

INSTRUCTION MANUAL

MRS-100 series

Digital Telemeter

Thank you for purchasing this KYOWA's product.

Read this instruction manual carefully in order to make full use of the high-performance capabilities of the product. Do not use the product in methods other than described in this instruction manual.

Note that this instruction manual mainly describes how to handle the hardware. on the software, please refer to "Setting Software INSTRUCTION MANUAL".

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The details of this instruction manual are subject to change without notice.

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CONTENTS

STANDARD ACCESSORIES	1
OPTIONAL ACCESSORY	4
SAFETY PRECAUTIONS	6
LIMITED LIDE PARTS AND PREVENTIVE MAINTENANCE	10
EQUIPMENT RENEWAL.....	10
INFORMATION SERVICE	10
NOTATIONS USED IN THE MANUAL	11
RADIO CERTIFICATION	12
1. PRODUCT OVERVIEW.....	1-1
1-1. Product overview	1-1
1-2. Controls and Indications	1-2
1-2-1. 1ch-Receiver / 4ch-Receiver (MRS-111B / MRS-114A)	1-2
1-2-2. 1ch-Strain Transmitter MRS-101B-S	1-9
1-2-3. 1ch-Strain Transmitter (EXT Antenna) MRS-101A-SE	1-10
1-2-4. 1ch-Voltage Transmitter MRS-101B-V	1-11
1-2-5. 1ch-Thermocouple Transmitter MRS-101B-T	1-12
1-2-6. 4ch-Strain Transmitter MRS-104A-S	1-13
2. Installation	2-1
2-1. Combination Model.....	2-1
2-2. Installation Procedure.....	2-2
2-3. MRS-111B/MRS-114A Installation.....	2-3
2-3-1. Power connector	2-3
2-3-2. Antenna Connections Connectors	2-6
2-3-3. Analog Output Connectors.....	2-7
2-3-4. USB connector	2-9
2-4. MRS-101B-S Installation	2-10
2-4-1. Input Pins	2-10
2-4-2. Transmitter Installation	2-12
2-4-3. Detachment of Full-bridge Adapter	2-13
2-5. MRS-101A-SE Installation	2-14
2-5-1. Input Pins	2-14
2-5-2. Antenna connector	2-16

CONTENTS

2-5-3. Transmitter Installation	2-17
2-5-4. Detachment of Adapter board	2-18
2-6. MRS-101B-V Installation	2-19
2-6-1. Input Pins	2-19
2-6-2. Transmitter Installation	2-21
2-6-3. Detachment of Voltage Adapter	2-22
2-7. MRS-101B-T Installation	2-23
2-7-1. Input Pins	2-23
2-7-2. Transmitter Installation	2-25
2-7-3. Detachment of Thermocouple Adapter	2-26
2-8. MRS-104A-S Installation	2-27
2-8-1. Input Pins	2-27
2-8-2. Transmitter Installation	2-29
2-8-3. Detachment of Full-bridge Adapter / Power Adapter	2-31
2-9. Connect To A PC	2-32
2-9-1. USB connection	2-32
2-9-2. Pairing Settings	2-34
2-9-3. Transmitter settings	2-35
3. MEASUREMENT	3-1
3-1. [Command Mode] and [Measuring Mode]	3-1
3-2. Operations Before Measurement	3-4
3-2-1. Transmitter's Firmware Ver. 2.00 or later	3-4
3-2-2. Transmitter's Firmware Ver. 1.00	3-7
4. OTHER FUNCTIONS	4-1
4-1. Balance Adjustment	4-1
4-1-1. If Using The MRS-101B-S, MRS-101A-SE or MRS-104A-S	4-1
4-1-2. If using the MRS-101B-V	4-3
4-2. Checking The Sensor	4-5
4-2-1. If Using The MRS-101B-S or MRS-101A-SE, MRS-104A-S	4-5
4-2-2. If Using The MRS-101B-V	4-9
4-2-3. If using the MRS-101B-T	4-9
4-3. SLEEP, Tx OFF	4-11
4-3-1. SLEEP	4-11
4-3-2. Tx OFF	4-12

5. SPECIFICATIONS	5-1
5-1. MRS-111B	5-1
5-2. MRS-114A	5-3
5-3. MRS-101B-S	5-5
5-4. MRS-101A-SE	5-7
5-5. MRS-101B-V	5-9
5-6. MRS-101B-T	5-11
5-7. MRS-104A-S	5-14
6. OUTSIDE DRAWING	6-1
6-1. MRS-111B outside drawing	6-1
6-2. MRS-114A outside drawing	6-2
6-3. MRS-101B-S outside drawing	6-3
6-4. MRS-101A-SE outside drawing	6-4
6-5. MRS-101A-V outside drawing	6-5
6-6. MRS-101B-T outside drawing	6-6
6-7. MRS-104A-S outside drawing	6-7
7. TECHNICAL INFORMATION	7-1
7-1. Antenna installation guide	7-1
7-1-1. Positional relationship of transmitter and receiver antennas	7-1
7-1-2. Location of Antenna	7-3
7-1-3. The direction/orientation of the antennas	7-4
7-2. Radiation characteristics	7-5
7-3. Polarization characteristics	7-6
7-4. Diversity reception techniques	7-8
7-4-1. Space diversity technique	7-9
7-4-2. Polarization diversity technique	7-10
7-5. Using the extension cable for the receiving antenna	7-11
7-6. Radio interference	7-12
7-7. Optional Accessories	7-13
8. APPENDIX	8-15
8-1. Transmitter power supply	8-15
8-1-1. Transmitter recommended battery	8-15
8-1-2. LEDs lighting conditions for monitoring transmitter power supply voltage	8-17
8-1-3. Estimated operating time of the battery (MRS-101B-S / MRS-101A-SE)	8-19

CONTENTS

8-1-4. Estimated operating time of the battery (MRS-101B-V)..... 8-22

8-1-5. Estimated operating time of the battery (MRS-101B-T)..... 8-25

8-1-6. Estimated operating time of the battery (MRS-104A-S)..... 8-28

STANDARD ACCESSORIES

The following standard accessories are packed with each receiver.

When unpacking, check the contents to ensure that all accessories are packed.

1ch-Receiver MRS-111B

Name	Quantity
Setting software (MRS-10B)	1
BNC-BNC cable (U-59)	1
USB cable (N-38)	1
AC adapter ^{*1}	1
Ground wire (P-72)	1
Receiving antenna (W1030)	2
High gain dipole antenna (DA-DB-05RP-SMA-08)	2
Extension cable for receiving antenna (2 m) (E-02)	2
Side hole suction cup (55 mm)	2
Cable tie	2
Product Warranty	1

^{*1} AC power cable is an optional accessory. (Select according to your county or region of use.)

4ch-Receiver MRS-114A

Name	Quantity
Setting software (MRS-10B)	1
BNC-BNC cable (U-59)	4
USB cable (N-38)	1
AC adapter ^{*1}	1
Ground wire (P-72)	1
Receiving antenna (W1030)	2
High gain dipole antenna (DA-DB-05RP-SMA-08)	2
Extension cable for receiving antenna (2 m) (E-02)	2
Side hole suction cup (55 mm)	2
Cable tie	2
Product Warranty	1

^{*2} AC power cable is an optional accessory. (Select according to your county or region of use.)

STANDARD ACCESSORIES

The following standard accessories are packed with each transmitter.

When unpacking, check the contents to ensure that all accessories are packed.

1ch-Strain Transmitter MRS-101B-S

Name	Quantity
Full-bridge Adapter (ADP-11S) ^{*3}	1
JCIS10-70 Miniature Screw (M2x4) ^{*3}	1
Battery holder (AAA Cellx2) (SBH4211AS)	1
ID label	1
Product Warranty	1

^{*3} Attached to the transmitter body

1ch-Strain Transmitter (EXT Antenna) MRS-101A-SE

Name	Quantity
Adapter Board (ADP-01) ^{*4}	1
JCIS10-70 Miniature Screw (M2x4) ^{*4}	1
Battery holder (AAA Cellx2) (SBH4211AS)	1
External antenna (W1030)	1
Antenna harness	1
ID label	1
Product Warranty	1

^{*4} Attached to the transmitter body

1ch-Voltage Transmitter MRS-101B-V

Name	Quantity
Voltage Adapter (ADP-11V) ^{*5}	1
JCIS10-70 Miniature Screw (M2x4) ^{*5}	1
Battery holder (AAA Cellx2) (SBH4211AS)	1
ID label	1
Product Warranty	1

^{*5} Attached to the transmitter body

1ch-Thermocouple Transmitter MRS-101B-T

Name	Quantity
Thermocouple Adapter (ADP-11T)^{*6}	1
JCIS10-70 Miniature Screw (M2x4) ^{*6}	1
Battery holder (AAA Cellx2) (SBH4211AS)	1
ID label	1
Product Warranty	1

^{*6} Attached to the transmitter body

4ch-Strain Transmitter MRS-104A-S

Name	Quantity
Full-bridge Adapter (ADP-401)^{*7}	2
Power Adapter (ADP-40P)^{*7}	1
JCIS10-70 Miniature Screw ^{*7}	3
Battery holder (AAA Cellx2) (SBH4211AS)	1
Fastening bracket	2
ID label	1
Product Warranty	1

^{*7} Attached to the transmitter body

OPTIONAL ACCESSORY

The following are optional accessories

1ch-Receiver MRS-111B

AC power cable (Japan)	P-38
AC power cable (USA)	P-39
AC power cable (EU)	P-41
AC power cable (India)	P-40
AC power cable (Thailand)	P-42
AC power cable (China)	P-43
AC power cable (Taiwan)	P-44
Small planar antenna	EXT-ANT1
Planar diversity antenna	EXT-ANT2
Extension cable for receiving antenna (6 m) ^{*1}	E-03
DC power cable (2 m)	P-76

*1 Cannot be used in EU.

4ch-Receiver MRS-114A

AC power cable (Japan)	P-38
AC power cable (USA)	P-39
AC power cable (India)	P-40
AC power cable (EU)	P-41
AC power cable (Thailand)	P-42
AC power cable (China)	P-43
AC power cable (Taiwan)	P-44
Small planar antenna	EXT-ANT1
Planar diversity antenna	EXT-ANT2
Extension cable for receiving antenna (6 m) ^{*2}	E-03
DC power cable (2 m)	P-76

*2 Cannot be used in EU.

1ch-Strain Transmitter MRS-101B-S

Full-bridge Adapter	ADP-11S
Quarter-bridge 2-wire Adapter (120 Ω)	ADP-12S-120
MRS junction kit	MRS-J11B

1ch-Strain Transmitter (EXT Antenna) MRS-101A-SE

Adapter Board	ADP-01
Quarter-bridge 2-wire Adapter (120 Ω)	ADP-02-120
MRS junction kit	MRS-J11A
MRS package kit	MRS-P11A

1ch-Voltage Transmitter MRS-101B-V

Voltage Adapter	ADP-11V
MRS junction kit	MRS-J11B

1ch-Thermocouple Transmitter MRS-101B-T

Thermocouple Adapter	ADP-11T
MRS junction kit	MRS-J11B

4ch-Strain Transmitter MRS-104A-S

Full-bridge Adapter	ADP-401
Power Adapter	ADP-40P
Quarter-bridge 2-wire Adapter (120 Ω) ^{*3}	ADP-402-120
Quarter-bridge 3-wire Adapter (120 Ω) ^{*3}	ADP-403-120

^{*3} Two adapters are required to measure 4 channels. (One adapter is available for 2 channels measurements.)

SAFETY PRECAUTIONS

This product complies with the specifications listed in "5 SPECIFICATIONS" on page 5-1.

Avoid using the product in environments that depart from the applicable specifications. Failure to observe this precaution may result in malfunctions.

Prior to use

To ensure safe use of this product, be sure to read the safety precautions before use. Kyowa Electronic Instruments Co., Ltd., assumes no liability for any damage resulting from the user's failure to comply with the safety precautions.

The following symbol is used to help ensure safe use of the product:

	Indicates the [GND] terminal. Be sure to connect the product's [GND] terminal to ground.
	Indicates the operator must refer to an explanation in the INSTRUCTION MANUAL in order to avoid the risk of injury or death of personnel or damage to the instrument.

Warning and Caution indicators

The following symbols are used to draw attention to important issues and to help ensure safe use of the product:

 WARNING	Improper use of the system may result in death or severe injury.
 CAUTION	Improper use of the system may result in injury and/or damage to the system.

 WARNING

- **Power supply**

- To prevent fire hazards, before turning on the product, make sure the power supply voltage specified for the product matches the local line voltage.
- If using the DC power cable P-76, be careful about the wiring polarity. Connecting the power polarity in reverse may cause accidents or malfunctions. Be sure not to do this.

- **Ground**

Be sure to connect the [GND] terminal to ground. Failure to do so may result in electric shock, performance degradation, or malfunctions.

- **Environments containing inflammable substances.**

To prevent the risk of fire and/or explosion, do not use the product in environments containing inflammable gas, vapor, or dust.

- **In the event of problems.**

If abnormalities such as smoke, abnormal odor, or abnormal noise occur, immediately turn off the power, disconnect the power cable from the main unit, and stop using it. Also, do not install the instrument on or near flammable materials to prevent a fire when an abnormality occurs.

- **Connecting and disconnecting cables**

Before connecting/disconnecting cables, turn off the power to the instrument and connected devices. Failure to do so may cause an electric shock, performance degradation, or malfunctions.

- **Location of this product**

- Never use the product in medical facilities. Also use the product away from the implantable pacemaker unit. Doing so may interfere with medical devices, posing a life-threatening risk.
- Never use the product at airports or in aircrafts. Doing so may cause airport equipment to malfunction, posing a life-threatening risk.

- **Concomitant use of conservation measures**

If there is a possibility that a secondary disaster may occur in the system due to a failure of the instrument, be sure to use another technical conservation measure.

- **Do not disassemble or modify the product.**

Failure to observe this precaution can result in electric shock or malfunctions. Attempting to disassemble or modify the product will invalidate the warranty.

- **Installation of Transmitter**

- If installing Transmitter, place it on a flat surface.
- If installing Transmitter on a rotating body, install a safety cover to secure safety from blown parts.
- If installing Transmitter with screws, install the transmitter with the specified screws and torque.

- **Handling of Batteries**

- If use primary batteries, do not recharge the primary batteries.
- If use secondary batteries, If use secondary batteries, charge the battery with the charger specified for the battery to be used.
- Connect positive (+) and negative (-) terminals of the batteries correctly. It may cause Liquid leakage, fever, ignite or explosion.
- Do not heat the batteries or throw the batteries into fire. It may cause Liquid leakage, fever, ignite or explosion.
- Do not short-circuit positive (+) and negative (-) terminals of the batteries. It may cause fever or ignite due to a rush current.
- if connecting batteries in parallel, use diodes or other means to prevent the batteries from being inadvertently charged.

 CAUTION

- **Use the product in a temperature range of -10 °C to 50 °C.**
Using the product at temperatures outside of the specified range, may lower product performance or result in malfunctions. If the product must be used under direct sunlight or in a cold place, protect the product with a screen or take proper measures to keep it warm.
- **Use the product in a relative humidity range of 20% to 90%.**
Using the product in environments in which the relative humidity falls outside the specified range, may degrade product performance or result in malfunctions.
- **Take care of condensation after an abrupt change in the environment.**
Abrupt changes in ambient temperature, such as during transportation, may cause condensation, which can degrade performance or cause malfunctions. Make sure that there is no condensation before using the instrument.
- **Avoid exposing the product to liquid.**
The product is not waterproof or drip-proof. Make sure no liquids come into contact the product; otherwise, electrical leakage or malfunctions may result.
- **Take care when operating the product in locations where the product may be subject to severe impact or vibration.**
Continuous vibration or severe impact may result in performance degradation or malfunctions. Also, when using in an environment with impact or vibration, please fix the chassis and connection cable.
- **Avoid using the product in the presence of strong electromagnetic fields.**
Use the product only in environments in which magnetic fields will not disrupt computer operations. Performance degradation, erratic operation, or malfunctions may occur if the product is used near radio equipment, microwave ovens, electric furnaces, or other equipment generating strong electromagnetic fields.
- **Pay attention to static electricity.**
It may cause damage due to static electricity. Before touching the equipment, touch a metal object to discharge static electricity.
- **Avoid using the product under poor power supply conditions.**
Failure to observe this precaution may result in performance degradation, erratic operations, or malfunctions. Be sure to use a power supply that does not emit noise or produce risk of instantaneous power outages.
- **Avoid installing sensors near a welding machine or performing measurements near a welding machine.**
Failure to observe this precaution may result in output abnormalities, erratic operations, or malfunctions.
- **When using or storing in an environment exposed to dust or corrosive gas, protect the opening with a connector cap.**
It may cause performance degradation or malfunctions. If dust gets inside, performance decreases. Make sure that dust does not enter during use as well as during storage.
- **If the product is used or stored in a place near the sea, take appropriate measures to protect the product from exposure to outside air.**
Failure to observe this precaution may result in performance degradation or malfunctions.
- **Take care when operating this product in high or low pressure environments.**
Failure to observe this precaution may result in malfunction, performance degradation, or failure. This product is designed to be used under pressure of the standard atmosphere.

 CAUTION

- **After power is turned OFF, wait at least 5 seconds before turning ON power once again.**

If power is turned on again within 5 seconds or if the power is repeatedly turned ON and OFF, the product may cause performance deterioration or failure due to the inrush current generated by the product being turned on.

- **Allow the product to warm up before use.**

If the power is turned on, the product will assume operational status in about 5 seconds. However, the internal electric parts and semiconductors need more time to reach thermal stability. To ensure stable operations, always let the product warm up for about 1 hours. If the product is insufficiently warmed up before use, measurement accuracy may fail to meet product specifications.

- **Do not pull on or apply excessive tension to the cables.**

Lay the cables with a certain safety margin of length to avoid subjecting the connections to excessive force. Applying excessive tension to a cable may result in abnormal output, conductor damage, or connector damage.

- **Wireless communication**

This product operates on the 2.4 GHz band, which wireless LAN, Bluetooth®, and microwave ovens also use. Devices on the wireless LAN or on other radio waves may generate electromagnetic interference that causes wireless communication errors in this product. Before using this product, check to confirm that there are no such devices nearby. In addition, note that the wireless LAN and Bluetooth® functions of the computer on which the Setting Software for this product is installed may generate electromagnetic interference. When controlling this product via the computer, turn off the computer's wireless LAN and Bluetooth® functions.

- **Take care when handling the CD-R.**

Do not store in direct sunlight, high temperature, or high humidity.

Do not apply force to the CD-R by placing objects on it or bending it.

Avoid fingerprints, smudges, and scratches on both sides of the CD-R.

- **Location of this product**

- Do not use the product where use of wireless devices, such as mobile phones, is prohibited.
- Use the product at the altitude up to 2,000 m.
- In case of installing the product at high place, select a safe location so that the antenna or antenna parts will not fall and cause harm or damage to people or objects.

- **Clean the product as needed.**

- If the product gets dirty, clean the product with a dry soft cloth. In case of dust exists inside the product, clean it by using an air blow gun and Do not touch electronic parts.
- Do not wipe the product with a wet cloth or with benzine, thinner, alcohol, etc. Doing so may cause discoloration or deformation.

LIMITED LIFE PARTS AND PREVENTIVE MAINTENANCE

The product consists of various electronic components and those components, if not all, have a useful life. These parts will degrade over the time, depending on the frequency of use, cumulative operating time, operating conditions (temperature and humidity), and other factors, leading eventually to potential performance degradation, erratic operations, or malfunctions. To prevent such problems, perform inspections/maintenance and replace parts as needed.

The limited lifespan parts used in the product and optional accessories are as follows:

- Aluminum electrolytic capacitor
- AC adapter (standard accessories)

To ensure that the product can be stably used over the long term, regular maintenance—including inspections and parts replacement—is necessary. For details on maintenance inspections or replacing limited lifespan parts, please contact our company's sales office or your nearest distributor.

EQUIPMENT RENEWAL

Maintaining the product and replacing components will help ensure optimal performance and prolong product service life. However, since only consumables and limited-lifespan parts can be replaced, natural age-related degradation will occur and progress for the entire the product. We recommend replacing the product that have served for an extended period or begin to require frequent repairs.

INFORMATION SERVICE

On our website, you can check the catalogs, Instruction manuals, CAD data and update information etc.

The detailed handling method is described in the instruction manual, so please use it after reading the latest instruction manual carefully.

https://www.kyowa-ei.com/eng/product/category/acquisition/s_mrs-100_series/index.html

NOTATIONS USED IN THE MANUAL

Notations used in the instruction manual

The digital telemeter MRS-100 series is collectively referred to as "the product".

Cautionary and reference notes

The notations below are used to attract your attention to important cautionary and reference notes when handling the product.

Examples of cautionary notations



CAUTION

Describes cases where incorrect handling could result in physical damage (product malfunctions, etc.).



NOTE

Describes important information pertaining to product usage.

Example of a reference note



Describes information useful for product usage.

Quoted text

If statements or other parts in the instruction manual are cited in other parts of the manual, they are enclosed in quotation marks ("").

Example: For terms and indicators used in the manual, please refer to "NOTATIONS USED IN THE MANUAL" on page 11.

RADIO CERTIFICATION

The product is for use only in the following countries and regions.

Use in other countries or regions is prohibited.

JAPAN (MIC)

Type certification

The product has been certified as a low-power data communications system in the 2.4 GHz band (Technical Regulations Conformity Certification System: Ordinance of MPT No. 37, 1981, Article 2, paragraph 1, item (19)) according to the Radio Law of Japan. Accordingly, no radio equipment license is required to use this product. However, the following actions may be punishable under law:

- Disassembling or modifying the product.
- Removing the certification label on the product.

Name of radio equipment: MR-2400MA Number of type certification: 007-AE0235

USA (FCC)

COMPLIANCE WITH ELECTRIC DIRECTIVES & REGULATIONS

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

[CAUTION]

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Contains Transmitter Module

FCC ID: 2AJE9, MR-2400MA

This device should be used EXCLUSIVELY as the digital devices for industrial, commercial or medical test equipment. "Test equipment" includes devices used for maintenance, research, evaluation, simulation and other analytical or scientific applications in areas such as industrial plants, public utilities, hospitals, universities, laboratories, automotive service centers and electronic repair shops.

CHINA**REGULATORY INFORMATION in China**

MRS-100 系列产品符合《微功率短距离无线电发射设备目录和技术要求》的无线电发射设备，无需取得无线电频率使用许可，无线电台执照，无线电发射设备型号核准。使用时请注意以下几点。

- (一) 符合“微功率短距离无线电发射设备目录和技术要求”的具体条款和使用场景，采用的天线类型和性能，控制、调整及开关等使用方法
- (二) 不得擅自改变使用场景或使用条件、扩大发射频率范围、加大发射功率(包括额外加装射频功率放大器)，不得擅自更改发射天线；
- (三) 不得对其他合法的无线电台(站)产生有害干扰，也不得提出免受有害干扰保护；
- (四) 应当承受辐射射频能量的工业、科学及医疗(ISM)应用设备的干扰或其他合法的无线电台(站)干扰；
- (五) 如对其他合法的无线电台(站)产生有害干扰时，应立即停止使用，并采取措施消除干扰后方可继续使用；
- (六) 在航空器内和依据法律法规、国家有关规定、标准划设的射电天文台、气象雷达站、卫星地球站(含测控、测距、接收、导航站)等军民用无线电台(站)、机场等的电磁环境保护区域内使用微功率设备，应当遵守电磁环境保护及相关行业主管部门的规定；
- (七) 禁止在以机场跑道中心点为圆心、半径 5000 米的区域内使用各类模型遥控器；
- (八) 微功率设备使用时温度和电压的环境条件。

INDIA (WPA)**REGULATORY INFORMATION in India**

Each model of WPC ETA ID is;

MRS-111B	: ETA-SD-20210805603
MRS-114A	: ETA-SD-20191207195
MRS-101A-SE	: ETA-SD-20191207189
MRS-104A-S	: ETA-SD-20191207137
MRS-101B-T	: ETA-SD-20210805601
MRS-101B-S	: ETA-SD-20210805604
MRS-101B-V	: ETA-SD-20210805605

THAILAND (NBTC)

REGULATORY INFORMATION in Thailand

เครื่องโทรคมนาคมและอุปกรณ์นี้ มีความสอดคล้องตามข้อกำหนดของ กสทช

Taiwan (NCC)

REGULATORY INFORMATION in Taiwan.

Contains the following NCC ID

MRS-111B and MRS-114A

內含發射器模組：CCAQ21LP0050T3

MRS-101A-SE CCAQ21LP0060T6

MRS-104A-S CCAQ21LP0070T9

MRS-101B-T CCAQ21LP0080T2

MRS-101B-S CCAQ21LP0081T1

MRS-101B-V CCAQ21LP0082T3

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Hereby, Kyowa Electronic Instruments Co., Ltd., declares that each equipment of the MRS-100 series is in compliance with Directive 2014/53/EU in countries of the European Economic Area (EEA) and EFTA countries (Iceland, Norway, Liechtenstein, Switzerland) and Turkey.

English:	This equipment is in compliance with the essential requirements and other relevant provisions of Directive 2014/53/EU.
Česky [Czech]:	Toto zařízení je v souladu se základními požadavky a ostatními odpovídajícími ustanoveními Směrnice 2014/53/EU.
Deutsch: [German]:	Dieses Gerät entspricht den grundlegenden Anforderungen und den weiteren entsprechenenden Vorgaben der Richtlinie 2014/53/EU.
Dansk:	Dette udstyr er i overensstemmelse med de væsentlige krav og andre relevante bestemmelser i Direktiv 2014/53/EU.
Español [Spain]:	Este equipo cumple con los requisitos esenciales así como con otras disposiciones de la Directiva 2014/53/EU.
Français [France]:	Cet appareil est conforme aux exigences essentielles et aux autres dispositions pertinentes de la Directive 2014/53/EU.
Ελληνική [Greek]:	Αυτός ο εξοπλισμός είναι σε συμμόρφωση με τις ουσιώδεις απαιτήσεις και άλλες σχετικές διατάξεις της Οδηγίας 2014/53/ΕΕ
Italiano [Italian]:	Questo apparato é conforme ai requisiti essenziali ed agli altri principi sanciti dalla Direttiva 2014/53/UE.
Magyar [Hungarian]:	Ez a készülék teljesíti az alapvető követelményeket és más 2014/53/EU irányelvben meghatározott vonatkozó rendelkezéseket.
Nederlands [Dutch]:	Dit apparaat voldoet aan de essentiële eisen en andere van toepassing zijnde bepalingen van de Richtlijn 2014/53/EU.
Norsk [Norwegian]:	Dette utstyret er i samsvar med de grunnleggende krav og andre relevante bestemmelser i EU-direktiv 2014/53/EU.
Português:	Este equipamento satisfaz os requisitos essenciais e outras provisões da Directiva 2014/53/EU.
Română [Romanian]:	Acest echipament este în conformitate cu cerințele esențiale și cu alte prevederi relevante ale Directivei 2014/53/UE.
Slovensko [Slovenian]:	Ta naprava je skladna z bistvenimi zahtevami in ostalimi relevantnimi pogoji Direktive 2014/53/EU.
Slovensky [Slovak]:	Toto zariadenie je v zhode so základnými požiadavkami a inými príslušnými nariadeniami direktív: 2014/53/EU.
Suomi [Finnish]:	Tämä laite täyttää direktiivin 2014/53/EU olennaiset vaatimukset ja on siinä asetettujen muiden laitetta koskevien määräysten mukainen.
Svenska [Swedish]:	Denna utrustning är i överensstämmelse med de väsentliga kraven och andra relevanta bestämmelser i Direktiv 2014/53/EU.

The full declaration of conformity for this product can be found at
https://www.kyowa-ei.com/eng/company/environment/eu_declaration.html

The maximum RF power is below:

The band 2405 - 2480 MHz is 4.0dBm

When mounting the product in customers systems, it is required to proceed additional certification processes before placing on the market in EU member states to make customers products fully comply with relative EU standards.

Kyowa can provide a test report of conducted measurement portion for the radio module to customers. Customers can utilize the test report for the certification processes of own systems as it requires radio.

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1. PRODUCT OVERVIEW

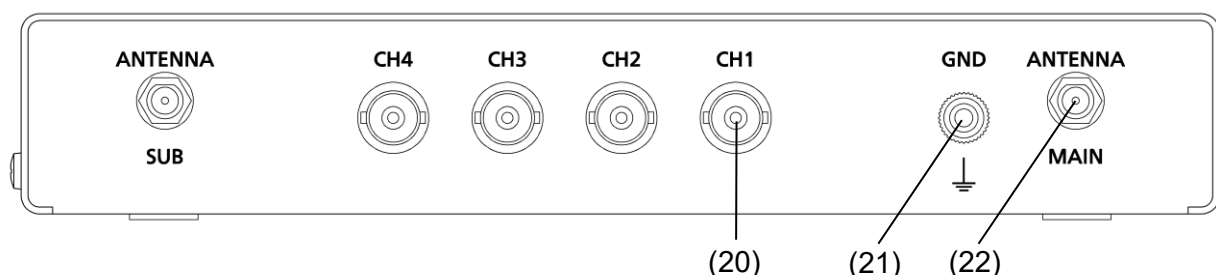
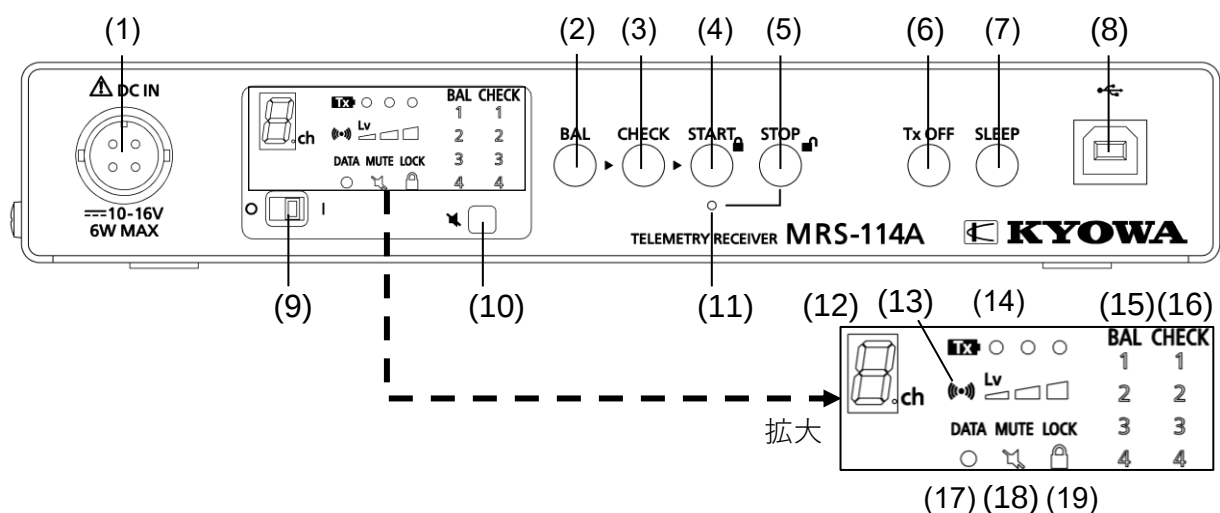
1-1. Product overview

Wireless measurements (telemeters) have long been desired to measure the torque of rotation shafts or to measure data at a place where wiring is difficult. The MRS-100 series is a telemeter to meet the strict system requirements and conditions (vibration resistance, impact resistance, small size for narrow space, high stability over the wide operating temperature range, low current consumption to get long time battery usage, and high-speed sampling).

- Telemeter that supports a maximum of 4-ch analog I/O
- Radio-signal condition inspection by the dedicated Setting Software.
- Easy operation without PC after initial settings.
- RSSI checking, transmitter 's battery voltage checking, and communication error checking.
- Diversity receiving system.
(Dual antennas improve the communication reliability.)

1-2. Controls and Indicators

1-2-1. 1ch-Receiver / 4ch-Receiver (MRS-111B / MRS-114A)



(1) Power connector

Connector for connecting a power supply. The power supply voltage range is 10 to 16 VDC. Connect the AC adapter (standard accessory) or DC power cable (optional accessory).

(2) “BAL” switch

Press this once while in [Command Mode] to perform balance adjustment

(3) “CHECK” switch

Press this once while in [Command Mode] to perform checking the sensor

(4) “START” switch

Press this once while in [Command Mode] to start measurement.

(5) “STOP” switch

Press this once while in [Measurement Mode] to stop measurement.

(6) “Tx OFF” switch

Press and hold this once for at least 3 seconds while in [Command mode] to turn off the transmitter.

(7) “SLEEP” switch

Press and hold this once for at least 3 seconds while in [Command mode] to transition the transmitter to sleep mode.

(8) USB connector

Connector for connecting a USB cable. Used to connect to a PC via USB.

(9) Power switch

Switch for turning on/off the power supply of this product.

" ○ " position: Power OFF, " | " position: Power ON

(10) MUTE switch

Press once to toggle the buzzer on/off.

(11) “START” LED

Indicates the mode of the receiver.

Table 1-1 “START” LED display

“START” LED display	Description
Lit in green	[Measurement Mode]
Off	[Command mode]

(12) Frequency channel LED

Indicates frequency channel currently set.

(13) RSSI (Received Signal Strength Indicator) LED

Indicates RSSI from the transmitter. For details on the lighting patterns and states, please refer to "Table 1-7 RSSI LED display " on page 1-7.

(14) Transmitter's battery voltage checking LED

Indicates the transmitter power supply voltage level. For details on the lighting patterns and states, please refer to "Table 1-8 Transmitter's battery voltage checking LED display" on page 1-8.

(15) "BAL" LED

Indicates the status of Balance adjustment.

MRS-111B have only "CH1".

Table 1-2 "BAL" LED display

"BAL" LED display	Description
Lit in green	Balance adjustment is successful.
Lit in red	Balance adjustment fails.
Off	Balance adjustment not performed.

(16) "CHECK" LED

Indicates the sensor check result when the sensor check is performed.

MRS-111B have only "CH1".

Table 1-3 "CHECK" LED display

"CHECK" LED display	Description
Lit in green	Sensor check is successful.
Lit in red	Sensor check fails.

(17) "DATA" LED

Indicates the status of wireless communication.

Table 1-4 "DATA" LED display

"DATA" LED display	Description
Lit in green	Normal wireless communication
Lit in red	Wireless communication error

(18) "MUTE" LED

Indicates the status of the buzzer.

Table 1-5 "MUTE" LED display

"MUTE" LED display	Description
Lit in green	MUTE ON (Buzzer OFF)
Off	MUTE OFF (Buzzer ON)

(19) "LOCK" LED

Indicates the receiver switch is locked.

In the [Measurement Mode], lit in green and no switches other than "STOP" and "MUTE" can be used.

Table 1-6 "LOCK" LED display

"MUTE" LED display	Description
Lit in green	Switch is locked.
Off	Switch is unlocked.

(20) Analog output connector

In the measurement mode, the measurement data of the transmitter is output as a voltage.

MRS-111B have only "CH1".

(21) GND terminal

Terminal for grounding. Use ground wire (Standard Accessories) to ground the product.

(22) Antenna connections connectors

Connector for connecting antennas.

The connector format is SMA Reverse (characteristic impedance 50 ohm).

The accessory antennas (W1030 or DA-DB-05RP-SMA-08) and optional antennas (EXT-ANT1 or EXT-ANT2) can be connected to the connector.

RSSI LED display

The following indicates RSSI from the transmitter in four levels.

Indicates RSSI from the transmitter in four levels by lighting up zero to three of the LEDs. Serves as a guideline when finding the best place for installation.

For stable wireless communication, choose an installation location where three RSSI LEDs are lit.

Table 1-7 RSSI LED display

LED display	Description	RSSI
	This is the recommended level.	Strong ↑
	Try to install the product in a different location with a better wireless signal.	
	Environments susceptible to wireless communication errors. Install the product in a different location.	
	Environments where connecting to wireless communication is difficult. Install the product in a different location.	Weal ↓



The receiver receives data via both "MAIN" and "SUB" antennas but prioritizes data received from the "MAIN" antenna. "SUB" antenna's data is used in case a wireless communication error occurs in the "MAIN" antenna's data to reduce the data defect rate. For this reason, even if there are no wireless communication receiving errors, the "RSSI" LEDs may switch between all lit and off depending on the sending/receiving environment. This situation occurs when there is minimal "MAIN" RSSI (enough to avoid receiving errors) but ample "SUB" RSSI (LEDs all lit).

