



Data Logger C 70

Manual

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1 Preparation

Use the C 70 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 C 70 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 C 70 carries out an appropriate analysis to determine the electromagnetic interaction the C 70 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.

Note

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

	5		
	Anger Danger Dature 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		
<u> </u>	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

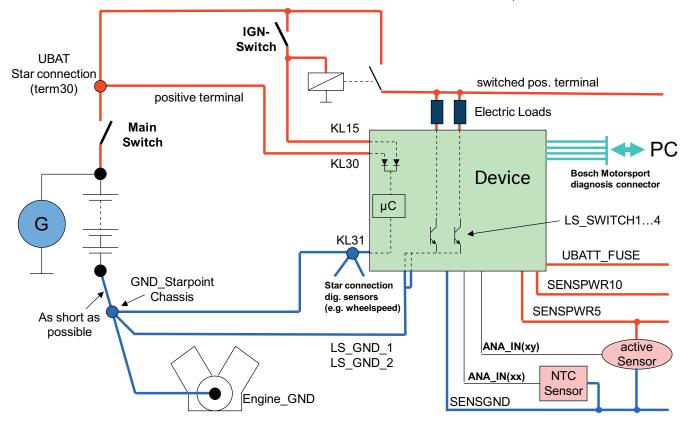
Please ensure that you have a good ground installation. That means:

- 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!



Note

This schematic is not device specific. Please see the section Technical Data for the specifications of your device.

4 Technical Data

The data logger C 70 integrates a programmable 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. The logger can be upgraded to a 2nd logging partition of 1 GB (e.g. for long term recording).

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 C 70.

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

Application

Processor	667 MHz Dual Core		
Converters	10 kHz 12 bit AD converters with digital low pass filter		
Internal power source	Li/Ion capacitor		
Configurable math channels			
User configurable CAN in/out messages			
Online data compression			
Internal logger			
 4 GB memory (standard) 			
– Plus 4 GB memory (optional)			
– 1,500 channels			
 1 ms Sampling rate 			
Logging rates			
 Usage of all features: 600 kB/s 			
 Primary logging use case: >1,200 kB/s 			
- Logging data download rate: up to 6.2 Ml	B/s		
LTE Ethernet telemetry support, GSM telemetr	y support		

Communication

CAN interfaces	2
Ethernet 100BaseT	2
Laptrigger input	1
RS232	Telemetry, GPS
Configuration via RaceCon	Over Ethernet or MSA-Box II

Mechanical Data

Size	151 x 126 x 25.5 mm
Weight	450 g
Protection Classification	IP54 to DIN 40050, Section 9, Issue 2008
Operating temperature internal	-20 to 85°C

Max. vibration	Vibration profile 1 (see Appendix or www.bosch-motorsport.com)
Electrical Data	
Supply voltage	5 to 18 V
Inputs	
4 x analog channels, additional 12 optional	
4 x analog channels, additional 12 optional 0 to 5 V input range	
5	
0 to 5 V input range	

Sensor Supplies and Screens

2 x Sensor supply 5 V ± 1 % (250 mA)
1 x Sensor supply 10 V ± 1 % (250 mA)
1 x Sensor supply U_Bat (250 mA)
4 x Sensor ground

Connectors and Wires

Motorsport connector on logger	AS216-35PN
Mating connector	F02U.000.466-01
AS616-35SN	

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.

Pin	Name	Comment	Status
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	Com_screen	Ethernet and USB 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		Incl.
34		over current protected 3.01 kOhm switchable	
34 35	ANA_IN_8	3.01 kOhm switchable	Opt.
	ANA_IN_10		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.
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.

4.1 Status LEDs

Power Status LED (permanent green)	e pow	
Boot Status LED (permanent green)————	BOOT C 70 Motorsport Data Logger	
Recording Status LED (green / amber / red)	e Run	BOSCH

Recording Status LED

Amber constant	Recorded Data	Telemetry
• No measurement configuration on Logger	No	No
Blinking green slow Measurement configuration loaded Start condition(s) not fulfilled	No	Yes
Blinking green fast Measurement configuration loaded Start conditions fulfilled Logger is recording data 	Yes	Yes
Blinking amber slow Measurement configuration loaded Measurement setup error (external device missing) Start condition(s) not fulfilled	No	Yes (but some missing)
Blinking amber fast • Measurement configuration loaded • Measurement setup error (external device missing) • Start conditions fulfilled, Logger is recording data	Yes (but some missing)	Yes (but some missing)
Blinking red fast • Firmware update in progress • Do not power off Logger	No	No
Blinking red slow • Firmware update has finished	No	No
Red constant • Error during firmware update	No	No

4.2 Upgrades

CCP/XCP_MASTER

Enables CCP/XCP master functionality to request data from foreign devices via CAN/CCP protocol or XCP over Ethernet (UDP).

(ASAP2 file from ECU manufacturer required)

FULL_LOG_2

Enable logging partition 2 with 4 GB memory

IO_EXTENS

Enable additional 12 analog input channels

USB_DATA

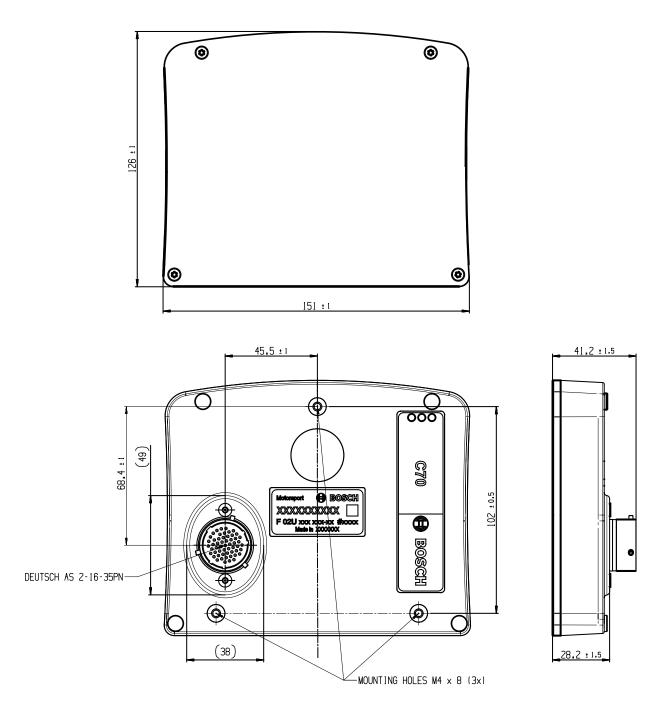
Rugged USB flash drive Bosch File System (BFS) format included, works with BFS preformatted USB flash drive only

Adapter cable to USB-Port

Adapter for wiring harness

SW license USB-Port unlocked

5 Mechanical Drawing



6 Communication Channels

CAN bus

The C 70 has two CAN buses configurable as input and output. Different baud rates are selectable. Please note that the C 70 does not contain any CAN termination resistors. Thus the CAN termination resistors need to be integrated into the wiring loom.

Ethernet channels

The C 70 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.

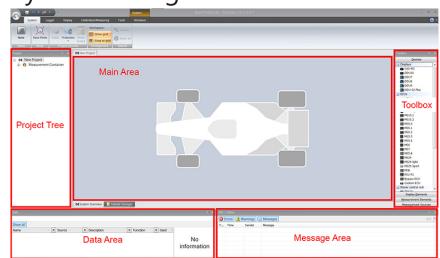
RS232 ports

The C 70 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 C 70
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 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	+



7 System Configuration Tool RaceCon

RaceCon is an all integrated software tool for configuration and calibration of Bosch Motorsport hardware products, such as ECUs, displays, loggers. The communication is based on Bosch Motorsport MSA-Box interface.

Calibration of ECU maps and curves
ECU data file up- and download
Parameter file up- and download
Diagnostic functionality for Bosch Motorsport ECUs
Data file / Work base management
Integrated flash functionality
Integrated Bosch sensor database
Configuration of Bosch Motorsport displays
Configuration of Bosch Motorsport data loggers
Configuration of Bosch Motorsport CAN modules
Communication via K-Line/CAN/Ethernet (KWP/CCP/XCP)
CAN communication log functionality (baud rate changeable)
Quick data access over Race Mode
Intuitive design, easy to use

Environment

PC

IBM PC Pentium/AMD Athlon compatible, min. 1.6 GHz Min. 2 GB RAM Min. 1 GB free hard disc space VGA/WGA monitor (min. 1,024 x 768) Recommended Operating System: Windows 10

Optional Accessories

MSA-Box II

F02U.V00.327-03

8 First Steps

Install the software required for the operation of the C 70. It is developed for Windows system software. The following software versions are used in this manual:

- C 70 setup, configuration and calibration: RaceCon Version .
- Measurement data analysis: WinDarab V7

Set up the 100 Mbit ethernet connection to the C 70.

- The ethernet port has "cable auto crossover" functionality.

8.1 Connecting the unit to RaceCon

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

Connection via MSA-Box

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

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

- 3. Open RaceCon and connect the MSA-Box to the computer.
- 4. In the 'Info / Status' Box of RaceCon, you will receive messages that the connection was successful.

Info /	Status			
() E	rrors 🔥 W	/arnings 🚺) Messages(2)	2/2 🗙
т	Time	Sender	Message	
(i)	12:16:09	RaceCon	Connected to MSA Box.	
(i)	12:16:09	RaceCon	MSA Box successfully connected.	
Info	/ Status CA	N Log - Stoppe	ed SYS Log - Stopped	

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

If the LED is off, check the wiring harness.

After you created a RaceCon project with the device, the status icon of the device will switch from grey to one of the following colors: red, orange, green. For further information on how to set up a project, see the chapter "Setting up a new RaceCon Project [> 15]". For the status color, see chapter "Color indication [> 26]".

Connection via Ethernet Cable

Instead of connecting the ethernet line to the MSA-Box, connect the ethernet directly to your computer.

Troubleshooting while setting up the network interface

The C 70 contains a DHCP server, network addresses can be assigned automatically to the configuration PC. In case of problems during the network connection, please try the following steps:

1. Switch off the PC's firewall.

2. Reconfigure the PC or the MSA-Box network interface settings to obtain an IP address automatically as shown in the pictures below.

8.2 Setting up a new RaceCon Project

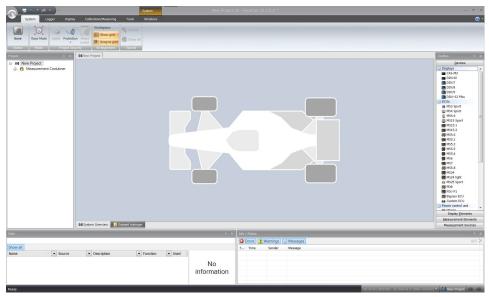
The following screenshot shows an overview of the RaceCon Main Screen with its areas. All (sub-) windows are resizable and dockable. You can find them under the 'Windows' tab.

	System	New Project.	rlp - RaceCon V2.5.5.0 *	- a x
System Logger Displa	y Calibration/Measuring Tools Windows			Ø ·
None Race Mode visible Project So	Workspace: Sheet Show grid Socked Workspace: Show grid Show all Special			
Project # X	dia New Project			Toolbox # ×
i⊖- 64 New Projecti ⊕- 10 Measurement Container	Main Area			Displays Displays CAS-M3 DOU10 DOU10 DOU7 DOU8 DOU7 DOU8 DOU-52 Plus ECU8 M MS Sourt
Project Tree				Toolbox H0133 H053 H053 H053 H053 H053 H053 H053 H054 H054 H054 H054 H054 H054 H054 H054 H054 H054 H054 H054 H055 H056 H05
				Display Elements Measurement Elements
	64 System Overview 🚺 Dataset manager			Measurement Sources
Show all Sho	■ Description ■ Function Data Area	• used No information	The Yanka Control (Menager T- Trie Sorder Menage Messsage Area	* × 0/0 X
Ready.			No errors detected - all cleared or state unkn	zwn • 📴 New Project 🐵 🚥

1. Start the RaceCon software.



2. In the 'File' menu, select 'New project' to create a new project.



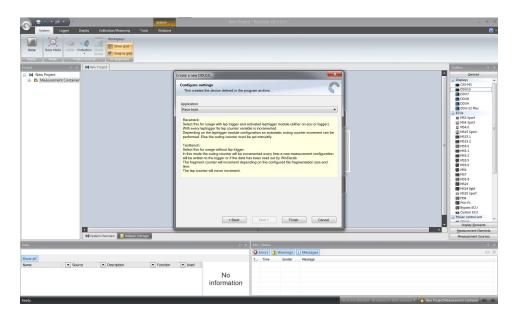
3. In the Toolbox, select the and drag it into the Main Area. A pop up window to specify the program archive appears.

System Logger Dopley Calibration/Messuring Tools Windows	New Project - RaceCon V2.5.5.0	_ s x 0•
Nore Rec Mode Utabi Protectors Street Data Note N		
Project 0 × 64 New Project		Teabox 9 ×
B \$4 New Project	Create a new DDU10.	Devices
(a) Mesurement Container	Specify the program archive This course defined in the program archive CU program archive CU program archive Recuse specify the ECU program archive.	Dephys CoxAn D0077 D0077 D0074 D0074 D0049 D0049 D0049 D0049 D0049 D0049 D0049 D0049 D0049
	<bob not=""> Freeh Const</bob>	II N3 Spot II
did System Overview		Medicinement Elements
		Measurement Sources
Deta	4 × Jnfo / Status	÷ ×
	🙆 Errors 🛕 Warnings 🕕 Messages	0/0 ×
Show all Name Source Description Function	T Time Sender Message	
nene () Sonce () Decipion () fundori	No information	

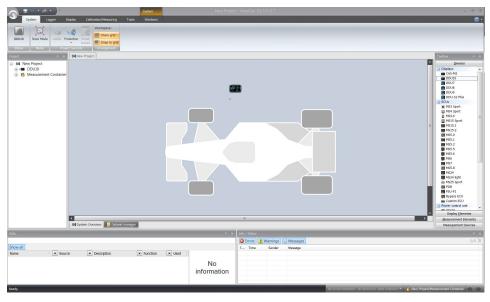
 Download the firmware for the C 70 from www.bosch-motorsport.com. An information shows if the archive is valid or not. Click 'Next'.

System System	New Project - RaceCon V2.5.5.0 *	-
System Logger Display Calibration/Measuring Tools Wind		Ø •
Nor Nor States Nor States Nor Nor Nor Nor Nor Nor Nor Nor Nor Nor		
Project V × 64 New Project		Toolbax # ×
Gil New Project Gil Measurement Container	Create a new DDU10	Devices Displays
E Measurement Container	Specify the program archive	CAS-M3
	This creates the device defined in the program archive	DDU10
	CD/ gragemeschell Characteritic/ULIL_BLAIE_UDIL_[TS14 path The program active value The program active value The program active value The program active value	Color Color
🖓 System Overview 📙 Dataset manager		Measugement Sources
Deta	9 × Info / Status	÷ ×
Source Source Funct Description Funct	No information	0,0 X
Ready.	No errors detected - all deared or state un	ünsenn 👻 🎁 New Project/Measurement Container 🛛 🚥

5. Select 'Race track' or 'Testbench' mode according to your application.



6. Click 'Finish'. The C 70 is inserted into the project and RaceCon tries to connect to the device.



RaceCon detects configuration differences between the C 70 and the RaceCon project and asks for permission for data download.

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

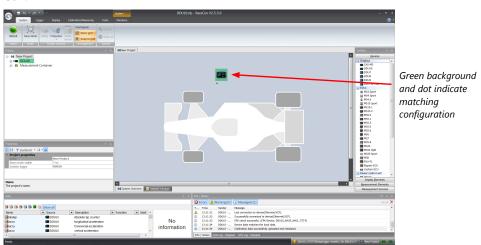


If the device turns red, you might need to do a firmware update on the device. For more information see chapter "Firmware update [> 131]".



The download starts and the C 70 carries out a reset.

After the reset, RaceCon reconnects to the C 70. Local configuration on both the PC and C 70 match (indicated by green background and dot). The C 70 is now connected to Race-Con.



For further information on the color indication, see chapter "Color indication [▶ 26]".

8.3 Feature activation

- Optional software feature packages are available for the C 70
- 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 C 70 does not work on any other C 70.
- 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 'C 70' in the Project Tree.
- 3. Click on the 'Features info' tab in the Main Area.

	A = + + +	System		DDU10_Test.rip - RaceCon	V2.5.5.0 - Masterlicense Bosch *	_ = ×
	COUID 227.5 Race Mode 227.5 Mode 227.5 Mode 227.5 Mode 227.5 Mode 227.5 Mode 227.5 Mode 227.5 Mode 227.5 Mode 227.5 Mode	ration,Measuring Tools Windows		_	_	Colors 0 ×
1st: Double-click	- Sal New Project	DDU10 feature			0=	Devices
on DDU	E COUID	DOU to Heature	is r/o			Displays A CAS-M3
	🔬 👸 Measurement Container	ECU ID	3950e778:1d0fd540		Copy to dipboard	00010
		Statun/Un	ock Order informations			BUDU8
		No 10 CO		e device to be CAN Communication Protocol Maste		DDU-S2 Mus
		ត្រំ ณ	L_LOG_1 F02U V02 304-01, Full log			CUs MS3 Sport
			L_LOG_2 F02U V02 305-01, Enable DATA F02U V02 214-01, Enable	a full logging on second partition a data copy from looper to Bosch USB stick		MS4 Sport B MS4.5
			ER_TELE F02U V02 138-01, Enable			MS15 Sport
		6 P.	EXTENS FO2U VO2 205-01, Enable	additional input / output channels		MS15.2
2nd: Click on						# MS5.0
'Features info'						M MS.2 M MS.5 M MS.5 M MS.4 M MS.7 MMS.4 MMS.4 MS.4 MS.4
				ages 🛛 🖏 Hacros 🖉 Settings 🚺 Device		Measurement Bements
		🖬 sateta 🗍 /r Hath Charmes 🗍 /r Co	1	ages 🔤 Hacros 📄 🗰 settings 🔲 🕕 Device Jole / Statua	no enora a esores no	Measurgement Sources
	Data			Cron(1) (Messac	16010	= 0 × 4595 ×
	👒 🗈 🔅 🗠 🐏 🗳 🖬 🖬 😁 Show al			Type Time Sender	Message	*
	Name / Source	Description Absolute lap count Provide		A 11:07:07 DDU10 - New Project 11:07:07 DDU10 - New Project	Data upload cancelled (try to resynchronize the device Lost connection to device(Ethernet/NOP).	ce by disconnecting/reconnecting it
	accx CDU10	longitudinal accele Quantis	ation: 0.1/mc	11:07:09 DDU10 - New Project 11:07:09 DDU10 - New Project DU10 - New Project	Successfully connected to device(Ethernet/NCP). BPK check successful, (BPK Device: DDU10 BASE 04	01 7574
	Beccy B00010	transversal accele Convers	0.5000 %7.1 (0.1*Channel+2500	11:07:11 DDU10 - New Project 11:07:11 DDU10 - New Project 11:07:11 DDU10 - New Project	Device data matches the local data. Calibration data successfully uploaded and initialized.	
	cocy COU10 cocz COU10	vertical accelerate " Address	pe: 16 Bit signed :: 0x24700301 *	· · · · · ·	Lateration data successfully uploaded and initialized.	
	K III	• •		Info / Status CAN Log - running	d on a state of the state of th	ed Charriel Charriel 🛲 🖷 🥳

4. The 'C 70 features info' window appears.

ECU ID 3950e778:1d0fd540 Copy to dipboard Status/Unlock Order informations Name Description		DDU 10 features info	
Status/Unick Order informations Name Description			
Name Description	ECU ID 🗕 🕂	ECU ID 3950e778:1d0fd540 Copy to dipboard	
Name Description			
Feature status — I ist of available	Feature status —		List of available
			features
USB_DATA F02U V02 214-01, Enable data copy from logger to Bosch USB stick			
ETHER_TELE F02U V02 138-01, Enable Ethernet / LTE Telemetry			
IO_EXTENS F02U V02 205-01, Enable additional input / output channels		IO_EXTENS F02U V02 205-01, Enable additional input / output channels	
		0	
📷 Locked (disabled) 🛛 🚺 Unlocked (activated)		Locked (disabled) Unlocked (activated)	
—		_	

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

	_	d0fd540 Copy to dipboa
Status/Unlock		Informations Description
FULL J	LOG_1 F	F02U V02 213-01, Enable device to be CAN Communication Protocoll Master F02U V02 304-01, Full logging on first partition F02U V02 400-01, Full logging on first partition F02U V02 400-01, Full logging on first partition F02U V02 400-01, Full F02 40
		ECU Protection

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

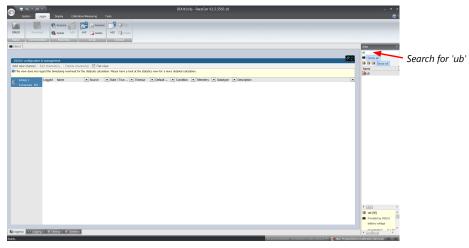
Status	/Unlock Orde	er informations	
	Name	Description	
6	CCP_MASTER	F02U V02 213-01, Enable device to be CAN Communication Protocoll Master	
ſ	FULL_LOG_1	F02U V02 304-01, Full logging on first partition	
Ð	FULL_LOG_2	F02U V02 305-01, Enable full logging on second partition	
ſ	USB_DATA	F02U V02 214-01, Enable data copy from logger to Bosch USB stick	
D	ETHER_TELE	F02U V02 138-01, Enable Ethernet / LTE Telemetry	
Ð	IO_EXTENS	F02U V02 205-01, Enable additional input / output channels	

- 7. Perform these steps to activate other features you purchased.
- 8. Switch the car's ignition off and on again to cycle the power of C 70.

8.4 First recording (Quick Start)

This chapter explains the configuration of the recording of the battery voltage channel. See chapter 'Recording [> 90]' 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.

