FURUNO
Field Time Sync Generator

TB-1

Operation Manual

(Document No. SE20-900-014-02)

FURUNO ELECTRIC CO., LTD.

www.furuno.com

IMPORTANT NOTICE

In this product, FURUNO can ensure safe performance only the commands and the sentences which are written in this document or are written in the document for this product. Please do not use the commands of the others products, otherwise this product may have troubles and FURUNO may not support about the troubles.

The following satellite systems are operated and controlled by the authorities of each government.

- GPS(USA)
- Galileo(Europe)
- QZSS(Japan)
- SBAS(USA: WASS, Europe: EGNOS, Japan: MSAS)

Thus FURUNO is not liable for the degradation of the above systems so therefore FURUNO cannot guarantee specification based on their conditions. User is expected to be familiar with the System and make full use of it with their own responsibility.

Revision History

No.	Contents	Date
0	First Release	2020.10.02
1	correct download website in page 6	2020.12.11
2	change the contact section in page 13	2020.03.05

Contents

1 Outline

TB-1 is an instrument that provides accurate frequency (10MHz) and time pulse (1PPS) based on GNSS signals.

2 Safety precautions

・Please read carefully before use. Be sure to follow these instructions. After reading this manual, be sure to keep it carefully.

・The precautions listed below are to prevent risk of harm to the user and others, as well as to prevent property damage. Be sure to follow these instructions.

・The following classifications describe the extent of harm or damage in the case of improper handling.

Warning	This content indicates risk of death or serious injury to the user in the case of improper handling.
Caution	This content indicates risk of injury to the user or damage to physical property in the case of improper handling.

Warning
・Do not disassemble or modify the device. It has high-temperature and high-voltage parts in it, posing great danger. May cause performance degradation or malfunction.
・Do not short-circuit the connector or internal parts with any type of of metal. May cause electric shock or malfunction.
・Do not let the apparatus get wet or place objects filled with liquids on the apparatus. Do not operate with wet hands. May cause electric shock or malfunction. Make sure that outdoor antenna connections are properly waterproofed.
・Do not operate the device in a malfunction or abnormal condition. If there is smoke, unusual noise or smell, excessive heat, or output/display error, turn off the power immediately and contact customer service. Otherwise there is a risk of fire or electric shock.

Caution
・Do not subject the device to vibration. May cause performance degradation or malfunction. This is a precision instrument equipped with parts that may deteriorate in performance due to vibration or impact.
・Do not carry the device by holding the connector or the cable connected. Do not apply excessive force to those parts, as they are not designed to withstand the weight of the device. The device may fall and cause injuries.
・Do not carry the device with cables connected. The cables may get caught on body or object and cause the device to fall over, resulting in injuries.
・Do not mount a connector that does not match the shape to the device. May cause malfunction or damage. Use an appropriate conversion adaptor when connecting cable with a different type connector.
・Do not use in extremely hot or cold locations. Do not exceed the operating temperature of the device.
・Operate at an altitude of less than 4000m.
・This product is designed to be used in places such as office, laboratory or residence(pollution level 2).
・Keep enough space and creepage distance. The CE compliance may become invalid if not follow the instruction.

