ZETABOX-420MA

TZS9011S-00

Instruction Manual

Version 1.3

Toppan Printing Co., Ltd.

Update history

Update date	Type	Contents	Version
2022/9/22	First edition	-	1.0
2022/10/24	Revision	Updated Section 3.1 System configuration diagram.	1.1
2022/12/27	Revision	5.5.4 Battery voltage notification error corrected Chapter 4.4 Antenna Installation Added	1.2
2023/4/27	Revision	Unification of model number names (TZS9011S→TZS9011S-00)	1.3

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Disclaimer

1. The contents of this manual are subject to change without prior notice due to changes in the specifications of the product or service.

2. We may not be able to respond to inquiries from customers other than those who purchased this product regarding the instruction manual of this product. If you have any questions about this manual, please contact Toppan Printing Co., Ltd.

3. We shall not be liable for any damage (including damage due to data corruption, interruption of business operations, loss of business information, etc., or the possibility of a claim for compensation from a third party) caused by the use of the Product or the inability to use the Product, unless exemption is not permitted by the provisions of law.

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1. Overview

ZETABOX™ (ZETABOX-420MA) is a wireless communication terminal that can notify the cloud server of readings via ZETA communication by connecting a sensor device with a typical 4-20mA power. By connecting wirelessly, periodic data collection can be performed automatically, and data can be collected at a higher frequency than in the past.

1.1. Features

- 3-wire 4-20mA IF 3 system
- Dry contact input 1 system
- Battery powered
- Low power consumption
- For outdoor use (for main unit IP67)
- ZETA communication (ZETA-S security-compatible)

1.2. Example of application

- Factory environmental solutions
- Smart office solutions
- Building maintenance solutions

2. Caution

2.1. Before using this product

- Before using this product, please read "Safety Precautions" in this manual.
- Please note that we shall not be liable for any damage caused by the use of the Product or the inability to use the Product.
  When exporting this product or a product incorporating this product, please confirm the regulations such as the "Foreign Exchange and Foreign Trade Law" and take the necessary procedures.

2.2. Safety Precautions

Before using the product, be sure to read the "Safety Precautions" to ensure correct use. It is essential that these precautions be observed to prevent injury to the user and third parties as well as damage to property.

⚠ Precautions	This mark indicates content that may result in personal injury or property damage if handled incorrectly.

⚠ Precautions	・ Do not disassemble or modify the product. ・ Do not insert metal or other foreign objects into the product. Doing so may cause an accident, fire or electric shock. ・ If you notice any abnormalities such as heat generation or unusual odor, stop using the product and do not use it while it is damaged. ・ This device uses CR batteries. Never attempt to charge this battery. When the battery is charged, the electrolyte inside the battery is heated, and the internal pressure rises due to the generation of gas, which may cause the battery to leak, overheat, explode or ignite. ・ When disposing of this product, dispose of the batteries in the dedicated box. ・ Do not use, store, or leave the product in places subject to high temperatures, high humidity, or direct sunlight for long periods of time. ・ Do not subject the product to strong impact or vibration such as dropping. It can cause failure. ・ This product uses parts susceptible to static electricity. Handle with care. ・ Keep out of reach of children. ・ The waterproofness of the main body of this product complies with IP67, and the waterproofness of the terminal box complies with IP65. Be careful when opening and closing the cabinet.

2.3. Precautions during Use

This product is intended for general consumer use, do not use for applications that require high reliability and safety, such as automotive equipment, aerospace equipment, nuclear power control equipment, and life support medical equipment.

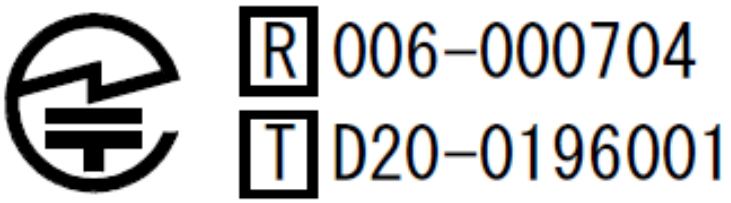
Please note that we shall not liable for any failures caused by using the product under conditions other than those described in this manual.

Please note that we are not liable for any problems related to intellectual property rights of third parties due to the use of this product.

This product is not designed to withstand radiation. Do not use under radiation stress.

- This product is not designed for use in a vibration environment.

  Do not use the product in an installation environment that is constantly exposed to vibration.
- Please note that this product may be affected by other wireless communication devices.
- Do not use the product near wireless devices, electromagnetic cookers, etc.
- This product is an electronic device that transmits radio waves. Do not use the product near medical equipment (including pacemakers, etc.) or inside an aircraft.
- This product is radio equipment that has received construction design certification when combined with a specific antenna and base station. A radio station license is not required when using this product.



3. Product Overview

3.1. System configuration

An example of a system using this product is shown below. By connecting ZETABOX to sensor equipment with a typical 4-20mA interface, it is possible to efficiently collect the data measured by the sensor equipment.

