Collision Avoidance System CAS-M 3 EVO

Manual

Version 1.0 10/12/2019

Content

1 System Overview

The Collision Avoidance System CAS-M 3 EVO features a Bosch mid-range radar sensor for a wider field of view in close-up range, a high-performance Bosch Motorsport display for fast video processing and a fast response high definition camera.

The CAS-M 3 EVO system provides real time visualization and warns the driver about approaching or overtaking cars via intuitive marking of the cars on the display. It helps prevent the most common collisions and allows drivers to focus on the race. With a momentary glance, the driver can tell how many cars are following and their classification depending on distance and relative speed. The radar tracks up to 40 objects and marks up to 4 objects on the display. In addition, bright flashing LEDs alert the driver when any car attempts a passing maneuver. All of these features work at night or in the rain when visibility is typically poor. Furthermore, the real time gap of a marked object is measured and can be provided over CAN or Ethernet.

The CAS-M 3 EVO system is fully integrated in the Bosch Motorsport Tool environment and can be configured with RaceCon.

2 Technical Data

2.1 Application

Range	95 m
Horizontal field of view	
Radar	85° from 0 to 29 m
	70° from 29 to 46 m
	50° from 46 to 73 m
	42° from 73 to 78 m
	20° from 78 to 95 m
Camera	78°
Number of tracked objects	Max. 40
Number of displayed classified objects	Max. 4
Display format	7''
Display resolution	800 x 480 pixel
User configurable CAN in/out messages	
User configurable LEDs	

2.2 Mechanical Data

Display Unit	
Dimensions	198 x 134 x 35 mm
Weight	830 g
Protection classification	IP67
Operating temperature internal	-20 to 85°C
Max. vibration	Vibration profile 1 (See Appendix or www.bosch-motorsport.com)
Rear Module	
Dimensions	120 x 150 x 115 mm
Weight	880 g
Protection classification	IP67
Operating temperature	0 to 70°C (rearview camera internal temperature*)
Max. vibration	Vibration profile 1 (See Appendix or www.bosch-motorsport.com)

*If the temperature limit is reached, forced air cooling of the camera is recommended.

2.3 Electrical Data

Supply voltage (Display and Rear Unit)	6 to 18 V
Current consumption	
Display Unit	2 A (at 12 V)
Rear Module	0.7 A (at 12 V)

Communication

Display Unit	
CAN	1x private CAN for radar, 1x CAN
Ethernet	1x private 1GBase-T Ethernet for camera, 1x 100Base-T Ethernet
Time sync synchronization Ethernet	1
Rear Module	
CAN	1x private CAN for radar
Ethernet	1x private 1GBase-T Ethernet for camera

Software Tools (free download)

Data analysis tool	WinDarab 7 Light
System configuration tool	RaceCon

2.4 Pin Layout

Connectors and Wires

Display Unit	
Motorsport connector on device	AS212-35PN
Mating connector AS612-35SN	F 02U 000 443-01
Pin 1	GigEthernet_TR3_N (private Eth camera)
Pin 2	GigEthernet_TR3_P (private Eth camera)
Pin 3	GigEthernet_TR2_N (private Eth camera)
Pin 4	GigEthernet_TR2_P (private Eth camera)
Pin 5	GigEthernet_TR1_N (private Eth camera)
Pin 6	GigEthernet_TR1_P (private Eth camera)
Pin 7	GigEthernet_TR0_N (private Eth camera)
Pin 8	GigEthernet_TR0_P (private Eth camera)
Pin 9	Ethernet_TXP
Pin 10	Ethernet_RXP
Pin 11	Ethernet_RXN
Pin 12	CAN_High_Vehicle
Pin 13	+12 V KL30
Pin 14	+12 V KL15
Pin 15	GND KL31
Pin 16	GND KL31
Pin 17	Time_Sync
Pin 18	ETH_Screen
Pin 19	Ethernet_TXN
Pin 20	CAN Low Vehicle
Pin 21	CAN High Radar (private CAN radar)
Pin 22	CAN Low Radar (private CAN radar)

Rear Module	
Motorsport connector on device	AS212-35PN
Mating connector AS612-35SN	F 02U 000 443-01
Pin 1	GigEthernet_TR3_P (private Eth camera)
Pin 2	GigEthernet_TR2_N (private Eth camera)
Pin 3	GigEthernet_TR2_P (private Eth camera)
Pin 4	GigEthernet_TR1_N (private Eth camera)
Pin 5	GigEthernet_TR1_P (private Eth camera)
Pin 6	GigEthernet_TR0_N (private Eth camera)
Pin 7	GigEthernet_TR0_P (private Eth camera)
Pin 8	+12 V Ubat
Pin 9	+12 V Ubat
Pin 10	+12 V Ubat (optional to display)
Pin 11	CAN High Radar (private CAN radar)
Pin 12	CAN Low Radar (private CAN radar)
Pin 13	n.c.
Pin 14	GigEthernet_TR3_N (private Eth camera)
Pin 15	GigEthernet Screen
Pin 16	n.c.
Pin 17	CAN Screen
Pin 18	GND
Pin 19	+12 V Ubat (optional to display)
Pin 20	GND
Pin 21	GND (optional to display)
Pin 22	GND (optional to display)

2.5 Installation Notes

The rear unit must be mounted 90° to the vehicles vertical and horizontal axis and within ± 200 mm of the vehicle lateral centerline.
Mounting distance of radar over ground: 300 to 1,000 mm
An open mounting position for the radar sensor is recommended.
Consider the maximum vibration limits for the mounting position of the rear module. The system is approved referred to vibration profile 1, see www.bosch-motorsport.com.
Check the radar sensor for travel inside the radar bracket. In this case, remove the radar sensor and check the locking pins at both sides of the sensor. Due to vibrations, these pins can be deformed. Exceeding travel of the sensor can damage the electric contacts.
The system needs yaw rate and vehicle speed information.
Cat 6 A standard for Gigabit Ethernet.
This product may contain open source software. Information about license terms and other obligations is given in the manual.
For the private CAN network between display and rear module, no termination resistor is needed in the wiring harness. There are pre-installed termination resistors in the radar sensor and the display.

2.6 Safety notes

⚠ WARNING

It is not permitted to use the system as mirror replacement.

3 Installation Guide

3.1 Rear Module Installation

An individual concept for each car mounting situation must be developed by the car manufacturer. The following mounting restrictions must be fulfilled to secure a proper function of the system.

- The rear unit must be mounted 90° to the vehicles vertical and horizontal axis and within ±200 mm of the vehicle lateral centerline.
- Radar sensor mounting height from 300 mm to 1,000 mm above the ground.
- It is critical that the radar sensor has an unobstructed (or radar-transparent) view out the rear of the vehicle. Mounting without any material in front of the sensor is optimal. If it must be mounted behind material, the plane in front of the sensor surface must be free of conductive materials (e.g. a thin layer of vinyl, fiberglass, or Kevlar). The distance between sensor and surface depends on the material used and should be approximately 5 mm.
- The radome design of the CAS-M 3 EVO radar sensor is chosen to minimize detrimental absorption effects on the sensor's performance due to water droplets or film on the radome surface.
- The CAS-M 3 EVO radar sensor is not released for installation behind covers.
- If the CAS-M 3 EVO radar sensor is used in Railway/Road Crossings obstacle detection system applications according to ETSI EN 301 091-3 V1.1.1, the mounting conditions mentioned in the standard have to be adhered to. For details on these mounting conditions, see ETSI EN 301 091-3 V1.1.1 Annex B.2. In the standard, a radiated emission level of 0.5 W/m^2 is mentioned; at more than 0.75 m distance to the CAS-M 3 EVO radar sensor, its radiated emission has decreased to below 0.5 W/m^2. Therefore, the CAS-M 3 EVO radar sensor inherently fulfills the requirement of ETSI EN 301 091-3 V1.1.1 Annex B.2 as the limit of 0.5 W/m^2 is valid only for distances larger than 2 m to the sensor.
- During operation, it must be ensured that a minimum distance of 6 cm is kept between the radar sensor and humans and animals to adhere to the safety levels with respect to human exposure to electromagnetic fields (cf. IEEE Std C95.1-2005 or 1999/519/EC). This 6 cm distance is related to continuous exposure. If the 6 cm distance is undercut, an averaged exposure time of 42 seconds has to be considered. In this 42 s averaging period, a maximum exposure time to the radar beam of 4 s has to be adhered to. The minimum distance of 6 cm is smaller than the minimal distance the radar sensor can measure. Therefore, a function violating the minimum distance cannot be realized. Thus, this exposure limit does not impose functional limitations.
- Consider the maximum vibration limits for the mounting position of the rear module. The system is approved up to Bosch Motorsport vibration profile 1 (see Bosch Motorsport catalog appendix for more information).
- The camera and radar sensor cannot be removed from the housing and separated from one another.

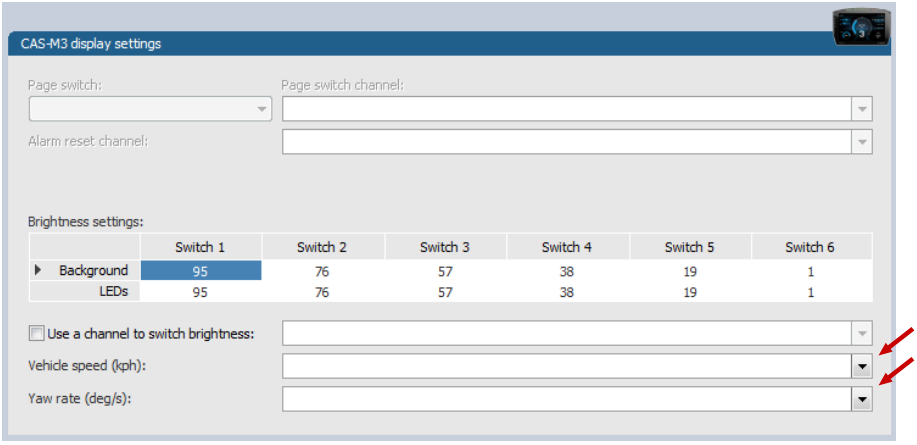
4 Quick Start Guide

4.1 Integration

Integrate and connect the system as described in sections “Pin Layout [▶ 6]” and “Rear Module Installation [▶ 9]”.

4.2 Assign yaw rate and speed input signals

Power on the system and connect it with RaceCon. Go to the “Display” sheet and switch to the “Settings” page.



Choose the inputs for Vehicle speed and Yaw rate. If you use CAN signals, you need to define the messages on the CAN input first.
For further information see section “CAN input”.

Now the system is ready to use with the predefined default settings. To adapt these settings to your needs please see section “Display Configuration [▶ 24]”.

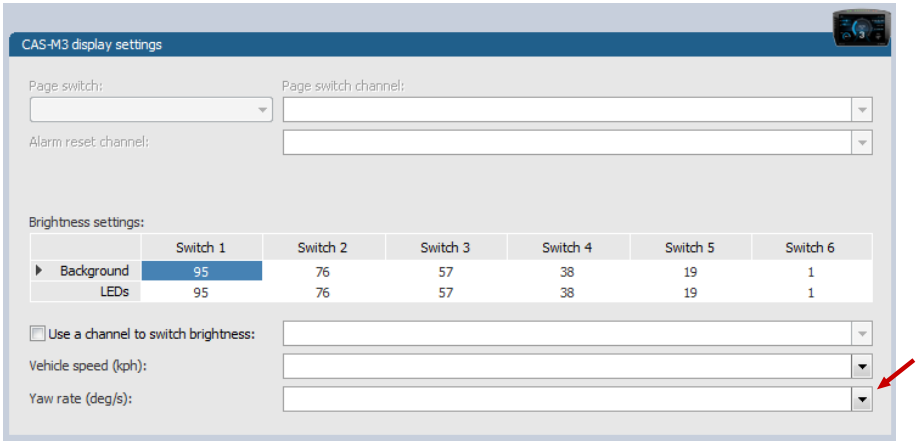
5 Input Signals

The system needs yaw rate and vehicle speed information for the object motion estimation. Vehicle coordinate system according to DIN 70000.

5.1 Yaw rate

Minimum resolution	0.005°/s
Minimum refresh rate (CAN)	50 Hz

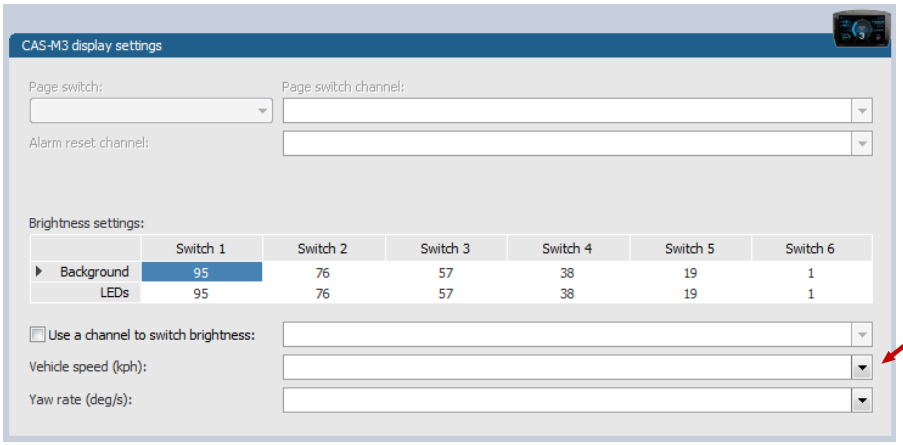
Assign the yaw rate input channel at the display settings page:



5.2 Vehicle speed

Minimum resolution	0.1 km/h
Minimum refresh rate (CAN)	50 Hz

Assign the vehicle speed input channel at the display settings page:



5.3 Default values

When receiving vehicle speed or yaw rate via CAN, care should be taken to configure signal time-outs and default values. These default values should then be reflected in the calibration parameters MRR_EGOVEHSPEED_INVLD and MRR_YAWRATE_INVLD to allow the system to detect and react correctly to signal losses.