3 Main Unit

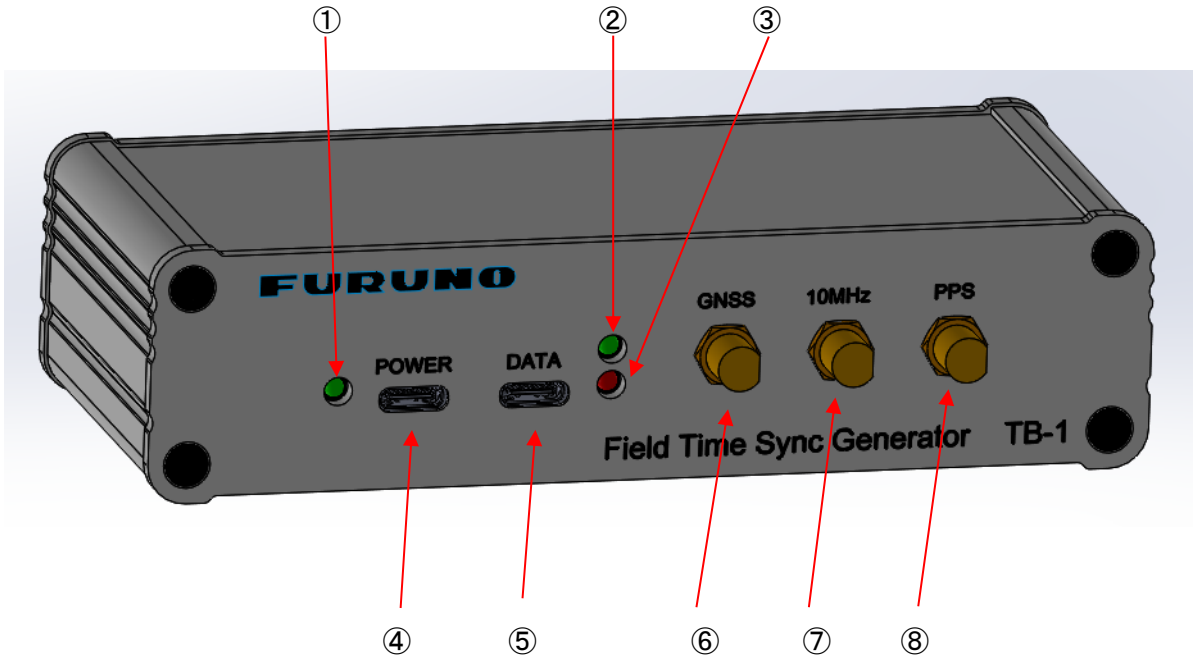
3.1 Unit and Accessories

Check below accessories before use.

■	TB-1 Unit	･･･	1
■	GNSS Antenna	･･･	1
■	USB Cable		
	･TypeC – TypeC	･･･	1
	･TypeC – TypeA	･･･	1
※	Power adapter is not included		