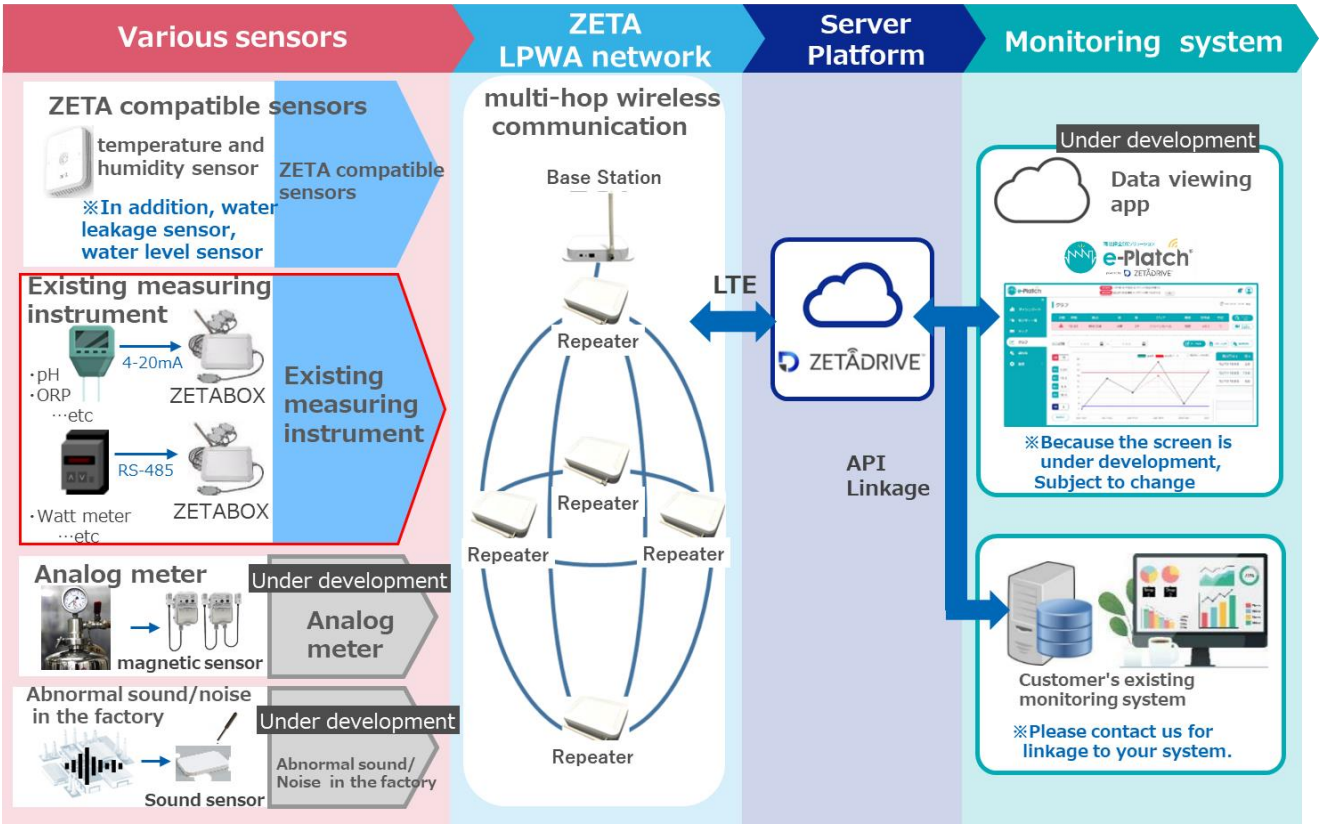
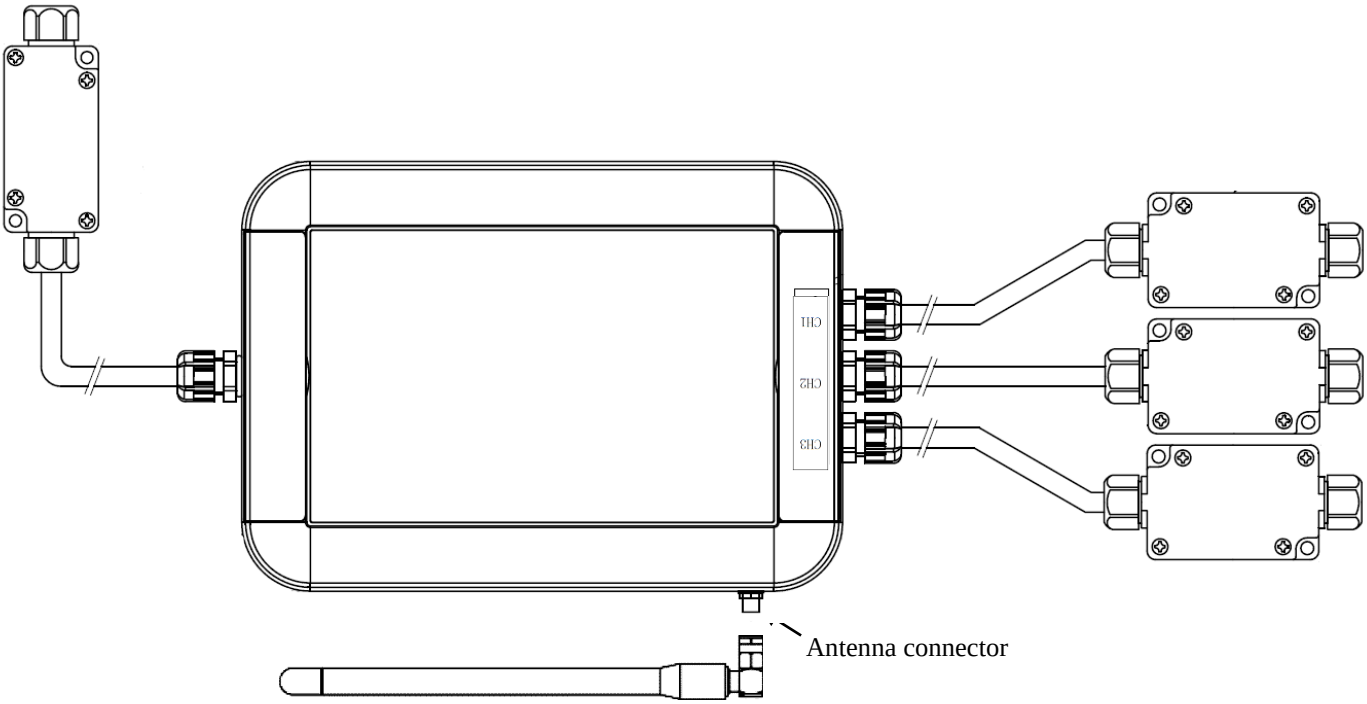