In this case, adjust the "MAIN" antenna direction or take other measures to improve RSSI.

Transmitter's battery voltage checking LED display

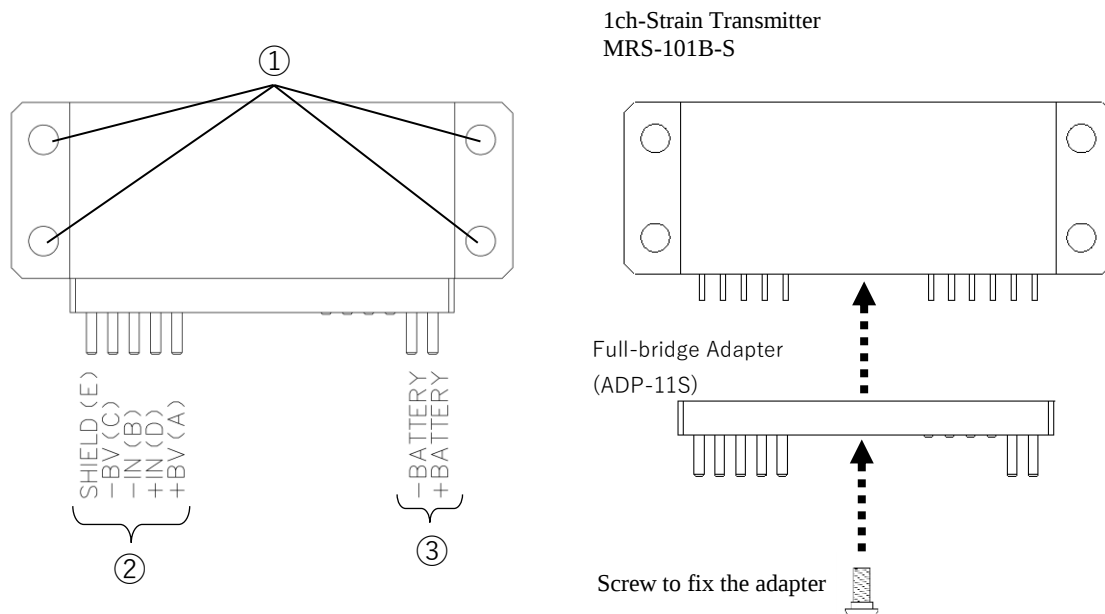
The following indicates the transmitter's battery voltage checking LED.

For details, please refer to "8-1 Transmitter power supply " on page 8-15

Table 1-8 Transmitter's battery voltage checking LED display

LED display	Transmitter power supply information		Power level
	Setting value	Default value	
	 or more	2.35 V or more	High ↑
	Less than 	Less than 2.35 V	
	Less than 	Less than 2.25 V	↓ Low
	Less than 	Less than 2.25 V	

1-2-2. 1ch-Strain Transmitter MRS-101B-S



(1) Screw hole to fix the transmitter

Screw hole for installing the transmitter on a fixed surface.

For installation screws, please refer to "2-4-2 Transmitter Installation" on page 2-12.

(2) Bridge input pins

Pins for bridge input.

For wiring method, please refer to "2-4-1 Input Pins" on page 2-10.

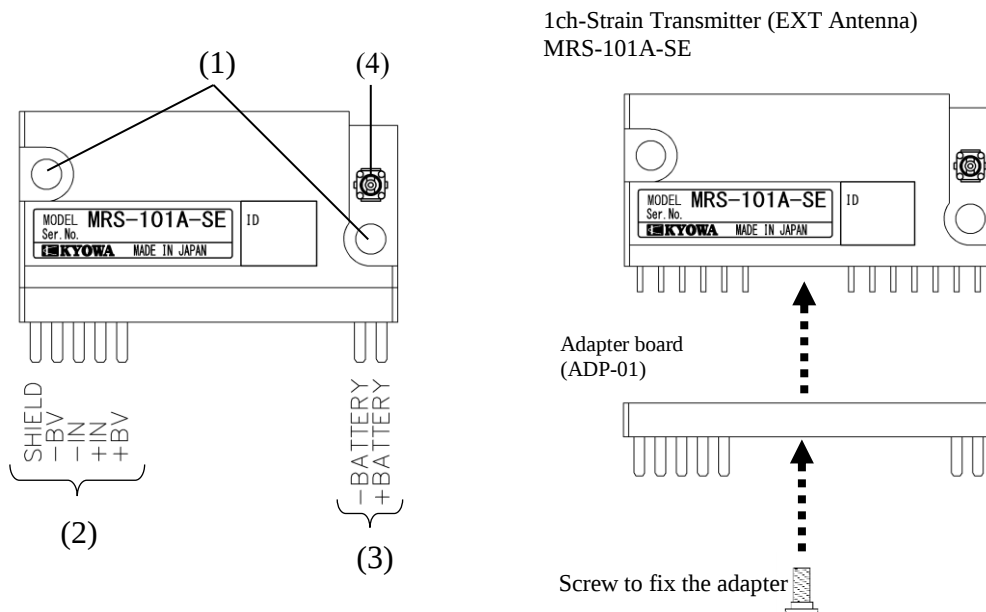
(3) Power input pins

Pins for power input.

For wiring method, please refer to "2-4-1 Input Pins" on page 2-10.

Be careful not to use the wrong polarity, as it may damage the product.

1-2-3. 1ch-Strain Transmitter (EXT Antenna) MRS-101A-SE



(1) Screw hole to fix the transmitter

Screw hole for installing the transmitter on a fixed surface.

For installation screws, please refer to "2-5-3 Transmitter Installation" on 2-17.

(2) Bridge input pins

Pins for bridge input.

For wiring method, please refer to "2-5-1 Input Pins" on page 2-14.

(3) Power input pins

Pins for power input.

For wiring method, please refer to "2-5-1 Input Pins" on page 2-14.

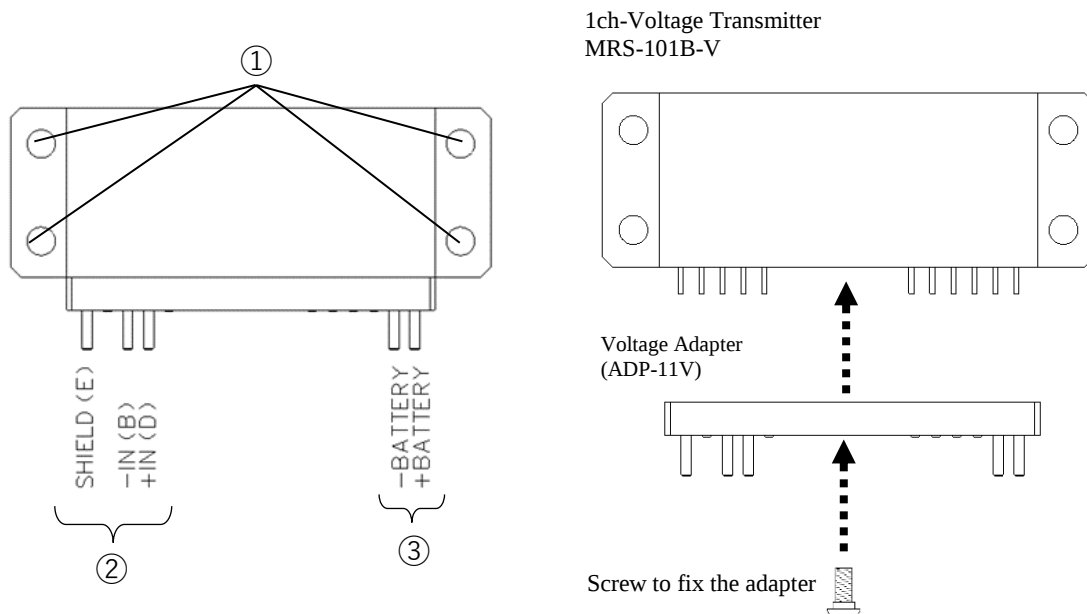
Be careful not to use the wrong polarity, as it may damage the product.

(4) Antenna connector

Connector for connecting the antenna harness.

For wiring method, please refer to "2-5-2 Antenna connector" on page 2-16.

1-2-4. 1ch-Voltage Transmitter MRS-101B-V



(1) Screw hole to fix the transmitter

Screw hole for installing the transmitter on a fixed surface.

For installation screws, please refer to "2-6-2 Transmitter Installation" on page 2-21.

(2) Voltage input pins

Pins for voltage input.

For wiring method, please refer to "2-6-1 Input Pins" on page 2-19.

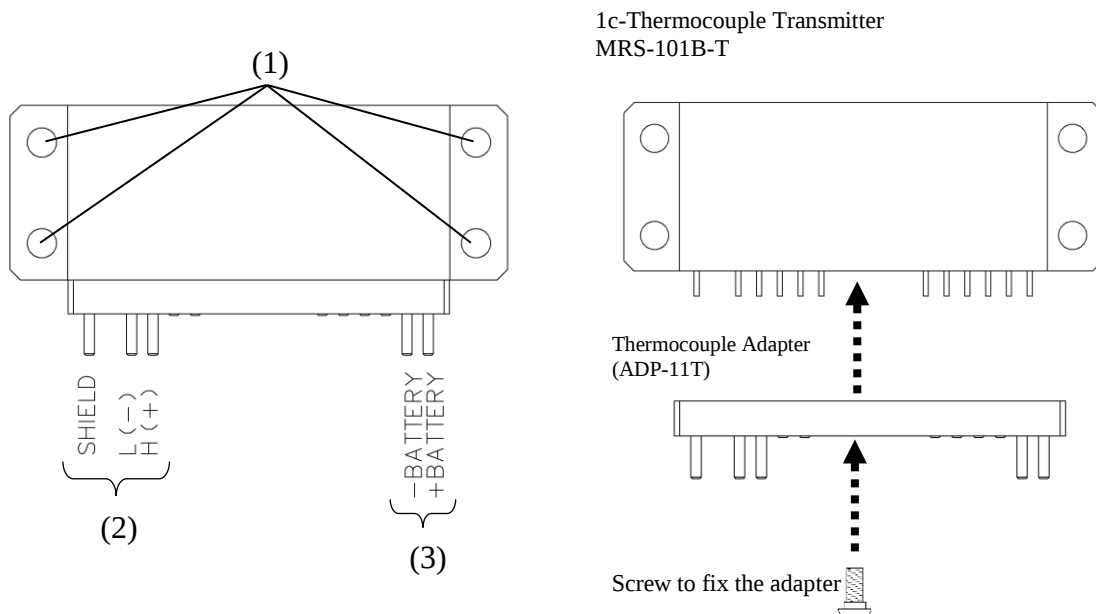
(3) Power input pins

Pins for power input.

For wiring method, please refer to "2-6-1 Input Pins" on page 2-19.

Be careful not to use the wrong polarity, as it may damage the product.

1-2-5. 1ch-Thermocouple Transmitter MRS-101B-T



(1) Screw hole to fix the transmitter

Screw hole for installing the transmitter on a fixed surface.

For installation screws, please refer to "2-7-2 Transmitter Installation" on page 2-25.

(2) Thermocouple input pins

Pins for thermocouple input.

For wiring method, please refer to "2-7-1 Input Pins" on page 2-23.

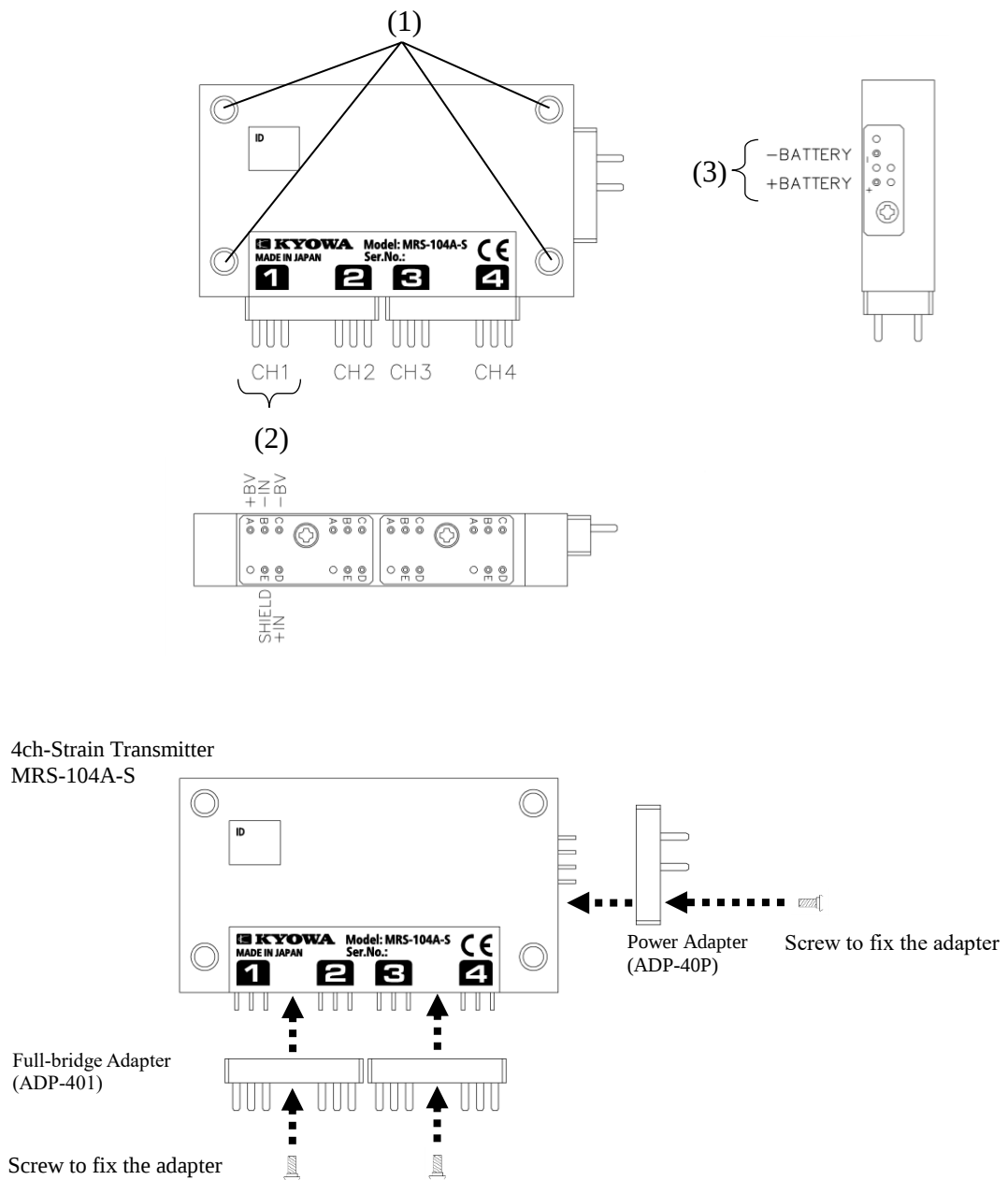
(3) Power input pins

Pins for power input.

For wiring method, please refer to "2-7-1 Input Pins" on page 2-23.

Be careful not to use the wrong polarity, as it may damage the product.

1-2-6. 4ch-Strain Transmitter MRS-104A-S



(1) Screw hole to fix the transmitter

Screw hole for installing the transmitter on a fixed surface.

For installation screws, please refer to "2-8-2 Transmitter Installation" on page 2-29.

(2) Bridge input pins

Pins for bridge input.

For wiring method, please refer to "2-8-1 Input Pins" on page 2-27.

(3) Power input pins

Pins for power input.

For wiring method, please refer to "2-8-1 Input Pins" on page 2-27.

Be careful not to use the wrong polarity, as it may damage the product.

2.Installation

2-1. Combination Model

MRS-111B is used in combination with MRS-101B-S, MRS-101A-SE, MRS-101B-V or MRS-101B-T. MRS-114A is used in combination with MRS-101B-S, MRS-101A-SE, MRS-101B-V, MRS-101B-T or MRS-104A-S.

Table 2-1 Combination models

Receiver		Transmitter	
Model	Name	Model	Name
MRS-111B	1ch-Receiver	MRS-101B-S MRS-101A-SE	1ch-Strain Transmitter
		MRS-101B-V	1ch-Voltage Transmitter
		MRS-101B-T	1ch-Thermocouple Transmitter
MRS-114A	4ch-Receiver	MRS-101B-S MRS-101A-SE	1ch-Strain Transmitter
		MRS-101B-V	1ch-Voltage Transmitter
		MRS-101B-T	1ch-Thermocouple Transmitter
		MRS-104A-S	4ch-Strain Transmitter



NOTE

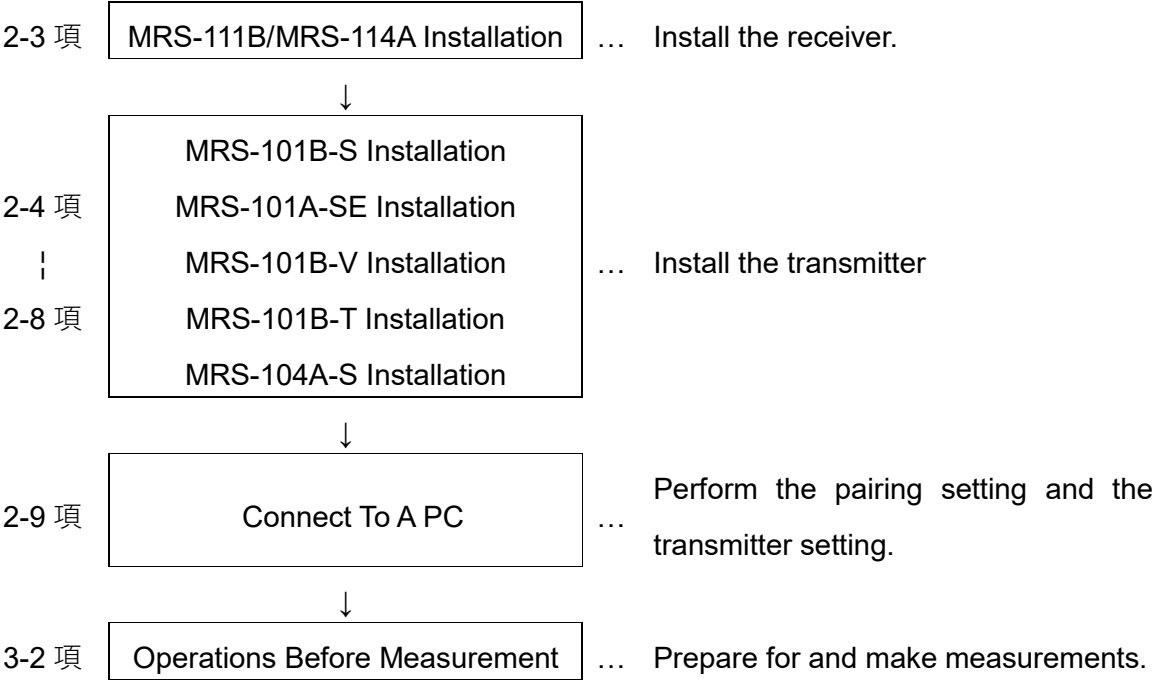
Use the latest versions of the Transmitter and Receiver Firmware and Setting Software.



The Transmitter and Receiver Firmware Ver. can be confirmed from the Setting software. For details, please refer to "Setting Software INSTRUCTION MANUAL".

2-2. Installation Procedure

This section explains the preparatory work necessary from installation to measurement.
Follow the procedure below.



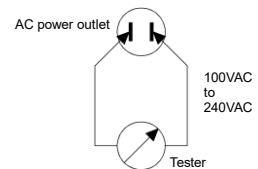
2-3.MRS-111B/MRS-114A Installation

2-3-1. Power connector

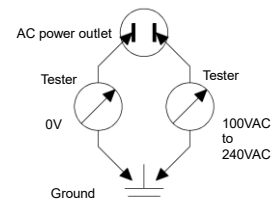
If using the AC adaptor (Standard accessory)

Confirm the power-supply voltage before connecting the AC plug of the AC adaptor to a power outlet. The power-supply voltage can be checked by doing the following:

- (1) Measure the voltage between the terminals of the AC power outlet with a tester to make sure it is within the range of 100VAC to 240 VAC.

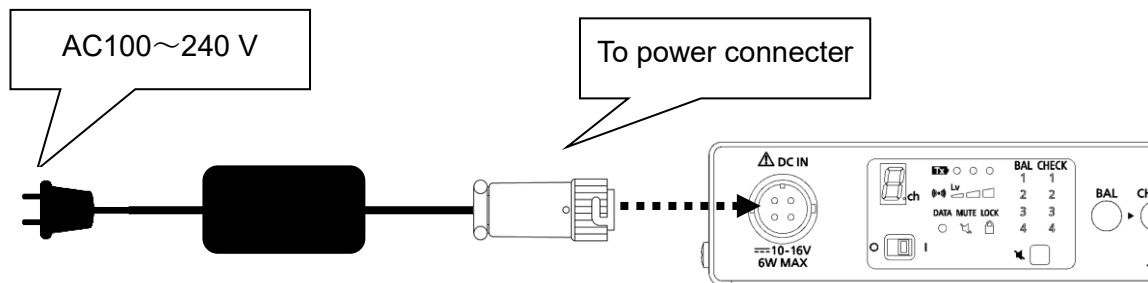


- (2) Measure the voltage between each of the terminals of the AC power outlet and ground to make sure the voltage at one terminal is 0 V and the voltage at the other terminal is within the range of 100 VAC to 240 VAC.



- (3) If an induction motor, electric welding machine, or other noisy equipment is used in the same environment, use an isolation transformer or a commercial noise cut transformer to minimize noise effects. The presence of significant noise is likely to result in poor power supply conditions.

After checking the power supply voltage, connect the AC adapter (Standard accessory) to the power connector.



CAUTION

- The acceptable range for the power supply voltage for the AC adapter is 100 VAC to 240 VAC, 50 Hz to 60 Hz. Make sure the power supply voltage is within this range.
- To prevent malfunctions and accidents, do not connect the AC adapter to the AC power outlet if the power supply voltage falls outside the allowable voltage range or if the voltage to ground at any power supply terminal may exceed the power supply voltage.
- Be sure to connect the [GND] terminal to ground. Failure to ground the product properly may result in electrical shock, degraded performance, or malfunctions.

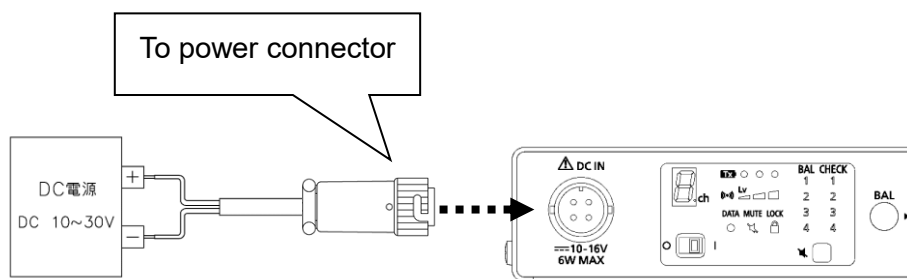
If using an external DC power supply

Confirm the power-supply voltage before connecting the DC power cable (optional accessory).

The acceptable range for the power-supply voltage is 10 VDC to 16 VDC. Make sure the DC power-supply voltage is within the allowable range. Be sure to ground the product.

Next, use the included DC power cable to supply power.

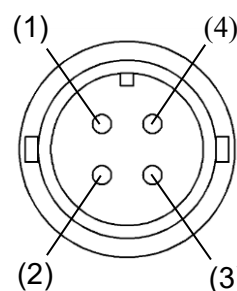
Connect the power cable connector to the power connector on the front panel.



The pin assignments and signals are shown below.

Table 2-2 Power connector

Pin No.	Signal name
(1)	Positive (+) power supply
(2)	Positive (+) power supply
(3)	Negative (-) power supply
(4)	Negative (-) power supply



CAUTION

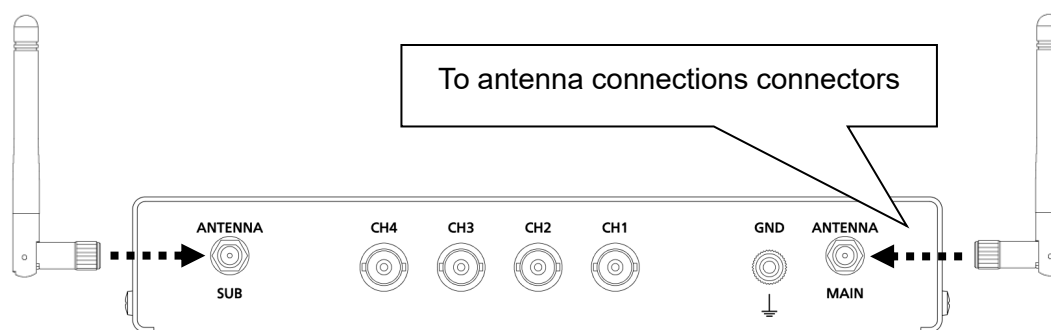
- Applying power supply voltage outside the power-supply voltage range or reversing the connection of the power supply polarity could cause malfunctions or accidents. Be sure not to do this.
- Be sure to ground the GND terminal. If it is not grounded, it could cause electric shocks, performance degradation, or malfunctions.

2-3-2. Antenna Connections Connectors

Connect the accessory antennas (W1030: approximately 110 mm long or DA-DB-05RP-SMA-08: approximately 195 mm long) or optional antennas (EXT-ANT1: approximately 28 mm long or EXT-ANT2: orthogonal polarization diversity planer antennas).

Also, the receiving antenna can be set up away from the receiver by using the extension cable (Standard accessory).

For details, please refer to "7-5 Using the extension cable for the receiving antenna" on page 7-11.



CAUTION

Not for use with receiving antennas except Kyowa-specified models. Using nonrecommended antennas violates the Radio Law.

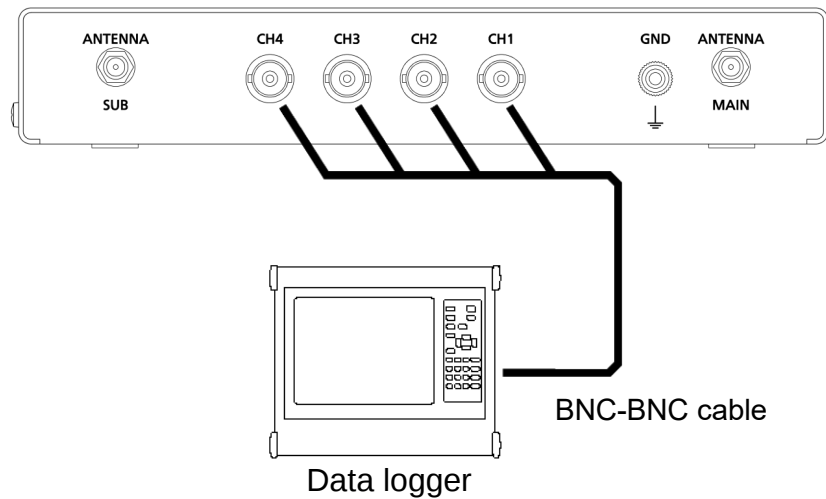


The receiver conforms to radio equipment standards and regulations, specifically for low-power data communications systems (ARIB STD-T66) and involving the Code of Federal Regulations for radio modules (FCC Part 15C) and the Indian Wireless Act 1933 (WPC ETA).

2-3-3. Analog Output Connectors

Connect the receiver to a data logger by using the BNC-BNC cable (standard accessory).

Analog output from receiver can be recorded with data logger prepared by users.



In the [Measuring Mode], The receiver outputs the measurement data of the transmitter as a voltage as follows:

- **Output Sensitivity**

The setting range for positive and negative rated output corresponds to ± 5 V.

For example

- **If the MRS-104A-S, MRS-101B-S or MRS-101A-SE**

If set to the 5000×10^{-6} strain range, when -4000×10^{-6} strain is input to the transmitter, -4 V is output from the analog output.

- **If the MRS-101B-V**

If set to the 10 V range, when +5 V is input to the transmitter, +2.5 V is output from the analog output.

- **If the MRS-101B-T**

If set to the K100 range, when the output equivalent to 25°C is input to the transmitter, 1.25 V is output from the analog output.

● DA Conversion Speed

The receiver analog output is output at the DA conversion speed shown in the following table for each paired transmitter and number of channels.

Table 2-3 Number of chnnels and DA conversion speed

Transmitter Model Name	Number Of Channels	DA Conversion Speed
MRS-101B-S MRS-101A-SE MRS-101B-V	1	4.8 kHz
MRS-101B-T	1	50 Hz
MRS-104A-S	1	4.8 kHz
	2	3.2 kHz
	3	2.4 kHz
	4	1.92 kHz

● Delay Time

From transmitter input to analog output, the constant delay shown in the following table occurs for each each paired transmitter and number of channels.

Table 2-4 Number of chnnels and Delay Time

Transmitter Model Name	Number Of Channels	Delay Time
MRS-101B-S MRS-101A-SE MRS-101B-V	1	11.1 ± 0.3 ms (at DC~480Hz)
MRS-101B-T	1	125 ± 25 ms (at DC~10.5Hz)
MRS-104A-S	1	11.1 ± 0.3 ms (at DC~480Hz)
	2	10.8 ± 0.3 ms (at DC~320Hz)
	3	9.8 ± 0.3 ms (at DC~240Hz)
	4	9.7 ± 0.3 ms (at DC~192Hz)

● Communication Error Handling

The communication error handling is as follows.

The communication error handling can be set by the setting software. For details, please refer to "Setting Software INSTRUCTION MANUAL".

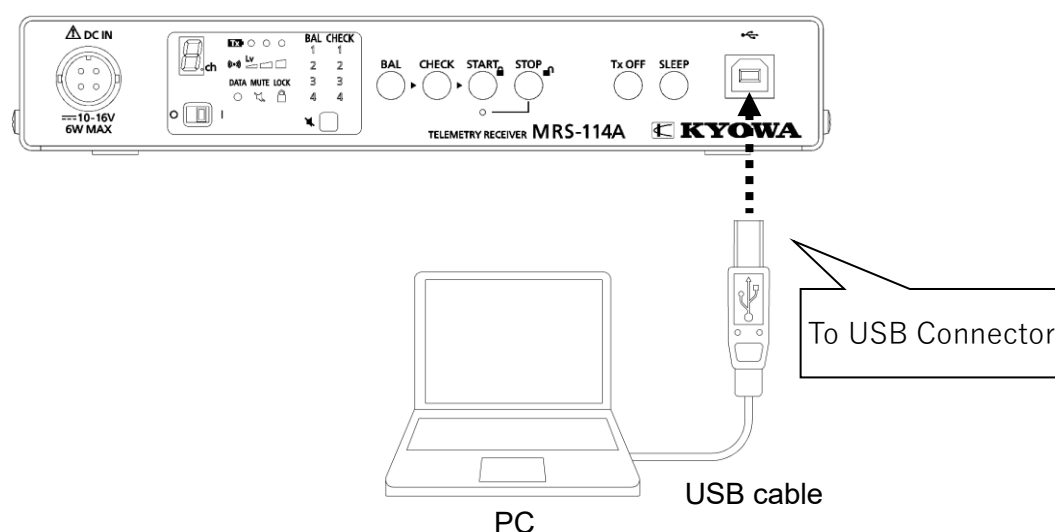
The default value is Over +5 V.

Table 2-5 Communication Error Handling

Communication Error Handling	Description
Over +5V	To recognize receiving errors, the product forces a jump in output to over +5 V.
Over -5V	To recognize receiving errors, the product forces a jump in output to under -5 V.
Retain previous value	Measurement data immediately before the error is output as-is.

2-3-4. USB connector

Connect the receiver to a PC by using the USB cable (standard accessory).



2-4. MRS-101B-S Installation

2-4-1. Input Pins

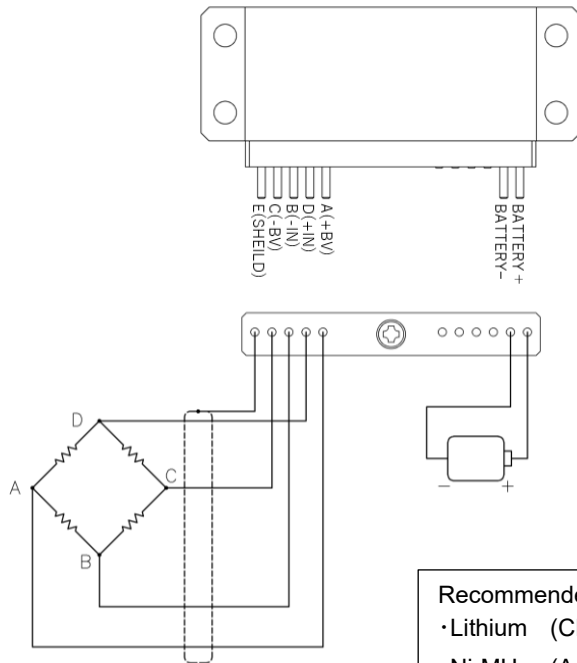


Table 2-6 MRS-101B-S's Pin assignment

Pin No.	Signal name	
A	+BV	Bridge excitation (+)
B	-IN	Bridge output (-)
C	-BV	Bridge excitation (+)
D	+IN	Bridge output (+)
E	SHIELD	Shield

Recommended battery
• Lithium (CR2 x1)
• Ni-MH (AAA cell x2)
• Alkaline (AAA cell x2)



CAUTION

- Wire the devices so as to avoid disconnection if the transmitter, strain gage, battery, or respective wiring is twisted or vibrates.
- The battery holder (Standard accessory), which houses two AAA-cell batteries, is not designed to withstand vibration, impact, or centrifugal force. Use the batteries in the holder only for checking operation.

**NOTE**

- Be careful not to incorrectly wire the sensor.
 - +BV (A) : Bridge excitation (+)
 - IN (B) : Bridge output (-)
 - BV (C) : Bridge excitation (+)
 - +IN (D) : Bridge output (+)
 - SHIELD (E) : Shield
- The Full-bridge Adapter can be removed for replacement. To reconnect it, solder the pins on the Adapter.
- Be careful, avoid exposing the Adapter to excessive solder and heat from the soldering iron.
- Keep the sensor wire short. Long wiring may introduce noise into sensor signals and negatively affect signal transmission and reception.
- Keep the battery wire short. Long wiring may negatively affect signal transmission and reception.
- Connecting the power polarity in reverse may cause accidents or malfunctions. Be sure not to do this.

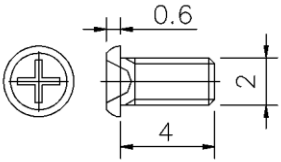
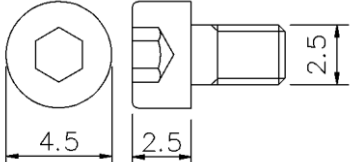


- MRS-101B-S is compatible with full bridge system.
- The full-bridge adapter is attached to the transmitter body of MRS-101B-S. If using the quarter-bridge strain gage, replace the Adapter to the Quarter-bridge 2-wire Adapter (optional accessory).

2-4-2. Transmitter Installation

Use the screws shown in the following table for fixing the transmitter and adapter and for mounting the transmitter body. Install the transmitter with the specified torque.

