

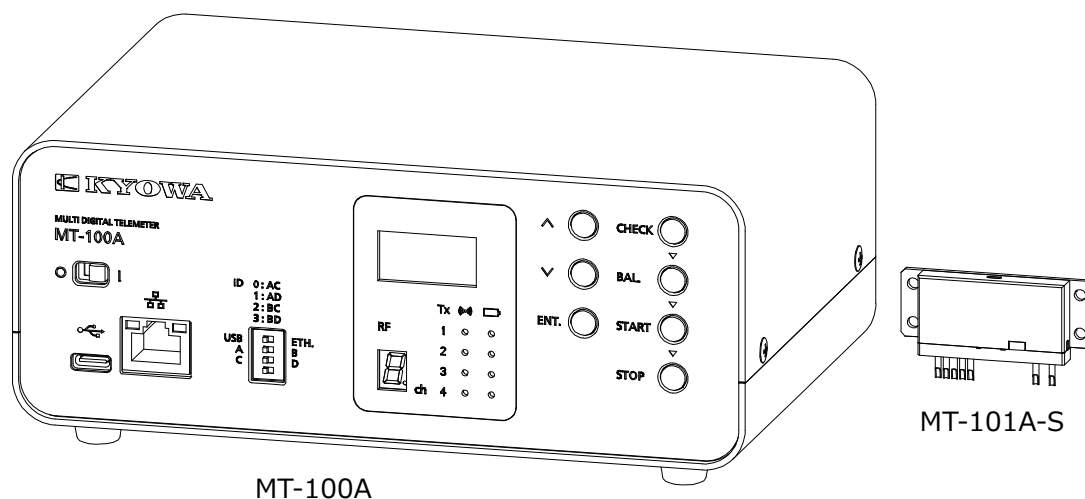
INSTRUCTION MANUAL

MT-100A Series

MULTI DIGITAL TELEMETER

Hardware Edition

Multi Digital Telemetry Receiver : MT-100A
Strain Transmitter : MT-101A-S



Business use only

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INTRODUCTION (PLEASE READ BEFORE USE)

ABOUT THIS DOCUMENT

Thank you for purchasing this KYOWA product.

This instruction manual (hereinafter referred to as **this document**) describes the hardware functions, usage methods, wiring methods and operating procedures for the MT-100A series (hereinafter referred to as **product**).

To ensure safe and proper use of this product, please read and fully understand this document before operation. After reading, keep it in a safe, accessible place for future reference.

Precautions in this document:

- Use this product as described in this document.
- The company names and product names described in this document are trademarks or registered trademarks of their respective companies.
- The copyright of this manual belongs to KYOWA ELECTRONIC INSTRUMENTS CO., LTD. Any unauthorized reproduction or copying of this document, in whole or in part, is strictly prohibited.
Copyright © KYOWA ELECTRONIC INSTRUMENTS CO., LTD.
- Please refer to our product website (<https://product.kyowa-ei.com/en>) for the latest information.
- The contents of this manual and the specifications of the main unit software may be changed without notice.

RELATED INSTRUCTION MANUALS

This product includes the following documents. Please refer to them according to your application.

Name	Content
MT-100A Series INSTRUCTION MANUAL Hardware Edition (This document)	The document is the instruction manual for the hardware of this product. It describes the hardware functions, usage method, wiring method, and operating procedure for this product
MT-100A Series INSTRUCTION MANUAL Control Command Edition	The document is the instruction manual for the control commands of this product. It describes a list and descriptions of the control commands used with this product.
MT-10A Control Software INSTRUCTION MANUAL	The document is the instruction manual for the control software (MT-10A). It describes the connection procedures, operating methods, and specifications for the software.
MT-100A Series PRECAUTIONS FOR USING WIRELESS PRODUCTS	The document is the precautions for using radio wave for the product. It describes precautions for using wireless communication and the certifications of usable countries for this product.
MT-100A Multi Digital Telemetry Receiver READ BEFORE USING THE PRODUCT	The document describes the pre-operation checks and the package contents to ensure the safe and proper use of the Multi digital telemetry receiver (MT-100A).
MT-101A-S Strain Transmitter READ BEFORE USING THE PRODUCT	The document describes the pre-operation checks and the package contents to ensure the safe and proper use of the strain transmitter (MT-101A-S).

ABOUT THE USER

- This product should only be used by someone with experience in using electrical measuring equipment who has understood the contents of this document and confirmed safety before using it
- If using this product without experience in electrical measuring instruments, always receive training from experienced personnel in electrical measurement. Alternatively, understand the contents of this document and confirm safety under the supervision of experienced personnel in electrical measurement before operation.
- If tasks are to be performed by non-native English speakers, the customer is responsible for providing education regarding worker safety and related tasks.

NOTATION IN THIS DOCUMENT

This document makes use of certain notations to ensure that this product is used properly, prevent injury to people, and prevent physical damage. The meanings of the notations are described below.

Hazard Levels (Signal Words)

The following signal words are used in this document to indicate product precautions.

Please be sure to read them.

 DANGER	Indicates that incorrect handling poses a high and imminent risk of death or serious injury to the user.
 WARNING	Indicates that incorrect handling poses a potential risk of death or serious injury to the user.
 CAUTION	Indicates that incorrect handling poses a potential risk of minor injury to the user.
NOTE	Indicates that incorrect handling poses a risk of property damage.

Symbols

In this document, the following symbols are used in addition to Signal Words (**DANGER**, **WARNING**, **CAUTION**, and **NOTE**) to make the safety information easier to understand.

The following symbols are mainly used in this document:

Symbol	Content
	Indicates content that prohibited actions.
	Indicates content that requires caution and warnings.
	Indicates content that must be strictly followed.

Notations Used in This document

Terms Used in This document

The following terms are used to refer to related products in this document.

- The MT-100A series is collectively referred to as **this product**.
- The MT-100A receiver of the MT-100A series is referred to as **receiver**.
- The MT-101A-S transmitter of the MT-100A series is referred to as **transmitter**.
- The MT-10A control software for the MT-100A series is referred to as **control software**.

Other Symbols Used in This document

The following symbols are used in this document.

Symbol	Content
	Indicates content that may be helpful as a reference for handling this product.
ENTER (Boxed text)	Boxed text in this document indicates the name of a push-button switch. Example: ENTER switch
[]	Names of setting items, menus, tabs, and buttons on the display or control software are enclosed in square brackets. Example: [OK] button.
" "	References to other parts of this document are enclosed in double quotation marks (" ") and function as links in this document. Example: For notation, please refer to "Notation in this document."
*	Indicates the presence of a footnote or annotation for a term or content, which is provided below it.

SAFETY PRECAUTIONS

Before using this product, please read the following precautions carefully.

PRECAUTIONS BEFORE USE

DANGER

Do not use this product in environments or for applications that are outside its product specifications.



This product is designed according to the contents of "10 PRODUCT SPECIFICATIONS". Using this product in environments or for applications that are outside its product specifications may cause accidents or malfunctions.

This product must be used by persons experienced with electrical measuring instruments who understand the contents of this document and have confirmed all safety procedures.



Incorrect use of this product can lead to personal injury (death, injury), or damage to the device and sensors.

WARNING

If this product is to be used by persons without experience in electrical measuring instruments, they must receive training from an experienced person or use it under the supervision of an experienced person, after understanding the contents of this document and confirming all safety procedures.



If used by persons without electrical knowledge, there is a risk of fire, electric shock, and personal injury (death, injury).

PRECAUTIONS REGARDING THE SURROUNDING ENVIRONMENT

DANGER

Do not use this product in locations with flammable gases, flammable vapors, or flammable dust.



If this product is used in a flammable environment, it can cause fire or explosion.

Do not use this product on or near combustible materials.



If this product is used on or near combustible materials, it can cause a fire due to heat generation.

! DANGER**Do not use this product in a location with corrosive gases.**

Performance degradation caused by corrosive gases can lead to damage and electric shock. Furthermore, if parts scatter as a result of this degradation, it can cause personal injury (death, injury).

! WARNING**Do not use this product in an environment where it may be splashed with water.**

This product does not have waterproof or drip-proof functions. If liquid such as water enters this product, it may lead to malfunction or electrical leakage.

NOTE**When using this product in an environment with rapid changes in ambient temperature and humidity, confirm that there is no condensation before use.**

Rapid changes in ambient temperature and humidity, such as during transport, can cause condensation. If liquid enters this product, it can lead to performance degradation or malfunction. When using this product in such an environment, confirm that no condensation is present before turning on the power.

When using or storing this product near the sea, take measures to block the outside air.

Salt from seawater can cause performance degradation or malfunction. When using or storing near the sea, take measures to block the outside air.

Do not use this product under loads (such as vibration, shock, and centrifugal acceleration) that are outside its specified range.

Continuous loads (such as vibration, shock, and centrifugal acceleration) outside the specified range can cause performance degradation or malfunction. Please be particularly cautious when using this product in environments with significant loads. Additionally, when using in an environment with loads, please secure both the housing and the connecting cables.

Do not install or use this product near a welding machine.

This can cause this product to operate outside its temperature range, leading to output abnormalities, malfunction, or failure.

NOTE**Do not use under high or low pressure environments.**

This product is designed for use under standard atmospheric pressure. Use outside of standard atmospheric pressure can cause malfunction, performance degradation, or failure. Please use at an altitude of 2000 m or less.

**Do not use or store in environments exposed to dust or powder.**

If dust or powder enters the interior of this product, it may lead to performance degradation or malfunction.

PRECAUTIONS REGARDING PRODUCT HANDLING**WARNING****The GND terminal of this product must be grounded**

Failure to ground may lead to electric shock, performance degradation, or malfunction.

**If abnormalities (such as smoke, strange odors, or unusual sounds) occur, turn off this product's power.**

Continuing to use this product in an abnormal state can lead to electric shock, fire, performance degradation, or malfunction. After turning off the power due to an abnormality, disconnect all cables connected to this product and discontinue use.

**When connecting this product to an external system, thoroughly verify the system's operation before use.**

An output abnormality from this product could cause unexpected behavior in the external system, leading to accidents or damage to peripheral equipment. To prevent such behavior, thoroughly verify the system's operation before use.

**Wire each connector and adapter to prevent short circuits and miswiring.**

Short circuits or miswiring of connectors and adapters may lead to fire or malfunction. When wiring, use a multimeter or similar tool to confirm that there are no miswirings or short circuits.

**Connect or disconnect cables only when the power to this product and all connected devices is turned OFF.**

Connecting or disconnecting cables while the power is on may lead to fire, electric shock, performance degradation, or malfunction of this product. When connect or disconnect cables only when the power to this product and all connected devices is turned OFF.

**WARNING**

Do not use this product outside the input power voltage range specified in this product.



Operating this product with a power voltage outside the specified range may lead to electric shock, fire, or malfunction. Before connecting the power supply, always confirm that its voltage is within this product's specified range. Furthermore, power voltages outside the specified range due to instantaneous power outages or noise can cause performance degradation, malfunction, or failure.

Do not disassemble or modify this product.



Doing so may lead to fire, electric shock, or malfunction. It will also void the warranty. If this product requires repair, contact our sales office, the nearest distributor, or our website

NOTE

Before touching this product, touch a metal object to discharge static electricity.

Static electricity may cause a malfunction of this product and its peripheral equipment.



After turning off the power to this product, please wait at least 5 seconds before turning it back on.

If this product is restarted immediately after turning off the power, the voltage of the internal circuit does not fall sufficiently, and it causes abnormal operation, performance degradation, and a failure of the product. When turning on the power again, please wait at least 5 seconds after turning it off before turning it back on.

PRECAUTIONS REGARDING INSTALLATION

DANGER

When installing, operating, and removing this product from a system, be sure to confirm the following before use.

Improper installing methods for this product can cause it to detach and scatter due to system operation (vibration, shock, rotational loads, etc.), leading to personal injury (death, injury), or the damage and destruction of equipment and sensors. For safety, confirm the following when installing, operating, and removing the product from a system:



- When installing, removing, or repairing, turn off the power to all related equipment, including the object to which this product is attached.
- Before starting the system, after replacing parts, after a malfunction, and after a long period of inactivity, confirm that the transmitter, battery, transducer, or strain gauge and their wiring will not detach under the loads of system operation (vibration, shock, rotation, etc.).
- As a safety measure against flying parts, install protective covers to prevent scattering.

If operating this product for a long period, periodically check the mounting condition and replace the bolts.



During long-term operation, bolts may loosen and deteriorate due to aging. This can cause this product to become detached and scatter, leading to personal injury (death, injury), or the damage and destruction of equipment and sensors.

If installing this product in a high location, take measures to prevent it from falling.



If this product is installed at a high location, the falling of the main unit, antenna, or mounting parts can lead to personal injury (death, injury), or the damage and destruction of equipment and sensors. Take measures to prevent this product from falling. Also, check the area below the installation site and install it in a safe location.

If installing this product in a high-load environment, use a threadlocker.



If this product is installed in a high-load environment, the bolts loosen and deteriorate due to rotary motion, vibration, and repeated impact. As a result, this product flies off, causing death and injuries, as well as failure and damage to the device and sensors. To suppress screw loosening caused by vibration and impact and prevent the detachment of this product and related parts when installing it in a high-load environment, always use a threadlocker.

** DANGER**

Do not install this product under conditions other than those specified.



If installed under non-specified conditions, this product may become detached and scatter, which can lead to personal injury (death, injury), or the damage and destruction of equipment and sensors, especially in environments with strong loads (vibration, shock, centrifugal acceleration, etc.).

** CAUTION**

When performing installation and maintenance, always wear protective gloves.

To prevent injuries from the edges, screw holes, and machined burrs of this product when performing installation and maintenance, always wear protective gloves.

PRECAUTIONS REGARDING BATTERY USE** DANGER**

When using batteries, understand the contents of the battery's instruction manual and confirm safety before use.

Improper use of batteries can result in fire, electric shock, and personal injury (death, injury). The batteries must be used in accordance with their instruction manual.



Do not use the included battery case in an environment with loads (vibration, shock, centrifugal acceleration, etc.).

The included battery case is for operational checks only. It is not designed to withstand vibration, shock, or centrifugal acceleration. In an environment with strong loads (vibration, shock, centrifugal acceleration, etc.), if it scatters, it can lead to personal injury (death, injury), or damage and destruction of the equipment and sensors. Also, in such an environment, the transmitter's power may suddenly turn off.

! WARNING**Use the batteries within the operating temperature and humidity range specified by the battery manufacturer**

Using batteries outside their operating temperature range can lead to performance degradation, leakage, heat generation, or rupture, which may result in injury or equipment malfunction.

**When connecting to this product, pay attention to the polarity and connect the + (plus) and - (minus) terminals correctly.**

Connecting batteries with reversed polarity can lead to leakage, heat generation, or rupture, and may result in injury or equipment malfunction. Ensure the connection is correct before proceeding.

**When connecting batteries in parallel, use measures such as diodes to prevent unintentional charging.**

Since individual batteries have variations in output voltage, connecting them directly in parallel can lead to leakage, heat generation, rupture, injury, or equipment malfunction. When connecting batteries in parallel, use measures such as diodes to prevent unintentional charging.

NOTE**When storing this product, remove the batteries.**

If this product is stored for a long period with the batteries installed, damage from leakage and corrosion may occur. When this product will not be used for an extended period, remove the batteries before storage.

PRECAUTIONS REGARDING WIRELESS COMMUNICATION**! DANGER****Never use this product in areas of medical institutions where wireless equipment is prohibited, or near medical electrical equipment such as pacemakers.**

The radio waves from this product can cause medical equipment to malfunction, which can lead to personal injury.

**Never use this product in aviation facilities or on aircraft.**

The radio waves from this product can cause aviation equipment to malfunction, which can lead to personal injury and damages.

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GENERAL PRECAUTIONS FOR USE

FOR CORRECT USE

- This product was designed according to the information in "10 PRODUCT SPECIFICATIONS". Do not use this product in environments or for purposes outside of specifications.
- To ensure correct use, periodic maintenance and calibration are recommended. For details, please refer to "MAINTENANCE AND INSPECTION".

PRECAUTIONS REGARDING THE SURROUNDING ENVIRONMENT

- This product is designed to operate within the following temperature and humidity ranges. Please use this product within the specified temperature and humidity ranges.

Model	Operating Temperature Range	Operating Humidity Range
MT-100A	0 to 50 °C	20 to 85 % (non-condensing)
MT-101A-S	-25 to 100 °C	20 to 85 % (non-condensing)

- This product is intended for indoor use. It is designed to be used normally and safely indoors.

PRECAUTIONS REGARDING PRODUCT HANDLING

- This product is designed to operate at the following power supply voltage. Please use this product within the specified power supply voltage input range.

Model	Power Supply Voltage Range
MT-100A	10 to 30 VDC
MT-101A-S	2.2 to 4.4 VDC

PRECAUTIONS REGARDING WIRELESS COMMUNICATION

- The wireless communication of this product uses the same 2.4 GHz frequency band as wireless LAN, Bluetooth®, and microwave ovens. Devices on the same frequency band as this product's wireless communication can cause mutual radio interference. This interference may reduce communication stability or affect the operation of other devices.
- The use of radio waves requires certification in each country. For details on usable countries and regions, please refer to "PRECAUTIONS FOR USING WIRELESS PRODUCTS". Use in countries other than those specified is a violation of the law and may be punishable.
- The wireless LAN and Bluetooth® capabilities of a PC on which this product's dedicated control software is installed can also be a source of interfering radio waves. When operating this product using a PC, please disable the wireless LAN and Bluetooth® on your computer.

SYMBOLS ON THIS PRODUCT

Symbols on The Receiver

The receiver displays the following symbols on this product.

Symbol	Content
	Indicates Caution. For areas with this symbol, be sure to refer to the relevant section of the instruction manual (this document) before use.
	Indicates power ON.
	Indicates power OFF.
	Indicates direct current (DC).
	Indicates a ground terminal.

7-Segment Display Notation on the Receiver

The receiver displays 7-segment characters as follows.

0	1	2	3	4	5	6	7	8	9
									

A	B	C	D	E	F				
									

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MAINTENANCE AND INSPECTION

LIFE-LIMITED PARTS

Limited-life parts will deteriorate or become worn depending on factors such as usage frequency, operating time, and usage environment (temperature, humidity, etc.). If left unchecked, this could cause reduced performance, malfunction, or failure.

For the replacement of limited-life parts, please contact our sales office, your nearest distributor, or visit our website.

Item	Service life
OLED Display	The service life of the OLED display is <u>approximately 4 years</u> , depending on usage frequency and operating temperature. Replacement is performed at KYOWA.
Internal memory	The service life of the internal memory is <u>approximately 10 years</u> , depending on usage frequency and operating temperature. Replacement is performed at KYOWA.
AC adapter	The service life of the AC adapter is <u>approximately 5 years</u> , depending on usage frequency and operating temperature. Replace the AC adapter every 5 years.

MAINTENANCE INSPECTIONS

Regular maintenance and inspections of this product are recommended.

To ensure stable long-term use of this product, periodic inspections and part replacement are necessary. For replacement of limited-life parts or system calibration, please contact our sales office, nearest distributor, or visit our website.

Item	Service life
Operation confirmation and calibration	Periodic inspections are recommended <u>once a year</u> to ensure the proper operation of this product. Periodic inspections are performed at KYOWA.

ABOUT PRODUCT REPLACEMENT

Periodic maintenance and part replacement are effective for maintaining the performance of this product and ensuring stable operation. However, replaceable parts are limited, and these measures cannot prevent the overall deterioration of the product caused by aging over long periods of use. The rate of deterioration varies depending on the operating environment and usage frequency.

If any of the following conditions are observed, it indicates that the product is deteriorating due to aging. For safety reasons, replacement of the product is strongly recommended.

- The frequency of failures or repairs has increased compared to the past.
- The performance of this device has noticeably declined.
- Abnormal noises or vibrations occur during operation.

CONTACT INFORMATION FOR EMERGENCIES OR ABNORMALITIES

In the unlikely event that an abnormality occurs in this product, please contact the sales office where you purchased the product, your nearest distributor, or visit our website.

The following URL is for our website.

<https://www.kyowa-ei.com/en/corporate/location-information>



CONTACT INFORMATION
FOR EMERGENCIES OR ABNORMALITIES

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1. PRODUCT OVERVIEW

1-1. PRODUCT OVERVIEW

This product is a telemeter that enables measurement via wireless communication when wired connection to a sensor is difficult (e.g., measuring torque on a rotating shaft, or when wiring to a sensor is challenging).

One receiver can be wirelessly connected to four transmitters simultaneously. Furthermore, by using the inter-receiver synchronization function, simultaneous measurement with up to 16 transmitters is possible.

The transmitter can be used even in harsh environments and conditions (vibration and shock resistance, installation in tight spaces, wide operating temperature range, etc.).

Features

- Small, thin, and robust transmitter
- Transmitter operable at high temperatures (100 °C)
- One receiver can be wirelessly connected to up to four transmitters simultaneously
- By synchronizing receivers, the system can be expanded to allow synchronized measurement using up to 16 transmitters
- Long communication distance
- Long-term measurement
- Measurement is possible without a PC, except for settings

1-2. PACKAGE CONTENTS

The following standard accessories are included with this product.

After opening the package, please confirm that all accessories are present.

MT-100A Multi Digital Telemetry Receiver

Name	Quantity
Multi digital telemetry receiver (MT-100A)	1
Receiving antenna (W1030)	2
Error output terminal block (1714964)	1
USB cable Type C – Type A (N-141)	1
Ground wire (P-72)	1
MT-100A Receiver READ BEFORE USING THE PRODUCT	1
MT-100A Series PRECAUTIONS FOR USING WIRELESS PRODUCTS	1
Product Warranty	1

MT-101A-S Strain Transmitter

Name	Quantity
Strain Transmitter (MT-101A-S)	1
4G MT Adapter (MT-AD-S1) *1	1
Pan head screw (Size 0, Type 1, M2x4) *1	1
Battery holder (For AAA Cellx2) (SBH4211AS)	1
MT-101A-S Strain Transmitter READ BEFORE USING PRODUCT	1
MT-100A Series PRECAUTIONS FOR USING WIRELESS PRODUCTS	1
Product Warranty	1
*1. Attached to the transmitter body	

1-3. OPTIONAL ACCESSORIES

The optional accessories for this product are as follows.

MT-100A Multi Digital Telemetry Receiver

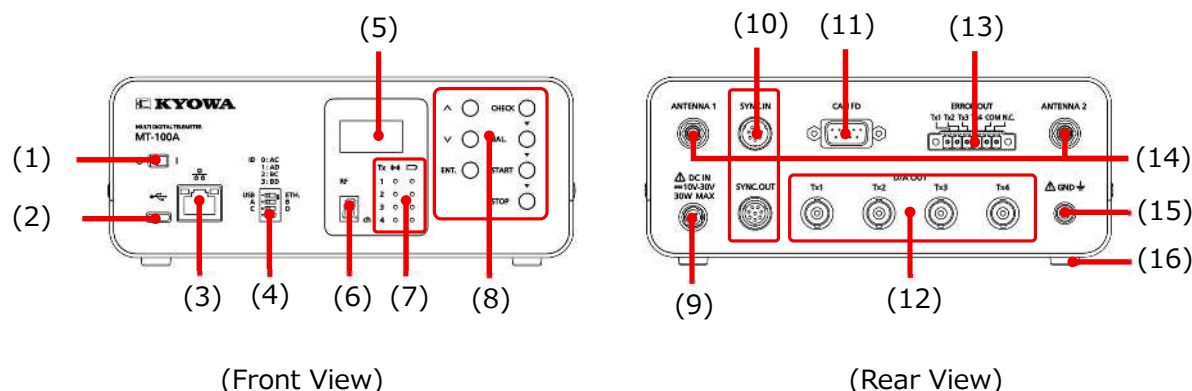
Name	Model
AC adapter	UNI318-1215-HR10
AC power cable (Japan) *2	P-38
AC power cable (USA) *2	P-39
AC power cable (India) *2	P-40
AC power cable (Thailand)*2	P-42
AC power cable (China) *2	P-43
AC power cable (Taiwan) *2	P-44
DC power cable	P-81
BNC - BNC cable (Red)	U-08
BNC - BNC cable (Black)	U-59
CAN cable D-Sub9 - D-Sub9	N-102
MT sync cable	N-140
MT sync extension cable	N-143
USB cable TypeC – TypeC	N-142
LAN cable (20 m)	NWYC5E-STP-S-BL-20
LAN cable (50 m)	LD-CTTBU500
Small Planar Antenna	EXT-ANT1
Diversity Planar Antenna	EXT-ANT2
Dual-Polarization Antenna	EXT-ANT7
Receiver Extension Cable (2 m)	E-02
Receiver Extension Cable (6 m)	E-03
*2. Please select according to the country or region of use.	

MT-101A-S Strain Transmitter

Name	Model
1G2W MT Adapter (120Ω) *3	MT-AD-S2-120
Battery Kit *4	MT-BK
S32-7 to 4 conductors with shield wire, bared at the tip cable (10cm)	N-97
*3. Includes a pan head screw (Size 0, Type 1, M2x4) for transmitter installation. *4. Includes a hexagon socket head cap screw (M2.5x5) for transmitter installation.	

1-4. NAMES AND MAIN FUNCTIONS OF EACH PART

1-4-1.MT-100A Receiver



- | | | |
|--|---|--|
| (1) Power Switch | : | Operate the power. (O :OFF, I :ON). For details, please refer to "2-4-1 Turning on the Receiver Power". |
| (2) USB Connector
(USB Type-C) | : | Connects a USB cable for USB communication. For details, please refer to "6-1 USB Connection" for details. |
| (3) LAN Connector (RJ-45) | : | Connects a LAN cable for Ethernet communication. For details, please refer to "6-2 LAN Connection". |
| (4) Receiver Setting Switch | : | Sets the communication interface and receiver ID. For details, please refer to "2-1-1 Receiver Setting Switch Settings". |
| (5) Display | : | OLED display. |
| (6) RFCH Display | : | Displays the RFCH (Wireless Frequency Channel) set on the receiver. |
| (7) Transmitter Status LED | : | Displays the wireless signal level and power voltage level of the transmitters. For details, please refer to "About the Transmitter Status LED". |
| (8) Control Switches | : | Used to operate the main unit. For details, please refer to "About the Control Switches". |
| (9) Power Connector | : | Connects an AC adapter or DC power cable. For details, please refer to "2-1-2 Connecting To The Power Connector". |
| (10) Synchronization Signal
Connector | : | Connects the MT sync cable when using the inter-receiver synchronization function. For details, please refer to "2-1-7 Connecting To The Synchronization Signal Input/Output Connector". |

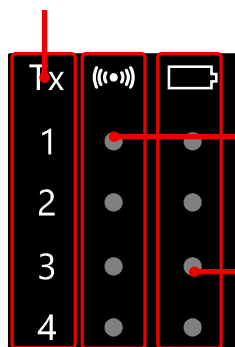
- (11)CAN Output Connector : Connects a CAN cable when using the CAN output function.
(D-Sub 9-Pin) For details, please refer to "2-1-6 Connecting To The CAN Output Connector (D-Sub 9-Pin)".
- (12)Analog Output Connector (BNC) : Connects a BNC cable when using the analog output function. for details, please refer to "2-1-4 Connecting To The Analog Output Connector".
- (13)Error Output Connector : Connects the included terminal block when using the error output. For details, please refer to "2-1-5 Connecting To The Error Output Connector".
- (14)Antenna Connector : Connects the specified antenna. For details, please refer to "2-1-3 Connecting To The Antenna Connector".
- (15)GND Terminal : Connects the ground wire (accessories).
- (16)Rubber Feet : Removing the rubber feet reveals utility nuts (threaded holes) for fixing the receiver. For details, please refer to "7-6 UTILITY NUTS".

1-4-1-1. About the Transmitter Status LED

The transmitter status LED displays the wireless signal level and power voltage level for each paired transmitter (Tx1 to Tx4).

Number of transmitter

Number of paired transmitter (Tx1 to Tx4)



Wireless Signal Level LED

Displays the radio signal level of each transmitter.

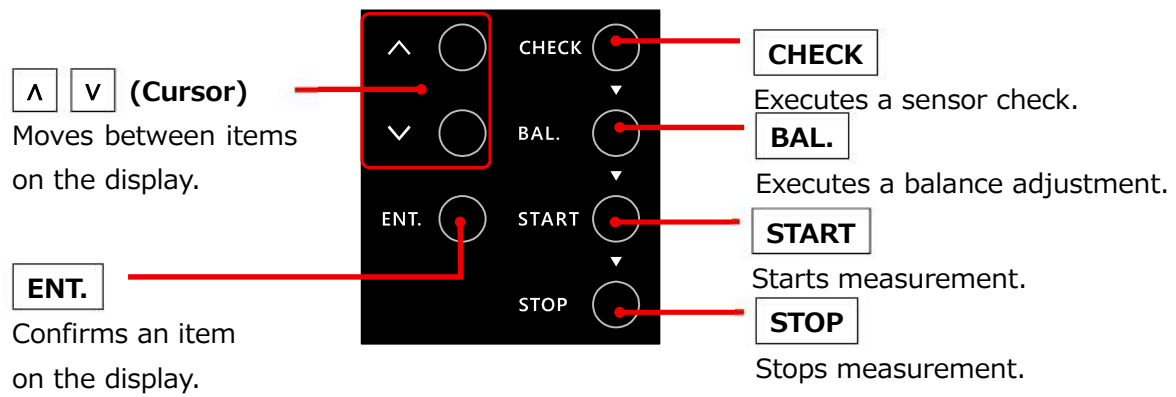
Power Voltage Level LED

Displays the power voltage level of each transmitter.

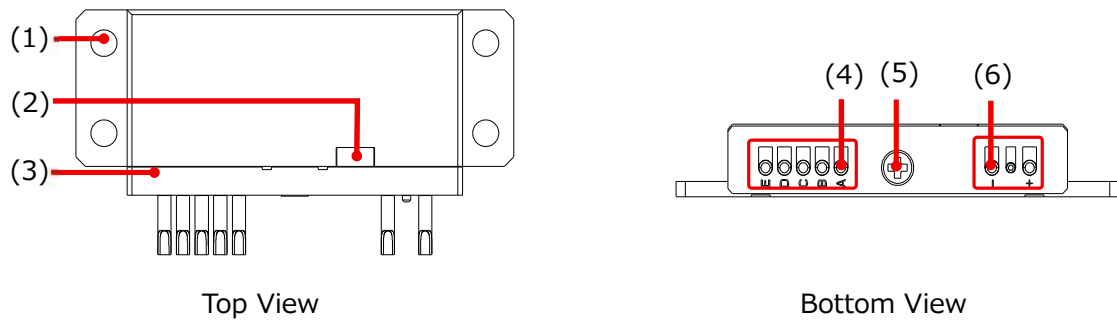
LED Display			Wireless Signal Level LED		Power Voltage Level LED
	Green on		Good		2.40 V or higher
	Orange on		Medium		2.39 to 2.30V
	Red on		Weak		2.29 to 2.20V
	Off		No signal		Less than 2.20 V

1-4-1-2. About the Control Switches

The control switches execute display operations and various functions with a single press.



1-4-2.MT-101A-S Strain Transmitter



- (1) Mounting Hole : Used for securing the transmitter body with bolts. For details, please refer to "2-3 TRANSMITTER INSTALLATION".
- (2) Status LED : Displays the status of the transmitter. For details, please refer to "About the Status LED".
- (3) MT Adapter : An adapter for wiring connections. For details, please refer to "2-2-1 Connecting to the MT Adapter".
- (4) Sensor Input Pins : Connect sensor output wires by soldering. For details, please refer to "2-2-1-4 Connecting to the Sensor Input Pins".
- (5) MT Adapter Fixing Screw : A screw for fixing the adapter.
- (6) Power Input Pins : Connects the power supply. For details, please refer to "2-2-1-3 Connecting to the Power Input Pins".

