

Aspiring always to be an environmentally friendly and trustworthy company

# TAMAGAWA NEWS

## New products

Interference type fiber optic gyro (i-FOG)

Triaxial inertial measurement unit with built-in i-FOG

Third-generation MEMS IMU

## Information

Soil Improvement Technology Expo 2018

Security & Safety Trade Expo 2018  
(RISCON TOKYO)

Japan International Aerospace Exhibition  
2018 Tokyo (JA2018 TOKYO)

Notice of Website Renewal

March 2019

Vol. 22

*Tamagawa*



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### The cover of this edition



Neba village, the southernmost point of Nagano prefecture  
**Two-thousand tsurushi-bina (suspended dolls and stuffed goods) at Neba Land**

Tsurushi-bina event is held from mid-January to the beginning of April every year. It is said that this event started when people displayed handmade dolls wishing for healthy growth of girls. The atmosphere of the venue is glamorous with two thousands of stuffed balls, peaches, gold fishes, and bags made of chirimen textiles and old fabrics displayed. In Neba Land, soft cream made from fresh milk and gibier cuisine using game meat are popular.

●Contact: Neba Land,  
4918-1 Neba village, Shimoina-gun, Nagano  
TEL:+81-265-49-2880  
Official website●<http://nebaland.com>  
\* Website in Japanese language only

### Tastes from the region

## Yume Kurumin using local walnuts Cafe Furatto Hotto

Yume Kurumin is baked goods sold at Cafe Furatto Hotto in Shopping Town Pier, which is located near Hirugami hot spring resort.



The local walnuts that fill Yume Kurumin are carefully cut out one by one by members with a disability working for Yume No Tsubasa.

Yume Kurumin is moist and rich with butter taste, and is popular as gift and souvenir. Since it is handmade, and thus cannot be mass produced, it is available only at Cafe Furatto Hotto. Yume No Tsubasa produces and sells other products such as pain demie, tube



cake, pound cake, and increasingly popular apple pie. Menus of the cafe include coffee using coffee beans of Maruyama Coffee established in Karuizawa, oyaki (bun), venison gibier curry, local apple juice, tomato juice, and other food and drink made in the local area. Please visit the cafe when you come to Minami Shinshu.



●Contact **Antenna shop of Achi, Hiraya, and Neba: Cafe Furatto Hotto (Yume No Tsubasa)**  
Inside Shopping Town Pier, Komaba, Achi village, Shimoina-gun, Nagano TEL&FAX : +81-265-43-3170  
Opening hours: 10:00 a.m. - 7:00 p.m. ◆Open until 7:30 p.m. from June to August \* Closed on some Mondays.  
Website : <http://www.yume-tsubasa.com> \* Website in Japanese language only

## Tamagawa Hightech Corporation

Following Aomori prefecture's initiatives for attracting enterprises with the aim of regional development, Tamagawa Seiki Co., Ltd., in April 1991, established a local corporation Hachinohe Tamagawa in Kikyono Industrial Complex as its base in Tohoku region. Tamagawa Hightech Corporation started to produce mainly OEM products.

When Hachinohe Plant of Tamagawa Seiki Co., Ltd. was established in February 2000, Hachinohe Tamagawa changed its name to Hachinohe Hightech Corporation and started to supply processed precision parts. From January 2006, the company started sheet metal business, and from October 2009, servo motor sensor business.

In February 2012, the company changed its name to Tamagawa Hightech Corporation. Production of large servo motors was transferred from Tamagawa Seiki Second Plant to Tamagawa Hightech Corporation in March 2013, which made the company a hub in Japan for production of servo motor for FA market.

Based on the manufacturing policy of limited production of a wide variety of products, the company tries its best to secure QCD and to improve technologies and skills as well as itself so that customers are satisfied with our products.

Tamagawa Hightech Corporation aims to be a company loved by the community and customers, and appreciates your continued support.