Fig. 1 System configuration example

3.2. Names of the parts

Fig. 2 shows the names of each part of the product.

(surface)



(Back)

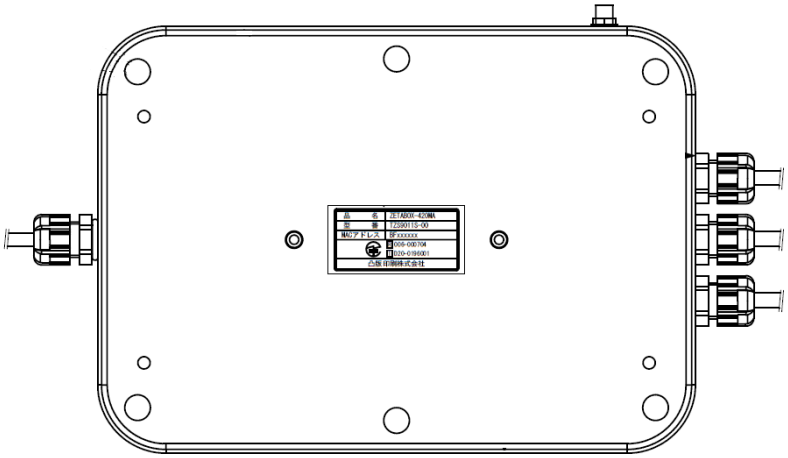


Figure 2 Part Names

3.3. External dimensions

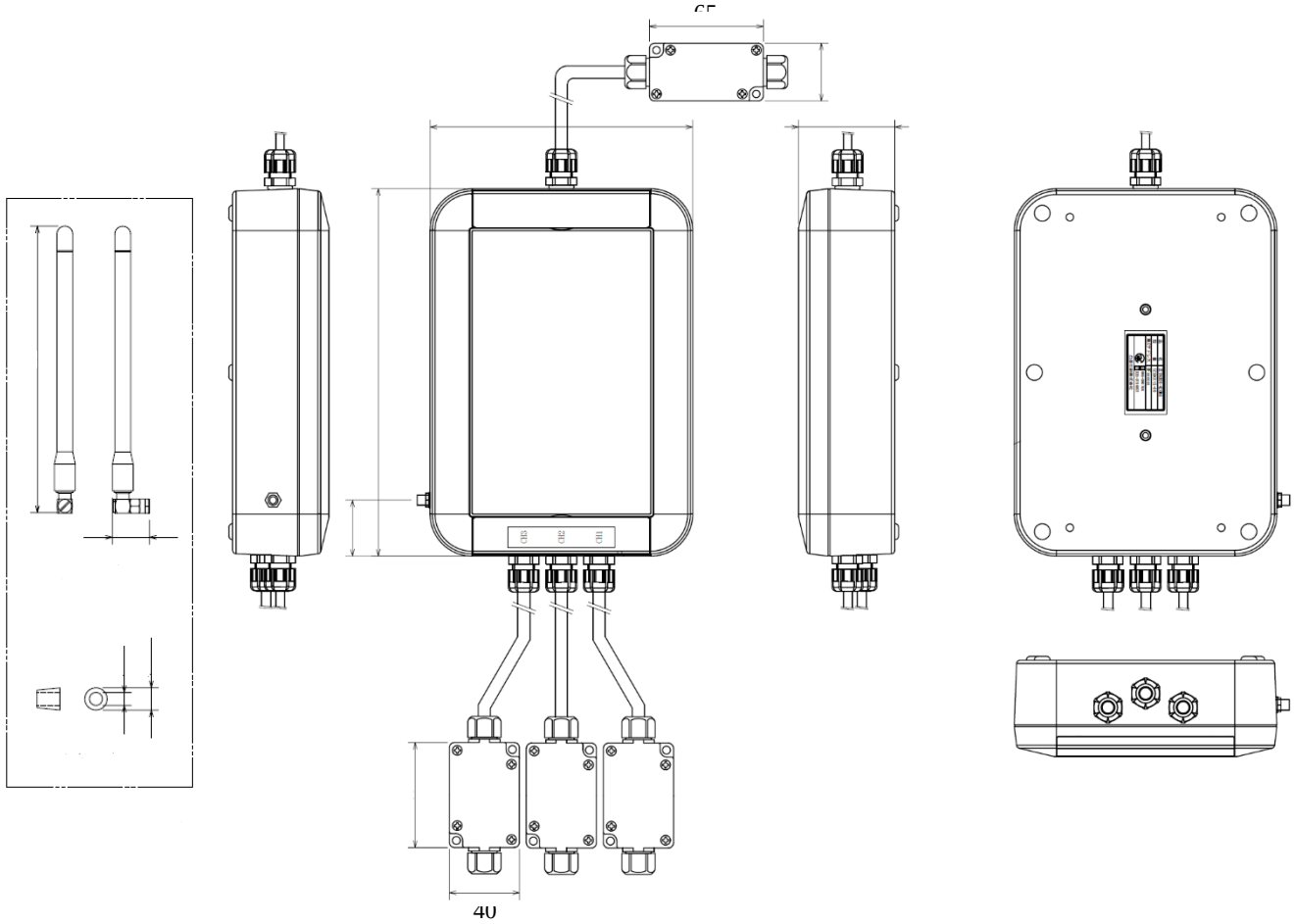


Fig. 3 Dimensions

3.4. Product label

Product labels are attached to the body of the product. This product has been certified to comply with technical regulations under the Telecommunications Business Law and has been certified to comply with technical regulations under the Radio Law.

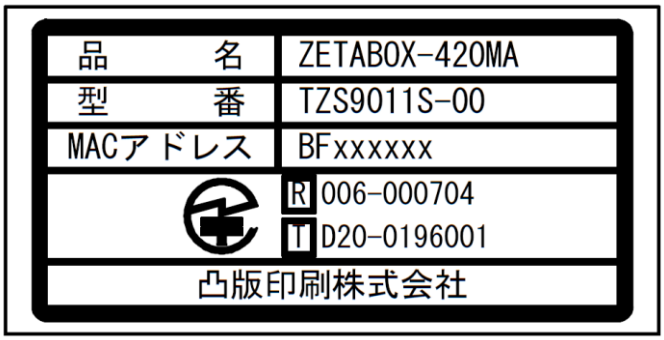


Figure 4 Product

4. Before use

4.1. Checking when unpacking

This product is shipped after appearance and electrical inspection. Check that there is no damage to the main unit, cables, or terminal box when unpacking. If there are any defects, please contact the inquiry center.

4.2. Accessories

