



# Engine Control Unit MS 6 EVO

Manual

Version 2.4 29/04/2025

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# 1 Getting Started

### Disclaimer

Due to continuous enhancements we reserve the rights to change illustrations, photos or technical data within this manual. Please retain this manual for your records.

### Before starting

Before starting your engine for the first time, install the complete software. Bosch Motorsport software is developed for Windows operation systems. Read the manual carefully and follow the application hints step by step. Don't hesitate to contact us. Contact data can be found on the backside of this document.



### 

### Risk of injury if using the MS 6 EVO inappropriately.

Use the MS 6 EVO only as intended in this manual. Any maintenance or repair must be performed by authorized and qualified personnel approved by Bosch Motorsport.



### 

# **Risk of injury if using the MS 6 EVO with uncertified combinations and accessories**

Operation of the MS 6 EVO 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 is only permitted when they have been determined to be compliant from a performance and safety standpoint by a representative from Bosch Motorsport.



### NOTICE

### For professionals only

The Bosch Motorsport MS 6 EVO was developed for use by professionals and requires in depth knowledge of automobile technology and experience in motorsport. Using the system does not come without its risks.

It is the duty of the customer to use the system for motor racing purposes only and not on public roads. We accept no responsibility for the reliability of the system on public roads. If the system is used on public roads, we shall not be held responsible or liable for damages.

# 2 Technical Data

The MS 6 EVO engine control unit features a powerful digital processing dual-core with floating point arithmetic and a high-end field programmable gate array FPGA for ultimate performance and flexibility.

The software development process is based on MATLAB® & Simulink®. It significantly speeds algorithm development by using automatic code and documentation generation.

Custom functions can be generated quickly and easily. The flexible hardware design allows the MS 6 EVO to support complex or unusual engine or chassis configurations. Integrated logger control areas present a cost efficient and weight optimized all-in-one solution.

# 2.1 System Layout



### Layout restrictions

CAN Network	Extended number of members and wiring leads extend the risk of error frames
RS232	Limited to one additional component
USB	Limited to additional Bosch Motorsport USB stick
LIN	Permitted for the use of Bosch Motorsport preconfigured configur- ations
SENT	Use with preconfigured configurations that are available from Bosch Motorsport on request

# 2.2 Mechanical Data

Aluminum housing			
2 automotive connectors, 196 pins in total			
ibration suppression via multipoint fixed circuit boards			
Size without connectors	226 x 181 x 44 mm		
Weight	1,086 g		

Protection Classification	IP54	
Temperature range	-20 to 80°C (0 to 80°C for P-Versions)	

Inspection services recommended after 220 h or 2 years, no components to replace

# 2.3 Electrical Data

Power supply	6 to 18 V
CPU	Dual Core 667 MHz; FPGA (866 MHz for P-Versions)

### 2.3.1 Inputs

The analogue inputs are divided in different hardware classes and qualities.

3.01 kOhm pull-ups are fixed or switchable designed to assist passive sensor elements like NTC temperature sensors or to change to active signal inputs.

Some of the inputs assist only active sensors and offer no pull-up.

To improve measurement tasks, angle related measurements are an option for some inputs, mainly used for engine related leading signals.

The connection between function and related input is free selectable, beside electronic throttle functionalities.

All linearization mappings are open to the customer, some signals offer online modes to calibrate gain and offset.

Digital inputs for speed measuring offer divers hardware options to connect inductive- or digital speed sensors.

Please respect: for camshaft- or wheel speed signals Hall-effect or DF11 sensors have to be used and for wide range Lambda measurement and control the Lambda sensor Bosch LSU 4.9 has to be used.

Standard number of Inputs; for additional channels see Structure of Devices and Licenses [> 8]

#### 38 analog inputs (CUP: 26; 6.1, 6.3: 21)

6 x reserved for electronic throttle controls (Cup: 4)

10 x no integrated pull-up (Cup: 5; 6.1, 6.3: 3)

4 x option for angle synchronous measurement, no integrated pull-up (Cup, 6.1, 6.3: 3)

5 x fixed 3.01 kOhm pull-up (Cup, 6.1, 6.3: 4)

13 x switchable 3.01 kOhm pull-up (Cup: 10; 6.1, 6.3: 5)

#### 8 analog/digital inputs (shared) (CUP, 6.1, 6.3: 0)

8 x option for angle synchronous measurement / digital (e.g. SENT)

#### 10 digital inputs (CUP, 6.1, 6.3: 18)

1 x switchable Hall or inductive sensor for flywheel measurement

2 x Hall sensor for sync wheel detection

- 4 x switchable Hall or DF11 sensors for camshaft position or wheel speed
- 2 x switchable Hall or inductive sensors for turbo speed measurement

#### 10 digital inputs (CUP, 6.1, 6.3: 18)

1 x digital switch for engine ON/OFF

8 x digital inputs, e.g. SENT (Only CUP, 6.1, 6.3)

#### 6 internal measurements

1 x ambient pressure

1 x acceleration 6-axis

2 x ECU temperature

2 x ECU voltage

#### 9 function related inputs (CUP: 3; 6.1, 6.3: 8)

2 x thermocouple exhaust gas temperature sensors (K-type) (CUP, 6.1, 6.3: 1)

2 x Lambda interfaces for LSU 4.9 sensor types (CUP: 1)

1 x lap trigger/beacon input (CUP: 0)

4 x knock sensors (CUP: 1)

### 2.3.2 Sensor supplies and screens

- 4 x sensor supplies 5 V / 50 mA
- 3 x sensor supplies 5 V / 150 mA
- 7 x sensor grounds
- 2 x sensor screens

### 2.3.3 Outputs

#### 38 function related outputs (CUP: 15; 6.1, 6.2: 28)

High Pressure Injection (not 6.1, 6.2)

- 8 x high pressure injection power stages for magnetic valves, e.g. HDEV 5 (CUP: 4)
- 2 x outputs for high pressure pump with MSV controls (6.3: on request; CUP: 1)

Low Pressure Injection

 12 x low pressure injection power stages for high impedance valves (max. 2.2 amps and min. 6 Ohm internal resistance of the injectors) (CUP: 4)

Ignition

- 12 x ignition controls, support of coils with integrated amplifier only (CUP: 4)

2 x 8.5 amp H-bridge for electronic throttle control (CUP: 1)

2 x 4 amp pwm lowside switch for Lambda heater (CUP: 1)

### 19 freely configurable outputs (CUP: 13)

1 x 8.5 amp H-bridge (CUP: 2)

2 x 4 amp pwm lowside switch (CUP: 1)

- 4 x 3 amp pwm lowside switch (CUP: 2)
- 8 x 2.2 amp pwm lowside switch (CUP: 5)

#### 19 freely configurable outputs (CUP: 13)

4 x 1 amp pwm lowside switch (CUP: 3)

#### 3 output signals

1 x engine rpm

1 x flywheel

1 x trigger wheel

### 2.4 Communication

3 x CAN	The MS 6 EVO has 3 CAN buses configurable as input and output. Different baud rates are selectable. Please note that the MS 6 EVO contain integrated switchable 120 Ohm CAN termination resistors.			
1 x LIN	The Bus is not configurable by the customer, but Bosch Motorspo offers data selectable protocols to integrate LIN based devices int the system.			
8 x SENT	The MS 6 EVO has 8 SENT interfaces for using SAEJ2716.			
2 x Ethernet	Integrated are 100 Mbit full duplex Ethernet communication ports, internally connected with an Ethernet switch. The ports have "cable auto crossover" functionality			
1 x USB	For data transfer to an USB-stick			
1 x RS232	One serial port with programmable baud rate for online telemetry			
1 x Timesync Co- ordination	For additional devices added via Ethernet			

# 2.5 Structure of Devices and Licenses

To accommodate the wide range of different engine requirements and racetrack operating conditions, the MS 6 EVO Motronic system is classified into the main groups high- and low pressure injection support, subdivided into fully equipped and functional reduced versions.

Beside the change from low- to high-pressure systems, all limited functions may be activated later. The license concept is related to the individual device and the requested upgrading.

For MS 6.1 EVO	
Engine function package I	To activate electronic throttle, camshaft, and turbo control
Engine function package II	To activate traction and launch control

For MS 6.1 EVO and MS 6.3 EVO	
Measurement package	17 Additional analog inputs

For MS 6.1 EVO and MS 6.3 EVO	
	7 x no integrated pull-up 1 x option for angle synchronous measurement, no integrated pull-up 1 x fixed 3.01 kOhm pull-up 8 x switchable 3.01 kOhm pull-up
	<b>Extension</b> of the use of 8 digital channels as ana-logue / digital inputs (shared)
	1 x Additional Thermocouple K-type

### For MS 6.3 EVO

High pressure injection package

Enables the control of a 2<sup>nd</sup> high pressure pump

#### For MS 6.4P EVO

PERF\_LOG\_1 (requires FULL\_LOG\_1) Increase logging Partition 1 from 4 GB to 16 GB memory

Specific project SW for MS 6.4P EVO, based on MS 6.4 EVO SW, offered as engineering service

For	all	MS	6	<b>EVO</b>	Versions
101	an	1413	U	LVU	VEISIONS

Hardware Upgrade for CCA per device	Provides the option to run customer developed soft- ware code on Bosch ECU			
FULL_LOG_1	Extension for Recording 1			
	• 1,500 channels			
	fastest sampling 1,000 Hz or 1 syncro			
FULL_LOG_2	Activation of Recording 2			
	• 1,500 channels			
	• 4 GB memory (enabled at MS 6 EVO CUP)			
	• fastest sampling 1,000 Hz or 1 syncro			
DATA_USB	Data copy to USB flash drive			
Gear control package I	Gear control MEGA-Line functionality, must be used with MEGA-Line components (License model via MEGA-Line)			
Link to Mega Line Support Request				
Link to Mega-Line License Request Form				
Gear control package II	Gear control Bosch Motorsport functionality			
SW Package MS 6 Drag 1	Launch Timer			
(not for CUP)	Launch Distance			
	Launch RPM Control			
	Universal Outputs for Time/Distance Controls			

For all MS 6 EVO Versions	
SW Package MS 6 Drag 2 (requires Drag 1 License) (not for CUP)	Acceleration Sensor MM5.10 included Time/Distance Boost Control Driveshaft Speed Control Driveshaft Gradient Control Acceleration Control Wheelie Control
Innovation License Device	Activation of a set of additional functions for a single device:
	<ul> <li>Crank rotation direction detection (using sensor DG23i)</li> </ul>
	<ul> <li>Using a 2nd crank backup sensor</li> </ul>
	<ul> <li>Crank-Pre-set, quick start based on previous crank stop position</li> </ul>
	<ul> <li>Far-Bank, 2nd injector per cylinder possible</li> </ul>
	<ul> <li>Cam-only-synchronisation, engine run without crank sensor signal (specific cam trigger wheel needed)</li> </ul>
Innovation Package Project	Innovation Package Project has the same content as Innovation License Device, but license is valid for the whole project instead of a single device.



### NOTICE

Verify the necessity of gearbox control licenses by checking the Features info window in RaceCon (see section Feature/License Activation [▶ 20]).

# 2.6 Installation

Mounting	Fastening with $\textbf{Velcro}^{\circ}$ / $\textbf{3M}$ $\textbf{Dual Lock}^{\circ}$ or rubber band
Offer drawing	Available at Bosch Motorsport website on MS 6 EVO product page.
3D Data	Available at Bosch Motorsport website on MS 6 EVO product page.

### Recommendation

Use rubber vibration absorbers for soft mounting in the vehicle. To assist the heat flow, especially if HP injection is active, the device must be mounted uncovered and air circulation must be guaranteed around the entire surface area.

Inside touring cars placement passenger side is favoured, open connectors should not be uncovered to vertical axe. It must be assured in mounting position that water cannot infiltrate through wiring harness into the ECU and that the pressure compensating element and the sealing in the revolving groove do not get submerged in water. Wiring harness needs to be fixed mechanically around the ECU in a way that excitation of ECU has the same sequence.

## 2.7 Supply System

Please ensure that you have a good ground installation with a solid, low resistance connection to the battery minus terminal. The connection should be free from dirt, grease, paint, anodizing, etc.

- MS 6 EVO power consumption at appr. 13 V (vary according to use cases)
  - ~ 25 30 amps (4 cyl. FDI at 8,500 1/min/200 bar single injection, 1 MSV, 1 electronic throttle, standard chassis equipment)
  - ~ 35 40 amps (8 cyl. FDI at 8,500 1/min/200 bar single injection, 2 MSV, 2 electronic throttle, standard chassis equipment)
- Power consumption of LP-injectors, actuators and coils are to calculate separately.
- The MS 6 EVO power supply is separated into the maintenance of controller and power stages.
- Ensure controller supply UBAT is activated before the power stages.
- The MS 6 EVO is able to control a main relay or even the power box itself via a low side output.
- As long as the controller is activated, data logging, telemetry and communication is also ongoing.
- The engine On/Off switch activates the ignition and injection outputs to enable engine start separately from power supply.

### 2.8 Harness

#### Harness connectors

Bosch automotive connectors are not available as complete set of components, so Bosch Motorsport itself offers such a package. For more technical details please check Boschconnector homepage, 196 pins

http://www.bosch-connectors.com/bogscoca/category/142

MS 6 harness connector type A (105 con- tacts), coding variant 1	F02U.B00.712-01
MS 6 harness connector type K ( 91 con- tacts), coding variant 1	F02U.B00.711-01
Protection Classification	IP X6K, X8, X9K
Temperature range	-40 to 120°C
Shakeproofed	Max. 3.4 g
Wiring diameter	0.35 to 2.5 mm <sup>2</sup>
Pinsize	1.2 mm; 2.8 mm

### Dummy Plug

Dummy plug 1928.405.459 for unused con- nections	Matrix 1.2 / CB / 0.75 to 1.0 mm <sup>2</sup>
Dummy plug 1928.405.460 for unused con- nections	Matrix 1.2 / CB / 1.0 - 1.5 mm <sup>2</sup>
Dummy plug 1928.301.207	BTL 2.8

### Tools and Contacts

ТооІ	Matrix	Contact	Wire size
1928.498.212	Matrix 1.2	Clean Body 1928.498.991	0.35 to 0.5 mm <sup>2</sup>
1928.498.213	Matrix 1.2	Clean Body 1928.498.992	0.75 to 1.0 mm <sup>2</sup>
1928.498.837	1928.498.840	BTL 2.8 1928.498.651	1.5 to 2.5 mm <sup>2</sup>

### Wiring

Bosch Motorsport recommends using the specified cable material and harness layout for automotive connectors and wiring applications.

For Ethernet and USB connection CAT5 specified material is recommended and the pairs and shield connections have to be strictly respected as shown in the wiring diagram.

For USB, the maximum wiring length is limited to 3 m and it is not allowed to be included into a common harness and also there is no interruption allowed.

Due to installation condition, the length may have to be reduced.

Keep network wiring in distance to main sources of electrical noise like coils, coil- and HPinjector wirings and also in distance to any telemetry transmitter.

CAN-networks need a 120 Ohm termination at 2 ends of the wiring.

The MS 6 EVO is able to switch on an internal 120 Ohm termination, set CWCANx\_TERM true to enable the termination.

For wiring layout, respect the common rules of failure reduction like separated sensor power supply between important system sensors (e.g. camshaft detection) and measure options (e.g. damper position).

Be ensure HP-injectors, electronic throttles and other high frequently switched actuators are connected within the wiring limits of 2.5 m and all wires are manufactured as twisted pairs.

If using a preinstalled production harness, first verify the way of sensor- and actuator controls.

Often production parts have to be connected to 12 V power supply and actuators are controlled in different ways. The production harness may need to be modified.

### Office harness

Reduced layout to realize communication between PC, MS 6 EVO device and Display DDU, recommended for flash configuration, display configuration and installation tasks. Bosch Motorsport part number: F02U.V01.809

# 2.9 Ignition Trigger Wheel

To detect the engine position and to calculate the exact crankcase position, the system assumes toothed trigger wheels for proper operation. Recommended is to use 60 (-2) teeth for the flywheel and one teeth for the camshaft detection. Modifications of the mechanical designs are possible, such as using quick-start production designs for the camshaft or different number of teeth for the flywheel **(limited to 30 to 60 teeth)**.



### NOTICE

### Less number of teeth reduces the accuracy of the system angle measurement.

Not usable are flywheels with 4-1 or 6-1 teeth. Please follow the description below as recommendation for the mechanical dimensions.

#### Recommended values:

- D = min. 160 mm
- h1 = 3.5 mm
- h2 = h1/2 (important for the use of inductive sensor)
- LSKW = 0.8 mm +/- 0.3 mm
- t = min. 5 mm
- LNSW = 1.0 mm +/- 0.5 mm





(\*)° before TDC compression for cyl. #1 , the tooth on the cam trigger must overlap the reference mark of the crank trigger (= 2nd falling edge).

 $({}^{*})^{\rm o}$  before TDC exhaust for cyl. #1 , the tooth at the cam trigger mustNOT overlap the reference mark of the crank trigger.



### NOTICE

### All angles are shown and indicated in crankshaft degrees.

The width of the cam trigger tooth is not important, however it is recommended to use at least 48 crankshaft degrees (24 cam degrees).

The Hall effect signal may be the inversion of its cam trigger: the tooth effects a "low" signal at the sensor and vice versa for other trigger wheel configurations the indicated values may vary.

# 3 Starting up



### NOTICE

All following chapters (Starting up to Harness / Wiring) refer to the MS 6 base family. Some screenshots were taken from the MS 6 family.

### 3.1 Installation of Software Tools

PC tools and for the MS 6 EVO system are available at Bosch Motorsport homepage for free download, ECU programs and function description on request.

- RaceCon V2.7.0.9 or higher is the tool for system configuration, data application and online measurement.
- WinDarab V7 is the analysis tool, Light version as shareware or Expert version if license available.

All tools are delivered as self-installing executable files.

Select your personal installation folder.

### 3.1.1 Communication PC to device

Ethernet as used network may have some restrictions by firewall and IT protections. Be assure no firewall is active at the PC.

For assistance, Bosch Motorsport homepage explains the necessary PC installations.

The MS 6 EVO system requests a defined IP-adress at the PC, for example 10.10.0.14.

Internet Protocol Version 4 (TCP/IPv4)	Properties
General	
You can get IP settings assigned auton this capability. Otherwise, you need to for the appropriate IP settings.	natically if your network supports ask your network administrator
Obtain an IP address automatically	
O Use the following IP address:	
IP address:	10 . 10 . 0 . 14
Subnet mask:	255 . 255 . 255 . 🧕
Default gateway:	· · ·
Obtain DNS server address autor	natically
Ouse the following DNS server add	resses:
Preferred DNS server:	
Alternate DNS server:	· · ·
Validate settings upon exit	Advanced
	OK Cancel

Middle of 2016, programs and basic systems were extended to handle automatic TCP/IP selection also. Former produced devices and program versions may be modified to customer request and -order.

MS 6 EVO devices are connectable via commercial CAT7 cables to the PC; also Bosch Motorsport offers diagnostic cable and programming harnesses as track- and office connections.

Successful connection between PC and MS 6 EVO is shown as green marked connection in the top left corner of RaceCon.

# 3.2 Configuration of the system

Bosch MS 6 EVO devices are delivered in a not engine executable mode. The customer must include the correct programs, data applications and licenses.

The MS 6 EVO offers two mainly different configuration areas, related to the two core areas of the controller.

### MS 6 EVO ECU

1<sup>st</sup> core area for the functional part of the MS 6 EVO program. The available content is documented in the functional descriptions Bosch Motorsport adds to the customer deliveries. Application works will be done via opening the data labels in the edition windows of INCA or RaceCon.

### MS 6 EVO Logger

2<sup>nd</sup> core area for the tool displayed parts like logger-, lap trigger, telemetry, and CAN-network configurations. Application work will be done in the predefined function windows of RaceCon.

### MS 6 EVO Programming

For system programming or flashing of the device we developed the system configuration tool RaceCon. After the start of the tool, RaceCon opens the screen "Welcome to Race-Con".

With "Last Projects" former projects can be opened directly.

### 3.2.1 First Steps to create and configure a Project

File / New / RaceCon Project opens a new project in RaceCon.

	System	New Project.rlp - RaceCon V2.5.5.0 *	- a x
System Logger Dropfor	Calleodern/Messuring Tools Windows      Calleodern/Messuring     Tools Windows      Windows      Windows      Show of d     Show of d     Show of d     Show all     Special		<b>@</b> .
Project = ×	Gid New Project		Toolbox # ×
<ul> <li>Ge Mew Project</li> <li>Be Measurement Container</li> </ul>	Main Area		
Project			Toolbox
Tree	M Outer Danies		COCIDOX
Data		4 a Info / Status	+ x
		🔘 Errors 🛕 Warnings 🕕 Messages	0/0 ×
Show all Name / 💌 Source	Description     Tunction     Data Area	No information	e Area
Ready.		No err	ors detected - all cleared or state unknown - 💽 New Project 😁 😁

To create a new vehicle configuration, the devices can be pushed via drag & drop from the toolbox to the vehicle. Then they are part of the project and can be configured.