Main Factory (Hachinohe City)



First Fukuchi Factory



Second Fukuchi Factory



Servo motors



Sensors

#### Information

●Address: Main Factory/1-3-47 Kita-Inter-Kogyodanchi, Hachinohe city, Aomori prefecture, 033-2245

○Large servo motor, die-casting

#### First Fukuchi Factory

1-1 Kanuemonyama, Houshioka, Nambu-cho, Sannohe-gun, Aomori prefecture, 039-0811

○Processing of precision sheet metal

#### Second Fukuchi Factory

3-23 Niuemonyama, Houshioka, Nambu-cho, Sannohe-gun, Aomori prefecture, 039-0811

○Small servo motor, sensor, and precision instrument processing

●Establishment/April 1991 ●Capital/70 million yen ●Number of employees/390

●Product and service/Assembling of servo motor and sensor, processing of aluminum die-casting, precision instrument and precision sheet metal

## Tour of Iida City and Its Neighborhood

No. 22

### Kitchen of Minami Shinshu

## Toyooka Marche Roadside Station Toyooka village

Minami Shinshu Toyooka Marche is surrounded by two alps mountains. It is located along side of the Tenryu River and opened in April 2018. Minami Shinshu area is characterized by small rainfall and big difference in temperature between day and night. Apple, grape, peach, pear, Japanese persimmon and many other fruits are cultivated every season.

With a farm stand selling agricultural products, a restaurant, and a cafe, Toyooka Marche, as a kitchen of Minami Shinshu, is crowded with people.

You can get fresh products in Shikisai Market, the farm stand, because farmers themselves bring in their fruits and vegetables.

It also has processed food and specialty of the region.

Apple pie made only of Fuji Apple produced in Toyooka Village and pickled local vegetables made



by farmers are the two most popular products. At Bakery Cafe Kirara, freshly baked bread and soft cream directly delivered from Nagato Ranch in Shinshu Shirakaba Kogen are popular. Kitchen Sorara is the restaurant with popular menus of authentic western cuisine with lots of local ingredients such as Minami Shinshu beef and alps salmon prepared by the chef who has experience in a hotel restaurant. Handmade deli made mainly of local food ingredients are provided every day at a deli stand so-zai Kurara. The deli stand has a spacious viewing deck

where you can enjoy the view of alps and 360-degree sky without any obstacle. Please visit Roadside Station Minami Shinshu Toyooka Marche.

#### [Inquiries]

◆Roadside Station Minami Shinshu Toyooka Marche  
12410, Kumashiro, Toyooka village, Shimoina-gun,  
Nagano prefecture, 399-3202

TEL: 0265-48-8061

Website/

<https://www.toyooka-marche.jp/>

\* Website in Japanese language only

facebook/

<https://www.facebook.com/toyookamarche/>

\* Website in Japanese language only

#### [Opening hours]

Shikisai Market: 9:00 a.m. - 6:00 p.m.

(Open until 5:00 p.m. in winter season)

Bakery Cafe Kirara: 10:00 a.m. - 5:30 p.m.

(Open until 5:00 p.m. in winter season)

Kitchen Sorara: 11:00 a.m.-4:00 p.m.

(Last order for lunch at 2:00 p.m., and for cafe time at 3:30 p.m.)

Information: 9:00 a.m. - 5:30 p.m.

(Open until 5:00 p.m. in winter season)

[Holiday] January 1 and 2, and temporarily closed for maintenance.

Kitchen Sorara only is closed on Thursdays.



## Interference type fiber optic gyro (i-FOG)

An interference type fiber optic gyro which managed to achieve both low price and 0.1°/h- class high precision



### ■Type TA7774 Series

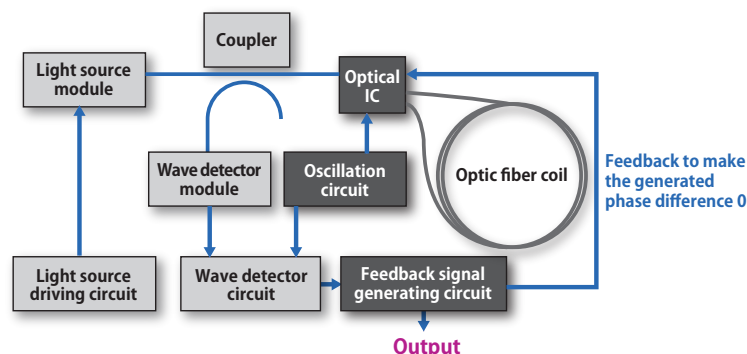
#### ■Features

- High-precision [0.1°/h] gyro. Precision required for automated driving level 4 technology for vehicles was realized.
- Low price was realized by applying automated winding technology developed by the manufacturing process of our brushless resolvers (FA-Solver) and servo motors and by optical IC production technology of MEMS gyro oscillator.
- Precision was increased by adopting the closed loop method