Table 2-7 The screws and the specified torque

Mounting object		Full-bridge Adapter board	Fixing surface
Screw	Type	JCIS10-70 Miniature Screw (M2)	Hexagon socket head cap Screw (M2.5)
	Material	SWCH	SCM435
	Size	 [mm]	 [mm]
Max.Torque to the Transmitter Main Body		0.1 N·m	0.45 N·m

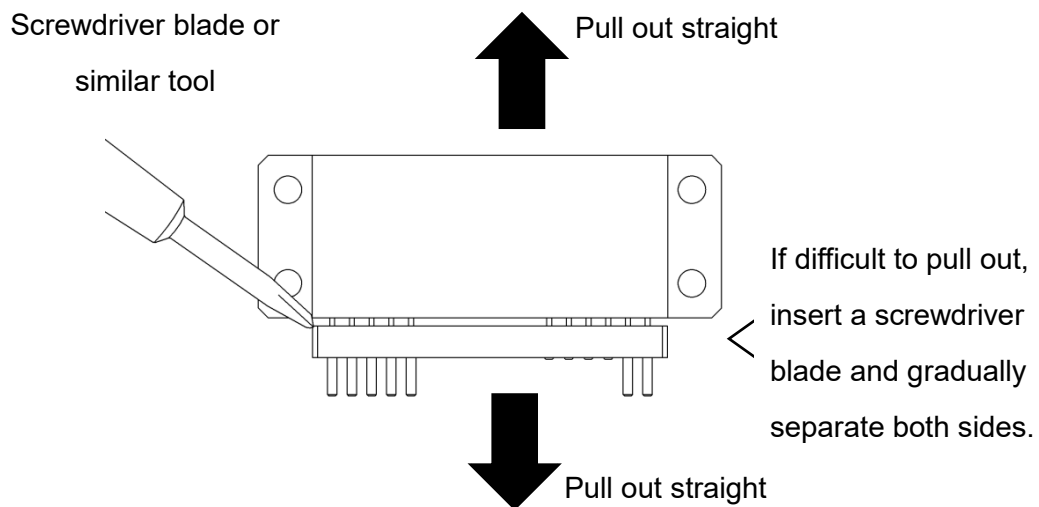


CAUTION

- If installing this product, place it on a flat surface. If the transmitter is installed on a warped or uneven surface, it may cause damage or cracks in the body of the transmitter.
- If exceeding the Max.Torque, it may cause damage or cracks in the body of the transmitter.
- The catalog value of centrifugal acceleration resistance is the value when fixed with the above screws and torque. If fixed in any other way, this value may not be guaranteed. Please contact our sales representative for more information.
- If installing this product on a rotating body, install a safety cover to secure safety from blown parts.

2-4-3. Detachment of Full-bridge Adapter

When removing the Full-bridge Adapter from the transmitter, after removing the small screw (M2), pull out the Adapter straight. Be careful when handling the transmitter pins, as they can bend easily. If the Full-bridge Adapter is difficult to pull out, insert a flat tool, such as a screwdriver blade, between the transmitter and Full-bridge Adapter and gradually separate both sides, one after the other.



CAUTION

If the pins become bent, use tweezers or similar tool to straighten them before use. Be careful, because inserting the Full-bridge Adapter when the pins are bent may damage the transmitter pins.

2-5.MRS-101A-SE Installation

2-5-1. Input Pins

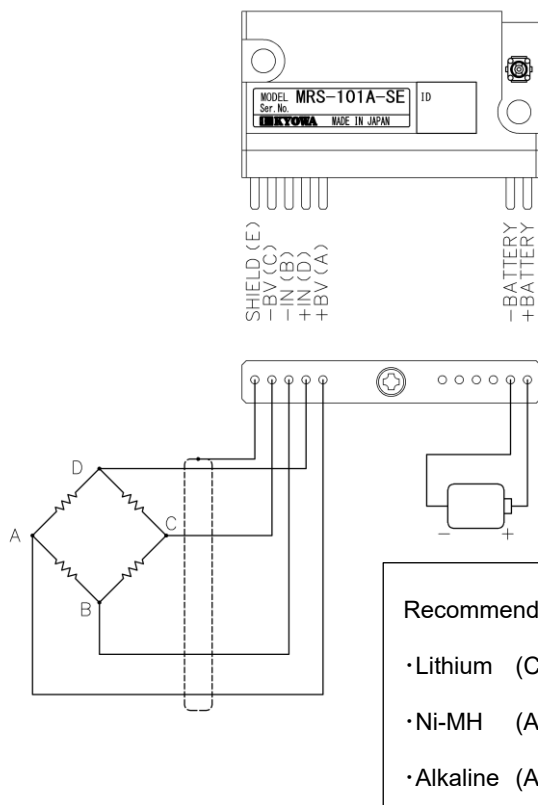


Table 2-8 MRS-101A-SE's Pin assignment

Pin No.	Signal name	
A	+BV	Bridge excitation (+)
B	-IN	Bridge output (-)
C	-BV	Bridge excitation (+)
D	+IN	Bridge output (+)
E	SHIELD	Shield



CAUTION

- Wire the devices so as to avoid disconnection if the transmitter, strain gage, battery, or respective wiring is twisted or vibrates.
- The battery holder (Standard accessory), which houses two AAA-cell batteries, is not designed to withstand vibration, impact, or centrifugal force. Use the batteries in the holder only for checking operation.

**NOTE**

- Be careful not to incorrectly wire the sensor.

+BV (A)	: Bridge excitation (+)
-IN (B)	: Bridge output (-)
-BV (C)	: Bridge excitation (+)
+IN (D)	: Bridge output (+)
SHIELD (E)	: Shield
- The Adapter Board can be removed for replacement. To reconnect it, solder the pins on the Adapter Board.
- Be careful, avoid exposing the Adapter to excessive solder and heat from the soldering iron.
- Keep the sensor wire short. Long wiring may introduce noise into sensor signals and negatively affect signal transmission and reception.
- Keep the battery wire short. Long wiring may negatively affect signal transmission and reception.
- Connecting the power polarity in reverse may cause accidents or malfunctions. Be sure not to do this.

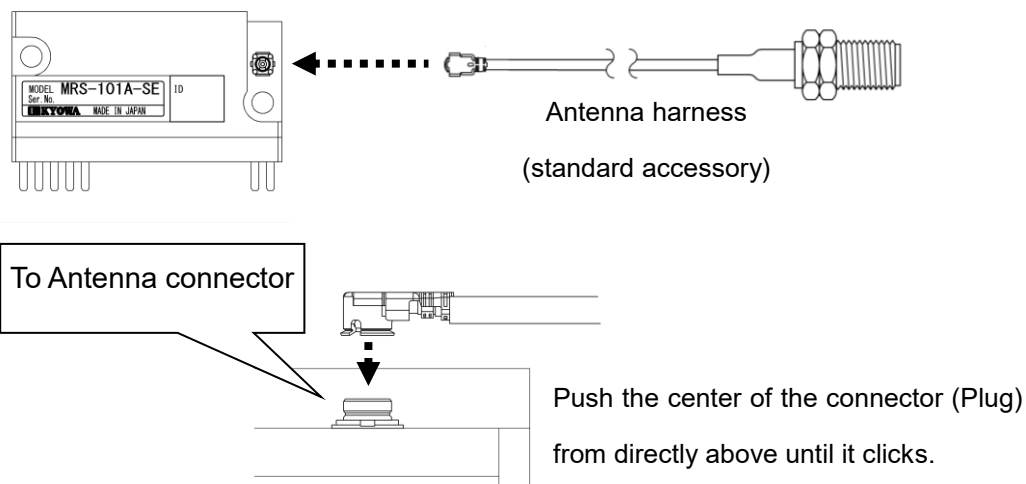


- MRS-101A-SE is compatible with full bridge system.
- The Adapter board is attached to the transmitter body of MRS-101A-SE. If using the quarter-bridge strain gage, replace the Adapter board to the quarter-bridge 2-wire Adapter (optional accessory).

2-5-2. Antenna connector

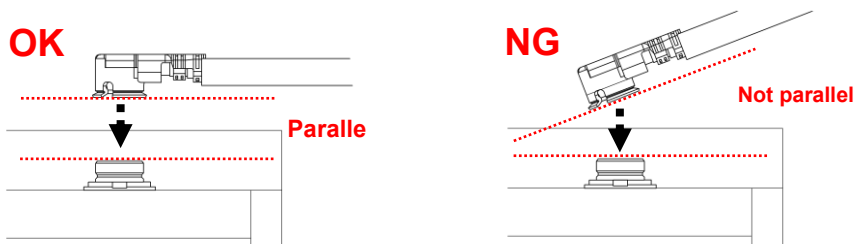
Connect to Antenna harness (standard accessory).

For details, please refer to "1ch-Strain Transmitter (EXT Antenna) READ IN THE BEGINNING".



NOTE

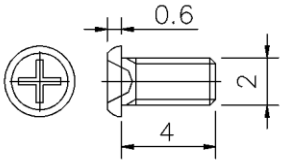
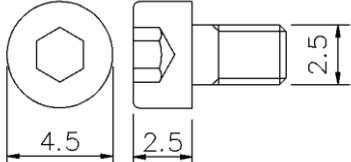
- Frequent insertion and removal can cause the connector to wear out and result in problems. Limit insertion and removal as much as possible. (Try to avoid doing this any more than about 30 times.)
- Be sure to turn off the power before attaching or detaching the antenna harness and antenna.
- Insert or remove the connector so that the mating surface is always parallel. When it is not parallel, each connector will be damaged



2-5-3. Transmitter Installation

Use the screws shown in the following table for fixing the transmitter and adapter and for mounting the transmitter body. Install the transmitter with the specified torque.

Table 2-9 The screws and the specified torque

Mounting object		Adapter board	Fixing surface
Screw	Type	JCIS10-70 Miniature Screw (M2)	Hexagon socket head cap Screw (M2.5)
	Material	SWCH	SCM435
	Size	 [mm]	 [mm]
Max.Torque to the Transmitter Main Body		0.1 N·m	0.45 N·m



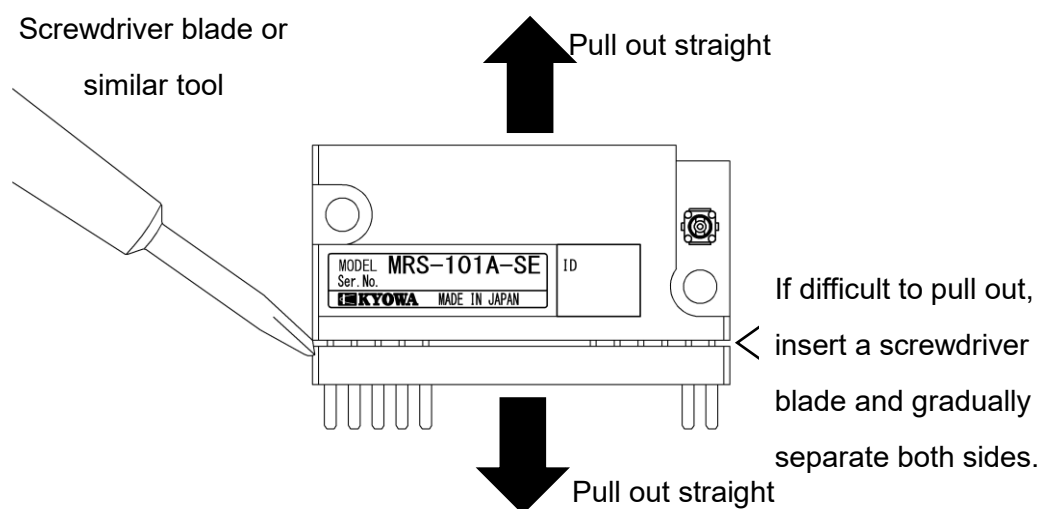
CAUTION

- If installing this product, place it on a flat surface. If the transmitter is installed on a warped or uneven surface, it may cause damage or cracks in the body of the transmitter.
- If exceeding the Max.Torque, it may cause damage or cracks in the body of the transmitter.

2-5-4. Detachment of Adapter board

When removing the Adapter board from the transmitter, after removing the small screw (M2), pull out the Adapter board straight. Be careful when handling the transmitter pins, as they can bend easily.

If the Adapter board is difficult to pull out, insert a flat tool, such as a screwdriver blade, between the transmitter and Adapter board and gradually separate both sides, one after the other.

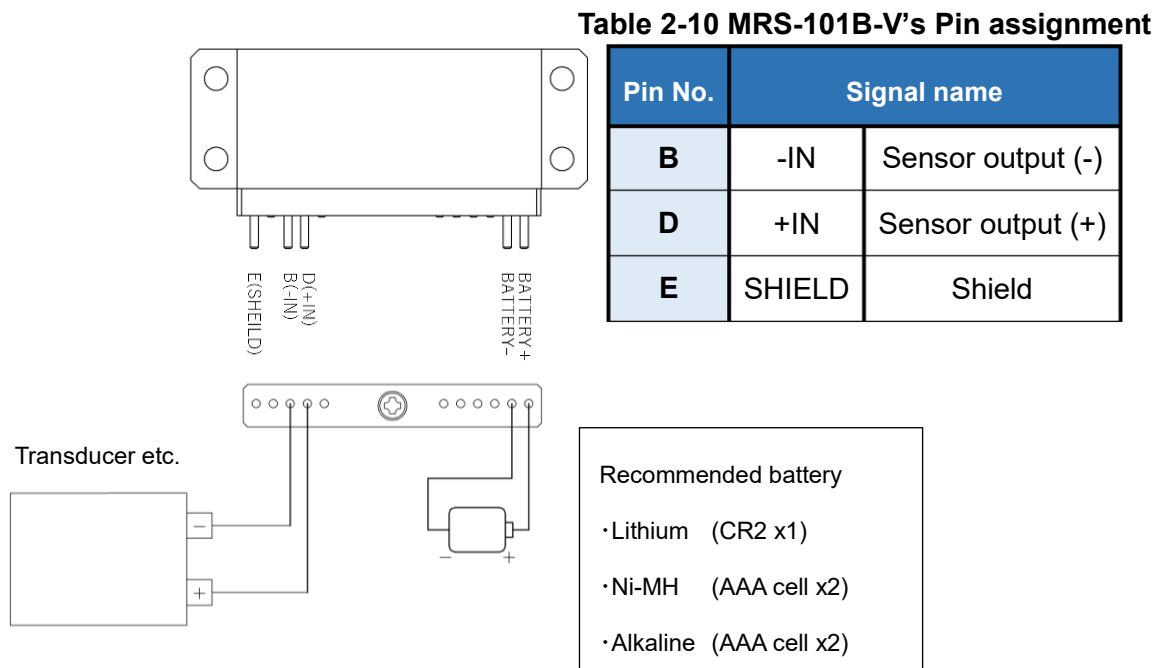


CAUTION

If the pins become bent, use tweezers or similar tool to straighten them before use. Be careful, because inserting the Adapter board when the pins are bent may damage the transmitter pins.

2-6.MRS-101B-V Installation

2-6-1. Input Pins



CAUTION

- Wire the devices so as to avoid disconnection if the transmitter, sensor, battery, or respective wiring is twisted or vibrates.
- The battery holder (Standard accessory), which houses two AAA-cell batteries, is not designed to withstand vibration, impact, or centrifugal force. Use the batteries in the holder only for checking operation.

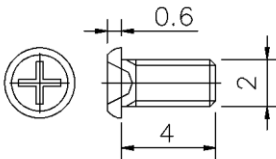
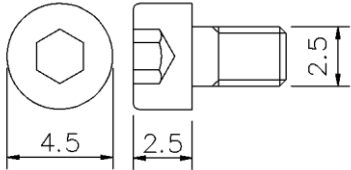
**NOTE**

- Be careful not to incorrectly wire the sensor.
 - IN (B) : Sensor output (-)
 - +IN (D) : Sensor output (+)
 - SHIELD (E) : Shield
- Do not input a voltage exceeding the absolute Input voltage range between D terminal and B terminal, D terminal and E terminal, or B terminal and E terminal. If you input a voltage exceeding the Absolute Input Voltage Range, it can cause lower performance, device failures, etc. MRS-101B-V's Absolute Input Voltage Ranges are as follows
 - D terminal - B terminal within ± 32 V
 - D terminal - E terminal and B terminal -E terminal within ± 16 V.
- Be careful, if using E terminal, the absolute input voltage range is lower. For details, please refer to "1ch-Voltage Transmitter READ IN THE BEGINNING".
- Voltage Adapter can be removed for replacement. To reconnect it, solder the pins on the Adapter.
- Be careful, avoid exposing Voltage Adapter to excessive solder and heat from the soldering iron.
- Keep the sensor wire short. Long wiring may introduce noise into sensor signals and negatively affect signal transmission and reception.
- Keep the battery wire short. Long wiring may negatively affect signal transmission and reception.
- Connecting the power polarity in reverse may cause accidents or malfunctions. Be sure not to do this.

2-6-2. Transmitter Installation

Use the screws shown in the following table for fixing the transmitter and adapter and for mounting the transmitter body. Install the transmitter with the specified torque.

Table 2-11 The screws and the specified torque

Mounting object		Voltage Adapter	Fixing surface
Screw	Type	JCIS10-70 Miniature Screw (M2)	Hexagon socket head cap Screw (M2.5)
	Material	SWCH	SCM435
	Size	 [mm]	 [mm]
Max.Torque to the Transmitter Main Body		0.1 N·m	0.45 N·m



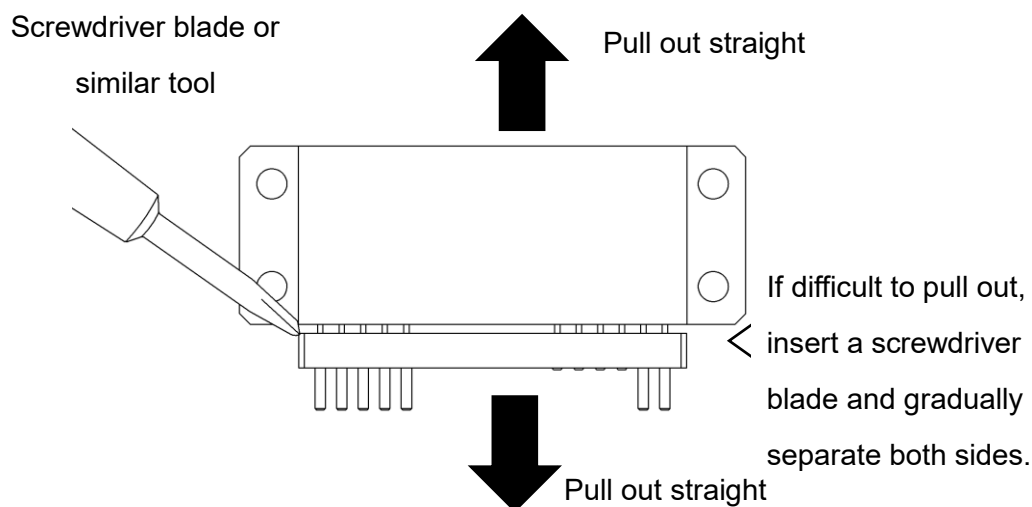
CAUTION

- If installing this product, place it on a flat surface. If the transmitter is installed on a warped or uneven surface, it may cause damage or cracks in the body of the transmitter.
- If exceeding the Max.Torque, it may cause damage or cracks in the body of the transmitter.
- The catalog value of centrifugal acceleration resistance is the value when fixed with the above screws and torque. If fixed in any other way, this value may not be guaranteed. Please contact our sales representative for more information.
- If installing this product on a rotating body, install a safety cover to secure safety from blown parts.

2-6-3. Detachment of Voltage Adapter

When removing the Voltage Adapter from the transmitter, after removing the small screw (M2), pull out the Voltage Adapter straight. Be careful when handling the transmitter pins, as they can bend easily.

If the Voltage Adapter is difficult to pull out, insert a flat tool, such as a screwdriver blade, between the transmitter and Voltage Adapter and gradually separate both sides, one after the other.



CAUTION

If the pins become bent, use tweezers or similar tool to straighten them before use. Be careful, because inserting the Voltage Adapter when the pins are bent may damage the transmitter pins.

2-7.MRS-101B-T Installation

2-7-1. Input Pins

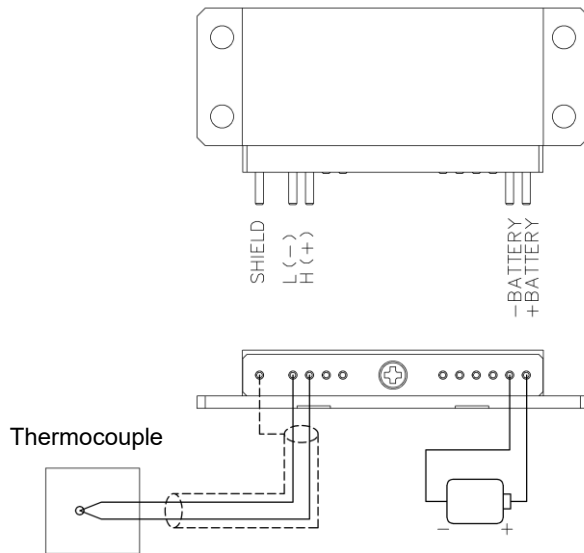


Table 2-12 MRS-101B-T's pin assignment

Pin No.	Signal name	
L	-IN	Thermocouple output (-)
H	+IN	Thermocouple output (+)
S	SHIELD	Shield

Recommended battery

- Lithium (CR2 x1)
- Ni-MH (AAA cell x2)
- Alkaline (AAA cell x2)



CAUTION

- Wire the devices so as to avoid disconnection if the transmitter, thermocouple, battery, or respective wiring is twisted or vibrates.
- The battery holder (standard accessory), which houses two AAA-cell batteries, is not designed to withstand vibration, impact, or centrifugal force. Use the batteries in the holder only for checking operation.



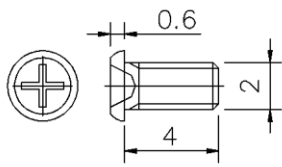
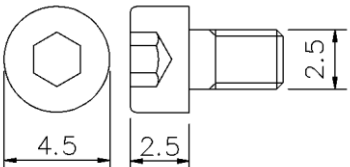
NOTE

- Be careful not to incorrectly wire the thermocouple.
H (+IN) : Thermocouple output (+)
L (-IN) : Thermocouple output (-)
SHIELD (E) : Shield
- Thermocouple Adapter can be removed for replacement. To reconnect it, solder the pins on the Adapter.
- Be careful, avoid exposing the adapter to excessive solder and heat from the soldering iron.
- Keep the sensor wire short. Long wiring may introduce noise into sensor signals and negatively affect signal transmission and reception.
- Keep the battery wire short. Long wiring may negatively affect signal transmission and reception.
- Connecting the power polarity in reverse may cause accidents or malfunctions. Be sure not to do this.

2-7-2. Transmitter Installation

Use the screws shown in the following table for fixing the transmitter and adapter and for mounting the transmitter body. Install the transmitter with the specified torque.

Table 2-13 The screws and the specified torque

Mounting object		Thermocouple Adapter	Fixing surface
Screw	Screw	JCIS10-70 Miniature Screw (M2)	Hexagon socket head cap Screw (M2.5)
	Material	SWCH	SCM435 (Tensile strength ranking 10.9 or more)
	Size	 [mm]	 [mm]
Torque to the Transmitter Main Body		0.1 N·m	0.9 N·m



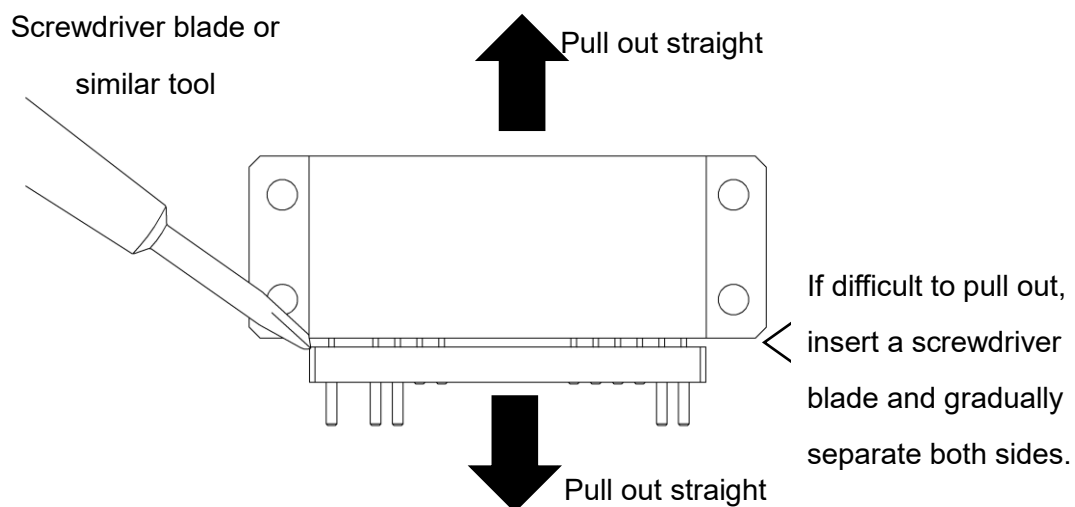
CAUTION

- If installing this product, place it on a flat surface. If the transmitter is installed on a warped or uneven surface, it may cause damage or cracks in the body of the transmitter.
- If exceeding the torque, it may cause damage or cracks in the body of the transmitter.
- The catalog value of centrifugal acceleration resistance is the value when fixed with the above screws and torque. If fixed in any other way, this value may not be guaranteed. Please contact our sales representative for more information.
- If installing this product on a rotating body, install a safety cover to secure safety from blown parts.

2-7-3. Detachment of Thermocouple Adapter

When removing the Thermocouple Adapter from the transmitter, after removing the small screw (M2), pull out the Thermocouple Adapter straight. Be careful when handling the transmitter pins, as they can bend easily.

If the Thermocouple Adapter is difficult to pull out, insert a flat tool, such as a screwdriver blade, between the transmitter and Thermocouple Adapter and gradually separate both sides, one after the other.



CAUTION

If the pins become bent, use tweezers or similar tool to straighten them before use. Be careful, because inserting the Thermocouple Adapter when the pins are bent may damage the transmitter pins.

2-8.MRS-104A-S Installation

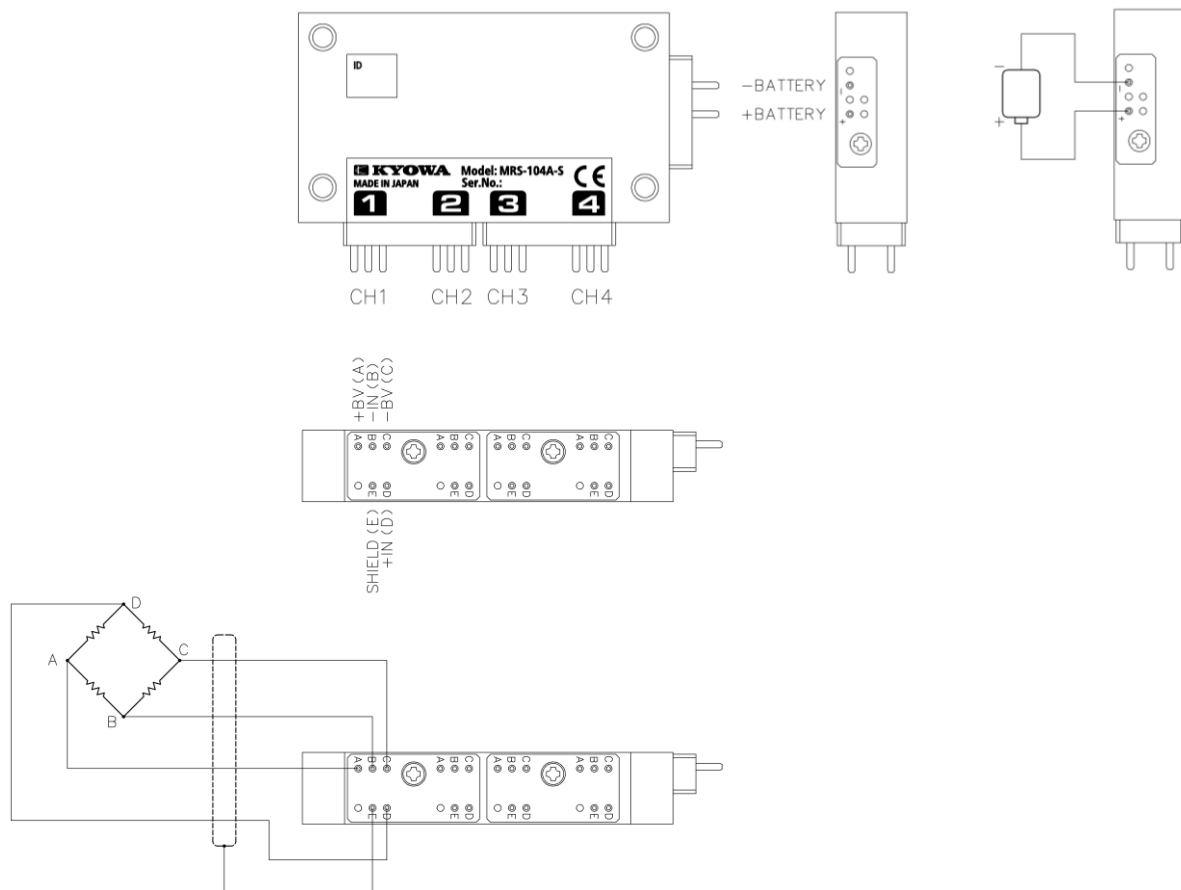
2-8-1. Input Pins

Table 2-14 MRS-104A-S's Pin assignment

Pin No.	Signal name	
A	+BV	Bridge excitation (+)
B	-IN	Bridge output (-)
C	-BV	Bridge excitation (+)
D	+IN	Bridge output (+)
E	SHIELD	Shield

Recommended battery

- Lithium (CR2 x1)
- Ni-MH (AAA cell x2)
- Alkaline (AAA cell x2)





CAUTION

- Wire the devices so as to avoid disconnection if the transmitter, strain gage, battery, or respective wiring is twisted or vibrates.
- The battery holder (standard accessory), which houses two AAA-cell batteries, is not designed to withstand vibration, impact, or centrifugal force. Use the batteries in the holder only for checking operation.



NOTE

- Be careful not to incorrectly wire the sensor.

+BV (A)	: Bridge excitation (+)
-IN (B)	: Bridge output (-)
-BV (C)	: Bridge excitation (+)
+IN (D)	: Bridge output (+)
SHIELD (E)	: Shield
- Full-bridge Adapter and Power Adapter can be removed for replacement. To reconnect it, solder the pins on adapters.
- Be careful, avoid exposing the Full-bridge Adapter and Power Adapter to excessive solder and heat from the soldering iron.
- Keep the sensor wire short. Long wiring may introduce noise into sensor signals and negatively affect signal transmission and reception.
- Keep the battery wire short. Long wiring may negatively affect signal transmission and reception.
- Connecting the power polarity in reverse may cause accidents or malfunctions. Be sure not to do this.

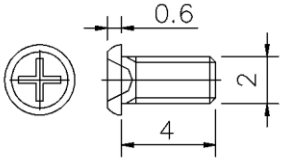
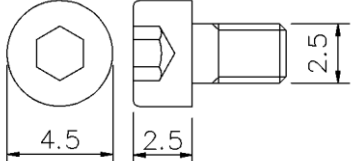


- MRS-104A-S is compatible with full bridge system.
- Full-bridge adapters is attached to the transmitter body of MRS-104A-S. If using the quarter-bridge strain gage, replace the Full-bridge Adapter to the Quarter-bridge 2-wire Adapter (optional accessory) or Quarter-bridge 3-wire Adapter (optional accessory).

2-8-2. Transmitter Installation

Use the screws shown in the following table for fixing the transmitter and adapter and for mounting the transmitter body. Install the transmitter with the specified torque.

Table 2-15 The screws and the specified torque

Mounting object		Full-bridge Adapter Power Adapter	Fixing surface
Screw	Type	JCIS10-70 Miniature Screw (M2)	Hexagon socket head cap Screw (M2.5)
	Material	SWCH	SCM435
	Size	 [mm]	 [mm]
Max.Torque to the Transmitter Main Body		0.1 N·m	0.45 N·m

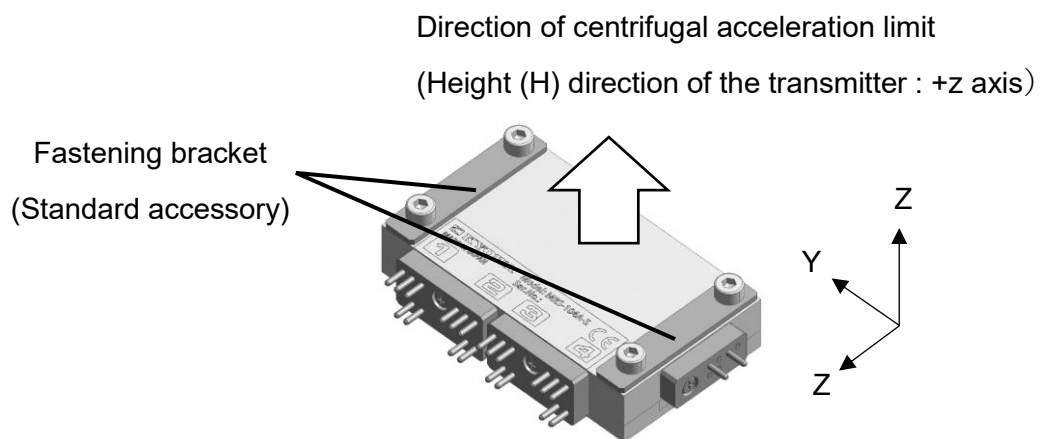


CAUTION

- If installing this product, place it on a flat surface. If the transmitter is installed on a warped or uneven surface, it may cause damage or cracks in the body of the transmitter.
- If exceeding the Max.Torque, it may cause damage or cracks in the body of the transmitter.
- The catalog value of centrifugal acceleration resistance is the value when fixed with the above screws and torque. If fixed in any other way, this value may not be guaranteed. Please contact our sales representative for more information.
- If installing this product on a rotating body, install a safety cover to secure safety from blown parts.
- The specification of centrifugal acceleration is assumed for height (H) direction of the transmitter.

**NOTE**

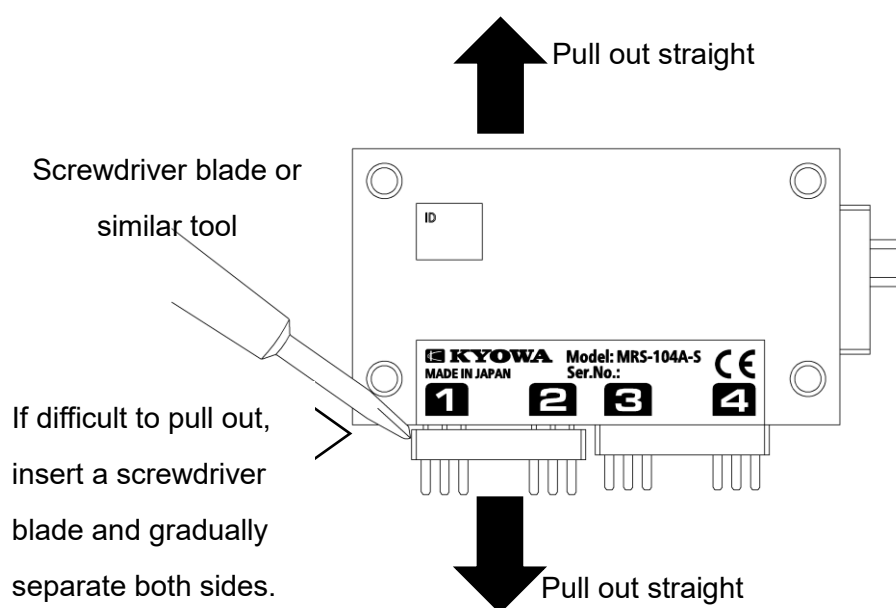
In order to operate the transmitter (MRS-104A-S) for a long period of time, fix the transmitter with bolts via the Fastening bracket (Standard accessory) shown in the figure below



2-8-3. Detachment of Full-bridge Adapter / Power Adapter

When removing the Full-bridge Adapter or Power Adapter from the transmitter, after removing the small screw (M2), pull out the Full-bridge Adapter or Power Adapter straight. Be careful when handling the transmitter pins, as they can bend easily.

If the Full-bridge Adapter or Power Adapter is difficult to pull out, insert a flat tool, such as a screwdriver blade, between the transmitter and Full-bridge Adapter or Power Adapter and gradually separate both sides, one after the other.



CAUTION

If the pins become bent, use tweezers or similar tool to straighten them before use. Be careful, because inserting the Full-bridge Adapter or Power Adapter when the pins are bent may damage the transmitter pins.

2-9. Connect To A PC

The product cannot be used unless [Pairing settings] should be done for use of the transmitter and receiver. When using the product for the first time, connect to a PC and specify the [Pairing settings] by using the Setting Software.