¹								DDU10.rl	p - RaceCon V	2.5.5503.10					×
System	Logger	Display Callb	ration/Measuring	Tools	s										<u>.</u>
		Rename 🦂	Re Re	ame	🕉 🖵 Edit										
	Download	Delete Add	Add _ Del		Add 🕞 Delete										
Status Cor	ommunication	Recording	Group		Channel										
DDU10															Data P
														_	ub
DDU10 config															Show all
		hannel(s) Delete ch he timestamp overhead			Please have a loc	k at the statist	ics view for a n	ore detailed calc	alation.						Name / [
Group 1		ged Name	 Source 							- Dububa	e 💌 Descriptio				Bub
1 channels	⊨ Ø0	geu wane ✓ ub	DOU10		LO ms	Tineour	• Delauk	- condition	None		signed battery w				
										_					/
														_	
													Drag + Drop		
													gp		
															🗎 ub [V] 🔺
															Provided by DDU10 battery voltage
															Quantisation: 0,1 [V]
															Limits: 025,5 Format: %4.1
															Precision: 0 Resolution: 0
Logging1	Logging2	🗈 Settings 🛛 🕌 Statisti	8												Conversion: (ub)/1/ *
Ready.												145 61		ED New Project/DDU10/Logger/	oggings/Group 1/ub 🚥 🚥 "ff

4. Click on the 'Download' button in the upper left corner. The configuration download starts and the C 70 carries out a reset. Now you can find the 'ub' measurement channel in the 'Data Area'. As we did not define global start conditions, recording starts immediately.

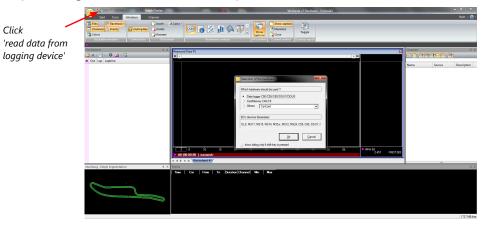
System Logger Display Calibration/Messuring Tools	DDU10.rlp - RaceCon V2.5.5.0		. • ×
DUID DUID Stocs Node			
Import ● x ● M New Project: ● • • • • • • • • • • • • • • • • • • •	ţ,	I de la construir de la constr	tus t t U U U U U U U U U U U U U U U U U
Deta	System Overview Documentary Vocumentary F x Info / Status	Measugemen	e v ×
🕞 🤮 🗃 🗃 🗃 📓 📓	C Errors A Warnings	() Messages(6) Message	6/6 🗙
	unction V Used A NO information 0 13:11:19 00/10- 0 13:11:20 00/10	Successfully connected to devol(TehenetXCP), UPK check survesche (UPK beite), USKE[_BH61TST4) Orteling configuration Stanted devolvable of configuration files Reconfing datage is channet	II V

5. Start the WinDarab software.

🥝 🛰 · · · · · · · · · · · · · · · · · ·	WinDarab v7 Developer - Formula3		
Start Tools Windows			Style 🗵 🔞 🗸
Files Inset Channels Lvents Colors Control Bars Dockable windows Control Bars	Cope Toogle		
•			
File Explorer 0 ×		Channels	a ×
Out Lap Laptime			1
		Name Source	Descripti
	H 4 D H X Workshetf	^	
Events	•		0 ×
Time Car From To Dorston/Dorsel 1	An Mar		
			1702 MR (ma

- 6. Disconnect the C 70 network cable.
- 7. Click on the 'Read Data from Logging Device' icon.

Choose your logger and click 'OK' when done. The 'Data Logger Import' dialog opens. Refer to the WinDarab V7 manual for instructions on how to use the 'Data Logger Import' dialog and for more detailed descriptions and instructions.



8. Choose the device and the IP address for the device.

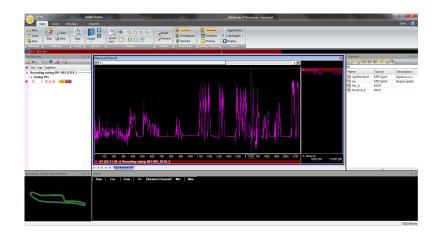
Click 'Apply changes' when done.

Data Logger Import			- 🗆 × Cho	ose your Device / IF
ettings Current Import Recent Import				n dropdown list
Import sources	Common options			•
FlashCard / USB-Stick	Delete ARP cache	e entry after ping to device failed.		
Device	Force password,	if not set by recording configuration:		
Burst		V New		
Device / IP: VCU > 10.10.0.210 Export file: One file Save files in: C:\	 	Import al on connect Delete transferred files Import latest files first		
Subfolder template:		✓ [a]+		
Filename template: [CardInfo]_out [outing]_la	p[lap]_frag[fragment]_[hour]_[n]	✓ [a]+		

- 9. Connect the C 70 network cable.
- 10. Click on the 'Current Import' tab.
- 11. Click on 'Import' in the lower right corner. If the 'Import all on connect' box is checked, the data transmission from the C 70 starts automatically. Measurement files are stored automatically in the folder defined under 'Settings'.

🧐 Data Logger Import						
Settings Current Import Recent Import						
Data source: FTP 23.06.2015 12:11:11				Network DDU7 - 10.10.0.20	7 0	18 ms
Name	Size (MB)	Get	Get (MB)	Progress		
FTP 23.06.2015 12:11:11	0.0		0.0	Connecting		
Auto Scroll Show all files					In	nport

- 12. Click on 'Close' when the transmission has finished.
- 13. Click on the Start button and choose 'Open measurement file'.
- 14. Select the measurement files from the storage folder.
- 15. Click on 'Open'.
- 16. Click on 'New Desktop' to open a new measurement data window.
- 17. 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.

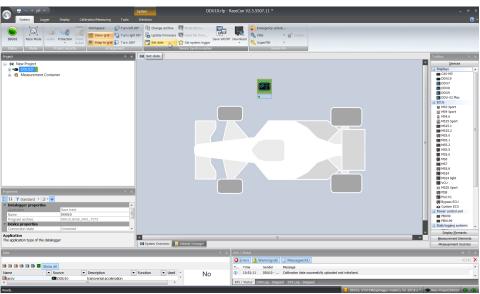


8.5 Set date and time

The C 70 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 C 70 to the PC.
- 2. Click on the 'Set date' button in the 'System' tab menu.



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

Project				🕂 🗙 🖓 🖓 🖓 🖓
🖃 📾 New Project	_			
	Open			
📄 💼 Di: 🏁	Create measuring views			
	Download configuration			
	Synchronize	•	Ø	Set Date & Time
	Current measuring media	•	4 2	with ECU
	Create dataset		Ð	Change program archive
	PIN/SuperPIN	•		Update firmware
	Export			Upload configuration
🕀 📮 CA 🏵	Import		×	Clear logged data
	Properties		1 1 1	Clone ECU
	Delete			Adjustment data
🛅 Co aje	Rename			Save •
📩 📲 I/O Ch	annels			

- 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

8.6 Color indication

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

Visible color indications:

- In the status area in the upper left corner.



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

) 🔵 🔵
--	-------

C80 Logger C80 Logger C80 Logger C80 Logger C80 Logger

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

E New Project	🖃 📾 New Project
Laptrigger	🖶 🛥 DDU10 🎽
🚛 👸 Measurement Container	🗄 🎁 Measurement Container

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

set New Project DDU10 Measurement Container	wew Project wew Project wew DDU10 Measurement Container
	New Project Zaptrigger DDU9 DDU0

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

Existing DDU10 er	rors		Existing DDU10	errors			
MIL 😑			MIL 🔵				
Location	Location Type Du		Location	Туре			
ANA04 Open line			Location	1700	Du		

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

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

The colors and their meaning:

- Grey: No connection with the device.
- Green: Matching configuration and firmware between device and project.
- Orange: A different configuration between device and project.
- Red: A different firmware between device and project.
- Purple: Device is bricked, too many resets. Reflash the device, reconsider last changes.
- Colored background with orange stripes: Matching configuration with stored (inactive) errors in the device.
- Blinking colored background with orange stripes: Matching configuration with active errors in the device.
- Black MIL: No errors.
- Orange MIL: Inactive Errors (Error entries existing, but no longer active).
- Blinking MIL (orange/black): Active Errors.

For further information, see chapter Error Memory Properties [> 84].

9 Project Configuration

9.1 Math Channels

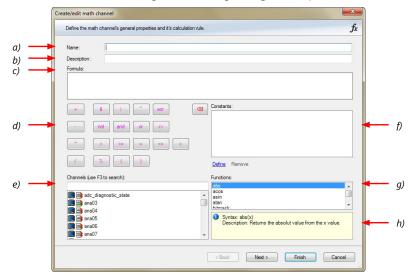
- Arithmetic and logical operations on up to 4 measurement channel(s)
- Numerical result
- Result can be used as input source for various display elements (numeric elements, alarms, bargraphs) and further calculations in the whole RaceCon project

Creating a new Math Channel

1. Follow the steps shown in the screenshot. The "Create/edit math channel" window appears.

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	System Logger Dapi	Politen pr Californite/Measuring Tools Introdees		×
	DUJ7 Race Mode volic Prote			
		loded korky		
	Project 0 X	/ Mar Project / 💼 0007	4 b x Toobes Devices	0 X
	B COUT	00.0 riefs demol configuration	Display Element Mezourement. Elem	en's
	8- 🚞 CAN Bus 1	Ag Add charmel. • () Edd charmel. f ₀ Delate charmel(s) Name • • Pomola • poly of the charmel • poly • • • • • • • • • • • • • • • • • • •	Measurement Sou	
1st: Double-click on	GAN Bas 2 — CAN Bas 2 — Computed Channels	Name V Formula V Boorp V Value V conditional value	Bosch Wizerd	
	8- 🗐 1/0 Channels 👦 Calibration Items	T	Customized Senso Analog sources	*
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	& Math Charrels		Multipoint Adjustr	Jent
the Project tree	- Group adjustments		Prequency sources	
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	ID- Container Container		Velocity	
			Computed sources	
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	Show all		Paul	
	Name Soc		Gear Lookup Tabl	
2 de Cliete e a			Hysteresis Exptripper	
2nd: Click on			NVM Out	
"Add channel"			Sensid wity/Offset	
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	x			
	Properties - Heth Channels 0 🗙	📓 Statistica 🕺 Math-Channella 🎉 Conditional Onamella 🔯 CAN messages 陸 Macros 💷 Settings (1) Device Into 🥹 Emorithis 🙆 Peatures Into		
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	El Debag CanChangedPto True	Type Time Sender Message	1.34	
	CarChangeVabi True	Image Image Image 01101 11028 D007-1000 BYK desk successFul. EPK Device: D007 BASE 0727)		
	Hath channels properties Norre Math Channels	A 11/38/20 Alarm - Ne No drannel source configured, skipping element		
		() 11883 0007-Pe Logor data ratification data. ▲ 11883 0007-Pe Logor data ratification data.		
		11:30:24 D0U7-Ne Successfully connected to device(Ethernet/NCP).		
		() 11.18:24 DDU7-Ne BY Check successIA. BY Clevice: DDU7,BASE_2727) ▲ 11.18:25 Marr. Ne In chararie successIA. BY Clevice: DDU7,BASE_2727)	-	
		11120:25 DDU7-Ne Logger data watches the local data.		
		Print States Philling - staged		

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



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

Click 'Finish' when done. The math channel is displayed in the math channel window.

9.2 Conditional Functions

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

Creating a new Conditional Function

1. Follow the steps shown in the screenshot. The "create/edit math channel" window appears.

	0	0///01 - Maceum V25.0.2002	
	System Logger Dop	ry Calibration/Measuring Tools Windows	Ø -
	Status Node Project	early	
	Project 8 X	/ New Project 1 0007	x Toobax 0 X
	E- Gal New Project		Devices
		COUT neft dennel confecte ton	Display Elements Measurement Elements
1st: Double-click	on 🗈 🖪 Display	Contract source charger and the second	Neasurement Sources
ISt. Double eller	CAN Bus 1	A Math channel. a Poscio. • Value • conditional value •	 Sereore
"Math Channels"	- Computed Channels	/o Conditional function	Ecoch Wizerd Customized Sensor
i idili cildilileis	(i) 1/0 Channels (ii) Calibration Items		Analog sources
in Project Tree	- Macros	A A A A A A A A A A A A A A A A A A A	Characteristic Curve
	fr Math Channels		Multipoint Adjustment Sensitivity/Offset
	Group adjustments		Frequency sources
	GCP Mester Measurement Container		Characteristic Curve
2nd: Click on	B- Measurement Cottainer		Velocity
			Computed sources
the dropdown	Data - Math Channels 🛛 🕸 🗙		Adjustment channel Characteristic Curve
			Fuel
arrow beside	Show all None		🔛 Gear Lookup Table
	Name Day		Hysteresis Laotigoer
'Add channel'			PWH Out
ridd channet			Sensitivity/Offset
			Speed
2 1 61	T T T T T T T T T	🖀 Statistica 🖌 Mark Charrels 💪 Conditional Charrels 🔯 CAN messages 🚳 Macras 🔄 Settings 🕕 Device Info 😵 Error Info 🚳 Peatures Info	
3rd: Choose	Tild V stepted a UI a		ĸ
	E Debug	C Erren(3) (Mensegu(87) (Messegu(87) 144/144	< .
'Conditional	CanChangeditrol True CanChangelitsbil True	Type Time Sender Message	*
<i>.</i>	E Math channels properties	1140-53 00/7-14e BK check successful. (BK Device: 100/7_5kGE_0727) 1140-53 Kam-14e No channel source configured, slopping element	
function'	Name Math Channels	(i) 11:42:53 D007 - Ne Logger data matches the local data.	
		11/8/13 D0077-Ne Lost connection to device@therret0029. 11/8/14 D0077-Ne Successfully connected to device@therret0029.	
		(i) 11-42:14 DDU7 - Ne BPK check successful. (DPK Device: DDU7_BAGE_0727)	
	CanChangedProtectionState	A 119-0.15 Alam - Ne No dwared source configured, alsoing element (D) 119-0.15 Alam - Ne Iso dwared to uncert for load late	
		U TINETS UNOTHER COOPERATING THE DOLLARS.	•

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

	ĺ	Create/edit conditional function		×		
		Define the conditional function's general properties and it's calculation rules. f_{x}				
a)		Name: p_br_fromt_mx				
u)	1	f:	Then:			
b)	-	p_br_front > 20	<pre>/// max (p_br_front, p_br_front_mx)</pre>		-	d)
c)		Otherwise:	Reset value:			2)
<i>c)</i>			2 10			e)
		 If (p_br_front > 20) is TRUE, then return Reset value is used: before If-condition becomes TRUE for th or when If-condition changes state from 	. (max (p_br_front, p_br_front_mx)), else return (p_br_front_mx), he first time after power-up FALSE to TRUE			
			< Back Next > Finish	Cancel		

a) Enter the name of the conditional function.

b) Enter the If-condition. Click pencil symbol to open an editor to enter expressions.c) Enter the Then-condition. Click pencil symbol to open an editor to enter expressions.d) Enter the Otherwise-condition. Click pencil symbol to open an editor to enter expressions.

e) Enter the reset value (must be a number).

Click 'Finish' when done.

The conditional function works the following way:

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

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

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

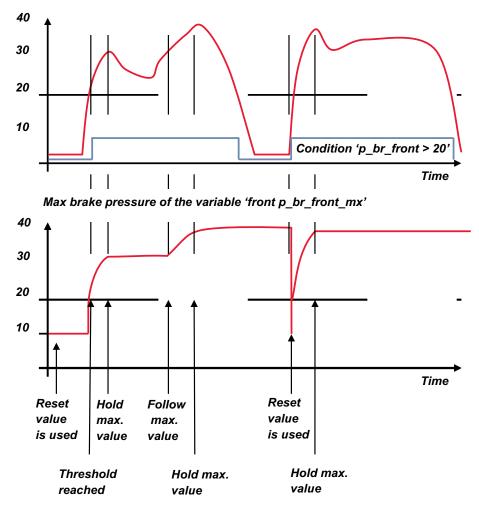
The reset value is always set for the new variable (entered in "Name"):

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

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

The conditional function is displayed in the C 70 math channel window.

Example: Setting up a condition for maximum front brake pressure Brake pressure 'front p_br_front'



- At power-up, the reset value (10) is used for 'p_br_front_mx'.

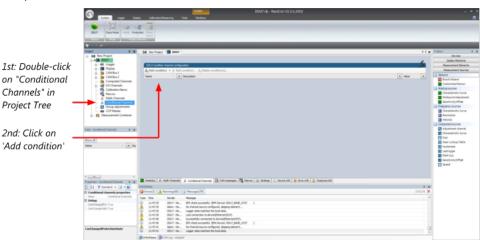
- 'p_br_front' rises to 30. As 'p_br_front' is > 20 (condition is TRUE), the condition 'max (p_br_front, p_br_front_mx)' in the THEN window is triggered. The condition sets the bigger value as new value for 'p_br_front_mx'. As 'p_br_front' (30) is bigger than 'p_br_front_mx' (10), the new value for 'p_br_front_mx'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

9.3 Conditional Channels

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

Creating a new Conditional Channel

1. Follow the steps shown in the screenshot. The "Create/edit condition" window appears.



2. Define the condition channel, using the following configuration possibilities:

Name: Comparing mode Comparing mode Constant Channel Constant Constant Constant value:	Jx	ring mode.			general properties and the nannel/value or multiple constant	Define the conditions g Select between single ch	
Constant Channel Coperator: Constant value: T						Name:	
		 Multiple (constant list) 	e	⊚ Range	Channel		-
			Constant value:	<u> </u>		Input channel:	-
General antices							
			Output settings			General settings	
Debounce time: 0 - ms Output mode: Constant TRUE/FALSE	-	Constant TRUE/FALSE	Output mode:				
Tum off delay:				ms	0	Tum off delay:	-1

a) Enter the name of the conditional channel.

b) Select the comparing mode:

- Constant: Compare a measurement channel with a constant value.
- Channel: Compare a measurement channel with a measurement channel.
- Range: Compare a measurement channel with a defined value range.
- Multiple: Compare a measurement channel with up to 5 constant values.

c) Depending on the chosen comparing mode, you can enter the following values:

- Constant: Choose the measurement channel or condition, the operator and enter the value of the channel.
- Channel: Choose the measurement channel or condition, the operator and the measurement channel or condition to be compared.
- Range: Choose the measurement channel or condition, the operator and define the minium and maximum value.
- Multiple: Choose the measurement channel or condition, the operator and enter the value of up to 5 constants.

d) Enter the minimal time to detect the signal of the measurement channel, to avoid highfrequent switchovers.

e) Enter the time by which the signal of the measuring channel is delayed after its end.

f) Choose the output setting of the result.

- Constant TRUE/FALSE: Result is as a constant with the value TRUE or FALSE.
- Blinking: Result is a blinking, if the condition is fulfilled.
- Pulse: Result is a short one-time pulse, if the condition is fulfilled.
- Toggling output: Result is a pulse that lasts until the next condition is fulfilled.
- Click 'Ok' when done. The conditional channel is displayed in the C 70 condition channel window.

9.4 Condition Combination

- Combination of several (up to 16) conditional channels for more complex calculations
- Logical results
- All conditions can be used globally in the whole C 70 project.

Creating a new Condition Combination

Follow the steps shown in the screenshot.

		EXAN A BANCIN VS.5.5.000	•
		Taba	N Today & K
1st: Double-click on 'Conditional Channels' in Project Tree	Construction C	The continue comparation of the second secon	Daplas Benerits Heasurement Denenis Heasurement Jourses
2nd: Click on the dropdown arrow beside 'Add	Sels Confiltent Durrets 8 K Down 8 Name > (*) (8)		Chapters States Chapters States Charterstates Chart Ch
condition'	r r Propries Conditord Correls # # 20 21 Y danked	Balana A - Malana A - Canada - Canada - Canada B - Canada -	×
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		Bahadhada Barting straged	

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

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

a) Enter the name of the condition combination.

b) Create the condition combination in the window.

- Choose a channel (condition, conditional function, math, measurement channel with binary values) to be compared.
- Combine multiple conditions, by adding 'AND' or 'OR' relations.
- To negate a condition, click with the right mouse-button on the condition and select 'Negation (!)'.
- Combine several (up to 16) conditions.

Click 'Next' to go to the next page. Choose the output setting of the result:

Create / edit condition combination		×
Create / edit condition combination		f.
Combine multiple conditions.		ير ر
Name:		
condComb		
Output configuration:		
Constant TRUE/FALSE		ĸ
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	< Back Next >	Finish Cancel

- Constant TRUE/FALSE: Result is as a constant with the value TRUE or FALSE.
- Blinking: Result is a blinking, if the condition is fulfilled.
- Pulsing: Result is a short one-time pulse, if the condition is fulfilled.
- Toggling output: Result is a pulse that lasts until the next condition is fulfilled.

Click 'Finish' when done. The conditional combination is displayed in the C 70 condition channel window.

9.5 Display Switch Module

You can use the Display Switch Module to switch display pages and brightness. The output is a display page or brightness output that can be used in display configurations. The value sustains over a power cycle.

The conditions for incrementing/decrementing the value can be set freely. The maximum value can be set as constant or read from a measurement.

The page can be configured to wrap around. In this case, no page down condition is needed.

Display Switch Wizard - Add New				×
Display Switch properties Setup the up and down signal sources and the maximum count of steps.				-+
Source for signal Up:			Edge:	
睅 🙆 page_up	<u>/</u>	\sim	Falling	\sim
Source for signal Down:			Edge:	
睅 📴 page_dn	<i>.</i>	\sim	Falling	~
Maximum count of steps: O Signal source: O Constant: Display switch does not wrap around Measurement Sheet:			12	
				~
< Back Next > Finis	sh		Cano	el

The resulting outputs are the display switch value and the input conditions.

Measurement label	Function
name	page or brightness value
name_ dn	input condition for decrement
name_ up	input condition for increment
Example:	
🙆 displayPage	C80 Logger
displayPage_dn	📮 C80 Logger
displayPage_up	📮 C80 Logger

9.6 Timer Module

The Timer Module is designed to implement timing triggers, i.e. for rallye stage timing or minimum pit time calculations. Any event in the system can be used for starting, stopping and resetting the timer.

Up counting mode and down counting mode are available, triggers are fired at set time (up counting) or at zero (down counting). The running timer will keep its state over a power cycle.

