SETUPS - WHEELSPEEDS	Revision	
	Date	

Wheelspeeds overview

Distance is one of the most important channels used in Toolbox and Toolset and is fundamental for features like **Qualifying Mode**. The value of distance is derived from the integral of speed. Therefore, the setup of wheelspeed strategies is critical to make sure that the speed and distance values generated are consistent and correct.

The **Wheelspeed** node is used to configure the wheelspeed inputs and the speed and distance outputs.

Select wheelspeed input type

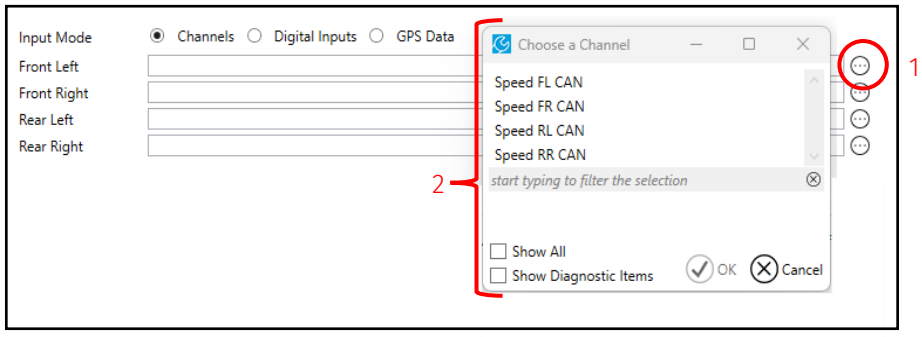
First, configure the wheelspeed inputs. Select the source of speed for each wheel from either a Channel or Digital Input, or vehicle speed from GPS data.

- **Channel** – Use for a channel with units of 'speed', such as a channel being received over CAN from an ECU or other device.
- **Digital Inputs** – Use if rotational sensors or DF11i wheelspeed sensors are configured on the Sensors node.
- **GPS Data** – Use if speed is being decoded from GPS data sourced from the NMEA 0183 Decode node.

Channel inputs

Configure inputs

If you use channel inputs, click the 'browse' tool to select the channel inputs (1), and then select the required channel from the menu (2).



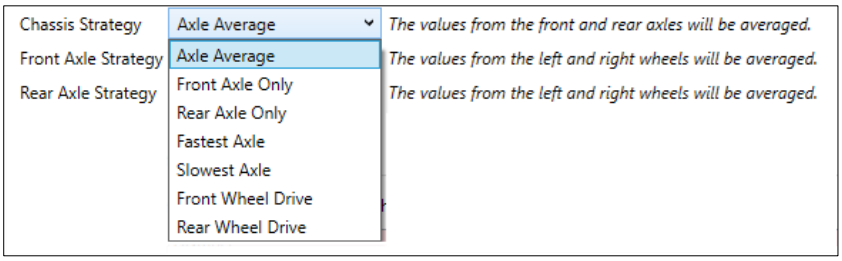
Note: – You must configure the channel with units of 'speed'. Channels with other units are not available to select.

Processing

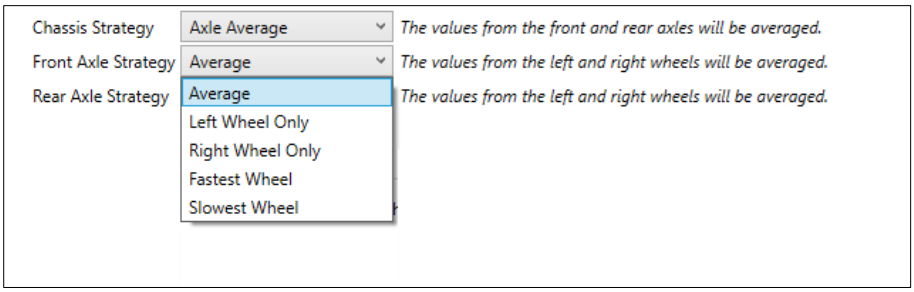
Next, select how the individual wheelspeed inputs are combined to calculate the vehicle speed and distance. Individual wheelspeeds are first combined to produce front and rear axle speeds. The front and rear axle speeds are combined to produce overall speed and distance channels.