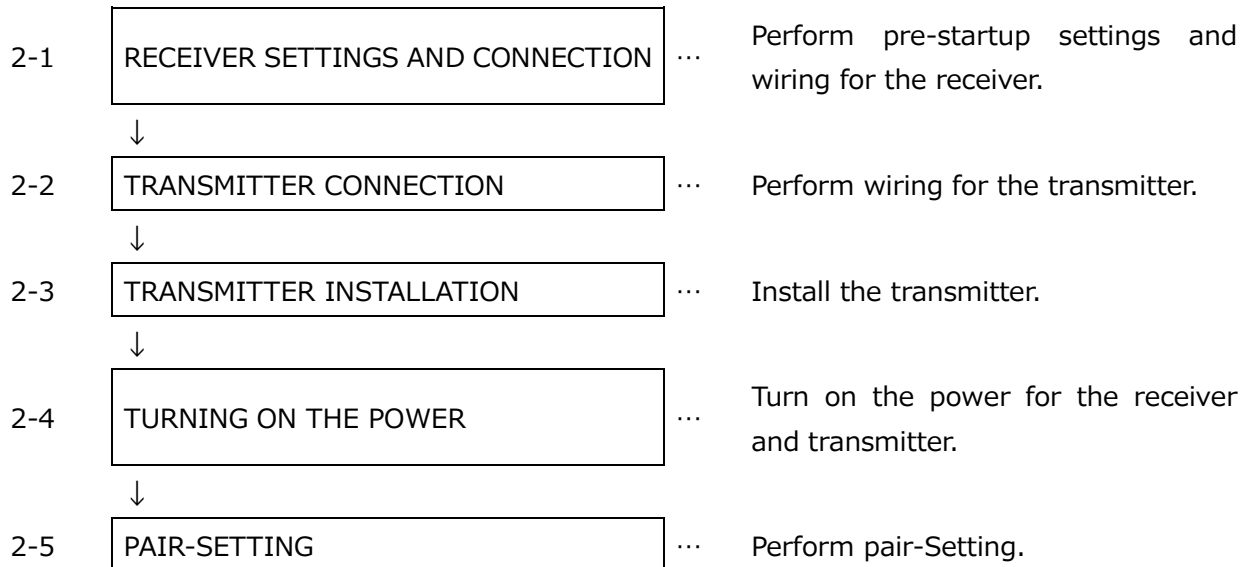
1-4-2-1. About the Status LED

The status LED lights up blue according to the transmitter's status.

Status LED Display	Transmitter Status
	Standby State
	Processing or Pre-Sleep State
	Measuring State
	Sleep State
	Power OFF or Low Voltage

2. PREPARATION BEFORE MEASUREMENT

The following flowchart shows the preparation steps before measurement.



2-1. RECEIVER SETTINGS AND CONNECTION

2-1-1. Receiver Setting Switch Settings

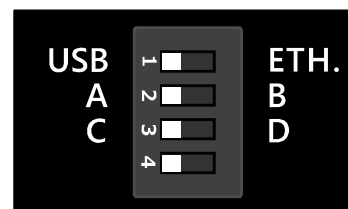
The receiver setting switch sets the receiver's communication interface and receiver ID. Before turning on the power, set the switch according to the function to be used. The switch settings are read when the receiver starts up.



- When using the inter-receiver synchronization function, do not set the same receiver ID within the system. If identical receiver IDs exist within the system, the control commands and control software will not operate correctly. For details on the receiver synchronization function, please refer to "7-5 INTER-RECEIVER SYNCHRONIZATION FUNCTION".
- Do not toggle the receiver setting switch after turning on the power to the receiver. Changing the switch position after the power is turned on causes the receiver to malfunction. To change the receiver setting switch, turn off the power, toggle the switch, and then turn the power back on.

The layout of the receiver setting switches is as follows:

Number	Content
1	USB/LAN Connection Switch
2	Receiver ID Setting Switch
3	Receiver ID Setting Switch
4	Reserve



Connection Interface Setting

Set the USB/LAN connection switch according to the connection interface to be used.

Connection Interface	USB/LAN Connection Switch	
USB Connection	USB	
LAN Connection	ETH.	

Receiver ID Setting

If the inter-receiver synchronization function is not used, set the receiver ID to 0 (MAIN). If the inter-receiver synchronization function is used, set the receiver ID setting switch to the desired ID. For details on the inter-receiver synchronization function, please refer to "7-5 INTER-RECEIVER SYNCHRONIZATION FUNCTION".

MAIN/SUB	ID	Receiver ID Setting Switch	
MAIN	0	AC	
SUB1	1	AD	
SUB2	2	BC	
SUB3	3	BD	

2-1-2.Connecting To The Power Connector

The power connector is used to connect an AC adapter (optional accessories) or a DC power cable (optional accessories).

When using an AC adapter

When using an AC adapter, connect the AC adapter and AC power cable (optional accessories), and plug it into an outlet.



WARNING

Do not use the AC adapter outside its rated input power voltage range.



Operating the AC adapter outside its rated input power voltage range can cause electric shock, fire, or malfunction. Before connecting the power supply, always confirm that the voltage is within the AC adapter's rated input range.

Use an optional AC power cable that is compatible with the country or region of use.



AC outlet voltages and frequencies vary by country and region. Using an incompatible AC power cable can lead to fire or electric shock. Please use an optional AC power cable that is compatible with the country or region of use.

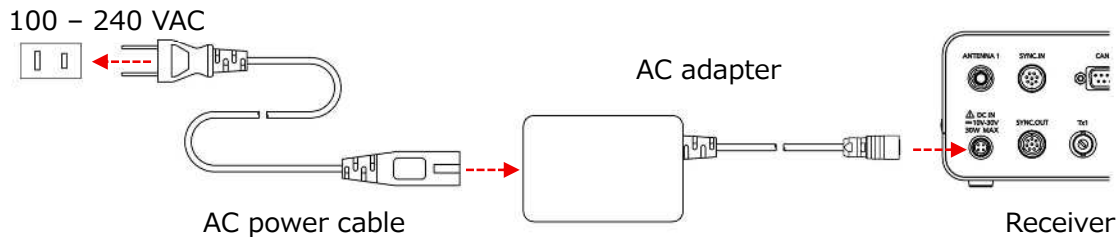


- In environments where noise-generating equipment such as induction motors or electric welders are used, there may be significant noise and poor power conditions. Use an isolation transformer or a commercially available noise-cut transformer to mitigate noise.

The power ratings for the AC adapter (optional accessories) are as follows:

Rated Input Power Voltage	: 100 to 240 VAC
Allowable Input Voltage Fluctuation Range	: 90 to 264 VAC
Rated Input Power Frequency	: 50 / 60 Hz
Allowable Input Frequency Fluctuation Range	: 47 to 63 Hz
Maximum Input Current	: 0.28 A
Rated Output Voltage	: 12 V
Rated Maximum Output Current	: 2 A

- (1) Confirm that the receiver's power switch is OFF.
- (2) Connect the AC power cable to the AC adapter.
- (3) Connect the AC adapter's plug to the power connector.
- (4) Plug the AC power cable into an outlet.



When using a DC power cable

When using a DC power cable, connect the DC power cable (optional accessories) to the receiver and to an external DC power supply.

! WARNING

Do not use the receiver outside the input power voltage range specified in this product specifications.



Operating the receiver with a power voltage outside the specified range can lead to electric shock, fire, or malfunction. Before connecting the power supply, always confirm that its voltage is within this receiver's specified range. Furthermore, power voltages outside the specified range due to instantaneous power outages or noise can cause performance degradation, malfunction, or failure.

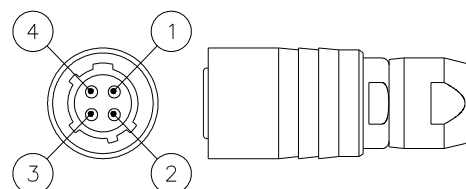


When wiring the DC power cable, confirm that the power polarity (+/-) is connected correctly.

Connecting the DC power cable to the receiver with reversed polarity can cause electric shock, fire, or malfunction. Before connecting to the receiver, confirm that the DC power cable is connected correctly.

The pin assignment and signals for the power connector plug are as follows:

Pin Number	Signal Name
1	Plus (+) Power
2	Plus (+) Power
3	Minus (-) Power
4	Minus (-) Power

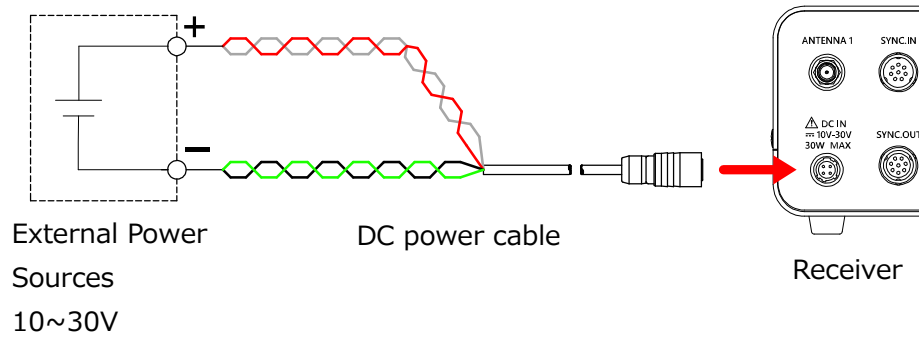


Connector Model : HR10-7P-4S(73)

Manufacturer : HIROSE

PREPARATION BEFORE MEASUREMENT

- (1) Confirm that the receiver's power switch is OFF.
- (2) Connect the DC power cable's plug to the power connector.
- (3) Connect the bare wire end of the DC power cable to a DC power supply.



2-1-3.Connecting To The Antenna Connector

Connect an antenna (standard accessories or optional accessories) to the receiver.



- Do not connect any antenna other than the included and optional antennas. Doing so may violate radio laws and be punishable. The usable antennas are as follows:

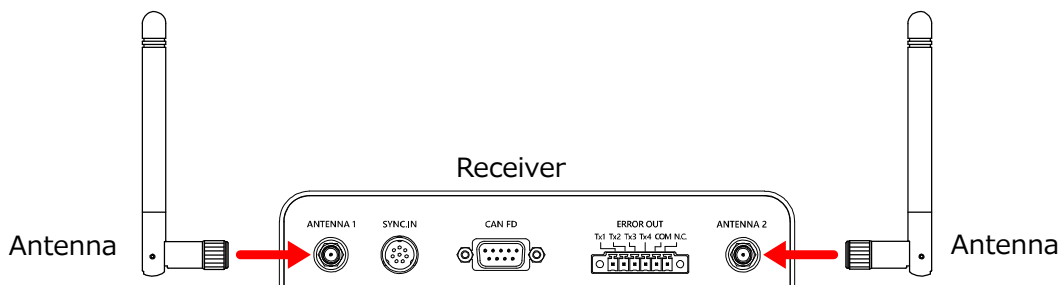
Name	Model
Receiver Antenna (standard accessories)	W1030
Small Planar Antenna (optional accessories)	EXT-ANT1
Diversity Planar Antenna (optional accessories)	EXT-ANT2
Dual-Polarization Antenna (optional accessories)	EXT-ANT7

For details on each antenna, please refer to "9-9 COMPATIBLE ANTENNAS".

- The antenna can be installed at a location away from the receiver using a receiver extension cable (optional accessories).
- The receiver receives data from both ANTENNA1 and 2, but it prioritizes data received from the ANTENNA1 side. If a reception error occurs on the ANTENNA1 side, it adopts the data received from the ANTENNA2 side, thereby improving the stability of wireless communication.

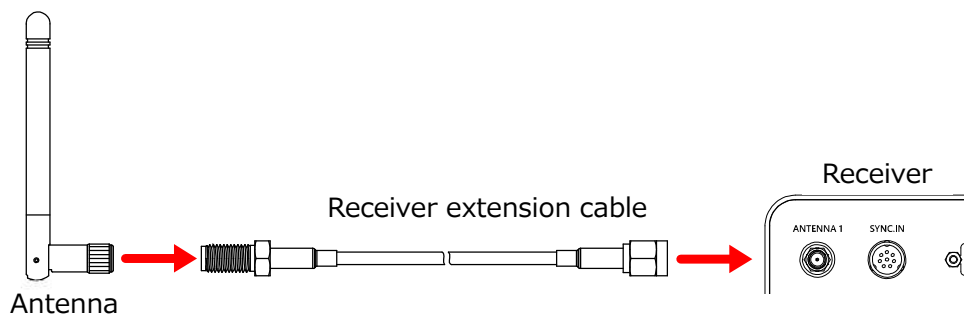
Connect the antennas to be used with the receiver to each antenna connector. Please connect antennas to both ANTENNA1 and 2.

For direct antenna connection (without receiver extension cables).



For use receiver extension cable

The following is the connection for ANTENNA1. Connect ANTENNA2 in the same manner.



2-1-4.Connecting To The Analog Output Connector

When using the analog output function, use a BNC-BNC cable (optional accessories) to connect the analog output connector to a data logger or similar device.

WARNING

Connect devices with an input resistance that meets or exceeds the specified value to the analog output connector.

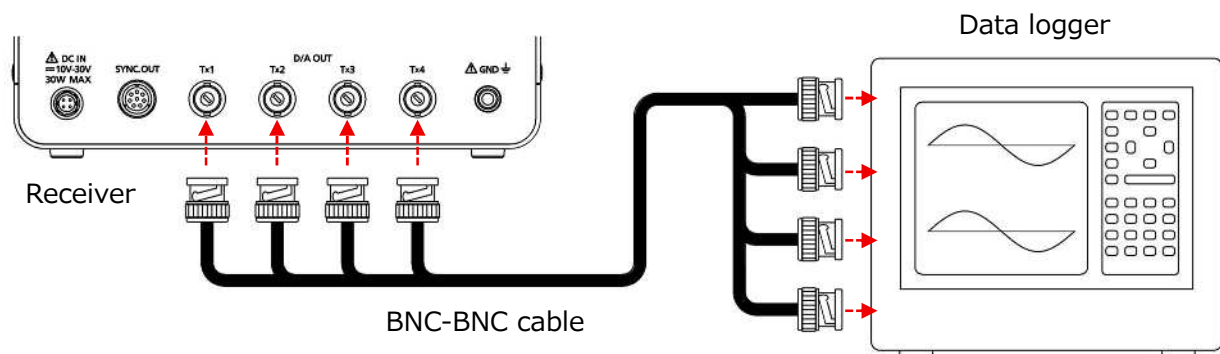


Connecting a device with a resistance below the specification causes performance degradation, malfunction, or equipment failure. In particular, connecting a device with extremely low resistance leads to excessive current flow in the circuit. This poses a risk of fire, explosion, or burning of internal components due to abnormal heat generation, as well as electrical shock from current leakage. Check the specifications of the external device and ensure its input resistance meets the requirements of the product before connection.



- Connect devices with an input resistance of 5 k Ω or higher to the analog output connector.
- The D/A conversion speed of the analog output is the same as the maximum output data rate among the transmitters configured via PAIR-SETTING.
- Example: When configured via PAIR-SETTING with the following two transmitters, the D/A conversion speed is 2000 Hz:
 - Transmitter 1 Output Data Rate: 1000 Hz
 - Transmitter 2 Output Data Rate: 2000 Hz
- The delay time of the analog output varies depending on the output data rate of each transmitter. For details, please refer to "9-2-1 ANALOG OUTPUT DELAY TIME" for details.

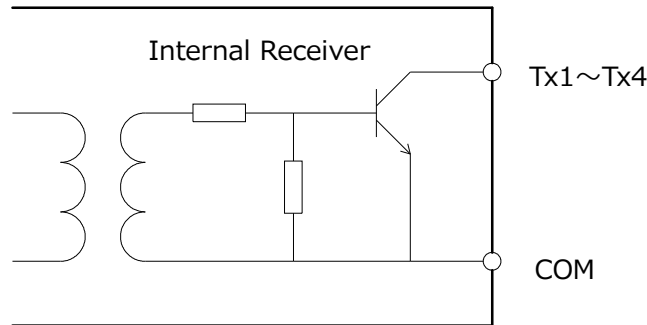
- (1) Connect the BNC-BNC cable to the analog output connector.
- (2) Connect the BNC-BNC cable to your data logger or other device.



2-1-5.Connecting To The Error Output Connector

When using the error output function, use the error output terminal block (accessories) to connect wires.

The error output is an NPN current sink open-collector output. The maximum capacity of the open-collector output is DC 30V, 30mA.



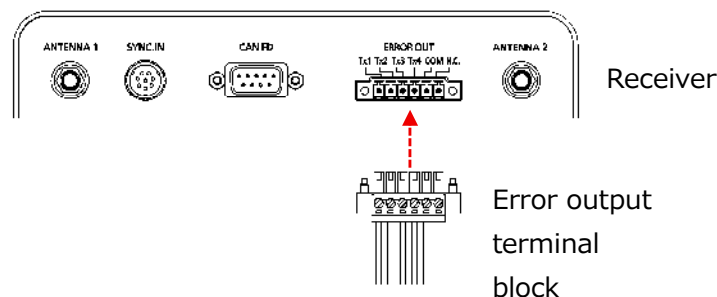
NOTE

When connecting a relay, connect a diode in parallel with the relay coil.



If the error output connector is connected directly to a relay, it may malfunction due to the DC surge voltage that occurs when the relay is turned OFF. As a protection circuit, connect the diode's cathode to the power supply side. Also, insert a surge killer at the relay contacts. For details on surge killers, please contact the relay manufacturer.

- (1) Wire the error output terminal block.
For details, please refer to "Connecting to the Error Output Terminal Block".
- (2) Connect the terminal block to the error output connector.
- (3) Tighten the screws with a flat-head screwdriver to secure the terminal block. The tightening torque is 0.3 N·m.



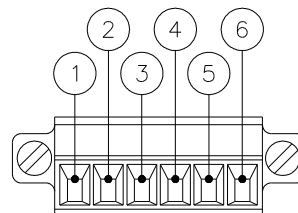
Connecting to the Error Output Terminal Block

Before connecting to the error output connector, connect the wires to the error output terminal block. The compatible wire size is 1.25 to 0.08 SQ (AWG 16 to 28).

	- When connecting multiple wires, twist them together beforehand and confirm that the wire gage is within the connectable range. - When wiring over a distance of 1 m or more, use a shielded twisted-pair cable and connect the shield wire to the ground terminal. - When wiring over a distance of 30 m or more, or when wiring outdoors, take separate noise and surge countermeasures.
---	---

The pin assignment for the error output terminal block is as follows:

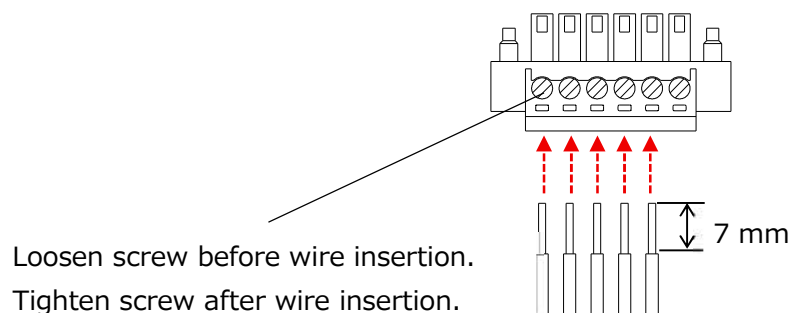
Pin Number	Signal Name
1	Tx1 Error Output
2	Tx2 Error Output
3	Tx3 Error Output
4	Tx4 Error Output
5	COM
6	N.C.



Connector Model : 1714964

Manufacturer : PHOENIX CONTACT

- (1) Strip about 7 mm of the insulation from the wire to be connected and twist the end so it does not fray.
- (2) Loosen the screw of the terminal to be used with a flat-head screwdriver.
- (3) Insert the wire into the error output terminal block.
- (4) Tighten the screw of the terminal where the wire was inserted with a flat-head screwdriver to secure the wire. The tightening torque is 0.25 N·m.
- (5) Confirm that the fixed wire cannot be pulled out.

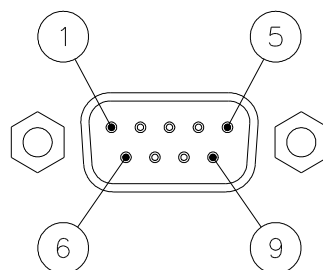


2-1-6.Connecting To The CAN Output Connector (D-Sub 9-Pin)

When using the CAN output function, use a CAN cable (optional accessories) to connect the CAN output connector to a CAN-compatible data logger or similar device.

The pin assignment for the CAN output connector is as follows:

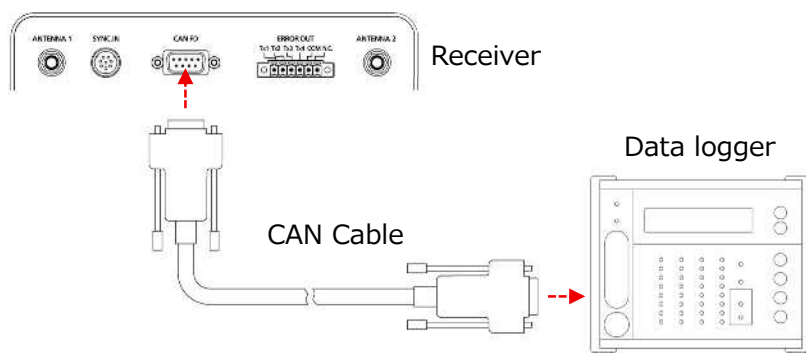
Pin Number	Signal Name
1	N.C.
2	CAN_L
3	COM
4	N.C.
5	N.C.
6	N.C.
7	CAN_H
8	N.C.
9	N.C.



Connector Model : JCDE9EPAN4B

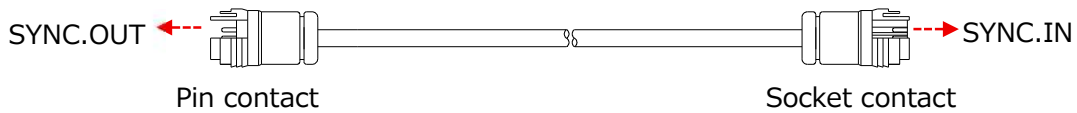
Manufacturer : JC ELECTRONICS

- (1) Connect the CAN cable to the CAN output connector.
- (2) Connect the CAN cable to your CAN-compatible data logger or other device.



2-1-7.Connecting To The Synchronization Signal Input/Output Connector

When using the inter-receiver synchronization function, use an MT sync cable (optional accessories) to connect the synchronization signal input and output connectors of each receiver. Both ends of the MT sync cable are plugs, but one side has pin contacts (connects to SYNC.OUT) and the other side has socket contacts (connects to SYNC.IN).



NOTE



Do not use any cable other than the specified one for the synchronization signal input/output connector.

Using a cable other than the specified one may lead to product malfunction. When using the inter-receiver synchronization function, please use the optional accessories MT sync cable.



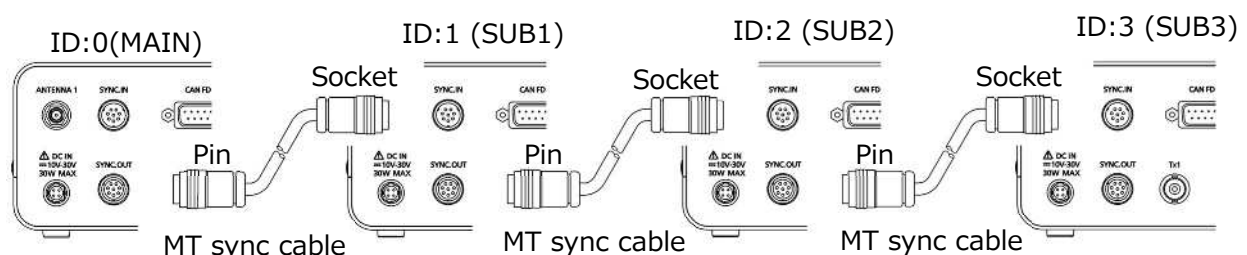
When connecting the MT sync cable, please check to ensure the contacts are not mismatched.

Both ends of the MT synchronization cable are plugs. Attempting to force a connection with the wrong contact side may lead to damage to the connector. When connecting the MT sync cable, please ensure the correct contacts are aligned.



- A maximum of 4 receivers can be connected using the receiver synchronization function.
- The receiver ID is set with the receiver setting switch. For details, please refer to "2-1-1 Receiver Setting Switch Settings".

- (1) Connect the pin contact side of the MT sync cable to the synchronization signal output connector (SYNC.OUT) of the receiver set to ID: 0 (MAIN).
- (2) Connect the socket contact side of the MT sync cable to the synchronization signal input connector (SYNC.IN) of the receiver set to ID: 1 (SUB1).
- (3) If necessary, use MT sync cables to connect the synchronization signal input/output connectors of the receivers set to ID: 2 (SUB2) and ID: 3 (SUB3) in the same manner.



2-2. TRANSMITTER CONNECTION

2-2-1.Connecting to the MT Adapter

The transmitter connects to power and sensors (strain gages and strain-gage transducers) by soldering to the MT adapter (accessories and optional accessories).

DANGER

The MT adapter must be fixed under the specified conditions.



Fixing it under conditions other than those specified may cause damage or cause the MT adapter to detach and scatter during testing. If it scatters in an environment with strong loads (vibration, shock, centrifugal acceleration, etc.), it can lead to personal injury (death, injury), or damage and destruction of the equipment and sensors.

CAUTION

When performing soldering work, prevent burns and injuries.



To prevent burns from a high-temperature soldering iron and injuries from solder splatter when soldering, wear protective equipment such as safety glasses and heat-resistant gloves, and ensure a safe operating environment.

NOTE

Do not force the MT adapter onto the transmitter if the transmitter's pins are bent.



Forcing the MT adapter onto a transmitter with bent pins may lead to damage to the transmitter's pins. If the transmitter's pins are bent, do not force it; instead, straighten the pins with tweezers or a similar tool before inserting them into the MT adapter.

The usable MT adapters are as follows. Please use according to your application.

Name	Model	Weight	Measurement Target
4G MT Adapter (Accessories)	MT-AD-S1	Approx. 2 g	Strain gages*5 and strain-gage-based transducers
1G2W MT Adapter (Optional accessories)	MT-AD-S2-120	Approx. 2 g	120Ω strain gages*6
*5. Full-bridge system			
*6. Quarter bridge 2-wire system			

The fixing screws and fastening conditions for the MT adapter are as follows. The fixing screws for the MT adapter are included with the transmitter and each adapter.

Screw Type	: Pan head screw (Size 0, Type 1, M2)
Reference Model	: U-0240-01 (Wilco)
Screw Length	: 4 mm
Material	: SUSXM7
Tightening Torque	: 0.1 N·m
Number of Screws	: 1

2-2-1-1. Remove the MT Adapter

Remove the MT adapter from the transmitter.

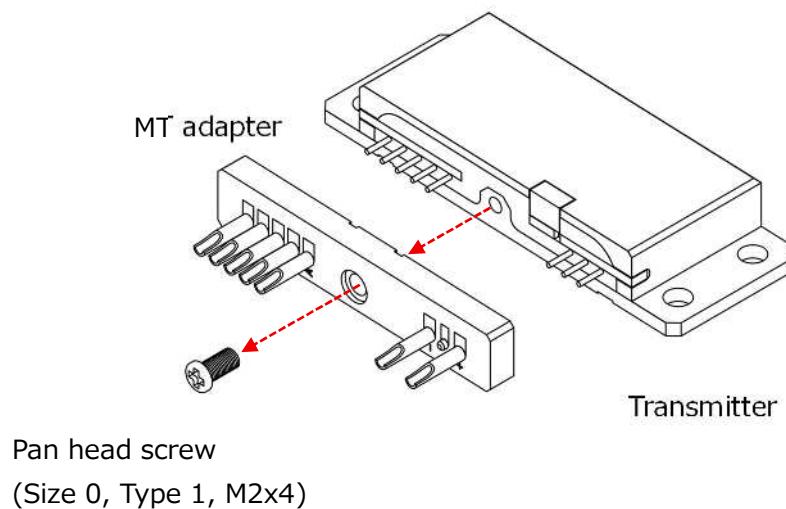
NOTE

When removing the MT adapter, be careful not to bend the pins.



The pins of the transmitter bend very easily. If the transmitter is pulled out forcibly, it causes damage to the pins of the transmitter. If it is difficult to pull out, insert a thin object such as a flat-head screwdriver between the transmitter and the adapter and gently pry both ends apart to remove it.

- (1) Remove the pan head screw (Size 0, Type 1, M2x4).
- (2) Pull the MT adapter straight off.



2-2-1-2. Attach the MT Adapter

Attach the MT adapter to the transmitter.

DANGER

If installing the transmitter in a high-load environment, use a threadlocker.



If the transmitter is installed in a high-load environment, the screws loosen and deteriorate due to rotary motion, vibration, and repeated impact. As a result, the transmitter flies off, causing death and injuries, as well as failure and damage to the device and sensors. To suppress screw loosening caused by vibration and impact and prevent the detachment of the transmitter and related parts when installing it in a high-load environment, always apply a threadlocker to the screws.

NOTE

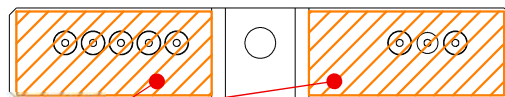
Do not force the MT adapter onto the transmitter if the transmitter's pins are bent.



Forcing the MT adapter onto a transmitter with bent pins may lead to damage to the transmitter's pins. If the transmitter's pins are bent, do not force it; instead, straighten the pins with tweezers or a similar tool before inserting them into the MT adapter.



- The MT adapter has heat-resistant tape applied to prevent the pins from coming loose. When attaching the adapter, do not peel off the heat-resistant tape before attaching the transmitter to the adapter.

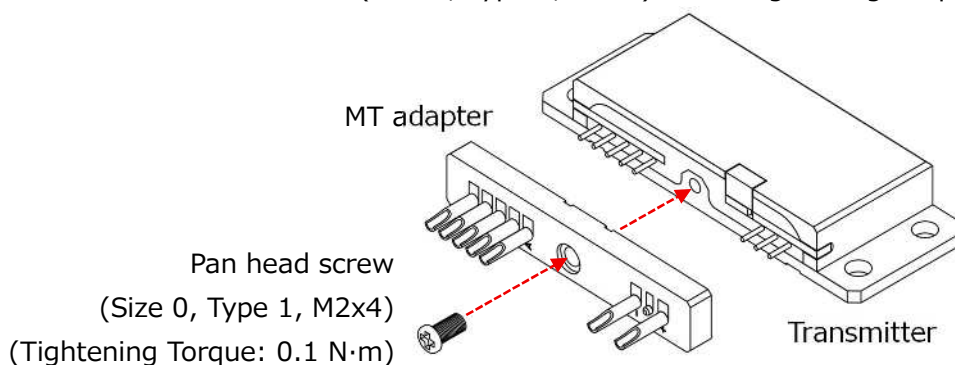


Heat-resistant tape

- If a threadlocker is used to prevent detachment, the screws may become difficult to remove.

(1) Attach the MT adapter to be used to the transmitter's pins.

(2) Fasten the Pan head screw (Size 0, Type 1, M2x4) with a tightening torque of 0.1 N·m.



2-2-1-3. Connecting to the Power Input Pins

Solder the wires of the external power supply to the power input pins (solder pins) of the MT adapter (accessories and optional accessories). The transmitter starts automatically when power is supplied. The compatible wire size for the power input pins is a maximum of 0.3 SQ (AWG 22).

WARNING

Use the transmitter within the power voltage range specified in this product specifications.



Applying a voltage outside the power voltage range can cause electric shock, fire, or malfunction. Before connecting to the transmitter, confirm that the external DC power supply is within the transmitter's power voltage range.

When wiring the power pins, confirm that the power polarity (+/-) is connected correctly.



Connecting the power pins to the transmitter with reversed polarity can cause electric shock, fire, or malfunction. Before connecting to the transmitter, confirm that the power pin connection is correct.

CAUTION

When performing soldering work, prevent burns and injuries.



To prevent burns from a high-temperature soldering iron and injuries from solder splatter when soldering, wear protective equipment such as safety glasses and heat-resistant gloves, and ensure a safe operating environment.

NOTE

When wiring to the MT adapter, be careful not to apply the soldering iron for too long or let the tip temperature get too high.



The heat from the soldering iron may cause the solder pins of the MT adapter to detach, leading to a malfunction of the MT adapter. When wiring to the MT adapter, be careful not to apply the soldering iron for too long or let the tip temperature get too high.

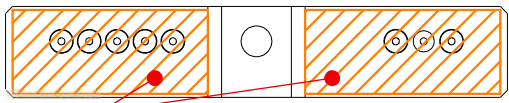
When wiring to the MT adapter, remove it from the transmitter before soldering.



