



Display DDU 9

Manual

Version 1.1 24/06/2020

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1 Preparation

Use the DDU 9 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 9 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 9 carries out an appropriate analysis to determine the electromagnetic interaction the DDU 9 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, many screenshots are created by way of example for a display. Please consider this and replace the product names with the name of your device.

2 Warnings and safety instructions

The classification of the warnings and safety instructions is carried out by the respective signal word (Danger, Warning, Caution) next to the warning symbol.

Danger

\mathbf{A}	
	Nature and source of danger
	Consequences
	Warning of death or serious physical injury, which are sure to occur if ignored.
	Warning
	Nature and source of danger
	Consequences
	Warning of death or serious injury, which can occur if this is not observed.
	Caution
	Nature and source of danger
	Consequences
	Warning of slight bodily injury in case of Disregard.
	Notice
	NOTICE
	Nature and source of danger
	Consequences

Warning of damage to equipment in case of ignoring.

3 Onboard Network Concept

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 Technical Data

The display DDU 9 integrates a programmable full color dashboard display with a data logging system for motorsport applications for a very competitive price. Additional input devices can be connected via Ethernet and CAN buses.

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 (e.g. for long term recording) can be activated.

Customers can implement 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. The stick is connected to the wiring harness for the DDU 9.

The device comes with 4 analogue and 4 speed inputs as standard; further 12 analogue inputs are available as optional upgrade.

Display	 5.7" graphic color display 		
	- 12 user configurable	display pages	
	- 10 multicolor freely	configurable (RGB) LEDs	
Resolution		640 x 480 pixel	
Supported image file	formats	BMP, GIF, JPG, PNG, TIF	
Processor		667 MHz Dual Core	
Converters		8 kHz AD converters with digital low pass filter	
Internal power source	2	Li/lon capacitor	
Configurable math ch	annels		
User configurable CA	N in/out messages		
Sampling rate		50 ms (standard), max. 1 ms (optional)	
Online data compress	sion		
Logging rate		Max. 600 kB/s	
Recording channels		100 channels (standard), up to 1,040 in total (optional)	
Logged data downloa	ad speed	Max. 1,000 kB/s	
Internal storage capa	city	3 GB (standard), plus 1 GB (optional)	
LTE Ethernet telemetr	y support, GSM telemeti	y support	
RS232 for GPS and te	lemetry		

CCP-Master, data acquisition from ECU that support CAN calibration protocol (optional)

Mechanical Data

Size	151 x 126 x 33.5 mm
Weight	540 g
Protection Classification	IP54 to DIN 40050, Section 9, Issue 2008
Operating temperature internal	-20 to 85°C
Operating temperature Display	-20 to 70°C

N 4 11 11	
Max. vibration	Vibration profile 1 (see Appendix or www.bosch-motorsport.com)
Electrical Data	
Supply voltage	5 to 18 V
Inputs	
Analog channels	4 standard, additional 12 optional
Input range	0 to 5 V
Resolution	12 bit
Switchable pull up resistor	For all ANA_IN
Wheel speed inputs	4 Hall-effect or DF11, switchable
Outputs	
Sensor supply 5 V \pm 1 % (250 mA)	2
Sensor supply 10 V ± 1 % (250 mA)	1
Sensor supply U_Bat 250 mA	1
Sensor ground	4
Environment	
Environmente	
External switch for page selection, 12 steps	B 261 209 658-01
External switch for page selection, 12 steps External switch for brightness adjustment or page selection, 6 steps	B 261 209 658-01 B 261 209 659-01
External switch for page selection, 12 steps External switch for brightness adjustment or page selection, 6 steps Optional Upgrades	B 261 209 658-01 B 261 209 659-01
External switch for page selection, 12 steps External switch for brightness adjustment or page selection, 6 steps Optional Upgrades USB Kit	B 261 209 658-01 B 261 209 659-01 Kugged USB flash drive Bosch File System (BFS) format, works with Bosch File Sys- tem (BFS) preformatted USB Flash drive only
External switch for page selection, 12 steps External switch for brightness adjustment or page selection, 6 steps Optional Upgrades USB Kit	 B 261 209 658-01 B 261 209 659-01 Rugged USB flash drive Bosch File System (BFS) format, works with Bosch File System (BFS) preformatted USB Flash drive only Adapter cable to USB-Port
External switch for page selection, 12 steps External switch for brightness adjustment or page selection, 6 steps Optional Upgrades USB Kit	 B 261 209 658-01 B 261 209 659-01 Rugged USB flash drive Bosch File System (BFS) format, works with Bosch File System (BFS) preformatted USB Flash drive only Adapter cable to USB-Port Adapter for wiring harness
External switch for page selection, 12 steps External switch for brightness adjustment or page selection, 6 steps Optional Upgrades USB Kit	 B 261 209 658-01 B 261 209 659-01 Rugged USB flash drive Bosch File System (BFS) format, works with Bosch File System (BFS) preformatted USB Flash drive only Adapter cable to USB-Port Adapter for wiring harness SW licence USB-Port unlocked
External switch for page selection, 12 steps External switch for brightness adjustment or page selection, 6 steps Optional Upgrades USB Kit	 B 261 209 658-01 B 261 209 659-01 B 261 209 659-01 Rugged USB flash drive Bosch File System (BFS) format, works with Bosch File System (BFS) preformatted USB Flash drive only Adapter cable to USB-Port Adapter for wiring harness SW licence USB-Port unlocked CCP-Master (ASAP2 file from ECU manu- facturer required)
External switch for page selection, 12 steps External switch for brightness adjustment or page selection, 6 steps Optional Upgrades USB Kit CCP_MASTER FULL_LOG_1	 B 261 209 658-01 B 261 209 659-01 B 261 209 659-01 Rugged USB flash drive Bosch File System (BFS) format, works with Bosch File System (BFS) preformatted USB Flash drive only Adapter cable to USB-Port Adapter for wiring harness SW licence USB-Port unlocked CCP-Master (ASAP2 file from ECU manufacturer required) Enable full logging performance of 3 GB partition 1
External switch for page selection, 12 steps External switch for brightness adjustment or page selection, 6 steps Optional Upgrades USB Kit CCP_MASTER FULL_LOG_1 FULL_LOG_2	 B 261 209 658-01 B 261 209 659-01 B 261 209 659-01 Rugged USB flash drive Bosch File System (BFS) format, works with Bosch File System (BFS) preformatted USB Flash drive only Adapter cable to USB-Port Adapter for wiring harness SW licence USB-Port unlocked CCP-Master (ASAP2 file from ECU manufacturer required) Enable full logging performance of 3 GB partition 1 Enable full logging performance of 1 GB partition 2

Connectors and Wires

Motorsport connector on Display AS2	216-35PN
Mating connector F02 AS616-35SN	2U.000.466-01

Pin Configuration

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.
13	Laptrigger_In		Incl.
14	CAN_2_H	CAN speed selectable	Incl.
15	CAN_1_H	CAN speed selectable	Incl.
16	Ethernet_2_RXP		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.
24	Ethernet_2_RXN		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.
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.
40	Sens_Gnd_1	fused	Incl.
41	ANA_IN_11	3.01 kOhm switchable	Opt.

Pin	Name	Comment	Status
42	ANA_IN_9	3.01 kOhm switchable	Opt.
43	RS232_TX_GPS		Incl.
44	ANA_IN_16	3.01 kOhm switchable	Opt.
45	USB_Device_Power	to Bosch USB stick	Opt.
46	Ethernet_1_RXP		Incl.
47	ANA_IN_12	3.01 kOhm switchable	Opt.
48	ANA_IN_6	3.01 kOhm switchable	Opt.
49	ANA_IN_2	3.01 kOhm switchable	Incl.
50	ANA_IN_13	3.01 kOhm switchable	Opt.
51	ANA_IN_15	3.01 kOhm switchable	Opt.
52	Ethernet_1_RXN		Incl.
53	ANA_IN_5	3.01 kOhm switchable	Opt.
54	RS232_RX_GPS	for GPS sensor input	Incl.
55	ANA_IN_14	3.01 kOhm switchable	Opt.

5 Inputs and Outputs

5.1 Input channels

Analog inputs

The DDU 9 analog inputs accept an input signal of 0 to 5 V. A 3.01 kOhm pull-up resistor can be activated by software.

Digital inputs

The digital inputs of the DDU 9 accept 0 V to 5 V signals of Hall-effect sensors by default. Connect the output of the Hall-effect sensor to the REVn_P pin and leave the REVn_M pin open.

5.2 Output channels

Sensor power supply

The DDU 9 has four sensor power supplies: $2 \times 5 V$, $1 \times 10 V$ and 1×0 Ubat regulated voltage. They are short circuit protected to battery voltage and GND.

5.3 Communication channels

CAN bus

The DDU 9 has two CAN buses configurable as input and output. Different baud rates are selectable. Please note that the DDU 9 does not contain any CAN termination resistors. Thus the CAN termination resistors need to be integrated into the wiring loom.

Ethernet channels

The DDU 9 has one 100 MBit full duplex Ethernet communication ports. The port is internally connected with an Ethernet switch. The Ethernet ports have 'cable auto crossover' functionality.

RS232 ports

The DDU 9 has two RS232 serial ports. Baud rate for both ports is programmable. RS232 port 1 is reserved for online telemetry, port 2 can be used for reception of data from a serial GPS receiver.

Vehicle diagnosis connector

The Bosch Motorsport vehicle diagnosis connector is used as a standard interface to connect the vehicle to a PC e.g. via a MSA-Box II. Loom connector: AS012-35SN

Pin	Name	Description	Used for DDU 9
Pin 1	Terminal 30	Permanent positive	+
Pin 2	Terminal 15	Switched positive	+
Pin 3	Terminal 31	GND	+
Pin 4	CAN High	Diagnostic CAN bus	
Pin 16	CAN Low	Diagnostic CAN bus	

Pin	Name	Description	Used for DDU 9
Pin 10	K-Line	ECU diagnosis	
Pin 8	Ethernet RxD +	Ethernet interface	+
Pin 9	Ethernet RxD -	Ethernet interface	+
Pin 11	Ethernet TxD +	Ethernet interface	+
Pin 12	Ethernet TxD -	Ethernet interface	+
Pin 22	Screen	Cable screen	+

6 Mechanical Drawing



7 Starting up

7.1 Feature activation

- Optional software feature packages are available for the DDU 9 .
- 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 9 does not work on any other DDU 9.
- 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 9' in the Project Tree.
- 3. Click on the 'Features info' tab in the Main Area.



The 'DDU 9 features info' window appears.

	DOU10 features info	
ECU ID 🗕	ECU ID 3950e778:1d0fd540 Copy to dipboard	
	Status/Unlock Order informations	
	Name Description	
Feature status —	CCP_MASTER F02U V02 213-01, Enable device to be CAN Communication Protocol Master	List of available
, cuture status	FULL_LOG_1 F02U V02 304-01, Full logging on first partition	features
	ISB DATA E02U V02 205-01, Enable data copy from looser to Basch USB stick	features
	ETHER TELE F02U V02 138-01. Enable Ethernet /LTE Telemetry	
	IO_EXTENS F02U V02 205-01, Enable additional input / output channels	
	<u>_</u>	
	Unlocked (disabled)	

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

DDU 10 features in		
ECO ID	506/78.100/0540	Copy to clipboard
Status/Unlock	k Order informations	
Name	e Description	
CCP_M	MASTER F02U V02 213-01, Enable device to be CAN Communication Protocoll Master	
FULL_D	LOG_1 F02U V02 304-01, Full logging on first partition	
FULL D	LOG 2 FCU Protection	×
	DATA Unlock Feature	
	TENS Unlock specified feature.	
	ETHER_TELE	
	Requested KEY:	
	d29856aa	
	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'.

ECU ID	atures info 3950e778:	1d0fd540	Copy to dipboard
Status	JUnlock Orde	r informations	
	Name	Description	
	CCP_MASTER	F02U V02 213-01, Enable device to be CAN Communication Protocoll Master	
1	FULL_LOG_1	F02U V02 304-01, Full logging on first partition	
0	FULL_LOG_2	F02U V02 305-01, Enable full logging on second partition	
l 🗗	USB_DATA	F02U V02 214-01, Enable data copy from logger to Bosch USB stick	
f	ETHER_TELE	F02U V02 138-01, Enable Ethernet / LTE Telemetry	
E C	IO_EXTENS	F02U V02 205-01, Enable additional input / output channels	

- 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 9.

7.2 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 9 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 9 display configuration area.



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).

	Search for 'ub
BOSCH	Andrig 200 A

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 9 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 9.

7.3 First recording (Quick Start)

This chapter explains the configuration of the recording of the battery voltage channel. See chapter 'Recording [> 103]' 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.



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

The configuration download starts and the DDU 9 carries out a reset. Now you can find the 'ub' measurement channel in the 'Data Area'.

