Data Sheet

SOMAT

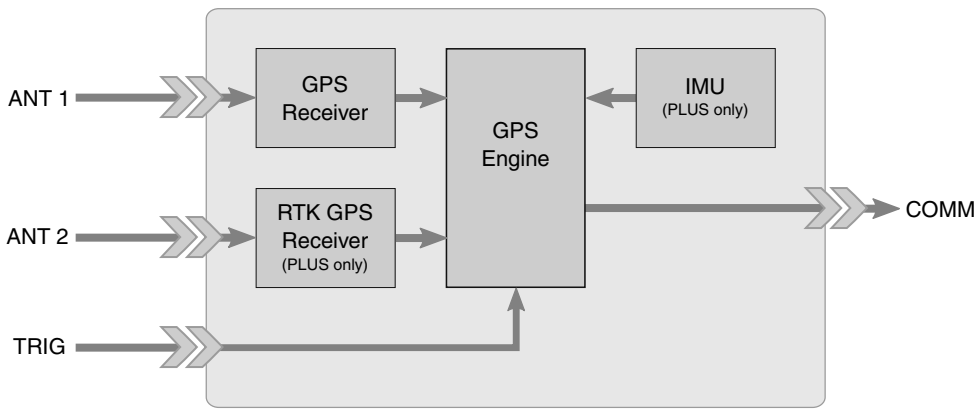
EGPS-200

Precision GPS Module

Special Features

- **High-accuracy speed output with update rate of 200 Hz**
- **22 base measurement channels**
- **PLUS package with RTK and IMU options provides additional channels and accuracy**
- **Rugged environmental protection to IP 67 standard**
- **Integrated trigger input to synchronize measurements with external events**

Block Diagram



HBM

Detailed Description

The SoMat Precision GPS (EGPS-200) is a GPS receiver designed for non-contact speed measurements in professional vehicle testing applications such as braking, acceleration and general vehicle dynamics. The EGPS-200 module combines data from GPS and inertial sensors to provide a robust 200-Hz update rate for maximum reliability and accuracy, even in areas with short interruptions in GPS reception. This combination of GPS and accelerometer data allows the EGPS-200 to outperform devices that are solely dependent on GPS or survey grade receivers with an emphasis on absolute position rather than speed.

The EGPS-200 is available in both a base model and a PLUS package. The base model provides 22 possible channels including speed, absolute position, three-axis instantaneous acceleration, number of satellites and date and time information. The base model also includes an input trigger channel which allows synchronization of data values with external events such as brake pedal depression or passing a marker point.

The PLUS package provides all the channels of the base model plus IMU (inertial measurement unit) and RTK (real time kinematic) measurements. The IMU option improves acceleration accuracy and completes the six degrees of freedom measurements by adding axis rotation (roll, pitch and yaw). The RTK option uses readings from two GPS antennas to output high-accuracy yaw, pitch and slip angle measurements. The EGPS-200 directly measures the yaw and pitch at any time, while the slip angle calculations require the vehicle to be in motion.

The EGPS-200 is a sealed, compact module engineered to operate within temperature ranges from -20 to 65 °C and have an IP 67 protection class rating. Four mounting hole locations provide easy and secure attachment to the test object. EGPS-200 modules are ideally designed to interface with the HBM SoMat eDAQ or eDAQ*lite* data acquisition system. A single module can be powered directly from the GPS connector on a Vehicle Network Communications (ECOM[1] or ELCOM) layer.

Ordering Options

Order No.	Description
1-EGPS-200-B-2	Precision GPS Receiver Compatible with SoMat eDAQ & eDAQ*lite* COM layers Includes (1) Trigger Cable and (1) GPS Antenna
1-EGPS-200-P-2	Precision GPS Receiver PLUS Package - IMU and RTK Measurements Compatible with SoMat eDAQ & eDAQ*lite* COM layers Includes (1) Trigger Cable, (2) GPS Antennas and (1) Dual Antenna Template

Cables and Accessories (Order Separately)