Select an ECU model MS 6 EVO from the Toolbox / Devices / ECUs.



Drag the ECU icon with pressed left mouse click on the vehicle view, then a dialog opens.

Now the ECU program archive PST files must be selected. These archives are delivered by Bosch or are available at Bosch Motorsport homepage. Specify the MS 6 EVO program archive: MS6B\_XXX\_xxx.pst.



Access to all configurable data is now available.

Installation may now be saved as customer project for further data application.



### 3.2.2 Programs Installation

Going Online for program and license configuration

In the project tree both parts of the MS 6 EVO core are shown as >red<, means MS 6 EVO device and RaceCon project differ in the used program version.



Synchronize MS 6 EVO and RaceCon program version / update the firmware of the device:

Project-tree / right mouse button to one of the red MS 6 EVO core / synchronize / update firmware >select customer software of the MS 6 EVO (file with extension: -.pst)

-	
vare	010
pdate of a device.	LUPDA
ive (PSD file-	
\Daten\MS6\MS6A_BASE_0403\Customer-Delivery	/\MS6A_BASE_0403.pst
ta Preserve a Dataset	
rchi dat	mware e update of a device. 6 crchive (PST) file: con\Daten\MS6\MS6A_BASE_0403\Customer-Delivery data Preserve a Dataset

In the project tree, the MS 6 EVO logger core is shown as >yellow<, means the firmware of MS 6 EVO device and project are identical, but the data differs.



The offline preconfigured data have to be sent to the MS 6 EVO. Option one, select: Project tree / right mouse button to the yellow MS 6 EVO core / synchronize / or follow the RaceCon menu:



Both MS 6 EVO cores are shown as green, means firmware and data of device and project are now identical.



### 3.2.3 Feature/License Activation

For code area generation, additional functionalities and/or data logging licenses may be requested for activation. Generally all MS 6 EVO licenses are related to one specific device and the delivered code is only to activate for this ECU. Both cores, MS 6 EVO ECU and MS 6 EVO logger, content own license structures. Double-click to the core symbol at the project and choice features info. Select the license feature and activate the functionality using the related license code.



Unlock Feature	
Unlock specified feature.	
ENG_PACK2	
Requested KEY:	
Gitter Piro	

The licenses for gearbox and engine controls are to activate at the MS 6 EVO ECU core. The licenses for USB or logger packages are handled in the MS 6 EVO logger core. MS 6 EVO ECU is now ready for customer data and use.

# 4 Prepare Data Base

Using RaceCon, the data base is already generated and the modification may start immediately. For information, please see RaceCon manual.

# 4.1 Initial Data Application

The following chapter deals only with the main parameters which should be checked before a first engine startup. Several functions are recommended to be switched off; many software labels will not be explained in detail. To work on these functions and labels after the first startup, please refer the full-scope function description. The offline data application guide shall help to get the engine started the first time without problems.



### NOTICE

Wrong engine setup data may lead to serious engine damages.

### 4.1.1 Basic Engine Data

. . .

The MS 6 EVO system can be used for engines up to 12 cylinders. Please ensure that the correct software variant is loaded in your ECU. Define the engine parameters like number of cylinders, firing order, injection system, and cam- and crankshaft designs in relation to TDC.

### 4.1.2 Crank- and Camshaft Wheel

The system initially supports wheels with 60-2 teeth. Other configurations **in** the limits between **30- and 60 teeth** may be possible to configure also. Please refer also to the chapter Ignition Trigger Wheel.

r	Main Data Labels to configure for crank- and camshaft wheel		
C	RANK_TOOTH_CNT	Number of teeth of the flywheel (including the missing teeth) (limited to 30-60 teeth)	
F	PIN_IN_CRANK	Selection of used crankshaft input pin	
C	CWINTF_L43_L44	Selection of used crankshaft sensor type (Hall or induct- ive type), example for used pins L43/L44	
C	RANK_GAP_TOOTH_CNT	Number of missing teeth on the flywheel	
P	PIN_IN_CAM_x	Selection of used camshaft input pin	
C	CAM_MODE	Camshaft position detection mode	
C	CAM_TOOTH_CNTx	Number of teeth on the camshaft	
S	SYNC_CAM	Camshaft signal used for engine synchronization	

### 4.1.3 Initial Steps

The following data must be set initially to start injection calibration for the first time.

Main Data Labels to configure for firing order and engine design		
DISPLACEMENT	Displacement of all cylinders	
CYLBANK	Cylinder allocations bank 1 or bank 2	
	Example typ. 8 cyl. engine:	
	Cylinder 1 2 3 4 5 6 7 8 9 10 11 12	
	CYLBANK 1 1 1 1 2 2 2 2 0 0 0 0	
	Engines with one Lambda sensor (e.g. 4-in-a-row) run as 1- bank-system.	
	Set CYLBANK to 1.	
CYLNUMBER	Number of cylinders	
CYLANGLE	Angle of cylinder TDCs relative to reference mark (RM $\rightarrow$ TDC)	
QSTAT	Static valve quantity for n-heptane in g/min (injectors are typically measured with n-heptane)	
MP_TDTECORR	Injection valve delay correction map, low pressure	
TECORPRAIL	Rail pressure correction for injection time	

### 4.1.4 Basic Path of Injection Calculation

The ECU MS 6 EVO is a so called physically based system. This means that corrections are made according to their origin influence (e.g., air temperature, fuel pressure etc.). For it, the initial engine load signal (throttle angle ath) or the engine charge signal rl (relative load) is defined as 100 % if the cylinder is filled with air of 20°C and 1013 mbar ("standard condition"). Corrections related to the air path (air temperature, ambient pressure) are therefore performed to this value rl. Based on this central value most of the relevant ECU signals are calculated, first and foremost injection and ignition.

Due to this constellation changes in the air path are centrally considered for all following functions, independently whether they are caused by ambient influences, mechanical changes of the intake system or even a change from alpha/n-system to p/n-system.

Using this rl value, a relative fuel mass rfm is constructed. For an operating point of rl = 100 %, a fuel amount of 100 % is needed if the desired Lambda = 1. All corrections to the desired fuel quantity like start enrichment, warm up factor, transient compensation, but also the desired Lambda value and the correction factor of the Lambda control are considered as an adjustment of this relative fuel mass. I.e., all corrections are still made independently of the size and other specifications of the injectors.

Next step is the conversion of the relative fuel mass to a desired injection time te. Here the engine's displacement, the fuel flow through the injector and influences of the fuel pressure are considered.

Finally, the actual duration of the control pulse ti is calculated, considering pick-up delays of the injectors, fuel cutoff (e.g., overrun cutoff, speed limiter, gear cut) and cylinder individual correction factors. Please refer also to the system overview in the Function Description ECOV.

## 4.1.5 Main Data Labels to configure for Engine Start up

### Main Data Labels to configure for engine start up

MP_MIXCORR	Mixture correction, set to 1.0 for startup
MIXCORR_APP	Global factor for mixture correction, set to 1.0 for the be- gin of startup
CWPRAILCOR	If a correction by fuel pressure is intended, set = 1. In this case please set PRAILREF according to the referenced fuel pressure. Also refer to MP_P22MOD. Usually the pre-defined values are suitable. If unsure, set CWPRAILCOR to 0 for first startup.
FINJ_WARMUP	Correction via engine coolant temperature. Usually the predefined values are suitable. Ensure, that for coolant temperatures driven on your dyno during calibration, no warm up factor applies (i.e. FINJ_WARMUP is 0.0 for this temperature).
MP_LAM_MP1	Desired Lambda value, valid for map position 1. According to your expectations, e.g. 0.9. For alternative positions of your map switch, the maps MP_LAM_MP2 (3) or (_PACE) apply, therefore ensure correct switch position

### 4.1.6 Main Data Labels for Load Calculation

Main Data Labels for Load Calculation		
CWLOAD	Decision between alpha/n or p/n related load calculation	
CWLOADP1	Decision between P1 and ambient pressure	
FRLTINT	Correction via ambient temperature. Usually, the pre- defined values are suitable. If unsure, set FRLTINT to 1.0 for first startup.	
alpha/n system		
MP_RL	Relative load depending on throttle angle and engine speed. Set value until your desired Lambda is matched.	
MP_FRLPLOAD	Correction via intake air pressure	
p/n system		
FRLPTHR	Factor to throttle dependence. If unsure, set to 1.0 for startup.	
MP_RLP1P4	Relative load depending on throttle position 1-4	
PALTCOR	Altitude correction for relative load. If unsure, set PALTCOR to 0.0.	
MP_RL	Relative load depending on throttle angle and engine speed. Set value until your desired Lambda is matched.	
Notice: For details please refer	to the Function Description LOADCALC	

### 4.1.7 Main Data Labels for Injection

Main Data Labels for injection	
CWINJMODE	Choice of injection system:

Main Data Labels for injection	
	– Low Pressure
	<ul> <li>Low Pressure plus Far Bank</li> </ul>
	<ul> <li>High Pressure</li> </ul>
	<ul> <li>High Pressure plus Far Bank</li> </ul>
CWINJANGMODE	Choice of angle of injection relation
MP_AOINJ	Map begin/end of injection
Notice: Before calibration starts, turn off Lambda closed loop control.	
CWLC	Codeword for enabling of the Lambda closed loop control. Set to FALSE during initial calibration, afterwards TRUE.

# 4.1.8 Main Data Labels for Ignition

The MS 6 EVO provides two alternatives to drive the ignition coils: For engines up to 8 cylinders the internal powerstages may be used. Alternatively, or for engines up to 12 cylinders external powerstages may be used.

IGNDRV_TYPE	For ignition coils with integrated powerstage set
	IGNDRV_TYPE to 0 ("External PS (CK200)"). To
	use the ECU's internal powerstages (for ignition
	coils without integrated powerstage), set
	IGNDRV_TYPE to 1 ("Internal PS") The ECU must
	be restarted for changes to take effect.

### Main Data Labels for ignition

Notice: Positive values stand for ignition angles before TDC, negative values after TDC. Begin with moderate values to protect your engine from damages.

MP_TDWELL	Coil dwell time. Consult the coil manufacturer for details. Most coils need dwell times about 1.5 to 2.5 ms at 12 to 14 V. For further back- ground information please refer to the Function Description IGNITION.
DIGN_CYL112	Cylinder individual corrections. Set to 0.0. Num- bering refers to mechanical cylinders.
MP_IGN_START/DIGN_ST_TINT	Base spark advance during engine start. Set to 5 to 10 deg, according to the requirements of the engine.
MP_IGN(2/3)	Base ignition timing in deg crankshaft before TDC. Use modest values at the first time. Atmo- spheric engines may run safe at 20 to 25 deg in part load, turbo engines at high boosts may de- mand even less spark advance. These values are strongly dependant on compression ratio, fuel quality, temperature, and engine specifics. If you know you're using "poor" fuel, run at high tem- peratures or your engine is very sensitive on spark advance, go to the safe side.
MP_DIGN_TEMP/MP_DIGN_TEMPW	Ignition angle temperature dependent

Main Data Labels for ignition	
DIGN_APPL	Delta value for spark advance, use for applica- tion work. Start at 0.0 for first startup.
IGN_IDLE_STAT	Ignition timing during idle. 10 deg are suitable for most applications
NIDLE_NOM / DIGN_IDLECTRL	Desired engine idle speed for idle stabilization. Set value to desired speed or deactivate stabiliz- ation by setting DIGN_IDLECTRL to 0.0.

### 4.1.9 Main Data Labels for Engine Speed Limitation

The rev limiter works in two steps:

- Soft limitation by ignition retardation or cylinder individual cutoff of injection and/or ignition
- Hard limitation by injection cut off and/or ignition cutoff of all cylinders

To achieve a good dynamic behaviour by advanced intervention, the engine speed is predicted by means of the speed gradient.

Main Data Labels for engine speed limitation	
CWNMAX_CUTOFF	Codeword for type of intervention during soft limiter:
	– no cut-off
	<ul> <li>injection cut-off</li> </ul>
	<ul> <li>ignition cut-off</li> </ul>
	<ul> <li>injection and ignition cut-off</li> </ul>
CWNMAXH_CUTOFF	Codeword for type of intervention during hard limiter:
	<ul> <li>injection cut-off</li> </ul>
	<ul> <li>ignition cut-off</li> </ul>
	<ul> <li>injection and ignition cut-off</li> </ul>
NMAX_GEAR	Engine speed limit, gear dependent
NMAX_P	Determines the slope of the soft limiter between soft limit and hard limit.
	Predefined. Vary according to your engine's dynamic beha- viour.
TC_GEARNMAXPR	Prediction time for rev limiter, depends on the inertial torque of the engine. If oscillations occur, reduce value, or turn off by setting = 0.0.

### 4.1.10 Main Data Labels for Cutoff Pattern

Cutoff Pattern	
MP_COPATTERN	Defines the appropriate cylinders for torque reduction by cylinder cutoff.
	At the beginning of an intervention the next possible cylin- der for starting the cutoff pattern is determined. Based on this info the actual pattern is taken out of the map.

Cutoff Pattern	
	Pattern should be defined in view of minimized oscillations of the crankshaft.
	Usually, a regular distribution of firing and non-firing cylin- ders leads to the best result. However, investigations of the individual engine are recommendable.
	For it, cutoff pattern can be also turned on manually via CUTOFF_APP and CWCUTOFF_APP
	Example: 4-cylinder engine
	Start Cyl./Cutoff stage 1 2 3 4
	1 1 (=0001b) 2 (=0010b) 4 (=0100b) 8 (=1000b)
	2 9 (=1001b) 6 (=0110b) 6 (=0110b) 9 (=1001b)
	3 11 (=1011b) 14 (=1110b) 7 (=0111b) 13 (=1101b)
	4 15 (=1111b) 15 (=1111b) 15 (=1111b) 15 (=1111b)
	The cylinders are assigned bitwise, the lowest bit represents cylinder 1.
	Numbering refers to mechanical cylinders, e.g. pattern = 9: Mechanical cylinders 1 and 4 are fade out.
CUTOFF_APP	Cutoff pattern for test purposes. Bit representation as de- scribed at MP_COPATTERN
CWCUTOFF_APP	Set Codeword for type of intervention during test cutoff:
	– disabled
	– Injection
	– Ignition
	<ul> <li>Injection and Ignition</li> </ul>

Notice: This option is also useful for searching a misfiring cylinder. Select one cylinder after the other during test cutoff and watch your engine.

### 4.2 Peripherals

Sensors and peripherals can be checked when the system is powered up electrically.

Do not start the engine before all steps in this chapter are carried out.



### NOTICE

Make sure the battery is connected properly, all sensors are connected, and ground wiring is fixed before powering up the system. Check all sensors for errors (E\_...) and reliable measure values before starting the engine.

### Sensor configuration

The MS 6 EVO has the option to link a lot of functionalities to a possible hardware input. The chapters "ECUPINS, SWITCHMATRIX and Input Signal Processing" of the functional description explains the details. All functions of Base MS 6 EVO programs are linked like described in the MS 6 EVO documents (e.g. function description ADC\_ECU\_MAP) or the wiring diagrams.

### Analogue sensor inputs

The physical way of conversion from sensor signal voltage to physical values follow the same structures. The hardware input may be connected to different kinds of pull-up options. Inputs with fixed 1.47 kOhm or 3.01 kOhm pull-up resistors are prepared to handle passive sensor elements, for instance temperature sensors with integrated resistors (NTCor PT100 sensors). Inputs without any pull-up resistors are prepared to handle active sensor elements, which deliver 0 to 5 V signals, for instance pressure-, potentiometer- or acceleration sensors. Inputs with switchable 1.47 kOhm pull-ups are designed to handle mainly active sensors with disabled pull-up, but are prepared for future measuring of digital signals. Inputs with switchable 3.01 kOhm pull-ups offer the most options and are recommended to link after the standard sensors are connected. The pull-up resistor itself is not modifiable and for better measure results may be, the version of sensor/mapping line has to be changed. To activate the Pin-Selection, first the label "PIN\_IN\_function" has to be enabled. Error detection of an analogue input signal detects short cuts to ground, U"function" MIN recommended to be set to 0.2 V and short cuts to power supply U"function"\_MAX recommended to be set to 4.8 V. Failure are activated after the adjustable debounce time of diagnosis TD"function". If a sensor error is set, the output is switched to the default value "function"\_DEF.



### Pressure measurements

The system offers many different pressure channels; please see function description input signal processing for details. For gradient and offset information contact sensor manufacturer.

Example: Ambient Pressure	
PAMB_DEF	Default value if an error occurred.
FCPAMB	Filter constant. For ambient pressure use 1
	second, for other pressures choose appro- priate values, ~ 100 to 200 milliseconds

All other variables are named by the same rule; replace "pamb" by e.g. "poil" to apply data for the oil pressure sensor.

#### Temperature measurements

The system offers many different temperature channels; please see function description input signal processing for details.

Example: Intake Air Temperature	
UTINT_MIN, UTINT_MAX	Minimum and maximum accepted sensor voltage. When violated, an error is set (E_tint = 1).
TINT_CONV	Sensor characteristic. Consult the sensor manufacturer.
PULLUP_TINT	Value of the used pull-up resistor. If only the ECU's pull-up is used (standard case). Keep the predefined value of 3.01 kOhm.

### Thermocouples

The exhaust gas temperatures are measured via thermocouple elements, using a special evaluation circuit. Predefined values should be suitable for NiCrNi or k-type elements. For further details and project specific variants, please refer to the function description.

### Digital sensor inputs

MS 6 EVO digital sensor inputs used for frequency measurements can be configured for different sensor types.

CWINTF_A047_A048	Selection between Hall effect or inductive sensor for flywheel measurement, related to MS 6 EVO contact A047 (use ground A048 if inductive type is selected).
CWINTF_K045/K046	Selection between Hall effect or inductive sensors for frequency measurements, like turbo- or driveshaft speeds, related to MS 6 EVO contacts K045 or K046 (use ground K062 if inductive types are selected).
CWINTF_A049/A050/A051/A052	Selection between Hall effect or DF11 sensors for frequency measurement, like wheel speeds or cam position detection, re- lated to MS 6 EVO contacts A49, A50, A51 or A52.

# 4.3 Throttle Control

The system supports mechanic and electronic throttle controls.

Using an MS 6 EVO device, respect the necessary license for electronic throttle is activated. Electronic Throttle Control is a safety-critical function. Depending on specific use and/or construction, the safety functions, fault detections and fault responses of the ETC system may differ in several points from ETC systems used in series production. Hence before each vehicle-commissioning the system must be checked for accuracy and faultlessness.

The customer is responsible for the activation of all ETC-relevant diagnosis and for their correct parameterization. By disregarding this information, the functionality of the ECU and the safety cannot be ensured.

#### Notice: For detailed information see function description ETC

The usual route of ETC determines the drivers input measuring the pedal position and transferring this leading signal via functionality options into the control of an electrical throttle actuator. Pedal- and actuator positions are generally measured in a secondary redundant way to verify the reliability of the function. To activate the system, first verify the signal tolerances and error messages by moving acceleration pedal and throttle actuator manually. An inactive system usually is the result of inverted wired sensor signals or actuator controls. Calibrate the pedal- and throttle positions.

Verification of acceleration pedal signals:

The mathematic value of voltage pedal signal 1 - 2\*voltage pedal signal 2 has to be below 0.5 V or below value of "UAPSCM\_MAX".



### Signal principle of an acceleration pedal sensor:

uaps_a	Voltage APS potentiometer a
uaps_b	Voltage APS potentiometer b
aps	Acceleration pedal position
UAPS_MIN, UAPS_MAX	Minimum and maximum accepted sensor voltage. Set to approx. 200 mV/4,800 mV. Check if the uaps(x) outputs are changing when the pedal is moved.

CWAPSADJ	Codeword to adjust acceleration pedal sig- nal:
	<ul> <li>calibration inactive</li> </ul>
	<ul> <li>calibrate release pedal</li> </ul>
	<ul> <li>calibrate full-pressed pedal</li> </ul>
E_aps	Detected error messages of acceleration pedal functionality. If errors are detected, the ETC functionality will become inactive.

### Verification of throttle position signals:

The mathematic value of voltage throttle signal 1 + voltage throttle signal 2 - 5 V has to be below value of "UDTHRCM\_MAX" (recommended 0.2 V)





### Throttle position main data labels:

C	CWTHR C	Codeword for type of throttle controls:
		- manual throttle, without backup sensor
		- manual throttle, with backup sensor
		- electronic throttle, single bank
		<ul> <li>electronic throttle, dual bank</li> </ul>

### Throttle position signals:

UDTHR_MIN, UDTHR_MAX	Minimum and maximum accepted sensor voltage. When violated, an error is set (E_thr = 1). Set to approx. 200 mV/4800 mV. Check if the uthrottle(xx) outputs are changing when throttles are moved
uthrottle	2 sensor output values and their redundant
uthrottle_b	signals (_b). The system expect a rising
uthrottle2	voltage for the main signals and a falling
uthrottle2_b	signation the redundant one.

