Tamagawa

Compact & High-accuracy

IMU

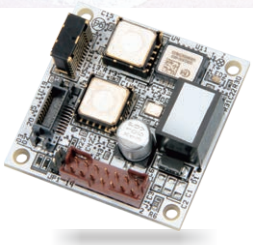
Inertial Measurement Unit

FOG & MEMS combined IMU

NEW

TAG320

TAG300



AU7684

TAMAGAWA SEIKI CO., LTD.

MEMS IMU i-FOG

Inertial Measurement Unit (IMU) is an electronic device that measures various kinds of motions in vehicle dynamics, attitude (roll & pitch) or heading (yaw) angle.
In addition, it is an essential technology in autonomous driving for localization and dead-reckoning. Tamagawa Seiki Co., Ltd. offers wide range of product, such as MEMS Gyro, FOG or AHRS. We provide the best option for your application.

01 Automobile

Equipped with a high-precision IMU, enabling accurate vehicle position and attitude measurement.

02 Unmanned Construction Machine

IMU offers stable output under large vibration by utilizing gyroscope and accelerometer.

03 Unmanned Agricultural Machine

The combination of GNSS and IMU enables not only tractor heading and attitude measurement, but also autonomous driving.

04 Security Robot

IMU is used for attitude control in security robot.

Attitude control of micro satellite

04 Tilt measurement of security robots

Attitude Control in Rehabilitation

05 Attitude Control for Drone

Inertial Navigation System (INS) for Light Aircraft

01 Vehicle Dynamics Testing

07 Motion Sensing for Train

Navigation for AGV in Harbor

08 Navigation System for Ship Motion Sensing on Deck Stabilization for Monitoring Camera

Bridge Deck Deflection

05 Drone

IMU is used for attitude control in drone.

06 Automated Guided Vehicle (AGV)

Gyroscope is used for AGV Magnetic Guidance to secure high running stability.

07 Train

IMU detects angular velocity and acceleration to measure the comfort level of a train with GPS location information.

08 Ship

IMU is used for inertial navigation and motion detection of ships.

MEMS IMU

NEW

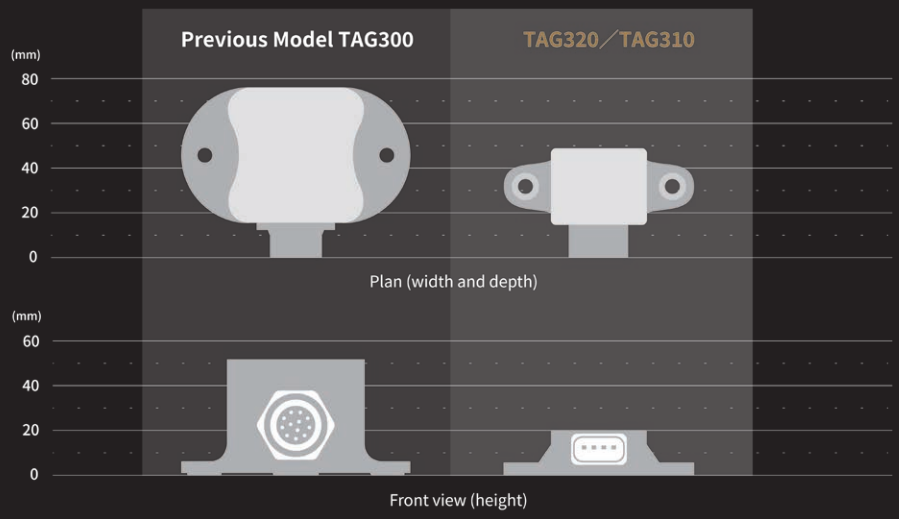
TAG320 (Standard Model / High-Precision Model)
TAG310

A compact, waterproof type MEMS IMU suitable for attitude control of construction and agricultural machinery, industrial machines, AGVs, and others

FEATURES

Compact Design

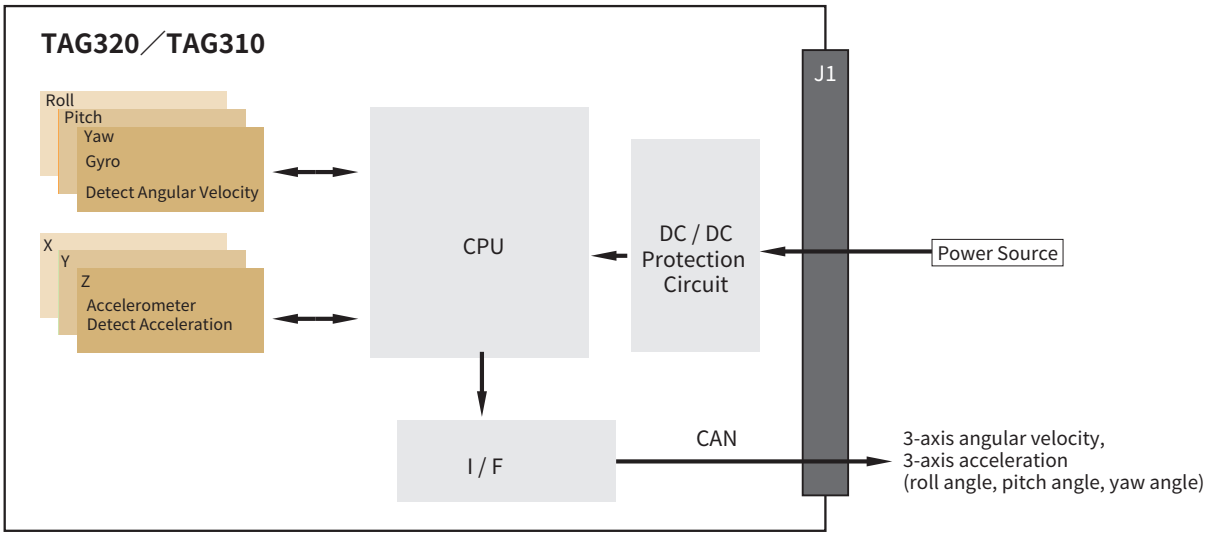
Significantly smaller than previous models, allowing for installation in a wider range of locations.



Waterproof Type

Compliant with IP67 standards. Suitable for use with industrial machinery in outdoor environments.

Functional block diagram



PART NUMBER

MEMS IMU

- Standard Model : **TAG320N1000**
- High-Precision Model : **TAG320N2000**
- Base Model : **TAG310N1000**

PERFORMANCE

MEMS IMU

Item	Specification			Remark
	TAG320N1000	TAG320N2000	TAG310N1000	
Dimension	83×47.9×20 mm			
Mass	50 g MAX			
Power Supply Voltage	8 to 32 V DC		8 to 28 V DC	
Interface / Baud Rate	CAN Standard + Extensions ※Custom configurations can support CANFD		CAN Standard + Extensions	
Output Cycle	1,000 Hz Max			
Operation Mode	Leveling Calculation			Refer to P17-18
Gyro Range	±200 °/s			
Gyro Bias	0.2°/s rms	0.1°/s rms	0.2°/s rms	Room temp.
Gyro Scale Factor Error	0.2% FS rms	0.1% FS rms	0.2% FS rms	FS: Full Scall
Acceleration Range	±4 G	±6 G	±4 G	
Acceleration Bias	0.0392 m/s² rms	0.0196 m/s² rms	0.0392 m/s² rms	Room temp.
Acceleration Scale Factor Error	0.5% FS rms	0.2% FS rms	0.5% FS rms	
Static Accuracy (Roll & Pitch)	0.5° rms	0.1° rms	0.5° rms	Room temp.
In-run Drift (Yaw)	0.03 °/s rms	0.002 °/s rms	0.03 °/s rms	Within 5 minutes after performing offset cancellation following warm-up
Operation Temp. Range	−40 to +85°C			
Vibration	98 m/s² rms 5 Hz to 2 kHz		29.4 m/s² rms 5 Hz to 2 kHz	Random vibration
Shock	2000 G 0.5 ms		500 G 1ms	

FUNCTION

MEMS IMU

Item	Specification	Remark
Vehicle Speed (VS) Input I/F	CAN	
Power Protection Circuit	○	
GNSS Input I/F	—	
CAN ID Allocation	○	
Compatible with Extended CANID	○	
Initial Attitude Alignment Function	○	
Definition of Axis	○	
Offset Cancellation Function	○	
Azimuth Reset Function	○	
Leveling Constant Adjustment Function	○	
CAN Cable Termination Process	—	

USER CONFIGURABLE COMMANDS

MEMS IMU

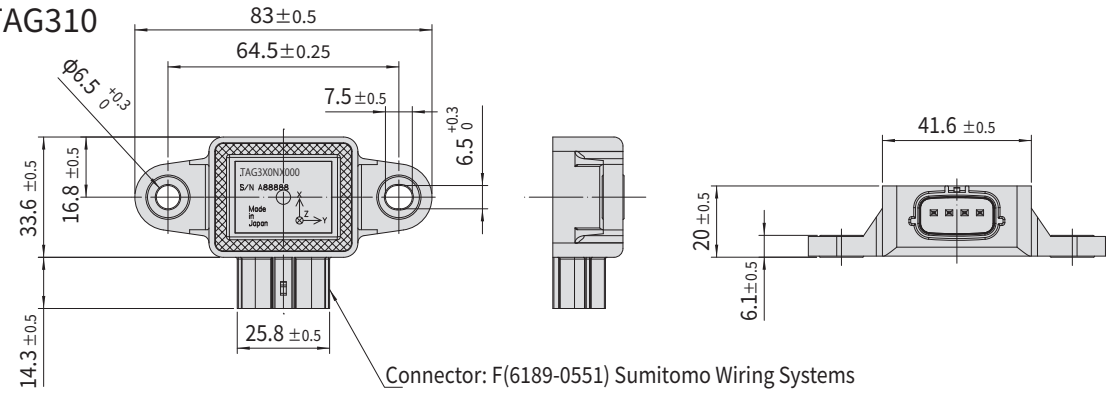
Function	Explanation
Alignment Compensation	If mounting surface is tilting, its attitude angle can be recognized as a zero (horizontal).
Definition of Axis	You can select not only Z axis but also X and Y axis as vertical axis.
Update Cycle & Output Cycle	The calculation update cycle & output cycle can be changed.
CAN Format, CAN ID allocation	CAN format (standard/extended) and CAN ID allocation can be changed.

