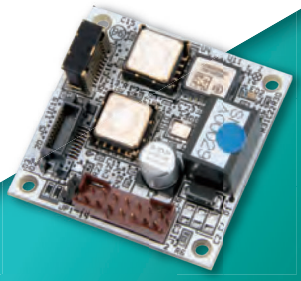
Tamagawa

MEMS IMU

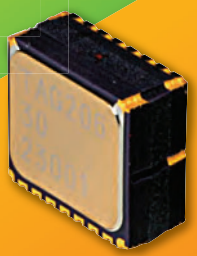
3-axis Inertial Measurement Unit (6DoF sensors)



AU7684
PCB Type

TAG300
Waterproof Case Type

TAG204
MEMS Gyro



TAG206
MEMS Gyro

i-FOG
TA7774
High accuracy FOG

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.

●Unmanned Construction Machine
IMU offers stable output under large vibration by utilizing gyroscope and accelerometer.

●Automated Guided Vehicle (AGV)
Gyroscope is used for AGV Magnetic Guidance to secure high running stability.

●Unmanned Agricultural Machine
IMU detects attitude (roll & pitch) and heading (yaw) angle of agricultural tractor. In addition, it is used for autonomous driving by combining GNSS.

AU7684

PCB Type

TAG300

Waterproof Case Type

High-accuracy MEMS IMU

P.03

TAG206

TAG204

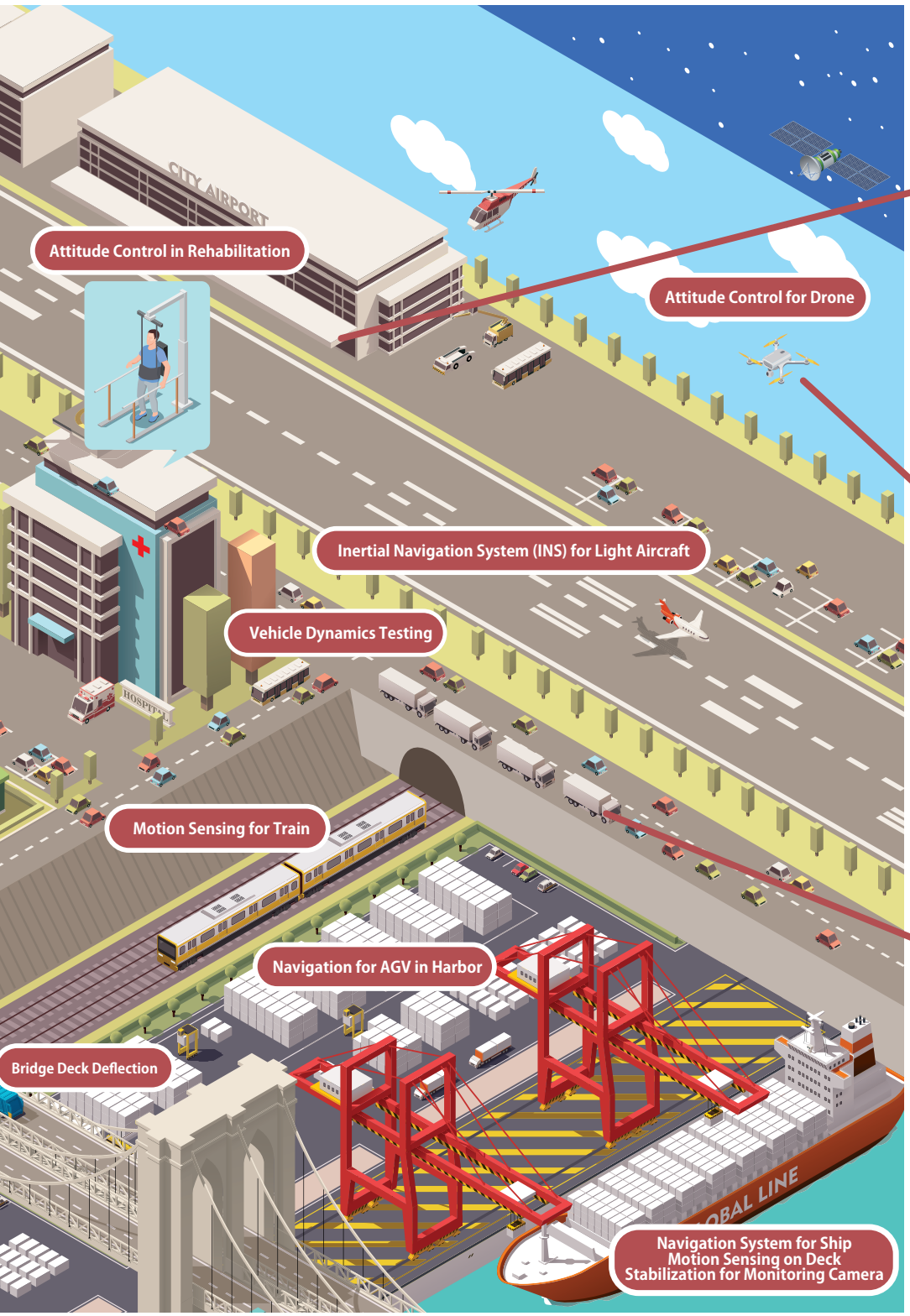
MEMS Gyro

P.07

TA7774

Interferometric Fiber Optic Gyro (i-FOG)

P.09



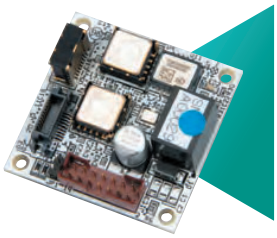
●Security Robot
IMU is used for attitude control in security robot

●Drone
IMU is used for attitude control in drone.