3.2 Part names and Functions

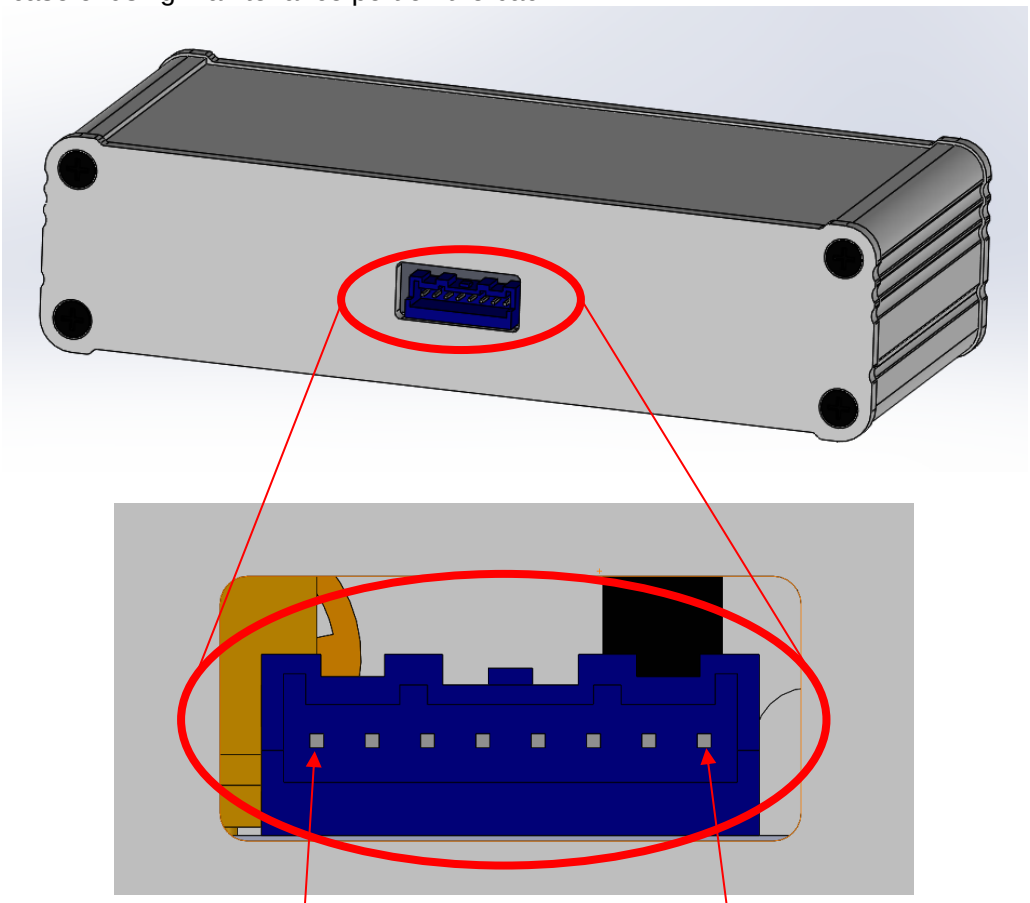
3.2.1 Front Side



No.	Name	Display	Shape	Description
①	Power LED	Green	-	Illuminates when the power is on.
②	Lock LED	Green	-	Display device status. The light illuminates in approx. 5 minutes after system power-on and stable GNSS reception.
③	ALARM LED	Red	-	Illuminates when internal anomaly is detected.
④	POWER USB	POWER	USB TypeC	Power supply connection only. Not available for data communication.
⑤	DATA USB	DATA	USB TypeC	USB jack for data communication (also available for power supply.) It is designed to transfer data with an Android device to keep record of the internal status.
⑥	GNSS ANT	GNSS	SMA	Connect GNSS antenna
⑦	10MHz Out	10MHz	SMA	Outputs 10Mhz
⑧	1PPS Out	PPS	SMA	Outputs 1PPS

3.2.2 Back side (Maintenance Board)

Contact us in case of using maintenance port on the back.



Connector: S08B-PASK-2 (JST)

■I/O Signal Description

#	Pin Name	Type	Description
1	VCC	Power Input	Main power supply input pin
2	GND	-	-
3	GND	-	-
4	TXD	232C output	Serial communication output pin
5	RXD	232C input	Serial communication input pin
6	GND	-	-
7	LOCK	Digital output	Lock signal output pin Logic L :Unlock Logic H :Lock
8	ALM_N	Digital output	Alarm signal output pin Logic L : Abnormal Logic H : Normal

■Power Supply

Items	Symbol	Min	Typ	Max	Unit	Notes
VCC supply voltage	V_{CC}	4.75	5	5.25	V	-
VCC current consumption (at start up)	P_{WU}	-	-	4.5	W	-
VCC current consumption (at stable state)	P_{ST}	-	2.5	-	W	-

■232C Interface Signal

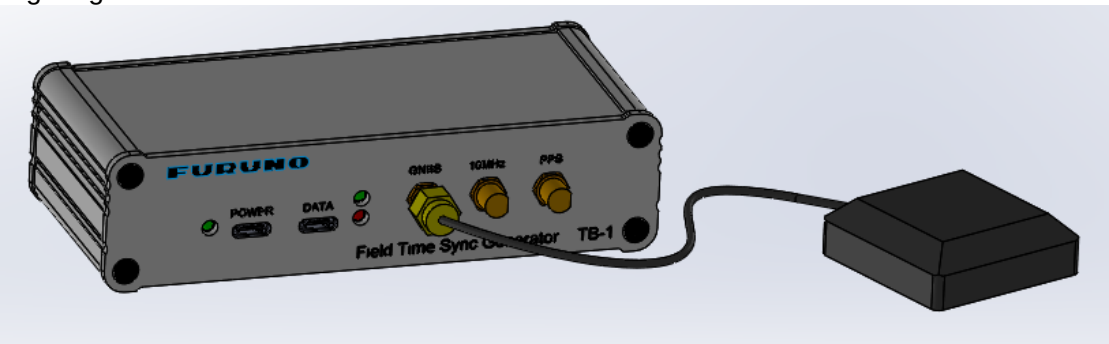
Items	Symbol	Min	Typ	Max	Unit	Notes
Low-Level input voltage	V_{RXD_IL}	0.6	1.2	-	V	-
High-Level input voltage	V_{RXD_IH}	-	1.5	2.4	V	-
Low-Level output voltage	V_{TXD_OL}	-5	-5.4	-	V	-
High-Level output voltage	V_{TXD_OH}	5	5.4	-	V	-
RXD input pull-down resistor	R_{RXD_PD}	3	5	7	kΩ	-