#### ■Application examples

- Automated driving for vehicles (level 4)
- ADAS (Advanced Driver-Assistance Systems): For construction machine and agricultural machine as an attitude control sensor
- MMS (Mobile Mapping System): As a behavior measuring sensor for mobile objects such as vehicles
- As a complement for quasi-zenith satellites characterized by high-precision positioning
- Compass to measure true azimuth used with shield machine

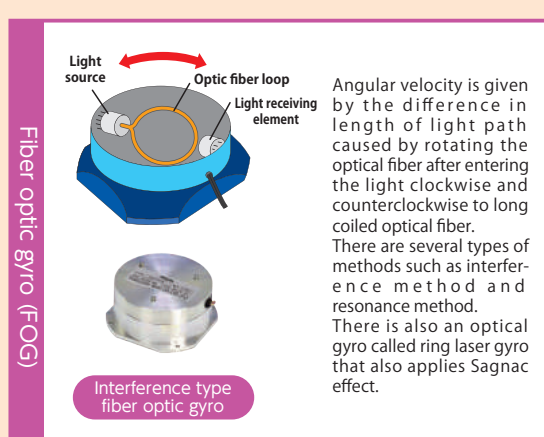
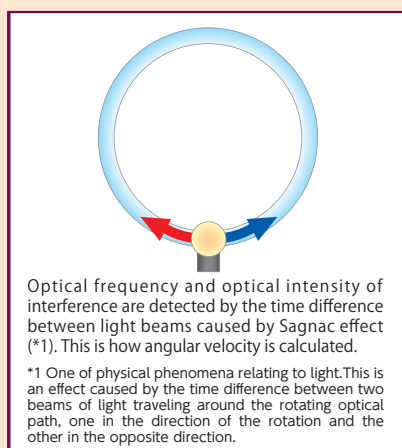
#### ■Diagram



#### ■Specifications

Types	TA7774
Dynamic range	±200°/s
Bias repeatability	0.1°/h (1σ) (25°C static)
Bias instability	0.1°/h or below
Angular random walk	0.01° /√ or below
Precision of scale factor	100 ppm or below
Linearity of scale factor	100 ppm or below Full scale
Frequency response	40Hz
Mass	300 g or below
Input power source	±5V, ±15V
Power consumption	±5V: 1.0A or less (normal use), 1.5A or less (while warming up) ±15V : 0.2A or below
Operational temperature range	-20~+60°C
Storage temperature range	-30~+70°C

## Principle of fiber optic gyro: Sagnac effect



## Triaxial inertial measurement unit with built-in i-FOG

Precision was increased by using i-FOG, the closed loop method



### Types TA7589 Series

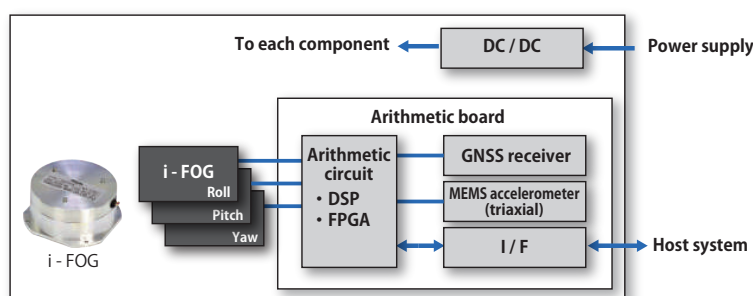
#### Features

- Excellent bias reproducibility, stability and linearity were realized by using three axes of high-precision [0.1°/h] gyro.
- True north can be detected.
- Compound navigation system with built-in GPS receiver

#### Application examples

- Measurement of behavior of mobile objects such as vehicle, vessel, and flying object.
- Attitude control of mobile objects

