

RS3

Math Channels – channels meanings

Question:

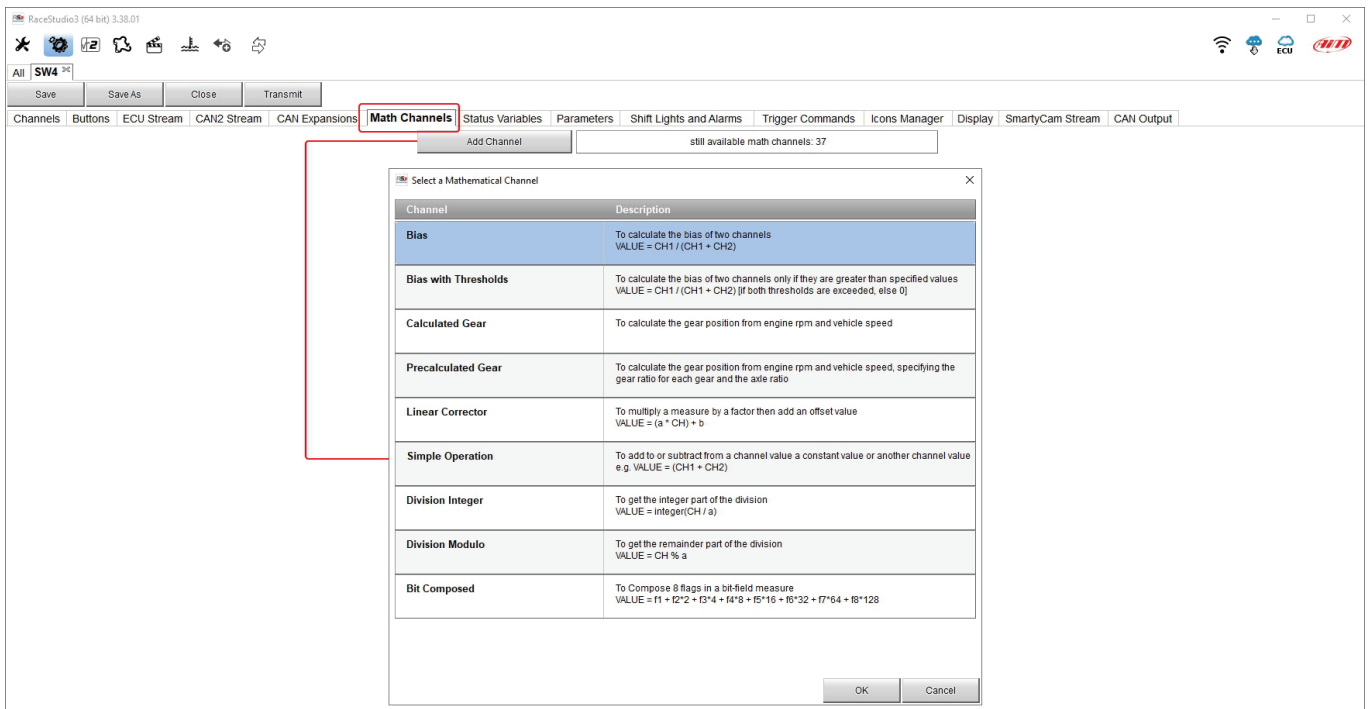
How can I use mathematical channels and how should I interpret their calculated values?

Answer:

Mathematical channels use one or more configuration channels for math calculations in this way obtaining an additional channel based on instant reference values recorded during the session.

To create mathematical channels:

