Instruction Manual

Measurement and judgment system

MET Series

- **Before using or maintaining this product, carefully read and understand the warnings in this manual before beginning work. Failure to follow the instructions and warnings in this manual may lead to serious personal injury, death, or property damage.**

- **Store this manual near equipment for future reference.**

- **If any questions related to safety arise about this manual, please confirm them with the distributor or our company.**

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1   Introduction

◆ Safety Warning Terms and Safety Warning Symbols
◆ Disclaimer and Instructions for Use of the Manual
◆ Warranty and Disclaimer
◆ Disposal Information
◆ Others

Introduction

This manual provides detailed information about the Length Measurement and Judgment System (MET Series) to help users understand the performance and functions and to ensure safe and proper operation. Before using this product, please be sure to read this instruction manual thoroughly and understand the proper usage methods correctly.

Also, be sure to follow the instructions and warnings in the "Important Safety Information" and "Precautions for Use" sections at the beginning of this manual. Failure to follow these instructions may result in serious personal injury.

Safety Warning Terms and Safety Warning Symbols

This manual categorizes and displays particularly important handling precautions according to the degree of danger (magnitude of potential harm) as follows. Please fully understand the meaning of these terms and follow the instructions to perform the operation safely.

⚠ Safety Alert・Symbols

This is a safety Alert symbol. This symbol is used to warn you to potential personal injury hazards. To avoid possible injury or death, follow all safety messages that follow this safety alert symbol.

⚠ DANGER	Failure to observe the precautions indicated by this symbol may result in serious injury or death, leading to severe personal accidents.
⚠ WARNING	Failure to observe the precautions indicated by this symbol may result in serious injury or death.
⚠ CAUTION	Failure to observe the precautions indicated by this symbol may result in minor or moderate injury.
NOTICE	Failure to observe the precautions indicated by this symbol may result in malfunction or damage to the product, shortened service life, or damage to peripheral devices.

Disclaimer and Instructions for Use of the Manual

● This product is a device that connects to scale-specification robot hands, etc. to perform dimensional measurement and judgment. If you intend to use it for any other purpose, please consult with our company.

● We cannot accept the responsibility for malfunctions or accidents that occur due to failure to follow the warning items in this instruction manual.

● This content of this manual do not anticipate all potential hazards in operation, handling, inspection, and maintenance under all environmental conditions. There are countless things that cannot be done or should not be done, and this manual cannot cover all of them. Therefore, Unless specifically stated in this manual that an action is permitted or can be done, assumed that it is prohibited and must not be performed.

● When performing operation, handling, inspection, or maintenance not described in this manual, please consider the necessary safety precautions yourself and perform such activities at your own responsibility.

Warranty and Disclaimer

The product warranty period is one year after delivery.
Please use all parts supplied by our company. We are not responsible for personal injury, death, damage, or loss caused by the parts other than genuine parts manufactured by our company. In addition, all warranties are void if parts other than genuine parts manufactured by our company are used.

Disposal Information

Please dispose this product and the batteries incorporated in this product in accordance with the laws and regulations of the country to which the user belongs.

Others

The contents of this manual are subject to change without notice for the purpose of improvement or specification change.

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MET manual

2 Important Safety Warnings

◆ Warning
◆ Caution

The following is a list of important safety warnings that you should be aware of and follow. Please be sure to read it before use.

■ The types of precautions that must be observed are categorized and explained using symbols.

| 🚫 | Indicates 「Things that must not be done」 | ❗ | Indicates 「Things that must be done」 |

⚠️ WARNING

When Using

❗ **Mandatory**

■ **Before using, make sure that the sheathed parts of the power cable and wires are not damaged.**
   Contact with damaged cable or parts may cause electric shock.

■ **Cable should be routed so that they are not pulled forcefully, pinched, or damaged.**
   Cable damage may occur, and contact with the damaged area may cause electric shock.

🚫 **Prohibit**

■ **Do not operate with wet hands.**
   Wet conditions increase electrical conductivity and may cause electric shock.

■ **Do not operate while under the influence of alcohol or drugs.**
   This is dangerous because it can lead to impaired judgment and incorrect operation.

Installation

🚫 **Prohibit**

■ **Do not apply any voltage other than the specified voltage to each terminal.**
   Equipment failure may result in fire or burns.

■ **Do not install near high temperature heat sources.**
   Equipment failure or high temperature ignition may result in fire or burns.

Maintenance

❗ **Mandatory**

■ **If the device malfunctions, disconnect the power supply.**
   Energizing faulty components may result in fire, burns, or electric shock.

■ **Use only parts specified by our company for replacement.**
   Inappropriate replacement work may result in reduced safety, leading to fire, burn, or electric shock.

🚫 **Prohibit**

■ **Do not disassemble or modify units.**
   This may cause ignition leading to fire or burns, or electric shock due to contact with energized or high temperature components.

⚠ CAUTION

When Using

!
Mandatory

- Use within environmental conditions specified in the basic specifications.
  Equipment failure may result in fire, burns, or electric shock.

Installation, Transportation, and Storage

!
Mandatory

- Store and transport under the environmental conditions specified in the basic specifications.
  Equipment failure or high temperature ignition may result in fire or burns.
- Wiring must be done correctly and securely.
  Equipment failure may result in fire, burns, or electric shock.

🚫
Prohibit

- Do not drop or subject the product to the strong impact.
  Equipment failure may result in fire, burns, or electric shock.
  Dropping may cause injury.

Data

!
Mandatory

- Registered parameters should be backed up and stored.
  Equipment failure may result in data lost.

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MET manual

3 Overview

3 Overview

3-1 Overview

The MET Series measurement and judgment system is an automated device designed to connect to various sensors primarily Measurement robot hands- to measure the dimensions of work pieces (target objects) on production lines and perform standard judgment (pass/fail) based on the measured values. The system can start Measurement operations upon command signals from external equipment and output the judgment results to external equipment. It also provides functions to record and output the measurement results, judgment results and measurement date/time as data.

3-2 Features

◆ 5 -Points Dimension Measurement Function

The Measurement and judgment system can set up to 5 measurement positions and items per sample for measuring the dimensions (length, etc.) of target work pieces.

(Ex.)
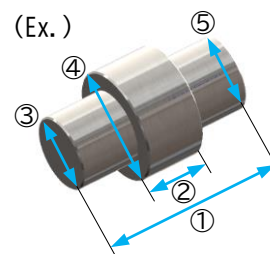
◆ 5-Level Pass/Fail Judgment Function

The system compares the measured values with the thresholds set in the Measurement and judgment system, and performs a 5-level judgment to determine whether the target work piece is "good", "marginal", or "defective". Judgment conditions (judgment thresholds, etc.) are set and modified using the dedicated PC tool.

(Ex.)   −Threshold   Standard   +Threshold

| OUT− | IN− | OK | IN+ | OUT+ |

−0.03   −0.01   +0.01   +0.03
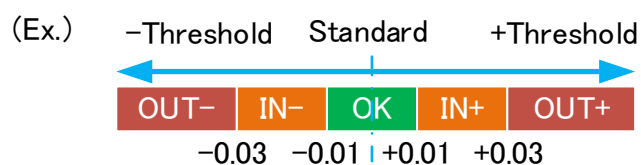
◆ Work piece Dimension Calculation Function

Performs calculation to convert work piece dimensions according to the jaw shape of the measuring hand.
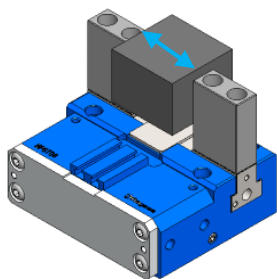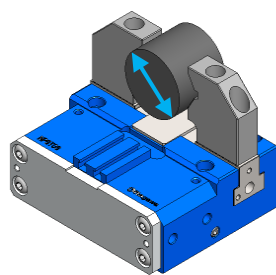
Linear Measurement | Outer Diameter Measurement (2-Jaws V- Shape) | Inner and Outer Diameter Measurement (3- Jaws)
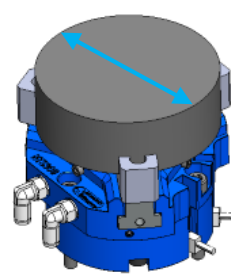
◆ Measurement Data Recording and Output Function

The measured data is saved to internal memory. The saved data can be exported as CSV files to USB memory or PC files. This can be utilized for work piece dimension management and traceability.

CSV

MET-CT | USB Flash Drive or PC Storage

◆ Easy Configure with Setting & Monitoring Tool.

The Setting & Monitoring Tool can be operated on a Windows OS PC or tablet. Each item that requires configuration can be intuitively reviewed through graphical explanation screens. Also, measured values and judgment results are displayed on the monitor in real-time.
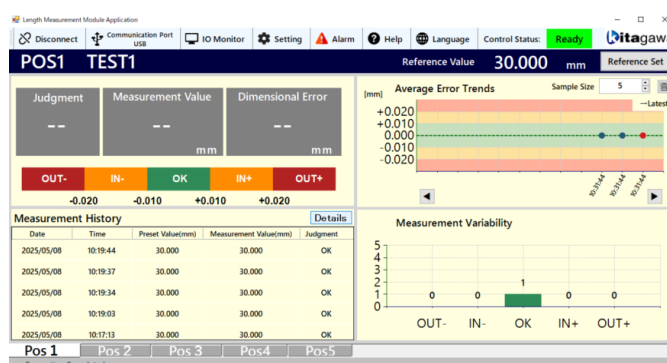
3-3 System Configuration Diagram

This shows the configuration when all units of Measurement and judgment system are used.
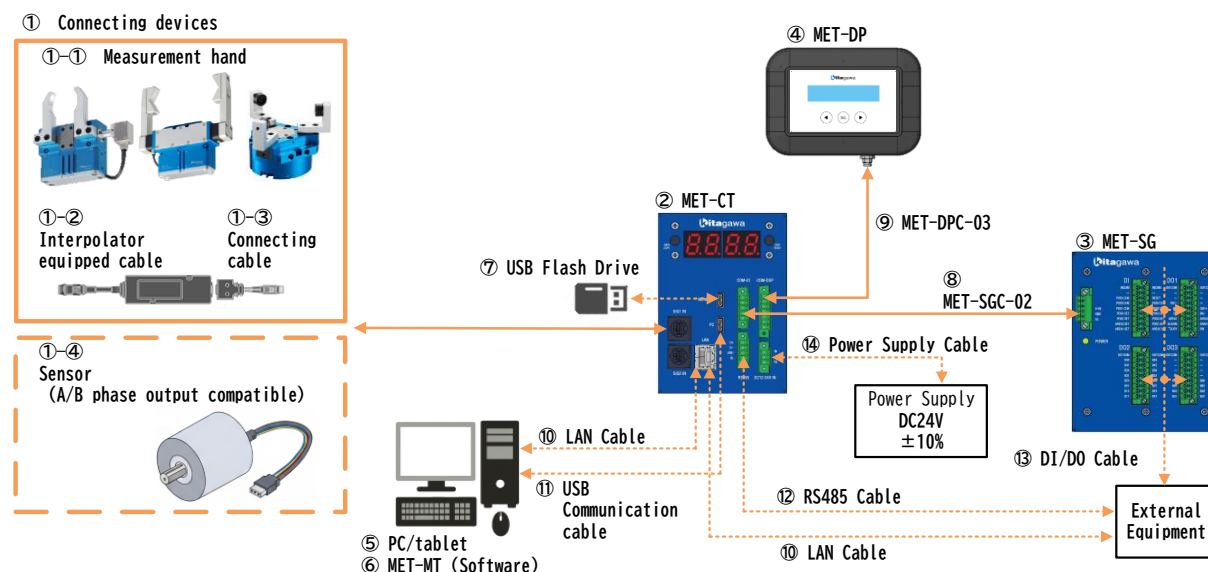
No.	Name		Model	Manufacturer	Remarks
①-①	Connecting devices	Measurement hand	NPGT_S NPL_S NTS3_S	Kitagawa	For details, please refer to the hand catalog manual.
①-②		Interpolator equipped cable	LD-050 DT01DT01	Kitagawa	For details, please refer to the hand catalog manual.
①-③		Connecting cable	CK-T213	Kitagawa	For details, please refer to the hand catalog manual.
①-④		Sensor	—	—	A/B phase output compatible sensor
②	Control Unit		MET-CT	Kitagawa	MET Series components
③	I/O Signal Unit		MET-SG	Kitagawa	MET Series components It is necessary when external devices and DI/DO communication
④	Display Unit		MET-DP	Kitagawa	MET Series components It is necessary when judgment results are checked at any time.
⑤	PC/tablet		—	Customer	For Windows10/11
⑥	Setting & Monitor Tool (Software)		MET-MT	Kitagawa	MET Series components Obtain from Kitagawa HP
⑦	USB Flash Drive		—	Customer	Type-C
⑧	I/O signal unit Connecting cable		MET-SGC-02	Kitagawa	I/O signal unit accessories (2m)
⑨	Display unitConnecting Cable		MET-DPC-03	Kitagawa	Display Unit Accessories (3m)
⑩	LAN cable		—	Customer	Above Cat5e Cross/straight
⑪	USB communication cable		—	Customer	Control unit side: Type-C
⑫	RS485 cable		—	Customer	Refers to "8 Modbus Communication" Chapter
⑬	DI/DO cable		—	Customer	Refers to "9 DI/DO Communication" Chapter
⑭	Power Supply Cable		—	Customer	Refers to "5-2-2 Power Supply Connection" Chapter

3-4 Measurement Process Flow

3-4-1 Preliminary Preparation

The necessary preparation for using dimensional measurement and judgment system are listed below.

Item	Related articles	Remarks
Installation	"5-1 Installation" Chapter	—
Connection to Sensor	"5-2-1 Connection to sensor" Chapter	—
Connection to Power Supply	"5-2-2 Connection to Power Supply" Chapter	—
I/O Connection to Signal Unit	"5-2-3 MET-CT and MET-SGConnection" Chapter	It is necessary for DI/DO communication (I/O signal unit) with periphery devices. It is not needed for Modbus communication.
Connection to Display Unit	"5-2-4 MET-CT and MET-DPConnection" Chapter	It is necessary to do regular checks using display unit.
External device connection (Modbus)	"8-2 Modbus/RTU communication" Chapter "8-3 Modbus/TCP communication" Chapter	It is necessary to external device communication to Modbus. Connect either with Modbus/RTU or Modbus/TCP
External device connection (DI/DO)	"9-2 schematic diagram. Connection example" Chapter	It is necessary to do DI/DO communication (I/O signal unit) with external devices.
PC/Tablet Connection	"6-4 Communication with Measurement and judgment system" Chapter	—
POS1~5 Measurement Connection Setting	"6-5 Setting" Chapter	MET-CT is used. Setting > POS1~5 Set measurement type, name, reference value and threshold value.

3-4-2 Measurement Flow

Item	Related articles	Remarks
Grip the masterwork or reference master gauge.	—	—
Reference Position setting[※1] (POS* SET)	"3-4-3 Reference Position Setting" "8 Modbus Communication" "9 DI/DO Communication"	The reference setting (POS SET) defines the position while grasping the master workpiece.
Grip the work piece.	—	—
Measure and judge. (POS* CHK)	"3-4-4 Measurement and Judge" "8 Modbus Communication" "9 DI/DO Communication"	When the Measurement (POS CHK) is performed, one of five levels of judgment(OK、IN+、IN−、OUT+、OUT−) and the measure length value are outputted.Measurement data are saved as history of internal memory.
Other function Area output (AREA SET)	"3-4-5 Area Output" "8 Modbus Communication" "9 DI/DO Communication"	The function output the signal when the jaw of the measurement hand is within the specified position. For example, it can be used to detect the open or closed end of the hand or to detect the grip of the work piece.

※1 Once reference position (POS＊SET) is performed, the position is maintained until the power is turned off.so it is not necessary to do it every time before Measurement (POS＊CHK). However, since the measurement accuracy is changed due to the influence of temperature change and wear of mechanical structure, high precision measurement can be maintained by periodically perform reference position set (POS ＊ SET).This will prevent from position deviations and errors caused by external factors and allow stable Measurement and judgment results.

3-4-3 Reference set (POS＊SET)

By performing reference set, reference position for Measurement can be decided. Up to five reference positions can be registered.

◆ Setting example (when POS1 SET is performed)
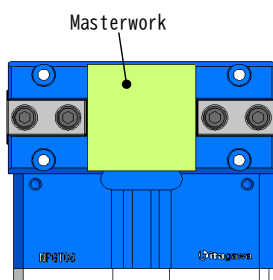
Masterwork

● Setting
① Grip the masterwork (20.000 mm)
② Reference position set (POS1 SET)is performed.
③ Set the masterwork acquired position to POS1 [WORK1] reference position 20 mm.
● Setting parameters
① Name : WORK1
② Measurement type : 0 (2 jaw linear measurement)
③ Reference value : 20.000

◆ Workflow
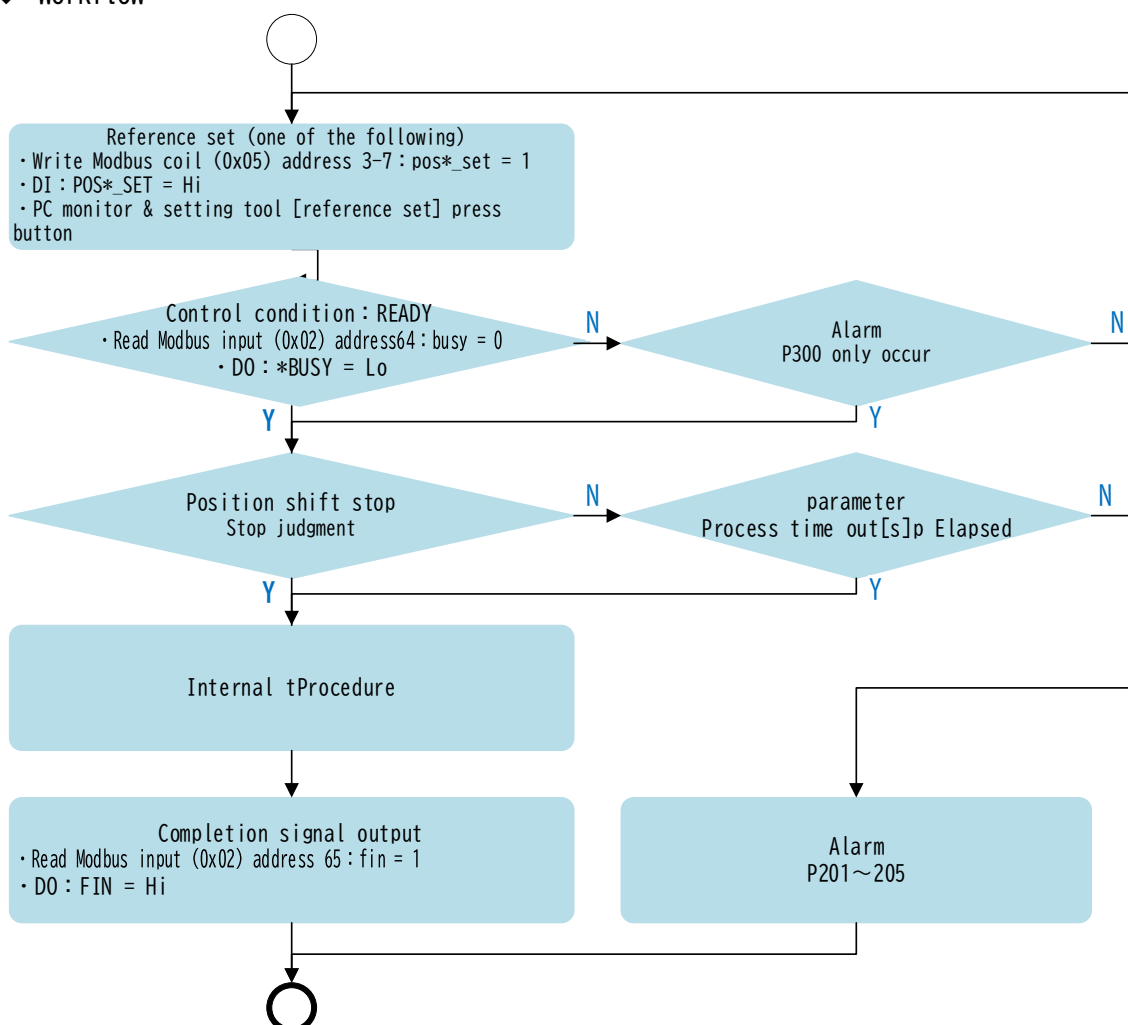
Reference set (one of the following)
・Write Modbus coil (0x05) address 3-7：pos＊_set = 1
・DI：POS＊_SET = Hi
・PC monitor & setting tool [reference set] press button

Control condition : READY
・Read Modbus input (0x02) address64：busy = 0
・DO：＊BUSY = Lo

→ N

Alarm
P300 only occur

→ N

Y — Y

Position shift stop
Stop judgment

→ N

parameter
Process time out[s]p Elapsed

→ N

Y — Y

Internal tProcedure

Completion signal output
・Read Modbus input (0x02) address 65：fin = 1
・DO：FIN = Hi

Alarm
P201～205

⚠️CAUTION

Because this system is Incremental comparison measurement, if the power supply is cut out, the standard position data registered on POS SET can be lost. Be sure to perform the reference position set (POS SET) after turning on power.

3-4-4　Measurement and judgment　(POS*CHK)

When the judgment signal is input, measurement is performed and a 5 level judgment result is output according to the pre-set judgment parameters.

◆ Output example (when POS1 CHK is performed)

Workpiece
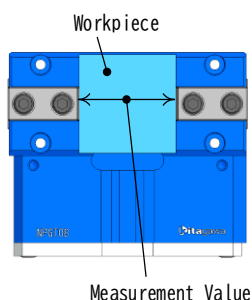
Measurement Value

● Output

① Grip the work.

② Perform the Measurement and judgment 1 (POS1 CHK).

③ The dimensions of the grasped work position are measured and the measured values are displayed as output.

④ The judgment results are displayed and output based on the reference set values and thresholds of the setting parameters.

Measurement values and judgment results are saved in the internal memory.

● Setting parameter　("6-5-2-2　POS1~5") example

①　Name : WORK1

②　Measurement type : 0 (2 jaw linear measurement)

③　Reference set value : 20.000

④　Thresholds : -OUT Threshold、-OK Threshold、+OK Threshold、+OUT Threshold

◆ Workflow

```
        ○
        │
┌───────────────────────────────────────────┐
│ Length Measurement and Judgment            │◄─┐
│ • Modbus Coil Write (0x05) Addresses 8-12: │  │
│   pos*_chk = 1                             │  │
│ • DI: POS*_CHK = Hi                        │  │
│ • Press the PC monitor & setting tool      │  │
│   [Length Measurement and Judgment] button │  │
└───────────────────────────────────────────┘  │
        │                                        │
   ◇ Control Status: READY ──────N──────────────┘
   • Modbus Input Read (0x02) Address 64: busy = 0
   • DO: *BUSY = Lo
        │ Y
   ◇ Reference Set Executed ──────N──────────────────┐
        │ Y                                            │
   ◇ Position Shift – Stop ──N──► ◇ Parameters         │──N──┐
     Stop Judgment              Process Timeout [s]          │
        │ Y                       Elapsed                     │
        │         ┌─────────────────┘ Y                       │
┌───────────────────────┐                                     │
│ Internal Procedure    │                                     │
└───────────────────────┘                                     │
        │                    ┌──────────────────────────┐     │
┌────────────────────────┐  │ Alarm                     │◄────┘
│ Completion Signal      │  │ P211~215                  │
│ Output                 │  └──────────────────────────┘
│ ...                    │           │
└────────────────────────┘           │
        │                            │
        ○◄───────────────────────────┘
```

Length Measurement and Judgment
• Modbus Coil Write (0x05) Addresses 8-12: pos*_chk = 1
• DI: POS*_CHK = Hi
• Press the PC monitor & setting tool [Length Measurement and Judgment] button

Control Status: READY
• Modbus Input Read (0x02) Address 64: busy = 0
• DO: *BUSY = Lo

Reference Set Executed

Position Shift – Stop
Stop Judgment

Parameters
Process Timeout [s] Elapsed

Internal Procedure

Alarm
P211~215

Completion Signal Output
• Modbus Input Read (0x02) Address 65: fin = 1
• DO: FIN = Hi

Measured Value and Judgment Signal Output
• Modbus Input Read (0x02) Addresses 70-74:
　　:One of the following = 1: OK / IN+ / IN- / OUT+ / OUT-
• Modbus Input Register Read (0x04) Addresses 5-14:
　　:POS*Value (H/L Word) = ****** (Measured Value)
• DO: One of the following = Hi: OK / IN+ / IN- / OUT+ / OUT-
• DO: B** (BCD) = Hi

Measured Value and Judgment Result Saving

3-4-5　Area Output (AREA∗・AREA∗ SET)

Area Output is a function that output area output signal (AREA) when the jaw of robot hand is within specified position. Up to three area outputs, AREA 1 to AREA 3 can be registered. For example, when using measuring hand, this can be used to detect open/close ends of jaws, work piece gripping, etc. Area output is available after the area output reference set （AREA∗ SET) is executed.

3-4-5-1　Area Output Reference Set （AREA∗ SET)

By performing area output set (AREA∗ SET) ,you can set the area to be output. Up to three areas output settings can be registered.

◆ Example of Operation (AREA1 SET runtime)
① Perform area output set 1 (AREA SET)
② Set the current position on reference position of AREA 1.

◆ Workflow
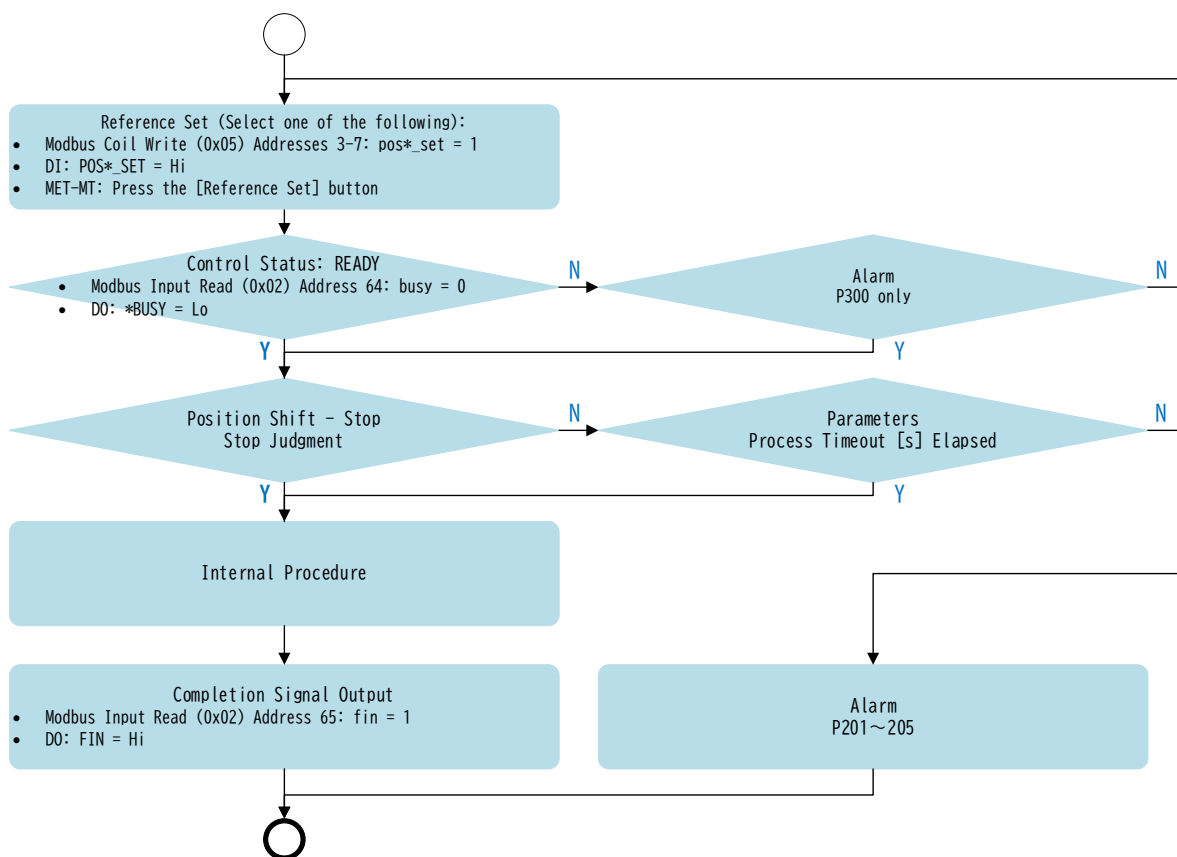
⚠CAUTION

Because this system is Incremental comparison measurement, if the power supply is cut out, the standard position data registered on POS SET can be lost. If the area setting output is used, please perform one of standard setting after turning on power. Because offset relationship of AREA 1, AREA 2 and AREA 3 is memorized, three standard positions can be obtained by performing one set.

3-4-5-2　Area Output　(AREA*)

If the target is within the range of the area output, the area output　(AREA1~3) will be output.

◆ Operation Example (AREA* Output Specification)
- ● Operation
 - ① If it is located within the range output, AREA1 is output according to setting parameters.
- ● Setting parameter
  - ・ AREA*threshold
  - ・ Area output specification
  - ・ Area output timer
  - ・ Area output delay timer

◆ Timing diagram

When [Range Output Specification] = 0
When [Range Output Timer] = 0.0

Current Scale Position

[AREA1 + Threshold]
AREA1 SET Position
[AREA1 − Threshold]

[Range Output Delay Timer]　　　[Range Output Delay Timer]

Output: AREA1

When [Range Output Specification] = 0
When [Range Output Timer] ≠ 0.0

Current Scale Position

[AREA1 + Threshold]
AREA1 SET Position
[AREA1 − Threshold]

[Range Output Delay Timer]　[Range Output Timer]　[Range Output Delay Timer]　[Range Output Timer]

Output: AREA1

When [Range Output Specification] = 1

Current Scale Position

[AREA1 + Threshold]
AREA1 SET Position
[AREA1 - Threshold]

Movement Judgment

Stop Judgment

Output: AREA1

When output <AREA1> got Hi, perform the following step.

◆ Read the address value 67～69 by input reading of Modbus (function code 0x02) and set the applicable AREA on [1].