After [Pairing settings] is done, the transmitter information is registered in the receiver. Registered information is saved in the receiver, so saved information can be kept even after power is off.

As the interface to connect to a PC, USB is used.

2-9-1. USB connection

Setting up the USB driver

To use the setting software, it is necessary to set up the USB driver on the PC.

For details, please refer to "Setting Software INSTRUCTION MANUAL".

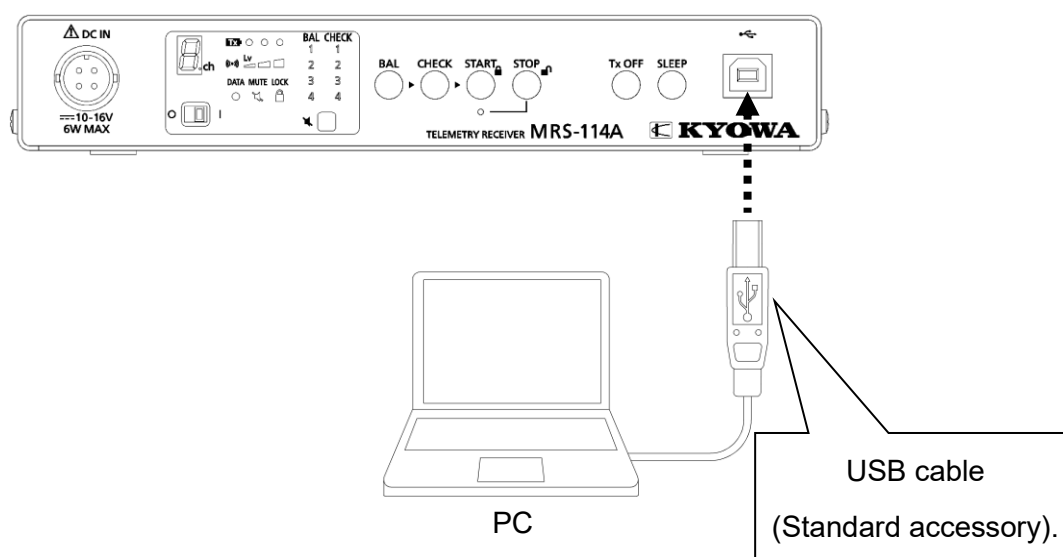
Setting up the setting software

To use the setting software, it is necessary to set up the USB driver on the PC.

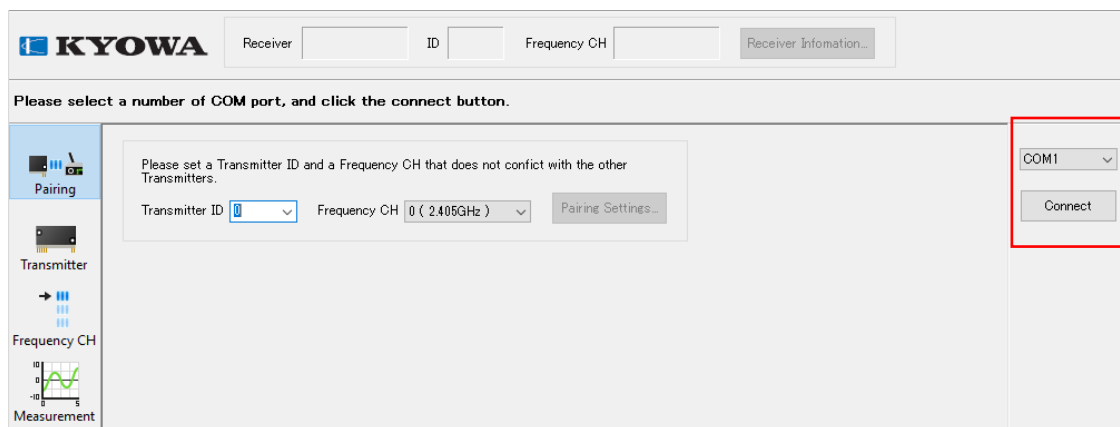
For details, please refer to "Setting Software INSTRUCTION MANUAL".

Connecting to a PC

Connect the CTRS-100A to a PC by using the USB cable (Standard accessory).



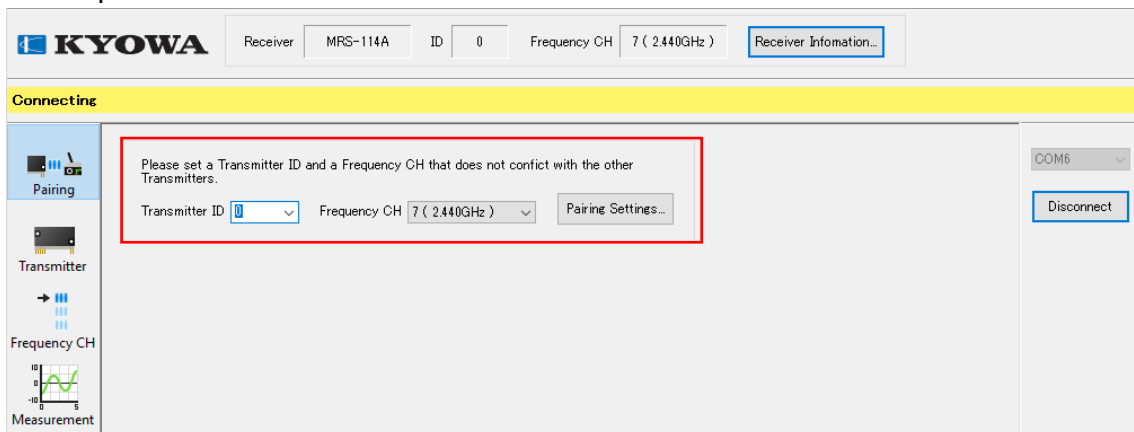
Start up the setting software, Select the COM port to which the receiver is connected, and then click **Connect**. For details, please refer to "Setting Software INSTRUCTION MANUAL".

**NOTE**

If the receiver is connected to a computer, the switches on the receiver cannot be used.

2-9-2. Pairing Settings

For proper use of transmitter, frequency CH of the transmitter and receiver should be same, and transmitter ID and transmitter information (the range and transmitter type .etc) should be registered in receiver. For matching transmitter ID and frequency CH, [Pairing settings] should be done in Setting Software and transmitter information should be registered in receiver. Registered information is saved in nonvolatile memory, so saved information can be kept even after power is off.



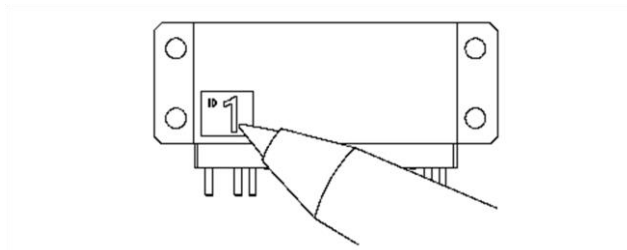
NOTE

- The product cannot be used unless [Pairing settings] should be done for use of the Transmitter and Receiver. When using the product for the first time, connect to a PC and specify the [Pairing settings] by using the Setting Software. For details, please refer to "Setting Software INSTRUCTION MANUAL".
- When using multiple transmitter-receiver pairs, ensure the Transmitter ID and Frequency CH are not the same as the ones used by other pairs.
- The Transmitter ID and Frequency CH are important information to establish communication. Please manage the Transmitter ID and Frequency CH carefully.
- For accurate [Pairing settings], distance of transmitter and receiver should be within 50cm. [Pairing settings] must be performed by each pair of transceivers, when several pairs of them are used.



ID label is packed with the transmitter.

ID label is applied onto the transmitter body to write the transmitter ID on the label with pen.



CAUTION

If attaching the ID label to the transmitter, do not use it in an environment subject to centrifugal acceleration such as a rotating body.

2-9-3. Transmitter settings

Click the [Transmitter] tab on the Setting Software, set the measurement channels (MRS-104A-S only), range, and bridge resistance (Except for MRS-101B-V and MRS-101B-T) to be used for the measurement. For details, please refer to "Setting Software INSTRUCTION MANUAL".

The screenshot shows the KYOWA Setting Software interface. At the top, there are tabs for Receiver, MRS-114A, ID, 9, Frequency CH, 9 (2.450GHz), and Receiver Information... Below this is a yellow bar labeled "Connecting". On the left sidebar, there are icons for Pairing, Transmitter, Frequency CH, and Measurement. The main area displays settings for Transmitter MRS-104A-S, Sampling Frequency 1920 Hz, and Transmitter Information... Below this is a table with 7 columns: CH, Measurement, Range, BAL, CHECK, Bridge Resistance, and CH Name. The table has 4 rows, all with checkboxes checked in the Measurement column. Below the table is a section for Transmitter power supply information, including Voltage level settings to light up (2.35 V, 2.30 V, 2.25 V), Low voltage threshold (2.1 V), Sleep period settings (60 min), and Communication Error Handling (Retain previous value). At the bottom, there are buttons for Load Condition..., Set Condition..., SLEEP, and Tx OFF.

CH	Measurement	Range	BAL	CHECK	Bridge Resistance	CH Name
1	☒	2500um/m	☒	☒	120 OHM	
2	☒	2500um/m	☒	☒	120 OHM	
3	☒	2500um/m	☒	☒	120 OHM	
4	☒	2500um/m	☒	☒	120 OHM	

Transmitter power supply information		Sleep period settings	Communication Error Handling
Voltage level settings to light up	Low voltage threshold		
2.35 V	2.1 V	60 min	Retain previous value
2.30 V			
2.25 V			

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3. MEASUREMENT

3-1.[Command Mode] and [Measuring Mode]

The product has two modes: [Command Mode] and [Measuring Mode].

The [command mode] and [measurement mode] are switched by the “START” and “STOP” switches.

[Command Mode]

In the [Command Mode], various operations can be performed by setting the transmitter using the setting software or by operating switches such as "BAL" and "CHECK" on the Receiver. Press the “START” switch to switch to the [Measurement Mode].

[Measurement Mode]

In [Measurement Mode], the measurement data of the Transmitter is being output from the analog output of the Receiver. The Transmitter groups sampled measurement data into packets, each of which contains a certain quantity of data, and sends packets intermittently and continuously by wireless communication. The Receiver receives these packets.

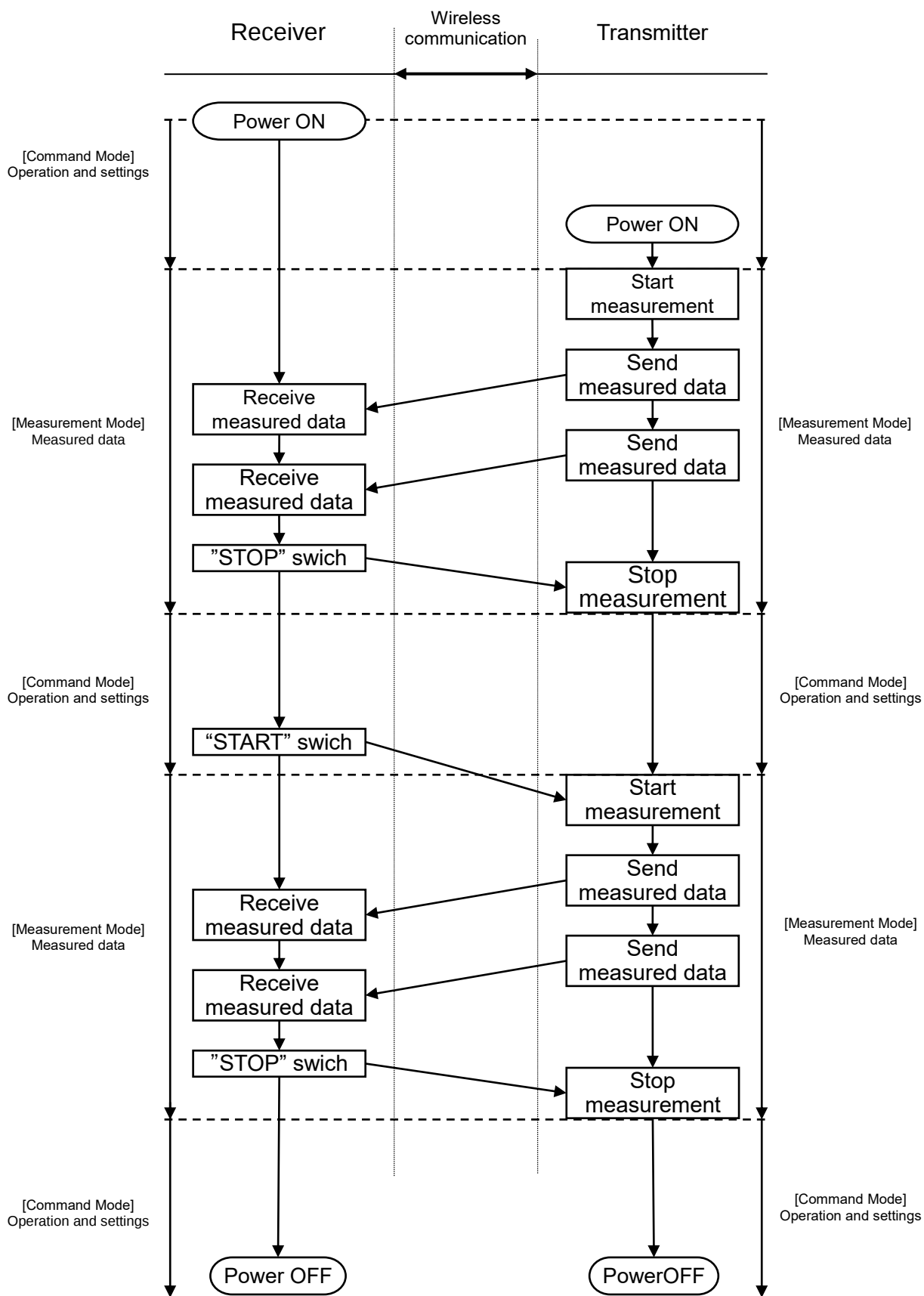
In the measurement mode, the receiver's "LOCK" LED lit in green, and it cannot be executed except by the "STOP" switch. Press the “STOP” switch to switch to the [Command Mode].

Table 3-1 [Command Mode] and [Measurement Mode]

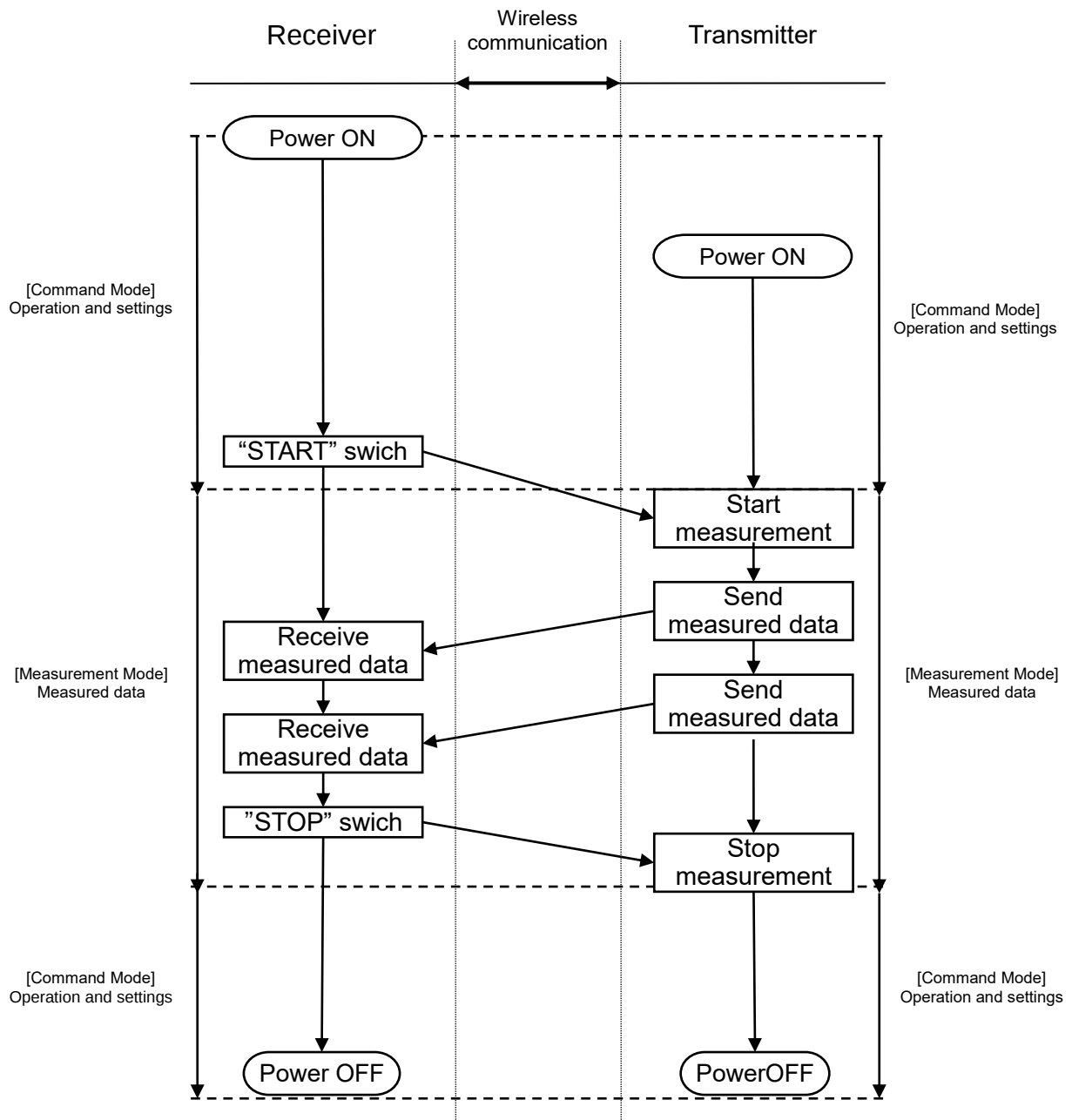
Mode	“START” LED display	“LOCK” LED display	Receiver analog output
[Command Mode]	Off	Off	No change
[Measurement Mode]	lit in green	lit in green	Outputting measurement data

The following is a diagram that shows the communication sequence between the transmitter and receiver. However, the operation differs depending on the transmitter's Firmware Ver.

Transmitter's Firmware Ver. 2.00 or later



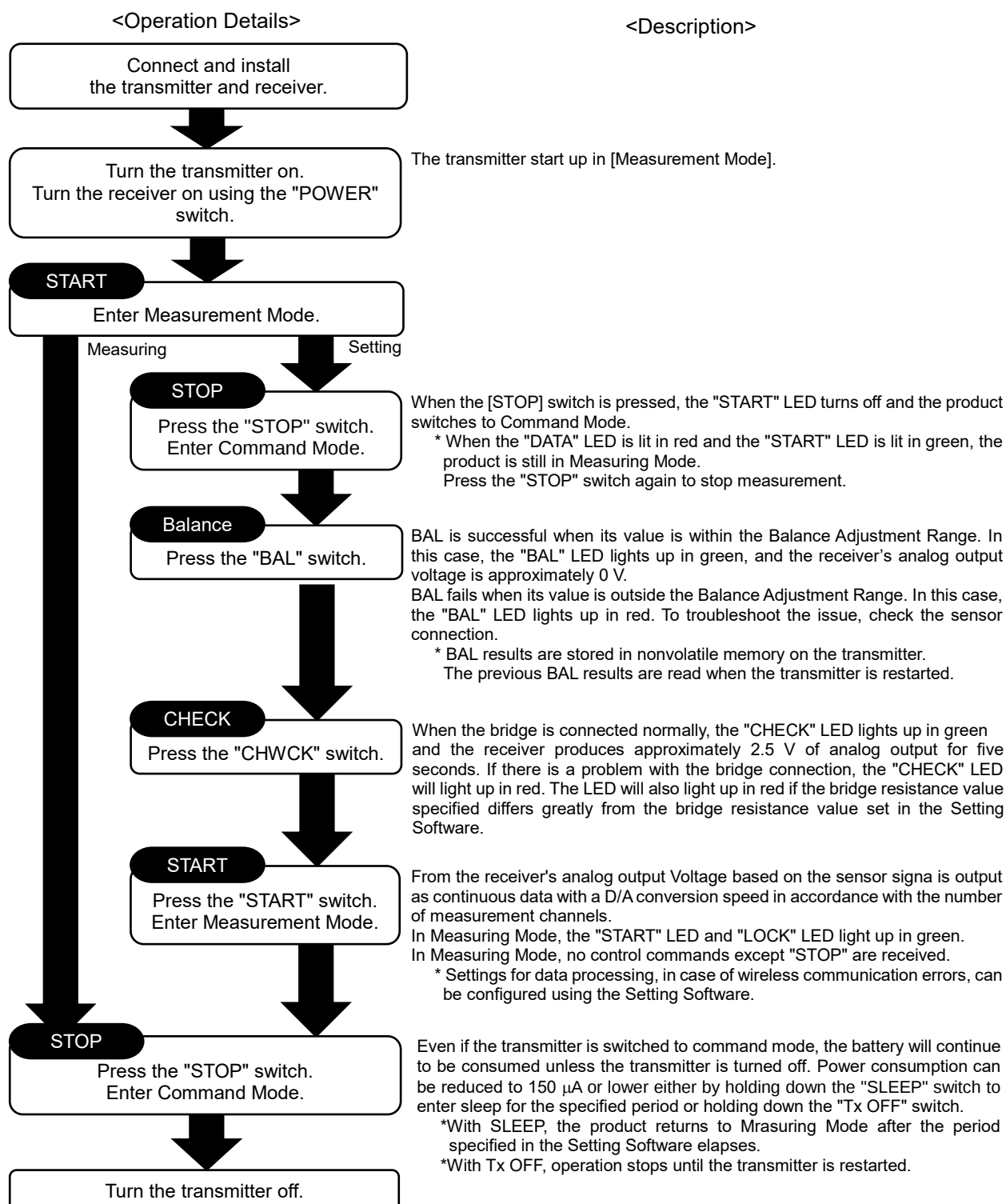
Transmitter's Firmware Ver. 1.00



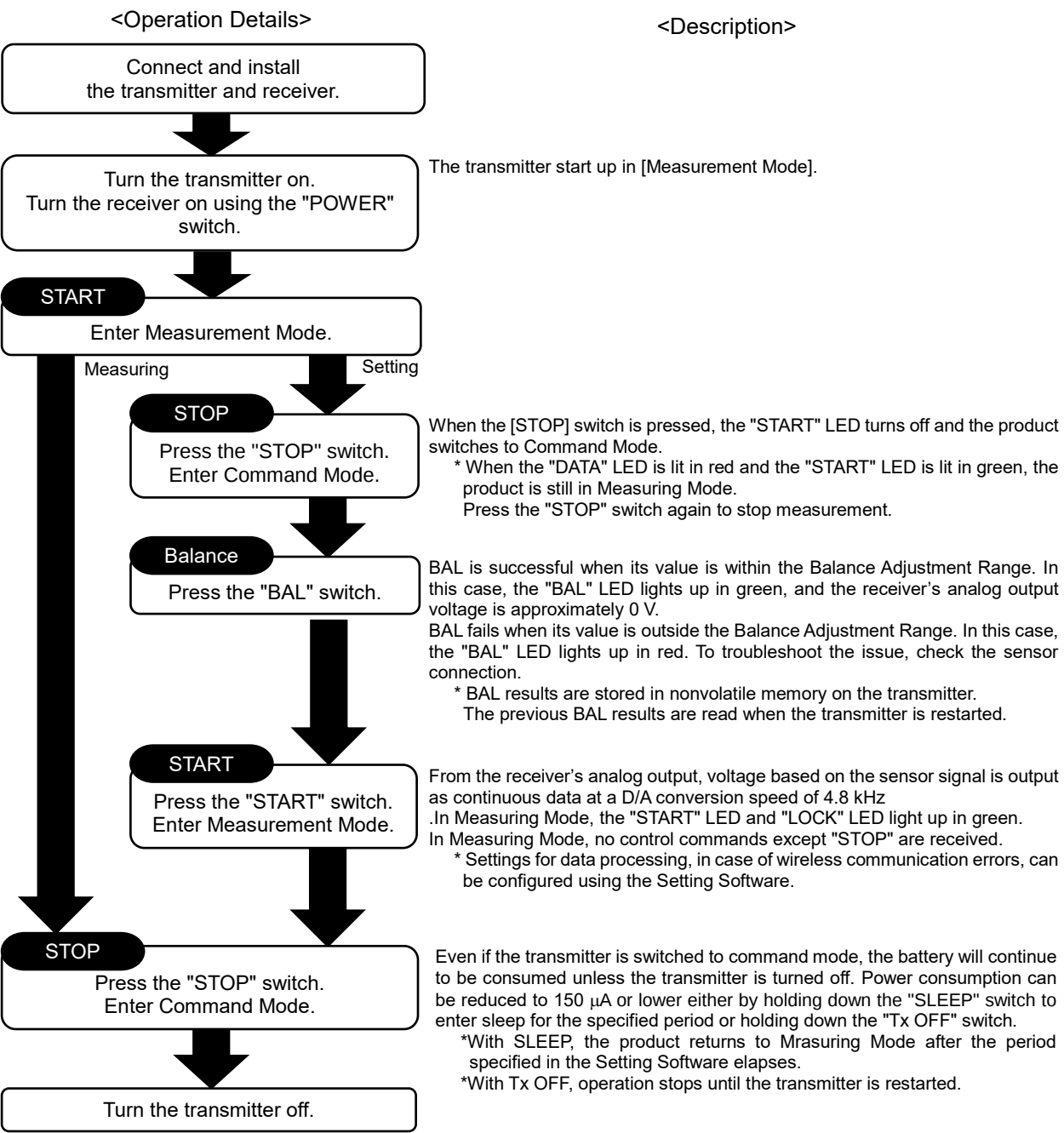
3-2. Operations Before Measurement

3-2-1. Transmitter's Firmware Ver. 2.00 or later

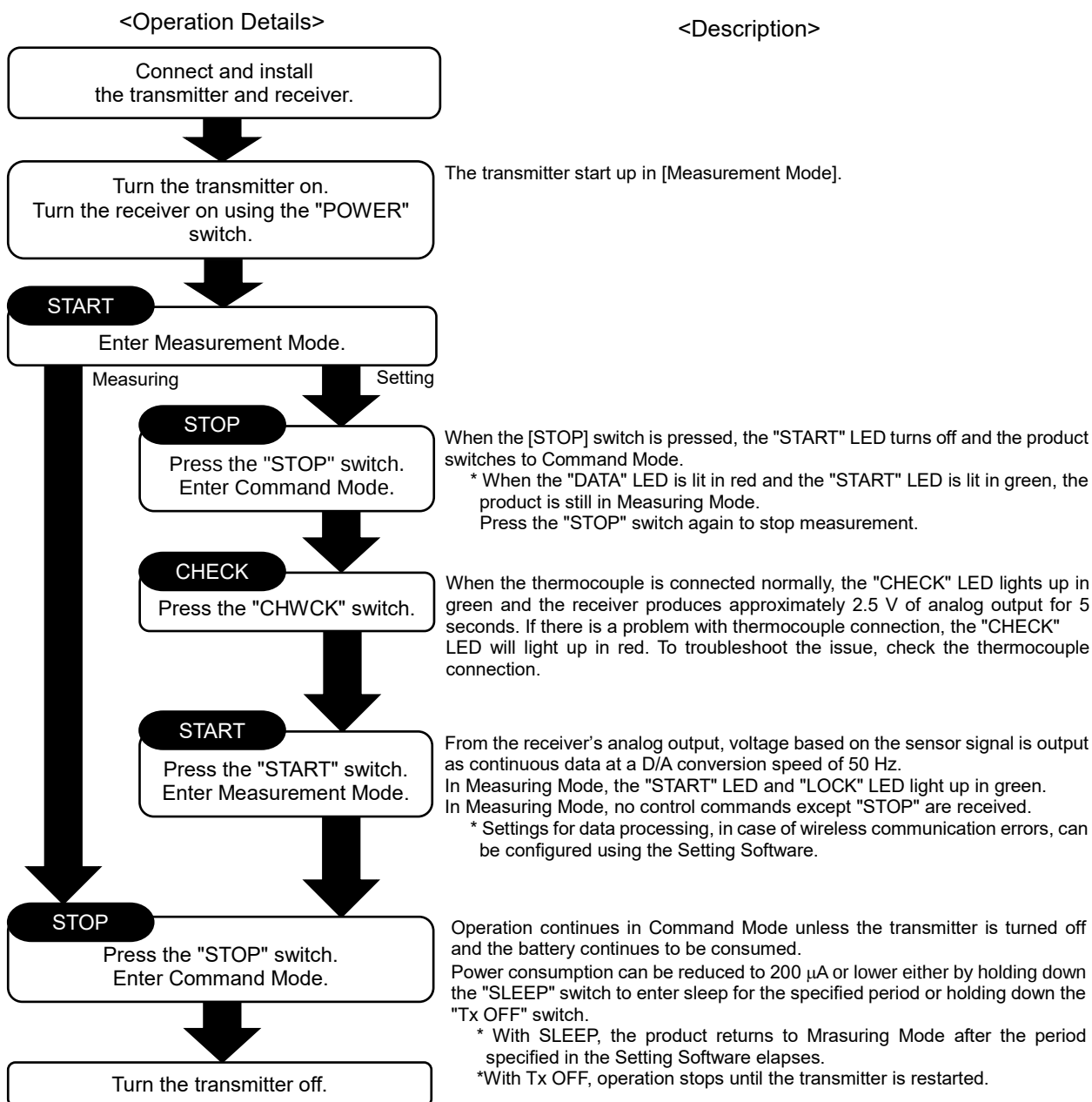
If using the MRS-104A-S, MRS-101B-S, MRS-101A-SE



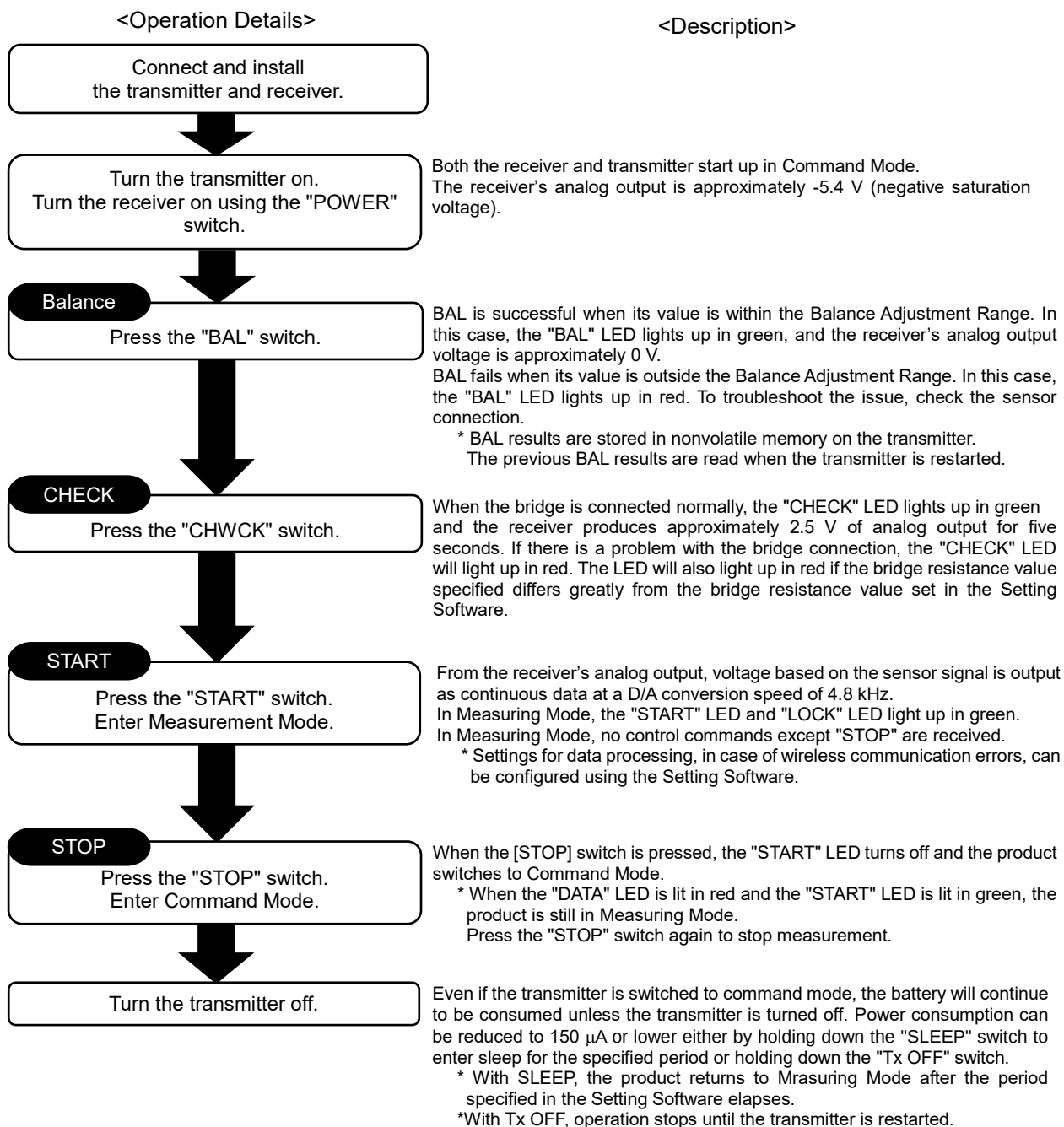
If using the MRS-101B-V



If using the MRS-101B-T



3-2-2. Transmitter's Firmware Ver. 1.00



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4. OTHER FUNCTIONS

4-1. Balance Adjustment

Balance adjustment is negates the transmitter's bridge unbalance value or the transmitter's initial input voltage value and performs Balance adjustment. The function varies depending on the transmitter used.

Table 4-1 "BAL"Switch Function

Transmitter	Function
MRS-101B-S MRS-101A-SE MRS-104A-S MRS-101B-V	Balance adjustment
MRS-101B-T	No function

4-1-1. If Using The MRS-101B-S, MRS-101A-SE or MRS-104A-S

Balance adjustment is negates the transmitter's bridge unbalance value and performs Balance adjustment.



The specification for the Balance Adjustment Range is $\pm 10000 \times 10^{-6}$ strain, but the product is designed to support Balance adjustment of approximately $\pm 14000 \times 10^{-6}$ strain.

Operating procedure

- (1) Pressing "BAL" switch while in [Command Mode], the balance adjustment is performed for the measurement channels for which the balance adjustment is enabled. While the balance adjustment is being performed, the "BAL" LED and "DATA" LED of the measurement channel for which the balance adjustment is enabled lit up in green.



If a wireless communication error occurs, "BAL" LED the flashing in green, "DATA" LED lit in red and the buzzer sounds (If "MUTE" is on, the buzzer does not sound).

In this case, the balance adjustment is not performed. After both "BAL" and "DATA" LEDs are turned off, perform the balance adjustment again in an environment where wireless communication is normal.

(2) After the balance adjustment is completed, the "BAL" LED continues to be lit to indicate the result of the balance adjustment, and the "DATA" LED turns off. The receiver analog output is based on the result of the balance adjustment.

Table 4-2 The result of the balance adjustment (MRS-101B-S, MRS-101A-SE, MRS-104A-S)

Status	"BAL" LED display	Receiver Analog Output
Balance adjustment is successful	Lit in green	Approximately 0 V output
Balance adjustment fails	Lit in red	Output of a value corresponding to the bridge unbalance value
A wireless communication error occurs	Flashing in green ↓ Off	No change



- The balance adjustment of each measurement channel can be set in the setting software.
For details, please refer to "Setting Software INSTRUCTION MANUAL".
- If no bridge is connected to the transmitter, the receiver's analog output is approximately -5.4 V when the balance adjustment is performed.
- If a wireless communication error occurs, perform the balance adjustment again in an environment where wireless communication is normal.

4-1-2. If using the MRS-101B-V

Balance adjustment is negates the transmitter's initial input voltage value and performs Balance adjustment.



The specification for the Balance Adjustment Range is ± 5 V, but the product is designed to support Balance adjustment of approximately ± 6 V.