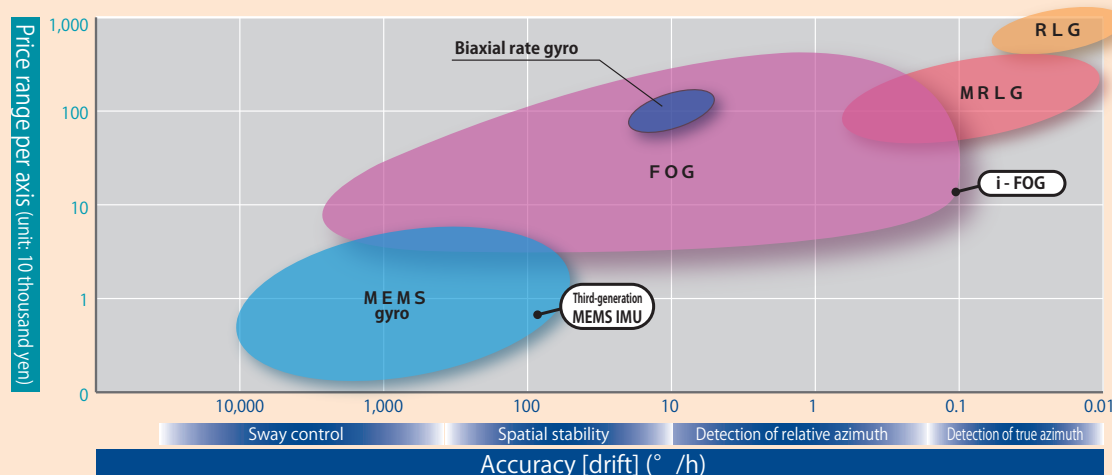
#### Diagram



#### Specifications

Type	TA7589
Dynamic range	Roll $\pm 180^\circ$
	Pitch $\pm 90^\circ$
	Yaw $\pm 180^\circ$
Angular accuracy of attitude	0.1° maximum
Angular accuracy of azimuth	0.5 maximum (°GPS composite)
Speed accuracy	50m/s (full inertial) maximum, to 1m/s (GPS composite) maximum
positional accuracy	120NM/hCEP (full inertial) maximum, 5m (GPS composite) maximum
Input power source	28V DC
Mass	3.5kg or below
Power consumption	30W or below
Operational temperature range	-20~+60°C
Storage temperature range	-30~+70°C

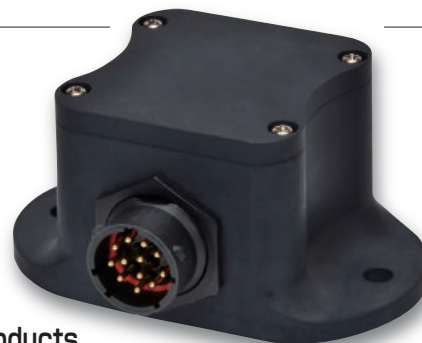
## Price range and precision of gyro products



