



## Display DDU 10

Manual

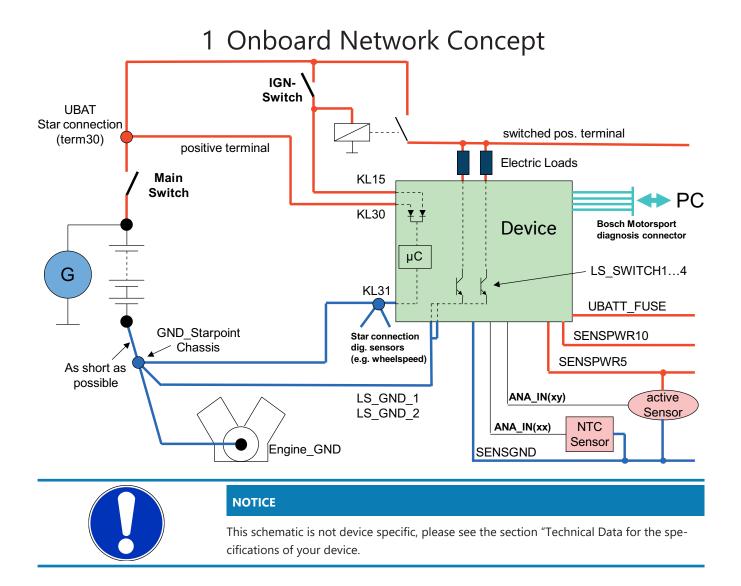
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## 2 Preparation

Use the DDU 10 only as intended in this manual. Any maintenance or repair must be performed by authorized and qualified personnel approved by Bosch Motorsport.

Operation of the DDU 10 is only certified with the combinations and accessories that are specified in this manual. The use of variant combinations, accessories, and other devices outside the scope of this manual are only permitted when they have been determined to be compliant from a performance and safety standpoint by a representative from Bosch Motorsport.

Read the manual carefully and follow the application hints step by step. Do not hesitate to contact us, contact data can be found on the last page of this document.

### Important information on Electromagnetic Conformity

To avoid unwanted interference with the environment (people, animals, electronic devices) or unwanted harm to the environment, it is mandatory that the user of the DDU 10 carries out an appropriate analysis to determine the electromagnetic interaction the DDU 10 may have with its individual installation environment.

#### Disclaimer

Due to continuous enhancements, we reserve the rights to change any illustrations, photos and technical data within this manual.

Please retain this manual for your records.



### NOTICE

In this document, all screenshots are created by way of example for a display. Please consider this and replace the product names with the name of your device.

## 3 Power Supply

Please ensure that you have a good ground installation. That means:

- A ground that has a solid, low resistance connection to the negative battery terminal
- Connection should be free from dirt, grease, paint, anodizing, etc.
- Use large diameter wire
- More metal-to-metal contact is better!

The following notations for power signals are used:

- KL 15 is a switched battery rail controlled by the IGN-switch
- KL 30 is an unswitched battery positive rail (same as battery positive terminal)
- KL 31 is an unswitched ground rail (same as battery negative terminal)

Be careful to observe current limits of wires and connector pins!

## 4 Starting Up

## 4.1 Before starting

Install the software required for the operation of the DDU 10. It is developed for Windows system software. The following software versions are used in this manual:

- DDU 10 setup, configuration and calibration: RaceCon Version 2.6.
- Measurement data analysis: WinDarab V7

Set up the 100 Mbit ethernet connection to the DDU 10.

- The ethernet port has "cable auto crossover" functionality

### 4.1.1 Starting the unit

The DDU 10 powers up by turning on the ignition of the car. At startup the DDU 10 will display a Bosch logo.

After a moment the DDU 10 shows a display element screen.

### 4.1.2 Connecting the unit to RaceCon

For testing new device configurations, you can connect the device to your computer via MSA-Box or ethernet cable.

### Connection via MSA-Box

- 1. Reassure that the MSA-Box is installed properly on your computer. If needed, download the MSA-Box Diver from www.bosch-motorsport.com.
- 2. Connect an ethernet line of the device to the ethernet line of the MSA-Box.

Please note, that the MSA-Box also requires power supply on the MSA-Box connector of your wiring loom.

3. Open RaceCon and connect the MSA-Box to the computer.

In the 'Info / Status' Box of RaceCon you will receive messages that the connection was successful.

<mark>2</mark> E	Errors 👔 🛝	Narnings (	i) Messages(2)	2/2
г	Time	Sender	Message	
D	12:16:09	RaceCon	Connected to MSA Box.	
D	12:16:09	RaceCon	MSA Box successfully connected.	

- 4. Reassure that the device is switched on.
- 5. 'Link LED' at the computer's network adapter will illuminate.

If the LED is off, check the wiring harness.

After you created a RaceCon project with the device, the status icon of the device will switch from grey to one of the following colors: red, orange, green. For further information on how to set up a project, see the chapter "Setting up a new RaceCon Project [> 9]". For the status color, see chapter "Color indication [> 22]".

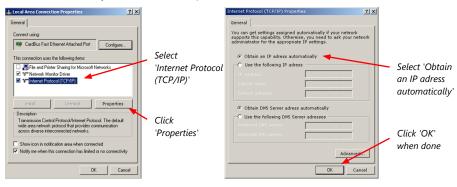
### Connection via Ethernet Cable

- 1. Follow the steps above for a connection via MSA-Box.
- 2. Instead of connecting the ethernet line to the MSA-Box, Connect the ethernet directly to your computer.

#### Troubleshooting while setting up the network interface

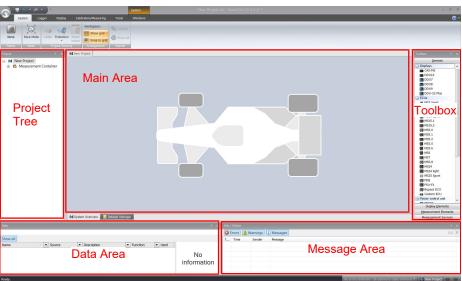
The DDU 10 contains a DHCP server, network addresses can be assigned automatically to the configuration PC. In case of problems during the network connection, please try the following steps:

- 1. Switch off the PC's firewall.
- 2. Reconfigure the PC or the MSA-Box network interface settings, to obtain an IP address automatically as shown in the pictures below.



### 4.1.3 Setting up a new RaceCon Project

The following screenshot shows an overview of the RaceCon Main Screen with its areas. All (sub-) windows are resizable and dockable. You can find them under the 'Windows' tab.



1. Start the RaceCon software.

	RaceCon V2.5.5601.11	- с X
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2. In the 'File' menu select 'New project' to create a new project.

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Data		i × Info / Status	÷ ×
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Ready.			No errors setected - all cleared or sola uninsur . Or New Project and Ch

3. In the Toolbox select the DDU 10 and drag it into the Main Area. A pop up window to specify the DDU 10 program archive appears.

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System Logger Display Calibration/Measuring Tools Windows		() ·
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	Please specify the ECU program archive	DDU-52 Plus
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4. Download the firmware for the DDU 10 from www.bosch-motorsport.com.

An information shows if the archive is valid or not.

5. Click 'Next'.

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Project 0 x 64 New Project		Toolsox + X
det New Project     Measurement Container	Create a new DDU10	23 Performance Participation P
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64 System Overview		Measurement Sources
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6. Select 'Race track' or 'Testbench' mode according to your application.

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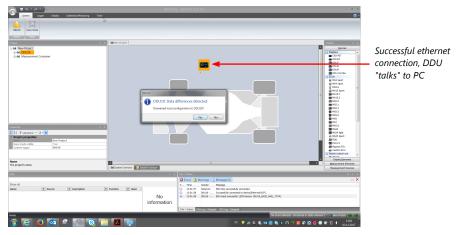
7. Click 'Finish'.

The DDU 10 is inserted into the project and RaceCon tries to connect to the device.

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	No information	
Reedy.	No errors detected - all cleared or sta	la urknown 🔹 🎁 New Project/Neasurement. Container 🖶 🚥

RaceCon detects configuration differences between the DDU 10 and the RaceCon project and asks for permission for data download.

8. Click 'Yes' to download the configurations to the device or 'No' to continue without downloading the data.

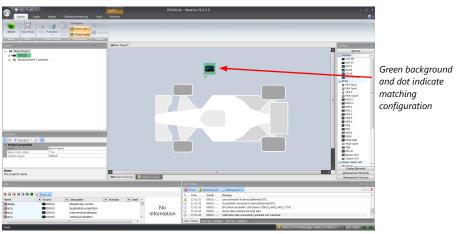


If the device turns red, you might need to do a firmware update on the device. For more information see chapter "Firmware update [> 177]".

The download starts and the DDU 10 carries out a reset.

	System DDU10.rlp - RaceCon V2.5.5.0	. σ X
System Logger Display Calibration/Measuring Tools	Windows	0 -
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K I III Ready.	the f Status     CAN Log - Stopped SYS Log - Stopped	🛑 DOU10, CAND2(Warring), for 7,2 s * 🔯 New Project 🥶 🌚

After the reset, RaceCon reconnects to the DDU 10. Local configuration on both the PC and DDU 10 match (indicated by green background and dot). The DDU 10 is now connected to RaceCon.



For further information on the color indication, see chapter "Color indication [> 22]".

## 4.2 First display configuration (Quick Start)

This chapter explains the configuration of a display element showing the battery voltage. See chapter Display element configuration for a detailed instruction to configure display elements.

- 1. Click on '+' to expand the DDU 10 project tree.
- 2. Click on '+' to expand 'Display'.
- 3. Double-click on 'New Page', or click on the 'Display' tab.

RaceCon changes to the page 'Display' to open the DDU 10 display configuration area.

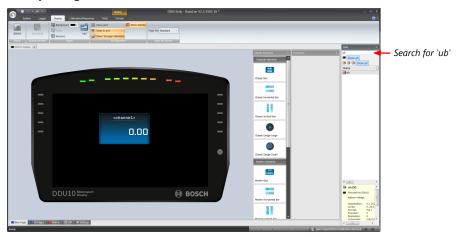
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	-		3169 / Status CAN Log - Stopped 5	515 Log - Stopped	

4. Drag any display element from the Toolbox and drop it on the display page.

The status signal in the upper left corner switches from green to orange, because the configuration in the tool differs from the configuration of the device.



5. Use the search bar in the 'Data' window, to search for 'ub' (measurement channel for battery voltage).

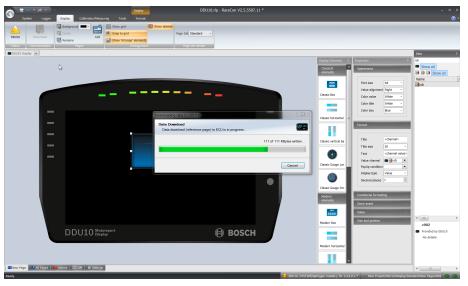


6. Drag the 'ub' measurement channel from the 'Data' window and drop it on the display element.



7. Click on the 'Download' button in the upper left corner.

The configuration download starts and the DDU 10 carries out a reset. The status signal in the upper left corner switches to green.

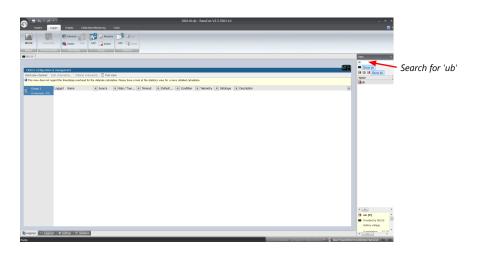


The value of the battery voltage is displayed on the DDU 10.

## 4.3 First recording (Quick Start)

This chapter explains the configuration of the recording of the battery voltage channel. See chapter 'Recording' for a detailed instruction to configure recordings.

- 1. Click on the 'Logger' tab to go to the page 'Logger'.
- 2. Use the search bar in the 'Data' window, to search for 'ub' (measurement channel for battery voltage).



3. Drag and drop the 'ub' measurement channel into the recording area.

ODU110.rlp - RaceCon V2.5.5503.10 *	
System Logger Display Calibration/Necesuring Tools	
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DDU10 configuration & management	Show all
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🖝 Group 1 Logged Name 💌 Source 💌 Rate / True 💌 Timeout 💌 Default 💌 Condition 💌 Telemetry 💌 Datatype 💌 Descript	
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Ready.	No errors detected - all cleared or state unknows - 🔳 New Project/CCU10/Logger/Logging1/Group 1/ub 🚥 🎟 🦽

4. Click on the 'Download' button in the upper left corner.

The configuration download starts and the DDU 10 carries out a reset.

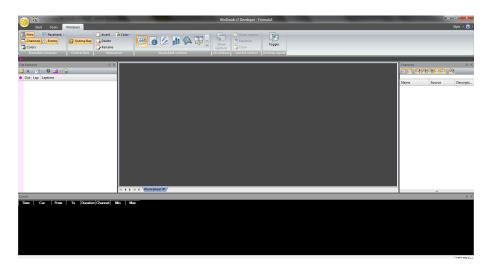
Now you can find the 'ub' measurement channel in the 'Data Area'.

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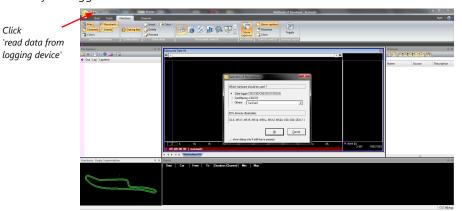
As we did not define global start conditions, recording starts immediately.

5. Start the WinDarab software.

. . .



- 6. Disconnect the DDU 10 network cable.
- 7. Click on the 'Read Data from Logging Device' icon.
- 8. Choose your logger and click 'OK' when done.



The 'Data Logger Import' dialog opens.



#### NOTICE

Refer to the WinDarab V7 manual for instructions on how to use the 'Data Logger Import' dialog and for more detailed descriptions and instructions.

- 9. Choose the device and the IP address for the device.
- 10. Click 'Apply changes' when done.

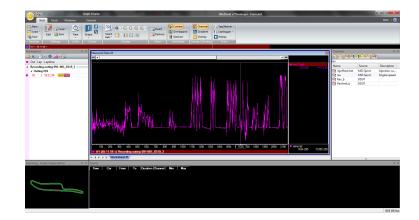
trom drondown lis
from dropdown lis
Delete ARP cache entry after ping to device failed.
Force password, if not set by recording configuration:
▼ New
Import all on connect
V Delete transferred files
▼ [a]+
▼ [a] +
D

- 11. Connect the DDU 10 network cable.
- 12. Click on the 'Current Import' tab.
- 13. Click on 'Import' in the lower right corner.

If the 'Import all on connect' box is checked, the data transmission from the DDU 10 starts automatically. Measurement files are stored automatically in the folder defined under 'Settings'.

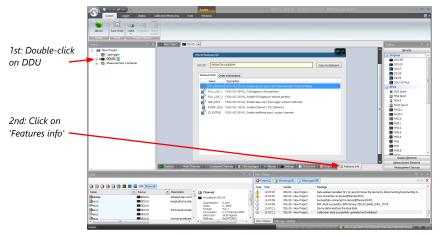
Data Logger Import     Settings Current Import Recent Import					<b>— — X</b>
Data source: FTP 23.06.2015 12:11:11				Network DDU7 - 10.10.0.207	7 🔷 18 ms
Name	Size (MB)	Get	Get (MB)	Progress	
FTP 23.06.2015 12:11:11	0.0		0.0	Connecting	
Auto Scroll Show all files					Import

- 14. Click on 'Close' when the transmission has finished.
- 15. Click on the Start button and choose 'Open measurement file'.
- 16. Select the measurement files from the storage folder.
- 17. Click on 'Open'.
- 18. Click on 'New Desktop' to open a new measurement data window.
- 19. Drag the 'ub' measurement channel from the channel list and drop it into the measurement data window. The 'ub' measurement channel's graph is displayed.



### 4.4 Feature activation

- Optional software feature packages are available for the DDU 10.
- All software feature packages can be purchased prior to delivery or after you have received your device.
- If you have purchased an optional software feature package, it must be activated before it becomes operational.
- The feature activation status is stored permanently in the device and requires activating once only.
- As the activation key is device specific, a key delivered with one DDU 10 does not work on any other DDU 10.
- When purchasing a software feature package, you have to tell Bosch the ECU ID code.
   The ECU ID code is device specific and can be found in the 'features info' window, shown in the screenshots below.
- If you have not purchased an optional software feature package, the next steps can be skipped.
- 1. Ensure a connection to the device.
- 2. To activate a feature, double-click on 'DDU 10' in the Project Tree.
- 3. Click on the 'Features info' tab in the Main Area.



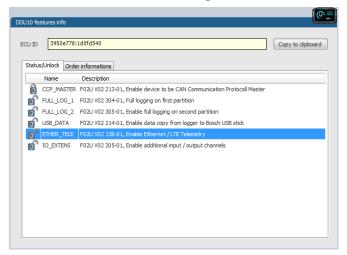
The 'DDU 10 features info' window appears.

ECU ID 🗕		DDU 10 fea	tures info 3950e778:	1d0fd540	Copy to dipboard	
		Status	Unlock Orde	r informations		
			Name	Description		
Feature status			CCP_MASTER			List of available
i cuture status	,			F02U V02 304-01, Full logging on first partition		features
				F02U V02 305-01, Enable full logging on second partition		jeutures
			-	F02U V02 214-01, Enable data copy from logger to Bosch USB stick F02U V02 138-01, Enable Ethernet / LTE Telemetry		
				F020 V02 138-01, Enable additional input / output channels		
		0	Locked (	(disabled) 💼 Unlocked (acti	vated)	

4. Double-click on the feature you want to activate. A feature unlock window appears.

CU ID	3950e778:	1d0fd540 Copy to dipboar
Status	/Unlock Orde	r informations
	Name	Description
ß	CCP_MASTER	F02U V02 213-01, Enable device to be CAN Communication Protocoll Master
ſ	FULL_LOG_1	F02U V02 304-01, Full logging on first partition
ſ	FULL_LOG_2	ECU Protection
6	USB_DATA ETHER_TELE IO_EXTENS	Unlock Feature Unlock specified feature.
		ETHER_TELE Requested KEY: d29856aaj
		OK Cancel

5. Enter the activation key you received for this feature on this device and click 'OK' when done. The feature's status changes to 'unlocked'.



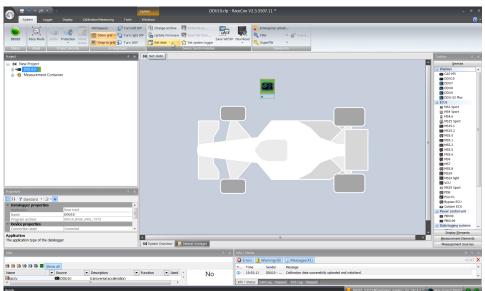
- 6. Perform these steps to activate other features you purchased.
- 7. Switch the car's ignition off and on again to cycle the power of DDU 10.

### 4.5 Set time and date

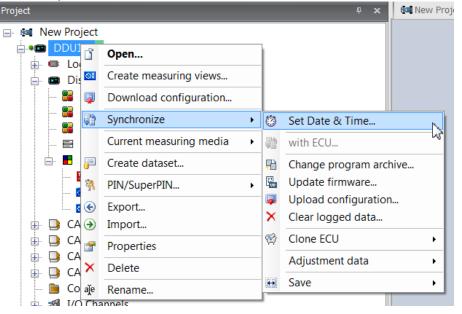
The DDU 10 is equipped with a real time clock which is supplied by an internal accumulator. Once this accumulator is charged correctly by 12 V supply of the display, 'Date & Time' can be programmed by RaceCon.

Reassure that the time is set correctly, if the device has not been used for more than two weeks.

- 1. Connect the DDU 10 to the PC.
- 2. Click on the 'Set date' button in the 'System' tab menu.



3. Alternatively, click on 'Set Date & Time' in the context menu of the device.



A 'Set Date & Time' menu opens

4. Set the current local date and time as coordinated universal time.

5. At 'Set a specific date & time' click and type on the value you want to change, or choose from the dropdown menu.

Set date&time for DDU10	<b>— X</b>
Sets the date & time on a logger device. Use the 'set' buttons to configure the logger's recording date	e & time.
Set current local date & time 11/8/2017 Set as UTC Set	
Set a specific date & time 08.11.2017 10:53:35	
The logger's current date & time 1/13/2000 17:33:01	
	Close

### 4.6 Color indication

The color indication in RaceCon visualizes different messages, such as differences between tool and device, status of the device configuration or the accrual of errors.

#### Visible color indications:

- In the status area in the upper left corner.



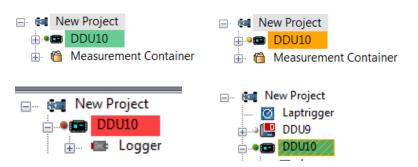
 As a background, as well as a little dot around the display icon in the 'System window'.



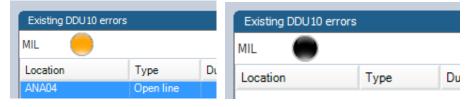
- As a colored stripe beside the device name in the project tree.

🖃 📲 New Project	🖃 🛤 New Project
E → C Container Container	DDU10 DDU10 Container

- As a colored background around the device name in the project tree.



- As a colored MIL in the "Error Info" window.



- As a colored dot in the error memory at the bottom.

🟓 DDU10, SYSTEM(laptrigger master), for 885,6 s 🔻

#### The colors and their meaning:

- Grey: No connection with the device.
- Green: Matching configuration and firmware between device and project.
- Orange: A different configuration between device and project.
- Red: A different firmware between device and project.
- Colored background with orange stripes: Matching configuration with stored (inactive) errors in the device.
- Blinking colored background with orange stripes: Matching configuration with active errors in the device.
- Black MIL: No errors.
- Orange MIL: Inactive Errors (Error entries existing, but not longer active).
- Blinking MIL (orange/black): Active Errors.

For further information, see chapter Error Memory Properties [> 57].

## 5 Export and Import in RaceCon

You can perform an export or an import on almost any level in the project tree.

### 5.1 Export in RaceCon

You can choose to export the whole project or you can export specific parts of the project.

Proceed with the following steps to perform an export:

- 1. Click with the right mouse button on an item in the project tree.
- 2. Select 'Export...' from menu. An 'Export Selection' window opens.

Elements to export		Dependencies	
hese elements will be exported		These elements will be also exported because they are used at New Project	
34 New Project	~	🕀 🍘 Measurement Container	
😑 🛍 Measurement Container		😑 🗎 Measurement Folder 1	
Measurement Folder 1		🕀 🚮 Sheet 1	
E Sheet 1	=	III p_oil	
p_oil		- 12 Sheet 2	
Sheet 2		😑 📾 DDU10	
🗖 📟 DDU10		- Macros	
- Macros		- fr Math Channels	
- 🖉 Math Channels		-Jx Conditional Channels	
-f. Conditional Channels		Sroup adjustments	
- Sroup adjustments		- Computed Channels	
Computed Channels		- 🐗 I/O Channels	
- 🐗 I/O Channels		🖶 🕮 Logger	
🚊 🖙 Logger		🕂 🛍 Logging2	
🖨 🖥 Logging2		- B Group 1	
Group 1	-	🖃 🛍 Logging 1	

- 3. Click on 'Export' to select a destination to store.
- 4. Specify the filename.
- 5. Click 'Save' when done.

### 5.2 Import in RaceCon

You can choose to import into the whole project or you can import into specific parts of the project.

Proceed with the following steps to perform an import:

- 1. Click with the right mouse button on any item in the project tree.
- 2. Select 'Import...' from menu. A file browser opens.
- 3. Select the input file and click 'Open'. An 'Import Selection' window opens.

orting from file export_test.rex(2.5.5.0) rag&Drop elements from the import contor Summary: 0 imported elements	ent to the current project.	
Import content (source)		Current Project (target)
CAN Dut 1	Di p_oi	CAN Bus 3 CAN Bus 3 CAN Bus 4

4. Select channels to import.

5. Drag and drop the channel to 'CAN Input' of desired CAN bus on right hand side.

port content (source)		Current Project (target)
CAN Input CAN Outputs	, coi	CAN Bus 1 CAN Bus 1 CAN Bus 1 CAN Bus 1 CAN Bus 1 CAN Bus 2 CAN Bus 3 CAN Bus 3 CAN Bus 4

6. Click 'Finish'. If a measurement channel belongs to more than one source (e.g. DDU 10 and MS 5.1), the 'Solve Label Ambiguity' window opens.

abels Status	Source	Import	Source	Project Label	Description
	DDU8	time_sec/CAN row 1/CANMessage_123/C	DDU8	time_sec	Linkable with 'time_sec' label
õ	DDU8	time_min/CAN row 1/CANMessage_123/CA		time_min	Linkable with 'time_min' label
Ø	DDU8	time_hour/CAN row 1/CANMessage_123/C	DDU8	time_hour	Linkable with 'time_hour' label

- 7. Assign the ambiguous channels to the desired source.
- 8. Click 'Finish'.

## 6 Analog and Frequency Inputs

### Analog inputs

- 0 to 5 V
- 12 bit A/D converter
- Switchable 3.01 kOhm pull-up resistor
- 10 kHz acquisition rate, up to 1 kHz recording rate
- Linear phase digital filter

### Frequency inputs

- 5 V Hall-effect type, 2.5 V trigger level (DF11 input with current interface or 5 V Halleffect input with 2.5 V trigger level)
- 20 kHz max. frequency
- 10 ms measurement window

## 6.1 Analog inputs

### 6.1.1 Measurements channels

For each analog channel, several 'subchannels' are available.

Data - New Pi	roject - DDU 7 - Input-cha	innels - ANA	\06 - f_wheel_fl		<b></b> д	x
<u>S</u> earch:						
Used	Name 🔺 💌	Source	<ul> <li>Description</li> </ul>	•		
	📑 f_wheel_fl	DDU7	Wheel force front left			
	📑 f_wheel_fl_fi	DDU7	Wheel force front left			
	💁 raw_f_wheel_fl	DDU7	Wheel force front left			
	💁 raw_f_wheel_fl_fi	DDU7	Wheel force front left			

Measurement labels with the characters 'raw' show the exact values in mV.

Measurement labels with the characters '\_fi' show filtered values.

The word 'name' in the table is a placeholder for the channel's name.

Measurement label	Function
raw_name	mV value of sensor
raw_name_fi	Filtered mV value of sensor
name	Physical value of sensor
name_fi	Filtered physical value

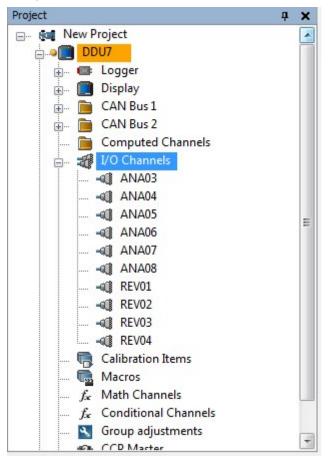
Filtered channels are routed through digital low pass filters:

- DDU 10 uses A/D converter oversampling and digital filtering to recording rate
- Digital filters eliminate 'out-of-band' noise
- Cut-off frequency automatically adjusted to recording rate
- Linear phase no signal distortion
- Latency compensation no filter delay in recorded data

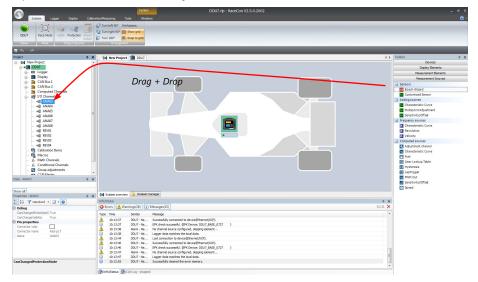
## 6.2 Configuring inputs

# 6.2.1 Configuring a predefined Bosch sensor with the 'Bosch Sensor Wizard'

- 1. Click on 'Measurement Sources' in the Toolbox.
- 2. To expand the list of 'I/O Channels', click on '+' in the DDU 10 Project Tree.



3. Drag the "Bosch Sensor Wizard" from the Toolbox and drop it on the desired analog input channel in the DDU 10 Project Tree.



The "Bosch Sensor Wizard" opens.

Bosch Sensor Wizard					×	
1st: Choose the sensor's category	ed on the order number.				B	-
Sensor category T	EMPERATURE SENSORS		on data			
Sensor group	ITC M12	• 7	ullup			
2nd: To narrow your		_	Ohm	°C	· · •	These calibration
choice, choose a Order number			89	130		values will be used
type 0 280 130 026 B 261 209 160			113	120		
F 02U V00 123-01			144	110		
3rd: Select the 🦯			186	100	=	
exact type			322	80		
			435	70		
	Sensor category		834	50		
	TEMPERATURE SENSORS	_	1175 1707	40		
	Sensor group		2500	30		
Opens sensor's	NTC M12		3792	10		
datasheet		_   _	5896	0	-	
	Open datasheet		0000			
	< Bac	k 📄 🚺	lext >	Finish	Cancel	

4. Click 'Finish' when done.

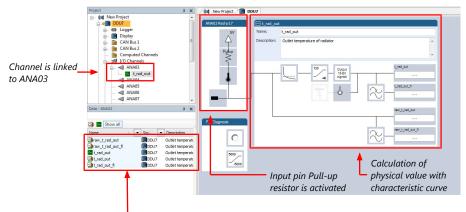
The "Create channel" window opens.

5. Enter the channel name and description.

eate channel on DDU7	
Create Channel	
Set the unique name for the chan	nel and add an optional description. 🥄
Name:	
t_rad_out	
Description:	
Outlet temperature of radiator	
	<u>Q</u> k <u>C</u> ancel

6. Click 'Ok' when done.

The channel is inserted into the DDU 10 Project Tree.



Available measurements for channel:

Measurement label	Function
raw_name	mV value of sensor
raw_name_fi	Filtered mV value of sensor
name	Physical value of sensor
name_ <b>fi</b>	Filtered physical value

### 6.2.2 Configuring a generic linear sensor

#### Example: Acceleration sensor 5 g

- From sensor data sheet - operating characteristics:

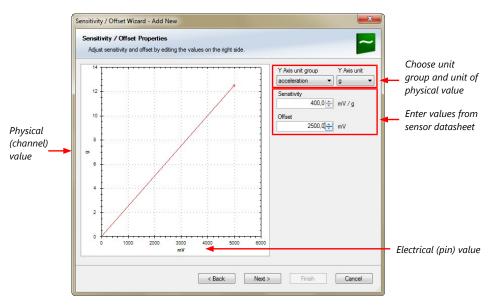
Dutput Signal			2.545	2000	
Zero g (T <sub>A</sub> = 25°C, V <sub>DD</sub> = 5.0 V) <sup>(4)</sup>	VOFF	2.25	2.5	2.75	V
Zero g (V <sub>DD</sub> = 5.0 V)	VOFF	2.0	2.5	3.0	V
Sensitivity $(T_A = 25^{\circ}C, V_{DD} = 5.0 \text{ V})^{(5)}$	S	380	400	420	mV/g
Sensitivity (V <sub>DD</sub> = 5.0 V)	S	370	400	430.1	mV/g
Bandwidth Response	f_3dB	42.5	50	57.5	Hz
Nonlinearity	NLOUT	-1.0	-	+1.0	% FSO

- Sensitivity 400 mV/g, Offset 2,500 mV
- The sensor has a linear output signal with sensitivity and offset
- 1. Click on 'Measurement Sources' in the Toolbox.
- 2. To expand the list of 'I/O Channels', click on '+' in the DDU 10 Project Tree.
- Drag the "Sensitivity/Offset" analog signal source from the Toolbox and drop it on the desired analog input channel in the DDU 10 Project Tree. A "Sensitivity/Offset Wizard" opens.
- 4. To activate the internal pullup-resistor, check the box. The internal pullup-resistor is used to get a 5 V signal at the analog channel of the DDU 10. It allows you to use a push-button. The fixed value of the internal pullup-resistor is 3,010 Ohm. If using an additional external pullup-resistor, set up the overall resistance.

Pin Properties						-
Configure the anal	og pin properties.					
Pullup value:	3,01 kOhm					2
	Pin Diagnosis	& monitoring limi	ts			
	Enabled	Minimum:	-5000	mV		
		Maximum:	5000	M		

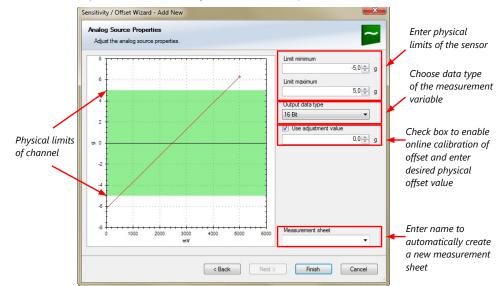
5. Click 'Next' when done.

The second part of the "Sensitivity/Offset Wizard" opens.



6. Click 'Next' when done.

The third part of the "Sensitivity/Offset Wizard" opens.

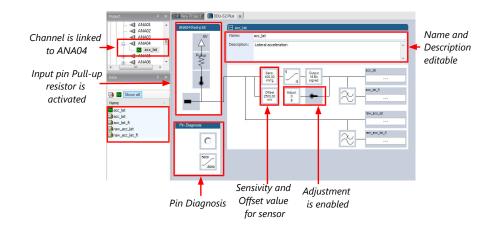




#### NOTICE

Working with automatically created measurement sheets is explained in chapter 'Setting up an online measurement [> 46]'.

- 7. Click 'Finish' when done.
- 8. Enter a channel name and a description.
- Click 'OK' when done. The channel is inserted into the DDU 10 Project Tree.



Available measurements for channel:

Measurement label	Function
raw_name	mV value of sensor
raw_name_fi	filtered mV value of sensor
name	physical value of sensor
name_ <b>fi</b>	filtered physical value

## 6.2.3 Configuring a generic nonlinear sensor

Toper [°C] 0

#### Example: Thermistor 5 kOhm

 From sensor data sheet - resistance values over temperature: PART NR.: 2381 640 502 HTCLE100E3502

Toper	RT
[°C]	<b>[</b> Ω]
-40	166 047
-35	119 950
-30	87 600
-25	64 643
-20	48 179
-15	36 250
-10	27 523
-5	21 078

RT	
<b>[</b> Ω]	
16 277	
12 669	
9 936	
7 849	
8 244	
5 000	
4 030	
3 267	

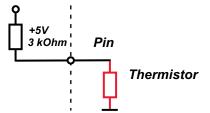
Toper	RT
[°C]	[Ω]
40	2 685
45	2 166
50	1 903
55	1 494
60	1 245
65	1 024
70	876
75	740

Toper	RT
[°C]	[Ω]
80	628
85	535
90	457
95	399
100	338
105	292
110	251
115	221

- The sensor has a nonlinear behavior

- Use characteristic curve for linearization

Input voltage is the ratio between pull-up resistor and thermistor



1. Click 'Measurement Sources' in the Toolbox.

- 2. To expand the list of 'I/O Channels', click on '+' in the DDU 10 Project Tree.
- 3. Drag the "Characteristic Curve" analogue signal source from the Toolbox and drop it on the desired analogue input channel in the DDU 10 Project Tree.

