ECU MASTER GPStoCAN V2 Module User Manual

MASTER GPStoCAN V2 Module
User Manual

Contents

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Introduction

This document provides information about the ECUMASTER GPStoCAN V2 module including a device description, specifications, available features and use cases.

Document created for firmware version 1.x. Description of all the features can differ from other firmware versions, so upgrade is recommended.

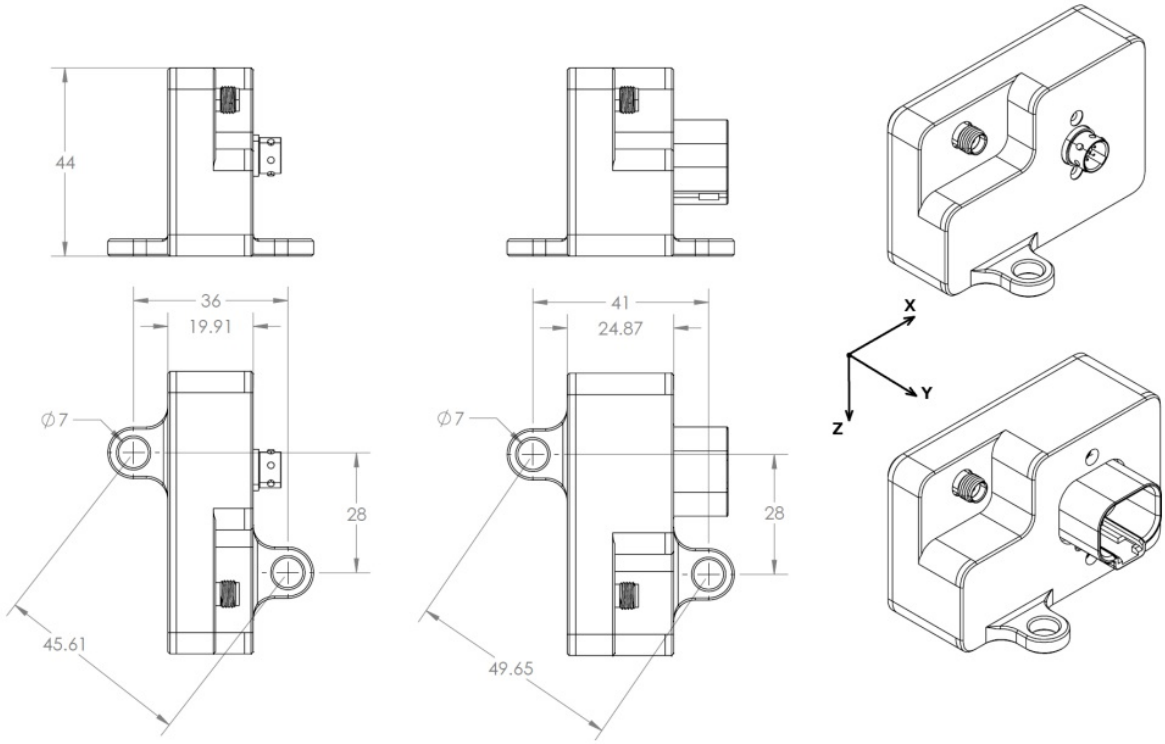
Description

GPStoCAN V2 is a device designed to provide position information over CAN bus. This module can use up to four concurrent navigation systems (GPS, GLONASS, BeiDou, Galileo) to provide position updates at a rate of 25 Hz. Position data can be used to measure lap times, estimate current lap time, draw track maps and analyze vehicle logs with respect to track position.

