should always be No, if the target is not SDCard.
	Yes	If the target of the logger is SDCard, a common ouput file will be created for all loggers, that have activated this feature. The name of that common fille will end with MIX instead of the channel.

7.4.3 Mixed mode

When using the HARP-5 in the handheld mode you can configure the logging from the menu. The menu allows to configure the so called mixed mode.

Usually each logger will log the information from its channel to its own file. If you activate the mixed mode, all loggers will log into the same log file. This log file will have a "MIX" postfix instead of the channel postifx in its filename. If the mixed mode is used, all loggers will use the same format and target settings.

Warning
Each logger still has to be started individually, even if the mixed mode is activated.
the setup.

7.5 Log data targets

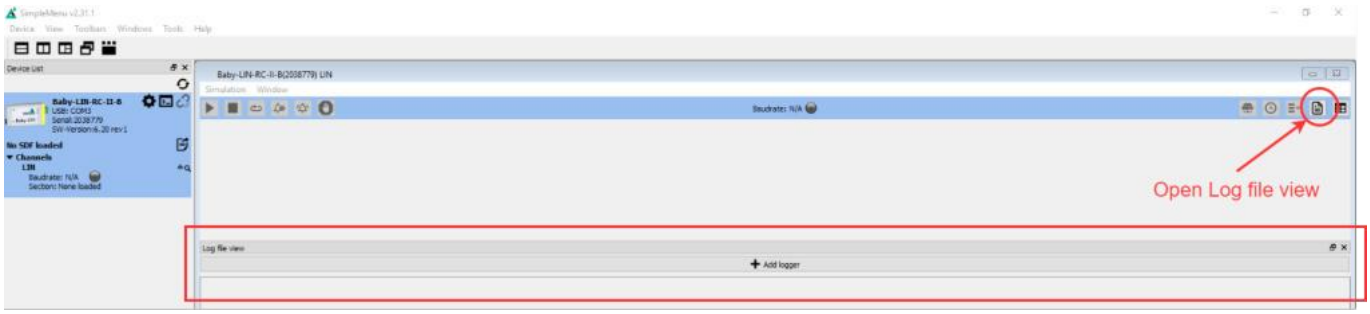
7.5.1 Overview

The HARP-5 can write log data to the following targets:

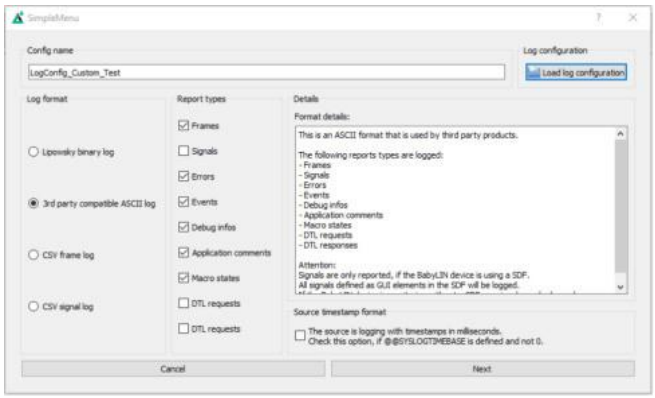
Target	Description
"SimpleMenu"	The logging data can be viewed and written into a file by using the "SimpleMenu".
"USB connection"	The log data are send via the USB connection to a PC.
"SD card"	The logging data are stored as a file on the SD card.
"CAN-HS interface"	The logging data are re-send via the CAN-1 highspeed interface.

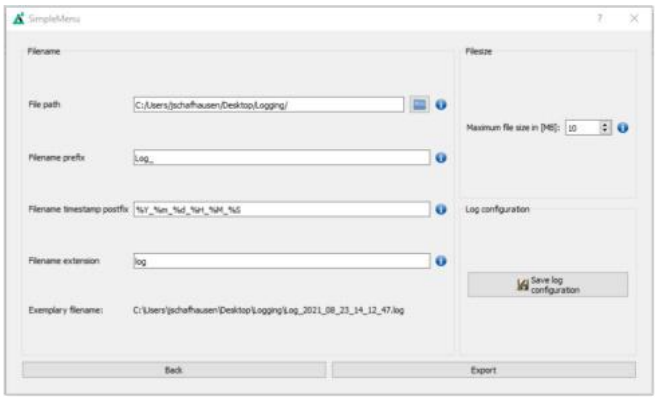
7.5.1.1 SimpleMenu

The SimpleMenu offers the possibility to record the complete bus communication of the Baby-LIN-Decvice and to save it locally in a file on the computer. To do this, open the integrated log viewer in the SimpleMenu.



After opening the Log file View, you can now add a logger. Adding the logger opens the Logging Configuration. Existing LOG configurations can be loaded or new ones can be created.





You can customise the logging of bus communication according to your requirements. You can select which data should be tracked and how this data should be saved in the next step.

7.5.2 USB connection

The log data are transmitted using the USB connection over the "X8 - PC connector" interface. The Baby-LIN driver shows the connection to the HARP-5 as virtual COM port. You can receive and log these data on a PC using a terminal program. Use the following settings to connect to the HARP-5:

- COM port: The virtual COM port of the HARP-5.
- Baud rate: Depending on the setting of the HARP-5 115,200 Bd or 921,600 Bd.
- Data bits: 8
- Stop bits: 1
- Parity: None
- Flow control: None

Warning
The PC mode of the HARP-5 may not be activated. Check chapter "PC mode" for more information.
the setup.

Check chapter "X8 - PC connector" for more information.

7.5.3 SD card

The log data are stored as a file on the micro SD card. The folder in which the log files are stored is `HARP-5 Loggs`. The filename will contain the date, time and channel the log file was started on.

Advice
The following microSD card types are supported:

Type	Explicit type description	Maximum size
microSD	SD (SDSC): Secure Digital Standard Capacity	2 GB
microSDHC	SDHC: Secure Digital High Capacity	32 GB

Warning
The microSD card has to be formatted as FAT16 or FAT32..

7.5.4 CAN-HS interface

Received LIN frames can be resend as CAN-Bus frames over the CAN-HS interface. For this purpose you can edit the following properties of the transmitted CAN frame:

ID-Offset	This offset is added to the frame ID of the received frame. The resulting value will be the frame ID of the transmitted CAN frame.
29Bit ID	This value decides whether the CAN frame will be transmitted using a 11 Bit ID or a 29 Bit ID.

Check chapter "X7 - LIN and CAN" for more information.

Warning
• Only frames from a LIN-Bus can be resend over the CAN-HS interface. It is not possible to resend frames from the CAN-LS interface.
• This target can not be selected, if the "Mixed mode" is used.

7.5.5 Log data formats

7.5.5.1 Binary format

This format uses a proprietary binary data format to store the log data. It is optimized for speed and a low file size. This file can be viewed, edited and converted into other formats using the "LogViewer" .

7.5.5.2 ASCII format

This format is a human readable ASCII format. It consists of a header, the logged frame data and comments. It can be processed by many third party products. The ASCII format has the following structure:

```
date Fri May 12 13:38:13 2017
base hex timestamps absolute
internal events logged
// version HARP-4 V.1.43 Build1
 2.788508 Li           11 Tx 1 00                      checksum = ff         CSM = classic
 2.788508 Li           11 Tx 1 00                      checksum = ff         CSM = classic
 3.288498 Li           12 Rx 8 43 a1 16 d0 a7 53 29 00 checksum = 10         CSM = classic
 3.538493 Li           13 Rx 0                         NodeResponseMissing
 3.788488 Li           11 Tx 1 01                      checksum = fe         CSM = classic
 4.288531 Li           12 Rx 8 4d a6 19 d3 a9 54 2a 00 checksum = f6         CSM = classic
 4.538525 Li           13 Rx 0                          NodeResponseMissing
 4.788519 Li           11 Tx 1 02                      checksum = fd         CSM = classic
 5.288509 Li           12 Rx 8 56 ab 1d d5 ab 55 2a 00 checksum = df         CSM = classic
 5.538504 Li           13 Rx 0                          NodeResponseMissing
 5.788499 Li           11 Tx 1 03                      checksum = fc         CSM = classic
 6.288489 Li           12 Rx 8 60 b0 20 d8 ad 56 2b 00 checksum = c6         CSM = classic
 6.538536 Li           13 Rx 0                          NodeResponseMissing
 6.788531 Li           11 Tx 1 04                      checksum = fb         CSM = classic
 7.288521 Li           12 Rx 8 6a b5 23 da af 57 2b 00 checksum = af
 7.538515 Li           13 Rx 0                          NodeResponseMissing
 7.788510 Li           11 Tx 1 05                      checksum = fa         CSM = classic
 8.288500 Li           12 Rx 8 74 ba 27 dd b1 58 2c 00 checksum = 95         CSM = classic
 8.538495 Li           13 Rx 0                          NodeResponseMissing
 8.788490 Li           11 Tx 1 06                      checksum = f9         CSM = classic
 9.288532 Li           12 Rx 8 7e bf 2a df b3 59 2c 00 checksum = 7e         CSM = classic
 9.538527 Li           13 Rx 0                          NodeResponseMissing
 9.788522 Li           11 Tx 1 07                      checksum = f8         CSM = classic
 10.288511 Li          12 Rx 8 88 c4 2d e2 b5 5a 2d 00 checksum = 65         CSM = classic
 10.538506 Li          13 Rx 0                          NodeResponseMissing
 10.788501 Li          11 Tx 1 08                      checksum = f7         CSM = classic
```

The frame line components are explained using the first frame:

TarComponentget	Description
2.788508	This is a timestamp. It represents the seconds since the Baby-LIN-MB-II was powered on.
Li	A bus identifier
11	The ID of the frame
Tx	The direction of the frame
1	The lenght of the frame
00	All data bytes of the frame
checksum = ff	The checksum of the frame.
CSM = classic	The checkszum type used by the frame