Check the accessories (antenna, rubber bushing 4pcs and quick reference) when unpacking. If there are any deficiencies, please contact the inquiry center.

4.3. Terminal connection

4.3.1. 4-20mA terminal

Pin for 4-20mA. Three channels of 4-20mA signals can be input from CH1 to CH3. Fix the wire to the terminal block with a crimp terminal (R1.25-3). Screw tightly to maintain water resistance.

No	Wire color	Signal name
①	Green	N.C.
②	Black	GND
③	White	4-20mA
④	Red	+12V

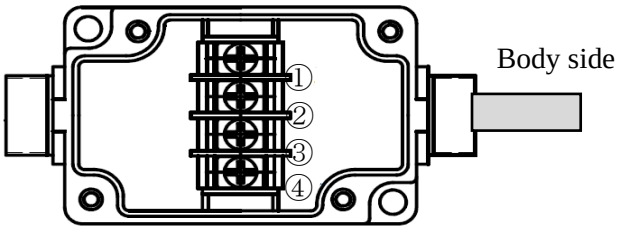


Fig. 5 4-20mA terminal box

4.3.2. Dry contact terminal

Dry contact terminal. Dry-contact input is 3.3V when open. Fix the wire to the terminal block with a crimp terminal (R1.25-3). Screw tightly to maintain water resistance.

No	Wire color	Signal name
①	Black	GND
②	-	N.C.
③	White	Dry contact input

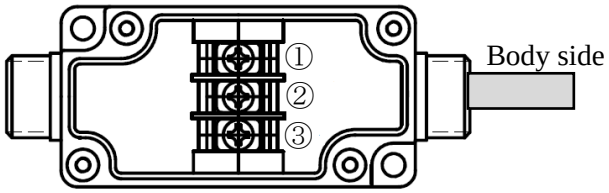


Fig. 6 Dry contact terminal box

4.3.3. Processing of unconnected terminal

"If you are not using 4-20mA, dry-contact terminals,

process as follows.