	System	DDU10.rlp - RaceCon V2.5.5.0		
System Logger Display Calibration/Measuring Tool	Windows			0
DDUIS Race Mode visits Protection State Status Mode visits Protection State Hode Race Mode visits Protection State	nsa w all Si			
Project P	× Stan New Project			Toobax 0
Company Container Container Project Container Project Container Project Container		incaring data to DOUID the Domethod Data download (reference page) to ECU as in progress.		Coords Coord
Name The project's name.	۲.		8	Measurement Elements
	64 System Over	w 📃 Dataset manager		Measugement Sources
Cota		0 × Info / Status		
		S Errors 🔥 Warning	s () Messages(6)	6/6
	- Reportion	T Time Sende	r Message Successfully connected to device/Dhamat/VCR	
absiap Babsiap Bab	- rendon	() 13:11:19 00010 () 13:11:20 00010	 EPK check successful. (EPK Device: DDU10_BASE_0401_TST+ 	0
accx DDU10 longtudinal acceleration		No (0 13:11:26 00010	Creating configuration	
Baccy DDU10 transversal acceleration		information (0 13:11:27 00010	Started downloading contiguration files Beronding storage is cleared	
accz DDU10 vertical acceleration		*		
		Info / Status GAN Log -	Stopped SYS Log - Stopped	
Ready.				😑 DOU10, CAN((2)(Warning), for 7,2 s * 🛛 🕅 New Project 🥶 🚳

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

5. Start the WinDarab software.

Walibasis v/ Deceloper - Formula3	_	- 0 -×
Start Tools Windows		Style - 🔞 -
Contanti Contanta Poet Poet		
1 factorer = 0 × 1 ⇒ x ⊡ + 10 ⊕ - ⊋	Channels	* * *
Out Lap Laptime	Name	Source Descripti
+ + + × * BRAINTE		^
Ivents		# ×
Tens Car Trom To Dazdon/Oawad Mr. Man		
		1702 100 (

- 6. Disconnect the DDU 9 network cable.
- 7. Click on the 'Read Data from Logging Device' icon.
- 8. Choose your logger and click 'OK' when done.

	(a) (a)	ih Display	WinDarab v7 Developer - Formula3			
	Start Tools Windows O	hannel				Style 😧
Click	To Title Charrents Control Con	Clearer Color - Color Parsane Worksheet	Storr caption Soci Corport Caption Corport			
τεύα αυτά ποπτ	Er futter	3 X			Chantek	3.2
loaaina device'	🨅 x 🖄 - I Q, 🛥 - 🔂	Measured Data #1		≥ 82		2
logging derice	Out Lap Laptime				Name Source	Description
					internet in the second	Coopier
			Sector of the industry			
			Which hardware should be used ?			
			Data logger C50/C55/C60/DDU7/DDU8			
			> Cardilency C40/C5			
			1 1			
			BCU devices (Examples)			
			DLS. MS17. MS15. MS14. MS5x. MS12. MS24. C50. C60. DDU7. I			
			Qk Cancel			
			show datag only if shift key is pressed			
		2 5 10 15	<u>5 a a a a 20</u> 56	2.457 -74937.083		
		H 4 F H X Worksheet #1				
	Numburg - Empty Segmentation	0 × Events				3 ×
		Time Car From To Dur	ation Channel Min Max			
	<u> </u>					
		~				
						_

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.

🢐 Data Logger Import		
Settings Current Import Recent Import		Choose your DDU
Import sources Import sources	Common options Delete ARP cache entry after ping to device failed.	from dropdown list
V Device	Force password, if not set by recording configuration:	
Burst	▼ New	
Device/Flash IP / Device: DU7=10.10.0.207 Export file: One file for each lap Save files in: C:\Bosch\WinDarab\Data\DataFiles Subfolder template: Filename template: [CardInfo] outing [outing03]-[lap0	Ø import all on connect Ø Delete transferred files • • •	
Advanced Comment Fields	Apply changes	

- 11. Connect the DDU 9 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 9 starts automatically. Measurement files are stored automatically in the folder defined under 'Settings'.

Data Logger Import						
Data source: FTP 23.06.2015 12:11:11	<u>1</u>			Network DDU7 - 10.10.0.207	•	18 ms
Name	Size (MB)	Get	Get (MB)	Progress	_	
FTP 23.06.2015 12:11:11	0.0		0.0	Connecting		

- 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.



7.4 Set time and date

The DDU 9 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 9 to the PC.
- 2. Click on the 'Set date' button in the 'System' tab menu.



🛤 New Proj Project 🖃 📾 New Project ľ Open... 🗄 🖙 Lo Ø. Create measuring views... 🗄 🚥 Dis ą Download configuration... Synchronize Set Date & Time... ł <u>ک</u> 2 Current measuring media with ECU... ۲ in 📕 Create dataset... Change program archive... Dpdate firmware... PIN/SuperPIN... ۲ 1 ł Ţ. Upload configuration... Export... 5 € X Clear logged data... 🗄 🕒 CA 🏵 Import... 😚 Clone ECU ۲ 🗄 🕒 CA 1 Properties 🗄 📮 CA Adjustment data ۲ Delete × ÷. CA \leftrightarrow Save Þ Co aje Rename... # I/O Channels ÷.

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	X
Sets the date & time on a logger device. Use the 'set' buttons to configure the logger's recording date &	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

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

8 Display Configuration

- DDU 9 features: 800 x 480 full color TFT display + 10 color LEDs
- Display and LEDs are fully configurable
- ECU channels, analog channels, and CAN channels can be displayed
- Display elements: large numeric, medium numeric, bar graph style, alarm messages, static elements, image element
- DDU 9 supports up to 12 display pages, 6 brightness settings for display and LEDs

8.1 Display page setup

8.1.1 Organizing display pages



- All Pages: Display elements placed on this page are displayed on all pages. Recommended for 'Alarm' display elements.
- Single Page: Display elements placed on this page are displayed only on this page.

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

Example: An Alarm placed on 'All Pages' is displayed on all display pages and is always in front of other display elements.

8.1.2 Adding a new display page

Right-click on 'Display' and click 'Add Page' in the menu.

	Open
8	Add page
۲	Export
۲	Import
2	Properties

A new empty page opens.

8.1.3 Selecting display pages

Click on 'DDU 9' in the DDU 9 Project Tree, then on 'Display' and double-click on the page you want to select (example: 'New Page').

		_		
	<u> </u>		Display	
		_	📲 LEDs	
			🛄 Alarms	
			🚾 All Pages	
		l	🛐 New Pag	1
-			_	

In the Main Area, a representation of the DDU 9 opens.



8.2 Display element configuration

8.2.1 Numeric display element

Adding a numeric display element to display page

The 'Large Element' and the 'Medium Element' numeric display elements differ in element and font size. The element and font size can be changed using the Numeric Wizard.



NOTICE

In this view the displayed values are random values and do not show the real values of the measurement channels.

1. Drag a numeric display element from the Toolbox and drop it on the display page. A message in the numeric element box shows that it is not linked to a measurement channel.



2. Drag a measurement channel from the Data Area and drop it on the numeric display element.



The measurement channel is linked to the numeric display element.

Configuring a numeric display element

1. Double-click on the numeric display element. The Numeric Wizard window opens.

General Cons	Nonal Formatting			
→ Itle:	[uil	Formatt Forst size:	Nonal	
Value		Higment	MiddleRight	*
➡ Test	colitannel valueo	Dordesstyles	Single line	*
+ Darrel	<u>د</u> ه	Background	D; Q; D	-
Display type:	Value 💌	Foreground	295; 295; 295	*
		· Extended		

a) Enter the title displayed on top of the numeric display element.

b) Enter the text displayed in the middle of the numeric display element.

The variable <channel value> displays the value of the measurement channel.

c) Choose he measurement channel.

d) Choose the type of input data: Value, Gear, Time (in different formats)

e) Enter the number of decimal places of the measurement channel.

f) Choose the font size, alignment, borderstyle, background and foreground color of the numeric display element. g) Click the Extended button to show further options to change the color of the title, border and text individually.

2. Click 'OK' when done.

8.2.2 Bargraph display element

Bargraph display element

Drag the 'Bargraph' display element from the Toolbox and drop it on the display page.

Configuring a 'Bargraph' display element

1. Double-click on the 'Bargraph' display element. The Bargraph Wizard window opens.

General	Conditional P	omating			
			Formal		
Inc	ba	tery_voltage	Drientatiox	Harizontal, from the left to the	e ligit 💌
Dian	et 🖪	- a 6	Eolor gode:	Solid	
Test	et		Show tics:	True	-
	Tic label	Value	Ecedestyle:	None	*
Ľ	12	0,00	Minisun velue:		0.5
	8.5	8.50	Maximum value	-	28-2
	17,0	17,00	Background	B.0.0	
	21,3	21,25	Forecast	200 200 200	
	25,5	25,90			_
			Ethended		

a) Enter the title displayed on top of the 'Bargraph' display element.

b) Choose the measurement channel.

c) Define the tick text corresponding with the physical value. You can add more tic labels by entering values

in the row labeled with *.

d) Choose the orientation of the Bargraph (horizontal or vertical).

e) Chose the color mode of the Bargraph:

Solid: The whole Bargraph and tics are colored in one color

Stacked: The Bargraph is subdivided in segments with different colors.

The colors are set in the tab 'Conditional Formatting'. For details, see chapter 'Conditional formatting'.

a) Define if ticks and numbers are shown.

b) Choose the style of the border lines.

- c) Enter the physical value where the Bargraph begins.
- d) Enter the physical value where the Bargraph ends.
- e) Choose the background color of the Bargraph.
- f) Choose the foreground color of the Bargraph.
- g) Click the Extended button to show further options to change the color of the title, border and text individually.

2. Click 'OK' when done.



NOTICE

The tab 'Conditional Formatting' is explained in chapter 'Conditional formatting [> 30]'.

8.2.3 'Alarm' display element

The 'Alarm' display element displays a warning message in case of a defined condition becoming 'true'. In case of a condition becoming 'false', the 'Alarm' display element is not shown.

Two types of 'Alarm' display elements are available:

- Alarm: An alarm displaying a defined text
- Alarm Icon: An alarm displaying a defined image (e.g. a warning triangle)

Adding an 'Alarm' display element to display page

Drag an 'Alarm' element from the Toolbox and drop it on the display page.

Configuring an 'Alarm' (text) display element

1. Double-click on the 'Alarm' display element. The Alarm Wizard window opens.

	General Alarma	representation Conditional F	ionsafing	-		
-	<u>Tèle:</u>	battery_voltage		Ford size:	Normal	-
-	Condition	📾 🗃 batten_voltage	- /	Algersort	MiddeCenter	•
	Value			Eordentyle:	Single ine	
	Tagt	siam teat		Radigound	240; 80: 60	•
	Dravet	de 😸 📾	-	Foregound	240; 240; 240	•
	Display type:	Value	-	🕑 Estended		
	Decinal places	c .	0土			

a) Enter the title displayed on top of the 'Alarm' display element.

b) Choose the condition when the alarm will be activated:

• Create a condition using the Condition Creator. For more information see chapter 'Creating a new condition channel'.

• Choose an existing condition

The Alarm is displayed if function is 'TRUE', i.e. result of the calculation is >0.

c) Enter the alarm message displayed in the middle of the 'Alarm' display element. Enter the variable <channel value> to display the value of the measurement channel.

d) Choose the measurement channel.

e) Choose the type of input data:

• Value

• Gear

• Time (in different formats)

f) Enter the number of decimal places of the measurement channel.

g) Choose the font size, alignment, borderstyle, background and foreground color of the 'Alarm' display element.

2. Switch to the tab 'Alarm representation'.



a) Choose if the alarm can be reset or not.

b) Choose if the alarm blinks slowly, fast or does not blink.

c) Enter the minimum time the Alarm display element is displayed if an alarm is triggered.

d) Enter the time until the Alarm resets automatically after the minimum display time entered in c (only possible if Alarm is resettable).

e) Enter the time until the Alarm can appear again after a reset.

- 3. Click 'OK' when done.
- 4. Copy alarm to all display pages by clicking 'Move to' -> 'All Pages'.



Configuring an 'Alarm Icon' (image) display element

1. Double-click on the 'Alarm Icon' display element.

the alarm icon element Enable Use transparency/ to define parts of the in al Alam representation a) Calent nintern b) - 1 c) P d) • Data e) . . Cancel Qk.

The Alarm Icon Wizard window opens.

a) Select the image from the hard drive that is shown in case of an alarm.

b) Choose the condition when the alarm will be activated:

• Create a condition using the Condition Creator. For more information see chapter 'Creating a new condition channel'.

• Choose an existing condition

The 'Alarm Icon' is displayed if function is 'TRUE', i.e. result of the calculation is >0.

c) Enable the checkbox if you want to define parts of the image as transparent.

d) Select the basic transparent color key. This means that any pixel of the image near (depending of the tolerance value) to this color gets transparent.

e) Select a tolerance in percent to define parts of the image as transparent.

- 2. Switch to the tab 'Alarm representation'. It is configured in the same way as the 'Alarm' text display element.
- 3. Click 'OK' when done.



NOTICE

If several active alarms in the display overlap, each alarm is in the foreground for 2 seconds.

Configuring an 'Alarm Reset Channel'

The Alarm Reset Channel can be defined in the display setting menu.

1. Double click on the display icon in the project tree.



On the settings Tab the Alarm Reset Channel can be defined.

DDU8 display setti	ngs							000 #
General settings Page switch:	Rotary switch	1		•		Alarm reset	channel:	•
Brightness settin	igs							
		Switch 1	Switch 2	Switch 3	Switch 4	Switch 5	Switch 6	
Background	nd brightness	95	76	57	38	19	1	
LE	D brightness	95	76	57	38	19	1	

8.2.4 Other display elements

Two types of other display elements are available:

- Label: A label displaying a specified text
- Picture element: An element displaying a static picture (e.g. temperature warning)

Adding a Label or picture display element to display page

Drag the Label or picture display element from the Toolbox and drop it on the display page.

Configuring a Label display element

1. Double-click on the Label display element. The Label Wizard window opens.

General
Formal Entries: Nerval Entries: Nerval Entries: Nerval Entries: Single line Entries: Nerval En
© Extended

a) Enter the title displayed on top of the Label display element.

b) Enter the text displayed in the middle of the Label display element.

c) Choose the font size, alignment, borderstyle, background and foreground color of the Label display element.

d) Click the Extended button to show further options to change the color of the title, border and text individually.

