CANBUS Emulator Mini – BRZ/GT86/FRS Steering Emulator V1.1

Overview - Installation and Operating Instructions

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Overview

The AGT Engineering “Canbus Emulator Mini-Steering Emulator” allows the use of the BRZ/GT86/FRS electric power steering column in certain conversions and in a stand alone environment, when the Canbus signals that are mandatory for it to work properly are not present.

The main signals the emulator emulates is Engine Speed (RPM), and Vehicle Speed.

Vehicle Speed is used by the power steering controller to work out the amount of assist required. At very low vehicle speeds (say manoeuvring within a carpark), the assist level is the highest to account for the extra forces to turn the wheel when the wheels are not rotating quickly.

At highway speeds, power steering is not really required, and so the assist is turned down to prevent the steering from feeling too light.

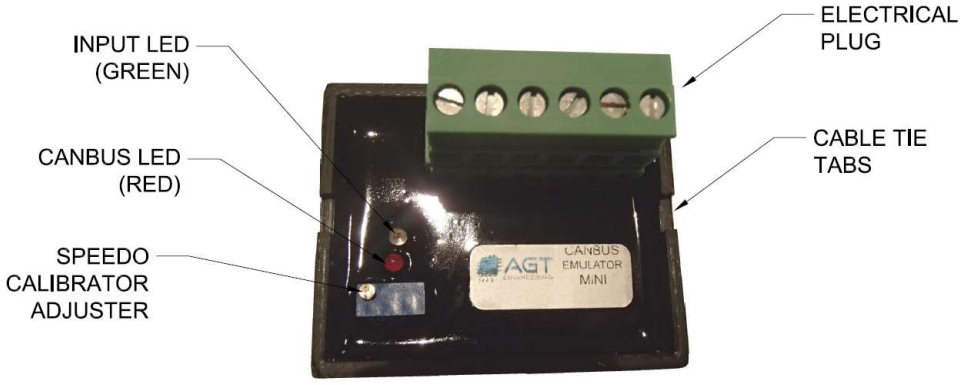
In the BRZ/86/FRS, the vehicle speed is obtained via the ABS unit and transmitted to the power steering controller over the Canbus communication network. If the ABS unit is not used (if the column is standalone, or in a BRZ/86/FRS without OEM ABS), the Canbus Emulator can provide the speed signal over Canbus from a single conventional wheel speed sensor. This can be a simple $10 “Ebay” negative switching proximity sensor and a metal wheel with approximately 5 targets per wheel revolution. It can also be fed from another source such as a different vehicle speed pulse, or aftermarket ECU. If variable assist is not required, the emulator can be configured to provide a manually adjustable speed simulation. This manual control can also be expanded by providing an OEM looking variable adjustment on the dash.

The emulator can also be used to display the vehicle speed on the standard instrument cluster (if present), using an aftermarket speed sensor. The speedometer calibration can be calibrated to match different sensors, diff ratios and tyres sizes.

Engine Speed is used to turn off the power assist when the engine has stopped. In the BR/86/FRS, the engine speed is obtained via the engine ECU and distributed over the Canbus communication network. If the original engine ECU is not used (if the column is standalone, or still in a BRZ/86/FRS without the original ECU), the Canbus Emulator provides an engine rpm signal. The Canbus Emulator can be wired with an optional Tacho input to determine if the engine is rotating. If omitted, the Canbus Emulator can still operate the controller as described later in the operation chapter.

The Canbus Emulator also emulates healthy engine and ABS unit signals, allowing the original 86/BRZ/FRS instrument cluster to be used and extinguishing the engine and ABS/VDC warning lamps when these units are removed. To provide further instrument cluster functionality, a Canbus **Translator** should be used.

The Canbus Emulator is housed in a robust, water resistant plastic case complete with recessed tabs to enable it to be secured to the wiring harness using cable ties. A 6 way “Phoenix” style screw termination plug is used for the electrical connections.



Installation using a speed sensor and tachometer input.

PIN	BRZ/GT86/FRS wire colours		NAME
1	BLACK	POWER	GROUND
2		Input [1]	Vehicle Speed
3		Input [2]	Tachometer
4	WHITE	HS CAN[3]	HS-CAN-L
5	BLACK	HS CAN[3]	HS-CAN-H
6	GREEN/WHITE	POWER	+12V IGNITION

[1] Speed input is a 0-12V digital pulse of approximately 4-5 pulses per wheel revolution. The wire is pulled “high” by the emulator, and suits a negatively switched output speed sensor (most speed sensors, including Subaru are this type). A standard diode may be required in line with the speed input wire (with the polarity band facing the sensor) for the $10 “eBay” style proximity sensors.