●Automobile
IMU measures vehicle dynamics, attitude (roll & pitch) or heading (yaw) angle. In addition, it is used for autonomous driving by combining GNSS.

MEMS IMU

AU7684
TAG300



Inertial Measurement Unit (IMU) incorporates high-accuracy MEMS gyroscope. Both accuracy and cost are improved compared to conventional equipment. In addition to an external GNSS type, on-board Extended Kalman Filter based Dead Reckoning type is newly released.

▶ FEATURES

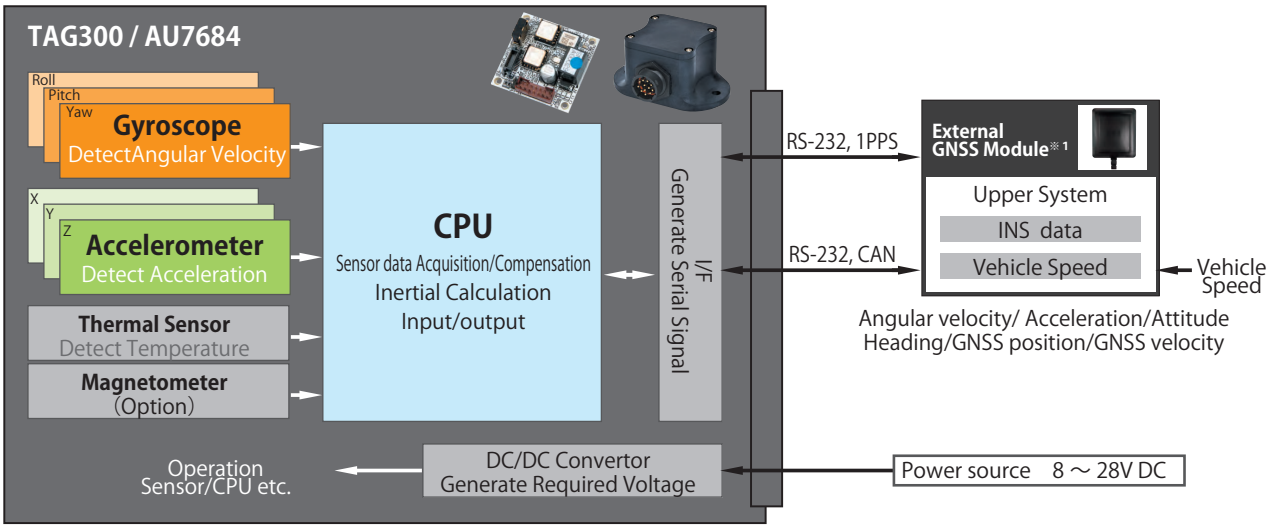
01 **Enhanced Accuracy (Roll & Pitch)**
Attitude Angle <0.1°

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

■MEMS IMU functional block diagram



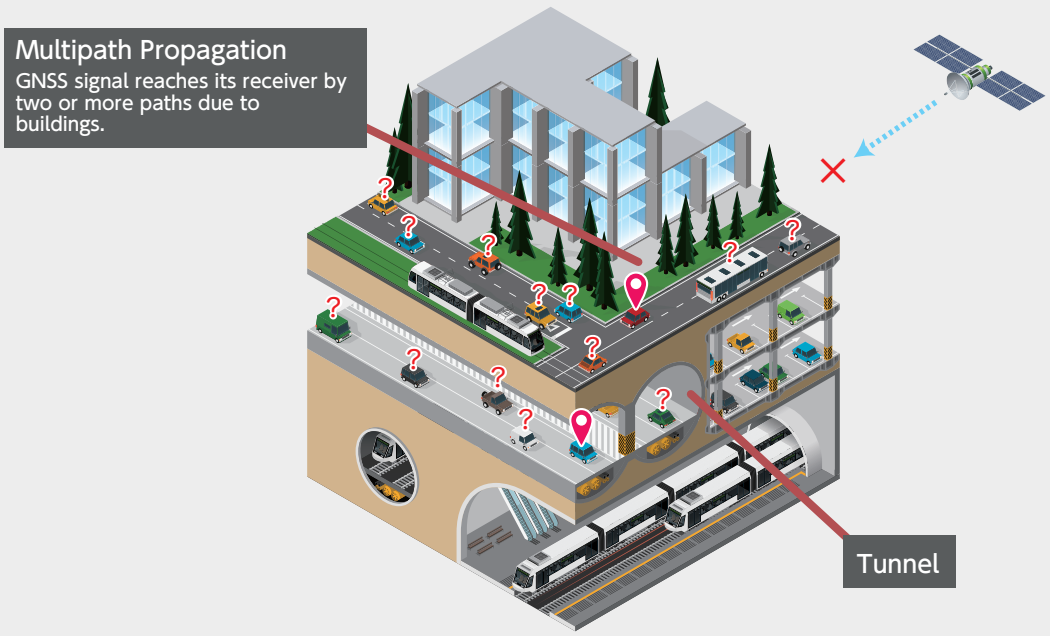
Note)
External GNSS Module including cable and antenna is not attached to the product. If required, GNSS module should be prepared by customer.
■Connectable GNSS Module: KGM-810GRB1_PS_917/Position
Regarding the inquiries or purchases, please contact to our sales representative.