①On the printed circuit board to which the wiring is connected,

loosen the terminal block screws and remove the wiring.

②Loosen the nut of the cable gland and pull out the cable.

③Tighten the nut of the cable gland firmly.

Seal the cable gland hole with a sealing plug (Takachi SP-12, sold separately).

To maintain water resistance,

Pay attention when installing of cable glands and sealing plugs.

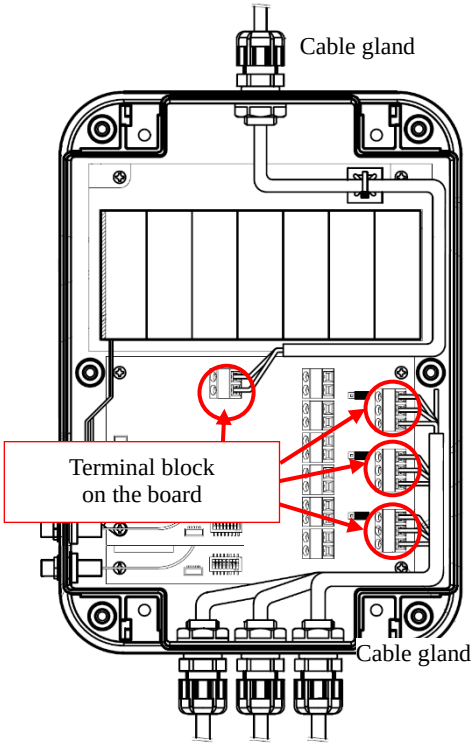


Figure 7 Terminal Block Positions on Board

4.4 Installing the Antenna

Attach the supplied antenna to the main unit antenna connector.

When installing, fix the direction of the main unit and use 0.9Nm torque wrench.

4.5 Connecting the battery connector

This product is shipped without connecting the battery connector. Remove the six screws from the back of the unit and insert ① the battery connector into ② the socket. After installing the battery connector, tighten the six screws on the back of the unit. Screw tightly to maintain water resistance.

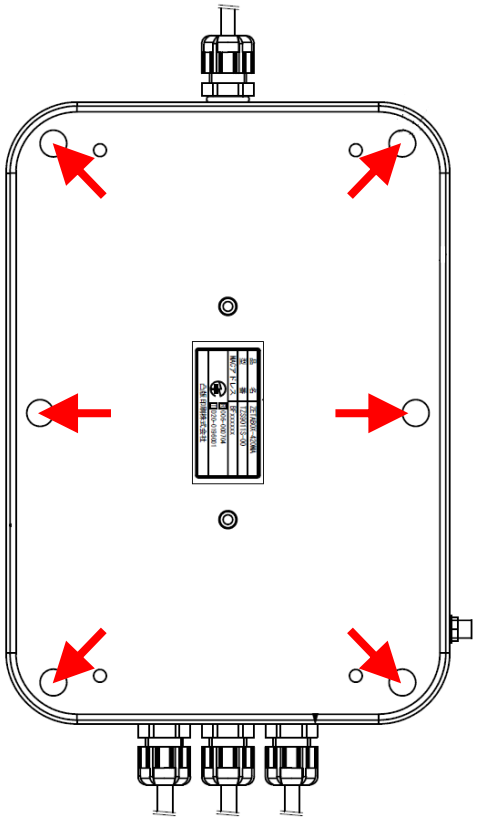


Fig. 8 Body screw fixing position

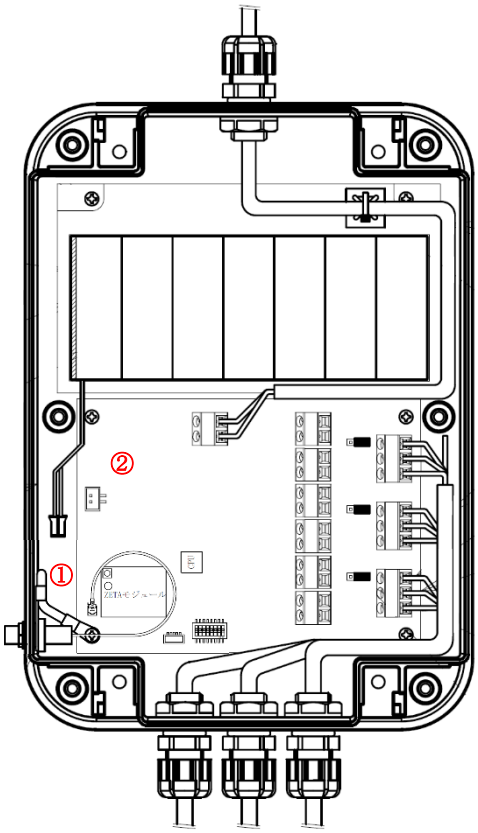
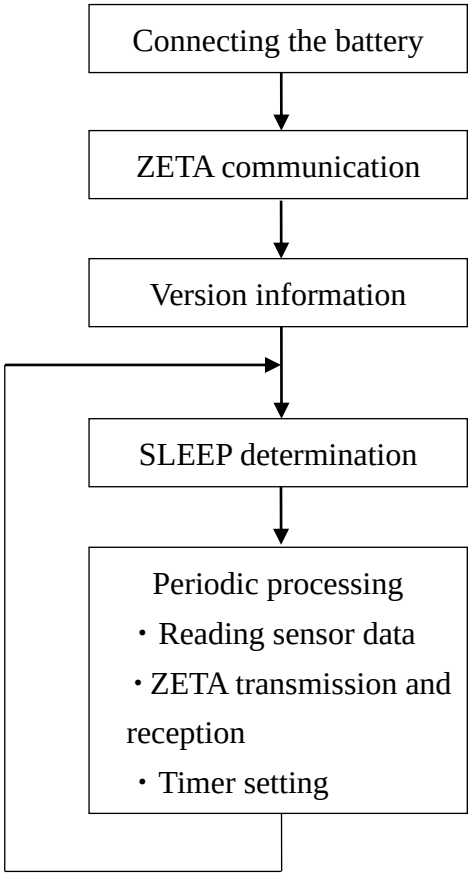