2. Click 'OK' when done.

Configuring a Picture display element

Supported image file formats are: bmp, jpg, gif, png, tif

1. Double-click on the Picture display element. The Picture Wizard window opens.

Enable Use	e transperency' to define parts of the image as transperent.
General	
🔶 Select pict	fuae:
	V Use image transparency
Color I	keşt 🔲 0:0:0
	nos:
-	

The lower and the upper limits are configured in the same way.

a) Check the box to activate the formatting at a lower limit.

b) Enter the limit value when the formatting is active.

c) Enter the limit value when the reset hysteresis function is active. The reset hysteresis function avoids the

high-frequent switchover of the measurement channel value.

d) Choose the borderstyle, background and foreground color of the numeric display element.

e) Click the Extended button to show further options to change the color of the title, border and text individually. If a 'Bargraph' display element is used, its colors can also be changed.

2. Click 'OK' when done.

8.2.5 Conditional formatting

This function pigments the displayed values in dependence of a specified measurement channel value.

Example: The text color changes from white to red when the battery voltage is fewer than 12 V.

Conditional Formatting is available at numeric, 'Bargraph' and 'Alarm' display element.

- 1. Double-click on the display element. The Numeric Wizard window opens.
- 2. Switch to the tab 'Conditional Formatting'.

	General Conditional Formatting			
_	► 🗟 Use jover linit	🗟 Use ypper linit		
	Lover Init	Upper init.		
_	Linit value:	12 Link volue:		14
-	Reset hysteresis:	0 - Reset hysteresiz	-	0
-	Boxdesatale: Double line	Bodestele:	Double ine	2
	Background: 🛄 0: 0: 0	- Background	0;0:0	
	Foreground: 🛅 255; 0; 0	Foreground	0;255;0	
_	Estended	Extended		

The lower and the upper limits are configured in the same way.

a) Check the box to activate the formatting at a lower limit.

b) Enter the limit value when the formatting is active.

c) Enter the limit value when the reset hysteresis function is active. The reset hysteresis function avoids the high-frequent switchover of the measurement channel value.

 d) Choose the borderstyle, background and foreground color of the numeric display element.
 e) Click the Extended button to show further options to change the color of the title, border and text individually. If a 'Bargraph' display element is used, its colors can also be changed.

3. Click 'OK' when done.

8.2.6 Context menu

The context menu appears by right-clicking on a display element.



8.3 LEDs

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

8.3.1 Configuring shift LEDs

To use shift LEDs, RPM and gear measurement channels an ECU has to be loaded in Race-Con.

- 1. Click on the tab 'LEDs' in the display view.
- 2. Click on the button 'Add shift lights'.

2	Welcome to RaceCon 🙀 New Project 🖀 Display	4 Þ 🗙
	DDIRLED configuration	U
	Add pattern . Add shift lights JEdit entry Delete entry 1 Move up & Move down	
	Priority Pattern	Condition
Button 'Add		
shift liahts'		
onne nginto		
	7	
	rity	
Tab 'LEDs' 😽		
	🛐 New Page 🔯 All Pages 🔡 LEDs 🔛 Alarms 🛅 Settings	

The shift light configuration window appears.

Shift Light Configuration

1. Set up the shifting lights using the following configuration possibilities:

	- Input config	rolea										
-	Bevolution of	hannel	tome 💽 🗰			*	Ees o	Gest charvel 🗰 🗃 gest 💌 🛨				
-	► IF Lite RP1	il hystesesis	O the spee				Needs an input in ASCII format (a.g. gear_dbl, Gear Lookup can be used to transiste numero values to ASCII.					
	Patton style	selection or	nd revolution	to gear map	ping							
_	Select Pada	e state i						-				
_	Delaut	1	2	3	4	5	6	7	8	Selected LED pattern		
	6800	6800	6300	6200	6800	6800	68330	6200	6330			
	6700	6700	6700	6700	6700	6700	6700	6700	6700			
	9600	6600	6600	6600	6600	6600	6600	6600	6600			
_	6500	6500	62500	62500	62500	6500	62530	62500	6500			
	6400	6400	6400	6400	6400	6400	6400	6400	6400	••••••		
	6300	6300	6300	6300	6300	6300	6300	6300	6300			
	6200	6200	6200	6200	6200	6200	6200	6200	6200			
	6100	6100	6100	6100	6100	6100	6100	6100	6100			
	6050	6050	6050	6050	6050	6050	6050	6050	6250			
		6000	6700	6000	6000	6000	6000	6000	6330			

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 gear (must be ASCII quantization). Only if gear channel is used.

e) Define the RPM-limits individually for each LED and each gear.

f) 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'.)

g) Choose the number and color of the LEDs corresponding to the RPM-limits shown in the table. You can choose the number and color of each LED individually by right-clicking.

2. Click 'OK' when done.

The configuration is displayed in the DDU 9 LED Configuration window.

8.3.2 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.

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

32 / 156



The Gear Lookup Table Wizard appears.

Gear Lookup Table Wizard

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



2. Click 'OK' when done. The 'Create channel on DDU 8' window appears.

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

Create channel on DDU8	×
Create Channel	
Set the unique name for the channel and add an optional description.	
Name:	
gear_ASCII	
Description:	
<u>O</u> k <u>C</u> ancel	
	11

3. Click 'Ok' when done.

A graphic shows the connection between the input and output channels. The measurement channel can now be used in the shift LED configuration.

8.3.3 Creating customized LED pattern

You can create your own LED pattern with an individually created condition. The LEDs 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 number and color of the LEDs by right-clicking.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 one color. Then choose 'Display "off" pattern' and define the LEDs in the other color.

- 2. Click 'OK' when done.
- 3. The configuration is displayed in the DDU 9 LED Configuration window.

8.3.4 Assigning display pattern priority

Assigning display pattern priority

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

The 1st display pattern is activated before all following pattern if its condition is 'true'. The 2nd display pattern is only activated if the condition of the 1st display pattern is 'false' or the LEDs of the 1st display pattern are transparent.

Change the priority by clicking the 'Move up' or 'Move down' button.

DU8	BLED co	nfiguration					1.0.1					3
Add	f pattern Priority	Pattern	shift lights		ry 🧠 Del	ete entry	T Move u	p 👃 Move	down		Condition	
	_1					-	-		-	-	test	
	2		-	-		-	-			-	Shift lights	
ority												

8.4 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.

8.4.1 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.



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 <= the value < 2.5

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

•••

Switch 6 is shown with 5.5 <= the value

8.4.2 Option 1: 12 Hardwired position switch

1. 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	og pin properties.	
Pullup <mark>va</mark> lue:	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'.

Create Channel	-
Set the unique name for the ch	annel and add an optional description.
Name:	
Page_select_Rotary_sw	
Description:	
Page_select_Rotary_sw	
	Ok Cancel

ANA04 Red-p18	Page_sel	ect_Rotary_sw
5V	Name:	Page_select_Rotary_sw
Pyllup	Description:	Page_select_Rotary_sw
•		Adjust
Pin Diagnosis		raw_Page_select_Rotary
5000		
-5000		

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 settin	gs					_	
Page switch: Channel based Channel based Alarm reset channel:	•	Page switch ch	annel:				•
Brightness settings:	Switch 1	Switch 2	Switch 3	Switch 4	Switch 5	Switch 6	
 Background LEDs 	95 95	76 76	57 57	38 38	19 19	1	
Use a channel to	switch brightness:						

- 11. Click the 'Download' button at the top, to download the configuration.
- 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.



8.4.3 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 9.

	Toolbox 🖓	x
	Devices	
	Display Elements	
	Measurement Elements	
	Measurement Sources	
	 Analog sources 	
	Characteristic Curve Multipoint Adjustment	
	Sensitivity/Offset	
	Frequency sources	
00188	Characteristic Curve	
	In Velocity	
	Computed sources	Ш
	Adjustment channel	
	Display Switch	1
	 ▶ Fuel ➡ Gear Lookup Table ➡ Hysteresis 	
	l aptrioner	

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.

Diselau Cuitab amagdian						
Display Switch properties						
Setup the up and down signal sou	urces and the i	maximum co	unt of pages.			-
Source for signal Up:					Edge:	
🔲 🔿 ana05				-	Falling	
Source for signal Down:					Edge:	
🛄 📑 ana06				-	Falling	13
 Signal source: Constant: Display switch does wrap around 					1:	▼ 2÷
Measurement Sheet:						
Page_select_Toggle_sw						12

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

	annel			-	
Set the ur	ique name for the chan	nel and add	an optional de	scription. 🔪	
Name:					
Page_selec	t_Toggle_sw				
Description:					
Page_selec	t_Toggle_sw				
			Ok	Cancel	
					048
<i>.</i>					
— Page_sele	ct_Toggle_sw				
A 10 March 10 Marc					
Name:	Page_select_Toggle_sw				
Name: Description:	Page_select_Toggle_sw Page_select_Toggle_sw	v			
Name: Description:	Page_select_Toggle_sw Page_select_Toggle_sw	v			
Name: Description:	Page_select_Toggle_sw Page_select_Toggle_sw	V (Data select Te
Name: Description: Page Ui	Page_select_Toggle_sw Page_select_Toggle_sw Channel			- ¢	Page_select_To
Name: Description: Page Up at	Page_select_Toggle_sw Page_select_Toggle_sw Channel	1			Page_select_To
Name: Description: Page Uj ai Page Dov	Page_select_Toggle_sw Page_select_Toggle_sw Channel a05 m Channel	<u>+</u>		¢	Page_select_To
Name: Description: Page U; ai Page Dov ai	Page_select_Toggle_sw Page_select_Toggle_sw Channel motos			ę	Page_select_To
Name: Description: Page Ut an Page Dov an Max Page C	Page_select_Toggle_sw Page_select_Toggle_sw Channel 1005	₹		æ -	Page_select_To

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:						
Background	95	76	57	38	19	1
LEDs	95	76	57	38	19	1

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	Ф Х	New Project		
New Project	A			
Dis	Open			
	Download config	uration		
	Synchronize	•		
<u>⊠1</u> <u>™</u> CA	Current measurin	g media 🛛 🕨		
🗄 – 🧰 CA 🕞	Create dataset			
	VIN/SuperPIN	÷.		
	Export			
	Import			
	Properties			
	Delete			
	e Rename			
	EV02 ration Items			
1 1				
Device voltage	13,4 V	Device curre	ent 710 mA	
DDU-S2 Plus channels Name V V Pin Page_select_Rotary_sw 44 ANA04 Page select Topole sw	Connector Type Diagnosis Red-p18 phys Other	 Evaluation module characteristic curve with offset togole switch 	adjustment	Value Unit R,98 none 6,00 none
raw_Page_select_Rotary_sw 44 ANA04	Red-p18 raw	characteristic curve with offset	adjustment	2.225,00 mV
Statistics 🌾 Math Channels 🎼 Conditi	anal Channels 🛛 🔮 CAN messages 🛛 🌆 Macr	os 🖽 Settings 🕕 Device info	🥥 Error info 🛛 🚊 Features info	

8.4.4 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.

DDU10.rfp - RankOn V2.5.5503.10	_ = ×
System Logger Digring Calibration/Messauring Tools Format	😡 -
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DDU10 Musersert Bosch	No information
Californ Page 24 Al Pages 24 Al Pages 24 Al Pages	

A 'display settings' window opens.

					6	-	
DDU-S2 Plus display settings							
I se a channel to switch names						J	
Alarm reset channel:						-	
Technology and the second							
origniness securigs: Switch 1	Switch 2	Switch 3	Switch 4	Switch 5	Switch 6		
Background 95	76	57	38	19	1		
LEDs 95	76	57	38	19	1		
Use a channel to switch brightness:	CAN_Ang	ple_2				•	

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-S2 Plus display settings							000
Alarm reset channel:	witch pages:	Can Jan	gic_2				•
Brightness settings:							
 Background LEDs 	Switch 1 95 95	Switch 2 76 76	Switch 3 57 57	Switch 4 38 38	Switch 5 19 19	Switch 6	
Use a channel to s	witch 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.

8.5 Math and condition channels

8.5.1 Math channels

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

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 channels can be used globally in the whole DDU 9 project.

8.5.2 Creating a new math channel

1. Follow the steps shown in the screenshot.



The 'create/edit math channel' window appears.

Create/Edit Math Channel Window

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



- f) Define a value that can be used as a constant in the formula.
- g) Define a value that can be used as a constant in the form
 g) Choose a function.
- *h)* Describes the function selected above.
- 2. Click 'Finish' when done. The math channel is displayed in the DDU 9 math channel window.

8.5.3 Creating a new conditional function

1. Follow the steps shown in the screenshot.

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	Ball New Project		Devices
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	🛞 💼 CAN Bus 1	In Add channel • J. Edit channel In Delete channel	- Sensors
	CAN Bus 2	In the second s	Bosch Wigard
	& Conditional Channels	A Conditional function three capital and	Customized Sensor
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Add channel	tol III and		
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i unouon			
	Protection		
	If set to true, the object and at its childs will be protected from being modified.		
			Macro actions
	Ready.	No errors detected - all cleared or state uninown Jr.	New Project/DDUB/Math Channels/test

The 'create/edit conditional function' window appears.

Create/Edit Conditional Function Window

1. Define the conditional function 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).

e) Enter the reset value (must be a number

2. 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 If-condition becomes TRUE for the first time after power-up
- when 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 9 math channel window.

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



- 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).
- As '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 that is already set to 40 before, nothing changes.
- When 'p_br_front' rises to 40, the lf-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.
- Because 40 is bigger than 10 the new value of 'p_br_front_mx' is 40.

8.6 Condition channels

Condition 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.

Condition combination

- Combination of several (up to 16) condition channels for more complex calculations

- Logical results

All conditions can be used globally in the whole DDU 9 project.

8.6.1 Creating a new condition channel

1. Follow the steps shown in the screenshot.



The ,create/edit condition' window appears.

Create/Edit Condition Window

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



a) Enter the name of the condition channel.b) Select the comparing mode:

Constant: Compare a measurement channel with a constant value.

Channel: Compare a measurement channel with a constant value.

Range: Compare a measurement channel with a defined value range.

Multiple: 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 constant. 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 minimum 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.