There are a lot of other commands except for the above-mentioned.
The customer can change various settings.Please refer to the specification for the details.

OUTLINE DRAWING Dimension : mm

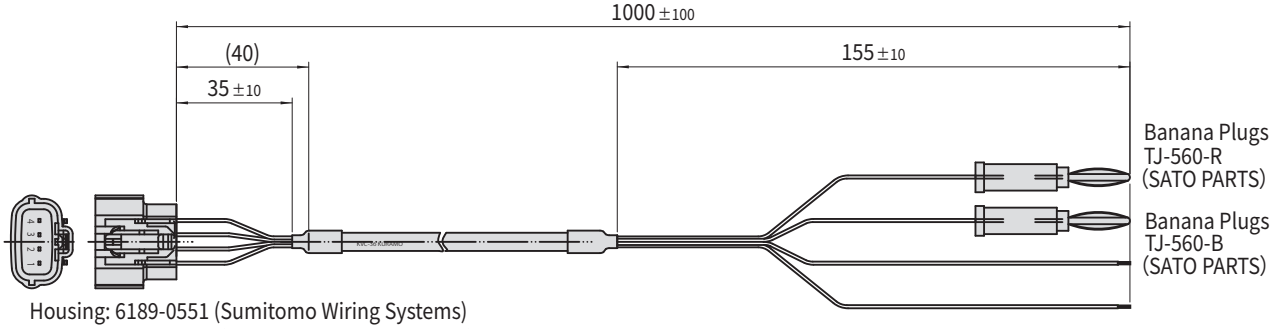
MEMS IMU

TAG320／TAG310



Connector: F(6189-0551) Sumitomo Wiring Systems

TAG320／TAG310 Interface Cable EU8974N1 (sold separately)



Housing: 6189-0551 (Sumitomo Wiring Systems)
Wire seal: 7165-0547 (Sumitomo Wiring Systems)
Terminal: 8100-1466 (Sumitomo Wiring Systems)

MEMS IMU

AU7684
TAG300
TAG289

We offer 2 types of MEMS IMU (3 axis inertial sensor unit). The one is low cost, but GNSS interface model.
The other is GNSS/INS model with extended Kalman Filter.

FEATURES

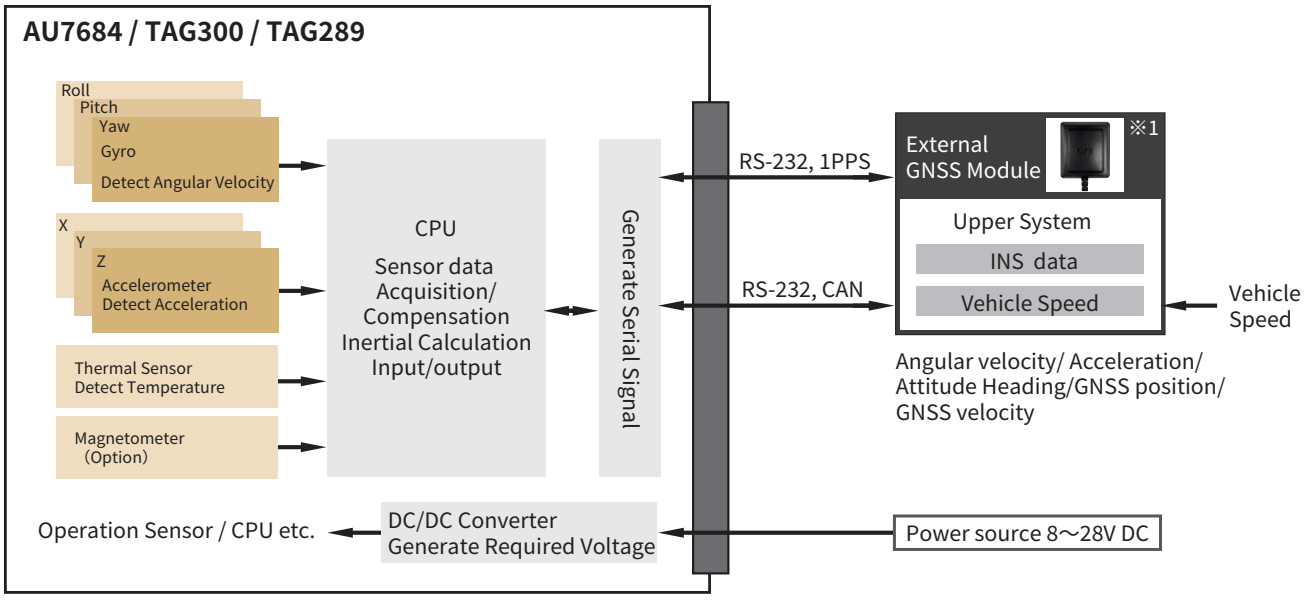
01 **Attitude Angle <0.1°**

02 **User-configurable Setting**
Definition of Axis, CAN ID Allocation,
Offset Cancel, Alignment, etc.

03 **Waterproof Case** (TAG300 Series)
IP65, M6 Mounting Configuration,
0.5sq Wire Diameter

- Power Protection Circuit
- Vehicle Speed (VS) Input I/F
- Output Cycle: 1kHz
- External GNSS Input I/F
- Extended Kalman Filter + Dead reckoning

Functional block diagram

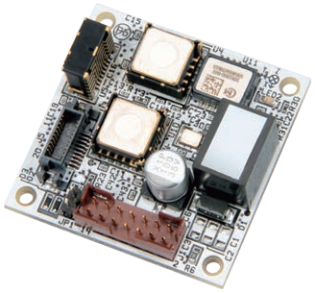


※1 External GNSS Module including cable and antenna is not attached to the product. If required, GNSS module should be prepared by customer.

■Connectable GNSS Module: KGM-810GRB1_PS_917/Position
For any questions or purchase requests, please contact our sales representative.

AU7684 (PCB Type)

AU7684N□□□□



Calculation ※2	Accelerometer/Magnetometer	Custom
1: Leveling 2: GNSS/INS/VS combined Navigation	0: Accelerometer±3G 1: Accelerometer±6G 2: Accelerometer±3G/Magnetometer (under development) 3: Accelerometer±6G/Magnetometer (under development)	00:Standard Others: Exclusive

TAG300 (Waterproof Case Type)

TAG300N□□□□

Calculation ※2	Accelerometer/Magnetometer	Custom
1: Leveling 2: GNSS/INS/VS combined Navigation	0: Accelerometer±3G 1: Accelerometer±6G 2: Accelerometer±3G/Magnetometer (under development) 3: Accelerometer±6G/Magnetometer (under development)	00:Standard Others: Exclusive

TAG289 (Case Type)

TAG289N□□□□

Calculation ※2	Accelerometer/Magnetometer	Custom
1: Leveling 2: GNSS/INS/VS combined Navigation	0: Accelerometer±3G 1: Accelerometer±6G	00:Standard Others: Exclusive

※2 Please refer to page 17, 18 for the details of operation mode.