NEW

Extended Kalman Filter + GNSS Dead reckoning type

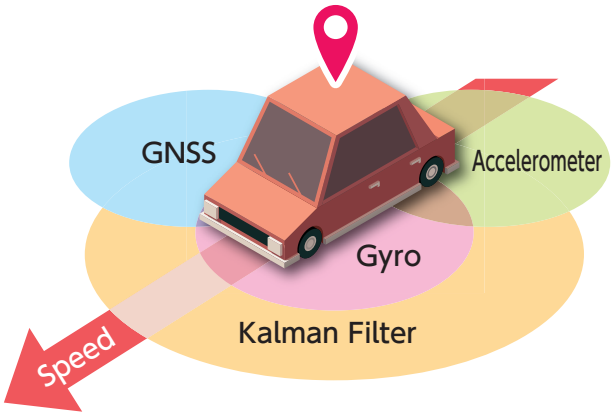
On-board Kalman Filter integrates measurements from 3-axis gyroscopes, accelerometers and GNSS to run a high-level estimation for dead-reckoning, localization and attitude detection.

■ GNSS-denied Environment

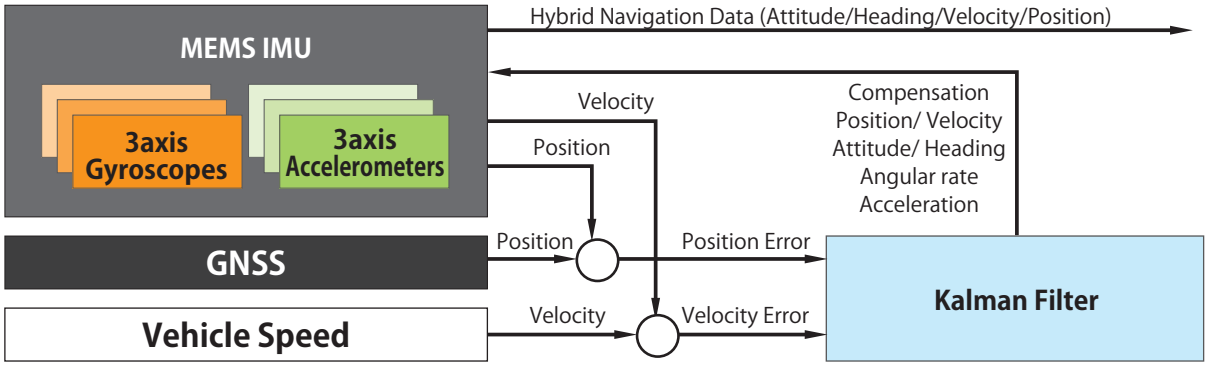


GNSS/INS/VS combined Navigation

IMU performs Dead Reckoning which is the process of calculating one's current position for a certain period time even in GNSS denied environment by using GNSS, Vehicle Speed and Kalman Filter that estimates gyro & acceleration error.



■GNSS/INS/VS combined Navigation Algorism



▶ PART NUMBER

■AU7684 (PCB Type)

AU7684N □□□□

Calculation	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	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

▶ PERFORMANCE

Item	Specification	Remark
Dimension（PCB Type）	35 × 35 × 16.1 mm	P/N: AU7684
Dimension（Waterproof Case Type）	100 × 59.8 × 49.5mm（IP65）	P/N: TAG300
Power supply voltage	8V ～ 28V　DC	
Interface/ Baud rate	RS-232: 115.2kbps CAN: 500kbps（Initial setting）	User can change CAN baud rate
Output Cycle	RS232C：200Hz, CAN：1000Hz	
Gyro Range	± 200deg/sec	
Gyro Bias	0.2° /sec rms	Room temp.
	± 0.2° /sec	Ambient temp.
Gyro Scale Factor Error	0.2% Full Scale rms	
Acceleration Range	± 3G or ± 6G	Factory setting
Acceleration Bias	0.0196m/sec² rms（2mG）	Room temp.
	0.049m/sec² rms（5mG）	Ambient temp.
Acceleration Scale Factor Error	0.2% Full Scale rms	
Static Accuracy（Roll & Pitch）	0.1deg rms（Range 3G）	Room temp.
	0.2deg rms（Range 3G）	Ambient temp
In-run Drift（Yaw）	0.01deg/s rms	Offset-cancel applied
Operation temp. range	－ 40℃ ～＋ 85℃	
Vibration	29.4m/s² rms（5Hz ～ 2kHz）（3G rms）	Random vibration
Shock	20G 10ms	