7.6 Setup of the HARP-5

The HARP-5 firmware can be configured by the following settings:

Setting	Possible values	Description
Display brightness	0 ... 20 Default: 20	Here you can change the brightness of the display. Higher values will drain the batteries faster
Display contrast	30 ... 60 Default: 35	here you can change the contrast of the display
Backlight off [min]	• Off • 0 ... 20 Default: off	Here you can set the time, after which the backlight of the display will switch off.If the backlight is always on, the batteries will drain faster.
Autoexec single SDF	• Off • SDF • SDF • KEYB Default: Off	Here you can setup, how a SDF file is started. The meaning depends on the following condition: Is only one SDF on the SD card and it contains a autostart macro: • Off : The SDF is not automatically started • SDF : The SDF is automatically started in the SDF menu. • KEYB : The SDF is automatically started in the keyboard menu. More than one SDF file or the SDF file has no autostart macro: • Off : The user decides on each start, in which mode the SDF starts. • SDF : The SDF is started in the SDF menu. • KEYB : The SDF is started in the keyboard menu.
No SD card => PC mode	• Off • On Default: Off	Here you can configure if the HARP-5 will automatically change into the PC mode, if no SD card is inserted.
Timeout signal display	• Off • 1 ... 60 Default: Off	Here you can configure a timeout, which will reset the display of a signal value, if this signal was not present on the bus for that amount of time. The timeout is specified in seconds.
Auto-On by DC-IN	• Off • On Default: On	Here you configure the HARP-5to automatically switch on, if the 24V supply is connected.
Logger baudrate	• 115.200 • 921.600 Default: 115.200	Here you can configure the baudrate, that is used, if a logger selects USB as target.

Setting	Possible values	Description
Accu charge enable	• No • Yes Default: No	Here you can configure, if the batteries of the HARP-5 will be charged over the 24V power supply.
Disconnect LIN-busses	• No • No textbullet Yes Default: No	Here you can configure, if the two LIN bus interfaces are connected. If you want to use the LIN bus interfaces separately, select Yes. If you want the conenction between the LIN bus interfaces, select No.
Set date and time	Submenu with the following options: • Summertime • Year • Month • Day • Hour • Minute	The HARP-5 features a real-time clock. In this sub menu you can edit the date and time of that clock. The summer time configuration is the same as Daylight saving time.
Daylight saving time	• Off • On Default: Off	The HARP-5 features a real-time clock. This configuration activates the summer time setting for your clock. The Daylight saving time configuration is the same as Summertime in the Set date and time sub menu.
Select SDF	• File name • Section name Default: file name	Here you can configure, if the "Run ECU menu" menu will show you the file name of the SDF or the name of the first section.
Firmware update	A dialogue opens and asks you whether you are sure.	With this option you can set up the firmware mode of the HARP-5.
Format SD card	A dialogue opens and asks you whether you are sure.	With this option you can format the SD card. The data on the SD card will be lost. You should make a backup of your SD card, before you format it.
CAN terminal	A dialog will open	This dialog can be used for basic CAN debugging. The functionality is very limited. When opened, the window will show all data bytes of the received frames with the ID 0x100 (Decimal: 256) on the CAN-HS interface, interpreted as ASCII characters. Therefor the CAN-HS bit rate has to be 250 kbit/s.

7.7 Hand control

7.7.1 Introduction

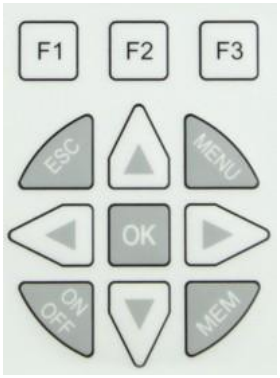
The HARP-5 features a graphical LCD display and a keypad with 12 keys. These features allow a hand control to monitor and control the LIN- or CAN-Busses.

The following chapters describe the "Key layout" as well as the different "Menus" the HARP-5 can show.

Finally the chapter "Navigation" gives you an overview, how to navigate through the different menus.

7.7.2 Key layout

The HARP-5 has a keypad with 12 keys. 3 of them can be used as functions keys.



Key	Name	Function
	Functions keys: F1, F2, F3	These function keys will have different functions depending on the current menu.
	ESC	The ESC key usually exits a menu and goes up in the menu hierarchy.
	MENU	The MENU key will open another menu depending on the current menu.
	OK	The OK key is used to confirm information and input dialogs.
	On/OFF	The ON/OFF key will switch the HARP-5 on and off.
	MEM	The MEM key is used to save changed settings.
	UP & DOWN	The UP/DOWN keys are used to navigate through list menus.
	LEF & RIGHT	The LEFT/RIGHT keys are used to change values.

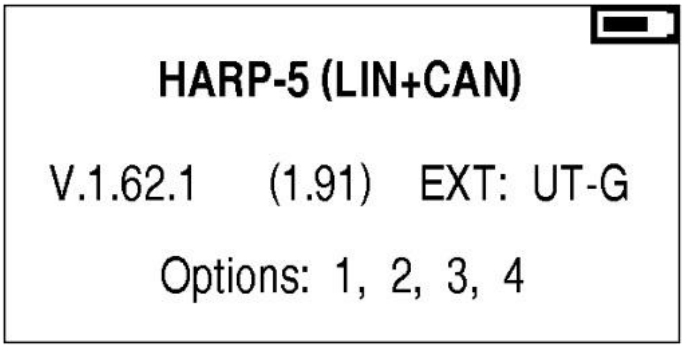
7.7.3 Menus

7.7.3.1 Boot screen

The boot screen will appear for a short time while the device is booting. By pressing ESC during that time, the boot screen will stay visible, until ESC is released.

The boot screen shows you the following information:

- The product name: HARP-5.
- The activated bus interfaces.
- The version of the main firmware and the charging CPU firmware in brackets.
- The hardware variant and revision of the installed Display-I-O-connector board.
- The activated options:
  - Support for SDF-V3
  - Activated CAN-HS channel
  - Activated CAN-LS channel
  - Activated second LIN channel

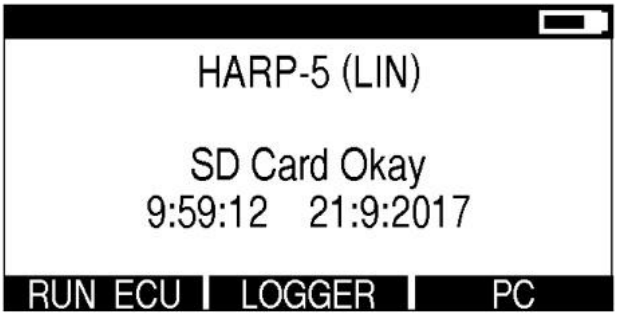


Key	Function Key	Function
ESC		Prevent the closing of the biit screen, while the key is pressed

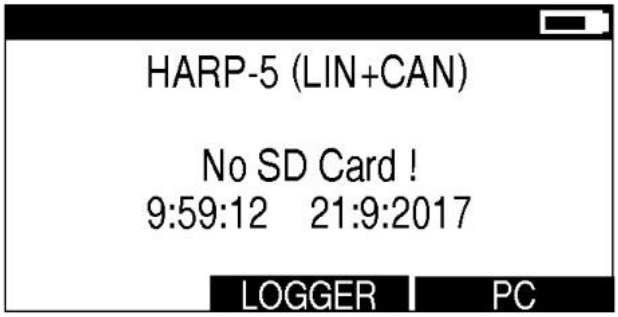
7.7.3.2 Main menu

The main menu shows you the following information:

- The product name: HARP-5.
- The activated bus interfaces.
- The current state of the SD card.
- The current time and date.



Example with SD card and no CAN license

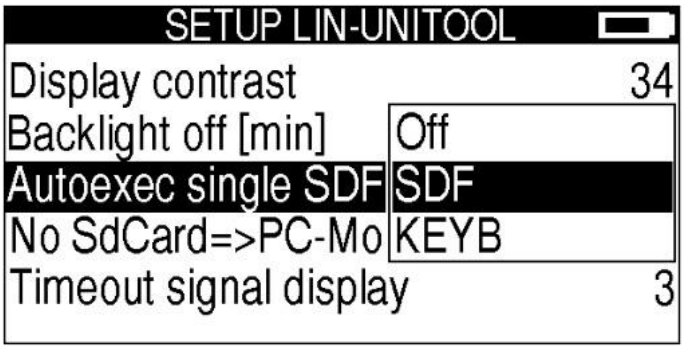


Example without SD card and with CAN license

Key	Function Key	Function
F1	RUN ECU	Navigate to the "Run ECU menu".
F2	LOGGER	Navigate to the " Logger menu".
F3	PC	Enter the "PC mode" and navigate to the "PC mode menu".
MENU		Navigate to the "Setup menu".

7.7.3.3 Setup menu

The setup menu shows you a list of all the options of the HARP-5 firmware. Check chapter "Setup of the HARP-5" for more information.



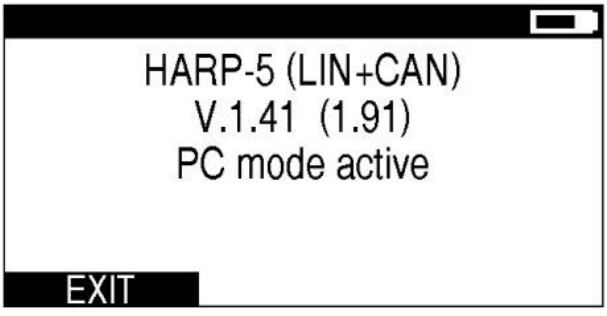
Key	Function Key	Function
ESC		Navigate to "Main menu". If you have not saved the changes you made by pressing the MEM key, a dialog will ask you, if you want to save your changes, before you can leave the setup menu. The changes are saved by pressing the MEM key or discarded by pressing the ESC key.
MEM		Save the changes you made.
UP & DOWN		Move the cursor of the currently selected option up or down.
OK & LEFT & RIGHT		Open the edtiting dialog for the currently selected option.