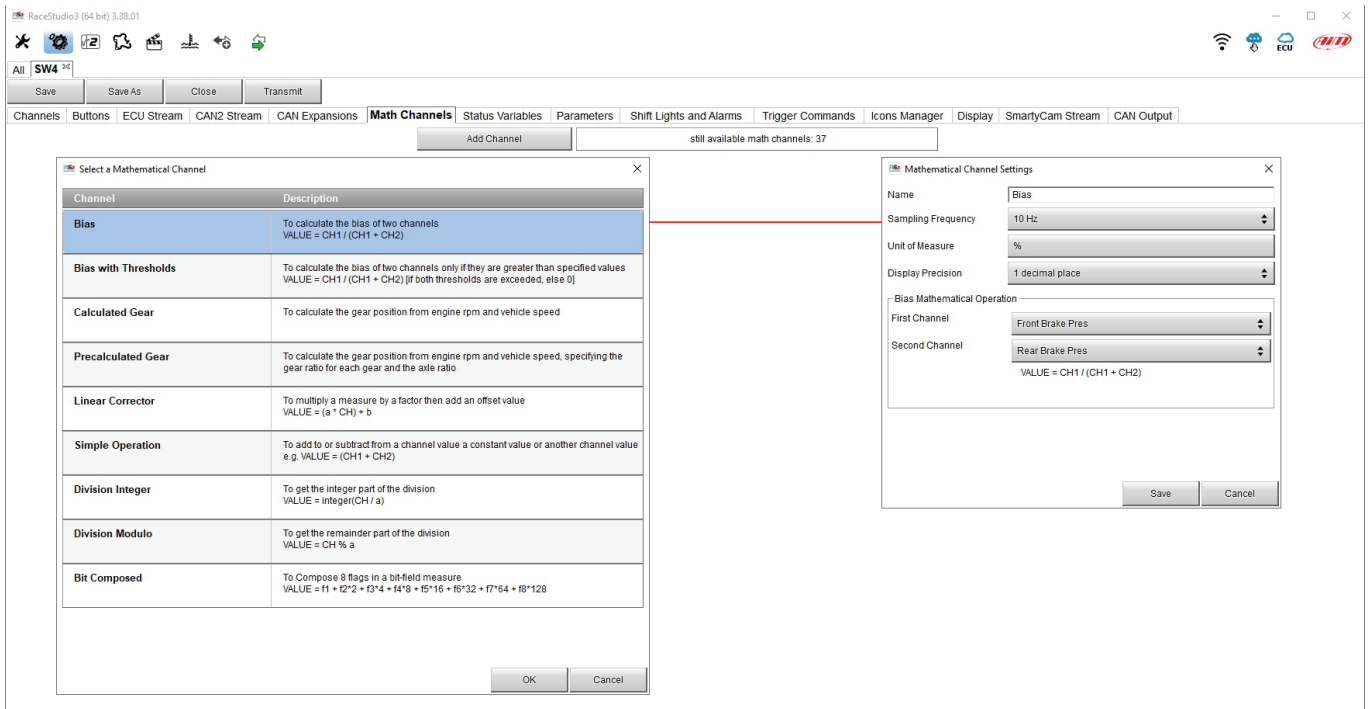
- enter “Math Channels” tab
- click “Add Channel” and a window that describes each available math channel logic is prompted.





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Bias: this math channel expresses the intervention percentage of the first between two selected channels (that must have the same function), calculating it in relation with their addition.
In the following example, the relation between front and rear brake pressure channels is expressed.





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Bias with Treshold: this math channel function is the same as “Bias” but the computation is performed from set threshold values onwards. This additional setting is useful, for example, when the selected channels show an unstable behaviour in low values.

This math channel value is different from zero when both channels instant values are higher than the fixed threshold ones.

The screenshot shows the RaceStudio3 interface with two dialog boxes open. The 'Select a Mathematical Channel' dialog lists various functions, with 'Bias with Thresholds' selected. The 'Mathematical Channel Settings' dialog shows the configuration for this function, including channel names and thresholds.

Channel	Description
Bias	To calculate the bias of two channels VALUE = CH1 / (CH1 + CH2)
Bias with Thresholds	To calculate the bias of two channels only if they are greater than specified values VALUE = CH1 / (CH1 + CH2) (if both thresholds are exceeded, else 0)
Calculated Gear	To calculate the gear position from engine rpm and vehicle speed
Precalculated Gear	To calculate the gear position from engine rpm and vehicle speed, specifying the gear ratio for each gear and the axle ratio
Linear Corrector	To multiply a measure by a factor then add an offset value VALUE = (a * CH) + b
Simple Operation	To add to or subtract from a channel value a constant value or another channel value e.g. VALUE = (CH1 + CH2)
Division Integer	To get the integer part of the division VALUE = integer(CH / a)
Division Modulo	To get the remainder part of the division VALUE = CH % a
Bit Composed	To Compose 8 flags in a bit-field measure VALUE = f1 + f2*2 + f3*4 + f4*8 + f5*16 + f6*32 + f7*64 + f8*128

Mathematical Channel Settings

Name: Bias w Thrs
Sampling Frequency: 10 Hz
Unit of Measure: %
Display Precision: 1 decimal place