Operating procedure

- (1) Pressing "BAL" switch while in [Command Mode], the balance adjustment is performed for the measurement channels for which the balance adjustment is enabled. While the balance adjustment is being performed, the "BAL" LED and "DATA" LED of the measurement channel for which the balance adjustment is enabled lit up in green.



If a wireless communication error occurs, "BAL" LED the flashing in green, "DATA" LED lit in red and the buzzer sounds (If "MUTE" is on, the buzzer does not sound).

In this case, the balance adjustment is not performed. After both "BAL" and "DATA" LEDs are turned off, perform the balance adjustment again in an environment where wireless communication is normal.

- (2) After the balance adjustment is completed, the "BAL" LED continues to be lit to indicate the result of the balance adjustment, and the "DATA" LED turns off. The receiver analog output is based on the result of the balance adjustment.

Table 4-3 The result of the balance adjustment (MRS-101B-V)

Status	"BAL" LED display	Receiver Analog Output
Balance adjustment is successful	Lit in green	Approximately 0 V output
Balance adjustment fails	Lit in red	Output of a value corresponding to the bridge unbalance value
A wireless communication error occurs	Flashing in green ↓ Off	No change

**NOTE**

For absolute voltage measurement and relative voltage measurement, caution is required for Balance execution and the connection method.

For details, please refer to "1ch-Voltage Transmitter READ IN THE BEGINNING".



The balance adjustment of each measurement channel can be set in the setting software. For details, please refer to "Setting Software INSTRUCTION MANUAL".

- If no bridge is connected to the transmitter, the receiver's analog output is approximately -5.4 V when the balance adjustment is performed.
- If a wireless communication error occurs, perform the balance adjustment again in an environment where wireless communication is normal.

4-2. Checking The Sensor

The sensor check is performed for bridge circuits and strain gage transducers. (MRS-101B-S, MRS-101A-SE, MRS-104A-S) The disconnection check is for checking the disconnection of thermocouple (MRS-101B-T) The function varies depending on the transmitter used.

Table 4-4 “CHECK” Switch Function

Transmitter	Function
MRS-101B-S MRS-101A-SE MRS-104-S	Sensor checks
MRS-101B-V	No function
MRS-101B-T	disconnection check

4-2-1. If Using The MRS-101B-S or MRS-101A-SE, MRS-104A-S

The sensor check is check the sensors of the bridge circuit and strain gage transducers connected to the transmitter.



NOTE

- Perform the sensor check after successful Balance adjustment.
- The sensor check uses the bridge resistance value that you set. Use the configuration software to set the bridge resistance of the connected sensor. For details, please refer to "Setting Software INSTRUCTION MANUAL".

Operating procedure

- (1) Pressing “CHECK” switch while in [Command Mode], the sensor check is performed for the measurement channels for which the sensor check is enabled. While the sensor check is being performed, the "CHECK" LED and "DATA" LED of the measurement channel for which the sensor check is enabled lit up in green.



If a wireless communication error occurs, "CHECK" LED the flashing in green, "DATA" LED lit in red and the buzzer sounds (If "MUTE" is on, the buzzer does not sound).

In this case, the balance adjustment is not performed. After both "CHECK" and "DATA" LEDs are turned off, perform the balance adjustment again in an environment where wireless communication is normal.

(2) After the sensor check is completed, the result of the sensor check is displayed on the "CHECK" LED, and the "DATA" LED turns off. The receiver analog output is based on the result of the sensor check.

Table 4-5 The result of the sensor check (MRS-101B-S, MRS-101A-SE, MRS-104A-S)

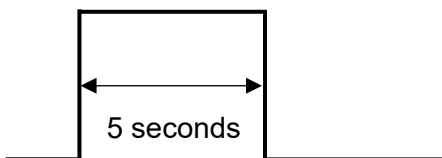
States	"CHECK" LED display	Receiver Analog Output
The sensor check is successful	Lit in green	For approximately 5 seconds Approximately 2.5 V output
The sensor check fails	Lit in red	No change
A wireless communication error occurs	Flashing in green ↓ Off	No change

**NOTE****Analog output from a successful the sensor check**

If the strain output before the sensor check isn't changed after the balance adjustment the value will return from 2.5 V to 0 V.

+2.5 V (if the sensor check is successful)

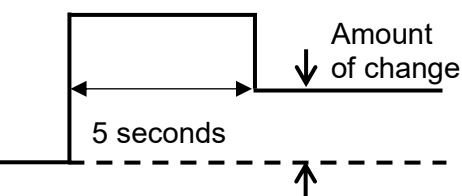
0 V (after Balance adjustment)



If the strain output before the sensor check is changed after balance adjustment, the value will not return from 2.5 V to 0 V.

+2.5 V (if the sensor check is successful)

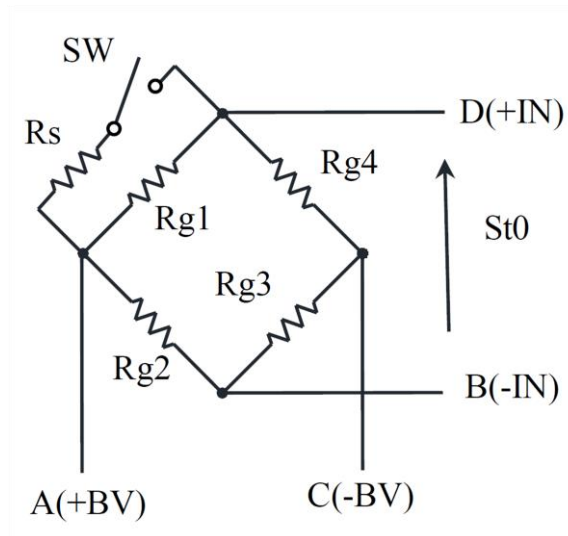
0 V (after Balance adjustment)





Conditions for a successful sensor check

The sensor check uses the tip parallel resistance method, as shown in the following bridge schematic diagram. The transmitter incorporates a parallel resistance value (R_s) and switch. Turning on the switch increases strain output. If this increase is within the range indicated in the last line of the following table, the sensor check is successful.



Name		Remarks
R_g	Bridge resistance	$R_g \equiv R_{g1} \equiv R_{g2} \equiv R_{g3} \equiv R_{g4}$ The bridge being used must be entered in the Setting Software.
R_s	Parallel resistance	$R_s = 361 \text{ k ohm}$
K	Gage factor	$k = 2.00$
St	Generating strain based on tip parallel resistance method	$St = \frac{R_g}{k} \times \frac{1}{R_g + R_s} \equiv \frac{R_g}{k \times R_s} \times (1 - \frac{R_g}{R_s})$
SW	Switch for sensor check	On when a sensor check is performed (Switch is in the transmitter)
St_0	Strain output when sensor check is OFF	When sensor check is off (Strain output for normal measurement)
St_1	Strain output when sensor check is ON	When sensor check is on (Switch is on [shorted])
$St_1 - St_0$	Increased strain output	Additional strain output when a sensor check is performed
Conditions for a successful sensor check: $0.7 \times St < St_1 - St_0 < 1.3 \times St$ If $R_g = 350 \text{ ohm}$: Based on $St = 484 \times 10^{-6} \text{ strain}$ $339.0 \times 10^{-6} < St_1 - St_0 < 629.6 \times 10^{-6} \text{ strain}$ If $R_g = 120 \text{ ohm}$: Based on $St = 166.1 \times 10^{-6} \text{ strain}$ $116.3 \times 10^{-6} < St_1 - St_0 < 216.0 \times 10^{-6} \text{ strain}$		

4-2-2. If Using The MRS-101B-V

MRS-101B-V does not have the sensor check function for confirming the sensor connection. Do not start measuring until you have confirmed that the input is connected.

If the "CHECK" switch is pressed, the receiver operates differently depending on the firmware version as shown below.

Table 4-6 The result of the check (MRS-101B-V)

Firmware Version	"CHECK" LED Display	"DATA" LED Display	Receiver Analog Output
Ver. 1.00	Lit in green ↓ Off	Lit in green	For approximately 5 seconds Approximately 2.5 V
Ver. 2.00 or later	Off	Off	No change

4-2-3. If using the MRS-101B-T

The disconnection check is check the disconnection of thermocouple connected to the transmitter.

Operating procedure

- (1) Pressing "CHECK" switch while in [Command Mode], performs the disconnection check of the thermocouple of the measurement channel for which the disconnection check is enabled. While the disconnection check is being performed, the "CHECK" LED and "DATA" LED of the measurement channel for which the disconnection check is enabled lit up in green.



If a wireless communication error occurs, "CHECK" LED the flashing in green, "DATA" LED lit in red and the buzzer sounds (If "MUTE" is on, the buzzer does not sound).

In this case, the the disconnection check is not performed. After both "CHECK" and "DATA" LEDs are turned off, perform the the disconnection check again in an environment where wireless communication is normal.

(2) After the disconnection check is completed, the result of the sensor check is displayed on the "CHECK" LED, and the "DATA" LED turns off. The receiver analog output is based on the result of the disconnection check.

Table 4-7 The result of the disconnection check (MRS-101B-T)

States	"CHECK" LED display	Receiver Analog Output
The disconnection check is successful	Lit in green	For approximately 5 seconds Approximately 2.5 V output
The disconnection check fails	Lit in red	No change
A wireless communication error occurs	Flashing in green ↓ Off	No change

4-3. SLEEP, Tx OFF

4-3-1. SLEEP

Transition the transmitter to the SLEEP state for the specified amount of the SLEEP period, to save battery life. In the SLEEP state, transmitter operations are not possible. Once the specified the SLEEP period elapses, the transmitter returns to the same state it was in after turning on the power.

The SLEEP period can be set in the Setting Software. For details, please refer to "Setting Software INSTRUCTION MANUAL".

Operating procedure

Press and hold "SLEEP" switch for at least 3 seconds while in [Command mode] to perform the SLEEP.

If the SLEEP is successfully performed, the "DATA" LED lit in green once, and the transmitter transmits in the SLEEP state.



- If a wireless communication error occurs, "DATA" LED lit in red and the buzzer sounds (If "MUTE" is on, the buzzer does not sound).

In this case, the SLEEP is not performed. After "DATA" LEDs are turned off, perform the SLEEP again in an environment where wireless communication is normal.

- Even if the transmitter is in the SLEEP state, restarting the transmitter back on will cause it to return.
- If the transmitter is turned on again or after the SLEEP period has elapsed, the transmitter's recovery status varies depending on the transmitter's firmware Ver. as follows:

For Firmware Ver.2.00 or later, Recovery in [Measurement mode].

For Firmware Ver.1.00, Recovery in [Command mode].

4-3-2. Tx OFF

If the Tx OFF is successfully performed, the transmitter powers off.

After the Tx OFF is performed, the transmitter remains off until it is manually restarted.

Operating procedure

Press and hold "Tx OFF" switch for at least 3 seconds while in [Command mode] to perform the Tx OFF.

If SLEEP is successfully performed, the "DATA" LED lit in green once, and the transmitter powers off.



- If a wireless communication error occurs, "DATA" LED lit in red and the buzzer sounds (If "MUTE" is on, the buzzer does not sound).
In this case, the Tx OFF is not performed. After "DATA" LEDs are turned off, perform the Tx OFF again in an environment where wireless communication is normal.
- Even if the transmitter is in the Tx OFF state, restarting the transmitter back on will cause it to return.

5. SPECIFICATIONS

5-1. MRS-111B

■ Hardware Specifications (1/2)

Number of Output Channels	1
Analog Output Voltage	±5 V / Range Full Scale
Analog Output Accuracy	Within ± 0.1 %FS
DA Resolution	16 bits
DA Conversion Speed	MRS-101A-S, MRS-101A-V, MRS-101B-S, MRS-101A-SE, MRS-101B-V 4.8 kHz MRS-101B-T 50 Hz
Operating Temperature and Humidity	0 to 50 °C, 20 to 85 % (Non condensing)
Vibration Resistance	29.42 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
Power Supply	10 to 16 VDC
Current Consumption	Within 280 mA
Operating Switch	MUTE: Turn buzzer on/off. BAL: Execute balance adjustment. CHECK: Check sensor connection. START: Start measurement. STOP: Stop measurement. Tx OFF: Turn transmitter off. SLEEP: Set transmitter to sleep. (Wake-up after the set time.)
Indicator	Monitor transmitter battery in 3 steps. Monitor Received Signal Strength in 3 steps. 7-segment LED: Indicate a frequency channel (0 to F) DATA: Light up in response to radio communication error /non - error. Lock: Light up to indicate keys are locked.
Dimensions	210 (W) x 35 (H) x 157.5 (D) mm * Excluding protrusions

■ Hardware Specifications (1/2)

Weight	Approx. 550 g
Compliance	Directive 2014/53/EU (RED) Directive 2011/65/EU, (EU)2015/863 (10 restricted substance) (RoHS)

■ RF Specifications

Transceiver Frequency Channel	1 (Choose 1 channel from 16 channels using setting software.)
Antennas	Specified antennas MAIN and SUB for diversity reception
Radio Communication Frequency Band	2.4GHz Band
Radio System	Digital modulation system
Radio Certification	Japan, USA, China, India, Thailand, Taiwan and EU
Radio Communications Distance	50 m (Max. line of sight distance)
Radio Environment of Usage	Environment where the wireless LAN and the Bluetooth®, etc. are not intermingled on the 2.4GHz
Frequency Channel and Central Frequency	

Frequency Channel	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

Frequency Channel	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

■ Specifications in Combination with a transmitter

Combination Accuracy	Refer to the specifications of each transmitter.
Compatible transmitter models	MRS-101A-S, MRS-101A-V, MRS-101B-S, MRS-101A-SE, MRS-101B-V, MRS-101B-T

5-2. MRS-114A

■ **Hardware Specifications (1/2)**

Number of Output Channels	4
Analog Output Voltage	±5 V / Range Full Scale
Analog Output Accuracy	Within ±0.1 %FS
DA Resolution	16 bits
DA Conversion Speed	MRS-101A-S, MRS-101A-V, MRS-101B-S, MRS-101A-SE, MRS-101B-V 4.8 kHz MRS-104A-S 1 measurement channel at 4.8 kHz 2 measurement channels at 3.2 kHz 3 measurement channels at 2.4 kHz 4 measurement channels at 1.92 kHz MRS-101B-T 50 Hz
Operating Temperature and Humidity	0 to 50 °C, 20 to 85 % (Non condensing)
Vibration Resistance	29.42 m/s ² (3 G), 10~200 Hz
Shock Resistance	294.2 m/s ² (30 G), 11 ms or less, Half-sine wave
Power Supply	10 to 16 VDC
Current Consumption	Within 280 mA
Operating Switch	MUTE: Turn buzzer on/off. BAL: Execute balance adjustment. CHECK: Check sensor connection. START: Start measurement. STOP: Stop measurement. Tx OFF: Turn transmitter off. SLEEP: Set transmitter to sleep. (Wake-up after the set time.)
Indicator	Monitor transmitter battery in 3 steps. Monitor Received Signal Strength in 3 steps. 7-segment LED: Indicate a frequency channel (0 to F) DATA: Light up in response to radio communication error /non- error. Lock: Light up to indicate keys are locked.
Dimensions	210(W) x 35(H) x 157.5(D) mm (Excluding protrusions)

■ Hardware Specifications (2/2)

Weight	Approx. 600 g
Compliance	Directive 2014/53/EU (RED) Directive 2011/65/EU, (EU)2015/863 (10 restricted substances) (RoHS)

■ RF Specifications

Transceiver Frequency Channel	1 (Choose 1 channel from 16 channels using setting software.)
Antennas	Specified antennas MAIN and SUB for diversity reception
Radio Communication Frequency Band	2.4GHz Band
Radio System	Digital Modulation System
Radio Certification	Japan, USA, China, India, Thailand, Taiwan and EU
Radio Communications Distance	50 m (Max. line of sight distance)
Radio Environment of Usage	Environment where the wireless LAN and the Bluetooth®, etc. are not intermingled on the 2.4GHz
Frequency Channel and Central Frequency	

Frequency Channel	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

Frequency Channel	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

Specifications in Combination with a transmitter

Combination Accuracy	Refer to the specifications of each transmitter. * The MRS-114A does not have multiple access capability. (Meaning the MRS-114A cannot connect two transmitters at the same time).
Compatible transmitter models	MRS-101A-S, MRS-101A-V, MRS-101B-S, MRS-101A-SE, MRS-101B-V, MRS-101B-T, MRS-104A-S

5-3. MRS-101B-S

■ Hardware Specifications(1/2)

Measuring targets	Strain gages (Full bridge system*) Strain gage transducers * Other bridge systems need bridge box or bridged adapter.
Channels	1
Compatible Bridge Resistance	120 to 1000 ohm
Gage Factor	2.00 fixed
Bridge Excitation	1 VDC
Measuring Range	1000, 2500, 5000, 10000, 25000 x 10 ⁻⁶ strain
Range Accuracy	Within ±0.15 %FS * 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.
Balancing Range	Within ±10000 x 10 ⁻⁶ strain
AD Resolution	16 bit
Sampling Frequency	4.8 kHz
Stability Temperature	Zero point : Within ±0.05 x 10 ⁻⁶ Strain / °C Sensitivity : Within ±0.01 % / °C
Operating Temperature and Humidity	-25 to 75 °C, 20 to 85 % (Non condensing)
Vibration Resistance	294.2 m/s ² (30 G), 10 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) * The figures are when installed with our specified screws and torque. * Use a shatterproof cover for safty.
Power Supply	2.2 to 4.4 VDC
Current Consumption	Within 32 mA * Test conditions: Power supply 3.0 V, bridge resistance 120 ohm
Hours of Continuous Use	Approx.28 hours [Lithium (CR2 manufactured by Panasonic)] Approx.24 hours [Ni-MH eneloop® (BK-4MCC,AAA cell x2)] Approx.34 hours [Alkaline EVOLTA (LR03EJ,AAA cell x2)] * Test conditions: 23 ± 5 °C, bridge resistance 120 ohm

■ Hardware Specifications(2/2)

Dimensions	47 (W) x 7 (H) x 20 (D) mm
	* With adapter, excluding protrusions
Weight	Approx. 17 g
	* With adapter
Compliance	Directive 2014/53/EU (RED)
	Directive 2011/65/EU, (EU)2015/863 (10 restricted substances) (RoHS)

■ RF Specifications

Transceiver Frequency Channel	1 (Choose 1 channel from 16 channels using setting software.)
Antennas	Built-in antenna
Radio Communication Frequency Band	2.4GHz Band
Radio System	Digital Modulation System
Radio Certification	Japan, USA, China, India, Thailand, Taiwan and EU
Radio Communications Distance	50 m (Max. line of sight distance)
Radio Environment of Usage	Environment where the wireless LAN and the Bluetooth®, etc. are not intermingled on the 2.4 GHz
Frequency Channel and Central Frequency	

Frequency Channel	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

Frequency Channel	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

■ Specifications in combination with Receiver

Compatible Receiver	MRS-111A (-E) Firmware Ver. 3.01 or later MRS-111B Firmware Ver. 3.01 or later MRS-114A Firmware Ver. 3.01 or later
Analog Output	±5 V / Range Full Scale
Combination Accuracy	Within ±0.2 %FS
Frequency Response	DC to 370 Hz (Dev. +0.5, -1 dB) -3 ± 1 dB (at 480 Hz)
Delay Time	11.1 ± 0.3 ms (at DC to 480 Hz)

5-4. MRS-101A-SE

■ Hardware Specifications (1/2)

Measuring targets	Strain gages (Full bridge system*) Strain gage transducers * Other bridge systems need bridge box or bridged adapter.
Channels	1
Compatible Bridge Resistance	120 to 1000 ohm
Gage Factor	2.00 fixed
Bridge Excitation	1 VDC
Measuring Range	1000, 2500, 5000, 10000, 25000 x 10 ⁻⁶ strain
Range Accuracy	Within ±0.15 %FS * 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.
Balance Adjustment Range	±10000 x 10 ⁻⁶ strain
AD Resolution	16 bits
Sampling Frequency	4.8 kHz
Stability Temperature	Zero point : Within ±0.05 x 10 ⁻⁶ Strain / °C Sensitivity : Within ±0.01 % / °C
Operating Temperature and Humidity	-25 to 75 °C, 20 to 85 % (Non condensing) *1
Vibration Resistance	294.2 m/s ² (3 G), 10 to 200 Hz *1
Shock Resistance	294.2 m/s ² (300 G), 11ms or less, Half-sine wave*1
Power Supply	2.2 to 4.4 VDC
Current Consumption	Within 32 mA * Test conditions: Power supply 3.0 V, bridge resistance 120 ohm
Hours of Continuous Use	Approx.28 hours (Lithium (CR2 manufactured by Panasonic)) Approx.24 hours (Ni-MH eneloop® (BK-4MCC,AAA cell x2)) Approx.34 hours (Alkaline EVOLTA (LR03EJ,AAA cell x2)) * Test conditions: 23±5 °C, bridge resistance 120 ohm
Dimensions	35 (W) x 5 (H) x 19.5 (D) mm * With adapter, excluding protrusions

■ Hardware Specifications (1/2)

Weight	Approx. 10 g
	* With adapter
Compliance	Directive 2014/53/EU (RED)
	Directive 2011/65/EU (6 restricted substances) (RoHS)
*1 If the ambient temperature exceeds 50 °C, it cannot be used in a vibration, shock, centrifugal acceleration by fixing the bolts in the body mounting holes.	

■ RF Specifications

Transceiver Frequency Channel	1 (Choose 1 channel from 16 channels using setting software.)
Antennas	External antenna
Radio Communication Frequency Band	2.4GHz Band
Radio System	Digital modulation system
Radio Certification	Japan, USA, China, India, Thailand, Taiwan and EU
Radio Communications Distance	50 m (Max. line of sight distance) (Using external antenna(W1030) of standard accessory)
Radio Environment of Usage	Environment where the wireless LAN and the Bluetooth®, etc. are not intermingled on the 2.4 GHz
Frequency Channel and Central Frequency	

Frequency Channel	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

Frequency Channel	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

■ Specifications in combination with Receiver

Compatible Receiver	MRS-111A (-E) Firmware Ver. 1.00 or later MRS-111B Firmware Ver. 3.00 or later MRS-114A Firmware Ver. 3.00 or later
Analog Output	±5 V / Range Full Scale
Combination Accuracy	Within ±0.2 %FS
Frequency Response	DC to 370 Hz (Dev. +0.5, -1 dB) -3 ± 1 dB (at 480 Hz)
Delay Time	11.1 ± 0.3 ms (at DC to 480 Hz)

5-5. MRS-101B-V

■ Hardware Specifications (1/2)

Measuring Targets	Voltage
Channels	1
Input Impedance	Approx. 1 M + 1 M ohm Between D (+IN) and B (-IN): Within ± 32 V Between D (+IN) and E (SHIELD), Between B and E: Within ± 16 V
Absolute Input Voltage *1	* Exceeding the absolute input voltage range may cause permanent damage to this product.
Measuring Range	5, 10 V Within ± 0.15 %FS
Range Accuracy	* 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.
Balance Adjustment Range	Within ± 5 V
AD Resolution	16 bit
Sampling Frequency	4.8 kHz
Stability Temperature	Zero point : Within ± 0.01 %FS / °C Sensitivity : Within ± 0.02 % / °C
Operating Temperature and Humidity	-25 to 75 °C, 20 to 85 % (Non condensing)
Vibration Resistance	294.2 m/s ² (30 G), 10 to 500 Hz
Shock Resistance	980.7 m/s ² (100 G), 11 ms or less, Half-sine wave 29420 m/s ² (3000 G)
Centrifugal Acceleration Resistance	* The figures are when installed with our specified screws and torque. * Use a shatterproof cover for safety.
Power supply	2.2 to 4.4 VDC
Current consumption	Within 22 mA * Test conditions: Power supply 3.0 V Approx.38 hours (Lithium (CR2 manufactured by Panasonic)) Approx.33 hours (Ni-MH eneloop® (BK-4MCC,AAA cell x2)) Approx.49 hours (Alkaline EVOLTA (LR03EJ,AAA cell x2))
Hours of continuous use	* Test conditions: 23 $\pm$ 5 °C

■ Hardware Specifications (2/2)

Dimensions	47 (W) x 7 (H) x 20 (D) mm
	* With adapter, Excluding protrusions
Weight	Approx. 17 g
	* With adapter
Compliance	Directive 2014/53/EU (RED)
	Directive 2011/65/EU, (EU) 2015/863 (10 restricted substances) (RoHS)

■ RF Specifications

Transceiver Frequency Channel	1 (Choose 1 channel from 16 channels using setting software.)
Antennas	Built-in antenna
Radio Communication Frequency Band	2.4GHz Band
Radio System	Digital modulation system
Radio Certification	Japan, USA, China, India, Thailand, Taiwan and EU
Radio Communications Distance	50 m (Max. line of sight distance)
Radio Environment of Usage	Environment where the wireless LAN and the Bluetooth®, etc. are not intermingled on the 2.4 GHz
Frequency Channel and Central Frequency	

Frequency Channel	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

Frequency Channel	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

■ Specifications in combination with Receiver

Compatible Receiver	MRS-111A (-E) Firmware Ver. 3.01 or later
	MRS-111B Firmware Ver. 3.01 or later
	MRS-114A Firmware Ver. 3.01 or later
Analog Output	±5 V / Range Full Scale
Combination Accuracy	Within ±0.2 %FS
Frequency Response	DC to 370 Hz (Dev. +0.5, -1 dB)
	-3 ± 1 dB (at 480 Hz)
Delay Time	11.1 ± 0.3 ms (at DC to 480 Hz)

5-6. MRS-101B-T

■ Hardware Specifications (1/2)

Measuring targets	Thermocouple	
Channels	1	
Compatible Thermocouple	K, T, N, J (Resistance of thermocouple: 500 ohm or less)	
Measuring Range	K1300	-200 to 1300 °C
	K500	-200 to 500 °C
	K100	-100 to 100 °C
	T400	-200 to 400 °C
	T100	-100 to 100 °C
	N1300	-200 to 1300 °C
	N500	-200 to 500 °C
	N100	-100 to 100 °C
	J1200	-200 to 1200 °C
	J500	-200 to 500 °C
	J100	-100 to 100 °C

Range Accuracy

Ambient Temperature	Measuring Temperature	Telemeter measuring accuracy (internal reference compensation mode)
20~30 °C	Below -50 °C	Within ± 0.4 %rdg ± 2.0 °C
	-50 °C or more	Within ± 0.1 %rdg ± 1.5 °C
0~50 °C	Below -50 °C	Within ± 0.4 %rdg ± 2.8 °C
	-50 °C or more	Within ± 0.1 %rdg ± 2.5 °C
-25~75 °C	Below -50 °C	Within ± 0.4 %rdg ± 3.8 °C
	-50 °C or more	Within ± 0.1 %rdg ± 3.5 °C

* The input terminal temperature is in equilibrium

* The above specifications apply to a stable temperature after warm up for about 60 minutes.

Check Functions	Burnout check
AD Resolution	16 bit
Sampling Frequency	4.8 kHz
Operating Temperature and Humidity	-25 to 75 °C, 20 to 85 % (Non condensing)
Vibration resistance	294.2 m/s ² (30 G), 10 to 500 Hz
Shock resistance	980.7 m/s ² (100 G), 11 ms or less, Half sine wave

■ Hardware Specifications (2/2)

Centrifugal acceleration limit	29420 m/s ² (3000 G)
	* The figures are when installed with our specified screws and torque.
	* Use a shatterproof cover for safety.
Power supply	2.2 to 4.4 VDC
Current consumption	Within 24 mA
	* Test conditions: Power supply 3.0 V
	Approx.33 hours
	[Lithium (CR2 manufactured by Panasonic)]
	Approx.30 hours
Hours of continuous use	[Ni-MH eneloop® (BK-4MCC,AAA cell x2)]
	Approx.45 hours
	[Alkaline EVOLTA (LR03EJ,AAA cell x2)]
	* Test conditions: 23 ± 5 °C
Dimensions	47 (W) x 7 (H) x 20 (D) mm
	* With adapter, excluding protrusions
Weight	Approx. 17 g
	* With adapter
Compliance	Directive 2014/53/EU (RED)
	Directive 2011/65/EU, (EU)2015/863
	(10 restricted substances) (RoHS)

■ RF Specifications

Transceiver Frequency Channel	1
	(Choose 1 channel from 16 channels using setting software.)
Antennas	Built-in antenna
Radio Communication Frequency Band	2.4GHz Band
Radio System	Digital modulation system
Radio Certification	Japan, USA, China, India, Thailand, Taiwan and EU
Radio Communications Distance	50 m (Max. line of sight distance)
Radio Environment of Usage	Environment where the wireless LAN and the Bluetooth®, etc. are not intermingled on the 2.4 GHz
Frequency Channel and Central Frequency	

Frequency Channel	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

Frequency Channel	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

■ Specifications in combination with Receiver

Compatible Receiver	MRS-111A (-E)	Firmware Ver. 3.01 or later
	MRS-111B	Firmware Ver. 3.01 or later
	MRS-114A	Firmware Ver. 3.01 or later
Analog Output	±5 V / Range Full Scale	

Measuring Range	Temperature Range	Analog Output Range
K1300, N1300	-200 to 1300 °C	-0.7692 to 5.000 V
K500, N500	-200 to 500 °C	-2.000 to 5.000 V
K100, N100	-100 to 100 °C	-5.000 to 5.000 V
T400	-200 to 400 °C	-2.500 to 5.000 V
T100	-100 to 100 °C	-5.000 to 5.000 V
J1200	-200 to 1200 °C	-0.8333 to 5.000 V
J500	-200 to 500 °C	-2.000 to 5.000 V
J100	-100 to 100 °C	-5.000 to 5.000 V

Range Accuracy

Ambient Temperature	Measuring Temperature	Measuring Accuracy (Combination With Transmitter and Receiver)
20 to 30 °C	Below -50 °C	Within (± 0.4 %rdg ± 2.0 °C) ± 0.1 %FS
	-50 °C or more	Within (± 0.1 %rdg ± 1.5 °C) ± 0.1 %FS
0 to 50 °C	Below -50 °C	Within (± 0.4 %rdg ± 2.8 °C) ± 0.1 %FS
	-50 °C or more	Within (± 0.1 %rdg ± 2.5 °C) ± 0.1 %FS
-25 to 75 °C	Below -50 °C	Within (± 0.4 %rdg ± 3.8 °C) ± 0.1 %FS
	-50 °C or more	Within (± 0.1 %rdg ± 3.5 °C) ± 0.1 %FS

Example :

When the measurement range is T400 and measuring temperature 200 °C in ambient temperature 20 to 30 °C, The accuracy is within:

$$“200\text{ °C} \times (\pm 0.1\%) + (\pm 1.5\text{ °C}) + 400\text{ °C} \times (\pm 0.1\%) = \pm 2.1\text{ °C}”.$$

Frequency Response	DC to 6 Hz (Dev. +0.5, -1 dB)
	-3 ± 1 dB (at 10.5 Hz)
Delay Time	125 ± 25 ms (at DC to 10.5 Hz)

5-7. MRS-104A-S

■ Hardware Specifications (1/2)

Measuring Targets	Strain gages (Full bridge system*) Strain gage transducers * Other bridge systems need bridge box or bridged adapter.
Maximum Number of Channels	4
Compatible Bridge Resistance	120 to 1000 ohm
Gage Factor	2.00 fixed
Bridge Excitation	1 VDC
Measuring Range	1000, 2500, 5000, 10000, 25000 x 10 ⁻⁶ strain
Range Accuracy	Within ±0.15 %FS * 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.
Balance Adjustment Range	±10000 x 10 ⁻⁶ strain
AD Resolution	16 bits
Sampling Frequencies	1 measurement channel at 4.8 kHz 2 measurement channels at 3.2 kHz 3 measurement channels at 2.4 kHz 4 measurement channels at 1.92 kHz
Stability Temperature	Zero point : Within ±0.05 x 10 ⁻⁶ Strain /°C Sensitivity : Within ±0.01 %/°C
Operating Temperature and Humidity	-25 to 75 °C, 20 to 85 % (Non condensing) *1
Vibration Resistance	294.2 m/s ² (30 G), 10 to 500 Hz *1
Shock Resistance	980.7 m/s ² (100 G), 11 ms or less, Half sine wave *1
Centrifugal Acceleration Resistance *1	980.7 m/s ² (100 G) *1,*2
Power Supply	2.2 to 4.4 VDC
Current Consumption	62 mA or less * Test conditions: Power supply 3.0 V, bridge resistance 120 ohm

■ Hardware Specifications (2/2)

Hours of Continuous Use	Approx. 12 hours [Lithium (CR2 manufactured by Panasonic)] Approx. 10 hours [Ni-MH eneloop® (BK-4MCC, AAA cell x2)] Approx. 13 hours [Alkaline EVOLTA (LR03EJ, AAA cell x2)] * Test conditions: 23 ± 5 °C, bridge resistance 120 ohm
Dimensions	55 (W) x 10 (H) x 32.5 (D) mm * With adapter, excluding protrusions
Weight	Approx. 32 g * With adapter
Compliance	Directive 2014/53/EU (RED) Directive 2011/65/EU, (EU)2015/863 (10 restricted substances) (RoHS)

*1 If the ambient temperature exceeds 50 °C, it cannot be used in a vibration, shock, centrifugal acceleration by fixing the bolts in the body mounting holes.

*2 The specification of centrifugal acceleration is assumed for height (H) direction of the transmitter. Use a shatterproof cover for safety.