PERFORMANCE MEMS IMU

Item	Specification			Remark
	AU7684 (PCB Type)	TAG300 (Waterproof Case Type (IP65))	TAG289 (Case Type)	
Dimension	35×35×16.1mm	100×59.8×49.5 mm	64×45×33 mm	
Mass	30 g Max	250 g Max		
Power supply voltage	8 to 28 V DC			
Interface/ Baud rate	RS232:115.2 kbps CAN：500 kbps			User can change CAN baud rate
Output Cycle	RS232C：200 Hz、CAN：1000 Hz			
Gyro Range	± 200 °/s			
Gyro Bias	0.2 °/s rms			Room temp.
	± 0.2 °/s			Ambient temp.
Gyro Scale Factor Error	0.2% FS rms			
Acceleration Range	± 3G / ± 6G			Factory setting
Acceleration Bias	0.0196 m/s² rms (2mG)			Room temp.
	0.049 m/s² rms (5mG)			Ambient temp.
Acceleration Scale Factor Error	0.2% FS rms			
Static Accuracy (Roll & Pitch)	0.1°rms (Range 3G)			Room temp.
	0.2°rms (Range 3G)			Ambient temp.
In-run Drift (Yaw)	0.01 °/s rms			Offset-cancel applied
Operation temp. range	− 40 to + 85°C			
Vibration	29.4 m/s² rms 5 Hz to 2 kHz			Random vibration
Shock	20 G 10 ms			

FUNCTION MEMS IMU

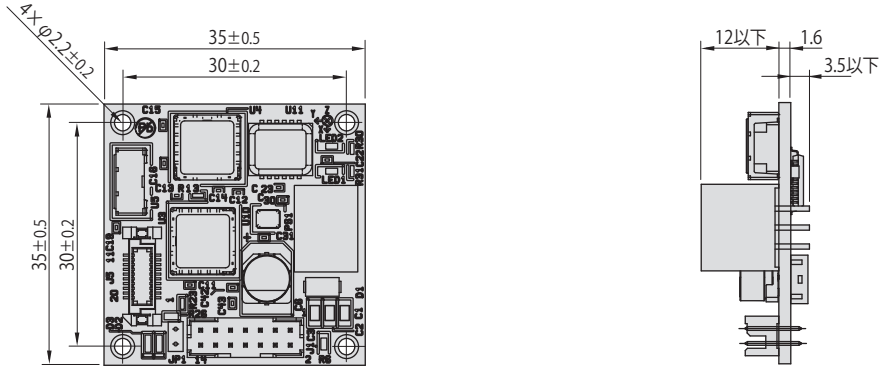
Item	Function	Remark
Waterproof Case	✓	IP65：TAG300
Magnetometer	✓	Under development
Vehicle Speed (VS) Input I/F	RS232 / CAN / Pulse	
Power Protection Circuit	✓	
GNSS Input I/F	✓	Recommendation / Customization
CAN cable termination process	–	

USER CONFIGURABLE COMMANDS MEMS IMU

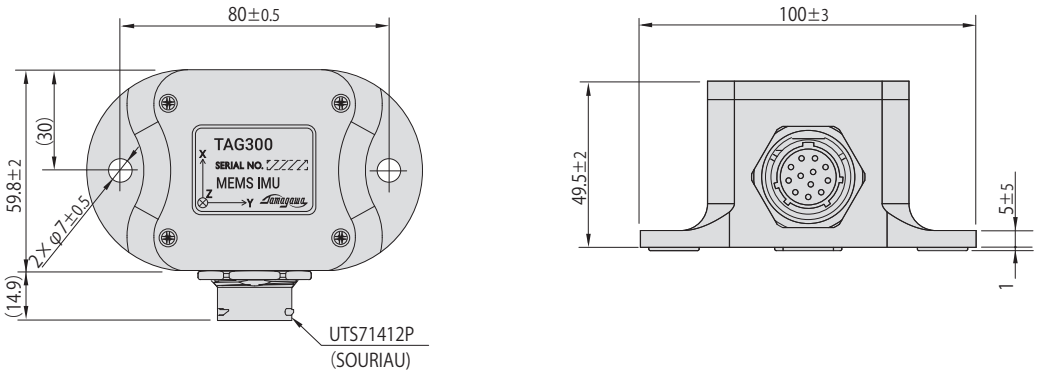
Function	Explanation
Alignment Compensation	If mounting surface is tilting, its attitude angle can be recognized as a zero (horizontal).
Definition of Axis	You can select not only Z axis but also X and Y axis as vertical axis.
Update Cycle & Output Cycle	The calculation update cycle & output cycle can be changed.
CAN Format, CAN ID allocation	CAN format (standard/extended) and CAN ID allocation can be changed.

There are a lot of other commands except for the above-mentioned. The customer can change various settings.Please refer to the specification for the details.

AU7684 (PCB Type)

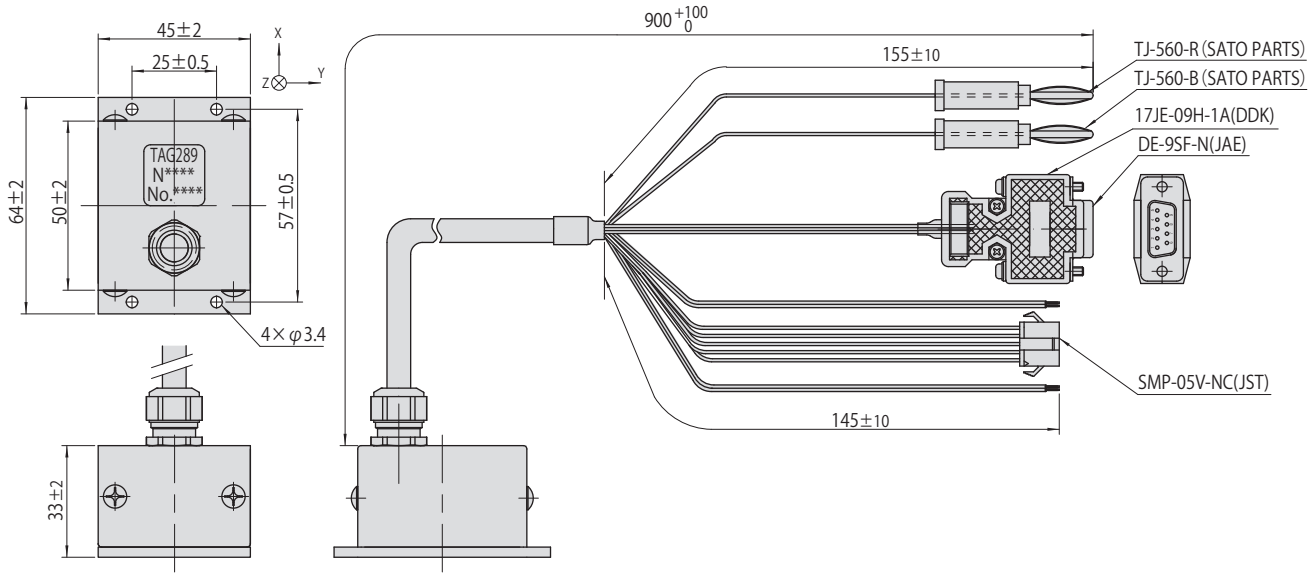


TAG300 (Waperproof Case Type)

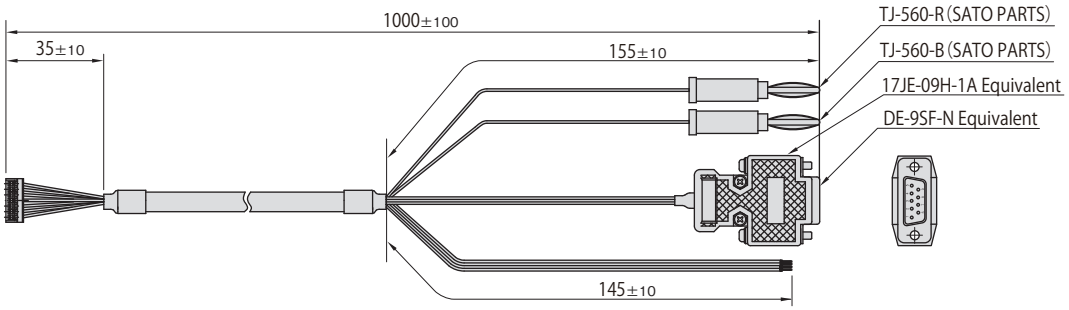


TAG289 (Case Type)

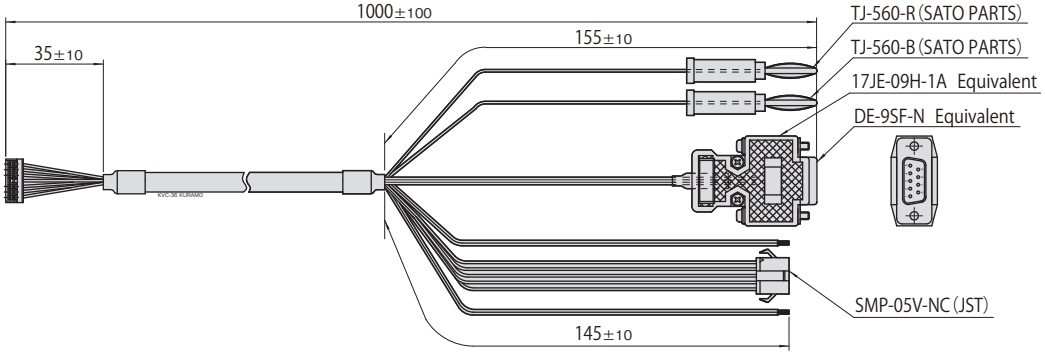
※ Interface cable is attached to TAG289 series.