※ AREA* indicates the area number (e.g., AREA1, AREA2, ...).

◆ In the digital output (DO), set the AREA* capability to [Hi].

4   Specification

4-1 Measurement System Model

◆ Unit Models

ＭＥＴ－ＣＴ ： Control Unit
ＭＥＴ－ＳＧ ： I/O Signal Unit
ＭＥＴ－ＤＰ ： Display Unit

Control Unit	I/O Signal Unit	Display Unit
MET-CT	MET-SG	MET-DP

◆ Software Type

ＭＥＴ－ＭＴ ： Setting & Monitoring Tool

4-2 Size and Weight

Dimensions (W×D×H) ※1	MET-CT	: 93×130×141 ㎜
	MET-SG	: 106×130×141 ㎜
	MET-DP	: 130×90×40 ㎜

Weight	MET-CT	: 940 g
	MET-SG	: 800 g
	MET-DP	: 270 g

※1 Dimensions do not include protruding parts凸 (buttons, connectors, screws, etc.) .

4-3 Part Names

◆ Control Unit
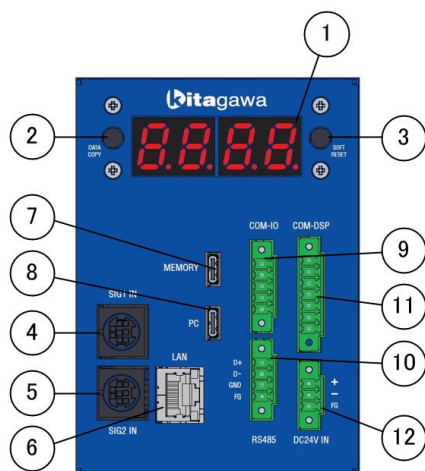
① 7-Segment Display, 4 Digits
② Push Button: Data Copy
③ Push Button: Soft Reset
④ Sensor Input Port 1
⑤ Sensor Input Port 2 (Unused)
⑥ Ethernet Port RJ-45
⑦ USB Port Type C (for memory connection)
⑧ USB Port Type C (for PC connection)
⑨ I/O Signal Unit Cable Connector
⑩ RS485 Connector (for external device connection)
⑪ Display Unit Connection Connector
⑫ Power Connector

◆ I/O Signal Unit
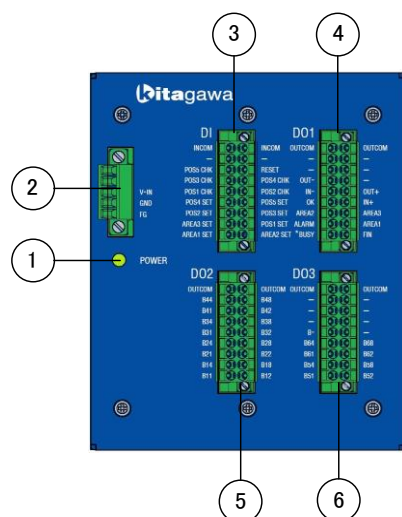
① Power Indicator
② Control Unit Cable Connector
③ Input Signal Connector (DI)
④ Output Signal 1 Connector (DO1)
⑤ Output Signal 2 Connector (DO2)
⑥ Output Signal 3 Connector (DO3)
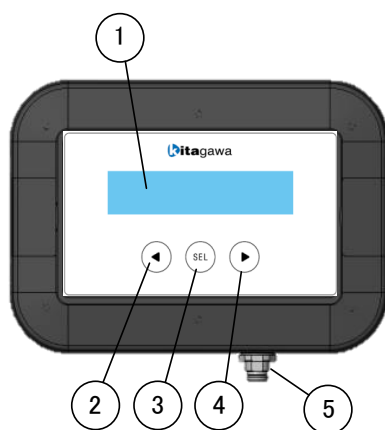
◆ Display Unit

① Display 16 Characters x 2 lines
② Push Button [◀]
③ Push Button [SEL]
④ Push Button [▶]
⑤ Control Unit Cable Connector

4-4 Standard Specifications

	Control Unit MET-CT	I/O Signal Unit MET-SG	Display Unit MET-DP
Power Supply Voltage	DC24V±10%		
Power Consumption	7.2W	2.4W	2.4W
Battery	Calendar Backup Lithium Battery (CR2032)	−	−
Memory Function	9999 Measurement Records	−	−
Dust/Water Resistance Specification	IP20	IP20	IP52
Operating Environment	Indoor and places not exposed to direct sunlight.		
Operating Temperature	0℃ ～ 55℃		
Operating Humidity Range	20% ～ 80%RH or less (no condensation)		
Operating Altitude	1000m or less		
Storage Environment	Store in locations where water, oil contamination, condensation, and freezing will not occur.		
Storage Temperature Range	−10～60℃		
Storage Humidity Range	90%RH or less (no condensation)		
Vibration Resistance	0.5G or less		
Shock Resistance	1.0G or less		

4-5 Communication Specifications

4-5-1 Control Unit Communication Specifications
4-5-1-1 Sensor Input Port 1

Item	Description
Communication Method	A/B phase (EIA-422 Compliant)
Response Frequency	50MHz
Output Voltage	DC5 V±5%
Sensor Resolution	0.5μm

4-5-1-2 Sensor Input Port 2
This port is non-connected port.

4-5-1-3 Ethernet

Item	Description
Communication Protocol	TCP/IP 、Modbus/TCP (Switchable via Setting)
Transmission Speed	100Mbps (100BASE-TX)
Transmission Medium	STP or Category 5 or higher UTP
Maximum transmission distance	100 m

4-5-1-4 USB (For memory connection)

Communication Port	Description
USB Standard	TYPE C USB2.0 for device connection
Transmission Speed	Max 480 Mbps
Maximum Transmission Distance	5 m

4-5-1-5 USB (For PC connection)

Communication Port	Description
USB Standard	TYPE C USB2.0 for host connection
Transmission Speed	Max 480 Mbps
Maximum Transmission Distance	5 m

4-5-1-6 RS485 Port Specifications

Item	Description
Communication Standard	EIA-485 Compliant
Communication Protocol	Modbus/RTU
Communication Method	Half-Duplex Communication Start-Stop Synchronization (data: 8 bits, stop bit: 1 bit/2 bits, parity: none/even/odd)
Transmission Speed	9,600、19,200、38,400、57,600、115,200、230,400 bps
Termination Resistance	120 Ω / Non Jumper Switch
Maximum Transmission Distance	100 m

4-5-2 I/O Signal Unit Interface Specifications

Input Signal Specifications		Output Signal Specifications	
Item	Specification	Item	Specification
ON Voltage	DC24V±10%V	Input Voltage	DC0～26.4V
ON Current	Within 3mA～9mA	ON Current	100mA or above
OFF Voltage	DC0V～5V	ON Resistance	10Ω or less
OFF Current	1mA or less	OFF Leakage Current	1.0μA or less
OFF→ON Response Time	Within 1.5ms	OFF→ON Response Time	Within 1.5ms
ON→OFF Response Time	Within 1.5ms	ON→OFF Response Time	Within 1.5ms

Input Signal List DI1		
Signal Name	Name	Description
INCOM	Input Common	Input Signal Common
AREA1 SET	Range Output 1 Standard Set	Set the current position for range output 1.
AREA2 SET	Range Output 2 Standard Set	Set the current position for range output 2.
AREA3 SET	Range Output 3 Standard Set	Set the current position for range output 3.
POS1 SET	POS1 Standard Set	Set the current position as the measurement reference for POS1.
POS2 SET	POS2 Standard Set	Set the current position as the measurement reference for POS2.
POS3 SET	POS3 Standard Set	Set the current position as the measurement reference for POS3.
POS4 SET	POS4 Standard Set	Set the current position as the measurement reference for POS4.
POS5 SET	POS5 Standard Set	Set the current position as the measurement reference for POS5.
POS1 CHK	POS1 Measurement Command	Start Measurement and judgment for POS1.
POS2 CHK	POS2 Measurement Command	Start Measurement and judgment for POS2.
POS3 CHK	POS3 Measurement Command	Start Measurement and judgment for POS3.
POS4 CHK	POS4 Measurement Command	Start Measurement and judgment for POS4.
POS5 CHK	POS5 Measurement Command	Start Measurement and judgment for POS5.
RESET	Alarm Reset	Clear alarms that meet release conditions.
—	N.C.	Disconnected

Output Signal List DO1		
Signal Name	Name	Description
OUTCOM	Output Common	Output Signal Common
*BUSY	Busy	Output Lo during busy state. Signal input is not accepted during busy state.
FIN	Process Complete	Output completion response for POS SET、POS CHK、AREA SET signals.
ALARM	Alarm Occurrence	Output during alarm occurrence
AREA1	Range Output 1	Output when the current position is within the threshold set in AREA1.
AREA2	Range Output 2	Output when the current position is within the threshold set in AREA2.
AREA3	Range Output 3	Output when the current position is within the threshold set in AREA3.
OK	Judgment Signal: OK	After POS CHK input, output is triggered when an OK judgment is made.
IN+	Judgment Signal: IN+	After POS CHK input, output is triggered when an IN+ judgment is made.
IN—	Judgment Signal: IN—	After POS CHK input, output is triggered when an IN— judgment is made.
OUT+	Judgment Signal: OUT+	After POS CHK input, output is triggered when an OUT+ judgment is made.
OUT—	Judgment Signal: OUT—	After POS CHK input, output is triggered when an OUT— judgment is made.

Output Signal List D01		
Signal Name	Name	Description
—	N.C.	Disconnected

Output Signal List D02		
Signal Name	Name	Description
OUTCOM	Output Common	Output Signal Common
B11	BCD Output1Digit 0 bit	After POS CHK input, BCD output 1 digit 3bit (1/1000th place) of the measured length value will be output.
B12	BCD Output1Digit 1bit	
B14	BCD Output1Digit 2bit	
B18	BCD Output1Digit 3bit	
B21	BCD Output 2 Digit 0bit	After POS CHK input, BCD output 2 digit 0bit (1/100th place) of the measured length value will be output.
B22	BCD Output 2 Digit 1bit	
B24	BCD Output 2 Digit 2bit	
B28	BCD Output 2 Digit 3bit	
B31	BCD Output 3 Digit 0bit	After POS CHK input, BCD output 3 digit 0bit (1/10th place) of the measured length value will be output.
B32	BCD Output 3 Digit 1bit	
B34	BCD Output 3 Digit 2bit	
B38	BCD Output 3 Digit 3bit	
B41	BCD Output 4 Digit 0bit	After POS CHK input, BCD output 4 digit 0bit (1's place) of the measured length value will be output.
B42	BCD Output 4 Digit 1bit	
B44	BCD Output 4 Digit 2bit	
B48	BCD Output 4 Digit 3bit	

Output Signal Port D03		
Signal Name	Name	Description
OUTCOM	Output Common	Output Signal Common
B51	BCD Output 5 Digit 0bit	After POS CHK input, BCD output 5 digit 0bit (10th place) of the measured length value will be output.
B52	BCD Output 5 Digit 1bit	
B54	BCD Output 5 Digit 2bit	
B58	BCD Output 5 Digit 3bit	
B61	BCD Output 6 Digit 0bit	After POS CHK input, BCD output 6 digit 0bit (100th place) of the measured length value will be output.
B62	BCD Output 6 Digit 1bit	
B64	BCD Output 6 Digit 2bit	
B68	BCD Output 6 Digit 3bit	
B—	BCD Output − Sign bit	After POS CHK input,− Sign bit of the measured length value will be output.
—	N.C.	Disconnected

4-6 Compliance Standards

The CE marking specification of this product has been designed and inspected in accordance with the following standards, and we self-declare conformity to EC directives.

● EMC Directive (2014/30/EU)
      <Emission> EN61326-1:2013
      <Emission> EN55011:2016/A11:2020(group1、classA)
      <Immunity> EN61326-1:2013
                  EN61000-4-2:2009
                  EN61000-4-3:2006+A1:2008/A2:2010
                  EN61000-4-4:2012
                  EN61000-4-6:2014+AC:2015
                  EN61000-4-8:2010
● RoHS Directive (2011/65/EU)
      EN IEC 63000:2018

This device is commercial electromagnetic wave generating equipment (Class A) and is intended for use in locations other than residential areas. Sellers and users should be aware of this.

5 Setup

5 Setup

5-1　Installation

This chapter describes the installation and wiring of the length measurement and judgment system. For the installation method of the length measurement hand, please refer to the length measurement hand instruction manual.

5-1-1　Control Unit and I/O Unit Installation
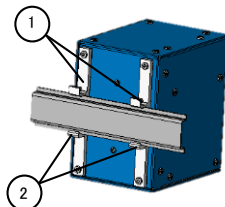
■ For DIN rail mounting: ① Hook the mounting claws on the top of the unit over the upper side of the DIN rail, ② Press the D unit against the lower mounting tab until you hear a "Click" sound.

■ For removal, please follow the reverse procedure of the above steps.

⚠ **CAUTION**

■ When using in the environment exceeding IP20, please use a cover or other protective equipment to ensure that the product's environment IP20 or less. Failure to do so may result fire, burn or electric shock due to equipment failure.

■ Always ensure the ambient temperature around the unit is 55℃ or below.

■ Provide a minimum cooling clearance of 30 mm (or more) above and below the unit to prevent obstruction of heat dissipation and airflow.
　If heat accumulates around the controller, ensure forced air circulation is applied.

■ Secure firmly to prevent falling.

■ Please install under conditions that satisfy the installation items in "Important Safety Warning Items" and the operating environment/physical environment items in "Specifications".

5-1-2　Display Unit Installation
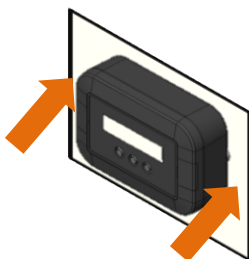
■ Mount by fixing to magnetic materials such as metal using the rear magnet.

⚠ **WARNING**

■ Do not bring this product close to people wearing pacemakers or implanted medical electronic devices. It may adversely affect the devices.

⚠ **CAUTION**
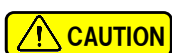
■ When using in the environment exceeding IP52, please use a cover or other protective equipment to ensure that the product's environment IP52 or less. –Otherwise, equipment malfunction may cause fire, burns, or electric shock.

■ Mount the unit on a flat surface free of oil, moisture, sand, dust, iron powder, and other

contaminants, with no irregularities. Insufficient magnetization may cause units to fall off.
■ Install the unit under conditions that comply with the "Installation" section of "Important Safety Precautions" and "Operating/Physical Environment" specifications.

5-2 Connection

⚠️ CAUTION

■ When performing wiring work, be sure to turn off the power supply and this device, and confirm that there is no electric current. Failure to do so may result in electric shock, equipment failure, or short circuit.

5-2-1 Sensor Connection

Connect the sensor to the SIG 1 IN port of the control unit.
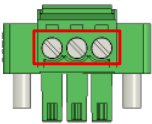
5-2-2 Power Supply Connection

Connect the circuit shown below to the power connector supplied with MET-CT..
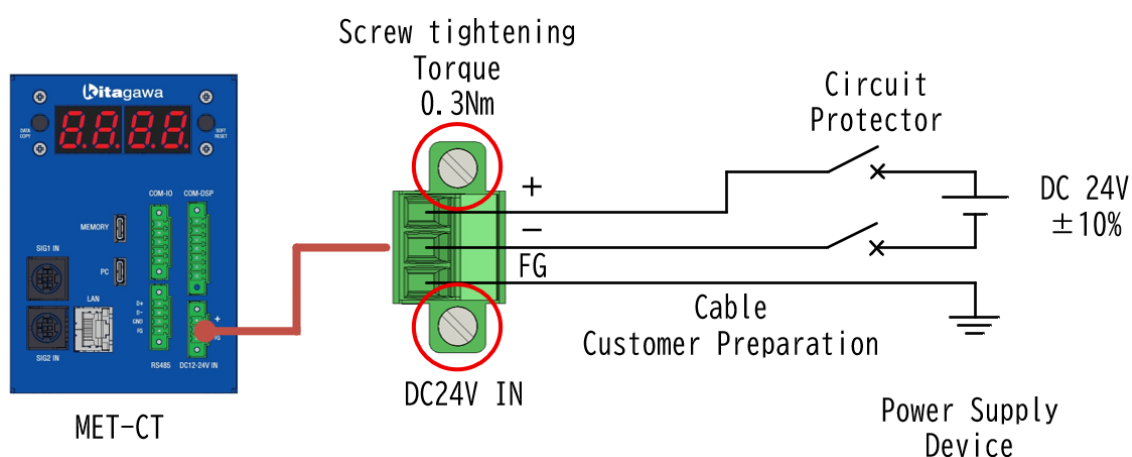
Use the following wiring materials for connecting to the connector and tighten the screen to the specified torque.

Connector Type	MC 1,5/ 3-STF-3,5 (1847068) [Phoenix Contact]
Screw Tightening Torque (Wire Tightening)	0.22 – 0.25 Nm

⚠ CAUTION

■ For safely use this device, please install protective devices such as an overcurrent protection device, in the power supply circuit. The overcurrent protection device will cut off power in case of short circuit or overload, preventing serious accidents such as damage to the equipment body and external circuits or fire.

5-2-3　MET-CT and MET-SG Connection

Connect the I/O signal unit connection cable: ~~MJS~~(MET-SGC-02) to the MET-CT and MET-SG.

MET-CT　　　COM-IO

Cable
MET-SGC-02
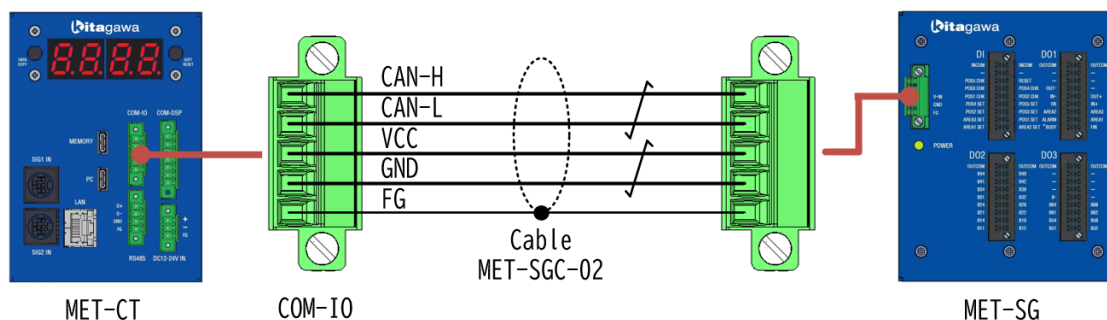
MET-SG

Tighten the connector with the specified torque.

Connector Type (MET-CT・MET-SG)	MC 1,5/ 3-STF-3,5 (1847068)　[Phoenix Contact]
Screw Tightening Torque	0.3 Nm

5-2-4　MET-CT and MET-DP Connection

Display unit connection cable: Connects to the MET-DPC-03 control unit and display unit.

MET-CT

COM-DSP

Cable
MET-DPC-03

MET-DP
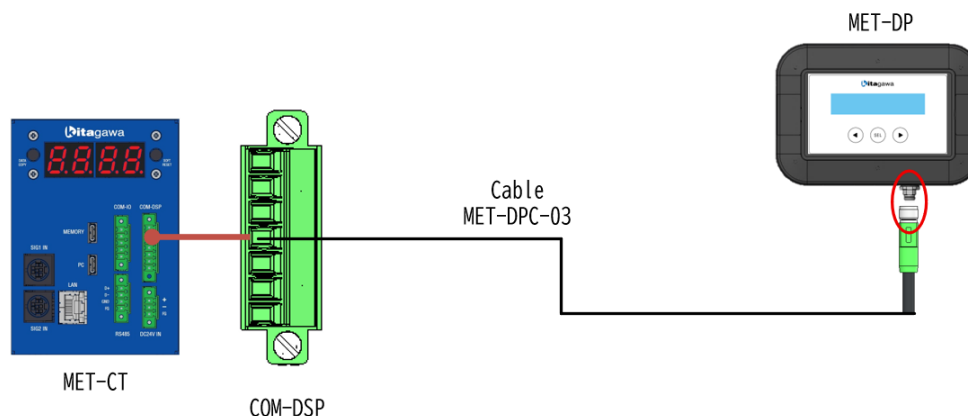
Tighten the connector with the specified torque.

Connector type	MC 1,5/ 7-STF-3,5 (1847107) [Phoenix Contact]	SAC-8P- 3,0-PUR/M 8FS SH (1404148) [Phoenix Contact]
Screw tightening torque	0.3 Nm	0.2 Nm

5-2-5   Control Unit－External Device Connection (Modbus/RTU)
Please refer to <u>chapter "8-2 Modbus/RTU communication"</u> for external device connection.

5-2-6   Control Unit－External Device Connection (Modbus/TCP)
Please refer to <u>chapter "8-3 Modbus/TCP communication"</u> for external device connection.

5-2-7   I/O Signal Unit－External Device Connection (DI/DO)
Please refer to <u>chapter "9 DI/DO communications"</u> for external device connection.

5-2-8   Control Unit and I/O Signal Unit FG Connection
To enhance the noise resistance of the product, on MET-CT and MET-SG, be sure to connect one of the points marked with O shown in the diagram below to frame ground (FG).
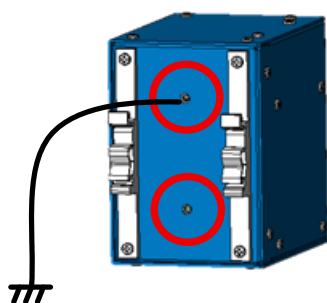
Wire Size	2.0mm^2(AWG14) or above
Mounting Screw Size	M4
Ground Type	Connect to a low resistance ground system 100Ω.

5-2-9   PC Communication
For the information about the PC communication and connection, please refer to <u>chapter "6: Setting& Monitor Tool"</u>.

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MET manual

6 Setting and Monitor Tool

6-1 Overview

By using the Windows-only software (MET-MT), you can configure the settings required to use the measurement inspection/judgment system and monitor judgment results and related data. This chapter provides an overview of the MET-MT Monitoring & Configuration Tool and explains how to install and use it.

In this section, the equipment used is referred to by the following terms.

- Monitor and Setting tool : MET-MT
- Control Unit   : MET-CT
- I/O Unit   : MET-SG
- Display Unit   : MET-DP

The main function of the software are as follows.

- Parameter settings
  - ➢ Configure the setting required to use the measurement judgment system and the communication settings with the MET-CT.
- Display of judgment results and measurement history
  - ➢ Displays measurement judgment results and, in real time, a history up to 9,999 measurement records.
- Display of alarm history
  - ➢ Display alarms that are currently active and those that occurred in the past.
- Graphs of measurement error trends and measurement variation
  - ➢ From the measurement history, displays trends in measurement error and variation in judgment outcomes (e.g, OK/NG). Enables analysis of measurement tendencies.
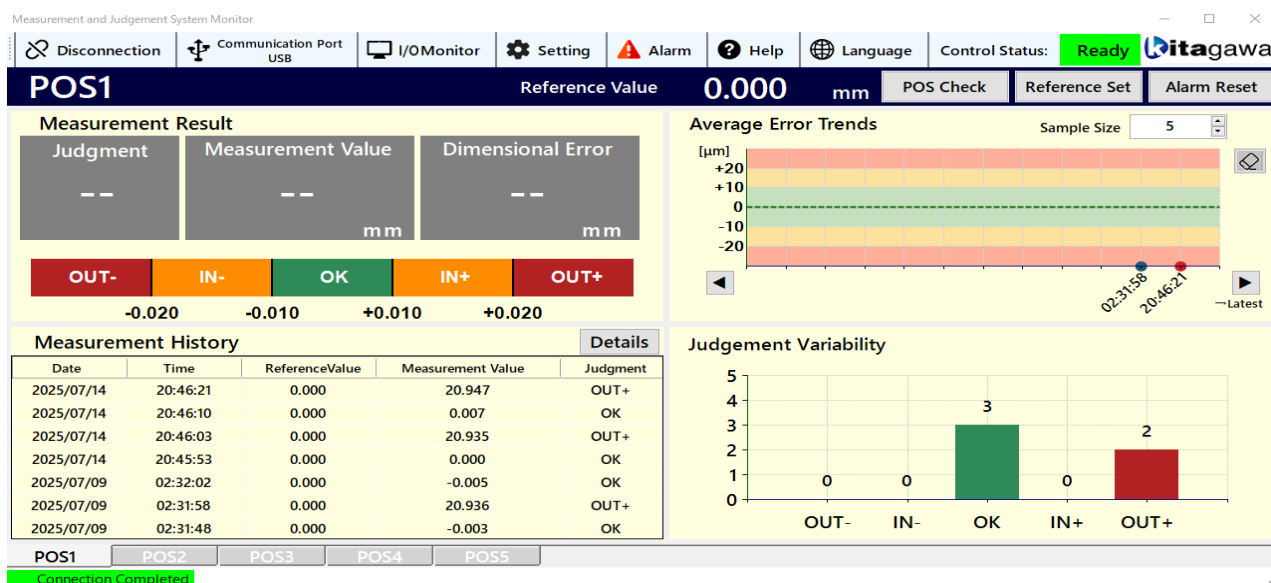
6-2 Software Installation

The following software is needed to be installed when MET-MT is used.

By performing software set-up application, the following software will be installed.

- Setting & monitor tool set-up application (METIS)
  - ➢ MET-MT
  - ➢ File access permission/attribute granting program
  - ➢ USB driver (CDM212364)

6-2-1 Preparation check

Please prepare a PC and cables that meet the following requirements for use with MET-MT Configuration & Monitoring Tool.

- PC   OS：Windows10/11 (64bit)

                       Free disk space：500MB or more

                       Communication port： at least one USB port

                                             At least one LAN port (recommended)

                       Software environment：.NETFramework4.7.2 of later

                       Display resolution：1920×1080or higher (set scaling to 150%)
- USB Type-C cable
- LAN cable   Category 5e or higher (MET-CT automatically detects straight/crossover)

6-2-2 Preparation before software installation

- Please download the software from the following URLs.
  - ➢ Japanese site ：https://prod.kiw.co.jp/mtools/automation/3685.html
  - ➢ English site ：https://www.kitagawa.com/en/mtools/automation/MET.html
- Please perform the installation with administrator privileges (Run as administrator)
- When installing the software, Microsoft Defender SmartScreen may appear depending on the security features built into you Windows PC. If it appears, verify the publisher (digital signature) before proceeding.

6-2-3 MET-MT (Setting & monitor tool installation steps)

1. Double-click the METIS.exe and perform installation.METIS.exe
2. In the User Control (UAC) dialog, when prompted "Do you want to allow this app to make changes to your device?" click Yes.

※ The appearance may vary depending on your environment.

3. When the software setup application starts, click [Setup Start], then follow the on-screen instructions to install the software. Click [Start MET-MT installation] to begin installing MET-MT.

4. When the MET-MT Setup Wizard appears, click [Next].

5. When the License Agreement screen appears, review the terms of the END User License Agreement (EULA), select [I Agree], and click[Next].

6. Select the destination folder. We recommend installing to the default location.
To change it, enter the new folder path in the Folder field. After confirming the older, click [Next].
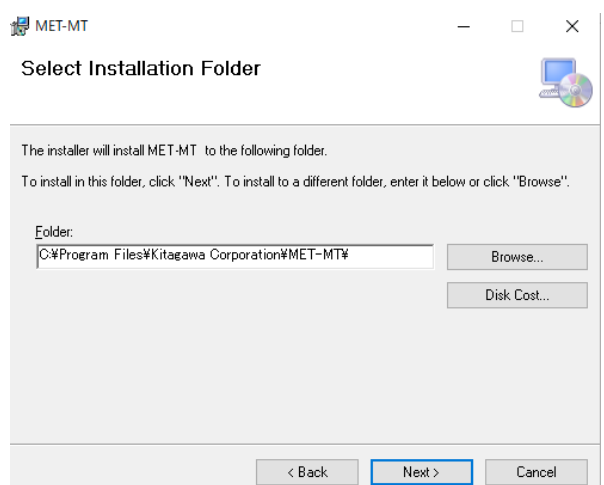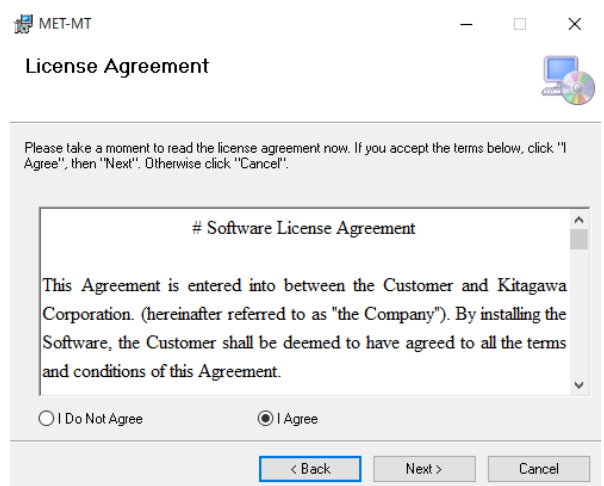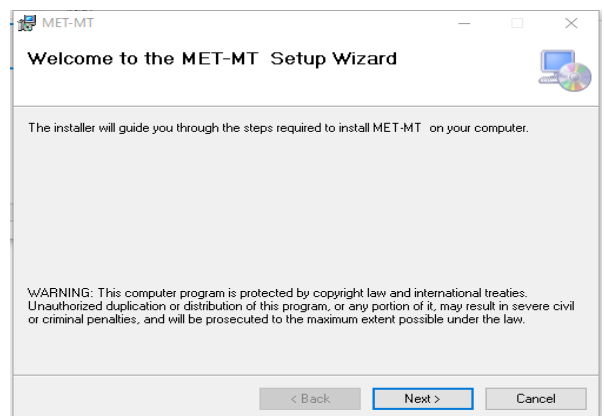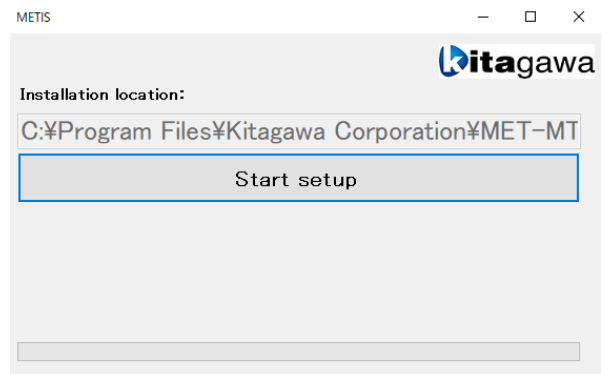
7. When the installation confirmation screen appears, click [Next] to start the installation. To ensure successful installation, do not interrupt the process until the Installation Completer screen (Step 8) appears.
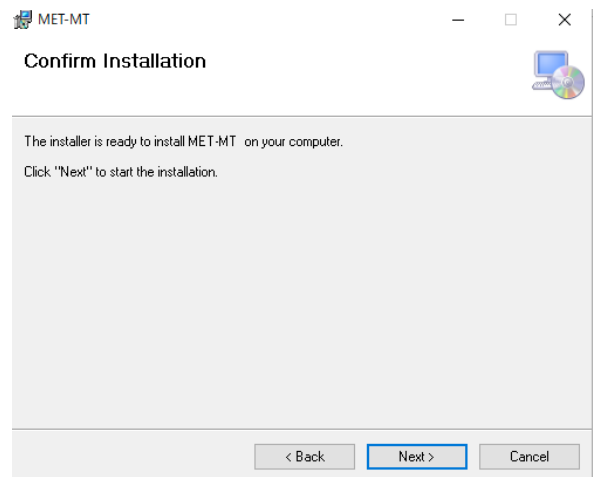
8. When the installation is complete, the following screen will appear. Click [Close] to finish the installation.
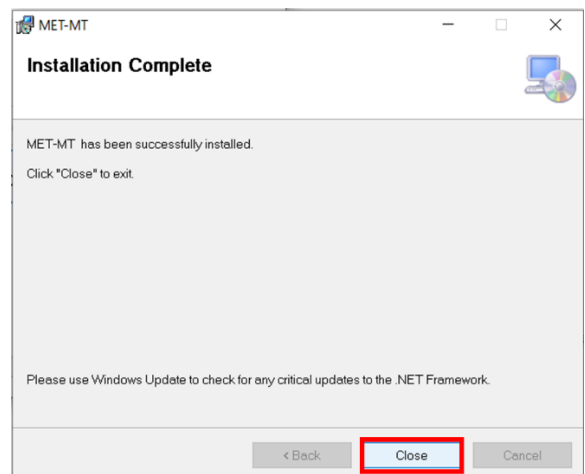
- After installation, the MET-MT application will appear in the list of apps accessible from the Windows Start button.
- C:ProgramFiles¥Kitagawa Corporation¥MET-MT After installation, the following folder is created (when using the default installation path): C:ProgramFiles¥Kitagawa Corporation¥MET-MT
- The application is designed to fit on screen when the display resolution is set to 1920×1080 with 150% scaling. Please adjust your PC`s display settings as needed to ensure th e application is fully visible when launched.