2. Click 'Ok' when done.

The conditional channel is displayed in the DDU 9 condition channel window.

8.6.2 Creating a new condition combination

1. Follow the steps shown in the screenshot.

	volles_display.rlp - RaceCon							X
	File Edit Wew Extras Help							
	100000000000000000000000000000000000000	• (* • 🖓 Synchronize	. Design mode	🕨 🖉 🞯 🔍	- 🔍 Race mode 📑 🍓	0		
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Conunional	E- E Logger							MS4 Sport
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	B any 05 new							MS15.1
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	B_gcu_34_new							MS24.3
condition'	B_gcu_35_new							MS24.4
	B_gcu_so_new							PD8
	B_gcu_42_new							Bypass ECU
	B_gcu_57_new							Custom ECU
rd	B_obr1F4_can_new							 Data logging systems
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The ,create/edit condition combination' window appears.

Create/Edit Condition Window

1. Define the condition combination using the following configuration possibilities:



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, right-click on the condition and select 'Negation (!)'.

Combine several (up to 16) conditions.

2. Click 'Next' to got 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.

3. Click 'Finish' when done.

The conditional combination is displayed in the DDU 9 condition channel window.

8.7 CPU Load Limits

As all microprocessors, the DDU 9's processor has limited capacities. The current load of the processor can be monitored using the channel "cpu_load". 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 DDU 9 not being able to fulfill its required measuring/logging/display tasks or even in the DDU 9 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 9 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 9 resets due to complex configuration setups, please consider reducing the demands on the DDU 9 adapting the influencing factors mentioned above.

9 CAN Bus

The DDU 9 has two fully configurable CAN buses.

- Baudrate (125 kbaud to 1 Mbaud)
- 11 Bit or 29 Bit identifiers
- Input configuration: Read messages from CAN bus and convert to DDU 9 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).

9.1 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 (120 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, 125 kbaud).



CAN item drop-down menu

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



9.2 CAN input

9.2.1 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.

N T N + (* *) *	System	DDU10.rlp - Ra		•			
System Logger Display Calibration/Measuring Too	xis Windows						
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New Project							Qevices
- DDU10							 Displays
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GAN Bus 2	Daviste.		DOM/HOC		COULTRE.		0008
GAN Bus 3 GAN Bus 4	OW RESIDE:		OW RESIDE:		CAN RESSERT: (1)		ODU-S2 Plus
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曲 増 I/O Channels	GAN Out rate limit:	0 messages/ms	CAN Out rate limit:	0 messages/ms	CAN Out rate limit:	messages/ms	III NS4 Sport
Calibration Items Macron	CAN Bus 4						III. NS15 Sport
- A Math Channels	Burlate	Mixed •					MS15.1
 A Conditional Channels 	CHIOMONIC						MSS.0
Group adjustments	Ownessor.						MSS.2
6 Measurement Container	CAN Out start delay:	0 ms					N25.5
	OW Out rate limit:	0 messages/ms					MS6
	CAN configuration filles	d					M57
		CAN In IDs 0 / 128			CAN Out IDs 0 / 128		INS2N
		CAN In channels 0 / 500			CAN Out channels 0 / 400		MS24 light
	Add CAN-IN + D, A	dd CAN-OUT • 🕑 Edit 🛄 Di	slete				Ki MS25 Sport
	GAVE BUS 1.	CAN ID 💌 Start 8	it 💌 Length (Bits)	💌 Grid 💌 Mu	tiplexer Value 💌 Type	 CAN Bus 	PDR PDR
	GAN Bus 2						Bypass ECU
	CAN Bus 3						Custam ECU Power costrol unit
ies (CAN BUS 4.	1					BB PS2x80
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A CAN channel configuration window opens.

3. Insert the name and description of the channel. New CAN-IN message X New CAN-IN message Configure the new CAN-IN message and an optic Name: p_oil Description engine oil pre hexms CAN ID: Extended 0 Taw raw Default value: Timeout: Measured Value Value: Raw: Use Multiple: 0 Length: Гуре Big Ŧ Data Repr Byte -Start: Length: 1 --0 Туре Endianes: • Unsigned • Little 2 3 6 7 0 Conver Factor: 1.0 🔹 none/Bit 0,0 none Minumum: Offset: 0.0 🍃 2 none 255,0 none Maximum: Adjust automatically Unitgroup • none Unit: none • Meas ent Sheet Select one, or enter a r The CAN-IN message will be added for measuring in the specified sheet. ew name OK Cancel

4. Click 'OK' when done.

The channel is listed in the Data window.

MIN DOS I			CAN Bus 2			CAN Bus 3		
audrate:	1 MBaud	•	Baudrate:	1 MBaud	•	Baudrate:	1 MBaud	•
AN Resistor:	off	Ŧ	CAN Resistor:	off	*	CAN Resistor:	off	Ŧ
AN Out start delay:	0	ms	CAN Out start delay:		0 ms	CAN Out start delay:		0 ms
AN Out rate limit:	0	messages/ms	CAN Out rate limit:		0 messages/m	CAN Out rate limit:		0 messages/ms
AN Bus 4								
audrate:	1 MBaud	•						
AN Resistor:	off	Ψ						
AN Resistor: AN Out start delay:	off 0	ms						
W Resistor: W Out start delay: W Out rate limit:	0ff 0	ms messages/ms						
W Resistor: W Out start delay: W Out rate limit: W configuration fill	off 0 level	ms messages/ms						
W Resistor: W Out start delay: W Out rate limit: W configuration fil	off 0 level CAN I	ms messages/ms n IDs 1 / 128				CAN Out IDs 0 / 12	28	
W Resistor: W Out start delay: W Out rate limit: W configuration fil	off 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	ms messages/ms n IDs 1 / 128 hannels 1 / 500				CAN Out IDs 0 / 12 CAN Out channels 0 /	28	
N Resistor: N Out start delay: N Out rate limit: N configuration fill Add CAN-IN • 2	off 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	ms messages/ms n IDs 1 / 128 hannels 1 / 500	lete			CAN Out IDs 0 / 12 CAN Out channels 0 /	28 400	
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Bosch Motorsport

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.



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



Special features

9.2.2 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	?7 me	ssage	s availa	ble				_		0	hannels	s to impo	ort:
Name	U	ld	Size	Row	Row	Description	1	<u> </u>					
ABS_Active		5C0	1										
ABS_Lamp		5C0	1						Add ->				
AX1	g	80	16				=	=					
AX1_Bremse60	g	5C0	16						Add all				
AY1	g	70	16							- 1			
AY1_Bremse60	9	5C0	16										
BLS		5C0	1										
EBD_Lamp		5C0	1						C Demen				
P_Hz	bar	5C0	16										
SwitchState		5C0	8						Remove al				
WS_FL	m/s	140	16			Radgeschwindig	ceit						
WS FI Bremse2	m/s	24A	16					-					
•							Þ						

- 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.

9.3 CAN output

9.3.1 Output configuration



9.3.2 Create a new CAN output message channel

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

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tes Soor all Nere / • Source • Deurghas •	Statistics of Weth Channels of Conditional Channels	Over message Schoras Schoras O Schoras Over Status Orenos Manage Trans Sender Neusage	ato Cimprinto B Fancera etc	Beaucenon Bornens Heangement Sources
Noody.	information	Info / Statue CAN Log - Stapped SYS Log - Stapped	This enters betweed - all cleared or statis 1	w skow B

The 'New CAN-OUT message' window opens.

w CAN-OUT messa	ge				
New CAN-OUT me Configure the CAN	ssage -OUT message and an optional multiplexer	г.			<
Name:					
CAN Message					
Description					
CAN ID:	0	🔶 hex	Extended		
Grid:	100 ms	•	Trigger channel:		*
			Trigger on:	Rising	▼ edge
Use Multiplexer					
Representation:	Byte	•	Value:	1	-
Start:	0		Length:	1	
			Endianes:	Big	•
🖥 Add row 🔜	Delete row(s) 🛛 😫 Add channel 📑 Add	I constant 🧧	👌 Edit 🔄 Delete	Bit index inverted	
Byte0 0 1 2 3 4 ▶ 1 1	Byte 1 Byte 2 Byte 3 4 5 6 7 0 1 2 3 4 5 6	Byte 3 7 0 1 2 3 4	Byte 4 5 6 7 0 1 2 3 4 5	Byte 5 Byte 6 6 7 0 1 2 3 4 5 6 7 0 1 2 3 4 5	Byte 7 3 7 0 1 2 3 4 5 6
				ОК	Cancel

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



- Click on 'Add channel' or 'Add constant', this opens the 'Add new CAN out channel' window.
- Select the desired measurement channel and specify the message settings.

<u></u>	System	DDU10.rlp - I	VaceCon V2.5.5507.11 *		- a x
System Logger Display Calibration/Measuring Too	Ne Windows				. •
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• locked 🔤 Set date	Set system logger			db.	
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⊖ • • DDU10		AN Message	Specify the properties of the CAN out ch	atrol.	Displays A
E Display	CANE	escription		_	COU10
GAN Bus 1	Out		Charles		0007
III 🕒 CAN Bus 2		DAN ID: 0	Enter a chornel nome to filter		000
E GAN Bus 3	CANIN		geleda 🐔 📾		000-52 Plus
CAN Bus 4	CANE	24d 100 ma	🛥 🔂 800X	Huttowed	EDDs HI MS3 Sout
# 1/0 Charnels	CAN 6		B B sccy	Lands I M	III NS4 Sport
Galibration Items			a la soci	Compart I	E NG4.5
- 👊 Macros	CANE	Use Multipleser	B and 1	Endanes: Little •	NS15.1
- & Math Channels	Bauda	opresentation: byte	💷 🗒 ana02		M515.2
- Jr Conditional Chantels	CAN B S	lant 0	📾 🗃 ana03		MSS.1
Master Devices			📾 📑 ana04	- Offset: 0.0	M25.2
Measurement Container Click horo	CAN C		Type: Unsigned	-	MS3.3
Cuck here	ONE		I ON THE AS A		NS6
	CANO	D/1 20 4 5 6 7 0 1 2 5 4 5 6 1	1 2 3 1 2 3	4 5 6 7	M57
		1 1			MSS A
Properties	× -			Of Cancel	MS24 light
💷 🖄 🐨 standard 🔹 💷 - 💓	C Arte			on conter	VCU at NC25 Search
Application Race track	A Name		<u></u>	I.	
Norte Douto	- ¥				Display Florents
Application The arctication ture of the databaser				OK Cancel	Measurement Diements
The approaches type of the databages	Statio				Measurement Sources
Ceta					
			C Emors A Warnings D Messages		0.9 X
🗃 🗃 🗃 🖪 🛤 🖬 🖬 Showall			T., Time Sector Herman		
Name Source Description	Function	Used *			
aéfa 🗖 DDU10		=			
a8fc DDU10					
absap DDU10 Absolute lap counter		A1.			
acty DOULO Ingluona accertation		No			
accz DDU10 vertical acceleration		Information			
ADC_DMGNOSTIC DOULO Triggers the on-demand	diagnos				
adc_diagnostic_state DDU10 Signais if on demand diag	nostic t				
adjust data ny coby III DOU10 no discription II			Infe / Status CAN Log - Stapped SYS Log - Stapped		
Panda.				No errors detected - of desced or state universe *	

The measurement channel is now assigned to the CAN message.

9.3.3 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.
- 3. Define the name of the constant, the required value in hex and define the CAN channel settings.

System Looser Diselar Celifection/Measure	DDU10.rlp - Ra	ceCon V2.5.5507.11	_ = ×
DOUL0 Status	€ ¹ Ture Mit 90* 10 ¹ 1 ² Turn right 90* 908 €) Turn 198*		_
ropat D 49 New Project DU10 DU10 DU10 Du10	New CAN-OUT message New CAN-OUT message Configure the CAN-OUT message and an optional multiplexer. Name: CAN Message		Toobox 0 x Image: Cool of the second secon
Con Organs Con Organs Con Organs Con Nos 3 Con Nos 3 Con Nos 3 Con Nos 4 Convers Convers Convers Convers Convers Convers Convers Convers Marrie	Deception Deception CAVL 0 0 Nor Got 50 m. • Point Point	And in the contrast of the CM and contrast.	COUP COU-27 Mm COU-27 Mm M 64 Sport M 64 Sport M 65 Sport M
Prostes Pro	. Pre2. Pre2. Pre2.	Aljust name fran value OK Cancel	Mi34 light VCU W M525 Sport Wessurement Elements Messurement Sources D C X 0/0 X
And the second s	No information	hts / Status CVV Log - Stupped 595 Log - Stopped	

4. Click 'OK' when done.

10 Analog and Frequency Inputs

Analog inputs

- 0 to 5 V
- 12 bit A/D converter
- Switchable 3.01 kOhm pull-up resistor
- 8 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
- 20 kHz max. frequency
- 10 ms measurement window

10.1 Analog inputs

10.1.1 Measurements channels

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

Data - New Project - DDU 7 - Input-channels - ANA06 - f_wheel_fl							
<u>S</u> earch:							
Used	Name 🔺 💌	Source	▼ Description	•			
	<pre> f_wheel_fl f_wheel_fl raw_f_wheel_fl raw_f_wheel_fl raw_f_wheel_fl_fi</pre>	DDU7 DDU7 DDU7 DDU7 DDU7	Wheel force front left Wheel force front left Wheel force front left 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 9 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

10.2 Configuring inputs

10.2.1 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 9 Project Tree.



3. Drag the "Bosch Sensor Wizard" from the Toolbox and drop it on the desired analog input channel in the DDU 9 Project Tree.



The "Bosch Sensor Wizard" opens.