The heat from soldering may lead to performance degradation or malfunction of the transmitter.

i

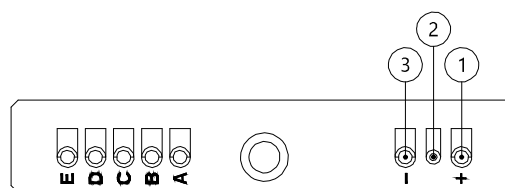
- When the power supply voltage drops below approximately 2.05 V, the transmitter automatically stops operating by the protection function to prevent abnormal operation and an overcurrent of the batteries. Even if used batteries have the specified voltage under no-load conditions, the voltage may drop to the operating stop voltage immediately after starting use. When replacing the batteries, use all unused batteries.
- The transmitter does not have a power ON/OFF function such as a power switch. If needed, use a battery box with a power switch or an external switch.
- Keep the power wiring short. Long wiring can cause noise to interfere, making the power voltage unstable.
- The MT adapter has heat-resistant tape applied to prevent the pins from coming loose. When wiring, solder without peeling off the tape.



heat-resistant tape

The pin assignment for the power input pins of the 4G MT adapter is as follows.

Pin Number	Signal Name	
1	+	plus (+) power supply
2		Unused
3	-	minus (-) power supply



- (1) Remove the MT adapter from the transmitter.

For details on the removal of the MT adapter, please refer to "2-2-1-1 Remove the MT Adapter".

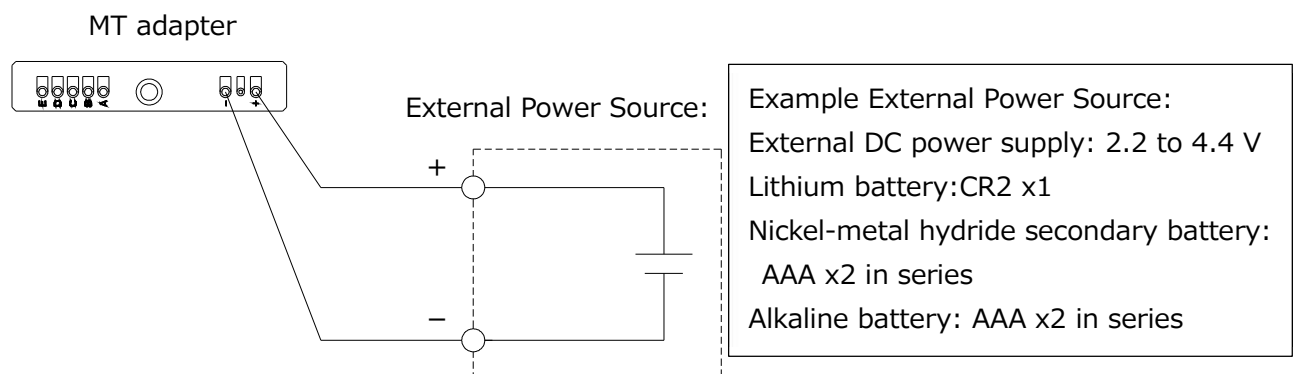
- (2) Solder the wires of the external power supply to the power input pins.

- (3) Solder the output wires of the sensor to the sensor input pins.

For details on connecting the sensor input pins, please refer to "2-2-1-4 Connecting to the Sensor Input Pins".

- (4) Attach the MT adapter to the transmitter.

For details on attaching the MT adapter, please refer to "2-2-1-2 Attach the MT Adapter".



2-2-1-4. Connecting to the Sensor Input Pins

Solder the sensor (strain gage or strain-gage transducer) to the sensor input pins (solder pins) of the MT adapter (accessories and optional accessories). The compatible wire size for the sensor input pins is a maximum of 0.3 SQ (AWG 22).

WARNING

When wiring the sensor input pins, confirm that the connection is correct.



Connecting the sensor input pins to the transmitter incorrectly can cause electric shock, fire, or malfunction. Before connecting to the transmitter, confirm that the sensor input pin connection is correct.

CAUTION

When performing soldering work, prevent burns and injuries.



To prevent burns from a high-temperature soldering iron and injuries from solder splatter when soldering, wear protective equipment such as safety glasses and heat-resistant gloves, and ensure a safe operating environment.

NOTE

When wiring to the MT adapter, be careful not to apply the soldering iron for too long or let the tip temperature get too high.



The heat from the soldering iron may cause the solder pins of the MT adapter to detach, leading to a malfunction of the MT adapter. When wiring to the MT adapter, be careful not to apply the soldering iron for too long or let the tip temperature get too high.

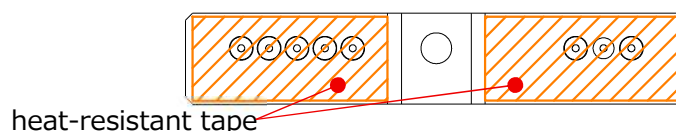
When wiring to the MT adapter, remove it from the transmitter before soldering.



The heat from soldering may lead to performance degradation or malfunction of the transmitter.



- Keep the sensor wiring short. Long wiring can cause noise to interfere with the sensor signal, leading to poor measurement accuracy.
- The MT adapter has heat-resistant tape applied to prevent the pins from coming loose. When wiring, solder without peeling off the tape.

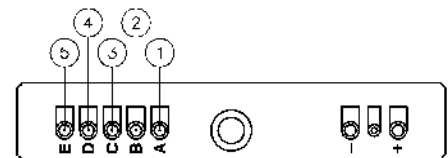


2-2-1-5. 4G MT Adapter

When measuring a sensor (strain gage or strain-gage transducer) compatible with a full-bridge system, use the 4G MT adapter (accessories and optional accessories) to connect to the sensor.

The pin assignment for the sensor input pins of the 4G MT adapter is as follows:

Pin Number	Signal Name	
1	A (+BV)	+ Bridge Power
2	B (-IN)	- Input
3	C (-BV)	- Bridge Power
4	D (+IN)	+ Input
5	E (SHIELD)	Shield



- (1) Remove the MT adapter from the transmitter.

For details on the removal of the MT adapter, please refer to "2-2-1-1 Remove the MT Adapter".

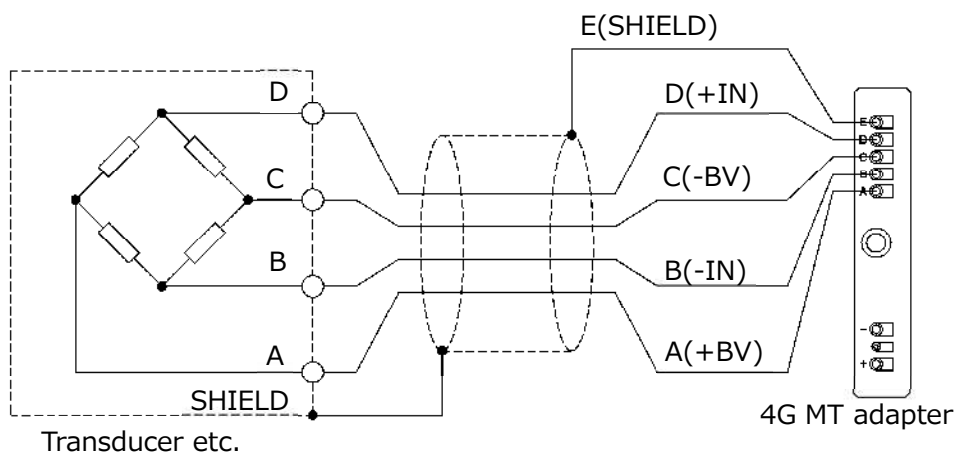
- (2) Solder the wires of the external power supply to the power input pins.

For details on connecting the power input pins, please refer to "2-2-1-3 Connecting to the Power Input Pins".

- (3) Solder the output wires of the sensor to the sensor input pins.

- (4) Attach the MT adapter to the transmitter.

For details on attaching the MT adapter, please refer to "2-2-1-2 Attach the MT Adapter".



2-2-1-6. 1G2W MT Adapter

When measuring a 120Ω strain gage with the quarter bridge 2-wire system use the 1G2W MT adapter (optional accessories) to connect to the strain gage.

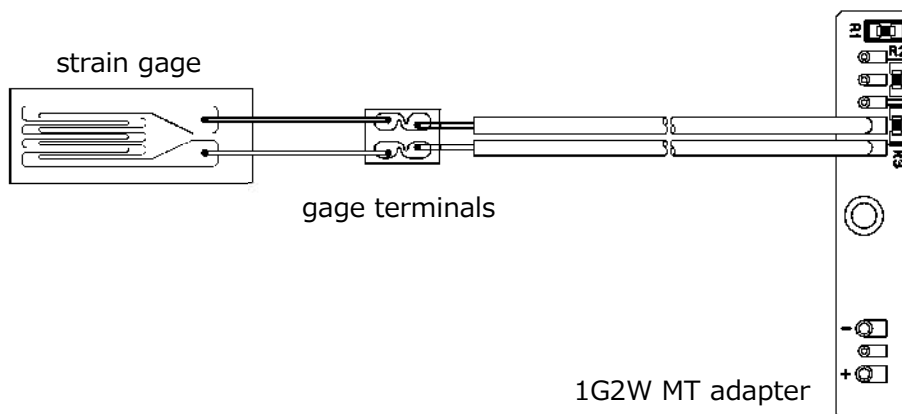
NOTE

When soldering the 1G2W MT adapter, use gage terminals.



Connecting the strain gage's gage leads to the lead wires of the 1G2W MT adapter can lead to damage to the gage leads due to load (shock, vibration, centrifugal acceleration, etc.). When connecting the 1G2W MT adapter and a strain gage, please use gage terminals.

- (1) Remove the MT adapter from the transmitter.
For details, refer to "2-2-1-1 Remove the MT Adapter".
- (2) Install the strain gage and gage terminals.
- (3) Solder the strain gage and gage terminals together.
- (4) Solder the lead wires of the 1G2W MT adapter and the gage terminals together.
- (5) Attach the 1G2W MT adapter to the transmitter.
For details, refer to "2-2-1-2 Attach the MT Adapter".



2-2-2.Connecting to the Battery kit

If the battery kit (optional accessories) is used, a power supply, a battery, and sensors (a strain gage (4-gage system) and a strain gage transducer) can be connected to the transmitter.



WARNING



Ensure the power is turned off before connecting the battery kit.

If the battery kit is connected to this product with the power turned on, it causes a fire, an electric shock, and a performance degradation or failure of this product. When connecting the battery kit to this product, turn off the power of the battery kit.

2-2-2-1. Attach the transmitter

Attach the transmitter to the battery kit.

NOTE



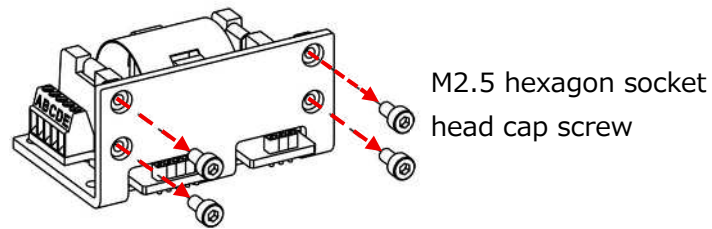
Do not force the battery kit onto the transmitter if the transmitter's pins are bent.

Forcing the battery kit onto a transmitter with bent pins may lead to damage to the transmitter's pins. If the transmitter's pins are bent, do not force it; instead, straighten the pins with tweezers or a similar tool before inserting them into the battery kit.

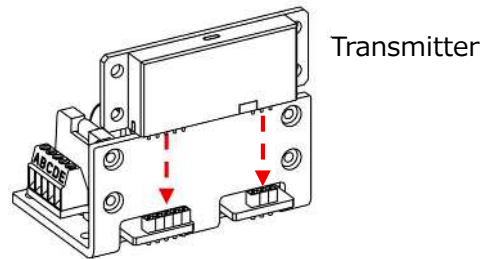
The bolts for fixing the transmitter and the fastening conditions are as follows. The bolts for fixing the transmitter are included in the battery kit.

Bolt Type	: M2.5 Hexagon socket head cap screw
Reference Model	: FC-2505EB (Wilco)
Bolt length	: 5 mm
Tightening Torque	: 0.29 N·m
Number of Bolts	: 4

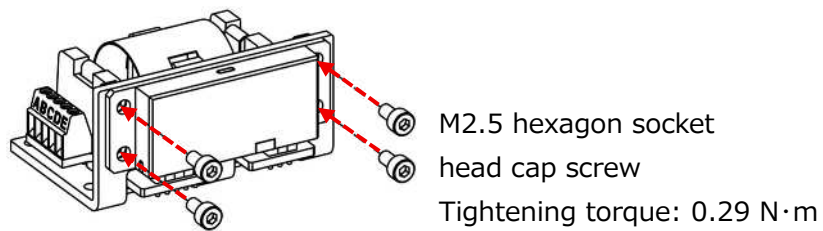
- (1) Remove all four M2.5 hexagon-socket head cap bolts attached to the battery kit.



- (2) Attach the transmitter to the battery kit.



- (3) Fasten the transmitter with the four removed M2.5 hexagon-socket head cap bolts at a fastening torque of 0.1 N·m.



2-2-2-2. Attach the battery

Attach the battery to the battery kit.



WARNING



When attaching the battery, confirm that the power polarity (+/-) is connected correctly.

Attaching the battery to the transmitter with reversed polarity can cause electric shock, fire, or malfunction. Before attaching to the battery kit, confirm that the battery connection is correct.



- When the power supply voltage drops below approximately 2.05 V, the transmitter automatically stops operating by the protection function to prevent abnormal operation and an overcurrent of the batteries. Even if used batteries have the specified voltage under no-load conditions, the voltage may drop to the operating stop voltage immediately after starting use. When replacing the batteries, use all unused batteries.

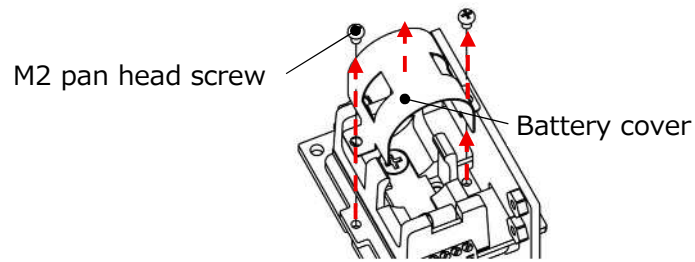
The battery compatible with the battery kit is as follows.

Battery type	: Lithium battery CR2
Rated voltage	: 3 V
Dimensions	: Approx. $\phi 15.6 \times 27$ mm

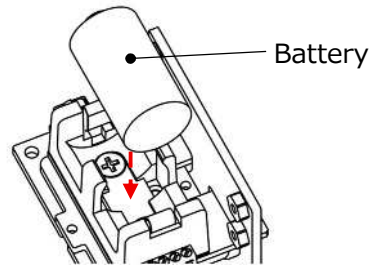
The screws for fixing the battery and the fastening conditions are as follows. The screws for fixing the battery are included in the battery kit.

Screw type	: M2 pan head screw
Reference Model	: F-0203EB (Wilco)
Bolt length	: 3 mm
Tightening Torque	: 0.15 N·m
Number of Bolts	: 2

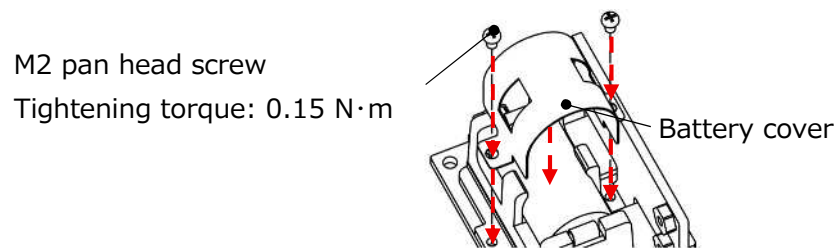
- (1) Remove both M2 pan head screws attached to the battery kit. Also, remove the battery cover.



- (2) Attach the battery.



- (3) Fasten the battery cover with the two removed M2 pan head screws at a fastening torque of 0.1 N·m.



2-2-2-3. Connecting to the sensor

Connect the sensors (a strain gage (4-gage system) and a strain gage transducer) to the screw terminal block of the battery kit (optional accessories). The compatible wire size for the screw terminal block is up to 0.5 sq (AWG 20).

WARNING

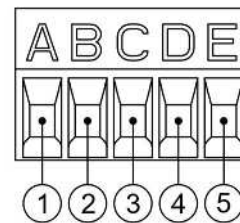
When wiring the sensor, confirm that the connection is correct.



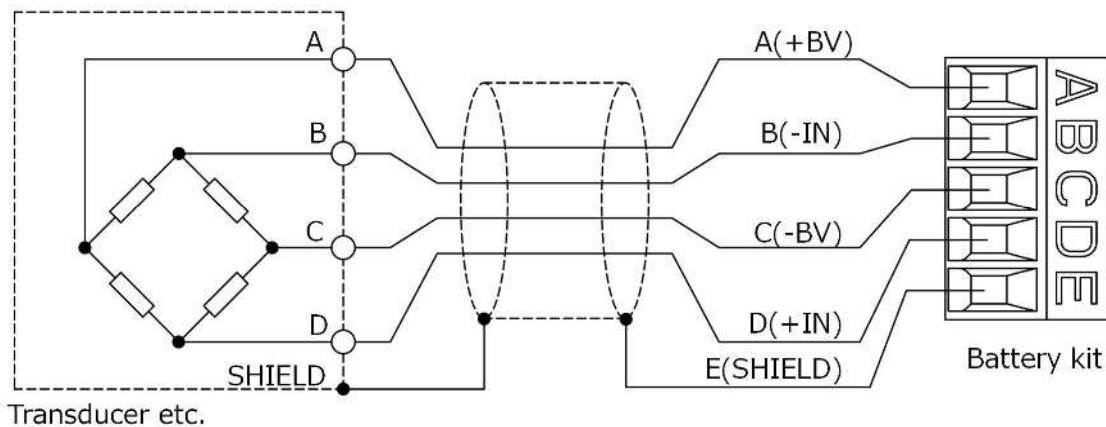
Connecting the sensor to the battery kit incorrectly can cause electric shock, fire, or malfunction. Before connecting to the battery kit, confirm that the sensor connection is correct.

The pin assignment for the screw-type terminal block is as follows.

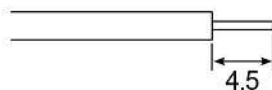
Pin Number	Signal Name	
1	A (+BV)	+ Bridge Excitation
2	B (-IN)	- Input
3	C (-BV)	- Bridge Excitation
4	D (+IN)	+ Input
5	E (SHIELD)	Shield



The wiring example for the battery kit is as follows.

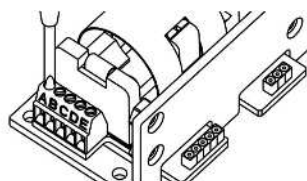


- (1) Strip about 4.5 mm of the insulation from the wire to be connected and twist the end so it does not fray.

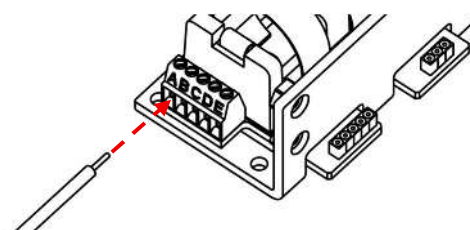


- The wire insulation of the S32-7 to 4 conductors with shield wire, bared at the tip cable (10cm) (optional accessories) is stripped by approx. 10 mm. If the cable is connected as it is, the conductors are exposed from the screw terminal block. Cut the exposed part of the conductors to approx. 4.5 mm.

- (2) Loosen the screw of the screw-type terminal block to be used with a flat-head screwdriver.

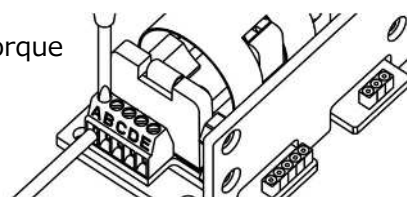


- (3) Insert the wire into the screw-type terminal block.



- (4) Tighten the screw of the terminal where the wire was inserted with a flat-head screwdriver to secure the wire. The tightening torque is 0.12 N·m.

tightening torque
0.12 N·m



- (5) Confirm that the fixed wire cannot be pulled out.

2-3. TRANSMITTER INSTALLATION

Before installing the transmitter, be sure to read "SAFETY " and "PRECAUTIONS BEFORE USE". Also, confirm that this product and peripheral devices are correctly connected and installed.

DANGER

Do not install this product under conditions other than those specified.



If installed under non-specified conditions, this product may become detached and scatter, which can lead to personal injury (death, injury), or the damage and destruction of equipment and sensors, especially in environments with strong loads (vibration, shock, centrifugal acceleration, etc.).

Do not use the included battery case in environments subject to strong loads (such as vibration, shock, or centrifugal acceleration).



The accessory battery case is for operation checks. It does not withstand vibration, impact, and centrifugal acceleration. If the battery case is used in an environment with strong loads (such as vibration, impact, and centrifugal acceleration) and scatters, it causes death or injury, and a failure or damage of the device and sensors. Also, in an environment with such strong loads, the power of the transmitter may suddenly turn off when using the included battery case.

If installing the transmitter in a high-load environment, use a threadlocker.



If the transmitter is installed in a high-load environment, the bolts loosen and deteriorate due to rotary motion, vibration, and repeated impact. As a result, the transmitter flies off, causing death and injuries, as well as failure and damage to the device and sensors. To suppress bolt loosening caused by vibration and impact and prevent the detachment of the transmitter and related parts when installing it in a high-load environment, always apply a threadlocker to the bolts used.

CAUTION

When performing installation and maintenance, always wear protective gloves.



To prevent injuries from the edges, screw holes, and machined burrs of this product when performing installation and maintenance, always wear protective gloves.



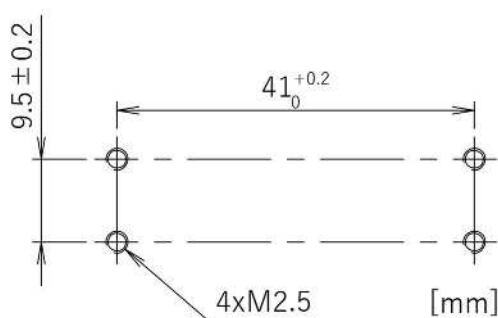
- The centrifugal acceleration resistance stated in the transmitter's product specifications is the value when it is fixed with the specified bolts and under the specified conditions. If fixed by other methods, this value may not be guaranteed. Please consult your sales representative for details.
- If a threadlocker is used to prevent detachment, the bolts may become difficult to remove.

2-3-1. When using the transmitter alone

Fasten the transmitter using the bolts provided for installing the transmitter. The fixing bolts and fastening conditions for the transmitter are as follows.

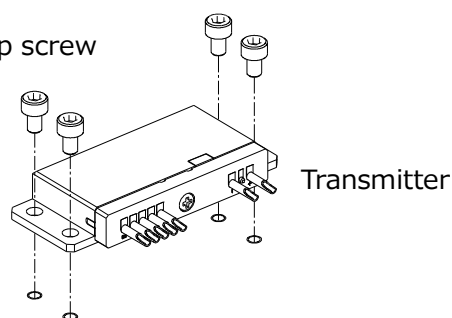
Bolt Type	: M2.5 hexagon socket head cap screw
Reference Model	: FC-2504E (Wilco)
Thread depth of bolts	: 2.5 mm or more (1.0d or more)
Material	: SCM435 (Strength class 10.9 or higher)
Tightening Torque	: 0.6 N·m
Number of Bolts	: 4

The dimensions for the transmitter's fixing bolt holes are as follows. The transmitter's metal plate thickness is 1.5 mm.



- (1) Insert the four specified M2.5 hexagon socket head cap screws into the mounting holes and tighten them to the specified torque to fix the transmitter.
- (2) Confirm that the fastened bolts are securely fixed.

M2.5 hexagon socket head cap screw
(Tightening torque: 0.6 N·m)



2-3-2. When using the battery kit

Fasten the battery kit using the bolts provided for installing the battery kit.

DANGER

Do not use the battery kit in environments subject to strong loads (such as vibration, shock, or centrifugal acceleration).

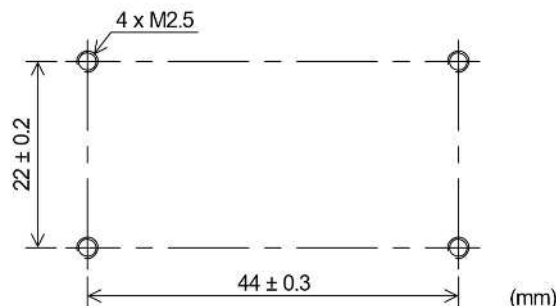


The battery kit is for operation checks. It does not withstand vibration, impact, and centrifugal acceleration. If the battery kit is used in an environment with strong loads (such as vibration, impact, and centrifugal acceleration) and scatters, it causes death or injury, and a failure or damage of the device and sensors. Also, in an environment with such strong loads, the power of the transmitter may suddenly turn off when using the battery kit.

The bolts for fixing the battery kit and the fastening conditions are as follows.

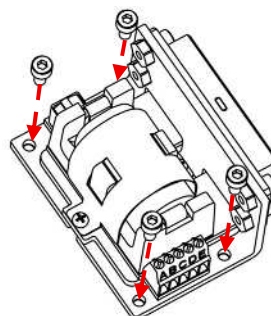
Bolt Type	: M2.5 hexagon socket head cap screw
Reference Model	: FC-2504E (Wilco)
Thread depth of bolts	: 2.5 mm or more (1.0d or more)
Tightening Torque	: 0.17 N·m
Number of Bolts	: 4

The dimensions for the battery kit's fixing bolt holes are as follows. The battery kit's metal plate thickness is 2 mm.



- (1) Fasten the transmitter to the mounting holes with the four specified M2.5 hexagon-socket head cap bolts at the specified fastening torque.
- (2) Confirm that the fastened bolts are securely fixed.

M2.5 hexagon socket
head cap screw
Tightening torque: 0.17 N·m



2-4. TURNING ON THE POWER

Before turning on the power of this product, be sure to read "SAFETY " and "PRECAUTIONS BEFORE USE". Also, confirm that this product and peripheral devices are correctly connected and installed.

NOTE

After turning off the power to this product, please wait at least 5 seconds before turning it back on.

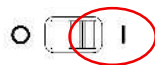


If this product is restarted immediately after turning off the power, the voltage of the internal circuit does not fall sufficiently, and it causes abnormal operation, performance degradation, and a failure of the product. When turning on the power again, please wait at least 5 seconds after turning it off before turning it back on.

2-4-1. Turning on the Receiver Power

Turn on the receiver's power by operating the power switch.

Set the power switch to ON (I).



The following screen is displayed during startup.

```
MT-100A
Setup
```



After startup, the following screen is displayed during startup.

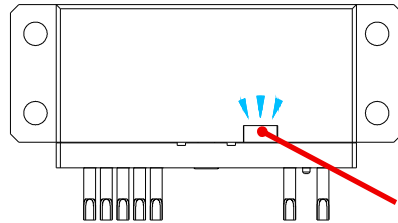
```
►Tx1 1ch S
MT-101A-S
AA1234567
```

2-4-2. Turning on the Transmitter Power

The transmitter starts automatically when power is supplied. When it starts normally, the status LED will blink.



- When the transmitter's power supply voltage drops, it automatically stops operation to prevent abnormal operation and protect the battery from overcurrent. In this case, the status LED turns off.

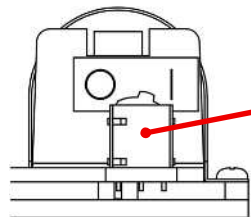


Status LED

Blinking (Standby State)

When using the battery kit

Turn on the power of the battery kit with the power switch.



Power switch

Set the power switch to ON (I).

2-5. PAIR-SETTING

Pair-setting enables wireless communication between the receiver and the transmitters using a specified RFCH. This setting allows up to four transmitters to be registered per receiver.

The information of the registered transmitters is displayed in the Transmitter Settings menu on the display. Furthermore, this information is retained even after the power is turned off.



- When using this product for the first time after purchase, please perform pair-setting.
- Pair-setting and transmitter search are performed via wireless communication. If it does not work well, reviewing the antenna installation or changing the RFCH may improve the stability of wireless communication. For details, please refer to “9-8 GUIDE TO ANTENNA INSTALLATION”.
- To change the RFCH, the pair-setting process must be re-executed.
- Pair-setting may fail if wireless communication stability is poor, so it is recommended to perform it before installing the transmitter.

Pair-setting can only be executed using the control software or control commands. For details, please refer to the respective instruction manuals.

(Blank)

3. BASIC OPERATION METHOD

3-1. DISPLAY OPERATION

The receiver allows for simple setting and confirmation of measurement conditions on the display without using a PC.

Display operations are performed with the   Switches and  Switch.



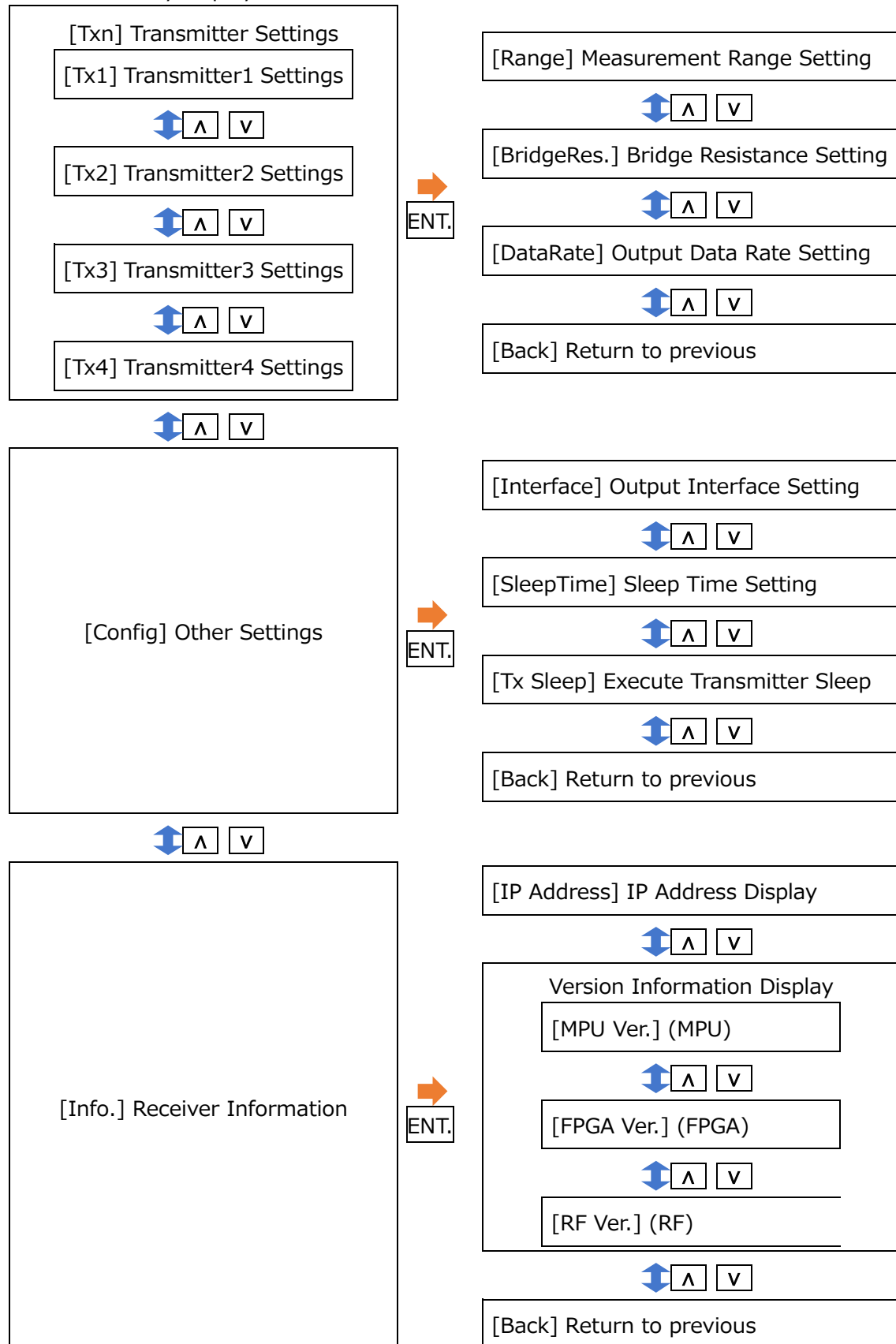
  switches: Move between items.  switch: Select an item.