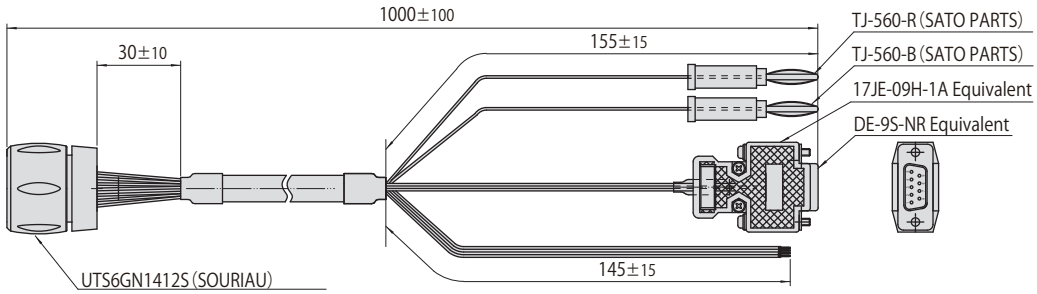
AU7684 Interface Cable EU8937N1000 (sold separately)



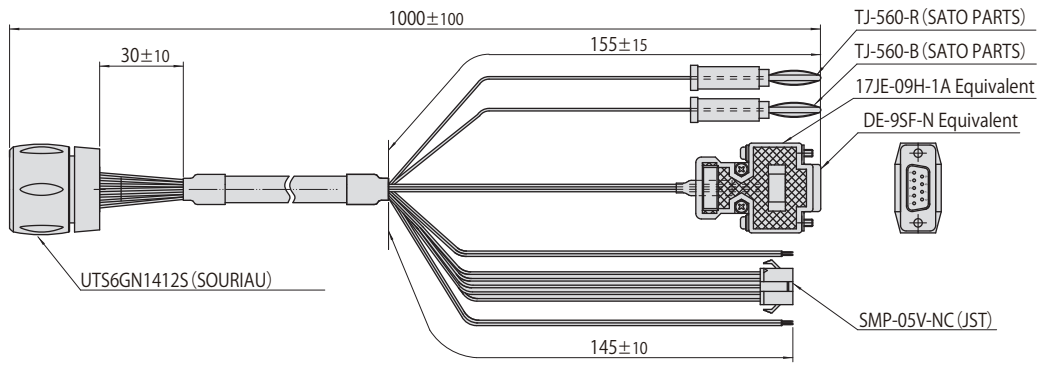
AU7684 Interface Cable・Interface Cable with GNSS connector EU8937N1001 (sold separately)



TAG300 Interface Cable EU8940N1000 (sold separately)

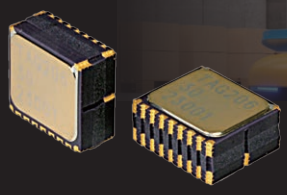


TAG300 Interface Cable・Interface Cable with GNSS connector EU8940N1001 (sold separately)



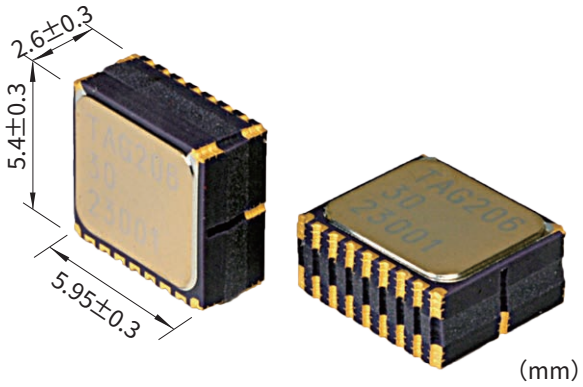
MEMS Gyro Sensor

TAG206N5000
TAG204N5000



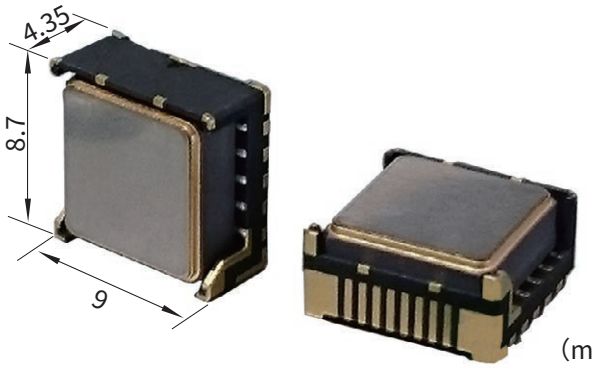
When an oscillating object is rotated, Coriolis Force works in the direction perpendicular to the vibration, and the other vibration occurs.
This induced vibration is detected and converted into voltage proportional to the amplitude of the vibration.

Widespread MEMS Gyro
TAG206N5000



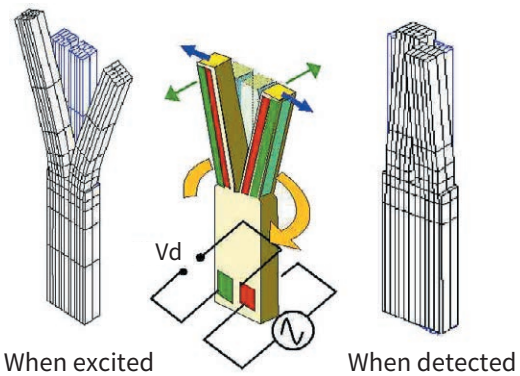
(mm)

High Accuracy MEMS Gyro
TAG204N5000

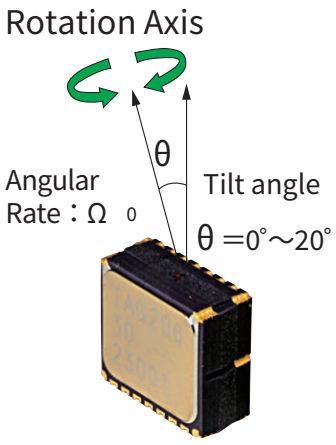


(mm)

DETECTION



Coriolis Force : $F_0 = 2mv\Omega_0$
Mass : m
Velocity : v



Inclined to the direction of Pin 1

IMU Simulator software

■ In dedicated software is able to graph monitor and data outputs of the IMU's output.

*There are two types of software with GNSS or without GNSS. Please check at the time of your order.

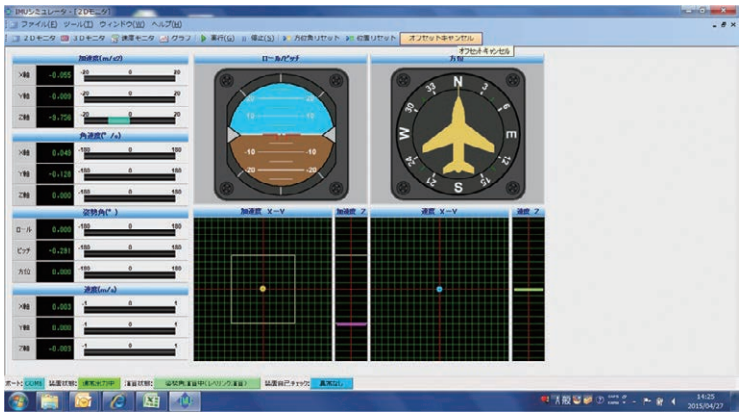
Software can be downloaded free from our HP.

＜MEMS IMU HP＞

https://mems.tamagawa-seiki.com/en/download/

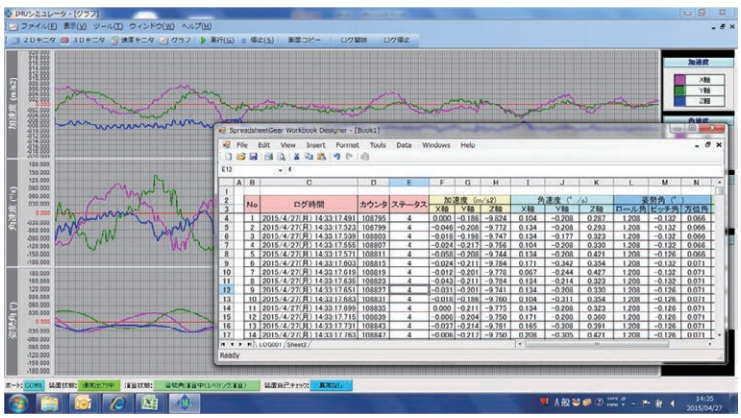
■ Simulator software

2D monitor



Graph monitor

Graph monitor
→ Data output



Interferometric Fiber Optic Gyro i-FOG

TA7774

High accuracy [0.1°/h] Gyro (1-axis), which is a key technology to realize fully autonomous driving.

