

RS3

Math Channels – channels meanings

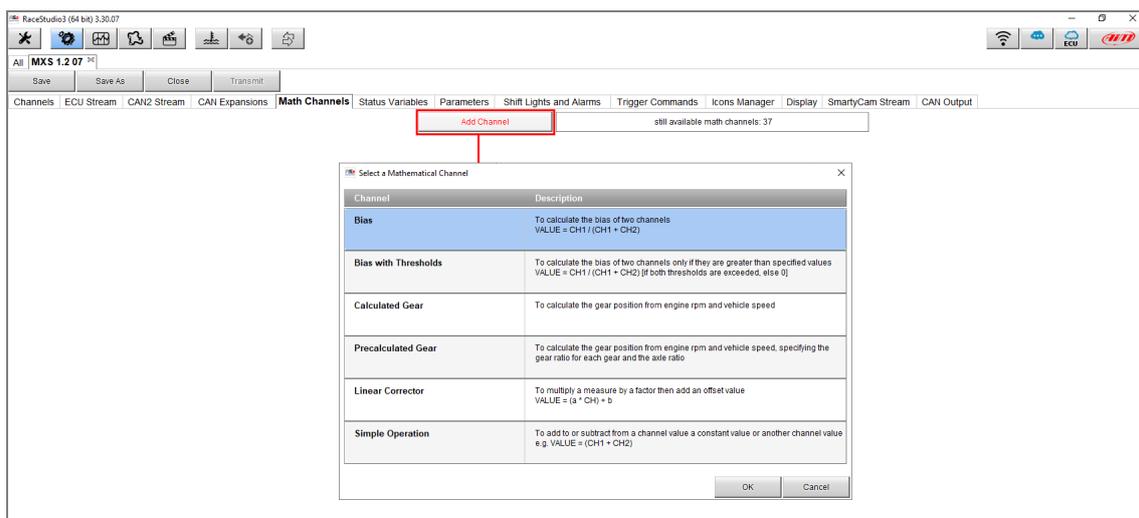
Question:

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

Answer:

Mathematical channels allow to apply mathematical calculations to one or more device channels: in this way, an additional channel is obtained, that refers the value of those operations, based on instant reference values recorded during the session.

To create mathematical channels, enter the “Math Channels” tab, available into the configuration section of the devices managed through Race Studio 3: clicking the “Add Channel” button (following image), a window appears that describes each available math channel logic.



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Bias: this math channel must be created to express the intervention percentage of the first between the two selected channels (that must be relevant, i.e.: with 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.

The screenshot shows a dialog box titled "Mathematical Channel Settings". The "Name" field contains "Bias". The "Sampling Frequency" is set to "20 Hz". The "Unit of Measure" is "%". The "Display Precision" is "no decimal place". Under "Bias Mathematical Operation", the "First Channel" is "Brake P F" and the "Second Channel" is "Brake P R". The formula displayed is $VALUE = CH1 / (CH1 + CH2)$. There are "Save" and "Cancel" buttons at the bottom right.

Bias with Treshold: this math channel function is the same as "Bias", with an additional threshold value that filters those values not exceeding it. This additional setting is useful, for example, when the two selected channels show a not stable behaviour, for example brake pressures not equal to zero.

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

The screenshot shows a dialog box titled "Mathematical Channel Settings". The "Name" field contains "Bias w Thrs". The "Sampling Frequency" is "20 Hz", "Unit of Measure" is "%", and "Display Precision" is "no decimal place". Under "Bias Mathematical Operation", the "First Channel" is "Brake P F" and the "Second Channel" is "Brake P R". There are two "Min. Threshold" input fields, both containing the value "2" and the unit "bar". The formula displayed is $VALUE = CH1 / (CH1 + CH2)$ [if both thresholds are exceeded, else 0]. There are "Save" and "Cancel" buttons at the bottom right.



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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 has been transmitted, it is necessary to perform a gear calibration lap, so that the system can calculate each gear ratio.

The image shows a software dialog box titled "Mathematical Channel Settings". It contains the following fields and controls:

- Name:** A text input field containing "Calculated Gear".
- Sampling Frequency:** A dropdown menu set to "10 Hz".
- Calculated Gear section:**
 - RPM Channel:** A dropdown menu set to "RPM".
 - Speed Channel:** A dropdown menu set to "Speed".
 - Shift Time:** A numeric input field set to "0.3" with a "[sec]" label and up/down arrow controls.
 - Highest Gear Number:** A numeric input field set to "5" with up/down arrow controls.
- Buttons:** "Save" and "Cancel" buttons at the bottom right.



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

Mathematical Channel Settings

Name: PreCalcGear

Sampling Frequency: 10 Hz

Calculated Gear

RPM Channel: M800 RPM

Speed Channel: M800 GROUNDSPEED

Wheel Circumference: 1600 [mm]

Axle Ratio (Load Shaft / Main Shaft): 1

Shift Time: 0.3 [sec]

Highest Gear Number: 5

Gear Ratio (Load Shaft / Main Shaft)

1	7	2	5.5	3	4
4	2	5	1		

Save Cancel

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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, Lambda channel is included into this operation (multiplied), to obtain its related AFR value.

The screenshot shows the 'Mathematical Channel Settings' dialog box. The 'Name' field is 'LinearCorr'. Under 'Linear Correction Parameters', the 'Channel' is 'M800 LAMBDA1 (lambda)', 'Multiplier (a)' is '0.680', and 'Offset (b)' is '0.000'. The formula 'VALUE = (a * CH) + b' is displayed. The 'Function' is 'AFR', 'Sampling Frequency' is '10 Hz', 'Unit of Measure' is 'A/F', and 'Display Precision' is '1 decimal place'. 'Save' and 'Cancel' buttons are at the bottom.

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, to obtain the resulting boost pressure value, given by the difference between these two channels values during the session.

The screenshot shows the 'Mathematical Channel Settings' dialog box. The 'Name' field is 'Boost'. The 'Function' is 'Pressure'. 'Sampling Frequency' is '20 Hz', 'Unit of Measure' is 'bar', and 'Display Precision' is '2 decimal places'. The 'Formula' section shows 'VALUE = MAP - P BARO'. 'Save' and 'Cancel' buttons are at the bottom.