- To prevent screen burn-in, the display of this product briefly turns off the screen at regular intervals. This operation may cause a slight flicker on the screen; however, it is a normal operation and does not indicate a product failure. It is safe to continue using the product.

3-2. MENU HIERARCHY

The menu hierarchy displayed on the screen is as follows. Menus at the same level are looped.



4. MEASUREMENT CONDITION SETTINGS

The operation methods in this section are for when setting up the receiver as a standalone unit.



- If each setting fails repeatedly, please refer to "8-1 TROUBLESHOOTING".

4-1. SETTING THE MEASUREMENT RANGE

Select an appropriate range based on the sensor's rated output and the expected maximum output value.

How to Set the Measurement Range

The following explanations omit the menu selection by the switches.

Tx1 1ch S
MT-101A-S
AA1234567

Select [Txn]*7 for the transmitter to be set with the switch.

*7. n is the pairing number of the transmitter.



Tx1 1ch S
Range
10000 $\mu\epsilon$

Select [Range] with the switch. The displayed value is the currently set range.



Tx1 1ch S
Range
1000 $\mu\epsilon$

Select the range to be set with the switch. The ranges that can be set with the receiver as a standalone unit are as follows:

[1000 $\mu\epsilon$], [2500 $\mu\epsilon$], [5000 $\mu\epsilon$], [10000 $\mu\epsilon$], [25000 $\mu\epsilon$], [50000 $\mu\epsilon$]

Additionally, selecting [Back] will return you to the previous screen.



Tx1 1ch S
Range
WaitTx

The setting is in progress. After completion, the setting result is automatically displayed.



Tx1 1ch S
Range
Success

The setting results are as follows. If a certain time elapses or the switch is pressed while the setting results are displayed, the screen returns to the initial screen.

Result	Content
[Success]	Setting successful
[Failed]	Setting failed

4-2. SETTING THE BRIDGE RESISTANCE VALUE

Set the bridge resistance value of the connected sensor.



- This setting is used only for the judgment of the sensor check function and does not affect the measurement values.

How to Set the Bridge Resistance Value

The following explanations omit the menu selection by the switches.

Tx1 1ch S
MT-101A-S
AA1234567



ENT.

Select [Txn]*8 for the transmitter to be set with the ENT. switch.
*8. n is the pairing number of the transmitter.

Tx1 1ch S
BridgeRes.
1000 Ω



ENT.

Select [BridgeRes.] with the ENT. switch. The displayed value is the currently set bridge resistance value.

Tx1 1ch S
BridgeRes.
120 Ω



ENT.

Select the bridge resistance value to be set with the ENT. switch. The bridge resistance values that can be set with the receiver as a standalone unit are as follows:

[120 Ω], [350Ω], [1000Ω]

Additionally, selecting [Back] will return you to the previous screen.

Tx1 1ch S
BridgeRes.
WaitTx



Tx1 1ch S
BridgeRes.
Success

The setting is in progress. After completion, the setting result is automatically displayed.

The setting results are as follows. If a certain time elapses or the ENT. switch is pressed while the setting results are displayed, the screen returns to the initial screen.

Result	Content
[Success]	Setting successful
[Failed]	Setting failed

4-3. SETTING THE OUTPUT DATA RATE

Set the output data rate of the measurement data sent from the transmitter to the receiver. When the output data rate is lowered, the transmitter decimates and downsamples the measurement data internally before sending it to the receiver. After downsampling, the number of data retransmissions between the transmitter and receiver is increased. This may improve communication stability.



- The transmitter sampling frequency is fixed at 8000 Hz, independent of the output data rate.
- If the output data rate is set to anything other than 8000 Hz, aliasing noise due to downsampling may occur.
- The delay time of the analog output at each output data rate varies depending on the maximum output data rate of the pair-setting. For details, please refer to "9-2 DELAY TIME".

The amount of data according to the output data rate setting is as follows:

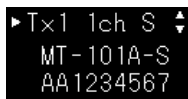
Output Data Rate	Data Volume
8000 Hz	1 (no decimation)
4000 Hz	1/2
2000 Hz	1/4
1000 Hz	1/8
500 Hz	1/16
100 Hz	1/80
50 Hz	1/160

The maximum configurable output data rate varies depending on the number of transmitter pairs configured.

Number of transmitters for pairing	Configurable output data rate
1	8000, 4000, 2000, 1000, 500, 100, 50 Hz
2	4000, 2000, 1000, 500, 100, 50 Hz
3	2000, 1000, 500, 100, 50 Hz
4	2000, 1000, 500, 100, 50 Hz

How to Set the Output Data Rate

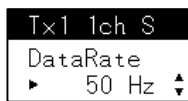
The following explanations omit the menu selection by the   switches.



Select [Txn]*9 for the transmitter to be set with the  switch.
*9. n is the pairing number of the transmitter.



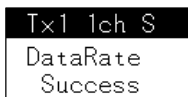

Select [DataRate] with the  switch. The displayed value is the currently set data rate value.

Select the data rate value to be set with the  switch. The data rate values that can be set with the receiver as a standalone unit are as follows: [50 Hz], [100 Hz], [500 Hz], [1000 Hz], [2000 Hz], [4000 Hz], [8000 Hz]. Additionally, selecting [Back] will return you to the previous screen.




The setting is in progress. After completion, the setting result is automatically displayed.

The setting results are as follows. If a certain time elapses or the  switch is pressed while the setting results are displayed, the screen returns to the initial screen.

Result	Content
[Success]	Setting successful
[Failed]	Setting failed

4-4. SETTING THE MEASUREMENT DATA OUTPUT INTERFACE

Set the interface used for outputting measurement data.



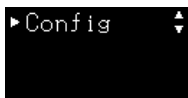
- If the output interface is set to USB/ETH, the measured data can be acquired only by using the control software or the control command. For details, please refer to each instruction manual.

The output destination and output data according to the output interface setting are as follows.

Output Interface	Output Destination	Output Data
[Analog]	Analog Output Connector	Voltage output at $\pm 5V$ /range full scale.
[USB/ETH]	USB Connector / LAN Connector	Acquire measurement values with the setting application or signed 24-bit data with control commands.
[CAN FD]	CAN Output Connector	Output signed 24-bit data via CAN output.

How to Set the Measurement Data Output Interface

The following explanations omit the menu selection by the Δ ∇ switches.



Select [Config] with the ENT. switch.



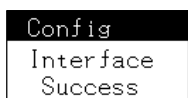
Select [Interface] with ENT. switch. The displayed value is the currently set output interface.



Select the output interface to be set with ENT. switch. The settable output interfaces are as follows:

[Analog], [USB/ETH], [CAN FD]

Additionally, selecting [Back] will return you to the previous screen.

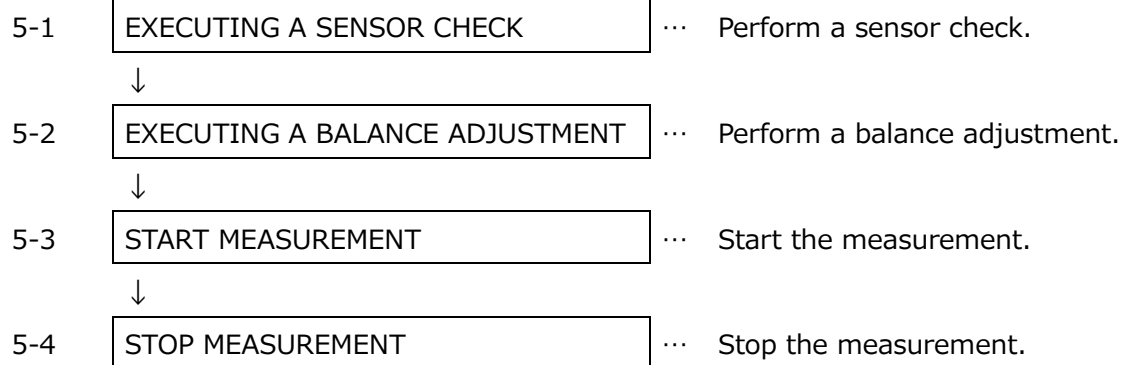


The setting results are as follows. If a certain time elapses or the ENT. switch is pressed while the setting results are displayed, the screen returns to the initial screen.

Result	Content
[Success]	Setting successful
[Failed]	Setting failed

(Blank)

5. MEASUREMENT



5-1. EXECUTING A SENSOR CHECK

The sensor check performs a simple check of the sensor's bridge circuit.



- When the sensor check is performed, a judgment is made using the set value of the bridge resistance.
- If the bridge resistance of the sensor in use differs from the set value of the bridge resistance, an incorrect judgment is made. For details on setting the bridge resistance, please refer to "4-2 Setting the Bridge Resistance Value".
- The sensor check inserts a shunt resistor built into the transmitter between the bridge's A (+BV) and D (+IN), calculates the bridge resistance from the increase in equivalent strain at that time, and makes a simple judgment. For details, please refer to "9-3 SENSOR CHECK".
- Please execute the sensor check in an unloaded state as much as possible. If there is an output from the connected sensor, the sensor check may fail.
- During the sensor check, the status LED of the transmitter that performed wireless communication will light up according to the transmitter's state.

How to Execute a Sensor Check

The following is the operation method when setting up with the receiver as a standalone unit.

▶Tx1 1ch S
MT-101A-S
AA1234567

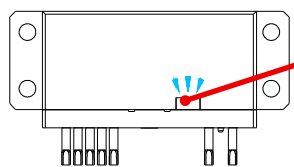
↓ CHECK

Check
WaitTx

Press and hold the **CHECK** switch for about 0.5 seconds.

The setting is in progress. After completion, the setting result is automatically displayed.

The status LED of the transmitter being processed will be fast blinking.



Status LED

Fast Blinking
(Processing state)



Check
Tx1 OK Tx2 NG
Tx3 ER Tx4 --

The sensor check result for each transmitter is displayed as follows. If a certain time elapses or the **ENT** switch is pressed while the sensor check result is displayed, the screen returns to the initial screen.

Result	Content
OK	Sensor check successful
NG	Sensor check failed
ER	Communication error
--	Not applicable or no pair

5-2. EXECUTING A BALANCE ADJUSTMENT

Balance adjustment can cancel out and remove the unbalance value occurring in the sensor's bridge circuit.



- The balance adjustment range in the transmitter's product specifications is within $\pm 10000 \times 10^{-6}$ Strain.
- If it exceeds approximately $\pm 11500 \times 10^{-6}$ Strain, the balance adjustment will fail.
- During balance adjustment, the status LED of the transmitter that performed wireless communication will light up according to the transmitter's state.
- The balance adjustment function can be set to OFF for each transmitter. For details, please refer to the respective instruction manuals for the control software or control commands.

How to Execute a Balance Adjustment

The following is the operation method when setting up with the receiver as a standalone unit.

▶ Tx1 1ch S
MT-101A-S
AA1234567

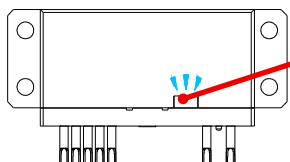
Press and hold the **BAL.** switch for about 2 seconds.



Balance
WaitTx

The setting is in progress. After completion, the setting result is automatically displayed.

The status LED of the transmitter being processed will be fast blinking.



Status LED

Fast Blinking
(Processing state)



Balance
Tx1 OK Tx2 NG
Tx3 ER Tx4 --

The balance adjustment result for each transmitter is displayed as follows. If a certain time elapses or the **ENT.** switch is pressed while the balance adjustment result is displayed, the screen returns to the initial screen.

Result	Content
OK	Balance adjustment successful
NG	Balance adjustment failed
ER	Communication error
--	Not applicable or no pair

5-3. START MEASUREMENT

Starts the measurement. The transmitter and receiver begin wireless communication and output measurement data according to the set output interface.

	The transmitter sampling frequency is fixed at 8000 Hz, independent of the output data rate.
---	--

The following is the operation method when starting measurement with the receiver as a standalone unit.

```

▶Tx1 1ch S
MT-101A-S
AA1234567
  
```



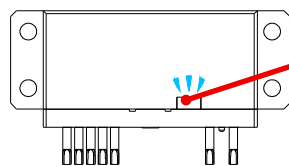
```

Measure
Monitor...
Analog
  
```

Press and hold the **START** switch for about 0.5 seconds.

Measurement is in progress. Measurement data is output according to the set output interface. The displayed shows the set output interface.

The status LED of a transmitter that is measuring is solid on.



Status LED

Solid On
(Measuring State)

5-4. STOP MEASUREMENT

Stops the measurement.

The following is the operation method when stopping measurement with the receiver as a standalone unit.

```
Measure
Monitor...
Analog
```

Press and hold the **STOP** switch for about 0.5 seconds.



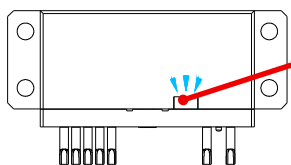
```
Measure
Stop
```

The measurement stop process is in progress. After completion, the menu screen is automatically displayed.



```
►Tx1 1ch S
MT-101A-S
AA1234567
```

After measurement is stopped, the transmitter's status LED blinks.



Status LED

Blinking
(Standby State)

(Blank)

6. PC CONNECTION

Either USB or LAN can be selected as the interface for connecting to a PC. Connecting the PC to the receiver enables functions such as pairing, configuration of measurement conditions, and acquisition of measurement data.



- Before connecting to a PC, it is necessary to set the connection interface with the USB/LAN connection switch in advance. For details, refer to “2-1-1 Receiver Setting Switch Settings”.
- If this product is connected to the PC, it can be controlled using the control software or the control command. For details, please refer to each instruction manual.
- The wireless LAN and Bluetooth® capabilities of a PC on which this product's dedicated control software is installed can also be a source of interfering radio waves. When operating this product using a PC, please disable the wireless LAN and Bluetooth® on your computer.

6-1. USB CONNECTION

Configure the settings for a USB connection.

USB Driver Setup

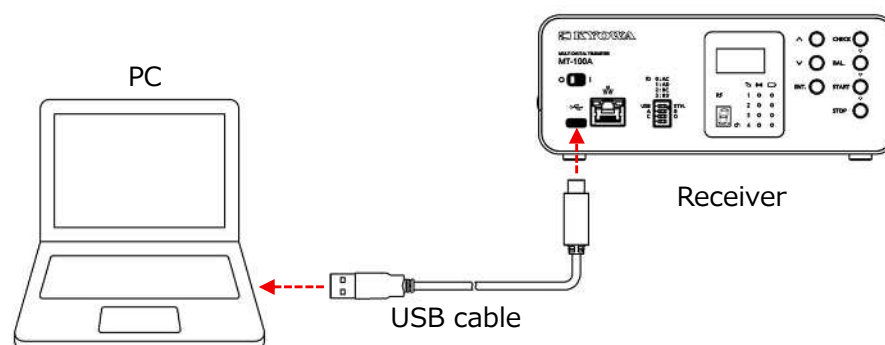
When connecting the receiver via USB, please install the USB driver for the MT-100A in advance.



- Please install the USB driver with administrator privileges.

USB Connector Connection

To communicate with a PC via USB, use a USB cable (accessories or optional accessories) to connect the USB connector and the PC. The receiver's data transfer speed is USB Hi-Speed (480 Mbps).



6-2. LAN CONNECTION

Configure the settings for a LAN connection.

LAN Interface Initial Setup

When connecting the receiver via LAN, it is necessary to set the network conditions for the receiver and the connected PC in advance. The receiver's IP address can only be set using the control software or control commands. For details, please refer to the respective instruction manuals.



- Be sure to set the network conditions before connecting via LAN.
- If the IP addresses of the connected receiver and PC are duplicated, communication will not be possible. Please set them so they do not overlap.
- The factory default network conditions for this product are as follows:

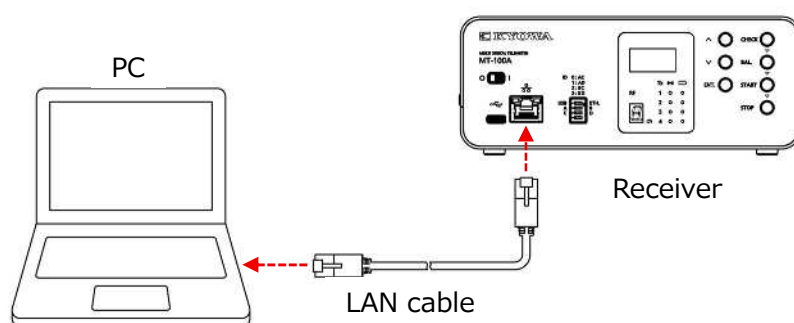
IP Address	:	192.168.70.100
Subnet Mask:	:	255.255.255.0
Default Gateway	:	0.0.0.0

The network condition setting items are as follows:

Setting Item	Content
IP Address	An address to identify devices connected on the network. Set it so it does not overlap with other devices on the network.
Subnet Mask	A setting to divide the IP address into a part indicating the network and a part indicating the device. Set the same value as other devices on the network.
Default Gateway	Set the same value as the default gateway in the PC's settings.

LAN Connector Connection

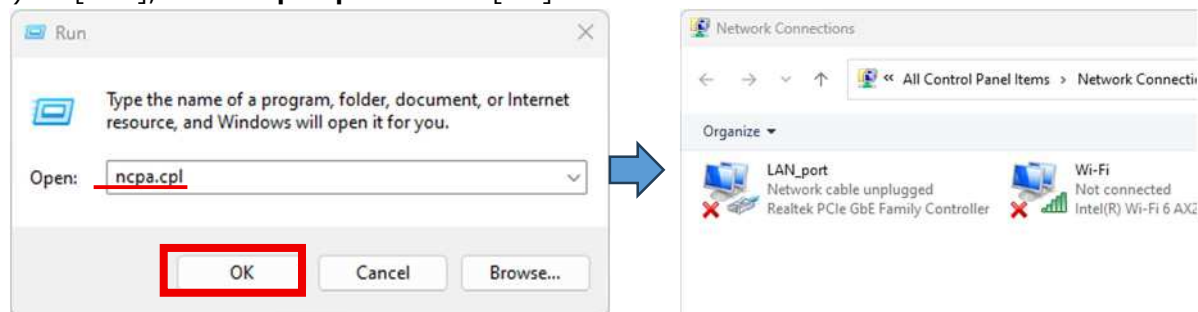
A To communicate with a PC via LAN, use a LAN cable to connect the LAN connector and the PC.



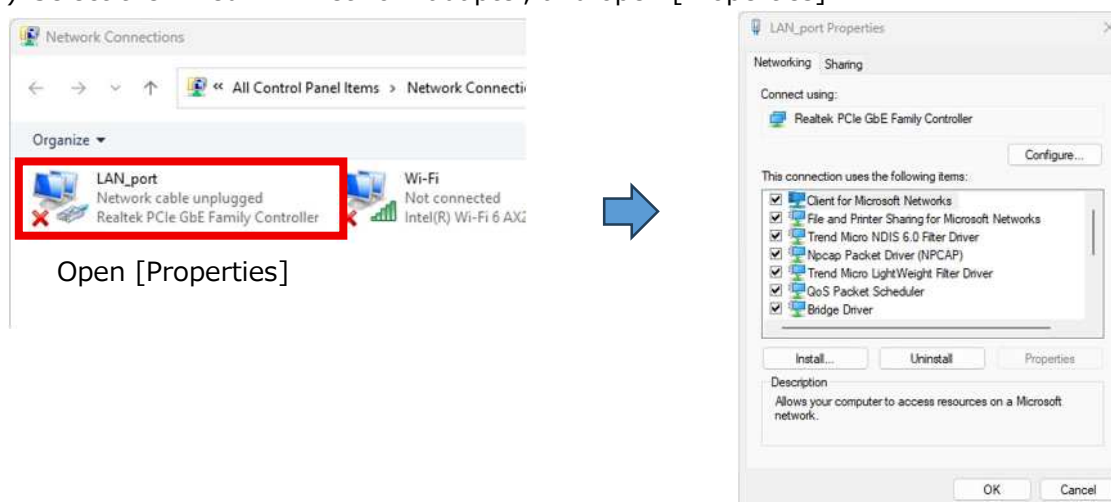
Network Setting Procedure for PC

When connecting the receiver via LAN, manually set the IP address of the PC so that the receiver and the PC have the same network address.

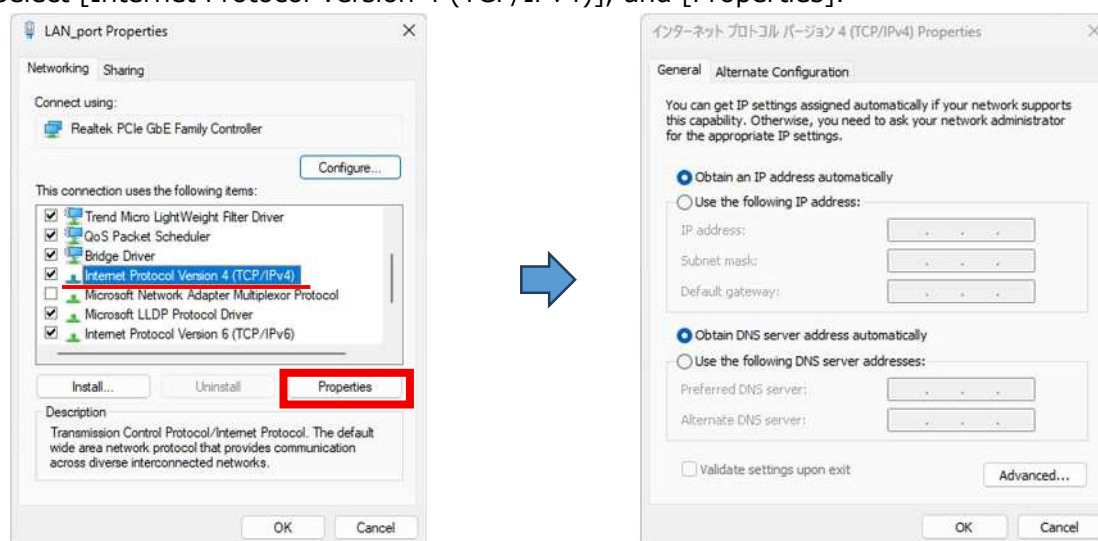
- (1) In [Run], enter **ncpa.cpl** and click [OK]



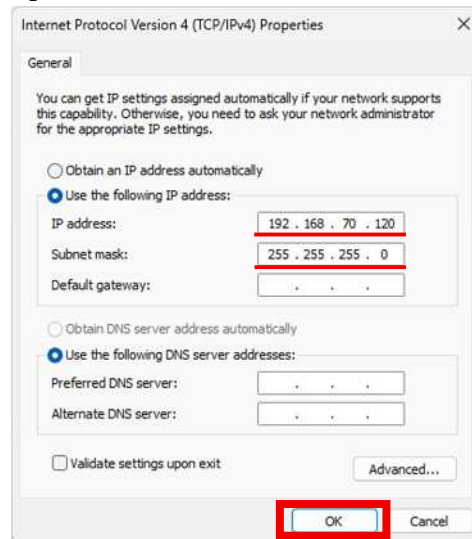
- (2) Select the wired LAN network adapter, and open [Properties].



- (3) Select [Internet Protocol Version 4 (TCP/IPv4)], and [Properties].



- (4) Enter the [IP address] and [subnet mask] so that they are on the same network address as the receiver, and click [OK].



7. OTHER FUNCTIONS

7-1. RADIO FREQUENCY CHANNEL (RFCH)

The Radio Frequency Channel (RFCH) is the frequency channel used for wireless communication between the transmitter and the receiver. The RFCH is configured during the pair-setting process. For details on the pair-setting, please refer to "2-5 PAIR-SETTING".

	• If multiple receivers are in use, do not use the same RFCH. The wireless communications may interfere with each other, which can cause communication errors. • This product uses 2.4 GHz band radio waves for wireless communication. The radio waves of other 2.4 GHz band wireless devices (wireless LAN, Bluetooth®, etc.) can act as interfering waves, which may cause communication errors. In this case, changing the RFCH may improve communication stability. • To change the RFCH, the pair-setting process must be re-executed. For details on the pair-setting, please refer to "2-5 PAIR-SETTING". • The wireless communication status for each RFCH can be checked with the RF status confirmation function of the control software. For details, please refer to the respective instruction manuals.
---	--

The Central frequency for each RFCH is as follows:

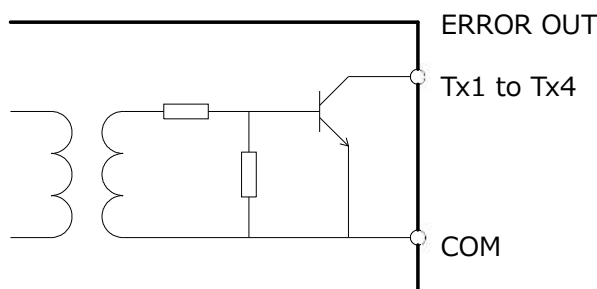
RFCH	0	1	2	3	4	5	6	7
Central frequency (GHz)	2.405	2.410	2.415	2.420	2.425	2.430	2.435	2.440

RFCH	8	9	A	B	C	D	E	F
Central frequency (GHz)	2.445	2.450	2.455	2.460	2.465	2.470	2.475	2.480

7-2. ERROR OUTPUT FUNCTION

If an error occurs during measurement, the error signal is output to an external device via the error output connector. To use this function, set the output interface to "Analog Output" to enable the error output function. For configuration details, please refer to "4-4 Setting the Measurement Data Output Interface".

When an error occurs, measurement data from the receiver (analog voltage output and digital output via USB, LAN, and CAN) is held at the value immediately preceding the error. During this state, the NPN output on the error output connector switches to the ON state.



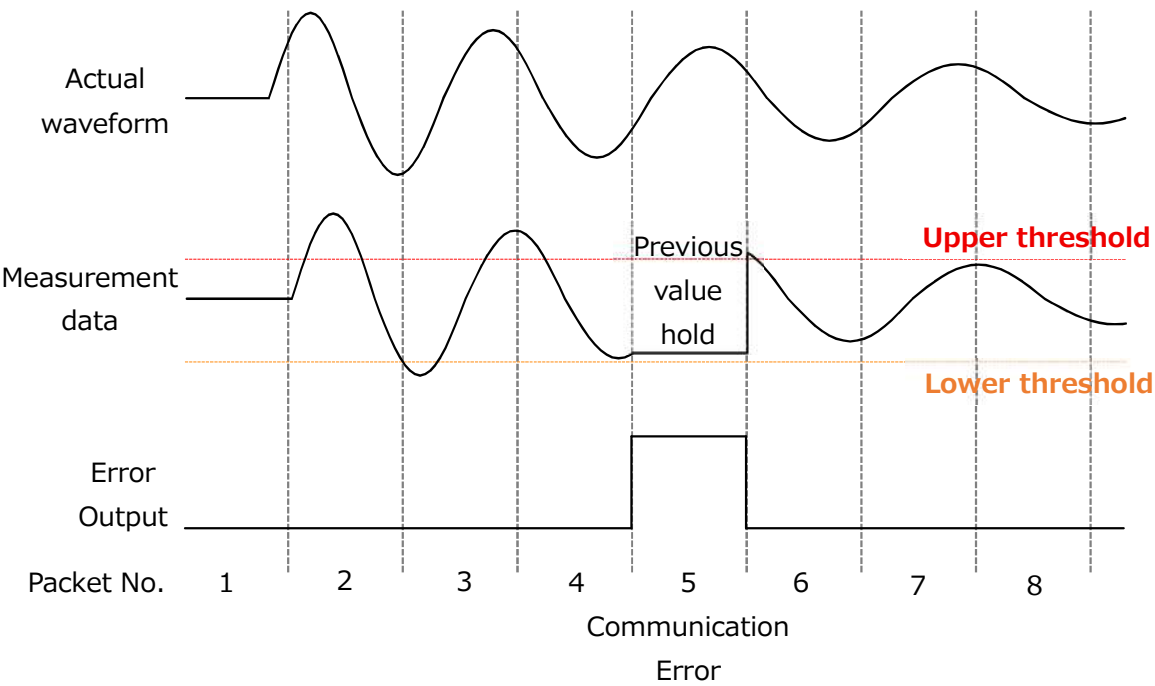
- The error output function settings can only be set with the control software or control commands. For details, please refer to the respective instruction manuals.
- Error output can be obtained not only from the error output connector but also by using CAN output or control commands. For details, please refer to "7-4 CAN OUTPUT FUNCTION" or the Control Command Edition instruction manual.
- In addition to the error output from the error output connector, it is also possible to sound a buzzer for each error occurrence. The buzzer setting can only be set using the control software or control commands. For details, please refer to the respective instruction manuals.

The error output settings can be selected from the following:

Error Output Setting	Content
Communication Error	Outputs an error if a communication error occurs during measurement.
Threshold Error	Outputs an error if the measured value is greater than or equal to the set upper threshold or less than or equal to the lower threshold during measurement.
Communication Error and Threshold Error	Outputs an error if a communication error occurs, or if the measured value is greater than or equal to the set upper threshold or less than or equal to the lower threshold during measurement.

Communication Error

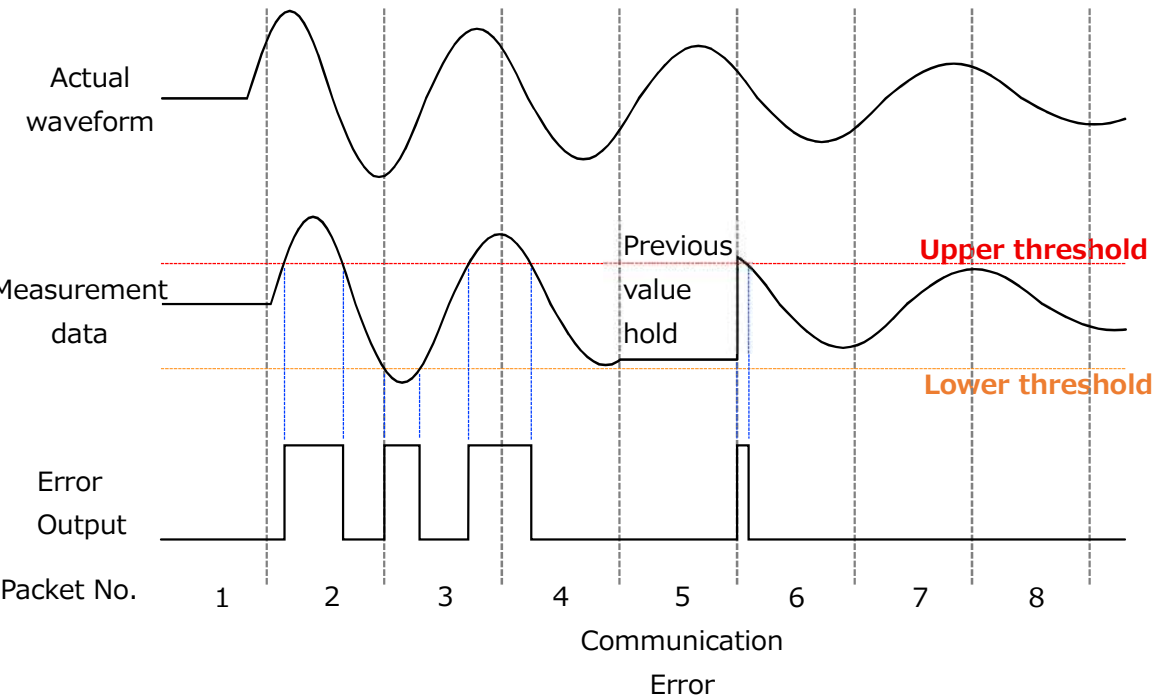
Outputs an error if a communication error occurs during measurement.