6-2-4   File access permission/attribute granted program

- You must grant access permissions to the data storage area used by the MET-MT Configuration & Monitoring Tool. After installation is complete, permissions and attributes are automatically applied to the required files.

1. When the "File Permission and Attribute Assignment" process starts, a Command Prompt window will open. Assigning permissions may take some time; please wait without losing the window.

2. When the permissions/attribute assignment is complete, a confirmation message will be displayed.
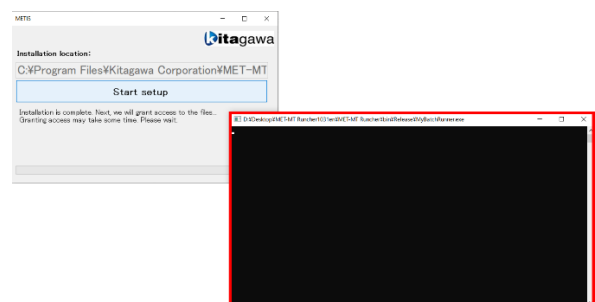
6-2-5 USB driver (CDM212364) installation steps

- Installing a USB driver may be required to connect the PC and MET-CT.

1. After installing [File Access Permissions/Attribute Assignment], the [USB driver] installation wizard will launch. When the installation wizard appears, click [Extract].

2. When the screen on the right appears, click [Next].

3. The license agreement will be displayed. Review it, Select [I Agree], and click [Next].

4. When the installation is complete, the screen on the right will appear. Click [Finish] to complete the installation.

5. When the setup is complete, the screen on the right will appear. Click [OK] to complete the installation.
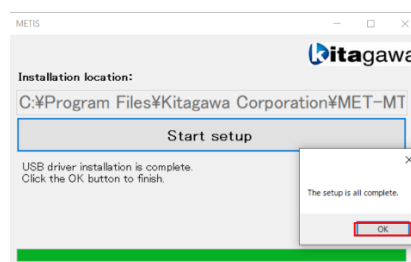
6. Verify that the connection via the driver is working. Launch Device Manager, then connect the measurement evaluation system and the PC with a USB cable.

    Click the search box on the Windows taskbar.

    Type "Device Manager".

    From the search results, select [Device Manager].
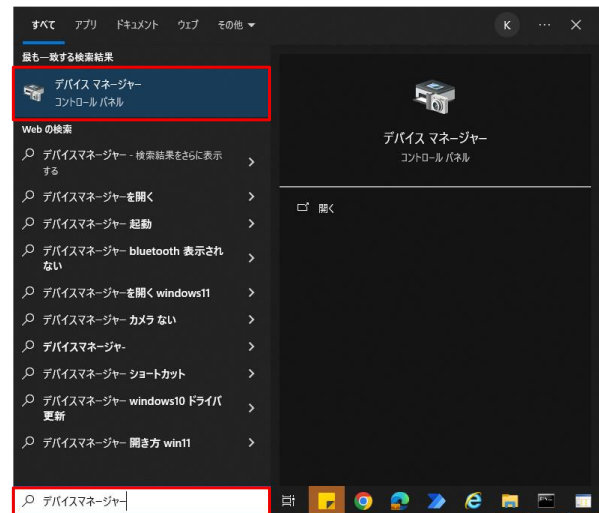
7. As shown in figure below, if the two red-boxed areas display as follows, the connection is normal.

8. The COM port number is assigned randomly and depends on the available ports in your PC environment.
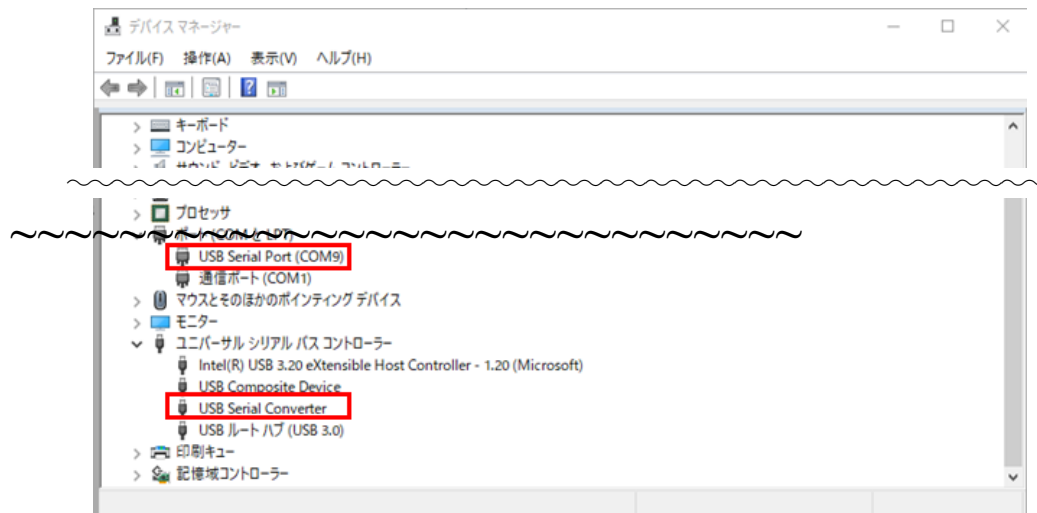
6-3 Screen Display and Operation Instructions

6-3-1   Main Screen Explanation
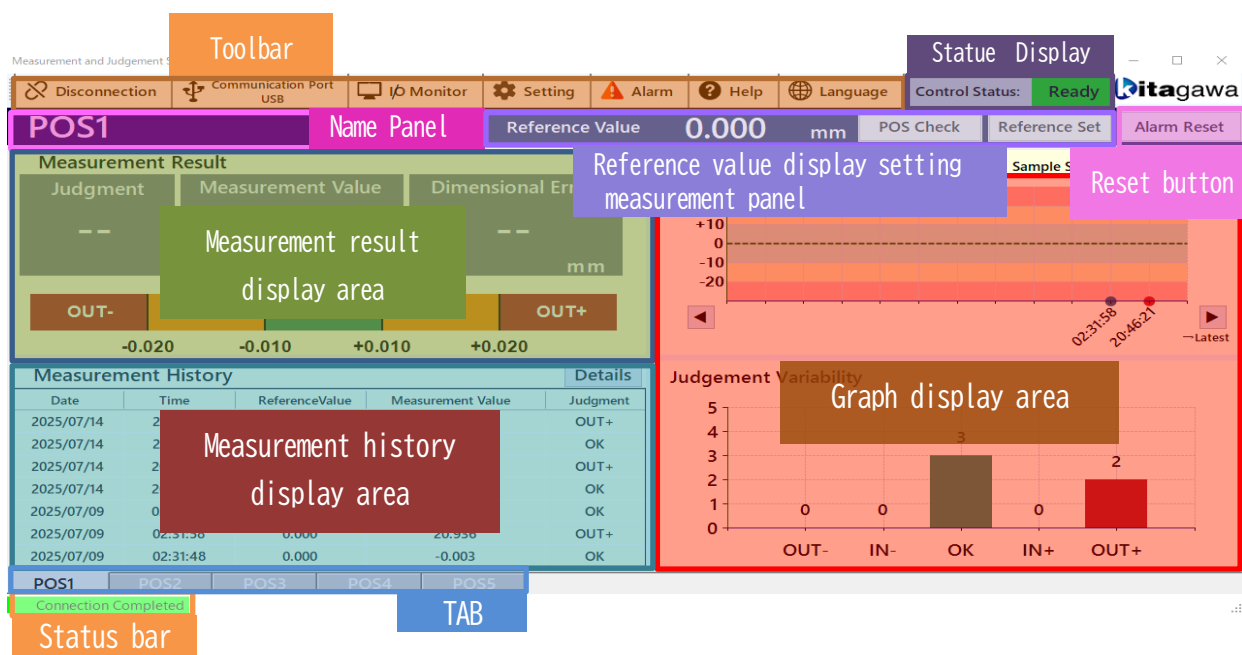
Display area/Panel Name	Contents
Tool bar	By pressing each button, you can establish communication connctions, adjust settings, and perform other operations.
Statue display	Display the control conditions of Control unit MET-CT.
Name Panel	Display POS1~5 and their corresponding names.
Reference value display settings measurement Panel	Display the reference value of POS. Perform the reference setting by clicking the reference set button. Perform the measurement by clicking measurement button.
measurement result display area	Display the real time data of measurement・judgment result and error value.
measurement history display area	Display the measurement data history.
Graph display area	Display the average error trend and measurement variability using graphs and charts.
Status bar	Display the processing status (normal/abnormal,etc.).
[POS1]~[POS5] tab	Switches the display of measurement data for POS1~5 according to the selected tab.
Reset button	Press reset button to clear any active alarms.

6-3-1-1　POS1～5 display・switch

The measurement and judgment system measures up to five positions (POS) and displays the evaluation results, history and graphs for each POS.

You can switch the display measurement data among the five POS by selecting the [POS1]～[POS5] tabs at the bottom of the main screen.
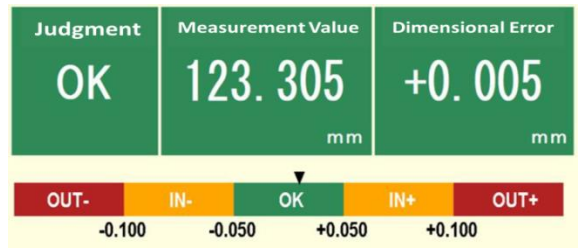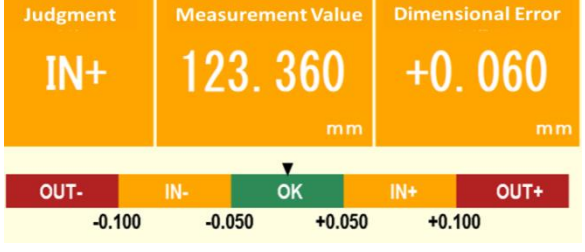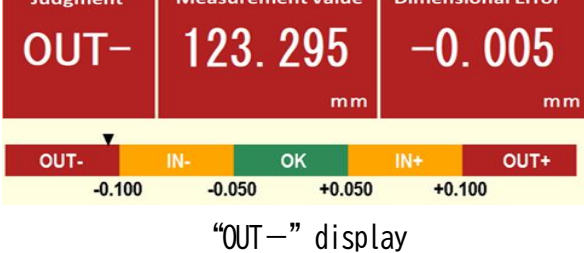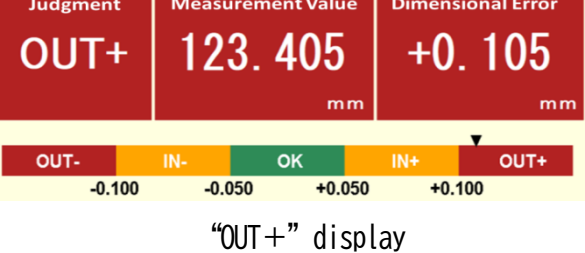
Use the name panel at the top of the screen to confirm the currently selected measurement position.

When you select a diferent POS tab, each display area (Measurement results, Graph, Measurement History) switches to the content for the selected POS.

POS1（Assume）

POS2

POS3

POS4

POS5
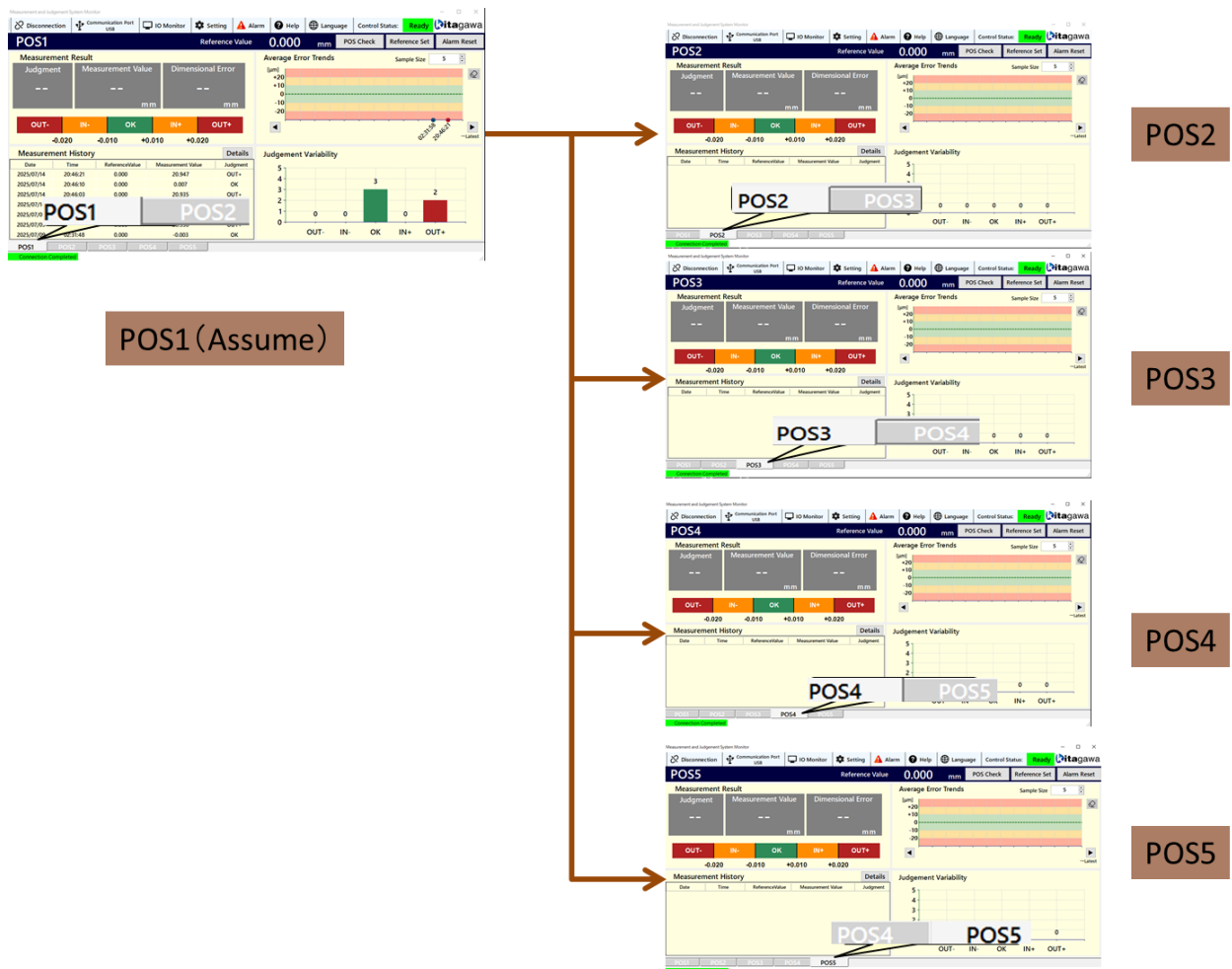
6-3-1-2 Measurement result display

Display the real time data of judgment results on measurement result display area.

The evaluation results are clearly displayed using color-coding based on the judgment result.

Judgment — **Measurement Value** — **Dimensional Error** — mm mm OUT- IN- OK IN+ OUT+ -0.100 -0.050 +0.050 +0.100 Initial Display If measurement is not executed,	**Judgment** OK **Measurement Value** 123.305 **Dimensional Error** +0.005 mm mm OUT- IN- OK IN+ OUT+ -0.100 -0.050 +0.050 +0.100 "OK" display If the judgment result is within the "OK" tolerance limits,
Judgment IN− **Measurement Value** 123.295 **Dimensional Error** −0.005 mm mm OUT- IN- OK IN+ OUT+ -0.100 -0.050 +0.050 +0.100 "IN−" display If the judgment result is within the "IN−" intermediate tolerance limits,	**Judgment** IN+ **Measurement Value** 123.360 **Dimensional Error** +0.060 mm mm OUT- IN- OK IN+ OUT+ -0.100 -0.050 +0.050 +0.100 "IN+" display If the judgment result is within the "IN+" intermediate tolerance limits,
Judgment OUT− **Measurement Value** 123.295 **Dimensional Error** −0.005 mm mm OUT- IN- OK IN+ OUT+ -0.100 -0.050 +0.050 +0.100 "OUT−" display If the judgment result exceeds the lower threshold limit for "OUT−"	**Judgment** OUT+ **Measurement Value** 123.405 **Dimensional Error** +0.105 mm mm OUT- IN- OK IN+ OUT+ -0.100 -0.050 +0.050 +0.100 "OUT+" display If the judgment result exceeds the upper threshold limit for "OUT+",

- The evaluation result display is retained until the next measurement is performed.
- When a different measurement position (POS) is measured, the content in the Measurement Results area automatically switches to the new POS.
- IF you change the measurement position (POS) using the POS tabs, the measurement results area returns to its initial display.

6-3-1-3　Measurement history display

In the measurement history area, the seven most recent records are displayed for each POS.To view the recent measurement history(up to 9,999 entries), click [Details].

No.	Name	Note
①	Date	Measurement date
②	Time	Measurement time
③	Position	Measured POS Number
④	Name	Measured POS name (Parameter setting)
⑤	Reference value (mm)	Reference value of measured POS(Parameter setting)
⑥	Measured value (mm)	Measured value
⑦	Error value (mm)	Error value (Measured value – reference value)
⑧	Judgment	Judgment result (OK/IN+/IN-/OUT+/OUT-)
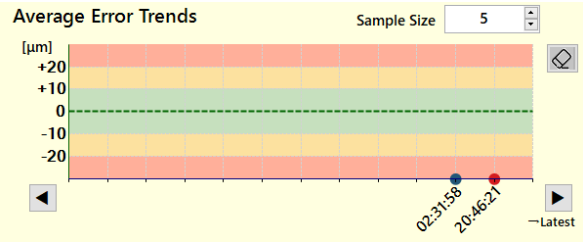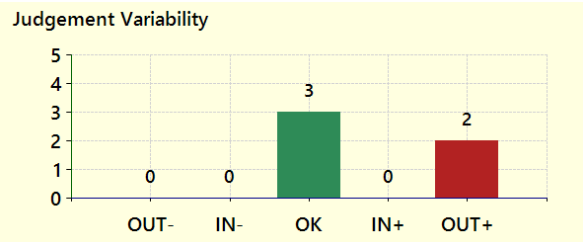
Cautions

- Only 9,999 measurement history records are stored. Records beyond 9,999 will be deleted, so please back up your data regularly.

6-3-1-4 Graph Display

In the graph display area, two types of graph are shown based on the measurement history.

- Average Error Trend Graph
- Judgment Variability Graph

Type of graph	Details
Average Error Trend Graph Average Error Trends Sample Size 5 [μm] +20 +10 0 -10 -20 ◀ 02:31:58 20:46:21 →Latest	One point (sample group[※1]) is plotted for each sample-size count derived from the measurement results. The average measurement error for each group is displayed together with the measurement timestamp. This can be used for analyzing error trends. For example, by setting the sample group to the number of workpiece manufacturing lots, you can track the trend the of the average measurement error for each lot.
Judgment Variability Graph Judgement Variability 5 4 3 3 2 2 1 0 0 0 0 OUT- IN- OK IN+ OUT+	The judgment variability graph shows the distribution of evaluation results for the sample group corresponding to each data point (the red dot on the Average Error Trend Graph). As an example, it can be used to review lot-level judgment results.

※1　Sample Group
　　　A block of data defined by the specified sample size that is plotted on the graph.
　　　For example, if the sample size is set to 5, every set of five measurement records (error values) constitutes one sample group.
　　　If you want to examine changes in individual error values, set the sample size to 1.
　　　When ou change the sample size, the graph is recalculated and redrawn.

Average Error Trends Sample Size 5
[μm]
+20
+10
0
-10
-20
◀ 02:31:58 20:46: →Latest

Measurement result

Judgement Variability
5
4
3   3
2   2
1   0   0   0
0
OUT-   IN-   OK   IN+   OUT+
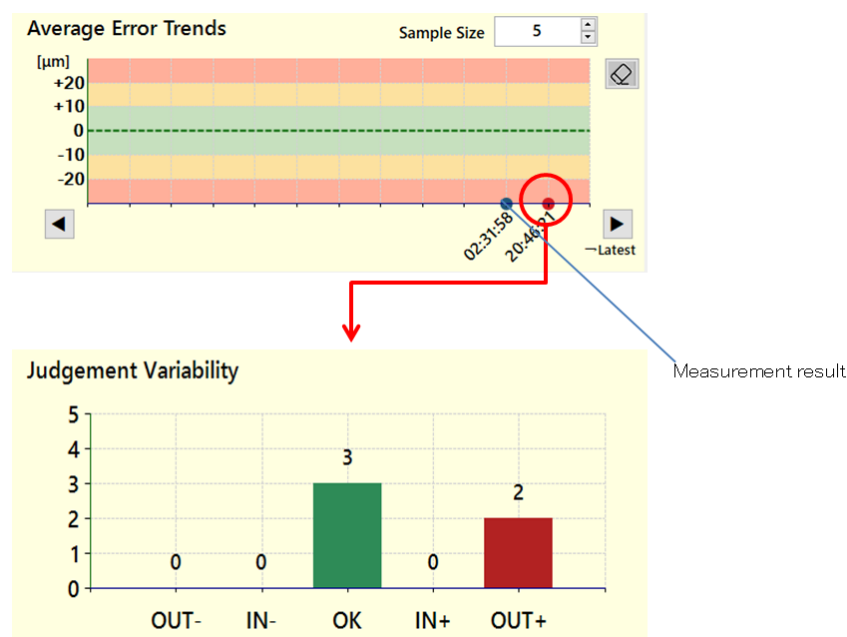
◆ **Change Graph Sample Size**

You can change the sample size of the sample groups displayed in the Average Error Trend graph and the Judgment Variability Graph. Adjust the sample size by entering a numeric value directly or by clicking the ▲and▼ buttons to increase or decrease the value.
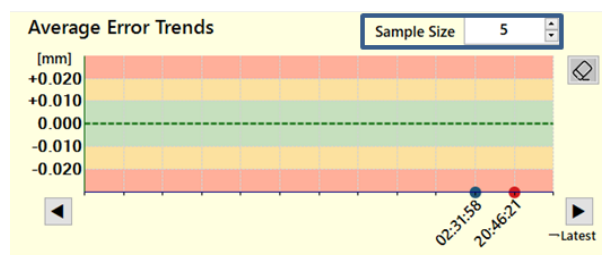
Enter a numeric value directly
▲Click: value +1
▼Click: value -1
Setting range
1 ～ 100

◆ **Switch sample group data points**

You can use ◄◄or►►buttons to move between the sample group data points (red dots) in the Average Error Trend graph, switching the displayed judgment variability for each selected data point.
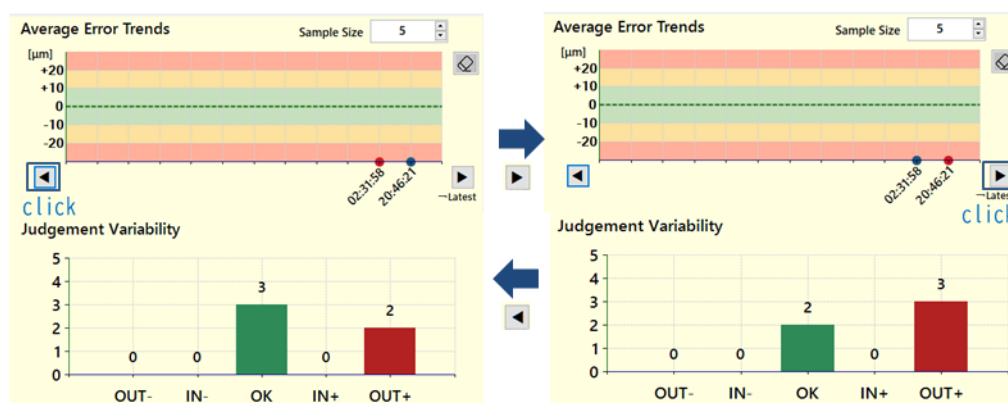
◆ **Change graph units (μm ⇔ mm)**

You can switch the vertical-axis units of the Average Error trend graph between micrometers [μm] and millimeters [mm]. To switch, click [μm] or [mm] on the graph's vertical axis.
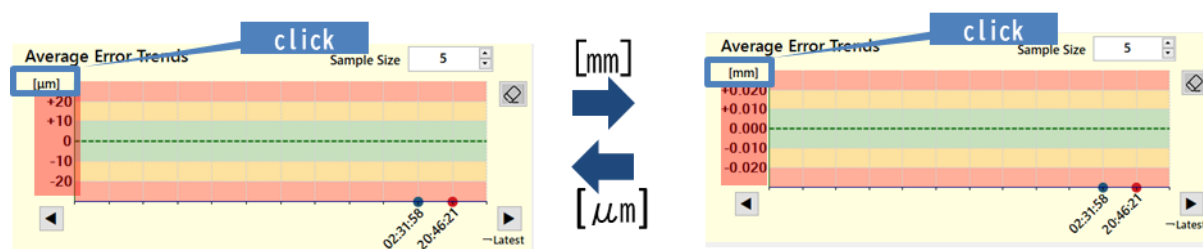
◆ **Change Timestamp display (Time ⇔ Date)**

You can switch the horizontal-axis units of the Average Error Trend graph between time[hh:mm:ss] and date[YY/MM/DD].To switch, click the date or time area on the graph's horizontal axis.
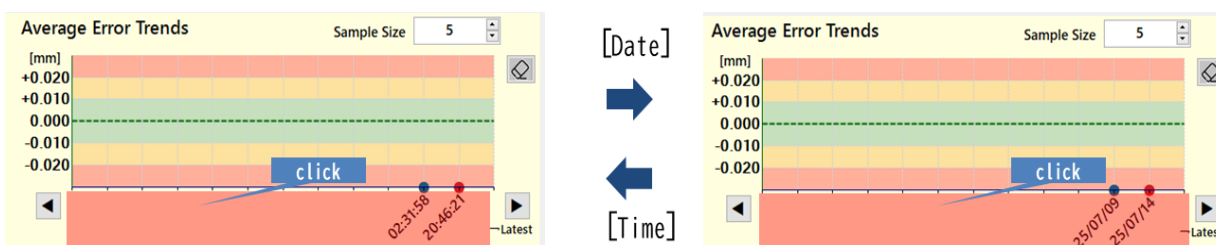
◆ **Delete Graph Display**

You can delete old graph display data and redraw a new graph.

Please note that once the graph display is cleared, it cannot be restored.

This operation does not delete the measurement history data itself.
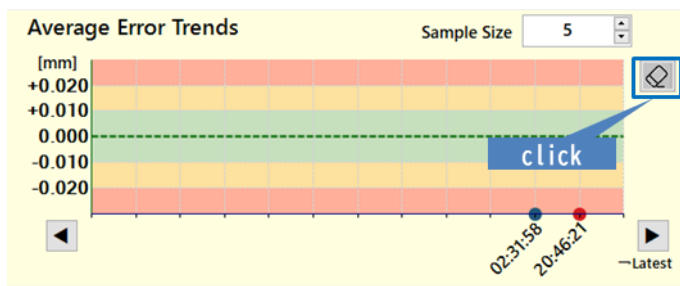
6-3-1-5 Reference Setup Operation

You can perform the reference set up from the MET-MT (Monitor & Settings Tool).

For details on the reference setup, please refer to <u>Chapter 3-4-3 Reference Setup</u>.