UDTHRCM_MAX	max. allowed difference between sensor output and redundant signal	
	abs (uthrottle(x)+uthrottle(x)_b)-5V < UD- THRCM_MAX	
Calibration:		
CWTHRADJ	Codeword for throttle adjust:	
	<ul> <li>calibration inactive</li> </ul>	
	<ul> <li>automatical calibration</li> </ul>	
	<ul> <li>calibrate 1st mech. stop</li> </ul>	
	- calibrate 2nd mech. stop	
	<ul> <li>calibrate limp home position</li> </ul>	

wiring check/recalculate

### Manual Procedure:

- Close throttle and set CWTHRADJ to 2.
- Open throttle fully and set CWTHRADJ to 3.
- Adjust the throttle to idle point.
- Do not forget to set CWTHRADJ back to 0. Check calibration by moving throttle.

### 4.4 Vehicle Test

Before starting with your vehicle test, some initial data should be set:

### Speed & distance measurements

The signals for speed calculation may be available from different sources, like MS 6 EVO own measurement, GPS data or via CAN received information from ABS calculation. For MS 6 EVO own calculation, mechanical influenced data like number of available sensors, front wheel drive, number of detected increments, wheel circumferences, and dynamic corrections like corner speed application, a lot of functional options assist the calculation of the effective vehicle speed. Distance measure channels may be derived from speed information. For detailed information, see function description >CARSPEED<

CWWHEELCAN	Selection for car speed from CAN signal
CWWHEEL	Connected number of wheel speed sensors or -signals
CWFWD	Selection of front driven vehicle
CWSPEEDDYN	Release of dynamic speed calculation
INC_FRONT	Number of pulses per revolution of the front speed signal
INC_REAR	Number of pulses per revolution of the rear speed signal
CIRCWHEEL_F	Wheel circumference of the front wheels
	Consider dynamic increase of the tire
CIRCWHEEL_R	Wheel circumference of the rear wheels. Consider dynamic increase of the tire.

vwheel_xx	Measure channel of the individual wheel speeds
speed	Result of calculated vehicle speed
accv	Result of speed based derivation of longit- udinal acceleration
Itdist	Lifetime distance as accumulated result of speed derivation

#### Lap information and -functions

The necessary data application is integrated in the system configuration tool RaceCon. The wizard leads to configure the beacon input, asks for trustable limits of lap- and signal detection. Additional options for track segmentation, additional on track beacons are also available. Drag and drop the subfolder lap trigger of the measurement sources into the project and follow the wizard.



*Illustration 1:* Depending to the configuration, values for lap-and outing counter, lap time, segment times and differential lap- or segment times for data analysis and driver information will be created.

#### Laptrigger\_xxxx\_yy

Results and measure channels of lap-functionalities

#### **Consumption-calculation**

Is designed in the same way as lap-information, drag and drop the subfolder to the project and follow the wizard.

#### Set Date & Time

MS 6 EVO device is equipped with a real time clock which is supplied for max. 14 days, if the ECU is disconnected from power supply. Please connect the ECU to the PC and click on "Set Date & Time" in the context menu of the MS 6 EVO

Ĵ	Open			
ØI	Create measuring views			
ą	Download configuration		1	
•	Save			
Ľ	Synchronize	•	Ø	Set Date & Time
P	Create dataset			with ECU
7	PIN/SuperPIN	٠		Change program archive
€	Export		0101 0101 1010	Update firmware
•	Import			Upload configuration
-	Properties		×	Clear logged data
×	Delete		-	Clone ECU .
ſe	Rename			Adjustment data

### time\_xx

The measure channels of the real time clock

# 5 ECU plus Data Logger

The MS 6 EVO combines ECU and data logger in one common housing for a cost efficient and weight optimized all-in-one solution.

# 5.1 Software Tools

RaceCon	Create and configure a project		
	Configuration & management of recordings		
	Create a new recording		
	Add channels to a recording		
	Create user-defined conditions for the re- cording		
	Download recording configuration		
WinDARAB	Upload recorded data		
	Display and analyze the data		

# 6 First Steps

Install the software required for the operation of the MS 6 EVO. It is developed for Windows system software. The following software versions are used in this manual:

- MS 6 EVO setup, configuration and calibration: RaceCon Version 2.9.0.7 or later.
- Measurement data analysis: WinDarab V7

Set up the 100 Mbit ethernet connection to the MS 6 EVO.

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

# 6.1 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				
<b>()</b> E	🖸 Errors 🚺 Warnings 🕕 Messages(2)				
т	Time	Sender	Message		
<b>(i)</b>	12:16:09	RaceCon	Connected to MSA Box.		
<b>(i)</b>	12:16:09	RaceCon	MSA Box successfully connected.		
Info	Info / Status CAN Log - Stopped 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 [▶ 37]". For the status color, see chapter "Color indication [▶ 48]".

### 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 MS 6 EVO 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:

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

## 6.2 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
None Race Made Visible Prote	Workspace: toban Sheet Socket Arrangement Arrangement			
Mora € New New York ⊕ € Mews were Container Project Tree	Main Area			Value     ●       ●     ●
Data Show all Name / V Source	● Decorption ● Function Data Area	No information	for and Wenney UMenage T_ Tree Service Neusop Messsage Area	× + X 0/0

1. Start the RaceCon software.



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



3. In the Toolbox, select the MS 6 EVO and drag it into the Main Area. A pop up window to specify the MS 6 EVO program archive appears.

Total         Color         Color <th< th=""><th>New Project - RoorCon V2.5.5.0</th><th>. • × 0•</th></th<>	New Project - RoorCon V2.5.5.0	. • × 0•
Project 0 x 04 New Project		Toobox 9 ×
😑 🛤 New Project	Create a new DDU10	Devices
⊕ 🍘 Measurement Container	Specify the program archive This creates the device defined in the program archive	Dispbys     A     CAS-M3     DU10     DU10     DU17
	ECU program archive: Please specify the ECU program archive	COUS COUS COUS COUS COUS COUS COUS COUS
	< Sect. Not > Freeh Const	* 10 Spot        * 10 Spot
A Defendence of the second sec	· · · · · · · · · · · · · · · · · · ·	Metsurement Elements
de system Overview		Measurement Sources
Deta	<ul> <li>× Into / Status</li> <li>Manager</li> </ul>	× + ×
Show all	T Time Sender Message	
Hame / • Source • Description • Aunction	No information	

- 4. Download the firmware for your device:
  - from the RaceConnect project file share for PSU. This .pst file should be provided to RaceCon.
  - from www.bosch-motorsport.com for VCUs, DDUs, and Loggers.
  - You can get firmware for ECUs on request.

An information shows if the archive is valid or not.

5. Click 'Next' (for PSU: go on with step 7).

	andara Calibrativa Mananajan Tarih	System	New Project - RaceCon V2.5	i.5.0 *		. a x
None Race Mode Project	Story Calle Buckey Monitories Called Control C	11114,000		-		
Project 0 x	Git New Project					Tosibox # x
<ul> <li>Be 44 New Project</li> <li>a          ▲ Measurement Container     </li> </ul>		Create a new BDU10. Genety the program. The costs the device Classification of the program. Classification of the program characteristic Classification of the program characteristic of the program characteristic Classification of the program characteristic of the program characteristic Classification of the program characteristic of t	archive	4 pd 4 pd 10 pd 100 b 105 b ref. means to any ECoo petitor Final		Based         Description           CA140         CA140           CA
Data			0 × Info / Status			* x
-			😫 Errors 🧘	Warnings i Messages		0,0 ×
Show all			T Time	Sender Message		
name Source	e vescription v	Function 💌 Used	No			2
Ready.					No errors detected - all cleared or state unknown *	🛅 New Project/Measurement Container 🛛 📟

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



7. Click 'Finish'.

🔊 = 🥎 t 🖉 t ) t		System					_ # X
System Logger De	splay Celibration/Measuring Tools	Windows					<b>0</b> •
	Workspace:						
	Show and						
DDU10 Race Mode visible Pro	tection Sheet						
Stebus Node Protec	t Security Arrangement						
Drainet D. V.	(and New Propert)						Toshov 0 v
To Ad New Project							A Devices
DDU10							Displays
💮 🎁 Measurement Container							CAS-M3
							DDU10
			10				DDUB
			-				DDU9
							ECUs
							III MS3 Sport
							MS4 Sport
							MS15 Sport
							= MS15.1
							m MS5.0
							MS5.1
							MSS.2
							MS5.6
							MS6
							MS7
							M524
							MS24 light
							B PSU-F1
							Custom ECU
							Power control unit
							Display Elements
	•			1		•	Measurement Elements
	🛤 System Overview 📙 Dataset manager						Neasugement Sources
Data			4 x	Info / Status			v ×
				CETTORS A Warnings	(i) Messages		0/0 ×
Show all				T Time Sender	Message		
Name / 💌 Source	e Description	Function     Used					
			NI-				
			INO				
			information				
Ready.						No errors detected - all cleared or state unknown - 🎽 Maw Proje	ct/Neasurement Container

The MS 6 EVO is inserted into the project and RaceCon tries to connect to the device.

RaceCon detects configuration differences between the MS 6 EVO 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 [▶ 122]".



The download starts and the MS 6 EVO carries out a reset.

After the reset, RaceCon reconnects to the MS 6 EVO. Local configuration on both the PC and MS 6 EVO match (indicated by green background and dot). The MS 6 EVO is now connected to RaceCon.



For further information on the color indication, see chapter "Color indication [▶ 48]".

### 6.3 Feature activation

- Optional software feature packages are available for the MS 6 EVO
- 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 MS 6 EVO does not work on any other MS 6 EVO.
- 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 'MS 6 EVO' in the Project Tree.
- 3. Click on the 'Features info' tab in the Main Area.

		System		_ = X
	System Logger Booky Calibration/Heasure DOUID Race Mode walke Protection Sheet Hode Protection Sheet	g Tools Windows		@ -
1st: Double-click on DDU	Anad         0         Marchage	COLD 10         [1952771:107654]           COLD 10         [1952771:107654]           Real/Adds.         [Order Admention]           Name         Description           Name         Description           Name         Description           Name         Description           Name         Description           Name         Description           Press         Description           Press	Core to defend and the second of the second	Index         0           Convert         0           Mittain         0           Mittain         0           Mittain         0           Mittain         0
2nd: Click on 'Features info'	2 2003	- Hah Danes - Costone Danes 2 CA res	age   @Hore   @Hore   @Deventh   @Deventh   @Deventh	Mac.a Mac Mac.a Ma
	Data -	* *	Info / Status	- • ×
	Image:	tetion	O femal()         Versing()         (1) Measpec()           Text         Fee         Sector           100707         COUID-Inter Freque         Sector Sector           100707         COUID-Inter Freque         Cound Sector           100707         COUID-Inter Freque         Device Sector           100701         COUID-Inter Freque         Colific Sector           100711         COUID-Inter Freque         Colific Freque           100711         COUID-Inter Freque         Colific Freque	4545 X

4. The 'MS 6 EVO features info' window appears.

	DDU10 features info	
ECUID —	ECU ID 3950e778:1d0fd540 Copy to dipboard	
	Status/Unlock Order informations	
	Name Description	
Foaturo status	CCP_MASTER F02U V02 213-01, Enable device to be CAN Communication Protocoll Master	List of quailable
realare status	FULL_LOG_1 F02U V02 304-01, Full logging on first partition	
	FULL_LOG_2 F02U V02 305-01, Enable full logging on second partition	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	
	0	
	🔟 Locked (disabled) 🛛 🚺 🕺 Unlocked (activated)	
	_	

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

CU ID 3950e77	Re:10hrd540 Copy to dipboar
Name	Description ER F02U V02 213-01, Enable device to be CAN Communication Protocoll Master E02U V02 213-01, Enable device on first particles E02U V02 304.01, Enable device on first particles E02U V02 213-01, Enable device E02U V02 213-01, Enable devi
C FULLOG USE_DATA F FHER_TEL T IO_EXTENS	2 ECU Protection Unlock Feature Unlock specified feature. ETHER_TELE Requested KEY: d23856aa  OK Cancel

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'.

Name         Description           CCP_MASTER         F02U V02 213-01, Enable device to be CAN Communication Protocoll Master           ULL_LOG_1         F02U V02 304-01, Full logging on first partition           ULL_LOG_2         F02U V02 305-01, Enable full logging on second partition           USE_DATA         F02U V02 14-01, Enable fata copy from logger to Bosch USB stick           ETHER_TELE         F02U V02 138-01, Enable Ethernet / LTE Telemetry           V0_EXTENS         F02U V02 205-01, Enable additional input / output channels	Name         Description           CCP_MASTER         FO2U V02 213-01, Enable device to be CAN Communication Protocoll Master           FULL_LOG_1         FO2U V02 304-01, Full logging on first partition           FULL_LOG_2         FO2U V02 205-01, Enable full logging on second partition           USB_DATA         FO2U V02 214-01, Fnable data copy from logger to Bosch USB stick           FILER_TELE         FO2U V02 213-01, Enable Ethernet /LTE Telemetry           IO_EXTENS         F02U V02 205-01, Enable additional input / output channels	MASTER F0 _LOG_1 F0 _LOG_2 F0	escription I2U V02 213-01, Enable device to be CAN Communication Protocoll Master I2U V02 304-01, Full logging on first partition	
CCP_MASTER       F02U V02 213-01, Enable device to be CAN Communication Protocoll Master         FULL_LOG_1       F02U V02 304-01, Full logging on first partition         FULL_LOG_2       F02U V02 305-01, Enable full logging on second partition         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         V0_EXTENS       F02U V02 205-01, Enable additional input / output channels	CCP_MASTER F02U V02 213-01, Enable device to be CAN Communication Protocoll Master FULL_LOG_1 F02U V02 304-01, Full logging on first partition FULL_LOG_2 F02U V02 305-01, Enable full logging on second partition USB_DATA F02U V02 214-01, Enable data copy from logger to Bosch USB stick FINER_TELE F02U V02 138-01, Enable Ethernet / ITE Telemetry T0_EXTENS F02U V02 205-01, Enable additional input / output channels	MASTER F0 _LOG_1 F0 _LOG_2 F0	12U V02 213-01, Enable device to be CAN Communication Protocoll Master 12U V02 304-01, Full logging on first partition	
FULL_LOG_1         F02U V02 304-01, Full logging on first partition           FULL_LOG_2         F02U V02 305-01, Enable full logging on second partition           USB_DATA         F02U V02 214-01, Enable data copy from logger to Bosch USB stick           ETHER_TELE         F02U V02 138-01, Enable Ethernet / UTE Telemetry           IO_EXTENS         F02U V02 205-01, Enable additional input / output channels	FULL_LOG_1       F02U V02 304-01, Full logging on first partition         FULL_LOG_2       F02U V02 305-01, Enable full logging on second partition         USB_DATA       F02U V02 214-01, Enable data copy from logger to Bosch USB stick         FHER_TELE       F02U V02 118-01, Enable Ethermet / LTE Telemetry         TO_EXTENS       F02U V02 205-01, Enable additional input / output channels	_LOG_1 F0 _LOG_2 F0	2U V02 304-01, Full logging on first partition	
FULL_LOG_2         F02U V02 305-01, Enable full logging on second partition           USB_DATA         F02U V02 214-01, Enable data copy from logger to Bosch USB stuck           ETHER_TELE         F02U V02 138-01, Enable Ethernet / LTE Telemetry           IO_EXTENS         F02U V02 205-01, Enable additional input / output channels	FULL_LOG_2       F02U V02 305-01, Enable full logging on second partition         USB_DATA       F02U V02 214-01, Enable data copy from logger to Bosch USB stick         ETHER_TELE       F02U V02 138-01, Enable Ethermet / LTE Telemetry         IO_EXTENS       F02U V02 205-01, Enable additional input / output channels	_LOG_2 F0		
JSB_DATA         F02J V02 214-01, Enable data copy from logger to Bosch USB stick           ETHER_TELE         F02J V02 138-01, Enable Ethernet / LTE Telemetry           IO_EXTENS         F02J V02 205-01, Enable additional input / output channels	USB_DATA F02U V02 214-01, Enable data copy from logger to Bosch USB stick  USB_THER_TELE F02U V02 138-01, Enable Ethernet / LTE Telemetry  IO_EXTENS F02U V02 205-01, Enable additional input / output channels		12U V02 305-01, Enable full logging on second partition	
ETHER_TELE         F02U V02 138-01, Enable Ethernet / LTE Telemetry           IO_EXTENS         F02U V02 205-01, Enable additional input / output channels	FTHER_TELE     F02U V02 138-01, Enable Ethernet / LTE Telemetry     IO_EXTENS     F02U V02 205-01, Enable additional input / output channels	DATA FO	12U V02 214-01, Enable data copy from logger to Bosch USB stick	
IO_EXTENS F02U V02 205-01, Enable additional input / output channels	IO_EXTENS F02U V02 205-01, Enable additional input / output channels	R_TELE FO	2U V02 138-01, Enable Ethernet / LTE Telemetry	
		EXTENS FO	)2U V02 205-01, Enable additional input / output channels	
			R_TELE FO	R_TELE         F02U V02 138-01, Enable Ethernet / LTE Telemetry           XTENS         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 MS 6 EVO.

## 6.4 First recording (Quick Start)

This chapter explains the configuration of the recording of the battery voltage channel. See chapter 'Recording [> 87]' 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.

		):					DDU10.rlp - RaceO	ion V2.5	5503.10 *					
Sys	stem Logg	er Display Calib	ration/Measuring	Tools										Ø •
		Rename	Rename	- Sedt										
DOU10	Download	Delete Add	Add _ Delete	Add 🕞 Delete										
Status	Communicati	an Recording	Group	Channel										
DDU10														Data 4
													_	ub
DDU10 c	configuration &	management												Show all
Add new	channel   Edi	t channel(s) Delete cl	hannel(s) E Flat vi	ew fim Rease have a lost	at the statistics	ion for a more	datailad calculation							Name 🕗
	a uter int rega	i une unestanp overneau		con mease name a los	at the statistics		unand cardiatoric							ub
Grou	ip1	logged Name	Source  DDU10	<ul> <li>Rate / True</li> <li>10 ms</li> </ul>	Timeout	Default	Condition Tele	metry	8 Bit unsigned battery vo	ion voltage				
							~							
								$\sim$						
										Dra	$aa \pm Da$	on		
										DI	iy i Dh	υp		
														Plub MI A
														Provided by DDU10
														battery voltage
														Quantisation: 0,1 [V] Limits: 025,5
														Format: %4.1 Precision: 0
-	-													Resolution: 0 Conversion: (ub)/11 **
Logging1	Logging2	📔 💷 Settings 🔤 🕍 Statisti	8		_	_				_				<
Ready.										No errors detecte		uriknown 👻 🕮 I	New Project/DDU10/Logg	er/Logging1/Group 1/ub 🚥 🚥 🥫

4. Click on the 'Download' button in the upper left corner. The configuration download starts and the MS 6 EVO 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.

	DDU10 r/p - RareCon V2.55.0	_ # X
System Dogor Dogley Calibration/Measuring Tools	Weben	@ ·
Project 0 ×	Bill New Project	Teobex 9 ×
E- \$4 New Project ⊕ • ■ DDU10		Displays
ii 6 Meaurement Container	Commissioning data to 20010	CAS-M3 CAS-M3 CDU10 DDU10 DDU18 DDU-52 Plus CO152 Plus M M53 Sport M M53 Sport M M53 Sport M M515 Sport M M515.2
ritgerita 6 a Bill 17 madad • 🗇 🔞	Data deveload (reference page) to ECU is in progress.	M PS2.0           M PS5.0           M PS5.1           M PS5.2           M PS5.6           M PS5.6           M PS5.8           M PS5.8
Project properties     Rew Project     Race mode viale     System logger     D0010		新 MS25 Sport 専 PDB 朝 PSU-F1 尊 Custom ECU @ Custom ECU
Name The project's name.	< II Désait manager II Désait manager	Display Elements     Measurement Elements     Measurement Sources
li l	s y trên / Statur	
	C Errors A Warnings () Messages(6)	6/6 🗙
🗎 🗃 🗃 🗃 🗃 📓 📓 🎽 Show all	T Time Sender Message	
Name V Source Decription V addaig Di DoUllo Absetute be counter Socie DOUllo Absetute be counter Socie DOUllo transverala acceleration Control Control Control Control Control Control Control Control Control Co	No         Dised         Otops	1

5. Start the WinDarab software.

				winu	arab v7 Developer - Formulas				
Start Tools	Windows								Style 👒 🔞 🗸
Files Pacetrack - Channels A Events Colors Dockable windows	Control Bars	Color -	🧭 🚺 🖉 Morksheet control	Show captions	Show caption Maximize Close Current control Desktop layou				
•							1		
	ر ب م	8					Channels		• × •
Out Lan Lantime									2
• our cap capanie		1					Name	Source	Descripti
for the			X (HORKSHEELEI)					^	0.14
Time Car From	To Duration Channel	Min Max							4 A
		1944							
									1702 MD /

- 6. Disconnect the MS 6 EVO 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			from	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:\	v <b>*</b>	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 MS 6 EVO 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 MS 6 EVO 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 🔿 18 ms
Name	Size (MB)	Get	Get (MB)	Progress	
FTP 23.06.2015 12:11:11	0.0		0.0	Connecting	
Auto Scroll Show all files					Import

- 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.