## Third-generation MEMS IMU

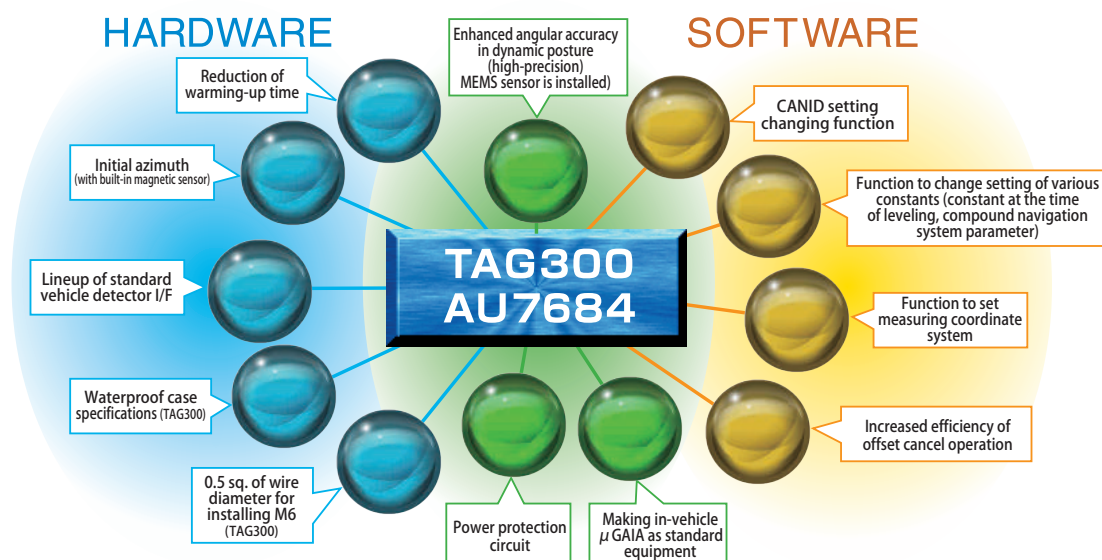
### Types

- AU7684 Series : Substrate type
- TAG300 Series : Waterproof case type



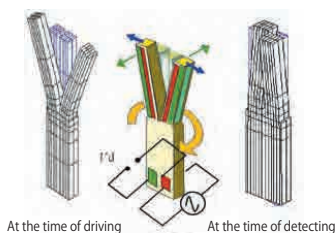
### Features

- Precision of built-in MEMS gyro doubled compared to the existing products. [Bias instability: 10°/h]
- Excellent functions
  - Waterproof case (IP65/TAG300 Series)
  - Built-in power protection circuit
  - Built-in magnetic direction sensor
  - CANID setting change function, etc.



## Principle of MEMS gyro : Coriolis force

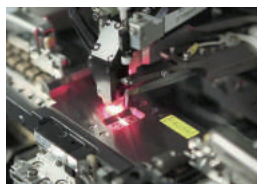
At the time of driving



Angular velocity is detected from Coriolis force (\*1) that is added to the element by vibrating the element.

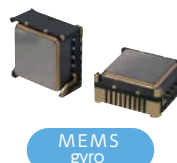
\*1 Force generated, when the object in motion is rotated, in a direction perpendicular to the direction of movement of an object and that of axis of rotation. (Deflecting force)

MEMS gyro 2



Gyro produced by using the technologies of MEMS (\*3). The product with uniform performance and quality can be manufactured with low cost.

\*2 MEMS gyro is not a principle or method but a name and classification of the product manufactured by a certain production method.  
\*3 MEMS stands for Micro Electro Mechanical Systems, and is a system that has a three-dimensional microstructure formulated with semiconductors processing technologies.



MEMS gyro

## Precision of gyro sensor was enhanced and functions improved. IMU in the new stage was released.

### Specifications

Item	Specification value	Remarks
External dimension (AU7684: substrate)	35×35×16.1 mm	
External dimension (TAG300: case)	100×59.8×49.5 mm waterproof	(IP65)
Power-supply voltage	8 ~ 28V DC	
Output signal	RS232 : 115.2 kbps CAN : 500kbps	User can change the CAN baud rate
Output cycle of data	RS232C : 200Hz, CAN : 1000Hz	
Range of angular velocity detection	±200 deg/sec	
Angular velocity bias	0.2 deg/s	Room temperature after warming up
	0.2 deg/s rms	Temperature fluctuation range of standard room temperature
Angular velocity SF error	0.3 %FS rms	SF : Scale factor FS : Full scale
Range of acceleration detection	±3 G or ±6 G	Factory default
Acceleration bias	0.0196 m/s <sup>2</sup> rms (2mG)	Room temperature after warming up
	0.049 m/s <sup>2</sup> rms (5mG)	Temperature fluctuation range of standard room temperature
Acceleration SF error	0.2 %FS rms	
Angular accuracy in static posture	0.1 deg rms (Range 3G)	Room temperature after warming up
	0.2 deg rms (Range 3G)	Temperature fluctuation range of standard room temperature
Azimuth drift	0.01 deg/s rms	In case of offset-cancelling after warming up
Operating temperature range	-40 ~ +85°C	
Vibration resistance	29.4 m/s <sup>2</sup> rms 5 ~ 2 kHz	Random vibration
Impact resistance	20 G 10 ms	

### List of functions

Item	Specification value	Remarks
Waterproof case	✓	Normal response
Magnetic direction sensor	✓	Standard feature
Input of vehicle speed	RS232/CAN/ Pulse	
Power protection circuit	✓	Standard feature
External GPS I/F	✓	Recommended product (Responded individually)
CAN termination resistance	None	
Warming-up time	5 minutes or below (typical time: 3 minutes)	Recommended value

### Example of major use

●Automobile



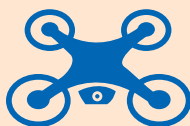
Measurement of  
vehicle motion and  
attitude

●Service robot



Measurement  
of security robot  
attitude

●Unmanned aircraft



Measurement  
of drone attitude

●Construction machine



Measurement of  
inclination angle  
of unmanned  
construction machine

●Agriculture machine



Measurement of  
remote-controlled  
tractor attitude

## Device to Measure Duct Hole Curvature with Built-in Camera and Inner Diameter Measuring Device

In collaboration with DAERYUK Electric facility Corporation (Incheon headquarters of Korea Electric Power Corporation (KEPCO)), we have developed TUG-NAVI with a built-in camera and inner diameter measuring device. It is a curvature measuring probe for KEPCO using our gyro technologies.