Specifications

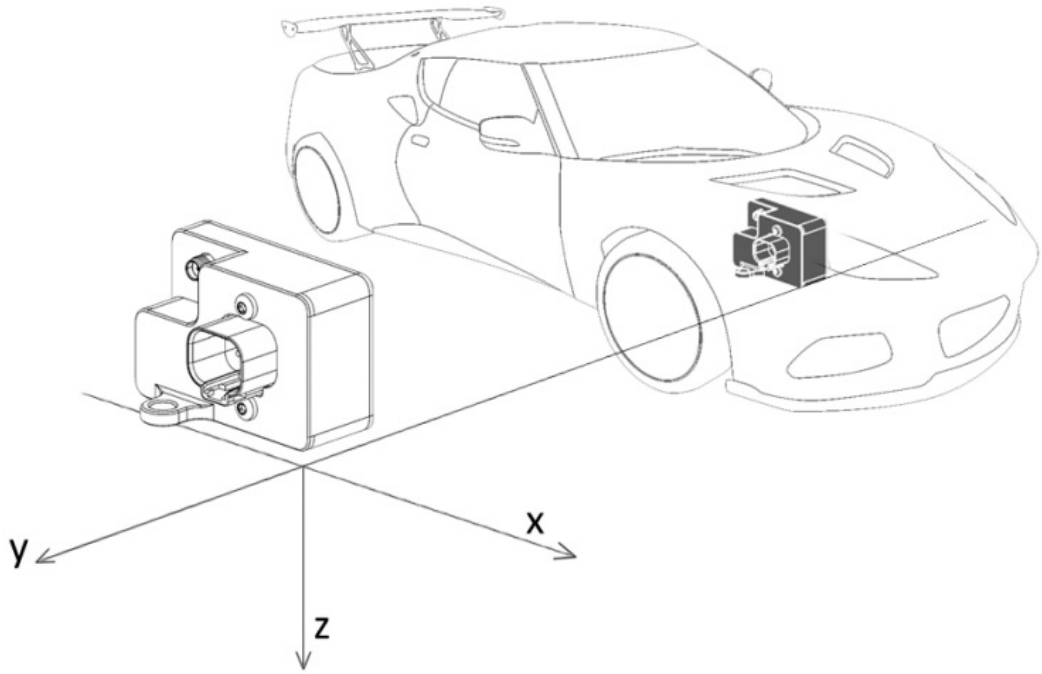
4.1. Mechanical drawings

Dimensions in mm
X – front
Y – right
Z – down

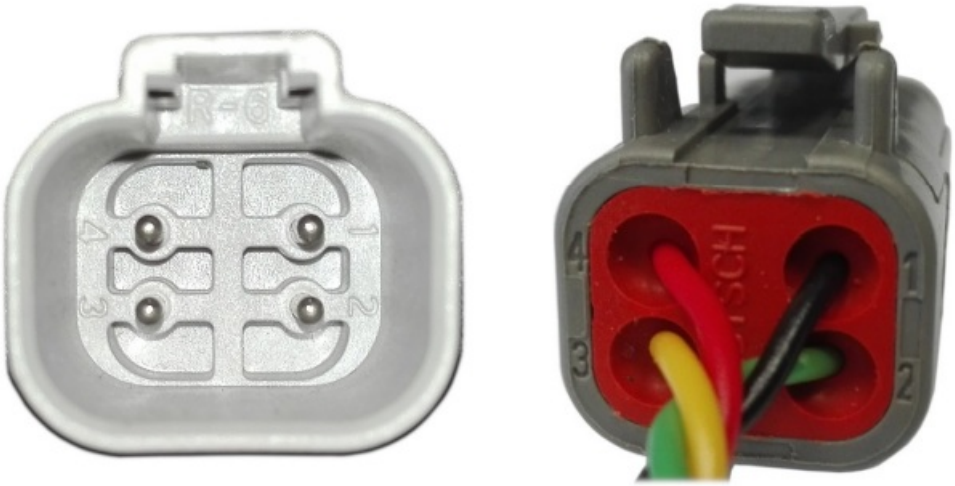


4.2. Mounting orientation

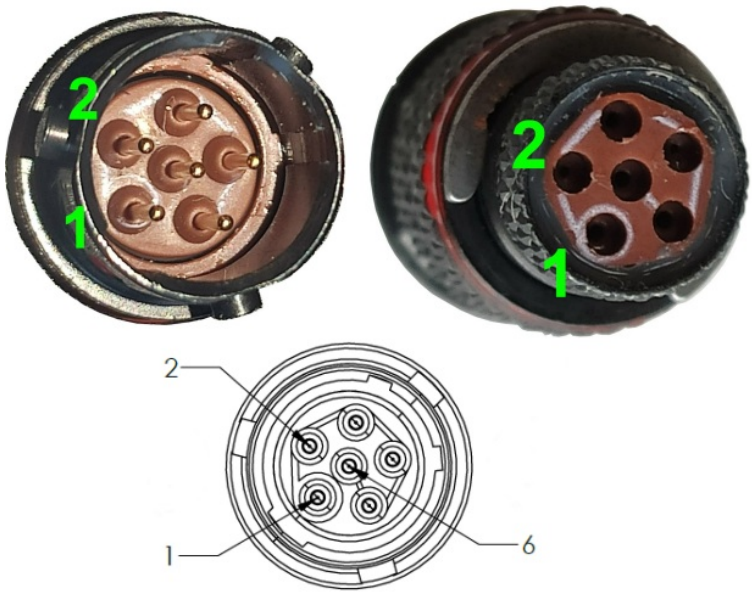
Acceleration in the directions shown below gives positive values
X – front
Y – right
Z – down