5.4 MRR Signals Testmode

Value	Valid data	Default
CASM_TESTMODE	On/Off	Off

Add test mode to display current MRR signals (vehicle speed and yaw rate) on the CAS-M3 display for the first implementation

6 CAN Bus

The CAS-M 3 EVO has four fully configurable CAN buses. Two of these are available as an upgrade.

- Baudrate (250 kbaud , 500 kbaud, 1 Mbaud)
- 11 Bit or 29 Bit identifiers
- Input configuration: Read messages from CAN bus and convert to CAS-M 3 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).

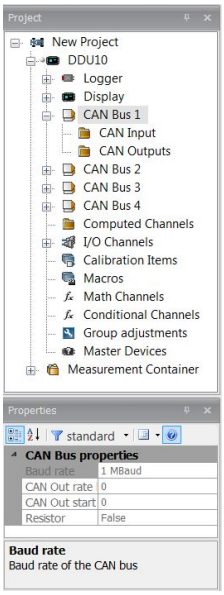
6.1 CAN bus trivia

CAN message

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

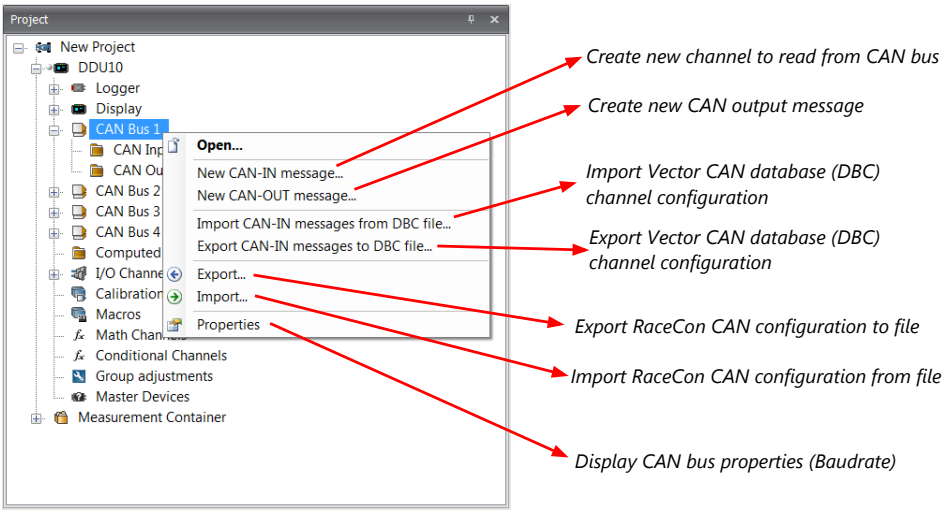
CAN bus

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



CAN item drop-down menu

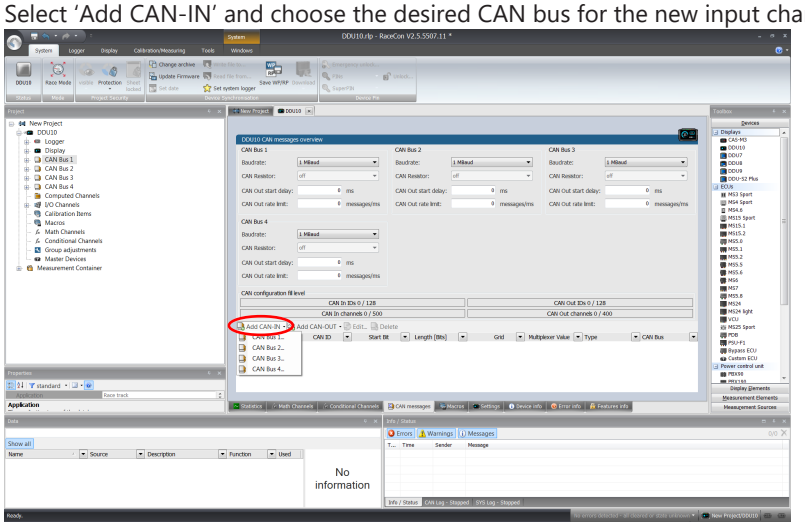
Click with the right mouse button on the desired CAN bus to open the CAN bus drop-down menu.



6.2 CAN input

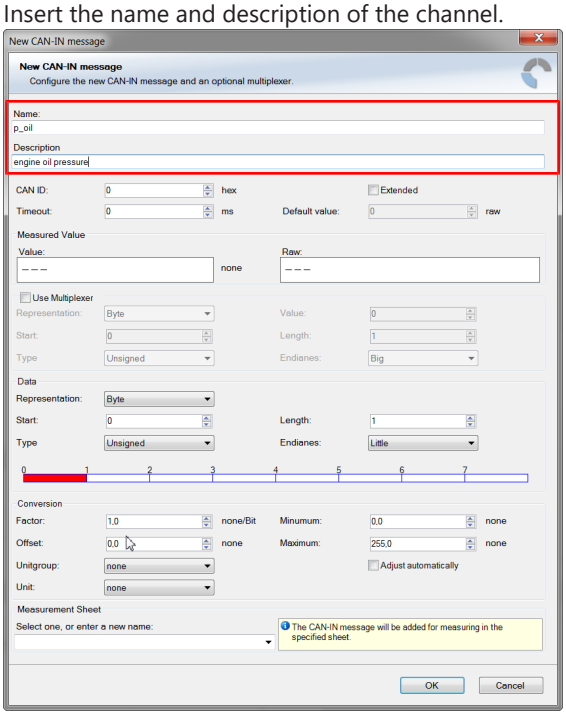
6.2.1 Create new CAN Input channel

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

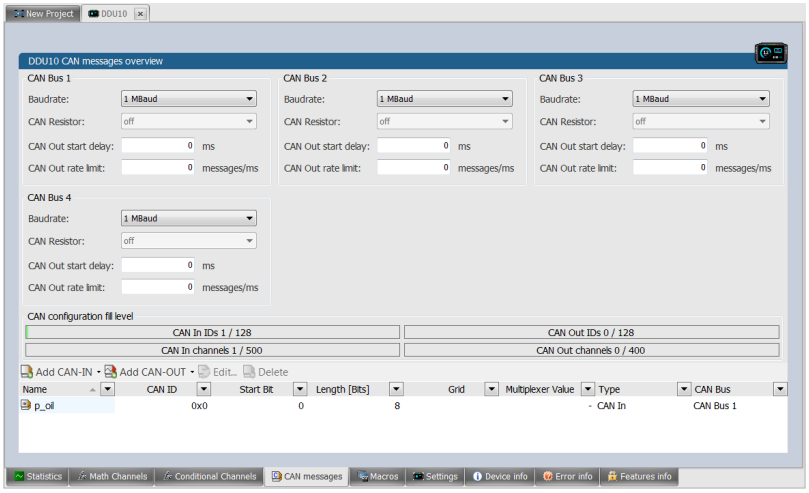


A CAN channel configuration window opens.

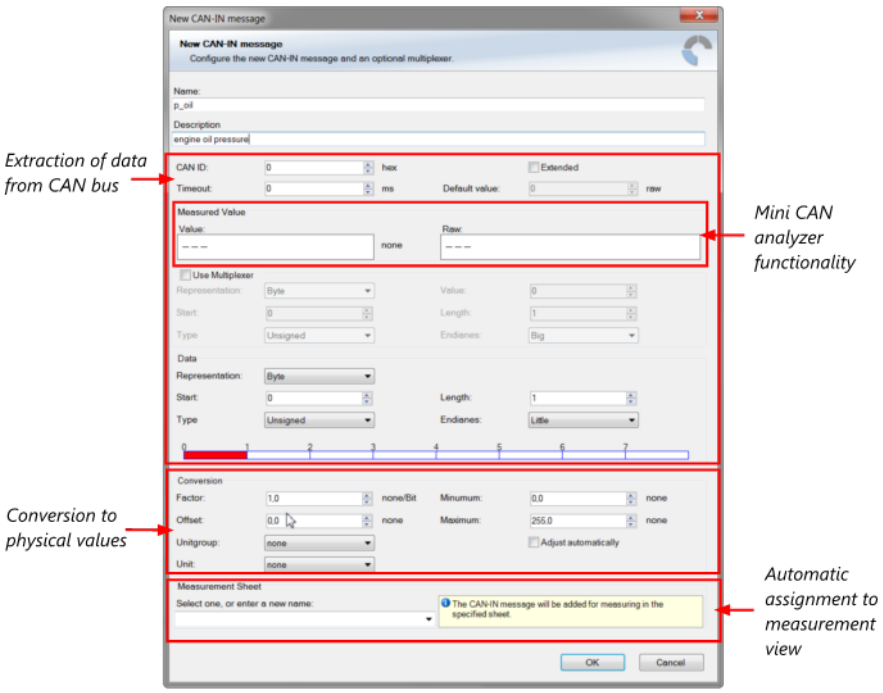
3. Insert the name and description of the channel.



4. Click ‘OK’ when done.
   The channel is listed in the Data window.



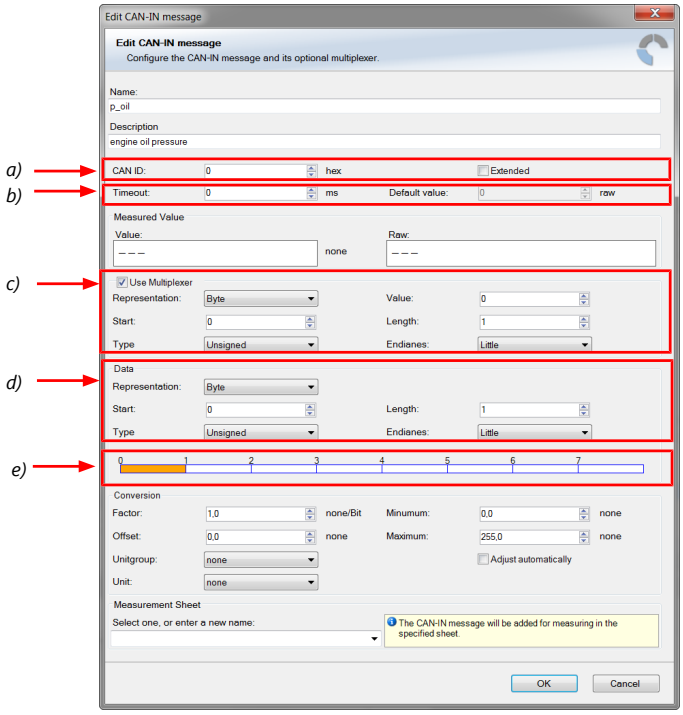
CAN channel configuration



Extracting data from CAN bus

Representation: Byte

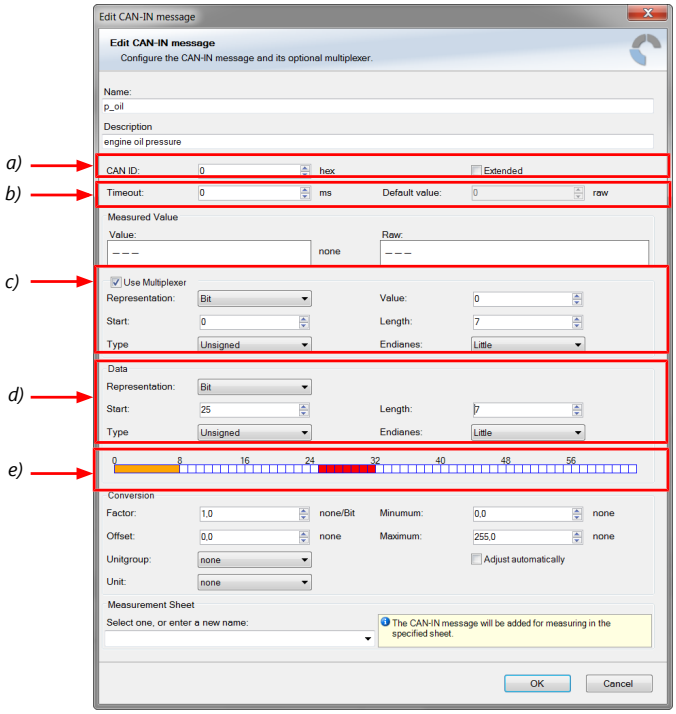
Some CAN devices need to be addressed by a byte represented CAN channel. The address can be assigned in this window and is illustrated by a bar graph.



a) Enter CAN message ID. If extended IDs (29 bit) are used, check the box.
b) If replacement values are used, specify timeout period and raw value.
c) If a multiplexer (row counter) is used, check the box.
d) Enter data position, length and format.
e) The bargraph shows assignment of the bytes.
- Red colored fields show the assignment of the data bytes.
- Orange colored fields show the assignment of the multiplexer bytes.