Figure 9 Battery Connector

5. Product Function

5.1 Operation after battery connection

This product starts communication with repeaters and base stations by connecting battery connectors. The operation flow is shown below.

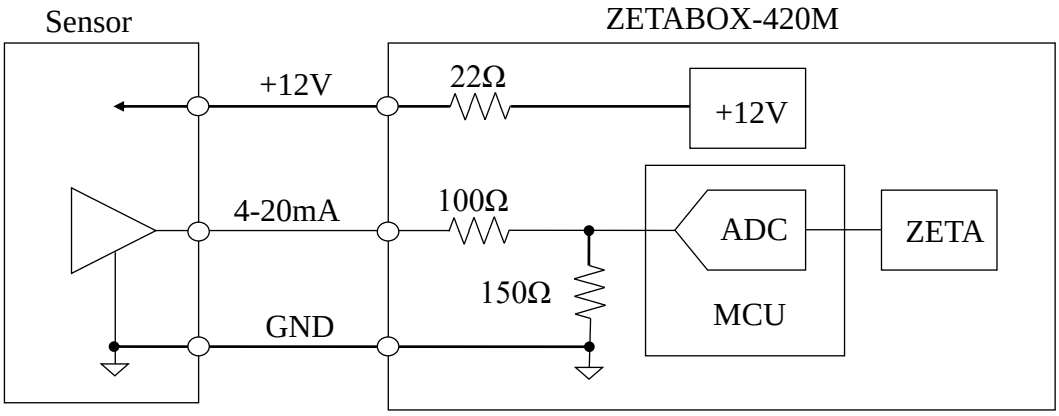


5.2 To convert 4-20mA

This equipment converts the input current of 4-20mA to a voltage with a load resistance of 150 ohms. The converted voltages are converted by AD converters and MCU and sent to ZETA server via ZETA-S communication uplinks. The formula for the output code is shown below.

Output code = Input current (mA) × Load resistance × 1000 = Input current (mA)×150×1000)

When the input current is 20mA, the output code is 0d3000=0x0BB8. If there is no current flow in 4-20mA terminal (input current <1mA, output code <0d150), 0xFFFF is notified to ZETA servers.



Graphic 10 4-20mA interface

5.3 Dry contact input

This product notifies the status of the dry contact together with the data of the sensor. The dry-contact terminal is 3.3V (H) when open. By short-circuiting the dry-contact terminal to GND (L) with a mechanical contact such as a relay or an open-collector, it can be used for detecting errors, etc.

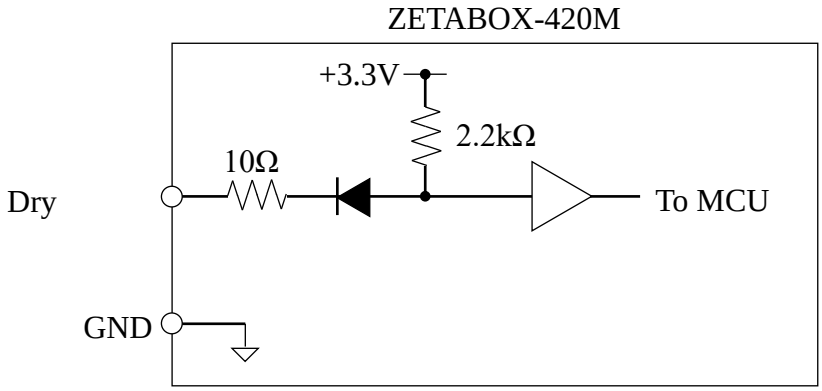


Fig. 11 Dry contact terminal

5.4 Downlink

This product executes commands by ZETA-S communication downlink (pass-through) from ZETA server.

5.4.1 System reset

Resets MCU of ZETABOX.