[2] Tacho input is a 0 to 12V alternating input, pulled low by the emulator. If this is wired up directly to an ignition coil circuit, a surge protector should be used to prevent high voltages from destroying the emulator.

[3] A 120ohm termination resistor is required between the CAN-H and CAN-L terminals (terminals 4&5). This resistor comes pre-installed on the connection plug.

Installation using a speed sensor only.

If the tachometer input is not used, the tachometer input should be joined to the +12V IGNITION.

PIN	BRZ/GT86/FRS wire colours		NAME
1	BLACK	POWER	GROUND
2		Input [1]	Vehicle Speed Sensor
3	GREEN/WHITE		+12V IGNITION
4	WHITE	HS CAN[2]	HS-CAN-L
5	BLACK	HS CAN[2]	HS-CAN-H
6	GREEN/WHITE	POWER	+12V IGNITION

[1] Speed input is a 0-12V digital pulse of approximately 4-5 pulses per wheel revolution. The wire is pulled "high" by the emulator, and suits a negatively switched output speed sensor (most speed sensors, including Subaru is this type). A standard diode may be required in line with the speed input wire (with the polarity band facing the sensor) for the $10 "eBay" style proximity sensors.

[2] A 120ohm termination resistor is required between the CAN-H and CAN-L terminals (terminals 4&5). This resistor comes pre-installed on the connection plug.

Installation using a manual assist (no speed sensor)

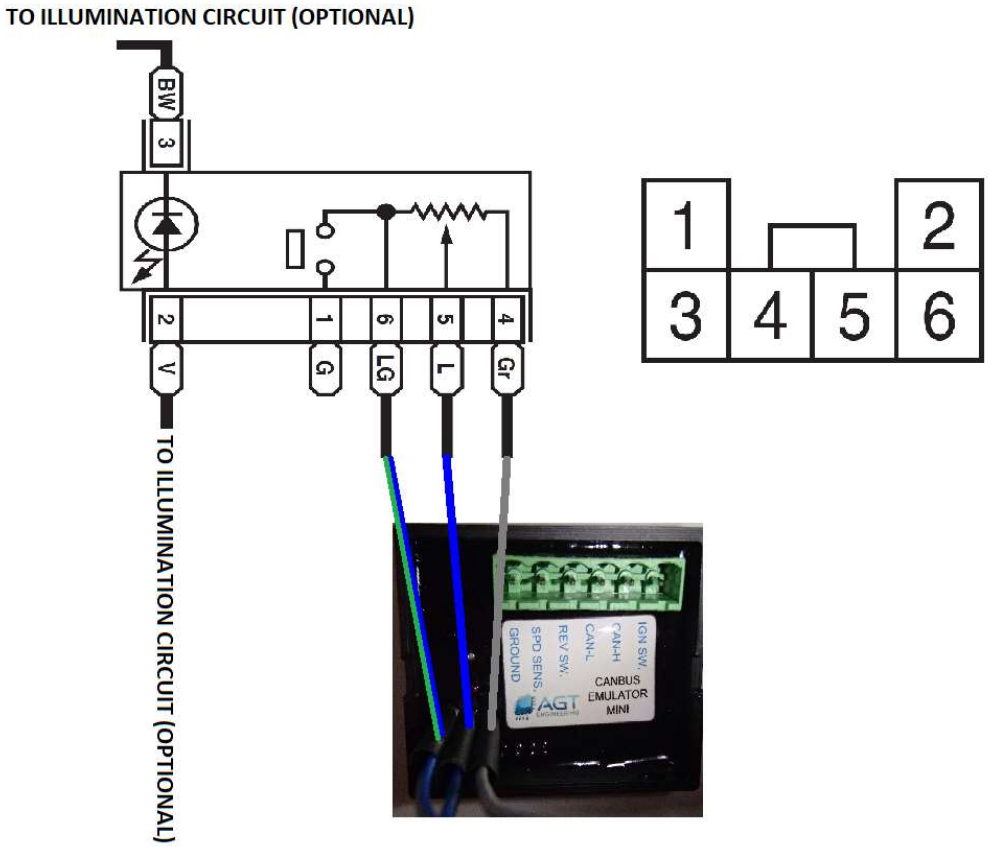
If the translator is configured as a manual adjust connect as follow:

PIN	BRZ/GT86/FRS wire colours		NAME
1	BLACK	POWER	GROUND
2	Not used	Not used	Not used
3	GREEN/WHITE	Input [1]	+12V IGNITION / Tachometer
4	WHITE	HS CAN[2]	HS-CAN-L
5	BLACK	HS CAN[2]	HS-CAN-H
6	GREEN/WHITE	POWER	+12V IGNITION

[1] Tacho input is a 0 to 12V alternating input, pulled low by the emulator. If this is wired up directly to an ignition coil circuit, a surge protector should be used to prevent high voltages from destroying the emulator. If the power steering is to be powered up with ignition (regardless of engine running), the Tachometer input can be wired to +12V Ignition (Bridged with terminal 6)

[2] A 120ohm termination resistor is required between the CAN-H and CAN-L terminals (terminals 4&5). This resistor comes pre-installed on the connection plug.