Threshold Error

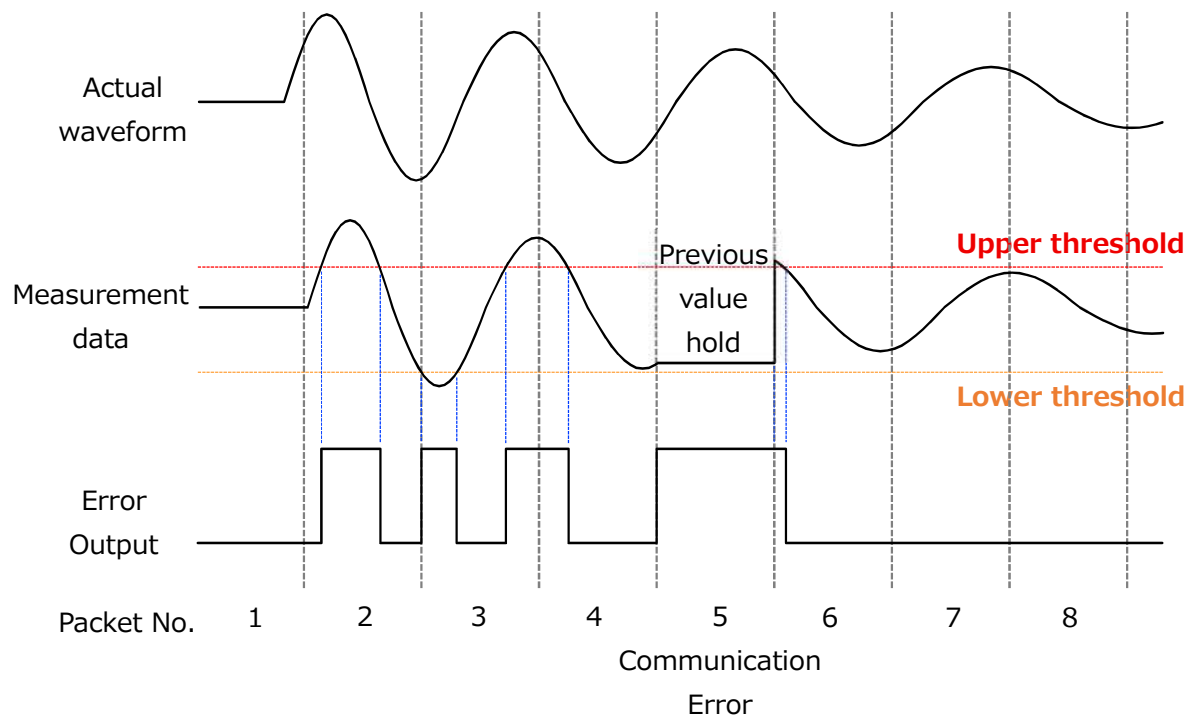
Outputs an error if the measured value is greater than or equal to the set upper threshold or less than or equal to the lower threshold during measurement.

- The upper and lower thresholds can only be set using the control software or control commands. For details, please refer to the respective instruction manuals.



Communication Error and Threshold Error

Outputs an error if a communication error occurs, or if the measured value is greater than or equal to the set upper threshold or less than or equal to the lower threshold during measurement.



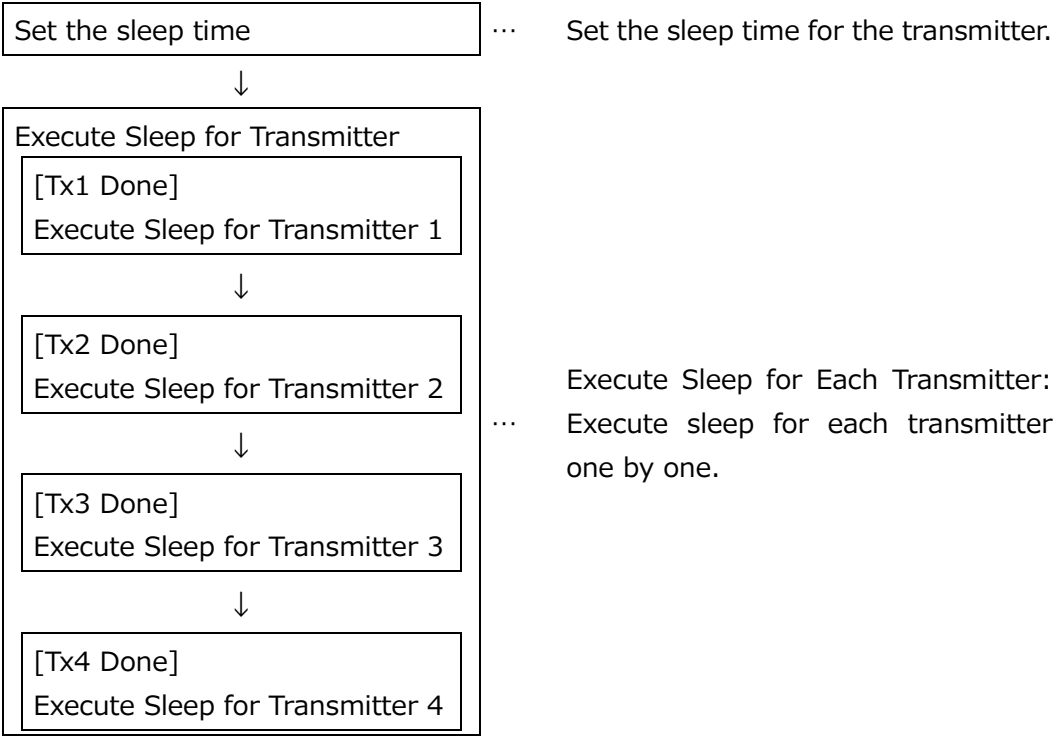
7-3. SLEEP FUNCTION

The sleep function allows the transmitter to enter a low-power state to reduce battery consumption. The sleep state is released after the set sleep time has elapsed, and the transmitter transitions to the standby state.



· The current consumption of the transmitter in sleep mode is 5 mA or less.

The flow for executing sleep is as follows.



Set the sleep time

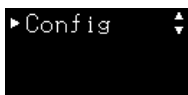
Set the time from when the transmitter starts sleeping until it enters standby.



- When using the control software and control commands, the sleep time can be set in minutes. For details, please refer to the respective instruction manuals.

The following is the operation method when setting up with the receiver as a standalone unit.

The following explanations omit the menu selection by the **[▲]** **[▼]** switches.



Select [Config] with the **[ENT.]** switch.



Select [SleepTime] with the **[ENT.]** switch.

The displayed value is the currently set sleep time.

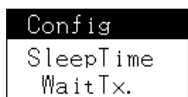


Select the sleep time with the **[ENT.]** switch.

The settable sleep times are as follows:

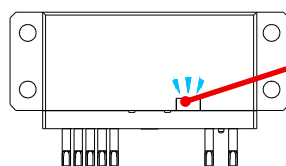
[0 h 30 m], [1 h 00 m], [12 h 00 m], [24 h 00 m]

Additionally, selecting [Back] will return you to the previous screen.



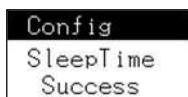
The setting is in progress. After completion, the setting result is automatically displayed.

The status LED of the transmitter being processed will be fast blinking.



Status LED

Fast Blinking (Processing state)



The setting results are as follows. If a certain time elapses or the **[ENT.]** switch is pressed while the setting results are displayed, the screen returns to the initial screen.

Result	Content
[Success]	Setting successful
[Failed]	Setting failed

Execute Sleep for Transmitter

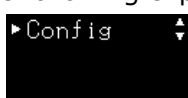
Executes sleep for the selected transmitter.



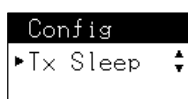
- If executing sleep for multiple transmitters, the operation must be performed for each transmitter individually.
- If the power is turned off and on again while in the sleep state, the sleep state is canceled and the transmitter enters the standby state.
- Once the transmitter enters the sleep state, it cannot be operated until the set sleep time has elapsed. To operate the transmitter during the sleep state, restart its power before proceeding.
- When the sleep function is activated, the transmitter enters the pre-sleep state. It transitions to the sleep state after approximately 3 minutes. The status LED indicates the transmitter's state.
- If the sleep command is executed again while a transmitter is in the pre-sleep state, the operation is canceled and the transmitter returns to the standby state.

The following is the operation method when setting up with the receiver as a standalone unit.

The following explanations omit the menu selection by the switches.



Select [Config] with the switch.



Select [Tx Sleep] with the switch.

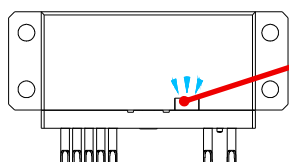


Select the transmitter for execute sleep with the switch. Additionally, selecting [Back] will return you to the previous screen.



The setting is in progress. After completion, the setting result is automatically displayed.

The status LED of the transmitter being processed will be fast blinking.

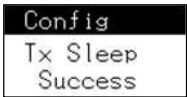


Status LED

Fast Blinking (Processing)



(Continued on the next page)



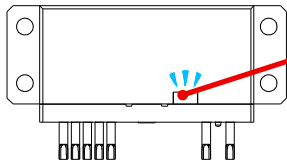
(Continued from the previous page)

The setting results are as follows. If a certain time elapses or the **ENT.** switch is pressed while the setting results are displayed, the screen returns to the initial screen.

Result	Content
[Success]	Setting successful
[Failed]	Setting failed



After the setting is successful, the transmitter transitions to the pre-sleep state.

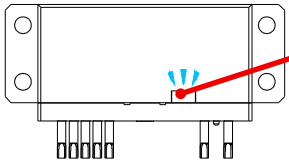


Status LED
Fast Blinking (Pre-sleep state)



About 3 minutes later

After 3 minutes in the pre-sleep state, the transmitter enters the sleep state.
The status LED is flashing while the transmitter is in the sleep state.



Status LED
Flashing (Sleep State)

7-4. CAN OUTPUT FUNCTION

When the measurement data output setting is set to CAN FD, measurement data is output from the CAN output connector via CAN or CAN FD.

	• A 120Ω termination resistor is required at both ends of the CAN bus. • This product is equipped with a built-in ON/OFF function for a 120Ω termination resistor. When this product is placed at both ends of the CAN bus, the termination resistor must be enabled. • The termination resistor setting can only be set using the control software or control commands. For details, please refer to the respective instruction manuals. • When using the CAN output function, please set the measurement data output Interface setting to CAN FD. • The output data for CAN is signed 24 bit.
---	---

7-4-1.CAN Output Data Format

The data frame for CAN varies depending on the output format setting (CAN and CAN FD).

The data that can be obtained with CAN output is as follows:

Name	Value	Content
Timestamp Counter (TSC)	Unsigned 64 bit	The timestamp counter for the transmitter data.
Transmitter data	Communication Error output	Unsigned 8 bit 0: No error 1: Error
	Power voltage level	Unsigned 8 bit 0: Less than 2.20 V 1: 2.29 to 2.20 V 2: 2.39 to 2.30 V 3: 2.40 V or higher
	Wireless signal level	Unsigned 8 bit 0: No signal 1: Weak 2: Medium 3: Good
	Measurement data	Signed 24 bit The Measurement Data for the transmitter.

The measurement data becomes 7000000 when the maximum value of the range setting is reached. Therefore, the conversion from the acquired measurement value to a physical quantity (strain value) can be done as follows:

$$\text{Physical Quantity} = \text{Measurement Data} \times \frac{\text{Measurement Range}}{7000000}$$

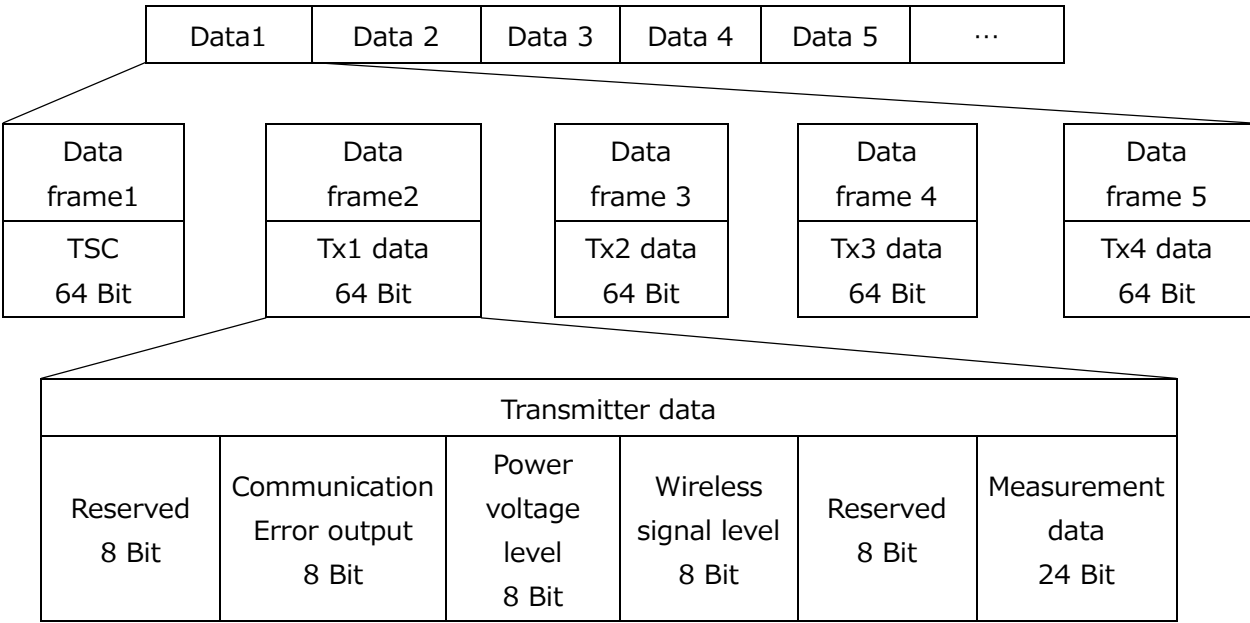
Example: When the range is 1000×10^{-6} strain and the measurement data is 3500000 the measured strain value is as follows:

$$1000 \times 10^{-6} \text{strain} \times \frac{3500000}{7000000} = 500 \times 10^{-6} \text{strain}$$

7-4-1-1. Output Format: CAN (CAN Standard or CAN Extended)

When the CAN format is selected for output, the Time Stamp Counter (TSC) and each transmitter's data are output in separate, dedicated data frames.

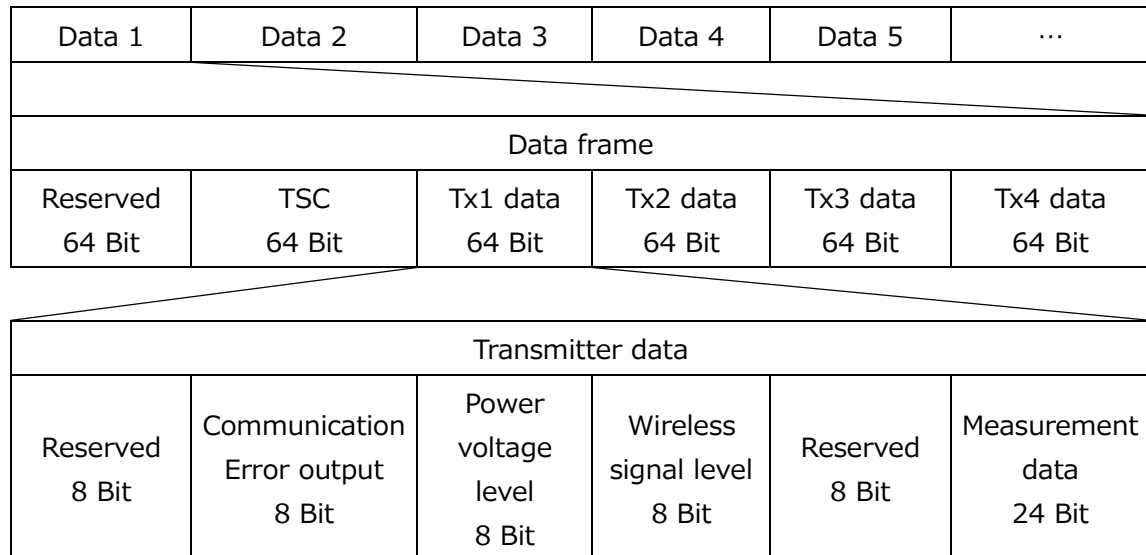
A maximum of five CAN outputs (TSC and Transmitters No. 1 through No. 4) are executed per single data output. Data frames for transmitter data are valid only for currently paired transmitters. All output data follow the Little Endian format.



	• Reserved area data are all set to 0.
---	--

7-4-1-2. Output Format: CAN FD (CAN FD Standard or CAN FD Extended)

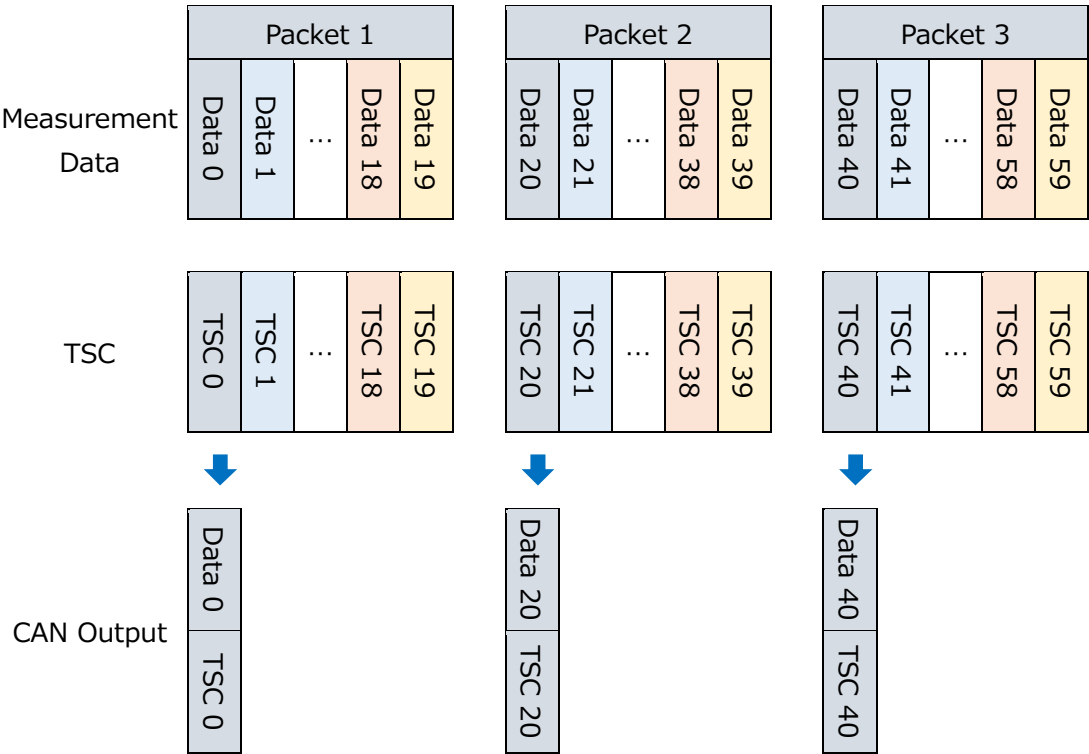
When the output format is CAN FD, the TSC (Timestamp Counter) and each transmitter's data (Txn data) are output in the same data frame. The data for unpaired transmitters will be all 0s. All output data follow the Little Endian format.



	Reserved area data are all set to 0.
---	--

7-4-2.Data Output Timing

CAN data output timing synchronizes with the send data rate (the packet send rate of the transmitter). This send data rate is defined as 1/20 of the maximum output data rate. The system transmits the leading data within the transmitter packet. Consequently, the TSC (Time Stamp Counter) increments according to the amount of data contained within each transmitter packet.



7-4-3.CAN Output Format

The CAN output settings can only be set with the control software or control commands. For details, please refer to the respective instruction manuals.

	Do not set duplicate values for each Message ID in the CAN Output Format. Normal CAN communication will not be possible.
---	--

The CAN Output Format is as follows:

CAN Output Format		Setting Value	Content
Output Format		CAN FD Standard, CAN FD Extended, CAN Standard, CAN Extended	Selects the format of the message to be output.
Communication Speed (kbps)		1000, 800, 500, 250, 125, 100, 83.3, 62.5, 50, 33.3, 25, 20, 10	Selects the communication speed for CAN and CAN FD.
CAN FD Data Phase Communication Speed		5, 4, 2, 1, 0.5 Mbps and OFF	Selects the communication speed for the CAN FD data phase. Refer to “CAN FD Data Phase Communication Speed”
CAN FD Data Frame Message ID		0x00000000 to 0xFFFFFFFF	Sets the Message ID for the CAN FD data frame.
CAN Data Frame Message ID	TSC	0x00000000 to 0xFFFFFFFF	Sets the Message ID for each CAN data frame.
	Tx1	0x00000000 to 0xFFFFFFFF	
	Tx2	0x00000000 to 0xFFFFFFFF	
	Tx3	0x00000000 to 0xFFFFFFFF	
	Tx4	0x00000000 to 0xFFFFFFFF	

CAN FD Data Phase Communication Speed

CAN FD allows for setting a higher communication speed in the data phase of the data frame.



- If the output format is CAN, the CAN FD data phase communication speed is not used, so please set it to OFF.

This product has the following possible combinations for the communication speed and CAN FD data phase communication speed in the CAN output settings.

Communication Speed (kbps)	Configurable CAN FD Data Phase Communication Speed
1000, 800	2, 1 Mbps and OFF
500, 250	5, 4, 2, 1, 0.5 Mbps and OFF
125	2, 1, 0.5 Mbps and OFF
100, 83.3, 62.5	1, 0.5 Mbps and OFF
50, 33.3	0.5 Mbps and OFF
25, 20, 10	OFF

Sample point setting

In CAN communication, it is necessary to set the sample point, which is the timing for judging the logical level within each communicated bit, and the Synchronous Jump Width (SJW) for delay compensation.

In this product, the sample point and SJW for each communication speed are set as follows. These values are fixed and cannot be changed.

125 kbps or less (Low Speed CAN)

Communication Speed (kbps)	Sample Point	SJW	CAN FD Data Phase		
			Communication Speed (kbps)	Sample Point	SJW
125	80%	32	2	80%	2
125	80%	32	1	80%	4
125	80%	16	0.5	80%	4
125	80%	4	OFF	80%	4
100	80%	20	1	80%	2
100	80%	20	0.5	80%	4
100	80%	4	OFF	80%	4
83.3	80%	24	1	80%	2
83.3	80%	24	0.5	80%	4
83.3	80%	4	OFF	80%	4
62.5	80%	32	1	80%	2
62.5	80%	32	0.5	80%	4
62.5	80%	4	OFF	80%	4
50	80%	20	0.5	80%	2
50	80%	4	OFF	80%	4
33.3	80%	30	0.5	80%	2
33.3	80%	4	OFF	80%	4
25	80%	4	OFF	80%	4
20	80%	4	OFF	80%	4
10	80%	4	OFF	80%	4

250 to 1000 kbps (High Speed CAN)

Communication Speed (kbps)	Sample Point	SJW	CAN FD Data Phase		
			Communication Speed (kbps)	Sample Point	SJW
1000	80%	8	2	75%	5
1000	80%	4	1	80%	4
1000	80%	4	OFF	80%	4
800	80%	10	2	75%	5
800	80%	5	1	80%	4
800	80%	2	OFF	80%	2
500	80%	16	5	62.5%	3
500	80%	16	4	70%	3
500	80%	16	2	75%	5
500	80%	8	1	80%	4
500	80%	4	0.5	80%	4
500	80%	4	OFF	80%	4
250	80%	32	5	62.5%	3
250	80%	32	4	70%	3
250	80%	32	2	75%	5
250	80%	16	1	80%	4
250	80%	8	0.5	80%	4
250	80%	4	OFF	80%	4

7-4-4.CAN COMMUNICATION CONFIGURATION

NOTE



Ensure the CAN bus load is within acceptable limits during configuration.

Setting an excessive output data rate relative to the CAN baud rate increases the bus occupancy. This condition may interfere with overall bus communication, potentially leading to malfunctions or equipment failure in other networked devices. If the bus load exceeds 30%, communication will not function as configured. Select an appropriate output data rate considering the total load on the CAN bus.

The recommended configuration for CAN communication varies depending on the output data rate and the number of paired transmitters. Refer to the table below for the recommended settings based on each CAN output condition.

7-4-4-1. Output Format: CAN (CAN Standard or CAN Extended)

Number of paired transmitters: 1 unit

Output data rate	Communication Speed (kbps)												
	1000	800	500	250	125	100	83.3	62.5	50	33.3	25	20	10
8000 Hz	R	R	R	N	N	N	N	N	N	N	N	N	N
4000 Hz	R	R	R	R	N	N	N	N	N	N	N	N	N
2000 Hz	R	R	R	R	R	R	N	N	N	N	N	N	N
1000 Hz	R	R	R	R	R	R	R	R	R	N	N	N	N
500 Hz	R	R	R	R	R	R	R	R	R	R	R	N	N
100 Hz	R	R	R	R	R	R	R	R	R	R	R	R	R
50 Hz	R	R	R	R	R	R	R	R	R	R	R	R	R
R: Recommended, N: Not recommended													

Number of paired transmitters: 2 unit

Output data rate	Communication Speed (kbps)												
	1000	800	500	250	125	100	83.3	62.5	50	33.3	25	20	10
4000 Hz	R	R	R	N	N	N	N	N	N	N	N	N	N
2000 Hz	R	R	R	R	N	N	N	N	N	N	N	N	N
1000 Hz	R	R	R	R	R	R	R	N	N	N	N	N	N
500 Hz	R	R	R	R	R	R	R	R	R	N	N	N	N
100 Hz	R	R	R	R	R	R	R	R	R	R	R	R	R
50 Hz	R	R	R	R	R	R	R	R	R	R	R	R	R
R: Recommended, N: Not recommended													

Number of paired transmitters: 3 unit

Output data rate	Communication Speed (kbps)												
	1000	800	500	250	125	100	83.3	62.5	50	33.3	25	20	10
2000 Hz	R	R	R	R	N	N	N	N	N	N	N	N	N
1000 Hz	R	R	R	R	R	R	N	N	N	N	N	N	N
500 Hz	R	R	R	R	R	R	R	R	R	N	N	N	N
100 Hz	R	R	R	R	R	R	R	R	R	R	R	R	R
50 Hz	R	R	R	R	R	R	R	R	R	R	R	R	R
R: Recommended, N: Not recommended													

Number of paired transmitters: 4 unit

Output data rate	Communication Speed (kbps)												
	1000	800	500	250	125	100	83.3	62.5	50	33.3	25	20	10
2000 Hz	R	R	R	R	N	N	N	N	N	N	N	N	N
1000 Hz	R	R	R	R	R	N	N	N	N	N	N	N	N
500 Hz	R	R	R	R	R	R	R	R	R	N	N	N	N
100 Hz	R	R	R	R	R	R	R	R	R	R	R	R	N
50 Hz	R	R	R	R	R	R	R	R	R	R	R	R	R
R: Recommended, N: Not recommended													

7-4-4-2. Output Format: CAN FD (CAN FD Standard or CAN FD Extended)

CAN FD Data Phase Communication Speed: 5 Mbps

Communication Speed (kbps)	Output data rate (Hz)						
	50	100	500	1000	2000	4000	8000
500	R	R	R	R	R	R	R
250	R	R	R	R	R	R	R
R: Recommended, N: Not recommended							

CAN FD Data Phase Communication Speed: 4 Mbps

Communication Speed (kbps)	Output data rate (Hz)						
	50	100	500	1000	2000	4000	8000
500	R	R	R	R	R	R	R
250	R	R	R	R	R	R	R
R: Recommended, N: Not recommended							

CAN FD Data Phase Communication Speed: 2 Mbps

Communication Speed (kbps)	Output data rate (Hz)						
	50	100	500	1000	2000	4000	8000
1000	R	R	R	R	R	R	R
800	R	R	R	R	R	R	R
500	R	R	R	R	R	R	R
250	R	R	R	R	R	R	R
125	R	R	R	R	R	R	R
R: Recommended, N: Not recommended							

CAN FD Data Phase Communication Speed: 1 Mbps

Communication Speed (kbps)	Output data rate (Hz)						
	50	100	500	1000	2000	4000	8000
1000	R	R	R	R	R	R	R
800	R	R	R	R	R	R	R
500	R	R	R	R	R	R	R
250	R	R	R	R	R	R	R
125	R	R	R	R	R	R	N
100	R	R	R	R	R	R	N
83.3	R	R	R	R	R	R	N
62.5	R	R	R	R	R	N	N
R: Recommended, N: Not recommended							

CAN FD Data Phase Communication Speed: 0.5 Mbps

Communication Speed (kbps)	Output data rate (Hz)						
	50	100	500	1000	2000	4000	8000
500	R	R	R	R	R	R	N
250	R	R	R	R	R	R	N
125	R	R	R	R	R	R	N
100	R	R	R	R	R	N	N
83.3	R	R	R	R	R	N	N
62.5	R	R	R	R	R	N	N
50	R	R	R	R	R	N	N
33.3	R	R	R	R	R	N	N
R: Recommended, N: Not recommended							

CAN FD Data Phase Communication Speed: OFF

Communication Speed (kbps)	Output data rate (Hz)						
	50	100	500	1000	2000	4000	8000
1000	R	R	R	R	R	R	R
800	R	R	R	R	R	R	R
500	R	R	R	R	R	R	N
250	R	R	R	R	R	N	N
125	R	R	R	R	N	N	N
100	R	R	R	R	N	N	N
83.3	R	R	R	N	N	N	N
62.5	R	R	R	N	N	N	N
50	R	R	R	N	N	N	N
33.3	R	R	N	N	N	N	N
25	R	R	N	N	N	N	N
20	R	R	N	N	N	N	N
10	R	R	N	N	N	N	N
R: Recommended, N: Not recommended							

7-5. INTER-RECEIVER SYNCHRONIZATION FUNCTION

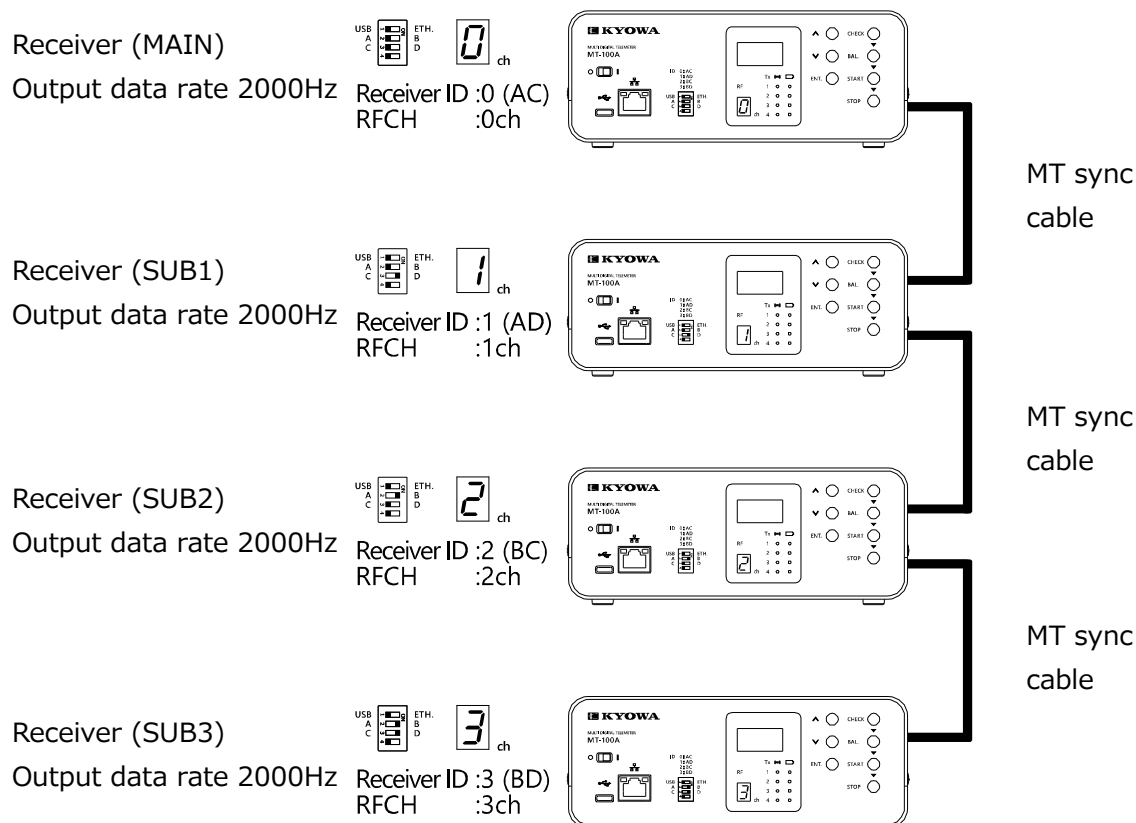
The inter-receiver synchronization function is a function that transmits a synchronization signal from multiple receivers to each transmitter at the same timing. This allows data to be received simultaneously from the transmitters that are PAIR-SET with each respective receiver. Additionally, data can be output from each receiver at the same timing.