FEATURES

01 High-accuracy
Achieved [0.1°/h] which is required for fully autonomous driving.

02 Low-price
Our unique technology for winding and Fiber Optical IC realizes cost reduction.

03 Closed-loop Type

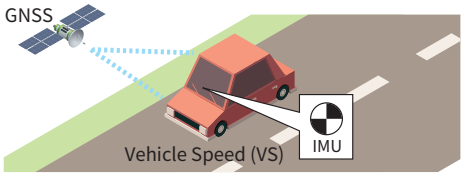
i-FOG Promotional Video

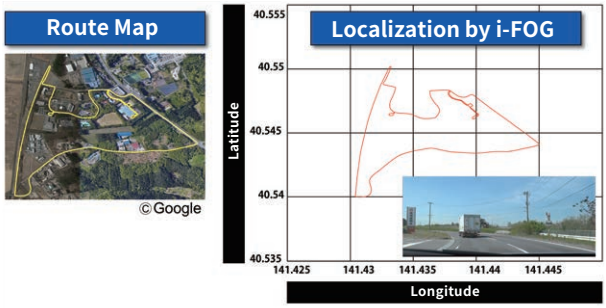
See the demonstration of i-FOG localization.

https://www.tamagawa-seiki.co.jp/products/gyro/1-axis-gyro-TA7774.html

CENTIMETER CLASS LOCALIZATION

The accuracy of localization of vehicles is increased to centimeter class by using i-FOG.
It is necessary to maintain the accuracy of localization at centimeter class under GNSS-denied environment.



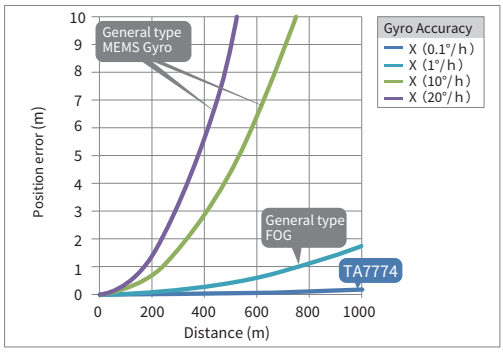


Red line is the track of localization by i-FOG

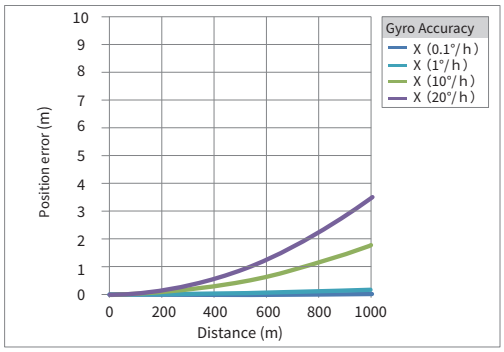
POSITION ACCURACY BY GYRO ERROR & VEHICLE SPEED

The accuracy of i-FOG (TA7774) is 0.1°/h, which is able to keep high accuracy localization for a certain period of time.

Position Accuracy at 10km/h



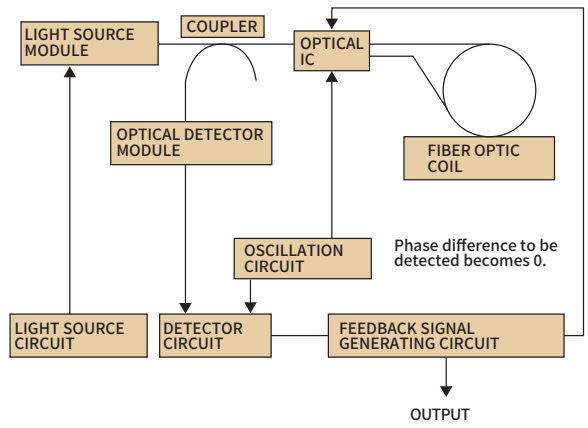
Position Accuracy at 100km/h



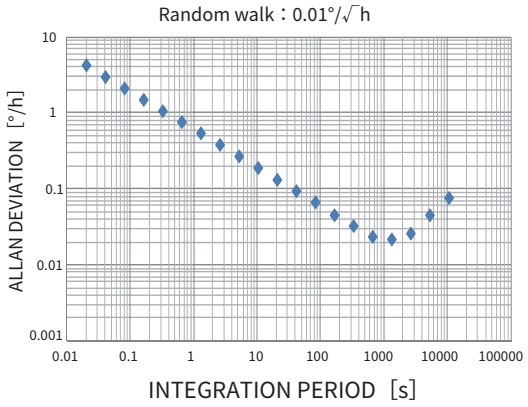
SPECIFICATION i-FOG

Part Number	TA7774
Dynamic Range	±200°/s
Bias Repeatability	0.1°/h (1δ) (25°C static)
Bias Instability	0.1°/h Max.
Random Walk	0.01°/√h Max.
Scale Factor Accuracy	±100ppm
Scale Factor Linearity	± 100ppm FS
Mass	400g Max.
Power-supply voltage	±5V, ±15V
Power Consumption	±5V：1.5A Max.
	±15V：0.2A Max.
Interface/ Baud rate	RS232：115.2kbps (fixed)
Output Cycle	50Hz
Operating Temperature	−20 to +60°C
Non-operating Temperature	−30 to +70°C

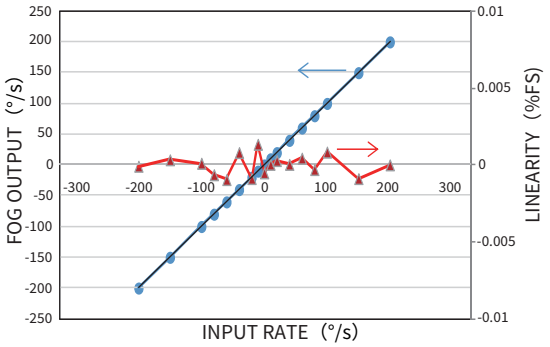
CONFIGURATION i-FOG



ALLAN VARIANCE i-FOG



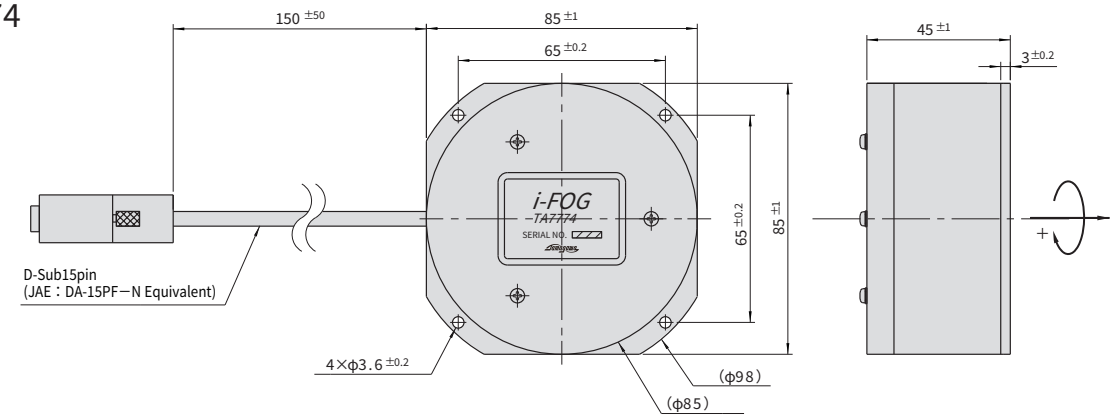
SCALE FACTOR & LINEARITY i-FOG



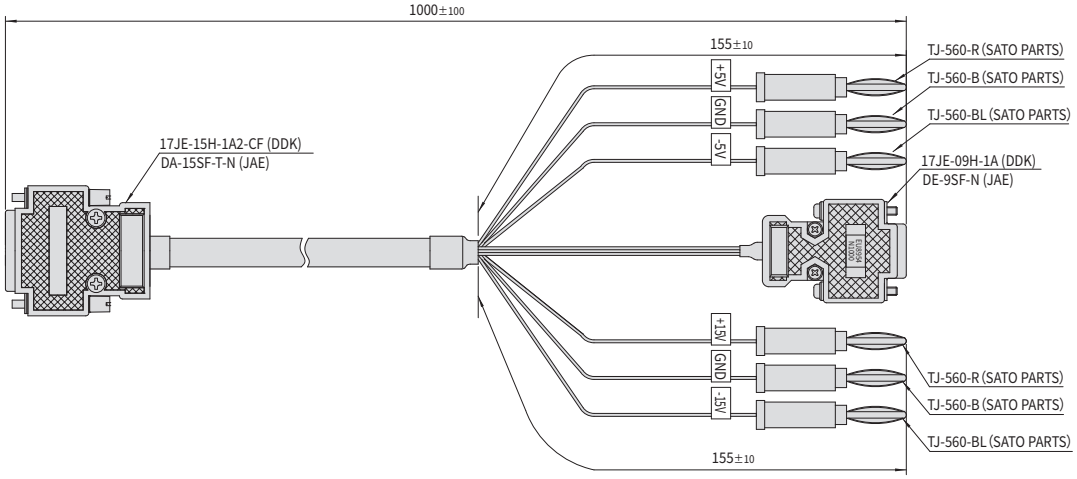
*For more details, contact to our technical support written in the last page.