4.3. Connectors pinout



DEUTSCH DT	
Pin	**Description**
1	Ground
2	CAN High
3	CAN Low
4	12V (after ignition)



DEUTSCH AS	
Pin	**Description**
1	12V (after ignition)
2	CAN High
3	Short these pins together to add CAN termination resistor
4	
5	CAN Low
6	Ground

4.4. Specification table

General		
Operating supply voltage	6-22 V, immunity to transients according to ISO 7637	
Reverse polarity protection	Yes, internal up to 16 V	
Temperature range	-40 to +85 °C	
Enclosure	IP65, bespoke CNC machined aluminum	
Size and weight (DT version)	66×53×44 mm, 92 g	
Size and weight (AS version)	66×49×44 mm, 74 g	
Connector (DT version)	Plug: DEUTSCH DT06-4S	Socket: DEUTSCH DT15-4P
Connector (AS version)	Plug: DEUTSCH ASX602-06SN	Socket: DEUTSCH ASX202-06PN
CAN-bus bitrate	1 Mbps, 500 kbps, 250 kbps, 125 kbps	
PC communication	Using USB to CAN interface (ECUMASTER USBtoCAN, PEAK, Kvaser)	
LED colors	Red – no position fix Green – position fix ready	
Navigation		
Supported systems	GPS, GLONASS, BeiDou, Galileo	
Supported antennas	Active	
Position update frequency	25 Hz	
IMU update frequency	100 Hz	
Velocity accuracy	0.05 m/s	
Velocity maximum	500 m/s	
Velocity resolution	0.01 m/s	
Velocity latency	< 20 ms	
Position accuracy	2 m	
Height accuracy	2.5 m	
Heading accuracy	0.3°	
Heading resolution	0.01°	
Acquisition	Cold start: 24 sec Hot start: 2 sec	

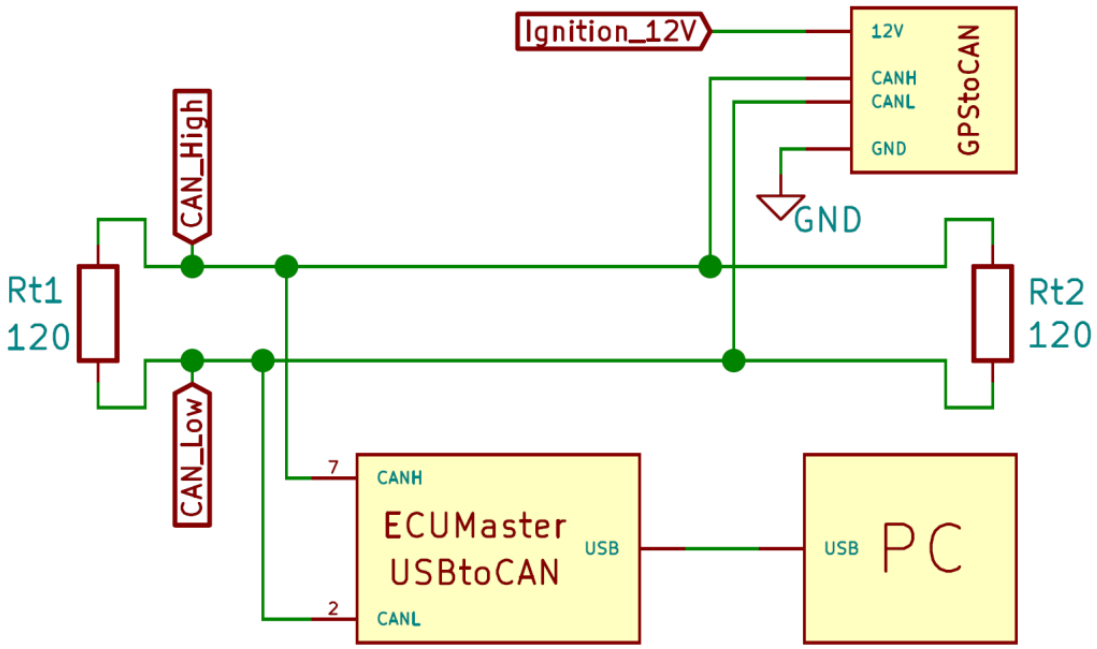
PC connection

Communication with PC software is done using CAN bus. This requires a special interface which converts CAN bus communication to USB 2.0. Interface is an independent device and must be purchased separately. Supported interfaces:

- ECUMASTER USBtoCAN (driver and manual: **http://www.ecumaster.com/download/**)