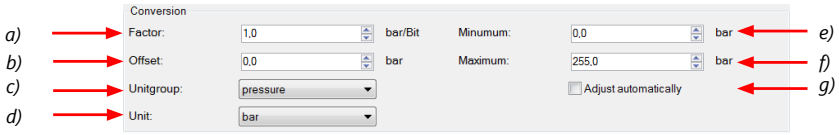
Representation: Bit

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



a) Enter CAN message ID. If extended IDs (29 bit) are used, check the box.
b) If replacement values are used, specify time-out period and raw value.
c) If a multiplexer (row counter) is used, check the box.
d) Enter data position, length and format.
e) The bargraph shows the assignment of the bits.
- Red colored fields show the assignment of the data bits.
- Orange colored fields show the assignment of the multiplexer bits.

Conversion to physical values



a) Enter factor (gain) for conversion to physical value.
b) Enter offset for conversion to physical value.
c) Select type of physical value.
d) Select unit of physical value.
e) Enter minimum physical limit of the channel. (for manual setup)
f) Enter maximum physical limit of the channel. (for manual setup)
g) Check the box to automatically adjust the limits of the channel.

Special features

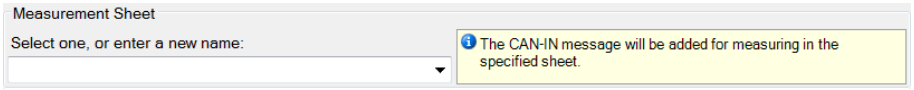
CAN analyzer functionality

This functionality is only available, if a MSA-Box (I or II) is used to connect the CAS-M 3 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.

Automatic creation of online measurement sheets

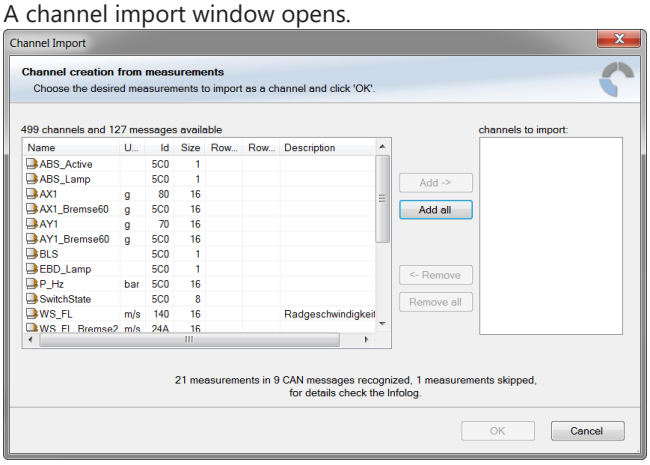
The CAN channel can be automatically inserted into a measurement sheet. Insert a name for a new sheet or select an existing sheet from the list box.

For an online view of the value measured by the CAS-M 3 EVO , insert the channel in an online measurement sheet which is described in the chapter Setting up an online measurement.



6.2.2 Import a CAN database (DBC) file

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



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

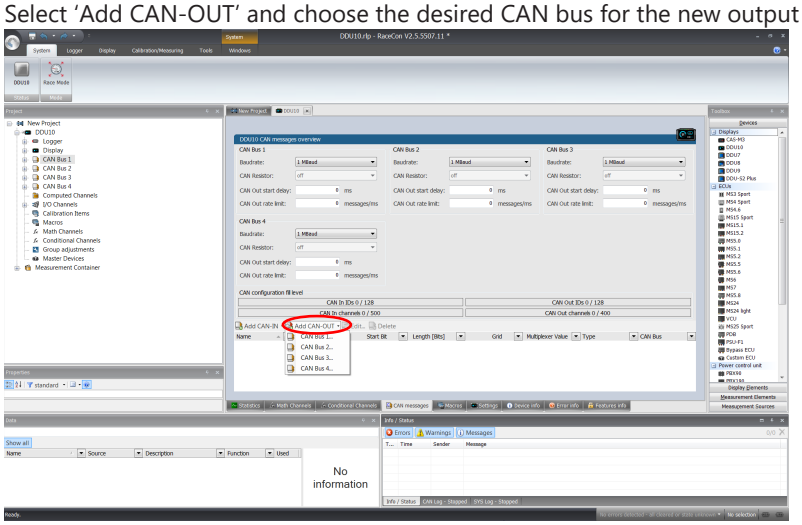
   The channels are inserted in the Data window.

6.3 CAN output

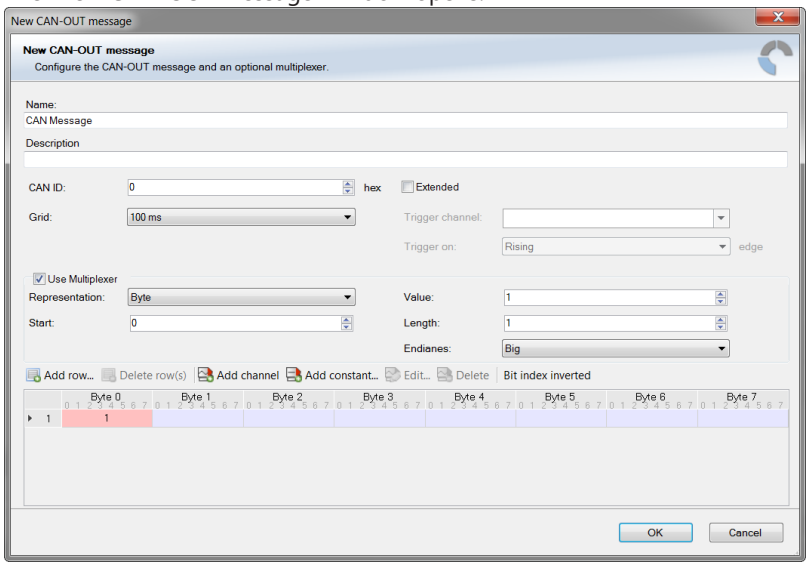
6.3.1 Create a new CAN output message and channel

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

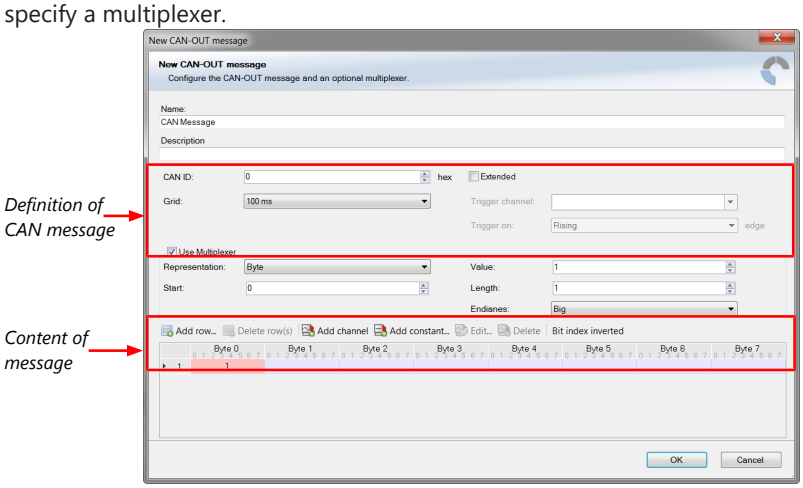
1. Select ‘Add CAN-OUT’ and choose the desired CAN bus for the new output channel.



The ‘New CAN-OUT message’ window opens.

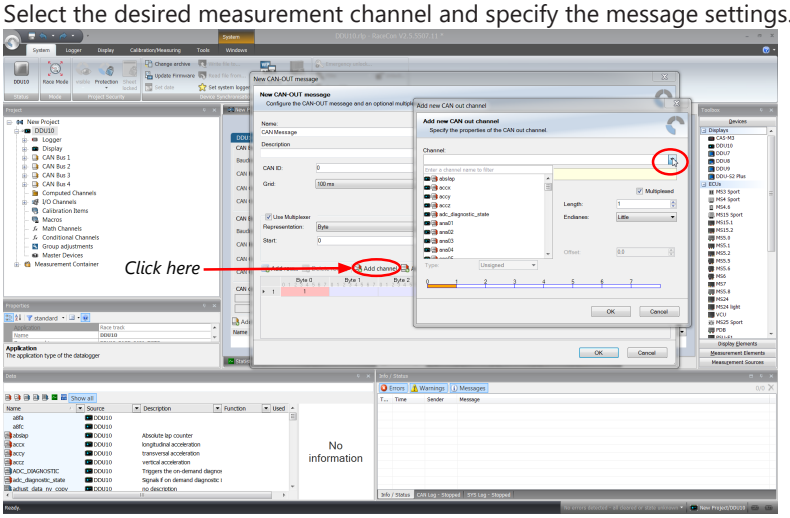


2. Enter name of message, description, CAN-Id and Grid (output interval). Optionally, specify a multiplexer.



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

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

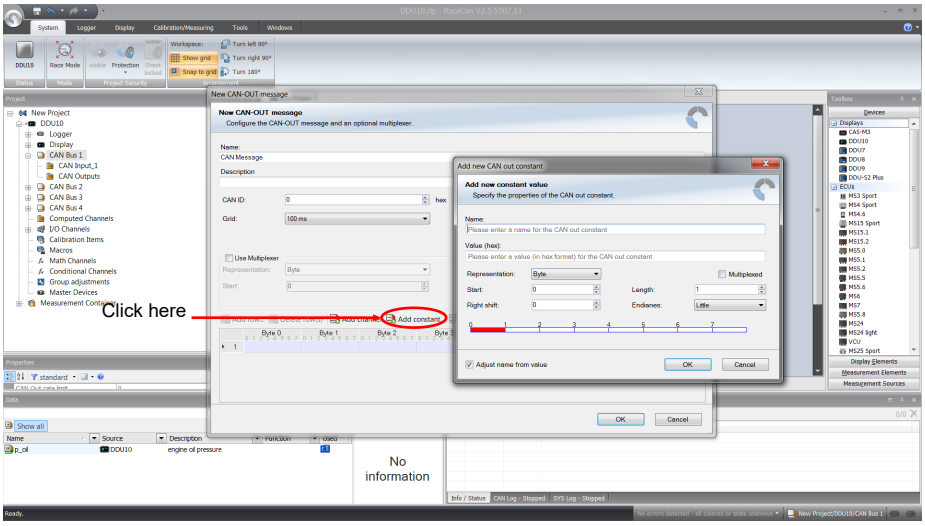


The measurement channel is now assigned to the CAN message.

6.3.2 Add CAN out constant

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

1. Create a new CAN output message or edit an existing message.
2. Click ‘Add constant’. The ‘Add new CAN Out constant’ window appears.
3. Define the name of the constant, the required value in hex and define the CAN channel settings.
4. Click ‘OK’ when done.



6.4 Multiplexer

Row counter concept

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

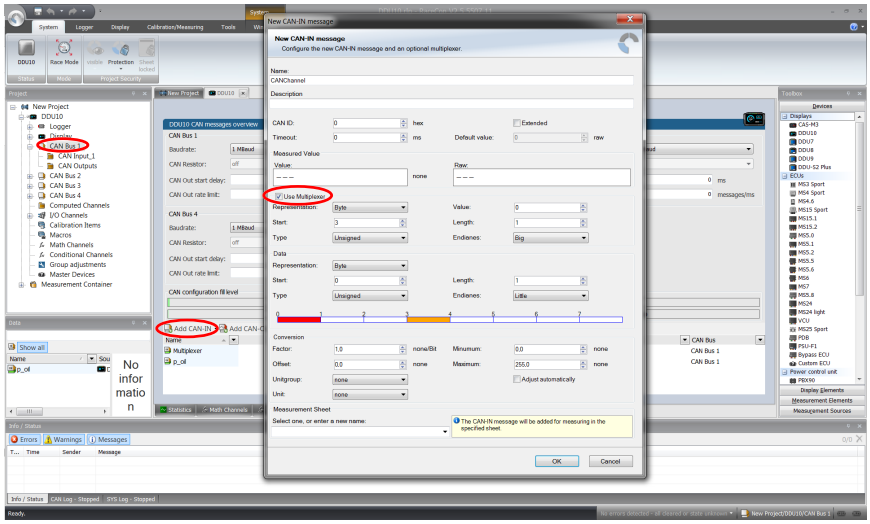
- Re-use (multiplex) of message identifiers by splitting it into several rows.
- Every row is assigned to a unique value of the multiplexer.
- One byte of message contains row counter.

– 7 bytes payload remaining. A multiplexer does not have to consist of one byte only, it can consist of several bytes as well as single bits.

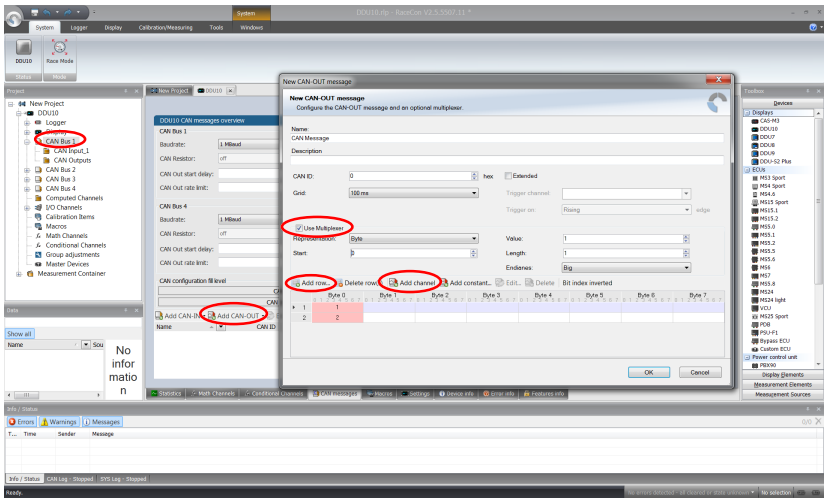
– Position of row counter is configurable.