Name		Byte	Data
Preamble		1	0xFF
		1	0x00
Length		1	0x08
Type		1	0x30 (WakeupReason Downlink Data)
Payload	Type1	1	0xEE
	Type2	1	0x00
	Data	1	0x00
		1	0x00

5.4.2 Data transmission interval setting

Set the data transmission interval (in minutes). The sent data send interval setting is saved in the non-volatile memory of ZETABOX, and data send is performed at the set interval at the next power-on.

Name		Byte	Data
Preamble		1	0xFF
		1	0x00
Length		1	0x08
Type		1	0x30 (WakeupReason Downlink Data)
Payload	Type1	1	0x02
	Type2	1	0x00
	Data	2	1 to 65535 (min)

5.4.3 Battery voltage interrogation

Sends the current battery voltage.

Name		Byte	Data
Preamble		1	0xFF
		1	0x00
Length		1	0x07
Type		1	0x30 (WakeupReason Downlink Data)
Payload	Type1	1	0x03
	Type2	1	0x00
	Data	1	0x00

5.4.4 ZETA modular Downlink pass-through

Sends the commands that ZETA module in ZETABOX accepts to MCU. MCU sends this Downlink commandto ZETA module..

Name		Byte	Data
Preamble		1	0xFF
		1	0x00
Length		1	0x04 + nByte
Type		1	0x30 (WakeupReason Downlink Data)
Payload	Type1	1	0x04
	Type2	1	0x00
	Data	N	ZETA UART Frame (n = 4～48) Preamble Length Type Payload

5.4.5 Analog input sensor startup wait time setting

Sets the time from the sensor power-on to the start of measurement conversion. The transmitted analog input sensor start wait time setting is stored in the non-volatile memory, and the sensor waits for start at the set time interval at the next power-up.

Name		Byte	Data
Preamble		1	0xFF
		1	0x00
Length		1	0x08
Type		1	0x30 (WakeupReason Downlink Data)
Payload	Type1	1	0x07
	Type2	1	0x00
	Data	2	1 to 65535ms defaults: 250ms

5.4.6 Data retransmission request

Outputs 3Ch of the last transmitted 4-20mA again.

Name		Byte	Data
Preamble		1	0xFF
		1	0x00
Length		1	0x08
Type		1	0x30 (WakeupReason Downlink Data)
Payload	Type1	1	0xEF
	Type2	1	0x000000

5.5 Uplink

With ZETA-S communication uplink, this product can send the following data to ZETA server.

5.5.1 Version information

Transmission timing: After the battery connector is connected and ZETA communication with the access point is registered (1 minute).

At system reset, version information is not transmitted.

Name		Byte	Data
Preamble		1	0xFF
		1	0x00
Length		1	0x0C
Type		1	0x02 (Send Variable data)
Payload	Data	7	ZETABOX [0]:5A ('Z') [1]:45 ('E') [2]:54 ('T') [3]:41 ('A') [4]:42 ('B') [5]:58 ('X') [6]: xx (for testing)
		1	Version Upper 4bit:Major Update Lower 4bit:Minor Change (e.g.) Ver1.0→0x10 0x10 → 0b00010000 → "1.00"

5.5.2 4-20mA (3ch)

Transmission timing: After sending version information and the interval specified in "Data transmission interval setting"

Name		Byte	Data	
Preamble		1	0xFF	
		1	0x00	
Length		1	0x0B	
Type		1	0x02 (Send Variable data)	
Payload	Type1	1	0x01	
	Data	2	Ch1	Data output Input current x resistance x 1000 Error data (below lower limit 0d150):0xFFFF (※1)(※2)
		2	Ch2	
		2	Ch3	

※1 The input current of the sensor sets the data acquired immediately before the transmission timing.

※2 Data output value → Current value conversion formula

5.5.3 Dry contact status change notification

Transmission timing: When the state of the dry contact is changed (open→close, close→open)

Name		Byte	Data
Preamble		1	0xFF
		1	0x00
Length		1	0x06
Type		1	0x02 (Send Variable data)
Payload	Type1	1	0x0E
	Data	1	0x01: Contact ON, 0x00: Contact OFF

5.5.4 Battery voltage notification

Transmission timing: When "Battery voltage query" is received at downlink

Name		Byte	Data
Preamble		1	0xFF
		1	0x00
Length		1	0x07
Type		1	0x02 (Send Variable data)
Payload	Type1	1	0x02
	Battery voltage Integer part	1	Battery Voltage (in 0.01V) (e.g.) For 3.21v [0]: 03h: 2-digit integer part [1]: 15h: 2 decimal places
	Battery voltage Decimal part	1	

6 Product Specifications

6.1 Product name and model number

This product is the product name "ZETABOX-420MA" and model name "TZS9011S-00".