■ RF Specifications

Transceiver Frequency Channel	1 (Choose 1 channel from 16 channels using setting software.)
Antennas	Built-in antenna
Radio Communication Frequency Band	2.4GHz Band
Radio System	Digital Modulation System
Radio Certification	Japan, USA, China, India, Thailand, Taiwan and EU
Radio Communications Distance	50 m (Max. line of sight distance)
Radio Environment of Usage	Environment where the wireless LAN and the Bluetooth®, etc. are not intermingled on the 2.4 GHz
Frequency Channel and Central Frequency	

Frequency Channel	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

Frequency Channel	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

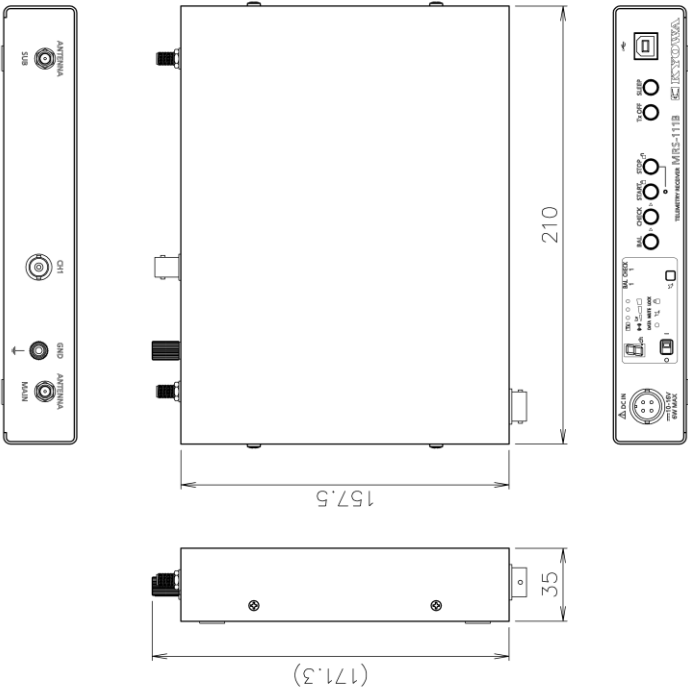
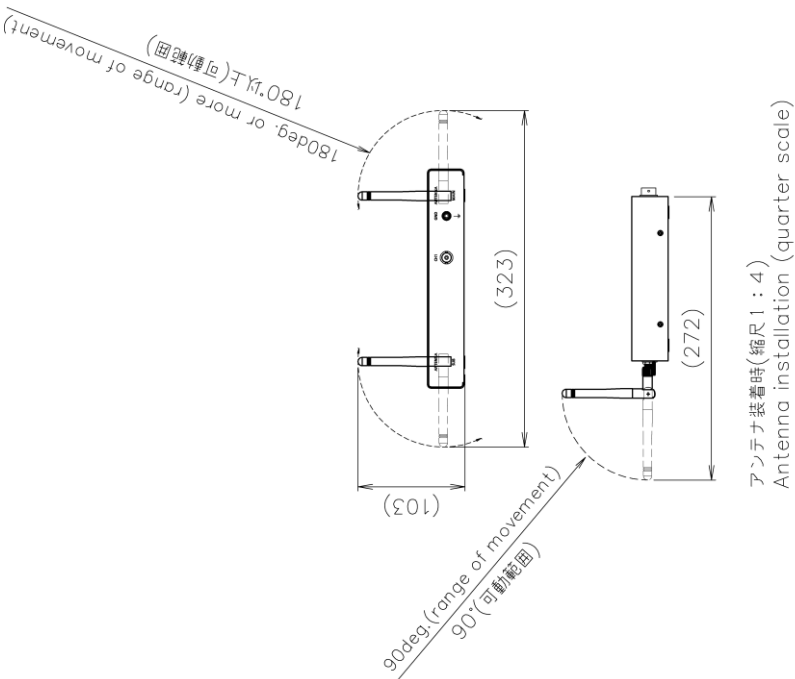
■ Specifications in combination with Receiver

Compatible Receiver MRS-114A Firmware Ver. 3.00 or later
* MRS-104A-S cannot be used in combination with
 MRS-111A/B (1ch receiver).
Analog Output ± 5 V / Range Full Scale
Combination Accuracy Within ± 0.2 %FS
Frequency Response Range and Delay Time

Number of Measurement Channels	Sampling Frequency	Frequency Response Range	DelayTime
1	4.8 kHz	DC to 370 Hz (Dev. +0.5, -1 dB) -3 $\pm$ 1 dB (at 480 Hz)	11.1 $\pm$ 0.3 ms (at DC to 480 Hz)
2	3.2 kHz	DC to 320 Hz(Dev. +0.5, -1 dB) -3 $\pm$ 1 dB (at 466 Hz)	10.8 $\pm$ 0.3 ms (at DC to 320 Hz)
3	2.4 kHz	DC to 240 Hz(Dev. +0.5, -1 dB) -3 $\pm$ 1 dB (at 424 Hz)	9.8 $\pm$ 0.3 ms (at DC to 240 Hz)
4	1.92 kHz	DC to 192 Hz(Dev. +0.5, -1 dB) -3 $\pm$ 1 dB (at 376 Hz)	9.7 $\pm$ 0.3 ms (at DC to 192 Hz)

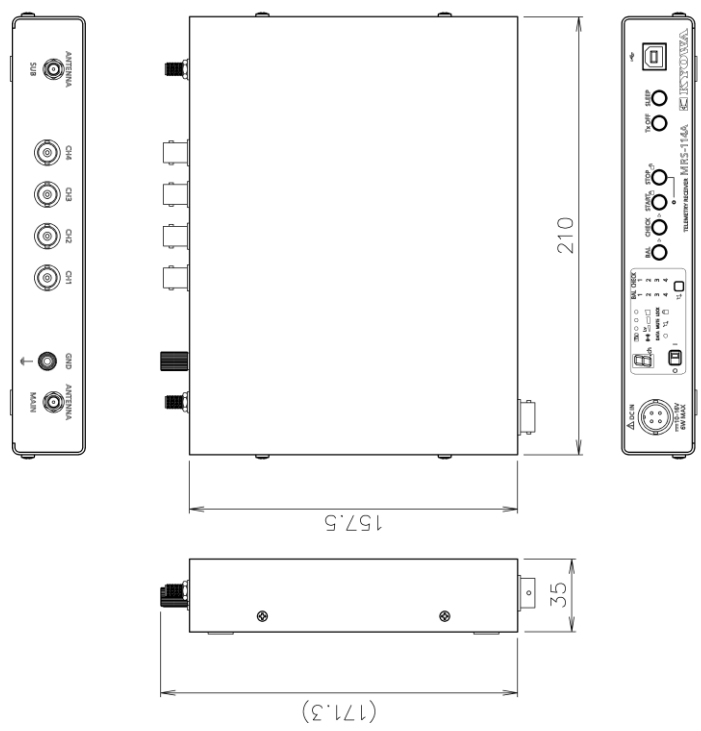
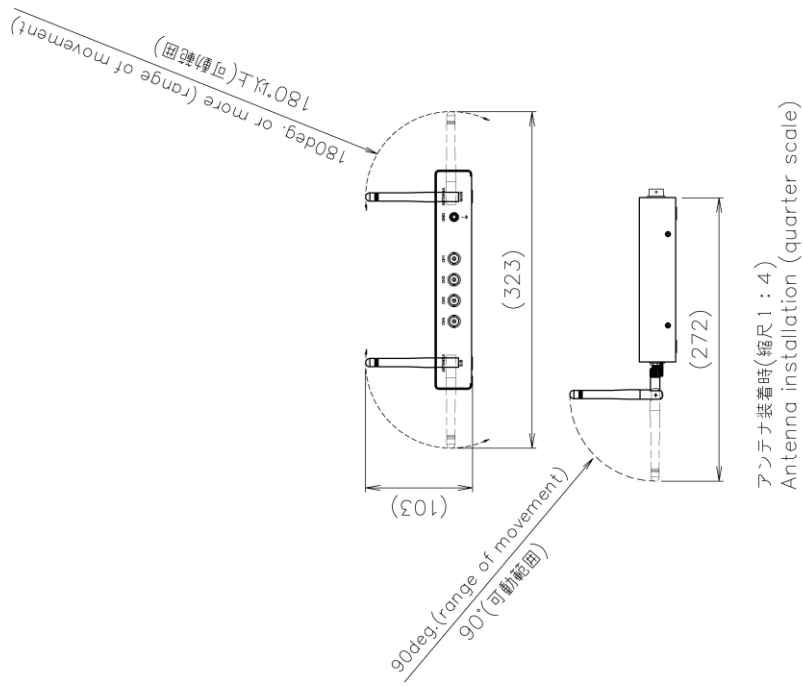
6. OUTSIDE DRAWING

6-1.MRS-111B outside drawing

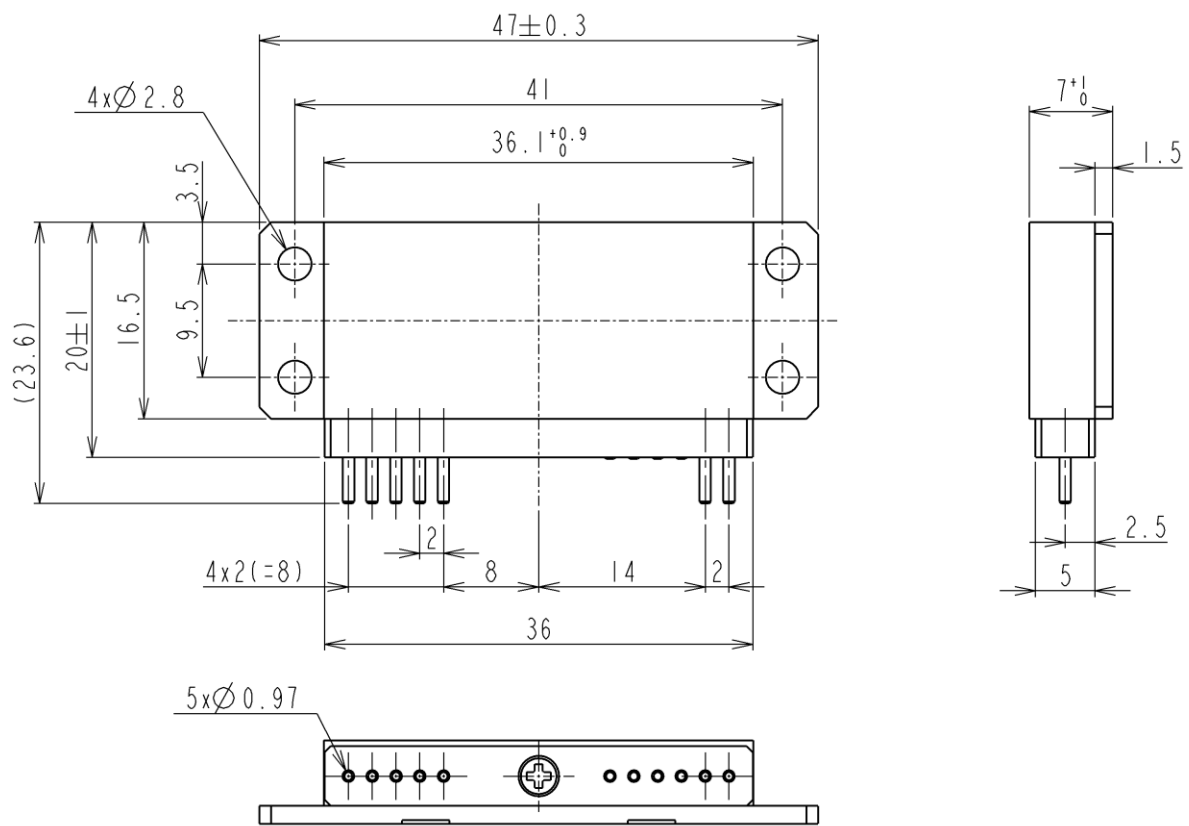


[mm]

6-2.MRS-114A outside drawing

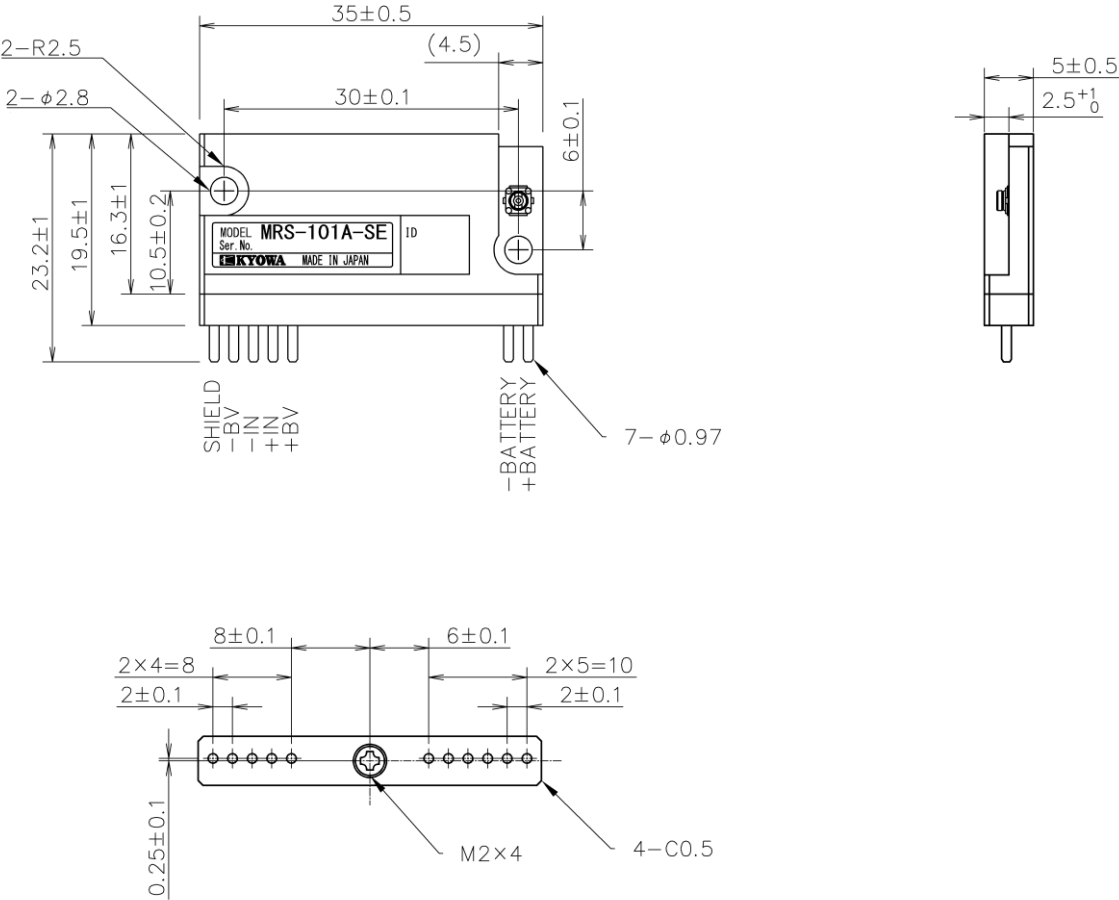


[mm]

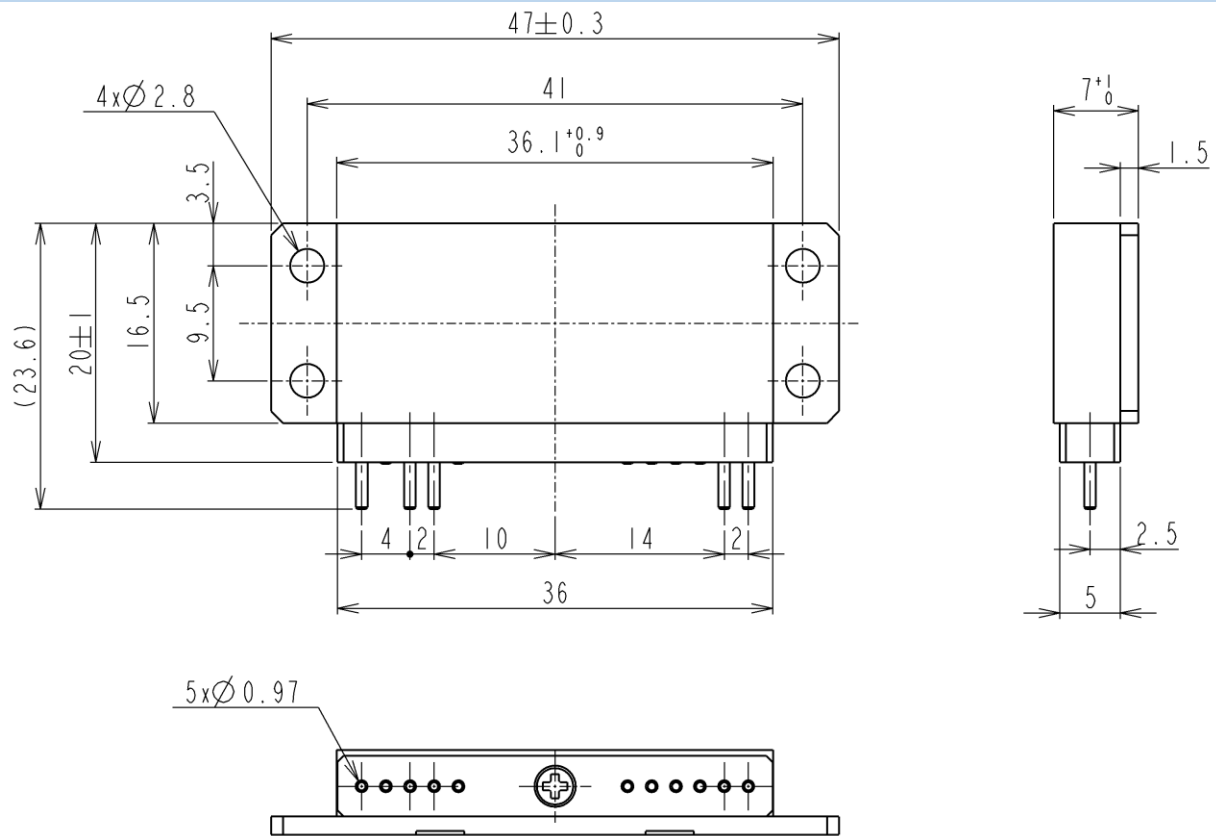
6-3.MRS-101B-S outside drawing

[mm]

6-4.MRS-101A-SE outside drawing

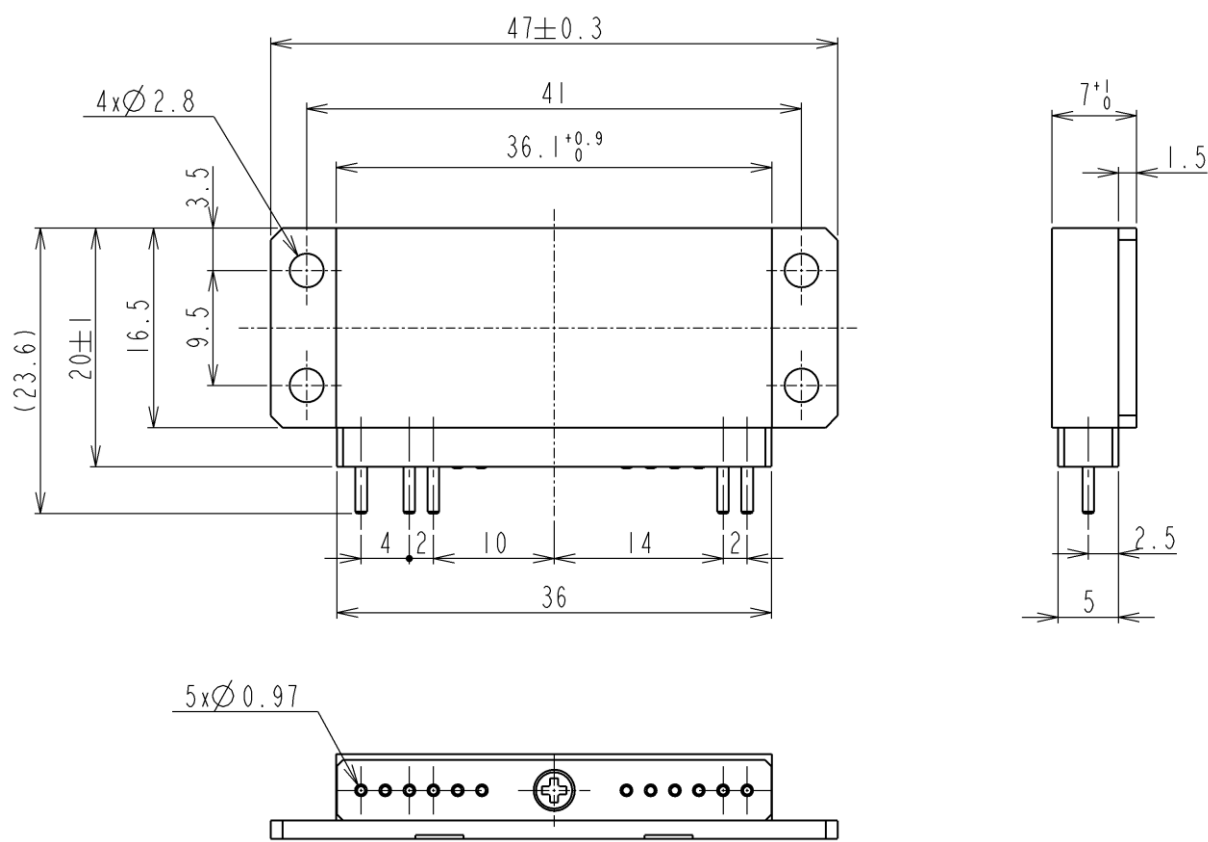


[mm]

6-5.MRS-101B-V outside drawing

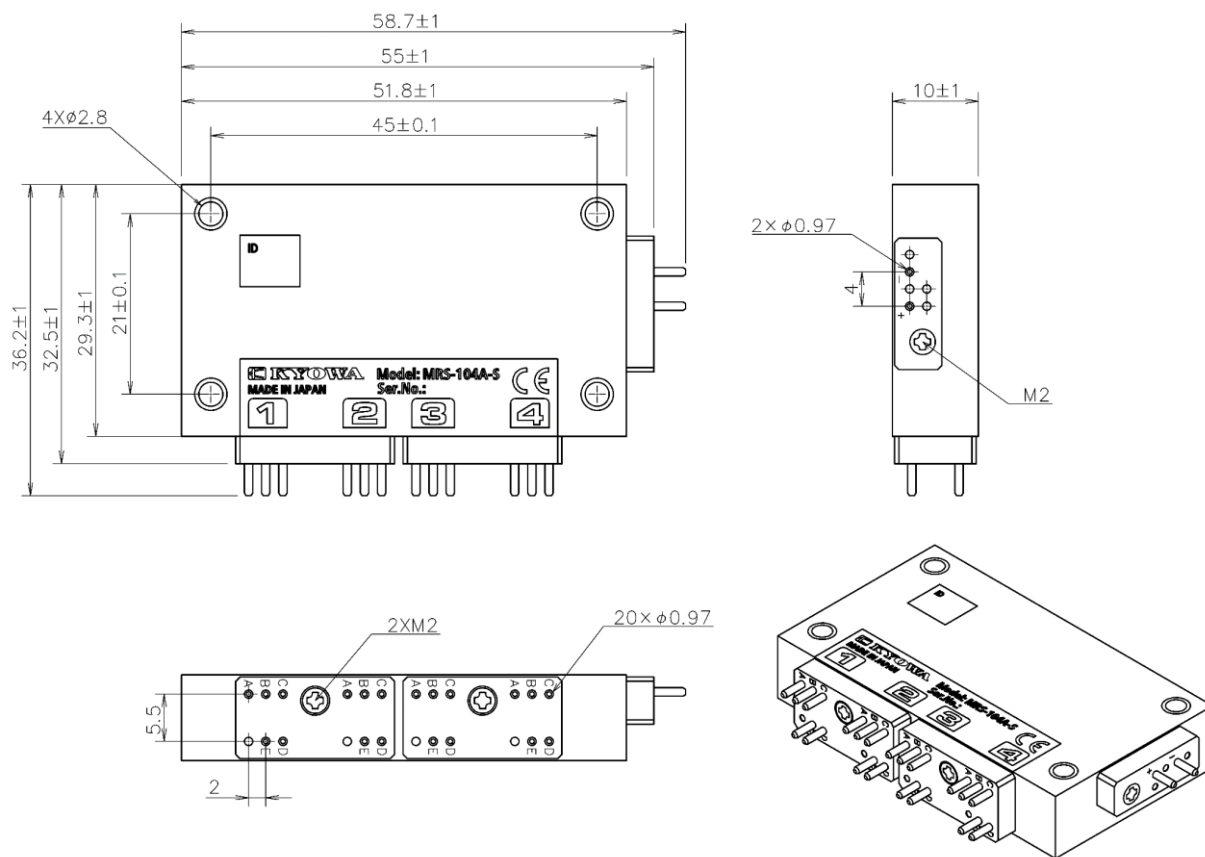
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6-6.MRS-101B-T outside drawing



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6-7.MRS-104A-S outside drawing



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7. TECHNICAL INFORMATION

7-1. Antenna installation guide

For favorable wireless communication, the orientations and positions where the transmitting and receiving antennas are installed must be adjusted to prevent a decrease in received signal strength. Wireless communication is greatly affected by the surrounding environment, such as the presence of obstacles, influence of reflected waves, and other wireless communication systems. Thus, installation in a suitable environment is necessary.

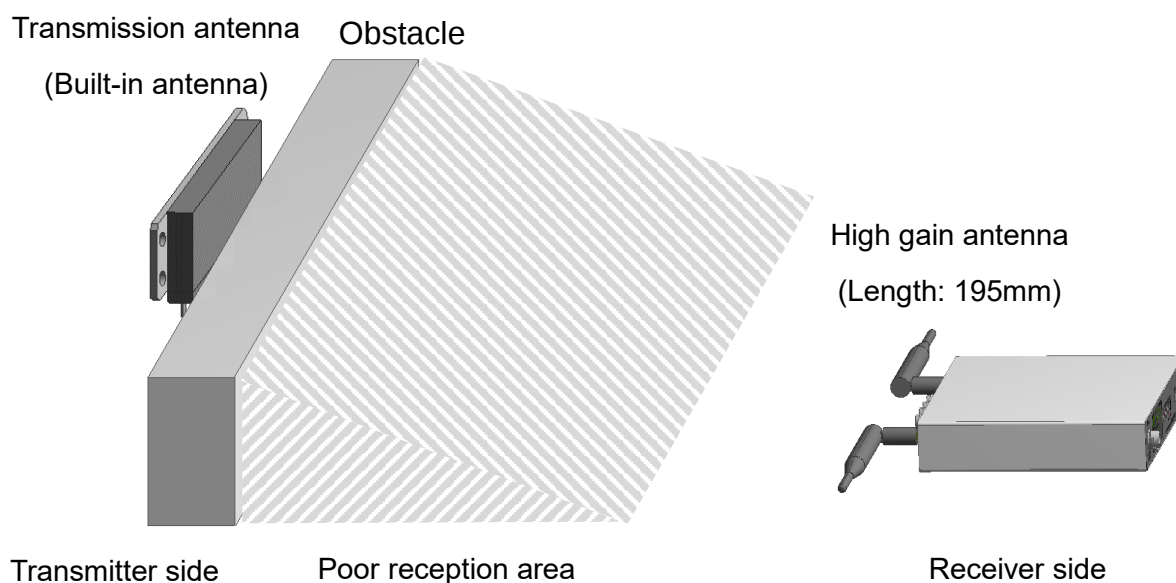
Before installing the antennas, refer to the following precautions on setting up the transmitter and receiver.

7-1-1. Positional relationship of transmitter and receiver antennas

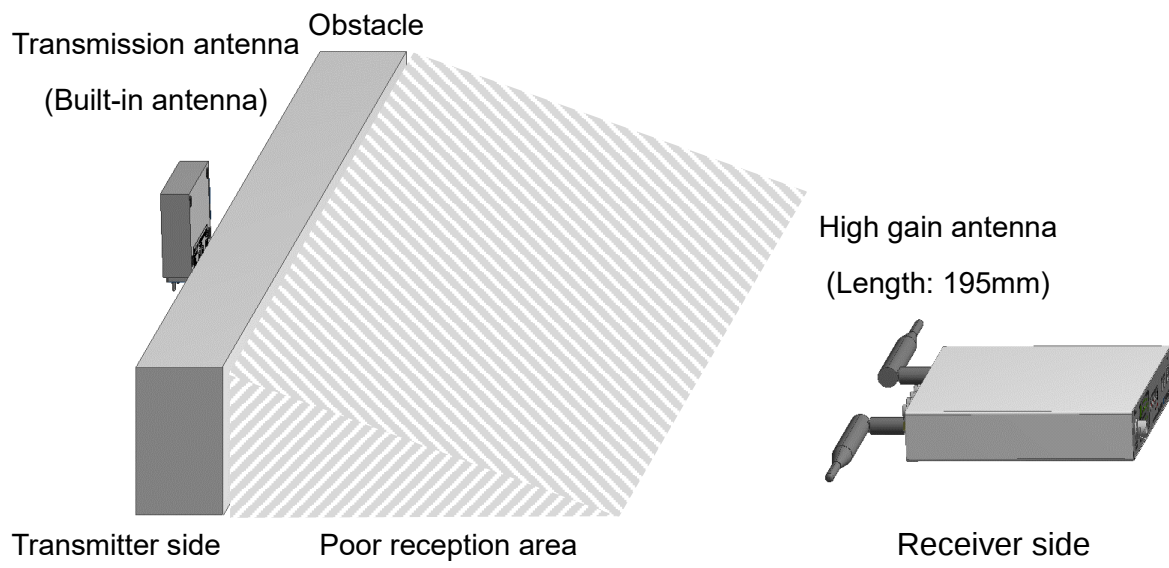
This product uses the 2.4 GHz band radio frequency.

Radio waves in this frequency band have high straightness, so the waves are less likely able to maneuver around obstacles. For this reason, install the transmitting and receiving antennas so that each antenna is visible from the position of the other. In addition, if the transmitter or receiver is installed in a place that moves, ensure that the transmitting and receiving antennas are mutually visible throughout the path of movement.

● If the MRS-101B-S/V/T



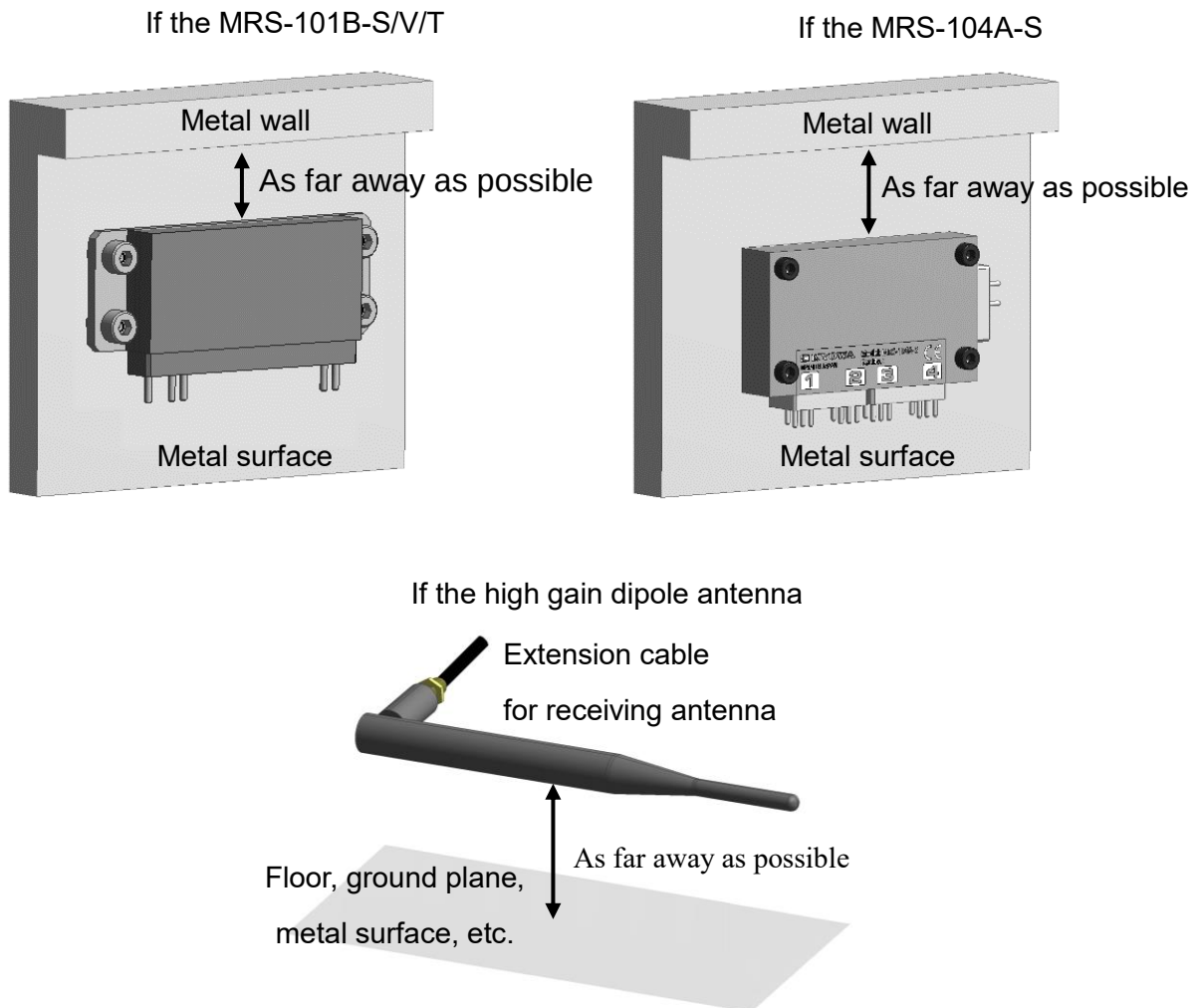
● If the MRS-104A-S



7-1-2. Location of Antenna

Avoid installing the antennas near the floor, the ground plane, and/or metal surfaces.

The antenna properties might worsen when the transmitting and receiving antennas are installed near the floor, the ground plane, and/or metal surfaces. Thus, to the extent possible, install the transmitting and receiving antennas away from those areas.



7-1-3. The direction/orientation of the antennas

The transmitting and receiving antennas can be positioned facing certain directions for reliable transmission and reception. This takes advantage of "radiation characteristics".

In addition, radio waves are sent from the transmitting and receiving antennas with a certain polarization, which makes it necessary to align their orientations. This takes advantage of "polarization characteristics."

Considering both of these characteristics when installing the antennas enables the transmitting and receiving antennas to operate at optimal performance, which in turn can ensure adequate transmission distance and improve the reliability of wireless communication.



Although the radiation and polarization characteristics of the transmitting and receiving antennas are important during installation, performance is also greatly affected by the actual environment, such as presence of obstacles, influence of reflected waves, other radio devices.

The characteristics of the transmitting and receiving antenna must be considered, and the antennas must be installed appropriately according to the usage environment.

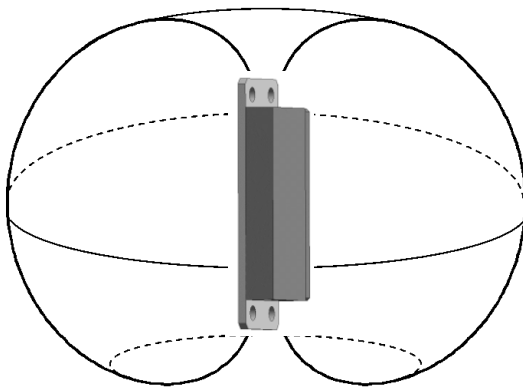
7-2. Radiation characteristics

An antenna has a direction in which radio waves are emitted and a direction in which radio waves are easily received. This is called "directional characteristics".

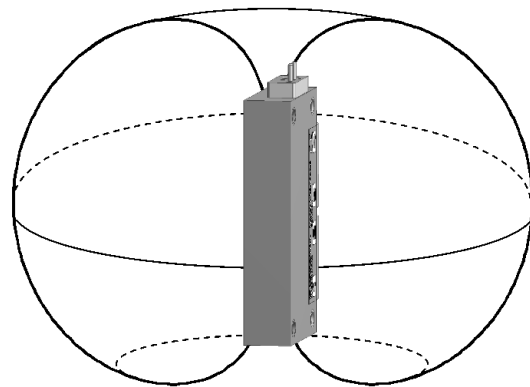
● Radiation characteristics of transmitting antennas (Transmitter)

On the other hand, the transmitter's built-in transmitting antenna of MRS-104A-S and MRS101B-S/V/T covers areas horizontally. (Imagine that it provides doughnut-shaped coverage).

If the MRS-101B-S/V/T



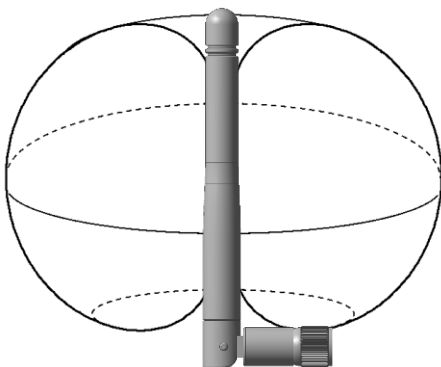
If the MRS-104A-S



● Radiation characteristics of receiving antennas (Receiver)

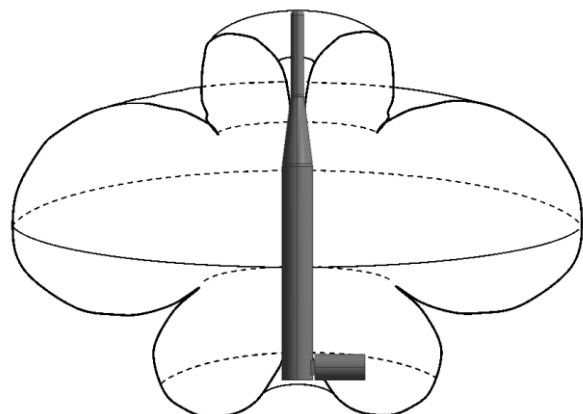
The two receiving antennas (Standard accessories) in the receiver covers areas horizontally when installed upright. (Imagine that it provides doughnut-shaped coverage.) Although radio waves spread out in every direction horizontally, they do not spread vertically, relative to the receiving antenna.