To use a multiplexer perform the following steps:

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

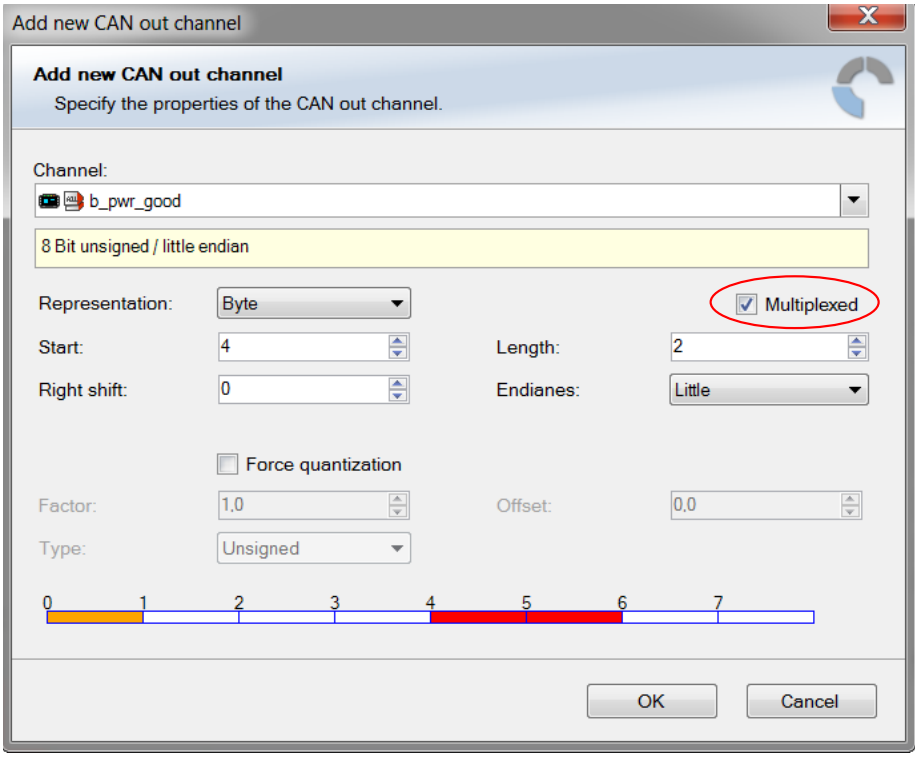


4. To configure the multiplexer for a CAN-OUT channel, select ‘Add CAN-OUT’.
5. Check the box ‘Use Multiplexer’ and click on the button ‘Add row…’ to split the message identifiers into several rows.
6. Click on one row and select ‘Add channel’ to assign a channel to the row.

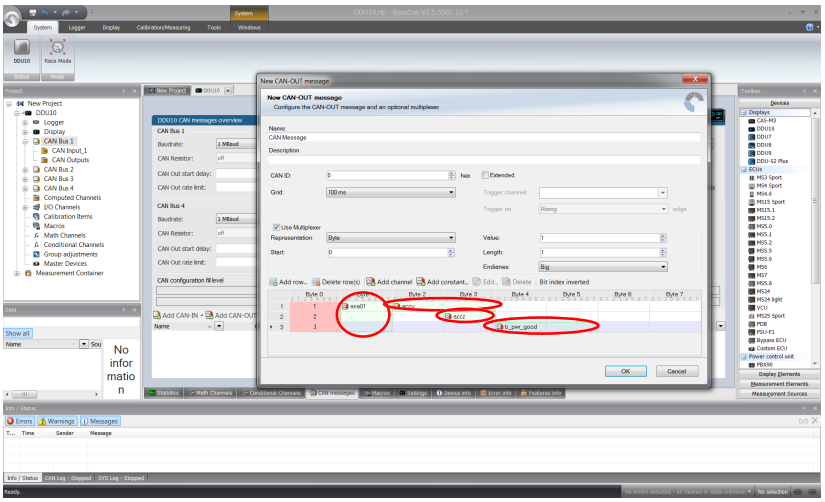


The ‘Add new CAN out channel’ dialog opens.

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



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



	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
0x100	0	p_oil		t_oil				
0x100	1	s_dam_fl		s_dam_fr				
0x100	2	s_dam_rl		s_dam_rr				

Message Id ***Row Counter*** ***Payload Area***

7 Display Configuration

7.1 Overtake Warning

Warning position

Value	Valid data	Default
CASM_OVTK_POSITION_DISP	Top Middle Bottom OFF	Top

This value sets the position of the red overtake warning arrow on the display.

Warning display duration

Value	Valid data	Default
CASM_OVTK_TURNOFF_DELAY	0 to 5 s	1 s

This value sets the duration of the warning signal on the display after an object has passed due to overtaking. As long as the object which is below the time to overtake (TTO) threshold is tracked the warning signal is enabled.

Warning threshold

Value	Valid data	Default
CASM_OVTK_THRESHOLD_TTO	0 to 5 s	1 s

This value sets the trigger for the overtake warning based on the TTO of the tracked object behind. I.e. the time before the calculated overtaking moment of another object.

Warning signal size

Value	Valid data	Default
CASM_OVTK_SIZE_DISP	Small Medium Large	Small

This value sets the size of the red overtake warning arrow.

Illustration 1: Small overtake arrow

Illustration 2: Medium overtake arrow

Illustration 3: Large overtake arrow

7.2 Vehicle Markings

Threshold for color gradient

Value	Valid data	Default
CASM_WARN_YELLOW_THRS	0 to 100 km/h	10 km/h
CASM_WARN_RED_THRS	0 to 100 km/h	20 km/h

These values define the color of the object marking. Based on its delta speed threshold the objects will be marked as follows:

Green	Delta speed ≤ CASM_WARN_YELLOW_THRS
Yellow	CASM_WARN_YELLOW_THRS ≥ Delta speed ≤ CASM_WARN_RED_THRS
Red	Delta speed ≥ CASM_WARN_RED_THRS

Z Position offset of markings

Value	Valid data	Default
CASM_OFFSET_Z_ABSOLUTE	-240 to 240 pixel	0 pixel

This value sets the Z offset position of the object marking in Z direction with pixel step-size. Reference level is the horizontal center of the display.

Shape of the vehicle markings

Value	Valid data	Default
CASM_MARKER_SHAPE	Triangle	Triangle
	Chevron	

This value defines the shape of the vehicle marking.

Illustration 4: Triangle vehicle marking

Illustration 5: Chevron vehicle marking

7.3 Side gauges

Value	Valid data	Default
CASM_GAUGE_LEFT	Off	Off
	Distance	
	Real time gap	
	Time to overtake	
CASM_GAUGE_RIGHT	Off	Off
	Distance	
	Real time gap	
	Time to overtake	

With the side gauges, you can display one of the following information on each side of the screen.

Off: No side gauge

Distance: Distance to the currently marked vehicles behind you in meters

Real time gap: Gap to the currently marked vehicles behind you in seconds

Time to overtake: Estimated time to overtake of the currently marked vehicles behind you in seconds

The vehicles will be displayed as small rectangles in the same color of their markings on the scale.

Illustration 6: Side gauges example

7.4 Own Vehicle Information

Invalid values

Value	Valid data	Default
MRR_EGOVEHSPEED_INVLD	0 to 6.553,5 km/h	6.553,5 km/h
MRR_YAWRATE_INVLD	-163,84 to 163,835°/s	-163,84°/s

These calibration values can be used to mark specific values as invalid, disabling the vehicle overlays if these values are present. The main intention is to react to time-outs of CAN input signals (see section “Default values [▷ 11]”).

7.5 Camera Temperature Warning

Value	Valid data	Default
CASM_HIDE_TEMPERR_THRS	0 to 6553,5 km/h	6553,5 km/h

This calibration value sets the speed threshold above which to hide the camera temperature warning. Recommendation for a warning which appears just in Pit Lane or stopped vehicle is ≥20 km/h.

7.6 LEDs

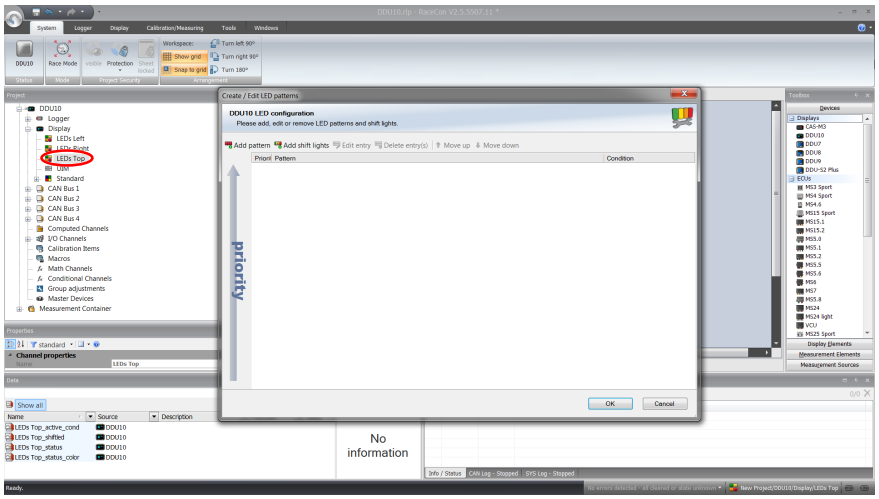
7.6.1 Configuring shift LEDs

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

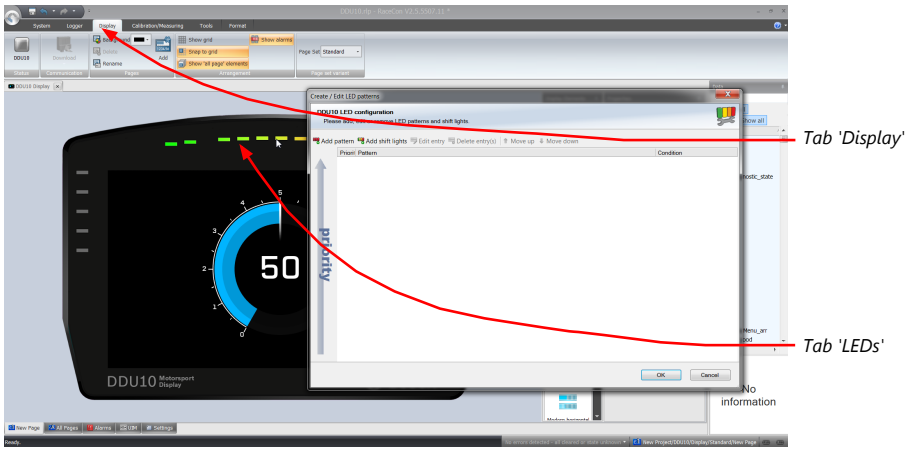
You can configure the shift LEDs only in the 'LEDs Top'.

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

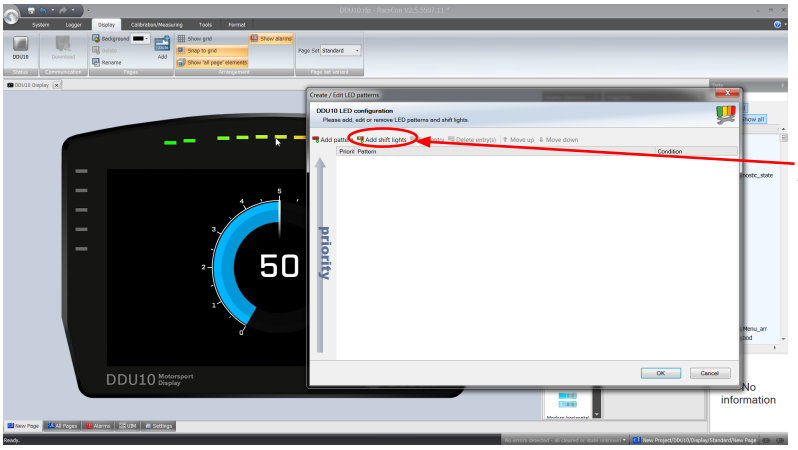
   You will find them under 'Display'.



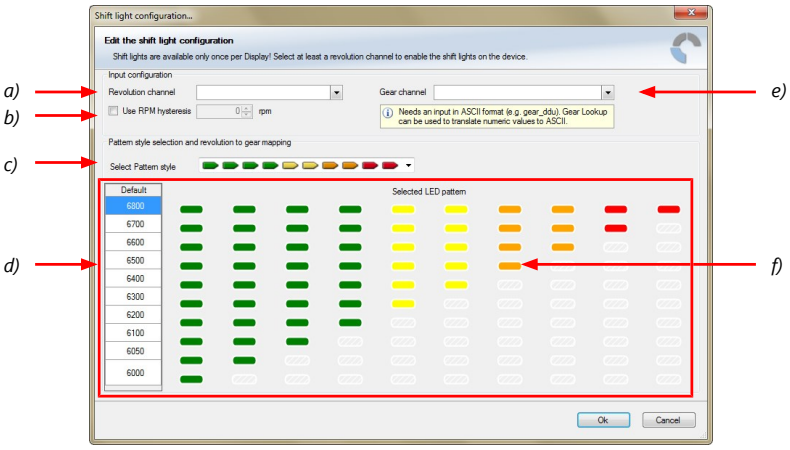
2. Alternatively, click on the 'Display' tab and then click on the colored LEDs at the top of the display image.



