# HOW-TO

## How-to Configure the Gear Calculator in ADU

**Document version: 1.0**
**Software version: 122.0 or later**
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ECUMASTER

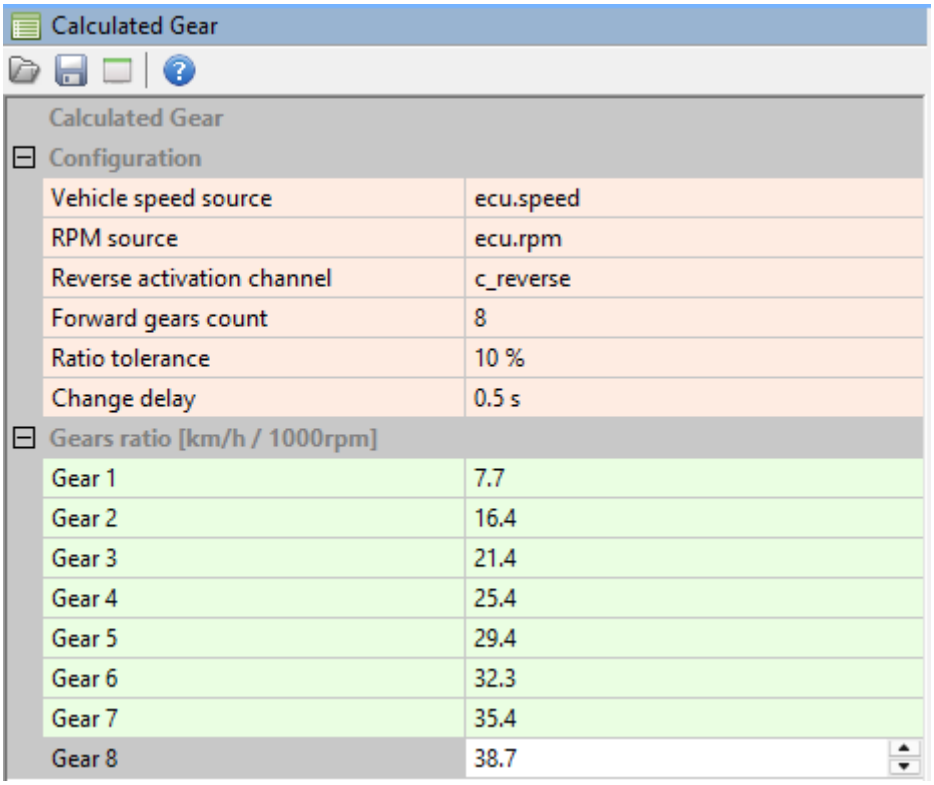
# 1. Description

**1. Feature Overview**

The ***Gear Calculator*** is a feature that automatically detects the current gear of the vehicle. This is achieved by comparing the real-time ratio of vehicle speed to engine RPM with a configured table of gear ratios. The detected gear can then be displayed on the dashboard, exported via CAN bus, or utilized by other firmware functions.

The feature supports up to 8 forward gears, a reverse gear (triggered via an external signal), and automatically detects neutral when the vehicle is stationary or the engine is turned off.

**2. Gear Ratio Calibration Procedure**




To configure the calculator correctly, the specific speed-to-RPM ratio for each gear must be determined. The ratio output variable is always active in the background, allowing it to be used for calibration even before the gear detection feature is fully configured.

**Example calibration steps:**

- Configure ADU to log the adu.gearRatio channel to a USB flash drive. For more information, see a separate how-to document: https://www.ecumaster.com/files/ADU/HowTo/How_to_Log_Data_to_a_USB_Drive_in_ADU.pdf.
- Drive the vehicle at a constant speed in every gear sequentially.
- Open the collected log in ADU Client or Data Master Software (https://www.ecumaster.com/products/data-master/).
- Read the gear ratios for each gear and enter these values as target reference ratios (parameters Gear Ratio 1-8) in the configuration panel.