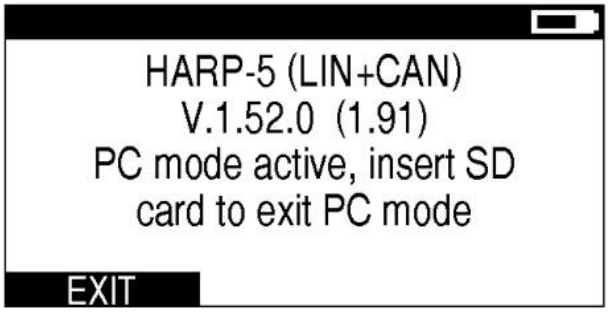
7.7.3.4 PC mode menu

The PC mode menu is visible, if the HARP-5 is in the PC mode.

The PC mode menu shows you the following information:

- The product name: HARP-5.
- The activated bus interfaces.
- The version of the main firmware and the charging CPU firmware in brackets.
- The information, that the PC mode is active. If it is active, because no SD card is inserted, the hint is given, that you can only exit it, if you insert a SD card.



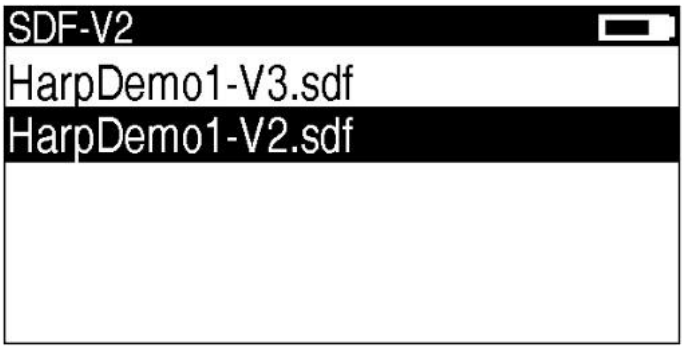


Key	Function Key	Function
F1	EXIT	Exit the PC mode and navigate to the "Main menu". If the setting No SD card => PC modeis activated, this item is only visible, if a readable SD card is inserted.
ESC		

7.7.3.5 Run ECU menu

The main menu shows you the following information:

- The type of the currently selected item.
- The folder tree of the inserted SD card including all SDFiles.



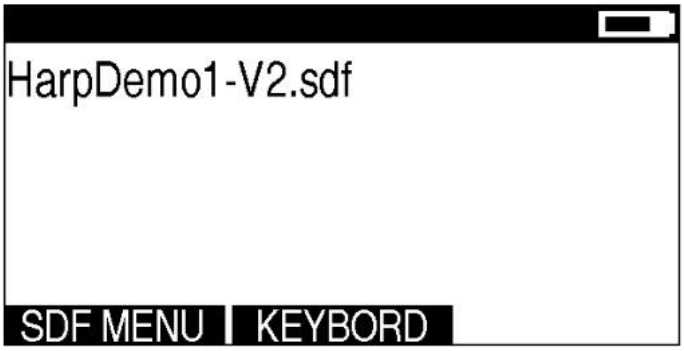
Key	Function Key	Function
ESC		Navigate to the "Main menu".
MENU		
UP & DOWN		Move the cursor of the currently selected entry up or down.
OK & LEFT & RIGHT		Select the currently selected entry. If the selected entry is a SDFile, is loaded and the "SDF start menu" is shown. If the selected entry is a folder, the content of the folder is shown.

Advice
After a SDFile is loaded, it is checked, if a macro is marked as autostart macro. If this is the case, the autostart macro will be executed either when the "SDF menu" or the "Keyboard menu" is shown for the first time.

7.7.3.6 SDF start menu

The SDF start menu shows you the following information:

- The file name of the selected SDF.
- The name of the first section (Only if the setting Select SDF is set to Section name).
- The possible start options:
  - SDF MENU: The GUI-Elements from the SDF are shown.
  - KEYBOARD: The display values and keyboard labels from the HARP-5 device specific options in the SDF are shown.



<table>
<tr><th>Key</th><th>Function Key</th><th>Function</th></tr>
<tr><td>F1</td><td>SDF MENU</td><td>Start the SDFile and navigate to the "SDF menu".</td></tr>
<tr><td>F2</td><td>KEYBOARD</td><td>
<table>
<tr><th>Section in SDFile</th><th>Funcction</th></tr>
<tr><td>The SDFile contains only 1 section</td><td>Start the SDF and navigate to the "Keyboard menu".</td></tr>
<tr><td>The SDFile contains multiple sections</td><td>Start the SDF and navigate to the"Section selection menu".</td></tr>
</table>
</td></tr>
<tr><td>ESC</td><td></td><td>Navigate to the "Main menu".</td></tr>
</table>

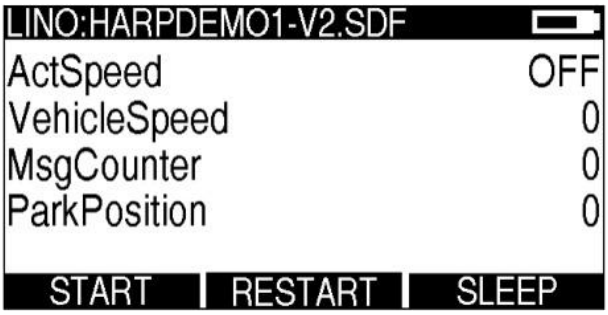
Warning
If the bus is started, it will continue to run until you press ESC. Then the bus and all SDF related functions will be stopped.

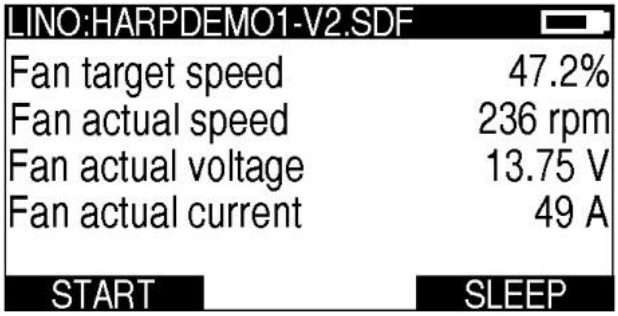
7.7.3.7 SDF menu

The SDF menu shows you the following information:

- The channel and SDFile or section name.
- A scrollable list with the elements defined in the GUI-Elements of the SDFile.
- Buttons to control the bus.

Advice
If you load a SDFile with multiple sections, all elements within the GUI-Elements of each section will be shown.





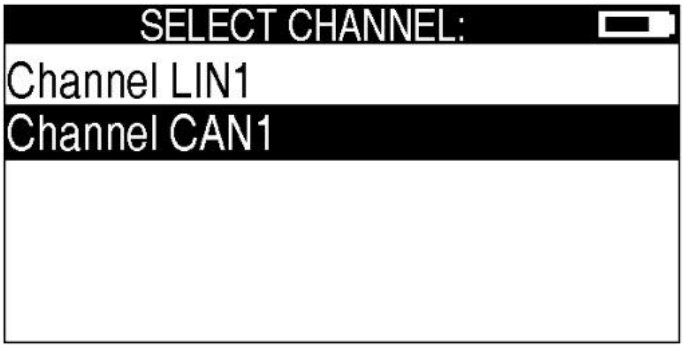
Key	Function Key	Function
F1	START	• Only available, if the bus is not running: Here you can start the bus, if it is not already running. All signals will be reset to their default value.
	STOP	• Only available, if the bus is running: Only available, if the bus is running:
F2	RESTART	• Only available, if the bus is not running: Here you can restart the bus, if it is not already running. A restart is like a start, but no signals will be reset to their default value.
F3	SLEEP	• Only available, if the bus is not running: Here you can send a sleep command to the bus.
ESC		Navigate to the "SDF start menu".
MENU		Navigate to the "Logger menu".
On / Off		Switch between signal representations: • Decimal raw signal value • Encoded signal value
Up / Down		Move the cursor of the currently selected entry up or down.
OK / LEFT / RIGHT		Edit the currently selected entry. • You can only edit signals, if they are added as Edit signal in the GUI-Elements of the section.

Advice
If the bus is started, it will continue to run even if you press ESC and enter the "SDF start menu". If you press ESC in the "SDF start menu" again, the bus will be stopped.

7.7.3.8 Section selection menu

The section selection menu shows you the following information:

- The available channels are shown

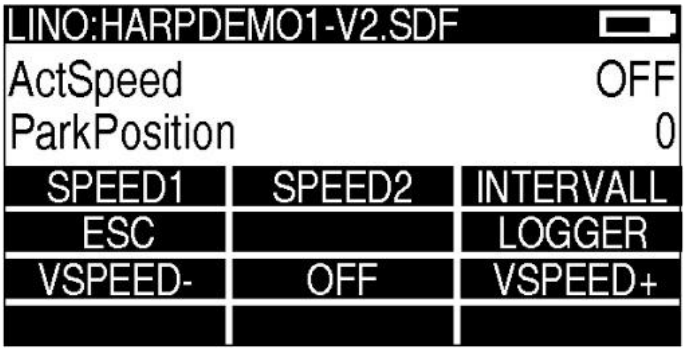


Key	Function Key	Function
ESC		Navigate to the "SDF start menu".
UP / DOWN		Move the cursor of the currently selected entry up or down.
OK / LEFT / RIGHT		Show the variables set in the keyboard menu of that section and navigate to the "Keyboard menu".