Timer Wizard - Add New X					
Timer configuration Specify timer properties and a set of	control signals.] N		
Properties Mode: Count down Count up Count up Count up Count up Count up Count up Count up Count down Count up Count down Count up Count down Count down Count down Count down Count down Count down Count down Count down Count down Count up Count down Count up Count down Count	Control signals Start timer: Stop timer (optional): Cond_start Stop timer (optional): Cond_stop Reset timer (optional): Cond_reset Use timer expiration to reset timer	Edge: Falling Edge: Falling Edge: Edge: Falling	~		
	< Back Next > F	nish Cance	el		

The output channels for this module depend on the name used for the module and are called ..._time and ..._trig.

Measurement label	Function
name_ time	actual timer value
name_ trig	trigger set by timer alarm

In this example, the module is named "Timer_Module". Resulting channels are:

Timer_Module_time	C70
Timer_Module_trig	C70

9.7 GPS Trigger Module

The GPS Trigger Module triggers depending on GPS-position, like the GPS-laptrigger.

There are 50 GPS trigger points for parameter application of latitude/longitude coordinates, as well as 10 macro-based coordinates.

If the car passes one of the trigger points, an output signal is set to 1 shortly. Each trigger requires a defined latitude, longitude, and detection range.

SPS Trigger configuration Specify GPS Trigger configuration.				5
Fudge Factor:	GPS positions (Parameter	based) Detection range (N	/acro based)	
	Latitude [DD]	Longitude [DD]	Detection range [m]	
Measurement sheet	0,0000000	0,0000000	20,00	
· ·	0,0000000	0.00000000	20,00	
	0,0000000	0,0000000	20,00	
	0.0000000	0.00000000	20.00	
	0,0000000	0.00000000	20,00	
	0,0000000	0.00000000	20,00	
	0,0000000	0.00000000	20,00	
	0,0000000	0.00000000	20,00	
	0,0000000	0,0000000	20,00	
	0,0000000	0.00000000	20,00	
	0,0000000	0,0000000	20,00	
	0,0000000	0.0000000	20,00	
	0,0000000	0,0000000	20,00	
	0,0000000	0.00000000	20.00	

The parameter-based trigger points need to be set manually in RaceCon, the macrobased trigger points will store latitude and longitude values when the configurable trigger condition comes true (i.e., steering wheel button). This trigger condition and the detection range need to be configured in RaceCon.

PS Trigger config Specify GPS Trigger				
specily GFS mgger	r conliguration.			
udge Factor:		GPS positions (Parameter based)	Detection range (Macro based)	
	1,000 🜩	20.00		m
easurement sheet		20,00		m
	~	20,00		m
		20,00		 m
		20,00		m

The GPS trigger points can also be used for segment triggering. If used as segment triggers and i.e., 3 trigger points are selected, the laptrigger module will use the first 3 trigger points on the list. The channel names depend on the name used for the module, in this example GPS_Trigger. Each trigger has a distance and a trigger channel with the abbreviation m for macro or p for parameter based. The trigger channel will be set to 1, when the lowest distance to the trigger point is detected. For the macro-based trigger, the stored latitude and longitude values can be seen with the channels.

Measurement label	Function
name_ lat	interpolated gps latitude
name_ long	interpolated gps longitude
name_ ptrig_150	trigger output of parameter based trigger (n)
name_ pdist_150	distance to trigger of parameter based trigger (n)
name_ mtrig_110	trigger output of macro based trigger (n)
name_ mdist_110	distance to trigger of parameter based trigger (n)
name_ macro_lat_110	stored latitude for macro based trigger (n)
name_macro_long_110	stored longitude for macro based trigger (n)
Example:	
GPS_Trigger_mdist_2	💽 C70
GPS_Trigger_mtrig_2	■C70
GPS_Trigger_pdist_2	■C70
GPS_Trigger_ptrig_2	■ C70
GPS_Trigger_macro_lat_2	■ C70
GPS_Trigger_macro_long_2	■ C70

9.8 CPU Load Limits

As all microprocessors, the two processors of the C 70 have limited capacities. The current load of the processors can be monitored using the channel "cpu_load_001" or "cpu_load_002". When configuring your device, please make sure the used CPU load is in a save range below 100 %.

Bosch recommends a maximum CPU load of 85 % (averaged). Exceeding this limit might result in the C 70 not being able to fulfill its required measuring/logging/display tasks or even in crashing and rebooting.

Main factors influencing the CPU load are:

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

To help respecting the limit of 85 % CPU load, the C 70 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 C 70 resets due to complex configuration setups, please consider reducing the demands on the C 70 adapting the influencing factors mentioned above.

10 CAN Configuration

The C 70 has 2 fully configurable CAN bus(es).

- Baudrate 125 kbaud to 1 Mbaud
- 11 Bit or 29 Bit identifiers
- Input configuration: Read messages from CAN bus and convert to C 70 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).

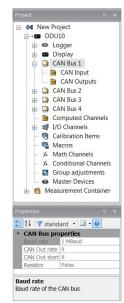
10.1 CAN Bus Trivia

CAN Message

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

CAN Bus

- Needs termination resistors 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



Row Counter Concept

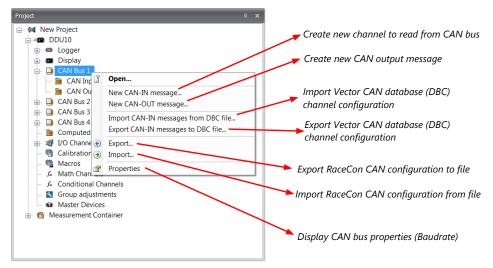
- Re-use (multiplex) of message identifiers
- One byte of message contains row counter
- 7 bytes payload remaining
- Position of row counter is configurable

	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
0x100	0	💁 p_oil		💁 t_oil				
0x100	1	💁 s_dam_fl		💁 s_dam_fr				
0x100	2	💁 s_dam_rl		Ns_dam_rr				
Message Id	Row Counter		d Area					

10.2 CAN input

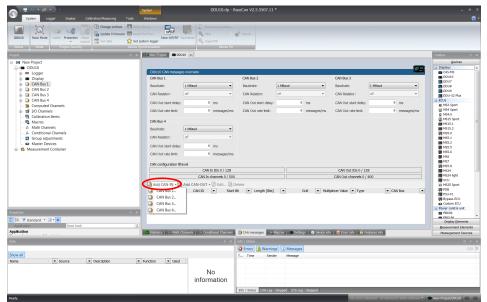
10.2.1 Input configuration

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



10.2.2 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.



3. A CAN channel configuration window opens.

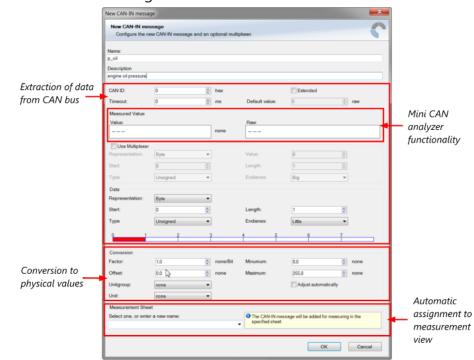
4. Insert the name and description of the channel.

News: Configure the new CAN-IN message and an optional multiplexer. Name: > o_oil Description Bescription angine oil pressure CAN ID: 0	
oil Description angine oil pressure CAN ID: 0	
Description angine oil pressure CAN ID: 0 0 ms Default value: 0 ms Default value: 0 ms Default value: Value: 0 Rev: mone Use Multiplexer Rev: Representation: Byte 0 Type Unsigned Unsigned Endianes: Big Data Representation: Byte Start: 0 Length: 1 1 Type Unsigned Endianes: Length: 1 Type Unsigned Inone/Bit Minumum: 0.0 Conversion none Factor: 10 none Maximum: 0.0 Adjust autom Unitigroup: none Maximum: 25.0 Unitigroup: none The CAN-IN message will be added for specified sheet	
angine oil pressure CAN ID: 0 hex Extended Timeout: 0 ms Default value: 0 Measured Value Value: None Use Multiplexer Representation: Byte v Value: 0 Start: 0 & Particular Start: 1 Type Unsigned v Endianes: Big Data Representation: Byte v Start: 0 & Particular Start: 1 Type Unsigned v Endianes: Big Data Representation: Byte v Start: 0 & Particular Start: 1 Type Unsigned v Endianes: Little 0 & Particular Start: 1 Type Unsigned v Endianes: Little 0 & Particular Start: 1 Type Unsigned v Endianes: Little 0 & Particular Start: 1 Start: 0 & Particular Start: 1 Type Unsigned v Endianes: Little 0 & Particular Start: 1 Start: 0 & Particular Start: 1 Minumum: 0.0 Offset: 0.0 & Particular Start	
CAN ID: 0 hex Extended Timeout: 0 ms Default value: 0 Measured Value Value: 0 mone 0 Value: none 0 0 Use Multiplexer Rew: 0 0 Representation: Byte Value: 0 Start: 0 1 1 Type Unsigned Endianes: Big Data Start: 0 1 Type Unsigned Endianes: Length: 1 1 1 1 Type Unsigned Endianes: Little 0 1 2 3 4 5 6 Conversion Factor: 1,0 Factor: 1,0 none/Bit Minumum: 0,0 Offset: 0,0 none Maximum: 255,0 Unitgroup: none Maximum: 255,0 Unitgroup: none Maximum: 255,0 Unit: none Maximum: 255,0 Unit: none Image: Start Image: Start	
Timeout: 0 Measured Value: 0 Value: none none Image: Start: 0 0 Image: Start: 1 Image: Start: 0 Image: Start: 1 Image: Start: 0 Image: Start: 1 Image: Start	
Measured Value Raw: Value: none none Use Multiplexer 0 Representation: Byte Start: 0 ① 2 Type Unsigned O 2 Data Endianes: Big Start: O 2 Jata Type Unsigned Unsigned Endianes: Length: 1 Type Unsigned O Image: Conversion Factor: 1.0 Offset: 0.0 Unitgroup: none Measurement Sheet Select one, or enter a new name:	
Value: Raw: none Use Multiplexer 0 Representation: Byte Value: 0 Start: 0 Endianes: Big Data Byte Start: 0 Endianes: Big Data Start: 0 Start: 0 Start: 0 Type Unsigned Endianes: Little 0 1 2 3 4 5 6 Conversion Factor: 1.0 none none Maximum: 0.0 0.0	raw
none Use Multiplexer 0 Representation: Byte Value: 0 Start: 0 Image: Construction of the state of the specified state of th	
□Use Multiplexer Representation: Byte ○ ↓ Start: ○ ○ ↓ Length: 1 Type Unsigned O ↓ Cata ● Representation: Byte Start: ○ ○ ↓ Length: 1 Image: Start: ○ ○ ↓ Start: ○ ↓ Length: Image: Start: ○ ↓ Image: Start: ↓	
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Representation: Byte Value: 0 Start: 0 Image: Endianes: Big Data Endianes: Big Data Start: 0 Image: Endianes: Start: 0 Image: Endianes: Image: Endianes: Start: 0 Image: Endianes: Image: Endianes: Start: 0 Image: Endianes: Image: Endianes: Operation Image: Endianes: Image: Endianes: Image: Endianes: Operation Image: Endianes: Image: Endianes: Image: Endianes: Operation Image: Endianes: Image: Endianes: Image: Endianes: Conversion Image: Endianes: Image: Endianes: Image: Endianes: Start: 0.0 Image: none/Bit Minumum: 0.0 Offset: 0.0 Image: none Maximum: 255.0 Unitgroup: none Image:	
Type Unsigned Endianes: Big Data	×
Type Unsigned Endianes: Big Data	
Data Representation: Byte Start:	
Representation: Byte Image: Constraint of the state of the st	
Type Unsigned Endianes: 0 1 2 3 4 5 6 Conversion	
Type Unsigned Endianes: 0 1 2 3 4 5 6 Conversion	
0 1 2 3 4 5 6 Conversion Factor: 1.0 ☐ none/Bit Minumum: 0.0 Offset: 0.0 ☐ none Maximum: 255.0 Unitgroup: none	
Factor: 1,0 none/Bit Minumum: 0,0 Offset: 0.0 none Maximum: 255,0 Unitgroup: none Adjust autom Unit: none Adjust autom Weasurement Sheet Select one, or enter a new name: The CAN-IN message will be added for specified sheet	
Factor: 1,0 none/Bit Minumum: 0,0 Offset: 0,0 none Maximum: 255,0 Unitgroup: none Adjust autom Adjust autom Unit: none The CAN-IN message will be added for specified speet Select one, or enter a new name: The CAN-IN message will be added for specified speet	7
Factor: 1,0 none/Bit Minumum: 0,0 Offset: 0,0 none Maximum: 255,0 Unitgroup: none Adjust autom Adjust autom Unit: none The CAN-IN message will be added for specified speet Select one, or enter a new name: The CAN-IN message will be added for specified speet	
Offset: 0,0 255,0 Unitgroup: none Adjust autom Unit: none Measurement Sheet Select one, or enter a new name: The CAN-IN message will be added for snerified sheet	none
Unitgroup: none Adjust autom Unit: none Measurement Sheet Select one, or enter a new name: Select one, or enter a new name:	none
Unit: none Measurement Sheet Select one, or enter a new name: Select one, or enter a new name:	
Measurement Sheet Select one, or enter a new name:	
Select one, or enter a new name: The CAN-IN message will be added for specified sheet	
specified sheet	or measuring in the
0	K Cancel

5. Click 'OK' when done.

The channel is listed in the Data window.

CAN Bus 1			0	N Bus 2				CAN Bu	3			
Baudrate:	1 MBaud		- Ba	udrate:		1 MBaud		▼ Baudrat	e:	1 MBaud		•
CAN Resistor:	off		- c	AN Resistor:		off		▼ CAN Re	sistor:	off		Ŧ
CAN Out start delay:		0 ms	G	AN Out start	delay:		0 ms	CAN OU	t start delay:		0 ms	
CAN Out rate limit:		0 messages,	/ms C	AN Out rate	lmit:		0 messages	s/ms CAN Ou	t rate limit:		0 message	s/m
AN Bus 4												
Baudrate:	1 MBaud		•									
CAN Resistor:	off		-									
CAN Out start delay:		0 ms										
CAN Out rate limit:		0 messages/	/ms									
CAN configuration fill	level											
	CAN	In IDs 1 / 12	8					CAN	Out IDs 0 / 12	8		
	CAN In	channels 1 /	500					CAN Out	channels 0 /	400		
Add CAN-IN 🝷 🗟	Add CAN-OUT	- 🕞 Edit	B Delete									
ame 🔺 💌	CAN ID	▼ 5	itart Bit	 Lengt 	n (Bits)	-	Grid 💌	Multiplexer Value	• 💌 Туре		CAN Bus	
		0x0		0		8			- CAN In		CAN Bus 1	

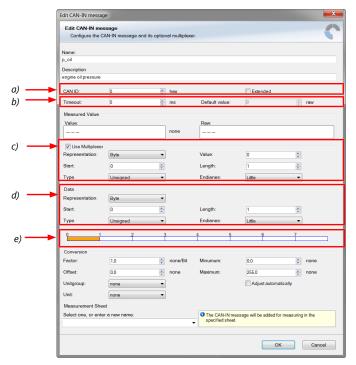


CAN channel configuration

10.2.3 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 bargraph.



- 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.

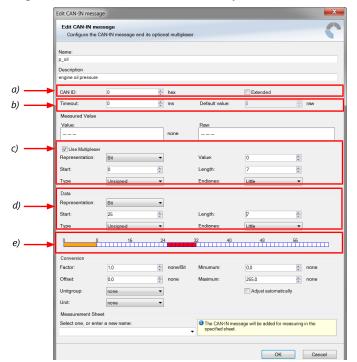
d) Enter data position, length and format.

e) The bargraph shows 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 assignment of the bytes.

- Red colored fields show the assignment of the data bytes.
- Orange colored fields show the assignment of the multiplexer bytes.

Conversion to physical value



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

b) Enter offset for conversion to physical value.

c) Select type of physical value.

d) Select unit of physical value.

e) Enter minimum physical limit of the channel. (for manual setup)

f) Enter maximum physical limit of the channel. (for manual setup)

g) Check the box to automatically adjust the limits of the channel.

CAN analyzer functionality

This functionality is only available, if a MSA-Box (I or II) is used to connect the C 70 to the PC. Choose the CAN bus that is connected to the MSA-Box to display the raw value and the converted physical value here.

Measured Value		
Value:		Raw:
	bar	

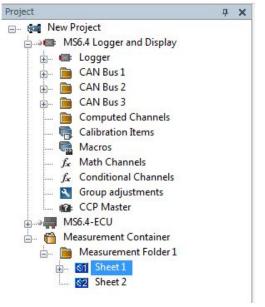
Automatic creation of online measurement sheets

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

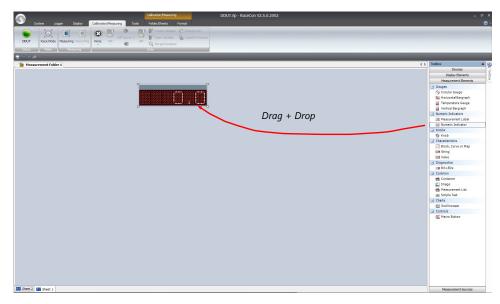
For an online view of the value measured by the C 70, insert the channel in an online measurement sheet which is described in the chapter Setting up an online measurement [> 73].

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

10.2.4 Online view of CAN channels in vehicle



- 1. Double-click on 'Sheet 1' in Project Tree. Measurement Sheet 1 is displayed in Main Area.
- 2. Click on 'Measurement elements' in the Toolbox.
- 3. Drag the desired Measurement element (e.g. Numeric Indicator) and drop it on the Measurement Sheet.



- 4. Click on folder 'CAN Input' of desired CAN bus to display available channels.
- 5. Drag desired Measurement channel and drop it on the Measurement element.

0	Calbration/Measuring	DDU7.rlp - RaceCon V2.5.0.2002	_ & X
System Logger Display Calibration,Measuring Tools	Folder/Sheets Format		
	👔 🦻 Create dataset 😨 Change A.2.		
COURT Days Made Management Description Minage Min	🖉 🕼 Open dataset 👫 Update Pirmare		
· · · · ·	Q Merge/Compare		
Status Mode Measuring	Data		
$\phi = \phi = \phi$			Data - Sheet 1 # D
Heasurement Folder 1		4.6	Data - Sheet 1 # P
			Show all
		°°	B B B B B Show all
			Name V 💌 Source
			🔜 p_al 🚺 0007
		Drag + Drop	
			< >
			P_oil [bor] Provided by DOU7 (phowed at Data) engine of pressure provided by DOU7 (phowed at Data)
			engine ol pressure
			Quantisation: 1 [bar] /inc
			Limits: 0255 Format: %3.0
Sheet 2 Sheet 1			Quantization: 1 (bar) /nc Limits: 0.255 Pomatr V3.0 Fektor: 1 Offset: 0
mi snor 2 M Sheet 1			Data type:8 Bit unsigned *

- 6. The measurement element displays the values of the assigned channel.
- 7. Connect PC to the vehicle and switch to 'Race Mode' by clicking 'F11' on the keyboard to display online data.

10.2.5 Import a CAN database (DBC) file

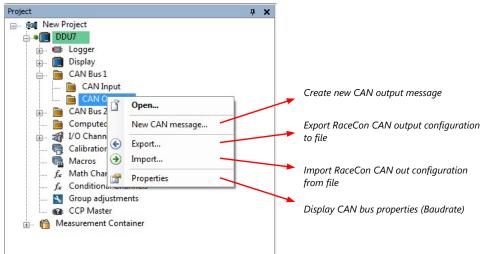
- 1. Right-click on CAN Input of desired bus (CAN1 or CAN2).
- 2. Select 'Import DBC file' from menu. A file browser opens.
- 3. Select DBC file to import and click 'OK' when done. A channel import window opens.

94 channels and 60	messag	ies availa	ble					channels to import:	
Name	Unit	ld	Size	RowCtr	Row/Val	Descrit 🔺		aps	
🌙 ассх	g	777	8			Vector,		ath	
🌙 ассу	g	777	8			Vector		1	
🜙 accz	9	777	8			Vector			
🜛 activate_blip	flag	100	1			Vector	A <u>d</u> d all		
🜛 activate_cut	flag	100	1			Vector			
🛃 aps	%	779	8			Vector			
🛃 ath	%	773	8			Vector			
🌛 ax1_Bremse60	g	5C0	16			Vector	<- Bemove	1	
🌛 ay1_Bremse60	g	5C0	16			Vector			
🜙 batt_u	V	779	8			Vector	Remove all		
→ battlow_b		77A	1	0	5	Vector 👻			
•						Þ			
<u> </u>						▶			

- 4. Select desired channels on the left and use the 'Add' button to add them to import list.
- 5. Click 'OK' when complete. The channels are inserted in the Data window.

10.3 CAN output

10.3.1 Output configuration



10.3.2 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.

System Loger Display Calbration/Measuring Tools	System DOU10.rtp - R Windows	aceCon V2.5.5507.11 *			_ = ×
DUUD Satar Mode					
Project P x	DDU10 ×				Toolbax 9 x
At New Project Image: Constraint of the Project of Constraint of Cons	DOUTO CM mesupes cervine DOUTO CM mesupes cervine CM Ito 1 Baudrate: Iffeed CM Ito 24 and ship: CM Col 24 and ship:	CAN Bos 2 Baudratic: I Meand CAN Bostor: of CAN Cost rate limit:		Maad • • o • ns • nesagatins	Enviros Destray = Col-32 = Col-32 # Col-32 # Col-32 # Col-32 # Col-32 # Col-32 # Mission #
	CAN In IDs 0 / 128		CAN Out IDs 0 / 128		MS24 MS24 light
nyanna t x 2 11 'Y tandard - 🗐 - 👰	CAN Bus 2 CAN Bus 3 CAN Bus 4	8t 💌 Length (Bits) 💌	CAN Out channeb 0 / 40 Grid 💌 Multiplexer Value 💌 Type	💌 CAN Bus 💌	VCU IM MS25 Sport POB PSU-F1 PSU-F1 PSU-F2 Power control unit Prover control unit PSU-F0 PSU-F0 PSU-F0 PSU-F0 PSU-F0 PSU-F0 PSU-F0 PSU-F0 PSU-F0 PSU-F0 PSU-F0 PSU-F0 PSU-F0 PSU-F0 PSU-F0 PSU-F0 PSU-F1 PSU-
	Statistics 🖉 Math Channels 👘 Conditional Channels		ettings 🕕 Device info 🛛 🥹 Error info 🛛 👫 Feat	ures info	Measugement Sources
lota Storr all Nane / T Source Description T	Function Used No information	Irfo / Status			0/0 X
		Info / Status CAN Log - Stopped SYS	i Log - Stopped		
Deader			100		to relation and the

- The 'New CAN-OUT message' window opens.