▶ FUNCTION

Item	Remark
Waterproof Case	IP65: TAG300
Magnetometer	Under development
Vehicle Speed（VS）Input I/F	RS232C/CAN/Pulse
Power Protection Circuit	
GNSS Input I/F	Recommendation/ Customization
CAN cable termination process	

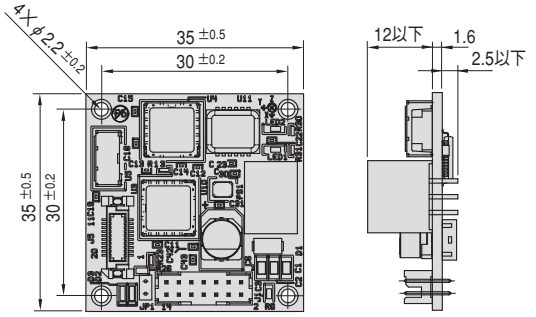
▶ USER CONFIGURABLE COMMANDS

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 allocationcan be changed.

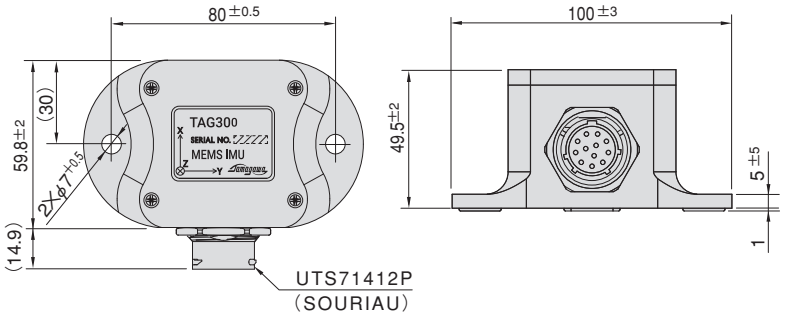
There are a lot of other commands except for the above-mentioned. The customercan change variours settings.
Please refer to the specification for the details.

▶ OUTLINE DRAWING

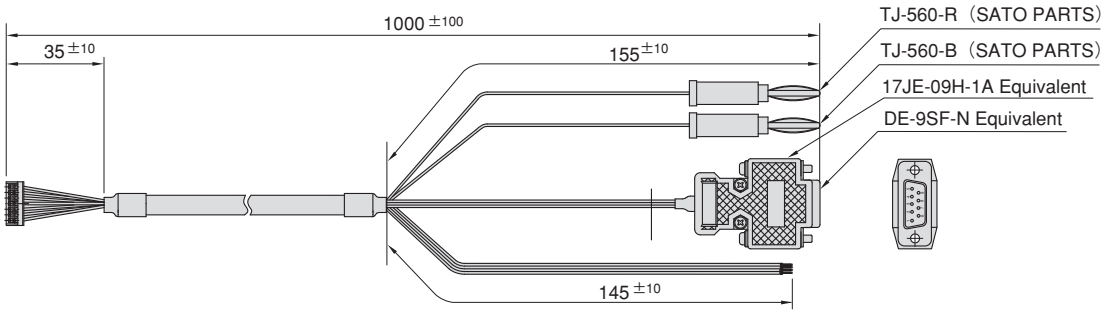
■AU7684 (PCB Type)



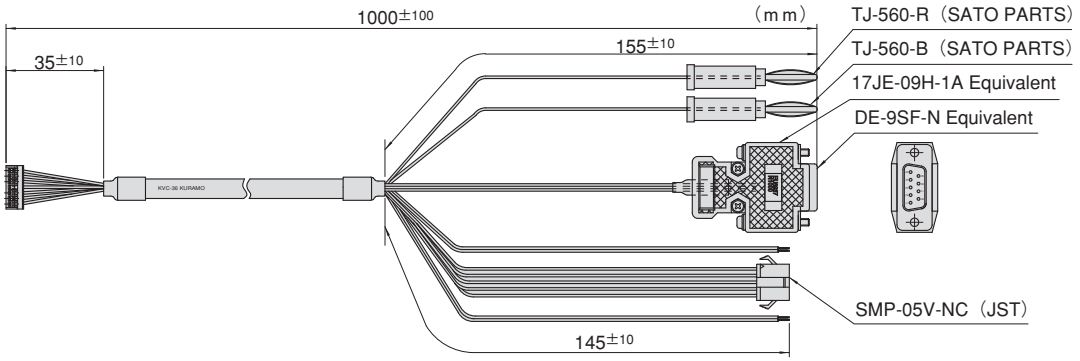
■TAG300 (Waperproof Case Type)