7.7.3.9 Keyboard menu

The keyboard menu shows you the following information:

- The channel and SDFile or section name.
- A fixed list with the elements defined in the Device-specific options of the HARP-5 in theSDFile.
- Up to 10 buttons, that can trigger user-defined actions.



Key	Function Key	Function
F1 F2 F3 UP LEFT OK RIGHT ON / OFF DOWN MEM	User-defined	The text and function of these buttons can be defined freely by the user within a SDFile.
MENU		• This button will trigger different actions depending on the length of the key press. **Duration the key is pressed** / **Function** Key is pressed short / Navigate to th "Logger menu". Key is pressed long / The key grid will be shown or hidden
ESC		Navigate to the "SDF start menu".

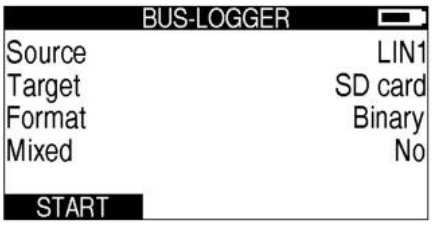
Advice
If the bus is started, it will continue to run even if you press ESC and enter the "SDF start menu". If you press ESC in the "SDF start menu" again, the bus will be stopped.

7.7.3.10 Logger menu

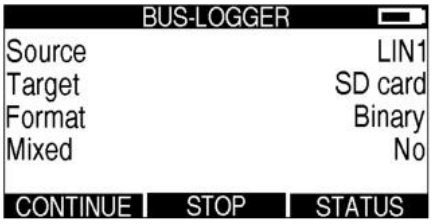
The logger menu lets you configure different logger. The following settings can be changed.

- `Source` : The source can be any activated channel.
- `Target` : Check chapter "Log data targets" for more information.
- `Format` : Check chapter "Log data formats" for more information.
- `Mixed` : With this option more then one logger can write into the same log file. Simple activate this option and start the logger for each channel individually.

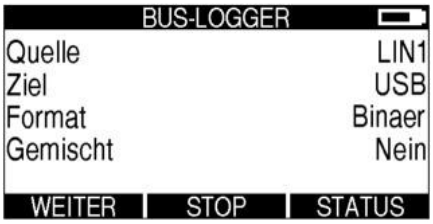
Check chapter "Configure and activate the logging" for more information.



If the logger is not started



If the logger os started



If the logger is paused

Key	Function Key	Function
F1	START	• This item is only visible, if the logger for this channel is currently not active. Start the logger for this channel
	PAUSE	• This item is only visible, if the logger for this channel is currently active and not paused. Pause the logger fpr this channel
	CONTINUE	• This item is only visible, if the logger for this channel is currently active, but paused. Continue the logger for this channel
F2	STOP	• This item is only visible, if the logger for this channel is currently active, but paused. Stop the logger for this channel
F3	Status	• This item is only visible, if the logger for this channel is currently active, but paused. Shwo the status of the logger for this channel
ESC MENU		Navigate to the "Main menu".
UP / DOWN		Move the cursor of the currently selected entry up or down.
OK / LEFT / RIGHT		Edit the currently selected entry.

7.7.4 Navigation

Current menu	Button	Next menu
"Main menu"	F1	Run ECU menu
	F2	Logger menu
	F2	PC mode menu
	MENU	Setup menu
"Setup menu"	ESC	Main menu
"PC mode menu"	F1	Main menu
	ESC	
"Run ECU menu"	ESC	Main menu
	MENU	
	LEFt RIGHT OK	If a SDFile is selected: SDF start menu
"SDF start menu"	ESC	SDF start menu
	MENU	Logger menu
"SDF menu"	ESC	SDF start menu
	MENU	Logger menu
"Section selection menu"	ESC	SDF start menu
	OK LEFT RIGHT	Keyboard menu
"Keyboard menu"	ESC	SDF start menu
	MENU	Logger menu
"Logger menu"	ESC	Back to the previous menu. The following menus are possible: • Main menu • SDF menu • Keyboard menu
	MENU	

8 Workflow

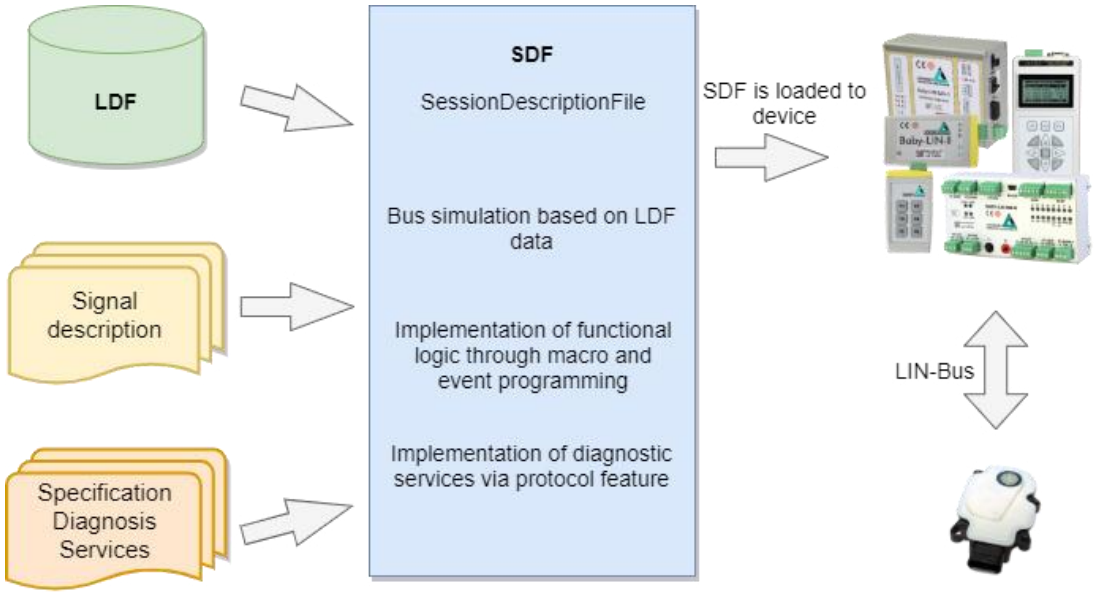
In this chapter we will show you how the workflow looks like in a typical LIN use case. For this purpose, we will introduce the following components to you:

- LDF
- Signal description
- Specification Diagnosis Services

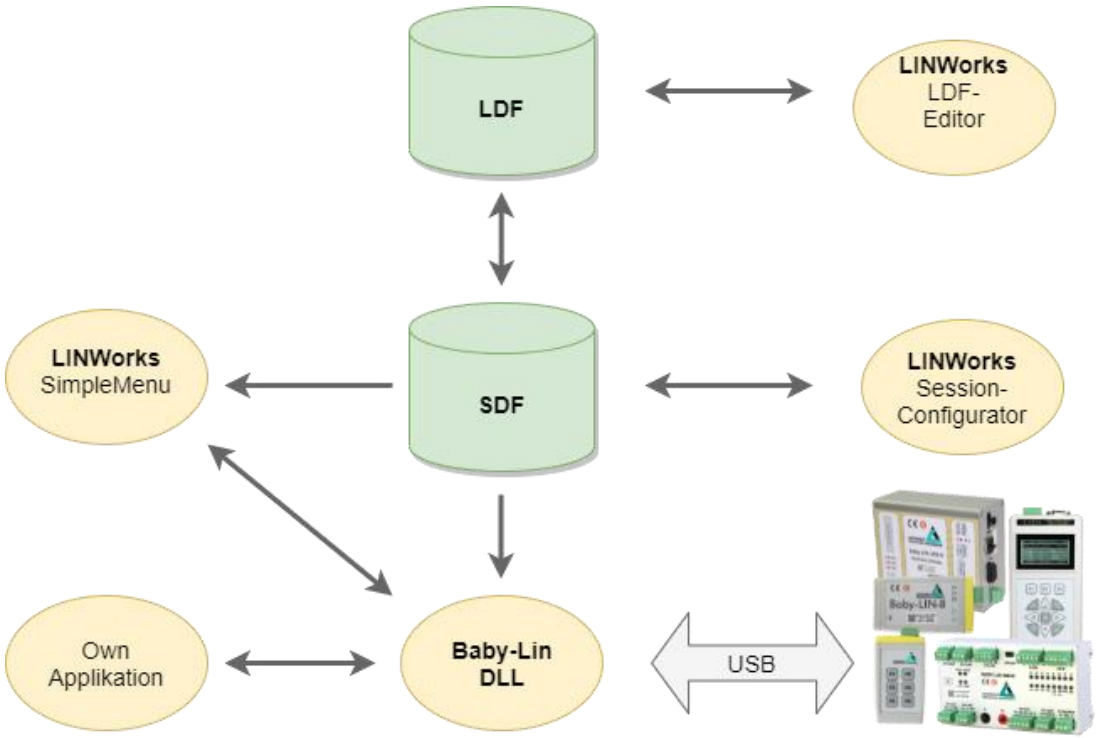
From this information, the SessionDescriptionFile (SDF) can be created. The SDF is the linchpin in LINWorks-based applications.

8.1 Overview

The following graphic shows the typical workflow of a LIN-based application with our Baby-LIN-Device.



This diagram shows how the individual LINWorks software applications are linked to each other.



8.2 Getting started

8.2.1 Introduction

This getting started guide will show you how to create your Lin application using the information from the LDF and the signal descriptions. In the following, you will learn how to create an LDF and integrate it into the SDF. Furthermore, the Unifeid Diagnostic Services will be introduced. After you have successfully created the SDF, the HARP-5 can be operated in standalone mode, LIN bus data can be logged, or macros can be defined for autostart.

Advice
This guide assumes you are using a Microsoft Windows operating system.

8.2.2 Installation

Before you can start using the HARP-5 you have to install several components of the LINWorks software.