Order No.	Description
1-EGPS-200-ANT-2	EGPS-200 GPS Antenna
1-EGPS-200-TEM-2	EGPS-200 Dual Antenna Template - RTK Required for EGPS-200 PLUS Package
1-SAC-GPSTRIG-2	EGPS-200 Trigger Cable TNC Male to Pigtail - 2 Meters Length
1-SAC-EXT-MF-0.4-2	Extension Cable - Male/Female Connectors - 0.4 Meters Length
1-SAC-EXT-MF-2-2	Extension Cable - Male/Female Connectors - 2 Meters Length
1-SAC-EXT-MF-5-2	Extension Cable - Male/Female Connectors - 5 Meters Length
1-SAC-EXT-MF-10-2	Extension Cable - Male/Female Connectors - 10 Meters Length
1-SAC-EXT-MF-15-2	Extension Cable - Male/Female Connectors - 15 Meters Length

1. Note that the ECOM layer must have ECO-1666 applied to be compatible with the EGPS-200.

Specifications

Parameter	Units	Value
Module dimensions (including connector)		
width	mm	135
length	mm	215
height	mm	40
Module weight	kg	1.4
Operating temperature range	°C	-20 ... 65
Storage temperature range	°C	-20 ... 65
Input power	W	2.4
Combined Speed		
accuracy [1]	km/h	±0.05
update rate	Hz	200
maximum	m/s	514
minimum	km/h	0.01
resolution	km/h	0.01
Absolute position		
accuracy (95% CEP) [1] [2]	m	±3
altidude accuracy	m	±6
update rate	Hz	20
resolution	°	1×10^{-7}
Heading		
accuracy (at 10 m/s)	°	0.05
resolution	°	1×10^{-5}
Acceleration		
accuracy	% of full scale	0.5
update rate	Hz	200
maximum (base)	*g*	±2
maximum (PLUS)	*g*	±6
resolution	*g*	0.01

[1] GPS velocity can be calculated far more accurately than GPS position data, since it is calculated using advanced techniques such as measuring changes in carrier frequency cycles from the satellites used to carry the raw GPS data. It is impossible to quote absolute positional accuracies of GPS systems simply because accuracy depends on time of day, satellite coverage, weather, antenna mounting, tree and building coverage, etc. The specifications provided represent typical real-world performance

[2] 95% CEP (circle of error probable) indicates that 95% of position readings will fall within a circle of the stated diameter.

Standards

Category	Standard	Description
Environmental	IP 67	dust tight, immersion up to 1 m
Radiated emissions and susceptibility	EN 61326-1:2006	

IMU Specifications (PLUS only)

Parameter	Units	Value
Gyroscope sensitivity (per axis)		
typical initial sensitivity (dynamic range = ±300 °/s, 25 °C)	°/s/LSB	0.07326
minimum initial sensitivity (dynamic range = ±300 °/s, 25 °C)	°/s/LSB	0.0725
maximum initial sensitivity (dynamic range = ±300 °/s, 25 °C)	°/s/LSB	0.0740
typical initial sensitivity (dynamic range = ±150 °/s, 25 °C)	°/s/LSB	0.03663
typical initial sensitivity (dynamic range = ±75 °/s, 25 °C)	°/s/LSB	0.01832
temperature coefficient	ppm/°C	40
axis nonorthogonality (difference from 90° ideal, 25 °C)	°	±0.05
axis misalignment (relative to base plate and guide pins, 25 °C)	°	±0.5
nonlinearity (best fit straight line)	% of full scale	0.1
Gyroscope bias		
in run bias stability (1 standard deviation, 25 °C)	°/s	0.015
angular random walk (25 °C)	°/√h	4.2
temperature coefficient	°/s/°C	0.01
linear acceleration effect (any axis, 1 standard deviation)	°/s/*g*	0.05
Gyroscope noise performance (25 °C)		
output noise (±300 °/s range, 2-tap filter setting)	°/s rms	0.60
output noise (±150 °/s range, 8-tap filter setting)	°/s rms	0.35
output noise (±75 °/s range, 32-tap filter setting)	°/s rms	0.17
rate noise density (f=25 Hz, ±300 °/s, no filtering)	°/s/√Hz rms	0.05
Gyroscope frequency response		
3 dB bandwidth	Hz	350
sensor resonant frequency	kHz	14
Accelerometer sensitivity		
typical dynamic range	*g*	±10
minimum dynamic range	*g*	±8
typical initial sensitivity (25 °C)	m*g*/LSB	2.522
minimum initial sensitivity (25 °C)	m*g*/LSB	2.471
maximum initial sensitivity (25 °C)	m*g*/LSB	2.572
temperature coefficient	ppm/°C	40
axis nonorthogonality (difference from 90° ideal, 25 °C)	°	±0.25
axis misalignment (relative to base plate and guide pins, 25 °C)	°	±0.5
nonlinearity (best fit straight line)	% of full scale	±0.2
Accelerometer bias		
in run bias stability (1 standard deviation, 25 °C)	m*g*	0.7
velocity random walk (25 °C)	m/s/√h	2.0
temperature coefficient	m*g*/°C	0.5
Accelerometer noise performance (25 °C, no filtering)		
output noise	m*g* rms	35
noise density	m*g*/√Hz rms	1.85
Accelerometer frequency response		
3 dB bandwidth	Hz	350
sensor resonant frequency	kHz	10