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



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



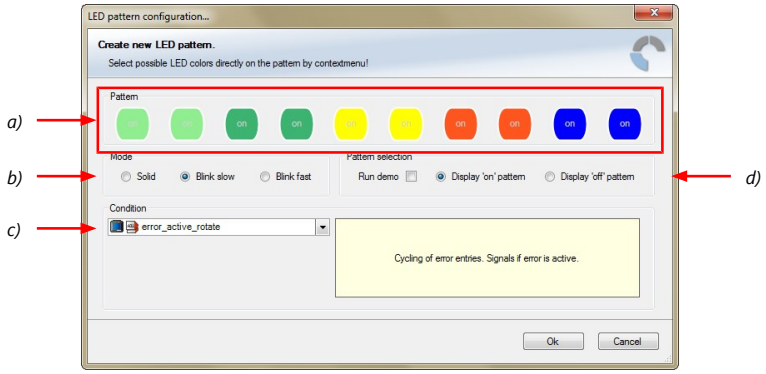
a) Choose the measurement channel for 'Revolution'. Revolution must have 1/min quantization.
b) Enter the limit value when the RPM hysteresis function is active. The RPM hysteresis function avoids the high-frequent switchover of the measurement channel value.
c) Choose a predefined Pattern style.
d) Define the rpm thresholds to show the LED pattern.
e) Choose the measurement channel for 'Gear'. Gear must have an ASCII quantization (1st gear='1' = 49, 2nd gear='2' = 50, ...). (ASCII quantization is standard for the 'gear' channel of Bosch ECUs.
If you get the gear information of a different control unit as the Bosch ECU (e.g. a gearbox control unit), use the Gear Lookup Table to translate numeric values to ASCII format.
For more information see chapter "Converting a gear channel to ASCII representation".)
f) Click with the right mouse button on the LEDs to reconfigure the LED patterns.

5. Click ‘OK’ when done. The configuration is displayed in the CAS-M 3 EVO LED Configuration window.

7.6.2 Creating customized LED pattern

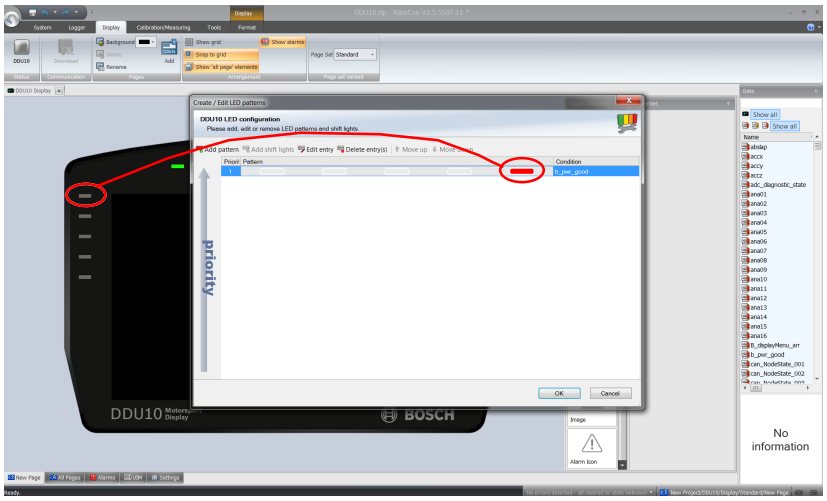
You can create your own LED pattern with an individually created condition, using the top LEDs and the ones on the sides. The LEDs illuminate or flash if the condition becomes true.

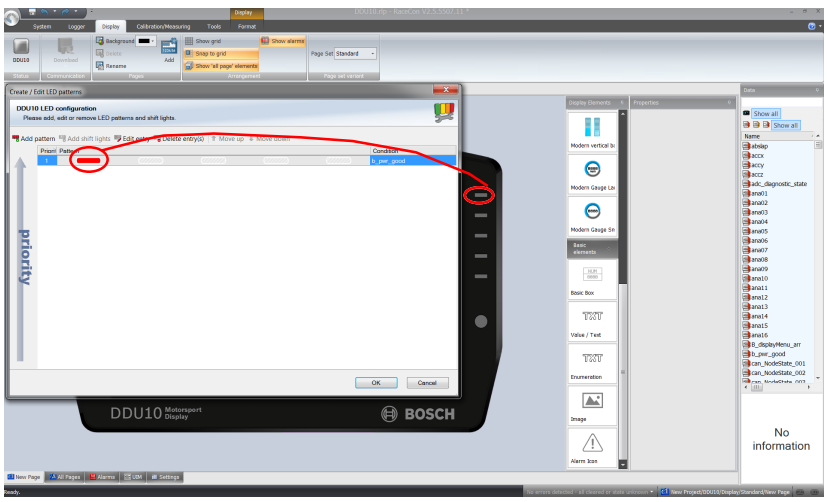
1. Click on the button ‘Add pattern’ in the display view. The LED pattern configuration window appears.



a) Choose the needed LEDs by clicking or via multiselect with ctrl + clicking and define the color of the LEDs by right-clicking on one of the selected LEDs
b) Select if the LEDs blink or do not blink.
c) Choose the condition when the LEDs will flash.
- Create a condition using the Condition Creator. For more information see chapter "Creating a new condition channel".
- Choose an existing condition.
d) Check the box to show a demo of the LEDs. (Important to check blinking)
To create a LED that alternately blinks in two different colors, choose 'Display "on" pattern' and define the LEDs in the first color. Then choose 'Display "off" pattern' and define the LEDs in the second color.

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





2. Click 'OK' when done.

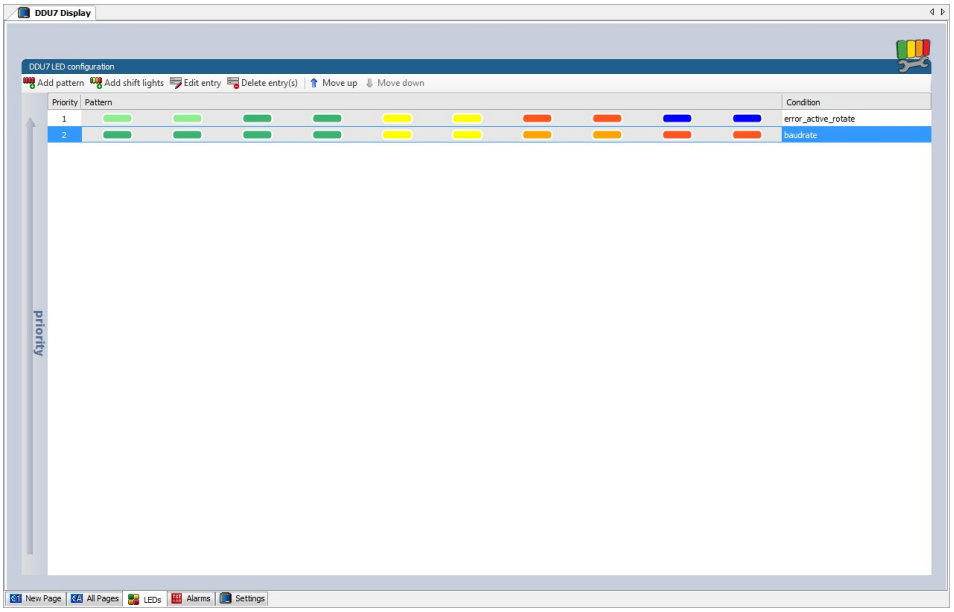
The configuration is displayed in the CAS-M 3 EVO LED Configuration window.

7.6.3 Assigning display pattern priority

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

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

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



7.6.4 Using LED sidebar for Overtaking warning

Additionally the LED sidebars of the CAS-M 3 EVO display can be used for overtake warnings.

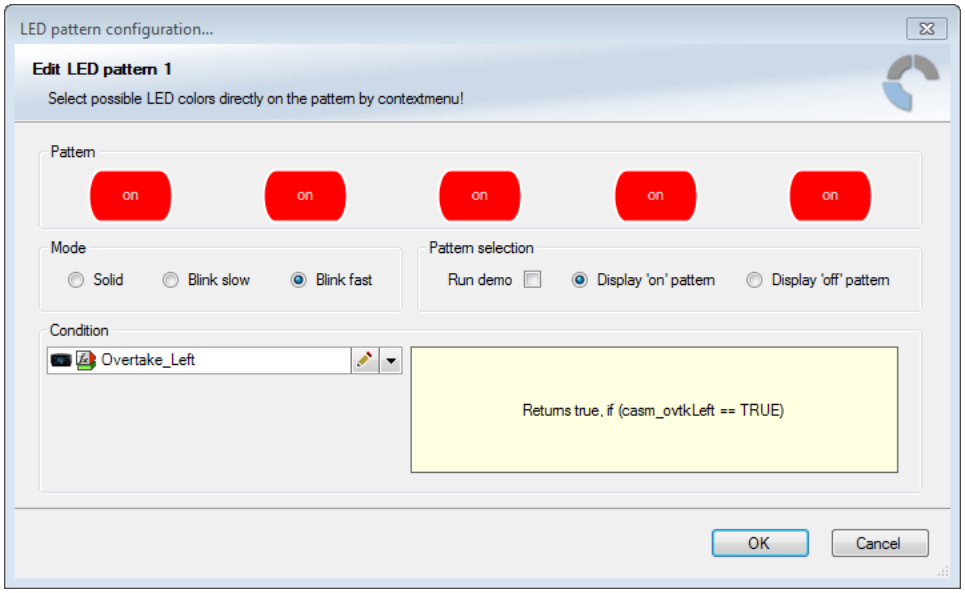
Trigger conditions for the overtake warnings are the following channels:

casm_ovtkLeft

casm_ovtkRight

These signals reflect the activation of the overtake-warning arrows on the display.

Example for overtake warning on the left:



See also

LEDs [▸ 28]

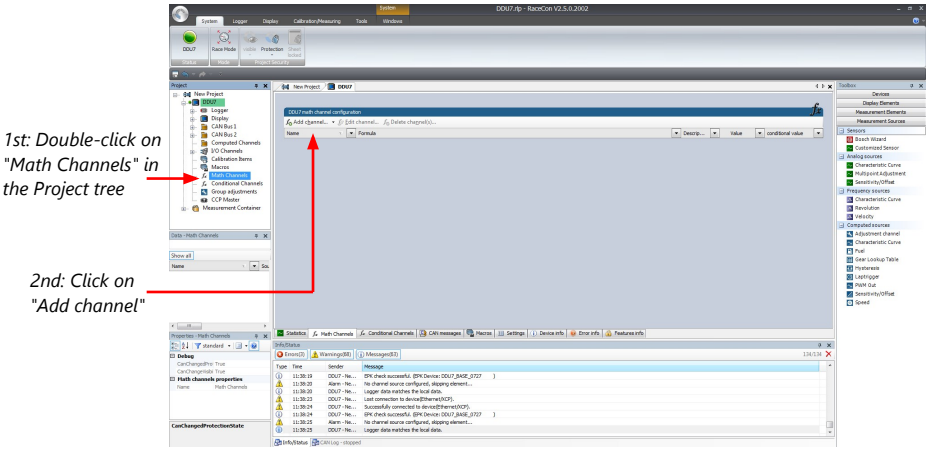
7.7 Math Channels and Conditional Functions

Math Channel

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

Creating a new math channel

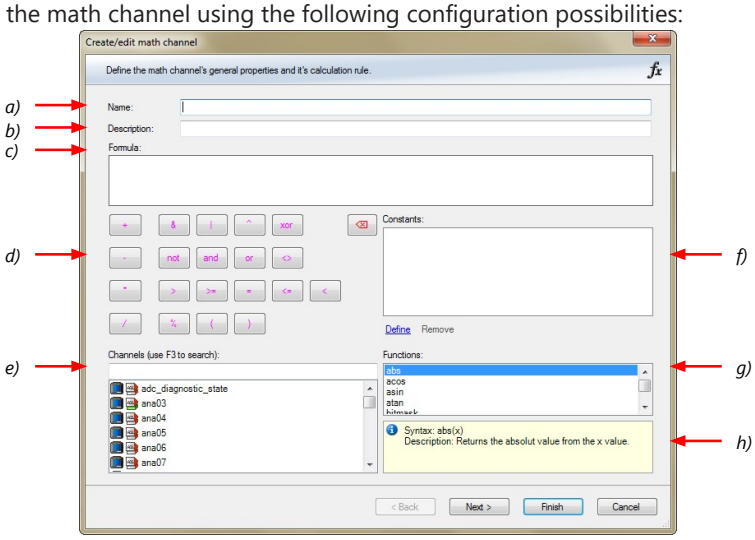
Follow the steps shown in the screenshot.



The “Create/edit math channel” window appears.