Bos	ch Sensor Wizard					×	
1st: Choose the sensor's category	ielect Sensor Select a sensor, ba	ased on the order number.					-
and: To parrow your	Sensor category Sensor group	TEMPERATURE SENSORS	Calit	ration data			-
zhai a sha sa			_	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 123-0	1		144	110		
3rd: Select the				186	100	-	
exact type				322	80	-	
				435	70		
				834	50		
		Sensor category	_	1175	40		
		TEMPENATORE SENSORS		1707	30		
Onens sensor's	- Alle	Sensor group		2500	20		
datachaot		NIC MIZ		3792	10		
uutusneet		Open datasheet		5896	0		
							-
		< B	ack	Next >	Finish	Cancel	
							-

- Click 'Finish' when done. The "Create channel" window opens.
- 5. Enter the channel name and description.

Create Channel	
Set the unique name for the cha	nnel and add an optional description. 🥎
Name:	
t_rad_out	
Description:	
Outlet temperature of radiator	

6. Click 'Ok' when done.

The channel is inserted into the DDU 9 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_ fi	Filtered physical value

10.2.2 Configuring a generic linear sensor

Example: Acceleration sensor 5 g

- From sensor data sheet - operating characteristics:

Output Signal			Vine 1	0.000	
Zero g (T _A = 25°C, V _{DD} = 5.0 V) ⁽⁴⁾	VOFF	2.25	2.5	2.75	V
Zero g (V _{DD} = 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 _{DD} = 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 9 Project Tree.
- Drag the "Sensitivity/Offset" analog signal source from the Toolbox and drop it on the desired analog input channel in the DDU 9 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 9. 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.

Pullup value: 3,01 kOhm Pin Diagnosis & monitoring limits Pin Diagnosis & monitorin	Configure the analo	og pin properties.					
Pullip Value: <u>3,01 kOhm</u> Pin Diagnosis & monitoring limits <u>Enabled</u> Minimum: <u>-5000</u> mV Maximum: <u>5000</u> mV	-						
Pin Diagnosis & monitoring limits Enabled Minimum: -5000 rmV Maximum: 5000 rmV mV	Pullup value:	3,01 kOhm					
Enabled Minimum: -5000 ± mV Maximum: 5000 ± mV		Pin Diagnosis	& monitoring lim	its			
Maximum: 5000 r WV		Enabled	Minimum:	-5000 🔶	mV		
			Maximum:	5000 🔶	mV		
					0		
					loot >	Gerick	 Cancel

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 [▶ 83]'.

- 7. Click 'Finish' when done.
- 8. Enter a channel name and a description.
- Click 'OK' when done. The channel is inserted into the DDU 9 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_ fi	filtered physical value

10.2.3 Configuring a generic nonlinear sensor

Example: Thermistor 5 kOhm

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

Toper	RT	
[°C]	[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	

Toper	RT
[°C]	[Ω]
0	16 277
5	12 669
10	9 936
15	7 849
20	8 244
25	5 000
30	4 030
35	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 9 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 9 Project Tree.

©	System DDU7.ttp - RaceCon V2.5.0.2002	- a x
System Logoer Deploy Clair DOU Solution Sol	tich Verzer Teal Wolfer Character Strategy and Strategy	© -
Next 0 No 0 No 0 M Property 0 No	Drag + Drop	Johns a x Deven Deven Deven
Image: Control of the section of the sectio	Q / Index sources Bibliotit Model: 9 Q / Index Sources Q / Index Sources 1000000000000000000000000000000000000	

A "Characteristic Curve Wizard" opens.

4. To activate the internal pull up-resistor, check the box. The DDU 9 pull up-resistor is used to get a 5 V signal at the analogue channel of the DDU 9. 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.

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. 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 9 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_ fi	filtered physical value



NOTICE

Working with automatically created measurement sheets is explained in chapter 'Setting up an online measurement [> 83]'.

10.2.4 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 9 Project Tree.
- 3. Drag the 'Multipoint Adjustment' analog signal source from the Toolbox and drop it on the desired analog input channel in DDU 9 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 9. 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	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 '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 9 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_ fi	filtered physical value

Online definition of the curve is covered in the chapter 'Online calibration of measurement channels [> 88]' of this manual.

NOTICE

Working with automatically created measurement sheets is explained in chapter 'Setting up an online measurement [> 83]'.

10.2.5 Digital filter details

DDU 9 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 %)</p>

Linear phase – no signal distortion



Recorded signal 100Hz (unfiltered)

Recorded signal 100Hz (filtered)

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 9 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

10.2.6 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 9 Project Tree.

3. Drag the 'Velocity' digital signal source from the Toolbox and drop it on the desired 'REV' input channel in the DDU 9 Project Tree.



The 'Velocity Wizard' opens.

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

Velocity Wizard - Add	New 📃	٢
Pin Properties Configure the free	Jancy pin properties.	-
Sensor type:	Halleffect	•
		1
	< Back Next > Finish Cancel	J

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

ocity Wizard - Add Ne	w			×		
Velocity Properties	oput 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			•	┢	Choose data type of the measurement variable
Limit minimum:				0 🚔 km/h		
Limit maximum:				400 丈 km/h		
Measurement sheet:				•		Enter name to automatically create a new measurement sheet
		< Back Nex	t > Finish	Cancel		

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

The channel is inserted into the DDU 9 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_ fi	filtered physical value



NOTICE

Measurement of 'Revolution' is similar.

10.3 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 9 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 9 Project Tree.



NOTICE

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

10.4 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.
- 2. Drag the 'Hysteresis' computed source from the Toolbox and drop it on 'Computed Channels' in the DDU 9 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 9 Project Tree.



10.4.1 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.

10.4.2 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 9 Project Tree. Do not drop it on 'DDU 9'!



A 'Calculated Speed Wizard' opens.

lculated Speed Wizard	- Add New	
Calculated Speed Cor Select speed inputs for	figuration Calculating a reference speed.	
Configure on device		Choose device
Input source:	Wheel speeds	Choose input source
Drive shaft switch:	Rear wheel drive	Choose driven axle
Speed input front left:	v_wheel_fl	
Speed input front right:	v_wheel_fl 🗨	Choose individual whee
Speed input rear left:	v_wheel_fi 🗸	speed channels
Speed input rear right:	V_wheel_fi V	
Speed difference:	5 👘 🤞	Set limit for speed
		difference for calculation
	< Back Next > Finish Cancel	

4. Click 'Finish' when done.

The speed calculation is inserted into the DDU 9 Project Tree.

Spood calculation	System Logor Desire Collection COUPT Race Mode Mode Characteria Mode Characteria COUPT Race Mode Mode Characteria Mode Characteria	Eysteen hybeauning Toolo Windows	0007 /b - RaceCon 1/2.5 /0.2002	_	- °× 0-
speed culculation					
in DDU Project	Property V	fall New Project 1 2007 2 Speed		11.8	Devices
an BBO moje					Display Elements
Tree	B- CB Logger				Measurement Dements Measurement Sources
1100	B- 🛄 Display				Sersars
	B- CAN 8451	Speed configuration		₩.	E Bosch Wizerd
	8- 🛅 Computed Channels				Customized Sensor
	B- 20 DO Channels Calibratian Items	Caringure an device	007		Characteristic Curve
	- 🖷 Mecros	Input source (ithe	al speed		Multipoint Adjustment
Measurement	- fe Math Osavnels				Senserveryornae
	- K Group adjustments	Conference (1997)	vheel drive		Characteristic Curve
channels	GP Master	Speed input front left	v_wheel_fl	-	Revolution
circumetes	E. C. Manual Contract	Screed input frantricht	a shad f		Computed sources
calculated speed	Cato-Speed 9 x			101	Adjustment chennel
culcululeu speeu		Speed input rear left	B_booke_v		Characteristic Curve
and calculated	a show all	Speed input rear right	v viteri f		Gen Lookup Table
una calcalatea	Mana				Mysteresis
distanco 🔶	Speed_det_ds B0007 detance	Speed difference		3.01 %	D Laphager
uistunce					Sensitivity/Offset
					C Speed
Configuration window	r	C configuration		3 X 1203 X	
waraow	North Sarrel A			1501100	
	El Debag	Type Time Sender Plessage 15-37-85 DD17 - No. Last connection to device Pl	thereat h(CP)		
	CanChangedProtectionS True	10:33-46 DDU7-Ne Successfully cannected to d	eviceEthernet(NCP).		
		JJ 10:33:46 DDU7 - Ne DN check successful. (DN: 10:33:47 Alarm - Ne In channel source configure	Device: DDU7_BASE_0727]		
	CanChangedProtectionState	D 18:33:47 DDU7 - Ne Logger data matches the lo	cal data.		
		Districtions a Children estrement			

11 Online Measurement

DDU 9 configuration

- System configuration (channel + display configuration, CAN I/O, etc.) is stored in theDDU 9
- Use RaceCon to create and download configuration from the PC toDDU 9
- 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

11.1 Setting up an online measurement

DDU 9 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.



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 9 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)

11.1.1 Automatic creation of measurement sheets

RaceCon can create measurement sheets automatically.

You can create and use measurement sheets with the DDU 9 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.

Limit maximum 3,3333333333333

Factor 1.0 w mA/inc Offset 0.0 w

-

•

Output data type

Force quantization

Measurement sheet

< Back Next > Finish Cancel

16 Bit





6 none

8 10

12

2

0

Mm

Set the unique name for the ch	nannel and add an optional description.
ama.	
ightness	
escription:	
scription:	

2. To create the sheets, right-click on DDU 9 and select 'Create measurement views...' from the DDU 9 context menu.

Project 4 X	New Project DDU7	
E Rew Project		
📩 📲 DDU7 💻 🗍 👘 👘 DDU7	Name: brightness	
🖶 📄 Dis 🔯 Create measuring views	Description:	_ Click to create
🚛 🚡 CAI 😡 Download configuration		measurement sheets
En Cor Synchronize		
E I/O Current measuring media	Input Channel	
🕞 Cal 🔐 Create dataset	display_brightness	
f_x Ma 🙀 PIN/SuperPIN 🕨		
Gro S Export		
Import		
😥 🛗 Measul 😭 Properties		
Data - Computed Char X Delete		
aje Rename		
🔁 🔼 Show all	-	
Name V 💌 Sou 💌 Description		
brightness DDU7		
brightness DDU7		

The automatically created sheet is inserted in the Project Tree under 'Measurement Container' and 'Device Channels'. If the DDU 9 is connected to RaceCon and the status is green, live values of the channels are shown.

11.1.2 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'.

0,0000 G	SENSITI	400,000		Zumpent editeder
2490,0 mV	OFFSET	2500,000	mV	
	MIN	-5,000	G	-
	MAX	5,000	G	
	ADJ_VAL	0.000		
	0,0000 G 2490,0 mV	0,0000 G SENSITI 2490,0 mV OFFSET MIN MAX ADJ_VAL	0,0000 G SENSITI 400,000 2490,0 mV OFFSET 2500,000 MIN -5,000 MAX 5,000 ADJ_VAL 0,000	0,0000 G SENSITI 400,000 2490,0 mV OFFSET 2500,000 mV MIN -5,000 G MAX 5,000 G ADJ_VAL 0,000

11.2 Online calibration of measurement channels

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



11.2.1 Enable online offset calibration for measurement channel

During creation of the measurement channel







11.2.2 Performing the online offset calibration

DDU 9 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.

11.3 Group adjustment

Group adjustment is the simultaneous online calibration of several channels. This is useful e.g. to set all wheel forces and damper positions to '0' when the vehicle is positioned on a flat patch.

11.3.1 Configuration of group adjustment

Group adjustment consists of two components:

- An input channel which triggers the adjustment event
- A group of input channels linked to the group adjustment event

11.3.2 Setting up the group adjustment trigger channel

- 1. Click 'Measurement Sources' in the Toolbox.
- Drag the 'Group Adjustment Channel' element from the Toolbox and drop it on the DDU 9



A 'Group Adjustment Channel Wizard' opens.





NOTICE

If a low-active signal is selected as an input channel, do not forget to enable the pull-up resistor for the pin. Otherwise the group adjustment will be triggered periodically.

See chapter 'Configuring a generic linear sensor' for further information concerning the pull-up-resistor.

3. Click 'Next' when done.

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





NOTICE

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

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

11.3.3 Assigning channels to the group adjustment

- 1. Double-click on the created channel (e.g. 'grp_adj_channel') in the Project Tree.
- 2. In the Main Area, an overview of the available adjustment channels opens.
- 3. To add measurement channel(s) to the group adjustment event, check the 'Calibrate' box of the desired channel(s).



The selected measurement channels are added to the group adjustment event.

11.3.4 Triggering the group adjustment

- 1. Connect the input pin to GND using a push-button.
- 2. Make sure the pullup-resistor is enabled, if you selected 'active low' trigger polarity.
- 3. Double-click on the input channel 'grp_adj_channel' of the group adjustment.
- 4. Download the configuration on the DDU 9. To connect the DDU 9 to RaceCon, see chapter 'Connecting the Unit to RaceCon'.
- 5. Open a measurement sheet by clicking on the desired measurement sheet in the Project Tree.
- 6. Drag the 'grp_adj_channel' and the 'input_grp_adj_channel' to the online measurement sheet.
- 7. Press and release the push-button.
- 8. The measurement labels indicate the state of the input pin and the state of the adjustment.





NOTICE

A display alarm can be linked to the trigger channel to indicate that the trigger has been detected.

11.4 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'.
- 2. Download the configuration on the DDU 9. To connect the DDU 9 to RaceCon, see chapter 'Connecting the Unit to RaceCon'.
- 3. Click on the desired channel in the DDU 9 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.

Point	Value	Unit	Calibration
1	745	Ν	Calibrate
2	12548	Ν	Calibrate
3	34075	N	Calibrate
4	45050	N	Calibrate

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



12 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.

12.1 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.



12.1.1 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.