1. Grasp the reference master work piece or gauge. Press "Set Reference" at the top right of the screen.
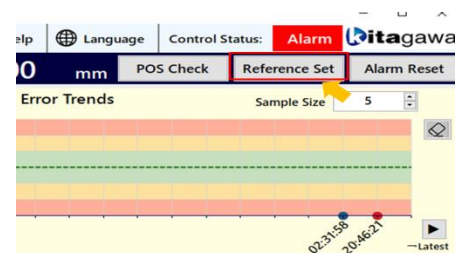
2. A confirmation popup will appear. Tap "Yes" to set the reference. When the reference has been set, a popup will appear saying "Reference set"
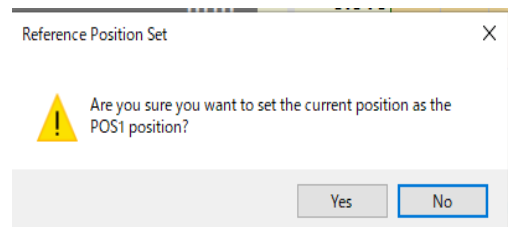
6-3-1-6 Measurement operation

Measurement can be performed from MET-MT.

1. Measure the length at the current position. The equipment will not move.
   Select the POS to measure from the tabs, then press "POS Check" at the top right of the screen.
   When the measurement is executed, the results will be reflected in "Measurement Result" "Graph display" and "Measurement History".
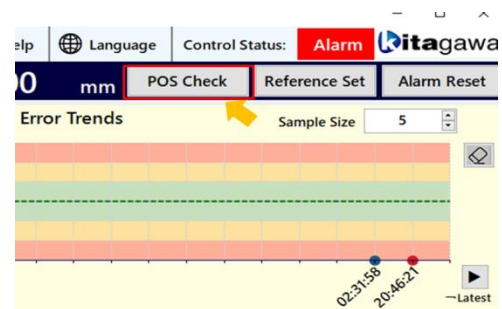
6-3-1-7 Operation of alarm reset

If the alarm is in a resettable state, you can reset it from MET-MT (Monitor & Setup Tool) by pressing "Alarm Reset".

The alarm can also be reset via an external signal or from the main unit itself. For details on alarm reset methods, please refer to Chapter 11-3-1.

1. While an alarm is active, click "Alarm Reset" at the top right of the screen.

2. When the alarm is reset, the status changes from "ALARM" to "READY". If the alarm condition has not been cleared, the alarm will not be reset.
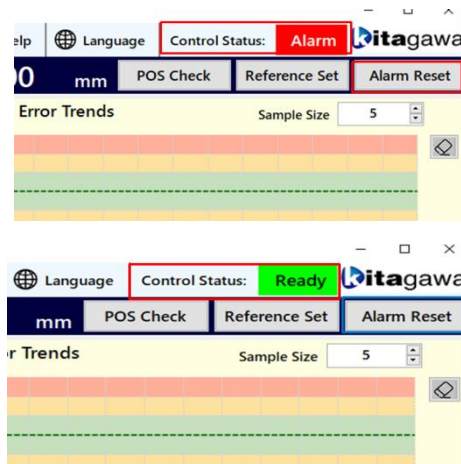
6-4 Communication with measurement and judgment system

Communicate between the PC and the measurement judgment system via either USB or Ethernet.

6-4-1 Selecting the Communication Method - USB

1. Connect the PC to the MET-CT (Control Unit) with a USB cable, using the MET-CT`s USB (PC) port.

2. Open MET-MT (Monitor & Setup Tool), press "Communication Port " and select the communication type. A communication port selection popup window will appear.
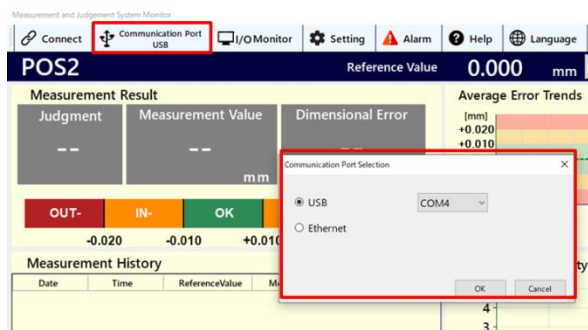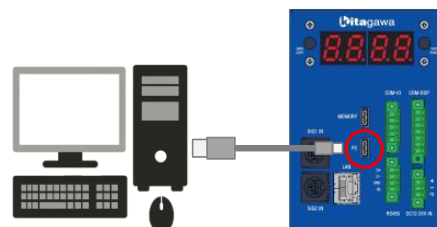
3. In the communication port selection popup window, select "USB". Select the COM port to which the MET-CT (Control-Unit) is connected, then click [OK].

•   For instructions on how to confirm which COM port of the MET-CT (Control Unit) is connected to, see below.
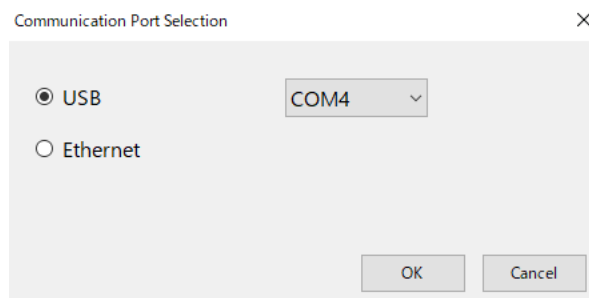
How to check which COM port the MET-CT is connected to:

•   Open Device Manager. (For instructions on how to open it, refer to Chapter 6.2.5, step 6).
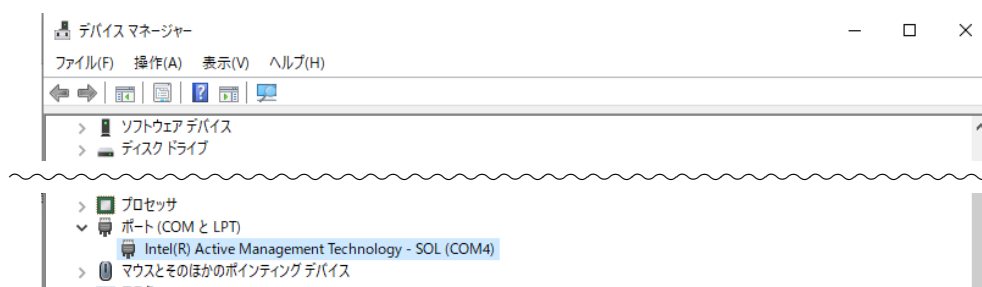
•   If the MET-CT (Control Unit) is connected, unplug the USB cable; the COM entry that disappears under "Port (COM & LPT)" is the COM port to select.

•   If the MET-CT (Control Unit) is not connected, plug in the USB cable; the COM entry that appears under "Port (COM & LPT)" is the COM port to select.

•   If the MET-CT (Control Unit) is connected, it will be shown as "USB Serial Port(COM*)".

6-4-2   Selecting the Communication Method - Ethernet

For first-time communication, start with US. After completing the Ethernet-related settings in Chapter 6-5-1-1, Ethernet communication will be available.

1. Connect the PC with LAN port of MET-CT (control unit) by LAN cable.
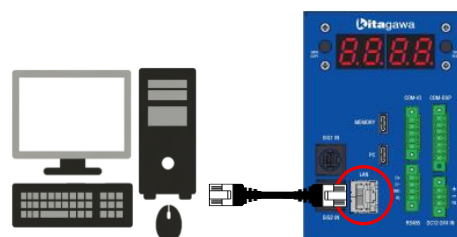
2. Open the Monitor & Setup Tool (MET-MT), select "Communication Port", and choose the communication type. A communication port selection popup window will appear.

MET manual
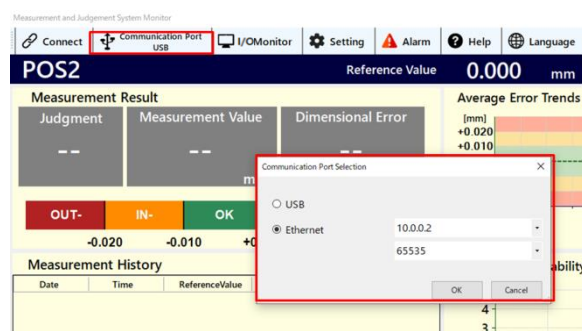
3. In the communication port selection popup window, select "Ethernet".Verify the IP address and port number of the control unit to be communicated with and configure them as needed. Up to 10 previously configured destination entries will be displayed.After confirming the settings, click [OK].

Communication Port Selection	✕
○ USB	
⦿ Ethernet	10.0.0.2 ▾
	65535 ▾
	OK Cancel
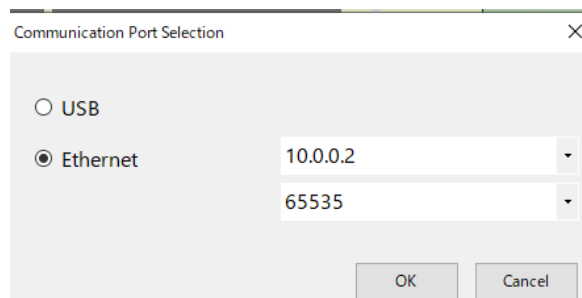
※1. The IP address and port number can be checked in 6-5-1-1 "Ethernet Modus/TCP Parameters" item 2, or by checking the IP address ad port number parameters.

6-4-3   Communication with measurement and judgment system

1. Verify that the communication name displayed on [communication port] matches the communication protocol you intend in use.
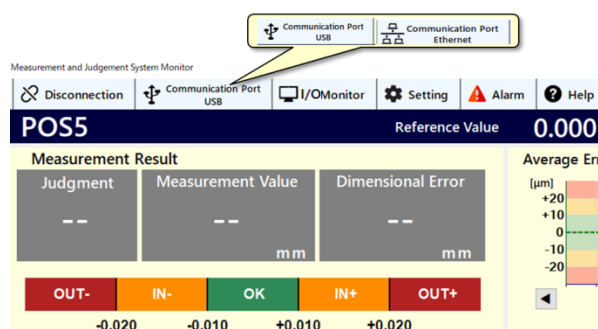
2. Select [Connect]. A confirmation pop-up window will appear asking "Do you want to connect?"; click [Yes].

3. When the connection is successfully established, the status changes as follows:

    [Connect] ⇔ [Disconnect]

    Status Display

    Status Bar

-   [Connect] changes to [Disconnect].(The display switches to the next operation options.)
-   The status display shows the control state. (Control state:READY/BUSY/ALARM)
-   The status bar displays "Connection completed"
※ Once connected, the measurement history data stored in the MET-CT (control unit) will be received. If there is a large amount of data, this process may take some time. During this period, data will gradually appear in the Measurement History and Graph areas
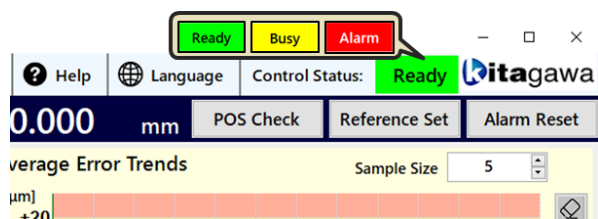
4. If the connection fails, a pop-up will display "Connection failed." Please check that the communication settings are correct and that the MET-CT (control unit) has started up and is operating normally.

5. To disconnect communication, press the [Disconnect] button.When disconnected, the status changes as follows:

•   The [Disconnect] button changes to [Connect].(The display switches to the next operation options.)

•   The status bar displays "Disconnected",

•   The control state is not shown in the status display.

6-5 Setting

We will configure parameters or the Measurement and Judgment system. On each parameter tem screen, the parameters configured in the MET-CT (control unit) are displayed. Configuration is performed while connected to the MET-CT.The configurable parameter items are listed below.
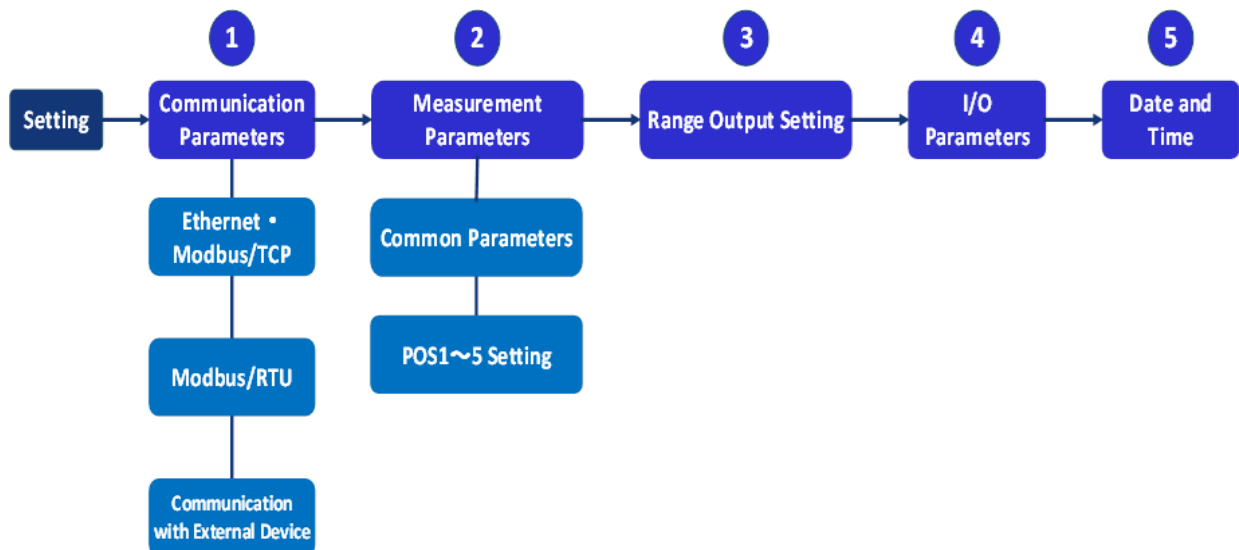
No.	Parameter name	Note
①	Communication parameter	Configure the parameters for communication between the PC and measurement judgment system, and between the Measurement Judgment system and devices.
②	Measurement parameter	Configure the parameters related to measurement process.
③	Area Output Setting	Configure the parameters related to Area output.
④	I/O parameters	Configure the parameters related to input and output signals.
⑤	Date and time setting	Configure the date and time on MET-CT (control unit).

6-5-1 Communication parameter

6-5-1-1 Ethernet・Modbus/TCP parameter

1. Perform display and setting of parameters related to Ethernet・Modbus/TCP.
   - ➢ Select [Setting].
   - ➢ Select [Communication parameter] → [Ethernet・Modbus/TCP]
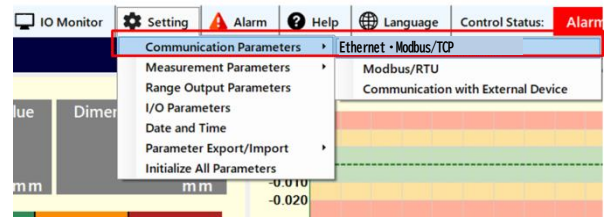
2. Enter the required items.
   - Press [Initialize] to reset the Ethernet parameters on both the Measurement Judgment System and the application to their default values.
   - Set [Set] to write the entered values to the measurement judgment system.
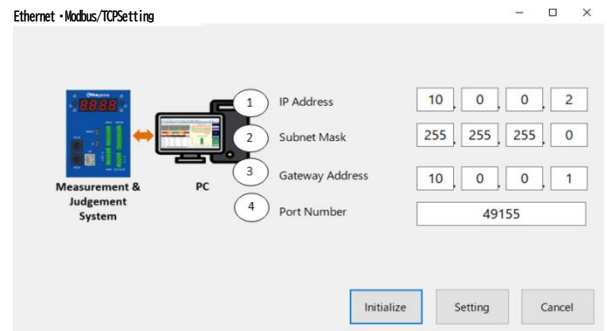
   - When you press [Cancel], the following will occur:

   If there are no changes, the "Ethernet/Modbus/TCP Settings" screen closes.

   If there are changes, a pop-up appears: "There are changes. Return to the previous screen?".

   If you select Yes, you return to the settings screen. If you select No, the changes are ignored and the "Ethernet/Modbus/TCP Settings " screen closes.

   ＊ After setting the parameters, be sure to restart the length measurement judgment system.

Parameter details

① Ip address		
【Initial value】	【Data range】	【Unit】
192.168.0.1	0.0.0.0 ― 255.255.255.255	―
【Note】 Set up IP address of Measurement and judgment system.		
② Subnet mask		
【Initial value】	【Data range】	【Unit】
255.255.255.0	255.0.0.0 ― 255.255.255.255	―
【Note】 Set up subnet mask of Measurement and judgment system.		
③ Gateway address		
【Initial value】	【Data range】	【Unit】
0.0.0.0	0.0.0.0 ― 255.255.255.255	―
【Note】 This is required when communicating with devices outside the network. Please set the gateway IP address to match the external device's network.		
④ Port Number		
【Initial value】	【Data range】	【Unit】
49155	0 ― 65535	―
【Note】 Setup the communication port used in data communication. Please confirm if the PC・exernal device・MET-CT (control unit) are the same value.		

6-5-1-2　Modbus/RTU parameter

1. Display and set up parameters for Modbus/RTU.
   - ➢ Select [Settings]
   - ➢ Select [Communication Parameters] → [Modbus/RTU]
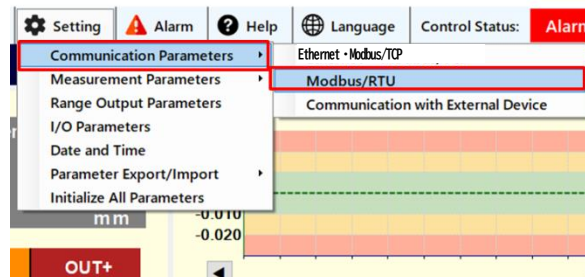
2. Enter the required items.
   - Press [Initialize] to reset the RS-485 parameters on both the Measurement judgment system and the application to their default values.
   - Press [Set] to write the entered values to the Measurement and Judgment system.
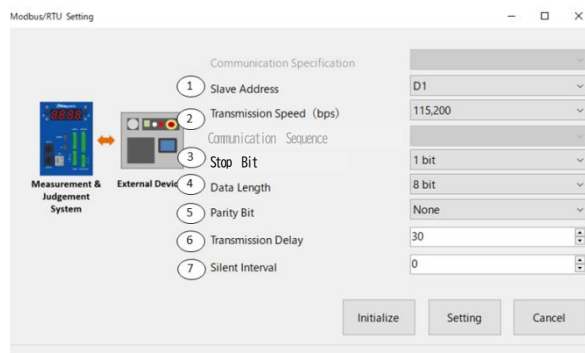
   - When you press [Cancel], the following occurs:
   If there are no changes, the "Modbus/RTU Settings" screen closes. If there are changes, a popup appears: "There are changes. Return to the previous screen?" If you select Yes, you return to the settings screen. If you select No, the changes are ignored and the "Modbus/RTU settings "screen closes.
   * After setting the parameters, be sure to restart the length measurement judgment system.

Parameter details

① Slave address		
【Initial value】 D1	【Data range】 D1 － D31	【Unit】 －
【Note】 Set up the slave address.		
②Transmission speed (bps)		
【Initial value】 115,200	【Data range】 9,600 / 19,200 / 38,400 / 57,600 / 115,200 / 230,400	【Unit】 bps
【Note】 Set up the transmission speed.		
③ Modbus stop bit		
【Initial value】 1 bit	【Data range】 0 bit / 1 bit	【Unit】 －
【Note】 Set up the stop bit.		
④ Data length		
【Initial value】 8 bit	【Data range】 7 bit / 8 bit	【Unit】 －
【Note】 Set up the data length.		
⑤ Parity bit		
【Initial value】 Even parity	【Data range】 None / Even prity/Odd parity	【Unit】 －
【Note】 Set up the parity bit.		

⑥　Trsnsmission waiting time		
【Initial value】	【Data range】	【Unit】
30	0 － 10000	0.1ms
【Note】 Set up the transmission waiting time.		
⑦　Silent interval		
【Initial value】	【Data range】	【Unit】
0	0 － 100	0.1ms
【Note】 Set up the silent interval. 0：Set up automatically.		
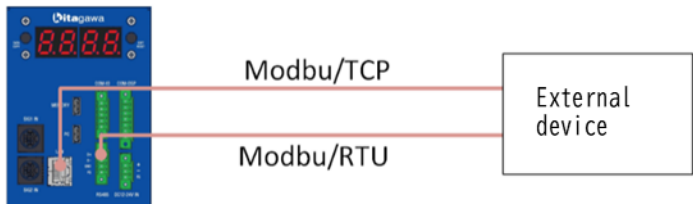
6-5-1-3　Communication with external devices

1. Select the communication method for external devices.
   ➢ Select[Settings].
   ➢ Select[Communication parameters] → [Communication with external devices]

2. Select the communication method or external devices: either "Modus/RTU (RS-485 connection)" or "Ethernet Modbus/TCP connection".
   • Press [Set] to confirm the selected communication method.
   • When you press [Cancel], the following occurs:
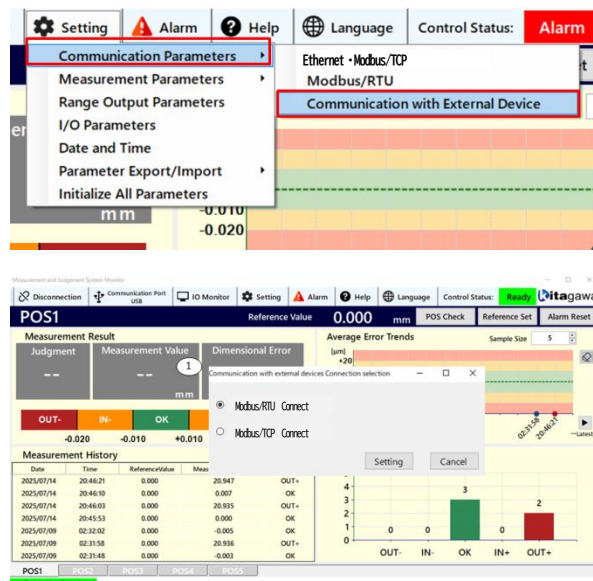
   If there are no changes, the "External Device Communication Settings" screen closes.
   If there are changes, a pop-up appears: "There are changes. Return to the previous screen?"
   If you select Yes, you return to the settings screen. I you select No, the changes are ignored and the "External Device Communication Settings" screen closes.

Parameter details

①　Communication with external devices		
【Initial value】	【Data range】	【Unit】
Modbu/RTU connection	Modbu/RTU connection 、Modbu/TCP connection	—
【Note】 Select the communication method of control unit and external device. 		

6-5-2　Measurement parameters

6-5-2-1　Common setting
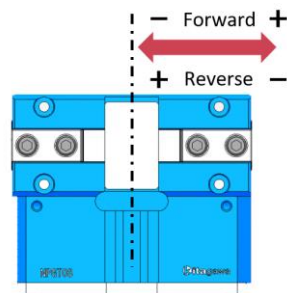
1. Display and set up parameters related to measurement.

   ➢ Select the setting
   ➢ Select【measurement parameter】→【common setting】

2. Enter the required items.
   • Press [Initialize] to reset the measurement parameters on both the Measurement and Judgment system and the application to their default values.
   • Press [Set] to write the entered values to the Measurement and judgment system.
   • When you press [Cancel], the following occurs:
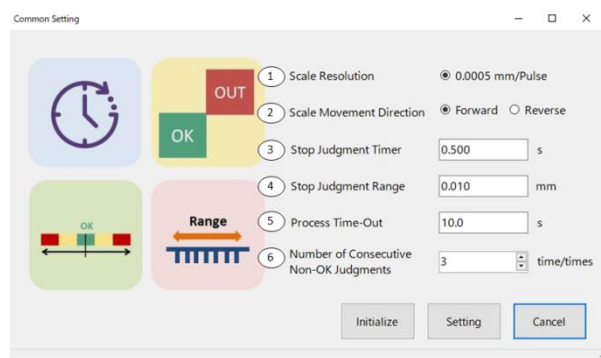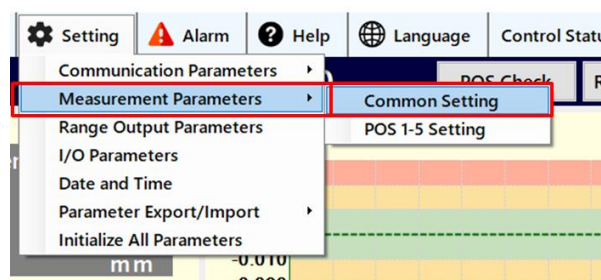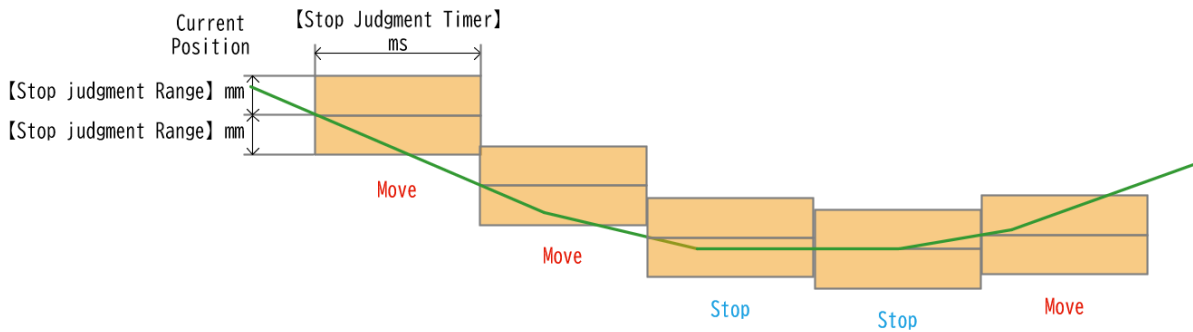
   If there are no changes, the "Common Settings" screen closes.

   If there are changes, a pop-up appears. "There are changes. Return to the previous screen?" If you select Yes, you return to the settings screen. If you select No, the changes are ignored and the "Common Settings" screen closes.

Parameter details

① Scale resolution		
【Initial value】 0.0005	【Data range】 0.0005(fixed)	【Unit】 mm/Pulse
【Note】 Select the scale resolution. Coordinates are converted to millimeters based on the configured value.		
② Direction of scale movement		
【Initial value】 Forward direction	【Data range】 Forward direction/Reverse direction	【Unit】 —
【Note】 Set up the direction of pulse count of scale.	(e.g) If measurement hand	

③ Stop judge timer

【Initial value】	【Data range】	【Unit】
0.500	0.000 — 5.000	second

④ Stop judge area

【Initial value】	【Data range】	【Unit】
0.001	0.000 — 5.000	mm

【Note】

During POS set, AREA set,and Length Judgment (POS CHK) operations, operations, processing starts when stop condition is determined.

During the [Stop Judgment Timer]if the current position changes by more than the [Stop,Judgment Range], it is regarded as moving; if the change s less than the [Stop judgment Range], it is regarded as stopped.

If the [Stop Judgment Timer] is set to 0.000, no move/stop judgment is performed and processing proceeds.

⑤ Process time out

【Initial value】	【Data range】	【Unit】
10.0	0.0 — 30.0	second

【Note】

When processing for POS set, AREA set, or length judgment (POS CHK) is started, if a stop condition is not determined or if processing does not complete due to abnormality, a timeout occurs after the times set in [Process Timeout].The processing is aborted and an alarm is triggered.

⑥ Consecutive Non-OK Judgment Count

【Initial value】	【Data range】	【Unit】
0	0 — 10	times

【Note】

If the measurement judgment produces a result other than OK occurs consecutively for the number specified by [Consecutive Non-OK Judgment Count], alarms [H201] ～[H205] will be triggered.
When this setting is 0, alarms [H201] ～[H205] are not triggered.

6-5-2-2 POS1～5 parameter

1. Display and set parameter related to measurement.

   ➢ Select 【setting】
   ➢ Select 【measurement parameter】 —
   【POS1～5 setting】

2. Enter required items.
   • Press [Initialize]to reset POS1～5 parameters on both the measurement and Judgment system and the application to their default values.
   • Press [Set] to write the entered values to the Measurement and judgment system.
   • When you press [Cancel], the following
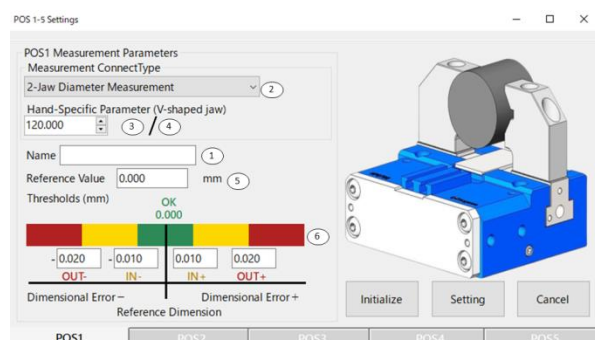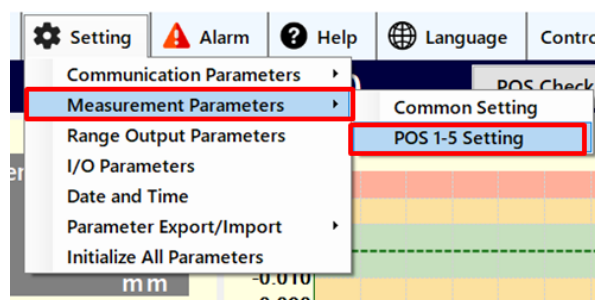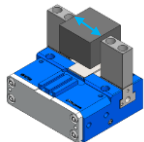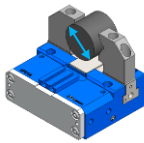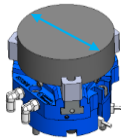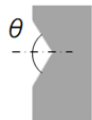
occurs:

If there are no changes, the "POS1～5 settings" screen closes.

If there are changes, a pop-up appears. "There are changes. Return to the previous screen ?" If you select Yes, you return to the settings screen. If you select No, the changes are ignored and the "POS1～5 settings" screen closes.

Parameter details

① Name		
【Initial value】 —	【Data range】 —	【Unit】 —
【Note】 You can resign an arbitrary name to each POS. You can register up to 16 characters using combinations of uppercase and lowercase letters, numbers and the following symbols: (! " # $ % & ' ( ) * + , - . / : ; = ? @ < > ¥ ^ _ ` { }	)		

② Meassurement type		
【Initial value】 2-jaw linear measurement	【Data range】 2-jaw linear measurement/ 2-jaw diameter measurement/ 3-jaw diameter measurement	【Unit】 —
【Note】 Switch tabs to set the measurement type used for POS length judgment. The measurement values are coordinate-transformed according to the selected measurement type.		