V Use Multiplexer Value: Representation: Byte Value: 1 Start: 0	
Name: CAN Message Description Description CAN ID: 0	
CAN Message Description CAN ID: 0 integration integration <t< th=""><th></th></t<>	
CAN ID: 0 hex Extended Grid: 100 ms Trigger channel: Trigger on: Resing VIse Multiplexer Representation: Byte Value: 1 6 Start: 0 Value: 1 6 Endianes: Big Add row Delete row(s) Add channel Add constant. Edit. Detete Bit index inverted Byte 0 2 Byte 1 2 Byte 2 2 Byte 3 2 Byte 3 2 Byte 4 2 7 Byte 5 7 Byte 6 7 1	
CAN ID: 0 hex Extended Grid: 100 ms Viger channel: Rising Channel: Rising Viger channel: Rising Channel: Rising Viger channel: Rising Chann	
Grid: 100 ms Trigger channel: Trigger channel: <td></td>	
Grid: 100 ms Trigger channel: Trigger channel: <td></td>	
Image: Construction of the second	
Vuse Multiplexer Representation: Byte Value: 1 6 Start: 0 Add row Delete row(s) Add channel Add constant Edit. Delete Bit index inverted Byte 0 Byte 1 Delete row(s) Add channel Add constant Edit. Delete Bit index inverted Delete Byte 0 Byte 1 Delete source and the second secon	ิล
V Use Multiplexer Representation: Byte Value: 1 1 8 Start: 0 Length: 1 8 Endianes: Big • Add row Delete row(s) Add channel Add constant Edit Delete Bit index inverted Byte 0 2 Byte 1 2 7 0 Byte 2 7 0 Byte 3 7 0 Byte 5 7 0 Byte 5 6 7 0 Byte 6 6 7 0 1	
Representation: Byte Value: 1 Start: 0 Image: Constraint of the start of the	edge
Start: 0 Length: 1 Big	
Endianes: Big · · · · · · · · · · · · · · · · · · ·	
Add row Delete row(s) Add channel Add constant C Edit Delete Bit index inverted Byte 0 5 6 7 0 1 Byte 1 5 6 7 0 1 Byte 2 5 6 7 0 1 Byte 3 6 7 0 1 Byte 5 6 7 0 1	-
Byte 0 0 1 2 3 4 5 6 7 0 1 2 3 4 5 6 7 0 1 2 3 4 5 6 7 0 1 2 3 4 5 6 7 0 1 2 3 4 5 6 7 0 1 2 3 4 5 6 7 0 1 2 3 4 5 6 7 0 1 2 3 4 5 6 7 0 1	•
	Byte 7
OK	Cancel

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

	New CAN-OUT messa	ige				X
	New CAN-OUT me Configure the CA	essage N-OUT message and an optional multiplexer				(
	Name: CAN Message Description					
	CAN ID:	0	🔹 hex	Extended		
Definition of	Grid:	100 ms	-	Trigger channel:		¥
CAN message				Trigger on:	Rising	▼ edge
5	Use Multiplexer					
	Representation:	Byte	-	Value:	1	×.
	Start:	0	-	Length:	1	*
				Endianes:	Big	-
Content of		Delete row(s) Add channel 📑 Add				
message	0 1 2 3 4	D Byte 1 Byte 2 5 6 7 0 1 2 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 6 7	Byte 7 0 1 2 3 4 5 6 7
message						
					ок	Cancel

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

	ntern logger	Chergency anisot. New CAN-OUT message		0 -
SOULD Race Mode Control Control <t< td=""><td>file to file from ritern logger</td><td>and the second s</td><td></td><td></td></t<>	file to file from ritern logger	and the second s		
Determine Mark Performance Out on Off Reserved 0 0 0 Image: Imag	CETTONE CAN E Bauda CAN E CAN E Bauda CAN E CAN E CAN E CAN E	Molecular Biological More CMA CUT message Configure At CORECUT message Configure At Core Cut Tomorphic at an operation of the Core Cut Tomorphic at an operation of the Cut Tomorp	Add and CM and Amend Concel	Qevices # Splays # QCD-V19 # QCD-V19<
Argonities C x It I T standard + C + C Rave truck Asame COULD Application Appl	Rame		OK Const	HS24 HS24 light VCU HS25 Sport HS25 Sport HD8 Leo Leo Olipting Elements Examplements
	statu (Accesignment Sources
Data			lefo / Sutua	= • ×
	Function		Errors & Warnings () Messages T Time Sender Message	0,10 ×
Min Control Control Control Min Control Control Control Control Marco Control Control Control Control Control Marco Control Con		No information	20/7868 Dilay Suppl. 2014; Suppl.	

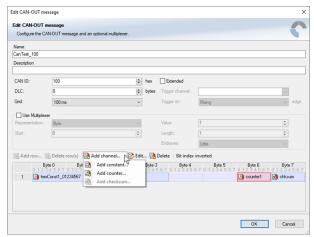
- Select the desired measurement channel and specify the message settings.

The measurement channel is now assigned to the CAN message.

10.3.2.1 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 small arrow beside 'Add channel...' and select '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.
- 4. Click 'OK' when done.



10.3.2.2 Adding CAN out counter

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

- 1. Create a new CAN output message or edit an existing message.
- 2. Click small arrow beside 'Add channel...' and select 'Add counter...'. The 'Add new CAN out counter' window appears.
- 3. Define the name of the counter, define the CAN channel settings.
- 4. Click 'OK' when done.

Add new Count	er				
Specify the prop	erties of the (CAN out Counter			
Name:					
counter1					
Representation:	Byte	\sim			
Start:	6	-	Length:	1	
Right shift:	0	-	Endianes:	Little	```
Counter start:	0	-	Counter end:	255	ŧ
	2	2	4 5		7
		3	4 7	6	

10.3.2.3 Adding CAN out checksum

To send a checksum on the CAN, perform the following steps:

- 1. Create a new CAN output message or edit an existing message.
- Click small arrow beside 'Add channel...' and select 'Add checksum...'. The 'Add new CAN out checksum' window appears.
- 3. Define the name of the checksum, the algorithm, the byte which should be covered by the checksum and define the CAN channel settings.
- 4. Click 'OK' when done.

Add new CAN out cont ant X									
Add new (Add new Checksum								
Specify the properties of the CAN out Checksum.									
Name:									
Please ente	er a name f	or the CAN	l out chec	ksum					
Position:	0	▲ ▼							
0	1 2	2 3	3 4	5	6	7			
Checksum ty	Checksum type: CRC8 (8H2F)								
Select bytes	s the chec	ksum shou	ld be com	outed from	(7 bytes se	lected)			
0	1	2	3	4	5	6	7		
				C	OK		Cancel		

10.4 Multiplexer

Row counter concept

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

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

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

To use a multiplexer perform the following steps:

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

System Logger Duplay C		New CAN-IN messa					• ו)		
26U10 Race Mode visite Protection She lock		New CAN-IN me	isage w CAN-IN message and	en optionel mult	iplexer.		S		
of New Project	Collo 💌	Description					- 1		Toolbox Devices
	DOU10 CAN messages overview CAN Rus 1 Boudrate: 1 Mileud	CAN ID: Timeout: Measured Value	0	 ▲ hex ▲ ms 	Default value:	Extended	raw		CAS-M3
CAN Dutputs CAN Bus 2 CAN Bus 3 CAN Bus 4	CAN Resistor: off CAN Out start delay: CAN Out rate limit:	Value:	>	none	Raw.				DDU9 DDU-52 Plas ECUs MS3 Sport MS4 Sport
Computed Channels 49 UO Channels Galibration Items Galibration Items Matrix Channels	CAN Bus 4 Baudrate: <u>1 MBaud</u> CAN Resistor: of	Representation: Start: Type	Byte 3 Unsigned	•	Value: Length: Endianes:	0 0 1 0 Big •			MS4.6 MS15 Sport MS15.1 MS15.2 MS5.0 MS5.1
A Conditional Channels Group adjustments Master Devices Measurement Container	CAN Out start delay: CAN Out rate limit: CAN configuration fill level	Data Representation: Start Type	ByN 0 Unsigned	•	Length: Endianes:	1			MISS.2 MISS.5 MISS.6 MISS.6 MISS.6 MISS.6 MISS.8 MISS.8
0 X	Add CAN-IN R Add CAN-	Conversion	7	3	1 1	<u>6</u> 7	- F	CAN Bus	MS24 MS24 light VCU W MS25 Sport PDB
ol No infor	 Multiplexer p_ol 	Factor: Offset: Unitgroup:	1.0 0.0 none		Minumum: Maximum:	0.0 ÷	none	CAN Bus 1 CAN Bus 1	PSU-F1 Pypass EOU Custom EOU Pywer control unit PRX50
matio n	Statistics 🗍 A Math Channels 🗍 .	Unit: Measurement She Select one, or ente		•	The CAN-IN mer	ssage will be added for measuring i	1 the	_	Display Elements Measurement Elemen Measurement Source
rors 🔔 Warnings (i) Messages Time Sender Message					•	OK	Cancel		0

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

Constant and a c	CON DUTY OF A DUTY OF	Nex CAN-OUT message Part Coll Coll Transage Configue the CAN-OUT message and an optional multiplear. Nex: Nex: Continues Conti	Toole Quotos Quotos Palas Quotos Palas Quotos Palas H315 Sport H315 Sport H315 Sport
And a second sec		Control Control Control Control Antones in	H55.6 H55.6 H55.6 H55.6 H55.7 H

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

Add new CAN ou Specify the prop	t channel erties of the CAN ou	ut channel			
opeeny me prop		it channel.			
Channel:					
🕮 📑 b_pwr_good					•
8 Bit unsigned / little	endian				
Representation:	Byte	•		Mult	tiplexed
Start:	4		Length:	2	▲ ▼
Right shift:	0		Endianes:	Little	•
	Force quantiz	zation			
Factor:	1,0		Offset:	0.0	A V
Туре:	Unsigned	•			
0 1	2 3	4	5 6	5 7	

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

System Logger Brayley C	Sydam Bhrasan/Messuring Tools Windows		aceCon V2.5.5507.11 *			_ = ×
	COULD CAT INVESSION COULD CAT INVESSION	Marc CALO OT message Marca Calo Control Contr	Nex Elberd Troyer d Troyer d Troyer d Troyer d Troyer d torophic Control Contro Contro Control Control Contro	hannel: Rising	v nije Sector Angeles Sector Angeles Sector Angeles	Interface Interface
Information Notation Torran (Warnings) () Messages T. Trive Sector Nonsige Marganeous () Messages T. Trive Sector Nonsige Marganeous () Messages Marganeous () Messages		oorad Claneds 🔐 CAI Inclusions 👁 Micros	Satarga O beens it is Gener m	lo 📙 🛱 features into	OK Cancel	Peer catel ut Peer catel ut Peer catel ut Peer catel Peer ca

11 Export and Import in RaceCon

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

11.1 Export in RaceCon

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

Proceed with the following steps to perform an export:

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

lements to export	Dependencies	
hese elements will be exported		be also exported because they are used at New Project
en New Project	🔺 📄 🞁 Measurement	t Container
🖶 🍘 Measurement Container	😑 🗎 Measurem	ient Folder 1
😑 🗎 Measurement Folder 1	🕀 💷 Sheet 1	
🖶 🏙 Sheet 1	::	
_ B p_oil	- 🙆 Sheet 2	2
-22 Sheet 2	😑 🚥 DDU10	
😑 📾 DDU10	- Macros	
- Macros	- 🖍 Math Chan	nnels
- fx Math Channels	- Jx Conditiona	al Channels
-fx Conditional Channels	- 🕙 Group adju	ustments
-S Group adjustments	- Computed	Channels
-B Computed Channels		els
	🖨 🖷 Logger	
🖨 🕮 Logger	🕀 🛍 Logging	g2
🕀 🛍 Logging2	- 🛅 Grou	up 1
- B Group 1	👻 📄 🖏 Logging	g1

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

11.2 Import in RaceCon

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

Proceed with the following steps to perform an import:

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

Importing from file export_test.rex(2.5.5.0)			
Drag&Drop elements from the import content to the Summary: 0 imported elements	e current project		∢
Import content (source)		Current Project (target)	
CAN Bus 1	₽_0	CAN Bus 1 CAN Bus 1 CAN Bus 1 CAN Bus 2 CAN Bus 3 CAN Bus 4	
	< Back	Next > Finish	Cancel

- 4. Select channels to import.
- 5. Drag and drop the channel to 'CAN Input' of desired CAN bus on right hand side.

import content (source)		Current Project (target)
DU10 DU10 D CAN Bus 1 D CAN Bus 1 D CAN Input CAN Outputs	(∰p_oii	CAN Bus 3 CAN Bus 1 CAN Uput CAN Cuputs CAN Cuputs CAN Cuputs CAN Bus 3 CAN Bus 3 CAN Bus 4

6. Click 'Finish'. If a measurement channel belongs to more than one source (e.g. C 70 and MS 6), the 'Solve Label Ambiguity' window opens.

_	ous objects the appropriate one			
				•
y: 7 imported	element, 3 ambigous label			0
Source	Import	Source	Project Label	Description
DDU8	time_sec/CAN row 1/CANMessage_123/C	DDU8	time_sec	Linkable with 'time_sec' label
DDU8	time_min/CAN row 1/CANMessage_123/CA	DDU8	time_min	Linkable with 'time_min' label
DDU8	time_hour/CAN row 1/CANMessage_123/C	DDU8	time_hour	Linkable with 'time_hour' label
		< <u>B</u> ack	<u>N</u> ext >	Finish Cancel
	DDU8 DDU8	DDU8 time_sec/CAN row 1/CANMessage_123/C DDU8 time_min/CAN row 1/CANMessage_123/CA	DDU8 time_sec/CAN row 1/CANMessage_123/C DDU8 DDU8 time_min/CAN row 1/CANMessage_123/CA DDU8 DDU8 time_hour/CAN row 1/CANMessage_123/C DDU8	DDU8 time_sec/CAN row 1/CANMessage_123/C DDU8 time_sec DDU8 time_min/CAN row 1/CANMessage_123/CA DDU8 time_min DDU8 time_hour/CAN row 1/CANMessage_123/CA DDU8 time_min DDU8 time_hour/CAN row 1/CANMessage_123/C DDU8 time_hour

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

12 Analog and Frequency Inputs

Analog inputs

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

Frequency inputs

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

12.1 Analog inputs

12.1.1 Measurements channels

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

Data - New P	Project - DDU 7 - Input-cha	innels - ANA	\06 - f_wheel_fl		д X
<u>S</u> earch:					
Used	Name 🔺 💌	Source	▼ Description	•	
	💁 f_wheel_fl	DDU7	Wheel force front left		
	💁 f_wheel_fl_fi	DDU7	Wheel force front left		
	💁 raw_f_wheel_fl	DDU7	Wheel force front left		
	📑 raw_f_wheel_fl_fi	DDU7	Wheel force front left		

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

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

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

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

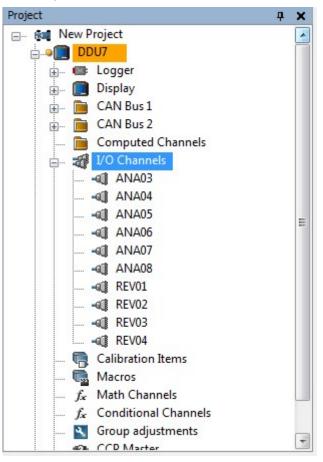
Filtered channels are routed through digital low pass filters:

- C 70 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

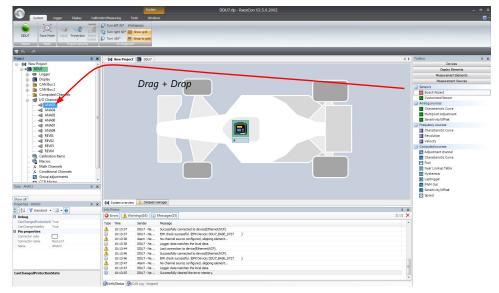
12.2 Configuring inputs

12.2.1 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 C 70 Project Tree.



3. Drag the "Bosch Sensor Wizard" from the Toolbox and drop it on the desired analog input channel in the C 70 Project Tree.



4. The "Bosch Sensor Wizard" opens.

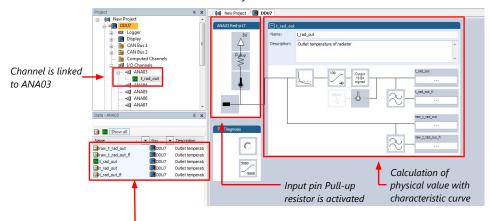
ĺ	Bosch Sensor Wizard					×	
1st: Choose the sensor´s category	Select Sensor Select a sensor, b	ased on the order number.				e	_
	Sensor category	TEMPERATURE SENSORS	Calibrati	on data			
and To name way	Sensor group	NTC M12	• V P	ullup			
2nd: To narrow you			_	Ohm	°C	× 4	These calibration
choice, choose 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	01		144	110		
3rd: Select the				186	100	-	
exact type				322	80		
				435	70		
				834	50		
		Sensor category TEMPERATURE SENSORS	_	1175	40		
				1707	30		
Opens sensor's		Sensor group NTC M12		2500	20		
datasheet		NIC MIZ		3792	10		
uulusneel		Open datasheet		5896	0		
							-
		< Bac	k N	ext >	Finish	Cancel	

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



7. Click 'Ok' when done.

The channel is inserted into the C 70 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

12.2.2 Configuring a generic linear sensor

Example: Acceleration sensor 5 g

- From sensor data sheet - operating characteristics:

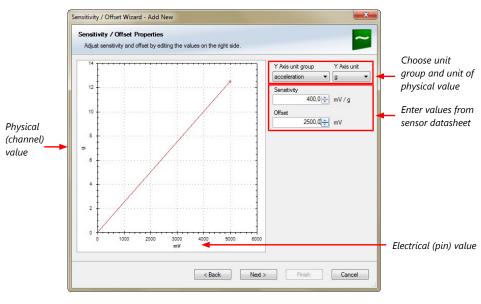
Dutput Signal			10.000	10000	
Zero g (T _A = 25°C, V _{DD} = 5.0 V) ⁽⁴⁾	VOFF	2.25	2.5	2.75	V
Zero g (V _{DD} = 5.0 V)	VOFF	2.0	2.5	3.0	V
Sensitivity (TA = 25°C, VDD = 5.0 V)(5)	S	380	400	420	mV/g
Sensitivity (V _{DD} = 5.0 V)	S	370	400	430.1	mV/g
Bandwidth Response	f_3dB	42.5	50	57.5	Hz
Nonlinearity	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 C 70 Project Tree.
- Drag the "Sensitivity/Offset" analog signal source from the Toolbox and drop it on the desired analog input channel in the C 70 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 C 70. It allows you to use a pushbutton. The fixed value of the internal pullup-resistor is 3,010 Ohm. If using an additional external pullup-resistor, set up the overall resistance.

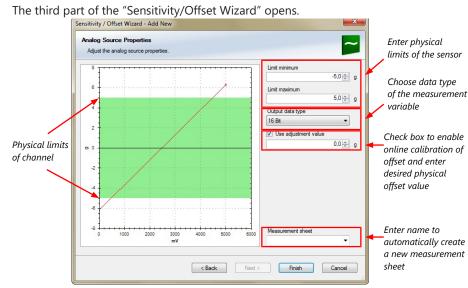
Pin Properties Configure the anal	og pin properties.	-
Pullup value:	3,01 kOhm	-
	Pin Diagnosis & monitoring limits	
	Enabled Minimum: -5000 mV	
	Maximum: 5000 🚖 mV	

5. Click 'Next' when done.

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

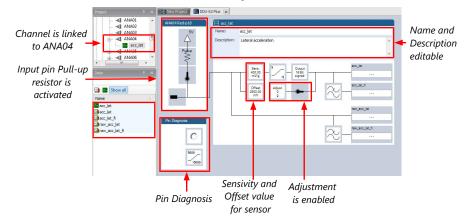


Click 'Next' when done. 6.



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

The channel is inserted into the C 70 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

Note

Working with automatically created measurement sheets is explained in chapter 'Setting up an online measurement [> 73]'.

12.2.3 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

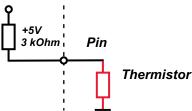
Toper	RT
[°C]	[Ω]
40	2 685
45	2 166
50	1 903
55	1 494
60	1 245
65	1 024
70	876
75	740

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 C 70 Project Tree.
- 3. Drag the "Characteristic Curve" analogue signal source from the Toolbox and drop it on the desired analogue input channel in the C 70 Project Tree.

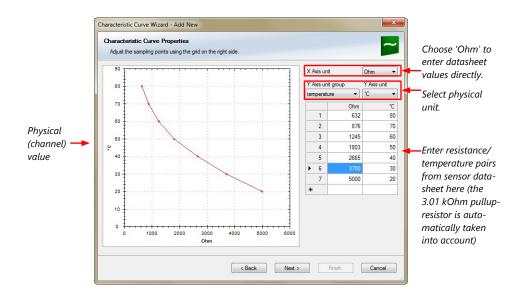
	System DDU7.rlp - RaceCon V2.5.0.2002	- r X
C		
		C C C
۰ <u></u>		
21 <	Type Time Sender Message	

- 4. A "Characteristic Curve Wizard" opens.
- 5. To activate the internal pull up-resistor, check the box. The C 70 pull up-resistor is used to get a 5 V signal at the analogue channel of the C 70. 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.

Characteristic Curve	Wizard - Add New
Pin Properties Configure the anal	og pin properties.
Pullup value:	3,01 kOhm 🔹
	Pin Diagnosis & monitoring limits
	Enabled Minimum: -5000 mV
	Maximum: 5000 (m) mV
	< Back Next > Finish Cancel

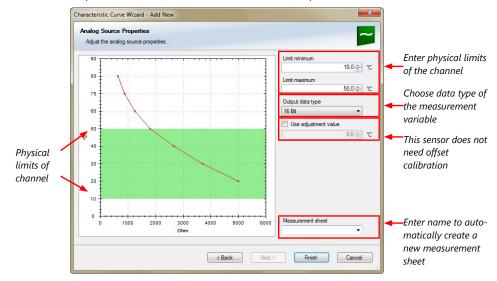
6. Click 'Next' when done.