- Please set the receiver IDs (MAIN, SUB1 to 3) so that there are no duplicates or gaps.
- The maximum number of synchronized receivers is 4. Connecting 5 or more units causes the system to malfunction.
- Assign a unique RFCH to each receiver to prevent duplication. Overlapping RFCHs cause radio interference in the wireless communication between transmitters and receivers. Radio interference leads to increased communication errors and the loss of measurement data.
- In this function, depending on the settings of the MAIN receiver, the number of transmitters that can be pair-set to the SUB receiver and the selectable output data rates are limited. For details, please refer to "7-5-1 Configurable Receiver Settings".
- The analog output delay time varies depending on the output data rate of each transmitter. For details, refer to "9-2 DELAY TIME" or "the Control Command Instruction Manual".

Connection Procedure

- (1) Set the receiver ID of each receiver with the receiver setting switch.
- (2) Connect each receiver with an MT sync cable (optional accessory).
- (3) Turn ON the power switch of the receivers.
- (4) Perform pair-Setting and configuration for each receiver and transmitter.
- (5) Press the **START** switch on the receiver with Receiver ID 0 (MAIN). All receivers will start measurement.



7-5-1. Configurable Receiver Settings

Based on the configurations of the MAIN Receiver, restrictions are applied to the number of pairable transmitters and the selectable the output data rate for the SUB Receiver. Configure the system appropriately according to the table below.

MAIN Receiver		SUB Receiver	
Transmitter Pairing Count	Max Output Data Rate	Max Pairable Transmitters	Selectable Output Data Rates
1 Unit	8000 Hz	1 Unit	50, 100, 500, 1000, 2000, 4000, 8000 Hz
	4000 Hz	Up to 2 Units	50, 100, 500, 1000, 2000, 4000 Hz
	2000 Hz	Up to 4 Units	50, 100, 500, 1000, 2000 Hz
	1000 Hz	Up to 4 Units	50, 100, 500, 1000 Hz
	500 Hz	Up to 4 Units	50, 100, 500 Hz
	100 Hz	Up to 4 Units	50, 100 Hz
	50 Hz	Up to 4 Units	50 Hz
2 Unit	4000 Hz	Up to 2 Units	50, 100, 500, 1000, 2000, 4000 Hz
	2000 Hz	Up to 4 Units	50, 100, 500, 1000, 2000 Hz
	1000 Hz	Up to 4 Units	50, 100, 500, 1000 Hz
	500 Hz	Up to 4 Units	50, 100, 500 Hz
	100 Hz	Up to 4 Units	50, 100 Hz
	50 Hz	Up to 4 Units	50 Hz
3 or 4 Units	2000 Hz	Up to 4 Units	50, 100, 500, 1000, 2000 Hz
	1000 Hz	Up to 4 Units	50, 100, 500, 1000 Hz
	500 Hz	Up to 4 Units	50, 100, 500 Hz
	100 Hz	Up to 4 Units	50, 100 Hz
	50 Hz	Up to 4 Units	50 Hz



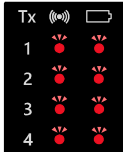
• If measurement is started with the number of pair-setting transmitters or the output data rate set to other than the above, the transmitter status LED flashes red as follows.



Off for approx. 0.5 sec.



Repeats



Light up red for approx. 0.5 sec.

7-25

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7-6. UTILITY NUTS

Removing the receiver's rubber feet allows the utility nuts to be used for fixing the receiver to a plate.

CAUTION



When performing installation and maintenance, always wear protective gloves.

To prevent injuries from the edges, screw holes, and machined burrs of this product when performing installation and maintenance, always wear protective gloves.

NOTE



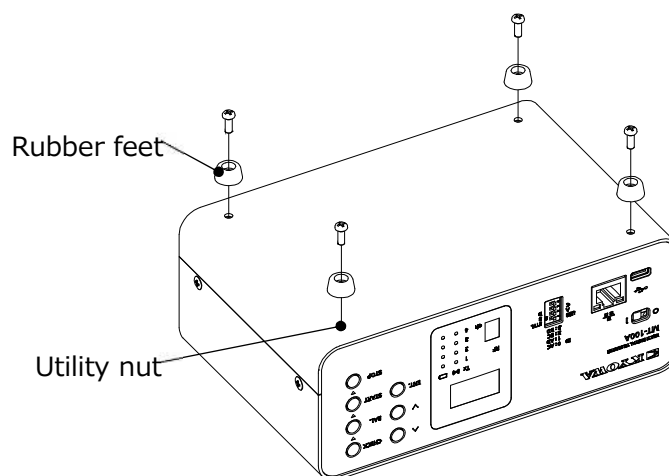
Be careful with the length of the screws used for the utility nuts.

If the screws used for the utility nuts are too long, they may damage the receiver. Also, if the screws used are too short, they cannot be fastened to the utility nuts. For details, refer to "7-6-2 Screws To Be Attached To The Utility Nuts".

The model and fastening conditions for the rubber feet are as follows:

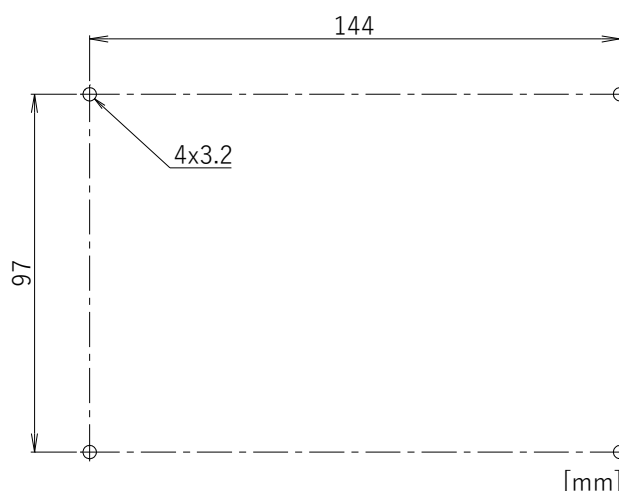
Model	: TW-K11W
Manufacturer	: Tochigiya
Screw Type	: M3 pan head screw
Screw Length	: 8 mm
Tightening Torque	: 0.29 N·m

- (1) Remove the four M3 pan head screws on the bottom of the receiver to remove the rubber feet.



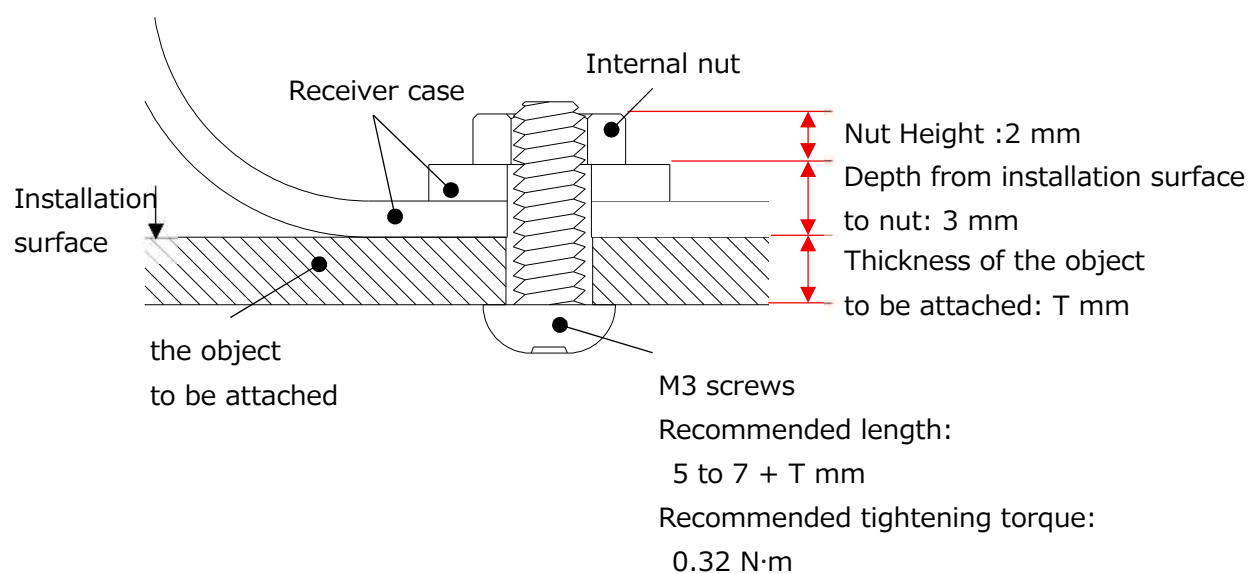
7-6-1.Utility Nut Mounting Holes

The mounting hole dimensions for the utility nuts are as follows.



7-6-2.Screws To Be Attached To The Utility Nuts

The dimensions related to the internal utility nuts from the mounting surface are as follows.



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8. BEFORE ASSUMING A MALFUNCTION

8-1. TROUBLESHOOTING

8-1-1.Receiver-Related Issues

Symptom	Confirmation	Solution
Receiver does not power on with AC adapter.	Check that the AC adapter is securely connected.	Recheck the AC adapter's connection.
	Check that the outlet voltage is within the AC 100-240V range.	Use an outlet that the AC adapter can be used with.
	Check that the specified AC adapter is being used.	Replace it with the specified AC adapter.
	Check that the AC adapter's output voltage is within the DC 10-30V range.	The AC adapter is faulty. Replace the AC adapter.
Receiver does not power on with DC power.	Check that the power cord is securely connected.	Recheck the power supply's connection.
	Check that the power supply polarity (+/-) is correct.	Recheck the power supply's connection.
	Check that the power supply has a capacity of 30W or more.	Replace it with a power supply with a larger capacity.
	Check that the power supply's output voltage is within the DC 10-30V range.	Recheck the power supply's settings.
Cannot connect via USB.	Check that the USB driver is installed on the PC.	Install the USB driver on the PC.
	Check that the USB cable is securely connected.	Recheck the USB cable's connection.
	Check that the USB/LAN connection switch is set to USB.	Set the USB/LAN connection switch to USB and restart.

Symptom	Confirmation	Solution
Cannot connect via LAN.	Check that the USB/LAN connection switch is set to ETHERNET.	Set the USB/LAN connection switch to ETHERNET and restart.
	Check that the IP address settings for the receiver and the PC have been configured.	Set the receiver and the PC IP address. The receiver IP address setting can only be set using the control software or control commands.
	Check that the IP addresses for the receiver and the PC are not duplicated.	Set them so that the receiver and computer do not have duplicate addresses.
	Check that no other device on the network has the same IP address as the receiver.	Set the IP address so that it does not duplicate on the same network.
Analog output is noisy.	Check that the GND terminal is grounded.	Recheck the ground connection. Noise may be reduced depending on the grounding method.
	Check that there is no noise-generating equipment, such as inverter motors, near the input cable.	Move the input cable away from the noise source.
No error output on communication error.	Check that the error output setting is set to communication error.	Set the error output setting to communication error or communication error and threshold error. The error output setting can only be set using the control software or control commands.

Symptom	Confirmation	Solution
No error output on threshold error.	Check that the error output setting is set to threshold error.	Set the error output setting to threshold error or communication error and threshold error. The error output setting can only be set using the control software or control commands.
	Check that the upper and lower thresholds are set.	Set the upper and lower thresholds for the threshold error. The error output setting can only be set using the control software or control commands.
Buzzer does not sound on error.	Check that the buzzer setting for errors is set to ON.	Set the buzzer setting for errors to ON. The buzzer setting can only be set using the control software or control commands.
Synchronized operation does not work.	Check that the Receiver ID setting switch is set correctly.	Set the receiver ID setting correctly and restart.
	Check that a different RFCH is set for each receiver.	Set a different RFCH for each receiver.
	Check that the maximum transmission data rate of the transmitters paired with each receiver is correct.	Set the output data rate of each transmitter to equal to or lower than the maximum output data rate of the MAIN receiver.

8-1-2. Transmitter-Related Issues

Symptom	Confirmation	Solution
Transmitter does not power on. The transmitter's status LED does not light up.	Check that the battery or power supply's output voltage is within the DC 2.2-4.4V range.	Recheck the power supply's settings.
	Check that the power supply has sufficient capacity.	Replace it with a power supply with a larger capacity.
	Check that the power supply polarity (+/-) is correct.	Recheck the power supply's connection.
	Check that the power cord is securely connected.	Recheck the power supply's connection.
Measurement condition setting does not work.	Check that the transmitter's power is on.	Turn on the transmitter's power.
	Check if the transmitter is in a sleep state.	Turn the transmitter's power on again to release the sleep state.
	Check that wireless communication is stable.	Perform an RF status check, review the antenna installation, or change to an RFCH with a good signal level.
Sensor check is not successful.	Check that the transmitter's power is on.	Turn on the transmitter's power.
	Check if the transmitter is in a sleep state.	Turn the transmitter's power on again to release the sleep state.
	Check that the sensor wiring is correct.	Recheck the sensor's wiring.
	Check that the bridge resistance value setting matches the resistance value of the sensor being used.	Match the bridge resistance value setting to the sensor's resistance value.
	Check that the input is not too large.	The sensor check will not succeed if the bridge circuit's initial unbalance value or input strain is large. Reduce the bridge circuit's initial unbalance value or the sensor's load to decrease the input strain.

Symptom	Confirmation	Solution
Balance adjustment is not successful.	Check that the transmitter's power is on.	Turn on the transmitter's power.
	Check if the transmitter is in a sleep state.	Turn the transmitter's power on again to release the sleep state.
	Check that the sensor wiring is correct.	Recheck the sensor's wiring.
	Check that balance adjustment is enabled.	Enable balance adjustment. The balance adjustment setting can only be set using the control software or control commands.
	Check that the input does not exceed the adjustment range.	The balance adjustment range is within $\pm 10000 \times 10^{-6}$ strain. Balance adjustment cannot be performed for inputs outside the balance adjustment range. Reduce the bridge circuit's initial unbalance value or the sensor's load to decrease the input strain.
	Check that there is no noise-generating equipment, such as inverter motors, near the input cable.	Move the input cable away from the noise source.
Measurement data is noisy.	Check that the SHIELD terminal is connected.	Recheck the ground connection. Noise may be reduced depending on the grounding method.
	Check that there is no noise-generating equipment, such as inverter motors, near the input cable.	Move the input cable away from the noise source.

8-1-3.CAN Communication-Related Issues

Symptom	Confirmation	Solution
CAN communication does not work.	Check that the communication speed and the CAN FD data phase communication speed are set correctly.	Set the correct communication speed and CAN FD data phase communication speed.
	Check that the termination resistor setting is correct.	Connect the CAN bus termination resistors correctly. If the receiver is at both ends of the CAN bus, the built-in termination resistor can be enabled.
	Check that the communication speed is set appropriately for the cable length.	Recheck the cable length and communication speed. If the cable length is long, communication may be possible by slowing down the communication speed.
	Check that CAN FD compatible and non-compatible nodes are not mixed on the same network.	If a node that is not compatible with CAN FD (only compatible with CAN) receives a CAN FD frame, a reception error will occur. Remove the node that is not compatible with CAN FD or use only CAN frames.
	Check that the device is not placed at the end of the bus with its power turned off.	When the receiver's power is OFF, the termination resistor is not ON. If the receiver is connected to the end of the CAN bus, turn the power ON and set the termination resistor to ON.

8-1-4. Wireless Communication-Related Issues

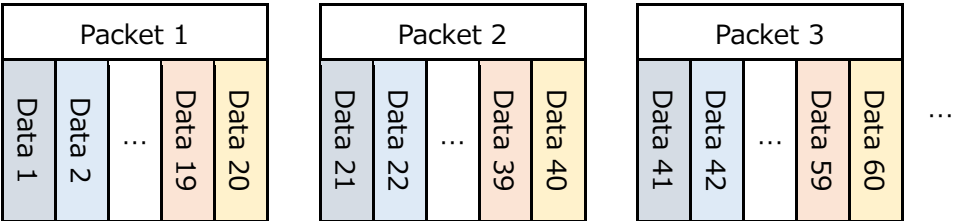
Symptom	Confirmation	Solution
Wireless communication does not work. (Transmitter is not detected during transmitter search. / Transmitter status LED does not light up.)	Check the transmitter's status LED does light up.	The transmitter is not powered on. Turn on the transmitter's power.
	Check that the receiver's antenna is securely connected.	Recheck the receiver's antenna connection.
	Check if the transmitter is in a sleep state.	Turn the transmitter's power on again to release the sleep state.
Wireless communication is unstable. (Pairing is not successful. / There are many errors during measurement. / The radio signal level LED is lit in red.)	Check that the receiver's antenna is securely connected.	Recheck the receiver's antenna connection.
	Check that the receiver and transmitter are not too far apart.	Move the receiver's antenna and the transmitter closer. The communication distance is about 50 m in an environment with no obstacles between the receiver and transmitter. Especially during setup, keep the distance between the receiver and transmitter within 10 m to ensure reliable communication.
	Check that there are no obstacles between the receiver and transmitter.	If there are obstacles between the receiver and transmitter, communication may not be possible. Take measures such as avoiding the obstacles.
	Check that there are no 2.4 GHz band wireless devices (such as wireless LAN, Bluetooth®) near the receiver and transmitter.	If there are 2.4 GHz band wireless devices around the receiver and transmitter, the radio waves they emit may be acting as interfering waves. Perform an RF status check and change to an RFCH with a good signal level.
	If multiple receivers are present, check that the RFCHs are not duplicated.	Set a different RFCH for each receiver.

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9. TECHNICAL INFORMATION

9-1. MEASUREMENT DATA

During measurement, the receiver transmits a data request signal to the transmitter at regular intervals. When the data request signal is received, 20 pieces of measured data held inside the transmitter are combined into one, and a data packet is generated. The generated data packets are transmitted one by one from the transmitter to the receiver at regular intervals. In addition, the transmission timing is corrected by the data request signal.

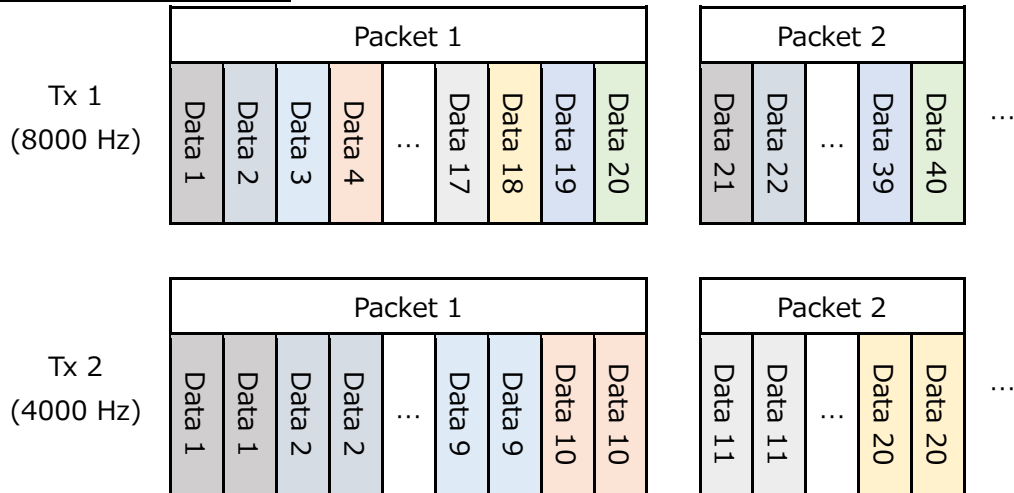


If a communication error occurs, the packets in the section are lost. When the packet is lost, previous value hold is applied to the measured data output from the receiver. In addition, a constant delay occurs in the measured data of the product with respect to the actual waveform. When the Output data rate is low, this delay becomes long. For details, please refer to "9-2 DELAY TIME".

- Each transmitter operates asynchronously. Therefore, the sampling timing differs among the transmitters. This difference may cause a deviation of ± 1 data point of the sampling frequency in the measured data.
- Depending on the timing of the data request signal and the sampling of the transmitter, one piece of measured data may be lost between the last measured data of a packet and the first measured data of the next packet.

If different output data rates are set for multiple transmitters, duplicate data is added to match the maximum output data rate of the pair-setting transmitters, and packets are generated.

Example: If Transmitter 1 has an output data rate of 8000 Hz and Transmitter 2 has an output data rate of 4000 Hz.



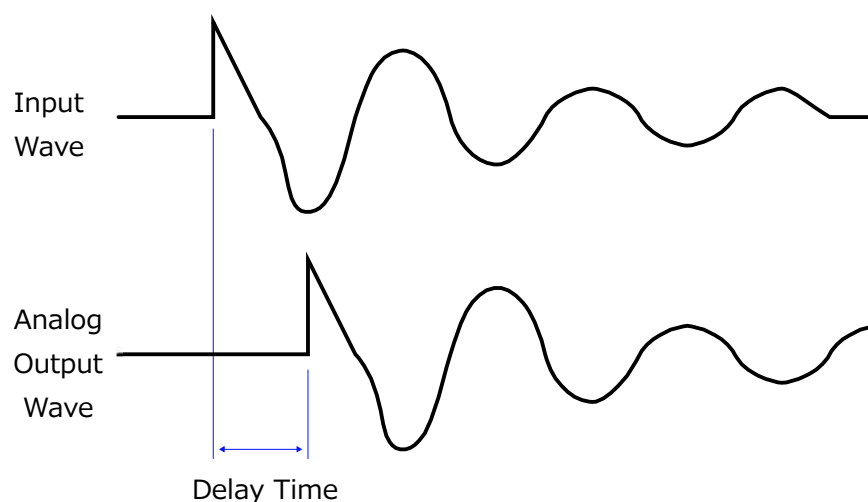
The number of duplicate data points for measurement data is as follows:

Output data rate (Hz)	Number of duplicate measurement data points						
	Maximum output data rate of the pair-setting transmitters						
	8000 Hz	4000 Hz	2000 Hz	1000 Hz	500 Hz	100 Hz	50 Hz
8000	1	-	-	-	-	-	-
4000	2	1	-	-	-	-	-
2000	4	2	1	-	-	-	-
1000	8	4	2	1	-	-	-
500	16	8	4	2	1	-	-
100	80	40	20	10	5	1	-
50	160	80	40	20	10	2	1

9-2. DELAY TIME

9-2-1.ANALOG OUTPUT DELAY TIME

The analog output timing of this product lags behind the actual waveform due to delays caused by packet processing during wireless communication and the analog output processing.



The delay time varies depending on the maximum output data rate of the receiver with Receiver ID 0 (MAIN) and the output data rate of each transmitter.

The approximate error output delay times for each setting are as follows.

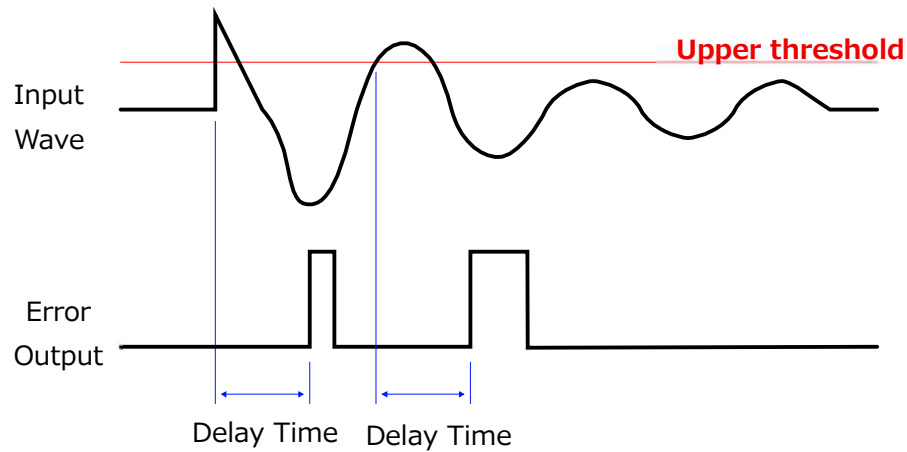
Output Datarate	Maximum output data rate for Receiver ID: 0 (MAIN)						
	8000 Hz	4000 Hz	2000 Hz	1000 Hz	500 Hz	100 Hz	50 Hz
8000 Hz	10.8 ms	-	-	-	-	-	-
4000 Hz	11.5 ms	21.6 ms	-	-	-	-	-
2000 Hz	13.2 ms	23.0 ms	43.2 ms	-	-	-	-
1000 Hz	15.8 ms	26.3 ms	46.0 ms	86.4 ms	-	-	-
500 Hz	22.5 ms	32.2 ms	52.6 ms	92.0 ms	173 ms	-	-
100 Hz	68.0 ms	81.4 ms	103 ms	142 ms	222 ms	864 ms	-
50 Hz	124 ms	145 ms	146 ms	203 ms	285 ms	919 ms	1728 ms



- The delay time may vary by ± 4 data for each output data rate. Example: When the output data rate is 8000 Hz, the variation of the delay time is ± 0.5 ms ($= (1 / 8000 \text{ Hz}) \times 4 \text{ data}$).

9-2-2.ERROR OUTPUT DELAY TIME

The error output timing of this product lags behind the actual waveform due to delays caused by packet processing during wireless communication and the error output processing.



The delay time varies depending on the maximum output data rate of the receiver with Receiver ID 0 (MAIN) and the output data rate of each transmitter.

The approximate error output delay times for each setting are as follows.

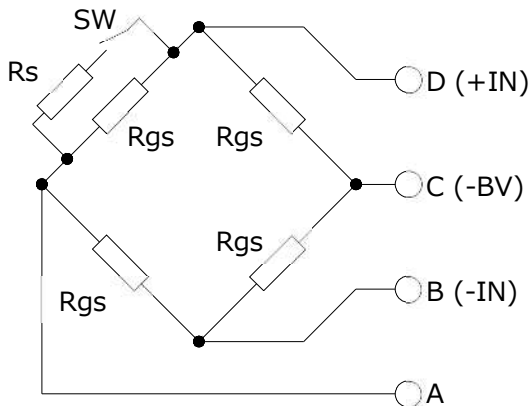
Output Datarate	Maximum output data rate for Receiver ID: 0 (MAIN)						
	8000 Hz	4000 Hz	2000 Hz	1000 Hz	500 Hz	100 Hz	50 Hz
8000 Hz	10.1 ms	-	-	-	-	-	-
4000 Hz	10.1 ms	20.2 ms	-	-	-	-	-
2000 Hz	10.3 ms	20.2 ms	40.2 ms	-	-	-	-
1000 Hz	10.6 ms	20.5 ms	40.2 ms	80.2 ms	-	-	-
500 Hz	11.0 ms	21.1 ms	40.7 ms	80.3 ms	160 ms	-	-
100 Hz	15.2 ms	24.9 ms	44.3 ms	85.1 ms	165 ms	805 ms	-
50 Hz	19.9 ms	30.5 ms	50.7 ms	90.5 ms	170 ms	810 ms	1610 ms



- The delay time may vary by ± 4 data for each output data rate. Example: When the output data rate is 8000 Hz, the variation of the delay time is ± 0.5 ms ($= (1 / 8000 \text{ Hz}) \times 4 \text{ data}$).

9-3. SENSOR CHECK

The sensor check of this product inserts a resistor (switch SW is ON) between A (+BV) and D (+IN) of the bridge circuit inside the transmitter, thereby inputting a pseudo-strain to the transmitter and performing a simple wire breakage check of the sensor.



Parameter	Content
Rg	Bridge resistance
Rgs	Setting Bridge resistance
Rs	Shunt resistance 361k Ohm
K	Gage factor 2.00
St	Generated pseudo-strain $St = \frac{Rg}{K \times (Rg + Rs)} \cong St1 - St0$
St0	Measurement before Shunt resistance insertion
St1	Measurement before Shunt resistance insertion
Rg _{cal}	Bridge resistance calculation value

The bridge resistance Rg_{cal} at this time can be derived from the generated pseudo-strain St with the following formula:

$$Rg_{cal} = \frac{K \times Rs \times St}{1 - K \times St} \cong \frac{2 \times Rs \times (St1 - St0)}{1 - 2 \times (St1 - St0)} \text{ (Ohm)}$$

The sensor check is successful if the calculated bridge resistance Rg_{cal} satisfies the following range:

$$0.8 \times Rgs \leq Rg_{cal} \leq 1.2 \times Rgs$$



- This sensor check is a simple wire breakage check function for the bridge circuit.
- It is recommended to execute the sensor check with no load applied. If the initial zero balance of the bridge circuit or the input strain is large, the judgment result may be NG even if the set value of the bridge resistance matches the resistance of the sensor.

9-4. CONTINUOUS OPERATING TIME ON TRANSMITTER BATTERIES

When operating the transmitter on battery power, select batteries that comply with the power supply voltage input range of the product.

DANGER

When using batteries, understand the contents of the battery's instruction manual and confirm safety before use.



Improper use of batteries can result in fire, electric shock, and personal injury (death, injury). The batteries must be used in accordance with their instruction manual.

WARNING

Use the batteries within the operating temperature and humidity range specified by the battery manufacturer



Using batteries outside their operating temperature range can lead to performance degradation, leakage, heat generation, or rupture, which may result in injury or equipment malfunction.

Use the transmitter within the power voltage range specified in this product specifications.



Applying a voltage outside the power voltage range can cause electric shock, fire, or malfunction. Before connecting to the transmitter, confirm that the external DC power supply is within the transmitter's power voltage range.

9-4-1. Calculation of Estimated Continuous Operating Time

Calculate the estimated continuous operating time using the following formula:

$$\text{Estimated continuous Operating Time (h)} = \frac{\text{Battery Capacity (mAh)}}{\text{Current Consumption (mA)}}$$

Example:

If a battery with a capacity of 800 mAh is used to measure a 120 ohm strain gage with the strain transmitter (current consumption: 38 mA), the estimated continuous operating time is approximately 21 hours.

$$\frac{800 \text{ mAh}}{38 \text{ mA}} \cong 21 \text{ h}$$



- Allow sufficient margin when selecting batteries. Battery capacity fluctuates significantly depending on ambient temperature and individual cell variations.
- The transmitter automatically stops operation when the power supply voltage drops to approximately 2.05 V or less. This function prevents abnormal operation and excessive battery discharge. The status LED turns off during a shutdown.

9-4-2. Battery Types and Capacity Reference

Depending on the type of battery used, please check the following estimated battery capacity.

	The described battery capacity is a general guide. The actual battery capacity varies significantly depending on the ambient temperature and individual differences.
---	--

Alkaline and Manganese Batteries (Nominal Voltage: 1.5 V)

Connect two batteries in series to operate the transmitter. In this configuration, each battery is utilized down to approximately 1.1 V.

The approximate battery capacity of alkaline and manganese dry cell batteries is as follows.

Battery Size	Typical battery capacity	
	Alkaline [mAh]	Manganese [mAh]
Size C	5500	2500
Size AA	2000	600
Size AAA	800	300
*Conditions: Ambient temperature approx. 20°C, Cut-off voltage 1.0 V		

Lithium Primary Batteries (Nominal Voltage: 3.0 V)

Connect one lithium primary battery to operate the transmitter.

The approximate battery capacity for lithium primary batteries is as follows.

Battery Size	Typical battery capacity
	Lithium Primary Battery [mAh]
CR123A	1500
CR2	800
*Conditions: Ambient temperature approx. 20°C, Cut-off voltage 2.0 V	

9-5. CENTRIFUGAL ACCELERATION

If this product is attached to a rotating body (such as a swivel arm, disk, or rotary table) for use, ensure in advance that the centrifugal acceleration caused by rotation does not exceed the centrifugal acceleration limit of the product.

DANGER

Do not install the product in environments where centrifugal acceleration exceeds its rated limit.



If this product is installed in an environment where the centrifugal acceleration exceeds the centrifugal acceleration limit of the product, the product may detach and fly off. If the product flies off in an environment where strong centrifugal acceleration is applied, it causes a personal injury (death or injury) and a failure or damage of the device and the sensor.



- The centrifugal acceleration limit of the transmitter is 29420 m/s^2 (= 3000 G).
- When attaching the transmitter to a rotating body, acceleration caused by the movement of the rotating body itself and vibration may be added in addition to the centrifugal acceleration. When installing the transmitter, consider loads such as vibration, and operate the transmitter with a margin, such as allowing for approximately 1.2 times the calculated value.