# 6.5 Set date and time

The MS 6 EVO 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 MS 6 EVO 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				P 🗙 🛛 🕬 Proj
🖃 🛤 New Project	_			
	Open			
📄 💼 Dis 💴	Create measuring views			
- 🛢 🗔	Download configuration			
	Synchronize	×	Ø	Set Date & Time
	Current measuring media	•	Þ	with ECU
	Create dataset		<del>I</del>	Change program archive
	PIN/SuperPIN	•		Update firmware
	Export		<b>₩</b>	Upload configuration
🕀 📮 CA 🕣	Import			
	Properties		¢	Clone ECU
	Delete			Adjustment data
🔤 Co aje	Rename			Save +
🖮 📲 1/0 Cha	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	
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

## 6.6 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'.

	I 🛆 🤇	) 🔴 🌘	
--	-------	-------	--

C80 Logger C80 Logger C80 Logger C80 Logger C80 Logger

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

🖃 🗤 🕅 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     DU10     Measurement Container	Generation See Project     Generation DDU10     Generation Generation     Generation Generation
	New Project     Datrigger     DDU9     DDU0

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

Existing DDU 10 er	rors		Existing DDU10	) errors	
MIL 😑			MIL 🔵		
Location	Туре	Du	Location	Type	Du
ANA04	Open line		Location	1300	00

- 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.

# 7 Project Configuration

## 7.1 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.

	©	DDU7.rb - RacoCon V2.5.0.2002	- • ×
	Spaten Logger Dop Spaten Logger	Galarhanarry 'sa 'lindon I an	U.
1st: Double-click on "Math Channels" in the Project tree 2nd: Click on	Prest     Organization     Organizatio     Organization     Organization     Organization     Organizat	14 toolnas 10 tool	A to a line a log a line line line a li
"Add channel"			Speed
	the second	Bitteling         // Lind Oursening         [/]: Colomange [/]: Coloma	<b>3 X</b> 34 <b>X</b>
		Pitets Gates (Ph CN) too - stagged	

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.

### 7.2 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.

		0000 U007.00 - Nace of V2502002	- • *
	System Logger Dop	y Califration/Measuring Tools Windows	Ø -
	🕒 🔯 🎯 🔇		
	0007 Race Mode visible Prote	See Sect	
	Status Nocle Project	auth	
	<b>3</b> • • • •		
	B- Gal New Project	/64 HexProject / 10 0007	Devices
	e + 🛄 bbu	£	Display Elements
1st: Double click	Disslay	D0./7 neh doniel configueiton J#	Measurement Elements
ISI. DOUDLE-CIICK	OTT GAN Bus 1	Jo Add charnel. • (j) Edit charnel. Jo Delete charges()	Measurement sources
"Math Channels"	B- B CAN But 2	Ao man channe.       Borto.       Veice      ordonal value	Sosch Wizerd
Math Channels	a a 1/0 Channels		Customized Sensor
· . · / <del>.</del>	- Calibration Items		Characteristic Curve
in Project Tree	fr Math Charactels	Т	Multipoint Adjustment
5	- f. Conditional Channels		Sensitivity/Offset
	Group adjustments		Characteristic Curve
2nd Click on	8- 6 Measurement Container		Replation
ZHU. CILCK OH			Velocity
the drondown	Parts - Mark / Barcolic B. W		Adustment channel
the aropaown	000 1001 000100 4 8		Characteristic Curve
arrow basida	Show all		Fuel
arrow beside	Name Sou		Hysteresis
			E Laptigor
'Add channel'			PWH Out
			Speed
2rd Chaosa	Properties - Math Channels & X	🔳 Slatistica 🕹 Mark Charresh 💪 Conditional Charresh 🖓 CMI reasages 🖏 Marces 🛄 Satistica i Davis info 😥 Error info 🏠 Readures info	
SIU. CHOUSE	811 6 Wetendard + 11 + 22	( )	1
Conditional	8 Debug	O Enten(3) ( 🛕 Warrings(4) ( 🕜 Messager(6) ) 14/144 3	
Conalional	Candhangelitisbi True	Type Time Server Message	
for a strange 1	E Math channels properties	U 1114/51 UU/ 196 PPC 0465 SUCESTIN (PPC 04065 (UU/) SUGE_SUCE / ) 1114/51 Software - No. Software Succession (PPC 04065 (UU/) Suge_SUCE / ) 	
function	name Math Channes	U 11-R2-53 0007-Ne Logger data matches the local data.	
-		III-III UUU - Ne Los connector no evice prevento UU-/.     III-III DUU - Ne Los connector no evice prevento UU-/.     III-III DUU - Ne	
		0 11-10:14 001/7-14c DK check successful. (DK Desice: 001/7_046E_5727 )	
	Can/ChangedProtectioe/State	113-0115 Alarn - Ne No channel source configured, elapoing element      113-0115 DD07 - Ne Iologe data matches the load data.	
			21

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

	1	Create/edit conditional function		×	
		Define the conditional function's gener	al properties and it's calculation rules.	fx	
		Name:			
a)	-	p_br_front_mx			
		H:	Then:		
b)	-	p_br_front > 20	<pre>max (p_br_front, p_br_front_mx)</pre>	(d)	
		Otherwise:	Reset value:		
c)		p_br_front_mx	10	— e)	
		If (a, br. front > 20) is TRUE, then return Reget 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). ve 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 MS 6 EVO 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.

## 7.3 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:

	Define the conditions general proper Select between single channel/value or n	ties and the condition if nultiple constant comparison	self. by selecting the comp	aring mode.	fx –
	Name:				
-	Comparing mode Constant  Channel	el 🔘 Ra	nge	Multiple (constant list)	
-	Input channel:	Operator:	Constant value:		
	General settings	-121	Output settings		
	Debounce time:	U 🖶 ms	Output mode:	Constant TRUE/FALSE	- 1
-1	Tum off delay:	U 🖶 ms			
					_

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 MS 6 EVO condition channel window.

## 7.4 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 MS 6 EVO project.

#### Creating a new Condition Combination

Follow the steps shown in the screenshot.

	State         State <td< th=""></td<>						
1st: Double-click on 'Conditional Channels' in Project Tree	Construction	I to long a long	Construction				
2nd: Click on the dropdown arrow beside 'Add	Tels - Confiltent Charends & M Charen all Neuron - N () () ()		Computer second Conductions of annual Constantiation Constantiatio				
condition	Properties Conditional Channels 3 # 22 21 V standard	Bolton   A. Init Carrieri   A. Contract Carrieri   D. Contemport   D. Terreri   D. Initian	* * *				
3rd: Choose 'Conditional combination'	New Conditions Charrels B Bebog CanChangelline Too CanChangelline Too CanChangellinetExerState	Image         Name         Name           1.113         1.01-0					

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.				Jx
Name:				
condComb				
Output configuration:				
Constant TRUE/FALSE				ĸ
Constant TRUE/FALSE Blinking				5
Pulsing				
l oggling output				
	< 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 MS 6 EVO condition channel window.

## 7.5 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:	
📮 🙆 page_up	0	$\sim$	Falling	~
Source for signal Down:			Edge:	
睅 🙆 page_dn	Ø	$\sim$	Falling	$\sim$
Maximum count of steps: Signal source: Constant: Display switch does not wrap around Measurement Sheet:			12	A
				~
< Back Next > Finis	sh		Cance	:I

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

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

## 7.6 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			×
Timer configuration Specify timer properties and a set of	control signals.		<b>D</b> n
Properties Mode: Count down Count up 10.00   s Measurement sheet V	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 V Edge: Falling V Falling V
	< Back Next >	Finish	Cancel:

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

Measurement label	Function
name_ <b>time</b>	actual timer value
name_ <b>trig</b>	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

# 7.7 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.

Specify GPS Trigger configuration.				5
Fudge Factor:	GPS positions (Parameter	based) Detection range (N	/acro based)	
	Latitude [DD]	Longitude [DD]	Detection range [m]	
	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 configuration		0
Specify GPS Trigger configuration.		
udge Factor:	GPS positions (Parameter based) Detection range (Macro based)	
1,000 <b>•</b>	20,00	m
	20,00	m
· ·	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_ <b>lat</b>	interpolated gps latitude
name_ <b>long</b>	interpolated gps longitude
name_ <b>ptrig_150</b>	trigger output of parameter based trigger (n)
name_ <b>pdist_150</b>	distance to trigger of parameter based trigger (n)
name_ <b>mtrig_110</b>	trigger output of macro based trigger (n)
name_ <b>mdist_110</b>	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	B1C70
GPS_Trigger_mtrig_2	C70
GPS_Trigger_pdist_2	C70
GPS_Trigger_ptrig_2	©1C70
GPS_Trigger_macro_lat_2	C70
GPS_Trigger_macro_long_2	C70

## 7.8 CPU Load Limits

As all microprocessors, the two processors of the MS 6 EVO 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 MS 6 EVO 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
- Logger configuration (total logging rate [kB/s], conditional measurement rates)

To help respecting the limit of 85 % CPU load, the MS 6 EVO 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 MS 6 EVO resets due to complex configuration setups, please consider reducing the demands on the MS 6 EVO adapting the influencing factors mentioned above.

## 8 CAN Configuration

The MS 6 EVO has 3 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 MS 6 EVO 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).

### 8.1 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 💁		Nam_rr 🎯				
M Ia	Message Row Payload A Id Counter		d Area						

## 8.2 CAN input

### 8.2.1 Input configuration

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



### 8.2.2 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.

e AN-IN message and an o	ptional multip	olexer.		<
A V				
(A)				
×				
	hex		Extended	
	ms	Default value:	0	raw
		Raw:		
	none			
rte ▼		Value:	0	
		Length:	1	
nsigned 🔻		Endianes:	Big 🔻	1
				1
∕te ▼				
		Length:	1	
signed 💌		Endianes:		1
loighta			Lino	J
2 3		4 5	6 7	
0	none/Bit	Minumum:	0.0	none
	none	Maximum:	255,0	none
one 🔻			Adjust automatically	
ne -				
ew name:		The CAN-IN mes	sage will be added for measuring	a in the
	Ŧ	specified sheet.		,
	signed	signed 2 3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Length: signed  Length: Endianes: 2 3 4 5 1 1 1 1 none/Bit Minumum: ne ne w name: The CAN-IN mes specified sheet.	Length: 1 signed  Endianes: Little  Constraints Little Little  Constraints Little Little  Constraints Li

5. Click 'OK' when done.

The channel is listed in the Data window.

CAN Bus 1		C	AN Bus 2			CAN Bus 3		
Baudrate:	1 MBaud	• в	audrate:	1 MBaud	-	Baudrate:	1 MBaud	•
CAN Resistor:	off	• c	AN Resistor:	off	¥	CAN Resistor:	off	Ŧ
CAN Out start delay:	0 ms	c	AN Out start delay:	0	ms	CAN Out start delay:	0	ms
:AN Out rate limit:	0 messa	iges/ms C	AN Out rate limit:	0	messages/ms	CAN Out rate limit:	0	messages/m
AN Bus 4								
Baudrate:	1 MBaud	-						
AN Resistor:	off	-						
AN Out start delay:	0 ms							
and the second second	0 messa	iges/ms						
AN OUT rate limit:								
AN OUT rate limit: AN configuration fill	level							
CAN OUT Fate limit:	level CAN In IDs 1	/ 128				CAN Out IDs 0 / 12	3	
An Out rate limit:	level CAN In IDs 1 CAN In channels	/ 128				CAN Out IDs 0 / 12 CAN Out channels 0 /	3 400	
AN CONFIGURATION FIL	CAN In IDs 1 CAN In channels Add CAN-OUT +	/ 128 s 1 / 500 t 🛄 Delete				CAN Out IDs 0 / 12 CAN Out channels 0 /	3 400	
AN OUT rate imit: AN configuration fil Add CAN-IN + A ime • •	CAN In IDs 1 CAN In channels Add CAN-OUT - Edi CAN ID	/ 128 s 1 / 500 it 🕞 Delete Start Bit	<ul> <li>Length [Bits]</li> </ul>		Grid 💌 Multij	CAN Out IDs 0 / 12 CAN Out channels 0 / - plexer Value Type	3 400 • CA	N Bus



#### CAN channel configuration

### 8.2.3 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 MS 6 EVO 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 MS 6 EVO, insert the channel in an online measurement sheet which is described in the chapter Setting up an online measurement [> 76].

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

### 8.2.4 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.

	Celbration/Measuring	DDU7.rlp - RaceCon V2.5.0.2002	
System Logger Display Calibration,Measuring Tools	Folder/Sheets Format		
0007 Race Mode Nessuring Recording Sature Node Nessuring	Create dataset Connece A2.  Connece A3.  Co		
B Measurement Folder 1		4 6	Data - Sheet 1 # R
		Drag + Drop	In Security
			The second
🛐 Sheet 2 🧱 Sheet 1			Quentization: I ber//nc Limite:0.255 Format:163.0 Factor: 1 Offsett0 Data tvoe: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.

### 8.2.5 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.

Name									
Turno I	Unit	ld	Size	RowCtr	RowVal	Descrit 🔺		aps	
всск	g	777	8			Vector,		am	
accy a	g	777	8			Vector	Add ->		
accz	g	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		
🜛 ay1_Bremse60	g	5C0	16			Vector			
🜛 batt_u	V	779	8			Vector	Remove all		
battlow_b		77A	1	0	5	Vector 💌			
l i i i i i i i i i i i i i i i i i i i						•			

- 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.

## 8.3 CAN output

### 8.3.1 Output configuration



### 8.3.2 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 Looser Diseley Celbration/Melasuring Tools	System DDU10.rlp - R	aceCon V2.5.5507.11 *		×
DUUD Settu Book				
Project P	DO New Project DOULO ×			Toolbax 9 x
ef New Project           Image: The Project	OUISIO CAN Inscription of white weights         Image: Canadian of the canadia	CAN ba 2 Buchtai: 198ed CAN Restor: CAN Restor: CAN Cost and day: CAN Cost and day: CAN Cost and bit: CAN Cost and Cost and CAN	CM bits 3           Back size:         1 Meed           CM bits 5:         of           CM bits 5:         of	Constant
neetros C × 2 21 V standard • 3 • 0 201 Son Son all Nome / ● Source ● Descripton	C CH Ba 2. C CH Ba 2. C CH Ba 3. C CH Ba 4. C CH	CAN receipt States (Section) Oncos of and point Centor (Maning) () Messages To The Societ Nessage	s   C foreach   A Feature ch	Pol-51     Pol-51     Pol-51     Pol-51     Pol-51     Pol-51     Pol-51     Pol-52     Pol-52

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

ew CAN-OUT messag	ge				
New CAN-OUT me	ssage				
Configure the CAN	-OUT message and an optional multiplexer.				
Name:					
CAN Message					
Description					
CAN ID:	0	hex	Extended		
Grid:	100 ms 👻		Trigger channel:		*
			Triagor op:	Dialag	- odao
			i rigger on:	Rising	• edge
Use Multiplexer					
Representation:	Byte 👻		Value:	1	
Start:	0		Length:	1	
			Endianes:	Big	•
🔥 Add row 🔜 🛛	Delete row(s) 🛛 🗟 Add channel 📑 Add const	ant 🔄	Edit 🔄 Delete	Bit index inverted	
Byte 0	Byte 1 Byte 2	Byte 3	Byte 4	Byte 5 Byte 6 7 1	Byte 7
▶ 1 1		2 0 4 0	0 1 0 1 2 0 4 0 0		
				ОК	Cancel

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

	New CAN-OUT messa	ige				<b>X</b>
	New CAN-OUT me Configure the CA	essage N-OUT message and an optional multiplexe	r.			\$
	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	<b>*</b>
	Start:	0	-	Length:	1	-
				Endianes:	Big	-
Content of	🗟 Add row 📃	Delete row(s) Add channel 🗟 Add	constant	👌 Edit 🗟 Delete	Bit index inverted	
messaae	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	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.

	System	DDU10.rlp - RaceCon	1V2.5.5507.11 * _ ⊕ ×
Image: Section 2010         The section 2010         The section 2010         The section 2010           Image: Section 2010         The section 2010         The section 2010         The section 2010         The section 2010           Image: Section 2010         The section 2010           Image: Section 2010         The section 2010	System Windows In Tax San State Franks San San San San San San San San San San San San San San San San San San	COURSE - Course     Course - Course - Course     Course - Cou	Add rate CAN but down Add rate CAN but down Add rate CAN but down Add rate CAN but down Const the regioner of the the regionero of the regioner of the regioner of the regioner of the
Calculation terms	CAN E Baudi CAN E CAN E CAN E CAN E CAN E	Dire         Dire           Diret         0           Statute         0           Statute         0	
	- 340V		Metsigement Sources
Interest Source Description	Function	No information	Territory () Menager Con X
Resty.			No errors detected - all deared or state animouri 💌 🎒 New Project/20046 🚥 🚥

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

The measurement channel is now assigned to the CAN message.

#### 8.3.2.1 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.
- 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.

Name:         Can1er_100           Can1er_100         Description           Description         Image: Can1er_1 and Can1er_	ontigure the CA	N-OUT message and an optional multiplexer.					
CAN LE: 100 Decorption CAN LD: 100	ime:						
Decorption  CAN ID: 100	nTest_100						
CAN ID:         100         Image: Channel:         Image: Channel:           DLC:         8         9         bytes         Tagger channel:         Image: Channel:	scription						
DLC:         8         byte         Tingger channel:         I           God:         100 ms         Tingger channel:         Rang           Uber Mutspieser         Tingger channel:         Rang           Stat:         0         Longht:         1           Stat:         0         Longht:         1         C           Endarres:         Lefte         Endarres:         Lefte         1	AN ID:	100	≑ hex	Extended			
Gidd:         100 ms         Tigger on:         Rang           Use Multiplexer	LC:	8	bytes	Trigger channel:		$\sim$	
Ube Mukiper           Representation:           Byte           Value:           1           Stat:           0           Endance:           Endance:           Utile           Bit index inverted	id:	100 ms	$\sim$	Trigger on:	Rising	~	edg
🖁 Add row 🔜 Delete row(s) 🛛 🔯 Add channel 🔯 Edit 🚱 Delete 🛛 Bit index inverted	epresentation: .art:	Byte 0	*	Value: Length: Endianes:	1 1 Little	<b>↓</b>   <b>↓</b>   ↓	
Byte 0         Byte 3         Add constant         Byte 3         Byte 4         Byte 5         Byte 5         Byte 5         Byte 3         Byte 4         Byte 7         Dia 24 56 7 0 12 34 5	Add row Byt 0 1 2 3 1	Delete row(s) Add channel	Edit 强 Byte 3 3 4	Delete Bit index Byte 4 5 6 7 0 1 2 3 4 5	inverted Byte 5 6 7 0 1 2 3 4 5 6 7 0	Byte 6 Byte 1 2 3 4 5 6 7 0 1 2 3 4 counter1 ☑ chksu	7 5 (

#### 8.3.2.2 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				1	J.
Name:							
counter1							
Representation:	Byte	$\sim$					
Start:	6	-	Length	1:	1		Ę
Right shift:	0	-	Endiar	nes:	Little		``
Counter start:	0	÷	Counte	er end:	255		¢
0 1	2	3	4	5	6	7	
Ĺ	Ī	Ī	Ĩ	Ī			

#### 8.3.2.3 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.

 $\times$ 

CIICK OK When done.

 Add new CAN out contant
 Add new Checksum
 Specify the properties of the CAN out Checksum.

 Name:

 IPlease enter a name for the CAN out checksum

 Position:
 0
 ①

3

Select bytes the checksum should be computed from (7 bytes selected)

3

4. Click 'OK' when done.

2

2

Checksum type: CRC8 (8H2F)

# 8.4 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.

Cancel

- Re-use (multiplex) of message identifiers by splitting it into several rows.

OK

- 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.