Wiring to an external manual adjust control (Subaru Illumination controller)



Note: Wiring colours of the three wires to the emulator may vary depending on the Subaru model the illumination controller was removed from.

Power Steering adjustment alongside illumination adjustment in a BRZ/GT86/FRS

Canbus Wiring within a BRZ/GT86/FRS.

The Emulator is designed to work in a stand alone system, however, depending on the application, the steering system within the vehicle may still be connected to the vehicles main Canbus network. This is OK, as long as the Canbus from the ABS unit AND the FA20 ECU are not connected to the Canbus network. If they are connected, these units will be outputting conflicting messages to the Emulator, and therefore, the steering may not operate correctly.

The easiest way to rectify this is to isolate the Power Steering and the Emulator from the rest of the vehicles Canbus network.

Operation

Operation with Tachometer input

The emulator looks for an alternating 0 to 12V voltage on the Tachometer pin. With the engine running (alternating input received), the translator will output a RPM of approximately 700rpm over Canbus. If the alternating tachometer signal is lost (engine stopped) the emulator will output an engine speed of 0rpm after a delay of around 5 seconds, telling the power steering unit to turn off. Note the steering controller will not turn off it still senses a vehicle speed, until the vehicle stops.

If the tachometer input changes state once stopped, it will again output an RPM until the input is lost and times out again.

The Speed input via the speed sensor will transmit the speed output via Canbus. This determines the level of power assist, with maximum assist at low speed.

Operation without Tachometer Input

The Tachometer input is optional. If the Tachometer input is not used, it must be wired to +12V ignition as per pin6 of the emulator plug.

In this mode, the emulator will simulate and rpm of approximately 700rpm the moment it is powered up, activating the power steering. This can drain the battery prematurely if left on for considerable amount of time (the power steering controller draws nearly 1Amp constantly when on, and the wheel is not moving). To prevent battery drain, the emulator incorporates a battery saving mode, in which it will turn the power steering controller off after approximately 4 minutes if it does not sense any vehicle movement via the speed sensor. The power steering will not reactivate until

Speed Sensor Calibration (variable assist versions)

The Canbus Emulator Mini is pre-calibrated for a standard Subaru 5 pulse/revolution gearbox speed sensor. You may need to calibrate this if using different types of sensors, diff ratios, or tyres sizes. If not using the BRZ/86/FRS instrument cluster (or using the column stand-alone), adjusting the speed sensor calibration can be used to adjust the amount of assist at different speeds. Simulating a faster speed will decrease the assist, simulating a slower speed will increase the assist.

Calibration is adjusted by turning the small screw on the blue potentiometer. There are a number of turns lock to lock and the default position is in the middle. Turning clockwise will increase the speed value (decreasing level of assist). Turning anti-clockwise will decrease the speed value (increasing the level of assist).

The level of calibration available is 0.25 to 2.5x standard. Other custom calibrations are possible; however, these need to be programmed specially at time of order.

If the potentiometer is turned all the way anti-clockwise, this will simulate a 40km/h constant speed. This may be useful for applications where a speed sensor is not wanted to be used and a constant mid-range power assist is acceptable.

Note: If a speed sensor is not used, the tachometer input is recommended, otherwise the power steering will be operational whenever the ignition switch is on, even with the engine not running.

Default Speed Vs Input Frequency

The default frequency is approximately 1.61km/h/Hz (1mph/Hz) as per the following table

Input Frequency (Hz)	km/h	mph
10	16	10
20	32	20
50	80	50
100	160	100

Indication Lights

There are two indication LEDs on the Canbus Emulator to display its status and for fault finding.

RED LED	SOLID – Indicate Power ON but no Canbus signal has been detected from the power steering controller (check a termination resistor is present and Constant 12V and ignition 12V is connected to the steering controller) FLASHING SLOW – Indicates the emulator is communicating to the power steering controller, however the steering controller is in the OFF or FAULTED state. FLASHING FAST – Indicates the emulator is is communicating to the power steering controller, and the steering controller is active and healthy (providing assist).
Green LED	Changes state every time the speed input changes state, or the tacho input changes state. This flash slowly at slow vehicle speed, and faster at faster speed (with tacho input removed) It will also flash slowly at low rpm and faster at high rpm (if tacho is wired and with no vehicle speed). For fixed assist versions, the Green LED will flash at a rate proportional to the speed setting of the potentiometer or remote dial.