TUG-NAVI is a device to measure duct hole curvature combined with our gyro technology and accelerometer. With this product, you can obtain accurate information about the duct hole curvature that cannot be seen from the ground. The sensor probe that goes through the duct buried underground provides you data that describes the shape of the line.

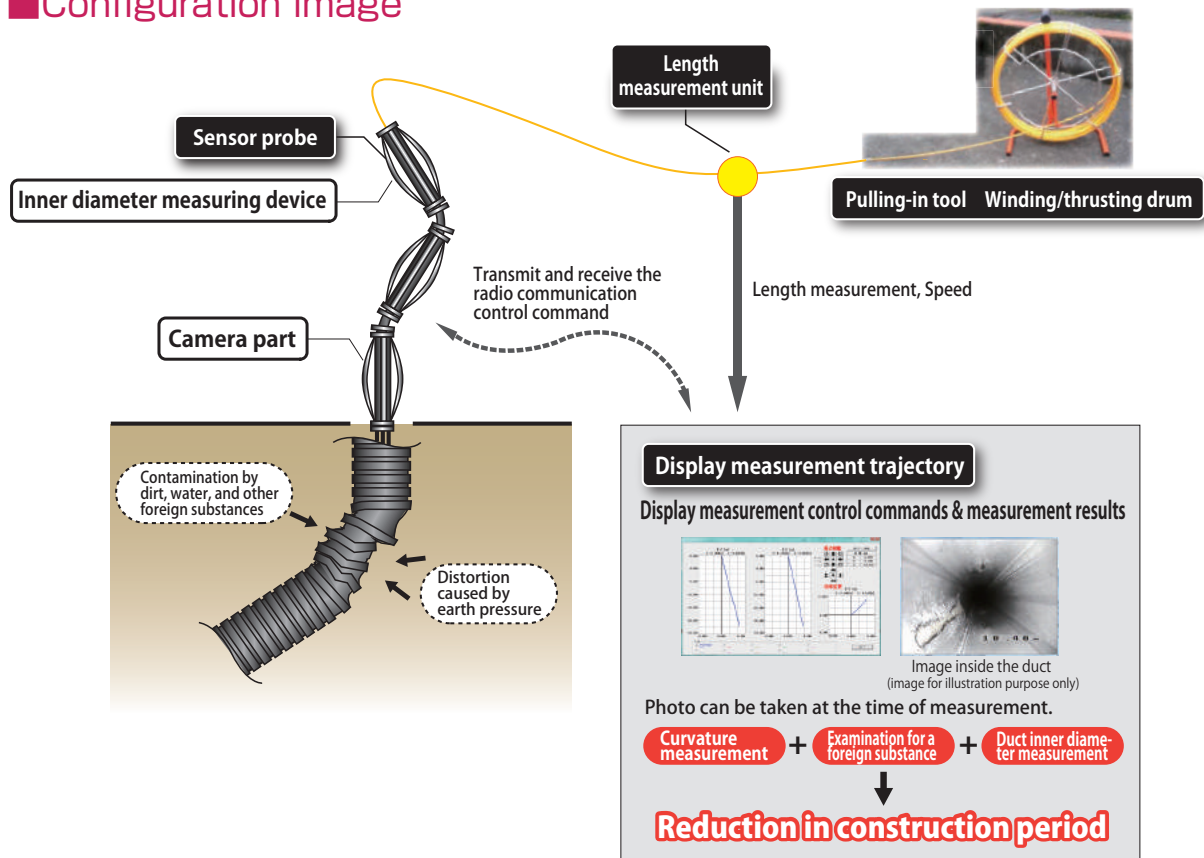
In the area with old underground duct lines in Korea, the map, which was created at the time the duct lines were buried, is often largely different from the reality. For example, the lines are straight on the map, but in reality, they are curved, which leads to damage accidents causing disconnected cable at the time of construction work in the neighborhood.

In addition, since most of the duct lines are bellows, many foreign substances such as water, dirt, stone, and sand come in. Sometimes inside the duct lines are distorted because of the earth pressure.

In the traditional measuring method, there were disadvantages in terms of time and cost because curvature measurement, examination for a foreign substance, and inner diameter measurement were carried out by individual sensors.