Station Locor Diplay Calibration/Measuring Tools W:	New CAN-IN message	
	New CAN-IN message Configure the new CAN-IN message and an optional multiplexer.	<b>C</b>
DBUID Race Mode visible Protection Sheet locked	Name: CANThonad	
Protect 0 x DEFray Protect COULD x	Description	Teshov 9 x
B 04 New Project		Devices
COUDICAL Inserger outwoon     CAN Bass     CAN Bass	CAND 0 0 0 0 mm Edwarded Tmeout 0 0 mm Defaultwater 0 0 0 mm Valaure Valae Valae	CA-H1     C
CAN Bus 3     CAN Bus 4     CAN Bus 4     CAN Bus 4     CAN Out rate limit:     CAN Out rate limit:     CAN Bus 4     CAN Out rate limit:     CAN Bus 4	Vise Maltglean Representation Byte Value: 0	0 ms 0 messages/ms 0 messages/ms 0 messages/ms 0 messages/ms 0 messages/ms 0 messages/ms 0 ms 0
Glickwison Items     Guidrate: I Miteud     Marcol     Marcol     Marcol     Marcol     Marcol     CAN Resistor: or     A Conditional Channels     CNN Out start oblay;     Glickwison Jacksments	Start 3 (2) Leogh 1 (2) Type (Unigned + Endonos (2) (2) Data Representation: (2) (2)	■ 41513 ■ 41513 ■ 4950 ■ 4950 ■ 4951 ■ 4955 ■ 4955 ■ 4955
Masser Derkes     Messerement Container     Concourtous mit     Concourtous mit	Start         0         0         0         Lergft:         1         0           Type         Lingsid         •         Endones         Link         •           0         1         2         3         4         6         7	9.965 1962.8 1962.8 1962.8 1962.8 1962.8 1962.8 1962.8 1962.8 1962.8 1962.8 1962.8 1962.8 1965.8 196
Nome A	Conversion	CAN Bus     V     GAN Bus
Show all     Muttploxer     Nome     No     No	Factor:         1.0         0         mone/Bit         Minumum.         0.0         0         none           Offset:         0.0         0         none         Maximum.         255.0         0         none	CAN Bus 1 III By Sture ECU CAN Bus 1 IIII CAN Bus 1
infor motio	Untgroup: Adjust automatically	Braver control unit     B PROXEO     T      Description
Intra (IO n statistics ⊂ Math Channels ⊂	Unit: Inone  Messurement Sheet	Messurement Bernets Messurement Sources
arfo / Status	Select one, or enter a new name:	• x
Errors      Warnings     Message     T Time Sender Message	OK	0/0 X
Trian CAN Log - Stopped STS Log - Stopped		

- 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.

A set index	Column (c)         Image           COLID CAL Insurance         Image	Nex CAN OUT message In CON OUT message Configue the CAN OUT message and an optional multiplear. Nex : Nex : CON Mussage Deverytion Con D D D D D D D D D D D D D D D D D D D	Toolte         0           00000         00000           00000         00000 </th
Annu at a second and an annu at a second a	Cit conjuganto lilicol Cit conjuganto lilicol A del CAN EL Canación del Canación Nare Cit del Consecto del Canación Con El Canación del Canación Con Canación del Canación del Canación Con Canación del Canación del Canación Con Canación del Ca	Control     Control     Control     Control     Control	Sick a     Sick a

- 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.
| Specify the prop        | erties of the CAN out channe | əl.       |            | 5  |
|-------------------------|------------------------------|-----------|------------|----|
| Channel:                |                              |           |            |    |
| 📾 📑 b_pwr_good          |                              |           |            | •  |
| 8 Bit unsigned / little | endian                       |           |            |    |
| Representation:         | Byte 💌                       |           | Multiplexe | d  |
| Start:                  | 4                            | Length:   | 2          | \$ |
| Right shift:            | 0                            | Endianes: | Little     | •  |
|                         | Force quantization           |           |            |    |
| Factor:                 | 1.0                          | Offset:   | 0.0        | -  |
| Туре:                   | Unsigned -                   |           |            |    |
| 0 1                     | 2 3 4                        | 4 5 6     | 7          |    |
|                         |                              |           |            |    |

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

System Logger Display Co	Ibraten/Messing Tools Window	s New CAN-OUT message	rlp - RaceCon V2.5.5507.11 *	-	-	<b></b> X	0 ·
A Nor Project     Service	Conception of the second seco	Her CA-017 message         Configure Mice CA-027 message and           Configure Mice CA-027 message and         Discretion           Discretion         0           Out II         0           Out III         0           Out IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII	an optional multiplear:	Convoid Convoi	Puray 1 1 9 9 8 1 8 9 9 9 9 9 9 9 9 9 9 9 9 9	* • • • • • • • • • • • • • • • • • • •	Constant Constan
Jafo / status ● Errors ▲ Warnings (L) Messages T Trise Seder Messages bits / Status CAV Lag - Stargeet = Stargeet bits / Status = CAV Lag - Stargeet = Stargeet	a (	_	_			No errors becass - all deared of	e x 0/0 X

### 9 Export and Import in RaceCon

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

### 9.1 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.

Export displayed content to		×
Selected items below will be exported. Please click 'Export' to select a destination to store to.		€
Image: Second structure         Image: Second structure		
Select all Deselect all	ort as patc	h file
Export	Cance	

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

### 9.2 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.

	roject:	Current Project:	
Category:	All		
Filter:	Exact V Type a Name	Imported elements: 👃 👔 Missing Links: 🌷 👔	
	uel sptrigger peed DU10 E Logger Display CAN Bus 1 CAN Input a can1_0x200_Rx_ana03 can1_0x200_Rx_timestamp_1ms can1_0x200_Rx_tub can1_0x200_Rx_tub can1_0x300_Rx_speed can1_0x300_Rx_trigger can1_0x301_Rx can1_0x301_Rx can1_0x302_Rx can1_0x302_Rx can1_0x302_Rx can1_0x302_Rx can1_0x302_Rx	<ul> <li>Wew Project</li> <li>Fuel</li> <li>Laptrigger</li> <li>Speed</li> <li>DDU10</li> <li>Logger</li> <li>Display</li> <li>CAN Bus 1</li> <li>CAN Input</li> <li>CAN Input</li> <li>CAN Bus 1</li> <li>CAN Bus 2</li> <li>CAN Bus 2</li> <li>CAN Bus 3</li> <li>CAN Bus 4</li> <li>Computed Channels</li> <li>Events</li> </ul>	

- 4. Select channels to import.
- 5. Drag and drop the channel to 'CAN Input' of desired CAN bus on right hand side.
- 6. Click 'Finish'. If a measurement channel belongs to more than one source (e.g. MS 6 EVO and MS 6), the 'Solve Label Ambiguity' window opens.

Importing from file dummy.rex(2.13.1.4)	— C	1 ×
Select for all ambigous objects the appropriate one.		•
Solve label ambiguity		
Ambigous Label	Target Label	
Import File/DDU10/Logger/Logging1/New Group/accz	🐖 😬 Current Project/MS6-ECU/accz	
Import File/DDU10/Logger/Logging1/New Group/accy		
Import File/DDU10/Logger/Logging1/New Group/accx		~
	Do not link Current Project/DDU10/Calibration Items/accx Current Project/MS6-ECU/accx	
	< Back Next > Finish C	ancel

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

### 10 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

### 10.1 Setting up an online measurement

MS 6 EVO supports online measurement of sensor values and diagnostic variables.

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



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



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

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



Tabs to switch between sheets

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

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



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



If the MS 6 EVO shows the green status, the value is displayed.

RaceCon offers different types of measurement elements:

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60



Circular gauge

Temperature gauge

23,51

Vertical Bar graph style

Horizontal Bar graph style





Numeric indicator



Oscilloscope (Chart)

### 10.1.1 Automatic creation of measurement sheets

RaceCon can create measurement sheets automatically.

You can create and use measurement sheets with the MS 6 EVO 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.



Bosch Motorsport

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

2. To create the sheets, right-click on MS 6 EVO and select 'Create measurement views...' from the MS 6 EVO context menu.



The automatically created sheet is inserted in the Project Tree under 'Measurement Container' and 'Device Channels'. If the MS 6 EVO is connected to RaceCon and the status is green, live values of the channels are shown.

### 10.1.2 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'.

90,0 mV OFFSET MIN MAX ADJ_VAI	2500,000 -5,000 5,000 -0,000	mV G G	
Min Max Adj_Vai	-5,000 5,000 L 0,000	G G	
MAX ADJ_VAI	5,000 0,000	G	
ADJ_VAI	0,000		

### 11 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.

### 11.1 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.



### 11.1.1 Accessing the memory

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

System Locose Deplay Calib DDU30 Race Mode vielle Protection Studiet	ation,Measuring Too	System is Winds	ws		DDU10_Test.	'p - RaceCon V	2.5.5.0 - Masterlicense Bosch *	_ = ×
Status Mode Project Security								
del New Project     Expringer     DU9	Existing DOU 10 errors						(# <u>1</u>	Devices Display Generits Measurement Berrents
in the Logger	ML 🦲						Clear	Measurement Sources
Depty     D	Location A9020 ANA06 ANA07 ANA09	Type Open line Open line Open line Open line	Duration A 302 293 294 294 29 29	ctive True True True True	Data Time 14/2006 528 55 AM 14/2000 528 25 AM 14/2000 528 25 AM 14/2000 528 27 AM	Occurrences	Description 1.65 Larbert elementation and 1. No further information and 1. No further information and 1. No further information and 1. No further information and	Bock Ward     Cuterines Sensor     Antilog source     Antilog source     Antilog source     Antilog source     Characteristic Curve     Millingoint-Algometer     Characteristic Curve     Revolution     Velop     Characteristic Curve     Revolution     Velop     Censuled source     Antilogicated double
	Start detection of a	able harnels j /r	Canditional Channels	CAN mes	aages 🛙 📚 Macros 🛛 🛲	(Settings 0 De	race n 🕡 Browinks 🛱 Features of	Chaladariad Curve
Deta			0	× Info	/Status		$\sim$	= + ×
erer_					Errors(1) 🔥 Warnings	(32) (i) Messag	es(119)	152/152 🗙
Rene / Source	Description	No	information	Tys () () () () ()	e Time Sende 17:33:10 D010 17:33:11 D010 17:33:12 D010 17:33:13 D010 17:33:16 D010	- New Project - New Project - New Project - New Project - New Project - New Project	Message Successfully connected to device/(Effermed ERK check uncessfull, (ERK Device: DDU JD Device data matches the local data. Calibration data successfully uploaded and Successfully devend the error memory. Start of cable breakage detection successful	(NTP). (MAR_0401_TTT4) (ritalased. 64.
*				Inf	o/Status CAN Log - runn	ving		



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.

### 11.1.2 Clearing the error memory

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





### 11.2 Writing an Error

For the functional part of the MS 6 EVO system (MS 6 EVO -ECU) the error bits are related to the function and have to be distinguished if the function is activated. If an error is detected, the information may be shown as part of the error monitor in RaceCon, as display information and as measure channel. To support driver visibility, an activated error may activate also an output to enable the MIL-light (B\_mildiag will be enabled).

CW_EM_xxx	Individual error related to a function
0	Error will not be stored in the monitor
1	Error is stored in the monitor
2	Not valid
3	Error is stored in the monitor and the MIL condition is switched on

The single error bits may be collected in the error monitor.

### **11.3 Error Memory Properties**

The following property is available for the error memory itself.

CLRERRMON	Reset of the error monitor
Error Status /device	measurement label error_state
0	No error present in the 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 value (0, 1 or 2) is translated into a verbal description.

Measurement list					
CLRERRMON	TRUE -				
error_state_MS7-ECU	Active error(s) present				
error_state_MS7 Logger	Active error(s) present				

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

0 (no error present in memory)

	hration Measuring Tools	System	DDU10_Test.rlp	- RaceCon V2.5.5.0 - Masterl	icense Bosch *	_ = X
DDU9 Status Status						
Project P ×	New Project DDU 10	×				Toolbox 🔍 🗸
- And New Project						Devices
Captrigger					_	Display Elements
	D. 117-1001140				•	Measurement Elements
DDU10	Existing DDU 10 errors					Measurement Sources
👜 📾 Logger	MIL 🔵				Clear	Sensors
Display	Location Typ	e Duration Acti	ve DateTime	Occurrences D	escription	Bosch Wizard
CAN Bus 1						Customized Sensor
CAN BUS 2						<ul> <li>Analog sources</li> </ul>
CAN Bus 4						Characteristic Curve
Computed Channels						Multipoint Adjustment
🚽 🛷 I/O Channels						Sensitivity/Offset
- 🧠 Calibration Items						Frequency sources
🖏 Macros						Characteristic Curve
f <sub>x</sub> Math Channels						Revolution
f. Conditional Channels						M Velocity
Group adjustments						<ul> <li>Computed sources</li> </ul>
Sa Marter Devicer						Adjustment channel
Measurement Container						Characteristic Curve
						Display Switch
						Fuel
						Gear Cookup Table
						Figure And
						PWM Out
						Sensitivity/Offset
	Start detection of cable	2				Speed
	Statistics 🥼 🎸 Math Chan	nels 🛛 🎪 Conditional Channels 🛛 일	CAN messages 🛛 👼 Macros 🖉 📼 Se	ettings 👔 Device info 😡 Error	info 🎽 Features inf 👝	
Data			K Info / Status			
error_			😮 Errors(1) 🔥 Warnings(33	i) Messages(124)		158/158 🗙
📑 🔤 🦉 Show all			Type Time Sender	Message		*
Name / Source	<ul> <li>Description</li> </ul>		A 17:35:13 DDU10 - 1	New Project Lost connection b	a device(Ethernet/XCP).	
			(i) 17:35:20 DDU10 - 1	New Project Successfully conn	ected to device(Ethernet/XCP).	
			<ol> <li>17:35:20 DDU10 - 1</li> </ol>	New Project EPK check succes	sful. (EPK Device: DDU 10_BASE_0	401_TST4)
		No information	(i) 17:35:22 DDU10 - 1	New Project Device data matc	hes the local data.	
		No information	17:35:22 DDU10 - 1	New Project Calibration data s	uccessfully uploaded and initializer	1.
			1/:35:54 00010-1	New Project Successfully clear	ed the error memory.	*
< m	ь		Info / Status CAN Log - running	,		
					1.0	

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

	ration Mean rion To	Syste	m		DDU10_Te	st.rlp - RaceCon	/2.5.5.0 - Mastericense Bosch *	_ = X
DDU9 Status				-				
Project P ×	New Project	U10 🗙						Toolbox 🛛 🖓 🗙
D. Ant. New Project								Devices
Laptrigger							_	Dienlay Flamente
😥	-						@ = !	Measurement Elements
DDU10	Existing DDU 10 errors							Measurement Sources
👜 - 📾 Logger	MIL 😑						Clear	Concert
😥 . 💼 Display	Location	Type	Duration	Active	DateTime	Occurrences	Description	Borch Witterd
GAN Bus 1     GAN     GAN Bus 1     GAN     GAN	ANA04	Open line	114.3	False	1/4/2000 6:28:26 A	M	1 No further information avai	Customized Sensor
B. CAN Bus 2	ANA06	Open line	113.9	False	1/4/2000 6:28:26 A	M	1 No further information avai	Analog sources
CAN Bus 3	ANA07	Open line	113,5	False	1/4/2000 6:28:26 A	M	1 No further information avai.	Characteristic Curve
CAN bus 4     Computed Channels	ANA09	Open line	113,1	False	1/4/2000 6:28:27 A	M	1 No further information avai.	Multipoint Adjustment
1/O Channels								Sensitivity/Offset
								<ul> <li>Frequency sources</li> </ul>
🧑 Macros								Characteristic Curve
f Math Channels								Revolution
f <sub>e</sub> Conditional Channels								Telocity
<ul> <li>Group adjustments</li> </ul>								<ul> <li>Computed sources</li> </ul>
All Marter Devicer								Adjustment channel
Measurement Container								Characteristic Curve
								Display Switch
								Carri ookuo Tabla
								Hystarasis
								Lantrigger
								N PWM Out
								Sensitivity/Offset
	Start detection of	cable						Speed
1 1	Statistics 🖉 Math (	Channels /	Conditional Channels	CAN me	ssages 🔍 Macros	🖬 Settings 🛛 👔 D	evice info 🛛 🥹 Error info 🛛 📅 Features inf	1
L. Data			J		L L	-		
						00 J 00 H	4.222	
					Errors(1)	ngs(33) (1) Messa	ges(123)	151/161
Snow all				h	/pe Time Ser	nder	Message	^
Name / Source	<ul> <li>Description</li> </ul>			Q	) 17:33:18 DD	U10 - New Project	Start of cable breakage detection successful.	
				4	17:35:13 DD	U 10 - New Project	Luss connection to device(Ethernet/XCP).	
		I		ä	) 17:35:20 DD	U10 - New Project	EPK check successful. (EPK Device: DDU10 BASE	0401 TST4)
		N	o information	d	) 17:35:22 DD	U10 - New Project	Device data matches the local data.	
				0	17:35:22 DD	U10 - New Project	Calibration data successfully uploaded and initializ	red.
								*
·	•			L	fo / Status CAN Log - r	running		
Ready.				_		i 🖯 🖯 🖯	IDU10, ANA09(Open line), for 113,1 s 🔹 🎼 New Pr	oject/DDU 10/I/O Channels 🔤 🚥 🚅

2 (at least one active error present in memory)



### 12 Recording

### 12.1 Features

- Synchronized recording of MS 6 EVO analog and digital input channels, MS 6 EVO 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)

### 12.2 Configuration of recordings

1. Expand the list of 'Loggers' by clicking on '+' in the MS 6 EVO Project Tree.



2. Double-click on 'Recording' in MS 6 EVO Project Tree. The recording configuration is displayed in the Main Area.



- 3. To add measurement channels to a recording, click 'MS 6 EVO' in the MS 6 EVO Project Tree. In the Data Area, the measurement channels are displayed.
- 4. Drag and drop desired measurement channels into recording group.

			DDU7.rlp -	RaceCon V2.5.0.2002				_ a x
System Logge	Display Calbration/M							
DOU7 Status	Add Colored Add	Rename Delete						
🚍 🗞 = 🎓 =								
0007						4.1	Data - DDU7	\$
DDU7 configuration manage Add new channel   Edit cl	ment sannel(s)   Delete channel(s)	1 Flat view					Show all Show all Name	• Sou • Description *
Group 1	Name	<ul> <li>Source</li> </ul>	Rate / True rate	· Condition	Telenetry	•	carid_dp_info_016	200U7 carid stored in d
Contraction (Contraction)	on.jgoni on.jgoni on.jgoni	Drag meas	ັສສ ສິສ		Recording p	roperties	Bendard, Java, San Bendard, Java	CCC/2         under store mild           CCC/2         under store mild
Recording US Settings	Statistics						Precision:0 Resolution:0 Conversion:cm lancount	~ *

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

MS 6 EVO 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 [> 91]' for more information.

### 12.2.1 Adding a recording

MS 6 EVO supports up to two independent recordings.

To add a recording, select 'Add Recording' from the context menu of the Logger in the MS 6 EVO Project Tree.



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

### 12.2.2 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.



### 12.2.3 Global settings

To display the global MS 6 EVO 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!

### 12.2.4 Recording statistics

The tab 'Statistics' shows the channels' allocation and their current data rate related to the transmission frequency of the MS 6 EVO 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 MS 6 EVO and limits the overall transmission speed.



### 12.2.5 Recording diagnosis

The channel 'statectrl\_ok' of the MS 6 EVO can be used for online monitoring of recording status.

Bit	Value	Name
0	1	RECORD
1	2	DATAOK
2	4	BLKOK
3	8	-
4	16	-
5	32	-
6	64	STARTED
7	128	-

#### Content of status bits

Name	Bitset	Bit cleared
RECORD	Measurement data is re- corded.	No measurement data will be stored because meas- urement thresholds are not reached.
DATAOK	Received data without error.	Discarding received data because of wrong timestamps. Check wiring of SYNC signal.
BLKOK	All measurement blocks have been set up cor- rectly.	Some measurement blocks have not been set up correctly.

Name	Bitset	Bit cleared
STARTED	A measurement has	A measurement is not set up. Either no recording
	been set up.	upgrade is not activated.

# 12.2.6 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.

DD0/iip*RateCol1v2:3.0.2002	
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Constant Con	
LUU/ Kace Hooe Messung Recording None WP d Nº Q Merga/Compare	
Status Mode Measuring Data	
Beasurement Folder 1	<ul> <li>Data - DOU7</li> <li></li></ul>
	Show all
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	Name Soul
	meas_ant_m03request
	meas_compression_m01
	meas_compression_m03
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	BIPCODE IN
	PM_ENABLE C
	rangemon_adc_high_error DI
	rangemon_adc_low_error DI
	REV1_Tmax
rtatecti_ok	REV2_Tmax
8 2 6 5 4 3 2 3	REV3_Tmax
	REV4_Tmax
	esserialnum Dt
	statectri_err
	BITELEMETRY MODE
	telemetry_state
	time_day
	trne_hour
	📑 time_min 🔳 DC 🖛
	< >
	and statectri_ok *
	Provided by DDU7
	Comment of a star and a surger of
	ourmary or system and measuremen
	Quantisation: 1/nc
	Format: %1.0
	Predsion:0
3 Sheet 1 2 3 Sheet 1	K IT B

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, MS 6 EVO 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.

### 12.2.7 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'.

Measurement label	Function
card_part1_size	Size of the first logging data partition in MB.
card_part2_size	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).
ftp_UserLoggedIn	This measurement allows to monitor for active FTP connections. RaceCon (WinDCP) and WinDarab may not connect in parallel.
meas_globcond_m01 / _m03	State of the global logging start condition for first / second logging. TRUE means data is actively recorded.
meas_rate_m01 / _m03	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.
meas_cnt_ecu / _fde	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.
meas_cnt_int / _forked	Processed data blocks per media (internal / USB).
meas_compression_m01 / _m03	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.
meas_pretrig_buf_size_ecu / _fde	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.
meas_backend_buf_size_ecu / _fde	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.
meas_write_rate_intern_001 / _002	Effective data write rate to internal storage media, after compression, for first / second logging.
meas_write_rate_usb_001 / _002	Effective data write rate to USB storage media, after compression, for first / second logging.