6.2 Electrical characteristics

6.2.1 Recommended operating conditions

No.	Item	Symbol	Measurement conditions	Standard value			Unit
				Minimum	Standard	Maximum	
1	Operating temperature	-	-	-20	-	60	℃
2	Storage temperature	-	-	-20	-	60	℃
3	Battery voltage	VCC	-	2.2(*1)	3.0	3.3	V
4	GND	VSS	-	-	0	-	V

*1 No load

6.2.2 4 -20mA interface

No.	Item	Symbol	Measurement conditions	Standard value			Unit
				Minimum	Standard	Maximum	
1	12V power supply	Vout12	-	-	12(*1)	-	V
2	12V power supply current	Iout12	-	-	-	40	mA
3	Current measurement range	-	-	4	-	20	mA
4	Conversion accuracy	-	-	-2	-	+2	%

*1 No load

6.2.3 ZETA communication

No.	Item	Symbol	Measurement conditions *1	Standard value			Unit
				Minimum	Standard	Maximum	
1	Frequency range	-	-	920.6	-	928.0	MHz
2	Frequency error	-	-	-2	-	+2	Ppm
3	Transmission speed	-	-	-	0.3	-	Kbps
4	Transmit power	-	-	-	10	-	dBm
5	Reception sensitivity	-	-	-	-127	-	dBm
6	ZETA protocols	-	-	ZETA-S			-

*1 Battery-voltage VCC=3.3V, temp. = 25℃

6.2.4 Other

No.	Item	Specification	Remarks
1	Dimensions (Width X height X depth)	150 X 210 X 55 mm	Main unit excluding connector and antenna
2	Weight	1000 g	Main unit excluding connector and antenna
3	Dust and water proof	IP67	Main unit
		IP65	Terminal box
4	Battery capacity	35000mAh	CR cells 14 in parallel

7 Product maintenance

7.1 Mounting method

This product can be mounted on a wall or metal fitting just by removing the blind cover. Mounting brackets (Takachi WPMB-M4-2 sold separately) can also be used for mounting on poles.

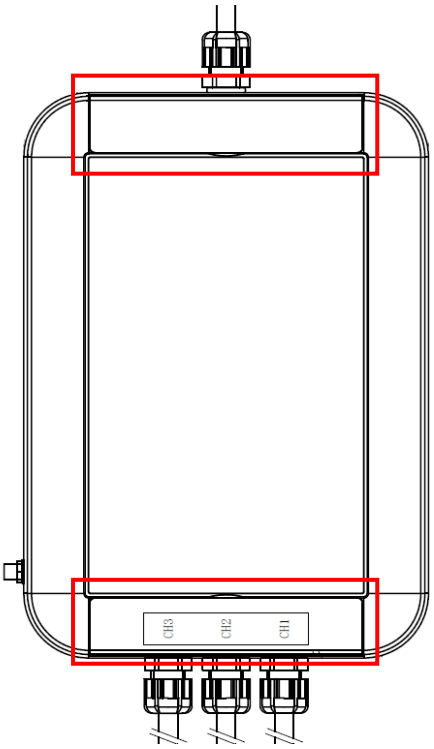


Figure 12 Blind Cover Position

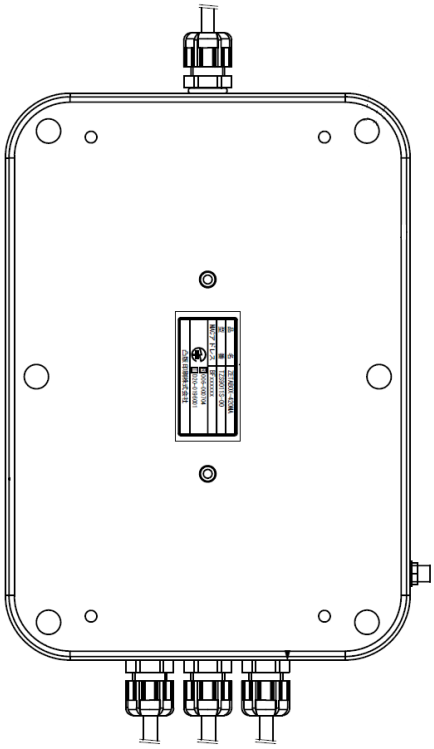


Figure 13 Mount Blanket Installation

7.2 Deformation of the cabinet

Since the gasket of this product is made of silicon rubber, it is highly airtight and cannot release the air pressure inside the cabinet caused by sudden temperature differences. The box may be deformed when used in an environment with extreme temperature variations.

7.3 Discoloration of the cabinet

This product is made of ASA that is resistant to discoloration and deterioration by ultraviolet light. However, if it is used outdoors for a long time, it may undergo deterioration such as deformation, discoloration and deterioration. If necessary, it is recommended to protect it with a cover, etc.

8 Contact for inquiries

If you have any inquiries about this product, please contact the following:

Sales Division I, Electronics Division, Toppan Printing Co., Ltd.

E-mail: tdc_se@toppan.co.jp

〒108-8539 Toppan Shibaura Building 3-19-26, Shibaura, Minato-ku, Tokyo

TEL 03-5418-3911

FCC Warning

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.

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

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

-Reorient or relocate the receiving antenna.

-Increase the separation between the equipment and receiver.

-Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

-Consult the dealer or an experienced radio/TV technician for help.

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.