Base Channels

Channel	Description	Units	Range	Update Rate
trigger	Current state of the trigger input.	-	0 or 1	200 Hz
latitude	Standard earth latitude position measurement.	°	-90 ... 90	20 Hz
longitude	Standard earth longitude position measurement.	°	-180 ... 180	20 Hz
altitude	Standard altitude measurement referenced to WGS84 ellipsoid (mean sea level).	m	-10000 ... 100000	20 Hz
speed_3d	Combined speed generated using raw speed and accelerometer channels.	km/h	0 ... 1852	200 Hz
speed_raw2d	2-D raw speed channel for testing on flat ground.	km/h	0 ... 1852	20 Hz
speed_raw3d	3-D raw speed channel for testing over elevation changes.	km/h	0 ... 1852	20 Hz
heading	Heading reference.	°	0 ... 360	20 Hz
gradient	Angle of orientation with respect to the horizontal reference plane.	°	-90 ... 90	20 Hz
accel_x	Instantaneous acceleration measurement for the x component.	*g*	-6 ... 6	200 Hz
accel_y	Instantaneous acceleration measurement for the y component.	*g*	-6 ... 6	200 Hz
accel_z	Instantaneous acceleration measurement for the z component.	*g*	-6 ... 6	200 Hz
year	Current year.	-	1998 ... 2038	as needed
month	Current calendar month.	-	1 ... 12	as needed
day	Current day of the month.	-	1 ... 31	as needed
hour	Current hour of the day.	-	0 ... 23	as needed
minute	Current minute.	-	0 ... 59	as needed
second	Current second.	-	0 ... 60 [1]	as needed
nsec	Current nanosecond.	-	0 ... $1x10^9$	user selected
nsat	Current total number of satellites in view.	-	0 ... 255	20 Hz
fix_quality	Quality of the GPS fix and speed channels data. 0: Inadequate for GPS location, inadequate for speed 1: Adequate for nominal GPS location, inadequate for speed 20: Adequate for GPS location, adequate (but not optimal) for speed 30: Optimal for GPS location, optimal for speed	-	0, 1, 20 or 30	20 Hz
faa_mode	Quality of GPS fix. A: Adequate for determination of nominal GPS location fixes N: Not adequate for determination of GPS location fixes	-	A (65) or N (78)	20 Hz

[1] A second value of 60 indicates the occurrence of a leap second.