### 12.3 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 L	ogger 🗙	
- Reg New Project	MS6 Logger Events		
MS6 Logger	🖉 Add Event 🍠 Edit	t Event 🖌 Delete Events	
🔬 - 📾 Logger	Active Name	V Description	
😥 📑 CAN Bus 1	Temperature	inh Chip temperature is critical high	B tempHigh
庄 – 🛄 CAN Bus 2			b_tempingri
E CAN Bus 3		Edit Event	×
Computed Channels		Edit Event	
- Calibration Items		Direct ellers in décide te edute enderte derroit	
Macros		Fill out all required fields to edit the selected event.	
free Math Channels		Name	
	×	Tamparatura High	
Properties 🖓	x		
📑 🗍 🍸 standard 🔸 📑 🗸 🔞		Description	
Y Event properties		Chip temperature is critical high	
Description Chip temperature is critica	al bio	Category	
Name TemperatureHigh		Warning	~
		Trigger Channel	
		📾 🙆 B_tempHigh	et 1997 -
		Edge	
Name		Rising	~
	- Statistics 🏾 🌾 Math Ch	Reset Delay	
		200	🔶 ms
Data			
Starts with $$			
🗲 🗋 Show all			OK Cancel
Name 🛆 🗸 Source	<ul> <li>Description</li> </ul>		

Display in WinDarab:



Events rules					ů ×
Name		•	Creator	Computer/Source	Desc
User defined events	۲	0			
▲ ♦ Chassis		0			
DamperFL_on_bump	۲	0	KAM7FH	ABTZOKEI	
▲ Gearbox		0			
Shift_2-3	۲	0	KAM7FH	ABTZOKEI	
A O SYNC		0			
@ sync_issue			KAM7FH	ABTZ0KL1	
MS6 Logger		5			
@ Test_event_2			RaceCon	MS6 Logger	
File events Events rules					

### 12.4 Data Logger and USB recording

### Default settings:



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.

### 12.5 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 DATA\_USB enables USB recording. To activate Software Upgrade DATA\_USB, enter the license key as described in the chapter 'Feature activation' [> 42].

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.

### 12.5.1 Recording data on USB device

- 1. Plug an USB device to MS 6 EVO.
- 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 MS 6 EVO.
- 5. Record measurement data. If an USB device is present, the MS 6 EVO 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.

WebBasb v7 Developer - Formula3		-	0 ×
Start Took Windows			style 🗸 🔞 🗸
Trace     Pactor       Consumed - Low     Exactor       Consumed - Low     Exactor       Consumed - Low     Exactor       Consumed - Low     Exactor       Consumed - Low     Work Intel       Uncluster Low     Consumed - Low			
Filisplorer a X	Channels		9 ×
	References from		3
	Name	Source	Descripti
freeds			0. ×
The Cor From To Durator/Durate/Mes Mus			

- 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 Logger Import		-		×
Settings Current Import Recent Import				
Import sources FlashCard / USB-Stick Device Burst	Common options Delete ARP cache entry after Force password, if not set by	ping to devic recording co	ce failed. Infiguration	::
Device/Flash Device / IP: 550  Export file: One file for each I Save files in: D:\daten	→ ✓ ✓ Import	all on connect transferred latest files fi	ct files irst	
Subfolder template:	o] outing [outing03]-[lap03]-[n]		✓ [a]+ ✓ [a]+	
Advanced Comment Fields	ß	Арр	ly 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.



- 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.

### 12.5.2 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 MS 6 EVO 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!

### 12.5.3 Troubleshooting

When no data on the USB device is recorded:

Configure the measurement label **usb\_mediastate** on a RaceCon measurement view or on a MS 6 EVO 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 MS 6 EVO 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 MS 6 EVO.
6: Error: Media corrupt	The USB device is not in valid BFS format. (Hint: Re-format the USB device in RaceCon.)

## 13 Lap Trigger

### 13.1 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)



### 13.1.1 Electrical trigger signal

In MS 6 EVO 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)

### 13.1.2 GPS Lap trigger

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

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



Photo: Google Maps

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

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

			$\vec{a}$
Define the latitude and lonaitude of the GPS		Laptiger configuration General Presetting Conditions Trigger Countdown Segment timing GPS Descript Data data	
detection point.		Decimal longitude:	DD
		8,56584700	DD
Define the detection			m
detection point.		urs charine source: Longitude source:	-
Define the channel		Latitude source:	•
sources for Longitude,	$\leq$	GPS direction source:	-
Latitude, Direction and Speed.		GPS speed source:	•
	Configuration		

#### 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.

### 13.1.3 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.

### 13.1.4 Forced triggers

Lap distance based insertion of 'forced trigger'.

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

### 13.1.5 Setting up a lap trigger

- 1. Click 'Measurement Sources' in Toolbox.
- 2. Drag 'Laptrigger' into 'System Overview'. Do not drop it on 'MS 6 EVO'!



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



a) Change signal device, if desired.

Onfiguration

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.

		1
asat values for lan counter	Laptrigger configuration	0
eset values for tap counter	General Presettings Conditions Trigger Countdown Segment timing	
nd outing counter 🛛 🛛 🤜	Lap counter start value:	aps
	Outing counter start value:	
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est lantime' is accented	Lap time threshold:	
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reset value for 'best laptime'	Lap une best preset:	s
	Configuration	Ō
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desired.	Speed source:	
ntor minimum croad for	and a speed	
	Ain. speed:	km/h
igger release.	Track distance:	
	4000 🖗 r	n
efine settings for distance	Min. distance:	04
ased retriager protection	20 (2)	m
used realigger protection.	V Enforce laptrigger	2
	Max. distance:	
	120 🗽	16
efine settings for distance	440 /	n
ased forced trigger.		
	Configuration	
		12
	Laptrigger configuration	Ú
efine settings for lap timing	Consent Resettions Conditions TriONE Constitution Consent trains	
	General Presettings Conditions Trigger Countdown Segment timing	

Laptrigger configuration
General Presettings Conditions Trigger Countdown Segment timing
Detection time: 15 🔆 ms
Retrigger lock time:
Use intermediate trigger
Detection time: 30 (b) ms
Retrigger lock time:

Configuration

			1
		Laptrigger configuration	(U)
		General Presettings Conditions Trigger Countdown Segment timing	
Define settings for countdown		Mode:	
		None	
umer.		Start Imag	
		120 ± 5	
	1971 - A		
	Comgaration	n j	
Define settings for segment timing.	•	Experience (Increasing)         Constants)         Toger           Mode:         Increasing         Increasing         Increasing           Mode:         Increasing         Increasing         Increasing           Lop segment distance from main bugger:         Increasing         Increasing	Ø
	Configuratio	tion	

#### Only applicable for a GPS Laptrigger

Define the latitude and	Laphigger configuration
ongitudo of the CDS	General Presettings Conditions Trigger Countdown Segment timing GPS
origitude of the GPS	Decimal latitude:
letection point.	49,32777400 DD
	Dedmal longitude:
	8,55584700 ÷ DD
	Laptrigger detection range:
Define the detection	20 🖈 m
anae around the	GPS channel sources:
	Longitude source:
letection point.	The second secon
	Latitude source:
ofing the channel	
	GPS direction source:
ources for Longitude, 🛛 🔫	gps_direction
atitude Direction and	GPS speed source:
utitude, Direction und	m mg gps_speed
Speed.	
	Configuration

### 13.1.6 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



### 13.1.7 Lap trigger presettings

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



## 13.2 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 [▶ 109])

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'.

### 13.3 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

### 13.3.1 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.





### 13.3.2 Distance based retrigger protection

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

		1
	Laptrigger configuration	
Change signal for vehicle speed,	General Presettings Conditions Trigger Countdown Segment timing	
f desired.	Speed source:	
	a speed v	
nter minimum speed for	Min. speed:	
	20 🛱 km/l	h
rigger release.	Track distance:	
	4000 <u>0</u> m	
efine settings for distance	Min. distance:	
· · · · · · · · · · · · · · · · · · ·	20 🔄 %	
ased retrigger protection.	800 m	
	Enforce bptrigger	
	Max. distance:	
	120 😓 %	
	4800 m	
Define settings for distance one for distance one forced trigger.		
	Configuration	


#### 13.3.3 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.





### 13.4 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

#### 13.4.1 Sub trigger mode

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

To deactivate sub trigger mode uncheck box.





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

#### 13.4.2 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'.





#### Main Trigger

### 13.5 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.



#### 13.6 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.

nera	Presettinas	Conditions	Trigger	Countdown	Seament timina	GPS	Known Racetracks			
Decim	al latitude:									GPS Track detection
								49,32777400 🜲	DD	Override Track distance & position
Decim	al longitude:									
								8,56584700 🜲	DD	
Laptri	gger detectio	on range:								
								30 🜩	m	
	gps_lat									~
onaitu										~
ongitu	gps_long									
ongitu	gps_long	:								
ongitu PS dire	gps_long ection source gps_direct	:: ion								~
ongitu PS dire PS dire SPS spe	gps_long ection source gps_direct eed source:	:: ion								Y

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.

neral	Presettings Conditions Trigger Countdov	n Segment timir	ng GPS Kno	wn Racetracks	
Builtin R	acetracks			User defined Racetracks	
Active	Track	^		Active Track	Add Track
$\checkmark$	Lime Rock Park			Nürburgring Nordschleife	Edit Trade
$\checkmark$	Magny cours				Eult Irack
$\checkmark$	Misano				Remove Track(s)
$\checkmark$	Monza				
$\checkmark$	Ningbo Speedpark			Edit RaceTrack 'Nürburgring Nordschleife'	
$\checkmark$	Nogaro				
	Nürburgring			Specity Racetrack properties	
$\checkmark$	Oschersleben		Conv	The GPS position indicates the position of the start-finish line.	
$\leq$	Oulton Park		Track >		
	Paul Ricard			Track Name: Núthursting Nordaphiafo	
	Pau-Ville			Nabarging Nordsenere	Get values from Laptrigg
	Portimao circuit			Track length: 25378 🖨 m	GF5 definition
	Portland Int Raceway			GPS Latitude: 50,33401400  DD	
	Redbuiring				
	Rodu America			GFS Longitude. 6,34527800 DD	Set values to Laptrigge
	Sepana				GPS definition
	Shannhai				
	Silverstone				
	Slovakiaring				OK Cano
	Spatterton 200				

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

### 13.7 Predicted Laptime

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

#### 13.7.1 Setting up the predicted laptime

To use the predicted laptime function you need to set up a laptrigger as described in the chapter Lap Trigger [▶ 100]. Under the ribbon "Segment timing", you need to choose your segmentation mode which can either be distance or intermediate trigger based.

	Gener	al Presettings Conditions Trigger Countries	Segment timing GPS	
ance or	Gener	a Presetangs Conditions migger Countait	With Segment analy Gro	
rmediate	Mode	1		
ger 🚽	Dista	nce		
	V U	se predated laptime		
er your	Lap s	egment lengths and times		
nent time	Nr.	Segment length (m)	Segment time (s)	
distance	1	500	44,800	
	2	1.000	93,200	
	3	1.500	135,600	
r your	-			
	Entire	e lap time:		

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

#### Note

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

#### 13.7.2 Functionality and channel outputs

Following output channels are generated by the predicted laptime function.

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

### 14 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

#### 14.1 Software setup

Drop Telemetry from Toolbox into system overview.

	System	Systemtest C80_BASE_0516.rtp - RaceCon V2.9.0.10 - Masterloense Bosch *	_ = ×
System Logger Display Ca	bration/Measuring Tools Windows		0 •
MSGLog Race Mode with Protection Sheet	Workspace: Show grid Shap to grid Show al		
Connection _ Hoose _ Hopect Security	Arrangement spesa		
Project V X	tage RaceCarinZ3		
			Devices           #52.4           #52.4           #52.4           #52.4           #52.4           #52.4           #52.4           #52.4           #52.4           #52.4           #52.4           #52.4           #52.4           #52.4           #52.4           #52.4           #52.4           #52.4           #52.4           #52.5           #50.6
<ul> <li>Project properties</li> <li>Rance models validle</li> <li>True</li> <li>True Hassan</li> <li>Charling Charlos</li> <li>Version bast written</li> <li>2.6.0.10</li> </ul>		Drad&Orep	Charloging system     Trio     Co     C
Name			
The project's name.	Sul System Overview		Measurement Elements
Contains v statec			<pre>&gt;</pre>
	3 🖼 Show all		
Name / Source Con_stateCard MS&Log Statectrl_err MS&Log Statectrl_err MS&Log Statectrl_err MS&Log	Cardmemory protocol state recording dev	No information	
Ready.		V The errors detected - all deared or state t	nintum 🔹 📴 RaceCar#23 🚥 💼 🧃

Adding channels to telemetry

- 1. Expand the list of 'Loggers' by clicking on '+' in the MS 6 EVO Project Tree.
- 2. Double-click on 'Recording' in MS 6 EVO 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

MS 6 EVO 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**

lecording channels:	<u>B</u> ate:
_wheel_rr _wheel_rl _wheel_fr	10 ms
_wheel_fl	Condition:
	True rate:
	V
	Telemetru
	East T

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

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.



#### 14.2 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".

Telemetry settings				
General Settings				1
WD Server INI Folder	Use RaceCon project folder			
Project key:	04d2			hex
Configure on Device:	E80 Logger		~	1
Device Settings			Channel settings	_
Type:		N	Distance channel:	
LTE65	~	2	🛺 🏊 Laptrigger_lapdist_dls	$\sim$
Mode:			Lap number channel:	
Ethernet	~		👭 👜 lapctr	$\sim$
Destination IP: 10	0.10.0.235		Lap fuel channel:	
Destination Port: 10	000		🐺 🔄 Fuel_fuelcons_dls	$\sim$
Data Rate:	20 4	it/s	Previous lap time channel:	
		140	🕌 🔄 Laptrigger_laptimeold_dls	$\sim$
Cloud statistics en	abled		GPS Latitude channel:	
<ul> <li>By enabling Cloud channel data will</li> </ul>	d statistics, I understand device distance or GPS be decoded and available to Bosch in the Bosch		🕌 😁 gps_lat	$\sim$
LTE Cloud.			GPS Longitude channel:	
To enable the Bo channels must be	sch LTE cloud, at least the Distance or both GPS configured.		💭 🔤 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.

/	Welcome to RaceCon		New Project	FM40						4 Þ 🗙
	FM40 configuration & r	nanagen	nent							
	Add a new channel	🛃 Ed	it channel(s)	<u>]</u> elete ch	nannel(s)					
	Name		Source		Vidth [Byte]	~	Telemetry mode	~	Channel type	~
	acc_lat		DDU8		2		Slow			
	distlap		MS5.1		2		Fast		Lap distance	
	fuelcons		MS5.1		2		Fast		Lap fuel	
	lapetr		DDU8		1		Fast		Lap number	
	laptime		MS5.1		2		Fast		Lap time	
	xtime		FM40		4		Fast		Time	
ļ.	I FM40									

### 14.3 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.

4 Þ ¥

C70 Test.bmscfg - WinDarab Server		- 0 <b>X</b>
Workdesk CF-Cards Telemetry Protocol Options ? D ☆ D ☆ P ↔ ?		
	Computer Car	Application
Load         Load         Unit	computer car	Abbucation
21.12 (017.17.15 CF Using log T, CF Usert MID2abt/AppDatkLocal/Temp/WDServer Protocol log 21.12 (17.17.15); WDServer IP vertiguation: 21.12 (21.17.17.15); Usinemy on poly COD (1CP/UDP) 21.12 (21.17.17.15); Usinemy on poly COD (1CP/UDP)	1	
A 12.201 17.1257 (PC Configuration) and a USA was to start data data using Curr. 27.12.201 17.1257 CPC Configuration for Current Watch Construct MaceCon Projects/Dop_1224_00 in/ WDServer Settings		
Add'Car		
CarSettings		
Press F1 to obtain help.		NUM

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

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

Car settings		×						
Car settings UDP:10000 New: COM								
Car name	Data output to back	up system						
Name: Car #1	Port:	<b></b>						
Comment:	Baudrate:	9600 👻						
Folder with the DCP-Configuration files   Image: Straig straig with the DCP-Configuration files   Image: Straig stra								
Save to file:								
ОК Са	ncel 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 Change
Template for the darab file name
[year]-[mon]-[day] [hour].[min] Car [carname] File #[n]
Folder to save the darab files in
Change
OK Cancel Apply Help

- 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 Help

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

- To 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.

#### 14.4 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:

Cipue file										
- Computer + V	intervel_05.0	C) + Booh	<ul> <li>Wirdlands + Confi</li> </ul>	y + W05enet			• 4	Separation Station		
Organics + New Note									• II	4
1/ MinDanak v7	A Name		2 C	Data modeled	Type	See				
WDServer	#E MS	D-TrackEaptoy	- Cer #Eldmonds	11/10/2003 11/42	WinDarak Talamatry		3.98			
Esta Ne locatione										
Taurity										
RE Desktep										
A Devenipads										
Tacent Places										
L 01 Event Data UNP2	1									
Speed Secret										
and paperson										
Ubrates.										
2 Decuments										
J Marie										
Pictures 1										
H Valence										
d Humapoup										
N Camputer	+.:									
Fixname								All supported hiss	("Ampline"	11
These Indones Hadd +							Add failer to locations	Open	Cance	

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

### 15 Firmware

### 15.1 Firmware and configuration

MS 6 EVO holds 2 types of data:

Firmware: The software (PST program file) of the MS 6 EVO.

Configuration: The default parameters for controlling the output of the MS 6 EVO.

#### 15.2 Firmware update

Firmware updates are performed via XCP. Following standards are supported:

- ASAM MCD-1 (XCP); Version 1.5.0; Date: 2017-11-30
- ASAM MCD-2 MC (ASAP2 / A2L); Version 1.7.1; Date: 2018-01-30

Additional files for firmware update (like ProF-Scripts for INCA) will be provided by BOSCH.

## 16 Cloning the Unit

Chapter left intentionally blank

### 17 Fuel Consumption Calculation

# 17.1 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 MS 6 EVO!



#### A 'fuel consumption wizard' opens.

Select a fuel consumption sour	ce channel for computing the	fuel consumption.		18	
General					
Configure on device	DDU7	<b>-</b>			
Tank capacity		80,0 🌲 📔 🔫			
Fuel consumption calculation					
Mode	Using fuel consumed				
Fuel input	🐺 🔿 fuelcons	▼ X 0.001	Adaption fa	actor to [ml]	
Consumption correction factor	1.000			10/07	
Mode Target lap consumption	Last lap's consumption	3.0 💭 1			
Reset fuel consumption					
Mode	By RaceCon	•			
Wode					
Reset signal source					
Reset signal source Reset signal threshold	Low active signal	*			
Reset signal source Reset signal threshold Release threshold	Low active signal	▼ Not Used			

- a) Change device for fuel calculation, if desired.
- b) Enter tank capacity of vehicle.
- c) Choose calculation mode:

- using fuel consumed (summed-up fuel consumption)
- using fuel flow rate (momentary fuel consumption)

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

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

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

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

- using fuel consumption of last lap completed
- using target lap consumption (entered in the field 'Target lap consumption')

g) Choose values to initiate a reset of fuel consumption, if desired:

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

Press 'Finish' when done.

#### 17.2 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.	
	Settops Tak legacity 64,0 [ Consumption correction fieldor 1,000 Target lap consumption Target lap consumption Reset luef consumption Reset luef consumption Ø RassCale	Button to reset total fuel consumption (Reset with RaceCon only) Button to reset fuel consumption manually (Can also be triggered)
Settings overview	■ contouration (B) Fuel layrem_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

### 18 RaceCon Shortcuts

The table shows important shortcuts simplify controlling the MS 6 EVO in RaceCon.

Shortcut	Function
General navigation	
F1	Open RaceCon help
F2	Rename selected object
F3	Select Data Area
F4	Select Project Tree
F5	-
F6	Start the data comparison
F7	Start dataset manager
F8	Toggle WP/RP
F9	Start measurement
CTRL + F9	Start recording
F10 or Alt	Go to menu bar
F11	Toggle display to fullscreen 'Race Mode'
F12	Enlarge main screen
CTRL + Tab	Switch between opened windows
Project Tree	
Plus (+) at numeric pad or right cursor	Expand selected node
Minus (-) at numeric pad or left cursor	Close selected node
Star (*) at numeric pad	Open all nodes
DEL	Delete seleted object
Display page, measurement	: page
Cursor	Move selected display element one grid unit in chosen direction
SHIFT + cursor	Enlarge/reduce selected display element one grid unit
Tab	Switch between display elements

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EN IEC 62368-1:2020+A11:2020

#### Materials

REACH - Nr. 1907/2006

#### EMC

UNECE10:rev.6/AMD1:2020

KS-C9990:2017

ISO11452-2

ISO11452-4

ISO10605

ISO7637-2

ISO7367-3

ISO16750-2

US FCC: Title 47, Part 15 Subpart B

ICES-003

#### Testing

SAEJ1211

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The primary ANTLR guy:

Terence Parr parrt@cs.usfca.edu parrt@antlr.org

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xml\_io\_tools

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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					

### 20 Disposal

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

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

### 21 Pin Layout

The pin layout is available at Bosch Motorsport website on MS 6 EVO product page.