- PEAK-System
- Kvaser

Wiring diagram:



Light Client description

ECUMASTER Light Client is the configuration software for many ECUMASTER products as well as tool for CAN bus monitoring. Light Client can be used to check available devices on the CAN bus, display channel values, change CAN bus bitrate and device specific properties. Monitoring of CAN bus is possible thanks to list of frames grouped by ID, saving traffic trace file and sending custom messages on the CAN bus.
Software and manual can be downloaded from: **https://www.ecumaster.com/products/light-client/**

Software features

7.1. Channels

Channels are different data values that are sent over CAN bus. Channels are sent as raw values, which means that obtaining a value with the correct unit requires some calculations.

$$Value[unit] = \frac{Value[raw] * Multiplier}{Divider} + Offset$$

Tables below describe how each channel is positioned inside CAN frames and how to obtain the correct value. All values are Big Endian.

Ecumaster format output:

Byte (bit)	Channel	Data type	Range	Multiplier	Divider	Offset	Unit
Ecumaster output ID (default: 0 x 400)							
0	Latitude	32bit signed	-90 – 90	1	10^7	0	°
4	Longitude	32bit signed	-180 – 180	1	10^7	0	°
Ecumaster output ID+1 (default: 0 x 401)							
0	Speed	16bit signed	-1179 – 1179	36	1000	0	km/h
2	Height	16bit signed	-32768 – 32767	1	1	0	m
5	Satellites number	8bit unsigned	0 – 72	1	1	0	–
6 (0)	GPS frame index	4bit unsigned	0 – 16	1	1	0	–
6 (4)	Empty frame index	4bit unsigned	0 – 16	1	1	0	–
7 (0)	GPS status	3bit unsigned	1 – 5	1	1	0	–
Ecumaster output ID+2 (default: 0 x 402)							
0	Heading motion	16bit unsigned	0 – 360	1	1	0	°
2	Heading vehicle	16bit unsigned	0 – 360	1	1	0	°
4	X angle rate	16bit signed	-250 – 250	1	100	0	°/s
6	Y angle rate	16bit signed	-250 – 250	1	100	0	°/s
Ecumaster output ID+3 (default: 0 x 403)							
0	Z angle rate	16bit signed	-250 – 250	1	100	0	°/s
2	X acceleration	16bit signed	-4 – 4	1	100	0	g
4	Y acceleration	16bit signed	-4 – 4	1	100	0	g
6	Z acceleration	16bit signed	-4 – 4	1	100	0	g

Byte (bit)	Channel	Data type	Range	Multiplier	Divider	Offset	Unit
Ecumaster output ID+4 (default: 0 x 404)							
0	UTC year	8bit unsigned	0 – 255	1	1	2000	–
1	UTC month	8bit unsigned	1 – 12	1	1	0	–
2	UTC day	8bit unsigned	1 – 31	1	1	0	–
3	UTC hour	8bit unsigned	0 – 23	1	1	0	–
4	UTC minute	8bit unsigned	0 – 59	1	1	0	–
5	UTC second	8bit unsigned	0 – 60	1	1	0	–
6	UTC millisecond	16bit unsigned	0 – 65535	1000	65536	0	–

Channels description:

Latitude – latitude position in degrees
Longitude – longitude position in degrees
Speed – ground speed in kilometers per hour
Height – height above mean sea level in meters
Satellites number – number of currently visible satellites
GPS frame index – increments cyclically from 0 to 15 for each position frame
Empty frame index – increments cyclically from 0 to 15 for each empty frame
GPS status – position fix status:

- 1 – “NoFix” – no position fix acquired
- 3 – “GPS-2D” – position is fixed in 2D space using GNSS satellites
- 4 – “GPS-3D” – position is fixed in 3D space using GNSS satellites

Heading motion – direction of vehicle motion in degrees
Heading vehicle – direction in which vehicle front is heading in degrees
X, Y, Z angle rate – angular velocity around longitudinal, lateral and vertical axis (referenced to the vehicle frame)
X, Y, Z acceleration – longitudinal, lateral and vertical acceleration (referenced to the vehicle frame)
UTC year, month, day – UTC date from navigation satellites
UTC hour, minute, second, millisecond – UTC time from navigation satellites

Format M output:

Byte (bit)	Channel	Data type	Range	Multiplier	Divider	Offset	Unit
Format M output ID (default: 0 x 680)							
0	Latitude (M)	32bit signed	-90 – 90	1	10^7	0	°
4	Longitude (M)	32bit signed	-180 – 180	1	10^7	0	°
Format M output ID+1 (default: 0 x 681)							
0	Time (M)	32bit signed	0 – 235959999	1	1	0	–
4	Speed (M)	16bit unsigned	0 – 1800	1	10	0	km/h
6	Altitude (M)	16bit signed	-32768 – 32767	1	10	0	m
Format M output ID+2 (default: 0 x 682)							
0	Date (M)	24bit unsigned	0 – 311299	1	1	0	–
3	Valid (M)	8bit signed	-1 – 1	1	1	0	–
4	True course (M)	16bit signed	-250 – 250	1	10	0	°
7	Satellites (M)	8bit unsigned	0 – 255	1	1	0	–
Format M output ID+3 (default: 0 x 683)							
4	FAA mode (M)	8bit signed	-1 – 1	1	1	0	–
5	Fix quality (M)	8bit signed	-1 – 1	1	1	0	–

Channels description:
Latitude (M) – latitude position in degrees
Longitude (M) – longitude position in degrees

Time (M) – time in HHMMSS.sss format
Speed (M) – ground speed in kilometers per hour
Altitude (M) – height above mean sea level in meters
Date (M) – date in DDMMYY format
Valid (M) – position data valid:

- -1 – “Warning” – position data may be invalid
- 0 – “Unknown” – position data is unknown
- 1 – “Valid” – position data is valid

True course (M) – direction of vehicle motion in degrees
Satellites (M) – number of currently visible satellites
FAA mode (M) – duplicate of ‘Fix quality 2’ field, see below
Fix quality (M) – fix quality status:

- -1 – “Unknown” – unknown fix quality
- 0 – “Invalid” – not enough satellites, invalid fix quality
- 1 – “GPS” – standard GPS signal position fix

High rate IMU output:

Byte (bit)	Channel	Data type	Range	Multiplier	Divider	Offset	Unit
High rate IMU output ID (default: 0 x 408)							
0	HR X ang rate	16bit signed	-250 – 250	1	100	0	°/s
2	HR Y ang rate	16bit signed	-250 – 250	1	100	0	°/s
4	HR Z ang rate	16bit signed	-250 – 250	1	100	0	°/s
High rate IMU output ID+1 (default: 0 x 409)							
0	HR X accel	16bit signed	-4 – 4	1	100	0	g
2	HR Y accel	16bit signed	-4 – 4	1	100	0	g
4	HR Z accel	16bit signed	-4 – 4	1	100	0	g

Channels description:
HR X, Y, Z ang rate – high rate angular velocity around longitudinal, lateral and vertical axis
HR X, Y, Z accel – high rate longitudinal, lateral and vertical acceleration

7.2. Properties
Device properties can be changed using the ECUMASTER Light Client software and connection interface. Each property is described below:
Ecumaster output:

- Enable – enable Ecumaster CAN frames output
- Output CAN ID – base frame ID for Ecumaster output

Format M output:

- Enable – enable format M CAN frames output
- Output CAN ID – base frame ID for format M output

High rate IMU output:

- Enable – enable high rate IMU CAN frames output
- Output CAN ID – base frame ID for high rate IMU output

Navigation config:

- Navigation systems – selected navigation systems to use in positioning

Static hold config:

- Enable – enable static hold, this option holds position constant and speed equal to 0 until distance or speed threshold is exceeded
- Distance threshold – threshold in meters for static hold to deactivate
- Speed threshold – threshold in kilometers per hour for static hold to deactivate

Device installation

8.1. Mounting method and location
Ideal mounting position is in the middle of the vehicle, attached to a vehicle frame using included rubber dampers and orientation that is shown in the “Mechanical drawings” chapter.
GPStoCAN V2 module must be mounted with rubber dampers in a vertical orientation (Z-axis pointing down). Mounting the module to a vertical plane with dampers horizontally can introduce problems with the IMU since bumps on the road could significantly move the module up and down relative to the vehicle.
8.2. Antenna connection
The GPStoCAN V2 module is designed to work with active antennas. Ideal antenna placement is on a big metal plane (roof, hood, trunk) with a clear view of the sky. The most common way to mount the antenna is to put it on the roof (using the magnetic base).
Antenna wire should be placed away from any harness with high currents or voltages (like engine harness). Fast changing current or voltage can generate noise in the antenna wire and interfere with GNSS signal.

Document revision history

Revision	Date	Changes
1.0	2023-04-03	– official release

Documents / Resources

	**ECU MASTER GPStoCAN V2 Module** [pdf] User Manual GPStoCAN V2 Module, GPStoCAN V2, Module

References

- Ecumaster Download
- Ecumaster Light Client