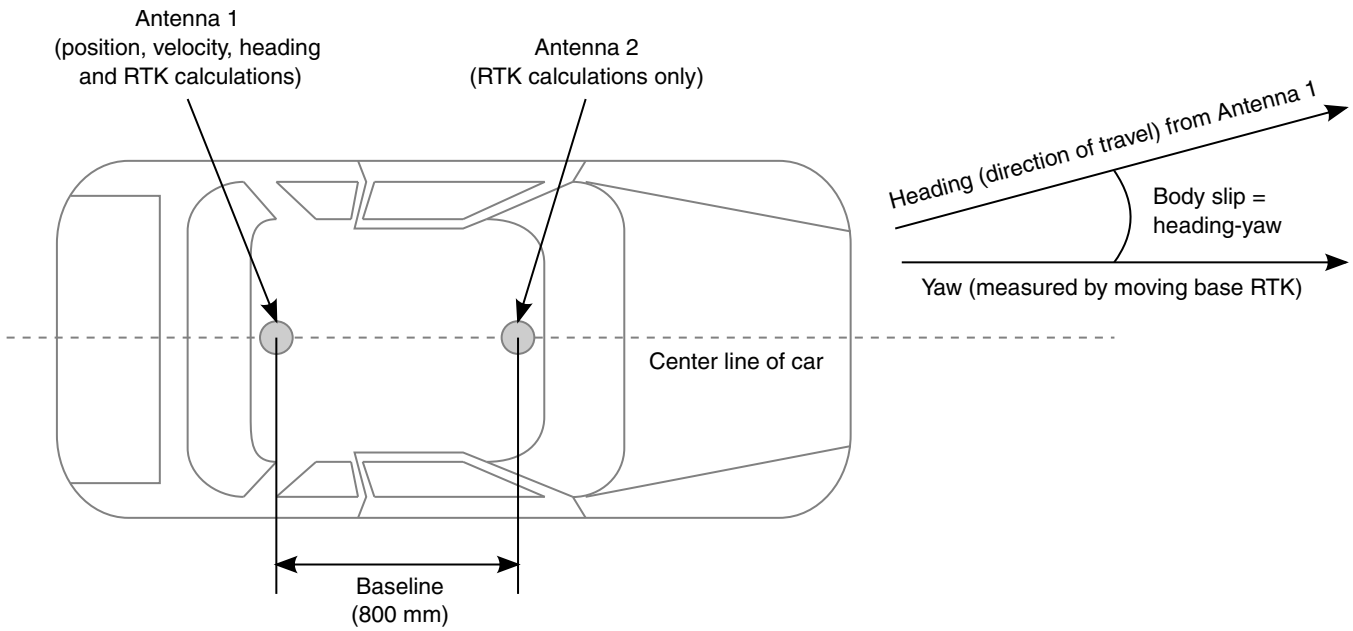
PLUS Package Channels (PLUS only)

The following channels are only available with the PLUS package. In addition, the base three-axis acceleration channels accel_x, accel_y and accel_z are derived from the higher accuracy IMU measurements.

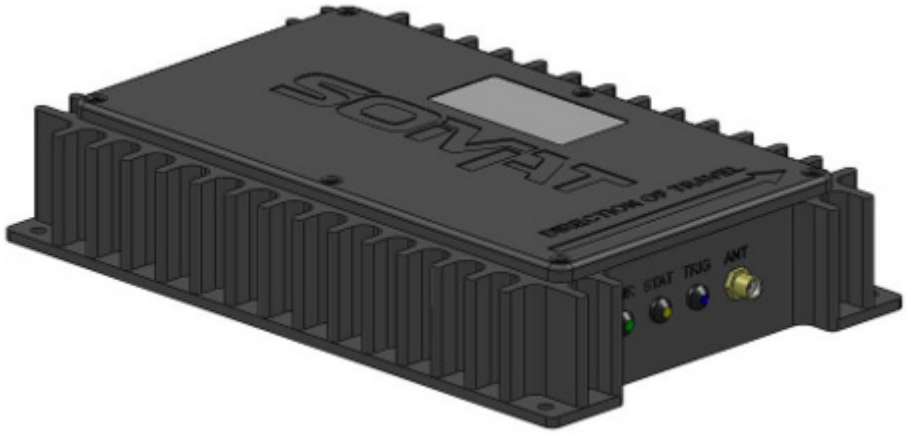
Channel	Description	Units	Update Rate
yaw_rate	Angular velocity about the yaw axis.	°/s	200 Hz
pitch_rate	Angular velocity about the pitch axis.	°/s	200 Hz
roll_rate	Angular velocity about the roll axis.	°/s	200 Hz
rtk_yaw	Angular position about the yaw axis. [1]	°	20 Hz
rtk_pitch	Angular position about the pitch axis.	°	20 Hz
rtk_baseline	Distance between RTK antennas (should be close to 800 mm).	mm	20 Hz
rtk_accuracy	Expected accuracy of rtk_yaw and rtk_pitch channel data.	mm	20 Hz

[1] Slip angle can be calculated as heading minus yaw angle.