If you have not already downloaded the LINWorks software, please download it now from our website: Link: *https://www.lipowsky.de/downloads/*

Advice
Check chapter "Downloads" for more information.

The following components are required for this getting started guide:

- Baby-LIN driver
- SessionConf
- SimpleMenu
- LDFEdit

8.3 LDF

LDF (LinDescriptionFile) has been developed by the LIN Consortium, in which various parties such as car manufacturers, suppliers and tool suppliers were involved. This means that the LDF specification is not dependent on a single manufacturer and can be used universally.The Format and syntax of the LDF are described in the LIN specification.

Each LIN bus has its own LDF, which collects all the properties of this specific bus in one document. This includes which nodes are present on the bus, which frames are defined and according to which scheme they are to be emulated.

8.3.1 LDF Example

The following example shows the LDF of a windscreen wiper motor.

LDF header

```
LIN_description_file ;
LIN_language_version = "1.3" ;
LIN_speed = 19.200 kbps ;
```

Node section

```
Nodes {
Master:MasterECU,1.0000 ms,0.1000 ms ;
Slaves:Slave1Motor,Slave2Sensor;
}
```

```
{ MessageCounter:8,0x00,MasterECU,Slave1Motor,Slave2Sensor;

Ignition:1,0x0,MasterECU,Slave1Motor,Slave2Sensor;
WiperSpeed:3,0x0,MasterECU,Slave1Motor;
Temperature:8,0xFF,MasterECU,Slave1Motor,Slave2Sensor;
WiperActive:1,0x0,Slave1Motor,MasterECU;
ParkPosition:1,0x0,Slave1Motor,MasterECU;
CycleCounter:16,0x00,Slave1Motor,MasterECU;
StatusSensor:8,0x00,Slave2Sensor,MasterECU;
ValueSensor:8,0x00,Slave2Sensor,MasterECU;
}
```

Frame section

```
Frames {
MasterCmd:0x10,MasterECU,4{MessageCounter,0;
Ignition,8; WiperSpeed,9; Temperature,16; }
MotorFrame:0x20,Slave1Motor,4{ WiperActive,0;
ParkPosition,1; CycleCounter,16; }
SensorFrame:0x30,Slave2Sensor,2StatusSensor,0; ValueSensor,8;
}
```

Schedule table

```
Schedule_tables {
Table1 { MasterCmd delay 20.0000 ms ;
MotorFrame delay 20.0000 ms ;
SensorFrame delay 20.0000 ms ;}
}
```

Signal section

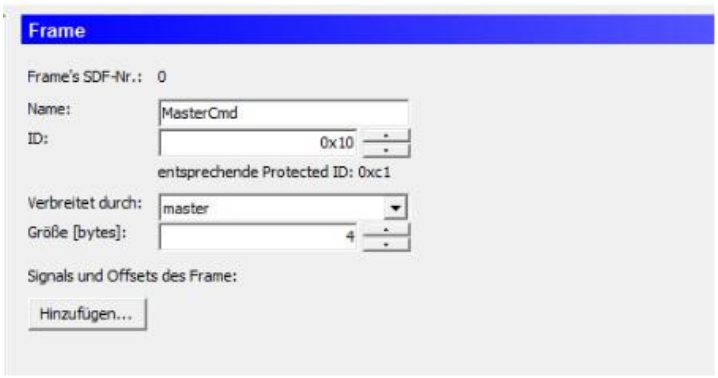
Signal encoding section

```
Signals
Signal_encoding_types {
EncodingSpeed { logical_value,0x00,"Off" ;
logical_value,0x01,"Speed1" ;
logical_value,0x02,"Speed2" ;
logical_value,0x03,"Interval" ;}
EncodingTemp { physical_value,0,253,0.8,- 35,"degrees C" ;
logical_value,0xFE,"Signal not supported" ;
logical_value,0xFF,"Signal not available" ;}
}

Signal_representation
{ EncodingSpeed:WiperSpee
d;
EncodingTemp:Temperature;
}
```

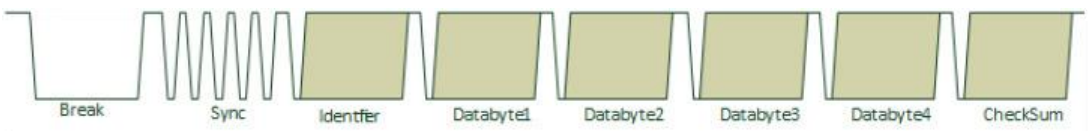
8.3.2 LIN application frames

With the information from an LDF, you can assign all frames that appear on the bus to your publisher using the PID. You can also interpret the data regarding the signals it contains.




```
Frames{
   MasterCmd:0x10,MasterECU,4 {
        MessageCounter,0;
        Ignition,8;
        WiperSpeed,9;
        Temperature,16; }
        }
```

The frame is structured as shown in the following graphic. The frame defined in the LDF is recognised with the identifier with ID = 0x10 and the signals can be mapped from the 4 databytes.



8.3.2.1 Protected LIN identifier

The Frame Id is 8 Bit in size, where by the upper 2 bits are used as parity bits. So only 6 bits remains to represent the effective frame identifier. This

makes a range of 64 different frame id‘s.

Paritybit P1 (ID.7)	Paritybit P0 (ID.6)	Identifier Bits ID.5 - ID.0
ID.1^ID.3^ID.4^ID.5	!(ID.0^ID.1^ID.2^ID.4)	0…63

Id dec	Id hex	PID	Id dec	Id Hex	PID	Id dec	Id hex	PID	Id dec	Id hex	PID
0	0x00	0x80	16	0x10	0x50	32	0x20	0x20	48	0x30	0xF0
1	0x01	0xc1	17	0x11	0x11	33	0x21	0x61	49	0x31	0xB1
2	0x02	0x42	18	0x12	0x92	34	0x22	0xE2	50	0x32	0x32
3	0x03	0x03	19	0x13	0xD3	35	0x23	0xA3	51	0x33	0x73
4	0x04	0xc4	20	0x14	0x14	36	0x24	0x64	52	0x34	0xB4
5	0x05	0x85	21	0x15	0x55	37	0x25	0x25	53	0x35	0xF5
6	0x06	0x06	22	0x16	0xD6	38	0x26	0xA6	54	0x36	0x76
7	0x07	0x47	23	0x17	0x97	39	0x27	0xE7	55	0x37	0x37
8	0x08	0x08	24	0x18	0xD8	40	0x28	0xA8	56	0x38	0x78
9	0x09	0x49	25	0x19	0x99	41	0x29	0xE9	57	0x39	0x39
10	0x0A	0xCA	26	0x1A	0x1A	42	0x2A	0x6A	58	0x3A	0xBA
11	0x0B	0x8B	27	0x1B	0x5B	43	0x2B	0x2B	59	0x3B	0xFB
12	0x0C	0x4C	28	0x1C	0x9C	44	0x2C	0xEC	60	0x3C	0x3C
13	0x0D	0x0D	29	0x1D	0xDD	45	0x2D	0xAD	61	0x3D	0x7D
14	0x0E	0x8E	30	0x1E	0x5E	46	0x2E	0x2E	62	0x3E	0xFE
15	0x0F	0xCF	31	0x1F	0x1F	47	0x2F	0x6F	63	0x3F	0xBF

Advice
Note that the following IDs are reserved for protocol extensions and diagnostic and configuration data:
• 60 (0x3C) and 61 (0x3D) are used to carry diagnostic and configuration data.
• 62 (0x3E) and 63 (0x3F) are reserved for future protocol enhancements.

8.3.3 LIN Scheduling

The order in which the frames are sent to the LIN bus is defined in a so-called Schedule Table. One or more Schedule Table(s) are defined in each LDF.

Each table entry describes a frame by its LDF name and a delay time, which is the time that is made available to the frame on the bus.

A Schedule Table is always selected as active and is executed by the master.The master places the corresponding frame headers on the bus and the publisher assigned to this frame places the corresponding data section + checksum on the bus.

Only the master can switch the Schedule Table. Thus the master application determines which frames appear on the bus in which time sequence.

8.3.4 LIN Diagnostic frames

Diagnostic frames are a pair of MasterRequest (0x3c) and SlaveResponse (0x3D) frames. Used to send information that is not described in the LDF.

0x3C MasterRequest:
Request Data define the node and the requested action.

0x3D SlaveResponse:
Data generated by the addressed slave; content depends on request

The Master Request and Slave Response have special properties:

- They are always 8 bytes long and always use the Classic Checksum.
- No static mapping of frame data to signals; frame(s) are containers for transporting generic data.
- Request and response data can consist of more than 8 data bytes.

The MasterRequest - SlaveResponse mechanism can be used to transmit a wide variety of data because it is a universal transport mechanism. A main application is the diagnosis and End of Line (EOL) configuration of nodes.

In the field there is a whole range of different protocols, depending on the vehicle and ECU manufacturer:

- A lot of proprietary diagnostics or EOL protocols
- DTL based protocols (Diagnostic Transport Layer)
- Keyword 2000 Protocol (ISO 14230 -1 to 4)
- UDS (Unified Diagnostic Services) (ISO 14229-1:2013)

8.4 Session Description File (SDF)

8.4.1 How to create a LIN application

1. Requirement

A LIN node (slave) and a suitable LDF file are available. An application is to be implemented in which a simulated LIN master allows the node to be operated in a certain way.

2. Requirement

However, the information in the LDF is usually not sufficient. The LDF describes the access and interpretation of the signals, but the LDF does not describe the functional logic behind these signals. Therefore you need an additional signal description which describes the functional logic of the signals.

3. Requirement

If the task also requires diagnostic communication, a specification of the diagnostic services supported by the nodes is also required. In the LDF, only the frames with the respective data bytes are defined, but not their meaning.

These requirements can then be defined and edited together in a Session Description file (SDF).