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



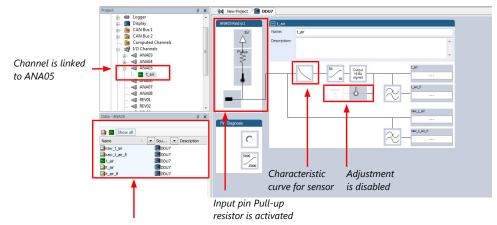
7. Click 'Next' when done.

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



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

The channel is inserted into the C 70 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

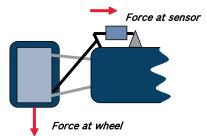
Note

Working with automatically created measurement sheets is explained in chapter 'Setting up an online measurement [> 73]'.

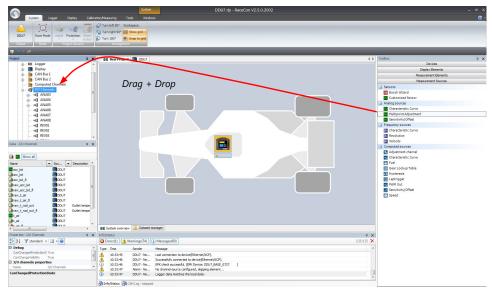
12.2.4 Configuring a multipoint adjustment

Example: Measurement of wheel force

- Physical property 'wheel force' not directly measurable
- 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 C 70 Project Tree.
- 3. Drag the 'Multipoint Adjustment' analog signal source from the Toolbox and drop it on the desired analog input channel in C 70 Project Tree.



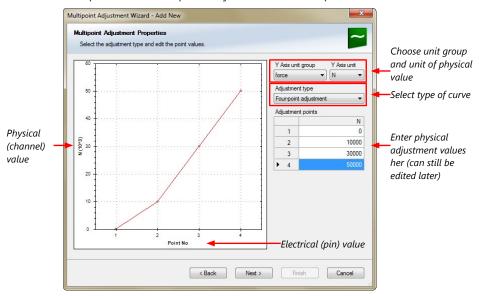
4. A 'Multipoint Adjustment Wizard' opens.

5. 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 C 70. 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.

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

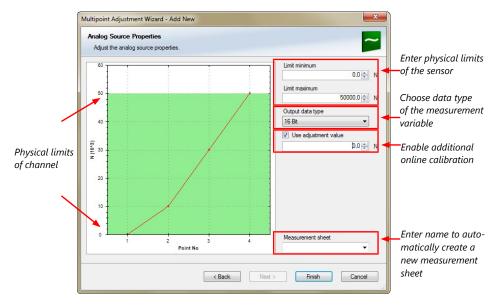
6. Click 'Next' when done.

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



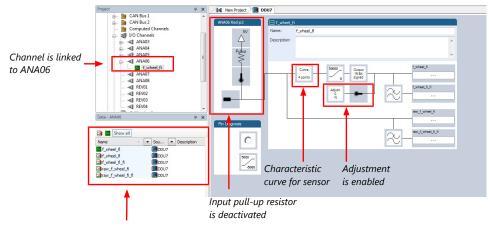
7. Click 'Next' when done.

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



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

The channel is inserted into the C 70 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

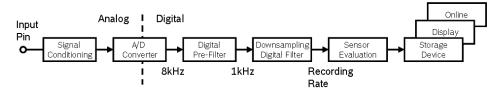
Online definition of the curve is covered in chapter 'Online calibration of measurement channels [▶ 78]'.

Note

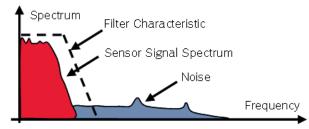
Working with automatically created measurement sheets is explained in chapter 'Setting up an online measurement $[\triangleright 73]$ '.

12.2.5 Digital filter details

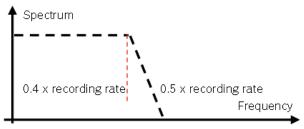
C 70 uses A/D converter oversampling and digital filtering to recording rate.



Digital filters eliminate 'out-of-band' noise



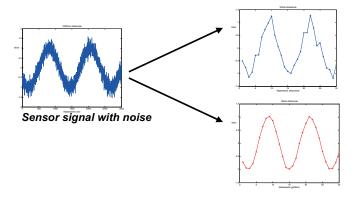
Cut-off frequency automatically adjusted to recording rate



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

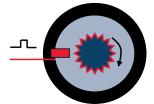
- Filtering is (smart) averaging over several samples
- Filtered signal is delayed with respect to real time signal

- C 70 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

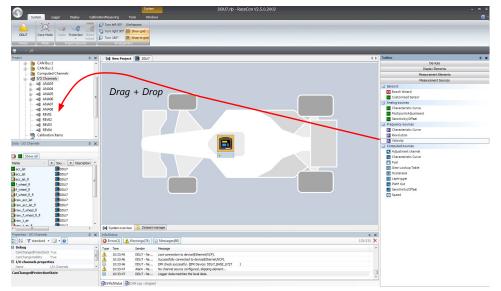
12.2.6 Configuring a frequency input

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 C 70 Project Tree.
- 3. Drag the 'Velocity' digital signal source from the Toolbox and drop it on the desired 'REV' input channel in the C 70 Project Tree.



- 4. The 'Velocity Wizard' opens.
- 5. Select the sensor type. The C 70 works with Hall effect and DF11 sensors.

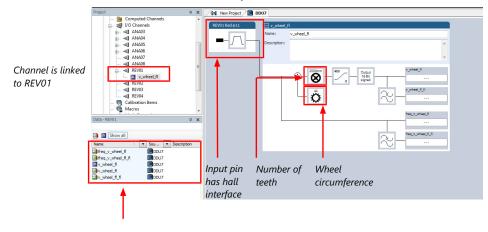
Pin Properties Configure the freq	uency pin properties.				
Sensor type:	Halleffect				•
		< Back	Next >	Finish	Cancel

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

ocity Wizard - Add N	ew	
Velocity Properties Configure a frequency	input to measure a linear velocity.	
Number of increments	: 44 <u>*</u>	Number of teeth on the pulse wheel
Wheel circumference:	2000 🛬 mm	Circumference of wheel for speed calculation
Output data type:	[16 Bt -	 Choose data type of the measurement variable
Limit minimum:	0 🔬 km/h	
Limit maximum:	400 🐳 km/h	
Measurement sheet:		 Enter name to automatically create a new measurement sheet
	< Back Next > Finish Cancel	

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

The channel is inserted into the C 70 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

Note

Measurement of 'Revolution' is similar.

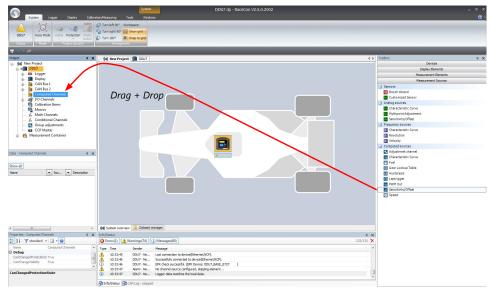
12.3 Configuring computed sources

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

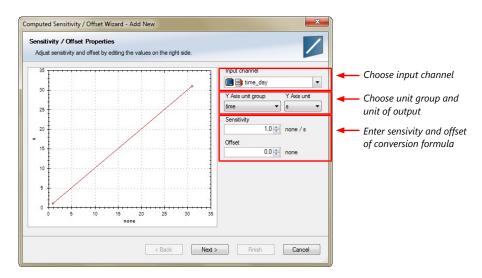
- Sensitivity/Offset calculation on input channel
- Characteristic curve calculation on input channel
- Computed vehicle speed
- Lap trigger (covered in a special separate section)

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 C 70 Project Tree.

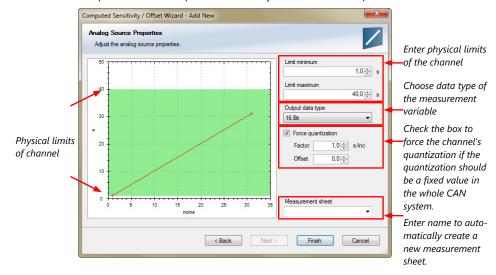


3. A 'Computed Sensitivity/Offset Wizard' opens.



4. Click 'Next' when done.

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



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

The channel is inserted into the C 70 Project Tree.

Note

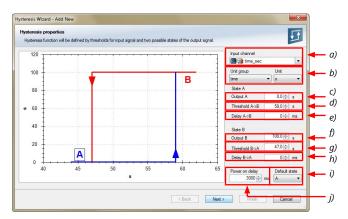
Working with automatically created measurement sheets is explained in chapter 'Setting up an online measurement [\triangleright 73]'.

12.4 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 C 70 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.

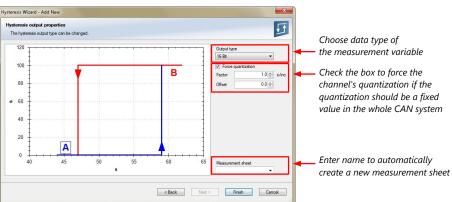
h) Enter delay time when state changes from B to A.

i) Enter time when the hysteresis function is activated after vehicle's startup.

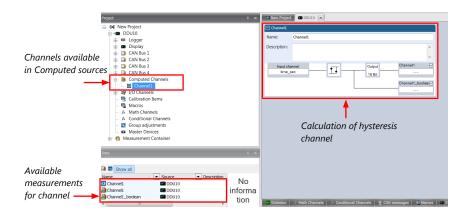
j) Enter the channel's state (A or B) at startup.

3. Click 'Next' when done.

The second part of the 'Hysteresis Wizard' opens.



- 4. Click 'Finish' when done.
- 5. Enter channel name and description.
- Click 'OK' when done. The channel is inserted into the C 70 Project Tree.



12.4.1 Special functionality: Vehicle speed

This functionality allows:

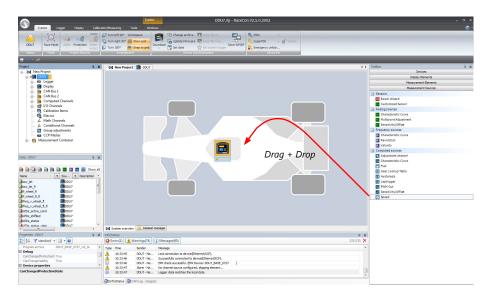
- high performance vehicle owners to measure wheel spin under acceleration and wheel slip/lock under braking.
- calculating vehicle 'speed over ground'.

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.

12.4.2 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 C 70 Project Tree. Do not drop it on 'C 70'!



A 'Calculated Speed Wizard' opens.

Calculated Speed Wizard	- Add New	
Calculated Speed Con Select speed inputs for	nfiguration Calculating a reference speed.	
Configure on device	■ DDU7	Choose device
Input source:	[Wheel speeds •	Choose input source (internal/external)
Drive shaft switch:	Rear wheel drive	Choose driven axle
Speed input front left:	v_wheel_fl	
Speed input front right:	v_wheel_fl	Choose individual wheel
Speed input rear left:	v_wheel_fi 👻	speed channels
Speed input rear right:	v_wheel_fi	
Speed difference:	5 * X	Set limit for speed
		difference for calculation
	< Back Next > Finish Cancel	

4. Click 'Finish' when done.

The speed calculation is inserted into the C 70 Project Tree.

		System	DDU7.rlp - RaceCon V2.5.0.2002			- 0 X
	States Losser Decky Colle	aton/Measuring Tools Windows				
	ڬ 😣 🐼 🖉					
	DDU7 Race Node visible Protection Street locked					
Conned calculation	Status Hode Project Security					
Speed calculation						
	Project 0 x	/Bill New Project 🛄 DOU7 🖸 Speed		41	x Toobox	8 X
in DDU Proje <u>ct</u>					Devices	_
					Display Elements Measurement Elements	
Tree	B- 45 Logger				Measurement Sources	
nee	B- Display B- B CAN Bes 1			æ	 Sersors 	
	a- CAN Bus 2	Speed configuration		8	Dosch Wizerd	
	8- 🖀 Computed Oxennels				Customized Sensor	
	 # 1/0 Channels Calibration Items 	Canfigure an device	CO 1/7		Characteristic Curve	
	- Macros	Insutation	Ubeel speed	-	Multipoint Adjustment	
Measurement	- fr Math Channels				Sensitivity/Offset	
rieusurement	Group ediustments	Drive shaft switch	Rear wheel drive	•	Prequency sources Characteristic Curve	
channels	CCP Master	Speed input front left	I a v wheel fl	-	2 Revalution	
chunnets	in- 👸 Measurement Container		a grower		M Velocity	
		Speed input front right	📖 🍙 v_sheel_fi		Computed sources Adjustment channel	
calculated speed	Cato-Speed 9 M	Speed input rear left	a a vieri il		Characteristic Curve	
					Tool .	
and calculated	a from all	Speed input rear right	Contract Contract		🛅 Geer Lookup Table	
and catculated	Bitgened det de	Speed difference		50 %	Hysteresis St. Laptrigger	
distance 🔶	Dispect of a COUT vehicle speed	speed orrena		2 M 2	PWH Out	
uisiunce					Sensitivity/Offset	
					Seed	
		•				
Configuration						
	reportes - Speed 9 M	Configuration				
window	1 21 T standard - 2 - 2	G Errors21 A Warnings210 D Messages(60)		13/13		
wuruow	None Speed				-	
	El Debag		device(Dherret)(CP).			
	CanChangedProtectionS True CanChangeVisibility True	A 18:33-46 DDU7 - Ne Successfully came	cted to device(Ethernet/bCP).			
			M. (SPK Device: DDU7_SASE_6727) confloared, skoping devent			
	CanChangedProtectionState	 LE 33:47 Alam - Ne No channel source LE 33:47 DDL7 - Ne Logger data match 				

13 Online Measurement and Calibration

C 70 configuration

- System configuration (channel + display configuration, CAN I/O, etc.) is stored in the C 70
- Use RaceCon to create and download configuration from the PC to C 70 Communication interface: Ethernet
- Communication protocol: XCP

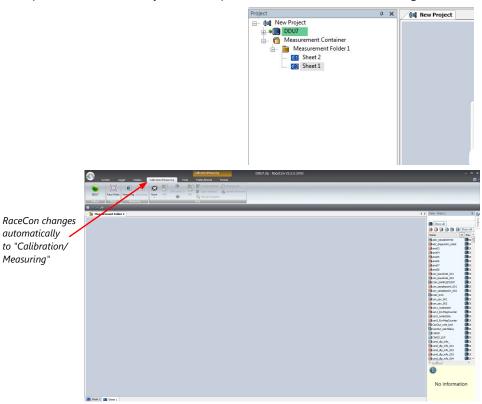
Online Measurement and Calibration

- 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

13.1 Setting up an online measurement

C 70 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.

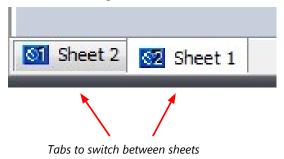


2. Click on the 'Folder/Sheets' tab, which appears when you are in the 'Calibration/ Measurement' window, to create a new measurement folder.

- 3. Click on the 'Add' button for folders in the upper left corner.

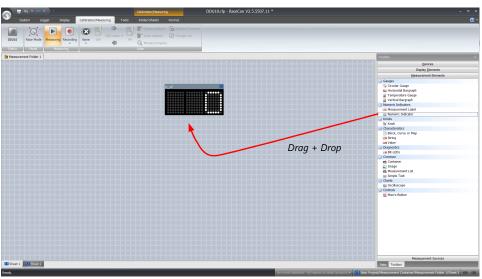
In the menu for sheets, you will find buttons to add, delete and rename new sheets

1. 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:

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



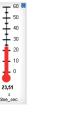
2. Select the desired measurement channel from the 'Data' area and drop it on the measurement element.

6 All Andrew State -Show Drag + Drop Signals no des raw va 1 😢 Sheet 2

If the C 70 shows the green status, the value is displayed.

RaceCon offers different types of measurement elements:







Horizontal Bar

graph style

Circular gauge

Temperature gauge

Vertical Bar graph style

60

- 10 **L** 0

23,51 s time sec

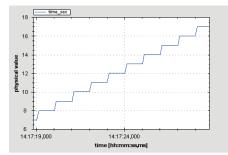




Measurement label



Numeric indicator

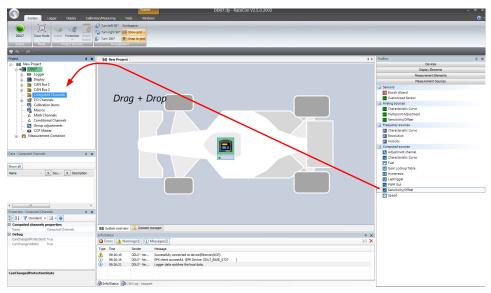


Oscilloscope (Chart)

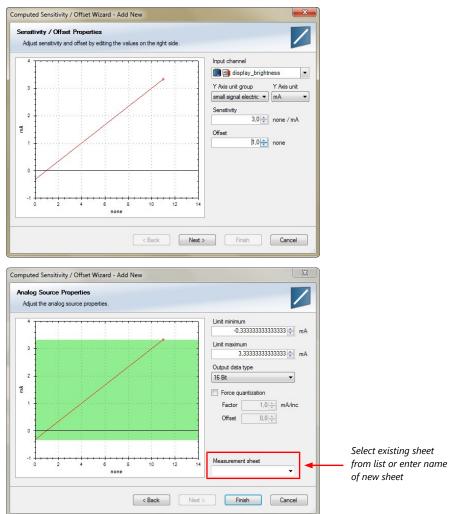
13.1.1 Automatic creation of measurement sheets

RaceCon can create measurement sheets automatically.

You can create and use measurement sheets with the C 70 as well as with all other devices connected to RaceCon.

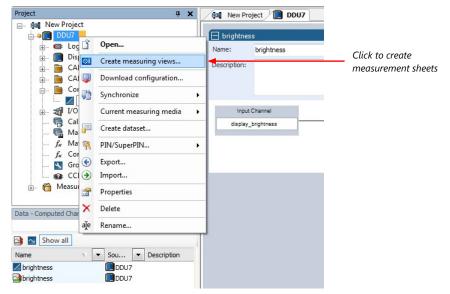


1. During the configuration of a measurement channel, select a measurement sheet from the list box or enter a name for a new measurement sheet.



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

2. To create the sheets, right-click on C 70 and select 'Create measurement views...' from the C 70 context menu.



The automatically created sheet is inserted in the Project Tree under 'Measurement Container' and 'Device Channels'. If the C 70 is connected to RaceCon and the status is green, live values of the channels are shown.

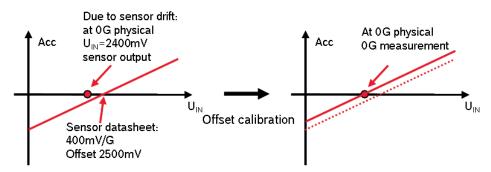
13.1.2 Using the measurement sheets

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

phys	0,0000 G	SENSITI	400,000		Z un pani calhador
raw	2490,0 mV	OFFSET	2500,000	mV	
		MIN	-5,000	G	
		MAX	5,000	G	
		ADJ_VAL	0,000		

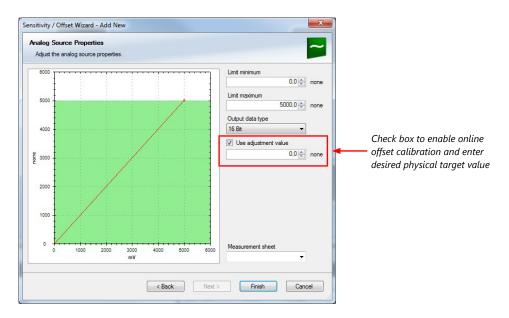
13.2 Online calibration of measurement channels

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

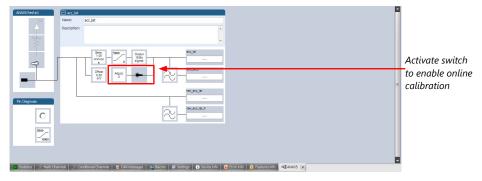


13.2.1 Enable online offset calibration for measurement channel

During creation of the measurement channel



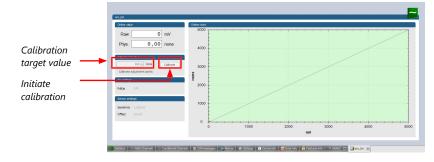




13.2.2 Performing the online offset calibration

C 70 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.

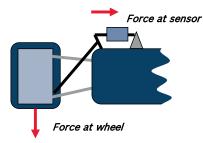


The sensor's offset is now calibrated.

13.3 Online calibration of multipoint adjustment channels

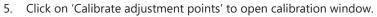
Example: measurement of wheel force

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



- 1. Create a multipoint adjustment measurement channel. To create a multipoint channel, see chapter 'Configuring a multipoint adjustment [▶ 62]'.
- 2. Download the configuration on the C 70. To connect the C 70 to RaceCon, see chapter 'Setting up a new RaceCon Project [▶ 15]'.
- 3. Click on the desired channel in the C 70 Project Tree.
- 4. Double-click on a measurement channel in the Data Area to open the online view.