	System DDU7.rb - RaceCon V2.5.0.2002	- c x
System Loscer Discley Calbra	ton Measuring Tools Windows	0 -
DUU7 State S	Constraint Difference      Constraint Diffe	
Project 3 X	64 Hew Project 🚺 0007 4 F	Tooloox 0, 🗙
Image: Second	Drag + Drop	Decos Decos Planarement Environ Planarement Envi
۰ II. ۲	6af System overview 🔐 Dataset manager	
Properties - DDU7 3 X	infojStatus 0 X	
📰 🔃 🖓 standard 🔹 🗔 🔹 🥪	C Errors(1) 🛕 Warnings(74) (1) Messages(80) 135/135 🗙	
Program andrive DDU7_BASE_0727_VI2_DL  Poleug CenChangedProtectionC5 True CenChangeRivElity True Device properties CenChangeRivElity True CenChangeRivElity True CenChangeRivElityTest	Tps         Tps         Sector         Weappy         ≠           0.3524         0.0514 <t< th=""><th></th></t<>	
Canchangen/rotectionscale	ID-332-47 DDU7-Ne Logger data matches the local data.     Zh Erfe(Status (Chromoson Constraints))	

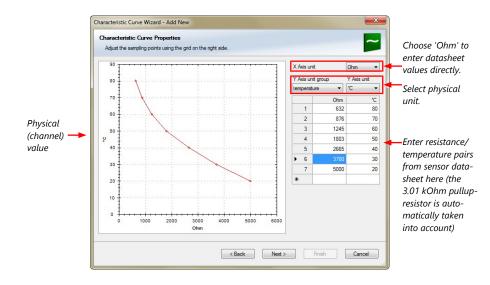
A "Characteristic Curve Wizard" opens.

4. To activate the internal pull up-resistor, check the box. The DDU 10 pull up-resistor is used to get a 5 V signal at the analogue channel of the DDU 10. It allows you, to use a push-button. The fixed value of the internal pull up-resistor is 3,010 Ohm. If using an additional external pull up-resistor, set up the overall resistance.

in Properties	
Configure the anal	log pin properties.
Pullup value:	3,01 kOhm .
	Pin Diagnosis & monitoring limits
	Enabled Minimum: -5000 📩 mV
	Maximum: 5000 🚖 mV

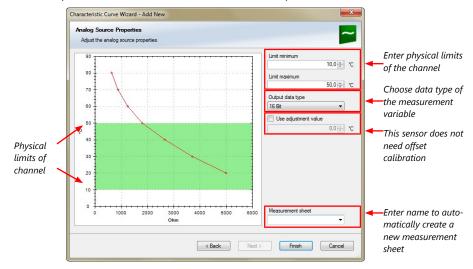
5. Click 'Next' when done.

The second part of the "Sensitivity/Offset Wizard" opens.



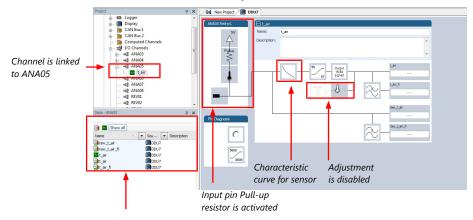
#### 6. Click 'Next' when done.

The third part of the "Characteristic Curve Wizard" opens.



- 7. Click 'Finish' when done.
- 8. Enter channel name and description.
- 9. Click 'OK' when done.

The channel is inserted into the DDU 10 Project Tree.



Available measurements for channel:

Measurement label	Function
<b>raw_</b> name	mV value of sensor
raw_name_fi	filtered mV value of sensor
name	physical value of sensor
name_ <b>fi</b>	filtered physical value

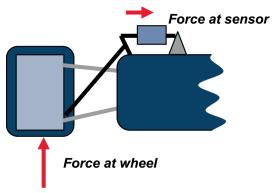
#### NOTICE

Working with automatically created measurement sheets is explained in chapter 'Setting up an online measurement [> 46]'.

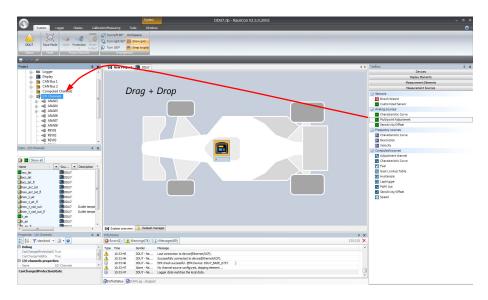
### 6.2.4 Configuring a multipoint adjustment

#### Example: Measurement of wheel force

- Physical property 'wheel force' not directly measureable
- Load transfer through suspension kinematics
- Physical value at sensor position defined by vehicle
- Curve definition by online adjustment at vehicle



- 1. Click on 'Measurement Sources' in the Toolbox.
- 2. Expand the list of 'I/O Channels' by clicking on '+' in the DDU 10 Project Tree.
- 3. Drag the 'Multipoint Adjustment' analog signal source from the Toolbox and drop it on the desired analog input channel in DDU 10 Project Tree.



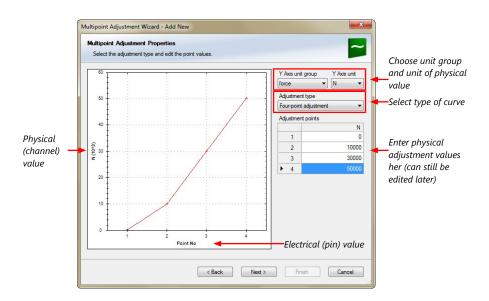
A 'Multipoint Adjustment Wizard' opens.

4. To activate the internal pullup-resistor, check the box. The internal pullup-resistor is used to get a 5 V signal at the analog channel of the DDU 10. It allows you to use a push-button. The fixed value of the internal pullup-resistor is 3.01 kOhm. If using an additional external pullup-resistor, set up the overall resistance.

ultipoint Adjustme	nt Wizard - Add New	×
Pin Properties		~
Configure the anal	og pin properties.	
Pullup value:	3,01 kOhm	•
	Pin Diagnosis & monitoring limits	
	Enabled Minimum: -5000 → mV	
	Maximum: 5000 🚔 mV	
	< Back Next > Finish	Cancel

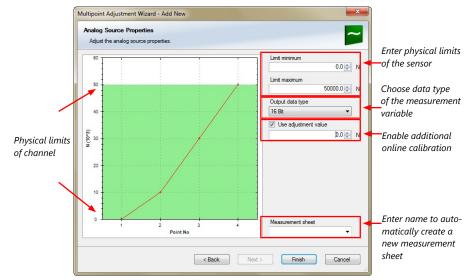
5. Click 'Next' when done.

The second part of the 'Multipoint Adjustment Wizard' opens.



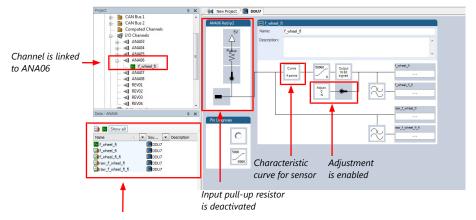
6. Click 'Next' when done.

The third part of the 'Multipoint Adjustment Wizard' opens.



- 7. Click 'Finish' when done.
- 8. Enter channel name and description.
- 9. Click 'OK' when done.

The channel is inserted into the DDU 10 Project Tree.



Available measurements for channel:

Measurement label	Function
raw_name	mV value of sensor
raw_name_fi	filtered mV value of sensor
name	physical value of sensor
name_ <b>fi</b>	filtered physical value

Online definition of the curve is covered in the chapter 'Online calibration of measurement channels [ $\triangleright$  51]' of this manual.

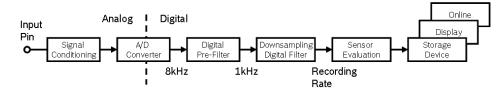


#### NOTICE

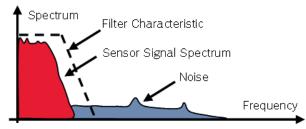
Working with automatically created measurement sheets is explained in chapter 'Setting up an online measurement [▶ 46]'.

## 6.2.5 Digital filter details

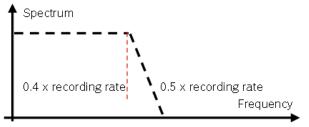
DDU 10 uses A/D converter oversampling and digital filtering to recording rate.



#### Digital filters eliminate 'out-of-band' noise



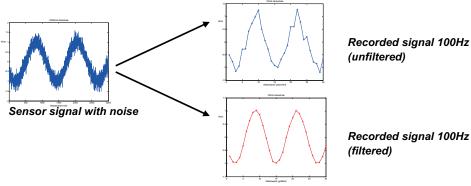
### Cut-off frequency automatically adjusted to recording rate



#### Example:

- 100 Hz recording rate (10 ms)
- <40 Hz pass band (>99 %)
- >50 Hz stop band (<1 %)</li>

#### Linear phase – no signal distortion



(unfiltered)

Recorded signal 100Hz

#### Latency compensation - no filter delay in recorded data

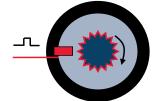
- Filtering is (smart) averaging over several samples
- Filtered signal is delayed with respect to real time signal \_

- DDU 10 filters have constant, frequency independent delay
- Delay (e.g. 22 samples at 10 ms) is corrected during recording
- No delay filtered vs. unfiltered in recorded data
- Correction is (of course) not possible for real time data (display, online, PWM out)
- Use filtered data for recording, use unfiltered data for real-time

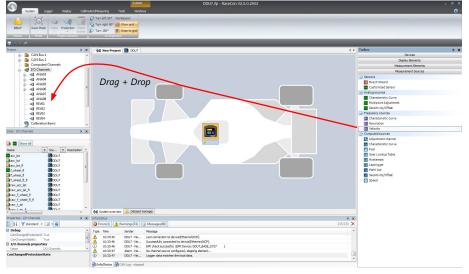
## 6.2.6 Configuring a frequency input

#### Example: measurement of wheel speed

- Pulse wheel attached to wheel
- Each passing tooth of pulse wheel triggers hall sensor
- Calculation of wheel speed with wheel circumference



- 1. Click on 'Measurement Sources' in the Toolbox.
- 2. To expand the list of 'I/O Channels', click on the '+' in the DDU 10 Project Tree.
- 3. Drag the 'Velocity' digital signal source from the Toolbox and drop it on the desired 'REV' input channel in the DDU 10 Project Tree.



The 'Velocity Wizard' opens.

4. Select the sensor type. The DDU10 works with Halleffect and DF11 sensors.

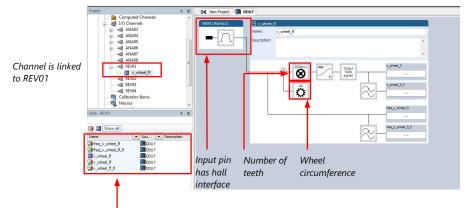
Pin Properties			
Configure the freq	uency pin properties		
Sensor type:	Halleffect		-

- 5. Click 'Next'.
- 6. Define the settings for the sensor.

ocity Wizard - Add Ne	w	
Velocity Properties Configure a frequency in	nput to measure a linear velocity.	
Number of increments:	44 📩	Number of teeth on the pulse wheel
Wheel circumference:	2000 ÷ mm	Circumference of wheel for speed calculation
Output data type:	[16 Bit -	<ul> <li>Choose data type of the measurement variable</li> </ul>
Limit minimum:	0( <u>*</u> ) (*)	
Limit maximum:	400 👘 km/h	
Measurement sheet:		Enter name to automatically create a new measurement sheet
	< Back Next > Finish Cancel	ereate a new measurement sneet

- 7. Click 'Finish' when done.
- 8. Enter the channel name and description.
- 9. Click 'OK' when done.

The channel is inserted into the DDU 10 Project Tree.



Available measurements for channel:

Measurement label	Function
raw_name	mV value of sensor
raw_name_fi	filtered mV value of sensor
name	physical value of sensor
name_ <b>fi</b>	filtered physical value



#### NOTICE

Measurement of 'Revolution' is similar.

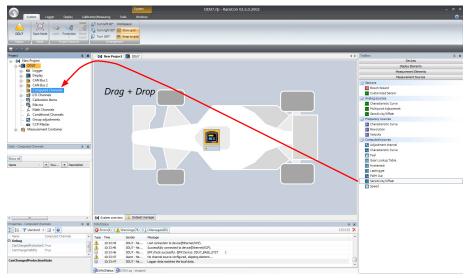
# 6.3 Configuring computed sources

Computed sources receive data from a measurement channel rather than an input pin.

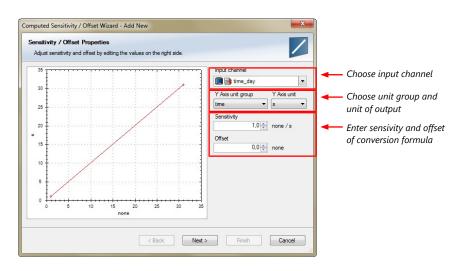
- Sensitivity/Offset calculation on input channel
- Characteristic curve calculation on input channel
- Computed vehicle speed
- Lap trigger (covered in a special separate section)

#### Example: Sensitivity/offset calculation on input channel

- 1. Click 'Measurement Sources' in the Toolbox.
- 2. Drag the 'Sensitivity/Offset' computed source from the Toolbox and drop it on 'Computed Channels' in the DDU 10 Project Tree.

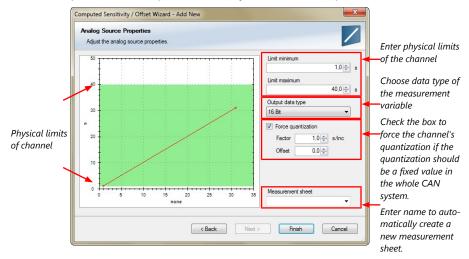


#### A 'Computed Sensitivity/Offset Wizard' opens.



3. Click 'Next' when done.

The second part of the 'Computed Sensitivity/Offset Wizard' opens.



- 4. Click 'Finish' when done.
- 5. Enter channel name and description.
- 6. Click 'OK' when done.

The channel is inserted into the DDU 10 Project Tree.



#### NOTICE

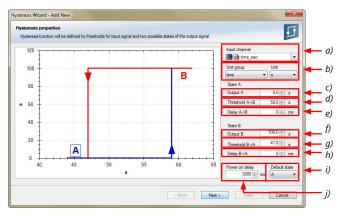
Working with automatically created measurement sheets is explained in chapter 'Setting up an online measurement'.

## 6.4 Hysteresis

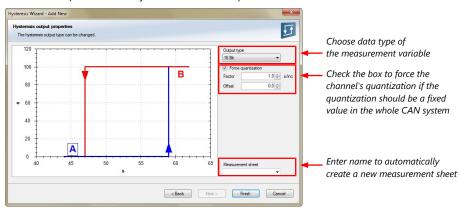
The hysteresis function avoids the high-frequent switchover of the measurement channel value. The hysteresis can be adjusted for each input measurement channel individually and can be used for further processing.

- 1. Click 'Measurement Sources' in the Toolbox.
- Drag the 'Hysteresis' computed source from the Toolbox and drop it on 'Computed Channels' in the DDU 10 Project Tree.

A 'Hysteresis Wizard' opens.

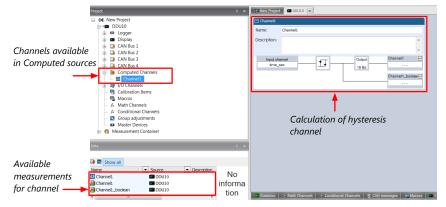


- a) Choose input measurement channel.
- b) Choose unit group and unit of output.
- c) Enter output value of state A in the unit selected in b).
- d) Enter threshold value when state changes from A to B.
- e) Enter delay time when state changes from A to B.
- f) Enter output value of state B in the unit selected in b).
- g) Enter threshold value when state changes from B to A.
- h) Enter delay time when state changes from B to A.
- i) Enter time when the hysteresis function is activated after vehicle's startup.
- j) Enter the channel's state (A or B) at startup.
- 3. Click 'Next' when done.
  - The second part of the 'Hysteresis Wizard' opens.



- 4. Click 'Finish' when done.
- 5. Enter channel name and description.
- 6. Click 'OK' when done.

The channel is inserted into the DDU 10 Project Tree.



## 6.4.1 Special functionality: Vehicle speed

This functionality allows:

- high performance vehicle owners to measure wheel spin under acceleration and wheel slip/lock under braking.
- calculating vehicle 'speed over ground'.

#### Vehicle speed calculation function

- Calculating vehicle speed of 2 wheel drive: (Wheel speeds of non-driven axle as input)

Calculated speed is average of both speeds if speed difference between wheels < limit.

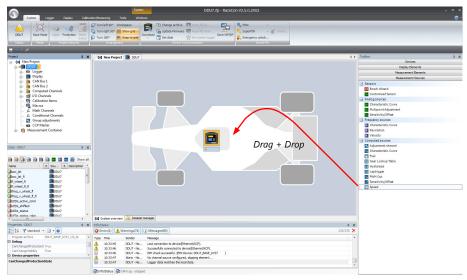
Calculated speed is maximum of both speeds if speed difference between wheels > limit.

- Calculating vehicle speed of 4 wheel drive: (Wheel speeds of all wheels as input)

Calculated speed is speed of 2nd fastest wheel.

## 6.4.2 Setting up calculated speed

- 1. Click on tab 'System Overview'.
- 2. Click on 'Measurement Sources' in the Toolbox.
- 3. Drag the 'Speed' computed source from the Toolbox and drop it on the project name in the DDU 10 Project Tree. Do not drop it on 'DDU 10'!



A 'Calculated Speed Wizard' opens.

Calculated Speed Wizard	- Add New	×	
Calculated Speed Con Select speed inputs for	rfiguration calculating a reference speed.		
Configure on device			- Choose device
Input source:	Wheel speeds	-	Choose input source (internal/external)
Drive shaft switch:	Rear wheel drive	-	Choose driven axle
Speed input front left:	v_wheel_fi		
Speed input front right:	v_wheel_fi	-	- Choose individual wheel
Speed input rear left:	v_wheel_fl v		speed channels
Speed input rear right:	v_wheel_fl v		
Speed difference:	5 <u></u>		<ul> <li>Set limit for speed difference for calculation</li> </ul>
	< Back Next > Finish Cancel		

4. Click 'Finish' when done.

The speed calculation is inserted into the DDU 10 Project Tree.

			0007.1p - Nacecon v2.50.200			
	Douber Logger Decker Calcol COUT Race Mode visible Protection Sheet Logger	an,Mezzuring Tools Windows				
Speed calculation	Status Node Project Security	_	_		_	
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-					Display Benents Measurement Dements	
Tree	B- C Legger B- Display				Measurement Sources	
	B- 🗃 CAN Bes 1			<b>A</b>	Sensors     Dock Ward	
	GAN Bas 2     Gampated Oxamels	Speed canfiguration			Customized Sensor	
	Gibration Items	Configure on device	DD07	•	Analog sources     Characteristic Curve	
	- 🙀 Macros	Input source	Wheel speed	•	Multipoint Adjustment	
Measurement	<ul> <li> <i>fa</i> Math Channels         <ul> <li> <i>fa</i> Conditional Channels         </li> </ul> </li> </ul>	Drive shaft switch	Rear obset drive		Sensitivity/Offset	
	Group adjustments				Characteristic Curve	
channels	GP Master     B-      Messurement Container	Speed input Front left	s_wheel_fl		Kevoluban	
		Speed input front right	🔳 💽 x_wheel_fl		Computed sources     Advatment channel	
calculated speed	Data - Speed 🛛 🖗 🗙	Speed input rear left	🔳 🔁 v_wheel_ft		Characteristic Curve	
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		▲ · · ·			G Speed	
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Configuration						
		Canfiguration				
window	Properties - Speed • X	Infa Status		¢ 13435		
Williaow	None Speed A	Type Time Sender Message			*	
	CarChangedProtectors True	A 10:33:45 DDU7 -Ne Lest connection to	device(Ethernet,000P).			
	CanChangeVisibility True	10:33:46 DDU7 - Ne BPK check successf	ted to device(Ethernet/XCP). d. (BPK Device: DDU7_BASE_0727 )			
	CanChangedProtectionState	30 10133-47 Alam - Ne No channel source 10 10132-47 DDU7 - Ne Logger data match				
		At trip Status At CAN Log - stocged			-	

# 7 Online Measurement

### DDU 10 configuration

- System configuration (channel + display configuration, CAN I/O, etc.) is stored in the DDU 10
- Use RaceCon to create and download configuration from the PC to DDU 10 Communication interface: Ethernet
- Communication protocol: XCP

#### Online measurement + calibration

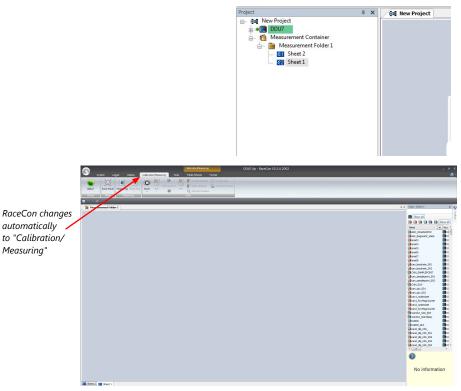
- System status and diagnosis
- Check and calibrate sensors in the vehicle
- Live display of sensor values on the PC
- Use RaceCon for diagnosis, online measurement and calibration
- Communication interface: Ethernet
- Communication protocol: XCP

## 7.1 Setting up an online measurement

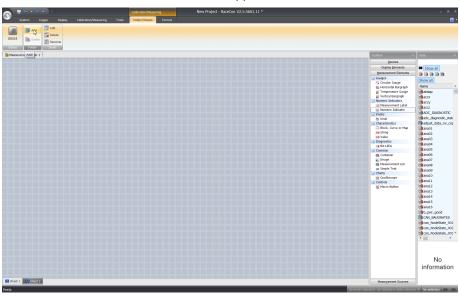
DDU 10 supports online measurement of sensor values and diagnostic variables.

1. Expand 'Measurement Container' and 'Measurement Folder 1' in the Project Tree and double-click on 'Sheet1'. Alternatively, click on the 'Calibration/Measuring' tab to open the window directly.

'Sheet 1' opens in a new 'Calibration/Measuring' window.



2. Click on the 'Folder/Sheets' tab, which appears when you are in the 'Calibration/ Measurement' window, to create a new measurement folder. 3. Click on the 'Add' button for folders in the upper left corner.



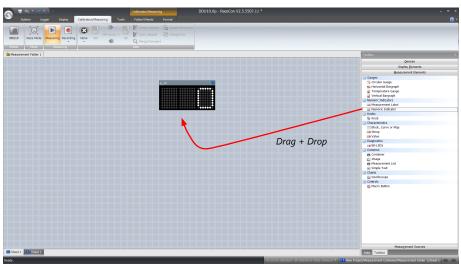
In the menu for sheets, you will find buttons to add, delete and rename new sheets

4. To change between different sheets, click on the tabs on the bottom of the 'Calibration/Measuring' window.

Sheet 2	Sheet 1
	the second s
×	1
$\sim$	
N	
Tabs to switch b	etween sheets

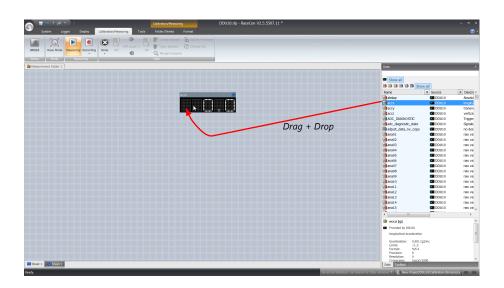
To add an element to a measurement sheet, perform the following steps:

5. Drag a measurement element from the Toolbox and drop it on the measurement sheet.



6. Select the desired measurement channel from the 'Data' area and drop it on the measurement element.

If the DDU 10 shows the green status, the value is displayed.

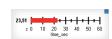


RaceCon offers different types of measurement elements:









Circular gauge

Temperature gauge

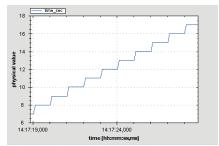
Vertical Bar graph style

Horizontal Bar graph style





Numeric indicator

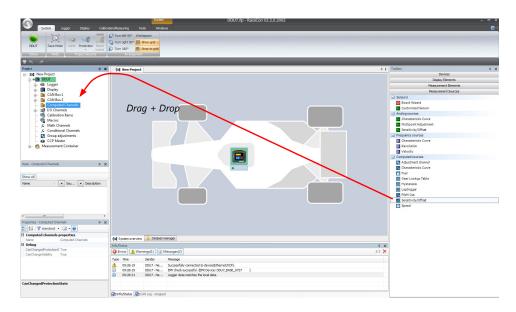


Oscilloscope (Chart)

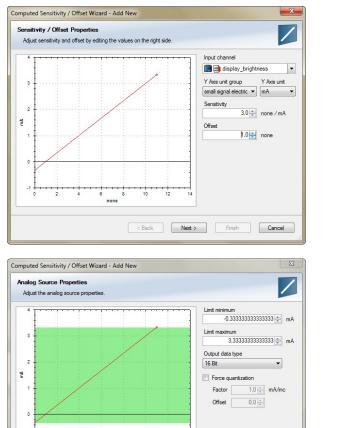
## 7.1.1 Automatic creation of measurement sheets

RaceCon can create measurement sheets automatically.

You can create and use measurement sheets with the DDU 10 as well as with all other devices connected to RaceCon.



1. During the configuration of a measurement channel, select a measurement sheet from the list box or enter a name for a new measurement sheet.



12

4 6 8 10

none

Measurement sheet

< Back Next > Finish Cancel

-

Select existing sheet from list or enter name of new sheet

Create Channel Set the unique name for	the channel and add an optional description.
Name:	
brightness	
Description:	

2. To create the sheets, right-click on DDU 10 and select 'Create measurement views...' from the DDU 10 context menu.

Project	<b>д х</b>	New Project DDU7	
🖃 📾 New Project			
⊜	Open	Name: brightness	
🚛 📄 Dis	Create measuring views	Description:	Click to create measurement sheets
🛓 🖻 CAI 📮	Download configuration		measurement sneets
	Synchronize	•	
	Current measuring media	Input Channel	
🕞 Cal	Create dataset	display_brightness	
f_x Ma 🙀	PIN/SuperPIN	•	
f_x Cor 🛐 Gro ⓒ	Export		
🕒 📭 CCI 🕑	Import		
🛓 👘 Measul 😭	Properties		
Data - Computed Char	Delete		
aļe	Rename		
🔄 🔼 Show all			
Name V	▼ Sou ▼ Description		
/ brightness	DDU7		
	DDU7		

The automatically created sheet is inserted in the Project Tree under 'Measurement Container' and 'Device Channels'. If the DDU 10 is connected to RaceCon and the status is green, live values of the channels are shown.

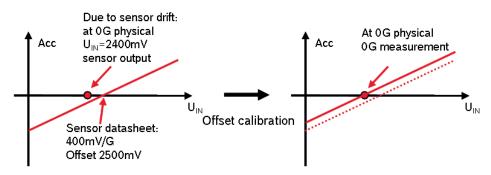
## 7.1.2 Using the measurement sheets

- 1. When RaceCon is online, press the 'F11' key to switch from 'Design Mode' into 'Race Mode'. The measurement sheet is extended to full screen. The button for offset calibration is active.
- 2. Switch between different sheets using the tabs at the bottom of the window.
- 3. Press the 'Esc' key to return to 'Design Mode'.

phys	<b>0,0000</b> G	SENSITI	400,000		Zemporet calibratur.
raw	2490,0 mV	OFFSET	2500,000	mV	
		MIN	-5,000	G	-
		MAX	5,000	G	
		ADJ_VAL	0,000		

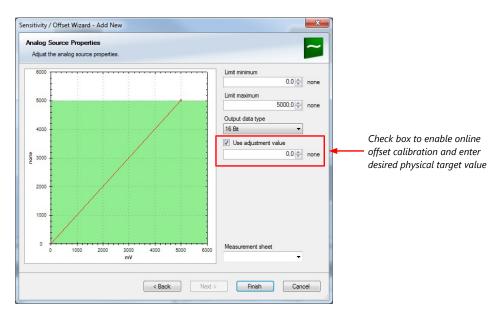
## 7.2 Online calibration of measurement channels

- Analog sensors drift with age, temperature, etc.
- Manual calibration is necessary
- Solution: online offset calibration
- Example: acceleration sensor



# 7.2.1 Enable online offset calibration for measurement channel

During creation of the measurement channel



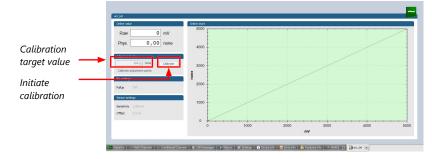




## 7.2.2 Performing the online offset calibration

DDU 10 has to be connected to RaceCon to calibrate the sensor's offset.

- 1. Apply the desired physical condition to the sensor (e.g. 1 G to an acceleration sensor).
- 2. Open the measurement channel's online page by double-clicking on the measurement channel name in the Data Area.
- 3. Enter the physical target value (e.g. 1 G) and press the 'Calibrate' button.

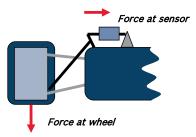


The sensor's offset is now calibrated.

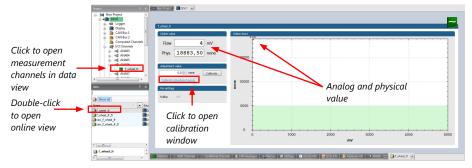
# 7.3 Online calibration of multipoint adjustment channels

#### Example: measurement of wheel force

- Physical property 'wheel force' not directly measureable
- Load transfer through suspension kinematics
- Physical value at sensor position defined by vehicle
- Curve definition by online adjustment at vehicle



- 1. Create a multipoint adjustment measurement channel. To create a multipoint channel, see chapter 'Configuring a multipoint adjustment [> 34]'.
- 2. Download the configuration on the DDU 10. To connect the DDU 10 to RaceCon, see chapter 'Setting up a new RaceCon Project [▶ 9]'.
- 3. Click on the desired channel in the DDU 10 Project Tree.
- 4. Double-click on a measurement channel in the Data Area to open the online view.



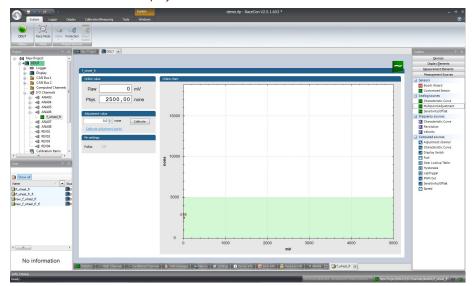
5. Click on 'Calibrate adjustment points' to open calibration window.

( )		
ne Calibrat	none	1
ne Calibrat	none	2
ne Calibrat	none	3
ne Calibrat	none	4
	noi	3

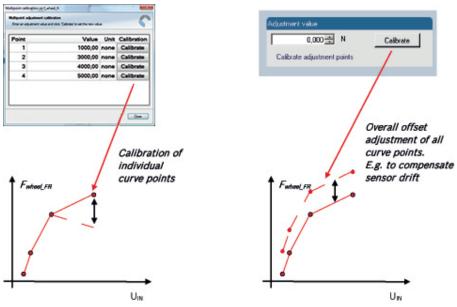
- 6. Apply the desired physical condition to the sensor (e.g. by applying a force on the wheel).
- Enter the physical value in the value column of the desired calibration point (e.g. 745 N).

- 8. Press the 'Calibrate' button of the desired calibration point.
- 9. Repeat for all curve points.
- 10. Click 'Close' when done.

The calibration curve is displayed in the online view.



## Adjustment points vs. offset adjustment



# 8 Error Memory

In this chapter "Error Memory", a lot of screenshots are created by way of example for DDU 8. Please consider this and replace the product name 'DDU 8' in this case with the name of your product.

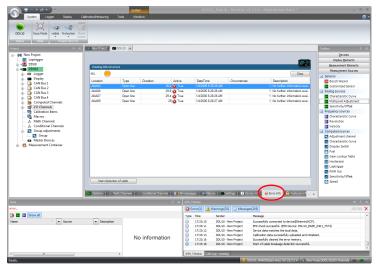
## 8.1 Error memory representation in RaceCon

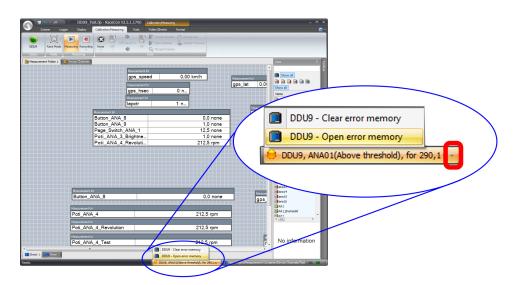
Bosch Motorsport devices feature an error memory. Information on errors can be visualized via RaceCon (online measurement) or can be transmitted via telemetry.



## 8.1.1 Accessing the memory

The error memory can be accessed as shown in the illustration:





The memory is situated inside the device and is non-volatile. As a consequence, an error which has occurred and has not been cleared by the user will remain in the error memory even after a power cycle. The error state will then reflect if the error is still active or not.

An error is deleted from the list when

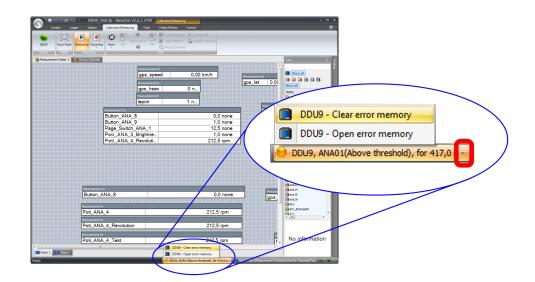
- the user actively clears the error memory
- the user updates the firmware

The error memory is not cleared by a configuration download and is not cleared by a power cycle.