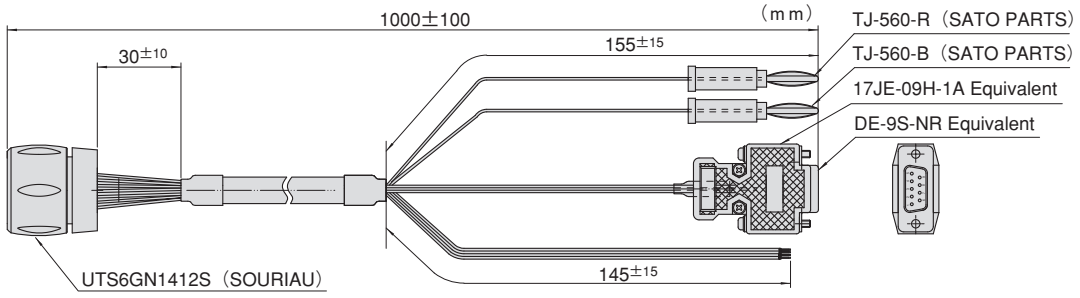
■AU7684 Interface Cable EU8937N1000 (sold separately)



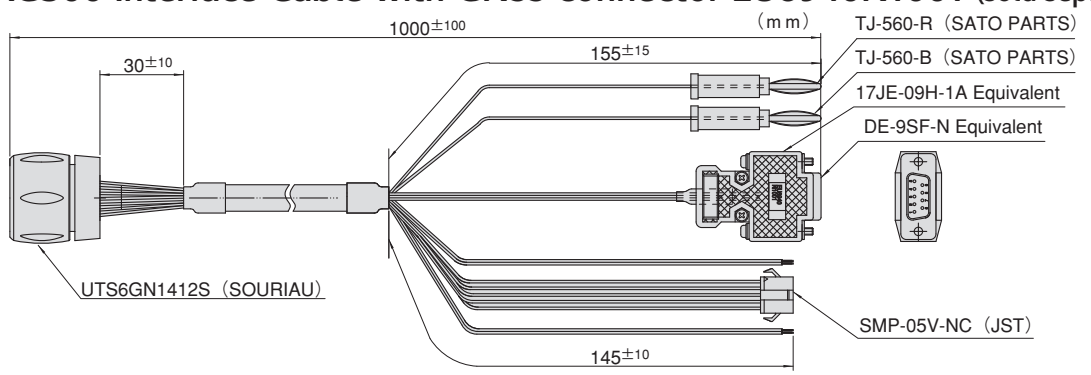
■AU7684 Interface Cable with GNSS connector EU8937N1001 (sold separately)



■TAG300 Interface Cable EU8940N1000 (sold separately)

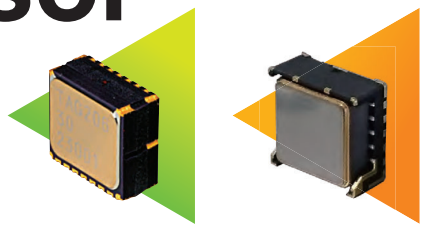


■TAG300 Interface Cable with GNSS connector EU8940N1001 (sold separately)



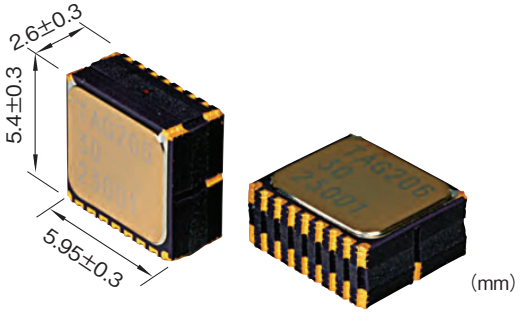
MEMS Gyro Sensor

TAG206N5000
TAG204N5000

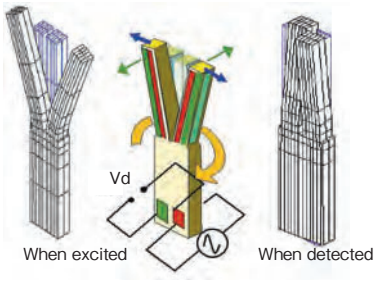


When an oscillating object is rotated, Coriolis Force works in the direction perpendicular to the vibration, and the other vibration occurs.
This induced vibration is detected and converted into voltage proportional to the amplitude of the vibration.