“Create/edit math channel” window

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



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

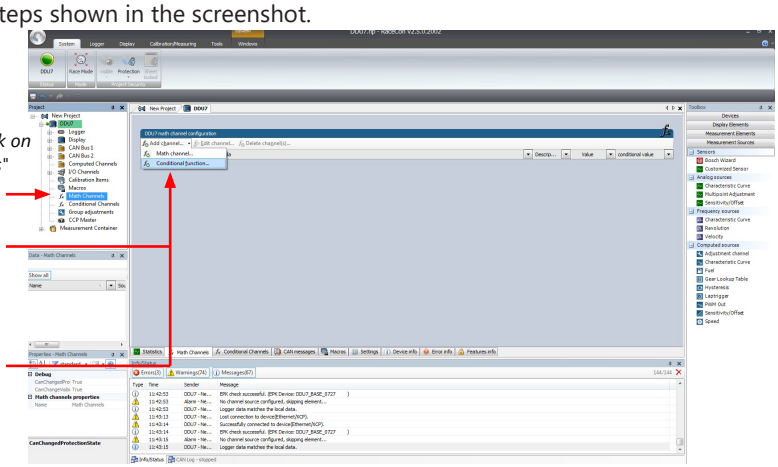
2. Click ‘Finish’ when done.
   The math channel is displayed in the CAS-M 3 EVO math channel window.

Conditional Function

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

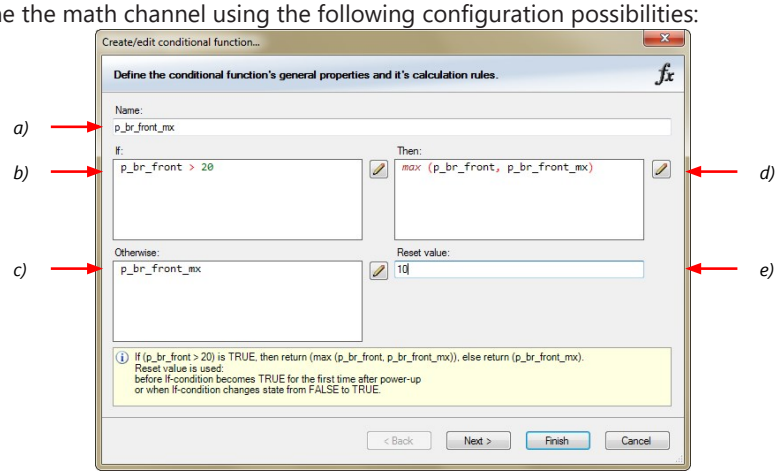
Creating a new Conditional Function

1. Follow the steps shown in the screenshot.



   The “create/edit math channel” window appears.

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



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

3. Click ‘Finish’ when done.

The conditional function works the following way:

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

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

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

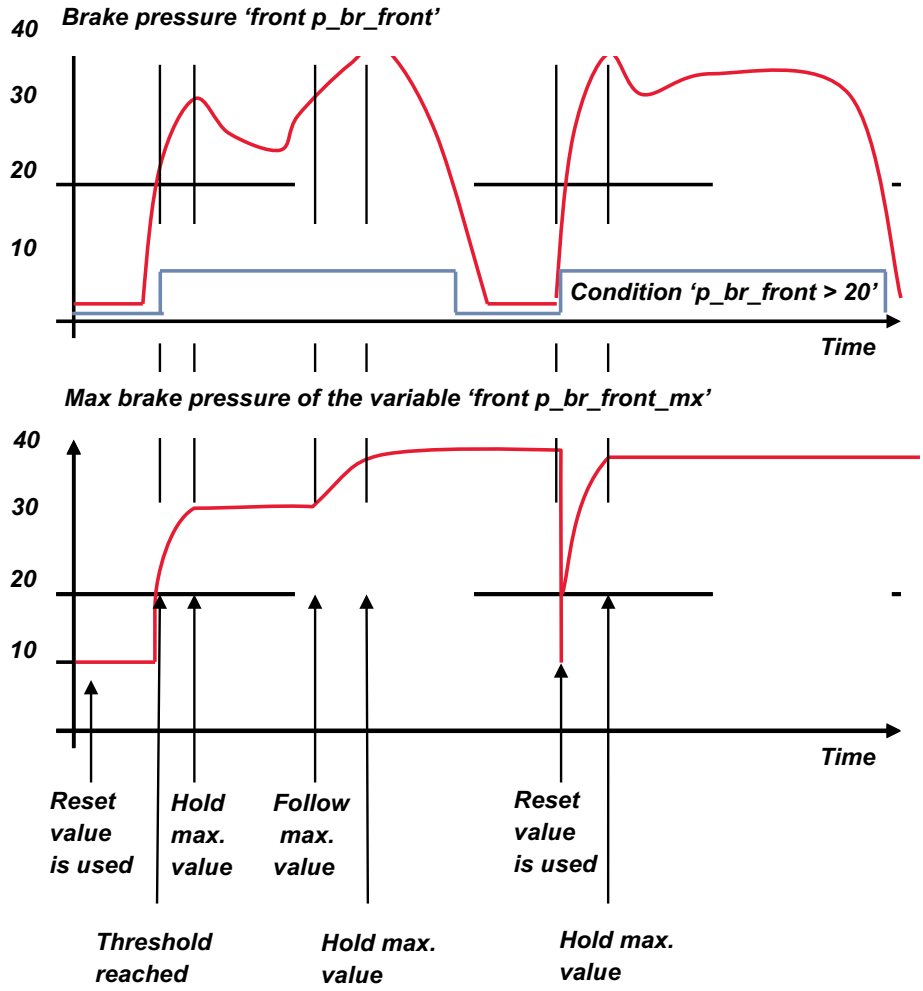
The reset value is always set for the new variable (entered in “Name”):

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

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

The conditional function is displayed in the CAS-M 3 EVO math channel window.

Example: Setting up a condition for maximum front brake pressure



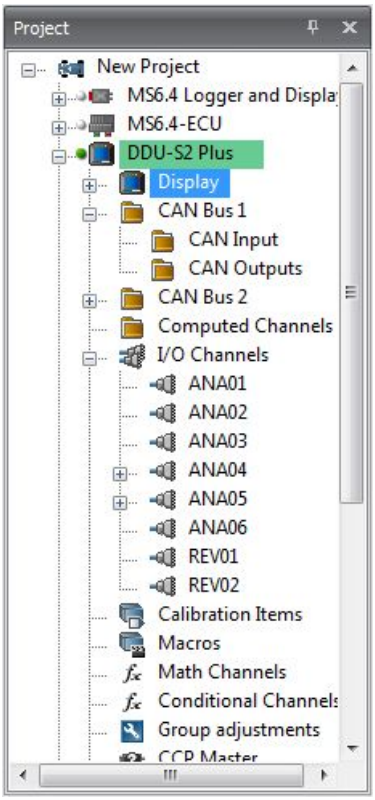
- At power-up, the reset value (10) is used for 'p_br_front_mx'.
- 'p_br_front' rises to 30. As 'p_br_front' is > 20 (condition is TRUE), the condition 'max (p_br_front, p_br_front_mx)' in the THEN window is triggered. The condition sets the bigger value as new value for 'p_br_front_mx'. As 'p_br_front'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

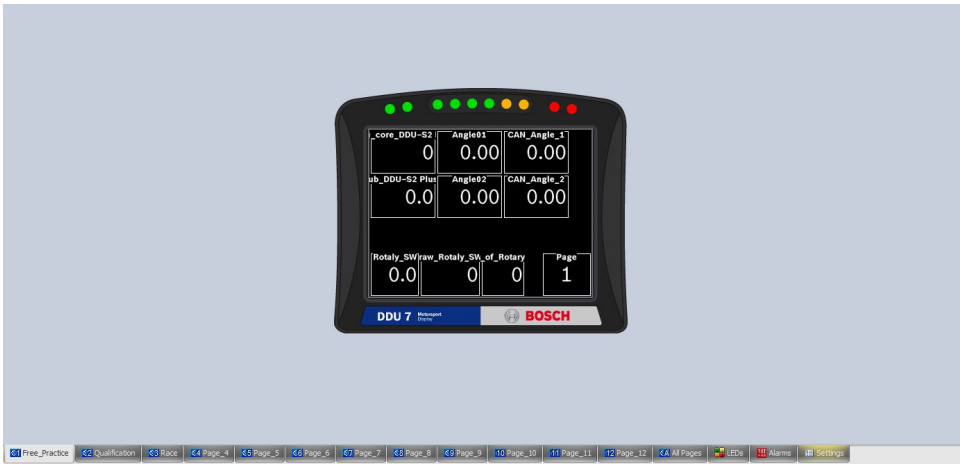
7.8 Display + LED brightness

Any “event” can be used to change display brightness. This can be a math channel etc.

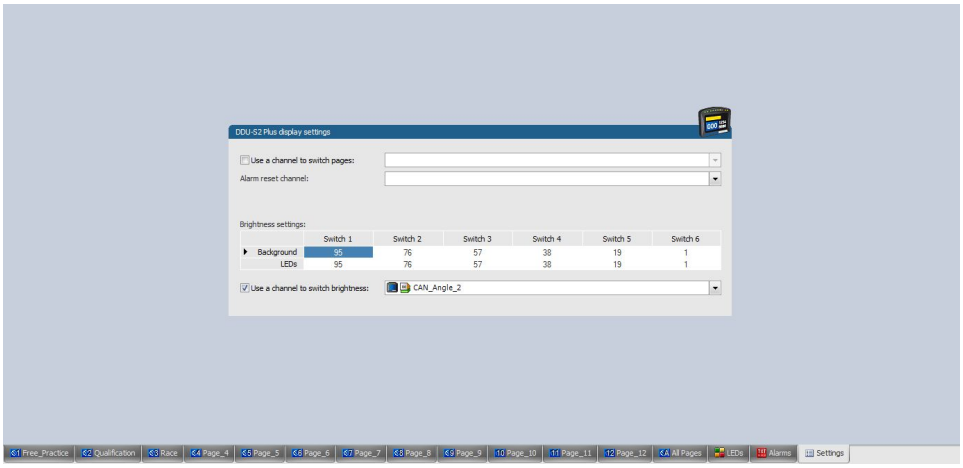
CAN input signal and math channel

Select Display and Setting.





Check “Use a channel to switch brightness:” and select CAN channel or math channel.
Change value for Background and LEDs for each switch position if it is needed.



The channel has to include value from 0.5 to 5.5.

Switch 1 is shown with the value <1.5

Switch 2 is shown with 1.5< = the value <2.5

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

Switch 6 is shown with 5.5< = the value

8 System Messages and Troubleshooting

In case of errors between the CAS-M 3 EVO display and the radar or camera, corresponding messages are shown on the display. Below is a list of the possible messages and their causes.

8.1 Camera status messages casm_cameraStatus

[0] OK

[1] Link down; searching for link partner

The Ethernet link is down on the camera interface; if the message persists beyond a few seconds after system power-up, this indicates an error condition.

Possible causes:

- camera powered off or disconnected
- cabling or connector issues
- internal display / camera fault

[2] Link up; searching for camera

The display has linked-up to an Ethernet network and is looking for a GigE-Vision camera; if the message persists beyond a few seconds after system power-up this indicates an error condition.

Possible causes:

- the display is connected to an unexpected Ethernet device
- internal display / camera fault

[3] Error: unknown camera

- The display is connected to a GigE-Vision camera but the camera model is unknown. Check / replace the connected camera.

[4] **Error: locked camera**

- The display is connected to a supported GigE-Vision camera model, but the camera is not unlocked for operation within the CAS-M 3 EVO system. Contact Bosch Motorsport.

[5] Error: video stream unstable

The display is correctly connected to the camera but fails to receive a (stable) video stream. The message can be permanent or indicate sporadic stream losses.

Possible causes:

- cabling or connector issues (vibrations)
- internal display / camera fault

[6] Overheat

The internal camera temperature has exceeded 70°C

For further information, see Camera Temperature Warning [▶ 28].

8.2 Radar status messages casm_radarStatus

[0] OK

[1] CAN bus error

This message indicates a physical error on the CAN bus to the radar sensor.

Possible causes:

- radar powered off or disconnected
- cabling or connector issues
- internal display / radar fault

[2] No data from radar

The display does not receive any CAN message from the radar sensor.

Possible causes:

- radar powered off or disconnected
- cabling or connector issues
- internal display / radar fault

[3] Incomplete data from radar

The display does not receive some CAN message from the radar sensor.

Possible causes:

- cabling or connector issues
- internal display / radar fault

[4] vehSpeed / yawRate error

This message indicates an error in the sending of vehicle information to the radar sensor.

Possible causes:

- Vehicle Speed / Yaw Rate signals are not configured (see section “Input Signals [▶ 11]”)
- Vehicle Speed / Yaw Rate signals are configured but not received by the display
- Vehicle Speed / Yaw Rate signals are not received by the radar sensor
  - cabling or connector issues
  - internal display / radar fault

[5] Overheat

The internal radar temperature has exceeded 120°C.

9 Signals

9.1 Main Signals - Function CASM_Main

Beyond the overlay configuration parameters (see section “Display Configuration [▶ 24]”), the function CASM_Main contains the following signals:

casm_camerastate

An enumeration reflecting the camera state is outlined in section “Camera status messages casm_cameraStatus [▶ 38]”.

casm_radarstate

An enumeration reflecting the radar state is outlined in section “Radar status messages casm_radarStatus [▶ 39]”.

casm_ovtk*

The current overtake warning states; see section “Using LED sidebar for Overtaking warning [▶ 31]”.

9.2 Radar Signals - Function CASM_Radar

MRR_EgoVehSpeed

The ego vehicle speed as sent to the radar sensor.

MRR_EgoYawRate

The ego yaw rate as sent to the radar sensor.