## 8.1.2 Clearing the error memory

There are two ways of clearing the error memory, both are shown in the following illustration:

DDU30 Race Mode visible Protection She body body body body body body body body									
int fixe	BR New Project	ອກແມ່ນ 🗐							Toobax 0
Mew Project									Devices
C Laptrigger								_	Display Elements
0 E DDU9	Existing DOULD								Measurement Elements
DDU10		errors							Measurement Sources
🛞 🚥 Logger	MIL 😑							Clear 🔰	- Sensors
Display	Location	Type	Duration	Active	DateTime	Occurrences	Description		Bosch Wizard
B- D CAN Bus 1	ANAD4	Open line		🚯 Trus	1/4/2000 6 28 26 AM		1 No further information	ióce avai	Customized Sensor
CAN Bus 2	ANA06	Open line		C True	1/4/2000 6 28 26 AM		1 No further informat		- Analog sources
GAN Bus 3     CAN Bus 4	AN407	Open line		True	1/4/2000 6:28:26 AM		1 No further informat		Characteristic Curve
E CAN Bus 4 E Computed Channels	ANA09	Open line		True	1/4/2000 6:28:27 AM		1 No further informat		Multipoint Adjustment
B 1/0 Channels				•					Sensitivity/Offset
Calibration Items									Frequency sources
Macros									Characteristic Curve
& Math Channels									Revolution
fr Conditional Channels									Velocity
Group adjustments									Computed sources
Group									Adjustment channel
<ul> <li>mit Master Devices</li> </ul>									
									Characteristic Curve
									Characteristic Curve Display Switch
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									Display Switch
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	Start datas	tren of cables							Display Switch     Fuel     Gear Lookup Table     Hysteresis     Lookup Table     Hysteresis     Lookup Table     Hysteresis     Lookup Table     SensitivityUOffset
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			/ contract counts						Oisplay Switch     Fuel     Gear Lookup Table     Hysteresis     Lopkup Gear     VMM Out     Sensitivity/Offset
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<ul> <li>Advancement Container</li> <li>Control of the second se</li></ul>	Statistics (*	Nath Channels		<ul> <li>X Info / 1</li> <li>Type</li> <li>1</li> <li>1</li> <li>1</li> <li>1</li> </ul>	Time Sende 17:35:10 OOU 17:35:11 OOU 17:35:12 OOU 17:35:13 OOU	r 0 - New Project 0 - New Project 0 - New Project 0 - New Project 0 - New Project	(119) Nessage Successfully connected to device (0 DPK check successful, (DPK Device) Device data matches the local data Calieration clash successful, uplea	themet/XCP). : DDU 30_BASE_0 e. ded and initialzes	Cositar Satish     Cositar
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<ul> <li>Adaparent Container</li> <li>Image: Show all</li> </ul>	Statistics (*	Nath Channels		<ul> <li>X Info / 1</li> <li>Type</li> <li>1</li> <li>1</li> <li>1</li> <li>1</li> </ul>	Time Sende 17:33:10 0003 17:33:11 0003 17:33:12 0003 17:33:12 0003 17:33:13 0003 17:33:14 0003	r 0 - New Project 0 - New Project 0 - New Project 0 - New Project 0 - New Project	(119) Nessage Successfully connected to device (0 DPK check successful, (DPK Device) Device data matches the local data Calieration clash successful, uplea	tthemet/XCP). : DDU 10_5ASE_0 a. ded and initialized sory.	Cospiry Swith     Cospiry Swith     Fiel     Fiel     Fiel     Fiel     Fiel     Fiel     Fiel     Fiel     Fiel     Field     Fiel



# 8.2 Information on errors available from the error memory

In general, properties of the error memory and properties of an individual error need to be distinguished.

## 8.2.1 Error Memory Properties

The following property is available for the error memory itself:

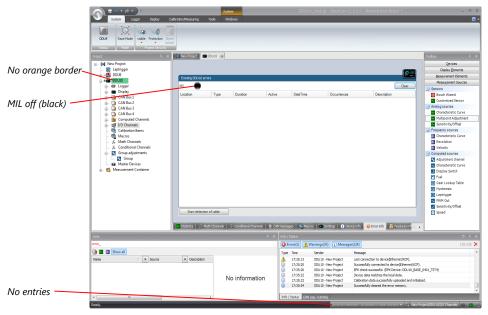
- Error Status (device measurement label "error\_state")0: no error present in memory
  - 1: at least one inactive error present in memory, no active errors
  - 2: at least one active error present in memory

If displayed in a measurement sheet, this property's value (0, 1 or 2) is translated into a verbal description:



It is also represented by a color scheme within RaceCon (provided RaceCon is online with the system):

0 (no error present in memory):



1 (at least one inactive error present in memory, no active errors):

			System		DDU10_Test.rip ·	RaceCon V2.5.5.0 · Maste	rlicense Bosch *	_ = X
	System Logor Dopky Co DOU9 Status Node Hode HoteCton Stor Status		als Windows	-	-	-	-	• •
Constantly orange border	😑 🕼 New Project	Existing DDU 10 errors	J10 🗶					Toobox 0 × Qevices Display Elements Messurement Elements
MIL constantly orange —	CAN Bus1     CAN Bus2	ANAD4		Active 114,3 Falce	1/4/2000 6:28:26 AM	1	Clear Description No further information avail.	Measurgement Sources Sensors Bosch Wizard Customized Sensor
, ,	CAN Bus 3     CAN Bus 4     Computed Channels     Computed Channels	ANA07	Open line 1	113,9 False 113,5 False 113,1 False	1/4/2000 6:28:26 AM 1/4/2000 6:28:26 AM 1/4/2000 6:28:27 AM	1	No further information avai No further information avai No further information avai	Analog sources Characteristic Curve Multipoint Adjustment Sensitivity/Offset
	Cabaroo Rem     Cabaroo Rem     A Mah Chanak     Kong Kabaroo Rem     Cabaroo Rem     Rem							Insectory source     Concerners Curve     Concerners     Vedocry     Vedocry     Vedocry     Vedocry     Concerners     Concernes     Concernes     Con
		Start detection of	cable	iels 🛛 🔌 CAN mess	ages 👼 Macros 🛤 Sett	tings 👔 Device info 🛛 😥 Bm	or info 🔒 Features Inf 🦲	Speed
	Data				/Status			= • ×
	error_ Show all				Errors(1) 🔥 Warnings(33)			157/157 🗙
Info cycling through errors, present in ————	Name / V Source	Description	No informatio		e Time Sender 17:33:18 DDU10 - Ne 17:35:13 DDU10 - Ne 17:35:20 DDU10 - Ne 17:35:22 DDU10 - Ne 17:35:22 DDU10 - Ne	ew Project Lost connection aw Project Successfully con ew Project EPK check succe aw Project Device data mal	reakage detection successful. to device[Ethernet/IICP). insched to device[Ethernet/IICP). essful. (EPK Device: DDU 10_BASE tohes the local data. successfully uploaded and initiali	
error memory	e at			Info	o/Status CAN Log - running		line), for 113, 1s + 👘 New Pi	rojest/00U101/0 Channels 👜 🌰!;

2 (at least one active error present in memory):

		albration Measuring 1	System		DDU10_Test.r	ip - RaceCon V2.5.5.0	<ul> <li>Masterlicense Bosch *</li> </ul>	- = × 0•
	DOUS Szaz Szaz Kode	et l						
	Project 0 ×	Grill New Project 💷 D	0010 🗙					Toobox 0 X
Blinking orange border	Gu New Project — Ø Laptrigger g→4 DDU9						0-	Qevices Display Elements Messurement Elements
	DOULO	Existing DDU 10 error	\$					Measurement Sources
	8- 📾 Logger	<u> MI </u>					Clear	Sensors
MIL blinking orange	e Display	Location	Type Duratio	Active	DateTime	Occurrences	Description	Bosch Wizard
MIL Duriking orange	GAN Bus 1     CAN Bus 2	AV404	Open line	83,3 👸 True	1/4/2000 6:28:26 AM		1 No further information avai	Customized Sensor
	E CAN Bus 3	AN406	Open line	82,9 👸 True	1/4/2000 6:28:26 AM		1 No further information avai	<ul> <li>Analog sources</li> </ul>
	😑 📑 CAN Bus 4	AN407 AN409	Open line Open line	82.5 设 True	14/2000 6:28:26 AM 1/4/2000 6:28:27 AM		1 No further information avai	Characteristic Curve
	Computed Channels	ANAUS	Upen line	82,1 😮 True	14/2000 6/28/27 AM		1 No further information avai.	Multipoint Adjustment
	8- 🐗 1/0 Channels - 📑 Calibration Items							Frequency sources
	- Guidenaura dens							Characteristic Curve
	$f_{s}$ Math Channels							Revolution
	<ul> <li><i>f<sub>s</sub></i> Conditional Channels</li> </ul>							Velocity
	<ul> <li>Group adjustments</li> <li>Group</li> </ul>							<ul> <li>Computed sources</li> </ul>
	Master Devices							Adjustment channel Characteristic Curve
	- 👸 Measurement Container							Display Switch
								Fuel
								🗄 Gear Lookup Table
								Hysteresis
								<ul> <li>Laptrigger</li> </ul>
								PWM Out
		Start detection	of cable					Sensitivity/Offset
								C speed
		Statistics 🍰 Mad	n Channels 🍐 Condition	al Channels 🛛 🤮 CAN r	ressages 👼 Macros 🛤	Settings 👔 Device Info	😥 Error Info 🔒 Features Inf 🧹	
	Data			0 x 1	info / Status			= ° ×
	error_				C Errors(1) 🔥 Warnings(	32) (i) Messages(119)		152/152 🗙
	🔁 🔤 🖸 Show all				Type Time Sender	Messa	voe	
	Name / Source	Description					ne ssfully connected to device(Ethernet/XCP	
					17:33:11 DOU10	- New Project EPK ch	heck successful. (BPK Device: DDU 10_BAS	
Info cycling through							e data matches the local data.	
ingo cycung unough	1		No info				ation data successfully uploaded and initia ssfully deared the error memory.	1260.
errors present in							of cable breakage detection successful.	
								•
error memory	с п				Info/Status GAN Log - runni			
)	Ready.					🖯 DOULO, AN	NA04(Open line), for 78,0 s + 📲 New I	hoject/DOU10/1/0 Channels 🐵 🜰 🥼

## 8.2.2 Error Properties

The following channels are recognized and memorized inside the devices:

Data		
err		
👜 😐 🥶 🎦 📟 🗖	r 🔢 🚥	Show all
Name 🗸 💽	Source 🔻	Description
error_active_rotate error_location_rotate error_state error_state error_type_rotate	DDU9 DDU9 DDU9 DDU9	error active rotation. signals if error is present or not error location rotation signals global state of error manager error type rotation

Error type (device label "error\_type\_rotate"):
 e.g. "below\_threshold" for a violation of the minimum voltage range defined in the configuration, "shortcut\_Batt" for a shortcut to battery voltage etc.

- Error locations (device label "error\_location\_rotate"):
   e.g. "ANA01" for an error concerning the first ANA channel
- Error durations

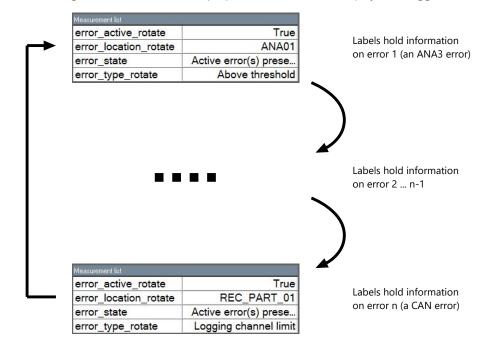
How long has the error been active? If an error encounters a non-active period before being cleared from the memory and is then detected again, the error duration keeps on accumulating. The number of active periods can be seen from the "number of oc-currences".

- Number of occurrences
   How many times has the error been detected since the last time the error memory was cleared.
- Error active state (device label "error\_active\_rotate")
   All failure modes are continuously diagnosed; any error detected will be written to the error memory. Once an error is detected, it is qualified as "active".
  - 1 (TRUE) Error was detected in most recent diagnose run (active)

 0 (FALSE) Error is inactive: error was not detected in most recent diagnostic run, however the error has not been cleared from the memory by the user and remains in the non-volatile memory

The aforementioned channels (error\_active\_rotate, error\_location\_rotate, error\_type\_rotate) are device specific properties (e.g. C 60) and are not related to the complete Race-Con project (e.g. "error no. 3 from the error memory"). Therefore, only one property label is available in each device. The errors from the error memory (possibly more than one error possible per device) share these three labels. The labels cycle through the errors currently present in the memory and represent the respective property of each error periodically.

The following screenshot shows error properties, which can be displayed or logged:



After the last error and its error properties have been displayed, the labels will start again with the first error in the error memory stack and its error properties will be displayed again. Therefore, monitoring these labels over a sufficiently long period provides the information on all individual errors in the error memory.

To understand this behavior, it is recommended to observe the three labels in a measurement sheet (while more than one error is active) and watch the values change periodically:

Measurement list	
error_active_rotate	True
error_location_rotate	REC_PART_01
error_state	Active error(s) prese
error_type_rotate	Logging channel limit

The verbal representation of the numerical codes of these labels can be visualized in the properties window of the measurement page:

🔮 👌 🝸 standard 👻 📃	• 🔘
A Channel Measurement	
Actual measurement rate	100 ms - time synchronous event channel
Default measurement rate	100 ms - time synchronous event channel
A Channel properties	
Address	0x25040B95
Annotations	
Description	signals global state of error manager
Name	error_state
Physical conversion	(Verbal)No error present[0]Passive error(s) present[1]Active error(s) present[2]
Physical maximum	2
Physical minimum	0
Physical quantisation	none
Physical unit	
Annotations	

# 8.3 Analog Input Diagnosis

# 8.3.1 Monitoring limits / Shortcut Detection / Cable Breakage

The pin diagnosis functionality (check whether measurement is within the desired range) can be activated in the ANA pin setup wizard; to allow for a diagnosis regarding shortcut to ground, shortcut to battery voltage and cable breakage, a minimum / maximum has to be defined.

Pin Properties Configure the anal	log pin properties.
Pullup value:	3.01 kOhm -
	Pin Diagnosis & monitoring limits
	V Enabled Minimum: 1000 🐑 mV
	Maximum: 4000 📩 mV
	Constant Nexts Dealer Course
	< Back Next > Finish Cancel
NA01 Red-p28	
VA01 Red-p28	Cancel           Page_Switch_ANA_1           Name:         Page_Switch_ANA_1
	Image_Switch_ANA_1
	Page_Switch_ANA_1 Name: Page_Switch_ANA_1
5V	Page_Switch_ANA_1 Name: Page_Switch_ANA_1 Descripton:
5V	Page_Switch_ANA_1 Name: Page_Switch_ANA_1 Description:
5V	Page_Switch_ANA_1           Name:         Page_Switch_ANA_1           Description:
5V	Page_Switch_ANA_1           Name:         Page_Switch_ANA_1           Description:         5000         Output           1588         Tis 88
5V	Page_Switch_ANA_1 Name: Page_Switch_ANA_1 Description:
SV Pyllup	Page_Switch_ANA_1           Name:         Page_Switch_ANA_1           Description:         5000
5V Fulup n Diognosts	Page_Switch_ANA_1           Name:         Page_Switch_ANA_1           Descripton:         9000_0         Orgat           Page_Switch_ANA_1
SV Pyllup	Page_Switch_ANA_1           Name:         Page_Switch_ANA_1           Descriptor:         9000_0         Orgat           Page_Switch_ANA_1         1588           Signed
Pylup Pylup n Diognosis	Page_Switch_ANA_1           Name:         Page_Switch_ANA_1           Description:         000000000000000000000000000000000000

## 8.3.2 Open Line Detection

The implementation of open line detection consists of pull up resistors being activated and deactivated; evaluating the behavior of the measured value detects cable breakage, regardless of the pull up resistor being activated by the user.

- 1. Open the Error Memory of the Device.
- 2. Click "start detection of cable".
- 3. Check the Error Memory for new fault entries, regarding "Open line errors".

00010 Race Mode Vigble Protection		System Windows	-	DDU10_Test	crip - RaceCon \	(2.5.5.0 - Masterlicense Bosch *	_ 0
Angele Constant of the second se	Existing COU XX errors Mil. OLL Location T AMAA OL AMAA OLL AMAA OLL	Syse Duration System Inve Determine Depending	Adra No (d fue 23 & Tra 23 & Tra 23 & Tra	DealTime 140000 (5 ab 20 ab 44) 140000 (5 ab 20 ab 44) 140000 (5 ab 20 ab 44)		Corporation of the second seco	Parken         Deves           Deves         Deves           Deves </th
Coto ener Image I Show all Name / V Source	<ul> <li>Statistics (r): Nafr O</li> <li>Description</li> </ul>	annels 📋 🎊 Conditional O	0 x srfc	(Stotus Errors(1) A Warning e Time Send 17533:10 DDU	p(32) 🕕 Messag	vice inda	152/15
< []	,	No informa	ation	17:33:12 DDU 17:33:13 DDU 17:33:16 DDU	30 - New Project 30 - New Project 30 - New Project 30 - New Project	Ern offen Boldessia, Jern Lern er beiter Dool Jene Device data anaches the local data. Calibration data successfully uploaded and initial Successfully deared the error memory. Start of cable breakage detection successful.	

## 9 Technical Data

The display DDU 10 integrates a programmable full color dashboard display with a data logging system for motorsport applications. Additional input devices can be connected via Ethernet, CAN buses and RS 232.

Data Analysis Software WinDarab is available free of charge as "WinDarab V7 free" on our website. A basic logging function of 100 channels with recording of 50 ms (3 GB) is always included. The logger can be upgraded to full logging performance (max. 1 ms). In addition a 2nd logging partition of 1 GB can be activated.

With the DDU 10, a completely new library of graphical elements for the individual design of display pages was implemented and an all-new user interface menu has been developed for the device. A configurable input activates the menu structure and the user can reset for example laptime, fuel consumption and many more, without having to connect a laptop to the DDU. The user can also install own graphics, pictures etc. on the 12 freely configurable display pages. For quick data transfer from the car, e.g. during pit stop, data copy to a USB stick is available as an option.

#### Mechanical Data

Size	198 x 134 x 35 mm
Weight	875 g
Protection classification	IP67
Operating temperature internal	-20 to 85°C
Max. vibration	Vibration profile 1 (see Appendix or www.bosch-motorsport.com)

### **Electrical Data**

Supply voltage	6 to 18 V
Current consumption (without sensor sup-	2 A (at 12 V)
ply)	

#### Inputs

Analog channels	4 standard, plus 12 optional
Input range	0 to 5 V
Resolution	12 bit
Switchable pull up resistor	For all analog inputs
Wheel speed inputs	4 Hall-effect or DF11, switchable
Outputs	
Sensor supply 5 V $\pm$ 1 % (250 mA)	2
Sensor supply 10 V $\pm$ 1 % (250 mA)	1
Sensor supply U_Bat (250 mA)	1

4

#### Environment

Sensor ground

External switch for page selection, 12 steps B 261 209 658-01

External switch for brightness adjustment B 261 209 659-01 or page selection, 6 steps

## **Optional Upgrades**

USB Kit	Rugged USB flash drive Bosch File System (BFS) format included, works with Bosch File System (BFS) preformatted USB Flash drive only
	Adapter cable to USB-Port
	Adapter for wiring harness
	SW license USB-Port unlocked
CCP_MASTER	CCP-Master (ASAP2 file from ECU manu- facturer required)
FULL_LOG_1	Enable full logging performance of 3 GB partition 1
FULL_LOG_2	Enable full logging performance of 1 GB partition 2
I_O EXTENS	Enable additional 12 analog inputs and 2 CAN channels

### Connectors and Wires

Live connector on display AS216-35PN	
Mating connector AS616-35SN	F 02U 000 466-01
Auxiliary connector on display AS212-35PN	
Mating connector AS612-35SN	F 02U 000 443-01

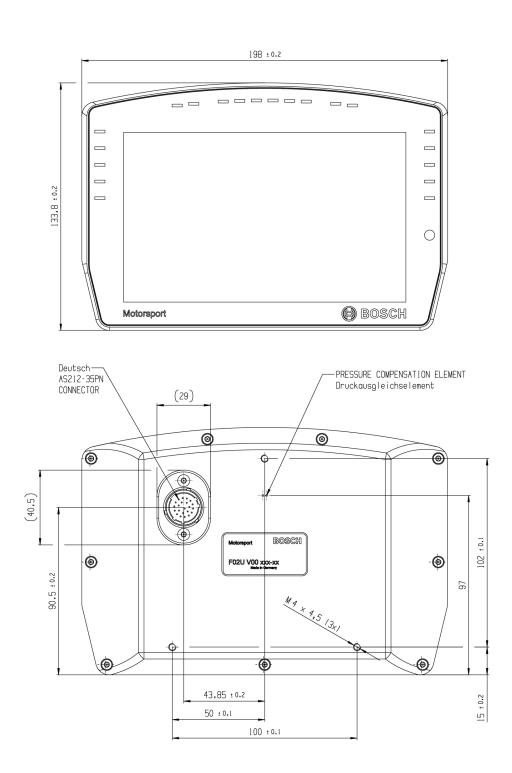
## Pin Configuration

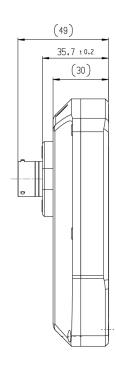
Live connector			
Pin	Name	Comment	Status
1	KL_31		Incl.
2	KL_15		Incl.
3	KL_30		Incl.
4	Rev_In_3	Hall or DF11 switchable	Incl.
5	Rev_In_1	Hall or DF11 switchable	Incl.
6	KL_31		Incl.
7	CAN_2_L	CAN speed selectable	Incl.
8	Ethernet_2_TXP		Incl.
9	Ethernet_2_TXN		Incl.
10	Sens_Power_12V	over current protected	Incl.
11	Rev_In_4	Hall or DF11 switchable	Incl.
12	Rev_In_2	Hall or DF11 switchable	Incl.

Internet         Incl.           14         CAN 2, H         CAN speed selectable         Incl.           15         CAN_1, H         CAN speed selectable         Incl.           16         Ethernet, 2, RXP         Incl.         Incl.           17         Sens_Gnd, 4         fused         Incl.           18         Sens_Power SV         over current protected         Incl.           19         ANA_IN, 3         3.01 kOhm switchable         Incl.           20         ANA_IN, 4         3.01 kOhm switchable         Incl.           21         Time, Sync         connection to Bosch ECU         Incl.           22         CAN_1, L         CAN speed selectable         Incl.           23         Ethernet_screen         Incl.         Incl.           24         Ethernet_STRN         Incl.         Incl.           25         Sens_Gnd_3         fused         Incl.           26         Sens_Power SV         over current protected         Incl.           27         ANA_IN_1         3.01 kOhm switchable         Incl.           28         ANA_IN_1         3.01 kOhm switchable         Incl.           29         USB_Device_DP         to Bosch USB stick         Opt. <th>Live c</th> <th>onnector</th> <th></th> <th></th>	Live c	onnector		
14       CAN speed selectable       Incl.         15       CAN_1_H       CAN speed selectable       Incl.         16       Ethernet_2_RXP       Incl.       Incl.         17       Sens_Gnd_4       fused       Incl.         18       Sens_Power 5V       over current protected       Incl.         19       ANA_IN_3       3.01 kOhm switchable       Incl.         20       ANA_IN_4       3.01 kOhm switchable       Incl.         21       Time_Sync       connection to Bosch ECU       Incl.         22       CAN_1_L       CAN speed selectable       Incl.         23       Ethernet_screen       Incl.       Incl.         24       Ethernet_STRAN       Incl.       Incl.         25       Sens_Gnd_3       fused       Incl.         26       Sens_Power 5V       over current protected       Incl.         27       ANA_IN_7       3.01 kOhm switchable       Opt.         30       RS232_TX_Telemetry       Incl.       Incl.         31       Ethernet_1_TXP       Incl.       Incl.         33       Sens_Gnd_2       fused       Incl.         34       ANA_IN_10       3.01 kOhm switchable       Opt. <th></th> <th></th> <th></th> <th>Incl</th>				Incl
15       CAN_1H       CAN speed selectable       Incl.         16       Ethernet_2,RXP       Incl.         17       Sens_God_4       fused       Incl.         18       Sens_Power 5V       over current protected       Incl.         19       ANA_IN_3       3.01 kOhm switchable       Incl.         20       ANA_IN_4       3.01 kOhm switchable       Incl.         21       Time_Sync       connection to Bosch ECU       Incl.         22       CAN_1_L       CAN speed selectable       Incl.         23       Ethernet_z_RXN       Incl.         24       Ethernet_Z_RXN       Incl.         25       Sens_God_3       fused       Incl.         26       Sens_Power 5V       over current protected       Incl.         27       ANA_IN_7       3.01 kOhm switchable       Opt.         28       ANA_IN_1       3.01 kOhm switchable       Opt.         30       RS232_TX_Telemetry       Incl.       Incl.         31       Ethernet_1_TXP       Incl.       Incl.         32       Sens_God_2       fused       Incl.         33       Sens_Power_10V       over current protected       Incl.         34			CAN speed selectable	
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Number         Number         Number         Incl.           19         ANA_IN_3         3.01 kOhm switchable         Incl.           20         ANA_IN_4         3.01 kOhm switchable         Incl.           21         Time_Sync         connection to Bosch ECU         Incl.           22         CAN_1_L         CAN speed selectable         Incl.           23         Ethernet_screen         Incl.         Incl.           24         Ethernet_Z_RXN         Incl.         Incl.           25         Sens_Gnd_3         fused         Incl.           26         Sens_Power 5V         over current protected         Incl.           27         ANA_IN_7         3.01 kOhm switchable         Opt.           28         ANA_IN_1         3.01 kOhm switchable         Incl.           29         USB_Device_DP         to Bosch USB stick         Opt.           30         RS232_TX_Telemetry         Incl.         Incl.           31         Ethernet_1_TXP         Incl.         Incl.           33         Sens_Gnd_2         fused         Incl.           34         ANA_IN_8         3.01 kOhm switchable         Opt.           35         ANA_IN_10         3.01 kOhm switchabl			fucad	
19ANA_IN_33.01 kOhm switchableIncl.20ANA_IN_43.01 kOhm switchableIncl.21Time_Syncconnection to Bosch ECUIncl.22CAN_1_LCAN speed selectableIncl.23Ethernet_ScreenIncl.24Ethernet_2_RXNIncl.25Sens_Gnd_3fusedIncl.26Sens_Power SVover current protectedIncl.27ANA_IN_73.01 kOhm switchableOpt.28ANA_IN_13.01 kOhm switchableIncl.29USB_Device_DPto Bosch USB stickOpt.30RS232_TX_TelemetryIncl.31Ethernet_1_TXPIncl.32Sens_Power_IOVover current protectedIncl.34ANA_IN_83.01 kOhm switchableOpt.35ANA_IN_103.01 kOhm switchableOpt.36USB_Device_Gndto Bosch USB stickOpt.37USB_Device_Gndto Bosch USB stickOpt.38RS232_RX_Telemetrye.g. GSM telemetryIncl.39Ethernet_1_TXNIncl.Incl.40Sens_Gnd_1fusedIncl.41ANA_IN_93.01 kOhm switchableOpt.42ANA_IN_163.01 kOhm switchableOpt.43RS232_RX_Telemetryto Bosch USB stickOpt.44ANA_IN_163.01 kOhm switchableOpt.45USB_Device_POwerto Bosch USB stickOpt.46Ethernet_1_RXP <td></td> <td></td> <td></td> <td></td>				
ANA_IN_43.01 kOhm switchableIncl.21Time_Syncconnection to Bosch ECUIncl.22CAN_1LCAN speed selectableIncl.23Ethernet_screenIncl.24Ethernet_2_RXNIncl.25Sens_Gnd_3fusedIncl.26Sens_Power 5Vover current protectedIncl.27ANA_IN_73.01 kOhm switchableOpt.28ANA_IN_13.01 kOhm switchableIncl.29USB_Device_DPto Bosch USB stickOpt.30RS232_TX_TelemetryIncl.31Ethernet_1_TXPIncl.32Sens_Power_10Vover current protectedIncl.34ANA_IN_83.01 kOhm switchableOpt.35ANA_IN_103.01 kOhm switchableOpt.36USB_Device_Gndto Bosch USB stickOpt.37USB_Device_Gndto Bosch USB stickOpt.38RS232_RX_Telemetrye.g.GSM telemetryIncl.39Ethernet_1_TXNIncl.Incl.40Sens_Gnd_1fusedIncl.41ANA_IN_93.01 kOhm switchableOpt.42ANA_IN_163.01 kOhm switchableOpt.43RS232_TX_GPSIncl.Incl.44ANA_IN_263.01 kOhm switchableOpt.45USB_Device_Powerto Bosch USB stickOpt.46Ethernet_1_RXPIncl.47ANA_IN_233.01 kOhm switchableOpt.48<		-		
21Time_Syncconnection to Bosch ECUIncl.22CAN_1_LCAN speed selectableIncl.23Ethernet_screenIncl.24Ethernet_2_RXNIncl.25Sens_Gnd_3fusedIncl.26Sens_Power 5Vover current protectedIncl.27ANA_IN_73.01 kOhm switchableOpt.28ANA_IN_13.01 kOhm switchableIncl.29USB_Device_DPto Bosch USB stickOpt.30RS232_TX_TelemetryIncl.31Ethernet_1_TXPIncl.32Sens_Gnd_2fused33Sens_Power_10Vover current protectedIncl.34ANA_IN_83.01 kOhm switchableOpt.35ANA_IN_103.01 kOhm switchableOpt.36USB_Device_Gndto Bosch USB stickOpt.37USB_Device_Gndto Bosch USB stickOpt.38RS232_RX_Telemetrye.gSM telemetryIncl.39Ethernet_1_TXNIncl.Incl.40Sens_Gnd_1fusedIncl.41ANA_IN_93.01 kOhm switchableOpt.42ANA_IN_93.01 kOhm switchableOpt.43RS232_TX_GPSIncl.Incl.44ANA_IN_163.01 kOhm switchableOpt.45USB_Device_Powerto Bosch USB stickOpt.46Ethernet_1_RXPIncl.47ANA_IN_23.01 kOhm switchableOpt.48ANA_IN_16 </td <td></td> <td></td> <td></td> <td></td>				
22CAN_1LCAN speed selectableIncl.23Ethernet_screenIncl.24Ethernet_2_RXNIncl.25Sens_Gnd_3fusedIncl.26Sens_Power SVover current protectedIncl.27ANA_IN_73.01 kOhm switchableOpt.28ANA_IN_13.01 kOhm switchableIncl.29USB_Device_DPto Bosch USB stickOpt.30RS232_TX_TelemetryIncl.31Ethernet_1_TXPIncl.32Sens_Gnd_2fusedIncl.33Sens_Power_10Vover current protectedIncl.34ANA_IN_83.01 kOhm switchableOpt.35ANA_IN_103.01 kOhm switchableOpt.36USB_Device_Gndto Bosch USB stickOpt.37USB_Device_DNto Bosch USB stickOpt.38RS232_RX_Telemetrye.g. GSM telemetryIncl.39Ethernet_1_TXNIncl.40Sens_Gnd_1fusedIncl.41ANA_IN_93.01 kOhm switchableOpt.43RS232_TX_GPSIncl.44ANA_IN_163.01 kOhm switchableOpt.45USB_Device_Powerto Bosch USB stickOpt.46Ethernet_1_RXPIncl.47ANA_IN_23.01 kOhm switchableOpt.48ANA_IN_63.01 kOhm switchableOpt.49ANA_IN_133.01 kOhm switchableOpt.50ANA_IN_153.01 kOhm				
23         Ethernet_screen         Incl.           24         Ethernet_2_RXN         Incl.           25         Sens_Gnd_3         fused         Incl.           26         Sens_Power 5V         over current protected         Incl.           27         ANA_IN_T         3.01 kOhm switchable         Opt.           28         ANA_IN_1         3.01 kOhm switchable         Incl.           29         USB_Device_DP         to Bosch USB stick         Opt.           30         RS232_TX_Telemetry         Incl.           31         Ethernet_1_TXP         Incl.           32         Sens_Gnd_2         fused         Incl.           33         Sens_Power_10V         over current protected         Incl.           34         ANA_IN_8         3.01 kOhm switchable         Opt.           35         ANA_IN_10         3.01 kOhm switchable         Opt.           36         USB_Device_ON         to Bosch USB stick         Opt.           37         USB_Device_DN         to Bosch USB stick         Opt.           38         RS232_RX_Telemetry         e.g. GSM telemetry         Incl.           39         Ethernet_1_TXN         Incl.           40         Sens_Gnd_1				
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25         Sens_Gnd_3         fused         Incl.           26         Sens_Power SV         over current protected         Incl.           27         ANA_IN_7         3.01 kOhm switchable         Opt.           28         ANA_IN_1         3.01 kOhm switchable         Incl.           29         USB_Device_DP         to Bosch USB stick         Opt.           30         RS232_TX_Telemetry         Incl.           31         Ethernet_1_TXP         Incl.           32         Sens_Gnd_2         fused         Incl.           33         Sens_Power_10V         over current protected         Incl.           34         ANA_IN_8         3.01 kOhm switchable         Opt.           35         ANA_IN_10         3.01 kOhm switchable         Opt.           36         USB_Device_Gnd         to Bosch USB stick         Opt.           37         USB_Device_DN         to Bosch USB stick         Opt.           38         RS232_RX_Telemetry         e.g. GSM telemetry         Incl.           39         Ethernet_1_TXN         Incl.         Incl.           40         Sens_Gnd_1         fused         Incl.           41         ANA_IN_16         3.01 kOhm switchable         Op				
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27       ANA_IN_7       3.01 kOhm switchable       Opt.         28       ANA_IN_1       3.01 kOhm switchable       Incl.         29       USB_Device_DP       to Bosch USB stick       Opt.         30       RS232_TX_Telemetry       Incl.         31       Ethernet_1_TXP       Incl.         32       Sens_Gnd_2       fused       Incl.         33       Sens_Power_10V       over current protected       Incl.         34       ANA_IN_8       3.01 kOhm switchable       Opt.         35       ANA_IN_10       3.01 kOhm switchable       Opt.         36       USB_Device_Gnd       to Bosch USB stick       Opt.         37       USB_Device_DN       to Bosch USB stick       Opt.         38       RS232_RX_Telemetry       e.g. GSM telemetry       Incl.         39       Ethernet_1_TXN       Incl.       Incl.         40       Sens_Gnd_1       fused       Incl.         41       ANA_IN_16       3.01 kOhm switchable       Opt.         42       ANA_IN_16       3.01 kOhm switchable       Opt.         43       RS232_TX_GPS       Incl.       Incl.         44       ANA_IN_16       3.01 kOhm switchable       Opt.				
28         ANA_IN_1         3.01 kOhm switchable         Incl.           29         USB_Device_DP         to Bosch USB stick         Opt.           30         RS232_TX_Telemetry         Incl.           31         Ethernet_1_TXP         Incl.           32         Sens_Gnd_2         fused         Incl.           33         Sens_Power_10V         over current protected         Incl.           34         ANA_IN_8         3.01 kOhm switchable         Opt.           35         ANA_IN_10         3.01 kOhm switchable         Opt.           36         USB_Device_Gnd         to Bosch USB stick         Opt.           37         USB_Device_DN         to Bosch USB stick         Opt.           38         RS232_RX_Telemetry         e.g. GSM telemetry         Incl.           39         Ethernet_1_TXN         Incl.         Incl.           40         Sens_Gnd_1         fused         Incl.           41         ANA_IN_9         3.01 kOhm switchable         Opt.           42         ANA_IN_16         3.01 kOhm switchable         Opt.           43         RS232_TX_GPS         Incl.         Incl.           44         ANA_IN_16         3.01 kOhm switchable         Opt. <td></td> <td></td> <td></td> <td></td>				
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38RS232_RX_Telemetrye.g. GSM telemetryIncl.39Ethernet_1_TXNIncl.40Sens_Gnd_1fusedIncl.41ANA_IN_113.01 kOhm switchableOpt.42ANA_IN_93.01 kOhm switchableOpt.43RS232_TX_GPSIncl.44ANA_IN_163.01 kOhm switchableOpt.45USB_Device_Powerto Bosch USB stickOpt.46Ethernet_1_RXPIncl.47ANA_IN_123.01 kOhm switchableOpt.48ANA_IN_63.01 kOhm switchableOpt.49ANA_IN_23.01 kOhm switchableOpt.50ANA_IN_153.01 kOhm switchableOpt.51ANA_IN_153.01 kOhm switchableOpt.52Ethernet_1_RXNIncl.53ANA_IN_53.01 kOhm switchableOpt.	36	USB_Device_Gnd	to Bosch USB stick	Opt.
39Ethernet_1_TXNIncl.40Sens_Gnd_1fusedIncl.41ANA_IN_113.01 kOhm switchableOpt.42ANA_IN_93.01 kOhm switchableOpt.43RS232_TX_GPSIncl.44ANA_IN_163.01 kOhm switchableOpt.45USB_Device_Powerto Bosch USB stickOpt.46Ethernet_1_RXPIncl.47ANA_IN_123.01 kOhm switchableOpt.48ANA_IN_63.01 kOhm switchableOpt.49ANA_IN_23.01 kOhm switchableOpt.50ANA_IN_133.01 kOhm switchableOpt.51ANA_IN_153.01 kOhm switchableOpt.52Ethernet_1_RXNIncl.53ANA_IN_53.01 kOhm switchableOpt.	37	USB_Device_DN	to Bosch USB stick	Opt.
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47ANA_IN_123.01 kOhm switchableOpt.48ANA_IN_63.01 kOhm switchableOpt.49ANA_IN_23.01 kOhm switchableIncl.50ANA_IN_133.01 kOhm switchableOpt.51ANA_IN_153.01 kOhm switchableOpt.52Ethernet_1_RXNIncl.53ANA_IN_53.01 kOhm switchableOpt.	45	USB_Device_Power	to Bosch USB stick	Opt.
48ANA_IN_63.01 kOhm switchableOpt.49ANA_IN_23.01 kOhm switchableIncl.50ANA_IN_133.01 kOhm switchableOpt.51ANA_IN_153.01 kOhm switchableOpt.52Ethernet_1_RXNIncl.53ANA_IN_53.01 kOhm switchableOpt.	46	Ethernet_1_RXP		Incl.
49ANA_IN_23.01 kOhm switchableIncl.50ANA_IN_133.01 kOhm switchableOpt.51ANA_IN_153.01 kOhm switchableOpt.52Ethernet_1_RXNIncl.53ANA_IN_53.01 kOhm switchableOpt.	47	ANA_IN_12	3.01 kOhm switchable	Opt.
50ANA_IN_133.01 kOhm switchableOpt.51ANA_IN_153.01 kOhm switchableOpt.52Ethernet_1_RXNIncl.53ANA_IN_53.01 kOhm switchableOpt.	48	ANA_IN_6	3.01 kOhm switchable	Opt.
51ANA_IN_153.01 kOhm switchableOpt.52Ethernet_1_RXNIncl.53ANA_IN_53.01 kOhm switchableOpt.	49	ANA_IN_2	3.01 kOhm switchable	Incl.
52Ethernet_1_RXNIncl.53ANA_IN_53.01 kOhm switchableOpt.	50	ANA_IN_13	3.01 kOhm switchable	Opt.
53ANA_IN_53.01 kOhm switchableOpt.	51	ANA_IN_15	3.01 kOhm switchable	Opt.
	52	Ethernet_1_RXN		Incl.
54 RS232_RX_GPS for GPS sensor input Incl.	53	ANA_IN_5	3.01 kOhm switchable	Opt.
	54	RS232_RX_GPS	for GPS sensor input	Incl.