See Wheelspeed strategy for more information about wheelspeed processing strategy.

Select the chassis strategy (the values from which the front and rear axles are averaged) from the **Chassis Strategy** dropdown menu.



Then select the front and rear axle strategies from the dropdown menus.



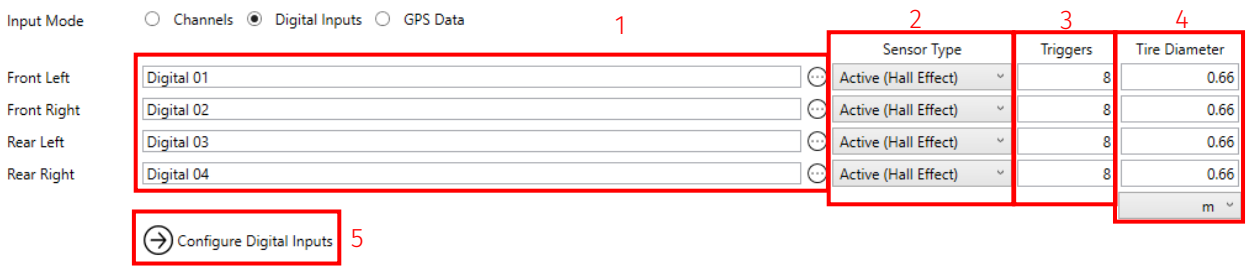
Generated channels

Enter a name for the distance and speed channels generated from the processed inputs in the text boxes.

Digital inputs

Configure inputs

If you use digital inputs, you must select the inputs for each wheel (1), specify the sensor type (2), the number of triggers per rotation (3), and the tire diameter (4). If digital inputs are not configured, you can use the shortcut to the **Hardware Settings** node (5) (see Hardware Settings).



Processing

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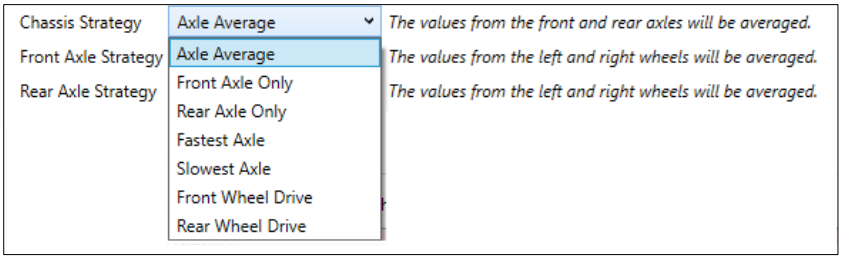
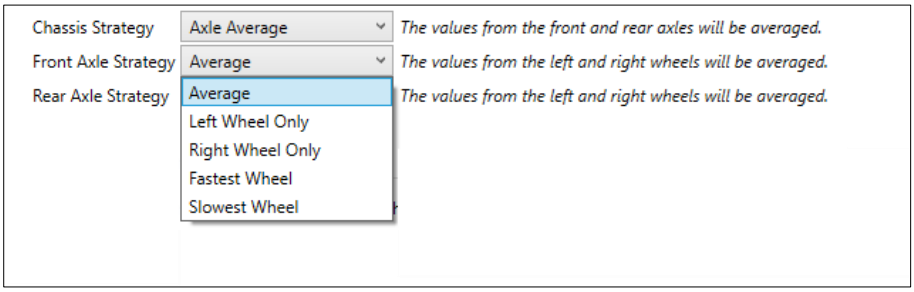
See Wheelspeed strategy for more information about wheelspeed processing strategy.

Select the chassis strategy (the values from which the front and rear axles are averaged) from the **Chassis Strategy** dropdown menu.