12.1.2 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 Sheer	oratoryMeasuring	Tools Vir	00m3		_	-		
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at New Project								Devices
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+m DDU10	Existing DOU10 er							Measurement Bements
E Logger	MIL 🔴						Clear	Measurement Sources
E Display	1		Dentes	A set of	Des Terr	0		⊡ Sensors
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😥 🛄 CAN Bus 3	AN407	Open line	20,0	o True	1/4/2000 6 28 26 AM		1 No further information avail	Characteristic Opera
E CAN BUS 4	ANA09	Open line	29	True	1/4/2000 6 28 27 AM		1 No further information avail	Multipoint Adjustment
S S VO Changels								Sensitivity/Offset
Calibration Terms								Frequency sources
Macros								Characteristic Curve
- fr Math Channels								Revolution
 f_c Conditional Channels 								Velocity
Group adjustments								 Computed sources
Group								Adjustment channel
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E- C messenen concerne								Display Switch
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- I Showall	Statistics /+ N	ath Channels 📋	🕆 Conditional Channels	CAN messa CAN messa F X terfo / Can be terfo / Type	pos Macros m Status mors(1) A Warnings(Time Sender	Settings Devic	enfo 😢 Error Info 🛱 Features Inf 🦲 L197	e # 152/152
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12.2 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.

12.2.1 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 - Ma 	isterlicense Bosch *	_ = X
	System Logor Diodey Cl DU9 Race Mode Visible Protection Sinc Status Node	albraton,Measuring Too	is Windows	-	-	-	-	() •
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	CAN Bus 4 Computed Channels	ANIA07 ANIA09	Open line T Open line T	113.5 False 113.1 False	1/4/2000 6:28:26 AM 1/4/2000 6:28:27 AM		No further information avai No further information avai	Characteristic Curve Multipoint Adjustment Constraints/bultified
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error memory	e ti Ready.			Info	CAN Log - running	1	Open line), for 113, 1s + 👘 New P	rojest/00010,1/0 Channes 👜 🖷 🕂



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12.2.2 Error Properties

The following channels are recognized and memorized inside the devices:

Data			
err			
			Show all
Name	1.	Source	Description
error_active_rotate ror_location_rotate error_location_rotate error_state rror_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 limi			

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

Channel Measurement		
Actual measurement rate	100 ms - time synchronous event channel	
Default measurement rate	100 ms - time synchronous event channel	
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		

12.3 Analog Input Diagnosis

12.3.1 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.

Pulup value: 3.01 KOhm Pin Dagnosis & montoring lints Pin Dagnosis & montoring lints Pin Dagnosis & montoring lints Pin Dagnosis & montoring lints Maxemum: 1000 m mV Maxemum: 4000 m mV Maxemum: 4000 m mV Cancel NA01 Red p28 NA01 Red p28 Piskin Piski	Pin Properties Configure the analo	ig pin properties.
Pin Dagnosis & montoring limits Pin Dagnosis & montoring limits Maximum: 1000 m V Maximum: 4000 m V Maximum: 4000 m V Maximum: 4000 m V Red P23 Page_Switch_ANA_1 Page_Switch_AN	Pullup value:	3.01 kOhm -
Violation Maximum: 1000 m/v Maximum: 4000 m/v Maximum: 4000 m/v Note Page_Soutch_ANA_1 Name: Page_Soutch_ANA_1 Page_Soutch_ANA_1 Page_Soutch_ANA_1		Pin Diagnosis & monitoring limits
Maximum: 4000 km < Back		I Enabled Minimum: 1000 ♠ mV
< Back		Maximum: 4000 mV
KAD I Red p28 Page_Switch_ANA_1 Name: Page_Switch_ANA_1 Page_Switch_WAA_1 Description: Place 900_0 Page_Switch_WAA_1 Description:		
Koll Red p28 Next > Finish Cancel Nome: Page_Switch_ANA_1 Page_Switch_NAA_1 Description:		
Rest Next > Finish Cancel VAD I Red p23 Page_Switch_ANA_1 None: Page_Switch_ANA_3 Page_Switch_MNA_3 Description: Image_Switch_MNA_3 Page_Switch_MNA_1 Image_Switch_MNA_1		
C Back Next > Finish Cancel NAD1 Red p26 Page_Switch_ANA_1 None: Page_Switch_ANA_1 Page_Switch_MAA_1		
C Back Next > Finish Cancel VA01Red p28 Page_Switch_ANA_1 Nnme: Page_Switch_ANA_1 Description: Page_Switch_ANA_1 Phop Symptom Page_Switch_ANA_1 Page_Switch_ANA_1 Description: Symptom Page_Switch_ANA_1 Page_Switch_ANA_1 Page_Switch_ANA_1 Page_Switch_ANA_1 Description: Symptom Page_Switch_ANA_1 Page_Switch_ANA_1 Page_Switch_ANA_1 Page_Switch_ANA_1 Description: Symptom Page_Switch_ANA_1 Page_Switch_ANA_1 Page_Switch_ANA_1 Page_Switch_ANA_1 Page_Switch_ANA_1 Symptom Page_Switch_ANA_1 Page_Switch_ANA_1 Page_Switch_ANA_1 Symptom		
C Back Next > Printh Cancel VA018cd p28 Page_Switch_ANA_1 </td <td></td> <td></td>		
C Back Next > Finish Cancel VAO1Red p26 Page_Switch_ANA_1 Pskp Page_Switch_ANA_3 Pskp Switch_Signal Switch_Signal Pskp Switch_Signal Switch_Signal		
Konstant Rese Ned > Frish Cancel A001Red p28 Page_Switch_ANA_1 Name: Page_Switch_ANA_3 Description: Page_Switch_ANA_1 Phype Stress Page_Switch_ANA_1 Page_Switch_ANA_1 Description: Stress Page_Switch_ANA_1 Page_Switch_ANA_1 Description: Stress Page_Switch_ANA_1 Page_Switch_ANA_1 Description: Stress Page_Switch_ANA_1 Stress		
C Back Ned > Frish Cancel 4001Red p28 Page_Switch_ANA_1 Name: Page_Switch_ANA_1 Description: Page_Switch_ANA_1 Phylip State Page_Switch_ANA_1 Page_Switch_ANA_1 Description: State Page_Switch_ANA_1 Page_Switch_ANA_1 Description: State Page_Switch_ANA_1 Page_Switch_ANA_1 Description: State Page_Switch_ANA_1 State Page_Switch_ANA_1 State Page_Switch_ANA_1 State Page_Switch_ANA_1 State Page_Switch_ANA_1 State Page_Switch_ANA_1 State		
NAO1Red p28 Page_Switch_ANA_1 Name: Page_Switch_ANA_1 Description: Pytep P		Paule Nant & Databa Conned
VAD1Red p23		
SV Name: Page_Switch_AVA_1 Description:	VA01 Red-p28	Page Switch ANA 1
Description:	5V	Name: Page_Switch_ANA_1
Pole Page Switch ANA. Amount of the second	Δ	Description:
Page.Switch_ANA_ 5000 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Pullup	
n Dognoss	2	S000 Outral Page_Switch_ANA_1
n Dognods		0 tipBt
n Dogrools		
n Dagnosis	•	Page_Swtch_ANA_1_fi
n Degroos		Page Switch_ANA_1_f
	-	Pept_Switch_ANA_1 f
	n Diagnosis	
	in Diagnosis	
4000	n Diegnosis	

12.3.2 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".

System Logger Digitary (Calibration/Measuring Tool	System Is Windows	-	DDU10_Test r	lp - RaceCon V	2.5.5.0 - Masterloense Bosch *	-
DUUID Race Mode visible Protection in scalars doce Project Security pect 6 x - set Project Security		10 💌					Toobox Qrvices
8	Existing EQUID errors					<u>e</u> :	Measurement Elements
C C DDUIO	ML					Cent	Measurement Sources
B- Display	Lundar 1	Tunn Duration	Aution	DataTime	0	Description	Sensors
E CAN Bus 1	AW//A	Type Duration	212 0 100	1007000 5-22-25 AM	occarrences	1 No.1 other information with	Costaniand Farmer
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B- D CAN Bus 3	AN407	Open line	29.4 49 True	1(4/2000 5/28/25 AM		1 No further information avail	Characteristic Curve
B- La CAN BUS 4	AN409	Open line	29 49 True	1/4/2000 6 28:27 AM		1 No further information avail	Nultinaint Adjustme
Computer Channels							Sensitivity/Offset
Calibration Terms							Frequency sources
Macros							Characteristic Curve
fx Math Channels							Revolution
f_c Conditional Channels							Velocity
🚊 📉 Group adjustments							Computed sources
Group Group Good Good	Start detertion of	THE D					Adjustmeth Channel Characteristic Curve Display Switch Puel Gear Lookup Table Hystensis Lubringper PVM Out Sensitivity/Offset Sensitivity/Offset
		~					
	Statistics 🥠 Nath C	hannels 🥼 Conditional Ch.	annels 🛛 🔃 CAN mes	sages 🕞 Macros 📾	Settings 🚯 De	vice info 🙀 Error info 🔐 Features inf 🦲	-
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The second second					and 167) unitary		
and the free section of	_		Typ	e ime Sender		message	
ne 🛛 🔽 💽 Source	Description	No informa	tion	17:33:10 00010 17:33:11 00010 17:33:12 00010 17:33:13 00010 17:33:16 00010 17:33:16 00010	New Project New Project New Project New Project New Project New Project New Project	Successfully connected to device (Ethernet)(EP) EPK check successfull. (EPK Device: DDUID_BAGE Device idea matches the local data. Calibration data successfully uploaded and initial Successfully deared the error memory. Start of cable breakage detection successfull.	_0+01_TST+0 zed.

13 Recording

13.1 Features

- Synchronized recording of DDU 9 analog and digital input channels, DDU 9 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)

13.2 Configuration of recordings

1. Expand the list of 'Loggers' by clicking on '+' in the DDU 9 Project Tree.



 Double-click on 'Recording' in DDU 9 Project Tree. The recording configuration is displayed in the Main Area.



- 3. To add measurement channels to a recording, click 'DDU 9' in the DDU 9 Project Tree. In the Data Area, the measurement channels are displayed.
- 4. Drag and drop desired measurement channels into recording group.

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Carlos Internet	Nurley Collegione Mars		000740-	NUCCON V2-3-0-2002					 -
DOU7 Status	Add C Delete Recording Gro	Rename Belete Delete X0							
🚍 🗞 + 🎓 - F									
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DOU7 configuration managem	nent seediid Dalata choosalid 12	1 Elst sizes				E	Show all	· Sou	Description ^
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2 alumula @13455	nais aujeonter aujeone aujeone	Drag meas	Urement no group	. Joann	Recording p	roperties	and dg, rb, 07 and dg, rb, 08 and dg, rb, 07 and dg, rb, 08 and dg, rb, 18 and dg, rb, 18	COUT COUT COUT COUT COUT COUT COUT COUT	card streed in d card stareed in d
Pr servete Stations	Satutica						Cardinaria (Cardinaria) Cardinaria (Cardinari	ter 2007 2007 2007 2007 2007 2007 2007 200	Cordmemory pri Condimensity pri Cardmemory pri Cardmet

5. To edit channel's settings, mark the channel(s) and click 'Edit Channel'. An 'Edit Recording Channels' window opens.



6. Click 'OK' when done.



NOTICE

If no condition is defined or 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'.

Using fast block/slow block transmission

DDU 9 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).



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. See chapter 'Recording statistics [**▶** 107]' for more information.

13.2.1 Adding a recording

DDU 9 supports up to two independent recordings.

To add a recording, select 'Add Recording' from the context menu of the Logger in the DDU 9 Project Tree.



Maximum two recordings are possible. In the device software the 2nd recording is reserved for scruteneering data. This recording is invisible (protected).

13.2.2 Adding a recording group

Recording channels can be grouped.

To add a new group, select 'Add group' in the context menu of the recording. The groups can be renamed to 'Gearbox', 'Aero', 'Engine', etc.



13.2.3 Global settings

To display the global DDU 9 settings, select the 'Settings' Tab.



a) Choose setting for outing counter mode:

- For testbench (without lap trigger) select 'Testbench'.
- For racetrack (with lap trigger) select 'Racetrack'.

b) Choose your WinDarab version. In V6 the file is encrypted by WinDarab. In V7 you can enter an optional self created password in the 'Encryption' field shown in f).

c) Recording Type (Engine or Chassis).

d) Statusblock configuration file for custom Statusblock definition.

e) Choose or create the condition to start recording.

- f) If selecting WinDarab V7 in b), enter a password hint and a password (optional).
- g) Setting for automatic fragmentation. Do not change!

13.2.4 Recording statistics

The tab 'Statistics' shows the channels' allocation and their current data rate related to the transmission frequency of the DDU 9 and the whole transmission system.

The overview helps to detect bandwidth bottlenecks of channels. Bandwidth bottlenecks can be solved by changing the 'fast/slow block' setting for each channel.

The data rate of the whole system is often less than the data rate of the DDU 9 and limits the overall transmission speed.



13.2.5 Recording diagnosis

The channel 'statectrl_ok' of the DDU 9 can be used for online monitoring of recording status.

Bit	Value	Name
0	1	RECORD
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.

Name	Bitset	Bit cleared
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.

13.2.6 Displaying online recording diagnosis ('statectrl_ok')

- 1. To add a Recording Diagnosis element to a measurement sheet, change to page "Calibration/Measuring" and 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.