Live c	onnector		
55	ANA_IN_14	3.01 kOhm switchable	Opt.
Auxili	ary connector		
Pin	Name	Comment	Status
1		Unused	
2		Unused	
3		Unused	
4		Unused	
5		Unused	
6		Unused	
7		Unused	
8		Unused	
9	Ethernet_3_TXP		Incl.
10	Ethernet_3_RXP		Incl.
11	Ethernet_3_RXN		Incl.
12	CAN_4_H		Opt.
13		Unused	
14		Unused	
15		Unused	
16		Unused	
17		Unused	
18	Ethernet_screen		Incl.
19	Ethernet_3_TXN		Incl.
20	CAN_4_L		Opt.
21	CAN_3_H		Opt.
22	CAN_3_L		Opt.

# 10 Mechanical Drawing

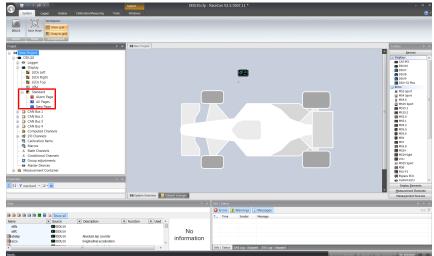




# 11 Display Configuration

## 11.1 Display page setup

## 11.1.1 Organizing display pages



- All Pages: Display elements placed on this page are displayed on all pages.
- Single Page: Display elements placed on this page are displayed only on this page.
- Under a Page set you can create different display configurations, like style or language based. You can choose which page set should be used on the device (via UIM), or via RaceCon, by right-clicking on the Page set in the project tree overview.

The priority of display elements placed on 'All Pages' is higher than the priority of display elements placed on single pages.

Alarm Elements have the highest priority and are displayed in front of all other elements. You can find alarm pages above "All pages" in the project tree.

Example: A bar graph placed on 'All Pages' is displayed on all display pages and is always in front of other display elements on single pages.

## 11.1.2 Adding a new display page

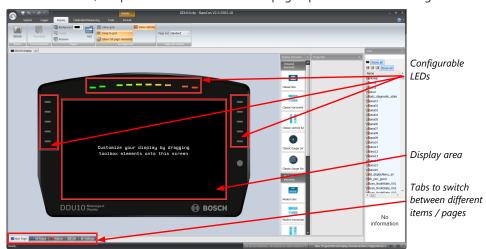
Click with the right mouse button on 'Display' in the project tree and click on 'Add page' in the menu or on the 'Add' button at the top.

	Open	
<u>6</u> 1	Add page	
۲	Export	
۲	Import	
<b>P</b>	Properties	

A new empty page opens.

## 11.1.3 Selecting display pages

Click on the 'Display' tab and then on one of the page tabs at the bottom (example: 'New Page').



In the Main Area, a representation of the selected page opens and can be configured.

## 11.2 Element Configuration

You can insert different display elements and configure these in the 'Properties' toolbox. For an overview of the display elements, see chapter 'Types of display elements [> 74]'.

1. Drag a display element from the toolbox and drop it on the display page.

The 'Properties' toolbox opens and you can configure the active element.

- 2. Use the search bar in the 'Data' window, to search for a measurement channel.
- 3. Drag the desired measurement channel from the 'Data' window and drop it on the display element.
- 4. Alternatively, use 'Value channel' in the 'Properties' toolbox to define a measurement.
- 5. To swap the active channel element, click on the needed element.
- 6. To perform a multi selection, click and hold the mouse button and swipe over the wanted elements. Alternatively, you can add or remove elements from the selection with CTRL + mouse click.

(Only overlapping properties will be displayed.)

You can find the following configuration options in the 'Properties' toolbox. The following screenshots are created by way of example for available options. Which options will be available, depends on which element is active:

#### Appearance

Properties 📮			
Appearance 🌧			
Font size	48 -	]	
Value alignment	Right -	]	
Color value	White -	]	
Color title	White -	]	
Color box	Blue -	]	
Format 🛛 🖓			
Conditional formatting $\qquad \qquad \qquad$			
Zoom event 🛛 👋			
Value ×			
Size and position			

- Font size: Defines the size of the font.
- Alignment: Defines the alignment of the element content.
- Value alignment: Defines the alignment of the value.
- Orientation: Defines the orientation of the element content.
- Color value: Defines the color of the value.
- Color title: Defines the color of the title.
- Color box: Defines the color of the box.
- Color bar: Defines the color of the bar.
- Color gauge: Defines the color of the gauge.
- Color ticks: Defines the color of the ticks.
- Color border: Defines the color of the border.
- Background: Defines the color of the background.
- Image file: Here you can select the image you want to display.
- Scale image: Enables the fitting of the image according to the box.
- Keep aspect ratio: Keeps the original ratio of the image.
- State channel: Defines the channel to which an alarm icon should react.
- Active icon: Defines an icon, which appears when the channel is active.
- Use inactive icon: Enables the usage of an inactive icon.
- Inactive icon: Defines an icon, which appears when the channel is inactive.

#### Visible icon

Properties	<del>P</del>
Appearance	~
Visible icon	*
Show active 🔽	
Size and position	*

- Show active: Enables testing of the active icon (only for alarm icon elements).

#### Format

Properties P				
Appearance 🛛				
Format	Format 🌣			
Title	<channel></channel>			
Title size	20	•		
Text	<channel value=""></channel>			
Value channel		•		
Display type	Value	-		
Decimal places	2			
Conditional format	ting	×		
Zoom event 🛛 👋				
Value ×				
Size and position				

- Title: Defines a specific title.

- Title size: Defines the font size of the title.
- Text: Defines a specific text and/or a value, which will always be displayed in the box.
- Value channel: Defines the value channel, which will be monitored.
- PopUp condition: Defines the condition when the element will be visible on the display.
- Display type: Defines the type of information, which will be displayed. You can differentiate between 'Value', 'Gear' and a type of time display.
- Decimal places: Defines the decimal places, which will be displayed.
- Fill style: Defines the style of the bar filling. You can choose between blocks and solid.
- Tick visibility: Defines the visibility of the ticks.
- Minimum value: Defines the minimum value at which the counting starts.

- Maximum value: Defines the maximum value at which the counting ends.
- Start angle: Defines the angle at which the ticks start.
- Angle range +/-: Defines the angle range of the ticks.
- Tick mark list: Here you can edit the tick mark position.
- Sub divisions: Defines the number of sub divisions between the main ticks.
- Conversion table: Here you can edit the conversion table.
- Fallback: Defines the displayed information when the value channel is invalid for the enumeration box.

#### Conditional formatting (lower and upper limit respectively)

Properties		+	
Appearance		×	
Format		×	
Conditional formatti	ing	*	
Lower limit			
Limit enable			
Limit	20,00		
Reset hysteresis	0,00		
Color value	White -		
Color title	Green -		
Color box	Green *		
Upper limit			
Limit enable			
Limit	80,00		
Reset hysteresis	0,00		
Color value	White -		
Color title	Red •		
Color box	Red -		
Zoom event 🛛 🔅			
Value 🛛 🐇			
Size and position			

- Limit enable: Enables a lower limit and an upper limit respectively.
- Limit: Defines the threshold limit.
- Reset hysteresis: Defines the value as off when the hysteresis will be reset. You can find more information about the hysteresis function in general in the chapter Hysteresis [> 42].
- Color value: Defines the color when the value is above/below the set threshold limit.
- Color title: Defines the new color of the title when the value is above/below the set threshold limit.
- Color box: Defines the new color of the element when the value is above/below the set threshold limit.
- Color gauge: Defines the new color of the gauge when the value is above/below the set threshold limit.
- Color ticks: Defines the color of the ticks when the value is above/below the set threshold limit.
- Color bar: Defines the color of the bar when the value is above/below the set threshold limit.
- Color border: Defines the new color of the border when the value is above/below the set threshold limit.
- Background: Defines the color of the background when the value is above/below the set threshold limit.

### Zoom event

Properties	Ŧ.
Appearance	×
Format	×
Conditional formatting	×
Zoom event	*
Zoom enable Zoom percent 30 Anchor point Center -	]
Value	×
Size and position	×

- Zoom enable: Enables the zoom event.

If checked, the box will increase its size for a short time, after the value changed.

- Zoom percent: Defines the percentage by which the box will zoom out.
- Anchor point: Defines the anchor point, which will be fixed during the zoom event.

#### Value

Properties	÷.
Appearance	×
Format	×
Conditional formatting	×
Zoom event	×
Value	*
Init value 0,00	
Size and position	×

 Init value: Defines the value, which will be shown in RaceCon during configuration or on the device if the channel has no link. Allows testing the conditional formatting by entering a representative value.

## Size and position

Properties	÷
Appearance	×
Format	×
Conditional formatting	×
Zoom event	×
Value	×
Size and position	~
X: 220 💭 Width: 260 Y: 20 💭 Height: 160	

- X-Pos: Defines the x-position of the top left corner of the box within the page.
- Y-Pos: Defines the y-position of the top left corner of the box within the page.
- Width: Defines the width of the element.
- Height: Defines the height of the element.

# 11.3 Types of display elements

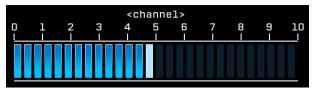
RaceCon has two types of element styles, the 'Classical elements' and the 'Modern elements'. Both styles contain the same type of elements; the difference is solely in appearance. Additionally there is the basic element collection, which consists of elements without any style. Some of these are also transparent and can be used in combination with other elements by layering them.

You can find the following display elements in the 'Display Elements' catalog:

#### Classic Box



#### Classic horizontal bar



Classic vertical bar



Classic Gauge Large



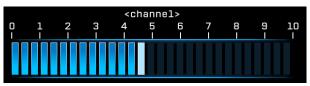
Classic Gauge Small



## Modern Box



Modern horizontal Bar

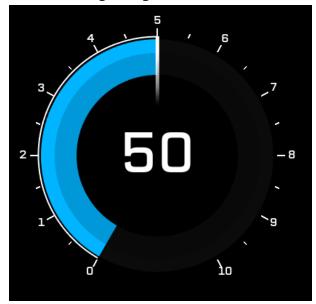


Bosch Motorsport

## Modern vertical Bar



## Modern Gauge Large



Modern Gauge Small



**Basic Box** 

<channel></channel>	
	0.00

Value / Text



Can be used as a simple value or text element, which might be placed on top of another element, like the classic gauge large.

#### Enumeration



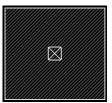
Can be used to translate a value into a text. For example for a wiper setting 0 - Off, 1 - Slow, 2 - fast

#### Image



Can be used to insert images, for example as background images.

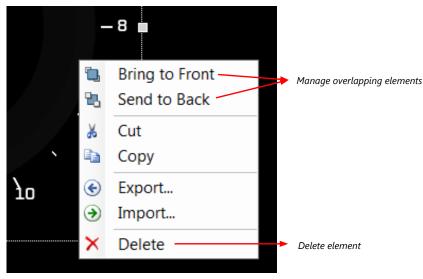
### Alarm Icon



Icon or Icons, which can be linked to a conditional channel.

# 11.4 Context menu

The context menu appears when you click with the right mouse button on a display element.



# 11.5 LEDs

The LEDs are fully configurable to show for example the optimal shifting point. They can also be configured to flash in case of a customized condition becoming 'true'.

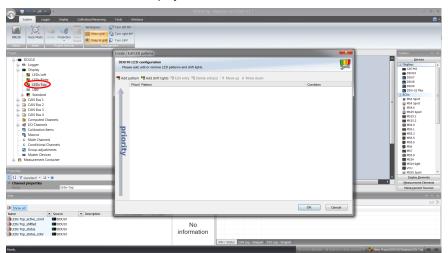
# 11.5.1 Configuring shift LEDs

To use shift LEDs, you need a channel with the unit RPM. It is also possible to use gear depending shift light.

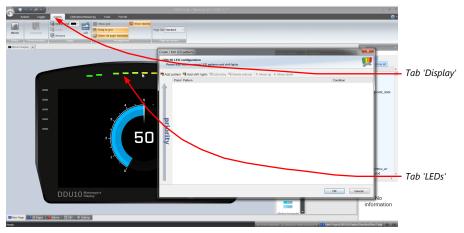
You can configure the shift LEDs only in the 'LEDs Top'.

1. Double-click on 'LEDs Top' in the project tree.

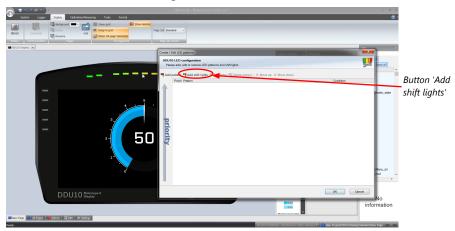
You will find them under 'Display'.



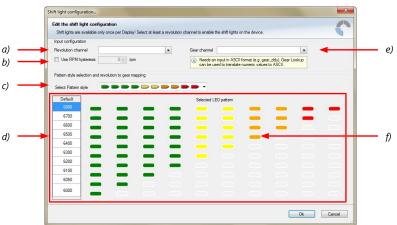
2. Alternatively, click on the 'Display' tab and then click on the colored LEDs at the top of the display image.



3. Click on the button 'Add shift lights'.



4. The 'shift light configuration' window appears. Set up the shifting lights using the following configuration possibilities:



a) Choose the measurement channel for 'Revolution'. Revolution must have 1/min quantization. b) Enter the limit value when the RPM hysteresis function is active. The RPM hysteresis function avoids the high-frequent switchover of the measurement channel value.

c) Choose a predefined Pattern style.

d) Define the rpm thresholds to show the LED pattern. e) Choose the measurement channel for 'Gear'. Gear must have an ASCII quantization (1st gear='1' = 49, 2nd gear='2' = 50, ...). (ASCII quantization is standard for the 'gear' channel of Bosch ECUs. If you get the gear information of a different control unit as the Bosch ECU (e.g. a gearbox control unit), use the Gear Lookup Table to translate numeric values to ASCII format. For more information see chapter "Converting a gear channel to ASCII representation".)

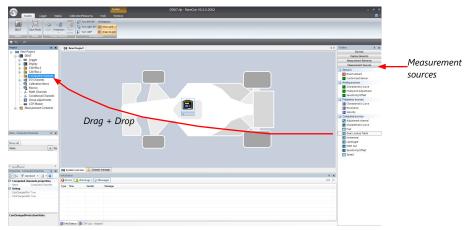
f) Click with the right mouse button on the LEDs to reconfigure the LED patterns.

5. Click 'OK' when done. The configuration is displayed in the DDU 10 LED Configuration window.

## 11.5.2 Converting a gear channel to ASCII representation

If you get the gear information of a different control unit as the Bosch ECU (e.g. a gearbox control unit), use the Gear Lookup Table to translate numeric values to ASCII format.

- Click on the 'Measurement Sources' button in the Toolbox. 1.
- Drag the 'Gear Lookup Table' symbol and drop it on the 'Computed Channels' folder. 2.



The Gear Lookup Table Wizard appears.

## Gear Lookup Table Wizard

Set up the settings as shown in the screenshot. 1.

	Gear lookup	ble Wizard - Add New table properties apping between input valu	es and corresponding output (	ASCII) values.		
This column shows	Mapping:	ut Value	Output (ASCII)	Input channel:		Choose the input
	► 1	a value	1	-		channel of the
the numeric value	2		2	Default output:		
of the input channel	3		3			gear information
	4		4		<u> </u>	
	5		5			Enter the default
	6		6			ASCII value that
	7		R			is set if no output
	0		N	_		value is entered
	*					in the table
This column shows						in the tuble
the ASCII value of						
the output channel						
			< Back	lext > Finish	Cancel	

2. Click 'OK' when done.

The 'Create channel on DDU 10' window appears.

3. Enter the name and an optional description of the translated ASCII measurement channel.

reate channel on DDU7	
Create Channel Set the unique name for the channel and add an optional description.	
Name:	e.g. 'gear ASCII'
Description:	e.g. gear no en
Ok Cancel	

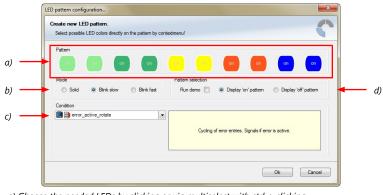
4. Click 'Ok' when done.

A graphic shows the connection between the input and output channels. You can now use the measurement channel in the shift LED configuration.

## 11.5.3 Creating customized LED pattern

You can create your own LED pattern with an individually created condition, using the top LEDs and the ones on the sides. The LEDs illuminate or flash if the condition becomes true.

1. Click on the button 'Add pattern' in the display view. The LED pattern configuration window appears.



- a) Choose the needed LEDs by clicking or via multiselect with ctrl + clicking and define the color of the LEDs by right-clicking on one of the selected LEDs
- b) Select if the LEDs blink or do not blink.
- c) Choose the condition when the LEDs will flash.
- Create a condition using the Condition Creator. For more information see chapter "Creating a new condition channel".
- Choose an existing condition.
- d) Check the box to show a demo of the LEDs. (Important to check blinking)

To create a LED that alternately blinks in two different colors, choose 'Display "on" pattern' and define the LEDs in the first color. Then choose 'Display "off" pattern' and define the LEDs in the second color.

The direction of the pattern changes for each side. For the LEDs on the left side the pattern starts at the bottom LEDs (**right** side of pattern is for the top LEDs), and for the LEDs on the right side the pattern starts at the top LEDs (**left** side of the pattern is for the top LEDs).



2. Click 'OK' when done.

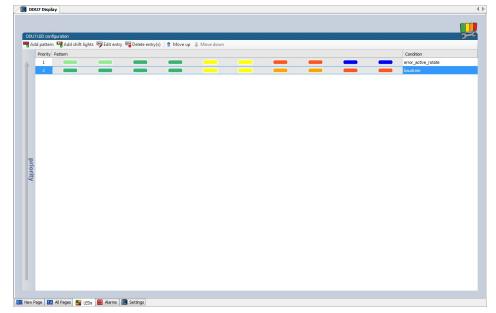
The configuration is displayed in the DDU 10 LED Configuration window.

# 11.5.4 Assigning display pattern priority

You can assign the priority of the created display pattern and shift lights.

The pattern with a higher priority will always cover patterns with a lower priority, when it becomes active. If a transparent (grey) LED is used in a pattern, the LEDs of lower patterns will be visible. Please ensure that for example shift lights do not cover important warnings.

Click the 'Move up' or 'Move down' button to change the priority. The pattern with the lowest number will have the highest priority.



# 11.6 Page select / Display brightness / LED brightness

Any "event" can be used to change the display and LED brightness or the display page. Those events can be any input channel or an internal calculated channel. In the following chapters, you will find some examples on how to set up such a configuration.

## 11.6.1 General information

To use a channel as a page switch, select "Channel based" as page switch and select the channel you configure for a switch in the 'display settings' dialog (as described in the following chapters).

To use a channel as a brightness switch, check the box "Use a channel to switch brightness" and select the channel you configure for a switch.

DDU10 display	settings						<b>e</b> =
Page switch: Channel base Channel base Alarm reset ch		Page switch ch	nannel:				•
Brightness sett	Switch 1 nd 95	Switch 2	Switch 3	Switch 4	Switch 5	Switch 6	
	Ds 95 nel to switch brightness:	76	57	38	19	1	

## Page switch

The pages can be switched from page one too twelve. If not all twelve pages are defined, the device switches up to the highest defined page number, and ignores higher numbers, which are not defined.

If the channel value does not only consist of integers, the pages will be switched as follows:

Page 1 is shown with the value < 1.5 Page 2 is shown with 1.5 <= the value < 2.5

Page 3 is shown with 2.5 <= the value < 3.5

...

Page 12 is shown with 11.5 <= the value

## Brightness switch

The brightness can be switched with 6 positions. In the display settings dialog you will find a chart for the 6 switch positions over the display brightness and the LED brightness (the values are in percent).

If the channel value does not only consist of integers, the pages will be switched as follows:

Switch 1 is shown with the value < 1.5

Switch 2 is shown with  $1.5 \le$  the value  $\le 2.5$ 

Switch 3 is shown with 2.5 <= the value < 3.5

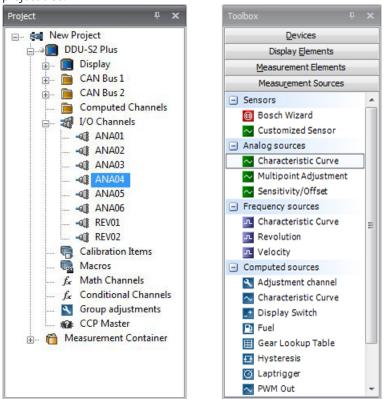
```
...
```

Switch 6 is shown with 5.5 <= the value

## 11.6.2 Option 1: 12 Hardwired position switch

- Connect a 6 or 12 position switch to one of the analog input pins ANAxx and to the sensor ground.
   For recommended position switches, please see the environment section in the chapter "Technical Data."
- 2. Select one of the analog inputs in the project tree.

 Go to 'Measurement Sources' in the toolbox and select the 'Characteristic Curve' under 'Analog sources'. Drag and drop it on the selected analog input channel in the project tree.

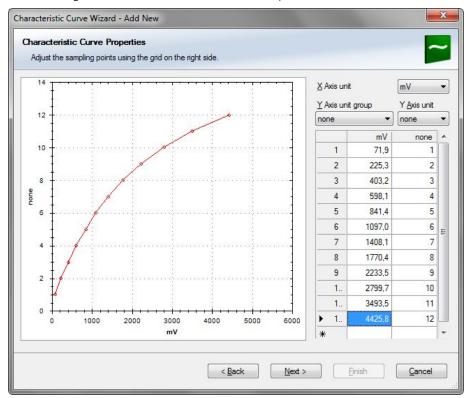


4. Select "Pull-up value:" 3.01 kOhm and click on 'Next'.

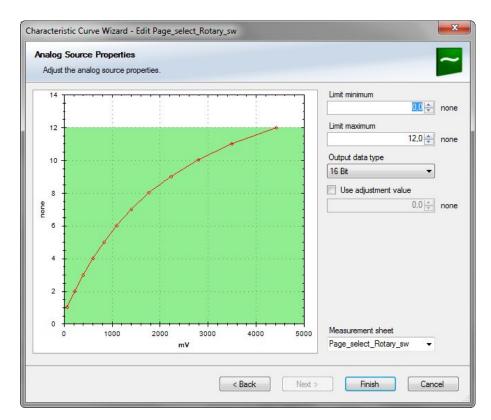
Pin Properties	-	_
Configure the ana	log pin properties.	
Pullup value:	3,01 kOhm	
	Pin Diagnosis & monitoring limits	
	Enabled Minimum: -5000 mV	
	Maximum: 5000 mV	

5. Define the relation between voltage and switch position and click on 'Next'. Voltage = 5000 x R/(R + 3010)
5000: Sensor supply (mV)
R: Resistor for each Rotary switch position (Ohm)
3010: Pull-up resistor (Ohm)

The following screenshot and the data are an example for a Bosch switch.

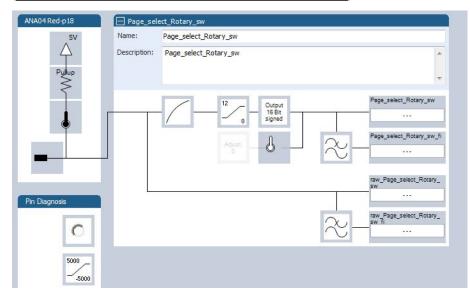


 Define minimum and maximum Limit. Select "Output data type" from 8, 16 or 32 Bit. Do not check "Use adjustment value". Choose the Measurement sheet and click on 'Finish'.



7. Define Name and Description and click on 'Ok'.

Set the unique name for the channel and add <u>Name:</u> Page_select_Rotary_sw	an optional description.
Page_select_Rotary_sw	
Description:	
Page_select_Rotary_sw	

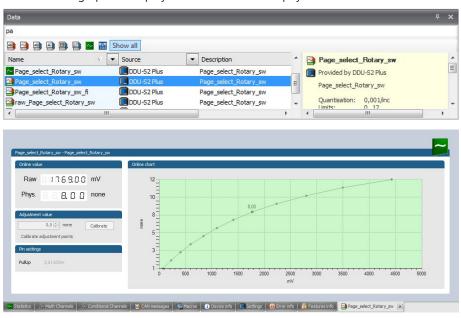


8. Click on the 'Display' tab and select the 'Settings' tab at the bottom.

- 9. To use the channel as a Page Switch, Select "Channel based" as page switch and select the channel configured above.
- 10. To use the channel as a brightness switch, check the box "Use a channel to switch brightness" and select the channel configured above.

DDU10 display sett	ings						<b>e</b> =
Page switch: Channel based Channel based Alarm reset channe	▼  :	Page switch ch	annel:				•
Brightness settings:							
	Switch 1	Switch 2	Switch 3	Switch 4	Switch 5	Switch 6	
<ul> <li>Background</li> </ul>	95	76	57	38	19	1	
LEDs	95	76	57	38	19	1	
☑ Use a channel to	o switch brightness:						•

- 11. Click the 'Download' button at the top, to download the configuration.
- 12. If you want to check your configured channel, ensure that the device status is green, search for the configured channel in the Data window and double-click on it. You will see a graphical display with the raw and the physical value of the channel.



## 11.6.3 Option 2: Up/Down switches

- 1. Define either one signal for a wrap around switch or two signals for an up/down switch.
- 2. Select the 'Display Switch' and drag it into the DDU 10.

Toolbox	₽×
Devices	
Display Elemen	its
Measurement Elen	nents
Measurement Sou	urces
Analog sources	
Characteristic Cu	
Sensitivity/Offse	t
Frequency sources     Characteristic Cu     Revolution     Velocity	rve
<ul> <li>Computed sources</li> <li>Adjustment chan</li> <li>Characteristic Cu</li> </ul>	
Display Switch	
Fuel Gear Lookup Tab Hysteresis Laptringer	le

Select the Source for signal Up/Down and Edge Falling or Rising.
 Select the Maximum count of steps from signal source or from constant.
 Select "Display switch does wrap around" or "Display switch does not wrap around".
 "Display switch does wrap around" goes from maximum position to minimum position or the other way around (by switching) in a loop, after the last page it starts again with the first page.

If you choose "Display switch does not wrap around", you need two switches to turn the pages in both directions.

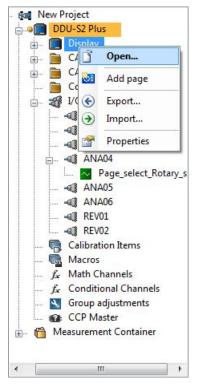
isplay Switch properties							
Setup the up and down signal so	ources and	the maximur	n count of	pages.			-
ource for signal Up:						Ed	ge:
📑 📑 ana05					-	Fa	alling
ource for signal Down:						Ed	ge:
🛄 👜 ana06						Fa	alling
Signal source:     Constant:							12
Display switch does wrap around							
leasurement Sheet: Page_select_ToggleLsw							

4. Define Name and Description and click on 'Ok'.

Create Channel	
Set the unique name for the ch	nannel and add an optional description.
Name:	
Page_select_Toggle_sw	
Description:	
Page_select_Toggle_sw	

Name:	Page_select_Toggle_sw	
Description:	Page_select_Toggle_sw	*
		-
Page U	p Channel:	Page_select_Toggle_sw
a	na05 🔶 🛨 🔶 🔶	
Page Do	vn Channel	
a	na06 <b>*</b>	
Max Page (	Count Channel	
	none 12	
-		

5. In the project tree, select "Display" and then "Open".

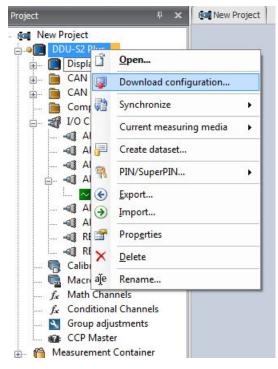


6. To use the channel as a Page Switch, check the box "Use a channel to switch pages" and select the channel configured above.

7. To use the channel as a brightness switch, check the box "Use a channel to switch brightness" and select the channel configured above.

Use a channel to	switch pages:	Page_se	elect_Toggle_sw			
Alarm reset channel:						
<ul> <li>Background LEDs</li> </ul>	95 95	76 76	57 57	38 38	19 19	1
Use a channel to						

8. In the project tree, select "Download configuration".



9. If you want to check your configured channel, reassure that the device status is green, double-click on the DDU 10 and select the "Statistics" tab.

The configured channel position opens.

Project	P         X         Rew Project
🖃 🛛 🖬 New Project	·
DDU-S2 PI	
📥 🛄 Dis 🚺	Open
	Download configuration
<b>(A</b>	Synchronize
	Current measuring media
⊕ 📄 CA ⋥ ⊕ 📄 Ca	Create dataset
🖡 🚽 I/c 🤻	PIN/SuperPIN
	Export
•	Import
e- 📲 😭	Properties
×	Delete
	Rename
Calibra	
DDU-52 Plus device info	
Device voltage	13,4 V Device current 710 mA

DOU-S2 Plus channels			
ama T Din			
onic • • •	Connector     Type     Dia	gnosis 💌 Evaluation module	▼ Value ▼ Unit
ige_select_Rotary_sw 44 At	VA04 Red-p18 phys	characteristic curve with offset adjustment	8,98 none
age_select_Toggle_sw	Other	toggle switch	6,00 none

# 11.6.4 Option 3: CAN input signal, math channel or ANA\_IN channel

Define your CAN, math or analog input channel.