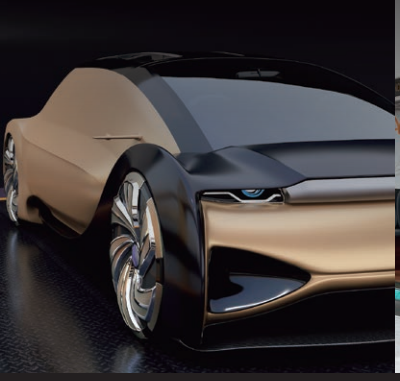
OUTLINE DRAWING Dimension：mm i-FOG

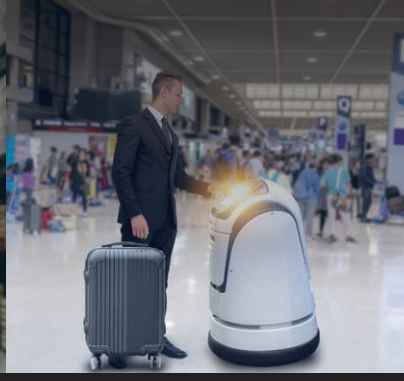
TA7774



Interface Cable EU8954N1000 (sold separately)







FOG & MEMS combined IMU

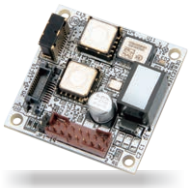
Accuracy for full autonomous driving

FOG & MEMS combined IMU incorporates 3-axis gyro (i-FOG for Z axis, MEMS gyro for X and Y axis) and accelerometers, which measure angular velocity and acceleration. In addition, attitude (roll & pitch) and heading (yaw) is calculated. An external GNSS module is connected to IMU; with position and speed data, IMU can be used as GNSS / INS / VS navigation.
The IP65 waterproof type has been newly added to the lineup.

New Synergy created in combination with MEMS & FOG

Fiber Optic Gyro
i-FOG

Heading **0.1 °/h**



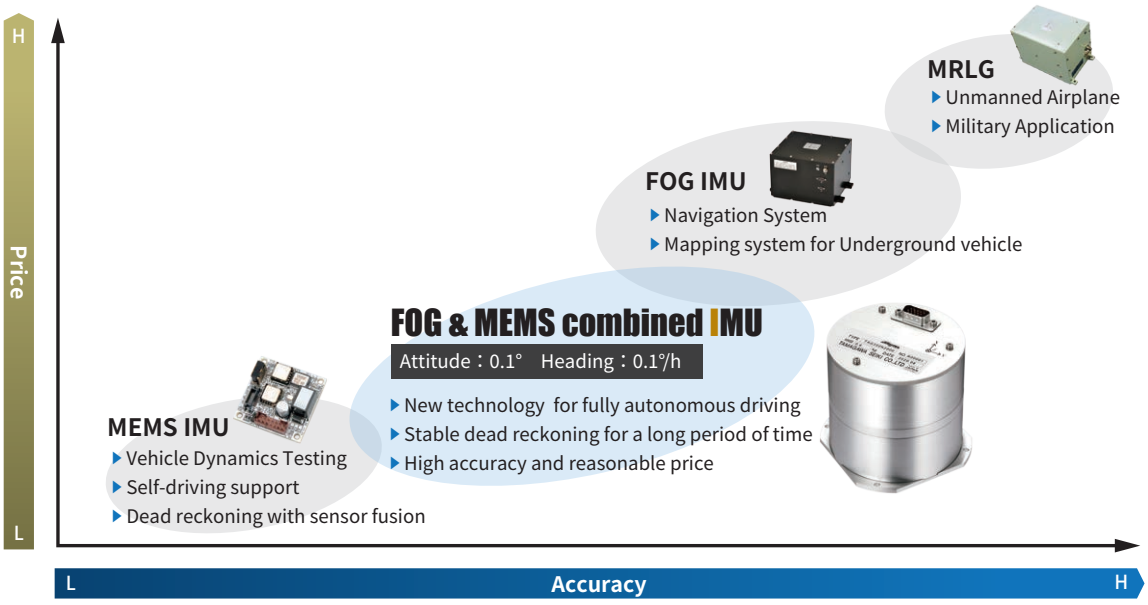
MEMS IMU

Attitude **0.1 °**

FOG & MEMS combined IMU

New IMU : Bridging the Gap between cost and accuracy

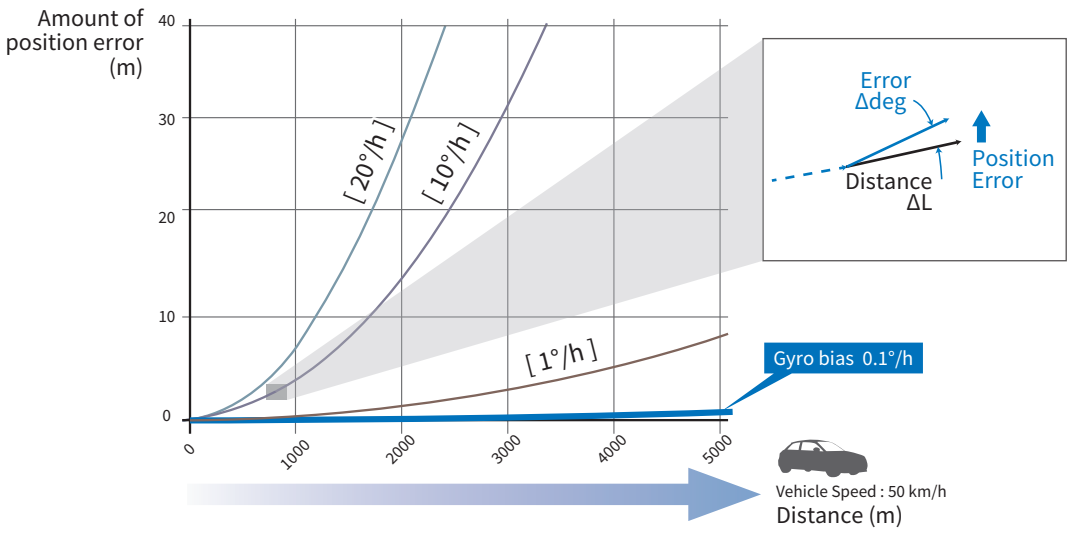
The accuracy of Gyroscope is classified by principle of operation. The customer needs to choose the suitable gyroscope depending on application or environment. FOG & MEMS combined IMU is a newly developed IMU with the concept of filling in the gap of cost and accuracy.



Accuracy of Self-localization

Through the use of GNSS with centimeter-level positioning accuracy, fully autonomous driving will come closer to realization. However, the accuracy of localization is worsened in Tunnel or Multipath propagation. Gyroscope is used in those conditions. In dead reckoning, position data is estimated by integral of gyroscope, odometer and accelerometer. Depending on the accuracy of gyroscope, errors of heading is accumulated. Therefore, high accuracy gyroscope is needed for dead reckoning.

Variation of position error of gyros with different accuracy



PART NUMBER

TAG35□N2□□□

Waterproof	Calculation ※1	Accelerometer	Custom
0：Case Type 2：Waterproof Case Type (IP65)	2：GNSS / INS / VS combined Navigation	0：Accelerometer±3G 1：Accelerometer±6G	00：Standard Others : Exclusive

※1 Please refer to page 17, 18 for the details of operation mode.

PERFORMANCE

FOG & MEMS combined IMU

Item	Specification		Remark
	TAG350	TAG352	
Dimension	85×85×78.5 mm	160×100×85 mm	
Mass	600 g Max	1,500 g Max	
Power supply voltage	9 to 28 V DC		
Interface/ Baud rate	RS232 C：115.2 kbps（fixed） CAN：500 kbps (Initial setting)		
Output Cycle	RS232C： 50 Hz CAN：50 Hz		
Gyro Range	± 200 °/s		
Gyro Bias	Z axis：0.1 °/h rms X , Y axis：0.2 °/s rms		
Gyro Scale Factor Error	Z axis：50 ppm FS rms X , Y axis：0.2 FS rms		SF : Scale Factor FS : Full Scale
Acceleration Range	± 3 G / ± 6 G		
Acceleration Bias	5 mG rms		
Acceleration Scale Factor Error	0.2% FS rms		
Static Accuracy (Roll & Pitch)	0.1° rms 0.2° rms		Room temp. Ambient temp.
In-run Drift (Yaw)	0.0001 °/s rms		
Operation temp. range	-20 to + 60 °C		
Vibration	29.4 m/s^2 rms (5 Hz to 2 kHz) (3 G rms)		Random vibration
Shock	20 G 10 ms		

FUNCTION

FOG & MEMS combined IMU

Item	Remark
Vehicle Speed （VS） Input I/F	RS232C/CAN/Pulse
Power Protection Circuit	✓
GNSS Input I/F	✓
CAN cable termination process	—