System Logor Display Colloration/Measuring Tools Folder/Sheets Format	Ø -
The second secon	
Diff count: 0 Di	
DUU/ Kace Hode Messung Kecording None WP (Merge/Compare	
Status Mode Measuring Data	
■ ☆ + <i>A</i> - 1	
	Dux 0012
B Measurement Folder 1	4.5 Data - DOO 4 4
	100
	Show all 8
	Name 000
	meas_cnt_m03request
	Bineas_compression_m01
	Bineas_compression_m03
	mess_globcond_m01
	meas_globcond_m03
	Biness_rate_rr01
	Breas_rate_m03
	Cutty D
	WOUTINGCTR_MODE DX
	BIOUTINGCTR_MODE_TESTBE X
	BPCODE ON
	Brangemon_adc_high_error
	Brangenon_adc_jow_error D
	REVI_max IX
Internet of the second s	REV2_max
8 7 6 5 4 3 2 1	telifike/3_max
	CIRCUT INAX III
	Bernahum III
	gistateon_enr luit
	Bittine boar
	· · · · · · · · · · · · · · · · · · ·
	A statestid ok
	Provided by DDU7
	Summary of system and measuremen
	Quantization: 1/m
	Limiter0. 255
	Format:%1.0
The second s	Predsontu Resolution
Sheet Z Les ander 1	с <u>п</u> э

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 9 is recording data: 255
- Values less than 254 indicate an error state
- 'statectrl_ok' can be linked to an alarm on the display. See chapter ''Alarm' display element' for details.

13.3 Recording data on USB device

- 1. Plug an USB device to DDU 9.
- 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 9.
- 5. Record measurement data. If an USB device is present, the DDU 9 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.

💫 🙀 -	WinDarab v7 Developer - Formula3		- 0 -×-
Start Tools Windows			Style v 🔞 v
Tiles V Racetrack - Channels A Events Colors Channels Colors Col	The second secon		
Dockable windows Control Bars Worksheet	Worksheet controls [All controls] Current control [Desktop layout]		
File Explorer 0 ×		Channels	* ×
Out Lap Laptime		Name Source	e Descripti
	y a x "Bekanet#/		
Events			9 ×
Time Car From To Duration Channel Min	Max		

- 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.



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

Settings Current Import	t Recent Import		Choose your DDU
Import sources Import sources Import ashCard / USB-1 Import Device Import Burst	Stick	Common options Delete ARP cache entry after ping to device failed. Force password, if not set by recording configuration: New	from dropdown list
Device/Flash IP / Device: Export file: Save files in: Subfolder template: Filename template:	DDU7 - 10. 10. 0. 207 One file for each lap C: \Bosch\WinDarab\Data\DataFiles [CardInfo] outing [outing03]-[lap03]	 ✓ Import all on connect ✓ Delete transferred files … (a)+ (a)+ 	
Advanced Co	mment Fields	Apply changes	

12. Activate 'Apply changes'.

Insert the USB device into the PC. Data transmission from device starts automatically. Measurement files are stored automatically in the base folder.

-	Data Logger Import							• ×
	Settings Current Import Recent Impo	ort						
	Data source: FTP 23.06.2015 12:11:1	1			Network	DDU7 - 10.10.0.	207 🔷	18 ms
	Name	Size (MB)	Get	Get (MB)	Progress			
	TP 23.06.2015 12:11:11	0.0		0.0	Connecting			
	auto Scroll Show all files							nport
L	Show dirines							

Size (MB)	Success	
	Size (MB)	Size (MB) Success

- 13. Click 'Close' when transmission has finished.
- 14. Click on the Start button and choose 'Open measurement file'.
- 15. Select the measurement files from the storage folder.

- 16. Click on 'Open'.
- 17. Click in 'New Desktop' to open a new measurement data window.
- 18. Drag the desired measurement channel from the Channel list and drop it into the measurement data window. The measurement channel's graph is displayed





NOTICE

For more detailed descriptions and instructions refer to the Win-Darab V7 manual.

13.3.1 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 9 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 9 is powered up, the DDU 9 still records data.

If the USB device is unplugged and re-inserted for > 4 s while the DDU 9 is powered up or a different USB device is plugged in, the DDU 9 restarts. In this case, the DDU 9 is not operational for 1.5 s.

13.3.2 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 9 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 9 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 9.
6: Error: Media corrupt	The USB device is not in valid BFS format. (Hint: Re-format the USB device in RaceCon.)

14 Telemetry

14.1 Features

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 9

14.2 Configuration of Online Telemetry

14.2.1 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





14.2.3 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	×	
👥 🖞 🏹 all 👻 🏹 standard 👻 💷 🗸 🞯		Baudrate of DDU (must match baudrate of FM 40)
Device properties	1	
Name FM40		
Security		Transmission pause
Protection False		(F0)
Telemetry properties	1 /	(5% recommended for improved re-
Baud rate 19200		synchronisation)
Pause [%] 5	_	oynom on out on y
Project Key 4711		
WDServer folder C:\Bosch\DLS\WinDA	lf .	Project Key (11119999)
		Path to configuration folder of WDServer on receiver PC
		(usually\WDServer\DCP) to store telemetry configuration file
MDC folder		
Folder for WDServer configuration files		

Adding channels to telemetry

- 1. Expand the list of 'Loggers' by clicking on '+' in the DDU 9 Project Tree.
- 2. Double-click on 'Recording' in DDU 9 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 9 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.

Change the rate or condition of the	recording channels. You may also change the telemetry mode.
Recording channels:	Bate:
r_wheel_rr f_wheel_rr f_wheel_fr f_wheel_fr	10 ms
[_wice[1	Condition:
	Truje rate:
	Telemetry:
	Fast None
	Slow

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

14.2.4 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).

- 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.

🕀 🕻 New Project 🛛 🗮 FM	140 x		
FM40 settings	;		
General Set	tings		
WDServer f	older: C:\Bosch\WDServer\DCPs		
Project key:	04d2	hex	
Baudrate:	115200	▼ bps	
Pause:	5	%	
Max. channe	els: 512	A V	
Channel set	tings		
Distance cha	nnel:		
		•	
Lap number	channel:		
		•	
Lap fuel char	nnel:		
		•	
Lap time cha	nnel:		
		▼	
Lap distance	channel:		
			_
FM40 ESttings	🔡 Statistics		

- 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.

Jame ▼ Souce Wddh (Byle) ▼ Telementy mode ▼ Dummel yee ▼ stdp D018 2 Sou Fast Lap dutnce Souce Sou	Add a new channel	Ed	t channel(s)	🛃 Delete char	nel(s)					
DDU9 2 Show stdap M55.1 2 Fast Lap datance sedara M55.1 2 Fast Lap Auf pcbr DDU9 1 Fast Lap Auf ptme M55.1 2 Fast Lap Auf ptme M55.1 2 Fast Lap number	Name	¥ ¥	Source	*	Width [Byte]	*	Telemetry mode	*	Channel type	~
MS1 2 Fast Lapidation wildown MS5.1 2 Fast Lapidation optim D0U8 1 Fast Lapinne plime MS5.1 2 Fast Lapinne plime MS5.1 2 Fast Lapinne	acc_lat		DDU8		2		Slow			
MS5.1 2 Fact Lap / Lal pdf DDUB 1 Fact Lap rumber ptime MS5.1 2 Fact Lap fime me PM0 4 Fact Time	fistlap		MS5.1		2		Fast		Lap distance	
potr D0U8 1 Fast Lap number pfme MS51 2 Fast Lap time me PM04 4 Fast Time	uelcons		MS5.1		2		Fast		Lap fuel	
plime MS5.1 2 Fast Loptime	apotr		DDU8		1		Fast		Lap number	
ine EM40 4 East Time	aptime		MS5.1		2		Fast		Lap time	
	time		FM40		4		Fast		Time	

14.3 Configuration of Ethernet Telemetry

The usage of ethernet telemetry requires the software upgrade ETHER_TELE (Enable ethernet telemetry).

14.3.1 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.

14.3.2 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.

et the channels	and properties for the new FM40.	
Set the specific ch	nannels for the telemetry. You may also change the telemetry settings.	
General Settings		
WDServer folder:	C:\Users\kfl2abt\Documents\RaceCon Projects	
Project key:	04d2	hex
Baudrate:	115200	▼ bps
Pause:	5	%
Max. channels:	512	*
ap number channe	l:	
ap fuel channel:		•
ap time channel:		
ap distance chann	el:	
		•

- 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.

14.3.3 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.

C70_Test.bmscfg - WinDarab Server			- • • ×
Workdesk CF-Cards Telemetry Protocol Options ?			
Car Settings Car Settings	Computer	Car	Application
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	x
Car settings UDP:10000 New: COM	
Car name	Data output to backup system
Name: Car #1	Port:
Comment:	Baudrate: 9600 👻
Folder with the DCP-Configuration files	ngs/Telemetry) No of lines per page: 64
ОКС	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	;lp

- 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.

Settings	X	3
Common	Network adapters Telemetry	
Folde	er for temporary files sers\kfl2abt\Documents\WD_Server Change	
Folde	er for log file 'wdserver.log" sers\kfl2abt\AppData\Local\Temp Change	
	OK Cancel Apply Help	

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
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

 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.

14.3.4 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:

Openfile								10.0
🖉 🖉 🖉 + Computer +	Wintewell,05(E) + Beach + Windows + Cor	rfig + Wittenat			• 4	Seven Hillianer		8
Organics +							• . Cli	
Contraction of	A Barn	Data resublish	Type	Sex				
WDferver	#1 MSD-TrackLaptop - Car #8L8month	11.100/2003 11.02	WinDucak Talamatry		388			
Constitutions Facestage Facest								
Decuments Marie Extrans								
H Valence								
ağ Hamaşınap								
(# Camputer	+							
File name						All supported fries	"longing"	1.
Show Inform Right +					Auto facilies to locations	Open v	Cancel	

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.

15 Lap Trigger

15.1 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)



15.1.1 Electrical trigger signal

In DDU 9 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.



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)

15.1.2 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) 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 detection point.		Laptrigger configuration General Presettings Conditions Trigger Countdown Segment timing GPS Decimal latitude: 49,32777400 - <td< th=""><th>DD DD</th></td<>	DD DD
Define the detection range around the detection point.		Laptigger detection range: 20 🔄 GPS channel sources: Longitude source: Longitude source:	m
Define the channel sources for Longitude, Latitude, Direction and Speed.		Labitude source:	
	Configuration		



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.

15.1.3 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.

15.1.4 Forced triggers

Lap distance based insertion of 'forced trigger'.

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

15.1.5 Setting up a lap trigger

- 1. Click 'Measurement Sources' in Toolbox.
- 2. Drag 'Laptrigger' into 'System Overview'. Do not drop it on 'DDU 9'!



A 'Laptrigger Wizard' 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'.

Click 'Finish' to complete the operation. A pre-configured lap trigger window opens.

0010	ersz kholjószti 😰 Laptrigger 🗵	
		Ö
	Laptrigger configuration	
Preset values for lap counter	General Presettings Conditions Trigger Countdown Segment timing	
and outing counter	Lap counter start value:	15
Minimum lantime that a new	Outing counter start value:	
	1 g out	6
best laptime' is accepted	10 2 5	
Preset value for 'best laptime'	→ Lap time best preset: 100,0 ⊕ s	
(@ Co	Configuration	
	Laptrigger configuration	Ø
Change signal for vehicle speed,	Access Recommend Providing Record Accession Record Record Record	
if desired.	Speed source:	
	a speed ▲	
Enter minimum speed for	Mn. speed:	1/h
trigger release.	Track distance:	
Define settings for distance	4000 🖗 m	
Define settings for distance	20 🖗 %	
based retrigger protection.	800 m	
	Enforce laptriager Max, distance:	
	120 👘 %	
	4800 m	
Define settings for distance		
based forced triager.		
(B)	Configuration	
	Laptrigger configuration	Θ
Define settings for lap timing	General Presettings Conditions Trigger Countdown Segment timing	
(main trigger).	Detection time:	
	15 ms	
	5000 x ms	
Define settings for sub trigger.	Use intermediate trigger	
Not applicable with a GPS lap trigger.	Detection time: 30 (2) ms	
	Retrigger lock time:	
	5000 (¹ / ₂) ms	
	Contiguration	

		(Å)	
		Laptrigger configuration	
		General Presettings Conditions Trigger Countdown Segment timing	
Define settings for countdown		Mode:	
timor		None	
uner.		Start time:	
		120 (<u>x</u>) 5	
	Configuration		
		()	
		aprige congration	
		General Presettings Conditions Trigger Countdown Segment timing	
Define settings for segment		Mode:	
timina.		None	
		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.	Lephager configuration General Presettings Conditions Trigger Countidown Segment timing GP5 Decimal lastitude: 49,32777400 [d] GP5 GP	00 DD
Define the detection range around the detection point.	Laptrigger detection range: 20 g	
Define the channel sources for Longitude, Latitude, Direction and Speed.	Lattude source: Grid de sour	
	Configuration	

15.1.6 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



15.1.7 Lap trigger presettings

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



15.2 Counting outing/laps/fragments



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 [▶ 132])

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'.

15.3 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		

Channel	Function
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

15.3.1 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.

Define settings for lap timing (main trigger).	Laptopor configuration Ø General (neesting) (contions) (right" (cautions) (segment timing) Detectors time: Detectors time: 13% ms
Define settings for sub trigger. Not applicable with a GPS lap trigger.	Refriger lock time: ms
Confi	guration



15.3.2 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 %.

	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
	Laptrigger configuration
Change signal for vehicle speed,	General Presettings Conditions Trigger Countdown Segment timing
if desired.	Speed source:
	and a speed
Enter minimum speed for	Min. speed:
triagor rologgo	20 🚖 km/h
trigger release.	Track distance:
	4000[@] m
Define settings for distance	Min. distance:
based retriager protection	2.00 00
buseu reingger protection.	800 m
	C Enforce laptrigger
	Max. distance:
	m uuer
Define settings for distance	
Define settings for distance	
based forced triager.	
55	
	Configuration



15.3.3 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.





15.4 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

15.4.1 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.

fine settings for lap timing	Laptroper configuration
ain trigger).	Detection time: 15 mm s
	Retrigger lock time: 5000 🖗 ms
fine settings for sub trigger.	Use intermediate trigger
ot applicable with a GPS lap trigger.	Detection time: 30 (2) ms
	Retrigger lock time: 5000 (m) ms



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

15.4.2 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'.