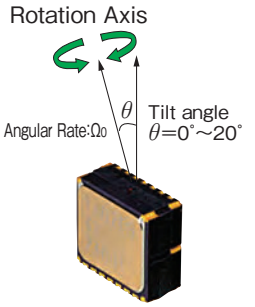
Widespread MEMS Gyro TAG206N5000



▶ DETECTION



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

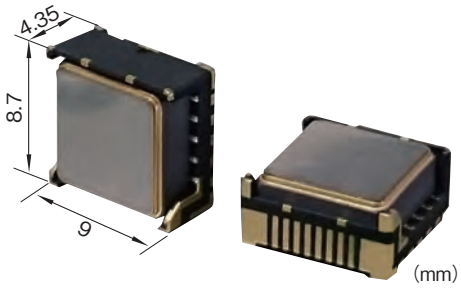


Inclined to the direction of Pin 1

▶ ELECTRICAL SPECIFICATION

Items	Digital Output				Analog Output				Remark
	MIN	TYP	MAX	Unit	MIN	TYP	Unit	Unit	
Supply Voltage	5V ± 5%			V	5V ± 5%			V	
Consumption Current	9mA Max.			mA	9mA Max.			mA	
Measurement Range	± 60deg/sec			deg/sec	± 60deg/sec			deg/sec	
Sampling Rate	1000Hz			Hz	-			-	
Maximum Output		16383d		-	3.9			V	
Minimum Output		0d		-			0.3	V	
Zero Rate Output	-12		+12	deg/sec	-12		+12	deg/sec	Ta=-40 ~ +85℃ Digital Output : 8192d is a standard Analog Output : 2.1V is a standard
Zero Rate Output with temperature variance	-3		+3	deg/sec	-3		+3	deg/sec	Ta=-40 ~ +85℃
Scale Factor	74	82	90	LSB/deg/sec	16.2	18	19.8	mV/deg/sec	Ta=-40 ~ +85℃
Linearity	-0.5		+0.5	%FS	-0.5		+0.5	%FS	
Scale Factor Variation with Temperature	-2		+2	%	-2		+2	%	
Temperature Output	8102d	8192d	8282d		2.08	2.1	2.12	V	25℃
Scale Factor of Temperature Sensor	-16	-18	-20	LSB/℃	-3.8	-4	-4.2	mV/℃	Ta=-40 ~ +85℃

High Accuracy MEMS Gyro
TAG204N5000



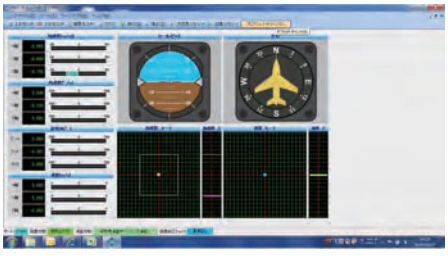
▶ ELECTRICAL SPECIFICATION

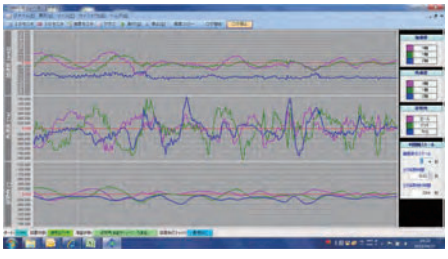
Items	Digital Output				Remark
	MIN	TYP	MAX	Unit	
Supply Voltage	5V ± 5%			V	
Consumption Current	9mA Max.			mA	
Measurement Range	± 60deg/sec			deg/sec	
Sampling Rate	1000Hz			Hz	
Maximum Output		16383d		-	
Minimum Output		0d		-	
Zero Rate Output	-6		+6	deg/sec	Ta=-40 ～ +85℃ Digital Output：8192d is a standard
Zero Rate Output with temperature variance	-2		+2	deg/sec	Ta=-40 ～ +85℃
Scale Factor	74	82	90	LSB/deg/sec	Ta=-40 ～ +85℃
Linearity	-0.5		+0.5	%FS	
Scale Factor Variation with Temperature	-2		+2	%	
Temperature Output	8102d	8192d	8282d		25℃
Scale Factor of Temperature Sensor	-16	-18	-20	LSB/℃	Ta=-40 ～ +85℃

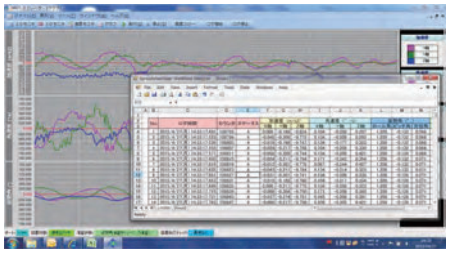
IMU Simulator software

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> http://mems.tamagawa-seiki.com/en/download/

■Simulator software


2D monitor


Graph monitor


Graph monitor → Data output

Interferometric Fiber Optic Gyro (i-FOG)

TA7774N4

High accuracy [0.1˚/h] Gyro, 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.

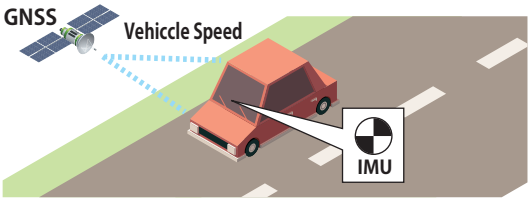
03 Closed-loop Type

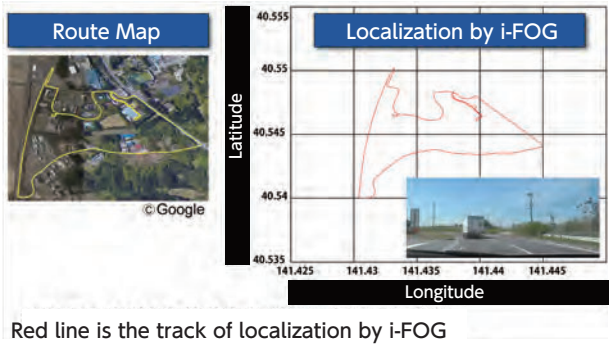
i-FOG Promotional Video
See the demonstration of i-FOG localization.

http://mems.tamagawa-seiki.com/en/movie/

▶ 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.