Bias Mathematical Operation

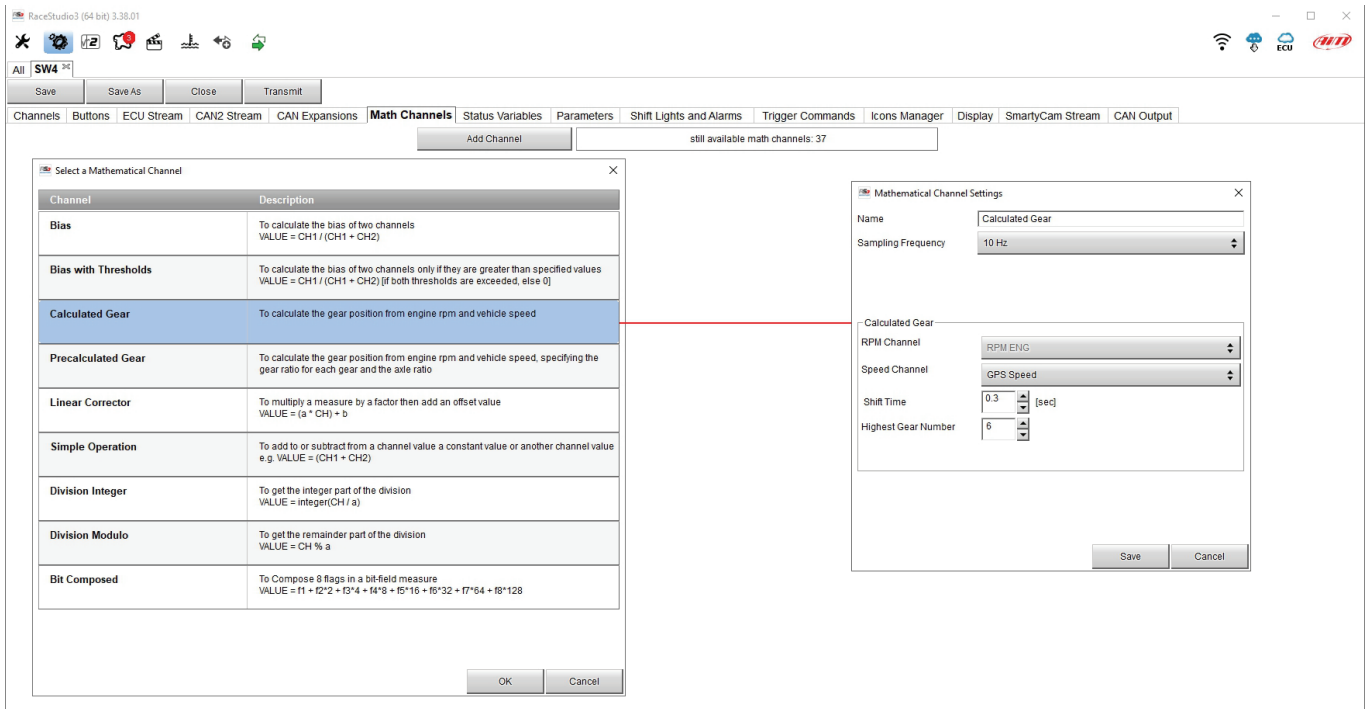
First Channel: Front Brake Pres, Mn. Threshold: 2 bar
Second Channel: Rear Brake Pres, Mn. Threshold: 2 bar

VALUE = CH1 / (CH1 + CH2) (if both thresholds are exceeded, else 0)



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Calculated Gear: this math channel can calculate gear selecting the reference RPM and speed channels, shifting time and the highest gear number. Once the setup transmitted a gear calibration lap is needed to make the system calculate each gear ratio.





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Pre-Calculated Gear: thanks to this math channel it is possible to pre-calculate gear, selecting reference RPM and speed channels and filling in the left settings, specifically all gear ratios, wheel circumference and axle ratio. In case a final transmission is also available (i.e. motorbikes), multiply the primary and final transmission ratio together and type the result in "Axle Ratio" box. In this case calibration lap is not needed.

The screenshot shows the RaceStudio3 (64 bit) 3.38.01 interface. The 'Math Channels' tab is active, and a 'Pre-Calculated Gear' channel is selected. The 'Mathematical Channel Settings' dialog is open, showing the following configuration:

- Name: PreCalcGear
- Sampling Frequency: 10 Hz
- Calculated Gear: (unchecked)
- RPM Channel: RPM
- Speed Channel: GPS Speed
- Wheel Circumference: 1600 [mm]
- Axle Ratio (Load Shaft / Main Shaft): 1
- Shift Time: 0.3 [sec]
- Highest Gear Number: 6
- Gear Ratio (Load Shaft / Main Shaft):

1	7	2	5.5	3	4.5
4	3	5	2	6	1

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Linear Corrector: it is possible to set a multiplier and a positive/negative offset to the channel instant value, so to correct its final measure.