Click to open measurement channels in data view Double-click to open	Alexandree A	Raw 4 mV Phys 18883,50 norm Raw 200 mm 10000000000000000000000000000000	0000 001 0000 0000 0000	Analog value	and physical	
to open	Store / Sou	Click to open	5000	Value		
online view		calibration window	0 0 0	1000 2000 mV	3000 4000	5000
	(a) f_wheel_fr ^	🗙 Statistics 🔰 🌾 Mafri Channels 🚽 🌾 Conditional Channel	I 😫 CAN messages 🖉 Macros 📲 Set	ttings 🔹 🕦 Device info 📄 🥪 timer info 📄 📅 Features	amis 💷 AXXAOS 🕱 🗃 f_wheel_fr 💌	

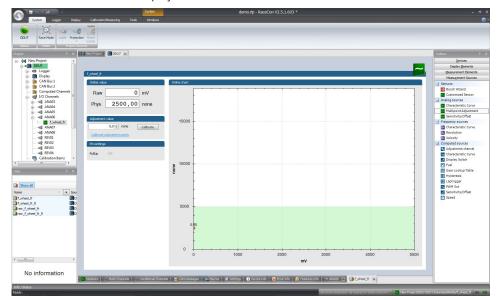


Point	Value	Unit	Calibration
1	1000,00	none	Calibrate
2	3000,00	none	Calibrate
3	4000,00	none	Calibrate
4	5000,00	none	Calibrate

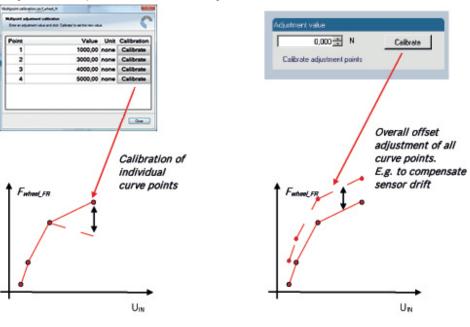
- 6. Apply the desired physical condition to the sensor (e.g. by applying a force on the wheel).
- Enter the physical value in the value column of the desired calibration point (e.g. 745 N).

- 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

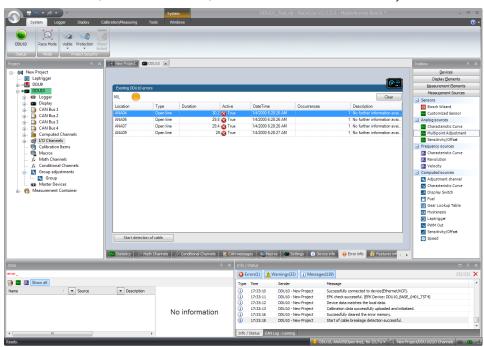


14 Error Memory

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.

14.1 Error memory representation in RaceCon

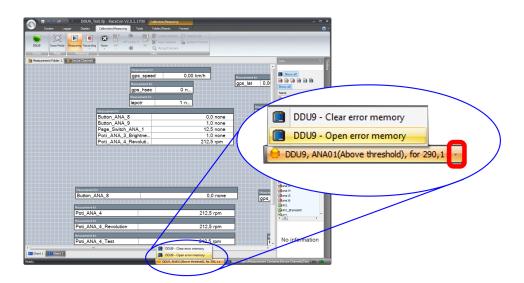
Bosch Motorsport devices feature an error memory. Information on errors can be visualized via RaceCon (online measurement) or can be transmitted via telemetry.



14.1.1 Accessing the memory

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

DCU20 Race Mode visible Protection Sheet	ation,Measuring Too	System is Windows	-	DDU10_	Test.nip - RaceCon V	12.5.5.0 - Mastericense Bosch *	_ = x
Status Mode Project Security Project 0 x	New Project 🛛 🚥 DOU						Toobox 0 X
Annu Project Burphiger Burphiger Burphiger Burphiger Burphiger CAN Bus 1 CAN Bus 2 CAN Bus 3	Existing DOU 30 errors MIL Location ANADA ANADA	Type Duras Open line Open line Open line	on Active 302 @ 7n 238 @ 7n 234 @ 7n	e 1/4/2000 6:28/2 e 1/4/2000 6:28/2	6 AM	Description	Devices Display Elements Beauxement Elements Messuement Sources Sensor Sensor Customized Sensor Antigo sources
CMBel CAnded Constant Constant Constant Constant Constant Constant Constant Constant Constant Constant Constant Constant Constant Constant Constant Constant Constant		Dpen line	254 🧕 In 23 🔮 Tr			1 No Lafar etternation inn. 1 No Lafar information wat-	Constantia Curre Const
	Start detection of o		ional Channels 🛛 😫 C4	N messages 🛛 👼 Macros	Settings 🕕 D	exce in 🕡 Bror info 🛱 Festures inf	Speed
Deta		_	• ×	Info / Status	_	\sim	= + ×
eror_					mings(32) 🕕 Messag		152/152 🗙
Source	Description	No info	ormation	1 17:33:10 1 17:33:11 1 17:33:12 1 17:33:13 1 17:33:16 1 17:33:18	Sender DDU 10 - New Project DDU 10 - New Project	Message Successfully connected to device/[Effernet/IUEP Eff: check successfull, (EPK Device: DDU2), SA Device data matches the local data. Calibration data successfull uploaded and Hits Successfully cleaned the error memory. Start of cable breakage detection successful.	8_0401_TST4)
<[]				Info/Status CAN Log) -running		



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.

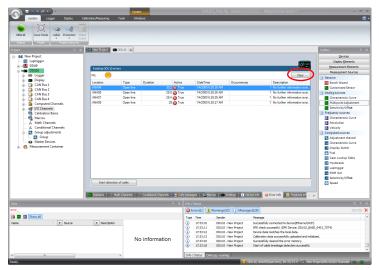
An error is deleted from the list when

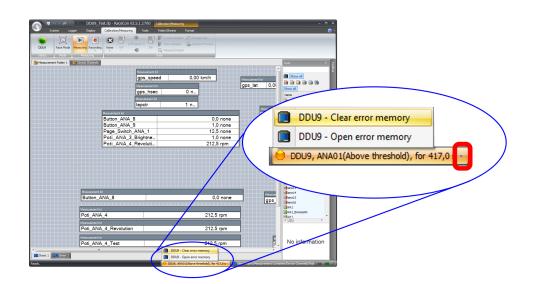
- the user actively clears the error memory
- the user updates the firmware

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

14.1.2 Clearing the error memory

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





14.2 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.

14.2.1 Error Memory Properties

The following property is available for the error memory itself:

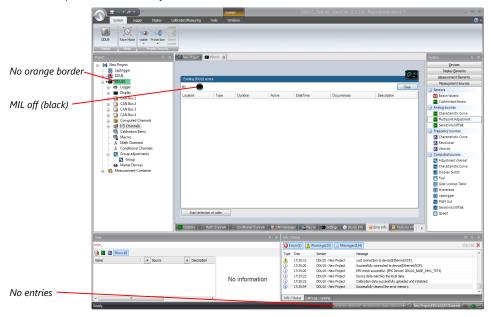
- Error Status (device measurement label "error_state")0: no error present in memory
 - 1: at least one inactive error present in memory, no active errors
 - 2: at least one active error present in memory

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.rl;	p - RaceCon V2.5.	5.0 - Masterlicense Bosch *	_ = X
	System Logger Display Ca DU9 Race Mode Du9 Node Wable Protection Since Boths		ks Windows	-	-	-	_	0 -
		🕫 New Project 🗰 DDU	10 ×					Toobox 0 X
Constantly orange border	Awy Project Awy Project Dup Dup Dup	Existing COU 10 errors						Display Benents Measurement Benents
MIL constantly orange	B Logger Display CAN Bus 1		Type Duration	Active 114.3 Fals	DateTime 14/2000 52825 AM	Occurrences	Description	Measurement Sources Sensors Sources Customized Sensor
MIL constantly orange	CAN Bus 2 CAN Bus 3 CAN Bus 4	ANAD6 ANAO7	Open line Open line Open line	113.9 Fels 113.5 Fels 113.1 Fels	e 1/4/2000 6:28:26 AM e 1/4/2000 6:28:26 AM		No further information avai. No further information avai. No further information avai. No further information avai.	Customized Sensor Analog sources Characteristic Curve Multipoint Adjustment
	Compared Counts Control Counts Galaxies to the counts Galaxies to the counts A Mathematical Counts A Continue Counts Galaxies Galaxies Manusement Container	Bart detection of c	złk	harnels 🔡 CM	ressors Transform	ietings O Device I	ti gibrante di consecutione di	Sessivity/Offet Frequency servers Characteristic Curve Encoded Servers Compared Servers Com
	Deta error_			¢ ×	Info / Status		-	= 0 × 157/157 ¥
	error Show all Name	Description			A 17:35:13 00U10 -	New Project St New Project Lo	essage art of cable breakage detection successful. st connection to device(Ethernet(NCP).	A
Info cycling through errors, present in ————			No inform	ation	(i) 17:35:20 DDU10 - (i) 17:35:22 DDU10 -	New Project El New Project Di	uccessfully connected to device(Ethernet/KCP) % check successful. (EPK Device: DDU10_BAS rvice data matches the local data. alloration data successfully uploaded and initial	E_0401_TST4)
error memory	e 11 Ready.				Info / Status C/N Log - rumin		ANAO9(Open line), for 113,15 + 47 New F	Project/EOU10/1/0 Channels 🛛 😁 🍂

Blinking orange border MLL blinking orange

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

14.2.2 Error Properties

The following channels are recognized and memorized inside the devices:

Data				
err				
👜 📖 🥶 🔄 👜		- 🔤 🏬 🚥	Show all	
Name	Δ.	▼ Source ▼	Description	-
error_active_rotate		DDU9	error active rotation. signals if error is present or not	
error_location_rotate		DDU9	error location rotation	
error_state		DDU9	signals global state of error manager	
error_type_rotate		DDU9	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 occurrences".

- Number of occurrences

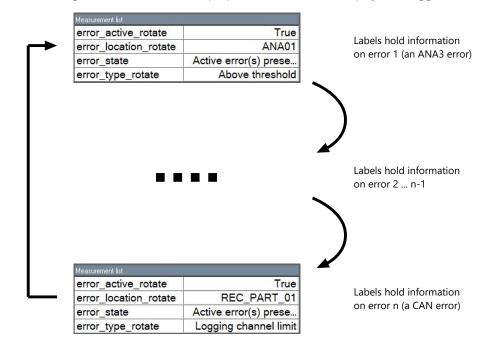
How many times has the error been detected since the last time the error memory was cleared.

- Error active state (device label "error_active_rotate")
 All failure modes are continuously diagnosed; any error detected will be written to the error memory. Once an error is detected, it is qualified as "active".
 - 1 (TRUE) Error was detected in most recent diagnose run (active)

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

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

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



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

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

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

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

👔 🤰 👕 standard 🔹 🗔 🔹		
A Channel Measurement		
Actual measurement rate	100 ms - time synchronous event channel	
Default measurement rate	100 ms - time synchronous event channel	
4 Channel properties		
Address	0x25040B95	
Annotations		
Description	signals global state of error manager	
Name	error_state	
Physical conversion	(Verbal)No error present[0]Passive error(s) present[1]Active error(s) present[2]	
Physical maximum	2	
Physical minimum	0	
Physical quantisation	none	
Physical unit		
Annotations		

14.3 Analog Input Diagnosis

14.3.1 Monitoring limits / Shortcut Detection / Cable Breakage

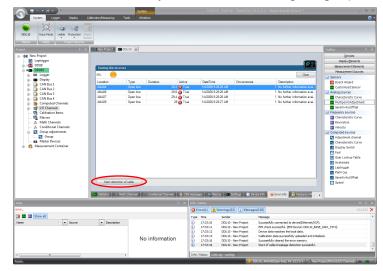
The pin diagnosis functionality (check whether measurement is within the desired range) can be activated in the ANA pin setup wizard; to allow for a diagnosis regarding shortcut to ground, shortcut to battery voltage and cable breakage, a minimum / maximum has to be defined.

Configure the analog pin properties. Pullup value: 3.01 kOhm Pin Dagnosis & monitoring limits Image: The Dagnosis & monitoring limits	Pin Properties	
Pin Dagnosis & montoring lints Pin Dagnosis & montoring lints Pin Dagnosis & montoring lints Maximum: 4000 m V Maximum: 400		og pin properties.
Enabled Minimum: 1000 + mV Maximum: 4000 + mV	Pullup value:	3,01 kOhm
Maximum: 4000 @ mV Acceleration of the second of the seco		Pin Diagnosis & monitoring limits
VAD 1Red p23 VAD 1Red p23 VA		
SV Page_Switch_ANA_1 Name: Page_Switch_ANA_1 Description: Page_Switch_ANA_1 Page_Switch_ANA_1 Description: To Description: Page_Switch_ANA_1.F To Description: To Page_Switch_ANA_1.F		Maximum: 4000 * mV
SV Page_Switch_ANA_1 Name: Page_Switch_ANA_1 Description: Page_Switch_ANA_1 Page_Switch_ANA_1 Description: To Description: Page_Switch_ANA_1.F To Description: To Page_Switch_ANA_1.F		
SV Page_Switch_ANA_1 Name: Page_Switch_ANA_1 Description: Page_Switch_ANA_1 Page_Switch_ANA_1 Description: To Description: Page_Switch_ANA_1.F To Description: To Page_Switch_ANA_1.F		
MOIRed p28 Page_Switch_ANA_1 Name: Page_Switch_ANA_1 Description: Pg&p Pgge_Switch_ANA_1 Description: Pgge_Switch_ANA_1 Regrege_Switch_ANA_1 Pgge_Switch_ANA_1 Regrege_Switch_ANA_1 Regrege		
MOIRed p28 Page_Switch_ANA_1 Name: Page_Switch_ANA_1 Description: Pg&p Pgge_Switch_ANA_1 Description: Pgge_Switch_ANA_1 Regrege_Switch_ANA_1 Pgge_Switch_ANA_1 Regrege_Switch_ANA_1 Regrege		
HAD1 Red p28 Page_Switch_ANA_1 Name: Page_Switch_ANA_1 Description: 900° Image: 900°		
HAD1 Red p28 Page_Switch_ANA_1 Name: Page_Switch_ANA_1 Description: Page_Switch_ANA_1 Description: Page_Switch_ANA_1 To Bage.Switch_ANA_1 Page_Switch_ANA_1 Description: Page_Switch_ANA_1 To Bage.Switch_ANA_1 Page_Switch_ANA_1 To Bage.Switch_ANA_1 Page_Switch_ANA_1 To Page_Switch_ANA_1 Page_Switch_ANA_1 To Page_Switch_ANA_1 Page_Switch_ANA_1 To Page_Switch_ANA_1 Page_Switch_ANA_1 To Page_Switch_ANA_1 Page_Switch_ANA_1		
ACI Red p20 ACI Red p20 Page_Switch_ANA_1 Name: Page_Switch_ANA_1 Description: Page_Switch_ANA_1 Description: Page_Switch_ANA_1 Page_Switc		
HAD1 Red p28 Page_Switch_ANA_1 Name: Page_Switch_ANA_1 Description: Page_Switch_ANA_1 Description: Page_Switch_ANA_1 To Bage.Switch_ANA_1 Page_Switch_ANA_1 Description: Page_Switch_ANA_1 To Bage.Switch_ANA_1 Page_Switch_ANA_1 To Bage.Switch_ANA_1 Page_Switch_ANA_1 To Page_Switch_ANA_1 Page_Switch_ANA_1 To Page_Switch_ANA_1 Page_Switch_ANA_1 To Page_Switch_ANA_1 Page_Switch_ANA_1 To Page_Switch_ANA_1 Page_Switch_ANA_1		
HAD1 Red p28 Page_Switch_ANA_1 Name: Page_Switch_ANA_1 Description: Page_Switch_ANA_1 Image: Output Page_Switch_ANA_1 Page_Switch_ANA_1 Description: Page_Switch_ANA_1 Image: Output Page_Switch_ANA_1 Image: Output Page_Switch_ANA_1 Image: Output Page_Switch_ANA_1 Image: Image: Output Image: Image: Image: Image: Image: I		
HAD1 Red p28 Page_Switch_ANA_1 Name: Page_Switch_ANA_1 Description: Page_Switch_ANA_1 Image: Output Page_Switch_ANA_1 Page_Switch_ANA_1 Description: Page_Switch_ANA_1 Image: Output Page_Switch_ANA_1 Image: Output Page_Switch_ANA_1 Image: Output Page_Switch_ANA_1 Image: Image: Output Image: Image: Image: Image: Image: I		
SV Name: Page_Switch_ANA_1 Description: 0 0 0 Image: Description: 0 0 0 0 Image: Description: 0 0 0 0 0 Image: Description: 0 0 0 0 0 0 Image: Description: 0		< Back Next > Finish Cancel
SV Name: Page_Switch_ANA_1 Description:		
Description: Psup		
Page_Switch_ANA_1	VA01 Red-p28	
Pag_Svitch_ANA_1 1683 		Name: Page_Switch_ANA_1
	sv	Name: Page_Switch_ANA_1
	sv	Name: Page_Switch_ANA_1 Description:
IDegroots Image: Sector ANA Image: Sector Ana Image: Sector Ana <	sv	Name: Page_Switch_ANA_1 Description:
n Dagnosis	sv	Name: Page_Switch_ANA_1 Description:
n Degnosis	sv	Name: Page_Switch_ANA_1 Description:
	sv	Name: Page_Switch_ANA_1 Description:
	sv	Name: Page_Switch_ANA_1 Description:
	SV Pulup	Name: Page_Switch_ANA_1 Description:
4000	5V Putup Putup	Name: Page_Switch_ANA_1 Description:
	5V Putup Putup	Name: Page_Switch_ANA_1 Description:

14.3.2 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".



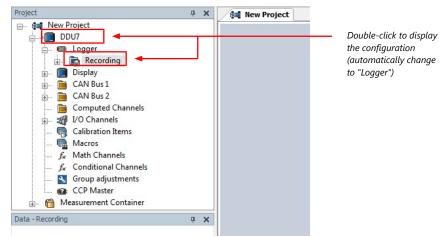
15 Recording

15.1 Features

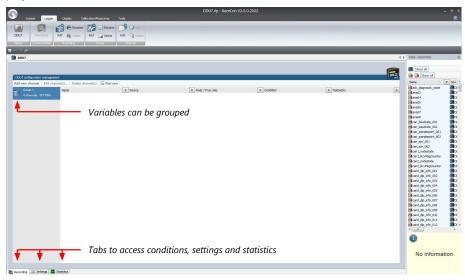
- Synchronized recording of C 70 analog and digital input channels, C 70 internal measurement channels, ECU data, Data from external sensor interfaces
- Up to two independent recordings
- Measurement rate 1 ms to 1 s
- Two global start conditions (thresholds)
- Up to 16 measurement conditions (fast-slow-switches)

15.2 Configuration of recordings

1. Expand the list of 'Loggers' by clicking on '+' in the C 70 Project Tree.



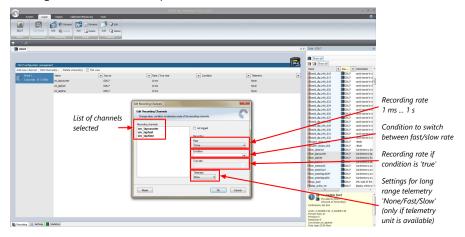
 Double-click on 'Recording' in C 70 Project Tree. The recording configuration is displayed in the Main Area.



- 3. To add measurement channels to a recording, click 'C 70' in the C 70 Project Tree. In the Data Area, the measurement channels are displayed.
- 4. Drag and drop desired measurement channels into recording group.

©			DOU7.rlp -	RaceCon V2.5.0.2002					- a x
System Logger Displ	ay Calbrator, Neasuring	Tooki							0 -
DOU7 Download Add Communication Reco	Rename Rename Delete Add Delete	Add B Delete							
🚍 🏟 = 🌧 = 🗉									
0007						4.1	Deta - DDU7		9
toti antyskin seneret Alf ner duardi i lat duardii. € standa i al alf ner duardii. e da	sconter obel pore	^π ^{αστ} ^{αστ ^{αστ} ^{αστ} ^{αστ} ^{αστ} ^{αστ} ^{αστ} ^{αστ ^{αστ} ^{αστ ^{αστ} ^{αστ ^{αστ} ^{αστ ^{αστ ^{αστ ^{αστ ^{αστ} ^{αστ ^{αστ ^{αστ ^{αστ ^{αστ ^{αστ} ^{αστ ^{αστ ^{αστ ^{αστ ^{αστ ^{αστ} ^{αστ ^{αστ ^{αστ ^{αστ ^{αστ ^{αστ ^{αστ ^{αστ ^{αστ ^{αστ ^{αστ ^{αστ ^{αστ ^{αστ ^{αστ ^{αστ ^{ασ}}}}}}}}}}}}}}}}}}}}}}}}}}}}}}}}}}}		Cardison	treestry trees tre	roperties	Image: State (State (Court C	Description and Stared in d and s
🖹 Recording 💷 Settings 🗖 Statistics							Cardmemory lap counter Quantisation: 1/nc Limite:0255 Pommet: 51.0 Precision:0 Resolution:0 Conversion:cm lapcounter		

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

C 70 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 [> 94]' for more information.

15.2.1 Adding a recording

C 70 supports up to two independent recordings.

To add a recording, select 'Add Recording' from the context menu of the Logger in the C 70 Project Tree.

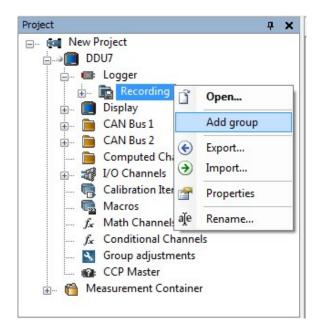
Project	 д	×
🖃 📲 New Project		
i i i i i i i i i i i i i i i i i i i		
Hand CAN Bu		
🕀 📄 CAN BU 📀 Export		
🛅 Compu 🏈 Import	- 1	
👼 Macros		
f. Math Channels		
f. Conditional Channels		
弦 Group adjustments		
CCP Master		
🗄 🖷 Measurement Container		

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

15.2.2 Adding a recording group

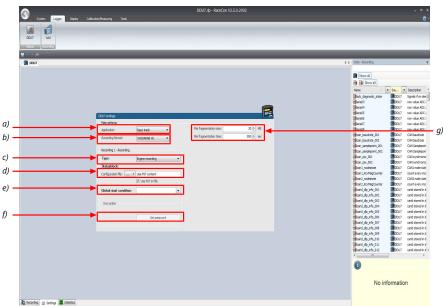
Recording channels can be grouped.

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.



15.2.3 Global settings

To display the global C 70 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.