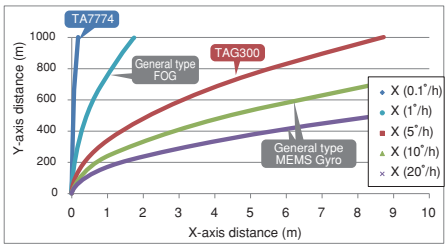


Red line is the track of localization by i-FOG

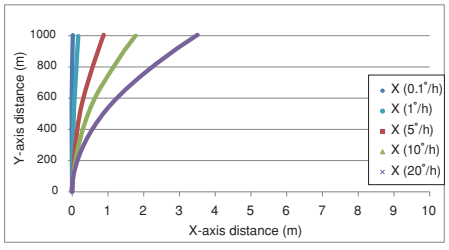
▶ POSITION ACCURACY BY GYRO ERROR & VEHICLE SPEED

The accuracy of FOG (TA7774) is 0.1 ˚/h which is possible to keep the accuracy of localization for a certain period of time. The accuracy of MEMS IMU (AU7684/TAG300) is better than standard class MEMS gyro. Therefore, customers can select the best type according to the requirement of accuracy.

Position Accuracy at 10km/h



Position Accuracy at 100km/h

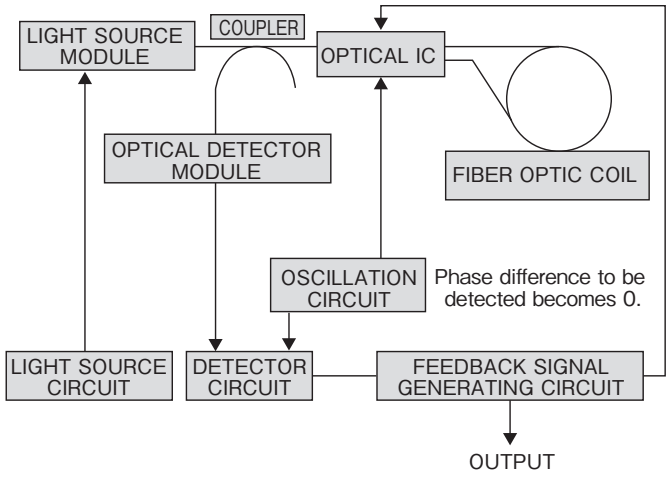


Part Number	AU7684/TAG300	TA7774
Built-in Gyroscope	MEMS Gyro × 3	FOG × 1
Accuracy	Good	Very Good
Cost	Very Good	Good
Size (3-axis of sensor)	Very Good	Good
Features	・Accuracy [5˚ /h] ・Suitable for short-term measurement for fast-moving machine ・Waterproof Case (TAG300 Series)	・High Accuracy [0.1˚ /h] ・Suitable for long-term measurement for slow-moving machine
Target Application	Construction machine, Agricultural machine	Automobile, Drone

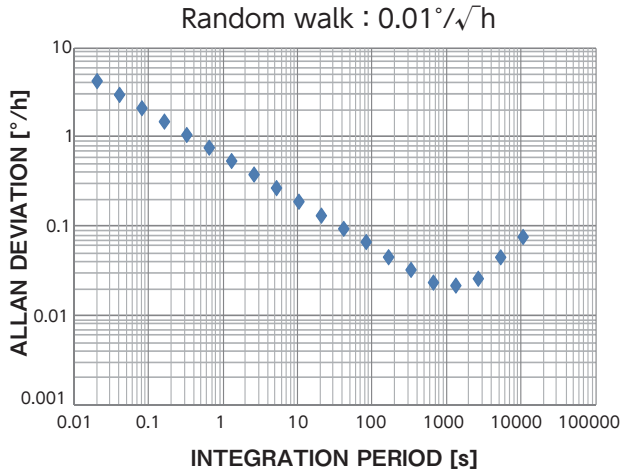
▶ SPECIFICATION

Part Number	TA7774N4
Dynamic Range	±200° /sec
Bias Repeatability	<0.1° /h (1σ) (at 25℃ static)
Bias Instability	<0.1° /h
Random Walk	<0.01° /h
Scale Factor Accuracy	±100ppm
Scale Factor Linearity	± 100ppm FS
Mass	<400g
Power-supply voltage	±5V, ±15V
Power Consumption	±5V: <1.5A at startup
	±15V : <0.2A
Operating Temprature	−20～+60℃
Non-operating Temperature	−30～+70℃