Then select the front and rear axle strategies from the dropdown menus.



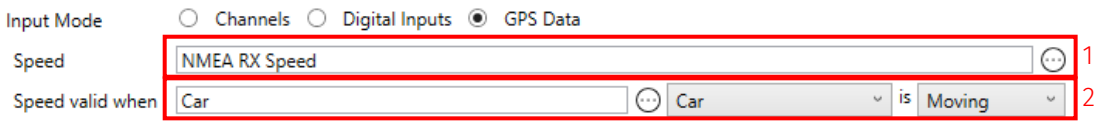
Generated channels

You can then name the channels generated from the processed inputs. When you use digital inputs, there is greater functionality and, therefore, more generated channels. Enter names for the output channels for the wheel speed, angular velocity, triggers, and tire diameter of all wheel inputs.

GPS data

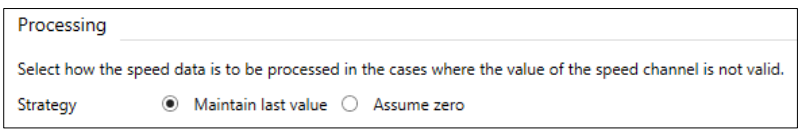
Configure inputs

If you use GPS data, select the GPS speed channel (sourced from the NMEA 0183 Decode) (1) and configure the strategy for when the speed is valid (2).



Processing

When the GPS signal is invalid, use the **Maintain last value** option to determine whether the speed value is held at the last known value, or select zero speed with the **Assume zero** option.



Generated channels

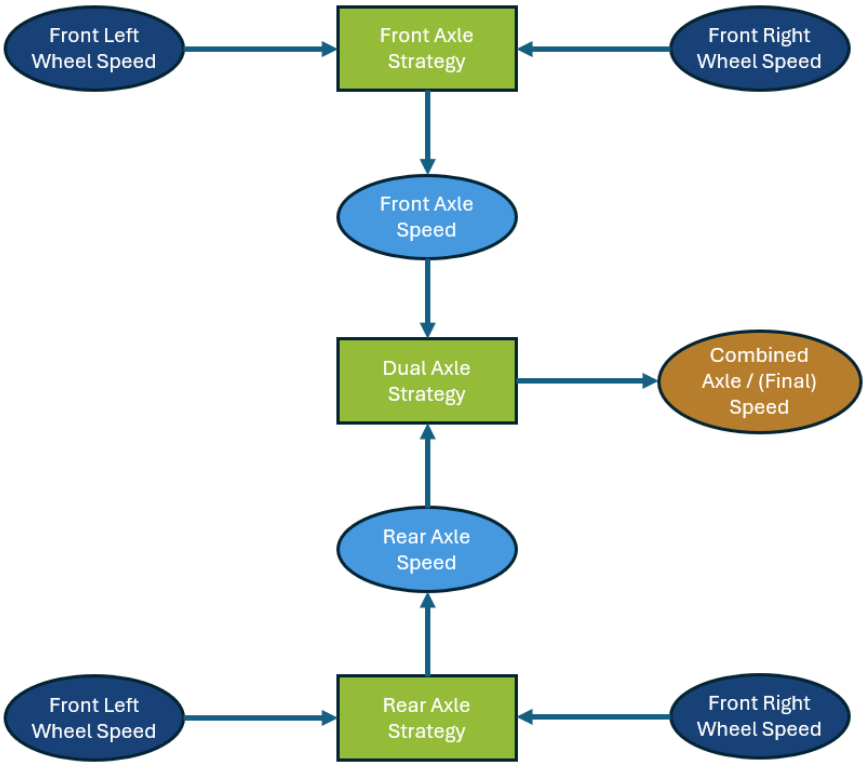
You can then name the distance and speed channels generated from the processed inputs.

Odometer

An odometer channel (a total distance channel stored in non-volatile memory) is also generated. Enter a name for the odometer (1). Click **Add Trip** to add a 'trip meter' channel (2 and add a name for the channel (3). You can also use a to reset the trip meter (see Buttons) (4). Use the 'bin' tool to delete a trip meter channel (5).