Thanks to the development of the product, curvature measurement, examination for a foreign substance, and inner diameter measurement can be carried out at one time, and thus, measurement time and construction period are reduced.

### ■ Configuration image



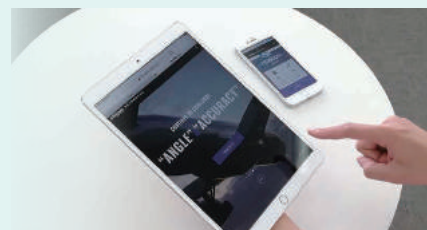
Sensor probe



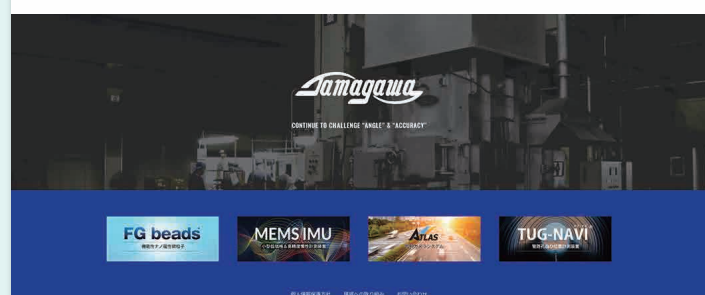


## Our new website was launched on November 21, 2018.

In this renewal, we redesigned the top page and product page to give the clear explanation about our applications and products. We will continue to enhance the content so that many customers can visit our website.



### Features of New Website



Top page (Visual Page)

#### 01 New design

In the new layout, we put bigger images and contents with the purpose of showing our applications and products in a clearer manner and having viewers easily find the information they are looking for.



Product top page

#### 02 Switching design

Design of the top page can be switched by a click. There are two types of design: Visual Page, focusing on impact and Simple Page, focusing on functionality. Click the Switch tab on the lower right or upper right on the top page to switch the design.



Top page (Simple Page)

#### 03 Website converted from HTTP to HTTPS

URL of our website changed as the site was redesigned. If you have bookmarked our website, please register the new URL.

[New URL] <https://www.tamagawa-seiki.co.jp/>

[Old URL] <http://www.tamagawa-seiki.co.jp/>



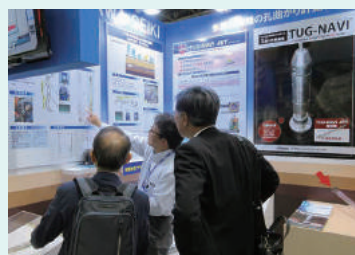
### 01 Soil Improvement Technology Expo 2018

Wed. September 26 to Fri. September 28  
Held at Tokyo Big Sight

Soil Improvement Technology Expo 2018, where all kinds of soil improvement construction methods to control liquefaction damage of the ground caused by earthquake were gathered, was held at Tokyo Big Sight in September. We had 9-square-meter booth (W 3m x D 3m).

At our booth, we exhibited the panels showing the images of examples of construction management using TUG-NAVI and five series of sensor probes, showed a video featuring the actual measurement process, and demonstrated the measurement using the small probe.

There are huge expectations for TUG-NAVI in difficult constructions such as those carried out under deep-depth, which will increase in the future. We will strive to expand the sales together with the interested party with a view to install TUG-NAVI into the shield machine in the next phase.



Exhibition booth



Demonstration of measurement using the small probe

### 02 Security & Safety Trade Expo 2018 (RISCON TOKYO)

Wed. October 10 to Fri. October 12  
Held at Tokyo Big Sight

This year, we displayed the following four products: (1) 360-degree Security Camera with sway stabilizing functions. This is a versatile 360-degree security camera put on top of towers such as power pylon. (2) Three-wavelength infrared color camera system that colorizes black-and-white images with near-infrared illuminator. (3) ATLAS-PLDN Urban Style Model with the design suitable also for urban environment. (4) "Furusa-tokun," the information camera that can transmit the shot images via our server. Number of visitors to our booth increased by 50% compared to the previous year.

We will strive to expand the ATLAS business with new selling system because visibility of ATLAS in the market has been increased gradually, and so does its number of the products delivered.