9-5-1. Calculation of Centrifugal Acceleration

The centrifugal acceleration can be calculated from the radius of rotation using the following formula.

$$\text{Centrifugal Acceleration} = 4\pi^2 \times \left(\frac{RPM}{60}\right)^2 \times R \cong 1.097 \times 10^{-5} \times RPM^2 \times r \text{ (m/s}^2\text{)}$$

RPM : Rotational speed (rpm)

R : Radius of rotation (m)

r : Radius of rotation (mm)

The centrifugal acceleration based on the standard gravitational acceleration *g* can be calculated using the following formula.

$$\text{Centrifugal Acceleration} = \frac{\text{Centrifugal Acceleration}}{g} \cong 1.118 \times 10^{-6} \times RPM^2 \times r [G]$$

g : standard gravitational acceleration = 9.80665 m/s^2

RPM : Rotational speed (rpm)

r : Radius of rotation (mm)

9-5-2. Estimation of Centrifugal Acceleration Using an Alignment Chart

The centrifugal acceleration can be easily obtained using an alignment chart.



- The estimated value obtained using an alignment chart is a visual guide. If an exact value is required, use the value calculated using the formula.

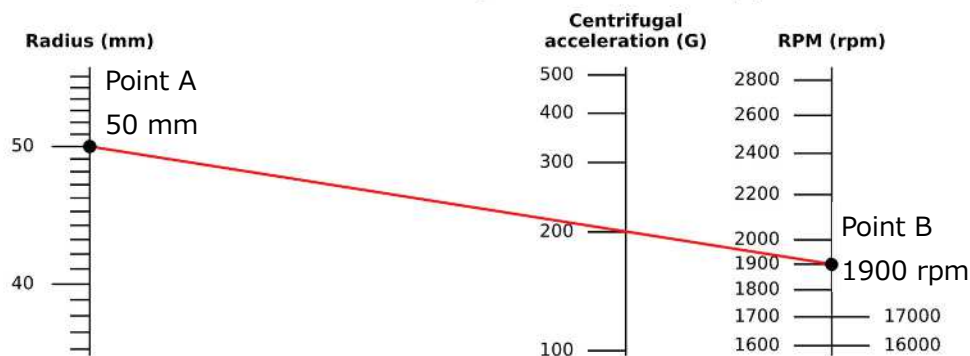
Usage method

- (1) Plot the radius of rotation on the Radius-axis (Point A).
 - (2) Plot the RPM on the RPM-axis (Point B).
 - (3) Connect Point A and Point B with a straight line.
 - (4) Read the value at the point where the straight line intersects the Centrifugal acceleration-axis as the centrifugal acceleration.
- * If the left side of the RPM-axis is used for plotting, read the value on the left side of the Centrifugal acceleration axis. If the right side of the RPM-axis is used for plotting, read the value on the right side of the Centrifugal acceleration axis.

Example 1: If the radius of rotation is 50 mm and the RPM is 1900 rpm.

Since the left side of the RPM axis is used, the centrifugal acceleration is approximately 200 G.

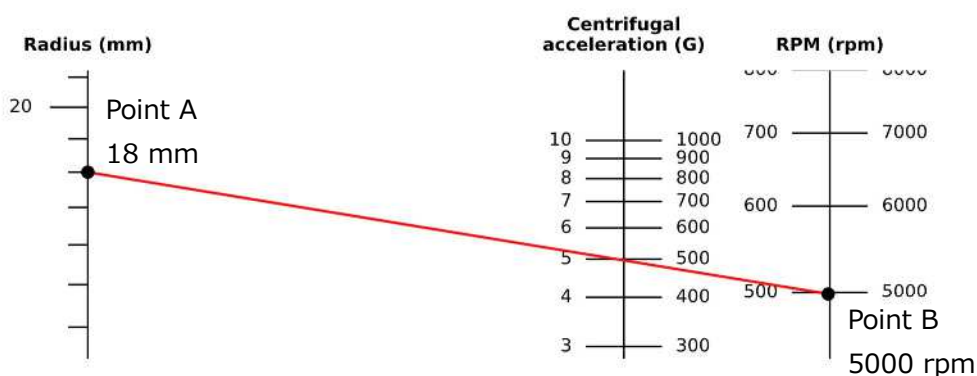
$$1.118 \times 10^{-6} \times 1900 \text{ rpm}^2 \times 50 \text{ mm} \cong 201 \text{ (G)}$$



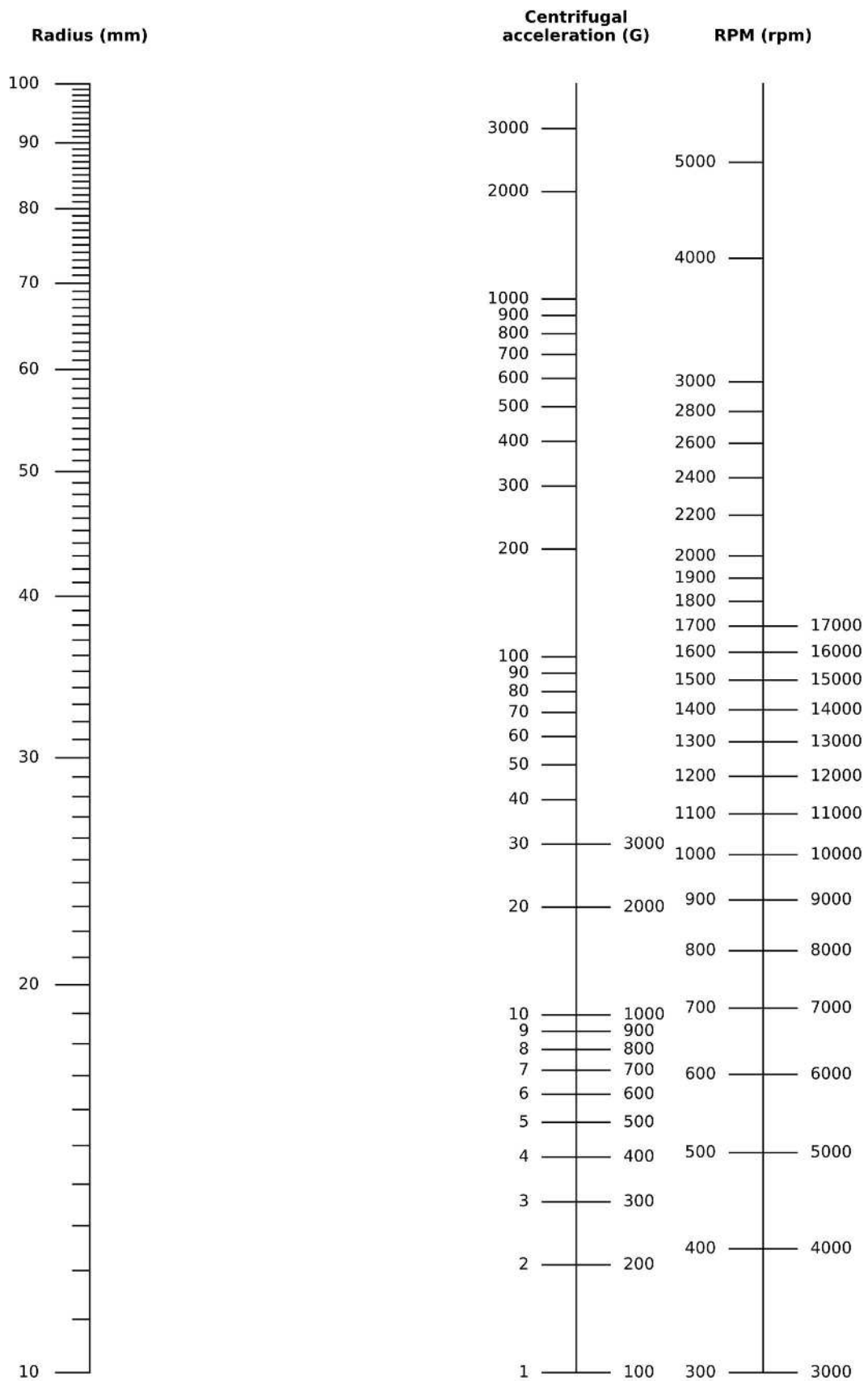
Example 2: If the radius of rotation is 18 mm and the RPM is 5000 rpm.

Since the right side of the RPM axis is used, the centrifugal acceleration is approximately 500 G.

$$1.118 \times 10^{-6} \times 5000 \text{ rpm}^2 \times 18 \text{ mm} \cong 503 \text{ (G)}$$

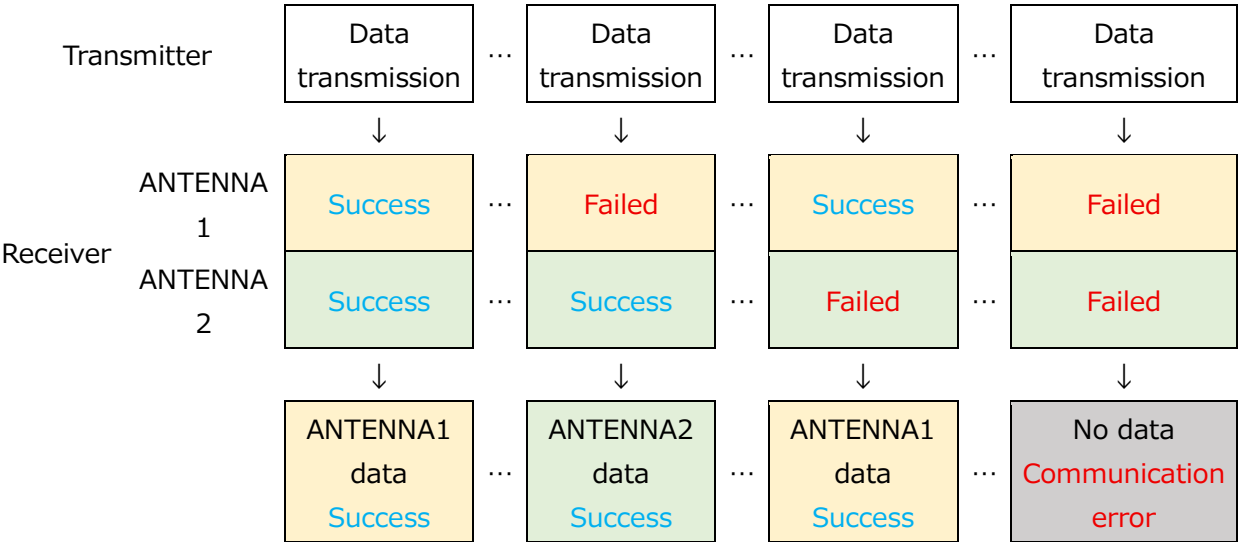


9-5-3.Centrifugal Acceleration Alignment Chart



9-6. COMMUNICATION ERROR

The receiver's communication error judgment is made when both antennas fail to receive. The stability of wireless communication can be improved by connecting antennas to both ANTENNA1 and ANTENNA2 of the receiver. For details on the positional relationship of the antennas, please refer to "9-8 GUIDE TO ANTENNA INSTALLATION".

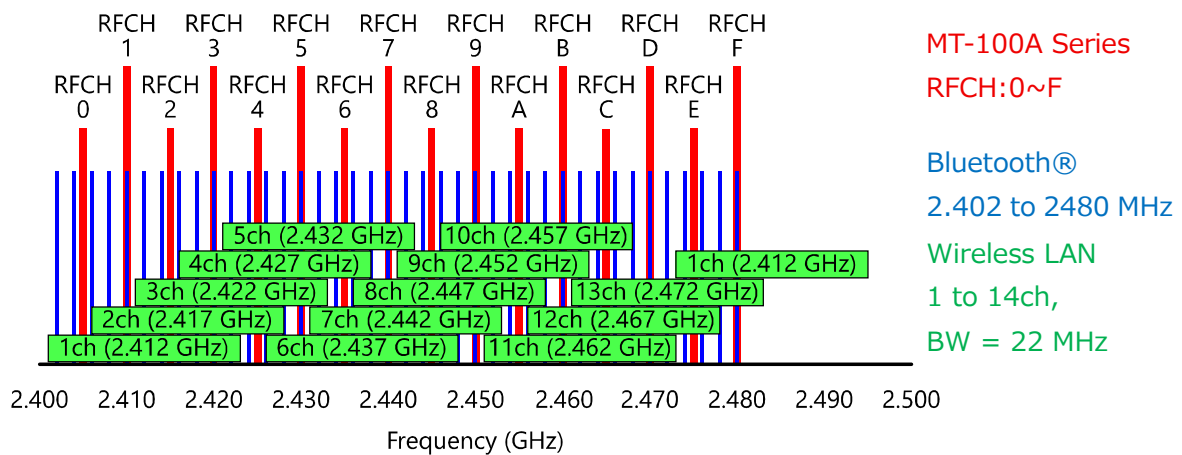


- The receiver constantly receives data using two antennas. Normally, the receiver preferentially selects the data received by ANTENNA 1. If a communication error occurs on ANTENNA 1, the receiver selects the data received by ANTENNA 2.

9-7. WIRELESS DEVICES USING THE 2.4 GHZ BAND

This product uses 2.4 GHz band radio waves for wireless communication. If other 2.4 GHz band wireless devices (wireless LAN, Bluetooth®, etc.) are using the same wireless frequency, their wireless communications may interfere with each other, which can cause communication errors. In this case, changing the RFCH may improve communication stability.

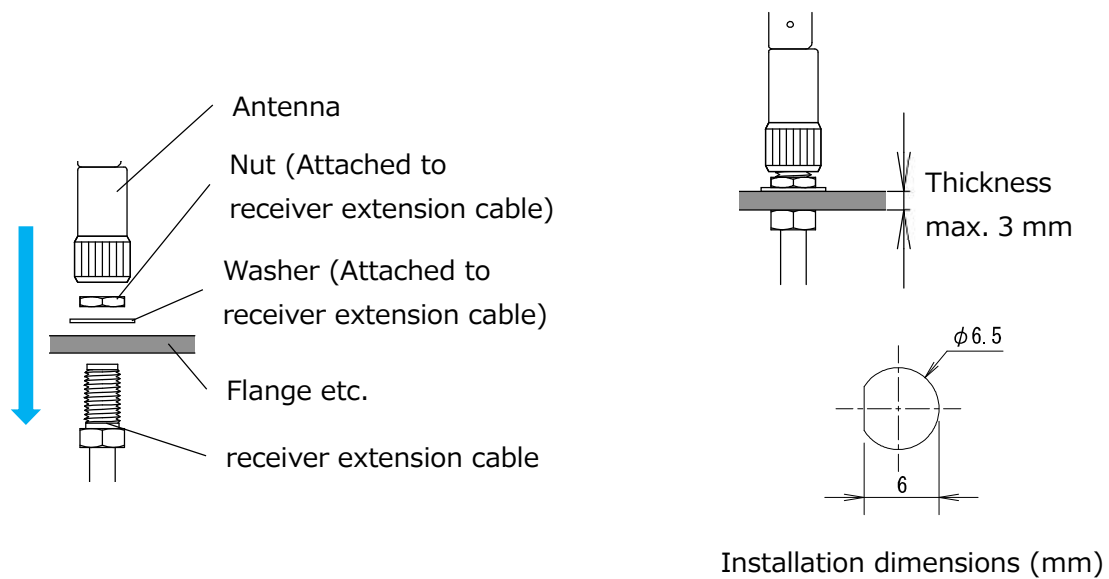
The following shows the wireless frequencies of typical wireless devices (wireless LAN, Bluetooth®) that use the 2.4 GHz band.



9-8. GUIDE TO ANTENNA INSTALLATION

The stability of wireless communication depends on various conditions such as the positions of antennas, obstacles, reflection and absorption of radio waves on walls and ceilings, and ambient radio waves. By adjusting the positions and orientations of the antennas between the transmitter and the receiver, the stability of wireless communication may be improved.

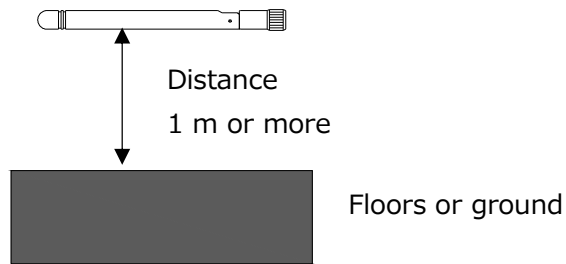
Additionally, the antenna of the receiver can be installed at a position away from the receiver by using a receiver extension cable (optional accessories). If the receiver extension cable is secured to a flange, it can be mounted in a hole with the following dimensions.



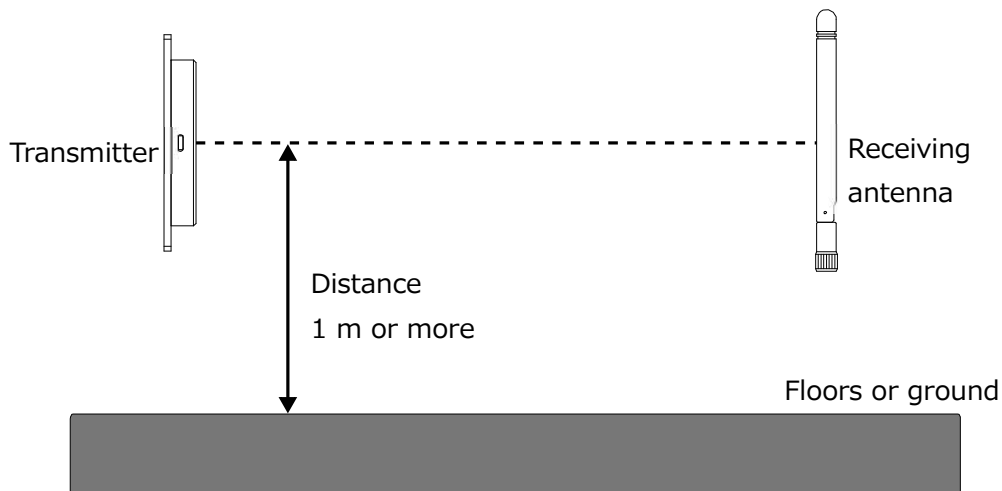
- For the antenna, use only the standard accessories or optional accessories. If an unspecified antenna is used, a penalty may be imposed for violating the Radio Law.
- If a receiver extension cable is used, please note that the strength of the received signal is attenuated by the cable.

9-8-1. Antenna Installation Height

Wireless communication is susceptible to the floor and the ground. Therefore, if the floor or the ground is near the antenna, the communication distance and stability of the wireless communication may decrease. By installing each antenna at a height of approximately 1 m or more from the floor and the ground, the communication distance and stability of the wireless communication may be improved.

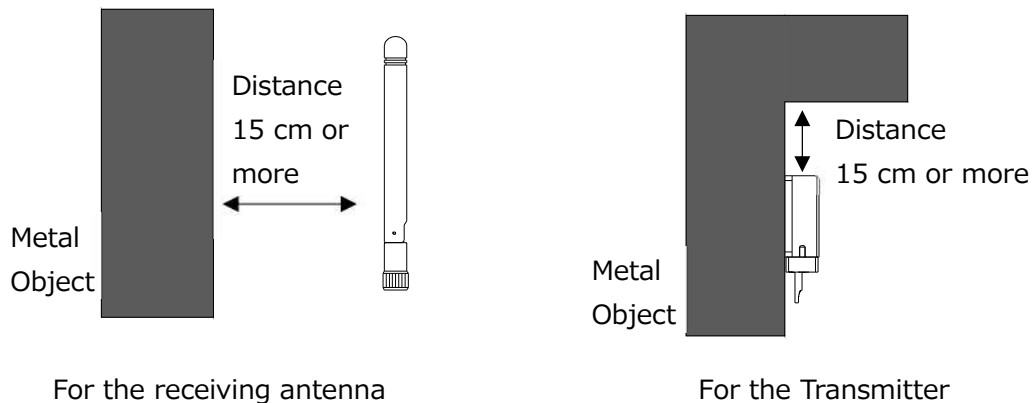


Additionally, by installing the antennas of the transmitter and the receiver at the same height, the communication distance and stability of the wireless communication may be further improved.



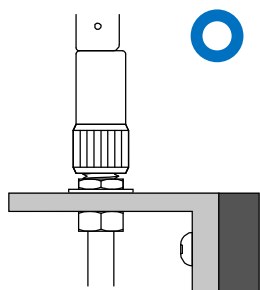
9-8-2. Antenna Surroundings

Wireless communication is susceptible to surrounding objects of the antenna. In particular, metal not only blocks radio waves but also reflects and diffracts them, which affects the stability of the wireless communication. By installing each antenna 15 cm or more away from metal, the effect of metal is reduced, and the communication distance and stability of the wireless communication may be improved.

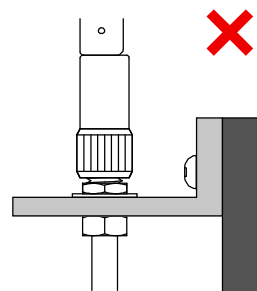


- If it is necessary to install the antenna near metal due to the restriction of the installation location, using an antenna (EXT-ANT1, EXT-ANT2, or EXT-ANT7) that is less susceptible to the effect of metal is effective. This may improve the communication distance and stability of the wireless communication.
- Even if the transmitter is installed on a flat metal surface, the antenna of the transmitter has a characteristic of being less susceptible to effects on the wireless communication. However, if metal is present above or in front of the transmitter, the communication distance and stability of the wireless communication may decrease.
- If the transmitter is powered by a battery, the battery affects wireless communication because it is metal. Please install the battery as far away from the antenna as possible.
- If a metal case is used to protect the transmitter, radio waves are blocked, and the communication distance and stability of the wireless communication decrease. By taking measures such as providing an opening in the case at the position of the antenna or using a case made of resin material, the communication distance and stability of the wireless communication may be improved.

If the antenna is secured to an L-shaped flange using a receiver extension cable, please install the antenna so that the L-shape is on the side of the receiver extension cable. This reduces the effect of the L-shaped flange.



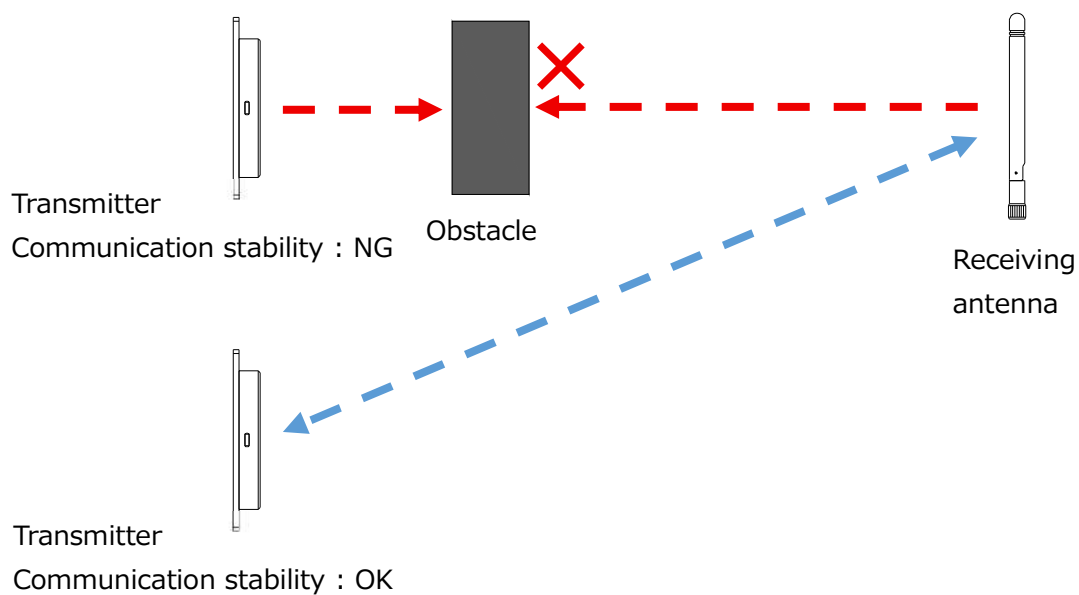
Communication stability: OK



Communication stability: NG

9-8-3.Obstacles Between Antennas

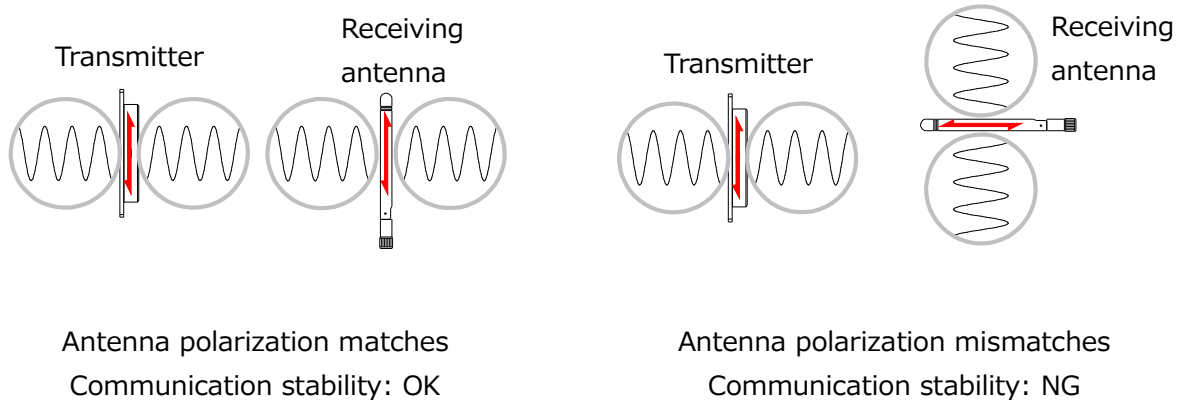
The 2.4 GHz band radio wave used for the wireless communication of this product is highly directional. Therefore, it is suitable for transmitting in a specific direction. On the other hand, if an obstacle is present, the radio wave has difficulty diffracting around it. By installing the antennas of the transmitter and the receiver in the line of sight of each other as much as possible, the communication distance and stability of the wireless communication may be improved. If obstacles are present between the antennas, the communication distance and stability of the wireless communication may decrease.



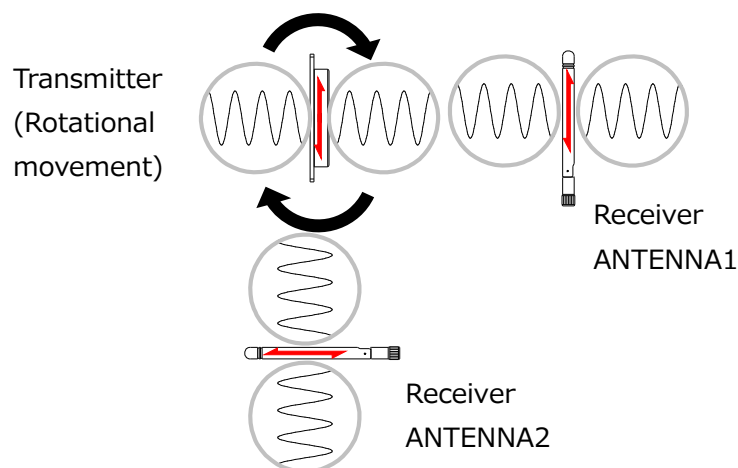
- If the antenna of the transmitter or the receiver moves, please install the antennas in the line of sight of each other throughout the moving area.

9-8-4. Antenna Orientation (Polarization)

Radio waves have an orientation depending on the direction of vibration of the wave. This direction is referred to as polarization. The orientation of polarization differs depending on each antenna. If the orientations of the antennas of the transmitter and the receiver differ, the communication distance and stability of the wireless communication decrease. By installing the antennas of the transmitter and the receiver with their polarizations aligned, the communication distance and stability of the wireless communication may be improved.



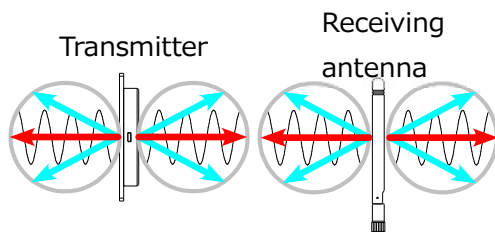
If the orientation of polarization rotates due to the rotation or movement of the transmitter, the method of installing the two antennas of the receiver offset by 90 degrees, such as vertically and horizontally, is effective. This method is referred to as polarization diversity. By using this method, even if the received power of one antenna decreases due to the misalignment of polarization, the other antenna functions to complement it. Therefore, regardless of the orientations of the antennas, the communication distance and stability of the wireless communication may be improved.



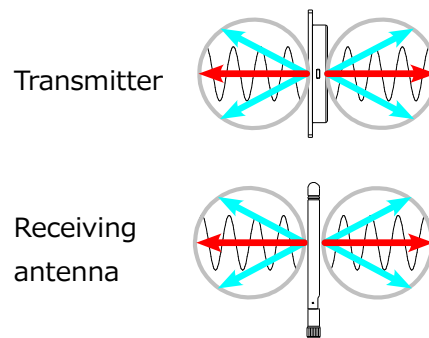
	• If obstacles are present near the antenna, radio waves may be reflected and diffract in a complex manner, and the orientation of polarization may rotate. Therefore, simply visually aligning the orientations of the antennas of the transmitter and the receiver may result in insufficient reception sensitivity of the wireless communication. • If the orientation of the transmitter changes frequently, or in an environment with frequent reflections, using an antenna (EXT-ANT2 or EXT-ANT7) capable of handling two different polarizations simultaneously is effective. This suppresses the decrease in received power due to the rotation of polarization. Therefore, the communication distance and stability of the wireless communication may be improved.
---	---

9-8-5. Antenna Directivity

Antennas have areas of high and low sensitivity. This characteristic is referred to as directivity. Directivity differs depending on each antenna. By installing the antennas of the transmitter and the receiver in the areas of high sensitivity of each other, the communication distance and stability of the wireless communication may be improved.



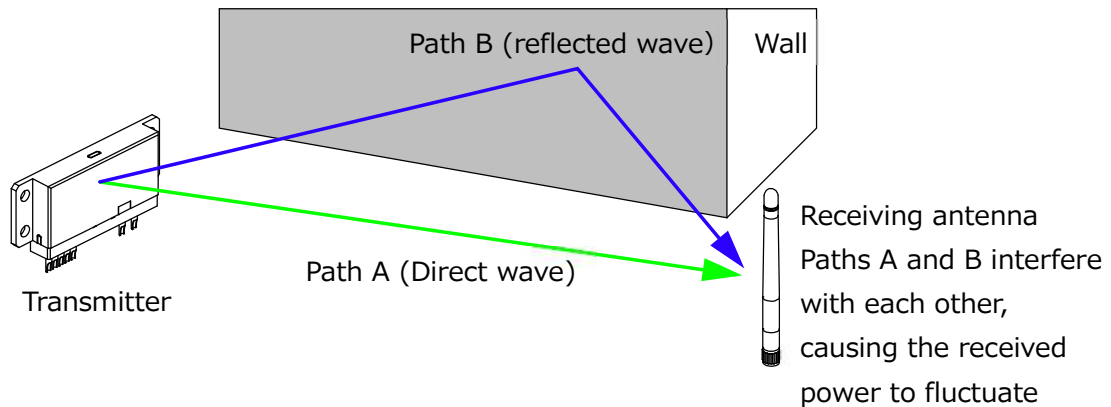
Placed in each other's sensitive areas
Communication stability: OK



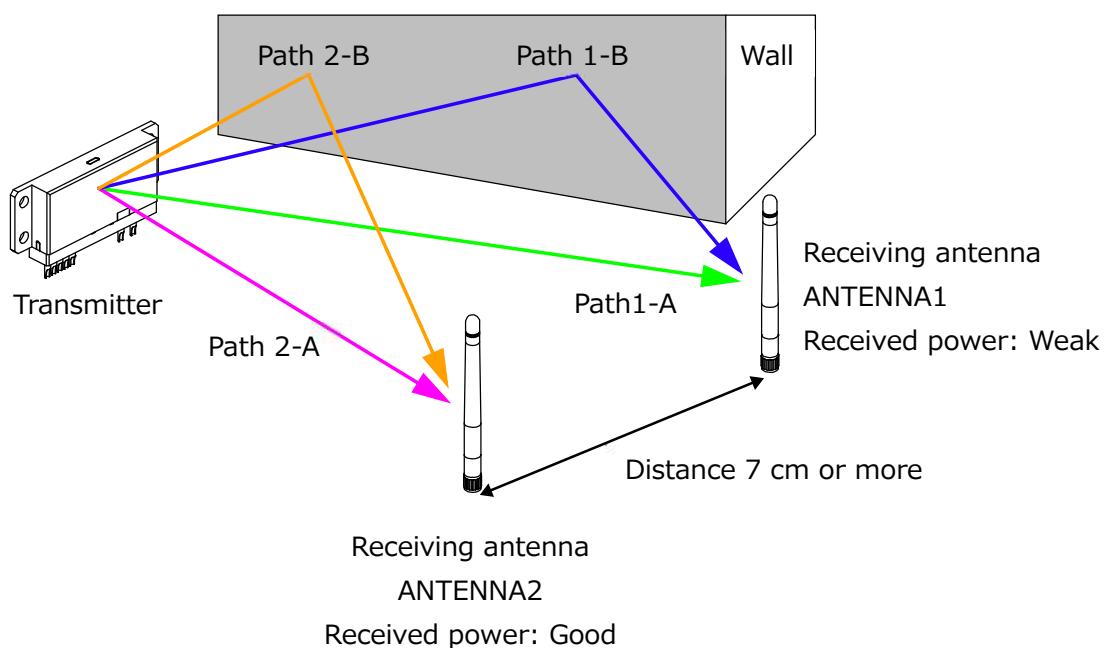
Placed in each other's insensitive areas
Communication stability: NG

9-8-6.Receiver Antenna Positional Relationship

In wireless communication, radio waves transmitted from the transmitter travel through multiple paths (multipath) by being reflected by obstacles such as walls and ceilings, and reach the receiver. The phenomenon in which the received power fluctuates drastically depending on the position due to the radio waves of these paths interfering with each other by strengthening or weakening each other is referred to as fading.