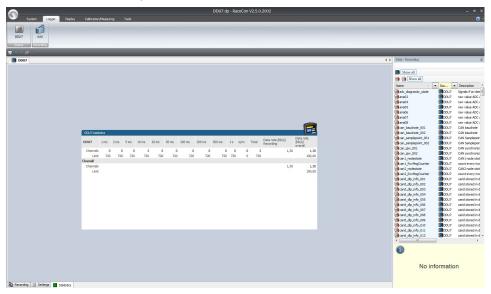
- f) If selecting WinDarab V7 in b), enter a password hint and a password (optional).
- g) Setting for automatic fragmentation. Do not change!

15.2.4 Recording statistics

The tab 'Statistics' shows the channels' allocation and their current data rate related to the transmission frequency of the C 70 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 C 70 and limits the overall transmission speed.



15.2.5 Recording diagnosis

The channel 'statectrl_ok' of the C 70 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	-

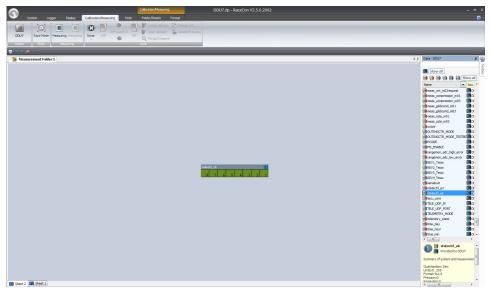
Content of status bits

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		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.

15.2.6 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.



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, C 70 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.

15.2.7 Further measurement labels

These additional measurement labels may help you diagnosing the state and operation of the data logging in more detail. There are a few more, but these are usually enough. Please refer to statectrl_ok, mentioned in more detail in chapter 'Recording diagnosis'.

Function
Size of the first logging data partition in MB.
Size of the second logging data partition in MB. Atten- tion, second logging can also be stored on first parti- tion, depending on chosen settings (Logger -> Set- tings).
This measurement allows to monitor for active FTP connections. RaceCon (WinDCP) and WinDarab may not connect in parallel.
State of the global logging start condition for first / second logging. TRUE means data is actively recorded.
Incoming measurement data rate (first / second log- ging) for further processing. Does not include com- pression. Active when meas_globcond_m0x is TRUE but may also be active while meas_globcond_m0x is FALSE, if a pretrigger time is configured. In that case data is transferred to the pretrigger buffer, but not necessarily written to storage medias.
Processed data blocks for first / second logging. This does not ensure writing the data to a storage media, e.g., if pretrigger is configured and meas_globcond is FALSE.
Processed data blocks per media (internal / USB).
Compression factor for first / second logging. For ex- ample, factor 2.0 means incoming data can be reduced to half the size, before data is written to storage me- dias.
Size of data buffered in pretrigger, e.g., while global logging condition is FALSE. Data will be forwarded to storage medias when logging condition becomes TRUE.
Size of data buffered (for first / second logging) for processing by different storage medias (intern / USB). It is possible, that e.g., internal storage has processed the data already, while USB is still busy writing the data blocks. Data is removed from the buffer as soon as all medias have processed it.
Effective data write rate to internal storage media, after compression, for first / second logging.
Effective data write rate to USB storage media, after compression, for first / second logging.

15.3 Event logging

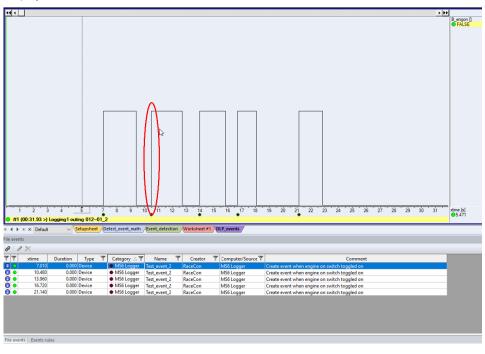
Event Logging implements the possibility to observe a channel if short spikes are expected. With Event Logging, every occurrence of a user defined threshold (more complex conditions are possible) leads to an event being raised. It is listed in a table along with its time stamp, its ID and even with a text string freely definable in RaceCon.

Events are stored as text in logging data and displayed in WinDarab like Darab-Events. Possible use cases are error entry, etc.

Configuration in RaceCon:

Project 🕂 🗴	💿 New Project 🛛 🖙 MS6 Lo	igger 🗙	
- Mew Project	MS6 Logger Events		
Hand MS6 Logger	🖉 Add Event 🚀 Edit I	Event 🐔 Delete Events	
😥 📾 Logger	Active Name	V Description	 Trigger Channel
CAN Bus 1 CAN Bus 2	TemperatureHig	gh Chip temperature is critical high	B_tempHigh
E- CAN Bus 2		Edit Event	×
Computed Channels			
- 👦 Events		Edit Event	
- 📮 Calibration Items		Fill out all required fields to edit the selected event.	
_		Name	
		TemperatureHigh	
Properties P ×		Description	
🔠 🖞 🛛 🍸 standard 🔹 💷 🗸 🧭		Chip temperature is critical high	
 Event properties 		Category	
Description Chip temperature is critical hig Name TemperatureHigh		Warning	~
Name Temperaturenign		Trigger Channel	-
		Ingger Charnier	✓
Name		Edge	
		Rising	~
	🔁 Statistics 🏾 🅼 Math Cha		
Data		200	▲ ms
Starts with			
F Show all			OK Cancel
Name A V Source	V Description		- Curicer

Display in WinDarab:



💁 = 💁 🈏					
Name		•	Creator	Computer/Source	Desc.
User defined events	۲	0			
▲ ♦ Chassis		0			
IDamperFL_on_bump	۲	0	KAM7FH	ABTZOKEI	
a Gearbox		0			
Shift_2-3	۲	0	KAM7FH	ABTZOKEI	
A + SYNC		0			
@ sync_issue			KAM7FH	ABTZ0KL1	
▲ MS6 Logger		5			
Test_event_2			RaceCon	MS6 Logger	

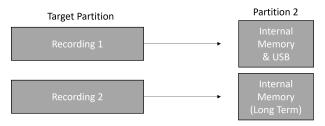
15.4 Data Logger and USB recording

Default settings: Target Partition Partition 1 & USB Recording 1 Internal Memory & USB

Data from **Recording 1** and **Recording 2** are stored both into the Internal Memory and additionally on the USB stick in copy.

To download the data from the Internal Memory of the logger, the Data Logger must be selected in WinDarab and the data will be downloaded in parallel.

Alternative setting:



Recording 1 is stored on the Internal Memory and additionally on the USB stick in copy. To download this data, the Data Logger must be selected in WinDarab.

Recording 2 is stored on only the Internal Memory. To download this data, the Long Term logger must be selected in WinDarab.

15.5 USB recording

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

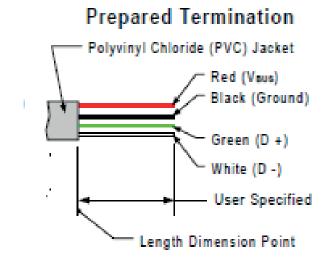
Software Upgrade USB_DATA enables USB recording. To activate Software Upgrade USB_DATA, enter the license key as described in the chapter 'Feature activation' [> 20].

For USB recording, Software Upgrade FULL_LOG_1 should also be enabled.

Wiring harness

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

For further information, see the pinlayout of the device.



Colors matching a standard USB cable

Storage device

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

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

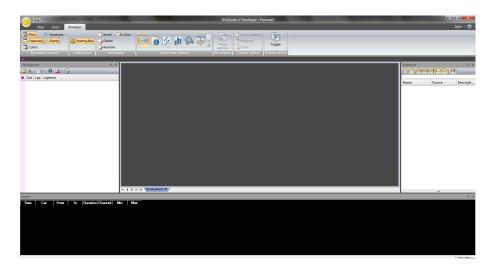
In RaceCon, select 'Tools' - 'Extras' and choose 'Format USB stick'.

Press 'Format'.

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

15.5.1 Recording data on USB device

- 1. Plug an USB device to C 70.
- 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 C 70.
- 5. Record measurement data. If an USB device is present, the C 70 stores the data in parallel on the internal memory and the USB device.
- 6. Power off the system.
- 7. Remove USB device from the vehicle.
- 8. Start the WinDarab software.



- 9. Click on the 'Import/Export' icon.
- 10. Select 'Data logger CXX/DDUX/MSX and click 'OK' when done. The 'Read measurement data' dialog opens.



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

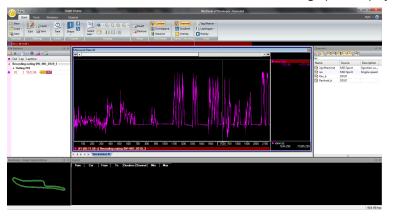
🢐 Data I	Logger Import					—		×
Settings	Current Import	Recent Import						
		ck		Common options				
Device	· .	C80 ∨ One file for each la	ap 🗸	~	☑ Import all c ☑ Delete trar □ Import late	nsferred f	files	
	Save files in:	D:\daten						
Subfo	older template:						∽ [a]+	
Filen	ame template:	C65-USB-[CardInf	o] outing [outing03]	-[lap03]-[n]			∨ [a]+	
Advan	ced Com	ment Fields			à	Арр	y 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 Import						
Data source: FTP 23.06.2015 12:11:11				Network DDU7 - 10.10	.0.207	18 ms
Name	Size (MB)					
FTP 23.06.2015 12:11:11	0.0		0.0	Connecting		
						Import
V Auto Scroll Show all files						Import
🏘 Data Logger Import						
Settings Current Import Recent Import						
Name	Size (MB)	Succe	55			

- 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



For more detailed descriptions and instructions, refer to the WinDarab V7 manual.

15.5.2 USB device handling hints

Using the USB device

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

If the USB device is plugged in after recording has started, only the current data is saved. Data recorded on the C 70 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!

15.5.3 Troubleshooting

When no data on the USB device is recorded:

Configure the measurement label **usb_mediastate** on a RaceCon measurement view or on a C 70 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!
4: Stop: Device unplugged	The USB device has been removed. The C 70 performs a restart when an USB device is re-plugged in.
5: Error: Media error	The communication to the USB device broke down. The USB device is defect. The USB device is not supported by C 70.
6: Error: Media corrupt	The USB device is not in valid BFS format. (Hint: Re-format the USB device in RaceCon.)

16 Lap Trigger

16.1 Lap trigger (timing beacon)

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

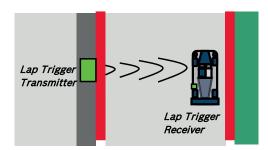
- Vehicle lap time measurement
- Calculation of lap-dependent functions (lap fuel consumption, min/max values)
- Calculation of lap distance dependent functions
- Control of data logging system

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)



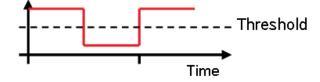
16.1.1 Electrical trigger signal

In C 70 all sources of measurement channels can be used as trigger signal.

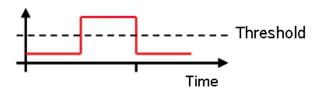
- Analog input
- Digital input
- CAN input

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)

16.1.2 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 [▶ 118]) 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.

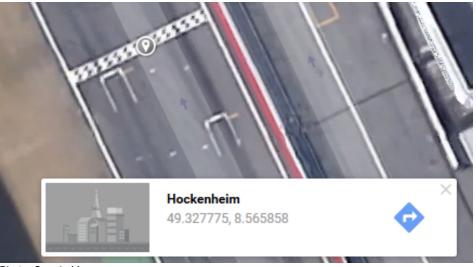
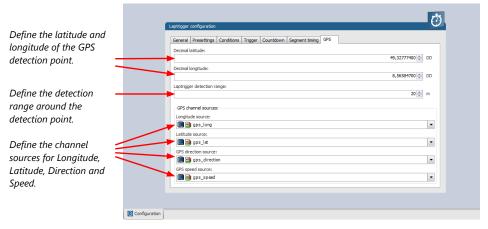


Photo: Google Maps

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.



Note

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.

16.1.3 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 Home Straight.
- Lap distance based retrigger protection prevents false triggers due to track topology.

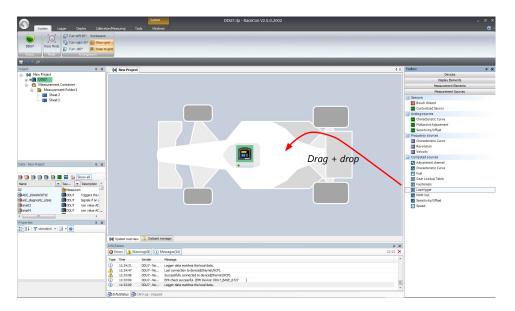
16.1.4 Forced triggers

Lap distance based insertion of 'forced trigger'.

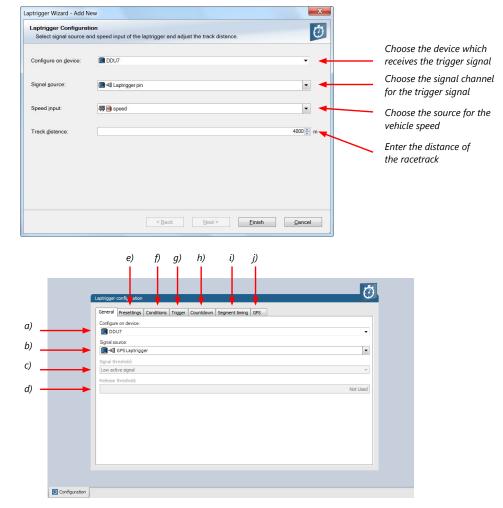
Under race conditions, trigger signals are sometimes missed. Software functionality introduces 'forced trigger'.

16.1.5 Setting up a lap trigger

- 1. Click 'Measurement Sources' in Toolbox.
- 2. Drag 'Laptrigger' into 'System Overview'. Do not drop it on 'C 70'!



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.

	Stalker Project 🐻 Laphrigger 💌
	Laptrigger configuration
Dragat values for lan sounter	
Preset values for lap counter	General Presettings Conditions Trigger Countdown Segment timing Lap counter start value:
and outing counter	1. taps
Minimum laptime that a new	Outing counter start value:
best laptime' is accepted	Lap time threshold:
	Lap time best preset:
Preset value for 'best laptime'	100,0 ± s
	Configuration
	Laptrigger configuration
hange signal for vehicle speed,	General Presettings Conditions Trigger Countdown Segment timing
desired.	Speed source:
	₩ The speed
iter minimum speed for	Mn. speed: 20 (b) km/h
igger release.	Track distance:
efine settings for distance	4000 🖄 m
	20 🙀 %
ased retrigger protection.	800 m
	Max. distance:
	120 👌 %
- fine and in the distance	
efine settings for distance	
ased forced trigger.	
	Configuration
	Laptrigger configuration
efine settinas for lan timina	
	General Presettings Conditions Trigger Countdown Segment timing Detection time:
	Detection time:
nain trigger).	Detection time: 13 mm retrieved to time:
nain trigger).	Detection time:
nain trigger).	Detection time:
nain trigger).	Detection time: Sector time:
nain trigger).	Detection time:
nain trigger).	Detection time: Stringer lock time: Use intermediate trigger Celection time: Stringer Stringer Stringer Stringer Stringer Stringer
Define settings for lap timing main trigger). Define settings for sub trigger.	Detection time: Stringer lock time: Use intermediate trigger Celection time: Stringer Stringer Stringer Stringer Stringer Stringer
nain trigger).	Detection time: Stringer lock time: Use intermediate trigger Celection time: Stringer Stringer Stringer Stringer Stringer Stringer
nain trigger).	Detection time: Stringer lock time: Use intermediate trigger Celection time: Stringer Stringer Stringer Stringer Stringer Stringer
nain trigger).	Detection time: Stringer lock time: Use intermediate trigger Celection time: Stringer Stringer Stringer Stringer Stringer Stringer

	Laptrigger configuration
Define settings for countdown	General Presettings Conditions Trigger Countdown Segment timing
	Mode: None
timer.	Start time:
	Sairt une: 120 😓 s
	Configuration
	Laptrigger configuration
	General Presettings Conditions Trigger Countdown Segment timing
Define settings for segment	Mode:
timing.	None 👻
tunuig.	Lap segment distance from main trigger:
	Nr. Segment distance (m)
	Configuration

Only applicable for a GPS Laptrigger

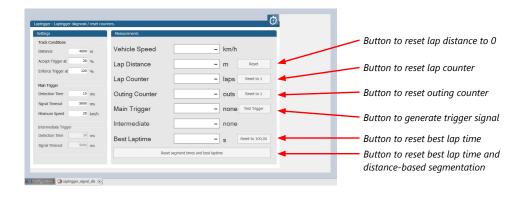
Define the latitude and longitude of the GPS detection point.	Laptrigger configuration Seneral Presettings Conditions Trigger Countidown Segment timing GPS Decimal latitude: 49,32777400 @ Decimal longitude:	
Define the detection – range around the detection point.	8,55584700 € Laptrigger detection range: 20 € GPS dnamel sources: Longitude sources:	
Define the channel sources for Longitude, Latitude, Direction and Speed.	Listué source: Grigor Specific Source: Grigo	
	Configuration	

16.1.6 Lap trigger channel diagnosis/counter reset

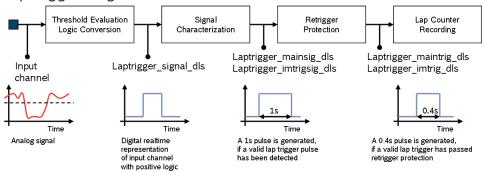
To display a quick lap trigger channel diagnosis and to reset counters use the diagnosis page in RaceCon. Any 'Laptrigger_xxx' channel can be displayed.

Double-click on any 'Laptrigger_xxx' channel in the Data Area. Example: 'laptrigger_lapdist_dls'

A diagnosis window opens in Main Area.

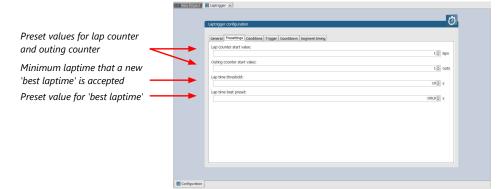


Lap trigger diagnosis scheme



16.1.7 Lap trigger presettings

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



16.2 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 [▶ 112])

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'.

16.3 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

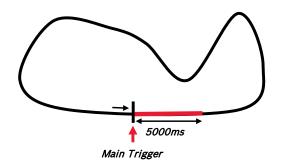
Channel	Function
Laptrigger_laptime_dls	Running laptime
Laptrigger_laptime_best_dls	Laptime of best lap
Laptrigger_laptimeold_dls	Laptime of last lap completed
Laptrigger_laptimeseg_dls	Segment time of last segment
Laptrigger_lapctr_dls	Number of completed laps

16.3.1 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.

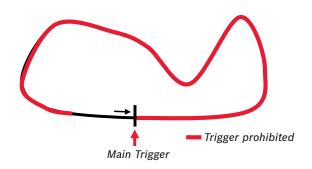
Define settings for lap timing	Laptroper configuration	
(main trigger).	Detection time: 150 ms	
Define settings for sub trigger.	Retriger lock time: 5000 (2) ms	
	Detection time:	
Not applicable with a GPS lap trigger.	30 ⁽²⁾ / ₃₂ ms	
	Retrigger lock time: 5000 (%) ms	
1	Configuration	



16.3.2 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 %.

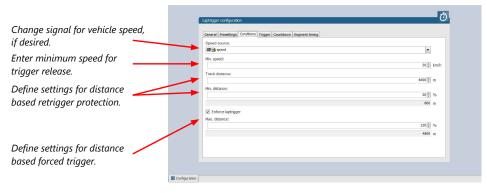
	25
	Laptrigger configuration 😶
Change signal for vehicle speed,	General Presettings Conditions Trigger Countdown Segment timing
if desired.	Speed source:
Enter minimum speed for	Min. speed:
	20 km/h
trigger release.	Track distance:
	4000 🖗 m
Define settings for distance	Mn. dstance:
	20 * %
based retrigger protection.	800 m
55 1	C Enforce laptrigger
	Max. distance:
	120 👘 %
	4800 m
Define settings for distance based forced trigger.	
	Comproton

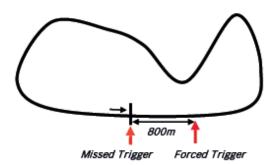


16.3.3 Distance based forced trigger

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.





16.4 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:

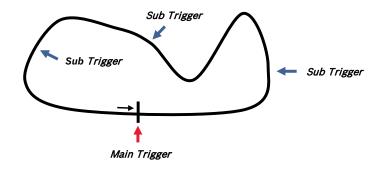
Channel	Function
Laptrigger_lapdiff	Time difference between finished lap and last lap
Laptrigger_lapdiffb	Time difference between finished lap and best lap
Laptrigger_lapseg_dlast	Difference of lap segment time compared to last lap
Laptrigger_lapseg_dbest	Difference of lap segment time compared to best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

16.4.1 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.

- Guna antikinan fan Inn tinsina	Laptrager configuration
efine settings for lap timing	General Presettings Conditions Trigger Countdown Segment timing Detection time:
	15 🖉 ms
	Retrigger lock time: S000 💮 ms
efine settings for sub trigger.	Use intermediate trigger
ot applicable with a GPS lap trigger.	Detection time: 30 (2) ms
	Retrigger lock time: 5000 🖓 ms
Config	guration



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

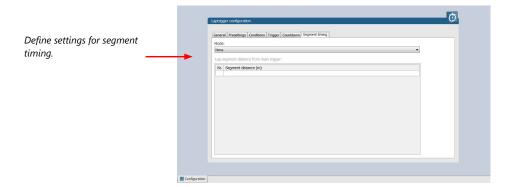
16.4.2 Distance mode

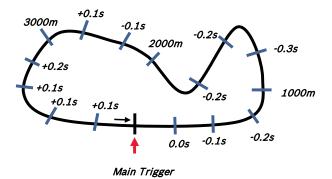
Using main trigger (20 ms pulse) at Start-Finish-Line.

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'.

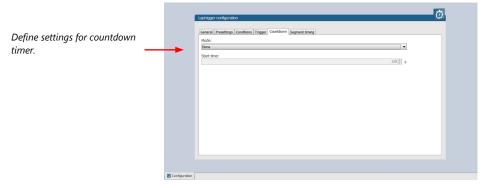




16.5 Countdown timer

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.



16.6 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.