1. Select the 'Display' tab and then the 'Settings' tab at the bottom.

중 문 속 후 / · · · · · · · · · · · · · · · · · ·		- = ×
System Logger Display Calibratory/Kessuring Tools Format		🥑 -
Dots         Constant         Constant         Dots         Dots		
C DOULD Desplay x		Data 4
	Mar Charles Bar	Show all Show all Show all Astroperations Strate Strate Strat
Customize your display by dragging toolbox elements onto this screen	Charac vertrar la Charac vertr	bic.sports_state hord:
	Modern hartsortes	No information
🔜 New Page 🛛 🗚 All Pages 🔛 Alornis 🛛 CLUUM 🗰 Settings	Manuel Press and (PDP) 11.9 / Patronice (PDP) and and (PDP)	

A 'display settings' window opens.

T

						F			
	52 Plus display settings Jee a channel to switch pages:					Le le	-		
Alar	m reset channel:								
Brig	htness settings:								
,	Switch 1 Background 95 LEDs 95	Switch 2 76 76	Switch 3 57 57	Switch 4 38 38	Switch 5 19 19	Switch 6 1			
<b>2</b> 1	Jse a channel to switch brightness:	CAN_Ang	gle_2				-		
e_Practice 2 Qualification 63 Race 64 Page_4 65	Page_5 66 Page_6 67 Page	7 88 Page_8	69 Page_9 00 P	age_10	11 12 Page_12	M Al Pages	📕 LEDs 🛛 🔛 Alarms	🔛 Settings	

2. To use the channel as a brightness switch, check the box "Use a channel to switch brightness" and select the channel configured above.

DDU-52 Plus displa						
Use a channel Alarm reset chan		CAN_An	gle_Z			•
Brightness setting						Switch 6
<ul> <li>Background</li> <li>LEDs</li> </ul>		Switch 2 76 76	Switch 3 57 57	Switch 4 38 38	Switch 5 19 19	1 1
Use a channel	to switch brightness:					

- 3. To use a channel as a Page Switch, check the box" Use a channel to switch page" and select the channel configured above.
- 4. Click on the 'Download' button in the upper left corner.

# 11.7 Alarms

The 'Alarm' display element displays a warning message, when a defined condition becomes 'true'. When a condition becomes 'false', the 'Alarm' display element disappears.

## 11.7.1 General information on the Alarm Representation

- Since an alarm is generally used for an urgent information, the 'Alarm' element has the highest priority and will always be displayed on top of other elements.
- The 'Alarm' elements can be defined in four separate areas. In each area, only one alarm message can be visible at the same time. If more than one alarm message is active in one area, each one will be visible for 1.5 seconds.
- The size and position within the alarm area is freely configurable.
- The 'Alarm' elements match the design styles of the general display elements and are available in the design styles "Classic" and "Modern". For better readability, both styles have a non-transparent background.
- An 'Alarm' element can display either a text, icon or a value, or any combination of those separately.

## 11.7.2 Alarm configuration

To create an alarm, perform the following steps:

- 1. Click on the 'Display' tab at the top.
- 2. Click on the 'Alarm' tab at the bottom. The alarm configuration window opens.



3. Choose one of the four alarm areas at the top left.

This defines the position on the screen, where the alarm will be displayed.

4. Select the design of the 'Alarm' element from the drop down list on the top right.

You can choose between the "Classic" and the "Modern" style. By clicking on the alarm style, an alarm will be added to the alarm list in the middle of the screen.

5. Select the "Alarm condition" channel, which will trigger the alarm when the channel becomes true.

The "Alarm condition" channel can be any Boolean channel, like any other conditional channel.

6. If desired, select a "Value Channel".

The value can be displayed or used for a conditional formatting.

7. Define the text, which will be displayed in the alarm icon.

If you use the phrase *<channel value>*in the text, it will be substituted with the value of the chosen channel value.

8. Check the size, position and appearance of the alarm in the "Alarm Area Preview". Change the appearance according to your needs with the properties described below.

## 11.7.3 Further Alarm Properties

## Representation

Properties
Appearance 🛛 🕹
Format 🛛 🗧
Icon 🛛
Representation 🌼
Reset mode no
Blink mode off 👻
Min. display time enable
Min. display time [s] 0 🔶
Auto reset enable
Auto reset after [s]
Retrigger lock enable
Retrigger lock time [s] 0
Conditional formatting $\qquad  imes$
Value ×
Size and position $\qquad \qquad \qquad$

- Reset Mode: Defines if the alarm is resettable. For more details, see chapter Resettable Alarm [> 99].
- Blink mode: Defines the blinking frequency of the alarm when displayed.
- Min. display time enable: Enables the function min. display time.
- Min. display time: Defines the minimum time an alarm will be displayed.
- Auto reset enable: Enables the function "Auto reset".
- Auto reset after: Defines the time after an alarm will be hidden, even when the condition is still true, only active for resettable alarms.
- Retrigger lock enable: Enables the function "Retrigger lock". For more details, see chapter Resettable Alarm [
   99].
- Retrigger lock time: Defines the time in which a new rising edge of the alarm condition will not be accepted anymore, after an alarm was reset.

## Appearance

Properties						
Appearance		\$				
Font size	58 -					
Text alignment	Left -					
Color value	White -	]				
Color box	Orange 🔹	]				
Format ×						
Icon 🛛						
Representation	Representation ×					
Conditional format	ting	×				
Value		×				
Size and position		×				

- Font size: Defines the size of the font.
- Text alignment: Defines the alignment of the text.
- Color value: Defines the color of the value inside the alarm box.
- Color box: Defines the color of the alarm box.

## Format

Properties					
Appearance	*				
Format	\$				
Text Alarm condition	Alarm <channel< th=""></channel<>				
Value channel Decimal places					
Icon	~				
Representation	*				
Conditional format	ting 🛛 🗧				
Value	*				
Size and position	*				

- Text: Defines the Text and/or the value of the alarm.

- Alarm condition: Defines the alarm condition.
- Value channel: Defines the value channel, which may be displayed and is relevant for the conditional formatting.
- Decimal places: Defines the decimal places, which should be displayed.

#### lcon

Properties
Appearance 🛛 👋
Format 🛛 🐇
Icon 🌣
Default icons Warning    Default color White
Representation $\otimes$
Conditional formatting $\qquad  imes$
Value 🛛 🕹
Size and position $\qquad \qquad \qquad$

- Default icons: Defines the alarm icon, which should be displayed.
- Default color: Defines the color of the icon.

Properties					
Appearance			×		
Format			×		
Icon			×		
Representation			×		
Conditional formatt	ing		\$		
Lower limit					
Limit enable					
Limit	0,00	<b>*</b>			
Reset hysteresis	0,00	<b>*</b>			
Color value	White	-			
Color box Green -					
Upper limit					
Limit enable					
Limit	0,00	<b>*</b>			
Reset hysteresis	0,00	▲ ▼			
Color value	White	-			
Color box	Red	-			
Value			×		
Size and position			×		

## Conditional formatting (lower and upper limit respectively)

- Limit enable: Enables a lower limit and an upper limit respectively.
- Limit: Defines the threshold limit.
- Reset hysteresis: Defines the value as off when the hysteresis should be reset. You can
  find more information about the hysteresis function in general in the chapter Hysteresis [▶ 42].
- Color value: Defines the color when the value is above/below the set threshold limit.
- Color box: Defines the new color of the box when the value is above/below the set threshold limit.

### Value

Properties	
Appearance 🛛 👋	
Format 🛛 👋	
Icon ×	
Representation ×	
Conditional formatting $\qquad \qquad \qquad$	
Value 🌼	
Init value 0,00	
Size and position $\qquad \qquad \qquad$	

 Init value: Defines the value, which will be shown in RaceCon during configuration or on the device if the channel has no link. Allows testing the conditional formatting by entering a representative value.

## Size and position

Properties	
Appearance	×
Format	×
Icon	×
Representation	×
Conditional formatting	×
Value	×
Size and position	\$
X-Pos 80 💭 Width 640 💭 Y-Pos 1 💭 Height 118	

- X-Pos: Defines the x-position of the top left corner of the alarm message within the alarm area.
- Y-Pos: Defines the y-position of the top left corner of the alarm message within the alarm area.
- Width: Defines the width of the alarm message.
- Height: Defines the height of the alarm message.

## 11.7.4 Edit/Delete/Change priority of an Alarm

Perform the following steps:

- 1. Click on the 'Display' tab and then on the 'Alarm' tab to go to the alarm configuration window.
- 2. Select the alarm area of the desired alarm.

The center of the alarm configuration window only shows the alarms of the selected alarm area.

- 3. Click on the alarm, which needs to be edited or deleted.
- 4. To delete the alarm, click on the red cross.
- 5. Change the properties of the alarm in the properties window on the right.
- 6. To change the priority of the alarm, click the up/down arrow to rearrange the priority list.

If the option "Show alarms" is ticked, the alarm with the highest priority will be visible on the display page configurator. The visibility of the alarms will not be influenced by the priority; the alarms will always rotate, if several conditions become true.

## 11.7.5 Resettable Alarm

An alarm can be configured as a resettable alarm. This means that the alarm can be linked to a second conditional channel, which will hide the alarm, when the condition becomes true.

To configure and use a resettable alarm, perform the following steps:

- 1. Click on the 'Display' tab and then on the 'Settings' tab to go to the "DDU10 display settings"
- 2. Select your "Alarm reset channel", which can be any boolean channel, like any other conditional channel.
- 3. Click on the 'Alarms' tab, to change to the alarm configuration window.
- 4. Create an alarm or edit an existing alarm as described in the previous chapters, to access the properties "Representation".
- 5. Change the "Reset mode" to resettable. The alarm will be displayed with a little cross at the top right corner.

#### Important information on resettable channels:

- Only visible alarms can be reset. If several alarms are active, only the alarm which is visible during the reset condition becoming true, will react to the reset.
- A reset alarm will not be shown again, if the alarm condition becomes true again, until the next power cycle. Exceptions are, a change of the display page or if the retrigger lock is enabled and the retrigger lock time is over.

# 11.8 User Interface Menu UIM

You can use the User Interface Menu (UIM) to conduct minor setting changes on the DDU, like lap time or fuel reset.

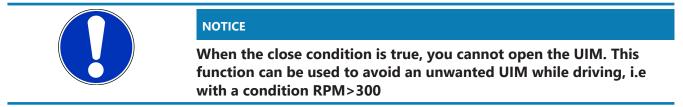
## How to configure the UIM

Perform the following steps, to set up an UIM on your device:

- 1. Click on the 'Display' tab on the top or double-click on "Display" in the project tree.
- 2. Click on the 'UIM' tab at the bottom. This will open the UIM configurator.

System Logor	Upper Californi V2.5.5601.11 * Deper	• • ×
DDU10 Display		
Open UIM channel:		
Close UIM channel:		Channels to navigate
Move up channel:		through the UIM
Move down channel:		
Select channel:		
	Prese add or which a meru page of here is allow the configuration. Move item/page up/down in the UIM menu tree Remove selected menu element Add menu item Add menu page	

3. Define the channels at the top, to navigate through the UIM. The selected channels can be any Boolean channels, such as conditional channels. You can also use condition combinations to open the UIM, to avoid an unintentional start of the UIM.



- 4. Click "Add menu page" to create a new link to a new page on the selected page.
- Click "Add menu item" to create a new item on the selected page.
   On a new page, you can create new items or pages as needed.
- 6. Define a name for your items and pages and define the settings for your items.

With a new item, you can define either labels, special functions or menu triggered events.

#### Labels

- With a label you can show any channel of the current project or just a text.

## **Special Functions**

Page set variation

This menu entry enables you to switch between all available page sets. Activating a different page set automatically reboots the device.

- Outing counter increment

Increments the outing counter by 1.

- Lap counter increment

Increments the lap counter by 1.

- Lap distance reset
  - Resets the traveled lap distance to zero.
- Lap counter reset

Resets the lap counter to the reset value configured in the Laptrigger options.

- Outing counter reset

Resets the outing counter to the reset value configured in the Laptrigger options.

- Best laptime reset

Resets the best laptime.

- Segment times reset

Resets the best laptime segment times.

### Menu Triggered Events

 With a menu triggered event you can define a new virtual Boolean channel, which will jump to the condition true for 100 ms, when selected through the UIM. You can use such a channel for sensor calibration or any further custom calculation.

A UIM configuration to change the current outing counter and to reset the best lap time could look like this:

	RaceCon V2.5.5601.11 *	Display				x
System Logger Display C	Calibration/Measuring Tools	Format			(	0 -
DDU10 Download						
Status Communication						
DDU 10 Display 🗙						Data
🖉 Open UIM channel: 🔳 🛄 open					•	
😮 Close UIM channel: 🔳 🛄 close					•	
Move up channel:					•	
🔇 Move down channel: 💷 🛄 down					•	
Select channel:					•	
Reset Duting Counter      Current Outing Counter      Current Outing Counter      Reset Best Laptime      Current Best Laptime	Configuration for Reset Best La Name : Reset Best Laptime Function : Special Function Channel to display :	aptime':		Type of special function: Best laptime reset Resets the best laptime.		
🚺 New Page 🛛 All Pages 🔛 Alarms 🖃 UII						
Ready.	No errors detected - all deared or sta	ate unknown 👻	🔄 New Project/DDU 10/Display/UIM,	UIM/Reset Best Laptime/Reset Best Laptime	15Te (10)	

# 12 Math Channels and Conditional Functions

## Math Channel

- Arithmetic and logical operations on up to 4 measurement channel(s)
- Numerical result
- Result can be used as input source for various display elements (numeric elements, alarms, bargraphs) and further calculations in the whole RaceCon project

## Creating a new math channel

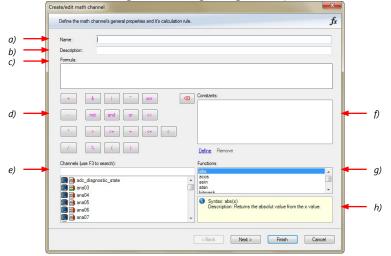
Follow the steps shown in the screenshot.

		Spiten DDU7.rdp - RaceCon V2.5.0.2002	_ a x
	S Perton Locor Dad	y Calibration/Measuring Tools Windows	<b>n</b> -
	slave robbit rob	a califord washing in the initial and a second s	
	DOUT Race Hode visits Prote		
	DDU/ Kace Pible Villos Prose	Son Jewei Ioded	
	Status Mode Project 5	narti	
	Project # X	/M_MexProject / 0007 4	F x Taobex 0 x
	B- dag New Project	24 100 1100 2 10 1000 1	Devices
	- + C 0007		Dapley Denents
	g. 📾 Logger	2007 meth dwared canfazzation	Measurement Dementa
	(g. 🖪 Display	6 Add channel. • & Edd channel 6. Delete channels).	Neasurement Sources
	8. 🎽 CAN But 1	Nere , Porná	-I Sensors
1st: Double-click on	GAN Bus 2     Gomputed Channels	Name Cettop A nau Control was	Baach Wizerd
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	- Calibration Berrs		<ul> <li>Analog sources</li> </ul>
"Math Channels" in	- Macros		Characteristic Curve
	fe Math Channels		Multipoint.Adjustment
the Duciest tues	- fe Conditional Channels		Sensitivity/Offset
the Project tree	- Sroup adjustments		Frequency sources
,	CCP Master		Cherecteristic Curve
	👜 - 📸 Measurement Container		Revolution
			Valocity Computed sources
			Adjustment chernel
	Data - Nath Channels 🛛 🕸 🗙		Cheracteristic Curve
			Pl Fuel
	Show all		Gear Lookup Table
	Name Soc		Husteresis
2nd Click an			E Leptripper
2nd: Click on			PWM Out
			Sensitivity/Offset
"Add channel"			Speed
Auu chunnet			
	x		
	Properties - Meth Channels 8 X	🖀 Statistics & Hath Channels & Canditional Channels 🔯 CAN messages 🖏 Hacros 🔟 Settings (1) Device info	
			×
		recently a Wavered (in Message 37)	
	🗆 Debug		<u>^</u>
	CanChangedPro True CanChangellisbi True	Type Time Sender Message	*
	Hath channels properties	(i) 11:30:19 DDU7-Na DFK dwork accessed al. (DFK Device: DDU7_BAGE_2727 )	
	Name Hets Channels	1:33-23 Airm - Ne Ne channel source configured, skipping element	
		1138-29 00/07-He (apport faits watches the local data.     1138-29 00/07-He (apport faits watches the local data.     1138-29 00/07-He	
		ILINE J DUCT-Nu. Last connectos la devolução marte(DLT).     ILINE J DUCT-Nu. Sociementos de devolução marte(DLT).     ILINE J DUCT-Nu. Sociementos de devolução marte(DLT).	
		1 11/8/24 OD/7-Ne. BY CHEVIC DV/RD/07/2012 1	
	ConChangedProtectionState	11:31:25 Karm - Ne No channel source configured, slipping element	13
	Card and your rescondered life	11:38:25 DDU7-Ne Logger data matches the local data.	×
		Print Status (Prication - strated	

The "Create/edit math channel" window appears.

## "Create/edit math channel" window

1. Define the math channel using the following configuration possibilities:



- a) Enter the name of the math channel.
- b) Enter a description of the math channel.
- c) Enter the formula.
- d) Select the logical operator.
- e) Choose a measurement channel.
- f) Define a value that can be used as a constant in the formula.
- g) Choose a function.
- h) Describes the function selected above.

2. Click 'Finish' when done.

The math channel is displayed in the DDU 10 math channel window.

## **Conditional Function**

- Arithmetic and logical operations on one or more measurement channel(s)
- If-Else structure with reset
- Numerical result
- Result can be used as input source for various display elements (numeric elements, alarms, bargraphs) and further calculations in the whole RaceCon project.
   All math and conditional channels can be used globally in the whole RaceCon project.

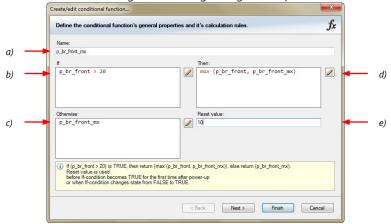
## Creating a new Conditional Function

1. Follow the steps shown in the screenshot.

	System Lopper De	ay Calendon/Measuring Tools Windows	<del>0</del> -
	🕤 🕤 🙆 💊		
		₩ ₩ ₩ ₩ ₩ ₩ ₩ ₩ ₩ ₩ ₩ ₩ ₩ ₩ ₩ ₩ ₩ ₩ ₩	
	Status Made Arojec		
	Project 0 x - 04 New Project	/ 64 Hen Project / 18 D647	P x Toobox 3 x Devices
	÷+000	-	Display Elements
1st: Double-click c	B- Cogger	(0)//redu dowed our figuration // fidd channel	Measurement Elements Measurement Sources
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"Math Channels"	- Disconstruction - Computed Chernels	As Conditional Junction.	Bosch Waard     Custamized Sensar
	10 Charmets Collection Rema		<ul> <li>Analog sources</li> </ul>
in Project Tree	- G Macros	<b>T</b>	Characteristic Curve Publicatint Adustment
	- & Conditional Channels		Sensitivity/Offset
	Group adjustments     Group Master		Frequency sources     Orareteristic Curve
2nd: Click on	2. 1 Measurement Container		Revolution
			Computed sources
the dropdown	Data - Math Channels 🛛 🛪 🗙		Adjustment channel
,			Characteristic Curve
arrow beside	Show all Name		III Gear Lookup Table
	Name i ok		Hysteresis Laptrigger
'Add channel'			PWM Out
			Sensitivity/Offset
	4 <u></u>		
3rd: Choose	Properties - Nath Channels 3 ×	🗱 Statetics v Hanh Channels / A. Conditional Channels 🕼 CAN nessages 📲 Nacros III Sections () Device info 💊 Error info 🏠 Features info	
	E Orbas	0 mm(8) ▲ Warning(78) () Message(77) [2]	×
'Conditional	CanChangedPro True CanChangedPro True	Type Time Sender Message	*
	E Math channels properties	() 114-253 DOUT-Ne BY deak accumule, BY Center DOUT, SACE 3727 ) 114-254 Asen -Ne In deard source confuged, signapa deserce	
function'	Name Math Channels	11:42:53 DDU7-Ne Logger data matches the local data.	
•		▲ 11:49.13 DUC <sup>-1</sup> Ne Los connection to device∰tement(NC <sup>1</sup> ). 11:49.14 DUC <sup>-1</sup> Ne Los connections du device∰tement(NC <sup>1</sup> ).	
		12-02.14     00.07 - Ne BYK dreek secondrik (BYK Device: DOUT_SARE_0727 )     12-02.15     Alsen - Ne No dramel source cardigued, sigging element	
	CanChangedProtectionState	II 14-113 Addin - Sec. No drafting Source (angular, support elever).     It 24-115 DDU7 - Neu. Logger data mathema the load data.	
		Balance Balance and	

The "create/edit math channel" window appears.

2. Define the math channel using the following configuration possibilities:



- a) Enter the name of the conditional function.
- b) Enter the If-condition. Click on the pencil symbol to open an editor to enter expressions.
- c) Enter the Then-condition. Click on the pencil symbol to open an editor to enter expressions.
- d) Enter the Otherwise-condition.Click on the pencil symbol to open an editor to enter expressions. e) Enter the reset value (must be a number).
- 3. Click 'Finish' when done.

The conditional function works the following way:

The program always calculates the condition entered in the IF window and checks if the condition is TRUE or FALSE.

If the condition entered in the IF window is TRUE, the program calculates the condition entered in the THEN window. The returned value is the content of the new variable (entered in "Name").

If the condition entered in the IF window is FALSE, the program calculates the condition entered in the OTHERWISE window. The returned value is the content of the new variable (entered in "Name").

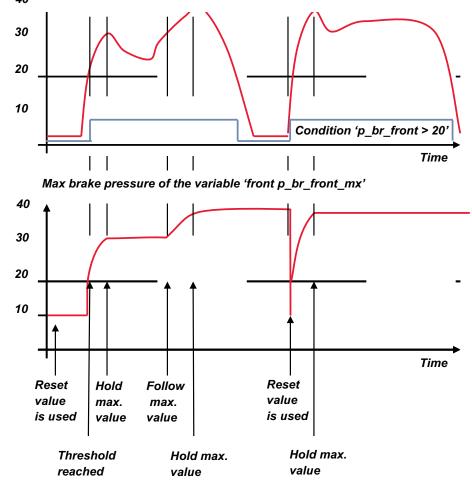
The reset value is always set for the new variable (entered in "Name"):

- before the If-condition becomes TRUE for the first time after power-up
- when the If-condition changes state from FALSE to TRUE.

An example of a condition to set up the maximum front brake pressure is given on the next page.

The conditional function is displayed in the DDU 10 math channel window.

### Example: Setting up a condition for maximum front brake pressure



40 Brake pressure 'front p\_br\_front'

- At power-up, the reset value (10) is used for 'p\_br\_front\_mx'.

'p\_br\_front' rises to 30. As 'p\_br\_front' is > 20 (condition is TRUE), the condition 'max (p\_br\_front, p\_br\_front\_mx)' in the THEN window is triggered. The condition sets the bigger value as new value for 'p\_br\_front\_mx'. As 'p\_br\_front' (30) is bigger than 'p\_br\_front\_mx' (10), the new value for 'p\_br\_front\_mx' is set to 30.

- Although 'p\_br\_front' falls to 25, the value of 'p\_br\_front\_mx' stays 30. This is caused by the THEN-condition, because p\_br\_front\_mx' (30) is still bigger than p\_br\_front' (25).
- 'p\_br\_front' rises to 40. As 'p\_br\_front' (40) is bigger than 'p\_br\_front\_mx' (30), the new value for 'p\_br\_front\_mx' is set to 40.
- As 'p\_br\_front' falls below 20, the IF-condition turns to FALSE. Now the OTHERWISE-condition is triggered. Because the condition 'p\_br\_front\_mx' sets the value of 'p\_br\_front\_mx' and the value is already set to 40, nothing changes.
- When 'p\_br\_front' rises to 40, the IF-condition changes to TRUE again and triggers the THEN-condition. Now the reset value (10) is used for 'p\_br\_front\_mx' in the THENcondition.
- The new value of 'p\_br\_front\_mx' is 40 because 40 is bigger than 10.

# 13 Conditional Channels and Condition Combination

## Conditional Channel

- Logical operations on measurement channel(s)
- If-Else structure with reset
- Logical result
- Result can be used as input source for alarm display elements and further calculations in the whole RaceCon project.

## Creating a new Conditional Channel

1. Follow the steps shown in the screenshot.

		DDU7./p - RaceCon V2.5.0.2002	
	States Lager In	play Collection/Heasuring 3xdb Vindows	
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on conditional	a. # 10 Channels		Customized Sensor
Channels" in	- Calibration Barro		Analog sources
Channels in	- Macres		Multipoint Adjustment
	- Je Meth Channels		Sensitivity Office
Project Tree	- D Group adjustments		Analysium Statements
	CCP Mether		Characteristic Carve
	8- 6 Messurement Container		Revolution Velocity
			Computed sources
	Data - Conditional Channels 8 34		Adustment channel
2nd: Click on			Characteristic Curve
	Show all		Fuel Gear Lookup Table
'Add condition'	Name 1 m Sa		Sear Lookup Table
Add condition			E Lashipper
			Page Dut
			Sensitivity/Offset
			I Speed
	×	🖀 Statistica 🔏 Hade Channels 🔏 Canadianad Channels 🔯 GAN messages 👰 Haccos 💷 Settings 👘 Device info 👜 Error info 🦓 Pastures info	
	Properties - Conditional Channels 8 36		
	21 24   T standard + 12 - 😜	Diversiti & Warringstiti (1) Messager/70	8 K 174/174 X
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	D Debug	Type fine fander Heasage	
	Cardhargedhol True	10         11:475.9         200.7 -96         RM deels successful. (BYC Device: DD07 JMDR 2027         )           11:475.9         XM mm - 56         Index device: confluent distance interact.	
	Carchergeritabi True	II-47.55 50U7-file Logger data matches the local data.	
		IL-0.39 2007-9m. Instrumentin to developfleement/07).     IL-0.39 2007-9m. Commenting research to developfleement/07).	
		II-0-9 00.0 <sup>-1</sup> As. Scenarkly connects to theorem(300)     II-0-9 00.0 <sup>-1</sup> As. Scenarkly connects(00)     II-0-9 00.0 <sup>-1</sup> As. BY deta knowski, BY deta knows (00.7 BARC 202)     II-0-9	
	CanChangedProtectionState	11-01-41 Alam - Ne No charred source configured, sligping element	
		(i) 11-42-41 00-07-58 Lagger data methods the local data.	*
		Disholada @ Chiling - stopped	

The "Create/edit condition" window appears.

- ate / Edit Condi fx Define the conditions general properties and the condition itself a) nparing m b) Channe C Range Multiple (constant list) Constant Input chan Operator tant value c) • ... • d) 0 💠 ms Output mode: ant TRUE/FALSE • Ð Deb C e) Tum off delar 0 💠 ms Ok Cancel
- 2. Define the condition channel, using the following configuration possibilities:

- a) Enter the name of the conditional channel.
- b) Select the comparing mode:
- Constant: Compare a measurement channel with a constant value.
- Channel: Compare a measurement channel with a measurement channel.
- Range: Compare a measurement channel with a defined value range.
- Multiple: Compare a measurement channel with up to 5 constant values.
- c) Depending on the chosen comparing mode, you can enter the following values:
- Constant: Choose the measurement channel or condition, the operator and enter the value of the channel.
- Channel: Choose the measurement channel or condition, the operator and the measurement channel or condition to be compared.
- Range: Choose the measurement channel or condition, the operator and define the minium and maximum value.
- Multiple: Choose the measurement channel or condition, the operator and enter the value of up to 5 constants.
- d) Enter the minimal time to detect the signal of the measurement channel, to avoid high-frequent switchovers.
- e) Enter the time the signal of the measurement channel is delayed after its ending.
- f) Choose the output setting of the result.
- Constant TRUE/FALSE: Result is as a constant with the value TRUE or FALSE.
- Blinking: Result is a blinking, if the condition is fulfilled.
- Pulse: Result is a short one-time pulse, if the condition is fulfilled.
- Toggling output: Result is a pulse that lasts until the next condition is fulfilled.
- Click 'Ok' when done. The conditional channel is displayed in the DDU 10 condition channel window.

## **Condition Combination**

- Combination of several (up to 16) conditional channels for more complex calculations
- Logical results

All conditions can be used globally in the whole DDU 10 project.

## Creating a new Condition Combination

1. Follow the steps shown in the screenshot.

	©	BDU7.40 - RackCon V2.5.0.2002	- a x
	DOU7 Race Mode visible Prote	9 Teleford States	© +
	Project # X	/ 🙀 Hen/Triplet / 📓 0007 4 P	X Teobex 3 X
	- • 🔁 COUT	6	Display Clements
1st: Double-click	g. 📾 Legger g. 📰 Display	COU.7 candition dwinell configuration 3	Measurement Elements
ISI. DOUDIE CIICK	g. 🛅 CANBus 1	Ap Add condition.   Ap Date condition.   Note:   Note:	Measurement Sources
on 'Conditional	8- CAN Bus 2	A Constant. • Not •	Basch Waard
	8- 10 Channels		Customized Sensor
Channels'	Macros	A	Characteristic Curve
	- fr Math Channels		Multipaint Adjustment
in Project Tree	Group adjuctments		Frequency sources
ann roject mee	GOP Master     Got Messurement Container		Characteristic Curve
	6. G		Velocity
	Casta - Conditional Channels a x		Computed sources     Adjustment channel
2nd: Click on	Data - Conditional Channels 8 X		Characteristic Curve
ZHU. CIICK OH	Show all		Fed Gear Lookup Table
the dropdown	Name Sou		Hysteresis
			Leptigger     PWM Out
arrow beside 'Add			Sensitivity/Offset
			Speed
condition'			
condition	Properties - Conditional Channels 8 X	🖀 Statistis 🖌 with Channels 💪 Conduced Channels 🚱 CAll residences 🔂 Ball residences 🔂 Statistics in Device Infe 😥 Entransitio	
		Info@paka #	
	Conditional channels properties	trents)     (1)     (1)     (1)     (2)	×
3rd: Choose	Name Canditional Channels El Debag	Type Time Sender Hessage	*
	CanChangedRo True CanChangevisio True	(j) 113128 DOUT-Ne BY deta successful, BYK-Deta	
'Conditional	concrete de roter in 16	(1) 113/17 2007-94c. [ogge diste matches the load deta. ▲ 18/917 0007-94c. [ogge distests the distest/fibratest/07/5.	
Conditional		11:52:12 DDU7-Ne Successfully connected to device [2thermet]/UCP].	
combination'	CenChangedProtectionState	1155112 DDUP-Ne BY Order sources (4), BY Device DDU 7,8448, 2727 )     1155114 Atten - Ne In charmal sources configured, adjustical entert	-
combination			-
		Dish Share Di Citil co - stranet	

2. The "Create/edit condition combination" window appears. Define the condition combination, using the following configuration possibilities:

	Create/edit condition combination						
	Combine multiple conditions.						
a)	 Name: Add AND Add OR Remove Edit						
b)							
	< Back Next > Finish Car	ncel					

- a) Enter the name of the condition combination.
- b) Create the condition combination in the window.
- Choose a channel (condition, conditional function, math, measurement channel with binary values) to be compared.
- Combine multiple conditions, by adding 'AND' or 'OR' relations.
- To negate a condition, click with the right mouse-button on the condition and select 'Negation (!)'.
- Combine several (up to 16) conditions.
- 3. Click 'Next' to go to the next page. Choose the output setting of the result:
  - Constant TRUE/FALSE: Result is as a constant with the value TRUE or FALSE.
  - Blinking: Result is a blinking, if the condition is fulfilled.
  - Pulse: Result is a short one-time pulse, if the condition is fulfilled.
  - Toggling output: Result is a pulse that lasts until the next condition is fulfilled.
- 4. Click 'Finish' when done. The conditional combination is displayed in the DDU 10 condition channel window.

# 14 Disposal

Hardware, accessories and packaging should be sorted for recycling in an environmentfriendly manner.

Do not dispose of this electronic device in your household waste.

# 15 CPU Load Limits

As all microprocessors, the two processors of the DDU 10 have limited capacities. The current load of the processors can be monitored using the channel "cpu\_load\_001" or "cpu\_load\_002". When configuring your device, please make sure the used CPU load is in a save range below 100 %.

Bosch recommends a maximum CPU load of 85 % (averaged). Exceeding this limit might result in the DDU 10 not being able to fulfill its required measuring/logging/display tasks or even in crashing and rebooting.

Main factors influencing the CPU load are:

- Number and complexity of math channels
- Number and complexity of conditions
- CAN traffic on both CAN lines
- Display configuration, especially displaying pictures
- Logger configuration (total logging rate [kB/s], conditional measurement rates)

To help respecting the limit of 85 % CPU load, the DDU 10 creates an error memory entry. To trigger this error entry, the CPU load must exceed the limit for 5 minutes without interruption.

When being confronted with this error memory entry (see 'Error info' in RaceCon) or when being confronted with DDU 10 resets due to complex configuration setups, please consider reducing the demands on the DDU 10 adapting the influencing factors mentioned above.

# 16 CAN Bus

The DDU 10 has four fully configurable CAN buses. Two of these are available as an upgrade.

- Baudrate (250 kbaud , 500 kbaud, 1 Mbaud)
- 11 Bit or 29 Bit identifiers
- Input configuration: Read messages from CAN bus and convert to DDU 10 measurement/display variables. CAN bus supports row counter configuration.
- Output configuration: Write RaceCon measurement variables to CAN messages, output frequency and row counter are configurable, CAN gateway functionality (transfer from one bus to another).

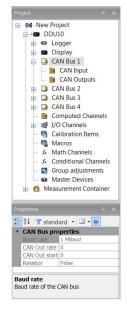
# 16.1 CAN bus trivia

#### CAN message

- 11 Bit (standard) or 29 Bit (extended) identifier
- Up to 8 bytes of data payload

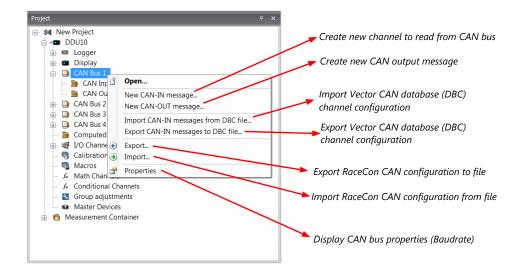
#### CAN bus

- Needs termination resistors (60 Ohm) in wiring harness
- All devices connected to the bus, must use identical data rate
- Configuration of bus data rate in the 'CAN messages overview' menu. To access the menu, double-click on one of the CAN bus items of the project tree (1 MBaud, 500 kBaud, 250 kBaud).



#### CAN item drop-down menu

Click with the right mouse button on the desired CAN bus to open the CAN bus dropdown menu.