2-jaw linear measurement   Measure the linear line using the 2-jaw robot hand.

2-jaw diameter measurement   Measure the diameter of circle using the 2-jaw robot hand.
Calculate the diameter based on the corresponding parameters.

3-jaw diameter measurement   Measure the circle diameter using 3-jaw robot hand.
Calculate the diameter based on the corresponding parameters,

③ Hand specified parameter 1 (V-shaped jaws)		
【Initial value】 120.000	【Data range】 0.001 — 180.000	【Unit】 deg
【Note】 This is applicable when Measurement type is 2-jaw outer diameter measurement. Set the angle (θ) of the V-shaped jaws.		θ

④ Hand specified parameter 2 (Wedge angle)		
【Initial value】 40.000	【Data range】 0.001 － 179.999	【Unit】 deg
【Note】 This is applicable when Measurement type = 3 jaw inner/outer diameter measurement. When using a Kitagawa 3-jaw hand/gripper, please set the following; Model: NTS3*S series set value : 40.000		
⑤ Reference set value		
【Initial value】 0.000	【Data range】 -999.999 － 999.999	【Unit】 mm
【Note】 Set the reference dimension (master work piece dimension) for each POS. By performing the reference set operation, the value configured in [Reference set] will be applied as the reference value.		
⑥ Thershold		
【Initial value】 0.010	【Data range】 0.000 － 10.000	【Unit】 mm
【Note】 Set the threshold value of POS measurement. Specify the setting as an absolute value. Judgment is determined as follows when measurement operation is performed using the configuration example as below. OK judge : -0.010mm ≦error value (measurement value－reference value) ≦ 0.010mm IN＋judge : 0.010mm ＜error value (measurement value－reference value) ≦ 0.020mm IN－judge : -0.020mm ≦error value (measurement value－reference value) ＜ -0.010mm OUT＋judge : 0.020mm ＜error value (measurement value－reference value) OUT－judge : error value (measurement value－reference value) ＜ -0.020mm 		

6-5-3   Range Output parameter

1. Display and set parameter related to range output.

   ➢ Select the [setting].
   ➢ Select [range output parameter].
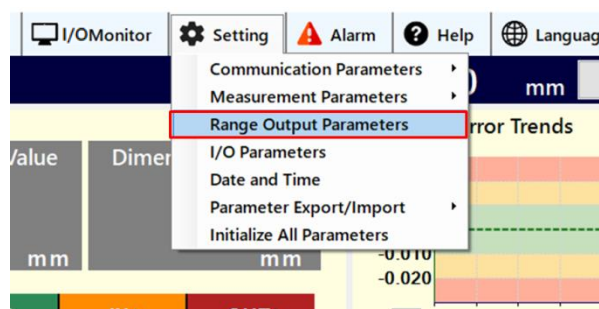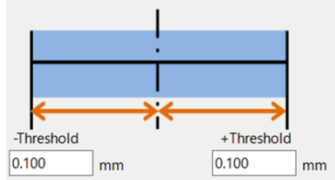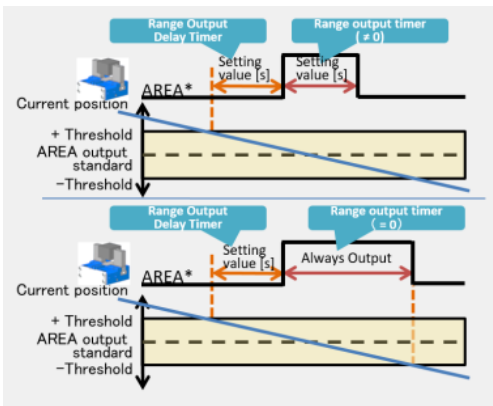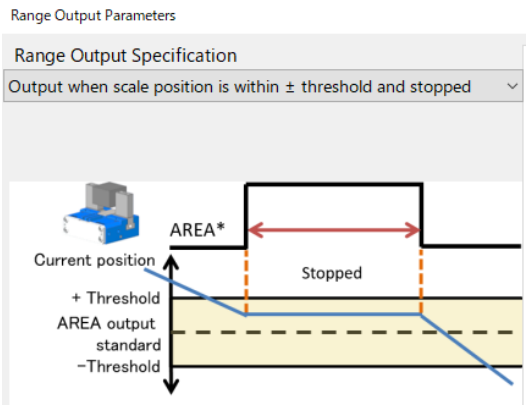
2. Enter the required items.
   • When [AREA1] tab is selected, AREA1 setting form is displayed,
   • When [AREA2] tab is selected, AREA2 setting form is displayed,
   • When [AREA3] tab is selected, AREA3 setting form is displayed,
   • Press [Initialize] to reset the range output parameters to their initial values on both the measurement judgment system and the application side.
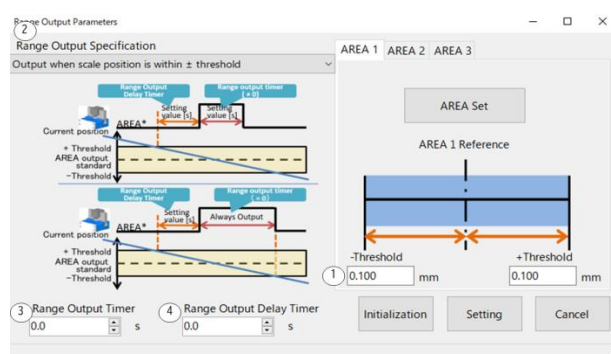
- Press [Set] to write the entered values to the measurement and judgment system.
- Press [Cancel]:If no changes have been made, the "Range Output Parameters" screen closes. If changes have been made, a popup appears: "Changes detected. Return to the previous screen?" Selecting "Yes" returns to the settings screen. Selecting "No" discards the changes and close the "Range Output Parameters" screen.

Parameter details

① AREA*thershold		
【Initial value】 0.100	【Data range】 0.000 — 999.999	【Data unit】 mm
【Note】 Set the ±threshold value AREA range output selected on ARIA* tab.		

② Range output specification		
【Initial value】 Output is generated when the current position is within the ± threshold.	【Data range】 Output is generated when the current position is within the ± threshold. / Output is generated when the current position is within the ± threshold AND the stop condition is met.	【【Unit】 —

③ Range output timer		
【Initial value】 0.0	【Data range】 0.0 — 5.0	【Unit】 s

④ Range output delay timer		
【Initial value】 0.0	【Data range】 0.0 — 3.0	【Unit】 s

【Note】
Set the area output specification, area output timer and range output delay timer.

Range output timer
Set the range output timer.
When the current position enters the AREA threshold, the range output is activated or the duration specified under [Setting Time], In accordance with the range-output specification conditions.
I 0.0 is set, the output remains active continuously while within the range.

<Range output delay timer>
Set the Range output delay timer.
After the current position enters the AREA threshold, the range output is activated once the [Range Output delay timer] has elapsed.

When range output specification：0

When range output specification：1

6-5-4　I/O parameter

1. Display and set parameter related to measurement.

   ➢ Select the [Setting]
   ➢ Select [I/O parameter].
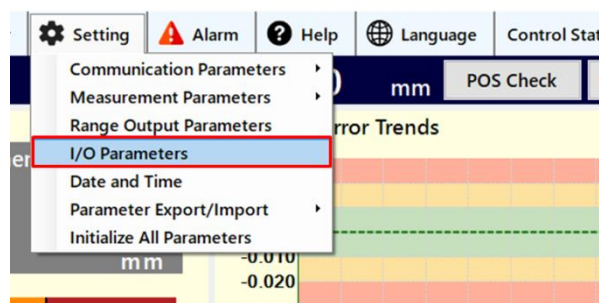
2. Enter the required items.
   • Press [Initialize] to reset the I/O parameters to their initial values on both the measurement judgment system and the application side.
   • Press [Set] to write the entered values to the measurement and judgment system.
   • Press [Cancel]:
   If no changes have been made, the "I/O parameters" screen close
   If changes have been made, a popup appears: "Changes detected. Return to the previous screen?" Selecting "Yes" returns to the settings screen. Selecting "No" discards the changes and closes the "I/O parameters" screen.
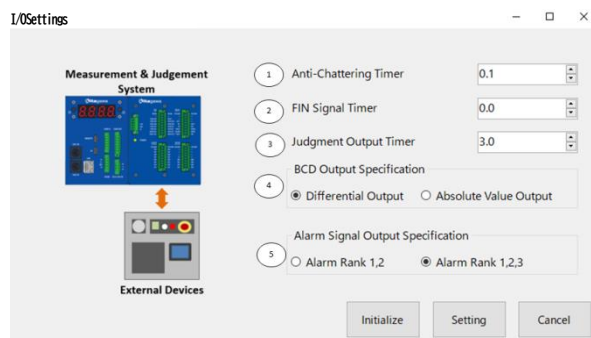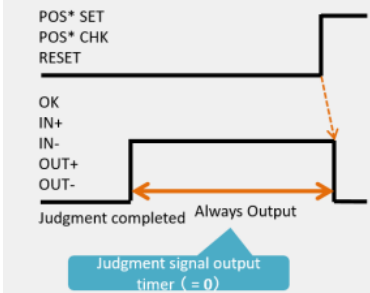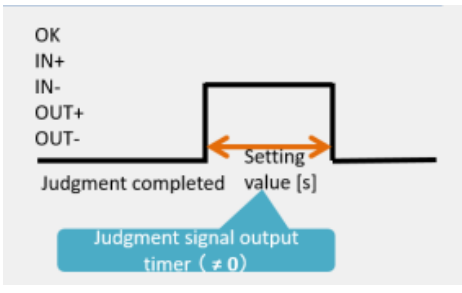
Parameter details

① Anti-chattering timer		
【Initial value】 0.1	【Data range】 0.0—1.0	【Unit】 s
【Note】 Set the anti-chattering timer for input signal reception.		

② FIN signal timer		
【Initial value】 0.0	【Data range】 0.0—1.0	【Unit】 s
【Note】 Set the timer for outputting the FIN signal. If 0.0 is set, the output will be synchronized with the input signal.		

③ Judgment output timer

【Initial value】	【Data range】	【Unit】
3.0	0.0—10.0	s

【Note】
Set the timer for outputting the judgment signals OK, IN+、IN-、OUT+、OUT-and the BCD signal during measurement judgment.
If 0.0 is set, the output will continue until the next measurement judgment is executed.

④ BCD output specification

【Initial value	【Data range】	【Unit】
Differential output	Differential output / absolute value output	—

【Note】
Set the BCD output specification.
Difference output ; Outputs the error value (measured length value – Reference set value)
Absolute output: Outputs the measured length.

⑤ Alarm signal output specification

【Initial value】	【Data range】	【Unit】
Alarm rank 1,2,3	Alarm rank1,2 / Alarm rank1,2,3	—

【説明】【Note】
Configure the alarm ranks that will output the <ALARM> signal.
Alarm ranks 1,2 : Outputs the alarm signal for ranks 1 and 2.
Alarm ranks 1,2,3 : Outputs the alarm signal for ranks 1,2 and 3.

6-5-5　Date & time

The measurement and judgment system requires setting the system date and time. The system date and time . The system date and time use UTC (Coordinated Universal Time). There are two configuration methods:

1. Automatically set based on the selected time zone and UTC time (synchronize)
2. Manually set a user- specified date and time

6-5-5-1　Automatic setting

To ensure precise synchronization, the system date and time can be automatically configured based on UTC (Coordinated Universal Time). To set the system date and time according to the current UTC, follow the steps below.

1. Display and set the parameters related to date and time.

   ➢ Select [Settings].
   ➢ Select [Date&Time].
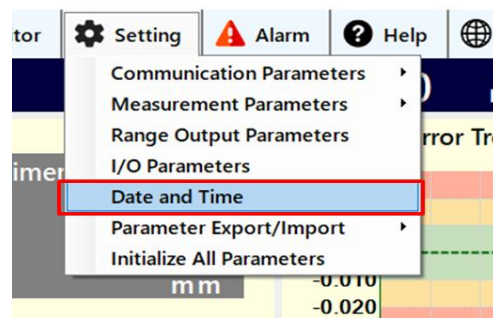
2. Enter the required items.
   When opening the settings for the first time, the current date and time of the user's PC are displayed as the default values.

3. Open the [Time Zone] drop down and select the desired time zone from the list.

4. After selecting a time zone, the date and time in the [Current time settings] section are automatically updated according to the selected time zone.

    • Press [Synchronize] to write the current date and time to the measurement and judgment system

    • Press [Cancel]:
      If no changes have been made, the "Date & time" screen cloes. If changes have been made, a popup appears: "Changes detected. Return to the previous screen?" Selecting "Yes" returns to the settings screen. Selecting "No" discards the changes and closes ths "Date & time" screen.

6-5-5-2 Manual date and time setting

To manually set a desired date and time, follow the steps below.

1. Display and set the parameters related to date and time.

    ➢ Select [Settings].
    ➢ Select [Date & Time].
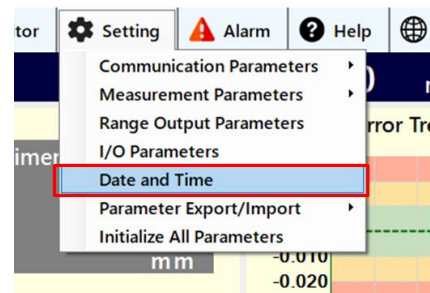
2. Enter the required items.
    When opening the settings for the first time, the current date and time of the user's PC are displayed as the default values.
    When changing the time zone, please follow the [Automatic Setting]procedure described above.

3. Go to the [Manual Setting] section and set the date and time.

    • Date : Enter the desired data directly in the input field or select it using the calendar.
    • Time : Enter the time manually or adjust it using the [▲] and [▼] buttons.
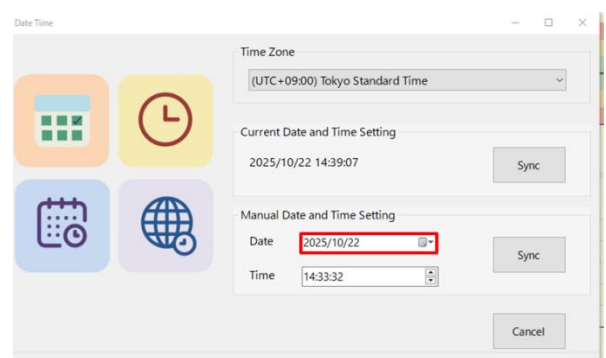
• Select [Synchronize] to write the currently specified date and time to the measurement and judgment system. The status bar will display "Manual setting applied."
• Select [Cancel]:
  If no changes have been made, the "Date & Time" screen closes. If changes have been made, a popup appears: "Changes detected. Return to the previous screen?" Selecting "Yes" returns to the settings screen. Selecting "No" discards the changes and closes the "Date & Time" screen.
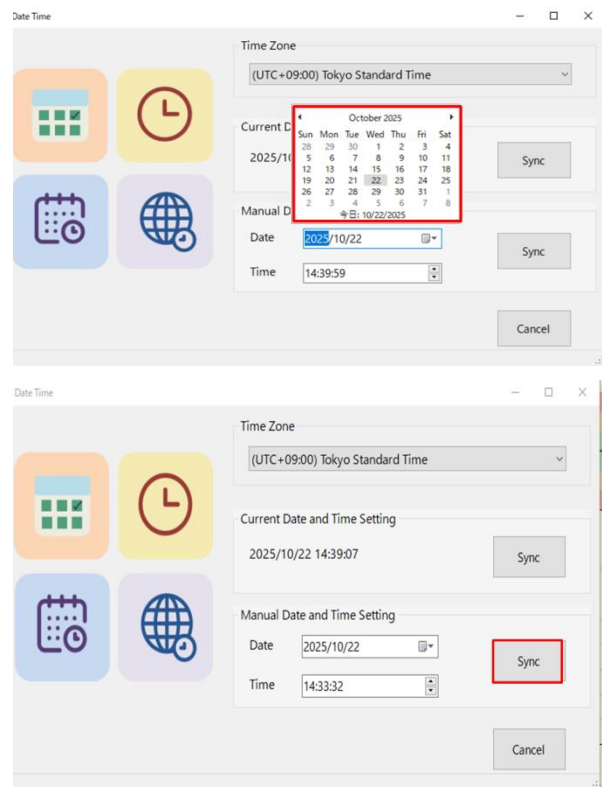
6-5-6 Parameter Export/Import

Using the parameter export/import feature, you can save and restore the list of parameters for the measurement and judgment system.
Export/Import files are in CSV file format.

6-5-6-1 Parameter export

The parameter export function outputs data from MET-CT.
The following parameters are exported:
• Communication parameters
• Measurement parameters
• I/O parameters
• Date and time

The exported CSV file is saved as read-only. To export parameters, follow the steps below.

1. Perform parameter export.

   ➢ Select [Settings].
   ➢ Select [Parameter export/import].
   ➢ Select [Export Prameters]
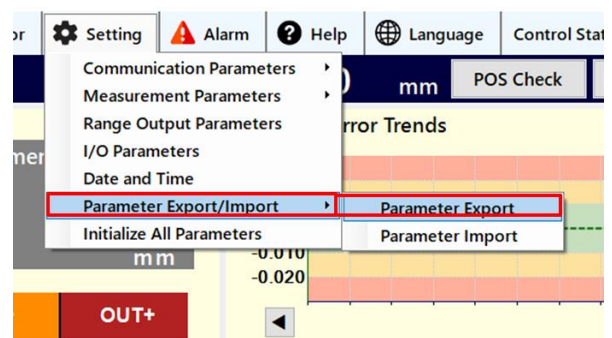
2. The parameter export settings screen appears. Select the parameters you want to export. To export all parameter settings, select the [All Parameters] checkbox. Selecting the [Export] button opens the file explorer.
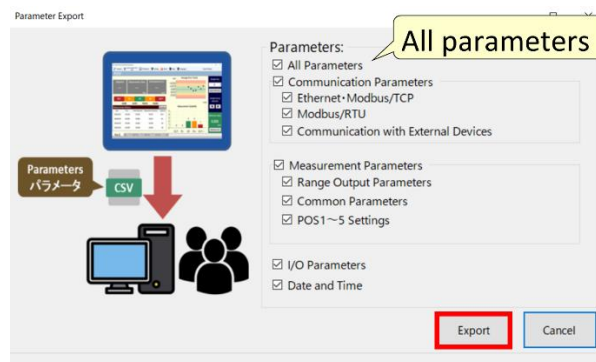
All parameters

3. Select the destination folder. You can also change the file name from the default "Parameter.csv." Select [Save] to export the parameter file. Overwriting a file with the same name is not possible because it is read-only; a warning will be displayed in a popup.

Default name : Parameter.csv
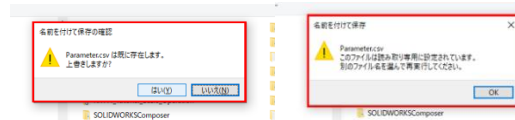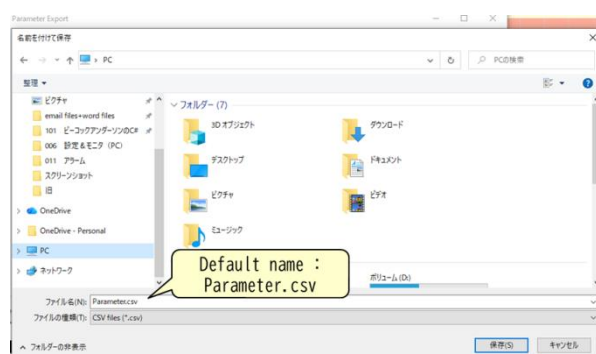
4. When the export is complete, a compleion message box is displayed. The status bar will show "CSV parameter file eport completed."
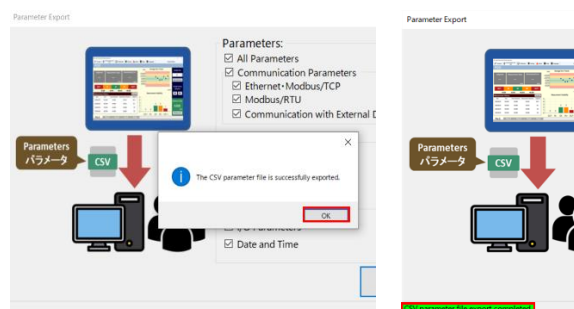
6-5-6-2 Parameter Inport

Import parameters into MET-CT. The import operation will modify MET-CT's parameters, so please review the parameter contents before proceeding with the import. To import prameters, follow the steps below.

1. Perform parameter import.

    ➢ Select [Settings].
    ➢ Select [Parameter Export/Import].
    ➢ Select [Import Parameters].
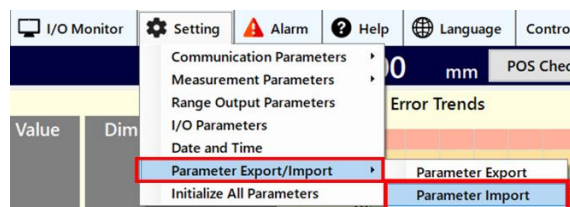
2. The file explorer will be displayed. Select the parameter file you want to import from the save location.
    Press [Open] to open the parameter file within the application.
    Press [Export] to display the file explorer.

3. When the import is complete, a completion message box is displayed. The status bar will show "Parameters have been imported."
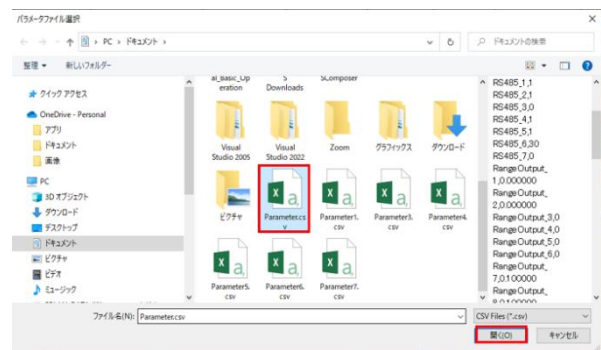
6-5-7 Parameter initialization

Parameter initialization reset the following parameters to their default values.

- Communication parameters
- Measurement parameters
- I/O parameters
- Date and time

To perform parameter initialization, follow the steps below.

1. Perform parameter initialization.

    ➢ Select [Settings]
    ➢ Select [Parameter initialization].

2. A confirmation popup window appears. Press [Yes] to proceed with initializing all parameter settings.

3. When parameter initialization is complete, all parameters in each settings screen are reset to their default values.
    A message box is displayed, and the status bar text is updated to "All parameters have been initialized."
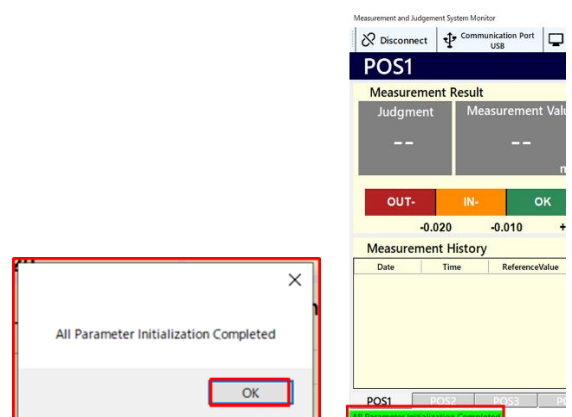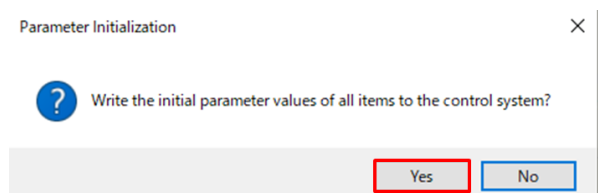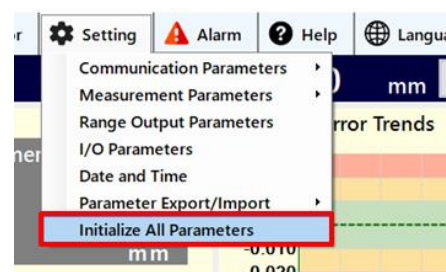
6-6 I/O parameter

The I/O Monitor feature allows you to monitor input and output signals in real time. To display the I/O monitor screen, follow the steps below.

1. Select the [I/O monitor] button of the tool bar.
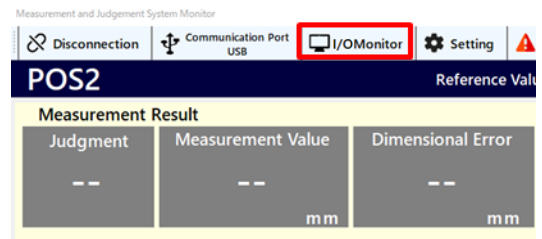
2. An I/O monitor pop-up window is displayed. When an input/output signal is in the Hi state, the signal's background turns green.
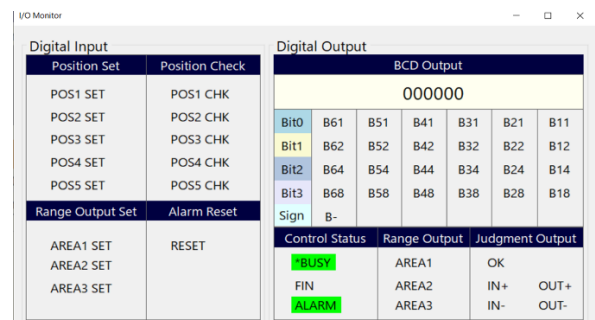
6-7 Alarm

Alarm that occurs in the measurement and judgment system will be explained.

6-7-1 Method to clear alarm

When an alarm occurs, please refers to <u>Chapter 11-5 Alarm details</u> to eliminate the cause.

After the cause has been removed, refer to <u>Chapter 11-3-1 Alarm reset</u> to clear the alarm

6-7-2 Display of alarm history

The Alarm History displays the following:
- Up to 1,000 past alarm entries can be shown.
- The most recently occurred alarm appears at the top of the Alarm History list.

To display the alarm history, follow the steps below.

1. Click the alarm button of toolbar.
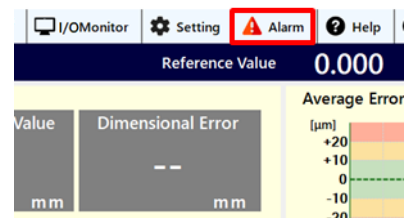
2. The Alarm history detail screen is displayed.

   Alarms are shown in descending order by occurrence date and time (newest first).

First column	Second column	Third column	Fourth column	Fifth column
Date and time	Alarm rank	Alarm title	Alarm Information	Alarm details

Alarm History

DateTime	AlarmRank	AlarmTitle	AlarmInformation	AlarmExplanation
2020/01/06 15:14:45	3	P300	POS Not Set	POS Set from POS1 to POS5 have not been implemented.
2020/01/06 15:14:45	3	b300	Battery Voltage Drop	Battery Voltage is below 2.0V.
2020/01/06 15:14:22	3	P300	POS Not Set	POS Set from POS1 to POS5 have not been implemented.
2020/01/06 15:14:22	3	b300	Battery Voltage Drop	Battery Voltage is below 2.0V.
2020/01/06 13:06:58	3	P300	POS Not Set	POS Set from POS1 to POS5 have not been implemented.
2020/01/06 13:06:58	3	b300	Battery Voltage Drop	Battery Voltage is below 2.0V.
2020/01/06 13:02:52	3	P300	POS Not Set	POS Set from POS1 to POS5 have not been implemented.
2020/01/06 13:02:48	3	P300	POS Not Set	POS Set from POS1 to POS5 have not been implemented.
2020/01/06 13:02:48	3	b300	Battery Voltage Drop	Battery Voltage is below 2.0V.
2020/01/01 18:00:10	3	P300	POS Not Set	POS Set from POS1 to POS5 have not been implemented.
2020/01/01 18:00:10	3	b300	Battery Voltage Drop	Battery Voltage is below 2.0V.
2020/01/01 18:00:07	3	P300	POS Not Set	POS Set from POS1 to POS5 have not been implemented.
2020/01/01 18:00:07	3	b300	Battery Voltage Drop	Battery Voltage is below 2.0V.

6-8 Help (Version management ・ Software version Update)

Display the information of MET-CT, MET-MT in Help.

Additionally, it includes a function to update the firmware of MET-CT.

6-8-1 Version Management screen

The following information items are displayed.

MET-CT	MET-MT	Content
Unit firmware version	Application version	Display the version
Firmware update date	Application update date	Display the date of update
Serial number		Display machine number information.

To display the version management screen, follow the steps below.

1. Display the version management screen.

   ➢ Click the [Help] button on the toolbar.
   ➢ Select [Version Management].
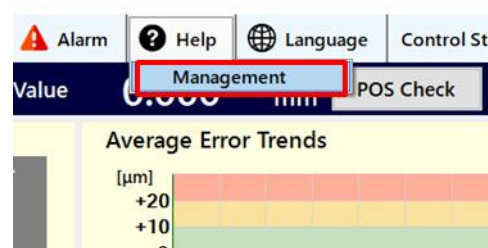
2. The Version Management screen displays information about the "Control Unit (MET-CT)" and the "Application".
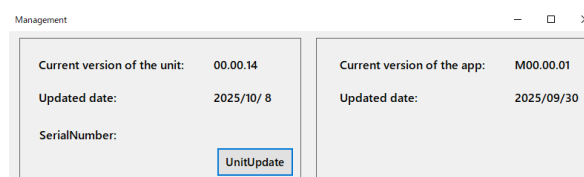
6-8-2 Firmware version update

Firmware update of MET-CT can be performed in the version management screen.

Please prepare the following items before performing firmware update.

• USB memory (USB flash drive) Type-C terminal

   FAT32 format (exFAT, NTFS cannot be used).

The steps to update firmware will be described.

1. Download the latest version of firmware on our company website.

   Obtain the latest version of firmware by the following URL.