RTK Antenna Location and Outputs (PLUS only)



Front and Rear Product Views

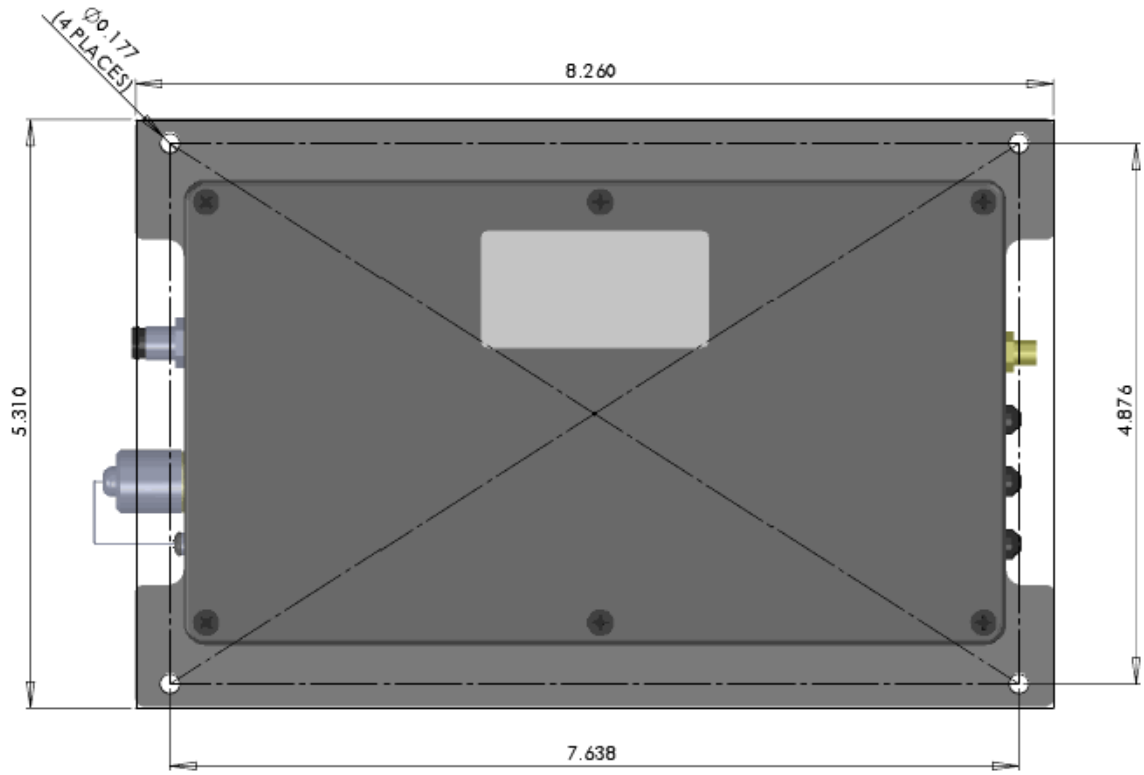


Front view of EGPS-200 base model showing ANT input and LED indicators.

Front view of EGPS-200 PLUS package showing ANT1 and ANT2 inputs and LED indicators.

Rear view of EGPS-200 showing COMM and TRIG inputs.

Mounting Locations



CE

Americas: HBM, Inc. · 19 Bartlett Street · Marlboro · MA 01752 · USA · Tel.: (800) 578 4260 · Email: info@usa.hbm.com

Asia: Hottinger Baldwin Measurement (Suzhou) Co., Ltd. · 106 Heng Shan Road · Suzhou 215009 · Jiangsu · China
Free hotline: 4006217621 (only in China) · Tel.: +86 512 682 47776 · Email: hbmchina@hbm.com.cn

Europe: Hottinger Baldwin Messtechnik GmbH · Im Tiefen See 45 · 64293 Darmstadt · Germany
Tel.: +49 6151 803-0 · Email: info@hbm.com

measure and predict with confidence

HBM

B2890-1.1 en DOC-0023-01