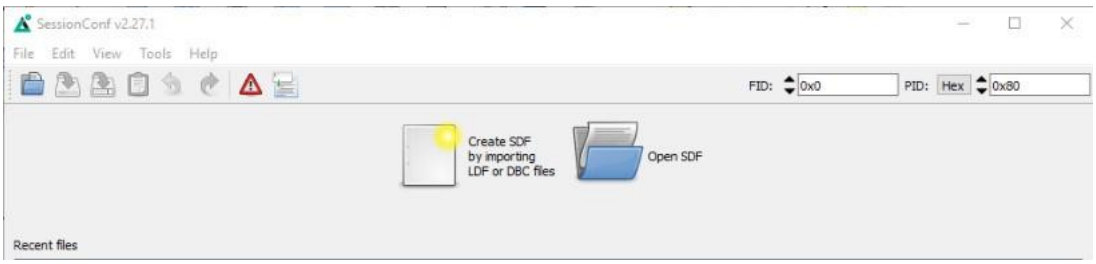
8.4.2 Introduction

The Session Description file (SDF) contains the bus simulation based on the LDF data. The logic of the individual frames and signals can be programmed by macros and events. In addition to the LDF LIN schedule, further diagnostic services can be implemented in the SDF via protocols.

This makes the SDF the central working point of all LINWorks applications.

8.4.3 Create a SDF

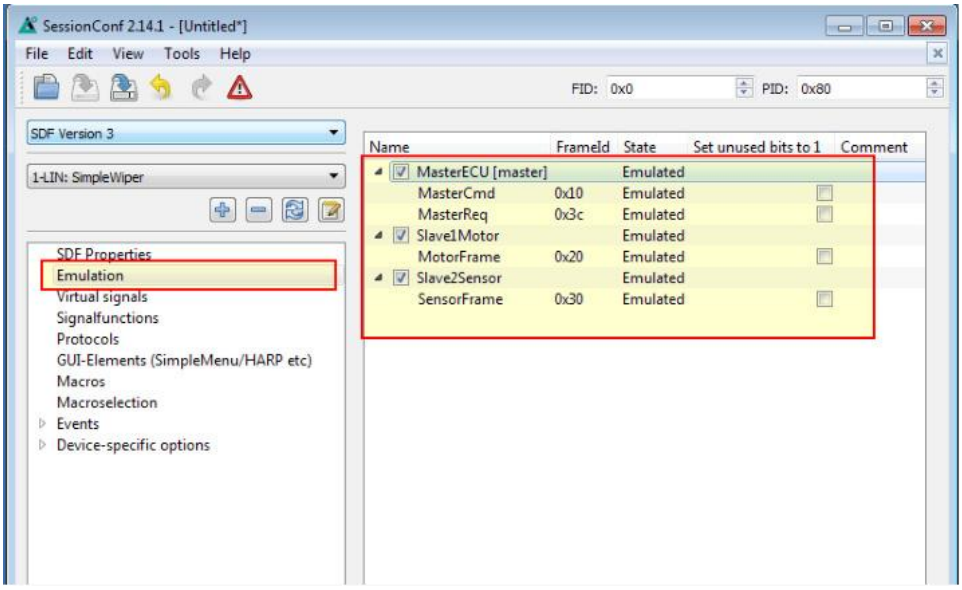
The SessionConf software application is used to create and edit the SDF. For this purpose, an existing LDF is imported.



8.4.4 Common Setup

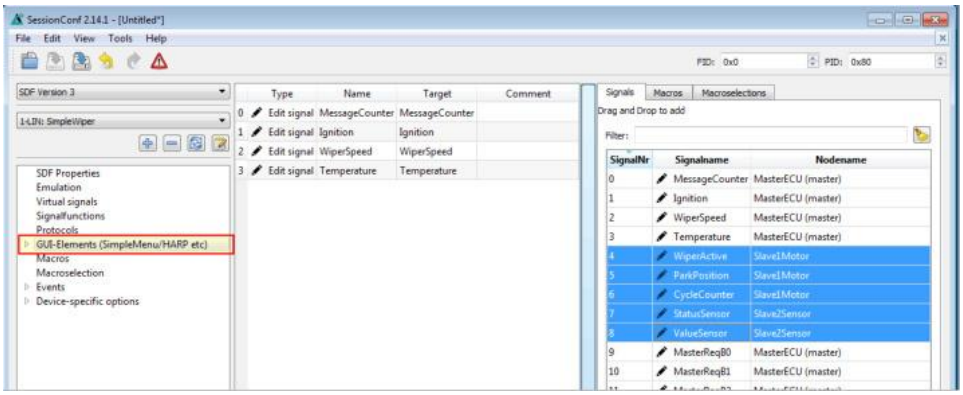
8.4.4.1 Emulation

Select Emulation in the navigation menu on the left. Here you can select which nodes you want to be simulated by the HARP-5. If you only want to monitor the LIN-Bus, select nothing.



8.4.4.2 GUI-Elements

Select GUI-Elements in the navigation menu on the left. Here you can add signals you want to monitor.



Advice
There are other ways to monitor frames and signals, but this is a good and configurable starting point.

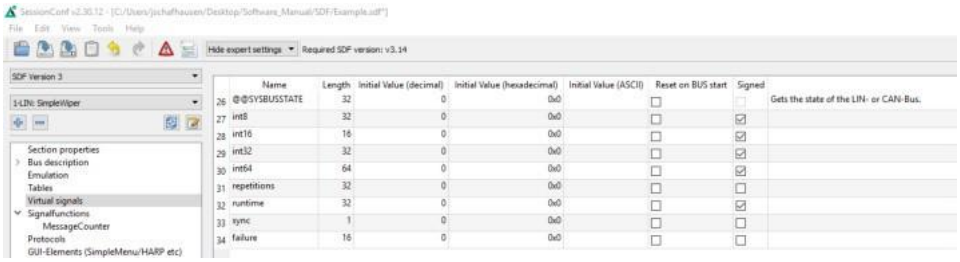
8.4.4.3 Virtual signals

Virtual signals can store values just like bus signals, but they do not appear on the bus. They can be used for many different tasks like:

- Temporary values, like counters
- Store constants
- Operands and results from calculations
- etc.

The size of a virtual signal can be set to 1...64 bits. important for use in the protocol feature.

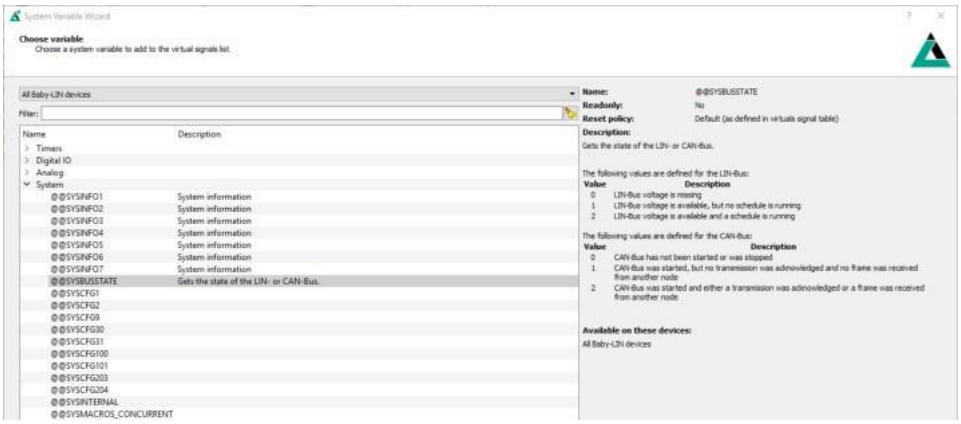
Each signal has a default value that is set when the SDF is loaded.



8.4.4.4 System signals

System signals are virtual signals with reserved names. When a system signal is applied, a virtual signal is created at the same time and linked to a specific behaviour.

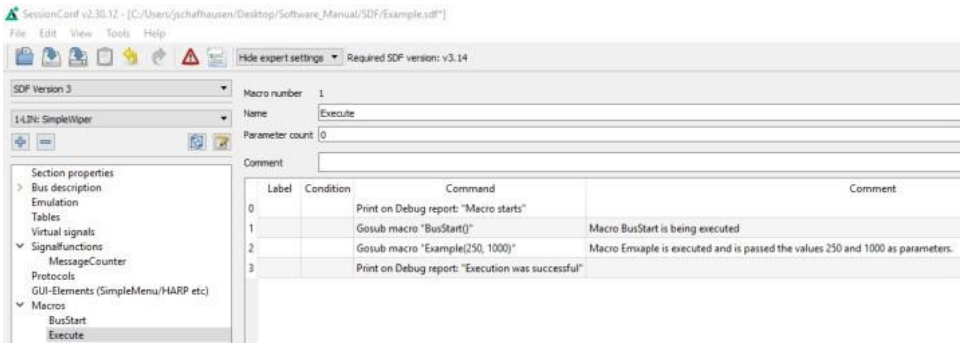
In this way, you can access timer, input and output resources and system information.



Advice
For more information and a list of all available system signals, please check the chapter "System variables".

8.4.4.5 Macros

Macros are used to combine multiple operations into a sequence. Macros can be started by events or, can also be called from other macros in the sense of a Goto or Gosub. The DLL API calls a macro with the macro_execute command.



All Macro Commands can use signals from the LDF and signals from the Virtual Signal section like the system signals.