■Interface Signal

Items	Symbol	Min	Typ	Max	Unit	Notes
Low-Level output voltage	V_{OL}	-	-	0.44	V	I_{OL} = 24mA
High-Level output voltage	V_{OH}	3.8	5	-	V	I_{OH} = -24mA

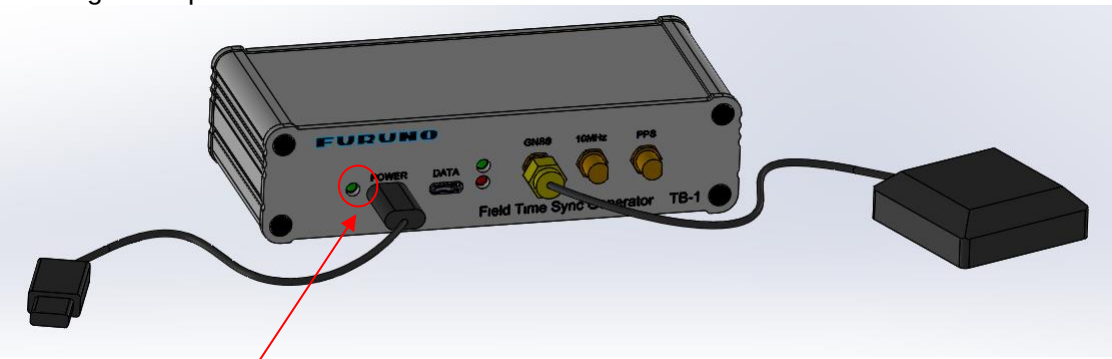
4 Getting started

1. Configuring the antenna



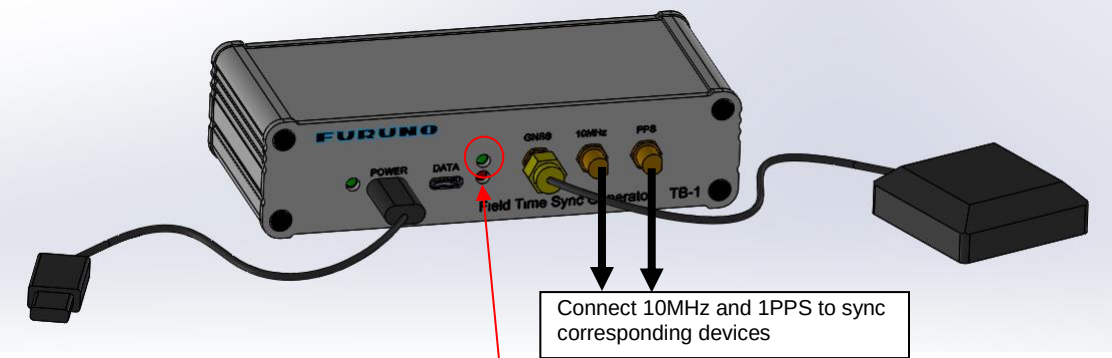
Connect the accessory antenna to the GNSS ANT of TB-1 unit.
Locate the antenna in an open sky condition. (Refer to Chapter 8. GNSS Antenna Installation)

2. Connecting to the power



Connect the included USB cable (TypeC connector) to the Power USB jack of TB-1, and TypeA connector to a USB power adapter.
※Power supply: DC5V 2A
※Power LED will illuminate.

3. Wait until Lock LED illuminates green.



In about 5 minutes after power-on, Lock LED(green) will illuminate and 10MHz & 1PPS becomes available to connect with the corresponding devices.