	Presettings	Conditions	Trigger	Countdown	Segment timing	GPS	Known Racetracks			
Decir	nal latitude:									GPS Track detection
								49,32777400 🐥	DD	Override Track distance & position
Decir	nal longitude:									L
								8,56584700 🔹	DD	
Lapt	igger detectio	on range:								
								30 🜲	m	
										~
e	gps_lat									
	gps_lat									
Longiti	-									~
Longiti	ude source:									~
Longiti E e	ude source:									~ ~
Longiti GPS di	ude source: gps_long rection source									

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.

ptrigger configuration	Ø
Bultin Racetracks Active Track Ime Rock Park Magny cours Maano Monza Mingbo Speedpark	nown Racetracks User defined Racetracks Active Track Active Track Edit Track Edit Track Remove Track(s) Edit RaceTrack 'Nürburgring Nordschleife'
Y Nogaro Y Nurburgring Y Ochersleben Y Ochersleben Y Paul Ricard Paul-Ville Paul-Ville Y Portimao dircuit Y Portunao dircuit Y Redbullring Y Road America Y Rodombam	Specify Racetrack properties Specify Racetrack properties The GPS position indicates the position of the start-finish line. Sector 2007 Track Name: <u>Netwurying Nordschlefe</u> Get values from Laptrigger's GPS definition GPS Lattude: 50.33401400(\$) DD GPS Longtude: 6.94527800(\$) DD
Sepang Shanghai Shorestone Slovakiaring Snetterton 300 v	OK 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

16.7 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.

16.7.1 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 [▶ 103]. Under the ribbon "Segment timing" you need to choose your segmentation mode which can either be distance or intermediate trigger based.

	aptrigg	er configuration		Ö			
Intermediate Triager	General Presettings Conditions Trigger Countdown Segment timing GPS Mode: Distance Image: Countdown Segment timing GPS Image: Countdown Use predated laptime Countdown Countdown Countdown Lap segment lengths and times Countdown Countdown Countdown Countdown Countdown						
segment time and distance —	Nr. 1 2 3	Segment length (m) S00 1.000 3.500	Segment time (s) 44,800 93,200 135,600				
Enter your expected laptime	Entire	lap time:	164,500	s			

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.

Note

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

16.7.2 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.

17 GPS Sensor

17.1 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 C 70 (not covered here)

Serial output -> Read in messages via RS232 Interface of C 70

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, C 70 supports 1,200 to 115,200 baud. GPS Rx interface baud rate must match C 70 interface baud rate. C 70 Baud rate can be set with the 'GPS_BAUDRATE' characteristic Data format: C 70 expects 8 data bits, no parity bit, 1 stop bit (8N1)

17.1.1 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, C 70 supports 1,200 to 115,200 baud. GPS Rx interface baud rate must match C 70 interface baud rate. C 70 Baud rate can be set with the 'GPS_BAUDRATE' characteristic Data format: C 70 expects 8 data bits, no parity bit, 1 stop bit (8N1)

17.2 Protocol

C 70 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.

17.3 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.

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

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

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

Transfer Rate

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

💽 Configure - Ports		
ANT (Antenna Settings)	UBX - CFG (Config) - PRT (Ports)	3 \$
CFG (Configuration)		
DAT (Datum)	Terret	
DOSC (Disciplined Oscillator)	Target 1 · USART1	
EKF (EKF Settings)	Protocol in 0+1+2 · UBX+NMEA+R1 -	
ESFGWT (Gyro+Wheeltick)	Protocol out 0+1 - UBX+NMEA	
ESRC (External Source Config)		
FXN (Fix Now Mode)	Baudrate 115200 💌	
GNSS (GNSS Config)	Auto bauding	
INF (Inf Messages)		
ITFM (Jamming/Interference Monitor)		
LOGFILTER (Log Settings)		
MSG (Messages)		
NAV5 (Navigation 5)		E
NAVX5 (Navigation Expert 5)		
NMEA (NMEA Protocol)	Oversampling	
ODO (Odometer/Low-Speed COG filter)		
PM (Power Management)		
PM2 (Extended Power Management)		
PRT (Ports)	Extended TX timeout (>=FW7.00)	
PWR (Power)	TX-Ready Feature (>=FW7.00)	
RATE (Rates)		
RINV (Remote Inventory)	Inverse Polarity (low-active)	
RST (Reset)		
RXM (Receiver Manager)	Threshold 0	
SBAS (SBAS Settings)	PID 0 -	
SMGR (Sync Manager Config)		-
A X IIISend BPOIL R III		

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

ANT (Antenna Settings) CFG (Configuration)	1	UBX - CFG (Config) -	CFG (Configuration)	
DAT (Datum)	ш	<u></u>		
DOSC (Disciplined Oscillator)	ш	C Revert to last sav	-	Devices
EKF (EKF Settings)	ш	C Revert all but ANT default configuration C Revert to default configuration U - BBR 1 - FLASH 2 - ICCFEPBRIM		
ESFGWT (Gyro+Wheeltick)	ш			2 · I2C-EEPROM
ESRC (External Source Config)	ш	Save current cont	-	4 - SPI-FLASH
FXN (Fix Now Mode)	ш	O User defined oper	ation	
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)	=	2 - INF 3 - NAV	3 - NAV	2 - INF 3 - NAV
MSG (Messages)	ш	4 - RXM	4 - RXM	4 - BXM
NAV5 (Navigation 5)	ш	5 - Reserved 6 - Reserved	5 - Reserved 6 - Reserved	5 - Reserved 6 - Reserved
NAVX5 (Navigation Expert 5)	ш	7 - Reserved	7 - Reserved	7 - Reserved
NMEA (NMEA Protocol)	ш	8 - EKF	8 - EKF	8 - EKF
ODO (Odometer/Low-Speed COG filter)	ш	9 - Reserved 10 - ANT	9 - Reserved 10 - ANT	9 - Reserved 10 - ANT
PM (Power Management)	ш	11 - LIC	11 - LIC	11 - LIC
PM2 (Extended Power Management)	ш	12 - USER 0	12 - USER 0	12 - USER 0
PRT (Ports)	ш	13 - USER 1 14 - USER 2	13 - USER 1 14 - USER 2	13 - USER 1 14 - USER 2
PWR (Power)		15 - USER 3	15 - 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)	-			

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.

S Configure - GNSS Configuration		- • •
ANT (Antenna Settings)	UBX - CFG (Config) - GNSS (GNSS Config)	
CFG (Configuration)		
DAT (Datum)	Channels	
DOSC (Disciplined Oscillator)	GNSS ID configure GNSS name enable min max Signals	
EKF (EKF Settings)		,
ESFGWT (Gyro+Wheeltick)	0 🔽 GPS 🔽 8 16	
ESRC (External Source Config)	1 🔽 SBAS 🔽 1 3	
FXN (Fix Now Mode)	2 Galileo 🔽 🛛 🔿	
GNSS (GNSS Config)		
INF (Inf Messages)		
ITFM (Jamming/Interference Monitor)	4 🗌 IMES 🔲 🛛 🖓	
LOGFILTER (Log Settings)	5 🔽 OZSS 🗌 0 3	L1SAIF
MSG (Messages)	_ `	
NAV5 (Navigation 5)	6 GLONASS 8 14	
NAVX5 (Navigation Expert 5)		
NMEA (NMEA Protocol)	Number of channels available 32	
ODO (Odometer/Low-Speed COG filter)		
PM (Power Management)	Number of channels to use 32 Auto set	
PM2 (Extended Power Management) PRT (Ports)	For specific SBAS configuration use CFG-SBAS	
PWR (Power)		
RATE (Rates)		
RINV (Remote Inventory)		
RST (Reset)		
RXM (Receiver Manager)	For specific GLONASS configuration use CFG-GLO	
SBAS (SBAS Settings)		
SMGR (Sync Manager Config)		
TMODE (Time Mede)	•	E F
🔒 🔀 🟥 Send ' 양 Poll 🔆 🕅 🕮 💷		

Update Rate

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

🧕 Configure - Rates		• 💌
ANT (Antenna Settings)	UBX - CFG (Config) - RATE (Rates)	9 s
CFG (Configuration)		33
DAT (Datum)	Time Source	
DOSC (Disciplined Oscillator)	Time Source 1 - GPS time	
EKF (EKF Settings)	Measurement Period 55 [ms]	
ESFGWT (Gyro+Wheeltick)	Measurement Frequency 18.18 [Hz]	
ESRC (External Source Config)		
FXN (Fix Now Mode)	Navigation Rate 1 [cyc]	
GNSS (GNSS Config)	Navigation Frequency 18.18 [Hz]	
INF (Inf Messages)		
ITFM (Jamming/Interference Monitor)		
LOGFILTER (Log Settings)		
MSG (Messages)		
NAV5 (Navigation 5)		
NAVX5 (Navigation Expert 5)		
NMEA (NMEA Protocol)		
ODO (Odometer/Low-Speed COG filter)		
PM (Power Management)		
PM2 (Extended Power Management)		
PRT (Ports)		
PWR (Power)		
RATE (Rates)		
RINV (Remote Inventory)		
RST (Reset)		
RXM (Receiver Manager)		
SBAS (SBAS Settings)		
SMGR (Sync Manager Config)		
TMODE (Time Mede)		
🔒 🗙 🖹 Send 🧗 Poll 🦹 💼		

Note

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

17.4 Measurement labels

The decoded NMEA messages are copied to these C 70 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
gps_speed	Speed over the ground in kilometers/hour
gps_direction	Track angle in degrees

Measurement label	Function
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

17.5 GPS troubleshooting

Electrical

Is the transmitter signal of the GPS sensor connected to the receiver pin of serial interface of the C 70?

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 C 70 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

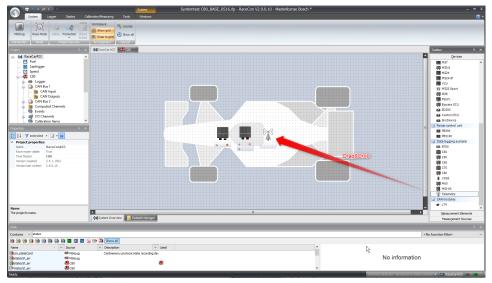
Does the sensor has lost its reception? The old values will be kept if the reception is lost. The gps_smask channel shows which NMEA sentence is received.

18 Telemetry System LTE 65

- Support for long-range online telemetry
- Individual programmable team code
- Fast block slow block mechanism
- Programmable data rate
- Ethernet or RS232 interface
- Full online track coverage on almost all tracks

18.1 Software setup

Drop Telemetry from Toolbox into system overview.



Adding channels to telemetry

- 1. Expand the list of 'Loggers' by clicking on '+' in the C 70 Project Tree.
- 2. Double-click on 'Recording' in C 70 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

C 70 telemetry has a bandwidth 200 kBit/s, the used bandwith can be adjusted to cope with the transmitting system. 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

Edit Recording Channels Edit Recording Channels Change the rate or condition of the reco	xiding channels. You may also change the telemetry mode.
Recording channels: f_wheel_rr f_wheel_rl f_wheel_fr	Bate:
f_wheel_fl	Condition:
	Tige rate:
	Telemetry Fast
<u>B</u> eset	Fast

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.



18.2 Telemetry channels with special functionality

The Telemetry system 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.: Laptrigger_lapdist_dls, fuelcons, lapctr, Laptrigger_lapdist_dls. Different channel names are possible between different devices (e.g. ECU MS6, laptrigger module used in RaceCon).

For displaying the position of the car in the cloud, additionally GPS-position and lapdist can be send to the cloud, this is activated with the checkbox "cloud statistics".

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

				((@))
Telemetry settings General Settings				AJA .
				_
WD Server INI Folde	r: Use RaceCon project folder			•
Project key:	04d2			hex
Configure on Device:	: 🚇 C80 Logger			~
Device Settings			Channel settings	
Type:		- N	Distance channel:	
LTE65	~	· 13	🛄 🔁 Laptrigger_lapdist_dls	\sim
Mode:			Lap number channel:	
Ethernet	~		📮 🔤 lapctr	~
Destination IP: 1	0.10.0.235	1	Lap fuel channel:	
			The full full cons_dis	~
Destination Port: 1	0000		Previous lap time channel:	
Data Rate:	20 束	kBit/s	Laptrigger_laptimeold_dls	~
Cloud statistics er	nabled			
By enabling Clou	ud statistics, I understand device distance or	GPS	GPS Latitude channel:	
channel data wil	ll be decoded and available to Bosch in the Bo	osch	桿 👜 gps_lat	~
			GPS Longitude channel:	
To enable the Bo channels must b	osch LTE cloud, at least the Distance or both e configured.	GPS	🕌 🔤 gps_long	\sim

- 1. Assign the desired channels to the channel types. The table below shows the function of the available channel types.
- 2. 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.

	Delete channel(s)		
✓ Source	Vidth [Byte]	✓ Telemetry mode	✓ Channel type
DDU8	2	Slow	
MS5.1	2	Fast	Lap distance
MS5.1	2	Fast	Lap fuel
DDU8	1	Fast	Lap number
MS5.1	2	Fast	Lap time
FM40	4	Fast	Time
	DDU8 MS5.1 MS5.1 DDU8 MS5.1	DDU8 2 MS5.1 2 MS5.1 2 DDU8 1 MS5.1 2	DDU8 2 Slow MS5.1 2 Fast MS5.1 2 Fast DDU8 1 Fast MS5.1 2 Fast

18.3 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		×				
Car settings UDP:10000 New: COM						
Car name	Data output to back	up system				
Name: Car #1	Port:	-				
Comment:	Baudrate:	9600 👻				
Folder with the DCP-Configuration files -	ngs/Telemetry) No of lines per pa	age: 64				
OK Cancel Apply Help						

- 3. 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 Telemetry and select 'Properties'. You can change this folder location for easier access if desired.
- 4. 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	hange
Template for the darab file name	
[year]-[mon]-[day] [hour].[min] Car [camame] File #[n]	
Folder to save the darab files in	
	hange
OK Cancel Apply	Help

- 5. 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	×
Car settings UDP:10000 New: COM	
Settings	
Port: UDP -	
Udp Port: 10000	
OK Cancel Apply H	lelp

7. Click 'OK', to close the window.

- 8. Select the button 'WDServer Settings'.
- 9. 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	×
Common	Network adapters Telemetry
	er for temporary files sers \kfl2abt \Documents \WD_Server Change
	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 WD-Server.

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

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

- To ensure 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 ensure that WDServer 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.

18.4 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:

w . Computer + We	ntews7,051C) + Boach + Wirdlands + Config	y + W05enet			• 4	H Server WEIGhner		
loganics + New fulder							11	4
WinDarah v?	None MISD TrackLaptor - Cor Will broads	Data modeled 15/09/20140-02	Type WinDurak Talamatry	Sex	1.48			
Core file locations Core file locations Country Count								
A Computer								
Fisname					-	All supported from (1)	india 1	
Show Inform Right +					Add folder to locations	Open I	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.

19 Firmware

19.1 Firmware and configuration

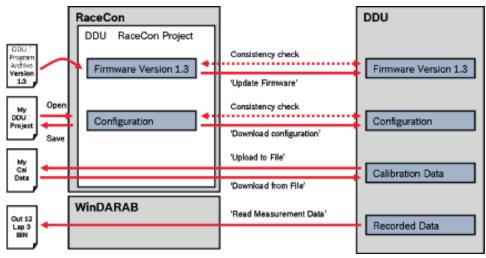
C 70 holds 4 types of data:

Firmware: the software (PST program file) of the C 70.

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

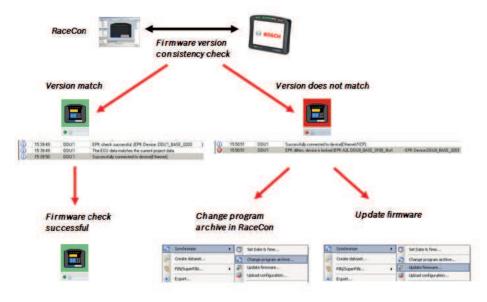
Calibration data: Characteristic curves and offsets created by online calibration at the vehicle.

Recorded data: Measurement data recorded during vehicle operation.



19.2 Firmware update

The scheme shows the process during each connection between RaceCon and C 70.



19.2.1 Performing the firmware update

Firmware update is only possible if the C 70 is connected to RaceCon. The configuration of Input channels, CAN I/O, display, recording + telemetry will not be changed.

1. In the C 70 Project Tree, right-click on 'C 70' and choose 'Synchronize' then 'Update firmware'. A pop-up menu opens.

ject		lew F	Project 🔲 DDU7
	New Project		
ľ	Open	1	
01	Create measuring views		
	Download configuration		
()	Synchronize	Ø	Set Date & Time
	Current measuring media	聯	with ECU
P	Create dataset		Change program archive
-	PIN/SuperPIN		Update firmware
	Export Import	×	Upload configuration Clear logged data
	Properties	Ŕ	Clone ECU .
×	Delete		Adjustment data
aĵe	Rename	**	Save

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		01
Perform a firmware update of a device.		UPD
ECU Type: DDU7		
Select program archive (PST) file:		
Keep current settings		
	Ok	

3. Click 'OK' when done. The firmware update starts. The C 70 displays the message 'Updating firmware'. Do not switch off the car's ignition or interrupt the power supply of the C 70!

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

When the firmware update is complete, the C 70 displays the message 'Updating firmware finished. Do a powercycle.' Switch the car's ignition off and on again to cycle the power of the C 70.



20 Cloning the Unit

To replace a C 70 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. Select "Extract" from the dropdown menu.

S	DDU10.rlp - RaceCon V2.3.5307.11	- • ×
System Logger Display Calibration/M	ksauro (Toole)	0 •
Update Update Create Office Office		Contex 0 × Zevices Displays
		COUP COUP
Rame () · · No atfa atfa atfa c · · · · nn bootep c · · · · · nn despect		PSU-P1 Byposs ECU Custom ECU Power control unit By Plax30 * Display [Jerrents
n 645ym	im Deenview 10 Detaile monoger	Measurement Elements Measurement Sources
Iréo / Status		• ×
Errors A Warnings 1 Messages		0/0 ×
T Time Sender Message		
Info / Status CAN Log - Stopped SYS Log - Stopped		

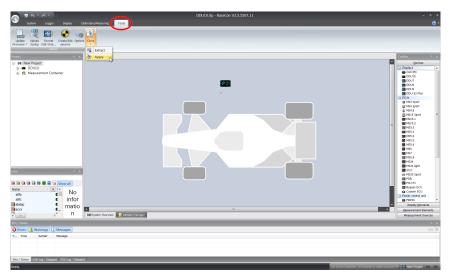
- 2. Choose the hardware device, which should be cloned.
- 3. Define destination and filename.

Jone 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	
This is the stand-alone clone extract ECU tool for MS5. protocol.	x devices using the FTP/Telnet

4. Click 'OK' to start procedure.

Applying a clone file to a device

1. Click 'Clone apply' in Extras menu.



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

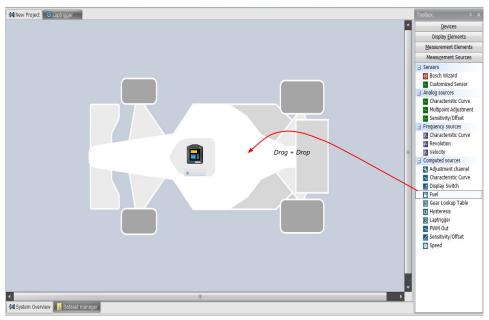
Please remember that following properties are not stored into the clone:

- Lifetime of device
- Serial number
- Upgrade features

21 Fuel Consumption Calculation

21.1 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 C 70!



A 'fuel consumption wizard' opens.

Select a fuel consumption sour	ce channel for computing the fuel consumption.	1
General		
Configure on device		
Tank capacity	80.0 😓 🛛	
Fuel consumption calculation		
Mode	Using fuel consumed	
Fuel input	Fuelcons X 0,001 Adaption factor to [m	ul 🗕 🚽
Consumption correction factor	1,000	
Remaining laps calculation Mode	Last lap's consumption	
Remaining laps calculation		
Remaining laps calculation Mode	Last lap's consumption	
Remaining laps calculation Mode Target lap consumption	Last lap's consumption	
Remaining laps calculation Mode Target lap consumption Reset fuel consumption	Lastlap's consumption 3.0 ^(k) / _√	
Remaining laps calculation Mode Target lap consumption Reset fuel consumption Mode	Last lap's consumption	
Remaining laps calculation Mode Target lap consumption Reset fuel consumption Mode Reset signal source	Last lap's consumption	

- 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.

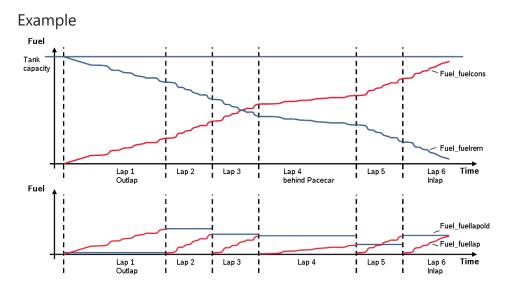
21.2 Fuel consumption diagnosis/counter reset

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 That capacity Fund capacity Consumption correction factor Loo Taget to consumption Taget to consumption Reset fact consumption Reset fact consumption	Hearements Total consumption Fuel consumption I 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

22 RaceCon Shortcuts

The table shows important shortcuts simplify controlling the C 70 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, measuremen	it page
Cursor	Move selected display element one grid unit in chosen dir- ection
SHIFT + cursor	Enlarge/reduce selected display element one grid unit
Tab	Switch between display elements

23 Legal

23.1 Legal Restrictions of Sale

The sale of this product in Mexico is prohibited.

Due to embargo restrictions, sale of this product in Russia, Belarus, Iran, Syria, and North Korea is prohibited.

23.2 REACH Statement

According to the REACH regulations, any supplier of an article containing a substance of very high concern (SVHC) in a concentration above 0.1 % (w/w) has the duty to provide the recipient of the article with sufficient information to allow safe use of the article. Our product contains:

SVHC Substance	CAS Number
Lead monoxide (lead oxide)	1317-36-8
Lead	7439-92-1

23.3 Open Source Software (OSS) declaration

23.3.1 antlr-2.7.7.jar License

ANTLR-2.7.7

SOFTWARE RIGHTS

ANTLR 1989-2006 Developed by Terence Parr

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The primary ANTLR guy:

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23.3.2 antlr311runtime.jar License

ANTLR-3.1.1

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