In the following image, this operation is performed on Lambda channel (multiplied), to obtain its related AFR value.

The screenshot shows the RaceStudio3 interface with the 'Math Channels' tab selected. A 'Select a Mathematical Channel' dialog box is open, listing various channels. The 'Linear Corrector' channel is highlighted. To the right, the 'Mathematical Channel Settings' dialog box is open, showing the configuration for the 'LinearCorr' channel. The channel is set to 'M800 LAMBDA1 (lambda)', the multiplier (a) is 0.680, and the offset (b) is 0.000. The function is set to 'Lambda', the sampling frequency is 10 Hz, the unit of measure is 'lambda', and the display precision is 1 decimal place.

Channel	Description
Bias	To calculate the bias of two channels VALUE = CH1 / (CH1 + CH2)
Bias with Thresholds	To calculate the bias of two channels only if they are greater than specified values VALUE = CH1 / (CH1 + CH2) (if both thresholds are exceeded, else 0)
Calculated Gear	To calculate the gear position from engine rpm and vehicle speed
Precalculated Gear	To calculate the gear position from engine rpm and vehicle speed, specifying the gear ratio for each gear and the axle ratio
Linear Corrector	To multiply a measure by a factor then add an offset value VALUE = (a * CH) + b
Simple Operation	To add to or subtract from a channel value a constant value or another channel value e.g. VALUE = (CH1 + CH2)
Division Integer	To get the integer part of the division VALUE = integer(CH / a)
Division Modulo	To get the remainder part of the division VALUE = CH % a
Bit Composed	To Compose 8 flags in a bit-field measure VALUE = f1 * 12^2 + f3^4 + f4^8 + f5^16 + f6^32 + f7^64 + f8^128

Mathematical Channel Settings

Name: LinearCorr

Linear Correction Parameters

Channel: M800 LAMBDA1 (lambda)

Multiplier (a): 0.680

Offset (b): 0.000

VALUE = (a * CH) + b

Function: Lambda

Sampling Frequency: 10 Hz

Unit of Measure: lambda

Display Precision: 1 decimal place

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Simple Operation: starting from an existing channel, a new math channel can be obtained, adding or subtracting a constant value or another configuration channel instant value.

In the following example, instant barometric pressure value is subtracted to the manifold air pressure one, so obtaining the boost pressure value, given by the difference between these two channels values during the session.

The screenshot shows the RaceStudio3 interface with the 'Math Channels' tab selected. A 'Select a Mathematical Channel' dialog is open, listing various mathematical functions. The 'Simple Operation' function is highlighted, with a description: 'To add to or subtract from a channel value a constant value or another channel value e.g. VALUE = (CH1 + CH2)'. A red line connects this function to the 'Mathematical Channel Settings' dialog, which is also open. The settings dialog shows the following configuration:

- Name: Boost
- Function: Pressure
- Sampling Frequency: 10 Hz
- Unit of Measure: bar
- Display Precision: 2 decimal places
- Formula: VALUE = M800 MANIFPRES - M800 EXHAUST PRESS

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Division integer: this math channel gives back the integer part of a division. In the example M800CHANN1 is divided by 1000. Assuming M800CHANN1 = 8530 Division integer is 8

The screenshot shows the RaceStudio3 interface with the 'Math Channels' tab selected. A dialog box titled 'Select a Mathematical Channel' is open, displaying a list of channel types. The 'Division Integer' channel is selected. A second dialog box, 'Mathematical Channel Settings', is open for the 'Division Integer' channel. The settings are as follows:

Channel	Description
Bias	To calculate the bias of two channels VALUE = CH1 / (CH1 + CH2)
Bias with Thresholds	To calculate the bias of two channels only if they are greater than specified values VALUE = CH1 / (CH1 + CH2) (if both thresholds are exceeded, else 0)
Calculated Gear	To calculate the gear position from engine rpm and vehicle speed
Precalculated Gear	To calculate the gear position from engine rpm and vehicle speed, specifying the gear ratio for each gear and the axle ratio
Linear Corrector	To multiply a measure by a factor then add an offset value VALUE = (a * CH) + b
Simple Operation	To add to or subtract from a channel value a constant value or another channel value e.g. VALUE = (CH1 + CH2)
Division Integer	To get the integer part of the division VALUE = integer(CH / a)
Division Modulo	To get the remainder part of the division VALUE = CH % a
Bit Composed	To Compose 8 flags in a bit-field measure VALUE = f1 * 12^2 + f3^4 + f4^8 + f5^16 + f6^32 + f7^64 + f8^128