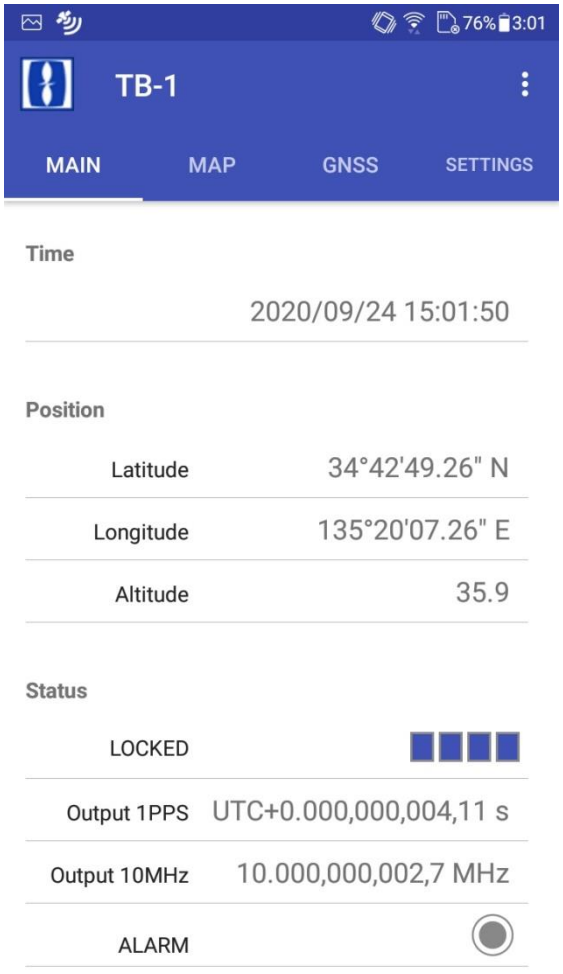
5 Checking TB-1 via Android™ App

TB-1 can communicate with an Android device. Check the status using FURUNO TB-1 App.

Download FURUNO TB-1 App (TB-1 App for Android™) and start.
FURUNO TB-1 App (TB-1 App for Android™) can be downloaded from Furuno website.
https://www.furuno.com/en/gnss/datadownload/

Connect DATA USB using TypeC-TypeC USB cable with Android device.

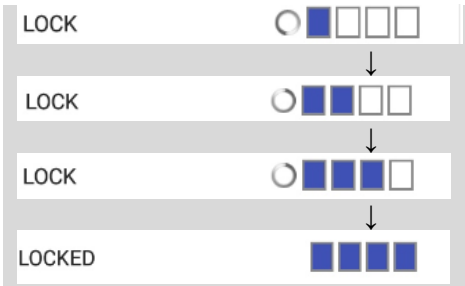
Main Screen



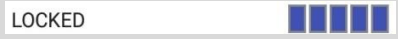
Current time
(displayed in the time zone of Android device)