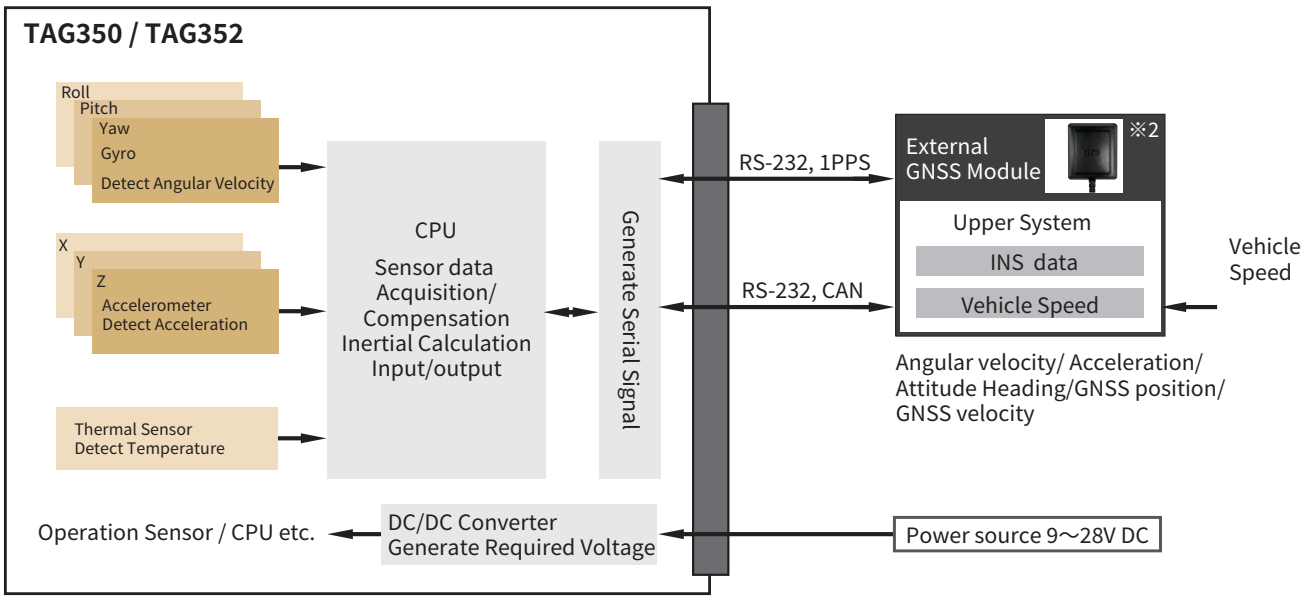
USER CONFIGURABLE COMMANDS

FOG & MEMS combined IMU

Function	Explanation
Alignment Compensation	If mounting surface is tilting, its attitude angle can be recognized as a zero (horizontal).
CAN Format, CAN ID allocation	CAN format (standard/extended) and CAN ID allocation can be changed.

There are a lot of other commands except for the above-mentioned.
The customer can change various settings.Please refer to the specification for the details.

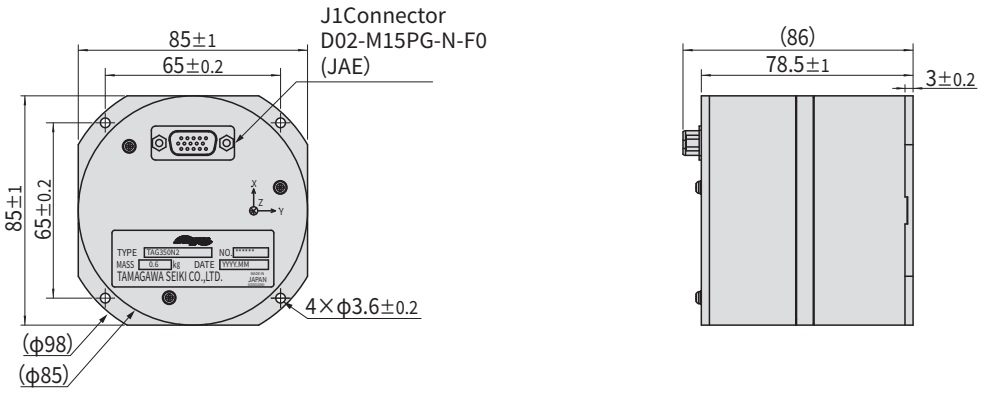
Functional block diagram



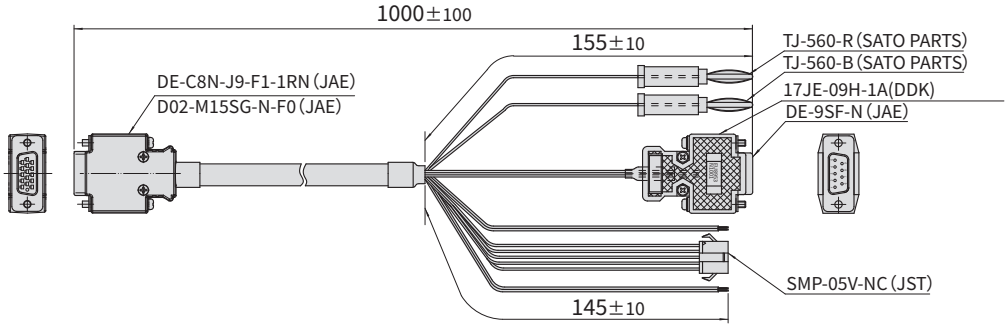
※2 External GNSS Module including cable and antenna is not attached to the product. If required, GNSS module should be prepared by customer.

■Connectable GNSS Module: KGM-810GRB1_PS_917/Position
For any questions or purchase requests, please contact our sales representative.

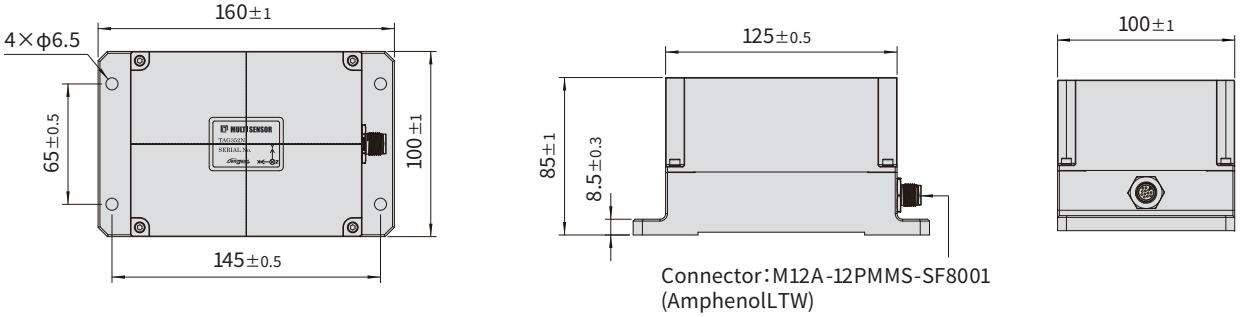
TAG350



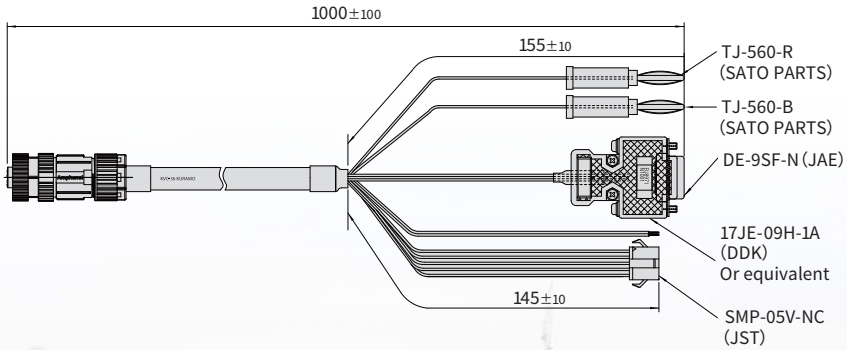
TAG350/ Interface Cable EU8953N1001 (sold separately)



TAG352



TAG352/ Interface Cable EU8971N1001 (sold separately)



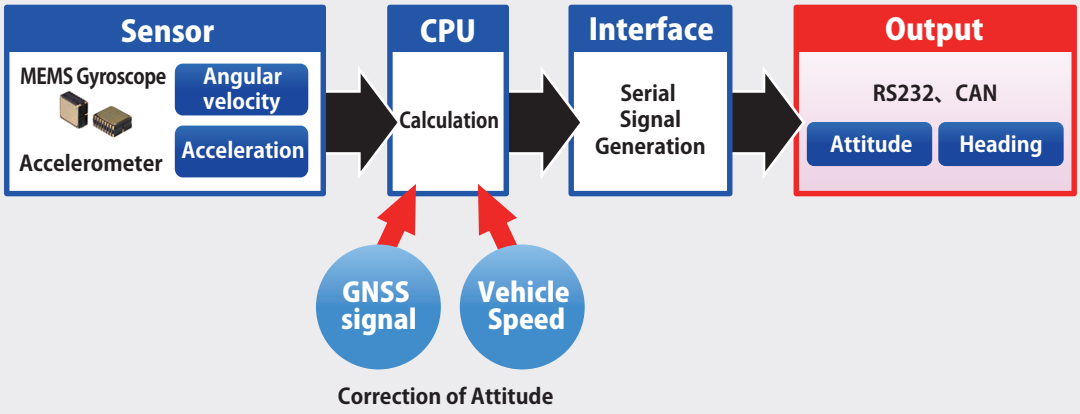
Technology

About Operation Mode

1, Leveling Mode

The feature of Leveling mode is stable output of attitude angle (roll & pitch) by a combination of accelerometers and gyroscopes.
If the device is affected by acceleration or centrifugal force for long hours, the errors of attitude angle may be increased. However, it can be suppressed by a compensation of GNSS and vehicle speed signal input.