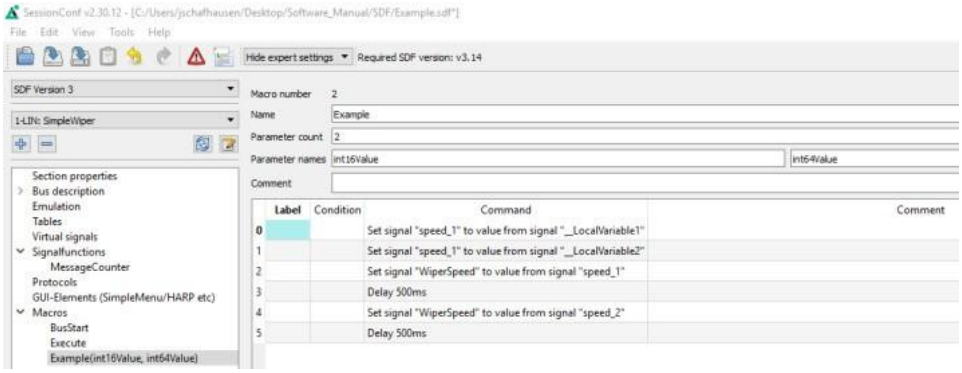
Another important function of the macros is to control the bus. The bus can be started and stopped via macro. Furthermore, the schedule can be selected and the status of the bus can be checked with the help of the system signals.

Advice
For more information or if you want to implement an autostart macro, please read the chapter "Configuring an autostart macro".

Each macro always provides 13 local signals:

`_LocalVariable1, _LocalVariable2, ..., _LocalVarable10, _Failure, _ResultLastMacroCommand, _Return`

The last 3 provide a mechanism to return values to a callcontext `_Return, _Failure`) or to check the result of a previous macro command. The signals `_LocalVariableX` can be used e.g. as temporary variables in a macro.



A macro can receive up to 10 parameters when called. In the macro definition, you can give these parameters names, which are then displayed on the left in the menu tree in brackets after the macro name. The parameters end up in the signals `_LocalVariable1...10` of the called. If no parameters or less than 10 parameters are are passed, the remaining `_LocalVariableX` signals receive the value 0.

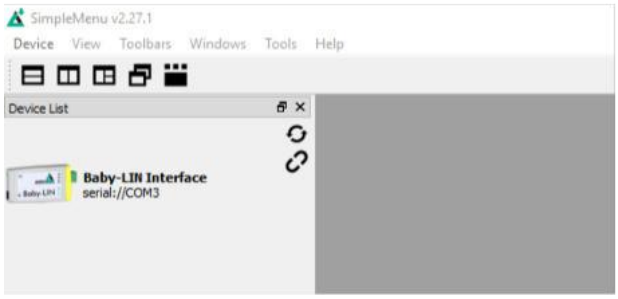
8.4.5 Example SDF

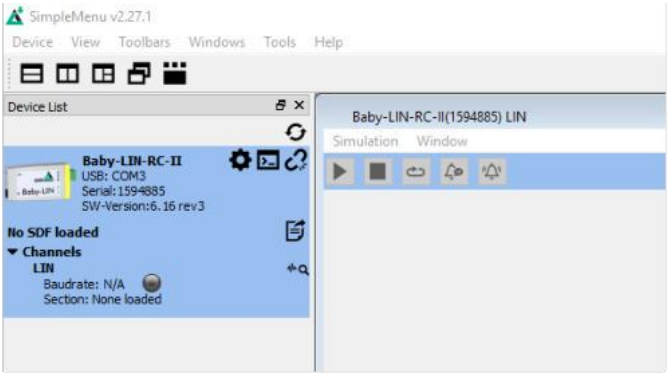
You can download the GettingStarted_Example SDF in the download area on our website under the following link.

Link: *https://www.lipowsky.de/downloads/*

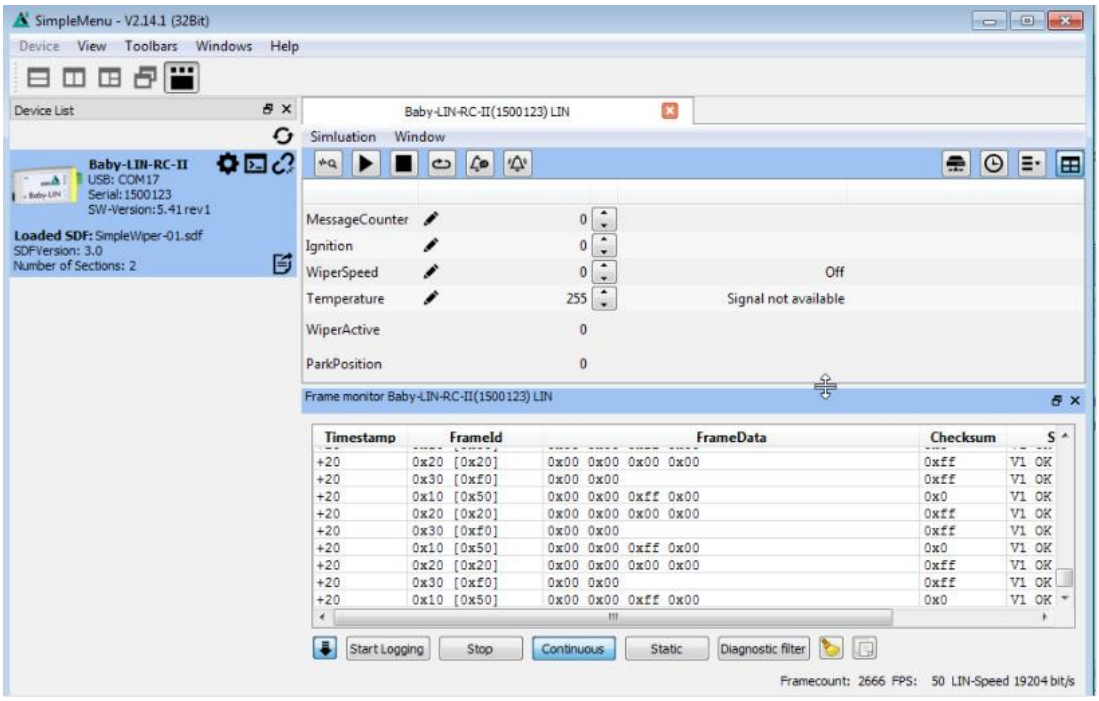
8.4.6 Start the bus communication

Start the SimpleMenu. You should be able to find your HARP-5 in the device list on the left. Click the connect button and then load the SDF you created earlier.





Now you can see the variables you added to monitor. To start the simulation/monitoring click on the start button.



Now you will see the changes of these signals.

Tip
The HARP-5 features a lot more features and possibilities and can be used for a wide selection of applications. Keep on reading this manual to learn more about the HARP-5 .

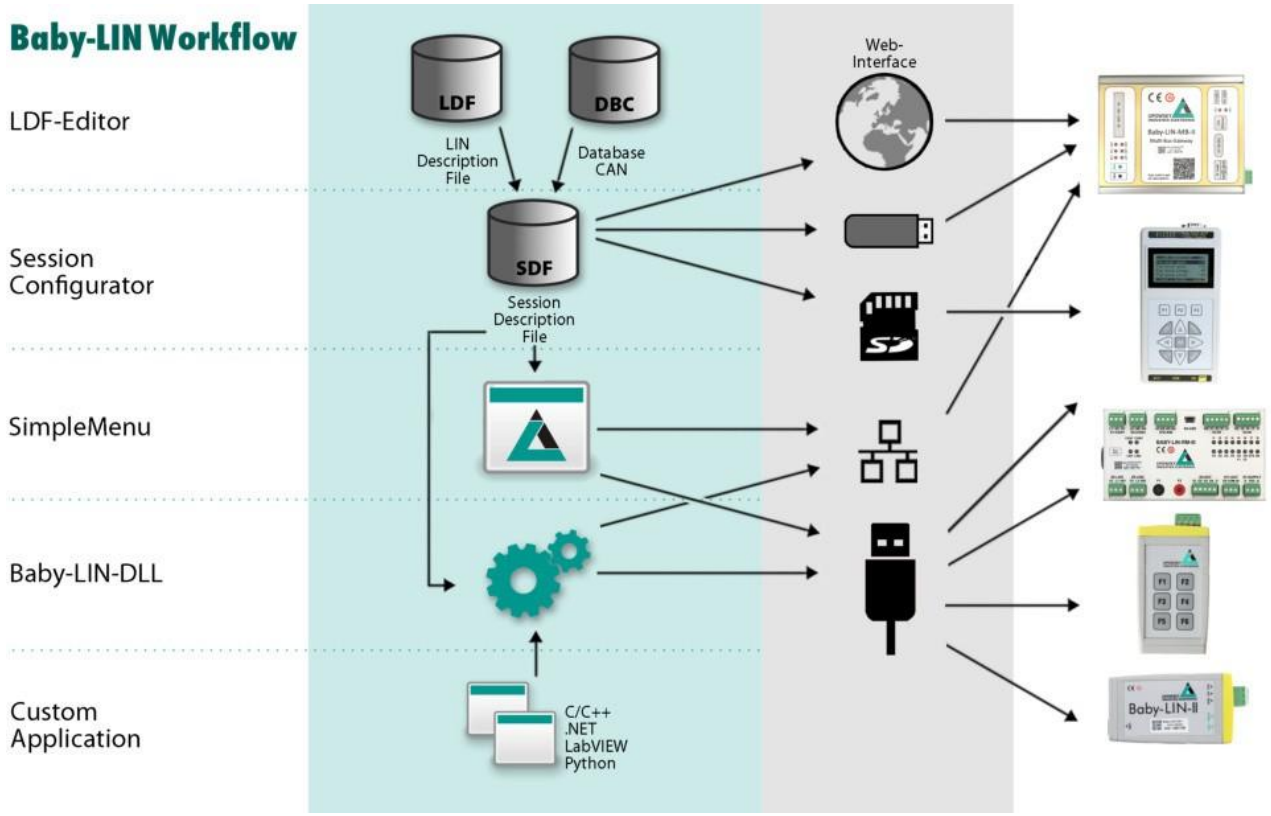
9 LINWorks Software - Overview

The LINWorks is a collection of software to operate the HARP-5.The complete LINWorks software package is available for download on our website. There you will also find the LINWorks Software Manual, which gives a detailed overview of the individual program and how to work with and create Session Description Files.