Current location

Status

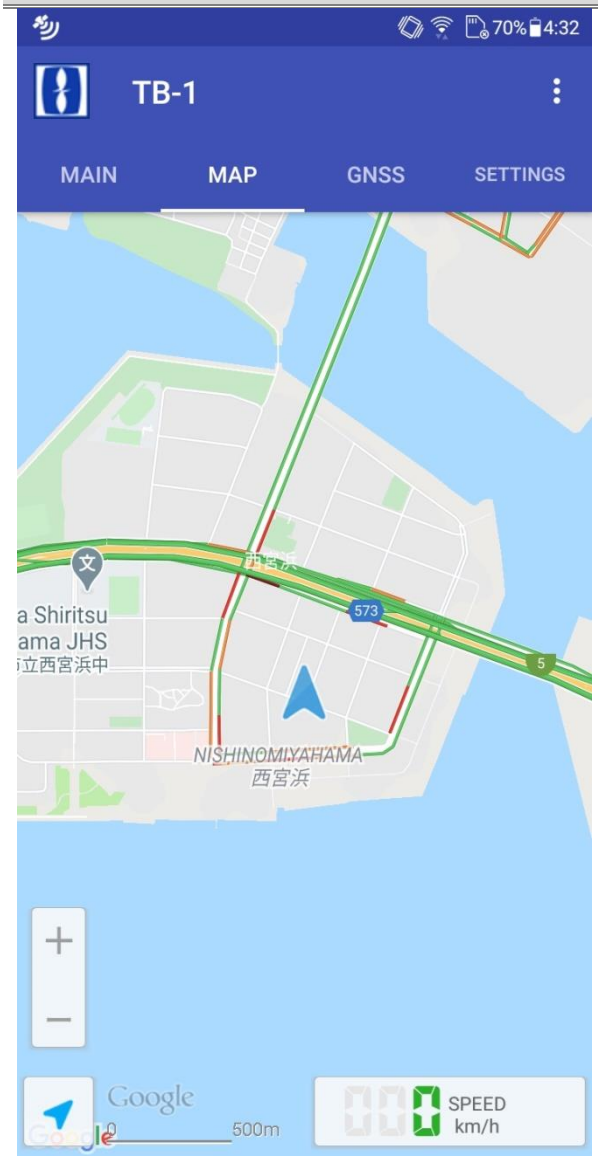


Status is indicated in 4 levels※. Only when all lights are activated, Lock LED illuminates on, indicating Locked status.
※"Measure atomic oscillator" mode requires 5 indicated levels

※ 

Output 1PPS: Displays the difference between 1 PPS output and UTC.
Output 10MHz: Displays the frequency of 10 MHz output.
ALARM: Displays the alarm status, which links with the ALARM LED on TB-1.

MAP Screen



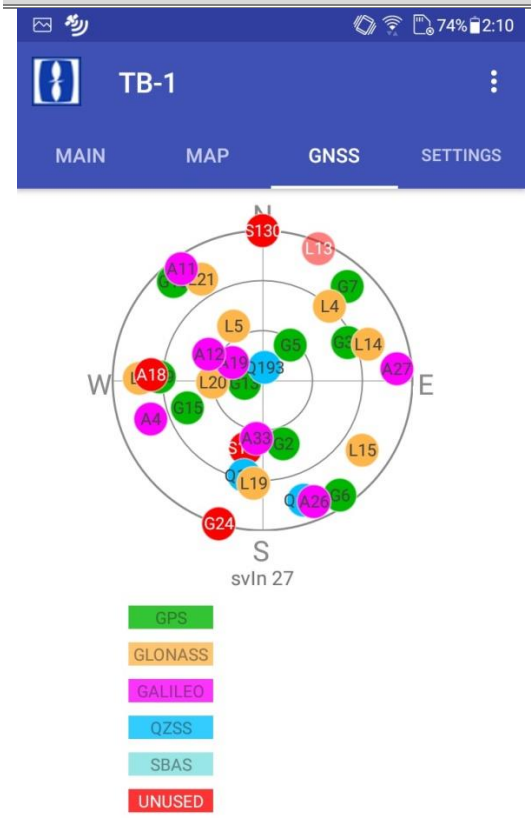
Current location

Click in the lower left, the current location will be displayed in the center.

Current speed

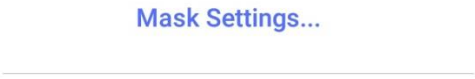
※A connection to the network is required to show the MAP screen.

GNSS Screen

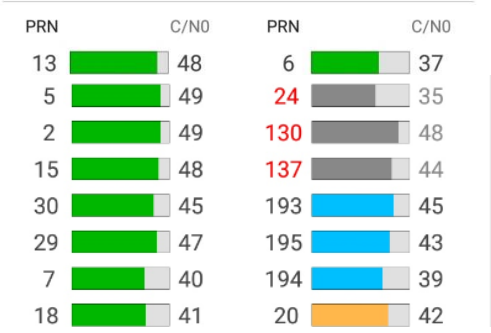


Status of GNSS satellite signal reception

Sky plot of GNSS satellite position.



Mask settings (refer to Chapter 6 Customization)