# 16.2 CAN input

## 16.2.1 Create new CAN Input channel

- 1. Double-click on any CAN bus item, to open the "CAN messages overview".
- 2. Select 'Add CAN-IN' and choose the desired CAN bus for the new input channel.

S	System	00010/np - Ki	secon v2.5.5507.11				
System Logger Display Calibration/Measuring	Tools Windows						6
DUD3 Race Made Voter Procedure Street Local Control of	Ave 💽 mitte file to were 🖏 Read file tom Save WH/RP Do Save WH/RP Do	wilaad	p veka				
njed	<ul> <li>x State Project</li> <li>COUL</li> </ul>	0 (R)					Taolbox 4
44         Mone Product           9         C0030           9         Congreg           9         Mone Congreg           9         Mone Congreg           9         Mone Congreg	CAN Resistor: CAN Out start delay: CAN Out rate limit: CAN Bas 4 Boudrate:	0/2019/00 11 Milead • 01 • 16 0 mssaga/ms 11 Milead • 01 • 0 mssaga/ms 01 • 0 mssaga/ms	CAN Bus 2 Baudrate: CAN Resistor: CAN Out start delay: CAN Out rate limit:	I Miteud eff * 0 mssages/ms	CNI Bus 3 Baufate: CNI Restor: CNI Out start delay: CNI Out start delay:	190xd • ef • 0 ms 0 mesage/ms	Course     Course
	CAN configuration fille	CAN In IDs 0 / 128			CAN Out IDs 0 / 1	15	MS3.8 MS24
perform	Add CAN-IN SI	CAN In channels 0 / 500 Add CAN-OUT • D Edit D D CAN ID • Start I	elete It 💌 Length (Ots)	● જ્યા ચાય	CAN Out channels 0 ) tiplecer Value • Type	400 VM Bus	NS24 light VCU SI NS24 light VCU SI NS25 Spart PCB
24 T standard - 2 · ·		_					Display gements
Application Race track							Measurement Berrents
pleation	Statistics 🖉 Math Ch			Macras Settings Device in	fo 🛛 😟 Errar info 🛛 👫 P	natures infa	Measupernent Sources
			lefe / Status				<b>•</b> 4
ow all			C Errors A Warnin				
me / • Source • Description	Punction     Used		T Time Send	er Messege			
		No information					
			Ma / Status Oni Log-	Stapped SYS Log - Stapped			
nh.						energia - all closers or state relevant •	······································

A CAN channel configuration window opens.

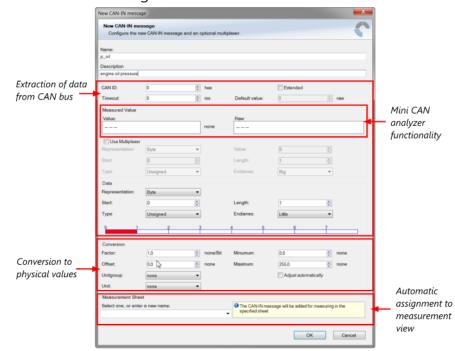
3. Insert the name and description of the channel.

Configure the n	ew CAN-IN message	and an op	otional multi	olexer.			
lame:							
o_oil							
Description angine oil pressure							
CAN ID:	0	×.	hex		Extended		
Timeout:	0		ms	Default value:	0	A V	raw
Measured Value							
Value:				Raw:			
			none				
Use Multiplexer							
Representation:	Byte	•		Value:	0	A. V	
Start:	0	×		Length:	1	A V	
Туре	Unsigned	•		Endianes:	Big	-	
Data							
Representation:	Byte	•					
Start:	0			Length:	1		
Туре	Unsigned	•		Endianes:	Little	•	
0 1	2	3		4 5	6	7	
Conversion							
Factor:	1.0		none/Bit	Minumum:	0.0	-	none
Offset:	0.0 😓	*	none	Maximum:	255,0	*	none
Unitgroup:	none	•			🥅 Adjust automati	cally	
Unit:	none	•					
Measurement She	et						
Select one, or ente	r a new name:			The CAN-IN mes specified sheet.	ssage will be added for	measuring	in the

#### 4. Click 'OK' when done.

The channel is listed in the Data window.

CAN Bus 1			CAN Bus 2			CAN Bus 3		
Baudrate:	1 MBaud	•	Baudrate:	1 MBaud	•	Baudrate:	1 MBaud	•
CAN Resistor:	off	-	CAN Resistor:	off	Ŧ	CAN Resistor:	off	*
CAN Out start delay:	0 ms		CAN Out start delay:	0	ms	CAN Out start delay:	0	ms
CAN Out rate limit:	0 me	ssages/ms	CAN Out rate limit:	0	messages/ms	CAN Out rate limit:	0	messages/ms
CAN Bus 4								
Baudrate:	1 MBaud	-						
CAN Resistor:	off	-						
CAN Out start delay:	0 ms							
CAN Out rate limit:	0 me	ssages/ms						
CAN configuration fill I	evel							
	CAN In IDs					CAN Out IDs 0 / 12	8	
	CAN In chann					CAN Out channels 0 /	400	
	Add CAN-OUT - 📄 E			_	_		_	
ame 🔺 💌	CAN ID 🔻	Start B			Grid 💌 Multij	olexer Value 💌 Type		N Bus
p_oi	0x0		0	8		- CAN In	CA	N Bus 1

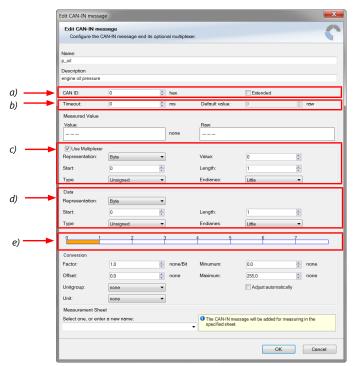


#### CAN channel configuration

#### **Extracting data from CAN bus**

#### Representation: Byte

Some CAN devices need to be addressed by a byte represented CAN channel. The address can be assigned in this window and is illustrated by a bar graph.



a) Enter CAN message ID. If extended IDs (29 bit) are used, check the box.

- b) If replacement values are used, specify timeout period and raw value.
- c) If a multiplexer (row counter) is used, check the box.
- d) Enter data position, length and format.
- e) The bargraph shows assignment of the bytes.
- Red colored fields show the assignment of the data bytes.
- Orange colored fields show the assignment of the multiplexer bytes.

#### Representation: Bit

Some CAN devices need to be addressed by a bit represented CAN channel. The address can be assigned in this window and is illustrated by a matrix table.

(	Edit CAN-IN message					<b>X</b>
	Edit CAN-IN mess Configure the CA	age N-IN message and its option	nal multiplexer.			\$
	Name:					
	p_oil					
	Description					
	engine oil pressure					
a) ——	CAN ID:	0	hex		Extended	
b) ——	Timeout:	0	ms	Default value:	0	raw
	Measured Value					
	Value:			Raw:		
			none			
c) —	Use Multiplexer					
-, .	Representation:	Bit 👻		Value:	0	
	Start:	0		Length:	7	
	Туре	Unsigned 👻		Endianes:	Little 👻	
	Data					
d)	Representation:	Bit 👻				
u)	Start:	25		Length:	7	
	Туре	Unsigned 👻		Endianes:	Little 👻	
e)	۹ <u>ــــــــــ</u>	16 2	4 3	2 40	48 56	
1	Conversion					
	Factor:	1,0	none/Bit	Minumum:	0,0	none
	Offset:	0,0	none	Maximum:	255,0	none
	Unitgroup:	none 💌			Adjust automatically	
	Unit:	none 🔻				
	Measurement Sheet					
	Select one, or enter	a new name:	•	The CAN-IN messa specified sheet.	age will be added for measuring	in the
					ОК	Cancel

a) Enter CAN message ID. If extended IDs (29 bit) are used, check the box.

- b) If replacement values are used, specify time-out period and raw value.
- c) If a multiplexer (row counter) is used, check the box.
- d) Enter data position, length and format.
- e) The bargraph shows the assignment of the bits.
- Red colored fields show the assignment of the data bits.
- Orange colored fields show the assignment of the multiplexer bits.

#### Conversion to physical values



a) Enter factor (gain) for conversion to physical value.

- b) Enter offset for conversion to physical value.
- c) Select type of physical value.

d) Select unit of physical value.

- e) Enter minimum physical limit of the channel. (for manual setup)
- f) Enter maximum physical limit of the channel. (for manual setup)
- g) Check the box to automatically adjust the limits of the channel.

#### **Special features**

#### CAN analyzer functionality

This functionality is only available, if a MSA-Box (I or II) is used to connect the DDU 10 to the PC. Choose the CAN bus that is connected to the MSA-Box to display the raw value and the converted physical value here.

 Measured Value
 Raw:

 -- bar
 --

#### Automatic creation of online measurement sheets

The CAN channel can be automatically inserted into a measurement sheet. Insert a name for a new sheet or select an existing sheet from the list box.

For an online view of the value measured by the DDU 10, insert the channel in an online measurement sheet which is described in the chapter Setting up an online measurement [> 46].

Measurement Sheet	
Select one, or enter a new name:	The CAN-IN message will be added for measuring in the
<b>▼</b>	specified sheet.

## 16.2.2 Import a CAN database (DBC) file

- 1. Click with the right mouse button on any CAN bus item.
- 2. Select 'Import CAN-IN messages from DBC file...' from menu.
- 3. A file browser opens.
- 4. Select the DBC file to import and click 'Open' when done.
- 5. A channel import window opens.

99 channels and 12 Name	U			Row	Description		channels to import:
ABS_Active	0	5C0	1	 11011	Description		
ABS_Lamp		5C0	1				Add ->
AX1	g						
AX1_Bremse60		5C0				Ξ	Add all
AY1	a	70	16				
AY1_Bremse60		5C0	16				
BLS		5C0	1				
BEBD_Lamp		5C0	1				<- Remove
P_Hz	bar	5C0	16				<- Remove
SwitchState		5C0	8				Remove all
WS_FL	m/s	140	16		Radgeschwindigkeit		
WS FL Bremse2	m/s	24A	16			Ŧ	
•							

- 6. Select the desired channels on the left and use the 'Add' button to add them to the import list.
- 7. Click 'OK' when done.

The channels are inserted in the Data window.

# 16.3 CAN output

# 16.3.1 Create a new CAN output message and channel

Double-click on any CAN bus item, to open the "CAN messages overview".

DUU18 Race Mode S2855 Mode										
ajoct	🗧 🛪 🗖 🖉 New Project 🗖 COUL	0 💌							Toolbax	
64 New Project									Devices	
COU10     Cooper	DOU10 CAN messages	mender							Displays     CAS-M3	
a Display	CAN Bus 1		CAN Bus 2			CAN Bus 3			COU10	
CAN Bus 1	Baudrate:	1 Mileod -	Baudrate:	1 Mileud	-	Baudrate:	1 Mileud		0007	
B GAN Bus 2				off.					0009	
(i) 🔂 CAN Bus 3	CAN Resistor:	• The	CAN Resistor:	off	¥	CAN Resistor:	aff	Ψ	COU-S2 Plus	
GAN Bus 4     Gomputed Channels	CAN Out start delay:	0 ms	CAN Out start delay:	0 ms		CAN Out start delay:		0 ms	ECUs M NSJ Sport	
a all VO Channels	CAN Out rate limit:	messages/ms	CAN Out rate limit:	0 me	553055/115	CAN Out rate limit:		nessages/ms	III NS4 Sport	
- S Calibration Items									MS4.6	
- 👒 Macros	CAN Bus 4								N515.1	
- A Math Channels	Baudrate:	1 MBead 👻							MS15.2	
A Conditional Channels     Group adjustments	CAN Resistor:	• To							MSS.0 MSS.1	
Master Devices		0 ms							MS5.2	
6 Measurement Container	CAN Out start delay:								NS5.5	
	ONI Out rate limit:	messages/ms							MS5	
	CAN configuration fille								M57	
	Certainga data me	GAN [n IDs 0 / 128				CAN Out IDs 0 / 1	10		MSS.8	
		CAN In channels 0 / 500				CAN Out channels 0			MS24 light	
	RABE CAN-IN	Add CAN-OUT							WCU KE NS25 Sport	
			t 💌 Length (Bits)	▼ Grid	<b>x</b> M 80	lexer Value 💌 Type		CAN Bus	REPOR	
		CAN Bus 2	c control form	0.0	- Party	con the	1000	Off Day	RSU-F3	
	i i i i i i i i i i i i i i i i i i i	CAN Bus 3							Cestern ECU	
specties	- i	CAN Bus 4.							Power control uni	t
	• ×								BB PSEX50	
24 🐨 standard - 🖂 - 😥									Display Eleme	18
		ornels 🕹 Conditional Channels							Measurement De	
	a sersos - ven ur			actus   • coupy	• Device into	Enterinto   M. P	estures mo		Measupement St	Herces.
		÷×	info / Status							
			Errors A Warnin	as (i) Messages						
the wo			T Time Send	er Nessage						
me Source Description	<ul> <li>Function</li> <li>Used</li> </ul>	1								
		N								
		No								
		information								

1. Select 'Add CAN-OUT' and choose the desired CAN bus for the new output channel.



ew CAN-OUT messag	je					<b>X</b>
New CAN-OUT me Configure the CAN	ssage -OUT message and an optional multipl	lexer.				<
	•					-
Name:						
CAN Message						
Description						
CAN ID:	0	🖨 hex	Extended			
Grid:	100 ms	•	Trigger channel:		<b>•</b>	
			Trigger on:	Rising		dge
			rigger on.	rusing	• ] 6	uge
Vse Multiplexer						
Representation:	Byte	•	Value:	1		
Start:	0		Length:	1		
			Endianes:	Big	•	
🜏 Add row 🔜 🛛	Delete row(s) 🔄 Add channel 📑	Add constant	Edit 🔄 Delete	Bit index inverted		
Byte 0 0 1 2 3 4 5	Byte 1 Byte 2	Byte 3 5 6 7 0 1 2 3 4 5	Byte 4	Byte 5 6 7 0 1 2 3 4 5 6 7 0	Byte 6 Byte 1 2 3 4 5 6 7 0 1 2 3 4	<b>7</b> 4 5 6 1
▶ 1 1						
					OK Can	icel

2. Enter name of message, description, CAN-Id and Grid (output interval). Optionally, specify a multiplexer.

	New CAN-OUT messa	age				<b></b>
	New CAN-OUT m Configure the CA	- essage N-OUT message and an optional multiplexer				S
	Name: CAN Message Description					
	CAN ID:	0	🗘 hex	Extended		
Definition of	Grid:	100 ms	•	Trigger channel:		•
CAN message				Trigger on:	Rising	▼ edge
5	Use Multiplexer					
	Representation:	Byte	•	Value:	1	* *
	Start:	0	*	Length:	1	A V
				Endianes:	Big	•
Content of	📑 Add row 📑	Delete row(s) Add channel 🛃 Add	constant	🕽 Edit 🗟 Delete	Bit index inverted	
message	Byte 1 0 1 2 3 4 ▶ 1 1	0 Byte 1 Byte 2 Byte 2 Byte 2 Byte 2 Byte 2 Byte 2 Byte 3 Byte 3 Byte 3 Byte 3 Byte 2	Byte 3 0 1 2 3 4	Byte 4 5 6 7 0 1 2 3 4 5	6701234567012	te6 Byte7 456701234567
5						
						OK Cancel

3. Click on 'Add channel' or 'Add constant', this opens the 'Add new CAN out channel' window.

4. Select the desired measurement channel and specify the message settings.

	System		
System Logger Display Calibration/Heasuring Tools	Windows		
Vertication of the constraint	note file to cod file from et system logge	Concerning     C	All conditional     Image from particular to fine (M) and classes.     Image from particular to fine (M) and classes.       Outcode     Image from particular to fine (M) and classes.       Outcode     Image from particular to fine (M) and classes.       Outcode     Image from particular to fine (M) and classes.       Outcode     Image from particular to fine (M) and classes.       Outcode     Image from particular to fine (M) and classes.       Outcode     Image from particular to fine (M) and classes.       Image from particular to fine (M) and classes.     Image from particular to fine (M) and classes.       Image from particular to fine (M) and classes.     Image from particular to fine (M) and classes.       Image from particular to fine (M) and classes.     Image from particular to fine (M) and classes.       Image from particular to fine (M) and classes.     Image from particular to fine (M) and classes.       Image from particular to fine (M) and classes.     Image from particular to fine (M) and classes.       Image from particular to fine (M) and classes.     Image from particular to fine (M) and classes.       Image from particular to fine (M) and classes.     Image from particular to fine (M) and classes.       Image from particular to fine (M) and classes.     Image from particular to fine (M) and classes.       Image from particular to fine (M) and classes.     Image from particular to fine (M) and classes.       Image from parting from particular to fine (M) and classes.     I
11 If and and         Image: Constraint of the second	Add Name		OK Growel B Vice Sector
Dela			
			Warnings () Messages
🗃 🗃 🗃 🗃 🖬 🖬 🖬 Showall		T., Time	Sender Message
Name Source Description	Function	Used A	
aéfa DDU10 aéfc DDU10		40.3	
abskp DDU10 Absolute lap counter			
accx DDU10 longitudinal acceleration		No	
accx DDU10 longitudinal acceleration accy DDU10 transversal acceleration			
acci DDU10 longitudinal acceleration accy DDU10 transversal acceleration accz DDU10 vertical acceleration		No information	
accx DDDU10 longitudinal acceleration accy DDDU10 transversal acceleration accz DDU10 vertical acceleration ACC_D942NOSTIC DDDU10 vertical acceleration			
CC     CD     DOU10     loogtudmixecelenton     accy     CD     DOU10     transversal accelenton     acco     CD     DOU10     ventos accelenton     ACC_DOU10     ventos accelenton     ACC_DOU10     Ventos     accelenton     Toggers the on-demand dayse     disposite_state     CD     DOU10     Series			
acce DDU10 longtudinal acceleration acce DDU10 transversal acceleration acce DDU10 vertical acceleration Acc_D046N0STIC DDU10 vertical acceleration		information	Ontig-theed intig-theed

The measurement channel is now assigned to the CAN message.

### 16.3.2 Add CAN out constant

To send a constant value on the CAN, perform the following steps:

- 1. Create a new CAN output message or edit an existing message.
- 2. Click 'Add constant'. The 'Add new CAN Out constant' window appears.
- Define the name of the constant, the required value in hex and define the CAN channel settings.

	·	Tota i a
	New CAN CUT message Catigues the CNACUT message and an optional multiplease CAN Incomp CAN Incomp CAN Incomp CAN Incomp CAN Incomp CAN Incomp CAN Incomp CAN Incomp	Addrew CAN out constant Addrew CAN out Addrew CAN o
de d'unes     de l'actionates     de de la constance     Mesurement Constance     Mesurement Constance	Use Multiplease Data Data Data Data Data Data Data Dat	Pinesa after a raise for the CM out consister         • KR3.1           Value (heit:         •           Pinesa after a raise for the CM out constant         • KR3.1           Pinesa after a raise for the CM out constant         • KR3.1           Pinesa after a raise for the CM out constant         • KR3.1           Pinesa after a raise for the CM out constant         • KR3.2           Pinesa after a raise for the CM out constant         • KR3.2           Right after 0         © Langth:         1           Right after 0         © Endewes         • KR5.2           • ****         ******         • KR5.2           • ******         • ************************************
Properties           11         * standard         • iii         · iii           Data         In         In         In           Data         In         In         In           Data         In         In         In		Algud name from visue     Algud name from visue     Algud name from visue     Algud name from visue     OK Concel     OK Concel
Name / ♥ Source ♥ Description  p.cd  Resolution  Resolution	No information	The filmer College Stephel 25 Ligs Stephel

4. Click 'OK' when done.

# 16.4 Multiplexer

#### Row counter concept

If certain channel messages are not time-critical and can be imported or exported slowly, you can use a multiplexer to put several channel messages on one message identifier.

- Re-use (multiplex) of message identifiers by splitting it into several rows.
- Every row is assigned to a unique value of the multiplexer.
- One byte of message contains row counter.

- 7 bytes payload remaining. A multiplexer does not have to consist of one byte only, it can consist of several bytes as well as single bits.
- Position of row counter is configurable.

To use a multiplexer perform the following steps:

- 1. Double-click on any CAN bus item to open the "CAN messages overview".
- 2. Select 'Add CAN-IN' and choose the desired CAN bus for the new input channel.
- Check the box 'Use Multiplexer' and configure the multiplexer for the new CAN-IN channel.

System Legger D	isplay C	albration/Measuring Tools W	New CAN-IN messa	ge .			_	<b></b>		<b>•</b>
	0		New CAN-IN me	ssage ew CAN-IN message and an	optional multi	plexer.		\$		Ĩ
	itection Shee		Name:							
	tt Security		CANChannel							
Project	ŶΧ	Seblew Project 🗰 COULO 💌	Description							Toolbax 9 ×
		CONID CMI mesogra overweit CON Dis 1 Badvatet: Inflemat CMI essenti: all CMI obstate Init: CMI obstate Init: CMI leastor: af CMI leastor: af CMI leastor: af CMI leastor: af	CAN ID: Timeout: Measurid Value Value Value Value Representation: Start Type Data Representation:	0 8 Dyte - 3 (d) Utnigned - Byte -	•	Default value: Raw:  Value: Length: Endienes:	0 A	IBN	0 ms 9 mesagestras	Dardees           © Obglink         A           © Obglink         B           © Obglink         B
Measurement Container	0 ×	CAN configuration fill level	Start: Type	0 0 Unsigned		Length: Endianes:	1 0	_		MS7 MS7 MS24 MS24 MS24 light VCU 80 MS25 Sport
		Name ^ *	Conversion						CAN Bus	AT PDB
Show all		Multiplexer	Factor:	1,0	none/Bit	Minumum:	0.0	none	CAN Bus 1	Bypass ECU
Name / X Sou	No	🗎 p_ol	Offset:	0.0	none	Maximum	255.0	none	CAN Bus 1	Custom ECU
	infor		Unitgroup:	rone	-		Adjust automatically			Power control unit     Psxso     T
	matio		Unit	none	-					Display Elements
4 III F	n	Statistics	Measurement She	et						Measurement Bements Measurement Sources
tríp í Satur	_		Select one, or ente	r a new name:		The CAN-IN me	ssage will be added for measuring	in the		
Errors A Warnings (1) Messa						<ul> <li>specified sheet</li> </ul>				0/0 X
T Time Sender Messa			1					-		
Too Toole Messa							ОК	Cancel		
Info / Status GAN Log - Stopped Str		al				_		_		
	- ug - Stoppe									
Ready.								No errors detected -	ell deared or state unknown 🔹 🛄 New Pro	ject/DDU10/CAN Bus 1 🚥 🚥

- 4. To configure the multiplexer for a CAN-OUT channel, select 'Add CAN-OUT'.
- 5. Check the box 'Use Multiplexer' and click on the button 'Add row...' to split the message identifiers into several rows.
- 6. Click on one row and select 'Add channel' to assign a channel to the row.

Status Mode oject 6 X	Die New Project 📾 DOUS	10 ×	New CAN-OUT m	nessage					Testes
A management of the second secon	COVIDENT CALL RESOLUTION COVIDENT COVIDENT CALL CALL STATE CALL CALL STATE CALL CALL STATE CALL CALL STATE CALL CALL STATE CALL CALL STATE Name	SPERTORN 1 Millioned (of 1 Millioned (of Add CAN-CALL) CAN II	Anne CAN Message Demosphere Grad CAN DC Grad National Nat	0 156 ms 156 ms 150	optioner inutgioner.	5 6 7 0 1 2 5 6 4	Rising	• • • • • • • • • • • • • • • • • • •	Other         Control           0         Control           0 </th

The 'Add new CAN out channel' dialog opens.

- 7. Select a channel and configure it. To assign it to the row selected before, check the box 'Multiplexed'.
- 8. To move the channel message, change the "Start" value or click and hold the green field in the "Add new CAN out message" window.
- 9. Click 'OK' when done.

Specify the prop	erties of the CAN	out channel.			
Channel:					
💼 😬 b_pwr_good					•
8 Bit unsigned / little	endian				
Representation:	Byte	•		V N	lultiplexed
Start:	4		Length:	2	
Right shift:	0		Endianes:	Little	•
	E Force quar	ntization			
Factor:	1.0		Offset:	0.0	* *
Туре:	Unsigned	•			
0 1	2 3	s 4	5	6 7	

- 10. The channel message is assigned to the selected fields.
- 11. Click 'OK' when done.

System Lagger Di	splay Calibration/Measuring	System Tools Windows	-	DDU10.rlp - ReceCon V2.5.	5907.11 *	-	-	-	• •
	CAN Basis Bushamic CAN Basis CAN BAS	torons     in	Name: CAN Mossipa: Exerciption CAN ID: 0 Grid: 100m Regressentation: 0 6 Add rows: 0 Ordere 1 2 3 Add rows: 0 Ordere 2 3 Add rows: 0 Ordere	nemergen and en optional multipleas to TomO	tex     Trigger cta     T	Rinny 1 1 Bg Bg Bit Index Inverted 545 4 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	• ====================================		2A6-H8 200101 20017 20017 2001-52 78m K5 Sport K5 Sport K
Reedy.							This errors detected - all	I deared or state unknown 🔹	ne selecter i 😁 🥥
	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	
0x100	0	💁 p_oil		🔄 t_oil					
0x100	1	⊴s_dam_fl		💁 s_dam_fr					
0x100	2	💁 s_dam_rl		⊴s_dam_rr					
Message Id	Row Counter	Payloa	ad Area						

# 17 Recording and Telemetry

Some of the functions described below may require an upgrade. Please refer to the data sheet of your device.

# 17.1 Features

#### Recording

- Synchronized recording of DDU 10 analog and digital input channels, DDU 10 internal measurement channels, ECU data, Data from external sensor interfaces
- Up to two independent recordings
- Measurement rate 1 ms to 1 s
- Two global start conditions (thresholds)
- Up to 16 measurement conditions (fast-slow-switches)

#### Telemetry

- Support for long-range online telemetry
- Individual programmable team code
- Fast block slow block mechanism
- Programmable data rate

#### **Burst telemetry**

- Support for burst telemetry (BT 60)
- Programmable IP configuration
- BT 60 diagnosis via DDU 10

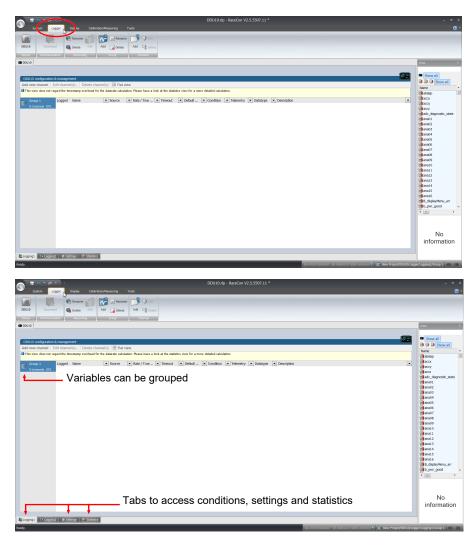
# 17.2 Configuration of Recordings

- 1. Expand the 'Logger' list by clicking on '+' in the DDU 10 Project Tree.
- 2. Double-click on 'Logging' in the DDU 10 Project Tree.

The recording configuration is displayed in the Main Area.

DDU10	*	_ Click on '+'
🚊 💷 Logger 🗲		
👜 💼 Logging1 🔶		Double-click on
🖽 💼 Logging2		<ul> <li>'Logging'</li> </ul>
🖶 📼 Display		55 5
🖶 🕒 CAN Bus 1		
🖶 🛄 CAN Bus 2		
🖶 🛄 CAN Bus 3		
🎰 🕒 CAN Bus 4	=	
<ul> <li>Computed Channels</li> </ul>		
🖶 🐗 I/O Channels		
晴 Calibration Items		
- 🖷 Macros		
- fr Math Channels		
fr Conditional Channels		
- Sroup adjustments		
Master Devices		
🛓 简 Measurement Container		
🛓 📄 Measurement Folder 1	-	
Dranartian		
Properties	+ ×	

3. Alternatively, click on the 'Logger' tab to open the configuration directly.

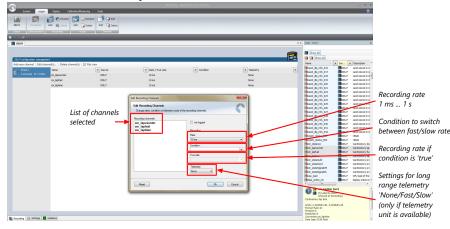


1. To add a measurement channel to a recording, select the wanted channel, drag and drop it onto the measurement group.

Renarme 💕 👔	VNASLANDY Told Proves Datas George Obters Channel				
id new channel   Edit channel(s)   Delete chann					Dota cm
					Show all
					Name
Croup 1 Lopped Name 2 chavane 00. If on populater II on papal II on papal II on papal	Source     Ref / Tue,     Timeout     DOUL0     DOUL0     10 ms     DOUL0     10 ms     DOUL0     10 ms	efault 💌 Condition 💌 Telemetry None None None	Debutype     To Description     Bit unsigned     Cardinemory the counter     32 Bit float     Cardinemory hall consumption t     32 Bit float     Cardinemory lap time	properties	Cm_lspcouter Cm_lspcuter Cm_lspcut Cm_lspcme Cm_stateSynaMes Cm_stateSynaMes Cm_stateSynaMes Cm_stateSynaMes Cm_stateSynaMes Cm_stateSynaMes Cm_stateSynaMes Cm_stateSynaMes
	Drag meas channels i				ern, stateSprastog msdcom_omdRxCf msdcom_omdRxCf msdcom_omdRxFi msdcom_omdRxFi msdcom_omdTxCr msdcom_omdTxCr msdcom_omdTxCr msdcom_omdTxCr msdcom_omdTxCr msdcom_omdTxCr msdcom_omdTxCr msdcom_omdTxCr msdcom_omdTxCr
ogngt if a (sogna) i 🖉 Settings i 🕊 Sekator i					Image of the second secon

1. To edit channel settings, mark the channel(s) and click 'Edit Recording Channel(s)'.

An 'Edit Recording Channels' window opens (if you choose only one channel, the window looks a bit differently).





#### NOTICE

If no recording condition is defined or the recording condition is 'false', measurement channels are recorded at the value chosen in 'Rate'.

If the condition is 'true', measurement channels are recorded at the value chosen in 'True rate'.

2. Click 'OK' when done.

### 17.2.1 Adding a recording group

Recording channels can be grouped. These groups will also be visible in Darab and will help to get a better overview during the data analysis

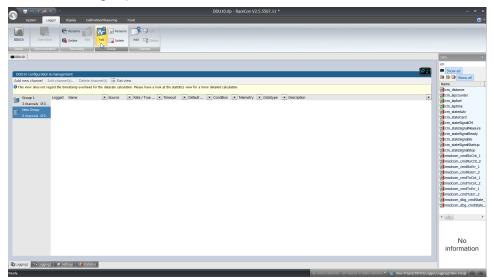
1. To add a new group, select the 'Logger' tab.

The 'Logger' window opens.

2. Click on the 'Add' button.

A new group will be added and can be renamed 'Gearbox', 'Aero', 'Engine', etc..

3. To rename a group, click on the 'Rename' button next to the 'Add' button.



## 17.2.2 Logger settings

To display the global DDU 10 settings, open the 'Logger' window and click on the 'Settings' tab at the bottom.

Download Add			
COULD 1			ons e Denne all di di di Scow all Hanne e r Hon distance
a)	DDU10 settings Main settings	The fragmentation space 20 2 HB	Conception Secondary
<b>b</b> )	Application: Race track •	File fragmentation time: 300 🚖 sec	on_stateSgnaMosure
:)	Recording 1 - Logging1 Type: Engine recording  Statusblock: Configuration fie: Use FST ontent Use FST in fie	Recording 2 - Logging2 Type: Statusblock: Configuration file: Use PST context J Use PST reference	munication and a static sector a static sector and a static sector a stat
l) (l	Globel start conditi	Global start condition	Bindscom_cmRxErr_1 Bindscom_cmRxErr_2 Bindscom_cmRxErr_2 Bindscom_cmRtxCrt_1 Bindscom_cmRtxCrt_2
e)	Passwerd protected data can only be spened by wenturals v/#     Set password	Password presented data can only be opened by weenaute or:     V like password from recording 1     Set password	msdcom_ondTxErr_1 msdcom_ondTxErr_2 msdcom_dbg_ondState_
			No information

- a) Choose setting for outing counter mode:
- For testbench (without lap trigger) select 'Testbench'.
- For racetrack (with lap trigger) select 'Racetrack'.

*b)* Choose wether the logging partition shall be named Engine recording or Chassis recording. *c)* Advanced setting: Select your logging configuration file, if provided by your Bosch Support Engineer.

- d) Choose or create the condition to start recording
- e) Enter a password hint and a password (optional).

f) Setting for automatic fragmentation. Do not change!

# 17.2.3 Recording statistics

The tab 'Statistics' shows the channels' allocation and their current data rate related to the transmission frequency of the DDU 10 and the whole transmission system.

The overview helps to detect bandwidth bottlenecks of channels. Bandwidth bottlenecks can be solved by changing the logging rate setting for each channel.

The data rate of the whole system is often less than the data rate of the DDU 10 and limits the overall transmission speed.

DDU8 sta	tistics									_			
DDU8	1 ms	2 ms	5 ms	10 ms	20 ms	50 ms	100 ms	200 ms	500 ms	1:	sync	Total	Data rate [KB/s]
Channels	0	0	0	4	0	0	0	0	0	0	0	4	0,80
Limit	720	720	720	720	720	720	720	720	720	720	0	720	200
System													
Channels													0,80
Limit													300

### 17.2.4 Recording diagnosis

The channel 'statectrl\_ok' of the DDU 10 can be used for online monitoring of recording status.

Bit	Value	Name
0	1	RECORD

Bit	Value	Name
1	2	DATAOK
2	4	BLKOK
3	8	-
4	16	-
5	32	-
6	64	STARTED
7	128	-

#### Content of status bits

Name	Bitset	Bit cleared
RECORD	Measurement data is re- corded.	No measurement data will be stored because meas- urement thresholds are not reached.
DATAOK	Received data without error.	Discarding received data because of wrong timestamps. Check wiring of SYNC signal.
BLKOK	All measurement blocks have been set up cor- rectly.	Some measurement blocks have not been set up correctly.
STARTED	A measurement has been set up.	A measurement is not set up. Either no recording configuration has been found or logger software upgrade is not activated.