The 'Mathematical Channel Settings' dialog for 'Division Integer' shows:

- Name: DivisionInteger
- Sampling Frequency: 10 Hz
- Display Precision: 1 decimal place
- Division Integer Mathematical Operation: First Channel: M800 CHANN1, Divider: 1000 #
- Formula: VALUE = integer(CH / a)



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Division Modulo: this math channel gives back the remainder in a division with integer result. In the example: M800 CHANN1 is divided by 1000. Assuming that M800 CHANN1= 8530 Division Modulo is 530.

The screenshot shows the RaceStudio3 interface with the 'Math Channels' tab selected. A dialog box titled 'Select a Mathematical Channel' is open, displaying a list of mathematical operations. The 'Division Modulo' option is highlighted. A second dialog box, 'Mathematical Channel Settings', is also open, showing the configuration for the 'DivisionModulo' channel. The settings include a name, sampling frequency of 10 Hz, and a display precision of 1 decimal place. Under 'Division Integer Mathematical Operation', the 'First Channel' is set to 'M800 CHANN1' and the 'Divider' is set to '1000'. The resulting formula is shown as 'VALUE = CH % a'.

Channel	Description
Bias	To calculate the bias of two channels VALUE = CH1 / (CH1 + CH2)
Bias with Thresholds	To calculate the bias of two channels only if they are greater than specified values VALUE = CH1 / (CH1 + CH2) (if both thresholds are exceeded, else 0)
Calculated Gear	To calculate the gear position from engine rpm and vehicle speed
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Division Modulo	To get the remainder part of the division VALUE = CH % a
Bit Composed	To Compose 8 flags in a bit-field measure VALUE = f1 * f2*2 + f3*4 + f4*8 + f5*16 + f6*32 + f7*64 + f8*128



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Bit composed: you need up to 8 channels with 0/1 values, you can use to compose these values into each single bit of a byte. Normally this can be used to compose more information into single channel of a byte to be sent via CAN bus.

The screenshot shows the RaceStudio3 interface with two dialog boxes open. The 'Select a Mathematical Channel' dialog is on the left, listing various mathematical operations. The 'Mathematical Channel Settings' dialog is on the right, showing the configuration for the 'Bit Composed' channel.

Channel	Description
Bias	To calculate the bias of two channels VALUE = CH1 / (CH1 + CH2)
Bias with Thresholds	To calculate the bias of two channels only if they are greater than specified values VALUE = CH1 / (CH1 + CH2) (if both thresholds are exceeded, else 0)
Calculated Gear	To calculate the gear position from engine rpm and vehicle speed
Precalculated Gear	To calculate the gear position from engine rpm and vehicle speed, specifying the gear ratio for each gear and the axle ratio
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Simple Operation	To add to or subtract from a channel value a constant value or another channel value e.g. VALUE = (CH1 + CH2)
Division Integer	To get the integer part of the division VALUE = integer(CH / a)
Division Modulo	To get the remainder part of the division VALUE = CH % a
Bit Composed	To Compose 8 flags in a bit-field measure VALUE = f1 * 12^2 + f3^4 + f4^8 + f5^16 + f6^32 + f7^64 + f8^128

The 'Mathematical Channel Settings' dialog for 'BitComposed' shows the following configuration:

- Name: BitComposed
- Sampling Frequency: 10 Hz
- Display Precision: no decimal place
- Bit Compositing Operation:
 - Enable:
 - Flag Channel 1 (f1): Left Button 2
 - Flag Channel 2 (f2): Left Button 3
 - Flag Channel 3 (f3): Left Button 4
 - Flag Channel 4 (f4): Left Button 5
 - Flag Channel 5 (f5): Right Button 2
 - Flag Channel 6 (f6): Right Button 3
 - Flag Channel 7 (f7): Right Button 4
 - Flag Channel 8 (f8): Right Button 5
- Formula: VALUE = f1 * 12^2 + f3^4 + f4^8 + f5^16 + f6^32 + f7^64 + f8^128