## 3. User-Configurable Parameters

To set up the Gear Calculator, the appropriate input channels and calibration parameters must be assigned in the configuration panel:

| Parameter | Description |
|---|---|
| ***Vehicle speed source*** | The primary input signal for vehicle speed (internally converted to km/h for calculation purposes). Default value: *ecu.speed*. |
| ***RPM source*** | The input signal for engine RPM. Default value: *ecu.rpm*. |
| ***Reverse activation channel*** | An optional signal to detect reverse gear. Any non-zero value immediately triggers reverse gear. Default value: not set. |
| ***Forward gears count*** | The total number of forward gears to be evaluated (up to 8). Default value: 6. |
| ***Ratio tolerance*** | The acceptable tolerance, expressed as a percentage. It determines how much the measured ratio can deviate from the reference value to still be recognized as a specific gear. Default value: 10% (0-100%). |
| ***Change delay*** | A debounce timer. The candidate gear must remain stable for this defined period before the gear change is confirmed on the display. Default value: 0.5 s (0-1s). |
| ***Gear Ratio 1–8*** | The reference speed-to-RPM ratio values determined during the calibration process. Unit: km/h per 1000 rpm. |

## 4. How It Works

The system continuously calculates the absolute difference between the currently measured ratio and the reference ratios for the configured gears. It checks if this difference falls within the configured tolerance. Among all gears that pass this tolerance check, the one with the smallest

difference (best match) is selected. If no gear matches within the tolerance, the gear is reported as "Unknown".

**Automatic Neutral:** Neutral is reported automatically when either of the following conditions is met:

- The engine RPM is zero (engine not running), OR
- The vehicle speed is below 1 km/h (vehicle stationary or nearly stationary).

**Reverse:** When the Reverse activation channel is active, the calculator immediately reports reverse gear, bypassing ratio calculations.

**Coasting in Neutral (Gear "Unknown"):** If the transmission is shifted to neutral while the vehicle is in motion, the measured speed-to-RPM ratio will no longer match any of the configured forward gears. Consequently, the system will report the gear as "Unknown". When the gear status is "Unknown", the "Gear indicator" control on the dashboard remains blank and will not display any value until a valid gear is engaged and successfully recognized again.

## 5. Output Channels and ECU Gear Override

The calculations performed by the feature are exported to dedicated ADU channels, which can be used across the project:

- **adu.gearRatio** – The currently measured real-time speed-to-RPM ratio.
- **adu.calculatedGear** – The final confirmed gear detected by the algorithm.

**Overriding the ecu.gear channel:** It is possible to replace the standard ECU gear channel with the data from the Gear Calculator. To overwrite the ecu.gear channel, go to the *Configuration* panel and set the *Source* in the *Gear source for ecu.gear* category to **Calculated gear (adu.calculatedGear)**.

## 6. Troubleshooting

**Gear always shows "Unknown"**

*Probable cause:* Reference ratios are not configured or the ratio tolerance is too low.

*Solution:* Measure actual ratio values, enter them, and increase the Ratio tolerance to 10–15%.

**Gear flickers or jumps between values**

*Probable cause:* Tolerance is too high (gear ranges overlap) or the Change delay is too short.

*Solution:* Decrease the Ratio tolerance or increase the Change delay time.

**Gear shows "Neutral" while driving**

*Probable cause:* Speed channel is not configured properly and reads 0.

*Solution:* Verify the Vehicle speed source assignment and check the signal quality.

**Reverse gear is not detected**

*Probable cause:* Reverse signal channel is not assigned or always reads 0.

*Solution:* Assign the correct signal to the Reverse activation channel.

**Gear changes are slow or delayed on screen**

*Probable cause:* Change delay parameter is set too high.

*Solution:* Reduce the Change delay time (e.g., to 0.2–0.4 s).

# 2. Document history

| Version | Date | Changes |
|---|---|---|
| 1.0 | 2026.03.30 | Initial release |