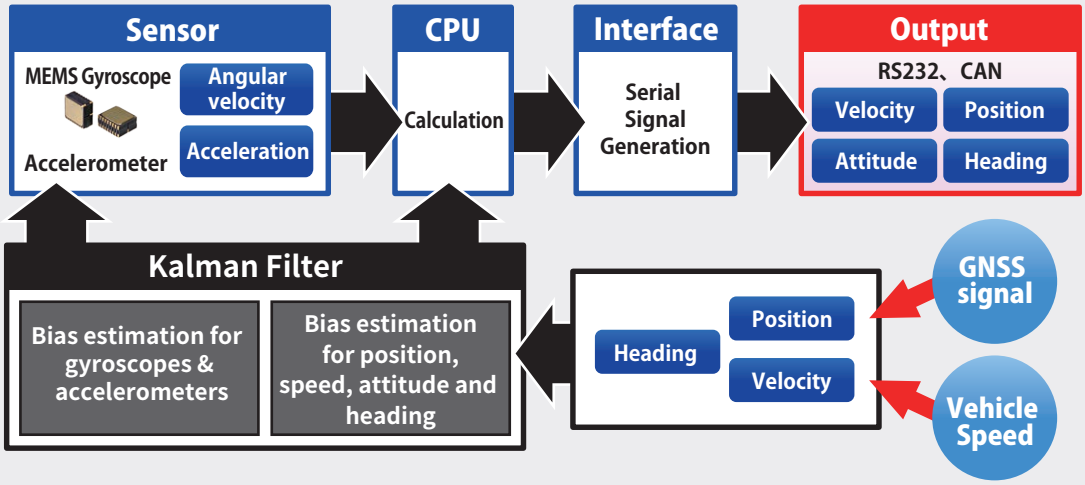
Overview, Configuration



2, GNSS/INS/VS Mode

GNSS/INS/VS is performed by combining gyroscopes angular velocity and accelerometers (INS data), external GNSS data and vehicle speed. In addition to GNSS and vehicle speed data, algorithm (Kalman filter) is used to estimate the error of INS data , and improve accuracy. It is also possible to output the position data even in GNSS-denied environment.

Overview, Configuration



Case Study for GNSS/INS Navigation

Dead Reckoning, a method of calculating position with GNSS/INS combined navigation in GNSS-denied environment such as a tunnel. Please take a look at the demonstration from here.

https://mems.tamagawa-seiki.com/product/multisensor.html

3, Leveling VS GNSS/INS/VS

Operation Mode		Leveling		GNSS/INS/VS
GNSS		Disconnected	Connected	Connected *necessary
Output Format	Inertial Sensor • Angular velocity • Acceleration	✓	✓	✓
	Attitude • Heading • Roll • Pitch • Yaw	✓	✓	✓
	GNSS • Latitude • Longitude • Altitude • Velocity • Time • Satellite	–	✓	✓
	Dead-reckoning • Latitude • Longitude • Altitude	–	–	✓
	Estimated Sensor Bias • Angular velocity • Acceleration	–	–	✓
Application		●Measurement of Attitude, Heading ●Motion Sensing ●Vibration ●Monitoring System ●Roll-over prevention Control ●Power Assist		●Localization in GNSS-denied environment (Autonomous-driving, Self-driving) ●High-accuracy measurement of Attitude & Heading

KEY WORDS

Please check for details.

	Term	Explanation
Type	**Inertial Measurement Unit（IMU）**	Inertial measurement unit (IMU) is used not only for measuring dynamics, posture, and orientation of various movements, but also for measuring position. Tamagawa Seiki manufactures various kinds of products such as MEMS Gyro, Fiber Optic Gyros (FOG) and Inertial Measurement Unit (IMU). Therefore customers can select the sensor for a wide range of applications.
	MEMS Gyro	Sensor making use of MEMS technology which detects the acceleration by using inertial force (Coriolis force) coming from vibration or rotation.
	Fiber Optic Gyro（FOG）	Turn the optical fibers like a coil in CW and CCW and input light to both directions. By the interference of the output, the wavelength is changed due to Doppler effect according to the motion (red and blue shift). A gyroscope which detects and outputs the change amount.
	Ring Laser Gyro（RLG）	Ring Laser Gyroscope (RLG) consists of a ring laser having two independent counter-propagating resonant modes over the same path. The difference in the frequencies is used to detect rotation. It operates on the principle of the Sagnac effect which is also usd for Fiber Optic Gyro (FOG).
Performance / Term	**Angular Velocity**	Change ratio of angle (rotation speed, rotation angle) per unit time.
	Acceleration	Change ratio of speed per unit time. The gravity is a kind of the acceleration.
	Attitude angle	The angle between the plane of object and the horizontal ground. Inclination towards front-back is called "pitch" while towards right-left is called "roll".
	Heading angle	Heading angle is compass direction in which the object's nose is pointed. Without compass direction, it is called "yaw" angle.
	Dynamic Range	Measurable range of a sensor from minimum to maximum of a motion. The reciprocal of a dynamic range is a scale factor.
	Bias	Deviation from ideal center. Difference between output in a stationary state and ideal zero. It is also called zero point bias or offset. It becomes an element of the error (integration error) in case of angle calculation.
	Drift	Drift is the indication of bias variation size under the influence of environmental condition such as temperature (rise or fall), power supply variation or vibration. There is also a successive change shifting slowly.
	Random Walk	Digitalized value of degree of variation (white noise). It is considered to be the noise which a sensor has.
	Scale Factor	Ratio of sensor output changed by input. It is also called sensitivity (Sensitivity is distinguished from scale in the IEC standard).
	Linearity	Linearity is the property of a mathematical relationship (function) that can be represented as a/A×100 (%) .
	Resolution	The resolution is the minimum input of angular velocity that the gyro can identify. To measure the resolution, input the minute angular velocity to the gyro on the precision rate turntable and see the significant change in the gyro output. In some cases, quantization error is interpreted as resolution.
	Cross Coupling	Sensitivity against the detection axis by another axis input. Misalignment which indicates direction accuracy is a kind of the cross coupling.

	Term	Explanation
Performance / Term	**Allan Variance**	Plot of quotient when the integrated value of gyro output is divided by integral time. It shows a cluster time (averaging time) in a horizontal axis and an Allan deviation (σ) in a vertical axis. We can read the random walk, bias stability etc. from the plot and also represent the noise component of gyro in a graph.
	Bias instability	Bias instability is one of indicators of gyroscope which is measured by Alan variance method. The smaller the number, the higher the performance of the gyroscope.
	Calibration	Calibration is the comparison of measurement values acquired from a device with those of a calibration standard equipment.
	Warm Up	Warming up operation after turning on the power.
Communication	**RS232**	RS-232 is a serial port interface standard standardized by the Electronic Industries Alliance (EIA). It is widely used as a communication standard for personal computers and communication devices.
	CAN	CAN is a communication standard standardized by ISO-11898. Originally used as a communication standard inside automobiles, it is now widely used in the fields of construction machinery, agricultural machinery and factory equipment.
Calculation	**GNSS/INS Hybrid Navigation System**	Compound navigation of GNSS and INS (Inertial Navigation System). Technology for high accuracy and stable navigation. The error estimation of inertial sensor by Kalman filter improves the accuracy.
	Leveling Calculation	Inertial operating algorithm of MEMS-IMU (IMU consists of MEMS gyros and MEMS accelerometers) made by Tamagawa. It enables a high precision dynamic posture measurement to a low cost (low accuracy) gyro. ※Leveling Calculation vs GNSS/INS/VS
	Inertia calculation	Calculations are performed only with the built-in gyro and accelerometer without referring to GNSS or external speed. This method can be used only in FOG IMU and RLG in which high-precision gyros are used.
	Inertial Navigation	A method of calculating the position and direction using only inertial sensor. However, there is a characteristic that the error accumulates and increases when moving a long distance.
	Kalman Filter	This is a calculation method that improves the accuracy of data by estimating the error for a quantity (position, velocity) that changes over time.
Function	**Offset Cancel**	This function calculates the average value of bias (zero point error) at a certain time. The average value of the bias is offset in the subsequent operations.
	Alignment	If there is a mounting error or tilt on the IMU installation surface, the tilt is normally output based on the horizontal plane, but when using this function, the installation surface can be set to zero.
	Dead zone (Yaw)	In order to suppress the yaw angle drift, the Z-axis of angular velocity in the dead zone is converted to zero and is not reflected in the yaw angle calculation.
	Dead Reckoning	Technology of position measurement with high accuracy even in a tunnel without GPS signal by the compound arithmetic procession of the information from gyro sensor, accelerometer etc.
	Sensor Fusion	By compounding data from several sensors, improve the measurement reliability of the unit or complement defects of each sensor.

MEMO

MEMO

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