Exhibition booth



Demonstration of 360-degree security camera

### 03 Japan International Aerospace Exhibition 2018 Tokyo (JA2018 TOKYO) Wed. November 28 to Fri. November 30/Held at Tokyo Big Sight

Japan International Aerospace Exhibition, the biggest exhibition in Japan, where aviation, space, and defense industries across the world gather, was held at Tokyo Big Sight. Tamagawa Seiki Co., Ltd. participated in the exhibition with Tamagawa Aero Systems Co., Ltd., one of our group companies, and exhibited products installed in aircraft, satellites and other products that play active roles in outer space.

In the field of aircraft, we exhibited auto throttle lever and actuator for business aircraft and a wide variety of sensors for pilot control system of middle-size jet aircraft, as well as fuel pump and impeller of large-size aircraft and five-axis vibration-proof camera system ATLAS-HD that can be installed into aircraft and helicopter.

In the field of space, we showed inertial sensor unit for measuring attitude loaded into super-small-size satellite (triaxial FOG unit/IRU), reaction wheel controlling the attitude, high-precision angle detector used for antenna pointing mechanism and earth observation equipment pointing mechanism, and Interference Type Fiber Optic Gyro (i-FOG), the new product that realized both 0.1°/h-class high-precision and low cost. All of them attract many visitors' attention.



Exhibition booth



## 04 TSC Techno Fair 2018

**Thu. September 27**  
**Held at First Plant of Tamagawa Seiki Co., Ltd.**

Material Purchasing Control Center of our company hosted the exhibition for material suppliers. We held this exhibition first time in 32 years with the aim of strengthening the ability of our group to purchase in the increasingly globalized material-purchasing environment.

62 companies participated in the exhibition and we had 262 visitors from various kinds of sectors such as design, purchasing, and production technology who actively exchanged information. In the age of the Internet when access to information is facilitated, people have fewer opportunities to actually see and touch the machines and devices. Visitors told us that they were pleased to see the actual products.

Many exhibitors, on the other hand, said that the exhibition was meaningful because they were given the chance to promote their products, and wanted us to hold it again.

Details of the next exhibition are not decided yet, but we would like to develop the plan to hold it on a regular basis.



Venue of the exhibition



**Exhibition information** We will be exhibiting at the following upcoming exhibitions. Please come along.

- |  |   |
|--|---|
| ● <b>TECHNO-FRONTIER 2019 The 37th Motor-tech exhibition</b>             | Period: Wed. April 17 to Fri. April 19/Venue: Makuhari Messe        |
| ● <b>Automotive Engineering Exposition 2019 Nagoya</b>                   | Period: Wed. July 17 to Fri. July 19/Venue: Port Messe Nagoya       |
| ● <b>DSEI JAPAN '19 (Defense &amp; Security Equipment International)</b> | Period: Mon. November 18 to Wed. November 20/Venue: Makuhari Messe  |
| ● <b>2019 International Robot Exhibition</b>                             | Period: Wed. December 18 to Sat. December 21/Venue: Tokyo Big Sight |

## Organizational change

On November 21, 2018, Biotronics Institute (BT Institute), which has been engaged in research and development of FG beads® and related devices, became Third Plant Production Department.

(Address and telephone/fax numbers are not changed)

Bio Sales Department of the sales company has taken over their tasks to the sales offices in North Kanto, Nagoya, and Fukuoka.

We strive to enhance the sales and service of FG beads® and the related devices at the place closer to the customers. If you need anything, feel free to contact the nearest sales office.

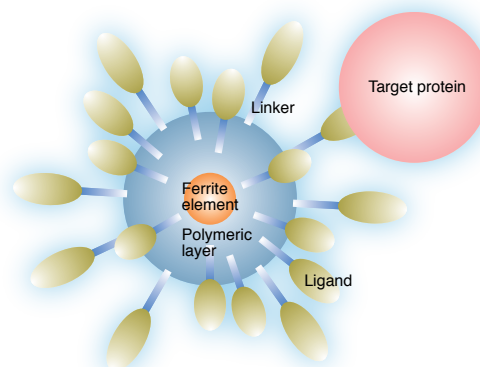
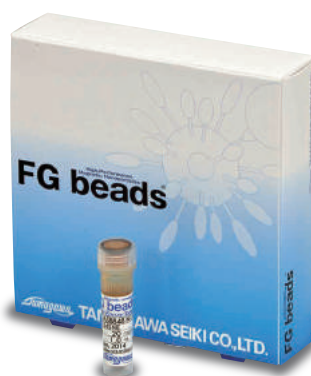


Illustration of FG beads®

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