15.5 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.



15.6 Automatic GPS Track Detection

With the GPS lap trigger, an automatic track detection can be activated by checking the highlighted box in the lap trigger configuration at the GPS tab.

Activating this functionality will overwrite the GPS trigger point coordinates and the track length with the values of a detected racetrack. The coordinates and the track length will be grayed out in the tool.

The function will compare the current GPS position with the coordinates of the known Racetracks list and use the closest GPS trigger point. If there are track variants with different track length, the system will adapt itself to the correct variant, if it is in the known racetrack list, after ~three detected laps. Please note that the track length needs to be quite accurate, within +/- 100 m, to adapt itself to another variant.

ncru	Presettings	Conditions	Trigger	Countdown	Segment timing	GPS	Known Racetracks				
Decin	nal latitude:									GPS Track detection	
								49,32777400 🛓	DD	Override Track distance & position	
Decin	nal longitude:										
								8,56584700 🜩	DD		
Laptr	igger detectio	on range:									
								30 🚔	m		
GPS cł Latitud	annel source e source:	s:									
GPS d	annel source e source:	s:									
GPS d Latitud	annel source e source: gps_lat	s:									~
GPS d Latitud	annel source e source: gps_lat ide source:	S:									~
GPS d Latitud Longitu	annel source: gps_lat ide source: gps_long	s:									~
GPS di Latitud Longitu GPS dii	annel source: gps_lat gps_long gps_long	s: ::									>
GPS d Latitud Longitu GPS dii	e source: gps_lat de source: gps_long ection source gps_direct	s:									>
GPS di Latitud Longitu GPS di GPS sp	annel source e source: gps_lat de source: gps_long rection source gps_direct eed source:	s:									> >

The known Racetrack list can be found in the lap trigger configuration menu within the Known Racetracks tab. It contains a built-in list and a user-defined list. Each track can be activated or deactivated with the checkbox to manually set the variant if needed.

User defined tracks can either be added from scratch with the Add Track button or with the Copy Track button as a modified version of a built in track. Both buttons will open the same Edit Race Track menu.

In the menu a track name, length and the coordinates of the detection point is required. The coordinates can be pulled from the GPS tab with the button "Get values ..." or sent to the GPS tab with the button "Set values ...". This allows an easy interaction with the manual GPS lap trigger mode.

The user-defined tracks will be part of the project. If the tracks are required in another project, the lap trigger module can be ex-/imported into another project.

rigger configuration		Ø
eneral Presettings Conditions Trigger Countdown Segment timin Builtin Racetracks	I GPS Known Racetracks User defined Racetracks	
Active Track ^ Lime Rock Park Magny cours Msano trans	Active Track Add Track. Add Track. Edit Track. Remove Trac	 k(s)
Ningbo Speedpark Ningbro Speedpark Nogaro Nichburgring Oschersleben	Edit RaceTrack 'Nürburgring Nordschleife' Specify Racetrack properties The GPS position indicates the position of the start-finish line.	ß
Outron Park Paul Reard Pau-Ville Portimes or cruit Portime or cruit Portand Int Raceway Redbullring Road America Road America Sepang	Track Name: Mutsuuring Notific Hiefe Track length: 25378 [\$] m GPS Lattude: 50.33401400 [\$] DD GPS Longtude: 6.94527800 [\$] DD	es from Laptrigger's PS definition ues to Laptrigger's PS definition
✓ Shanghai ✓ Silverstone ✓ Silvalkaring ✓ Snetterton 300	ок	Cancel

Following signals are assigned to the function:

Laptrigger_trackdet_id	Signal will show the track name from the Racetracks list as an enumeration or can show the ID number as raw value. The enu- merated name will also be visible in the log- ging.
Laptrigger_trackdet_laplen	Track length of the used track variant
Laptrigger_trackdet_lat	Latitude GPS coordinate of the used GPS trigger point
Laptrigger_trackdet_long	Longitude GPS coordinate of the used GPS trigger point

16 Firmware

16.1 Firmware and configuration

DDU 9 holds 4 types of data:

Firmware: the software (PST program file) of the DDU 9.

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.



16.2 Firmware update

The scheme shows the process during each connection between RaceCon and DDU 9.



16.2.1 Performing the firmware update

Firmware update is only possible if the DDU 9 is connected to RaceCon. The configuration of Input channels, CAN I/O, display, recording + telemetry will not be changed.

1. In the DDU 9 Project Tree, right-click on 'DDU 9' 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.	uroi uroi
ECU Type: DDU7 💌	
Select program archive (PST) file:	

3. Click 'OK' when done. The firmware update starts. The DDU 9 displays the message 'Updating firmware'. Do not switch off the car's ignition or interrupt the power supply of the DDU 9!

Jpdate firmware	X
Flash program firmware Perform a firmware update of a device.	010 101 UPDR1
 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 9 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 9.



17 Cloning the Unit

To replace a DDU 9 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.

O THEFT	DUU10.mp - KateCon V25.550/.11	
Syden Lager Display Crickows Update Uplaad Fernat Drawlybit Option Con Firmwere Sydeg USD-5354		Todas s x
definition definition		Constant of the second of
T n Ms	lystem Overview 📲 Gateset menosyer	Measurement Sources
Info / Status		6 ×
T., Time Sender Messages		× 0,0
We/Status CAN Log - Stopped SYS Log - Stopped		eer detected - all deared on state unknown • 🚺 New Protect 🐽 🚥
week.		

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

lone ECU	
Clone extract ecu Clone extract the ecu and upload the data to the selected	file.
ECU Type: DDU8	Select Device
Select clone file (bmsclone):	
C:\Test\DDU8_Bosch_Motorsport bmsclone	
protocol.	
1	

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

18 GPS Sensor

This function requires the installation of Software Upgrade 2.

18.1 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 9 (not covered here) Serial output -> Read in messages via RS232 Interface of DDU 9 (serial interface 2)

18.1.1 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 9 supports 1,200 to 115,200 baud. GPS Rx interface baud rate must match DDU 9 interface baud rate. DDU 9 Baud rate can be set with the 'GPS_BAUDRATE' characteristic Data format: DDU 9 expects 8 data bits, no parity bit, 1 stop bit (8N1)

18.2 Protocol

DDU 9 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.

18.3 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.

18.3.1 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)	*	UPY_CEG (Config)_PPT (Parts)	20 *
CFG (Configuration)			
DAT (Datum)	Ш	T i la uniora	
DOSC (Disciplined Oscillator)	Ш	Target 1-USART1	
EKF (EKF Settings)	Ш	Protocol in 0+1+2 · UBX+NMEA+R1 -	
ESFGWT (Gyro+Wheeltick)	Ш	Protocol out 0:1 LIDY: NMEA	
ESRC (External Source Config)	Ш		
FXN (Fix Now Mode)	Ш	Baudrate 115200 💌	
GNSS (GNSS Config)	Ш		
INF (Inf Messages)	Ш		
ITFM (Jamming/Interference Monitor)	Ш		
LOGFILTER (Log Settings)	=		
MSG (Messages)	Ш		
NAV5 (Navigation 5)	Ш		E
NAVX5 (Navigation Expert 5)	Ш		
NMEA (NMEA Protocol)	Ш	Oversampling	
ODO (Odometer/Low-Speed COG filter)	Ш		
PM (Power Management)	Ш		
PM2 (Extended Power Management)	Ш		
PRT (Ports)	Ш		
PWR (Power)	Ш	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)			
SMGR (Sync Manager Config)	-		-
A V Brend Road	ا ار د		
🖬 🔨 📰 Send 🖓 Poll 💥 🕮	•		

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

S Configure - Configuration									
ANT (Antenna Settings)	UBX - CFG (Config) - CFG (Configuration)								
CFG (Configuration)									
DAT (Datum)	C Revert to last saved configuration								
DOSC (Disciplined Oscillator)	Bevert all but ANT default configuration Depres								
EKF (EKF Settings)	C Revet to default configuration C Revet to default configuration Save current configuration C Revet to default configuration C Save current configuration C Revet to default configuration C Revet t								
ESFGWT (Gyro+Wheeltick)									
ESRC (External Source Config)									
FXN (Fix Now Mode)	C User defined operation								
GNSS (GNSS Config)	Clear	Save	Load						
INF (Inf Messages)	0 - PRT	0 · PRT	0-PRT						
ITFM (Jamming/Interference Monitor)	1 - MSG 2 - INF	1 - MSG 2 - INF	1 - MSG 2 - INF						
LOGFILTER (Log Settings)	3 - NAV	3 - NAV	3-NAV						
MSG (Messages)	4 - RXM	4 - RXM	4 - RXM						
NAV5 (Navigation 5)	6 - Reserved	6 - Reserved	6 - Reserved						
NAVX5 (Navigation Expert 5)	7 - Reserved	7 - Reserved	7 - Reserved						
NMEA (NMEA Protocol)	8 - EKF 9 - Becerved	8 - EKF 9 - Reserved	8 - EKF 9 - Beserved						
ODO (Odometer/Low-Speed COG filter)	10 · ANT	10 - ANT	10 - ANT						
PM (Power Management)	11 - LIC	11 - LIC	11 - LIC						
PM2 (Extended Power Management)	13 · USER 1	13 - USER 1	13-USER 0						
PRT (Ports)	14 - USER 2	14 - USER 2	14 - USER 2						
PWR (Power)	15 - USER 3	J15 - USER 3	15 - USER 3						
RATE (Rates)									
RINV (Remote Inventory)									
RST (Reset)									
RXM (Receiver Manager)									
SBAS (SBAS Settings)									
SMGR (Sync Manager Config)									
TMODE (Time Mede)									
🗂 🖹 🗡 🗎 📰 Send 🖓 Poll 🕅 🕅 🖞									

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 · CF	UBX - CFG (Confia) - GNSS (GNSS Confia)						
CFG (Configuration)				,				
DAT (Datum)					Channels			
DOSC (Disciplined Oscillator)	GNSS TD	configure	GNSS name	enable	min max	Signals		
EKF (EKF Settings)	0,000 10		or ob home			orginalia		
ESFGWT (Gyro+Wheeltick)	0		GPS	V	0 10			
ESRC (External Source Config)	1	\checkmark	SBAS	✓	1 3			
FXN (Fix Now Mode)	2		Galileo		0 0			
GNSS (GNSS Config)					0 16			
INF (Inf Messages)	3		BeiDou	_	0 10			
ITFM (Jamming/Interference Monitor)	4		IMES		0 0			
LOGFILTER (Log Settings) =	5	\checkmark	OZSS		0 3		L1SAIF	
MSG (Messages)					8 14			
NAV5 (Navigation 5)	6		GLONASS		0 11			
NAVX5 (Navigation Expert 5)								
NIVIEA (NIVIEA Protocol)	Number o	of channels a	available		32			
DDO (Odometer/Low-speed COG fliter)					22			
PNI (Power Management)	Number o	of channels t	to use		32	Auto set		
PIVIZ (Extended Power Management)	For speci	fic SBAS con	ifiguration use	CFG-SBA	S			
PKT (Ports)								
PWK (Power)								
RATE (Rates)								
PST (Peset)								
RST (Receiver Manager)	For speci	fic GLONASS	configuration	n use CFG	-GLO			
SBAS (SBAS Settings)								
SMGR (Sync Manager Config)								
TMODE (Time Mede)	•							- F
🔒 🗙 🟥 Send 读 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.





NOTICE

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

18.4 Measurement labels

The decoded NMEA messages are copied to these DDU 9 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

18.5 GPS troubleshooting

Electrical

Is the transmitter signal of the GPS sensor connected to the receiver pin of serial interface 2 of the DDU 9?

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 9 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.

19 Fuel Consumption Calculation

19.1 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 9!



A 'fuel consumption wizard' opens.

	rce channel for computing the	fuel consumption.		
General				
Configure on device	DDU7			
Tank capacity		80.0 🔷 ।		
Fuel consumption calculation				
Mode	Using fuel consumed			
Fuel input	fuelcons	▼ X 0,001	Adaption factor to	
Concumption correction factor	1,000			
Domaining long coloulation				
	1			
Mode	Last lap's consumption			
Target lap consumption		3,0 🛓		
Reset fuel consumption	C	•		
Reset fuel consumption	By RaceCon			
Reset fuel consumption Mode Reset signal source	By RaceCon			
Reset fuel consumption Mode Reset signal source Reset signal threshold	By RaceCon Low active signal	▲		
Reset fuel consumption Mode Reset signal source Reset signal threshold Release threshold	By RaceCon Low active signal	Vot 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)

Press 'Finish' when done.

19.2 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.

	Fuel - Computes the fuel consumption.		
	Settings Trail capacity Fund capacity Fund capacity Consumption Taget to consumption Taget to consumption Reset fuel consumption Reset fuel consumption	Measurements Total consumption Fuel consumption Fuel remaining I Last lap's consumption I Laps remaining	Button to reset total fuel consumption (Reset with RaceCon only) Button to reset fuel consumption manually (Can also be triggered)
Settings overview	■ Configuration (B) Fuel Japrem_dis (x		



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

19.3 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

20 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.

20.1 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 [> 123]. Under the ribbon "Segment timing" you need to choose your segmentation mode which can either be distance or intermediate trigger based.

			L Compatizing and
nce or	Gener	al Presettings Conditions Trigger Cour	tdown segment uning GPS
nediate	Mode		
ρr 🗕	Dista	nce	
	V V	se predated laptime	
your	Lap s	egment lengths and times	
ent time	Nr.	Segment length (m)	Segment time (s)
listance 🔶	1	500	44,800
	2	1.000	93,200
	3	1.500	135,600
your	-		
· .	Entire	e lap time:	

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.

20.2 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.

21 RaceCon Shortcuts

The table shows important shortcuts simplify controlling the DDU 9 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

22 Disposal

Hardware, accessories and packaging should be sorted for recycling in an environment-friendly manner.

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

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