# 17.2.5 Displaying online recording diagnosis ("statectrl\_ok")

- 1. To add a Recording Diagnosis element to a measurement sheet, drag a 'Bit-LED' element from the Toolbox and drop it on measurement sheet.
- 2. Drag channel 'statectrl\_ok' from the Data Area and drop it on the 'Bit-LED' element.

Project # X	○ + 設 Synchronize ・ 】 Design mode ▶ ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ●	X Toobox 9 :
E 🙀 New Project		Devices
DDU8		Display elements
🖻 🛗 Measurement Container		Measurement elements
E- Measurement Folder 1		Knob
- Sheet 3		Characteristics
Sheet 2		Block, Curve or Map
		- Value
	tatechi_ck 🦻	Diagnostics
	8 7 6 5 4 3 2 1	JI Bit-LEDs
		- Common
		Container
		T Image
ata-DDU8 a 🗙	Gi Sheet 3 🐼 Sheet 1 🥵 Sheet 2	Measurement List
		110 Simple Text
	p	
lsed Type Name 🕔 💌 📥	Errors 🚹 Warnings 🚺 Messages 0/0	Cociloscope
🛛 😅 statectri_ok	Type Time Sender Message	-I Controls
🗠 t rad out 👘		
두 trad_out		Measurement sources

The 'Bit-LED' element shows the state of received channel data in bit-representation. A green highlighted channel means 0, a red highlighted channel means 1.

- Measurement correctly initialized, but recording threshold(s) not reached: 254
- Measurement correctly initialized, DDU 10 is recording data: 255
- Values less than 254 indicate an error state

# 17.3 Configuration of online Telemetry

# 17.3.1 Long range telemetry system FM 40



440 MHz band

25 KHz bandwidth

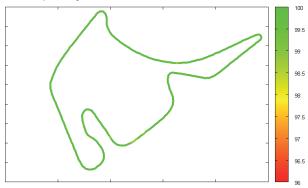
10 W max. RF output

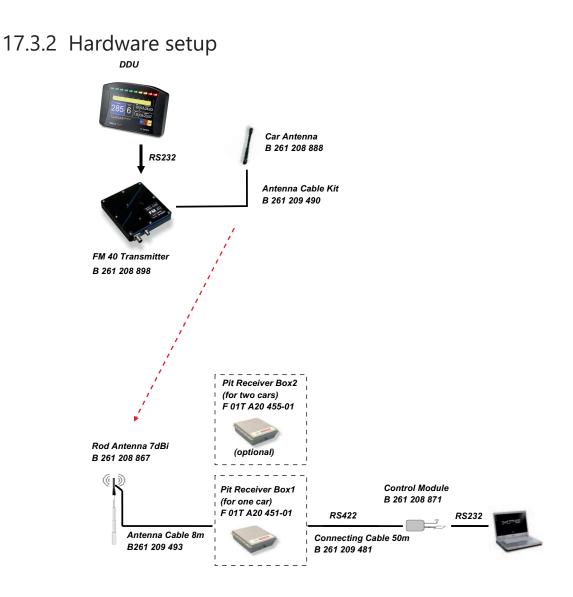
19.2 kBit/s data rate - unidirectional

RS232 interface

Full online track coverage on almost all tracks

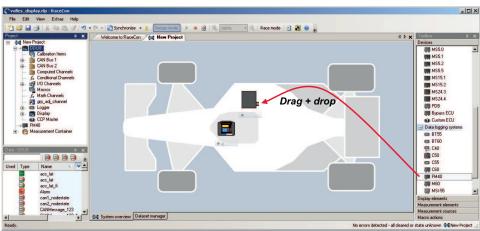
#### Link quality at Hockenheim





## 17.3.3 Software setup

1. Drop FM 40 from Toolbox into system overview.



2. Click on FM 40 in Project Tree to display the Properties Menu.

Properties - FM40	
1 2↓   🌾 all 🔹 🧐 standard 🔹 💷 🐨	Baudrate of DDU (must match baudrate of FM 40)
Device properties	
Name FM40	
Security	Transmission pause
Protection False	
Telemetry properties	(5% recommended for improved re-
Baud rate 19200	synchronisation)
Pause [%] 5	
Project Key 4711	
WDServer folder C:\Bosch\DLS\WinDAf	Project Key (11119999)
	Path to configuration folder of WDServer on receiver PC (usuallyWDServer\DCP) to store telemetry configuration file
WDServer folder Folder for WDServer configuration files	

#### Adding channels to telemetry

- 1. Expand the list of 'Loggers' by clicking on '+' in the DDU 10 Project Tree.
- 2. Double-click on 'Recording' in DDU 10 Project Tree.

The recording configuration is displayed in the Main Area.

3. Click 'Edit channel(s)'.

The 'Edit Recording Channels' window appears.

4. Choose between 'Fast/Slow block' transmission.

#### Using fast block/slow block transmission

DDU 10 telemetry uses available bandwidth of Telemetry Unit FM 40 (19,200 baud -> approx. 1,700 bytes/s). The bandwidth has to be divided into channel information to be transmitted high-frequently and low-frequently using the 'fast/ slow block' setting.

Channels are grouped into 8 blocks which are transferred each cycle:

- Fast block (Block 1) is transferred every cycle and used for a high-frequent transmission of channel information (e.g. speed, rpm).
- Slow blocks (Block 2...n) are transferred every n-th cycle and used for a low-frequent transmission of channel information (e.g. tire pressure, oil temperature).

Transmission Scheme



If the maximum bandwidth of a block is reached, a warning will be displayed. To fix this problem you can view the allocation of the channels and data rate in the 'Statistics' tab of the Main Area.

	_
Recording channels: f wheel rr	Bate:
f_wheel_rl f_wheel_fr f_wheel_fl	
	True rate:
	Telemetry Fast

None – channel(s) are not transferred Slow – channel(s) are transferred in the slow telemetry block Fast – channel(s) are transferred in the fast telemetry block

See also

Adding a recording group [▶ 124]

### 17.3.4 Telemetry channels with special functionality

The FM40 allows the transmission of special information such as running distance of current lap, lap number of current lap and lap time, fuel consumption of last lap completed. You have to assign the channel type to the telemetry channel so that it is recognized accurately by RaceCon.

Channel's names are e.g.: distlap, fuelcons, lapctr, laptime. Different channel names are possible between different devices (e.g. ECU MS 3 Sport, ECU MS 5.1).

- 1. Double-click on FM40 in the project tree. An overview of all available telemetry channels is displayed.
- 2. Click on the 'Settings' tab at the bottom, to edit the channels.

FM40 settings				
General Settings				
WDServer folder:	C:\Bosch\WDServer\DCPs			
Project key:	04d2		hex	
Baudrate:	115200	-	bps	
Pause:	5		%	
Max. channels:	512	▲ ▼		
Lap number channel	:		-	
Lap fuel channel:				
			-	
Lap time channel:				
			-	
Lap time channel:	Ŀ		▼	

- 3. Assign the desired channels to the channel types. The table below shows the function of the available channel types.
- 4. Click 'Ok' when done.

Measurement channel	Function
Distance	Running distance of current lap
Lap number	Lap number of current lap
Lap fuel	Fuel consumption of last lap completed
Lap time	Exact lap time of lap completed

The telemetry channels and their assigned channel types are displayed in the overview list.

Collid         D0U8         2         Slow           uttop         MSS1         2         Fait         Lap distance           exkors         MSS1         2         Fait         Lap fuel           optime         MSS1         2         Fait         Lap fuel           plime         MSS1         2         Fait         Lap fuel	Add a new channel	₽ Ed	it channel(s)	🔒 Delete char	nnel(s)					
intop         MSS1         2         Fast         Lap distance           weborik         MSS1         2         Fast         Lap hell           och         DDUB         1         Fast         Lap number           ptime         MSS1         2         Fast         Lap number	Name	- <b>v</b>	Source	*	Width (Byte)	*	Telemetry mode	*	Channel type	~
John         2         Fast         Lap (sel           pot         D0U8         1         Fast         Lap number           plime         MSS1         2         Fast         Lap number	ecc_lat		DDU8				Slow			
potr DDU9 1 Fast Lop number ptime MS5.1 2 Fast Lop time	fistlap		MS5.1		2		Fast		Lap distance	
ptime MS5.1 2 Fast Lap time	uelcons		MS5.1		2		Fast		Lap fuel	
	apotr		DDU8		1		Fast		Lap number	
ime FM40 4 Fast Time	aptime		MS5.1		2		Fast		Lap time	
	time		FM40		4		Fast		Time	

# 17.4 Configuration of Ethernet Telemetry

The usage of ethernet telemetry requires the software upgrade ETHER\_TELE (Enable ethernet telemetry).

### 17.4.1 Hardware Setup

You can use ethernet telemetry to connect a transmitter on an ethernet line of your device, to send the data to a pit unit and from there to your computer. It is also possible to connect the ethernet line directly to your computer, for example when you use the device on a dyno.

# 17.4.2 Software Setup

The following steps will show you how to insert an FM40 telemetry device in the RaceCon project for your vehicle. Please note that, in order for this action to be available, first you have to configure a data logger in RaceCon.

1. In the toolbox of the device, click on an FM40 telemetry device and drag it into the project window.

Please note that at this point, an ethernet module has not been integrated into the RaceCon software, yet. However, ethernet telemetry setup within RaceCon is identical to that of the FM40.

2. Adding a FM40 should open up the FM40 settings window. If this window does not show up, select FM40 - Settings.

reate a new Teleme	tryFM40	×
	and properties for the new FM40. nannels for the telemetry. You may also change the telemetry settings.	
General Settings WDServer folder: Project key:	C:\Users\ktl2abt\Documents\RaceCon Projects 04d2	 hex
Baudrate: Pause: Max. channels:	5 512	v bps %
Channel settings Distance channel:		•
Lap number channel Lap fuel channel:	k:	•
Lap time channel:		•
Lap distance chann	el:	•
	ОК	Cancel

- 3. Define the settings as described below:
  - WDServer folder: This is the folder where the ".INI" files for the WDServer are stored. Please make note of this folder path, as this path will need to be referenced by WDServer in order to enable telemetry live viewing and logging.
  - Project Key: The project key is a data security function, that is used by Darab to differentiate data from different users. This key should always be 4 digits long.
  - Baudrate: Set to 115,200 bps.
  - Channel settings: Select the needed channels for the FM40 configuration.
- 4. Change to a calibration/measuring page and drag and drop the following channels to the measurement sheet:
  - TELE\_UDP\_IP,
  - TELE\_UDP\_PORT,
  - TELEMETRY\_MODE.
- 5. Change the TELEMETRY\_MODE to UDP.
- 6. Set the TELE\_UDP\_IP to the IP address of the receiving device.
- 7. Set the TELE\_UDP\_PORT to a unique value for each unit. This will be relevant when connecting to WDServer.
- 8. Define your telemetry channels.

### 17.4.3 Setting up car in WDServer

WDServer is a program used to capture data streaming from a transmitter and convert to WinDarab; WDServer also creates a log of the data received over telemetry.

Computer Car Application Car	C70_Test.bmscfg - WinDarab Server			- O X
Computer Car Application  Car Settings  Computer Car Application  Car Settings  Computer Car Application  Computer Car Application  Computer Car Application  Car Settings  Computer Car Application  Computer Car Application  Car Settings  Computer Car Application  Computer Car	Workdesk CF-Cards Telemetry Protocol Options ?			
	Port: UDP-10000     Byte/Sec:: 0     Byte/Secce     Byte/Secce     Byte/Secce     Byte/Secece     Byte/	Computer	Car	Application
	Car Settings			
Press F1 to obtain help. NUM	Press F1 to obtain help.			NUM

- 1. To set up a new car, select 'Add Car'.
- 2. In the Car settings tab, enter a name for the new vehicle.

This name will be used as a part of the file name for WDServer's log of received telemetry data and will show up in WinDarab, when searching for the telemetry stream in the Network folder.

Car settings		×
Car settings UDP:10000 New: COM		
Car name	Data output to back	up system
Name: Car #1	Port:	<b>_</b>
Comment:	Baudrate:	9600 👻
<ul> <li>Use global settings (Workdesk/Settin</li> <li>This folder:</li> <li>Lap protocol</li> <li>Print to:</li> <li>Save to file:</li> </ul>	ngs/Telemetry) No of lines per p	age: 64
ОК Са	ancel Apply	Help

You are now at the final step of configuring the telemetry stream. In order for the data to be decrypted by WDServer, two \*.ini files must be referenced by WDServer. After the configuration is sent to the logger, these two different \*.ini files will be created in the base folder. You can find the base WDServer folder, if you right-click the FM40 and select 'Properties'. You can change this folder location for easier access if desired.

3. Define the link to the folder of the \*.ini files for each car or define it in the general WDServer settings, under the 'Telemetry' tab.

Settings
Common Network adapters Telemetry
Folder with the DCP-Configuration files C:\Users\kfl2abt\Documents\RaceCon Projects Change
Template for the darab file name
[year]-[mon]-[day] [hour].[min] Car [camame] File #[n]
Folder to save the darab files in Change
OK Cancel Apply Help

- 4. Under the 'UDP' tab, select the drop-down menu and type in "UDP".
- For the UDP Port, type in the port number assigned to the device in RaceCon.
   Each vehicle being read by a single receiver device must have a unique port number.
   This information will be provided by Bosch upon delivery of the devices.

Car settings	x
Car settings UDP:10000 New: COM	
Settings	
Port: UDP 👻	
Udp Port: 10000	
OK Cancel Apply He	elp
OK Cancel Apply He	

- 6. Click 'OK', to close the window.
- 7. Select the button 'WDServer Settings'.

8. Under the 'Common' tab, choose directories where WDServer can store its temporary files and log files. These are created during telemetry reception and can be used to help diagnose issues.

Under the 'Telemetry' tab, the first section requests a folder path for the DCP- Configuration files. This is the folder path where RaceCon stored the \*.ini files required by WDServer.

Click on the "Change" button next to this section and navigate to this folder.
 A template can also be specified for the file nomenclature for logged telemetry as well as a save location.

Settings X
Common Network adapters Telemetry
Folder with the DCP-Configuration files C:\Users\kfl2abt\Documents\RaceCon Projects Change
Template for the darab file name
[year]-[mon]-[day] [hour].[min] Car [carname] File #[n]
Folder to save the darab files in
Change
OK Cancel Apply Help

- To insure proper communication between WDServer and the receiver, do not delete any old \*.ini files from this folder path. As mentioned in section 5, RaceCon will generate a new \*.ini file each time a project is synchronized; each new \*.ini file instance has an incremented file name. Retaining all of these \*.ini file iterations will insure that WD-Server always has a reference to whichever configuration is programmed into your vehicle's logger system.
- If the RaceCon project for the vehicle resides on a different computer, than that which is used for telemetry, then all \*.ini files for a given project should be transferred to the telemetry computer after every data synchronization in RaceCon. WDServer may have trouble recognizing \*.ini files stored on removable media, so best practice is to copy these files to the telemetry computer's hard drive.

# 17.4.4 Loading the telemetry data

The following is an example of a file name and data format for Car #91. File is typically located in WinDarab/Config/WDServer:

Open He	Nindewolf,051C) + Beach + Windowsh + Config	a sufficience			- 14	Second Williamer		-
Organiza - New Futuler	and the second second second				-14	Clarent states and states	- 11	
MinDead 47 MinDead 47 MinDea	News #6.460-TockLaptop - Cer #81.8mmods	Determedikel Landekoltuler	Typer WorDowsk Talametry	305 1.02				
Musi:     Picture     Note:	•				+ faible to location	All supported line (*	Amailan*	

In the File Explorer, click 'Open' and navigate to the data set. Under 'Network', search for the car or cars that are required for viewing.

# 17.5 Setup for USB recording

This function requires the installation of Software Upgrades. Look into the datasheet of your device, to see which upgrades are available for your device.

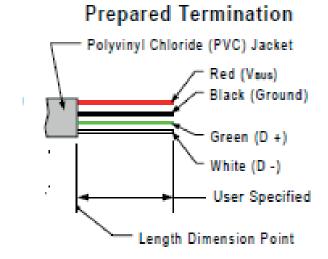
Software Upgrade USB\_DATA enables USB recording. To activate Software Upgrade USB\_DATA, enter the license key as described in the chapter 'Feature activation' [> 19].

For USB recording, Software Upgrade FULL\_LOG\_1 should also be enabled.

#### Wiring harness

Bit	Value
USB_Device_Power	Power (red)
USB_Device_DP	D+ (green)
USB_Device_DN	D- (white)
USB_Device_Gnd	GND (black)

For further information, see the pinlayout of the device.



Colors matching a standard USB cable

#### Storage device

The recording function can be used with a dedicated Bosch Motorsport USB device. The USB device has to be preformatted with the Bosch File System (BFS) in RaceCon before first use.

To format the USB device with the Bosch File System (BFS), do the following steps:

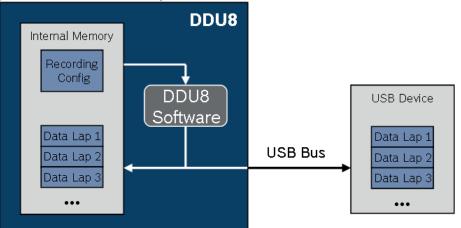
In RaceCon, select 'Tools' - 'Extras' and choose 'Format USB stick'.

Press 'Format'.

An USB device is recognized by Windows as a 'storage medium', but it can only be initialized with RaceCon and read with WinDarab.

### 17.5.1 Recording data on a USB device

- 1. Plug an USB device to DDU 10.
- 2. Prepare a recording configuration in RaceCon.
- 3. Power on the system and connect with RaceCon to the vehicle.
- 4. Download the configuration to the DDU 10.
- 5. Record measurement data. If an USB device is present, the DDU 10 stores the data in parallel on the internal memory and the USB device.



- 6. Power off the system.
- 7. Remove USB device from the vehicle.
- 8. Start the WinDarab software.
- 9. Click on the 'Import/Export' icon.
- 10. Select 'Data logger CXX/DDUX/MSX' and click 'OK' when done. The 'Read measurement data' dialog opens.

	💦 🖉 WinDarab v7 Free Graph Display = = 🛪
	Start Tools Windows Channel Style * &
Click 'Import/	Mew     Description     Description     Description     Description     Description       Base     Ent     Base     Tage     Tage     Tage     Tage     Tage       Centrol     Setting:     Addition     Curror     Description     Description     Description       Description     Setting:     Addition     Curror     Description     Description     Description
	File Depleter: 0 × Measured Data #1 0 ×
Export'	Image: State
	Image: Construction of the horizone shaded build
	1914 MB free

11. Click on 'Settings' tab and select the option 'Flash Card/USB Stick'.

12.	Click 'Apply changes'.	
	Tata Logger Import	

Device/Flash      IP / Device: DDU8 - 10.10.0.207      Export file: One file for each outing      Vice/Flash	New
IP / Device: DDU8 - 10.10.0.207 -	
Export file: One file for each outing	
	1 hies
Save files in: C: \Bosch \WinDarab V7\Data	
Subfolder template:	[a]+
Filename template: [n][CardInfo] (year]-[mon]-[day] (hour].[min] #[n]	[a]+

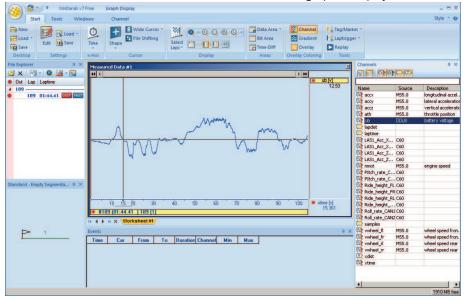
- 13. Change to the 'Current import' tab.
- 14. Insert the USB device. Data transmission from the device starts automatically, if "import all on connect" is selected in the settings, otherwise start the import manually. Measurement files are stored automatically in the base folder.
- 15. Click 'Close' when transmission has finished.



#### NOTICE

Refer to the WinDarab V7 manual for instructions on how to use the 'Data Logger Import' dialog and for more detailed descriptions and instructions.

- 16. Click on the Start button and choose 'Open measurement file'.
- 17. Select the measurement files from the storage folder.
- 18. Click on 'Open'.
- 19. Click 'New Desktop' to open a new measurement data window.
- 20. Drag the desired measurement channel from the Channel list and drop it into the measurement data window. The measurement channel's graph is displayed.



### 17.5.2 USB device handling hints

#### Using the USB device

Always plug the USB device into vehicle before power up to ensure that all measurement data is stored on the USB device.

If the USB device is plugged in after recording has started, only the current data is saved. Data recorded on the DDU 10 before the USB device is plugged in will not be saved.

#### Removing the USB device

Always power off the system before unplugging the USB device!

If the USB device is unplugged while recording is active, parts of the measurement data may be missing.

If the USB device is unplugged and re-inserted for < 4 s while the DDU 10 is powered up, the DDU 10 still records data.

If the USB device is unplugged and re-inserted for > 4 s while the DDU 10 is powered up or a different USB device is plugged in, the DDU 10 restarts. In this case, the DDU 10 is not operational for 1.5 s.

# 17.5.3 Troubleshooting

When no data on the USB device is recorded:

Configure the measurement label **usb\_mediastate** on a RaceCon measurement view or on a DDU 10 display page.

The value of **usb\_mediastate** reflects the operating condition of the USB bus:

State	Description
0: Wait: Device not found	The USB device is not found (also: waiting for re-plug stick). No USB device inserted. USB device is defect. No electrical connection or wiring harness problem. USB software upgrade not activated (Purchase of unlock code needed).
1: Wait: Device detected	An USB device is found, but not yet installed.
2: Ok: Media installed	The USB device is found and is operational (idle). This does not imply that recording data is written!
3: Stop: Device unplugged	The USB device has been removed. The DDU 10 performs a restart when an USB device is re- plugged in.
4: Ok: Media access	Data is currently read from/written to the USB device.
5: Error: Media error	The communication to the USB device broke down. The USB device is defect. The USB device is not supported by DDU 10.
6: Error: Media corrupt	The USB device is not in valid BFS format. (Hint: Re-format the USB device in RaceCon.)

# 18 Ambient Light Sensor

The DDU 10 is equipped with an ambient light sensor. The sensor is located at the front of the DDU 10 below the LEDs on the right side. The sensor is linked to the channel "eamb" with the unit lux.

The ambient light sensor can be used to calculate an automatic brightness switch. To use this function, please follow the steps below.

1. Measure the range of light intensity in your vehicle during all relevant conditions.

The easiest option to evaluate the needed range is to log the "eamb" channel and expose the vehicle to the brightest and darkest conditions it will face during usage.

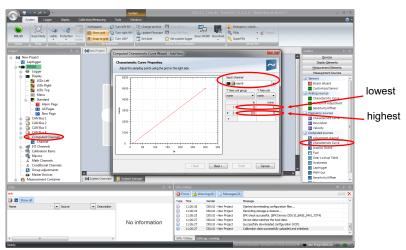
In this example, the expected value will be 10 lx as the lowest and 300 lx as the highest measured light intensity in the cockpit.

2. Drag and drop a "Characteristic Curve" from the "Computed Sources" onto the "Computed Channels".

This will open the configuration wizard.

- 3. Select "eamb" as input channel.
- 4. Assign the lowest lux value to the highest possible brightness switch setting (6) and the highest lux value to the lowest switch position (1).

This will generate a linear change of the switch. If needed you can include additional points to change the linear behavior.



5. Click "Next" when all points are defined as needed.

The "Analog Source Properties" window opens in the wizard. The maximum and minimum value of the channel is automatically assigned according to the previous settings. In general, it should be from 1 to 6.

- 6. Click "Finish".
- 7. Assign a suiting name to the new channel and click "OK".

In this example, the channel will be named "Ambient\_Light\_Switch\_Computed"

To avoid a toggling brightness setting, a math channel with a kind of hysteresis has to be created.

- 8. Double click on "Math Channels" and click on "Add channel".
- 9. Copy the Formula below into the new math channel and replace the example name with your name of the computed channel.

*latch*(#DDU10#Ambient\_Light\_Switch\_Computed+0.5, *abs*(#DDU10#Ambient\_Light\_Switch\_Computed-#DDU10#display\_brightness) > 0.6)

The formula compares the brightness setting of the device with the computed channel. If the deviation is within a certain range, it allows sending of the new value to the device. This formula only works correctly if it is used as the brightness switch channel.

- 10. Assign a suiting name to the new channel and click "OK".
- 11. Go to "Display" "Settings" and define the created math channel as the brightness switch channel.
- 12. Define the percentagewise brightness of the display and the LEDs according to each switch position.

# 19 Open Source Software (OSS) Declaration for the Display

These third party software components are used within the graphic rendering engine

# 19.1 EZXML License

The ezxml library (ezxml.sourceforge.net) provides XML model parsing support for the Graphic Engine.

Applies To:

libgre.dll, libgre.a

The ezxml xml parsing library is used by all Graphic Engine runtime configurations

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# 19.2 Simple OpenGL Library License (SOIL)

The SOIL library (http://www.lonesock.net/soil.html) is used to load images in a Graphic application.

Applies To:

libgre.dll, libgre.a

The SOIL image library is used by all Graphic Engine runtime configurations

Jonathan Dummer

2007-07-26-10.36

Simple OpenGL Image Library

Public Domain

using Sean Barret's stb\_image as a base

Thanks to:

\* Sean Barret - for the awesome stb\_image

\* Dan Venkitachalam - for finding some non-compliant DDS files, and patching some explicit casts \* everybody at gamedev.net

# 19.3 FreeType License

The FreeType Project's www.freetype.org) library is used by the Graphic Engine for nonbitmap font rendering.

Applies To:

All Graphic Runtime Engines using sbfreetype libraries

Applies To:

librender-plugin-\*.dll, librender-plugin-\*.a

Unless explicitly configured, all Graphic Engine render plugins link against the FreeType libraries.

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# 19.4 Lua License

The Lua engine (http://www.lua.org) provides a script interface for manipulating content in a Graphic application.

Applies To:

libgre-plugin-lua.dll, libgre-plugin-lua.a

The Lua Graphic Engine plugin

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The NetBSD getopt argument parsing function is used to parse command line arguments.

The Graphic Runtime engines used on all Windows platforms (win32, wince, wincompact7, wec2013) includes the getopt source from the NetBSD operating system distribution.

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The NetBSD getsubopt argument parsing function is used by Graphic Engine plugins to parse plugin options.

Applies To:

libgre.dll, libgre.a

The Graphic Runtime engines used on most operating systems, including all Windows platforms (win32).

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# 19.7 Imagination OpenGL License

The libEGL.dll and libEGLv2.dll libraries from Imagination Technologies to provide OpenGL rendering capabilities

Applies To:

libEGL.dll, libGLESv2.dll

The Graphic Runtime engines used on all Windows platforms (win32) that use the OpenGL bindings include the Imagination libraries.

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# 19.8 GNU LESSER GENERAL PUBLIC LICENSE (pthread-win32)

Applies To:

All Graphic Runtime Engines using Windows operating systems

Applies To:

pthreadVC2.dll, pthreadVC2.lib

This provides POSIX pthread API functionality in a Windows environment (win32, wince, wincompact7, wec2013).

Project Page: https://www.sourceware.org/pthreads-win32/ pthreads-win32 - a POSIX threads library for Microsoft Windows

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#### Why pthreads-win32 did not use the GNU General Public License

The goal of the pthreads-win32 project has been to provide a quality and complete implementation of the POSIX threads API for Microsoft Windows within the limits imposed by virtue of it being a stand-alone library and not linked directly to other POSIX compliant libraries. For example, some functions and features, such as those based on POSIX signals, are missing.

Pthreads-win32 is a library, available in several different versions depending on supported compilers, and may be used as a dynamically linked module or a statically linked set of binary modules. It is not an application on it's own.

It was fully intended that pthreads-win32 be usable with commercial software not covered by either the GPL or the LGPL licenses. Pthreads-win32 has many contributors to it's code base, many of whom have done so because they have used the library in commercial or proprietry software projects.

Releasing pthreads-win32 under the LGPL ensures that the library can be used widely, while at the same time ensures that bug fixes and improvements to the pthreads-win32 code itself is returned to benefit all current and future users of the library.

Although pthreads-win32 makes it possible for applications that use POSIX threads to be ported to Win32 platforms, the broader goal of the project is to encourage the use of open standards, and in particular, to make it just a little easier for developers writing Win32 applications to consider widening the potential market for their products.

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Version 2.1, February 1999

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/\* zlib.h -- interface of the 'zlib' general purpose compression library version 1.2.8, April 28th, 2013

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# 20 Lap Trigger

# 20.1 Lap trigger (timing beacon)

#### Why do we need a lap trigger (timing beacon)?

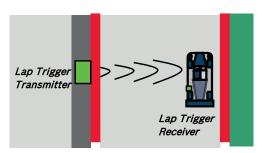
- Vehicle lap time measurement
- Calculation of lap-dependent functions (lap fuel consumption, min/max values)
- Calculation of lap distance dependent functions
- Control of data logging system

#### Types of Systems

- GPS based (low cost, low precision)
- IR based (low cost, high precision, limited reliability)
- RF (microwave) based (high precision, high reliability)

#### IR and RF based Systems consists of

- Transmitter (trackside unit)
- Receiver (in-vehicle unit)



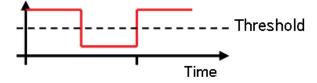
# 20.1.1 Electrical trigger signal

In DDU 10 all sources of measurement channels can be used as trigger signal.

- Analog input
- Digital input
- CAN input

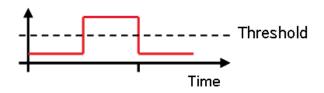
#### Signal (measurement channel) properties

Low active signal (Bosch triggers): Trigger releases if signal is below the threshold.



High active signal (other manufacturer's triggers): Trigger releases if signal is above the threshold.

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Two types of trigger signal:

- Main trigger (end-of-lap at start/finish line)
- Sub-trigger (segment time, optional, not applicable with GPS lap trigger)

#### Bosch standard:

- Main trigger 20 ms, low active (Recommendation for RaceCon "Detection Time" setting: 15 ms, Setting must be a slightly shorter period than the signal length of the trigger to avoid a missed trigger due to the update rate)
- Sub trigger 40 ms, low active (Recommendation for RaceCon "Detection Time" setting: 30 ms)

# 20.1.2 GPS Lap trigger

The GPS lap trigger uses a GPS signal to trigger the lap timer. To function this timer an external GPS sensor (see GPS Sensor [▶ 171]) has to be connected to the device and a detection point with a detection range has to be defined in RaceCon.

The GPS detection point is defined by the latitude and longitude. The easiest way to get the latitude and longitude of a finishing line is due to a web mapping program such as google maps. With google maps, simply left-klick on the spot where you want to set the detection point. The information about the latitude and longitude will show up, in general the latitude is given at first. You should insert at least five decimal places for sufficient precision.

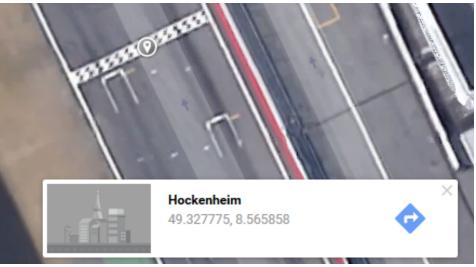


Photo: Google Maps

The detection range defines the radius of a circle around the detection point in which the lap trigger can be set. The lap trigger will be set as soon as the distance between the car and the detection point has reached its smallest peak. By this function an imaginary finishing line is calculated inside of the detection circle.

The imaginary finishing line can only be calculated if all channel sources are defined correctly. The latitude and longitude channel sources are mandatory for the functionality. Missing direction or speed source lowers the precision of the system.

Define the latitude and longitude of the GPS	Laptrigger configuration General Presettings Conditions Tr Decimal latitude:	igger Countdown Segment timing GPS	Ö
detection point.	Decimal longitude:		49,32777400 → DD 8,56584700 → DD
Define the detection – range around the detection point.	Laptrigger detection range: GPS channel sources: Longitude source: Im @ psp_long		20 📩 m
Define the channel sources for Longitude, Latitude, Direction and Speed.	Latitude source: Construction source: Construction source: Construction Constructi		•



#### NOTICE

The configuration of the sensor update rate and the detection range must insure to receive a valid GPS point in the detection range, despite the occurring vehicle speed near the detection point.

### 20.1.3 Prevention of false triggers

- Race track topology and transmitter location frequently cause false triggers.
- Software functionality prevents acceptance of false triggers.
- Minimum vehicle speed for acceptance of trigger prevents false triggers while vehicle is stationary in the pits.
- Time based re-trigger protection prevents false triggers due to signal reflections on main straight.
- Lap distance based retrigger protection prevents false triggers due to track topology.

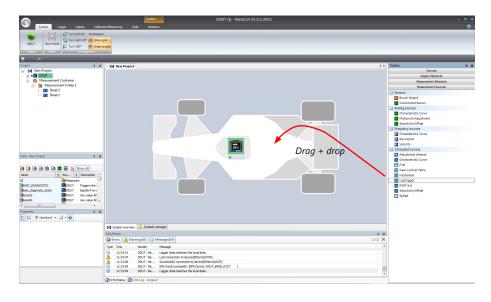
### 20.1.4 Forced triggers

Lap distance based insertion of 'forced trigger'.

Under race conditions, trigger signals are sometimes missed. Software functionality introduces 'forced trigger'.

### 20.1.5 Setting up a lap trigger

- 1. Click 'Measurement Sources' in Toolbox.
- 2. Drag 'Laptrigger' into 'System Overview'. Do not drop it on 'DDU 10'!



#### A 'Laptrigger Wizard' window opens.

Laptrigger Configura Select signal source a	tion and speed input of the laptrigger and adjust the track distance.
Configure on device:	■ DDU7
Signal <u>s</u> ource:	R - 43 Laptrigger pin
Speed input:	₩ 🔁 speed
Track <u>d</u> istance:	4000 🛫 m

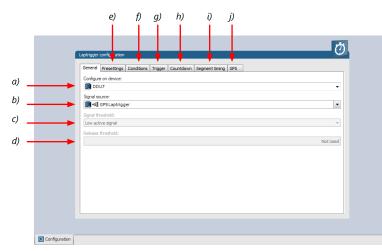
Choose the device which receives the trigger signal Choose the signal channel for the trigger signal

Choose the source for the vehicle speed

Enter the distance of the racetrack

3. Click 'Finish' to complete the operation.

A pre-configured lap trigger window opens.



a) Change signal device, if desired.

b) Change signal channel, if desired.

c) Choose signal threshold. See chapter 'Electrical trigger signal' for details.

d) Define threshold of input channel signal when trigger is released.

Only possible, if no digital source is selected as signal source.

e) Define presettings for trigger. See chapter 'Lap trigger presettings' for details.
 f) Define condition settings; change signal for vehicle speed, define speed settings.