You can download both from the following link: *https://www.lipowsky.de/downloads/*

Component	Archive subfolder	Description
Datasheets User manuals Application notes	Documentation	The datasheets show a quick overview about a Baby-LIN product and its features. The user manuals contain the main documentation. The application notes contain some older information, that have not been added to the user manuals yet.
Baby-LIN driver		The **Baby-LIN driver** is necessary to connect a HARP-5 to a windows PC via USB. The HARP-5 will be available as **virtual COM port**.
LDFEdit	LINWokrs	The **LDFEdit** allows the inspection, creation and edit of a LDFile (LIN Description File).
SessionConf	LINWokrs	The **SessionConf** allows the inspection, creation and edit of a SDFile (Session Description File) and features a file import for LDFiles (for LIN-Bus simulation). It defines everything needed for a complete simulation of each available bus, e.g. which nodes on each bus are available and which nodes should be simulated by the Baby- LIN-RC-II. Moreover it allows defining an application logic. This programming ability is available for each device out of the box.
SimpleMenu	LINWokrs	The **SimpleMenu** is used to establish a connection to the HARP-5 and upload SDFiles, change the device target configuration, control the bus and monitor the frames and signals on the bus. Even without a LDFile/ SDFile the bus can be monitored and the frames can be logged.
LogViewer	LINWorks	The **LogViewer** can show and convert the log files of the HARP-5 as well as the SimpleMenu.
Baby-LIN-DLL	Development	The **Baby-LIN-DLL** allows customers to create their own application and use all features of the HARP-5 like controlling and monitoring the LIN-Bus interfaces. The **Baby-LIN-DLL** is a native **C/C++** DLL. It is available for **Windows**, **Linux** and **RaspberryPi**. Wrapper for **.NET**, **Python**, **VB6** and **LabView** are available. Of course we provide examples for all supported languages.
Serial writer	Tools	The **serial writer** is used to change the **serial number**, that is stored within the persistent memory of a HARP-5 . This serial number influences the allocation of the **virtual COM port** number, the HARP-5 is available under.
BLProg	Tools	The **BLProg** is used to update the **firmware** of a Baby- LIN-RC-II. If you download a firmware package from our customer portal (*portal.lipowsky.de*) a current version of the **BLProg** will always be included.
Baby-LIN-MB-Tool	Tools	The **Baby-LIN-MB-Tool** allows to access many features of the Baby-LIN-MB-II. It can help to search and identify Baby-LIN-MB-IIs, change the **network configuration** and select different modes. Scripts using the **ASCII command protocol** can be executed, debugged and logged. The simulation mode allows to **simulate** certain behaviours of the Baby-LIN-MB-II to test custom applications. Additionally the Baby-LIN-MB-Tool features many different **logging** capabilities.

The following graphic shows how you can use our LINWorks software in connection with our the Baby-LIN-Devices.



10 Migration information

10.1 Migration from HARP-5 to HARP-4

All Baby-LIN products of the second generation were designed to be compatible with the first generation. Due to hardware and software changes, the compatibility may be affected in certain areas.

If you have used a HARP-4 in your environments and applications and now want to replace it with a HARP-5, the following chapters give you an overview of the topics, you have to consider.

Version incompatitbility
Each of the following chapters may decrease the compatibility depending on your application and the way, you use the HARP-5. Therefor you should check all these chapters very carefully.

subsectionLIN-Bus transceiver

Version incompatitbility
If you want to replace a HARP-4 with a HARP-5 you should check the following chapter, since this issue reduce the compatibility depending on your application and the way, you use the HARP-5.

The used LIN-Bus transceiver has changed. The following table shows you, what properties have changed:

Baby-LIN product	HARP-4	HARP-5
LIN-Bus transcceiver	Si9241A	MC33662
Maximum LIN-Bus baud rate	200 kBaud	125 kBaud
Minimal LIN-Bus voltage	3,8 V	6,9 V
Maximum LIN-Bus voltage	36 V	26 V

10.2 SDF versions: SDF-V3 and SDF-V2

SDFiles contain the configuration to setup all Baby-LIN products. New features are continuously developed and the format therefor changes.

The first generation of Baby-LIN products supported all features up to the main format version 2. This format is called SDF-V2.

With the second generation of Baby-LIN products new features were added to the SDFile format, that require the higher performance of the new devices. The format with these new features is called SDF-V3.

Since new features are added continuously to the SDFile format, you should always keep your LINWorks and firmware up to date. Check chapter "Update philosophy" for more information.

10.2.1 Compatibilities

All Baby-LIN products support the SDF-V2 format.

Attention
The SDF-V3 format must be unlocked on some devices using an optional voucher code..

Advice
If the Baby-LIN product is only needed to replace an old device or extend an old installation, the SDF-V3 option is not required.

The following table gives an overview over all Baby-LIN products and their support for SDF-V2 and SDF-V3:

Baby-LIN product generation	Baby-LIN product	SDF-V2	SDF-V3
Baby-LIN products Generation I	Baby-LIN	✓	
	Baby-LIN-RC	✓	
	Baby-LIN-RM	✓	
	Baby-LIN-MB	✓	
	HARP-4	✓	✓ (optional)
Baby-LIN products Generation II	Baby-LIN-II	✓	✓
	Baby-LIN-RC-II	✓	✓
	Baby-LIN-RM-III	✓	✓
	Baby-LIN-MB-II	✓	✓
	HARP-4	✓	✓

The format of a SDFile is visible and can be changed in the SessionConf. The conversion between the formats has the following rules:

Source format	Target format	Feasibility
SDF-V2	SDF-V3	This is always possible. After the change SDF-V3 features can be used.
SDF-V3	SDF-V2	This conversion is only possible, if no SDF-V3 features are used. If this is the case, the SessionConf will show a list of incompatible elements.

10.2.2 Section

Some of the Baby-LIN products of the second generation feature more than just one LIN-Bus interface. Multiple LIN-Bus interfaces are available as well as the new CAN-Bus interfaces. The content of a SDF-V2 SDFile will be mapped into a LIN section within a SDF-V3 SDFile.

The new CAN section support the same features as a LIN section with minor changes due to the differences of the LIN- and CAN-Bus.

The new device section is a container for features, that are not specific to a channel, but the device in common. The main feature of the device section is, that it may containt the target configuration for a device. This means, that the target-specific options may be configured simply by loading a SDFile. Check chapter "Target configuration and target-specific options" for more information.

SDFile format	Content
SDFV-2	The description of a single LIN interface. This is quivalent to a LIN section in a SDF-V3 SDFile.
SDF-V2	Multiple sections: • A device section. • Any number of LIN sections. A LIN section is based on a LDFile. • Any number of CAN sections. A CAN section is based on a DBC file or a ARXML file.

10.2.3 Target-specific options

The target-specific options are a set of options for a Baby-LIN product. They can be set using the SimpleMenu. Now with SDF-V3 they can also be stored within a SDFile.

The target-specific options within a SDF-V3 SDFile can be applied, when it is downloaded:

Download method	Effect
Download using the SimpleMenu	The user will be querried, if the target-specific options from the SDFile should be applied. The user can change the target-specific options manually.
Download using the Baby-LIN-DLL	The target-specific options are applied automatically.

Check chapter "Target configuration and target-specific options" for more information.

10.2.4 Names

The length of the element names within a SDFile have been increased.

Element in the SDFile	Length in a SDF-V2 SDFile	Length in a SDF-V3 SDFile
(Section) Description	450	4096
Element names	40	64

10.2.5 Emulation

Each emulated frame in a LIN section can now be configured to set unused bits to 1 instead of 0.

The emulation of CAN section differs slightly from the emulation of a LIN section:

- Each node can be configured to have on of three states:

Node state	Description
Off	The frame is not sent and its reception is not checked. The frame will still be visible to the user.
Monitored	The frame is expected to be received. If the timeout is exceeded, an error will be created.
Emulated	The frame will be sent with the given cycle time.

- Each frame can be configured to have an individual state based on the node state:

Node state	Frame state	Description
Off	Off	The frame is not sent and its receoption is not checked.
Monitored	Off	The reception of the frame is checked based on the given timeout.
	Monitored	The reception of the frame is checked based on the given timeout.
Emulated	Off	The frame is not sent and its receoption is not checked.
	Emulated	The frame is sent with the given cycle time.

10.2.6 Virtual signals and system variables

The size of virtual signals can now be increased to 64 bits.

The behaviour of the virtual signals on bus start can now be changed. Now it is possible to reset virtual signals, when the bus is resetted.

Virtual signals can now also be intrpreted as signed variables.

Element	Length in a SDF-V2 SDFile	Length in a SDF-V3 SDFile
Size of virtual signals	1 - 16	1 - 64
Size of system variables	16	32
Reset on Bus start	yes	configurable
Sign	unsigned	configurable

New system variables have been added. Since they are device specific, there usage does not depend on the format of the SDFile.

10.2.7 Signalfunctions

New AUTOSAR CRCs have been added to the signalfunctions. The CRC is calculated according to the AUTOSAR standard. Both, profile 1 and profile 2 are available.

All CRC signalfunctions have more properties to support custom deviations from the standard CRC calculation.

10.2.8 Macros

New macro commands have been added to improve the programming and reduce the number of required commands.

A conditional macro command execution has been added. Each macro command can now be configured to have a condition, e.g. a comparison between two signals. The macro command is only executed, if the condition is true.

A new feature is the call of a macro as sub macro. The calling macro blocks until the sub macro is finished. By passing arguments and a return value mechanism, the user can now define reusable functions.

With the addition of conditions, functions and new macro commands new powerful sequences can be realised.