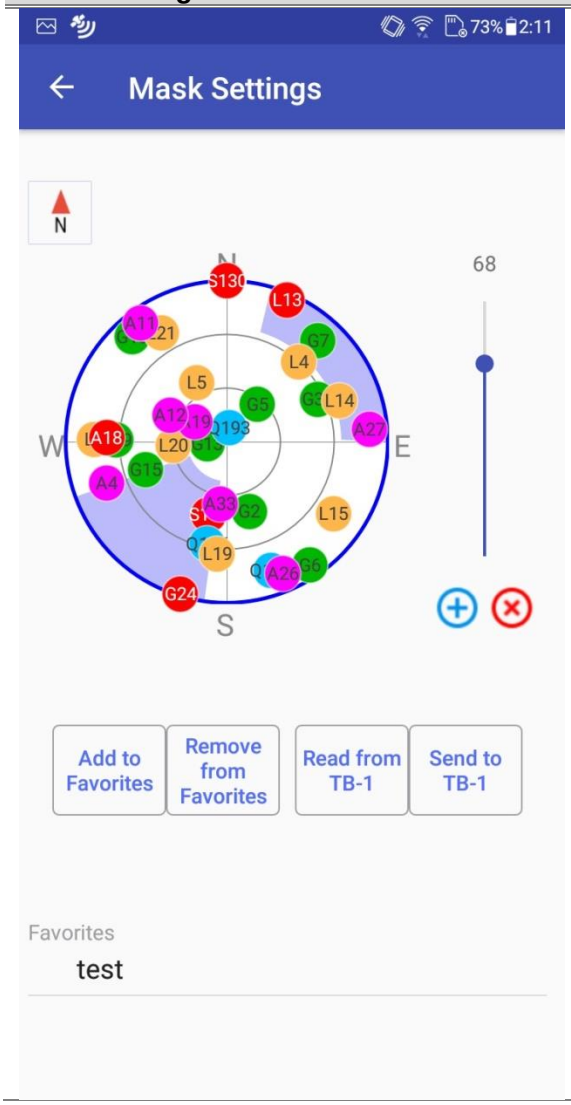


Displays the satellite number (PRN) and corresponding signal level (C/N0) of the GNSS satellite.

PRN in red indicates satellite numbers not used for positioning.

6 Customization

Mask Settings



Customize GNSS satellite mask from “Mask settings” menu.

If there is a tall building at a specific elevation or azimuth angle, the performance of TB-1 can be improved by disabling the use of those satellites for positioning.

Select “Read from TB-1” to show the current settings.

Choose a specific azimuth angle by tracing the perimeter of the sky plot, and adjust the elevation angle by drawing the bar next to the sky plot.

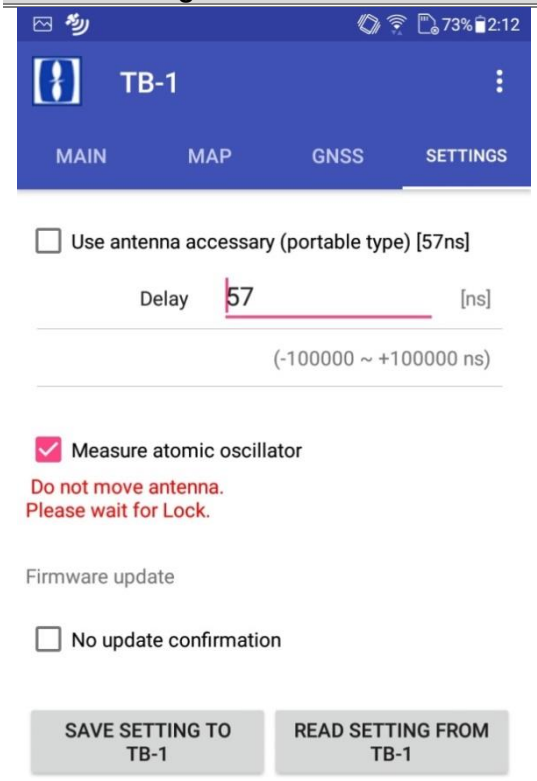
Click ⊕ to add new mask, or ⊗ to delete current mask.

Select “Send to TB-1” to apply the new settings.

Add/remove the mask settings from “Favorites”.

※The mask settings will be reset when power-off condition occurs.
※Add/remove the mask settings from “Favorites” needs internal storage access on Android device.

Other Settings



Uncheck “Use accessory antenna” checkbox when other specific antennas are preferred.
If optional antenna is used set the delay value according to the specific antenna and cable configuration. (NOTE: accessory antenna and cable delay value is 57ns)

Check “Measure atomic oscillator” checkbox to provide more precise frequency or time signals.

Above checkbox settings must be saved to TB-1. Select “SAVE SETTING TO TB-1” to save all.

※The delay value and “Measure atomic oscillator” mode settings will not be reset when power-off.