See chapter 'Distance based retrigger protection' and 'Distance based forced trigger' for details.

g) Define settings for main trigger. See chapter 'Lap timing' for details.
 h) Define settings for counddown timer. See chapter 'Countdown timer' for details.

i) Define settings for sub trigger. See chapter 'Segment timing' for details.

j) Define settings for a GPS lap trigger. See chapter 'GPS lap trigger' for details. Only applicable if the signal source is set to 'GPS lap trigger'.

	te Levin Forget (El Lepinger )x
Preset values for lap counter and outing counter	Liefoge conference.
Minimum laptime that a new 'best laptime' is accepted	Outing counter start value:         1 (b) outs           Lap time threshold:         10 (b) s
Preset value for 'best laptime'	Laptime best prest: 196.0 § s

Laptrigger configuration	(
hange signal for vehicle speed, General Presettings Conditions Trigger, Countdown Segment timing	
desired. Speed source:	
a speed	•
nter minimum speed for 💦 💦 🙀 Min. speed:	
igger release.	20 👷 km/h
In the distance:	4000 👘 m
	4000 ( <b>Q</b> ) III
efine settings for distance	20 💽 %
used retrigger protection.	800 m
Ax. distance:	
	120 💭 %
	4800 m
efine settings for distance	
ased forced trigger.	

	Laptrigger configuration	Ø
Define settings for lap timing		
(main trigger).	General Presettings Conditions Trager Countdown Segment timing Detection time:	
	15 (m) ms	
1	Retrigger lock time: 5000 ms	
Define settings for sub trigger.	Use intermediate trigger	
Not applicable with a GPS lap trigger.	Detection time: 30 🕅 ms	
11 1 55	Retrigger lock time:	
	500 (m) ms	
8	Configuration	
_		
		Ø
	Laptrigger configuration	
Define settings for countdown	General Presettings Conditions Trigger Countdown Segment timing	
timer.	Note:	
umer.	Start time:	
	120 <sup>(a)</sup> / <sub>(a)</sub> \$	
8	Configuration	
_		
		Ø
	Laptrigger configuration	
Define estimation for second	General Presettings Conditions Trigger Countdown Segment timing	
Define settings for segment	Node:	
timing.	Lap segment distance from main trigger:	
	Nr. Segment distance (m)	
	Configuration	

#### Only applicable for a GPS Laptrigger

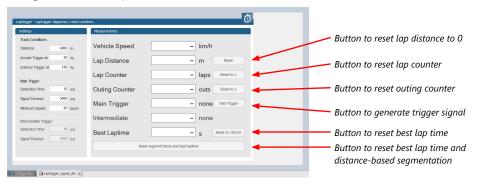
Define the latitude and longitude of the GPS detection point.	Leptroger configuration  General - Prestings - Conditions - Trigger - Countdown - Segment tening - PS  Decinal listude:	
Define the detection – range around the	Laptrigger detection range: 20 🚊	m
detection point.	Longitude source:	•
Define the channel	Grs direction source:	•
sources for Longitude, Latitude, Direction and Speed.	GPS speed source:	
	Configuration	

# 20.1.6 Lap trigger channel diagnosis/counter reset

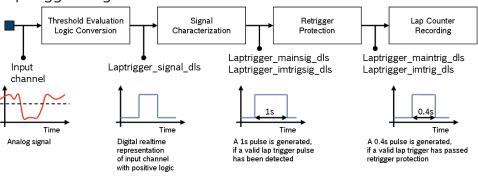
To display a quick lap trigger channel diagnosis and to reset counters use the diagnosis page in RaceCon. Any 'Laptrigger\_xxx' channel can be displayed.

Double-click on any 'Laptrigger\_xxx' channel in the Data Area. Example: 'laptrigger\_lapdist\_dls'

A diagnosis window opens in Main Area.



#### Lap trigger diagnosis scheme

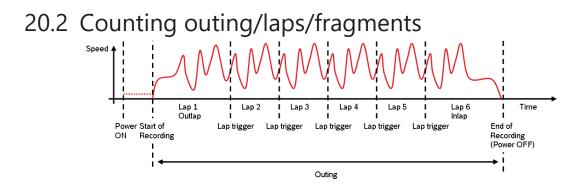


### 20.1.7 Lap trigger presettings

When the reset buttons on the diagnosis page are activated, these values are used.

Se New Project 💽 Laptrigger 😠

	Ö.
	Laptrigger configuration
Preset values for lap counter	General Presettings Conditions Trigger Countdown Segment timing
and outing counter	Lap counter start value:
	1 👘 laps
Minimum laptime that a new	Outing counter start value: 1 + outs
	Lap time threshold:
'best laptime' is accepted	10 ± s
Drasat value for 'best lantime'	Lap time best preset:
Preset value for 'best laptime'	100,0 🚖 s
	Configuration



#### Functionality

- Power ON: system + measurement is initialized but not yet started
- Global start condition fulfilled: recording starts
- Reception of valid lap trigger: recording of lap completed, new lap starts
- Power OFF or Global start condition not fulfilled: recording of lap completed, system shutdown

The system is counting:

#### Outing:

 The outing counter is incremented with each power cycle when at least one valid lap (not by forced lap trigger) was recorded

Lap:

- Leaving the pits to lap trigger
- Lap trigger to lap trigger
- Enforced lap trigger (see Distance based forced trigger [> 167])

#### Fragment:

- Test bench operation
- Power cycle on track or box (e.g. engine stalled)
- File fragmentation size [MB], time [sec]

#### Channels for display

To display counters use the following channels:

Channel	Function
Laptrigger_outcnt_dls	Outing counter
Laptrigger_lapctr_dls	Lap counter
Fractr	Fragment counter

#### Counting in WinDarab

To automatically name recorded files use filename templates in WinDarab dialog:

Filename template	Function
[outing]	Value of outing counter
[lap]	Value of lap counter
[fragment]	Value of fragment counter

[###03] indicates: 'always use 3 digits with leading zeros'.

# 20.3 Lap timing

There are different possibilities to adjust the lap trigger to the timing situation.

The detection time defines the minimum time the input signal changes its state. E.g. a low active signal needs to be below the threshold for min. 15 ms to release the trigger.

#### Channels for display

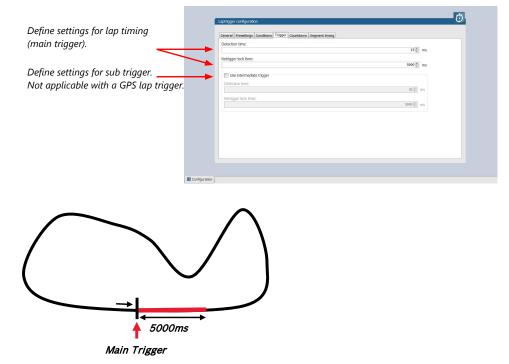
To display lap times use the following channels:

Channel	Function
Laptrigger_lapctr_dls	Number of completed laps
Laptrigger_laptime_dls	Running laptime
Laptrigger_laptime_best_dls	Laptime of best lap
Laptrigger_laptimeold_dls	Laptime of last lap completed
Laptrigger_laptimeseg_dls	Segment time of last segment
Laptrigger_lapctr_dls	Number of completed laps

### 20.3.1 Time based retrigger protection

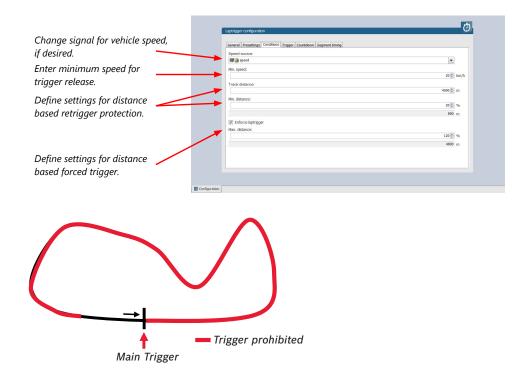
Trigger is locked for 5 s after main trigger was received.

To deactivate time based retrigger protection, set 'Retrigger lock time' to 0 ms.



# 20.3.2 Distance based retrigger protection

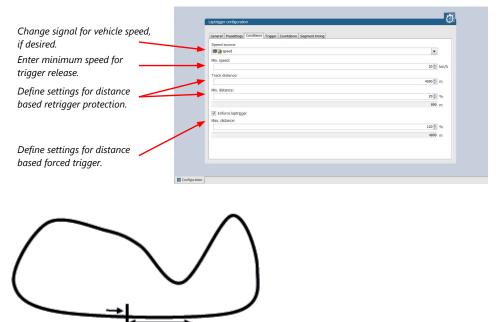
Trigger is locked until configured min distance (i.e. 80 %  $\rightarrow$  3200 m) of track distance (i.e. 4000 m) has been covered. To deactivate distance based retrigger protection, set min distance to 0 %.



### 20.3.3 Distance based forced trigger

After a missed main trigger, a forced trigger is inserted, if the configured max. distance (i.e. 120 %  $\rightarrow$  4800 m) of the track distance (i.e. 4000 m) has been reached. In this case, the channel 'Laptrigger\_distlap\_dls' starts at the delta between the max. distance and the track distance (i.e. 800 m).

To deactivate distance based forced triggers, uncheck box.



▲ 800m ↑
Missed Trigger Forced Trigger

# 20.4 Segment timing

Segment timing is the calculation of elapsed time for parts of laps (segments).

Segments are defined:

- based on sub-trigger signals (additional transmitters)
- based on distance travelled

Times for segments are compared to:

- Last lap completed
- Fastest lap

#### Channels for display

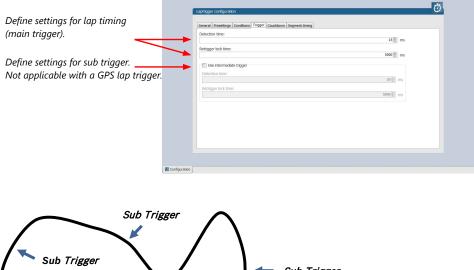
To display segment times use the following channels:

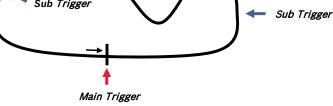
Channel	Function
Laptrigger_lapdiff	Time difference between finished lap and last lap
Laptrigger_lapdiffb	Time difference between finished lap and best lap
Laptrigger_lapseg_dlast	Difference of lap segment time compared to last lap
Laptrigger_lapseg_dbest	Difference of lap segment time compared to best lap

# 20.4.1 Sub trigger mode

Using main trigger (20 ms pulse) at Start-Finish-Line. 3 sub triggers (40 ms pulse) positioned at 1,000 m, 2,000 m and 3,000 m.

To deactivate sub trigger mode uncheck box.





The sub trigger mode cannot be used with the GPS lap trigger.

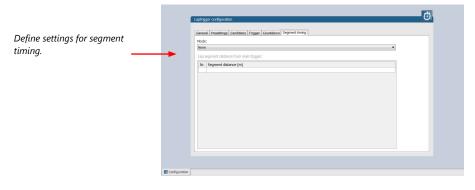
### 20.4.2 Distance mode

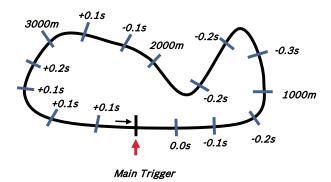
Using main trigger (20 ms pulse) at Start-Finish-Line.

Set 'Mode' to 'Distance' and enter desired segment distances.

Segment time is automatically calculated at each segment. Time difference to last lap and fastest lap is automatically calculated at each segment.

To deactivate distance mode set 'Mode' to 'None'.





# 20.5 Countdown timer

Some race classes require a minimum time spent in the pits. An additional lap trigger Tx is configured as a segment trigger positioned at pit entry. The trigger signal starts a timer countdown.

The current value of the timer is stored in the variable **Laptrigger\_cntdown\_dls** which can be displayed.

Define settings for countdown timer.	Lyttoger configuration  Secretal Resetting Condition Segment image  No:  Secretal Resetting  No:  Image  Secretal Resetting  Image  Image  Image

# 21 Predated Laptime

The predated laptime function allows to compare the current lap- and segment time with the predated time of an expected lap. Additional the function can estimate the laptime of the current lap. This functionality is integrated in the laptrigger module in RaceCon.

# 21.1 Setting up the predated laptime

To use the predated laptime function you need to set up a laptrigger as described in the chapter Lap Trigger [> 158]. Under the ribbon "Segment timing" you need to choose your segmentation mode which can either be distance or intermediate trigger based.

ince or	Genera	al Presettings Conditions Trigger Countdo	wn Segment timing GPS
mediate	Mode		
jer 🗕 🗕	Dista		
	U:	e predated laptime	
r your	Lap s	egment lengths and times	
nent time	Nr.	Segment length (m)	Segment time (s)
distance 🔶	1	500	44,800
	2	1.000	93,200
	3	1.500	135,600

For the distance mode you need to check on an old lap or estimate how long it takes to travel the segment distance. Please enter those values into input field. The values can also be copied and pasted to the input field from an excel sheet as a normal text. In the intermediate trigger you just need to set the expected time the driver takes to reach the segment trigger.



#### NOTICE

Please note that the segment time and length is always measured from the start line or where the main lap trigger is set.

# 21.2 Functionality and channel outputs

Following output channels are generated by the predated laptime function.

Laptrigger_lapdiff_pred_dls	Laptime difference between the predated and the last laptime
Laptrigger_lapsegdiffpred_dls	lagseg difference between the last segment and the predated segment.
Laptrigger_Lapcurrpred_dls	Estimated laptime of the current lap, based on the predated laptime and the predated segment deviations

The channel Laptrigger\_lapdiff\_pred\_dls is updated as soon as the main lap trigger is received. Both other channels are updated as soon as the next segment distance is travelled or the next intermediate trigger is received.

# 22 GPS Sensor

# 22.1 GPS (Global Positioning System)

Space-based global navigation satellite system.

GPS provides positioning, navigation, and timing services to worldwide users.

GPS receiver (sensor) gives digital information about position (longitude, latitude, height), ground speed, course, and status.

#### Two types of GPS receivers:

CAN output -> Read in messages via CAN Input of DDU 10 (not covered here) Serial output -> Read in messages via RS232 Interface of DDU 10 (serial interface 2)

# 22.1.1 Serial interface characterization

Serial Interface is characterized by:

Voltage levels: RS232 is standard (+/-12 V), UART (0 V/ 5 V) needs level shifter

Baud rate: 9,600 is standard for GPS, DDU 10 supports 1,200 to 115,200 baud. GPS Rx interface baud rate must match DDU 10 interface baud rate. DDU 10 Baud rate can be set with the 'GPS\_BAUDRATE' characteristic Data format: DDU 10 expects 8 data bits, no parity bit, 1 stop bit (8N1)

# 22.2 Protocol

DDU 10 expects NMEA Protocol (ASCII).

The following messages are decoded:

Message	Function
GGA	GPS fix information
GSA	Overall satellite data
GSV	Detailed satellite data
RMC	Recommended minimum data for GPS
VTG	Vector track and speed over the ground

On most GPS sensors, these messages are activated in the default configuration.

# 22.3 Sensor recommendation

The system has been tested with the Navilock NL-8004P MD6 Serial PPS Multi GNSS Receiver. This sensor is based on a U-Blox 8 chipset and is fully configurable with the Navilock "U-Center" software. To use this sensor with Bosch Motorsport components the transfer rate, the satellite system and the update rate need to be reconfigured. More information about the configuration can be found in the Appendix.

### 22.3.1 Configuration of the recommended Navilock NL-8004P MD6 Serial PPS Multi GNSS Receiver

For the sensor configuration, the sensor needs to be connected to the Navilock software "U-Center" which is available from Navilock free of charge. Navilock offers a USB connection cable for the sensor.

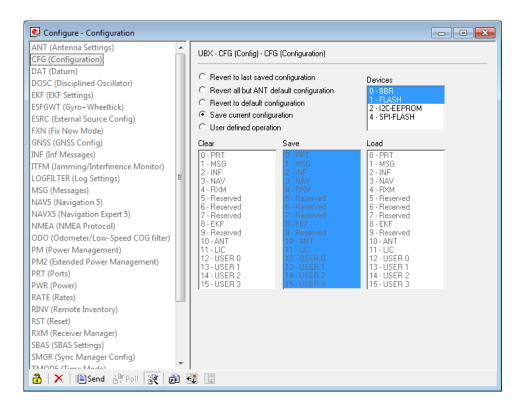
In "U-Center" click **"View"** – **"Configuration View"** to start the configuration. The following 3 points have to be changed:

#### Transfer Rate

- Click on "PRT (Ports)".
- Change the baud rate to a fixed value, this value needs to meet the setting of Race-Con. For a good signal quality we recommend 115,200 baud.
- Click on "Send" to store the new setting in "U-Center".

💽 Configure - Ports			- • ×
ANT (Antenna Settings)		UBX - CFG (Config) - PRT (Ports)	3 s
CFG (Configuration)			
DAT (Datum)		Target 1 · USABT1	
DOSC (Disciplined Oscillator)		Target 1 - USART1 -	
EKF (EKF Settings)		Protocol in 0+1+2 · UBX+NMEA+R1 ▼	
ESFGWT (Gyro+Wheeltick)		Protocol out 0+1 - UBX+NMEA	
ESRC (External Source Config)			
FXN (Fix Now Mode)		Baudrate 115200 💌	
GNSS (GNSS Config)		Auto bauding	
INF (Inf Messages)			
ITFM (Jamming/Interference Monitor)			
LOGFILTER (Log Settings)	=		
MSG (Messages)			
NAV5 (Navigation 5)			=
NAVX5 (Navigation Expert 5)			
NMEA (NMEA Protocol)		Oversampling	
ODO (Odometer/Low-Speed COG filter)			
PM (Power Management)			
PM2 (Extended Power Management)			
PRT (Ports)		E Estandad TV (in sect (s. Ev/2.00)	
PWR (Power)		Extended TX timeout (>=FW7.00)	
RATE (Rates)		TX-Ready Feature (>=FW7.00)	
RINV (Remote Inventory)			
RST (Reset)		Inverse Polarity (low-active)	
RXM (Receiver Manager)		Threshold 0	
SBAS (SBAS Settings)		PID 0 -	
SMGR (Sync Manager Config)	-		+
🔒 🗙 🖹 Send 💱 Poll 😵 🖞	a 4		

- Click on "CFG (Configuration)".
- Click on "Send" to save the new setting on the sensor.



#### Satellite System

- Click on "GNSS (GNSS Config)".
- Set the ticks as shown in the following picture.
- Click on "Send" to store the new setting in "U-Center".
- As during configuration step 1, click on "CFG (Configuration)".
- Click on"**Send**" to save the new setting on the sensor.

💽 Configure - GNSS Configuration				
ANT (Antenna Settings)	UBX - CFG (Config) - GNSS (GNSS Config)			
CFG (Configuration)				
DAT (Datum)	Channels			
DOSC (Disciplined Oscillator)	GNSS ID configure GNSS name enable min max Signals			
EKF (EKF Settings)				
ESFGWT (Gyro+Wheeltick)	0 GPS 🔽 8 16			
ESRC (External Source Config)	1 SBAS 🔽 1 3			
FXN (Fix Now Mode)	2 Galileo 🗌 0 0			
GNSS (GNSS Config)				
INF (Inf Messages)	3 🔽 BeiDou 🗌 8 16			
ITFM (Jamming/Interference Monitor)	4 🗆 IMES 🗖 🛛 🔿			
LOGFILTER (Log Settings)	5 🔽 OZSS 🗌 🛛 🕄	L LI SATE		
MSG (Messages)				
NAV5 (Navigation 5)	6 🔽 GLONASS 🗌 8 14			
NAVX5 (Navigation Expert 5)				
NMEA (NMEA Protocol)	Number of channels available 32			
ODO (Odometer/Low-Speed COG filter)				
PM (Power Management)	Number of channels to use 32 Auto set			
PM2 (Extended Power Management)	For specific SBAS configuration use CFG-SBAS			
PRT (Ports)				
PWR (Power)				
RATE (Rates)				
RINV (Remote Inventory)				
RST (Reset)				
RXM (Receiver Manager)	For specific GLONASS configuration use CFG-GLO			
SBAS (SBAS Settings)				
SMGR (Sync Manager Config)	<	•		
TMODE (Time Mede) ■ V I :: Strand : Repair (Strand				
🔒 🗙 🗐 Send 💱 Poll 🖹 🕼 🐻 💷				

#### Update Rate

- Click on "RATE (Rates)".
- Change the "Measurement Period" to 55 ms.
- Change the "Navigation Rate" to 1 cyc.
- Values which lead to a lower frequency will lower the precision of the sensor, we recommend the mentioned values.
- Click on "Send" to store the new setting in "U-Center".
- As during configuration step 1, click on "CFG (Configuration)".
- Click on"**Send**" to save the new setting on the sensor.

🤵 Configure - Rates			- • •
ANT (Antenna Settings)	*	UBX - CFG (Config) - RATE (Rates)	9 s
CFG (Configuration)			
DAT (Datum)		Time Source	
DOSC (Disciplined Oscillator)		Time Source 1 - GPS time	
EKF (EKF Settings)		Measurement Period 55 [ms]	
ESFGWT (Gyro+Wheeltick)		Measurement Frequency 18.18 [Hz]	
ESRC (External Source Config)			
FXN (Fix Now Mode)		Navigation Rate [Cyc]	
GNSS (GNSS Config)		Navigation Frequency 18.18 [Hz]	
INF (Inf Messages)		To to [12]	
ITFM (Jamming/Interference Monitor)			
LOGFILTER (Log Settings)	Ξ		
MSG (Messages)			
NAV5 (Navigation 5)			
NAVX5 (Navigation Expert 5)			
NMEA (NMEA Protocol)			
ODO (Odometer/Low-Speed COG filter)			
PM (Power Management)			
PM2 (Extended Power Management)			
PRT (Ports)			
PWR (Power)			
RATE (Rates)			
RINV (Remote Inventory)			
RST (Reset)			
RXM (Receiver Manager)			
SBAS (SBAS Settings)			
SMGR (Sync Manager Config)			
TMODE (Time Mede)			
🔒 🗙 🖹 Send 🧗 Poll 💦 🖉	1		



#### NOTICE

Sensor needs reception for visible signal. It takes time to start the sensor.

# 22.4 Measurement labels

The decoded NMEA messages are copied to these DDU 10 measurement labels.

Measurement label	Function
gps_PDOP	Position Dilution Of Precision
gps_HDOP	Horizontal Dilution Of Precision
gps_VDOP	Vertical Dilution Of Precision
gps_lat	Latitude +/- [degree]
gps_long	Longitude +/- [degree]
gps_elv	Antenna altitude above/below mean sea level (geoid) in meters

Measurement label	Function
gps_speed	Speed over the ground in kilometers/hour
gps_direction	Track angle in degrees
gps_declination	Magnetic variation degrees (Easterly var. subtracts from true course)
gps_year	Years since 1900
gps_mon	Months since January - [0,11]
gps_day	Day of the month - [1,31]
gps_hour	Hours since midnight - [0,23]
gps_min	Minutes after the hour - [0,59]
gps_sec	Seconds after the minute - [0,59]
gps_hsec	Hundredth part of second - [0,99]
gps_smask	Bit mask over received NMEA sentences (Bit 0 = GGA, Bit 1 = GSA, Bit 2 = GSV, Bit 3 = RMC, Bit 4 = VTG) within last second.
gps_sig	GPS quality indicator (0 = Invalid; 1 = Fix; 2 = Differential, 3 = Sensitive)
gps_fix	Operating mode, used for navigation (1 = Fix not available; 2 = 2D; 3 = 3D)

These measurement labels are arrays, where the indexed element points to the same satellite.

(E.g. gps\_info\_satsigstrength[3] tells the receiving signal strength of satellite 3. Satellite 3 has the SAT-ID given in gps\_info\_satid[3])

Measurement label	Function
gps_info_satid[ ]	Satellite PRN number
gps_info_satinuse[ ]	Used in position fix
gps_info_satelevation[ ]	Elevation in degrees, 90 maximum
gps_info_satazimuth[ ]	Azimuth, degrees from true north, 000 to 359
gps_info_satsigstrength[]	Signal, 00-99 dB

# 22.5 GPS troubleshooting

#### Electrical

Is the transmitter signal of the GPS sensor connected to the receiver pin of serial interface 2 of the DDU 10?

Is the GPS sensor powered up?

Does the GPS sensor deliver RS232 signal levels?

Is the sensor connected to the "sensor ground" of the device?

#### Interface

Do the baud rates of the GPS sensor and the DDU 10 match?

Is the GPS sensor set up for 8N1 transmission parameters?

Is the GPS sensor set up for NMEA messages?

Are the GGA, VTG, RMC messages activated?

#### GPS sensor start-up

Does the GPS sensor 'view' the sky?

Did the GPS sensor complete its initial start-up procedure? This may take up to 20 min.

A correct reception is indicated when 'gps\_fix' is showing '3D Fix'.

#### GPS sensor values are frozen

Does the sensor has lost its reception? The old values will be kept if the reception is lost. The gps\_smask channel shows which NMEA sentence is received.

# 23 Firmware

# 23.1 Firmware and configuration

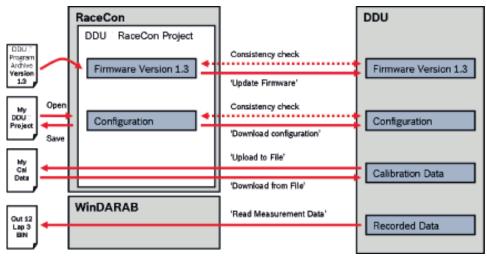
DDU 10 holds 4 types of data:

Firmware: the software (PST program file) of the DDU 10.

Configuration: the configuration of Input channels, CAN I/O, PWM, display configuration, recording + telemetry configuration.

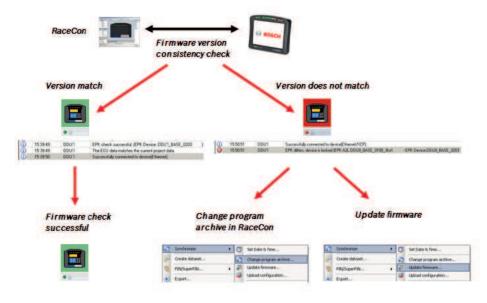
Calibration data: Characteristic curves and offsets created by online calibration at the vehicle.

Recorded data: Measurement data recorded during vehicle operation.



# 23.2 Firmware update

The scheme shows the process during each connection between RaceCon and DDU 10.

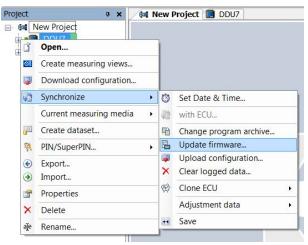


# 23.2.1 Performing the firmware update

Firmware update is only possible if the DDU 10 is connected to RaceCon.

The configuration of Input channels, CAN I/O, display, recording + telemetry will not be changed.

1. In the DDU 10 Project Tree, right-click on 'DDU 10' and choose 'Synchronize' then 'Update firmware'.



A pop-up menu opens.

2. Select the destination of the firmware archive (PST).

You can find the latest firmware for the device at the Bosch Motorsport homepage.

date firmware	×
lash program firmware	010
Perform a firmware update of a device.	LUPDA
ECU Type: DDU7 *	
Select program archive (PST) file:	
Keep current settings	
ECILIdentification	Ok Cancel

3. Click 'OK' when done.

The firmware update starts. The DDU 10 displays the message 'Updating firmware'. Do not switch off the car's ignition or interrupt the power supply of the DDU 10!

date firmware	
Flash program firmware	01
Perform a firmware update of a device.	цш
Loading configuration	
Connecting to DDU7	
Downloading content to DDU7	
Flashing controllers on DDU7	
Cleaning up	
	Flash completion 53%
	Cancel

When the firmware update is complete, the DDU 10 displays the message 'Updating firmware finished. Do a powercycle.'

Switch the car's ignition off and on again to cycle the power of the DDU 10.



# 24 Cloning the Unit

To replace a DDU 10 by another device, it is possible to clone it. A clone is a 1:1 copy of a device. This can be useful for copying specific data, like sensor-offset calibration to a spare unit for a specific car.

#### Creating a clone file

- 1. Open the 'Tools' window and click on the 'Clone' button in the 'Extras' menu.
- 2. Select "Extract" from the dropdown menu.

	DUUU.np - KateLon V2.3.30/.11	
System Lagger Display C	skrator/Mesozing Tools	0.
Uplate Uplade Format Create/Edit Option Primvere * Sysleg USD-Statk_ seesons Editor		
Project # ×	Apply 12	Toolbox 8 x
44 New Project.     ↓ ← Double     ↓ ← Double     ↓ ← Observationer		Image: Section of the sectio
0ata # X		10 M233 Sport 10 PDG 10 P9U-F1
Name / The A		U Bypass EOU Custom ECU
atto E infor		<ul> <li>Pawer control unit</li> </ul>
		Display Elements
acox matio		Measurement Elements
T n	Off System Dverview	Measurement Sources
Infa / Status		f x
C Errors 🔥 Warnings i Messages		0,0 X
T Time Sender Message		
Info / Status CAN Log - Stopped   SYS Log - Stoppe		
Ready.		No errors detected - all cleared or state a tinours - 📴 New Project 👘 🚥

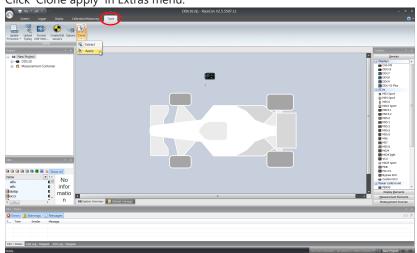
- 3. Choose the hardware device, which should be cloned.
- 4. Define destination and filename.

one ECU	
Clone extract ecu Clone extract the ecu and upload the data to the selected file.	5
ECU Type: DDU8	Select Device
Select clone file (bmsclone):	
C:\Test\DDU8_Bosch_Motorsport.bmsclone	
(i) This is the stand-alone clone extract ECU tool for MS5. protocol.	

5. Click 'OK' to start procedure.

#### Applying a clone file to a device

1. Click <u>'Clone apply' in Extras menu.</u>



- 2. Choose clone file.
- 3. Click 'Ok'.

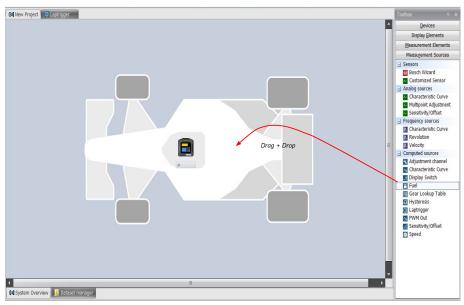
Please remember that following properties are not stored into the clone:

- Lifetime of device
- Serial number
- Upgrade features

# 25 Fuel Consumption Calculation

# 25.1 Setting up fuel consumption calculation and tank management

- 1. Select 'Measurement Sources' in Toolbox.
- 2. Drag 'Fuel' element and drop it on the vehicle in System Overview. Do not drop it on the DDU 10!



A 'fuel consumption wizard' opens.

Original		
General Configure on device	DDU7	
Tank capacity	80.0	
Fuel consumption calculation		
Mode	Using fuel consumed	
Fuel input	Fuelcons V 0,001 Adaption factor to [ml]	-
Consumption correction factor	1,000	
Mode	Last lap's consumption	
Target lap consumption	3.0 💭	
Reset fuel consumption		
Mode	By RaceCon 💌	
Reset signal source	▼ ◀	
- · · · · · · · · · · · ·	Low active signal	
Reset signal threshold		
Reset signal threshold	Not Used	

- a) Change device for fuel calculation, if desired.
- b) Enter tank capacity of vehicle.
- c) Choose calculation mode:
- using fuel consumed (summed-up fuel consumption)
- using fuel flow rate (momentary fuel consumption)

d) Choose input channel and enter adaption factor. Use adaption factor to adapt value of input channel to:

- 1ml per inc for summed-up fuel consumption • 1ml/s per inc for momentary consumption

e) Enter factor to correct calculated consumption in device vs. 'real' consumption of vehicle, if required.

f) Choose method to calculate remaining laps with fuel in tank, if desired:

• using fuel consumption of last lap completed

- using target lap consumption (entered in the field 'Target lap consumption')
- g) Choose values to initiate a reset of fuel consumption, if desired:

Manually using RaceCon

- On 'power down' (assuming that the tank is filled each time the ignition is turned off)
- By signal source as input channel (e.g. a switch connected to input pin)
- 3. Press 'Finish' when done.

# 25.2 Fuel consumption diagnosis/counter reset

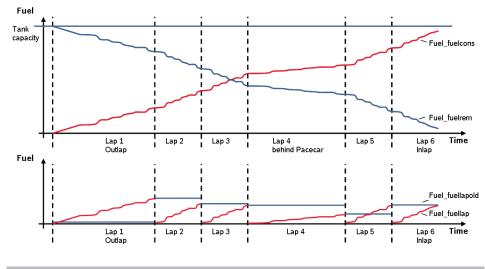
To display a fuel consumption diagnosis and to reset counters, use the diagnosis page in RaceCon.

Double-click on any 'fuel\_xxx' channel in channel list.

A diagnosis window opens in Main Area.



# 25.3 Example



Measurement label	Function
Fuel_fuelcons_dls	Running fuel consumption, starting at '0'
Fuel_fuelrem_dls	Remaining fuel in tank, starting at tank capacity
Fuel_fuellap_dls	Fuel consumption for current lap, starting at '0'
Fuel_fuellapold_dls	Fuel consumption of last lap completed
Fuel_laprem_dls	Remaining laps with fuel in tank

# 26 RaceCon Shortcuts

The table shows important shortcuts simplify controlling the DDU 10 in RaceCon.

Shortcut	Function
General navigation	
F1	Open RaceCon help
F2	Rename selected object
F3	Select Data Area
F4	Select Project Tree
F5	-
F6	Start the data comparison
F7	Start dataset manager
F8	Toggle WP/RP
F9	Start measurement
CTRL + F9	Start recording
F10 or Alt	Go to menu bar
F11	Toggle display to fullscreen 'Race Mode'
F12	Enlarge main screen
CTRL + Tab	Switch between opened windows
Project Tree	
Plus (+) at numeric pad or right cursor	Expand selected node
Minus (-) at numeric pad or left cursor	Close selected node
Star (*) at numeric pad	Open all nodes
DEL	Delete seleted object
Display page, measurement page	
Cursor	Move selected display element one grid unit in chosen direction
SHIFT + cursor	Enlarge/reduce selected display element one grid unit
Tab	Switch between display elements


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