MRR_Errors

A bitmask summarising possible errors on the CAN interface to the radar sensor:

- Bit 0: ego vehicle speed error (display-side: not configured or not received)
- Bit 1: ego yaw rate error (display-side: not configured or not received)
- Bit 4: “race car 0” message time-out
- Bit 5: “race car 1” message time-out
- Bit 6: “race car 2” message time-out
- Bit 7: “race car 3” message time-out
- Bit 8: “Object ID” message time-out
- Bit 12: “status” message time out
- Bit 16: ego vehicle speed error (radar-side: not received)
- Bit 17: ego yaw rate error (radar-side: not received)

MRR_RaceCar*

- The data on tracked race cars as received per CAN from the radar sensor.

MRR_Status*

– Radar sensor information (internal temperature + ego data acknowledgement).

9.3 Camera debug Signals - Function CASM_Camera_debug

CASM_Camera_debug contains various GigE-Vision error flags and counters which can be used by Bosch Motorsport to analyse video issues in the CAS-M 3 EVO system. Their description is beyond the scope of this document.

9.4 Radar debug Signals - Function CASM_Radar_debug

CASM_Radar_debug contains the radar CAN message counters.

10 Radar Sensor

10.1 Regulations

The CAS-M 3 EVO 3 radar sensor is based on the Bosch Engineering MRRe14HBW radar sensor. The MRRe14HBW meets the following statutory requirements for ground-based vehicles.

Also, only in the EU, the sensor meets the statutory requirements for installation at railway/road crossings (i.e. only at a crossing between a road and a railway, not for road only crossings or railway only crossings).

Country	Regulations
European Union	ETSI EN 301 091-1 V2.1.1 (2017-01)
	ETSI EN 301 091-3 V1.1.1 (2017-02)
	ETSI EN 303 396 V1.1.1 (2016-12)
	ETSI EN 301 489-1 V2.2.0 (draft) (2017-03)
	ETSI EN 301 489-3 V2.1.1 (final draft) (2017-03)
	ETSI EN 301 489-51 V2.1.0 (draft) (2017-03)
	EN 62368-1:2014/AC:2015
	IEC 62368-1:2014(2nd Edition) + Cor. 1: 2015
	EN 62311 (2008-01)
USA	47 CFR §2.925
	47 CFR §15.19
	47 CFR §15.21
	47 CFR §15.105
	47 CFR §95.3331
	47 CFR §95.3361
	47 CFR §95.3367
	47 CFR §95.3379
	47 CFR §95.3385
Canada	RSS-GEN Issue 4
	RSS-102 Issue 5 Section 2.6
	RSS-251 Issue 1
Japan	ARIB STD-48 V2.2
Australia	Radiocommunications (Low Interference Potential Devices) Class License 2015 - F2016C00432 - Radiodetermination - sensors using radar for measurement, 69. Radiodetermination transmitters 76 - 77 GHz.
New Zealand	Radiocommunications Regulations (Radio Standards) Notice 2016 - Road Transport and Traffic Telematics (76 GHz) - Level A1 conformity based on the ETSI EN 301 091-1 V2.1.1 standard.

If the MRRe14HBW and hence the CAS-M 3 EVO radar sensor SCU is not operated within this context, it lies within the customer's responsibility to ensure compliance of the application with national regulations and standards, e.g., electromagnetic compatibility and radio spectrum matters.

10.2 Intended Use

The application of the MRRe14HBW-based CAS-M 3 EVO radar sensor under the conditions described in this technical customer documentation and the associated arranged documents to described conditions (environment, application, installation conditions and loads) is a prerequisite for a warranty on the part of Bosch Engineering GmbH, that the product is suitable for the intended or usual application assumed after the contract, or has a certain state or quality.

All contractual requirements - including the aforementioned - are considered as fulfilled if the product passes the test range according to the technical customer documentation and the arranged documents. The safety of the application of the product in the vehicle is in the responsibility of the customer.

All changes in the surroundings of the product, which deviate from the technical customer documentation and the arranged documents, as well as use for applications not released by Bosch Engineering GmbH, are to be indicated to Bosch Engineering GmbH. Such an application or deployment of the product may take place only after release by Bosch Engineering GmbH on the basis of the changed surroundings or variance.

The product safety is ensured only if the permissible conditions are kept.

In the case of failure, the product needs to be replaced exclusively by an authorized body and is not serviceable.

The intended use of the CAS-M 3 EVO radar sensor is being mounted on ground based vehicles. These include but are not limited to construction equipment (excavators, dump trucks, bulldozers etc.), agriculture equipment (tractors, combine harvesters etc.), material handling equipment (forklifters, mobile industrial robots, cranes etc.), mobile work platforms, trains, trams, light rail vehicles, and automotive vehicles (passenger cars, trucks, busses).

In addition, only in the EU, another intended use of the CAS-M 3 EVO radar sensor is surveillance of railway/road crossings (i.e. only at a crossing between a road and a railway, not for road only crossings or railway only crossings).

It is not permitted to hand BOSCH ENGINEERING GmbH CAS-M 3 EVO **radar sensors, any documentation about BOSCH ENGINEERING GmbH** CAS-M 3 EVO **radar sensors, or any measurements using them to anyone who has not directly obtained the material from Bosch Engineering GmbH.**

It is not permitted to re-sell BOSCH ENGINEERING CAS-M 3 EVO **radar sensors unless otherwise agreed upon.**

It is not permitted to publish any results using the data from the BOSCH ENGINEERING GmbH CAS-M 3 EVO **radar sensor, where it is publicly available unless otherwise agreed upon.**

It is not permitted to use the CAS-M 3 EVO **radar sensor as fixed infrastructure equipment.**

It is not permitted to use the CAS-M 3 EVO **radar sensor for military applications.**

It is not permitted to operate the CAS-M 3 EVO **radar sensor in any country where frequency homologation type approval is not available.**

In the case, frequency homologation is available in a country, it is not permitted to operate the CAS-M 3 EVO **radar sensor in applications not covered by this frequency homologation in said country.**

10.3 Radio Frequency Homologation

10.3.1 Basic information on radio frequency homologation and import requirements

Definitions

- In radio frequency homologation, the MRRe14HBW radar on which the CAS-M 3 EVO radar sensor is based on falls into the group of Short Range devices (SRD). This classification does not have any relation to the functional classification used for these radars.
- e.g.: a long range radar from Bosch also comes under the Short Range device classification.
- The radar sensor is a component that is part of a ground-based vehicle or in the EU in a fixed infrastructure or railway/road crossings surveillance systems. The sensor as a component is not brought on to the market. This means that the sensor is not available for purchase by the target user.
- The radar sensor as a component cannot be operated stand alone. For the intended use of the component, a connection to the ground-based vehicle (or only in the EU to railway/road crossing surveillance system) is required (data connection, supply voltage).
- In some countries, components that cannot be operated stand alone and also are designated to be mounted in a vehicle, are exempted from radio frequency licensing.
- The radar sensor intentionally radiates RF energy. Therefore, a radio frequency type approval license may be required for any country in which the sensor is intended to be operated.
- A ground-based vehicle consists of a number of components. Depending on the country, the vehicle may be subject to additional homologation requirements (e.g. registration of components).
- Type approval is the process by which any radio equipment is authorized to be used in a specific country. The equipment's compliance with the applicable standards and regulations has to be checked by the customer (upon request, BEG may assist in this process).

Overview Homologation: tasks and responsibilities

	Radio frequency homologation (component)	**Equipment Type Approval / Import license (vehicle)**
Required for	Legal operation of the device in a country	Import and sale of a device in a country
Responsible	Bosch Engineering For countries specified in this document	OEM / (local registered) importer (Bosch Engineering customer)
Certificate holder	Bosch Engineering	OEM / Local agent / entity of OEM

	Radio frequency homologation (component)	Equipment Type Approval / Import license (vehicle)
Responsible for maintaining the certificate	Bosch Engineering For countries specified in this document	OEM
Timing	Available with Bosch Engineering SOP of the device	Must be obtained prior to importing of ground-based vehicles in a country

Responsibilities of the vehicle manufacturer

- It is in the responsibility of the ground-based vehicle manufacturer to obtain the required equipment type approvals or import licenses for bringing a ground-based vehicle into the market in a specific country.
- On customer request, Bosch Engineering will provide the necessary technical radio frequency related documentation to the OEM that is required for applying and obtaining the component (equipment) type approval / import license for the radar sensor as a component of the ground-based vehicle in a specific country.
- The maintenance and renewal for the ground-based vehicle type approval certificates and import licenses for the relevant vehicle platforms is in the responsibility of the vehicle manufacturer.

Impact of import destinations

- Depending on the location of the OEM´s manufacturing plants, it needs to be clarified who will act as the importer of the radar sensor component into these countries.
- The importer responsibilities relevant to that country have to be fulfilled by the party accordingly

Responsibilities of Bosch Engineering

- Bosch Engineering only provides radio frequency homologation for the sensor in the countries mentioned in this document.

The radio frequency homologation certificates for the specific sensor for the countries mentioned in this document are maintained by Bosch Engineering.

10.4 Remarks on the Radio Frequency Homologation

10.4.1 General Points

- Radio frequency homologation is required to operate 76-77 GHz radar sensors in a country. Frequency homologation in a country must be granted and available prior to selling in a country.
- Granting and defining the requirements for obtaining radio frequency type approvals is a task in the responsibility of a country´s telecommunication authority. Rejections of approvals or country specific restrictions are administrative decisions and cannot be influenced by Bosch Engineering.

- Bosch Engineering cannot control the elements involved in the radio frequency type approval process of a country:
  - Incurring costs and fees
  - Lead-time for obtaining the type approval
  - Validity of a type approval certificate
  - Content and requirements for obtaining a type approval certificate
  - Availability of the frequency band for radar sensor operation, as regulation may change
- The requirements and procedures for obtaining radio frequency type approval in a country may change. In case of uncertainty, reconfirmation of the requirements that apply may be necessary.

10.4.2 Markings on the Component and Manual Phrases

With receiving frequency homologation for a specific country, certain requirements have to be satisfied regarding

- Marking of the device
- Reproducing specific statements and labels in the vehicle user manual
- The markings to satisfy the homologation requirements of the Bosch Engineering focus countries are printed on the label on the back-cover of the CAS-M 3 EVO Bosch Engineering radar sensors
- Some of the countries listed in this document have requirements regarding specific markings and phrases for the vehicle´s user manual which are described in chapter Mandatory Country Specific User Manual Statements.
- For any country in which no type approval of the CAS-M 3 EVO radar sensor is available through Bosch Engineering, additional requirements regarding markings and user manual phrases may exist.
- A country may require additional product registration and/or markings to be added on the device or in the user manual, for a ground-based vehicle equipped with a radar sensor. Obtaining this information and the implementation of these requirements is the responsibility of the ground-based vehicle manufacturer.
- Example CAS-M 3 EVO radar sensor label (located on the back side of the sensor; measures are in millimeters):

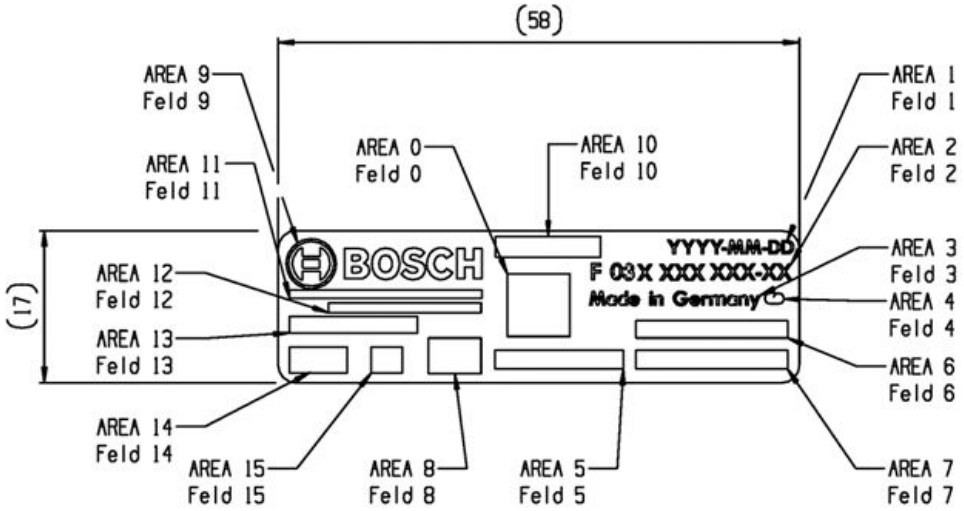


Illustration 7: Markings on the CAS-M 3 EVO Radar Sensor

Label area	Description
Area 0	Data matrix code
Area 1	Manufacturing date
Area 2	Product part number
Area 3	Designation of origin
Area 4	Business facility
Area 5	Naming
Area 6	Serial number
Area 7	Type naming
Area 8	CE conformity mark
Area 9	Bosch symbol and logotype
Area 10	Manufacturer address
Area 11	Frequency certification label / number USA
Area 12	Frequency certification label / number Canada
Area 13	Frequency certification label / number Japan
Area 14	Frequency certification label / number New Zealand

10.4.3 Countries where no type approval is obtained

– Application for type approval in countries that are not listed in Chapter 1.2 of this document may be handled on customer request and charged separately. In this case, the availability of the 76 GHz frequency range for ground-based vehicular radar, administrative requirements and incurring costs have to be confirmed by the customer prior to filing an application.

10.5 European type approval according to Radio Equipment Directive 2014/53/EU

Requirement according to RE-D Article 10(9): The OEM is required to translate the EU Declaration of Conformity into the official language of each EU target country.

10.5.1 General Statements

Statement according to RE-D Article 10(10): This Radio Equipment can be operated without member country restrictions related to Article 10(10) of the RE-D in the EU.