If the receiving antenna (W1030)



If the high gain dipole antenna

(DA-DB-05RP-SMA-08)



7-3. Polarization characteristics

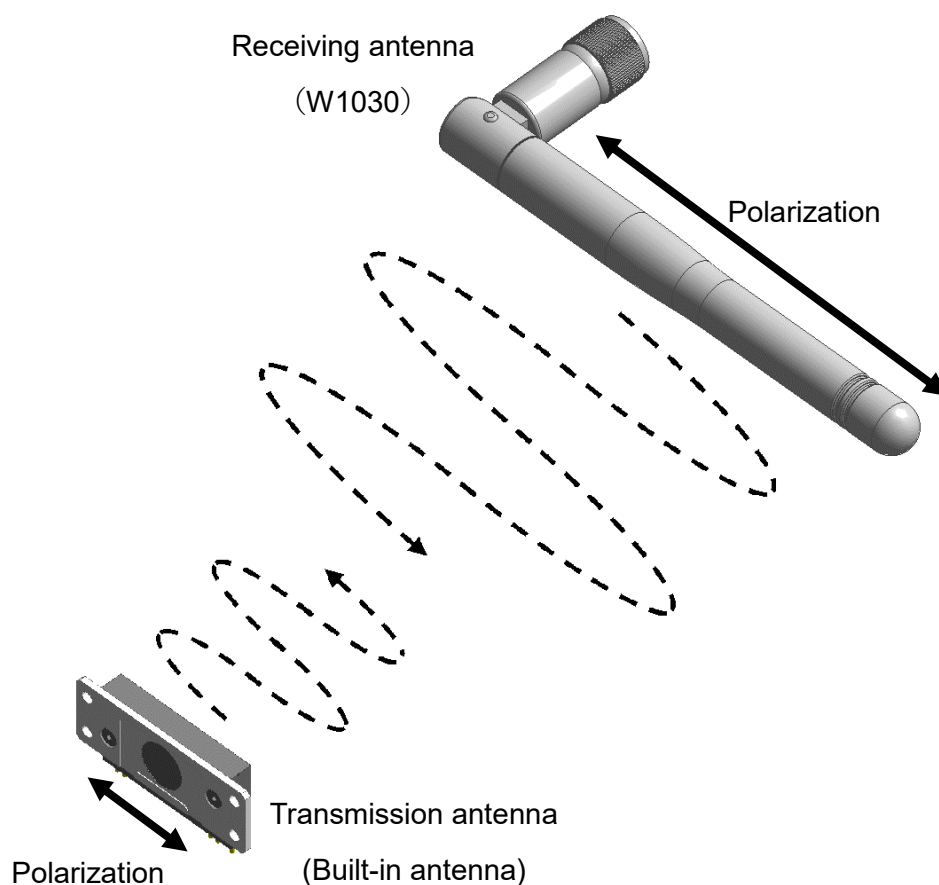
The radio wave output from the antenna has a wave direction. This is called "polarization characteristics".

Align the orientation of the transmitting and receiving antennas to form horizontal polarization. One way to comprehend this is to imagine a plane of polarization.

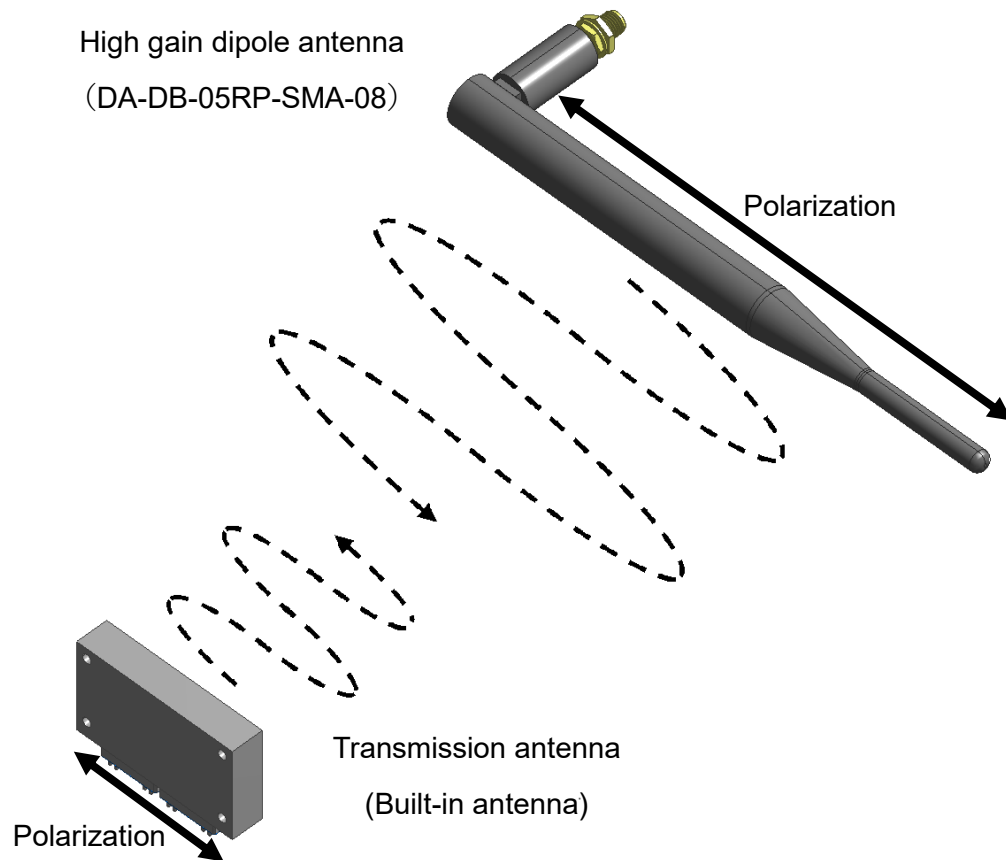
Polarization in the longitudinal direction is a characteristic of the transmitting antenna in the transmitter. Thus, installing the transmitter horizontally produces a plane of horizontal polarization, and installing it upright produces a plane of vertical polarization.

Similarly, polarization in the longitudinal direction is also a characteristic of two receiving antennas (Standard accessories) in the receiver. Placing the receiving antenna horizontally produces a plane of horizontal polarization, and placing it upright produces a plane of vertical polarization.送 Thus, in radio communication with both antennas, the planes of polarization match when the antennas are parallel.

- If the MRS-101B-S/V/T is combined with a receiving antenna (W1030)



- If the MRS-104A-S is combined with a High gain dipole antenna (DA-DB-05RP-SMA-08)



7-4. Diversity reception techniques

Reception techniques called “diversity reception methods” are used to increase the reliability of radio communication. For example, multiple receiving antennas may be used to prioritize signals from antennas with better receptions. Alternatively, radio signals from multiple receiving antennas may be combined.

A few types of diversity reception methods are used.



The receiver receives data via both "MAIN" and "SUB" antennas but prioritizes data received from the “MAIN” antenna.

In other words, as long as the "MAIN" antenna does not encounter any wireless communication errors, data from this antenna will continue to be used, but data from the "SUB" antenna will be used if the "MAIN" antenna encounters wireless communication errors.

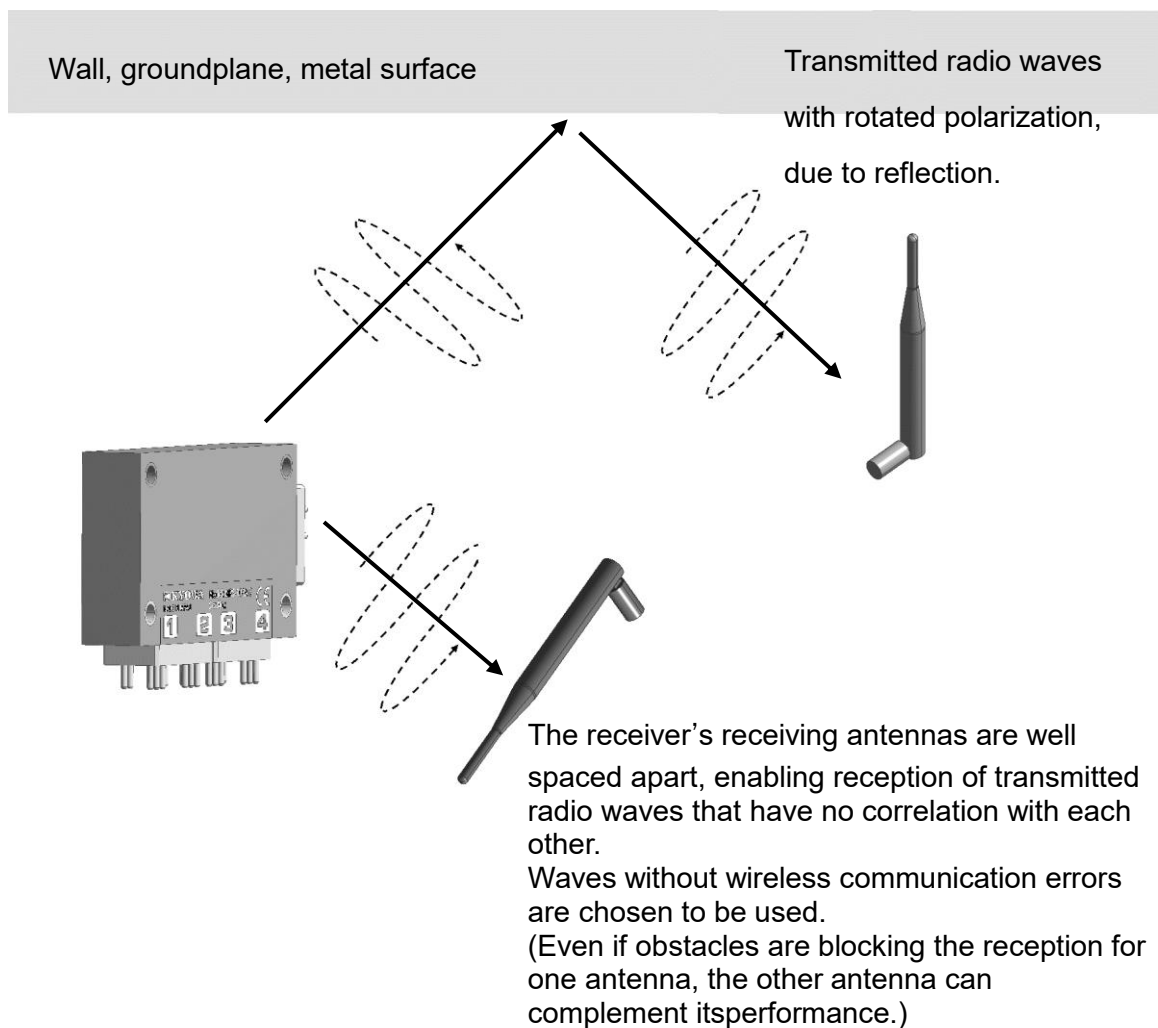
This Product supports both the space diversity and polarization diversity techniques.

When there is a direct line of sight between the transmitting and receiving antennas, use the space diversity technique, matching the plane of polarization of the transmitting and receiving antennas, for reception.

However, the plane of polarization constantly changes, and there are times when the rotating objects or environments where reflected waves from obstructions cannot be avoided. In this case, use the polarization diversity technique for reception, differing the planes of polarization of two receiving antennas. Specifically, forming a 90° angle with the receiver’s two receiving antennas enables reception by one receiving antenna even if the plane of polarization of the transmitter’s transmitting antenna changes, such as when the transmitter moves or rotates.

7-4-1. Space diversity technique

A reception technique in which the receiver's two receiving antennas are positioned at least a half-wave length apart (approximately 63 mm for 2.4 GHz radio waves) to receive radio waves at the receiving antennas that have no correlation to each other. For this reason, when radio waves are received in environments with a weak signal, even if conditions are poor at one receiving antenna, the other antenna can still be relied on to have reception.

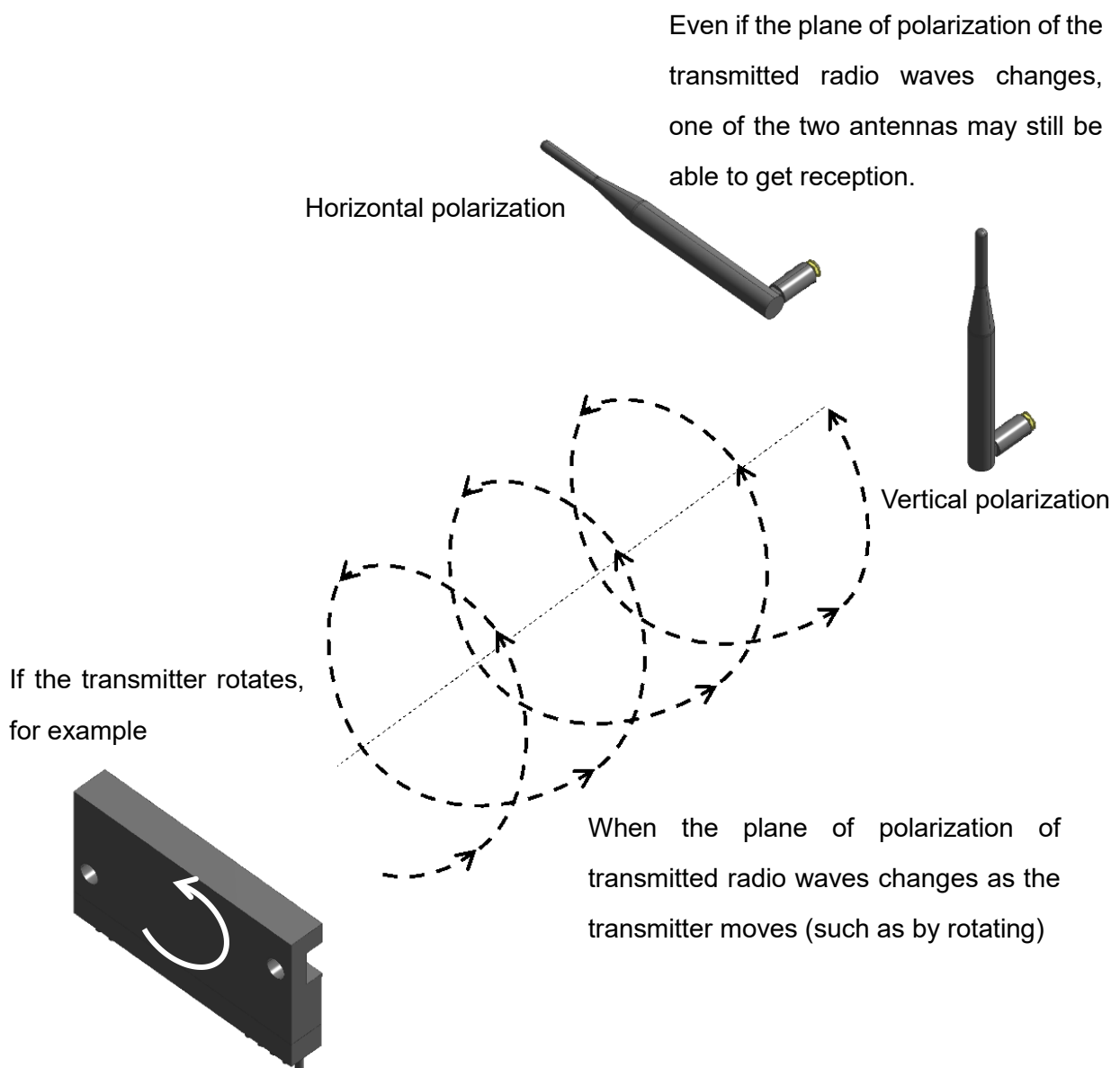


7-4-2. Polarization diversity technique

Radio waves sent from the transmitter may reach the receiver in a plane of polarization different from that of the transmitter's transmitted polarization, due to reflection on metal walls and/or other obstacles.

Alternatively, if the transmitter rotates because it is on a rotating object, the polarization as received by the receiver also rotates.

In such case, preparing a receiving antenna with a different plane of polarization enables the receiver to give precedence to the receiving antenna in a better receiving condition.

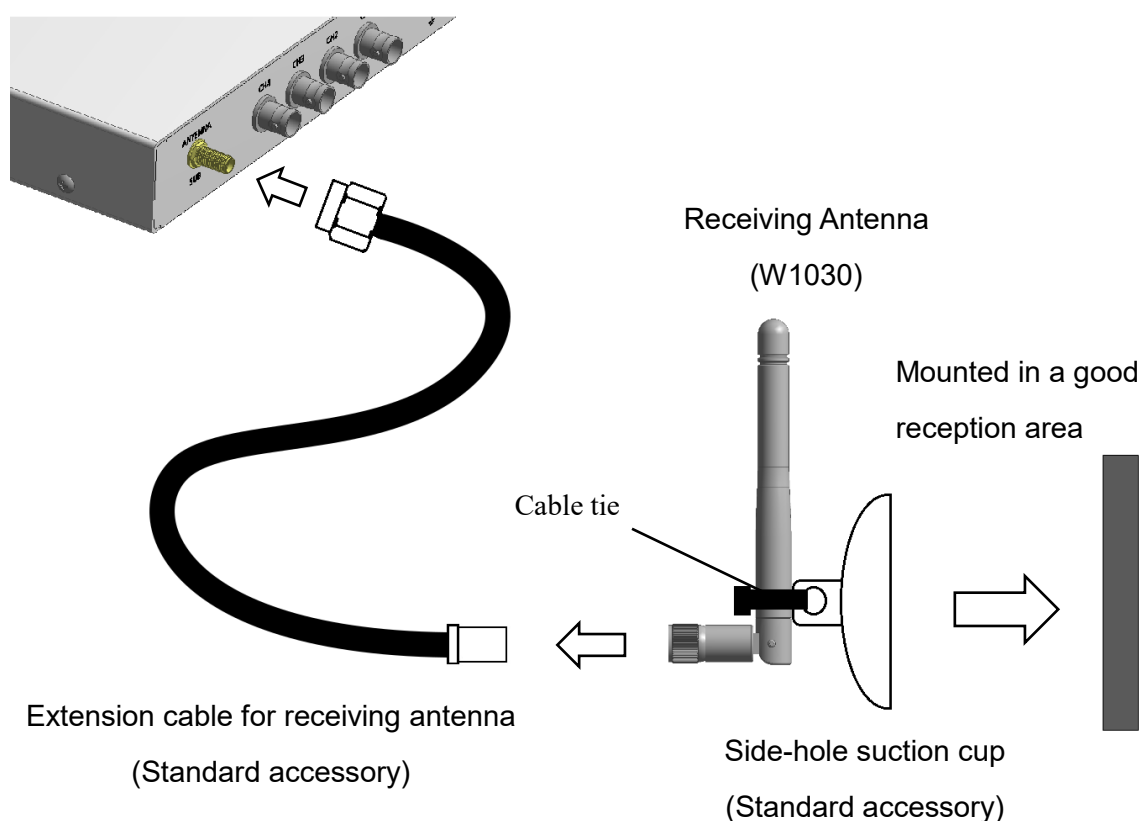


7-5. Using the extension cable for the receiving antenna

The receiving antenna can be set up away from the receiver by using the extension cable (Standard accessory).

Setting up the receiving antenna in a different location can be effective in poor reception areas, as when there are restrictions on where the receiver can be installed or when it would be difficult to install the transmitting and receiving antennas within sight of each other.

The receiving antenna can be mounted by using the side-hole suction cup and the cable tie (Standard accessory). When setting up the antenna, use a location that provides enough suction for the suction cup.



When using an extension cable for receiving antenna, note "RSSI."

A long cable will cause the "RSSI" to be weaker. When setting up the equipment, watch the RSSI on the "RSSI" LEDs.

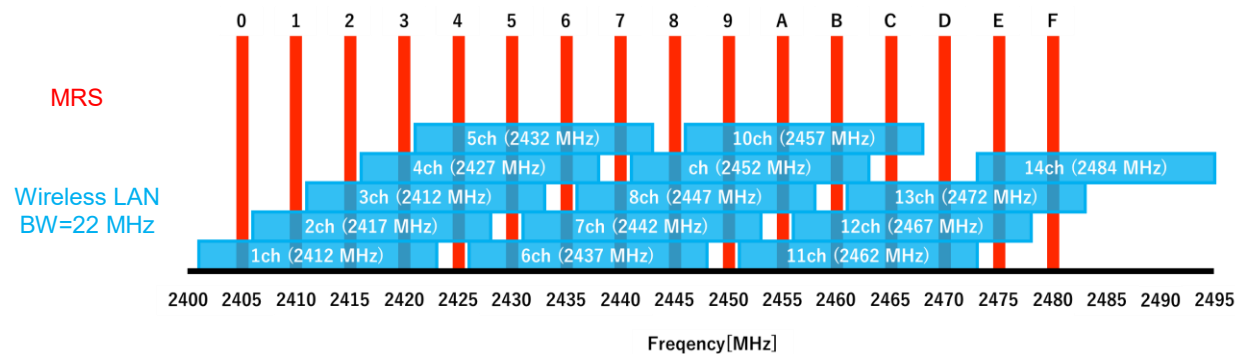
7-6. Radio interference

This product uses the 2.4 GHz band radio frequency.

If there are multiple other wireless systems, such as those using wireless LAN or Bluetooth®, or radio equipment on the 2.4 GHz band in the same environment, the other radio equipment may cause radio jamming and result in communication becoming unstable.

The following figure shows the frequency channels and radio frequency used for communication by this product and typical radio systems on the 2.4 GHz band. (This product : MRS, wireless LAN, Bluetooth®).

Normal radio communication can be interrupted if the transmitting and receiving radio frequency used by your radio equipment and this product overlaps. Switching to a frequency channel that will not affect the transmission or reception of the product may improve communication. Note that the telemeter is sensitive to wireless LAN communication.

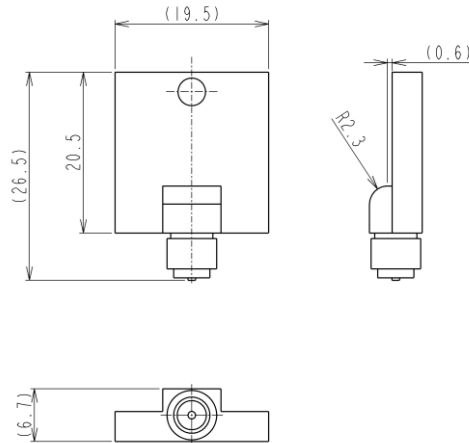


7-7. Optional Accessories

The following antenna related optional accessories are available for this product.

Small planar antenna (EXT-ANT1)

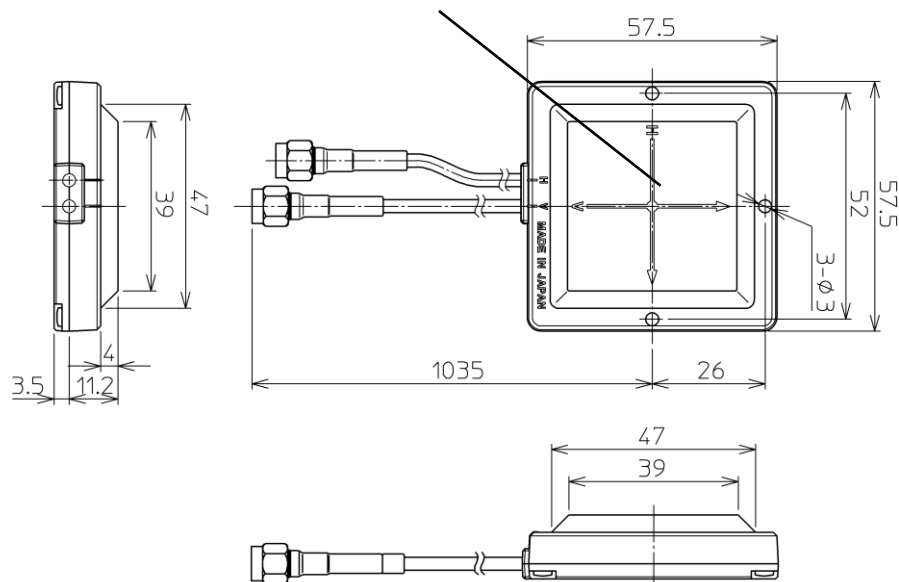
This is effective when the receiving antenna must be installed in a narrow space.



Planar diversity antenna (EXT-ANT2)

This single antenna has two orthogonal polarizations—vertical polarization (V-pol.) and horizontal polarization (H-pol.)—that enable reception even if the polarization changes.

Planes of polarized waves in two directions



- Connected to "MAIN" and "SUB" on the receiver, respectively.
- Can be connected to the antenna extension cable.

Extension cable for receiving antenna (6 m) (E-03)

The extension cable can provide an even longer extension for the receiver's receiving antenna.

The external diameter of the cable is 2.7 mm, which is the same as that of the included extension cable for the receiving antenna (2 m).



NOTE

E-03 cannot be used in Europe.

8. APPENDIX

8-1. Transmitter power supply

8-1-1. Transmitter recommended battery

Specification values for continuous operating time for the transmitter using the recommended power supply are shown in the following table.

Table 8-1 Specifications values for continuous transmitter operating time with the recommended power supply (MRS-101B-S/SE)

Transmitter model name (Name)	MRS-101B-S, MRS-101A-SE		
Test conditions	Ambient temperature (23 °C ± 5 °C) Bridge resistance (120 ohm)		
Battery type	Lithium	Ni-MH	Alkaline
Manufacturer	Panasonic	Panasonic (eneloop®)	Panasonic (EVOLTA)
Battery model name	CR15H270 (CR2 x1)	BK-4MCC (AAA cell x2)	LR03EJ (AAA cell x2)
Continuous operating time	Approx. 28 hours	Approx. 24 hours	Approx. 34 hours

Table 8-2 Specifications values for continuous transmitter operating time with the recommended power supply (MRS-101B-V)

Transmitter model name (Name)	MRS-101B-V		
Test conditions	Ambient temperature (23 °C ± 5 °C)		
Battery type	Lithium	Ni-MH	Alkaline
Manufacturer	Panasonic	Panasonic (eneloop®)	Panasonic (EVOLTA)
Battery model name	CR15H270 (CR2 x1)	BK-4MCC (AAA cell x2)	LR03EJ (AAA cell x2)
Continuous operating time	Approx. 38 hours	Approx. 33 hours	Approx. 49 hours

Table 8-3 Specifications values for continuous transmitter operating time with the recommended power supply (MRS-101B-T)

Transmitter model name (Name)	MRS-101B-T		
Test conditions	Ambient temperature (23 °C ± 5 °C)		
Battery type	Lithium	Ni-MH	Alkaline
Manufacturer	Panasonic	Panasonic (eneloop®)	Panasonic (EVOLTA)
Battery model name	CR15H270 (CR2 x1)	BK-4MCC (AAA cell x2)	LR03EJ (AAA cell x2)
Continuous operating time	Approx. 33 hours	Approx. 30 hours	Approx. 45 hours

Table 8-4 Specifications values for continuous transmitter operating time with the recommended power supply (MRS-104A-S)

Transmitter model name (Name)	MRS-104A-S		
Test conditions	Ambient temperature (23 °C ± 5 °C) Bridge resistance (120 ohm)		
Battery type	Lithium	Ni-MH	Alkaline
Manufacturer	Panasonic	Panasonic (eneloop®)	Panasonic (EVOLTA)
Battery model name	CR15H270 (CR2 x1)	BK-4MCC (AAA cell x2)	LR03EJ (AAA cell x2)
Continuous operating time	Approx. 12 hours	Approx. 10 hours	Approx. 13 hours



NOTE

- As shown in the previous diagram, ambient temperature has a significant impact on how the lighting status of the LEDs corresponds to the transmitter's remaining operating time.
- Even if the batteries are from the same manufacturing lot, the relationship between battery voltage and the continuous operating time of the transmitter (indicated by the curved lines in the chart) may vary depending on the following:
 - Under varying bridge resistance values, which represent load (a factor that makes values differ greatly)
 - Variation of battery manufacturing lots
 - Battery storage period and conditions

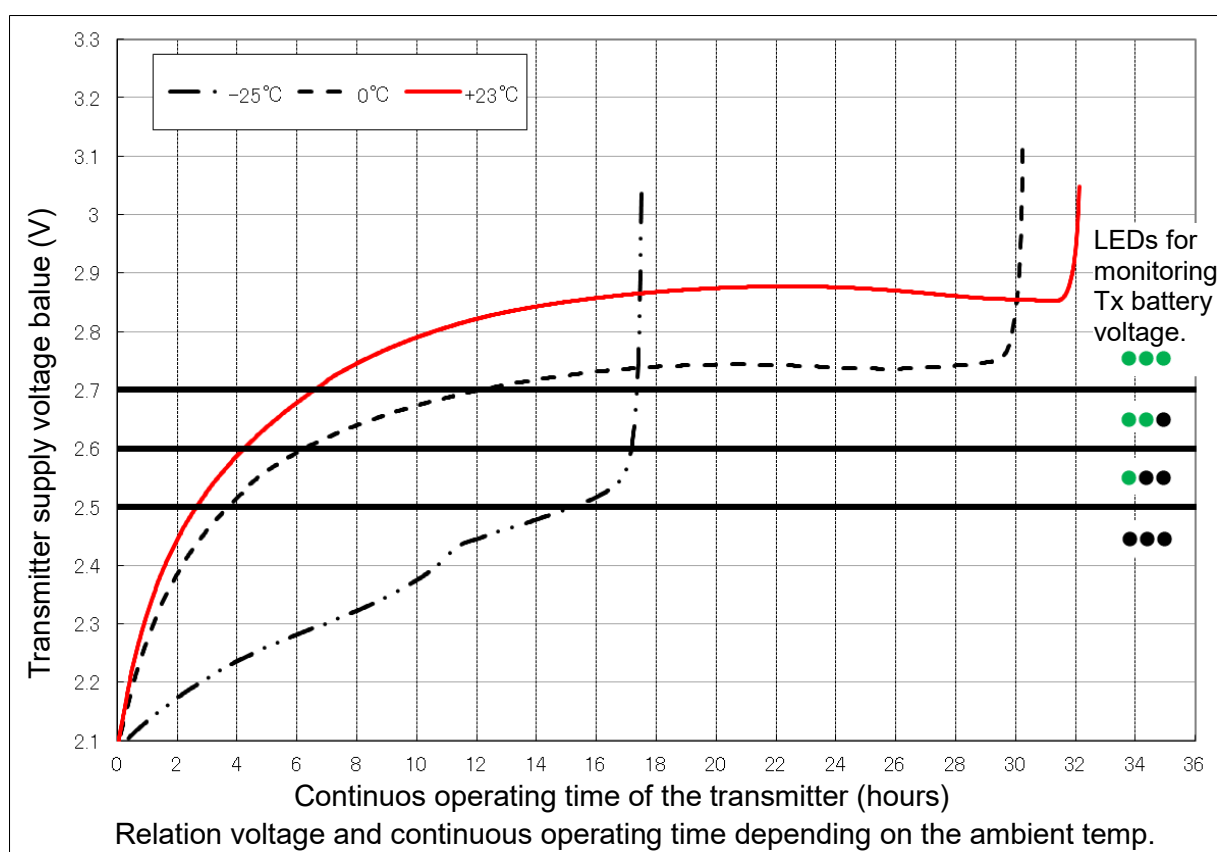
Considering these two points, the information on how the lighting status of the LEDs corresponds to the transmitter's remaining operating time should be viewed as reference data for the sake of estimates.