This Android app can update firmware for TB-1. Check “No update confirmation” if TB-1 does not need firmware update.

7 Troubleshooting

Problem	Solution
Does not operate.	Check Power LED. (Check the voltage and current of the power supply.)
Does not Lock.	It takes approximately 5 minutes after power-on in an open sky condition and additional 5 minutes when using “Measure atomic oscillator” mode. Check the antenna location and connections. Details refer to Chapter 8. GNSS Antenna Installation.
Cannot output 10MHz or 1PPS signal to the corresponding devices.	Check wiring of connecting cables. Check the impedance/voltage level of 10MHz・1PPS signal.
ARARM LED is displayed.	In case 10MHz or 1PPS is not available, it could be a malfunction, contact us for assistance. In case 10MHz or 1PPS output with Lock status, the device could be nearing the end of life, please replace with a new one.
Failed to connect to Android App.	Check if Android App is installed and run properly. Check if DATA USB properly connected with Android device..

8 GNSS Antenna Installation

In order to improve the reception of signals from GNSS satellites, GNSS antennas should be installed in an open sky condition. Open sky refers to an outdoor environment with a clear sky view and without obstacles along the entire periphery. GNSS signals may be reflected by buildings, trees, ground, etc., and reach the GNSS antenna through different paths, this is called multipath. It degrades the accuracy of GNSS poisoning, as well as the accuracy of time and frequency output from TB-1. It is therefore necessary to install the GNSS antenna in an open sky environment whenever possible.

In consideration of the multipath effect that can cause long wait times until Lock status, it is recommended to install the GNSS antenna in a place with a clear view. In particular when using “Measure atomic oscillator” mode which requires accurate GNSS positioning, it is strongly recommended that utmost care is exercised when selecting installation environment of the GNSS antenna.

In case of difficulty to install the GNSS antenna in an open sky environment (ex. indoor environment), it is better to install outside the window than near the window, particularly metalized glass windows. As viewed from the GNSS antenna, the signals from the direction of the building may have been affected by multipath, so it is recommended masking this heading (Mask Settings) to improve the accuracy of time and frequency output from TB-1.

Since the signals from GNSS satellite are extremely weak, RF noise may interfere via GNSS antenna and adversely affect the GNSS signal reception of TB-1. Avoid installing GNSS antenna near equipment emitting RF noise.

9 Others

9.1 Manufacturer

Furuno Electric Co. Ltd.
9-52 Ashihara-cho, Nishinomiya, Hyogo

9.2 Contact

Furuno Electric Co., Ltd.
System Products Division, Sales Department 1

Inquiry Form Link:
https://www.furuno.co.jp/en/contact/cnt_gps_e01.html

9.3 Warranty

The warranty term of this product is one year after delivery.

10 Specification

Items		Specification
Power Supply	Port	POWER USB / DATA USB
	Power	DC 5V 2A
Output 10MHz	Frequency	10MHz
	Power	6.5±1.5dBm Sine Wave
	Impedance	50Ω
	ADEV	< 5E-11(@τ=1s)
	Coherent to output 1PPS	Yes
Output 1PPS	Accuracy	< 40ns
	Stability	SDEV <4.5ns In conformity with PRTC-A / PRTC-B
	Edge	UP
	Impedance	50Ω
	Voltage	3.3V(LVCMOS)
Serial I/F	Port	DATA USB
	USB IC	FTDI FT230XS-U
	Speed	38400 bps
	Start / Data / Stop / Parity	1bit / 8bits / 1bit / None
	Character Codes	NMEA-0183 Ver.4.10 data based ASCII code
	Settings	Set via Android OS
LED		LOCK / ALARM / POWER
GNSS Reception Capability		GPS L1C/A, GLONASS L1OF, Galileo E1B/E1C, QZSS L1C/A, QZSS L1S, SBAS L1C/A
Antenna DC superimposed		3.3V
Time to Lock		< 5min
Size		141.0mm × 36.0mm × 60.0mm (Excluding the protruding parts)
Operating condition (Main Unit)	Operating Temperature	-40℃～+85℃
	Operating Humidity	Max 85%

Mouser Electronics

Authorized Distributor

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Kaga FEI:

TB-1KIT TB-1 (Main Unit only)