Most of MS 6 EVO functions to pin relations may be modified to project demands.

Please see details in the function description SWITCHMATRIX.

Bosch Motorsport tests check the defined connections of the pin layout.

Using a MS 6.1 EVO or MS 6.3 EVO version, ensure not using analogue inputs of the measurement package without enabled license.

For MS 6.1 EVO and MS 6.3 EVO, these hardware-options are only available if MS 6 EVO measurement package is in use.

#### Analogue Inputs

ECU Pin connector >A<	ECU Pin connector >K<	MS6.1 EVO MS6.3 EVO not available <sup>*)</sup>	MS6Cup EVO not available	І/О Туре	hardware	pin related functions	ecu_name	rec.wire size AWG	MS6 function recommendation	function to pin coordination	related physical input measure channel
A032				analog input	pullup 3k01, 12bit		I_A_ANA_FIXPU[1]	24	engine temperature sensor	PIN_IN_UTMOT	utmot
A033				analog input	pullup 3k01, 12bit		I_A_ANA_FIXPU[2]	24	oil temperature sensor	PIN_IN_UTOIL	utoil
A034				analog input	pullup 3k01, 12bit		I_A_ANA_FIXPU[3]	24	intake air temperature sensor	PIN_IN_UTINT	utint
A035		not avl.	not avl.	analog input	pullup 3k01, 12bit		I_A_ANA_FIXPU[4]	24	fuel temperature sensor	PIN_IN_UTFUEL	utfuel
A079				analog input	no pullup, 12bit angle- or time related measurement		I_A_ANA[12]	24	rail pressure sensor	PIN_IN_UPRAIL	uprail
A080		not avl.	not avl.	analog input	no pullup, 12bit angle- or time related measurement		I_A_ANA[13]	24	rail pressure sensor, bank 2	PIN_IN_UPRAIL2	uprail2
A081				analog input	no pullup, 12bit		I_A_ANA[1]	24	fuel pressure sensor	PIN_IN_UPFUEL	upfuel
A082				analog input	switchpullup 3k01 12bit	CWPULLUP_A082	I_A_ANA_SWPU[13]	24	oil pressure sensor	PIN_IN_UPOIL	upoil
A058				analog input	no pullup, 12bit angle- or time related measurement		I_A_ANA[14]	24	pressure upstream throttle	PIN_IN_UP21	up21
A059		not avl.	not avl.	analog input	no pullup, 12bit, angle- or time related measurement, shared with digital and SENT inputs		I_A_ANA[15]	24	pressure upstream throttle, bank 2	PIN_IN_UP21_2	up21_2
A060				analog input	no pullup, 12bit angle- or time related measurement		I_A_ANA[16]	24	intake manifold pressure, mean value	PIN_IN_UP22M	up22m
A061		not avl.	not avl.	analog input	no pullup, 12bit, angle- or time related measurement, shared with digital and SENT inputs		I_A_ANA[11]	24	intake manifold pressure, mean value, bank 2	PIN_IN_UP22M_2	up22m_2

ECU Pin connector >A<	ECU Pin connector >K<	MS6.1 EVO MS6.3 EVO not available <sup>*)</sup>	MS6Cup EVO not available	І/О Туре	hardware	pin related functions	ecu_name	rec.wire size AWG	MS6 function recommendation	function to pin coordination	related physical input measure channel
A056				analog input	no pullup, 12bit		I_A_APS1	24	APS potentiometer a	fixed function to pin coordination	uaps_a
A054				analog input	no pullup, 12bit		I_A_APS2	24	APS potentiometer b	fixed function to pin coordination	uaps_b
A041				analog input	no pullup, 12bit		I_A_UTH1	24	throttle potentiometer	fixed function to pin coordination	uthrottle
A053				analog input	no pullup, 12bit		I_A_UTH2	24	backup throttle poten- tiometer	fixed function to pin coordination	uthrottle_b
A036			not avl.	analog input	no pullup, 12bit		I_A_UTH3	24	throttle potentiometer. bank 2	fixed function to pin coordination	uthrottle2
A037			not avl.	analog input	no pullup, 12bit		I_A_UTH4	24	backup throttle poten- tiometer, bank 2	fixed function to pin coordination	uthrottle2_b
	K036			analog input	pullup 3k01, 12bit		I_A_ANA_FIXPU[5]	24	map switch	PIN_IN_UMAPSW	umapsw
	K031			analog input	switchpullup 3k01 12bit	CWPULLUP_K031	I_A_ANA_SWPU[1]	24	pitspeed switch	PIN_IN_UPITSPEEDSW	upitspeedsw
	K019	not avl.		analog input	switchpullup 3k01 12bit	CWPULLUP_K019	I_A_ANA_SWPU[2]	24	launch control switch	PIN_IN_ULAUNCHSW	ulaunchsw
	K015			analog input	switchpullup 3k01 12bit	CWPULLUP_K015	I_A_ANA_SWPU[3]	24	traction control switch	PIN_IN_UTCSW	utcsw
	K016	not avl.	not avl.	analog input	switchpullup 3k01 12bit	CWPULLUP_K016	I_A_ANA_SWPU[4]	24	reset chassis channels switch	PIN_IN_UCHRESSW	uchressw
	K017	not avl.	not avl.	analog input	switchpullup 3k01 12bit	CWPULLUP_K017	I_A_ANA_SWPU[5]	24	wet track switch	PIN_IN_UWETSW	uwetsw
A039				analog input	no pullup, 12bit		I_A_ANA[2]	24	gear poti	PIN_IN_UGEARP	ugearp
A055		not avl.		analog input	switchpullup 3k01 12bit	CWPULLUP_A055	I_A_ANA_SWPU[8]	24	reverse shift switch	PIN_IN_UREVSW	ushiftrevsw
A057		not avl.		analog input	switchpullup 3k01 12bit	CWPULLUP_A057	I_A_ANA_SWPU[9]	24	downshift switch	PIN_IN_USHIFTDNSW	ushiftdnsw
A076		not avl.		analog input	switchpullup 3k01 12bit	CWPULLUP_A076	I_A_ANA_SWPU[10]	24	up shift switch	PIN_IN_USHIFTUPSW	ushiftupsw
A077				analog input	switchpullup 3k01 12bit	CWPULLUP_A077	I_A_ANA_SWPU[11]	24	gearshift sensor	PIN_IN_UGS	ugs
A078		not avl.		analog input	switchpullup 3k01 12bit	CWPULLUP_A078	I_A_ANA_SWPU[12]	24	free measure channel A78		
A038		not avl.		analog input	no pullup, 12bit		I_A_ANA[5]	24	gearbox pneumatic pres- sure	PIN_IN_UPGEARAIR	upgearair
	K033	not avl.		analog input	no pullup, 12bit		I_A_ANA[4]	24	clutch pressure	PIN_IN_UPCLUTCH	upclutch
	K048	not avl.	not avl.	analog input	no pullup, 12bit		I_A_ANA[10]	24	free measure channel K48		

ECU Pin connector >K<	MS6.1 EVO MS6.3 EVO not available <sup>*)</sup>	MS6Cup EVO not available	І/О Туре	hardware	pin related functions	ecu_name	rec.wire size AWG	MS6 function recommendation	function to pin coordination	related physical input measure channel
			analog input	no pullup, 12bit		I_A_ANA[6]	24	pressure brake rear	PIN_IN_UPBRAKE_R	upbrake_r
K020			analog input	switchpullup 3k01 12bit	CWPULLUP_K020	I_A_ANA_SWPU[7]	24	pressure brake front	PIN_IN_UPBRAKE_F	upbrake_f
K018	not avl.	not avl.	analog input	switchpullup 3k01 12bit	CWPULLUP_K018	I_A_ANA_SWPU[6]	24	damper sensor front/left	PIN_IN_UDAM_FL	udam_fl
K032	not avl.	not avl.	analog input	no pullup, 12bit		I_A_ANA_[3]	24	damper sensor front/right	PIN_IN_UDAM_FR	udam_fr
K034	not avl.	not avl.	analog input	no pullup, 12bit		I_A_ANA_[7]	24	damper sensor rear/left	PIN_IN_UDAM_RL	udam_rl
K035	not avl.	not avl.	analog input	no pullup, 12bit		I_A_ANA_[8]	24	damper sensor rear/right	PIN_IN_UDAM_RR	udam_rr
K050	not avl.	not avl.	analog input	no pullup, 12bit		I_A_ANA_[9]	24	steering angle sensor	PIN_IN_USTEER	usteer
K066	not avl.	not avl.	analog input	no pullup, 12bit, angle- or time related measurement, shared with digital and SENT inputs		I_F_DIG_IN[5]	24	free measure channel K066		
K067	not avl.	not avl.	analog input	no pullup, 12bit, angle- or time related measurement, shared with digital and SENT inputs		I_F_DIG_IN[6]	24	free measure channel K067		
K083	not avl.	not avl.	analog input	no pullup, 12bit, angle- or time related measurement, shared with digital and SENT inputs		I_F_DIG_IN[3]	24	free measure channel K083		
K084	not avl.	not avl.	analog input	no pullup, 12bit, angle- or time related measurement, shared with digital and SENT inputs		I_F_DIG_IN[4]	24	free measure channel K084		
K049	not avl.	not avl.	analog input	no pullup, 12bit, angle- or time related measurement, shared with digital and SENT inputs		I_F_DIG_IN[7]	24	free measure channel K049		
	not avl.	not avl.	analog input	no pullup, 12bit, angle- or time related measurement, shared with digital and SENT inputs		I_F_DIG_IN[8]	24	free measure channel A083		
	ECU Pin connector >K	ECU Pin connector NS6.1 EVO MS6.3 EVO not available"K020	ECU Pin connector NS6.3 EVO not available'MS6.1 EVO EVO not availableK020Not avilable'K020International and availableK018not avil.K032not avil.K034not avil.K050not avil.K066not avil.K066not avil.K066not avil.K067not avil.K083not avil.K084not avil.K049not avil.Not avil.not avil.	ECU Pin connector >K         MS6.1 EVO not available"         MS6Cup not available         I/O Type           MS6.3 EVO not available"         not not available         I/O Type           MS6.1 EVO not available"         not available         analog input           K020         I         analog input           K020         I         not avl.         analog input           K018         not avl.         not avl.         analog input           K032         not avl.         not avl.         analog input           K034         not avl.         not avl.         analog input           K035         not avl.         not avl.         analog input           K050         not avl.         not avl.         analog input           K066         not avl.         not avl.         analog input           K067         not avl.         not avl.         analog input           K083         not avl.         not avl.         analog input           K084         not avl.         not avl.         analog input           K084         not avl.         not avl.         analog input           K049         not avl.         not avl.         analog input           Not avl.         not avl.	ECU Pin connector >KMS6.1 EVO MS6.3 EVO EVO not available"I/O TypehardwareMS6.3 EVO available"not and availableI/O TypehardwareK020IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII	ECU Pin connector > KMS6.1 EVO MS6.3 EVO IND available?V/O Type not not not available?hardwarepin related functionsK020	ECU Pin connector         MSG.1 EVO         MSG.0 EVO FVO available         I/O Type not available         hardware         pin related functions         ecu_name           KC         not available         analog input         no pullup, 12bit         I.A.ANA(6)           K020         I.S.         analog input         no pullup, 12bit         CWPULUUP_K020         I.A.ANA,SWPU[7]           K018         not avi.         not avi.         analog input         switch-pullup 3k01         CWPULUUP_K018         I.A.ANA,SWPU[7]           K032         not avi.         not avi.         analog input         switch-pullup, 12bit         I.A.ANA_SWPU[7]           K032         not avi.         not avi.         analog input         no pullup, 12bit         I.A.ANA_[3]           K033         not avi.         not avi.         analog input         no pullup, 12bit         I.A.ANA_[3]           K034         not avi.         not avi.         analog input         no pullup, 12bit         I.A.ANA_[3]           K056         not avi.         not avi.         analog input         no pullup, 12bit         I.A.ANA_[3]           K056         not avi.         not avi.         analog input         no pullup, 12bit, angle- or time related measurement, shared with digital and SENT inputs         I.F.DIG_IN[6]	ECU Pin connector available <sup>7</sup> MSG.1 EVO FOC         MSG.2 EVO FOC         Intervention         pin related functions         ecu.name functions         rec.wire size functions           K         no         not available <sup>7</sup> available         no pullup, 12bit         LA.ANA(5)         24           K020	ECU Print Connector         MS5.1 EVO MS5.3 EVO EVO available         V/0 Type not available         hardware presume available         pin related functions         evu name functions         resume available         MS5 function recommendation           K020         V         V         Top and analog input         no pullup.12bit         I A ANA[6]         24         pressure brake rear           K020         V         V         analog input         no pullup.12bit         CVPULUP_K020         I A ANA_SWPU[0]         24         damper sensor front/felt           K021         not avi         not avi         analog input         opullup.12bit         CVPULUP_K018         LA_ANA_SWPU[6]         24         damper sensor front/felt           K023         not avi         not avi         analog input         no pullup.12bit         LA_ANA_SWPU[6]         24         damper sensor front/felt           K023         not avi         not avi         analog input         no pullup.12bit         I A ANA [8]         24         damper sensor front/felt           K035         not avi         not avi         analog input         no pullup.12bit         I A ANA [8]         24         damper sensor rear/felt           K035         not avi         not avi         analog input         no pullup.12bit         I A ANA [8] <td< td=""><td>EEU promoted biol         M55.1 SUD M500 not available         Modeane status         processing status         rescanse status         M55 functions recommendation         functions to pin coordination           KV r         vanilable         vanilable         nanoig nput         manoig nput         maketh pullug 3401 tatai         LA ANALS         24         pressure looke rear         PNI N LVPERAKE R           K020         V         manoig nput         switch pullug 3401 tatai         CVPULUP_K020         LA ANALS/VPU[0]         24         pressure looke rear         PNI N LVPERAKE R           K020         V         malog nput         switch-pullug 3401 tatai         CVPULUP_K020         LA ANALS/VPU[0]         24         damper sensor from/refit         PNI N UDPARAE R           K021         vot avt         not avt         not avt         motig nput         mot pullug 1201         CVPULUP_K020         LA ANALSYPU[0]         24         damper sensor from/refit         PNI N UDPARAE R           K023         not avt         not avt         mot avt         mot avt         mot avt         mot avt         mot avt         not avt         not avt         mot avt</td></td<>	EEU promoted biol         M55.1 SUD M500 not available         Modeane status         processing status         rescanse status         M55 functions recommendation         functions to pin coordination           KV r         vanilable         vanilable         nanoig nput         manoig nput         maketh pullug 3401 tatai         LA ANALS         24         pressure looke rear         PNI N LVPERAKE R           K020         V         manoig nput         switch pullug 3401 tatai         CVPULUP_K020         LA ANALS/VPU[0]         24         pressure looke rear         PNI N LVPERAKE R           K020         V         malog nput         switch-pullug 3401 tatai         CVPULUP_K020         LA ANALS/VPU[0]         24         damper sensor from/refit         PNI N UDPARAE R           K021         vot avt         not avt         not avt         motig nput         mot pullug 1201         CVPULUP_K020         LA ANALSYPU[0]         24         damper sensor from/refit         PNI N UDPARAE R           K023         not avt         not avt         mot avt         mot avt         mot avt         mot avt         mot avt         not avt         not avt         mot avt

ECU Pin connector >A<	ECU Pin connector >K<	MS6.1 EVO MS6.3 EVO not available <sup>*)</sup>	MS6Cup EVO not available	І/О Туре	hardware	pin related functions	ecu_name	rec.wire size AWG	MS6 function recommendation
	K077			thermocouple 1+	k-type sensor		I_A_TC1A	24shield	exhaust gas temperatu sensor
	K076			thermocouple 1-			I_A_TC1B	thermo	
	К079	not avl.	not avl.	thermocouple 2+	k-type sensor		I_A_TC2A	24shield	exhaust gas temperatu
	K078	not avl.	not avl.	thermocouple 2-			I_A_TC2B	thermo	sensor, bank 2

ECU Pin connector >A<	ECU Pin connector >K<	MS6.1 EVC MS6.3 EVC not available <sup>*)</sup>	D MS6Cup D EVO not available	I/O Туре	hardware	pin related functions	ecu_name	rec.wire size AWG	e MS6 function recommendation	function to pin coordination	related physical input measure channel
	K077			thermocouple 1+	k-type sensor		I_A_TC1A	24shield	d exhaust gas temperatur	e fixed function to pin	utexh
	K076			thermocouple 1-			I_A_TC1B	thermo	sensor	coordination	
	К079	not avl.	not avl.	thermocouple 2+	k-type sensor		I_A_TC2A	24shield	d exhaust gas temperatur	e fixed function to pin	utexh2
	K078	not avl.	not avl.	thermocouple 2-			I_A_TC2B	thermo	sensor, bank 2	coordination	
Digital Inpu	uts										
ECU Pin connector >A<	ECU Pin connector >K<	MS6.1 EVO MS6.3 EVO not available <sup>*)</sup>	MS6Cup EVO not available	І/О Туре	hardware	pin related functions	ecu_name	rec.wire size AWG	MS6 function recommendation	function to pin coordination	related physical input measure channel
A047				crankshaft+ (Hall/Inductive)	switchable between halleffect- and	CWINTF_CRANK PIN_IN_CRANK	I_P_CRANKA	24shield	engine speed	fixed function to pin coordination	nmot
A048				crankshaft - (inductive)	inductive sensor	CWINTF_CRANK_K CWINTF_CRANK_TH	I_P_CRANKB	24shield			
074				distant is such	helleffest server ender			24abiald	annah aft in lat		001
A074								24shield			cam_pos_edges_001
A075				digital input	halleffect sensor only		I_P_CAM2	24shield	camshaft outlet	PIN_IN_CAM_OUT	cam_pos_edges_out_001
A049				digital input	switchable between halleffect- or DF11 sensors	CWINTF_A049	I_P_WHEEL1	24shield	camshaft inlet bank2 or wheelspeed front right	PIN_IN_CAM_IN2 or PIN_IN_FWEEL_FR	cam_pos_edges2_001 fwheel_fr
A050				digital input	switchable between halleffect- or DF11 sensors	CWINTF_A050	I_P_WHEEL2	24shield	camshaft outlet bank2 or wheelspeed front left	PIN_IN_CAM_OUT2 or PIN_IN_FWEEL_FL	cam_pos_edges_out2_001 fwheel_fl
A051				digital input	switchable between halleffect- or DF11 sensors	CWINTF_A051	I_P_WHEEL3	24shield	wheelspeed rear right	PIN_IN_FWHEEL_RR	fwheel_rr
A052				digital input	switchable between halleffect- or DF11 sensors	CWINTF_A052	I_P_WHEEL4	24shield	wheel speed rear left	PIN_IN_FWHEEL_RL	fwheel_rl
A059				digital input	switchpullup 14k7, shared with analogue and SENT inputs	CWPULLUP_A059	I_F_DIG_IN[1]	24shield	free digital channel A059		
A061				digital input	switchpullup 14k7, shared with analogue and SENT inputs	CWPULLUP_A061	I_F_DIG_IN[2]	24shield	free digital channel A061		

ECU Pin connector >A<	ECU Pin connector >K<	MS6.1 EVO MS6.3 EVO not available <sup>*)</sup>	MS6Cup EVO not available	І/О Туре	hardware	pin related functions	ecu_name	rec.wire size AWG	MS6 function recommendation	function to pin coordination	related physical input measure channel
	K066			digital input	switchpullup 14k7, shared with analogue and SENT inputs	CWPULLUP_K066	I_F_DIG_IN[3]	24shield	free digital channel K066		
	K067			digital input	switchpullup 14k7, shared with analogue and SENT inputs	CWPULLUP_K067	I_F_DIG_IN[4]	24shield	free digital channel K067		
	K083			digital input	switchpullup 14k7, shared with analogue and SENT inputs	CWPULLUP_K083	I_F_DIG_IN[5]	24shield	free digital channel K083		
	K084			digital input	switchpullup 14k7, shared with analogue and SENT inputs	CWPULLUP_K084	I_F_DIG_IN[6]	24shield	free digital channel K084		
	K049			digital input	switchpullup 14k7, shared with analogue and SENT inputs	CWPULLUP_K049	I_F_DIG_IN[7]	24shield	free digital channel K049		
A083				digital input	switchpullup 14k7, shared with analogue and SENT inputs	CWPULLUP_A083	I_F_DIG_IN[8]	24shield	free digital channel A083		
	K045			digital input	switchable between halleffect- and inductive sensor	CWINTF_K045 CWINTF_K045_K CWINTF_K045_TH	I_P_CAM3	24shield	turbo speed	PIN_IN_FTURBO	fturbo
	K046			digital input	switchable between halleffect- and inductive sensor	CWINTF_K046 CWINTF_K046_K CWINTF_K046_TH	I_P_CAM4	24shield	turbo speed bank2	PIN_IN_FTURBO2	fturbo2
	K062			ground supply	if inductive sensos are connected to K045 or K046		G_R_GNDCAM	24shield	ground for turbo speed and -2		
	K054			digital input			I_S_ENGINE_ON	20	Engine On/Off switch		b_engon(_in)
	K047			digital input	fixed pullup to 5volts		I_S_LAPTRIG	24	laptrigger	fixed function to pin coordination	lapctr
A013				knock sensor in- put			I_A_KNOCK_IN[1]	24shield	knock sensor 1, bank1	KCSENCYL	ikcraw_n