   Japanese website：https://prod.kiw.co.jp/mtools/automation/3685.html

   English website ：https://www.kitagawa.com/en/mtools/automation/MET.html

2. Save the latest downloaded firmware to a USB
   lash drive.
   Please ensure that only the latest firmware
   is stored on the USB lash drive.
3. Insert the USB flash drive into the MET-CT.
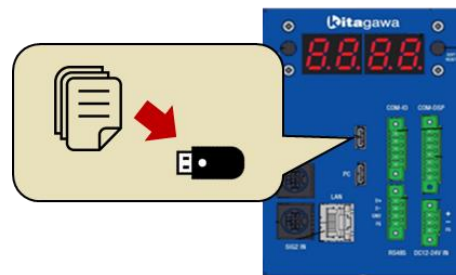
4. Open the Version Management screen by the following steps in the 6-8-1 Version Management screen procedure.
5. Select the [Update] button.
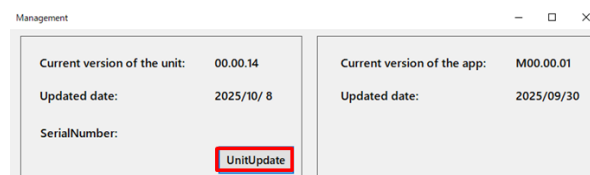
6. When the update starts, the MET-CT 7-segment display changes from "rdy" to "BUSy". In MET-MT, the Version Management screen closes and the connection to MET-CT is disconnected.
7. When the update completes, the 2-segment display changes from "BUSy" back to "rdy".
8. Reconnect the MET-CT (refer to 6-4-3 Communication connection wit the measurement judgment system), and confirms on the Version Management screen that the firmware version has been updated to the latest version.
   On MET-DT, you can check the firmware version at startup (refer to 7-3-3-2 Screen display and button operation).

6-9 Switch language

The Measurement Judgment System application (MET-MT) supports two languages : English and Japanese.
To select the language, follow the steps below.

1. Open the Settings & Monitor tool, and click the [Language] button to display a drop-down list of available languages.
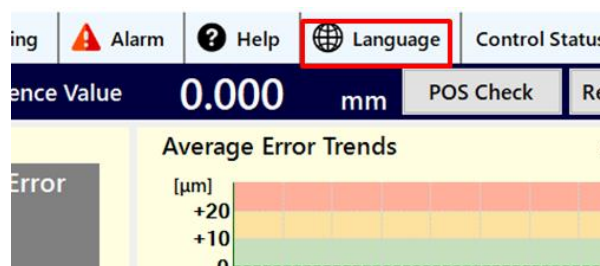
2. Click the language.
   English / 日本語
3. If you change the language via the language selection while connected to the Measurement and Judgment system, the connection will be disconnected.
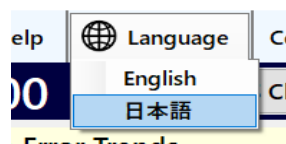
7 Basic Operation and Screen Display

7-1 Status

7-2 Button Operation

7-3 Display

7-1 Status

The control status of the length measurement and judgment system has three states which are BUSY, ALARM, and READY. Each state is explained below.

Status	Transition Condition	Operation Description
BUSY	• Power-up Processing • Reference Position Set (POS SET) Processing • Length Measurement (POS CHK) Processing • Range Output Set (AREA SET) Processing • Parameter Initialization Processing • Software Version Upgrade Processing	During BUSY state, button operations are disabled and signal inputs are not accepted.
ALARM	• Alarm Occurring	Depending on the alarm content that has occurred, some operations may be disabled or signal inputs are not accepted. For details, refer to "Chapter 11 Alarms"
READY	• Other than BUSY and ALARM states	Button operations and signal input are possible during READY state.

7-2 Button Operation

The control unit has the following two buttons. For details on the button operations, please refer to the relevant chapters in this document.

Data copy
Button

Software reset
Button
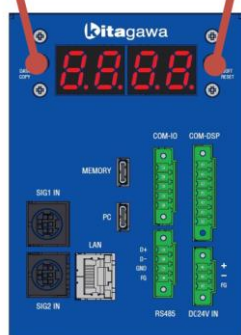
【Data Copy】Button
 For details, refer to "Chapter 10 Data Output (USB Flash Drive)"

【Software Reset】Button
 For details, refer to "Chapter 11-3 Stopping alarm"

MET manual

7-3 Display

7-3-1 Screen Display (MET-CT)

The following are displayed on screen of MET-CT.

- Control status (display alarm number when alarm occurrence)
- Judgment result after length measurement
- Button Operation Function

Control Unit Display	Display Description
	READY Status
	BUSY Status
(Ex.) ⇩	ALARM Status (Ex.) During alarm P300 occurrence When multiple alarms occur, the next alarm is displayed following the first alarm.
	Length Measurement Judgment Result 「OK」
	Length Measurement Judgment Result 「IN+」
	Length Measurement Judgment Result 「IN−」
	Length Measurement Judgment Result 「OUT+」
	Length Measurement Judgment Result 「OUT−」
	Blinking：Data Copy button is pressed (less than 3s) Steady：Data output to USB memory is in progress (3s passed)
	Blinking：Software Reset button is pressed (less than 3s) Steady：Pulse count processing is in progress (3s passed)

7-3-2 Power Indicator (MET-SG)

Display power supply on/off by indicator of MET-SG.
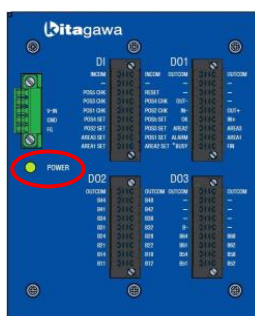
OFF：No power supplied
ON：Power supplied (DC24V)

7-3-3 Screen Display (MET-DP)

The following are displayed on screen of MET-DP.

- Control status
- Length value and judgment result after length measurement
- Input signal/Output signal monitor
- Button operation function
- alarm number when alarm occurrence

7-3-3-1 Screen Transition

The screen transitions of the display unit are described below.
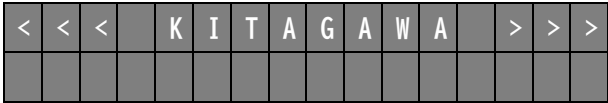
Screen can be switched by display unit buttons.

◄ Button   SEL Button   ► Button

● Power on

Screen No.1-1
Screen No.1-2
During Power-On
Initialization

► : Press ► butoon
◄ : Press ◄ butoon

| Screen No.2 Position |
| Screen No.3 Input Signal Monitor |
| Screen No.6 Alarm |
| Screen No.5 Output Signal 2 Monitor |
| Screen No.4 Output Signal 1 Monitor |
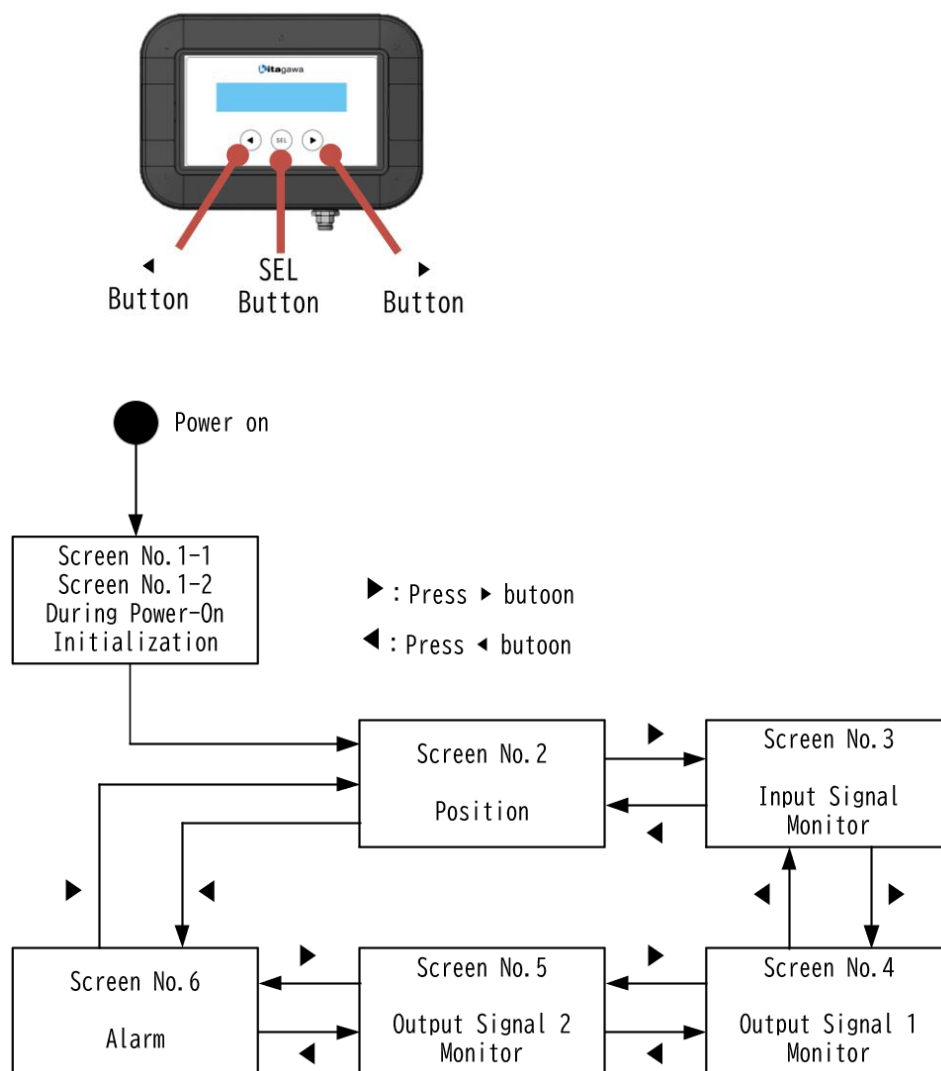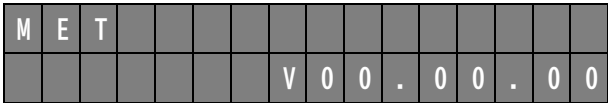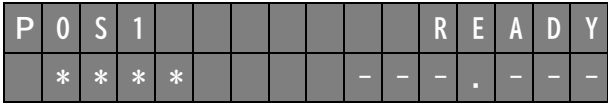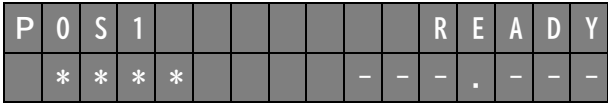
7-3-3-2 Screen Display and Button Operation

The figure below indicates the location of buttons on the display unit.

The screen details of the display unit and button operations are described below.

Screen No.1-1	Power-up in progress1

[Display Content]

Maker Display

<	<	<		K	I	T	A	G	A	W	A		>	>	>

[Screen Description]

■ This screen is displayed during power-on.

Screen No.1-2	Power-up in progress2

[Display Content]

Series Name

M	E	T													
							V	0	0	.	0	0	.	0	0

Software Version

[Screen Description]

■ This screen is displayed during power-on. It is displayed after screen No. 0-1.

Screen No.2	Position

[Display Content]

Position Name   Status

POS1~5   READY/BUSY/ALARM

P	0	S	1							R	E	A	D	Y
	*	*	*	*				-	-	-	.	-	-	-

Judgment Result   Measured Value

Before Measurement and Judgment :   Before Measurement and Judgment : − − − . − − −

No Display   After Measurement and Judgment :   123 .456 (Ex.)

After Measurement and Judgment :

OK/IN+/IN-/OUT+/OUT-

[Screen Description]

■ Displays the measured value and judgment result for POS1~POS5.

■ The measured value and judgment result will be updated after the measurement is completed.

[Button Operation]

■ Each time 【SEL】 button is pressed, the position display transition as follow.

　POS1 ⇒ POS2 ⇒ POS3 ⇒ POS4 ⇒ POS5 ⇒ POS1 ⇒ ・・・

■ Press 【▶】 button to transition to the Input Signal Monitor screen (No.3).

■ Press 【◀】 button to transition to the Alarm screen (No.6).

Screen No.3	Input Signal Monitor

[Display Content]

Signal Name※1

I	N	P	U	T			*	*	*	*	*	*	*	*
		O	0	1	1	1	1	0	1	1	0	1	1	0

Signal Status※1 : 「0」Lo, 「1」Hi

※1 Details of signal status (From the left)

RESET	POS5 CHK	POS4 CHK	POS3 CHK	POS2 CHK	POS1 CHK	POS5 SET
POS4 SET	POS3 SET	POS2 SET	POS1 SET	AREA3 SET	AREA2 SET	AREA1 SET

[Screen Description]

■ Displays the Hi or Lo status of the input signal.

[Button Operation]

■ Pressing 【SEL】 button displays the signal name and shows the corresponding signal state (「0」
   Lo、 「1」Hi) by blinking.
   • Press 【▶】 button to display the signal name and status one position to the right by blinking.
   • Press 【◀】 button to display the signal name and status one position to the left by blinking.
   • Press 【SEL】 button again will turn off the signal name display and signal state blinking.
■ Press 【▶】 button to transition to the Output Signal 1 Monitor screen (No.4).
■ Press 【◀】 button to transition to the Position screen (No.2).

Screen No.4	Output Signal1Monitor

[Display Content]

Signal Name※1

O	U	T	P	U	T	1			*	*	*	*	*	*
				1	1	1	1	0	1	1	0	1	1	0

Signal Status※1 : 「0」Lo, 「1」Hi

※1 Details of signal status (From the left)

OUT−	OUT+	IN−	IN+	OK	AREA3	AREA2	AREA1	*ALARM	FIN	*BUSY

[Screen Description]

■ Displays the Hi or Lo status of the output signal.

[Button Operation]

■ Pressing 【SEL】 button displays the signal name and shows the corresponding signal state (「0」
   Lo、 「1」Hi) by blinking.
   • Press 【▶】 button to display the signal name and status one position to the right by blinking.
   • Press 【◀】 button to display the signal name and status one position to the left by blinking.
   • Press 【SEL】 button again will turn off the signal name display and signal state blinking.
■ Press 【▶】 button to transition to the Output Signal 2 Monitor screen (No.4).
■ Press 【◀】 button to transition to the Input Signal Monitor screen (No.3).

Screen No.5	Output Signal 2 Monitor

[Display Content]

O	U	T	P	U	T	2						B	C	D
									1	2	3	4	5	6

Signal Status※1 : BCD Display

※1   Details of signal status (From the left)

B68 – B61	B58 – B51	B48 – B41	B38 – B31	B28 – B21	B18 – B11

[Screen Description]

■ Displays the output status of the output signal (BCD) in BCD format.

[Button Operation]

■ Press 【▶】 button to transition to the Alarm screen (No.6).

■ Press 【◀】 button to transition to the Output Signal 1Monitor screen (No.4).

Screen No.6	Alarm

[Display Content]

Active Alarm

A	L	A	R	M		P	3	0	0		F	1	1	0	
						U	2	0	1		P	3	0	1	

[Screen Description]

■ Displays active alarms.

[Button Operation]

■ Press 【SEL】 button to display the 5th and subsequent alarms when 5 or more alarms are occurring.

■ Press 【▶】 to transition to the Position screen (No.2).

■ Press 【◀】 to transition to the Output Signal 2 Monitor screen (No.5).

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8 Modbus Communication

8-1 Modbus Communication Specification

The Modbus protocol is widely used in industrial fields because its specifications are publicly available and simple. Using Modbus communication, the device supports sending and receiving control commands and responses with external equipment, and enables DI/DO and status monitoring. This system operates as a Modbus server (slave) device and can exchange data with Modbus clients (masters, external devices, host systems). This device does not support multi-slave operation or broadcast mode.

8-1-1 Communication method

This device support Modbus communication method described as below.

◆ Modbus/RTU (Serial Communication)

Data communication is performed using serial communication (RS485)

◆ Modbus/TCP (Ethernet)

Data communication is performed using standard cable and protocol.

Data communication is performed over the TCP/IP protocol using a standard LAN cable (Ethernet).

Client (external devices)		Server (Measurement and judgment System)
Slave address	Query	Slave address
Function code		Function code
Data	response	Data
Error check		Error check
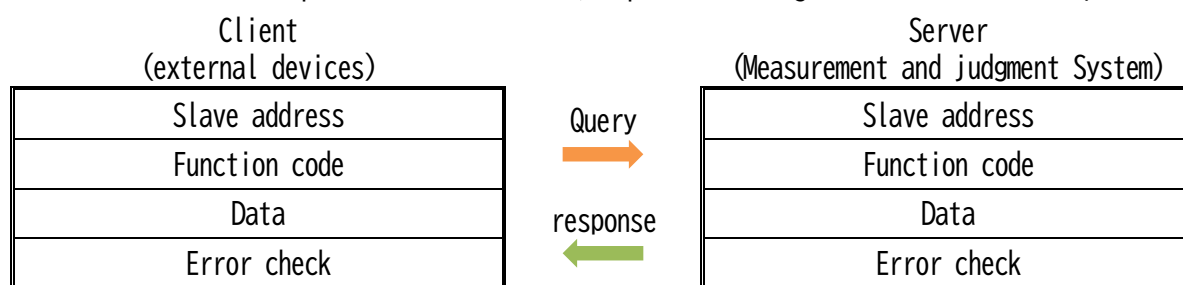
8-1-2 Configuration and Communication Model

Modbus communication use 「master・ slave method (client・server model)」.

◆ Master (Client)

Take the initiative of communication and submit a query.

◆ Slave (server)

Depending on the received query, send the response.

8-2 Modbus/RTU Communication

8-2-1 RS485 Port communication specifications

Item	Description
Communication Standard	EIA-485 Compliant
Communication Protocol	ModbusCompliant
Communication Method	Half-Duplex Communication Asynchronous System (Data:8bits, Stop Bit:1bit/2bits, Parity: None/Even/Odd)
Transmission Speed	9,600, 19,200, 38,400, 57,600, 115,200, 230,400 bps
Error check	CRC-16 type
Termination Resistor	120Ω
Maximum Transmission Distance	Maximum 100m
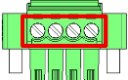
8-2-2 Wiring Diagram Connection Example

The Modbus/RTU wiring diagram is shown below.

Connect the following circuit to the connector attached to the control unit. After finish wiring, tighten the connector using the specified torque.
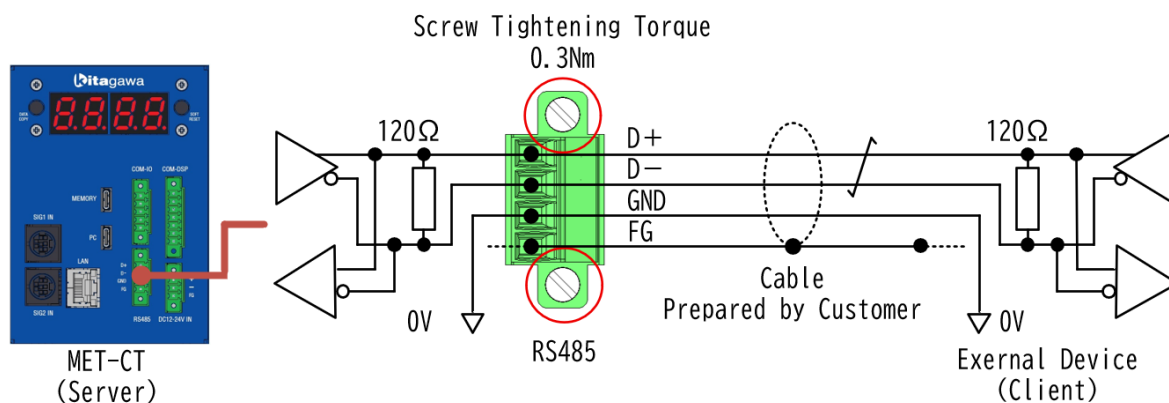
Use the wiring materials listed below for connecting, and tighten the connector with the specified torque.

Connector	MC 1,5/ 4-STF-3,5 (1847071) [Phoenix Contact]
Wire Tightening Torque	Screw Tightening Torque 0.22-0.25 Nm

8-2-3 Parameter setting

Refer to the following for explanations of the parameter when Modbus/RTU is used.

Modbus/RTU parameter setting : 6-5-1-2 Modbus/RTU parameter

Communication with external device : 6-5-1-3 communication with external device

8-3 Modbus/TCP Communication

8-3-1 Communication Specification

Modbus/TCP communication specification is described as below.

Name	Explanation
Communication standard	Ethernet
Communication protocol	Modbus protocol
Transmission rate	10 Mbps / 100Mbps (10BASE-T / 100BASE-TX)
Transmission medium	Category 5e or higher STP (supports cross/straight)
Maximum transmission distance	100m

8-3-2 Wiring diagram connection example

Modbus/TCP wiring diagram is described as below.

Connect LAN cable to LAN port and connects to the Modbus/TCP supported external device.

MET-CT
(Server)

Exernal
Device

(Client)
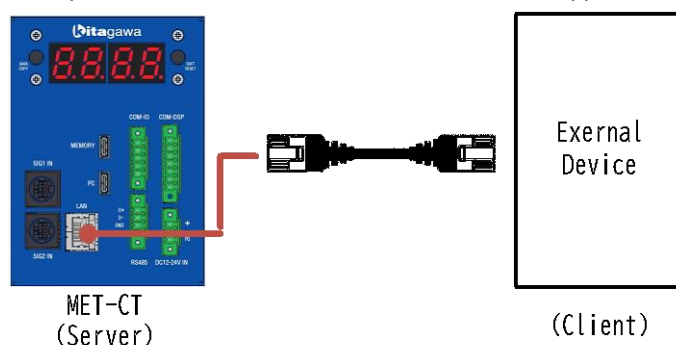
8-3-3 Parameter Setting

Refer to the following for explanations of the parameter when Modbus/TCP is used.

Modbus/TCP parameter setting : 6-5-1-1 Ethernet・Modbus/TCP parameter

Communication with external device : 6-5-1-3 communication with external device

8-4 Function Code

The function code and the message length supported by the Measurement and Judgment System are described below. Please note that sending function codes other than those introduced will not execute the system.

Function Code	Function	Registered Number
01h	Read Coil	0～13
02h	Read Input	0～157
03h	Read from Holding Register	0～210
04h	Read from Input Register	0～19
05h	Write Single Coil	0～13
06h	Write Single Holding Register	0～210
10h	Write Multiple Holding Registers	0～210

8-4-1 Read Coil Status (01h)

Read the ON/OFF status of the slave's DO. Broadcast is not supported.

◆ Query

The query message specifies the starting coil address and the number of coils. The following is the example of reading 14 coil statuses from address 0 to 13 on the slave device 1.

Field name		size byte	Ex.Data HEX	Note	※
Transaction ID	High Word	2	00	normally 0	T
	Low Word		00		
Protocol ID	High Word	2	00	must be 0	T
	Low Word		00		
Number of data bytes	High Word	2	00	Number of data bytes : 6 (example as below) • Slave address : 1 byte • Function code : 1 byte • Start address : 2 byte • Number of register : 2 byte	T
	Low Word		06		
Slave address		1	01	Slave address : 1 (RTU : fixed)	
Function code		1	01	Read coil	
read start address	High Word	2	00	Start from address 0	
	Low Word		00		
Number of read register	High Word	2	00	14 points	
	Low Word		0E		
Error check	High Word	2	**		R
	Low Word		**		

※T：Modbus/TCP only   ※R：Modbus/RTU only

◆ Response

Examples of response to query are described as below.

Field name		size byte	Ex.Data HEX	Note	※
Transaction ID	High Word	2	00	Normally 0 (same with query)	T
	Low Word		00		
Protocol ID	High Word	2	00	Must be 0 (same with query)	T
	Low Word		00		
Number of data bytes	High Word	2	00	Number of data bytes : 5 (example as below) • Slave address : 1 byte • Function code : 1 byte • Number of Data byte of data : 2 byte • Number of data : 2 byte	T
	Low Word		05		
Slave address		1	01	Slave address : 1 (RTU : fixed)	
Function code		1	01	Read coil (same with query)	
Data byte counts		1	02	2byte(14points)	
Data 1		1	53	Address 7～0 00110101 (Lo：0、Hi：1)	
Data 2		1	0A	Address 13～8 00001010 (Lo：0、Hi：1)	
Error check	High Word	2	**		R
	Low Word		**		

※T：Modbus/TCP only   ※R：Modbus/RTU only

8-4-2 Read Input Status (02h)

DI/DO of measurement system, Hi/Lo condition of internal state can be read.

◆ Query

The query message specifies the slave address, function code, the starting address of the inputs to read. An example query message is shown below.

Field name		size byte	Ex.data HEX	Note	※
Transaction ID	High Word	2	00	Normally 0	T
	Low Word		00		
Protocol ID	High Word	2	00	Must be 0	T
	Low Word		00		
Number of data bytes	High Word	2	00	Number of data bytes : 6 (example as below) • Slave address : 1byte • Function code : 1byte • Start address : 2byte • Number of register : 2byte	T
	Low Word		06		
Slave address		1	01	Slave address : 1 (RTU : fixed)	
Function code		1	02	Read input	
Read start address	High Word	2	00	Start from address 0	
	Low Word		00		
Number of read register	High Word	2	00	32 points	
	Low Word		20		
Error check	High Word	2	**		R
	Low Word		**		

※T：Modbus/TCP only ※R：Modbus/RTU only

◆ Response

Response message of query message is shown as below.

Field name		size byte	Ex.data HEX	Note	※
Transaction ID	High Word	2	00	Normally 0 (same as query)	T
	Low Word		00		
Protocol ID	High Word	2	00	Must be 0(same as query)	T
	Low Word		00		
Number of data bytes	High Word	2	00	Number of data bytes : 7 (example as below) • Slave address : 1byte • Function code: 1byte • Number of data bytes of data: 1 byte • Number of data:4byte	T
	Low Word		07		
Slave address		1	01	Slave address : 1 (RTU : fixed)	
Function code		1	02	Read input (same as query)	
Number of data bytes		1	02	4byte (32points)	
Data 1		1	15	Addressn7～0 00010101 (Lo：0、Hi：1)	
Data 2		1	D4	Address 15～8 11010100 (Lo：0、Hi：1)	
Data 3		1	3B	Address 23～16 00111011 (Lo：0、Hi：1)	
Data 4		1	0A	Address 31～24 00001010 (Lo：0、Hi：1)	
Error check	High Word	2	**		R
	Low Word		**		

※T：Modbus/TCP only ※R：Modbus/RTU only

8-4-3 Read Holding Register (03h)

The 16 bit holding registers (parameters) of measurement and judgment system can be read.

◆ Query

Query message specifies the slave address, function code, the starting address of the inputs to read. An example query message is shown below.

Field name		size byte	Ex. data HEX	Note	※
Transaction ID	High Word	2	00	Normally 0	T
	Low Word		00		
Protocol ID	High Word	2	00	Must be 0	T
	Low Word		00		
Number of data bytes	High Word	2	00	Number of data bytes : 6 (example as below) • Slave address : 1byte • Function code:1byte • Start address : 2byte • Number of register : 2byte	T
	Low Word		06		
Slave address		1	01	Slave address : 1 (RTU : fixed)	
Function code		1	03	Read holding register	
Read start address	High Word	2	00	Start from address 2	
	Low Word		02		
Number of read register	High Word	2	00	2 points	
	Low Word		02		
Error check	High Word	2	**		R
	Low Word		**		

※T：Modbus/TCPonly　　　※R：Modbus/RTU only

◆ Response

Response message of query message is shown as below.

Please read the high order and low order parts at the same time. If they are not read simultaneously, the value may become invalid or inconsistent.

Field name		size byte	Ex. data HEX	Note	※
Transaction ID	High Word	2	00	Normally 0 (same as query)	T
	Low Word		00		
Protocol ID	High Word	2	00	Must be 0 (same as query)	T
	Low Word		00		
Number of data bytes	High Word	2	00	Number of data bytes : 7 • Slave address : 1byte • Function code : 1byte • Start address : 2byte • Number of data : 4byte	T
	Low Word		07		
Slave address		1	01	Slave address : 1 (RTU : fixed)	
Function code		1	03	Read holding register (same as query)	
Number of data bytes		1	02	4byte (2Data×2byte)	
Data 1	High Word	2	00	Data of address 2 192	
	Low Word		C0		
Data 2	High Word	2	00	Data of address 3 168	
	Low Word		A8		
Error check	High Word	2	**		R
	Low Word		**		

※T：Modbus/TCPonly　　　※R：Modbus/RTUonly

8-4-4 Read Input Register (04h)

The 16 bits of input register (parameter) of measurement and judgment system can be read.

◆ Query

Query message specifies the slave address, function code, the starting address of the inputs to read. An example query message is shown below.

Field name		size byte	Ex.data HEX	Note	※
Transaction ID	High Word	2	00	Normally 0	T
	Low Word		00		
Protocol ID	High Word	2	00	Must be 0	T
	Low Word		00		
Number of data bytes	High Word	2	00	Number of data bytes : 6 (example as below) • Slave address : 1byte • Function code : 1byte • Start address : 2 byte • Number of register : 2byte	T
	Low Word		06		
Slave address		1	01	Slave address : 1 (RTU : fixed)	
Function code		1	04	Read input register	
Read start address	High Word	2	00	Start from address 5	
	Low Word		05		
Number of read register	High Word	2	00	2 points	
	Low Word		02		
Error check	High Word	2	**		R
	Low Word		**		

※T：Modbus/TCP only   ※R：Modbus/RTUonly

◆ Response

Please read the high order and low order parts at the same time. If they are not read simultaneously, the value may become invalid or inconsistent.

Field name		size byte	Ex.data HEX	Note	※
Transaction ID	High Word	2	00	Normally 0 (same as query)	T
	Low Word		00		
Protocol ID	High Word	2	00	Must be 0 (same as query)	T
	Low Word		00		
Number of data bytes	High Word	2	00	Number of data bytes : 7 (example as below) • Slave address : 1byte • Function code : 1byte • Start address : 2 byte • Number of data: 4byte	T
	Low Word		07		
Slave address		1	01	Slave address : 1 (RTU : fixed)	
Function code		1	04	Read input register (same as query)	
Number of data bytes		1	02	4byte (2data×2byte)	
Data 1	High Word	2	00	Data from address 5	
	Low Word		78	123	
Data 2	High Word	2	01	Data from address 6	
	Low Word		C8	456	
Error check	High Word	2	**		R
	Low Word		**		

※T：Modbus/TCP only   ※R：Modbus/RTU only

8-4-5 Force Single Coil (05h)

One digital output (DO) of the measurement and judgment system can be changed to either the High or Low state.

◆ Query

The query message specifies the slave address, function code, the address of the coil to write and the data to write (High/Low). An example query message is shown below.