8-1-3. Estimated operating time of the battery (MRS-101B-S / MRS-101A-SE)

(1). If Lithium (CR2 x1) are used

Transmitter model name	MRS-101B-S MRS-101A-SE
Bridge resistance	120 ohm
Battery type	Lithium
Manufacturer	Panasonic
Battery model name	CR15H270
Number of batteries	CR2 x1

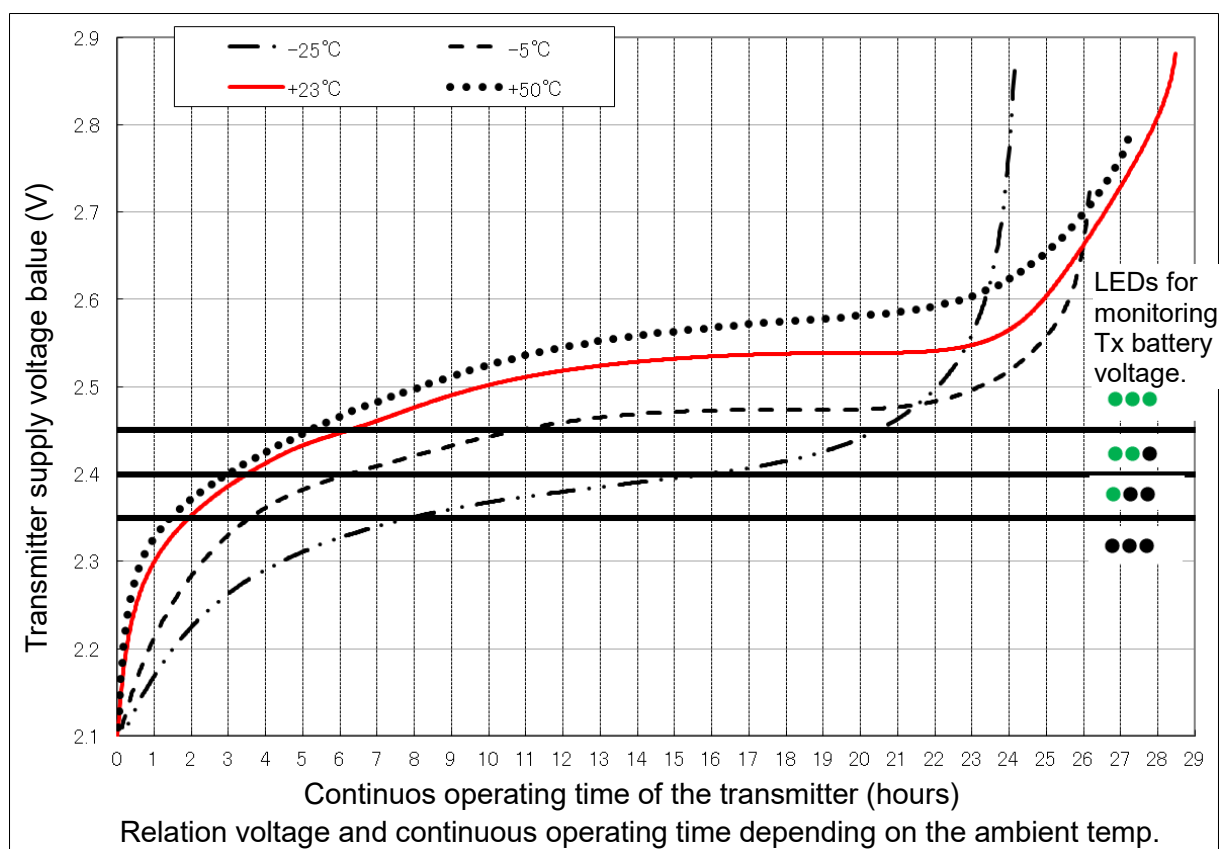
Voltage level settings to light up		Remaining etimated operating time (ambient temperature at +23°C)
Lighting status of LEDs	Voltage setting value	
	2.70 V	Approx.6.6 hours
	2.60 V	Approx.4.2 hours
	2.50 V	Approx.2.6 hours



(2). If Ni-MH (AAA cell x2) are used

Transmitter model name	MRS-101B-S MRS-101A-SE
Bridge resistance	120 ohm
Battery type	Ni-MH
Battery product name	eneloop®
Manufacturer	Panasonic
Battery model name	BK-4MCC
Number of batteries	AAA Cell x1

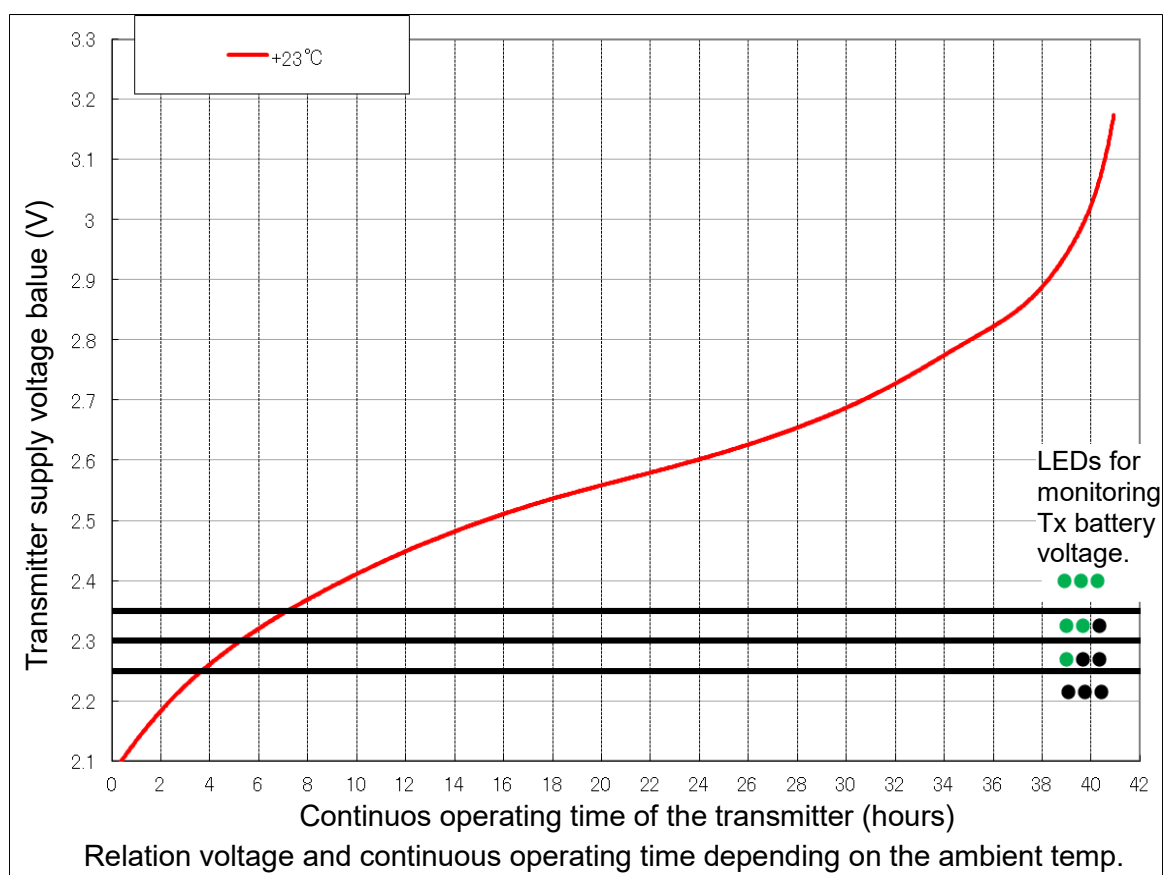
Voltage level settings to light up		Remaining etimated operating time (ambient temperature at +23°C)
Lighting status of LEDs	Voltage setting value	
	2.50 V	Approx.6.2 hours
	2.40 V	Approx.3.4 hours
	2.30 V	Approx.2.0 hours



(3). If alkaline (AAA cell x2) are used

Transmitter model name	MRS-101B-S MRS-101A-SE
Bridge resistance	120 ohm
Battery type	Alkaline
Battery product name	EVOLTA
Manufacturer	Panasonic
Battery model name	LR03EJ
Number of batteries	AAA Cell x1

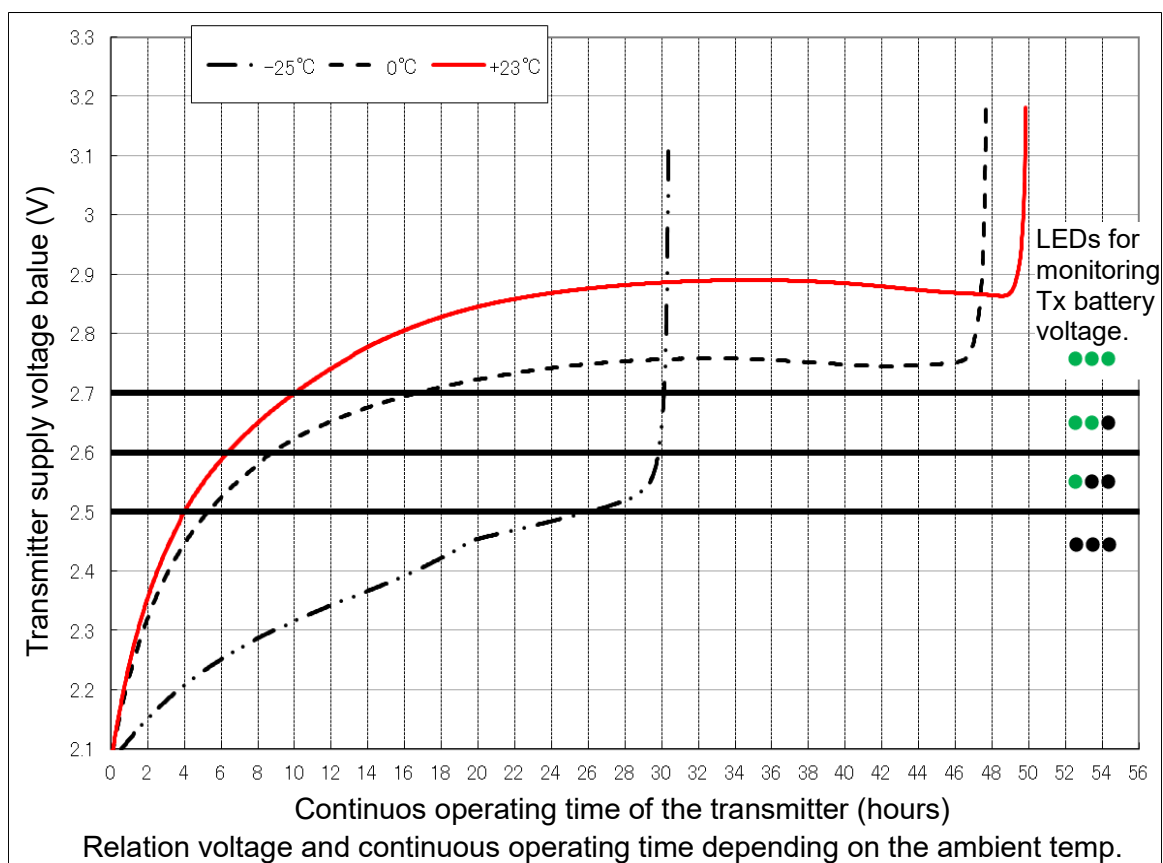
Voltage level settings to light up		Remaining etimated operating time (ambient temperature at +23°C)
Lighting status of LEDs	Voltage setting value	
	2.50 V	Approx.7.1 hours
	2.40 V	Approx.5.2 hours
	2.30 V	Approx.3.6 hours



8-1-4. Estimated operating time of the battery (MRS-101B-V)

(1). If Lithium (CR2 x1) are used

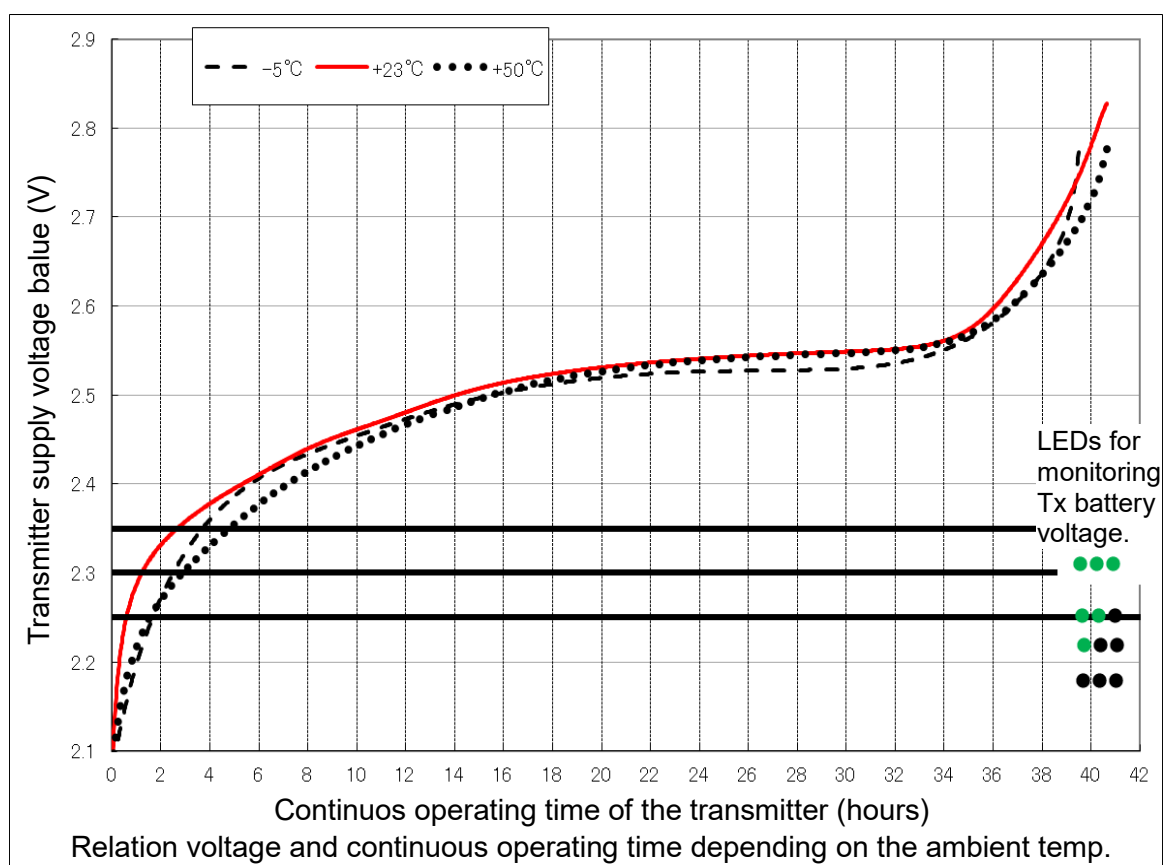
Transmitter model name	MRS-101B-V	Voltage level settings to light up		Remaining etimated operating time (ambient temperature at +23°C)
Battery type	Lithium	Lighting status of LEDs	Voltage setting value	
Manufacturer	Panasonic		2.70 V	Approx.10.0 hours
Battery model name	CR15H270		2.60 V	Approx.6.4 hours
Number of batteries	CR2 x1		2.50 V	Approx.4.0 hours



(2). If Ni-MH (AAA cell x2) are used

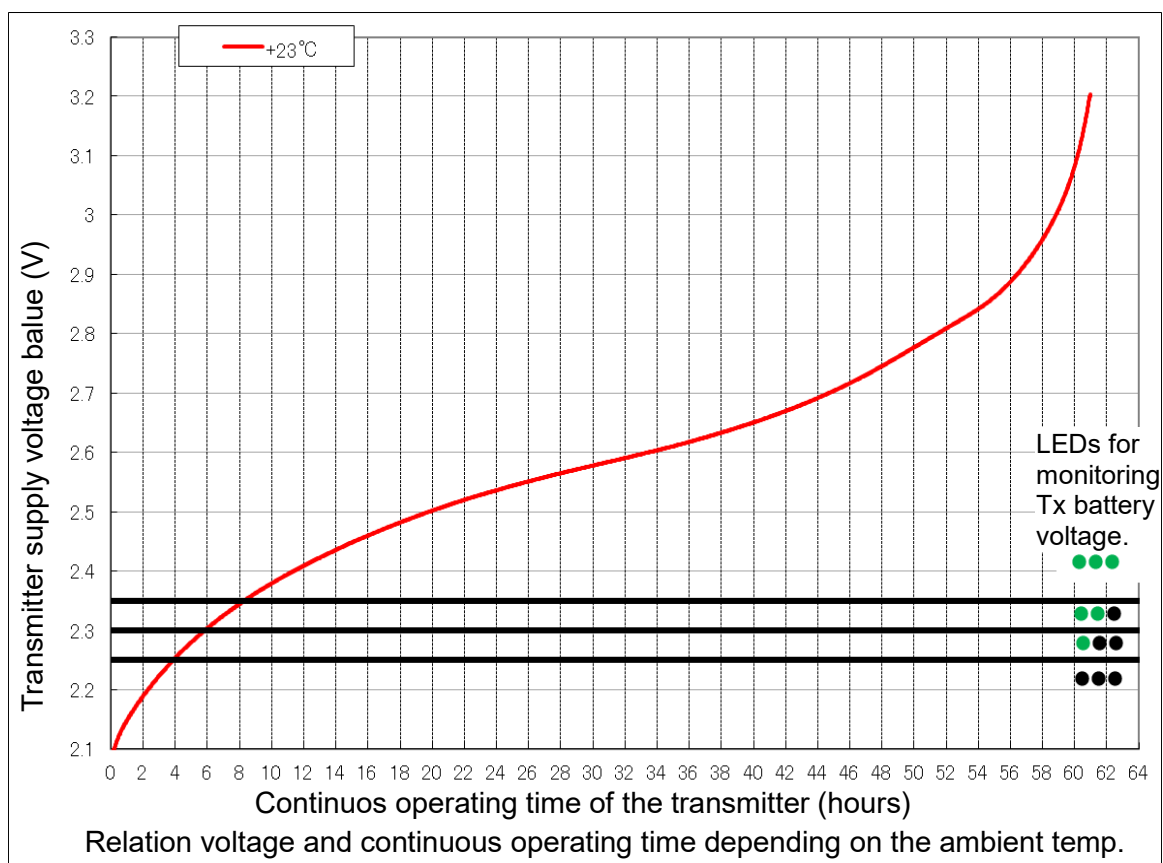
Transmitter model name	MRS-101B-V
Battery type	Ni-MH
Battery product name	eneloop®
Manufacturer	Panasonic
Battery model name	BK-4MCC
Number of batteries	AAA Cell x1

Voltage level settings to light up		Remaining etimated operating time (ambient temperature at +23°C)
Lighting status of LEDs	Voltage setting value	
	2.35 V	Approx.2.7 hours
	2.30 V	Approx.1.2 hours
	2.25 V	Approx.0.6 hours



(3). If alkaline (AAA cell x2) are used

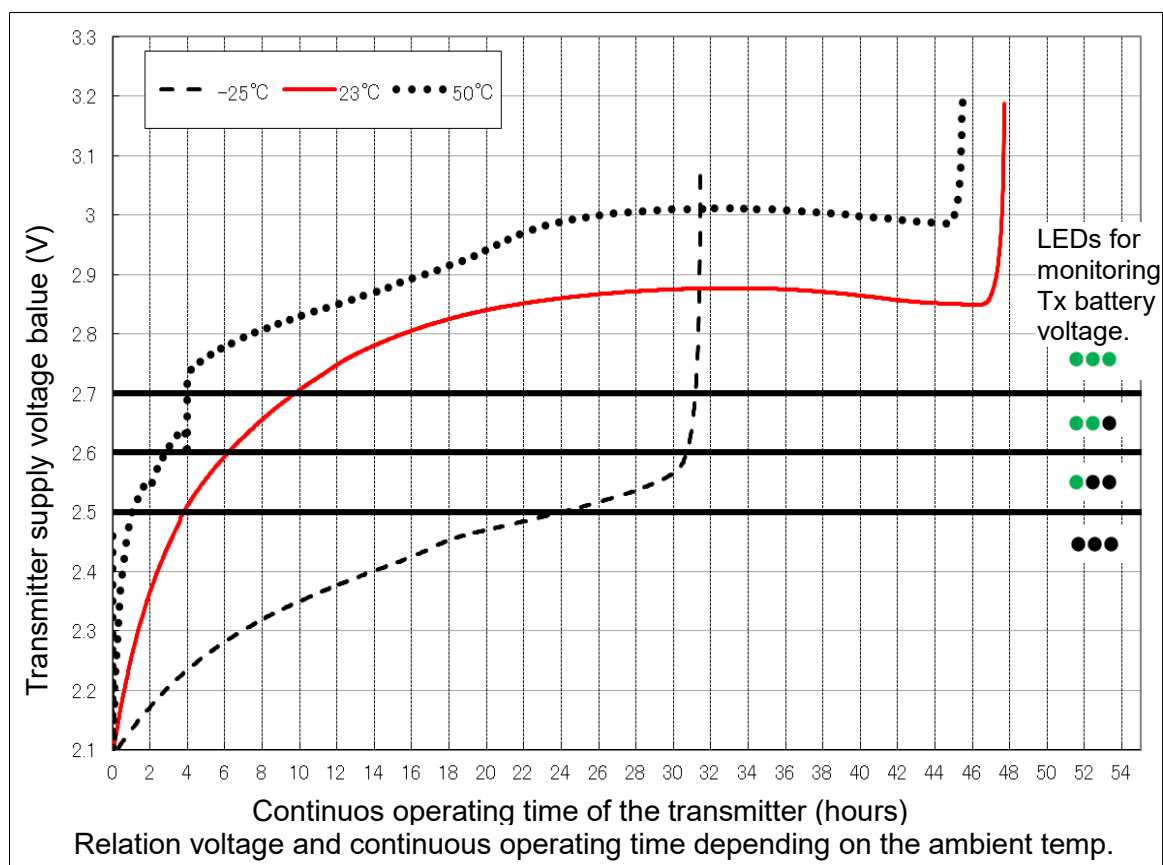
Transmitter model name	MRS-101B-V			
Battery type	Alkaline			
Battery product name	EVOLTA			
Manufacturer	Panasonic			
Battery model name	LR03EJ			
Number of batteries	AAA Cell x1			
		Voltage level settings to light up		Remaining etimated operating time (ambient temperature at +23°C)
		Lighting status of LEDs	Voltage setting value	
			2.35 V	
			2.30 V	Approx.5.9 hours
			2.25 V	Approx.3.9 hours



8-1-5. Estimated operating time of the battery (MRS-101B-T)

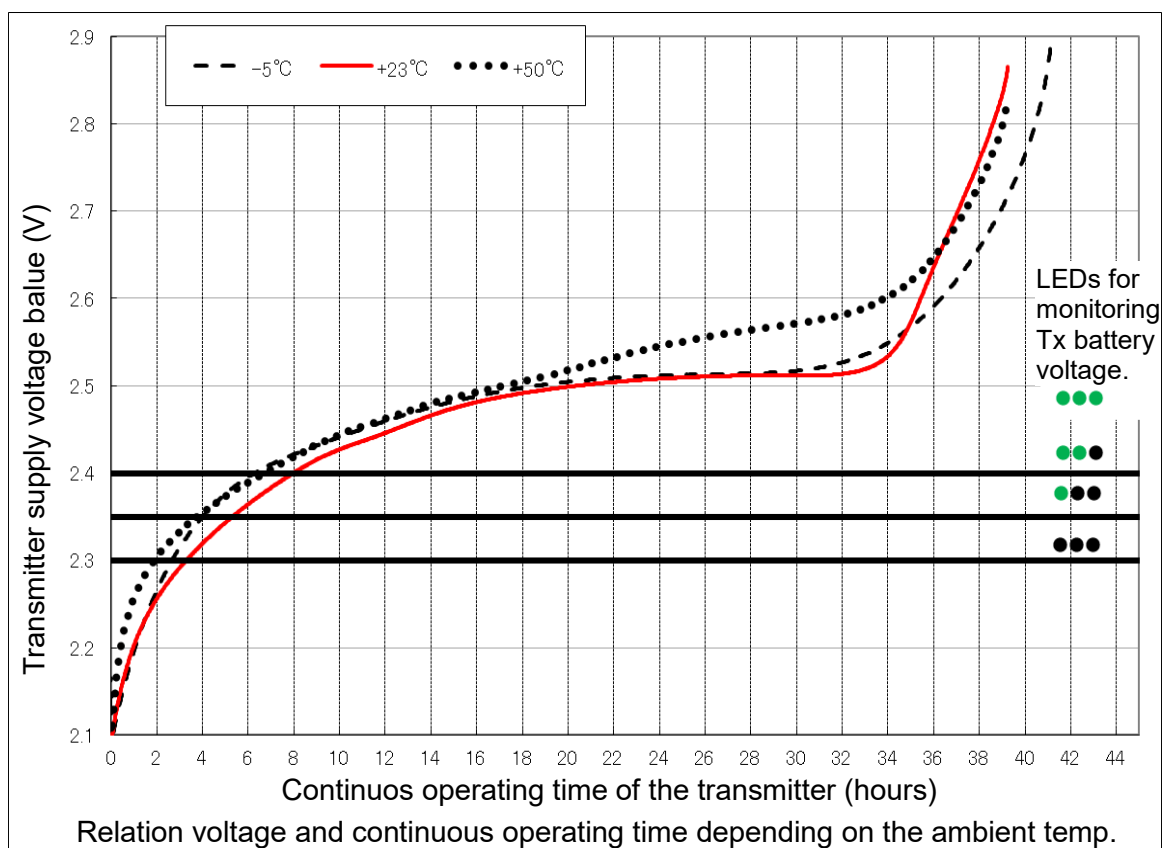
(1). If Lithium (CR2 x1) are used

Transmitter model name	MRS-101B-T	Voltage level settings to light up		Remaining etimated operating time (ambient temperature at +23°C)
Battery type	Lithium	Lighting status of LEDs	Voltage setting value	
Manufacturer	Panasonic		2.70 V	Approx.9.7 hours
Battery model name	CR15H270		2.60 V	Approx.6.2 hours
Number of batteries	CR2 x1		2.50 V	Approx.3.8 hours



(2). If Ni-MH (AAA cell x2) are used

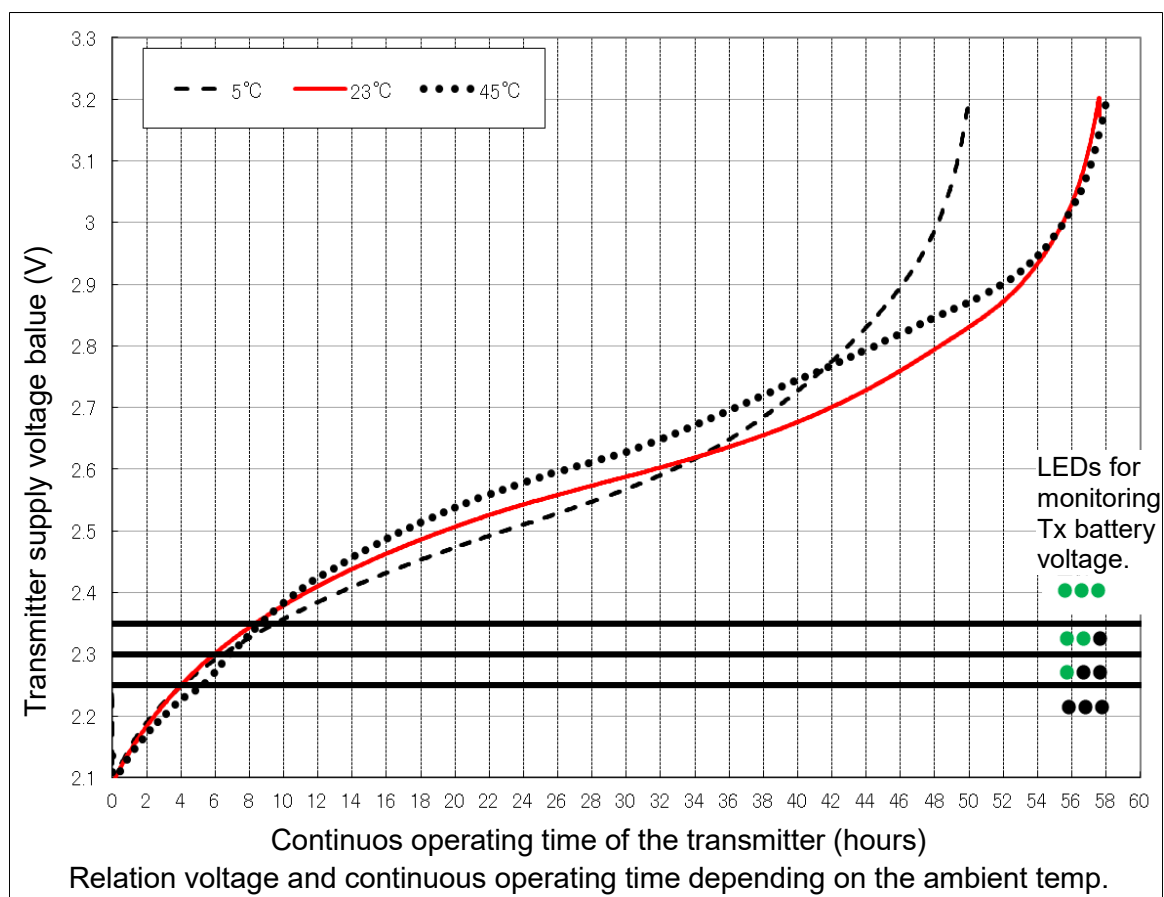
Transmitter model name	MRS-101B-T	Voltage level settings to light up		Remaining etimated operating time (ambient temperature at +23°C)
Battery type	Ni-MH	Lighting status of LEDs	Voltage setting value	
Battery product name	eneloop®		2.35 V	Approx.5.3 hours
Manufacturer	Panasonic		2.30 V	Approx.3.3 hours
Battery model name	BK-4MCC		2.25 V	Approx.1.9 hours
Number of batteries	AAA Cell x1			



(3). If alkaline (AAA cell x2) are used

Transmitter model name	MRS-101B-T
Battery type	Alkaline
Battery product name	EVOLTA
Manufacturer	Panasonic
Battery model name	LR03EJ
Number of batteries	AAA Cell x1

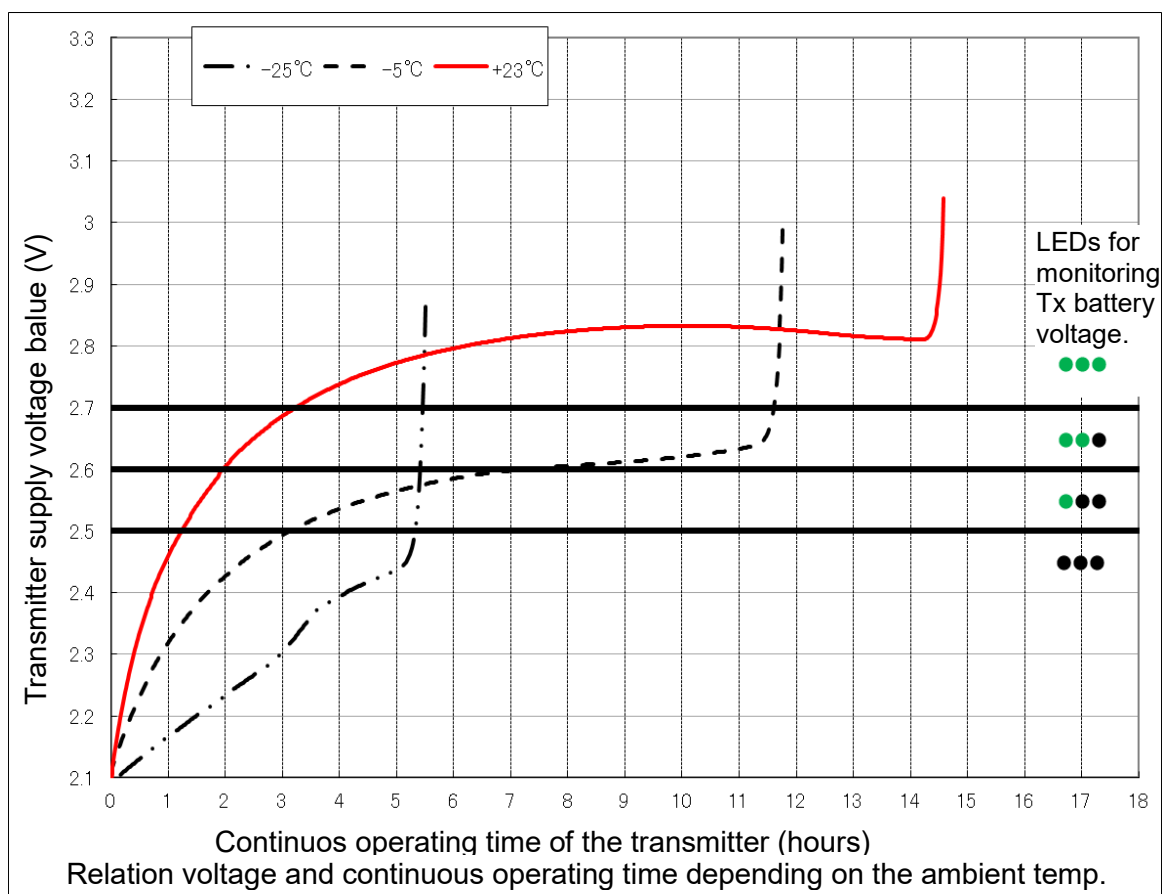
Voltage level settings to light up		Remaining etimated operating time (ambient temperature at +23°C)
Lighting status of LEDs	Voltage setting value	
	2.35 V	Approx.8.3 hours
	2.30 V	Approx.5.9 hours
	2.25 V	Approx.4.0 hours



8-1-6. Estimated operating time of the battery (MRS-104A-S)

(1). If Lithium (CR2 x1) are used

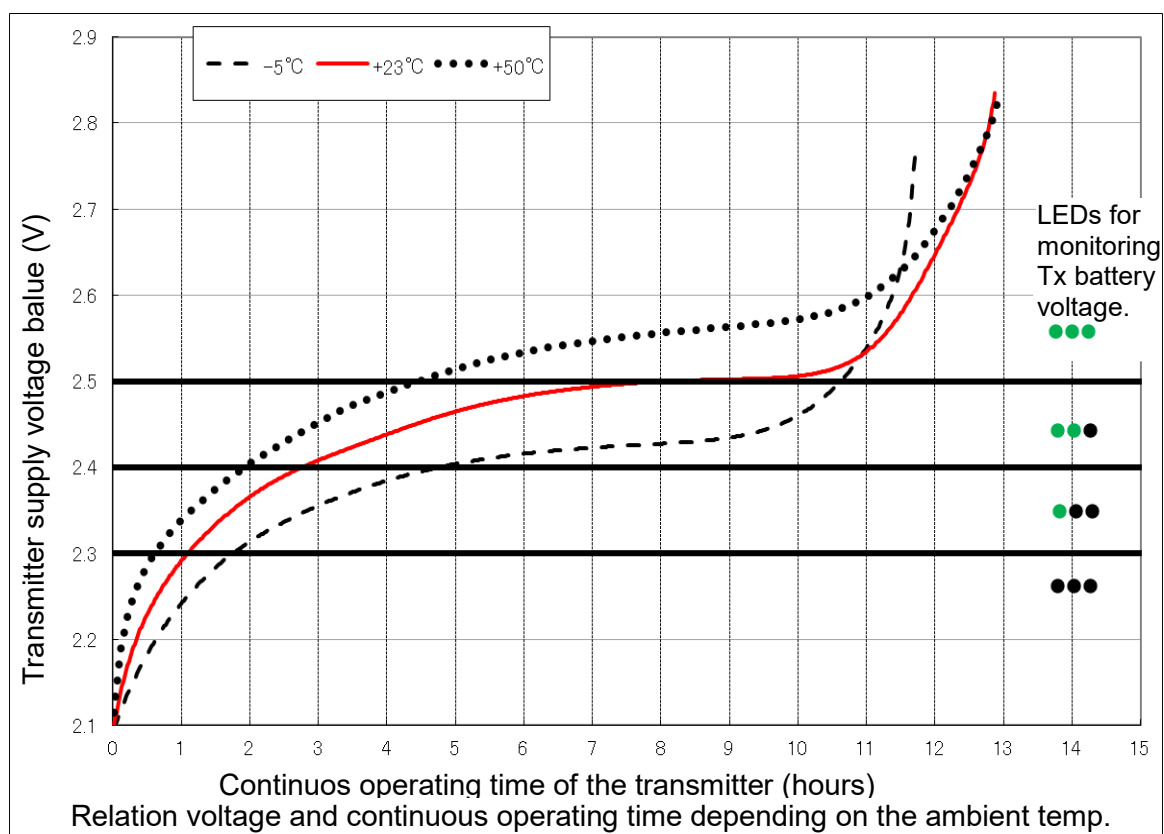
Transmitter model name	MRS-104A-S			
Bridge resistance	120 ohm			
Battery type	Lithium			
Manufacturer	Panasonic			
Battery model name	CR15H270			
Number of batteries	CR2 x1			
		Voltage level settings to light up		Remaining etimated operating time (ambient temperature at +23°C)
		Lighting status of LEDs	Voltage setting value	
			2.70 V	
			2.60 V	Approx. 1.9 hours
			2.50 V	Approx. 1.2 hours



(2). If Ni-MH (AAA cell x2) are used

Transmitter model name	MRS-104A-S
Bridge resistance	120 ohm
Battery type	Ni-MH
Battery product name	eneloop®
Manufacturer	Panasonic
Battery model name	BK-4MCC
Number of batteries	AAA Cell x1

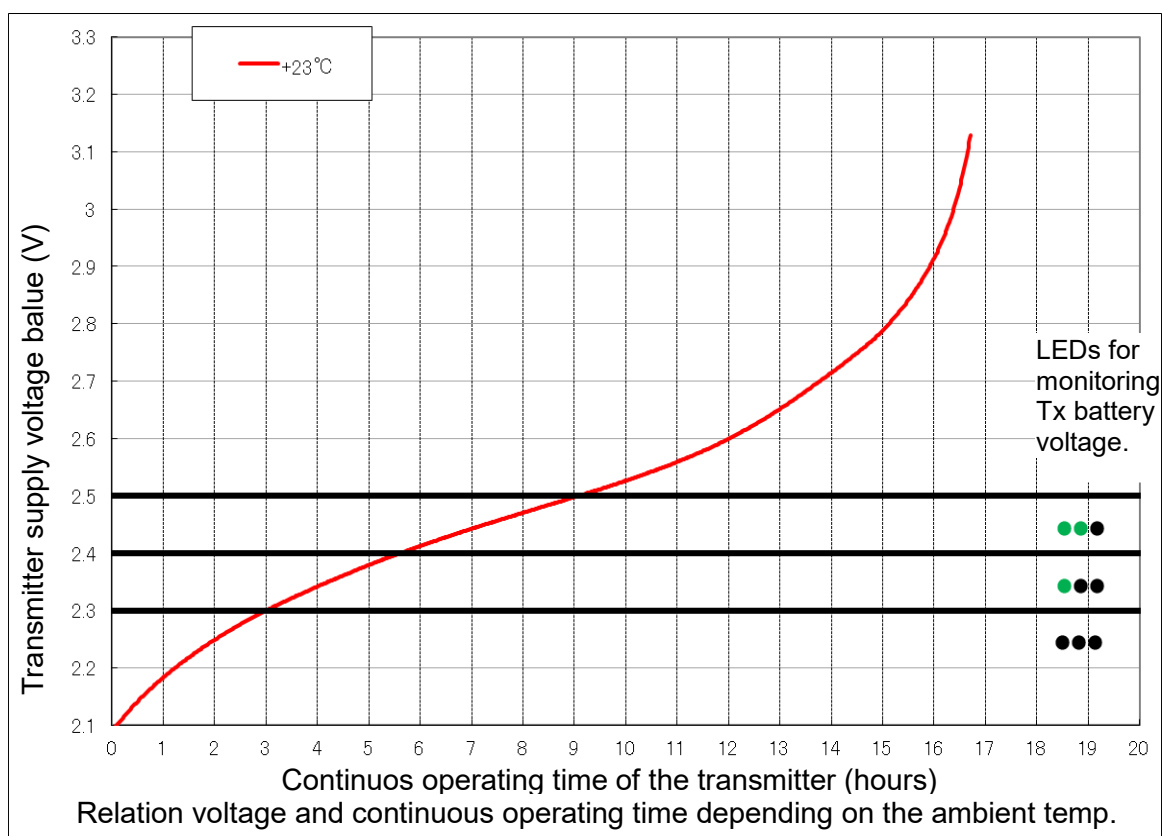
Voltage level settings to light up		Remaining etimated operating time (ambient temperature at +23°C)
Lighting status of LEDs	Voltage setting value	
	2.50 V	Approx.8.1 hours
	2.40 V	Approx.2.7 hours
	2.30 V	Approx.1.1 hours



(3). If alkaline (AAA cell x2) are used

Transmitter model name	MRS-104A-S
Bridge resistance	120 ohm
Battery type	Alkaline
Battery product name	EVOLTA
Manufacturer	Panasonic
Battery model name	LR03EJ
Number of batteries	AAA Cell x1

Voltage level settings to light up		Remaining etimated operating time (ambient temperature at +23°C)
Lighting status of LEDs	Voltage setting value	
	2.50 V	Approx.9.0 hours
	2.40 V	Approx.5.6 hours
	2.30 V	Approx.3.0 hours



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