ECU Pin connector >A<	ECU Pin connector >K<	MS6.1 EVO MS6.3 EVO not available <sup>*)</sup>	MS6Cup EVO not available	І/О Туре	hardware	pin related functions	ecu_name	rec.wire size AWG	MS6 function recommendation	
A014				knock sensor in- put			I_A_KNOCK_IN[2]	24shield	knock sensor 2, bank1	
A015			not avl.	knock sensor in- put			I_A_KNOCK_IN[3]	24shield	knock sensor 1, bank2	
A016			not avl.	knock sensor in- put			I_A_KNOCK_IN[4]	24shield	knock sensor 2, bank2	
A017				knock sensor ground			G_R_GNDKNOCK	24shield		
	K085			Lambda_IA	LSU4.9 probe only		I_A_LS1IA	24 Lambda	Lambda	
	K086			Lambda_IP			I_A_LS1IP	24		
	K087			Lambda_UN			I_A_LS1UN	24		
	K088			Lambda_VM			I_A_LS1VM	24		
	K068		not avl.	Lambda_IA	LSU4.9 probe only		I_A_LS2IA	24	Lambda bank2	
	K069		not avl.	Lambda_IP			I_A_LS2IP	24		
	K070		not avl.	Lambda_UN			I_A_LS2UN	24		
	K071		not avl.	Lambda_VM			I_A_LS2VM	24		

Ignition- & Injection Outputs

ECU Pin connector >A<	ECU Pin connector >K<	MS6.1 EVO MS6.3 EVO not available <sup>*)</sup>	MS6Cup EVO not available	І/О Туре	hardware	pin related functions	ecu_name	rec.wire size AWG	MS6 function recommendation
A026				ignition driver	output related to	CWIGNDRV_MODE IGNDRV_CURRENT	O_P_IGNOUT[1]	24	Ignition cyl.1
A027					mechanical cylinder		O_P_IGNOUT[2]	24	Ignition cyl.2
A028					number; use of coil integrated power stages only		O_P_IGNOUT[3]	24	Ignition cyl.3
A029							O_P_IGNOUT[4]	24	Ignition cyl.4
A030			not avl.				O_P_IGNOUT[5]	24	Ignition cyl.5
A031			not avl.				O_P_IGNOUT[6]	24	Ignition cyl.6
A068			not avl.				O_P_IGNOUT[7]	24	Ignition cyl.7
A069			not avl.				O_P_IGNOUT[8]	24	Ignition cyl.8
A070			not avl.				O_P_IGNOUT[9]	24	ignition cyl.9
A071			not avl.				O_P_IGNOUT[10]	24	ignition cyl.10
A072			not avl.				O_P_IGNOUT[11]	24	ignition cyl.11
A073			not avl.				O_P_IGNOUT[12]	24	ignition cyl.12

function to pin coordination	related physical input measure channel
KCSENCYL	ikcraw_n
KCSENCYL	ikcraw_n
KCSENCYL	ikcraw_n
fixed function to pin coordination	lambda
fined function to nin	lambda)
coordination	lambuaz
function to pin	related physical
coordination	input measure
	channel
CYLNUMBER	ign_out_n_001
CYLANGLE	ign_out_n_002
	ign_out_n_003
	ign_out_n_004
	ign_out_n_005
	ign_out_n_006
	ign_out_n_007
	ign_out_n_008
	ign_out_n_009
	ign_out_n_010
	ign_out_n_011
	ign_out_n_012

ECU Pin connector >A<	ECU Pin connector >K<	MS6.1 EVO MS6.3 EVO not available <sup>*)</sup>	MS6Cup EVO not available	І/О Туре	hardware	pin related functions	ecu_name	rec.wire size AWG	MS6 function recommendation	function to pin coordination	related physical input measure channel
A098				injector output	output related to		O_P_LSOUT_INJECTION[1]	24twist	Injection cyl.1	CYLNUMBER	tinj_n_001
A100					mechanical cylinder number;		O_P_LSOUT_INJECTION[2]	24twist	Injection cyl.2	CYLANGLE	tinj_n_002
A101							O_P_LSOUT_INJECTION[3]	24twist	Injection cyl.3		tinj_n_003
A096					low pressure high im-	_	O_P_LSOUT_INJECTION[4]	24twist	Injection cyl.4		tinj_n_004
A099			not avl.		pedance		O_P_LSOUT_INJECTION[5]	24twist	Injection cyl.5	PIN_OUT_LPINJ_A084)	tinj_n_005
A103			not avl.		injector types		O_P_LSOUT_INJECTION[6]	24twist	Injection cyl.6		tinj_n_006
A042			not avl.				O_P_LSOUT_INJECTION[7]	24twist	Injection cyl.7		tinj_n_007
A105			not avl.				O_P_LSOUT_INJECTION[8]	24twist	Injection cyl.8		tinj_n_008
A018			not avl.				O_P_LSOUT_INJECTION[9]	24twist	Injection cyl.9		tinj_n_009
A020			not avl.				O_P_LSOUT_INJECTION[10]	24twist	Injection cyl.10		tinj_n_010
A063			not avl.				O_P_LSOUT_INJECTION[11]	24twist	Injection cyl.11		tinj_n_011
A084			not avl.				O_P_LSOUT_INJECTION[12]	24twist	Injection cyl.12		tinj_n_012
A043				INJVH1	high pressure		O_P_INJVH1	20twist	Injection cyl.A	PIN_OUT_HPINJ11A_A043_A064	tinj_n_(cyl.A)
A064				INJVL11	magnetic injectors		O_P_INJVL11	20twist			
A002			not avl.	INJVH3			O_P_INJVH3	20twist	Injection cyl.B	PIN_OUT_HPINJ32B_A002_A023	tinj_n_(cyl.B)
A023			not avl.	INJVL32			O_P_INJVL32	20twist			
A003				INJVH2			O_P_INJVH2	20twist	Injection cyl.C	PIN_OUT_HPINJ21C_A003_A024	tinj_n_(cyl.C)
A024				INJVL21			O_P_INJVL21	20twist			
A046			not avl.	INJVH4			O_P_INJVH4	20twist	Injection cyl.D	PIN_OUT_HPINJ42D_A046_A067	tinj_n_(cyl.D)
A067			not avl.	INJVL42			O_P_INJVL42	20twist			
A044			not avl.	INJVH1			O_P_INJVH1	20twist	Injection cyl.E	PIN_OUT_HPINJ12E_A044_A065	tinj_n_(cyl.E)
A065			not avl.	INJVL12			O_P_INJVL12	20twist			
A001				INJVH3			O_P_INJVH3	20twist	Injection cyl.F	PIN_OUT_HPINJ31F_A001_A022	tinj_n_(cyl.F)
A022				INJVL31			O_P_INJVL31	20twist			
A004			not avl.	INJVH2			O_P_INJVH2	20twist	Injection cyl.G	PIN_OUT_HPINJ22G_A004_A025	tinj_n_(cyl.G)
A025			not avl.	INJVL22			O_P_INJVL22	20twist			
A045				INJVH4			O_P_INJVH4	20twist	Injection cyl.H	PIN_OUT_HPINJ41H_A045_A066	tinj_n_(cyl.H)
A066				INJVL41			O P INJVL41	20twist			
Outputs											
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ECU Pin connector >A<	ECU Pin connector >K<	MS6.1 EVO MS6.3 EVO not available <sup>*)</sup>	MS6Cup EVO not available	I/O Туре	hardware	pin related functions	ecu_name	rec.wire size AWG	MS6 function recommendation	function to pin coordination	related physical input measure channel
A095				lowside switch 4amps pwm			O_T_LSOUT_4A2[1]	24twist	camshaft inlet control	fixed pin to output control coordination	cam_pwm
A021			not avl.	lowside switch 4amps pwm			O_T_LSOUT_4A2[2]	24twist	camshaft inlet bank2 control	fixed pin to output control coordination	cam_pwm2
A102				lowside switch 3amps pwm			O_T_LSOUT_3A2[1]	24twist	camshaft outlet control	fixed pin to output control coordination	cam_pwm_out
A094			not avl.	lowside switch 3amps pwm			O_T_LSOUT_3A2[2]	24twist	camshaft outlet bank2 con- trol	fixed pin to output control coordination	cam_pwm_out2
A019				lowside switch 3amps pwm			O_T_LSOUT_3A2[4]	24twist		PIN_OUT_A019	
A104			not avl.	lowside switch 3amps pwm			O_T_LSOUT_3A2[3]	24twist		PIN_OUT_A104	
A097				lowside sw. 2,2amps pwm			O_T_LSOUT_2A2[1]	24twist	Wastegate 1inc	PIN_OUT_A097	wgc_inc_pwm
A093			not avl.	lowside sw. 2,2amps pwm			O_T_LSOUT_2A2[2]	24twist	Wastegate 2inc	PIN_OUT_A093	wgc_inc_pwm2
	K039		not avl.	lowside sw. 2,2amps pwm			O_T_LSOUT_2A2[5]	24twist		PIN_OUT_K039	
	K056			lowside sw. 2,2amps pwm			O_T_LSOUT_2A2[7]	24twist	air conditioning compressor	PIN_OUT_K056	comp_pwm
	K038			lowside sw. 2,2amps pwm			O_T_LSOUT_2A2[3]	24twist	gearshift actuator upshift	PIN_OUT_K038	shiftup_pwm
	K040		not avl.	lowside sw. 2,2amps pwm			O_T_LSOUT_2A2[6]	24twist		PIN_OUT_K040	
	K055			lowside sw. 2,2amps pwm			O_T_LSOUT_2A2[4]	24twist	gearshift actuator downshift	PIN_OUT_K055	shiftdn_pwm
	K074			lowside sw. 2,2amps pwm			O_T_LSOUT_2A2[8]	24twist		PIN_OUT_K074	
	K089			lowside switch 1amp pwm			O_T_LSOUT_1A[1]	24twist	fuel pump relay	PIN_OUT_K089	fpump_pwm
	K073		not avl.	lowside switch 1amp pwm			O_T_LSOUT_1A[2]	24twist		PIN_OUT_K073	
	K057			lowside switch 1amp pwm / reset < 3,5V			O_S_RELAY	24twist	control main relay	fixed pin to output control coordination	b_mainrelay
	K072			lowside switch 1amp pwm / reset < 3,5V			O_S_STARTER	24twist	Kl.50 / starter control	fixed pin to output control coordination	b_starter
	K022			lambda heater 4amp pwm			O_T_LSOUT_LSH[1]	24twist	heater lambda	fixed pin to output control coordination	lsuh_out

ECU Pin connector >A<	ECU Pin connector >K<	MS6.1 EVO MS6.3 EVO not available <sup>*)</sup>	MS6Cup EVO not available	I/O Type	hardware	pin related ecu_ functions	name	rec.wire size AWG	MS6 function recommendation	function to pin coordination	related physical input measure channel
	K023		not avl.	lambda heater 4amp pwm		0_T_	LSOUT_LSH[2]	24twist	heater lambda2	fixed pin to output control coordination	lsuh_out2
H-Bridges &	& Metering ሀ	Unit									
ECU Pin connector >A<	ECU Pin connector >K<	MS6.1 EVO MS6.3 EVO not available <sup>*)</sup>	MS6Cup EVO not available	I/O Туре	hardware	pin related functions	ecu_name	rec.wir size AWG	e MS6 function recommendation	function to pin coordination	related physical input measure channel
A089				H-Bridge 1 pos.	8,5 amps H-Bridge	CWHB1_EN	O_T_HB1_OUTA	24twist	electrical throttle 1	fixed pin to output control coordination	etc_pwm
A090 A091 A092				H-Bridge 2 pos. H-Bridge 2 neg.	8,5 amps H-Bridge	CWHB2_EN	O_T_HB2_OUTA O_T_HB2_OUTB	24twist	electrical throttle 2	fixed pin to output control coordination	etc_pwm2
K090 K091				H-Bridge 3 pos. H-Bridge 3 neg.	8,5 amps H-Bridge	CWHB3_EN	O_T_HB3_OUTA O_T_HB3_OUTB	24twist		fixed pin to output control coordination	
A085 A086				FCVH1 FCVL1			O_P_FCVH1 O P FCVL1	24twist	high press. pump MSV valve 1	fixed pin to output control coordination	msv_dlvy_angle
A087 A088		1	not avl. not avl.	FCVH2 FCVL2			O_P_FCVH2 O_P_FCVL2	24twist	high press. pump MSV valve 2	fixed pin to output control coordination	msv_dlvy_angle2
Network											
ECU Pin connector >A<	ECU Pin connector >K<	MS6.1 EVO MS6.3 EVO not available <sup>*)</sup>	MS6Cup EVO not available	I/O Туре	hardware	pin related functions	ecu_name	rec.wir size AWG	e MS6 function recommendation	function to pin coordination	related physical input measure channel
	К029			CAN1_H	switchable CAN 120	CWCAN1_TERM	B_D_CAN1_H	CAN	CAN1		E_can1
	K012			CAN1_L	Ohm resistor recommended for Mo- tronic, Powerbox and ABS control functions		B_D_CAN1_L				
	1/020							CAN	CANID		5 4
	K028			CAN2_L	Ohm resistor ~use for external ECU / gearbox control func- tions	CWCANZ_TERM	B_D_CAN2_H B_D_CAN2_L	CAN	CAINZ		E_Can I
	K027				switchable CAN 120	CWCANS TEDM		CAN	CANS		E can1
	K010			CAN3_L	Ohm resistor ~use for measurement functions		B_D_CAN3_H	CAN	CAIND		L_Call
	K052			RS232_RX	used for telemetry		B_D_RS232_RX	24twist	RS232		

ECU Pin connector >A<	ECU Pin connector >K<	MS6.1 EVO MS6.3 EVO not available <sup>*)</sup>	MS6Cup EVO not available	І/О Туре	hardware	pin related functions	ecu_name	rec.wire size AWG	MS6 function recommendation
	K053			RS232_TX			B_D_RS232_TX		
	K044			ETH1RX+	ecu communication		B_D_ETH1RX+	CAT7	Ethernet 1
	K043			ETH1RX-			B_D_ETH1RX-		
	K042			ETH1TX+			B_D_ETH1TX+		
	K041			ETH1TX-			B_D_ETH1TX-		
	K061			ETH2RX+	extended communica-		B_D_ETH2RX+	CAT7	Ethernet 2
	K060			ETH2RX-	tion to PBx90,		B_D_ETH2RX-		
	K059			ETH2TX+	DDU7, DDU8 or C60		B_D_ETH2TX+		
	K058			ETH2TX-			B_D_ETH2TX-		
	K025			USB_DP	use for additional data		B_D_USB_DP	USB	USB
	K024			USB_DN	stick		B_D_USB_DN		
	K007			USB_GND			G_G_USB_GND		
	K008			USB_VBUS			O_V_USB_VBUS		
	K014			TIMESYNC	timeline to Ethernet extension modules		B_F_TIMESYNC	24	data time syncronising
	K066			not used					
	K067			not used					
	K083			not used					
	K084			not used					
	K051			LIN	LIN communication	CWLINMODE	B_D_LIN	24	LIN-Bus
	K030			TN digital output	configurable rpm-output	TNSIG_PULSENUM TNSIG_PWM	O_F_DIGOUT[1]	24	rpm-signal
	K013			TN digital output	to check engine syn-		O_F_DIGOUT[2]	24	flywheel-signal
	K037			TN digital output	cronisation,		O_F_DIGOUT[3]	24	triggerwheel-signal
A059				SENT1	shared with analog and digital inputs	CWPULLUP_A059	I_F_DIG_IN[1]	24	SENT-BUS
A061				SENT2	shared with analog and digital inputs	CWPULLUP_A061	I_F_DIG_IN[2]	24	SENT-BUS
	K066			SENT3	shared with analog and digital inputs	CWPULLUP_K066	I_F_DIG_IN[3]	24	SENT-BUS

	function to pin coordination	related physical input measure channel
ne		
	PIN_OUT_K030	
	PIN OUT K013	
	PIN_OUT_K037	

ECU Pin connector >A<	ECU Pin connector >K<	MS6.1 EVO MS6.3 EVO not available <sup>*)</sup>	MS6Cup EVO not available	І/О Туре	hardware	pin related functions	ecu_name	rec.wire size AWG	MS6 function recommendation
	K067			SENT4	shared with analog and digital inputs	CWPULLUP_K067	I_F_DIG_IN[4]	24	SENT-BUS
	K083			SENT5	shared with analog and digital inputs	CWPULLUP_K083	I_F_DIG_IN[5]	24	SENT-BUS
	K084			SENT6	shared with analog and digital inputs	CWPULLUP_K084	I_F_DIG_IN[6]	24	SENT-BUS
	K049			SENT7	shared with analog and digital inputs	CWPULLUP_K049	I_F_DIG_IN[7]	24	SENT-BUS
A083				SENT8	shared with analog and digital inputs	CWPULLUP_A083	I_F_DIG_IN[8]	24	SENT-BUS

## **Power Supplies**

ECU Pin connector >A<	ECU Pin connector >K<	MS6.1 EVO MS6.3 EVO not available <sup>*)</sup>	MS6Cup EVO not available	І/О Туре	hardware	pin related functions	ecu_name	rec.wire size AWG	MS6 function recommendation
	K003			battery plus			V_V_DYNPWR	14	dynamic power supply
	K005			battery plus			V_V_DYNPWR	14	dynamic power supply
	K006			battery plus			V_V_DYNPWR	14	dynamic power supply
	K075			battery plus			V_V_VBAT	20	digital power supply
	K001			battery minus			G_G_GND	14	
	К002			battery minus			G_G_GND	14	
	K004			battery minus			G_G_GND	14	
A009				sensor supply 5V/50mamp	recommended supply for: aps_a, etc		O_V_5VSNS4	24	ETC sensor supply 1
A011				sensor supply 5V/50mamp	recommended supply for: aps_b, etc2		O_V_5VSNS5	24	ETC sensor supply 2
	K065			sensor supply 5V/150mamp		CW5VOUT3_EN	O_V_5VSNS3	24	5 V sensor supply 4
A007				sensor supply 5V/50mamp			O_V_5VSNS7	24	5 V sensor supply 5
A005				sensor supply 5V/150mamp		CW5VOUT1_EN	O_V_5VSNS1	24	5 V sensor supply 1
	K064			sensor supply 5V/150mamp		CW5VOUT2_EN	O_V_5VSNS2	24	5 V sensor supply 2

## function to pin coordination

related physical input measure channel

function to pin coordination

related physical input measure channel

ECU Pin connector >A<	ECU Pin connector >K<	MS6.1 EVO MS6.3 EVO not available <sup>*)</sup>	MS6Cup EVO not available	І/О Туре	hardware	pin related functions	ecu_name	rec.wire size AWG	MS6 function recommendation
	K063			sensor supply 5V/50mamp			O_V_5VSNS6	24	5 V sensor supply 3
	K080			sensor ground 1			M_R_GNDSNS1	20	ground sensor supply
	K081			sensor ground 2			M_R_GNDSNS6	20	ground sensor supply
	K082			sensor ground 3			M_R_GNDSNS7	20	ground sensor supply
A006				sensor ground 4			G_R_GNDSNS2	20	ground sensor supply
A008				sensor ground 5			G_R_GNDSNS3	20	ground sensor supply
A010				sensor ground 6	recommended ground for: aps_a, etc		G_R_GNDSNS4	20	ground sensor supply
A012				sensor ground 7	recommended ground for: aps_b, etc2		G_R_GNDSNS5	20	ground sensor supply
A062				screen ground			PCB_FUSE_2A	24	sensor screens
	K021			screen ground			PCB_FUSE_2A	24	sensor screens
	K026			screen ground			PCB_FUSE_2A	24	Ethernet and LIN screen
	K049			not used					
	K009			screen ground			PCB_FUSE_2A	24	USB screen
A083				not used					

## function to pin coordination

related physical input measure channel





The wiring diagram is available at Bosch Motorsport website on the MS 6 EVO product page.



## NOTICE

The wiring diagram shows a principle of wiring and connection options.

ECU pin relation may change to customer data application and program layout. Sensor-, actuator- and power supplies may also change to the request of the project.



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