Field name		size byte	Ex.data HEX	Note	※
Transaction ID	High Word	2	00	Normally 0	T
	Low Word		00		
Protocol ID	High Word	2	00	Must be 0	T
	Low Word		00		
Number of data bytes	High Word	2	00	Number of data bytes : 6 (example as below) • Slave address : 1byte • Function code : 1byte • Start address : 2byte • Written information : 2byte	T
	Low Word		06		
Slave address		1	01	Slave address : 1 (RTU : fixed)	
Function code		1	05	Read coil	
Write start address	High Word	2	00	Start from address 3	
	Low Word		03		
Written information	High Word	2	FF	0xFF00 ⇒ write Hi	
	Low Word		00	0x0000 ⇒ write Lo	
Error check	High Word	2	**		R
	Low Word		**		

※T：Modbus/TCP only   ※R：Modbus/RTU only

◆ Response

Response message example of query is shown as below.

Response message is the same as query,

Field name		size byte	Example data HEX	Note	※
Transaction ID	High Word	2	00	Normally 0 (same as query)	T
	Low Word		00		
Protocol ID	High Word	2	00	Must be 0 (same as query)	T
	Low Word		00		
Number of data bytes	High Word	2	00	Number of data bytes : 6 (same as query) (example as below) • Slave address : 1byte • Function code : 1byte • Start address : 2byte • Written information : 2byte	T
	Low Word		06		
Slave address		1	01	Slave address : 1 (RTU : fixed)	
Function code		1	05	Read coil (same as query)	
Write start address	High Word	2	00	Start from address 3 (same as query)	
	Low Word		03		
Written information	High Word	2	FF	0xFF00 ⇒ write Hi (same as query)	
	Low Word		00	0x0000 ⇒ write Lo	
Error check	High Word	2	**		R
	Low Word		**		

※T：Modbus/TCP only   ※R：Modbus/RTU only

8-4-6 Preset Single Register (06h)

Data of one holding register (parameter) (16bit) of measurement and judgment system can be changed.

◆ Query

The query message specifies the slave address, function code, start address of write register, number of write register. Example of query message is shown as below.

Field name		size byte	Ex. data HEX	Note	※
Transaction ID	High Word	2	00	Normally 0	T
	Low Word		00		
Protocol ID	High Word	2	00	Must be 0	T
	Low Word		00		
Number of data bytes	High Word	2	00	Number of data bytes : 6 (example as below) • Slave address : 1byte • Function code : 1byte • Start address : 2byte • Written information : 2byte	T
	Low Word		06		
Slave address		1	01	Slave address : 1 (RTU : fixed)	
Function code		1	06	Write holding register	
Write start address	High Word	2	00	Start from address 14	
	Low Word		0E		
Written information	High Word	2	01	Write 502 in address 14	
	Low Word		F6		
Error check	High Word	2	**		R
	Low Word		**		

※T：Modbus/TCP only　　※R：Modbus/RTU only

◆ Response

Example of response message of query is shown as below.

Response message is the same as query.

Field name		Size byte	Ex. data HEX	Note	※
Transaction ID	High Word	2	00	Normally 0 (same as query)	T
	Low Word		00		
Protocol ID	High Word	2	00	Must be 0 (same as query)	T
	Low Word		00		
Number of data bytes	High Word	2	00	Number of data bytes : 6 (same as query) (example as below) • Slave address : 1 byte • Function code : 1 byte • Start address : 2byte • Written information : 2byte	T
	Low Word		06		
Slave address		1	01	Slave address : 1 (RTU : fixed)	
Function code		1	06	Write holding register (same as query)	
Write start address	High Word	2	00	Start from address 14 (same as query)	
	Low Word		0E		
Written information	High word	2	01	Write 502 in address 14 (same as query)	
	Low Word		F6		
Error check	High Word	2	**		R
	Low Word		**		

※T：Modbus/TCPonly　　※R：Modbus/RTU only

8-4-7 Preset Multiple Registers (10h)

Data of multiple holding register (parameter) (16 bit) of measurement and judgment system can be changed.

◆ Query

Query message specifies the slave address, function code, start address of write register, number of write register, and number of data and value of write register.

Please write the high order and low order parts simultaneously. If they are not written at the same time, the resulting value may become invalid.

Writes are executed in ascending register address order.

Even if an exception response is returned for some data (e.g, out-of-range values), other data may have been written successfully.

An example query message is shown below.

Field name		Size byte	Ex.data HEX	Note	※
Transaction ID	High Word	2	00	Normally 0	T
	Low Word		00		
Protocol ID	High Word	2	00	Must be 0	T
	Low Word		00		
Number of data bytes	High Word	2	00	Number of data bytes : 6 (example as below) • Slave address : 1byte • Function code : 1byte • Start address : 2byte • Written register : 2byte • Written data bytes : 1byte • Written information : 4byte	T
	Low Word		10		
Slave address		1	01	Slave address : 1 (RTU : fixed)	
Function code		1	10	Write multiple registers	
Write start address	High Word	2	00	Start from address 14	
	Low Word		0E		
Number of read register	High Word	2	00	2 points	
	Low Word		02		
Number of written data bytes		1	04	4byte (2 data×2byte)	
Data 1	High Word	2	01	Write 502 in address 14	
	Low Word		F6		
Data 2	High Word	2	13	Write 5074 in address 15	
	Low Word		D2		
Error check	High Word	2	**		R
	Low Word		**		

※T：Modbus/TCPonly　　　※R：Modbus/RTU only

◆ Response

Example of response message of query is shown below.

Response message is the same value as slave address, function code, start address of write register and number of write register of query.

Field name		size byte	Ex.data HEX	Note	※
Transaction ID	High Word	2	00	Normally 0 (same as query)	T
	Low Word		00		
Protocol ID	High Word	2	00	Must be 0 (same as query)	T
	Low Word		00		
Number of data bytes	High Word	2	00	Number of data bytes : 6 (same as query) (example as below) • Slave address : 1byte • Function code : 1byte • Start address : 2byte • Written registers : 2byte	T
	Low Word		06		
Slave address		1	01	Slave address : 1 (RTU : fixed)	
Function code		1	10	Write multiple registers (same as query)	
write start address	High Word	2	00	Start from address 14	
	Low Word		0E		
Number of written register	High Word	2	00	2 points	
	Low Word		04		
Error check	High Word	2	**		R
	Low Word		**		

※T : Modbus/TCPonly   ※R : Modbus/RTU only

8-5 Error check

◆ For Modbus/RTU

Modbus/RTU performs error check using CRC-16. Error check is appended at the end of query・response message. CRC-16 error check is calculated and inspected automatically in this system.

When sending : add CRC-16 at the end of message

When receiving : Inspect the CRC-16 and if something wrong, reply error

CRC-16 confirmation steps

① Obtain the bytes from receiving data except from CRC part

Prepare the data byte excluding the final 2 byte (CRC part) from receiving frame.

② Perform CRC-16 operation

1. Reset CRC-value by 「0xFFFF」(make 1 for all 16 bit).

2. CRC calculation is performed by 1 byte orderly from the first byte of sending or receiving data.

Operate XOR to CRC value and that data byte.

Repeat 8 times (= 1byte) and perform the following to each bit.

➢ If the least significant bit (LSB) of the CRC value is 1:

Right-shift the CRC by one bit, then XOR it with the polynomial 0xA001.

➢ If the least significant bit (LSB) of the CRC value is 0;

Right-shift the CRC by one bit only (no XOR).

> Repeats this operation eight times for that byte.

3. Repeat 2 until all byte treatment finished

   Repeat the bit operation for all bytes.

   When all byte operation is finished, the 16-it CRC value at that point is the computed result (the final CRC).

③ Obtaining the 2 byte(CRC) of computed result

   Split the 16-bit calculated result into the low-order byte (LSB) and the high-order byte (MSB).

④ Compare the received CRC with the compute CRC.

   Check whether the last two bytes of the receiving frame ([CRC_L][CRC_H]) match the bytes o the computed CRC.

⑤ Handle according to the result

   Match : continue processing the frame

   Mismatch : discard the frame or send an error response.

Example :

[Address] [Function code] [Start address_H] [Start address_L] [number of registers_H] [number of registers_L] [CRC_L] [CRC_H]

01 05 00 00 00 0A C5 CD0.

①	The first byte[address01h]	0000 0000 0000 0001
②	CRC initial value FFFFh	1111 1111 1111 1111
③	XOR of ①and②	1111 1111 1111 1110
④	First right shift (LSB = 0)	0111 1111 1111 1111
⑤	Second right shift (LSB= 1)	0011 1111 1111 1111
⑥	Polynomial 0xA001	1010 0000 0000 0001
⑦	XOR of ⑤and⑥	0001 1111 1111 1110
⑧	Third right shift (LSB= 0)	0000 1111 1111 1111
⑨	Fourth right shift (LSB= 1)	0000 0111 1111 1111
⑩	Polynomial 0xA001	1010 0000 0000 0001
⑪	XOR of ⑨and⑩	1010 0111 1111 1110
⑫	Fifth right shift (LSB = 0)	0101 0011 1111 1111
⑬	Sixth right shift (LSB = 1)	0010 1001 1111 1111
⑭	Polynomial 0xA001	1010 0000 0000 0001
⑮	XOR of ⑬and⑭	1000 1001 1111 1110
⑯	Seventh right shit (LSB = 0)	0100 0100 1111 1111
⑰	Eighth right shift (LSB = 1)	0010 0010 0111 1111
⑱	Polynomial 0xA001	1010 0000 0000 0001
⑲	XOR of ⑰and ⑱	1000 0010 0111 1110
⑳	Second byte [function code05h]	0000 0000 0000 0101
㉑	XOR of ⑲and ⑳	1000 0010 0111 1011
㉒	Repeat right shift 8 times×remaining bytes with same procedure	・・・
	※LSB = Least significant value	

◆ For Modbus/TCP

Because Modbus/TCP runs over TCP/IP, a reliable stream protocol, CRC checking is not used.

CRC checking is skipped, and error detection is left to the TCP/IP checksum.

8-6 Address mapping

The following describe the Modbus address map when the measurement and judgment system is connected to the external device.

address	type	Name	Note
COIL Read-Write (R: 0x01, W: 0x05, 0x0F)			
DI			
0	BOOL	area1_set	AREA1 Reference set
1	BOOL	area2_set	AREA2 Reference set
2	BOOL	area3_set	AREA3 Reference set
3	BOOL	pos1_set	POS1 Reference set
4	BOOL	pos2_set	POS2 Reference set
5	BOOL	pos3_set	POS3 Reference set
6	BOOL	pos4_set	POS4 Reference set
7	BOOL	pos5_set	POS5 Reference set
8	BOOL	pos1_chk	POS1 measurement command
9	BOOL	pos2_chk	POS2 measurement command
10	BOOL	pos3_chk	POS3 measurement command
11	BOOL	pos4_chk	POS4 measurement command
12	BOOL	pos5_chk	POS5 measurement command
13	BOOL	reset	Alarm reset
14 - 63	BOOL	reserve	—

address	type	name	note
DISCRETE INPUT Read-Only (R: 0x02)			
DI			
0	BOOL	area1_set	Set Range Output 1 as Reference
1	BOOL	area2_set	Set Range Output 2 as Reference
2	BOOL	area3_set	Set Range Output 3 as Reference
3	BOOL	pos1_set	POS1 Reference set
4	BOOL	pos2_set	POS2 Reference set
5	BOOL	pos3_set	POS3 Reference set
6	BOOL	pos4_set	POS4 Reference set
7	BOOL	pos5_set	POS5 Reference set
8	BOOL	pos1_chk	POS1 measurement command
9	BOOL	pos2_chk	POS2 measurement command
10	BOOL	pos3_chk	POS3 measurement command
11	BOOL	pos4_chk	POS4 measurement command
12	BOOL	pos5_chk	POS5 measurement command
13	BOOL	reset	Alarm reset
14 - 63	BOOL	reserve	—
DO			
64	BOOL	busy	Busy (Signal input unavailable)
65	BOOL	fin	Operation complete
66	BOOL	alarm	Alarm
67	BOOL	area1	Range output 1
68	BOOL	area2	Range output 2
69	BOOL	area3	Range output 3
70	BOOL	ok	Judgment signal : OK
71	BOOL	in_pls	Judgment signal : IN+
72	BOOL	in_mns	Judgment signal : IN-
73	BOOL	out_pls	Judgment signal : OUT+
74	BOOL	out_mns	Judgment signal : OUT-
75	BOOL	b11	BCD output 1 digit 0 bit
76	BOOL	b12	BCD output 1 digit 1bit
77	BOOL	b14	BCD output 1 digit 2bit

DISCRETE INPUT Read-Only (R: 0x02)			
address	type	name	note
78	BOOL	b18	BCD output 1 digit 3bit
79	BOOL	b21	BCD output 2 digit 0 bit
80	BOOL	b22	BCD output 2 digit 1 bit
81	BOOL	b24	BCD output 2 digit 2 bit
82	BOOL	b28	BCD output 2 digit 3 bit
83	BOOL	b31	BCD output 3 digit 0 bit
84	BOOL	b32	BCD output 3 digit 1 bit
85	BOOL	b34	BCD output 3 digit 2 bit
86	BOOL	b38	BCD output 3 digit 3 bit
87	BOOL	b41	BCD output 4 digit 0 bit
88	BOOL	b42	BCD output 4 digit 1 bit
89	BOOL	b44	BCD output 4 digit 2 bit
90	BOOL	b48	BCD output 4 digit 3 bit
91	BOOL	b51	BCD output 5 digit 0 bit
92	BOOL	b52	BCD output 5 digit 1 bit
93	BOOL	b54	BCD output 5 digit 2 bit
94	BOOL	b58	BCD output 5 digit 3 bit
95	BOOL	b61	BCD output 6 digit 0 bit
96	BOOL	b62	BCD output 6 digit 1 bit
97	BOOL	b64	BCD output 6 digit 2 bit
98	BOOL	b68	BCD output 6 digit 3 bit
99	BOOL	b_mns	BCD output – sign bit
100 – 127	BOOL	reserve	—
ALARM			
128	BOOL	ER1_CPU	CPU error
129	BOOL	ER1_AB_PHASE_AB	Scale A/B phase signal fault
130	BOOL	ER1_OVERFLOW	Pulse count overflow
131	BOOL	ER2_SET_POS1	POS1 reference set failure
132	BOOL	ER2_SET_POS2	POS2 reference set failure
133	BOOL	ER2_SET_POS3	POS3 reference set failure
134	BOOL	ER2_SET_POS4	POS4 reference set failure
135	BOOL	ER2_SET_POS5	POS5 reference set failure
136	BOOL	ER2_MEAS_POS1	POS1 measurement failure
137	BOOL	ER2_MEAS_POS2	POS2 measurement failure
138	BOOL	ER2_MEAS_POS3	POS3 measurement failure
139	BOOL	ER2_MEAS_POS4	POS4 measurement failure
140	BOOL	ER2_MEAS_POS5	POS5 measurement failure
141	BOOL	ER2_SET_AREA1	AREA1 set failure
142	BOOL	ER2_SET_AREA2	AREA2 set failure
143	BOOL	ER2_SET_AREA3	AREA3 set failure
144	BOOL	ER2_JUDGE_POS1	Judge except consecutive OK (POS1)
145	BOOL	ER2_JUDGE_POS2	Judge except consecutive OK (POS2)
146	BOOL	ER2_JUDGE_POS3	Judge except consecutive OK (POS3)
147	BOOL	ER2_JUDGE_POS4	Judge except consecutive OK (POS4)
148	BOOL	ER2_JUDGE_POS5	Judge except consecutive OK (POS5)
149	BOOL	ER2_USB_CXN	USB data output failure (not connecting USB memory)
150	BOOL	ER2_USB_EXIST	USB data output failure (exist same file name)
151	BOOL	ER2_USB_SPACE	USB data output failure (Not sufficient storage)
152	BOOL	ER2_COMM_IO	Communication error (I/O unit)
153	BOOL	ER2_COMM_DISP	Communication unit (Display Unit)
154	BOOL	ER2_COMM_RS485	Communication error (external device RS485)
155	BOOL	ER2_COMM_ETH	Communication error (external device ether communication)
156	BOOL	ER3_POS_NOT_SET	POS not set
157	BOOL	ER3_LOW_BATT	Battery zero
158 – 159	BOOL	reserve	—

HOLDING REGISTER Read-Write, 16-bit Big-Endian (R: 0x03, W: 0x06, 0x10)			
Address	Type	Name	Note
PARAMETER			
0	UINT16	CX_PC	Communication protocol
1	UINT16	CX_SEN	Sensor port
2	UINT16 x 4	LAN_IP [A]	IP address [A].[B].[C].[D]
3		LAN_IP [B]	
4		LAN_IP [C]	
5		LAN_IP [D]	
6	UINT16 x 4	LAN_SM [A]	Sub net mask [A].[B].[C].[D]
7		LAN_SM [B]	
8		LAN_SM [C]	
9		LAN_SM [D]	
10	UINT16 x 4	LAN_GA [A]	Gateway [A].[B].[C].[D]
11		LAN_GA [B]	
12		LAN_GA [C]	
13		LAN_GA [D]	
14	UINT16	LAN_PN	Port Number
15	FLOAT32	CM_SR (High Word)	Scale resolution (High Word)
16		CM_SR (Low Word)	Scale resolution (Low Word)
17	UINT16	CM_SD	Scale moving direction
18	FLOAT32	CM_SJT (High Word)	Stop Judgment Timer (High Word)
19		CM_SJT (Low Word)	Stop Judgment Timer (Low Word)
20	FLOAT32	CM_SJR (High Word)	Stop Judgment Range (High Word)
21		CM_SJR (Low Word)	Stop Judgment Range (Low Word)
22	FLOAT32	CM_PTO (High Word)	Process time out (High Word)
23		CM_PTO (Low Word)	Process time out (Low Word)
24	UINT16	CM_NO	Judge except consecutive OK
25	FLOAT32	IO_CT (High Word)	Chattering protect timer (High)
26		IO_CT (Low Word)	Chattering protect timer (Low)
27	FLOAT32	IO_FT (High Word)	FIN signal timer (High Word)
28		IO_FT (Low Word)	FIN signal timer (Low Word)
29	FLOAT32	IO_JT (High Word)	Judgment output timer (High)
30		IO_JT (Low Word)	Judgment output timer (Low)
31	UINT16	IO_BO	BCD Output Specification
32	UINT16	IO_AS	Alarm Signal Output Specification
33	ASCII X 20	POS1_NM[CH01][CH02]	Name : [CH01][CH02]···[CH20]
34		POS1_NM[CH03][CH04]	
35		POS1_NM[CH05][CH06]	
36		POS1_NM[CH07][CH08]	
37		POS1_NM[CH09][CH10]	
38		POS1_NM[CH11][CH12]	
39		POS1_NM[CH13][CH14]	
40		POS1_NM[CH15][CH16]	
41		POS1_NM[CH17][CH18]	
42		POS1_NM[CH19][CH20]	
43	UINT16	POS1_MT	Measurement type
44	FLOAT32	POS1_H1 (High Word)	Hand specific parameter 1 (High Word)
45		POS1_H1 (Low Word)	Hand specific parameter 1 (Low Word)
46	FLOAT32	POS1_H2 (High Word)	Hand specific parameter 2 (High Word)
47		POS1_H2 (Low Word)	Hand specific parameter 2 (Low Word)
48	INT16	POS1_RP	Standard placement pulse
49	FLOAT32	POS1_PV (High Word)	POS1 reference set (High Word)
50		POS1_PV (Low Word)	POS1 reference set (Low Word)
51	FLOAT32	POS1_PLS (High Word)	POS1 +threshold (High Word)
52		POS1_PLS (Low Word)	POS1 +threshold (Low Word)
53	FLOAT32	POS1_MNS (High Word)	POS1 - threshold (High Word)
54		POS1_MNS (Low Word)	POS1 - threshold (Low Word)
55	FLOAT32	POS1_DPLS (High Word)	POS1+ +threshold (High Word)
56		POS1_DPLS (Low Word)	POS1+ +threshold (Low Word)

Address	Type	Name	Note
		HOLDING REGISTER Read-Write, 16-bit Big-Endian (R: 0x03, W: 0x06, 0x10)	
57	FLOAT32	POS1_DMNS(High Word)	POS1- -threshold (High Word)
58		POS1_DMNS(Low Word)	POS1- -threshold (Low Word)
59	ASCII X 20	POS2_NM[CH01][CH02]	Name : [CH01][CH02]…[CH20]
60		POS2_NM[CH03][CH04]	
61		POS2_NM[CH05][CH06]	
62		POS2_NM[CH07][CH08]	
63		POS2_NM[CH09][CH10]	
64		POS2_NM[CH11][CH12]	
65		POS2_NM[CH13][CH14]	
66		POS2_NM[CH15][CH16]	
67		POS2_NM[CH17][CH18]	
68		POS2_NM[CH19][CH20]	
69	UINT16	POS2_MT	Measurement type
70	FLOAT32	POS2_H1 (High Word)	Hand specific parameter 1 (High Word)
71		POS2_H1 (Low Word)	Hand specific parameter 1 (Low Word)
72	FLOAT32	POS2_H2 (High Word)	Hand specific parameter 2 (High Word)
73		POS2_H2 (Low Word)	Hand specific parameter 2 (Low Word)
74	INT16	POS2_RP	Standard placement pulse
75	FLOAT32	POS2_PV (High Word)	POS2 reference set (High Word)
76		POS2_PV (Low Word)	POS2 reference set (Low Word)
77	FLOAT32	POS2_PLS (High Word)	POS2 +threshold (High Word)
78		POS2_PLS (Low Word)	POS2 +threshold (Low Word)
79	FLOAT32	POS2_MNS (High Word)	POS2 -threshold (High Word)
80		POS2_MNS (Low Word)	POS2 -threshold (Low Word)
81	FLOAT32	POS2_DPLS (High Word)	POS2+ +threshold (High Word)
82		POS2_DPLS (Low Word)	POS2+ +threshold (Low Word)
83	FLOAT32	POS2_DMNS (High Word)	POS2- -threshold (High Word)
84		POS2_DMNS (Low Word)	POS2- -threshold (Low Word)
85	ASCII X 20	POS3_NM[CH01][CH02]	Name : [CH01][CH02]…[CH20]
86		POS3_NM[CH03][CH04]	
87		POS3_NM[CH05][CH06]	
88		POS3_NM[CH07][CH08]	
89		POS3_NM[CH09][CH10]	
90		POS3_NM[CH11][CH12]	
91		POS3_NM[CH13][CH14]	
92		POS3_NM[CH15][CH16]	
93		POS3_NM CH17][CH18]	
94		POS3_NM[CH19][CH20]	
95	UINT16	POS3_MT	Measurement type
96	FLOAT32	POS3_H1 (High Word)	Hand specific parameter 1 (High Word)
97		POS3_H1 (Low Word)	Hand specific parameter 1 (Low Word)
98	FLOAT32	POS3_H2 (High Word)	Hand specific parameter 2 (High Word)
99		POS3_H2 (Low Word)	Hand specific parameter 2 (Low Word)
100	INT16	POS3_RP	Standard placement pulse
101	FLOAT32	POS3_PV (High Word)	POS3 reference set (High Word)
102		POS3_PV (Low Word)	POS3 reference set (Low Word)
103	FLOAT32	POS3_PLS (High Word)	POS3 +threshold (High Word)
104		POS3_PLS (Low Word)	POS3 +threshold (Low Word)
105	FLOAT32	POS3_MNS (High Word)	POS3 -threshold (High Word)
106		POS3_MNS (Low Word)	POS3 -threshold (Low Word)
107	FLOAT32	POS3_DPLS (High Word)	POS3+ +threshold (High Word)
108		POS3_DPLS (Low Word)	POS3+ +threshold (Low Word)
109	FLOAT32	POS3_DMNS (High Word)	POS3- -threshold (High Word)
110		POS3_DMNS (Low Word)	POS3- -threshold (Low Word)

HOLDING REGISTER Read-Write, 16-bit Big-Endian (R: 0x03, W: 0x06, 0x10)			
Address	Type	Name	Note
111	ASCII X 20	POS4_NM CH01][CH02]	Name : [CH01][CH02]···[CH20]
112		POS4_NM[CH03][CH04]	
113		POS4_NM[CH05] CH06]	
114		POS4_NM CH07][CH08]	
115		POS4_NM [CH09]CH10]	
116		POS4_NM CH11][CH12]	
117		POS4_NM CH13][CH14]	
118		POS4_NM CH15][CH16]	
119		POS4_NM CH17][CH18]	
120		POS4_NM CH19][CH20]	
121	UINT16	POS4_MT	Measurement type
122	FLOAT32	POS4_H1 (High Word)	Hand specific parameter 1 (High Word)
123		POS4_H1 (Low Word)	Hand specific parameter 1 (Low Word)
124	FLOAT32	POS4_H2 (High Word)	Hand specific parameter 2 (High Word)
125		POS4_H2 (Low Word)	Hand specific parameter 2 (Low Word)
126	INT16	POS4_RP	Standard placement pulse
127	FLOAT32	POS4_PV (High Word)	POS4 reference set (High Word)
128		POS4_PV (Low Word)	POS4 reference set (Low Word)
129	FLOAT32	POS4_PLS (High Word)	POS4 +threshold (High Word)
130		POS4_PLS (Low Word)	POS4 +threshold (Low Word)
131	FLOAT32	POS4_MNS (High Word)	POS4 -threshold (High Word)
132		POS4_MNS (Low Word)	POS4 -threshold (Low Word)
133	FLOAT32	POS4_DPLS (High Word)	POS4+ +threshold (High Word)
134		POS4_DPLS (Low Word)	POS4+ +threshold (Low Word)
135	FLOAT32	POS4_DMNS (High Word)	POS4- -threshold (High Word)
136		POS4_DMNS (Low Word)	POS4- -threshold (Low Word)
137	ASCII X 20	POS5_NM[CH01][CH02]	Name : [CH01][CH02]···[CH20]
138		POS5_NM CH03][CH04]	
139		POS5_NM CH05][CH06]	
140		POS5_NM CH07][CH08]	
141		POS5_NM CH09][CH10]	
142		POS5_NM CH11][CH12]	
143		POS5_NM CH13][CH14]	
144		POS5_NM CH15][CH16]	
145		POS5_NM CH17][CH18]	
146		POS5_NM CH19][CH20]	
147	UINT16	POS5_MT	Measurement type
148	FLOAT32	POS5_H1 (High Word)	Hand specific parameter 1 (High Word)
149		POS5_H1 (Low Word)	Hand specific parameter 1 (Low Word)
150	FLOAT32	POS5_H2 (High Word)	Hand specific parameter 2 (High Word)
151		POS5_H2 (Low Word)	Hand specific parameter 2 (Low Word)
152	INT16	POS5_RP	Standard placement pulse
153	FLOAT32	POS5_PV (High Word)	POS5 reference set (High Word)
154		POS5_PV (Low Word)	POS5 reference set (Low Word)
155	FLOAT32	POS5_PLS (High Word)	POS5 +threshold (High Word)
156		POS5_PLS (Low Word)	POS5 +threshold (Low Word)
157	FLOAT32	POS5_MNS (High Word)	POS5 -threshold (High Word)
158		POS5_MNS (Low Word)	POS5 -threshold (Low Word)
159	FLOAT32	POS5_DPLS (High Word)	POS5+ +threshold (High Word)
160		POS5_DPLS (Low Word)	POS5+ +threshold (Low Word)
161	FLOAT32	POS5_DMNS (High Word)	POS5- -threshold (High Word)
162		POS5_DMNS (Low Word)	POS5- -threshold (Low Word)
163	INT16	AR_1P	AREA1 standard pulse
164	INT16	AR_2P	AREA2 standard pulse
165	INT16	AR_3P	AREA3 standard pulse
166	FLOAT32	AR_1PLS (High Word)	AREA1 +threshold (High Word)
167		AR_1PLS (Low Word)	AREA1 +threshold (Low Word)

HOLDING REGISTER Read-Write, 16-bit Big-Endian (R: 0x03, W: 0x06, 0x10)			
Address	Type	Name	Note
168	FLOAT32	AR_1MNS (High Word)	AREA1 -threshold (High Word)
169		AR_1MNS (Low Word)	AREA1 -threshold (Low Word)
170	FLOAT32	AR_2PLS (High Word)	AREA2 +threshold (High Word)
171		AR_2PLS (Low Word)	AREA2 +threshold (Low Word)
172	FLOAT32	AR_2MNS (High Word)	AREA2 -threshold (High Word)
173		AR_2MNS (Low Word)	AREA2 -threshold (Low Word)
174	FLOAT32	AR_3PLS (High Word)	AREA3 +threshold (High Word)
175		AR_3PLS (Low Word)	AREA3 +threshold (Low Word)
176	FLOAT32	AR_3MNS (High Word)	AREA3 -threshold (High Word)
177		AR_3MNS (Low Word)	AREA3 -threshold (Low Word)
178	UINT16	AR_OS	Range Output Specification
179	FLOAT32	AR_RT (High Word)	Range Output timer (High Word)
180		AR_RT (Low Word)	Range Output timer (Low Word)
181	FLOAT32	AR_RDT (High Word)	Range Output delay timer (High Word)
182		AR_RDT (Low Word)	Range Output delay timer (Low Word)
183	ASCII X 20	SM_SN [CH01] [CH02]	Serial Number: [CH01][CH02]···[CH20]
184		SM_SN [CH03] [CH04]	
185		SM_SN [CH05] [CH06]	
186		SM_SN [CH07] [CH08]	
187		SM_SN [CH09] [CH10]	
188		SM_SN [CH11] [CH12]	
189		SM_SN [CH13] [CH14]	
190		SM_SN [CH15] [CH16]	
191		SM_SN [CH17] [CH18]	
192		SM_SN [CH19] [CH20]	
193	ASCII X 20	SM_VR [CH01] [CH02]	F/W Version: [CH01][CH02]···[CH20]
194		SM_VR [CH03] [CH04]	
195		SM_VR [CH05] [CH06]	
196		SM_VR [CH07] [CH08]	
197		SM_VR [CH09] [CH10]	
198		SM_VR [CH11] [CH12]	
199		SM_VR [CH13] [CH14]	
200		SM_VR [CH15] [CH16]	
201		SM_VR [CH17] [CH18]	
202		SM_VR [CH19] [CH20]	
203	ASCII X 8	WL_ID [CH01] [CH02]	SSID: [CH01][CH02]···[CH08]【unused】
204		WL_ID [CH03] [CH04]	
205		WL_ID [CH05] [CH06]	
206		WL_ID [CH07] [CH08]	
207	ASCII X 8	WL_PW [CH01] [CH02]	Password: [CH01][CH02]···[CH08] 【unused】
208		WL_PW [CH03] [CH04]	
209		WL_PW [CH05] [CH06]	
210		WL_PW [CH07] [CH08]	

INPUT REGISTER Read-Only, 16-bit Big-Endian (R: 0x04)			
Address	Type	Name	Note
STATUS			
0	UINT16	Status	Status
PULSE COUNT			
1	INT32	Pulse1 (High Word)	Pulse1 (High)
2		Pulse1 (Low Word)	Pulse1 (Low)
3	INT32	Pulse2 (High Word)	Pulse2 (High) 【Unused】
4		Pulse2 (Low Word)	Pulse2 (Low)【Unused】
POS[1~5]			
5	INT32	POS1Value(High Word)	POS1 value (High Word)
6		POS1Value(Low Word)	POS1 value (Low Word)
7	INT32	POS2Value(High Word)	POS2 value (High Word)

INPUT REGISTER Read-Only, 16-bit Big-Endian (R: 0x04)			
Address	Type	Name	Note
8		POS2Value(Low Word)	POS2 value (Low Word)
9	INT32	POS3Value(High Word)	POS3 value (High Word)
10		POS3Value(Low Word)	POS3 value (Low Word)
11	INT32	POS4Value(High Word)	POS4 value (High Word)
12		POS4Value(Low Word)	POS4 value (Low Word)
13	INT32	POS5Value(High Word)	POS5 value (High Word)
14		POS5Value(Low Word)	POS5 value (Low Word)
15	UINT16	POS1 Judgment	POS1 Judgment
16	UINT16	POS2 Judgment	POS2 Judgment
17	UINT16	POS3 Judgment	POS3 Judgment
18	UINT16	POS4 Judgment	POS4 Judgment
19	UINT16	POS5 Judgment	POS5 Judgment

9 DI/DO Communication

9-1 DI/DO Overview

Connecting I/O signal unit to the control unit enables integration with external equipment via DI/DO communication.