Wheelspeed strategy

The following flow chart shows how the wheel speed strategies are combined to output the final speed value. Ellipses represent a true, measured, speed and rectangular shapes represent numerical processing or a calculation.

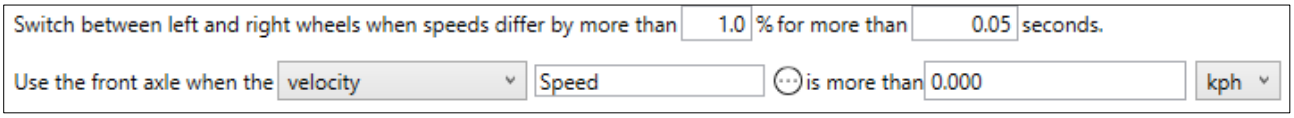


A table of the processing strategies available in Toolset is shown below:

	Strategy	Description
Single axle strategy	Left Wheel	Uses the value of the axle left wheel only
	Right Wheel	Uses the value of the axle right wheel only
	Fastest Wheel	Uses the axle fastest wheel
	Slowest Wheel	Uses the axle slowest wheel
	Wheel Average	Uses the average of the two wheels
Dual axle strategy	Front Axle	Uses the value of the front axle only
	Rear Axle	Uses the value of the rear axle only
	Fastest Axle	Uses the fastest axle value
	Slowest Axle	Uses the slowest axle value
	Axle Average	Uses the average of the two axles
	Front Wheel Drive	Uses the front axle value under a specified condition (braking), then the rear axle value at all other times
	Rear Wheel Drive	Uses the rear axle value under a specified condition (braking), then the front axle value at all other times

Switch strategies

Some older versions of setup metadata allow switching between strategies (for example, between the left and right wheel on an axle, or between the two axle speeds). In these versions of metadata there is a section to set the switching thresholds.



The percentage difference in speed is the percentage difference between the fastest and slowest wheel. The percentage difference to the fastest wheel is chosen and not percentage different to slowest wheel because this provides greater accuracy (see the table below):

FL Wheel Speed (kph)	FR Wheel Speed (kph)	Difference (kph)	Difference to Fastest (%)	Difference to Slowest (%)
10	5	5	(5/10)*100 = 50	(5/5)*100 = 100
100	101	1	(1/101)*100 = 0.9901	(1/100)*100 = 1
165	170	5	(5/170)*100 = 2.9412	(5/150)*100 = 3.3333

The time factor is the duration for which the difference statement must be true before the speed channel switches. It is advisable to set the time factor quite low. A good starting setting is below 1-2% and below 0.2 seconds and then amend the settings as required.

Select a strategy

The optimal wheelspeed strategy for a vehicle varies depending on many different variables, and there is no suggestion for the best all round strategy.

The table below outlines some vehicle characteristics together with a suggested approach (actual optimal strategies may vary).

Vehicle Characteristic	Description	Suggested Approach
Rear wheelspin likely	Rear Wheels could spin to a value higher than the vehicle speed	Try to use front wheels, depending on Front locking likelihood. Fastest Front Wheel will account for single wheel lockups but not two wheel lockups.
Front wheelspin likely	Front Wheels could spin to a value higher than the vehicle speed	Try to use rear wheels, depending on Rear locking likelihood. Fastest Rear would account for rear jacking / single rear wheel lockups.
Front locking	Front wheels could drop below representative vehicle speed	If single lockups, can use fastest front wheel, however for double front lockups, the rear wheels should be used if possible.
Rear locking / jacking under braking	Rear wheels could drop below representative vehicle speed	If single lockups, can use fastest rear wheel, however for double front lockups, the front wheels should be used if possible.

Double lockup events tend to affect the speed trace more than wheelspin events, so for a car with both lockups and wheelspin, it can be better to select the axle with wheelspin rather than lockups.