Statement according to RE-D Article 10(2): This Radio Equipment is constructed so that it can be operated in all EU member states without infringing applicable requirements in regard to the requirements on the use of radio spectrum.

10.5.2 Technical Parameters

Declaration of the technical parameters of the Radio Equipment under RE-D Article 10(8).

Frequency Band

Frequency band	76-77 GHz

Maximum Transmit Power

Nominal radiated power: e.i.r.p. (peak detector)	32 dBm
Nominal radiated power: e.i.r.p. (RMS detector)	27 dBm

10.5.3 EU Declaration of Conformity under RE-D 2014/53/EU

Hereby, Bosch Engineering GmbH declares that the radio equipment type CAS-M 3 EVO radar sensor is in compliance with Directive 2014/53/EU.

The full text of the EU declaration of conformity is available at the following internet address: http://eu-doc.bosch.com

Please enter the model MRRe14HBW to find the correct DoC in the database. CAS-M 3 EVO radar sensor is based on the MRRe14HBW sensor mentioned in the declaration of conformity.

10.6 Mandatory Country Specific User Manual Statements

The below mentioned countries have requirements regarding specific phrases that have to be reproduced in the vehicle user's manual. The specific phrases and labels result from the radio type approval requirements of those countries. The phrases have to be included in a conspicuous location in the vehicle user manual and accurately reprinted as indicated in the following sub-chapters:

10.6.1 USA

User manual statement according to §15.19:

NOTICE:

This device complies with Part 15 of the FCC Rules

Operation is subject to the following two conditions:

1. this device may not cause harmful interference, and
2. this device must accept any interference received, including interference that may cause undesired operation.

User manual statement according to §15.21:

Changes or modifications made to this equipment not expressly approved by Bosch Engineering GmbH may void the FCC authorization to operate this equipment.

User manual statements according to §15.105:

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause

harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

RF Exposure Information according 2.1091 / 2.1093 / KDB 447498 / OET bulletin 65:

Radiofrequency radiation exposure Information:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance of 20 cm between the radiator and your body.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

10.6.2 Canada

User manual statement according to RSS-GEN

NOTICE:

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device must not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

RF Exposure Information according to RSS-102

Radiofrequency radiation exposure Information:

This equipment complies with FCC and IC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance of 20 cm between the radiator and your body.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Cet équipement est conforme aux limites d'exposition aux rayonnements IC établies pour un

environnement non contrôlé. Cet équipement doit être installé et utilisé avec un minimum de

20 cm de distance entre la source de rayonnement et votre corps.

Ce transmetteur ne doit pas etre place au meme endroit ou utilise simultanement avec un autre transmetteur ou antenne.

10.6.3 Japan

This device is granted pursuant to the Japanese Radio Law (□□□) under the grant ID n° (□ □□□): 202-LSF075

This device should not be modified (otherwise the granted designation number will become invalid)

本製品の改造は禁止されています。（適合証明番号などが無効となります。）

10.6.4 Australia

The minimum height of the RCM mark should be 3 mm.

11 Disposal

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

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

12 Appendix

12.1 Order numbers and accessories

Parts	Order number
Collision Avoidance System CAS-M 3 EVO	F 02U V02 648-01
Accessories	
Display Unit	F 02U V02 660-01
Rear Module	F 02U V02 630-01
Camera Unit	F 02U V02 620-01
Radar Unit	F 02U V02 647-01
Radar Bracket	F 037 D00 084-01
Wiring Harness for Radar and Camera	F 02U V02 634-02
Interface Module (Housing and Electronics)	F 02U V02 639-01
Acceleration Sensor MM5.10 Without wire (1)	F 02U V01 511-02
Acceleration Sensor MM5.10 Wire with open end (2)	F 02U V01 511-91
Acceleration Sensor MM5.10 Wire with motorsport connector (3)	F 02U V01 512-02

12.2 Open Source Software (OSS) Declaration for the Display

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

12.2.1 EZXML License

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

Applies To:

libgre.dll, libgre.a

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

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12.2.2 Simple OpenGL Library License (SOIL)

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

Applies To:

libgre.dll, libgre.a

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

Jonathan Dummer

2007-07-26-10.36

Simple OpenGL Image Library

Public Domain

using Sean Barret's stb_image as a base

Thanks to:

* Sean Barret - for the awesome stb_image

* Dan Venkitachalam - for finding some non-compliant DDS files, and patching some explicit casts

* everybody at gamedev.net

12.2.3 FreeType License

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

Applies To:

All Graphic Runtime Engines using sbfreetype libraries

Applies To:

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

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

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12.2.4 Lua License

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

Applies To:

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

The Lua Graphic Engine plugin

License for Lua 5.0 and later versions

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12.2.5 BSD 4-Clause License (getopt)

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

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

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12.2.6 BSD 3-Clause License (getsubopt)

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

Applies To:

libgre.dll, libgre.a

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

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12.2.7 Imagination OpenGL License

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

Applies To:

libEGL.dll, libGLESv2.dll

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

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12.2.8 GNU LESSER GENERAL PUBLIC LICENSE (pthread-win32)

Applies To:

All Graphic Runtime Engines using Windows operating systems

Applies To:

pthreadVC2.dll, pthreadVC2.lib

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

Project Page: https://www.sourceware.org/pthreads-win32/

pthreads-win32 - a POSIX threads library for Microsoft Windows

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The contact addresses for pthreads-win32 is as follows:

Web: http://sources.redhat.com/pthreads-win32

Email: Ross Johnson

Please use: Firstname.Lastname@homemail.com.au

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

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

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

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

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

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

12.2.9 GNU LESSER GENERAL PUBLIC LICENSE

Version 2.1, February 1999

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zlib

Compression library, required by FreeType library http://www.zlib.net/

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

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*/

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13 Firmware

13.1 Firmware and configuration

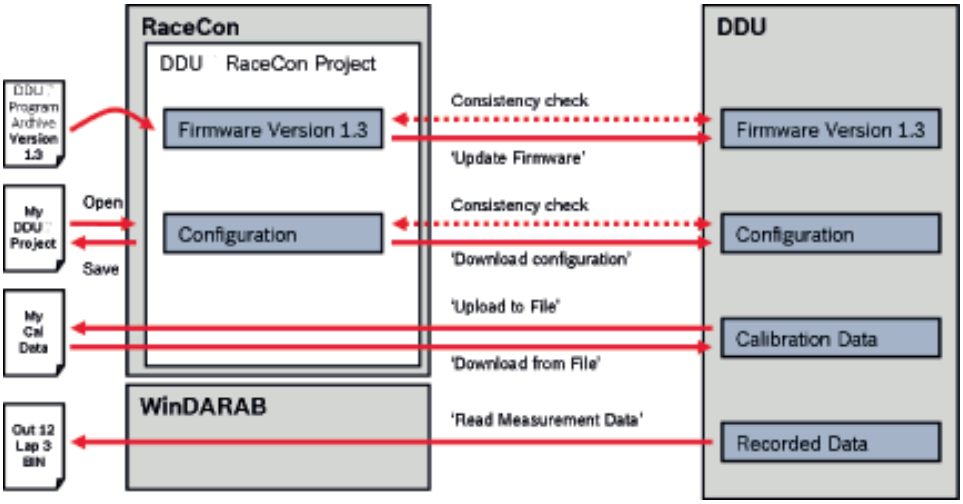
CAS-M 3 EVO holds 4 types of data:

Firmware: the software (PST program file) of the CAS-M 3 EVO.

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

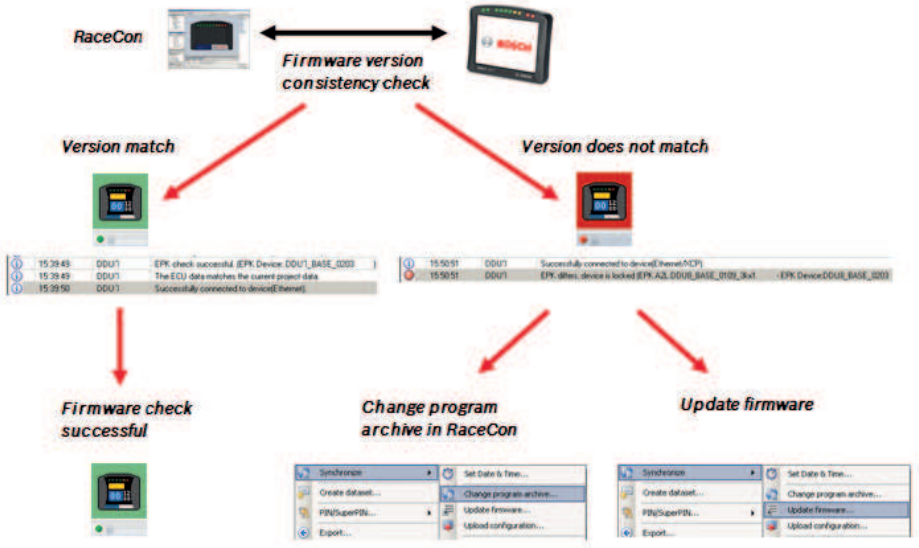
Calibration data: Characteristic curves and offsets created by online calibration at the vehicle.

Recorded data: Measurement data recorded during vehicle operation.



13.2 Firmware update

The scheme shows the process during each connection between RaceCon and CAS-M 3 EVO.

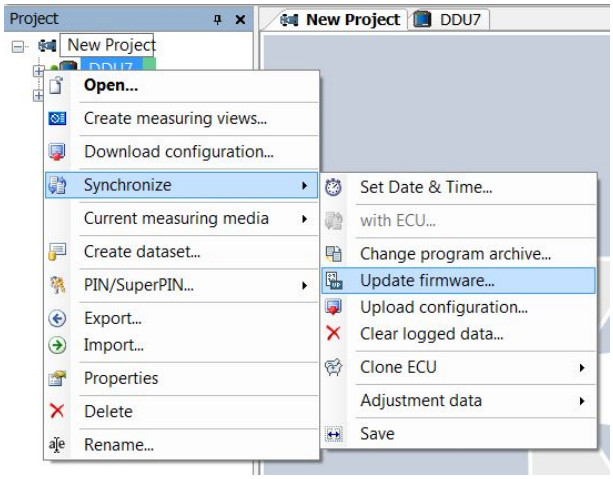


13.2.1 Performing the firmware update

Firmware update is only possible if the CAS-M 3 EVO is connected to RaceCon.

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

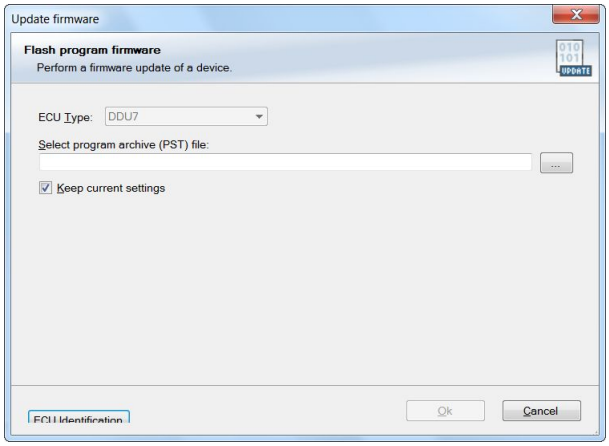
1. In the CAS-M 3 EVO Project Tree, right-click on ‘CAS-M 3 EVO’ and choose ‘Synchronize’ then ‘Update firmware’.



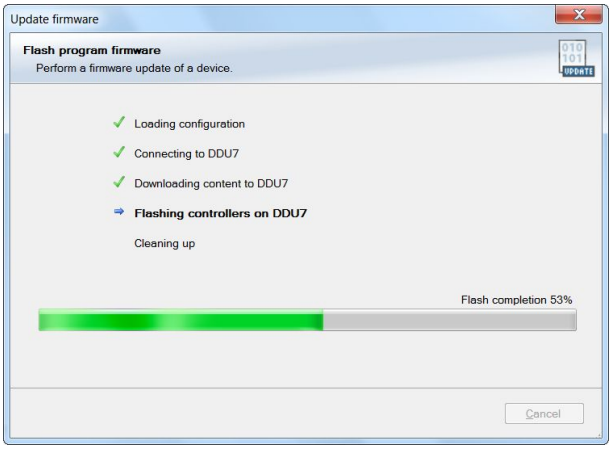
A pop-up menu opens.

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

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

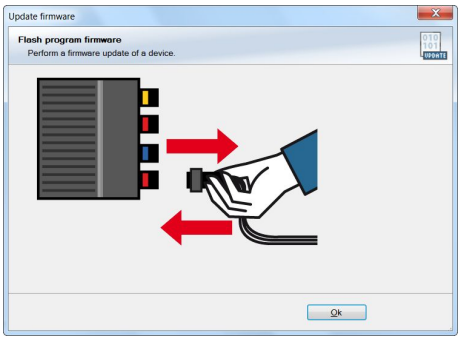


3. Click ‘OK’ when done.
The firmware update starts. The CAS-M 3 EVO displays the message ‘Updating firmware’. Do not switch off the car’s ignition or interrupt the power supply of the CAS-M 3 EVO!



When the firmware update is complete, the CAS-M 3 EVO displays the message 'Updating firmware finished. Do a powercycle.'

Switch the car's ignition off and on again to cycle the power of the CAS-M 3 EVO.



14 RaceCon Shortcuts

The table shows important shortcuts simplify controlling the CAS-M 3 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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