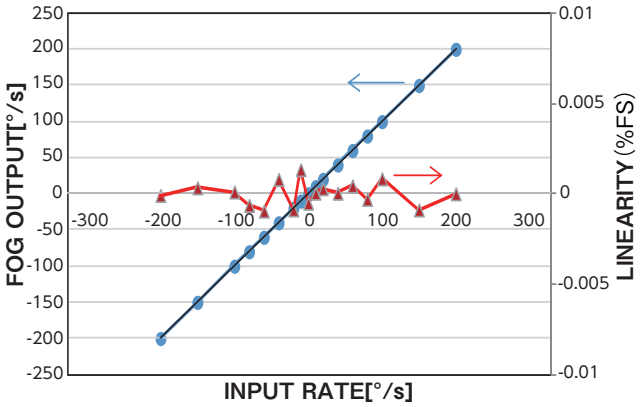
▶ CONFIGURATION



▶ ALLAN VARIANCE



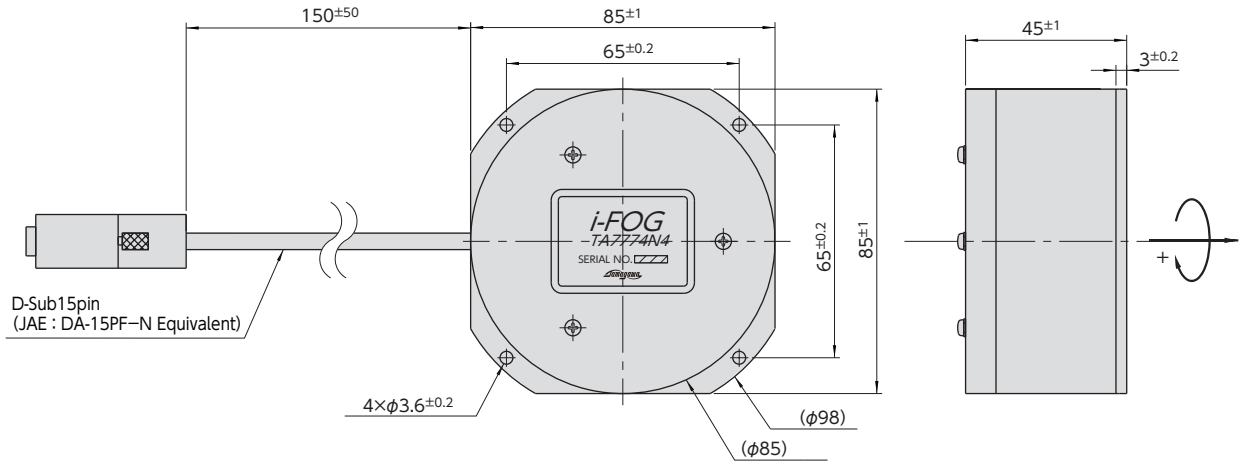
▶ SCALE FACTOR & LINEARITY



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

▶ OUTLINE DRAWING

Unit : mm



i-FOG + MEMS IMU

Combination of i-FOG (Yaw)& MEMS GYRO×2 (Roll & Pitch) is now under development.
Please contact to us for the details.

WARRANTY

When ordering, please contact our Sales Department as the contents of this catalog are subject to change without notice.

The outline of operation and the examples of an application circuit indicated in this catalog are only showing standard operation and usage of electronic components and do not guarantee the operation by actually used equipment. Therefore, please design equipment at your own risk in case you use our products. We cannot take responsibility for damages resulting from the use of our products.

The technical information containing the outline of operation and circuit diagram indicated in this catalog does not mean consent of intellectual property rights, such as patent right of our company or a third party, and copy right. Moreover, it does not guarantee that enforcement of a third party' s intellectual property rights or other rights can be performed. Therefore, we do not take responsibility for the infringement of a third party' s intellectual property rights or other rights resulting from the use of our technical information.

Products shown in this catalog are designed and manufactured with an object for general use, such as the ordinary industrial use, general office work, and personal/home use. They are not designed and manufactured for the use which requires high reliability (under-water stations and space satellites) , and the use which requires high safety and if the safety is not secured, it has serious influence socially and directly onto life and body (nuclear reaction control in nuclear facilities, airplane automatic flight control, air traffic control, traffic control in a mass transportation system, medical equipment for life maintenance, and missile launch control in an arms system) . Therefore those who are considering use of our products in these fields are advised to consult our Sales Department in advance. We cannot take responsibility for damages resulting from the failure in the consultation.

Failure of electronic components occurs in a certain probability. So we request you to establish safety designs, such as a redundant design of equipment, a design to prevent spread of a fire, an over-current prevention design, and a malfunction prevention design, even if the electronic components should break down so that an accident resulting in injury or death, a fire accident, and social damage may not take place.

In case our product in this catalog corresponds to a cargo or technology regulated based on "a foreign exchange and a foreign trade law" , the permission based on the law is required in exporting the product.

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