In order to suppress the effect of fading and improve the stability of the wireless communication, the receiver employs space diversity that receives the same signal using two antennas. This increases the probability that even if the received power of one antenna decreases due to interference, the other antenna can maintain a good received power. At this time, by installing the antennas of the receiver at a distance of a half-wavelength of the radio wave (approximately 70 mm for 2.4 GHz) or more from each other, the effect of fading received by each antenna is reduced, and the effect of diversity is maximized.



9-9. COMPATIBLE ANTENNAS

In addition to the standard accessories, optional accessories can be used as the antennas of the receiver.

9-9-1.Characteristics of Each Antenna

The main features of each antenna are as follows.

Model	W1030	EXT-ANT1	EXT-ANT2	EXT-ANT7
Name	Receiving antenna	Small Planar Antenna	Diversity Planar Antenna	Dual-Polarization Antenna
Category (Standard / Optional)	Standard	Optional	Optional	Optional
Max. units on Receiver	2 units	2 units	1 unit	2 units
Number of Polarizations	1-pol.	1-pol.	2-pol.	2-pol.
Signal Gain (Ref.)	■■■	■■	■■■	■
Signal Robustness	■	■■	■■	■■■
Metal Immunity	■	■■	■■	■■
Compactness	■■	■■■	■	■

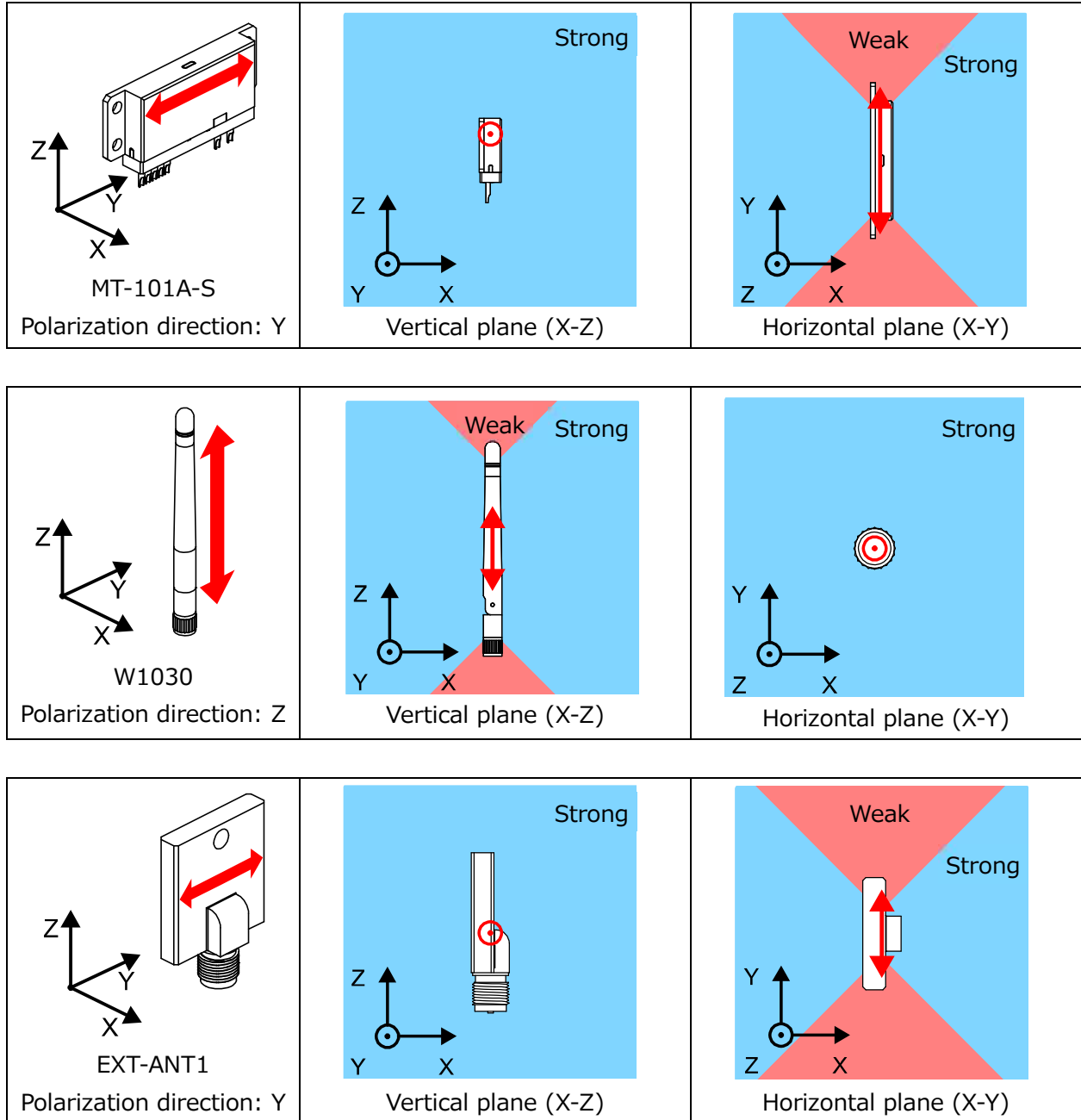
■■■: high, ■■: Med, ■: Standard

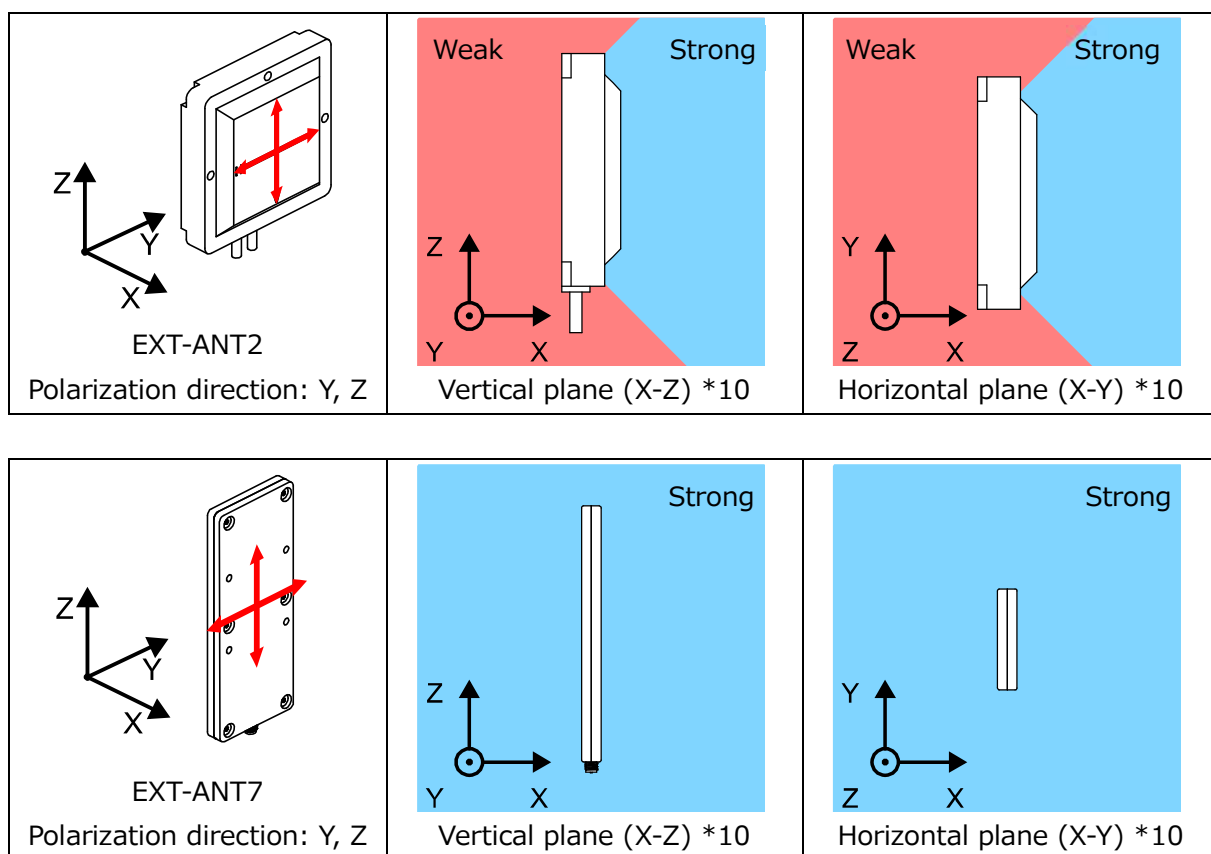
* The characteristics of each antenna fluctuate depending on the installation environment.

	• For the antenna, use only the standard accessories or optional accessories. If an unspecified antenna is used, a penalty may be imposed for violating the Radio Law. • The communication distance and stability of the wireless communication fluctuate greatly depending on surrounding obstacles such as walls and metal, the structure of the building, and surrounding radio wave conditions. • Install each antenna by aligning the orientations of polarization (vertical or horizontal). If the orientations of polarization differ, the stability of the wireless communication may decrease drastically. For details on the polarization of each antenna, please refer to "9-9-2 Polarization and Directivity of Each Antenna". • Install each antenna within the range of directivity. If the antenna is installed in a position with weak directivity, the stability of the wireless communication may decrease drastically. For details on the directivity of each antenna, please refer to "9-9-2 Polarization and Directivity of Each Antenna". • Even for an antenna less susceptible to the effect of metal, installing the antenna away from a metal surface is effective. This may further improve the stability of the wireless communication.
---	---

9-9-2.Polarization and Directivity of Each Antenna

The polarization and directivity of each antenna are as follows.





*10. This directivity has combined characteristics of two polarizations.

9-10. THIRD-PARTY SOFTWARE

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10. PRODUCT SPECIFICATIONS

10-1.MT-100A MULTI DIGITAL TELEMETRY RECEIVER

Model	:	MT-100A
Name	:	Multi Digital Telemetry Receiver

General Specifications

Compatible Transmitter Models	:	MT-101A-S
Number Of Pair Setting Transmitters	:	4
Number of Synchronized Receivers	:	4
Communication Interface	:	USB (USB 2.0 High Speed), Ethernet (100BASE-T)
Output Interface	:	Analog Output (BNC), CAN/CAN FD (D-Sub 9 pin)
Display	:	0.96-inch 128x64 OLED, Transmitter Status LED
Operating Switch	:	Receiver setting switch (4-bit DIP Switch) Control switch (Check, Balance, Start, Stop, Cursor, Enter)
Other Function	:	Error buzzer, Utility nuts (4 x M3)
Power Supply	:	10 to 25 VDC *11*12
Current Consumption	:	Approx. 140 mA (Power supply: 12 VDC, Standby, Control I/F and output I/F not connected)
Dimensions	:	180 (W) x 70 (H) x 120 (D) mm (Excluding protrusions)
Weight	:	Approx. 800 g
Operating Temperature and Humidity *13	:	0 to 50 °C, 20 to 85% (Non-condensing)
Vibration Resistance	:	29.4 m/s ² (3 G), 5 to 200 Hz
Shock Resistance	:	294.2 m/s ² (30 G), 11 ms or less, Half-sine wave

* This product does not contain the 10 restricted substances beyond the maximum concentration limit under RoHS Directive (2011/65/EU, (EU)2015/863). * Excluding exemptions allowed under RoHS Directive (2011/65/EU, (EU)2015/863).

*11. The allowable voltage range is 10 to 30 VDC.

*12. Maximum power consumption is Approx. 3 W

*13. The storage temperature is -10 to 60 °C.

Analog Output

Number Of Analog Output	:	4
Output Voltage	:	± 5 V/Range FS
Accuracy	:	Within $\pm 0.1\%$ FS
Load Resistance	:	5k ohm or more
DA Converter Resolution	:	16 bit
DA Conversion Rate	:	50, 100, 500, 1000, 2000, 4000, 8000 Hz *14
Temperature Stability	:	Zero point : Within ± 0.5 mV/°C Sensitivity : Within ± 0.005 %/°C
Time Stability	:	Zero point : Within ± 1.5 mV/8h Sensitivity : Within ± 0.025 %/8h

* The specifications apply to the state in which the temperature has stabilized after a preheating time of 30 minutes in an environment of 25 ± 5 °C.

*14. The DA conversion rate is automatically configured based on the number of paired units and the output data rate settings of the transmitters.

Error Output

Number of Error Output	:	4
Output Format	:	Open collector (NPN).
Load Capacity	:	30 VDC, 30 mA (Resistance load),

CAN Output

Output Format	:	CAN FD Standard, CAN FD Extended, CAN Standard, CAN Extended
Communication Speed	:	1000, 800, 500, 250, 125, 100, 83.3, 62.5, 50, 33.3, 25, 20, 10 kbps
CAN FD Data Phase Communication Speed	:	5, 4, 2, 1, 0.5 Mbps and OFF *15
Terminating resistor	:	Implementation (ON/OFF switchable)

*15. CAN FD data phase communication speed is limited by the communication speed. The configurable CAN FD data phase communication rates are as follows.

Communication Speed (kbps)	Configurable CAN FD Data Phase Communication Speed
1000, 800	2, 1 Mbps and OFF
500, 250	5, 4, 2, 1, 0.5 Mbps and OFF
125	2, 1, 0.5 Mbps and OFF
100, 83.3, 62.5	1, 0.5 Mbps and OFF
50, 33.3	0.5 Mbps and OFF
25, 20, 10	OFF

RF Specifications

Radio Frequency Channel (RFCH)	:	16 (Choose 1 channel from 16 channels using Setting software)
Antenna	:	Specified external antenna (ANTENNA1 and NATENNA2 for diversity reception.)
Radio Frequency Band	:	2.4 GHz Band
Radio System	:	Digital modulation system
Radio Certification	:	Japan, USA, China, India, Thailand, and Taiwan
Communication Distance	:	50 m (Max. line of sight distance)
Environment of Usage	:	Environment free from 2.4 GHz band interference (e.g., Wireless LAN, Bluetooth®).

RFCH and Radio frequency

RFCH	0	1	2	3	4	5	6	7
Radio frequency (GHz)	2.405	2.410	2.415	2.420	2.425	2.430	2.435	2.440

RFCH	8	9	A	B	C	D	E	F
Radio frequency (GHz)	2.445	2.450	2.455	2.460	2.465	2.470	2.475	2.480

10-2.MT-101A-S STRAIN TRANSMITTER

Model	:	MT-101A-S
Name	:	Strain Transmitter

General Specifications

Display	:	Status LED
Power Supply	:	2.2 to 4.4 VDC *16
Current Consumption	:	Approx. 38 mA (Power supply: 3.0 VDC, Bridge resistance: 120 Ω)
Dimensions	:	47 (W) $\times$ 19.6 (H) $\times$ 7 (D) mm (Excluding protrusions) *17
Weight	:	Approx. 17 g *17
Operating Temperature and Humidity	:	-25 to 100 $^{\circ}$ C, 20 to 85% (Non-condensing) *18
Vibration Resistance	:	294.2 m/s ² (30 G), 5 to 500 Hz
Shock Resistance	:	980.7 m/s ² (100 G), 11 ms or less, Half sine wave
Centrifugal Acceleration Resistance	:	29420 m/s ² (3000 G) *19*20

* This product does not contain the 10 restricted substances beyond the maximum concentration limit under RoHS Directive (2011/65/EU, (EU)2015/863). * Excluding exemptions allowed under RoHS Directive (2011/65/EU, (EU)2015/863).

*16. Maximum power consumption is Approx. 160 mW

*17. With the 4G MT Adapter (MT-AD-S1).

*18. The storage temperature is -25 to 100 $^{\circ}$ C.

*19. Use a protective cover to prevent fragmentation when using the product in environments subject to centrifugal acceleration.

*20. This value is based on the specified screws being tightened to the prescribed torque.

Strain Input

Measuring Targets	:	Strain gage *21, Strain gage transducer
Channels	:	1
Compatible Bridge Resistance	:	120 to 1000 Ohm
Gage Factor	:	2.00 fixed
Bridge Excitation	:	1 VDC
AD Converter Resolution	:	24 bit
Sampling Frequency	:	8000 Hz
Output Data Rate	:	50, 100, 500, 1000, 2000, 4000, 8000 Hz *22
Measuring Range	:	1000, 2500, 5000, 10000, 25000, 50000 $\times 10^{-6}$ strain
Accuracy	:	Within ± 0.15 %FS
Temperature Stability	:	Zero point: Within $\pm 0.25 \times 10^{-6}$ strain / $^{\circ}\text{C}$ Sensitivity: Within ± 0.01 % / $^{\circ}\text{C}$
Time Stability	:	Zero point: Within $\pm 2.0 \times 10^{-6}$ strain / 8 h Sensitivity: Within ± 0.15 % / 8 h
Balancing range	:	$\pm 10000 \times 10^{-6}$ strain
Sensor Check Function	:	Sensor resistance check

* The specifications apply to the state in which the temperature has stabilized after a preheating time of 30 minutes in an environment of 25 ± 5 $^{\circ}\text{C}$.

*21. Full-bridge system. Other bridge systems need bridge box or bridge adapter.

*22. Configurable output data rates are subject to the number of paired devices and the output data rate settings of other transmitters.

RF Specifications

Radio Frequency Channels (RFCH)	:	16 (Choose 1 channel from 16 channels using the control software)
Antenna	:	Internal antenna
Radio Frequency Band	:	2.4 GHz Band
Radio System	:	Digital modulation system
Radio Certification	:	Japan, USA, China, India, Thailand, and Taiwan
Communication Distance	:	50 m (Max. line of sight distance)
Environment of Usage	:	Environment free from 2.4 GHz band interference (e.g., Wireless LAN, Bluetooth®).

RFCH and Radio frequency

RFCH	0	1	2	3	4	5	6	7
Radio frequency (GHz)	2.405	2.410	2.415	2.420	2.425	2.430	2.435	2.440

RFCH	8	9	A	B	C	D	E	F
Radio frequency (GHz)	2.445	2.450	2.455	2.460	2.465	2.470	2.475	2.480

Receiver Combined Specifications

Compatible Receiver : MT-100A

Analog Output

Output Voltage : ± 5 V / Full scale range
(Load resistance 5k ohm or more)

System Accuracy : Within ± 0.2 %FS

Frequency Response

Output Data Rate	8000 Hz	4000 Hz	2000 Hz	1000 Hz	500 Hz	100 Hz	50 Hz
Cutoff Frequency *23	800 Hz	400 Hz	200 Hz	100 Hz	50 Hz	10 Hz	5 Hz

Delay Time

Output Data Rate	8000 Hz	4000 Hz	2000 Hz	1000 Hz	500 Hz
Delay Time *24	Approx. 10.8 ms	Approx. 21.6 ms	Approx. 43.2 ms	Approx. 86.4 ms	Approx. 173 ms

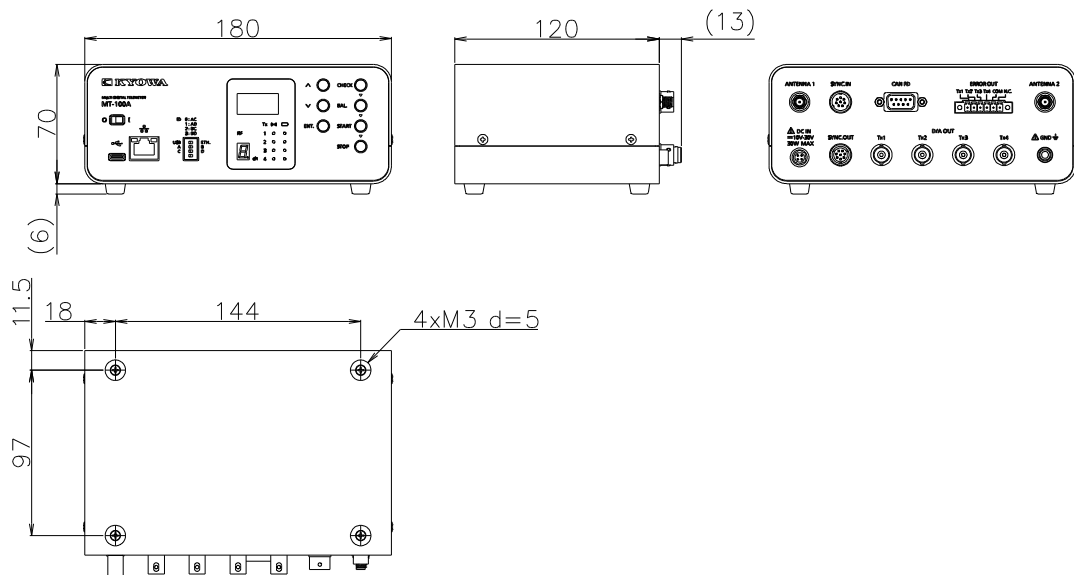
Output Data Rate	100 Hz	50 Hz
Delay Time *24	Approx. 864 ms	Approx. 1728 ms

*23. Amplitude ratio at cutoff point: -3 ± 1 dB

*24. When the output data rate of all paired transmitters matches

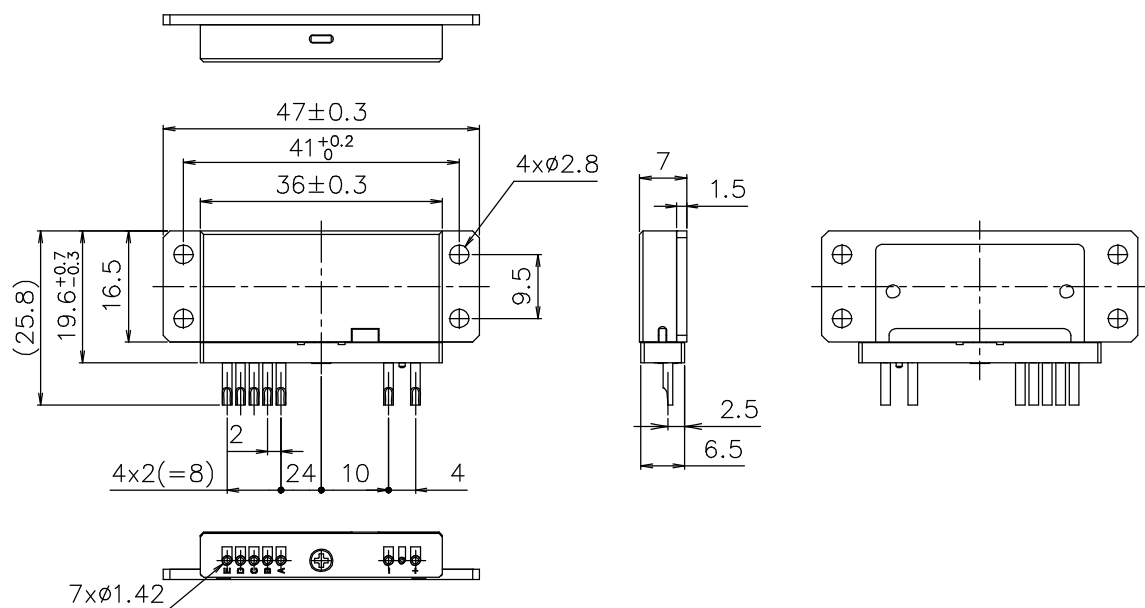
11. OUTLINE DRAWINGS

11-1.MT-100A RECEIVER



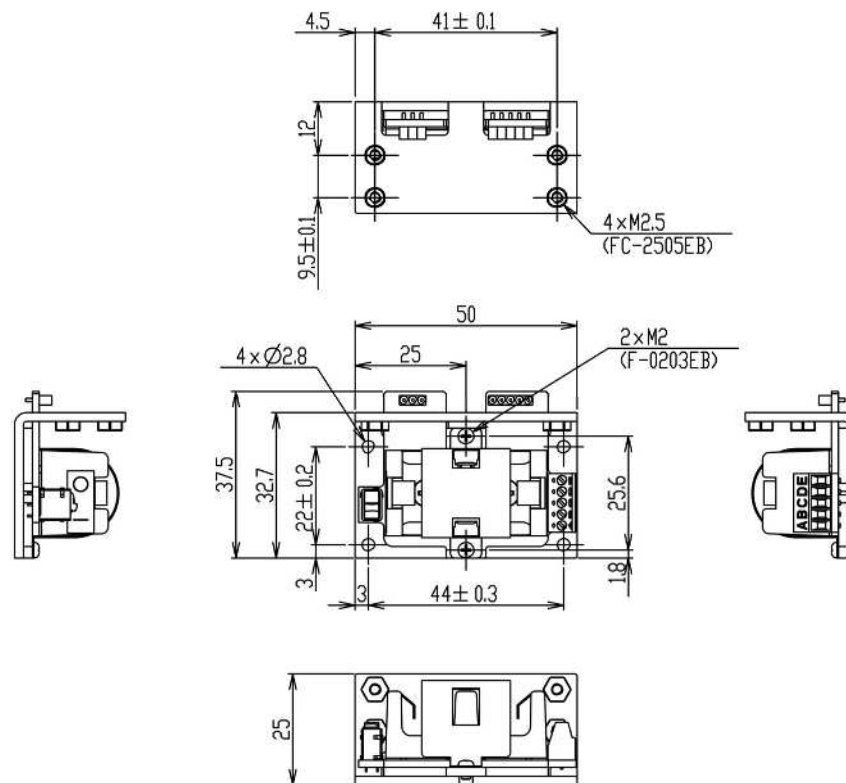
(mm)

11-2.MT-101A-S STRAIN TRANSMITTER



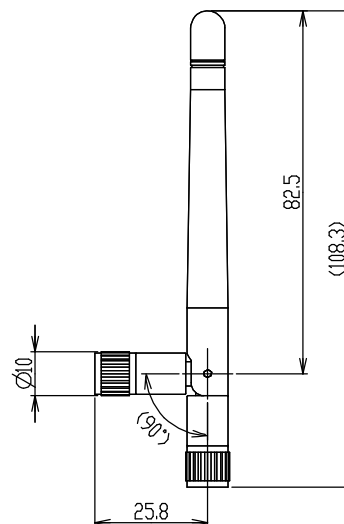
(mm)

11-3.MT-BK BATTERY KIT



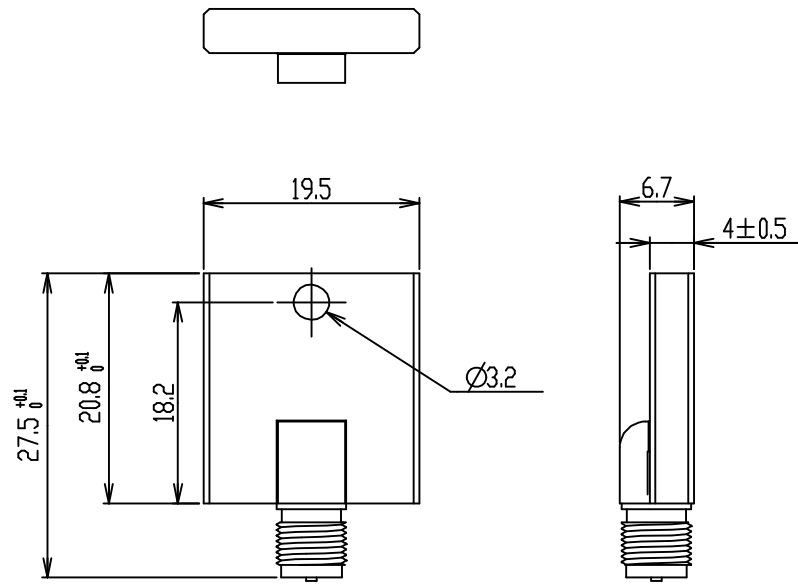
(mm)

11-4.W1030 RECEIVING ANTENNA



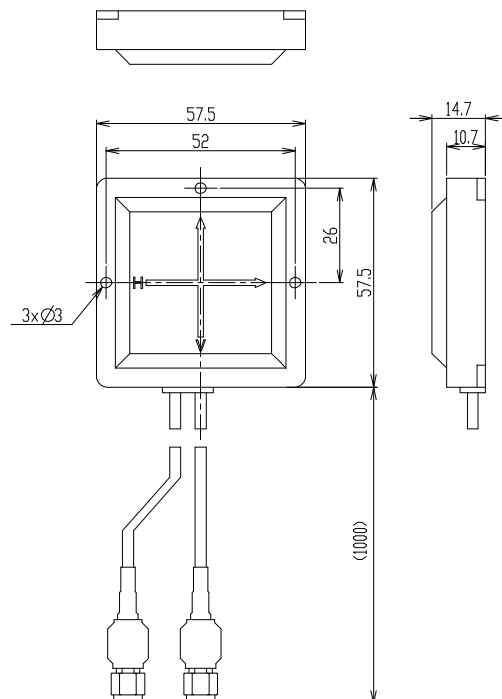
(mm)

11-5.EXT-ANT1 SMALL PLANAR ANTENNA



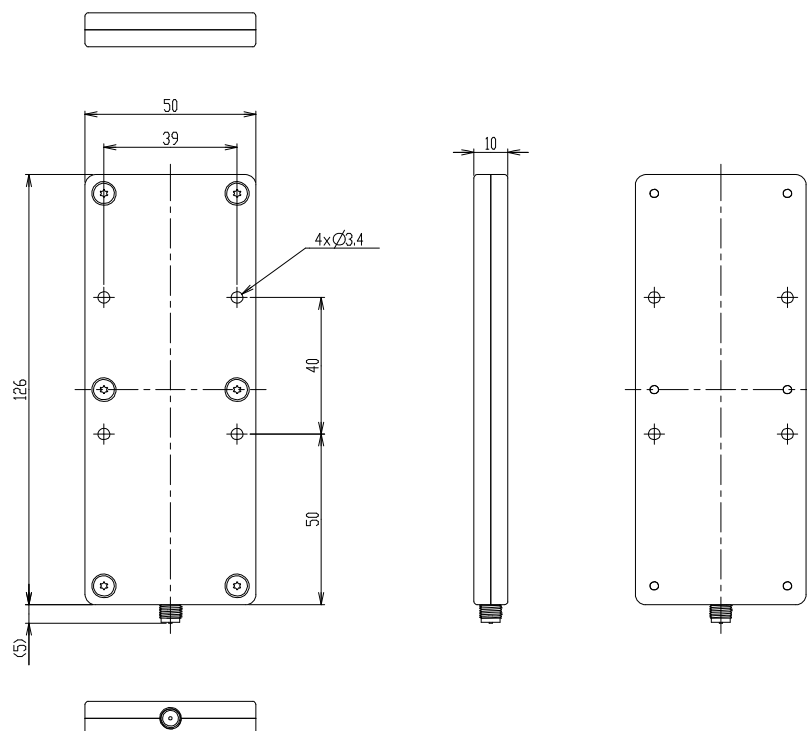
(mm)

11-6.EXT-ANT2 DIVERSITY PLANAR ANTENNA



(mm)

11-7.EXT-ANT7 DUAL-POLARIZATION ANTENNA



(mm)



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