9-2 Wiring diagram・Connecting example

Connect the attached connector to the MET/SG as shown in wiring figure. As coding pin is attached to four connectors （DI、DO1、DO2、DO3）, it will prevent incorrect insertion.
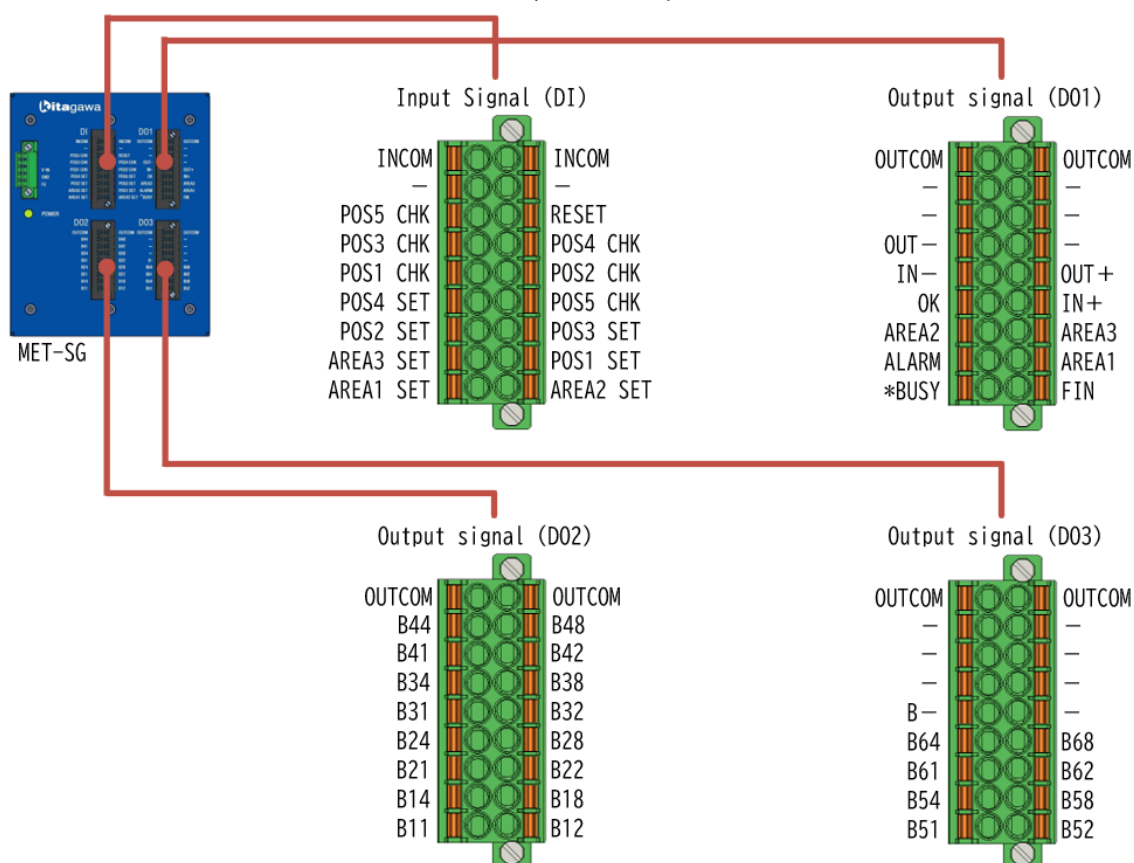
The wiring material connecting to the connector is used as shown in below and tightened with the specified torque.

Connector	DFMC 1,5/ 9-STF-3,5 (1790360) [Phoenix Contact]

For the connector wiring, solid conductors or wires with pin terminals/ferrules can be push-in connected without tools. For stranded conductors, press the lever with a small flat-blade screwdriver while inserting the wire.

DI — MET-SG / External device

| INCOM |
| INCOM |
| AREA1 SET |
| AREA2 SET |
| AREA3 SET |
| POS1 SET |
| POS2 SET |
| POS3 SET |
| POS4 SET |
| POS5 SET |
| POS1 CHK |
| POS2 CHK |
| POS3 CHK |
| POS4 CHK |
| POS5 CHK |
| RESET |
| − (N.C.) |
| − (N.C.) |

※1

DO1 — MET-SG / External device

| OUTCOM※3 |
| OUTCOM※3 |
| *BUSY |
| FIN |
| ALARM |
| AREA1 |
| AREA2 |
| AREA3 |
| OK |
| IN+ |
| IN− |
| OUT+ |
| OUT− |
| − (N.C.) |
| − (N.C.) |
| − (N.C.) |
| − (N.C.) |
| − (N.C.) |

※2

DO2 — MET-SG / External device

| OUTCOM※3 |
| OUTCOM※3 |
| B11 |
| B12 |
| B14 |
| B18 |
| B21 |
| B22 |
| B24 |
| B28 |
| B31 |
| B32 |
| B34 |
| B38 |
| B41 |
| B42 |
| B44 |
| B48 |

※2

DO3 — MET-SG / External device

| OUTCOM※3 |
| OUTCOM※3 |
| B51 |
| B52 |
| B54 |
| B58 |
| B61 |
| B62 |
| B64 |
| B68 |
| B− |
| − (N.C.) |
| − (N.C.) |
| − (N.C.) |
| − (N.C.) |
| − (N.C.) |
| − (N.C.) |
| − (N.C.) |

※2

※1   The input signal supports both sink and source types.

※2   The output signal supports both sink and source types.

※3   The OUTCOM terminals for DO1、DO2、DO3 are independent; there is no internal connection between them.

9-3 Standard set (POS SET)

Use the Reference Set (POS Set) to set the reference position for each POS. For details, please refer to "3-4-3 reference Set (POS＊SET)".

9-3-1 Time Chart

This section explains the conditions under which the Reference Set (POS SET) is executed and the behavior of the related signals.
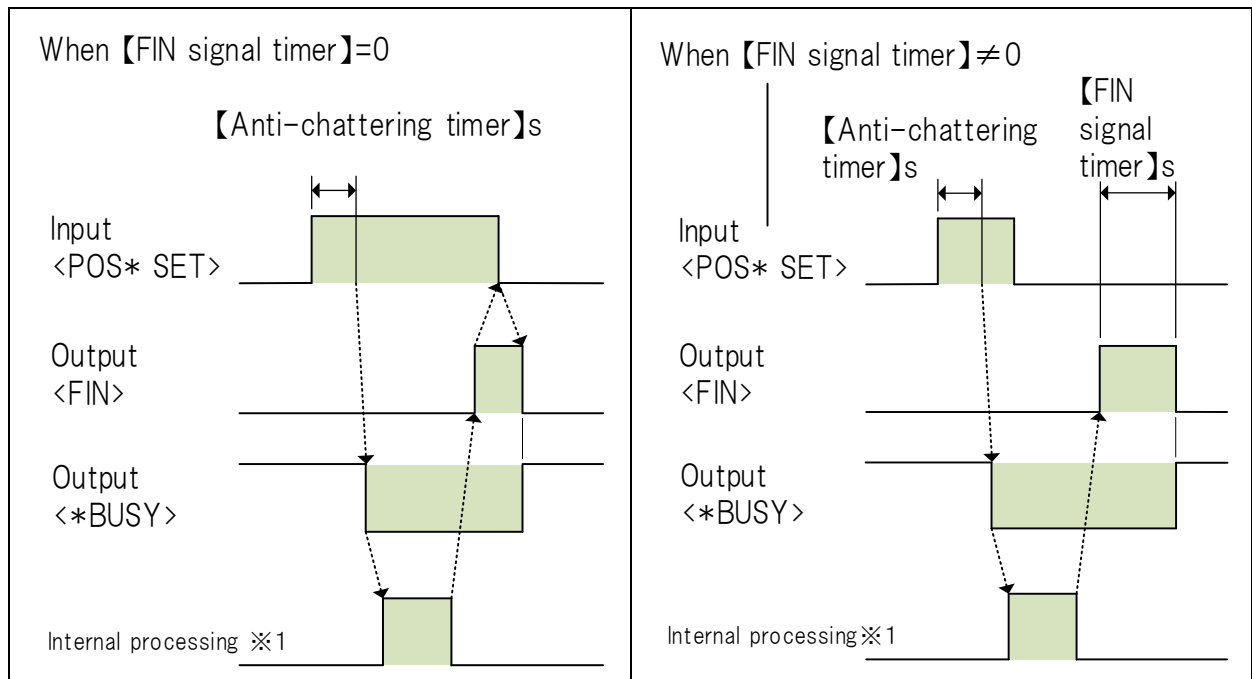
※1　When the length measuring hand's scale is determined to be stopped, internal processing starts. If the stop condition is not detected or the processing fails, one of alarms P201-P205 will be triggered. For the stop-detection conditions, please refer to the related parameters.

9-3-2 Related parameters

Related parameters are described as below. Please refer to the "6-5 Setting" for the setting method.

☐ Measurement parameter > common
- Stop timer
- Stop range
- Process time-out

☐ I/O parameter
- Anti-Chattering timer
- FIN signal timer

9-4　Measurement and judge

The measurement check (POS CHK) measures the deviation from the every POS reference position and outputs a pass/fail result according to the error amount. For details, please refer to "3-4-4 Measurement Check (POS*CHK)."

9-4-1　Timing chart

This section explains the conditions under which the Measurement Check (POS CHK) is performed and the behavior of the related signals.
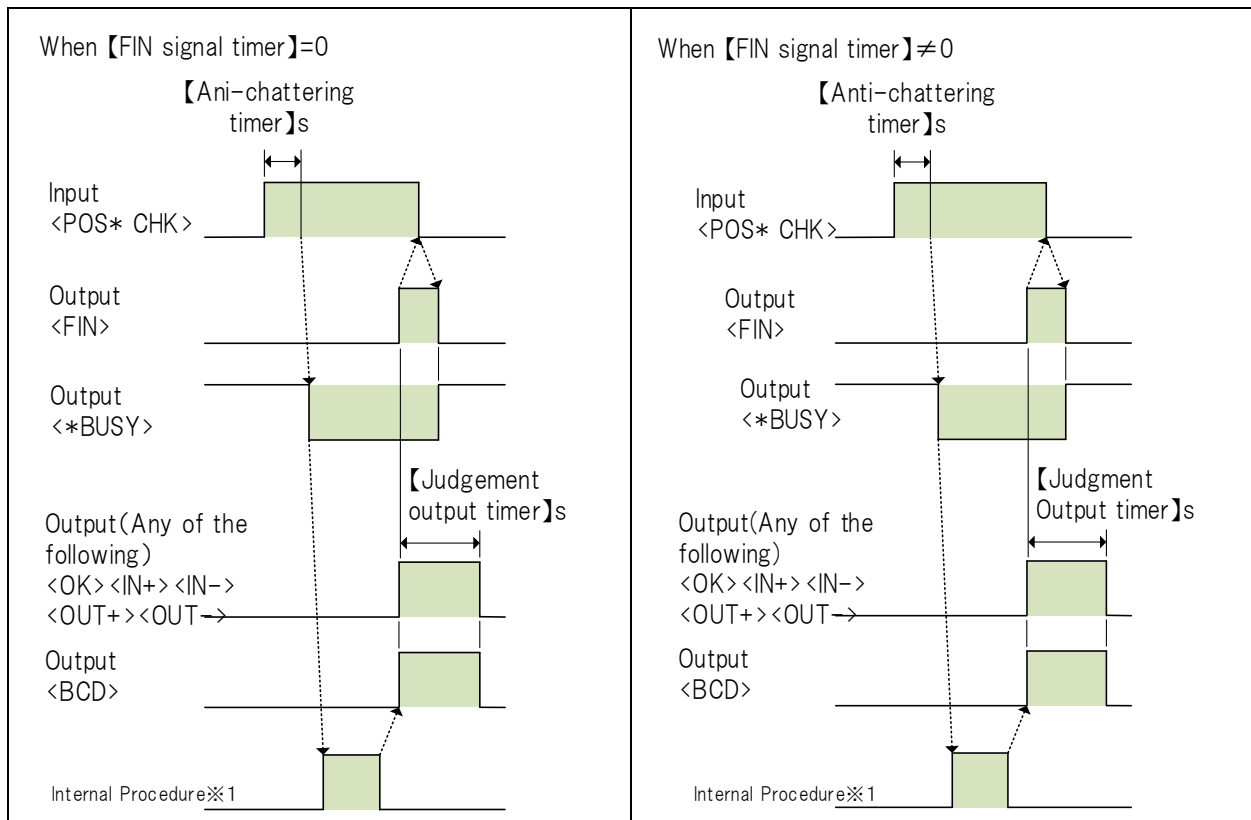
※1　When the measuring hand's scale is determined to be stationary, internal procedure starts. If the stop condition is not met or the procedure fails, one of alarms P201~P205 will occur. For the stop-detection criteria, please refer to the relevant parameters.

9-4-2　BCD Output

During POS CHK execution, as shown in "0 timing Chart Example," the system output either the measured value or the difference between the measured value and the Reference Set value in BCD format. The BCD output specifications are provided in Table 9-4-2.
For difference output, the difference between the measured value and the reference value is output.
For absolute‐value output, the measured value is output.
If the sign is negative ("–"), the sign bit < B– > is set Hi.
If the BCD output value is less than –999.999 or greater than 999.999, all bits are set Hi.

BCD output example	digit →	Symbol	3-digit integer — 6				5				4				3 decimal places — 3				2				1			
	Bit →	–	3	2	1	0	3	2	1	0	3	2	1	0	3	2	1	0	3	2	1	0	3	2	1	0
	Signal name →	B-	B68	B64	B62	B61	B58	B54	B52	B51	B48	B44	B42	B41	B38	B34	B32	B31	B28	B24	B22	B21	B18	B14	B12	B11
0.000		—	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
0.001		L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H
0.002		L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	L
1.234		L	L	L	L	L	L	L	L	L	L	L	L	H	L	L	H	L	L	L	H	H	L	H	L	L
987.654		L	H	L	L	H	H	L	L	L	L	H	H	H	L	H	H	L	L	H	L	H	L	H	L	L
−0.623		H	L	L	L	L	L	L	L	L	L	L	L	L	L	H	H	L	L	L	H	L	L	L	H	H
−471.540		H	L	H	L	L	L	H	H	H	L	L	L	H	L	H	L	H	L	H	L	L	L	L	L	L
1000.000		H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
−1000.000		H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H

Table エラー! 参照元が見つかりません。 BCD output specification （H：Hi / L：Lo)

9-4-3 Related Parameters

Related parameters are described as below. Please refer to the "6-5 Setting" for the setting method.

☐ Measurement parameter > common
- Stop timer
- Stop range
- Process time-out

☐ I/O parameter
- Anti-chattering timer
- FIN signal timer
- Judgment output timer
- BCD output specification

9-5 Range Output （AREA)

Range Output (AREA) is a function that outputs a signal when the unit is within a predefined, user-set area (preset position range). For details, please refer to section "3-4-5 Range Output (AREA)."

9-5-1 Range Output Setting (AREA SET) Time chart example

This section explains the conditions under which the Range output (AREA) is performed and the behavior of the related signals.
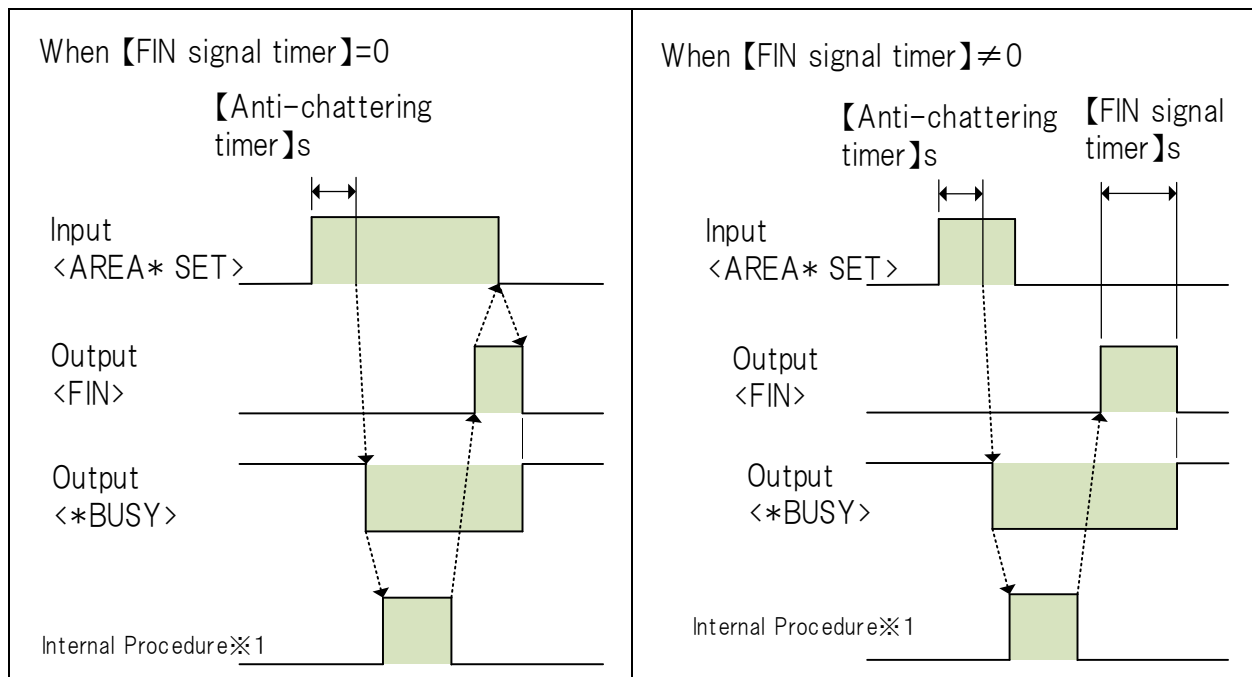
※1 When the scale on the measurement hand meets the stop condition, the system starts internal procedure. If a stop condition is not detected. Of if the procedure fails, one of alarms A201 to A203 will be triggered. For the specific criteria used to determine a stop, refer to the related parameters.

9-5-2 Range Output (AREA 1~3) Time chart example

For the conditions under which the Range output (AREA) is performed and the behavior of the related signals, refer to section "3-4-5 Range Output (AREA)"

9-5-3 Related parameters

Related parameters are described as below. Please refer to the "6-5 Setting" for the setting method.

☐ Related parameters > common
- Stop timer
- Stop range
- Process time-out

☐ Range output parameter
- AREA1 threshold
- AREA2 threshold
- AREA3 threshold
- Range output specification
- Range output timer

- Range output delay timer

☐ I/O parameter
- Anti-chattering timer
- FIN signal timer

10 Data Output (USB Flash Drive)

10-1 Data Output Description

10-2 Data Description

10-1 Data Output Description

The Measurement and Judgment System connect a USB Flash Drive device and output the following internal recorded data in CSV format:
• Measurement History (Measured Values, Reference Values, Errors, Judgment Results)
• Parameter List (Setting Value List)
• Alarm History

The procedure is shown below.
① Connect the USB Flash Drive (type-C).
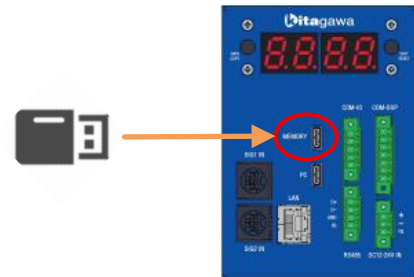
② Press and hold the data copy button for 3 seconds or more. The screen display 「USb」 will blink, and after 3 seconds when it changes from blinking to steady lighting, it will begin to transfer data to a USB Flash Drive.

Data copy button

⚠ CAUTION

Do not remove the USB Flash Drive while 「USb」 display is lit. Output processing may fail and data may be corrupted.

③ When the screen display changes from 「USb」 to another display(「rdy」 or 「AL.」), data output to the USB Flash Drive is completed. The USB Flash Drive can now be removed.
If data output fails, alarm U201, U202, U203 will occur.
For alarm details, please refer to "Chapter 11 Alarms" .
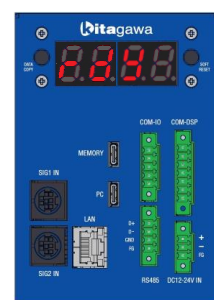
10-2 Data Description

The following data will be saved on the USB Flash Drive.
The data can be viewed in Excel or text (Notepad).

PARAMETERS.csv ←— Parameter List
MEASUREMENT.csv ←— Measurement History
ALARM.csv ←————— Alarm History

10-2-1 Parameter List Data

The data content of the parameter list (PARAMETERS.csv) is explained.

For details about parameter items and setting values, please refer to "Chapter 6 Setting & Monitor Tool".

Category	item	Name	Category	item	Name
CM	PTO	Mutual processing timeout	AR	1P	Area output 1 reference set value (read only)
CM	NO	Count of consecutive non-OK results	AR	2P	Area output 2 reference set value (read only)
IO	CT	I/O chattering timer	AR	3P	Area output 3 reference set value (read only)
IO	FT	I/O FIN signal timer	AR	1+	Area output 1 threshold
IO	JT	I/O judgment output timer	AR	1-	Area output 1 threshold
IO	BO	I/O BCD output specification	AR	2+	Area output 2 threshold
IO	AS	I/O alarm signal output specification	AR	2-	Area output 2 threshold
P1	NM	POS1 name	AR	3+	Area output 3 threshold
P1	MT	POS1 measurement type	AR	3-	Area output 3 threshold
P1	H1	POS1 hand specific parameter 1	AR	OS	Area output specification
P1	H2	POS1 hand specific parameter 2	AR	RT	Area output timer
P1	RP	POS1 standard pulse (read-only)	AR	RDT	Area output delay timer
P1	PV	POS1 reference set value	LAN	IP	IP address
P1	+	POS1 threshold	LAN	SM	Sub net mask
P1	-	POS1 threshold	LAN	GA	Gateway address
P1	++	POS1 threshold	LAN	PN	Port number
P1	--	POS1 threshold	WL	ID	Wireless LAN ID (unused)
P2	NM	POS2 name	WL	PW	Wireless LAN password (unused)
P2	MT	POS2 measurement type	RS485	CT	RS485 communication specification (unused)
P2	H1	POS2 hand specific parameter 1	RS485	SA	RS485 slave address
P2	H2	POS2 hand specific parameter 2	RS485	BR	RS485 transmission speed
P2	RP	POS2 standard pulse (read-only)	RS485	CO	RS485 communication order (unused)
P2	PV	POS2 reference set value	RS485	STB	RS485 standard bit
P2	+	POS2 threshold	RS485	SPB	RS485 stop bit
P2	-	POS2 threshold	RS485	DH	RS485 data length
P2	++	POS2 threshold	RS485	PB	RS485 parity bit
P2	--	POS2 threshold	RS485	TWT	RS485 transmission waiting time
P3	NM	POS3 name	RS485	SI	RS485 silent interval
P3	MT	POS3 measurement type	RS422	BR	RS422 transmission speed (unused)
P3	H1	POS3 hand specific parameter 1	RS422	STB	RS422 start bit (unused)
P3	H2	POS3 hand specific parameter 2	RS422	SPB	RS422 stop bit (unused)
P3	RP	POS3 standard pulse (read-only)	RS422	DH	RS422 data length (unused)
P3	PV	POS3 reference set value	RS422	PB	RS422 parity bit (unused)
P3	+	POS3 threshold	CAN	VR	CAN version (unused)
P3	-	POS3 threshold	SM	SN	System serial number (read only)
P3	++	POS3 threshold	SM	VR	System version (read only)
P3	--	POS3 threshold	SM	YR1	System calendar Year 1
P4	NM	POS4 name	SM	MTH1	System calendar Month 1
P4	MT	POS4 measurement type	SM	DAY1	System calendar Day 1
P4	H1	POS4 hand specific parameter 1	SM	YR	System calendar Year
P4	H2	POS4 hand specific parameter 2	SM	MTH	System calendar Month
P4	RP	POS4 standard pulse (read-only)	SM	DAY	System calendar Day
P4	PV	POS4 reference set value	SM	HR	System calendar Hour
P4	+	POS4 threshold	SM	MIN	System calendar Minute
P4	-	POS4 threshold	SM	SEC	System calendar Second
P4	++	POS4 threshold	CX	PC	PC connection confirm
P4	--	POS4 threshold	CX	EXT	
P5	NM	POS5 name	CX	SEN	External device connection (Modbus/TCP)
P5	MT	POS5 measurement type	CX	UIO	MET-SG connection confirm
P5	H1	POS5 hand specific parameter 1	CX	UDIS	MET-DP connection confirm
P5	H2	POS5 hand specific parameter 2			
P5	RP	POS5 standard pulse (read-only)			
P5	PV	POS5 reference set value			
P5	+	POS5 threshold			
P5	-	POS5 threshold			
P5	++	POS5 threshold			
P5	--	POS5 threshold			

10-2-2 Measurement History Data

The data content of the measurement history (MEASURMENT.csv) is explained.

When measurement (POS CHK) is performed, the measurement results are saved as history as follows.

10,000 records can be maintained as history.

When exceeding 10,000 records, data will be overwritten starting from No.0.

※Date and time are recorded as Coordinated Universal Time (UTC).

Measurement History Data Example

No.	Date	Time	POS	Name	−:Linear PHI:Diaφ	Reference Value	Measured Value	Error Value	Judgment
0	2025/6/16	17:15:10	P1	SQ A	−	15.5	15.518	0.018	OK
1	2025/6/17	8:18:53	P5	DIA OUT	PHI	24	24.082	0.112	IN+
2	2025/6/17	8:19:02	P5	DIA OUT	PHI	24	24.037	0.037	OK
3	2025/6/17	8:19:26	P2	SQ B	−	22.4	21.334	−0.066	IN−
4	2025/6/17	8:31:27	P3	PROD1	−	10	9.991	−0.009	OK
5	2025/7/3	10:31:44	P3	PROD1	−	10	10.205	0.205	OUT+
6	2025/7/3	14:05:55	P1	SQ A	−	15.5	15.441	−0..059	OK
7	2025/7/3	15:54:00	P4	DIA IN	PHI	17	16.985	−0..015	IN−
8	2025/7/3	16:07:10	P4	DIA IN	PHI	17	16.998	−0..002	OK
9	2025/8/5	13:12:20	P1	SQ A	−	15.5	15.518	0.018	OK
10	2025/8/5	14:40:26	P2	SQ B	−	22.4	21.266	−0.133	OUT−

10-2-3 Alarm History Data

Alarm history (ALARM.csv) is explained.

The history of the occurred alarms is saved as follows.

1,000 alarm records can be maintained as history. When exceeding 1,000 records, data will be overwritten starting from No. 0.

For alarm details, please refer to "Chapter 11 Alarms".

※Date and time are recorded as UTC.

Alarm history data example

No.	Date	Time	Alarm Number	Alarm Rank
0	2025/6/16	17:15:10	P300	3
1	2025/6/17	8:18:53	P215	2
2	2025/6/17	8:19:02	P202	2
3	2025/6/17	8:19:26	A203	2
4	2025/6/17	8:31:27	U201	2
5	2025/7/3	10:31:44	F110	1
6	2025/7/3	14:05:55	P300	3

11 Alarm

11-1 Alarm

The measurement and judgment system is designed to notify users of alarm events, failures, or operation errors through the status display and alarm history within the application.
Alarms help users to quickly identify the issue and take appropriate corrective measures.

11-1-1 Alarm Structure

Each alarm is composed of a combination of letters and numbers which each element has a specific meaning.
The meaning of each element is explained in the corresponding section.

F 1 1 0

→ Alarm Number
→ Alarm Rank
→ Alarm Type
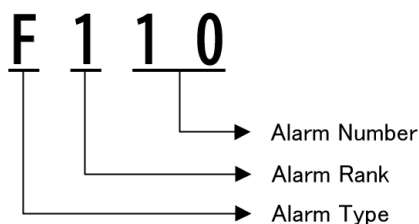
11-1-2 Alarm Type

Alarm type indicates the category or function related to the alarm.

Type	Content
A	Related to range output setting
b	Related to battery or voltage levels
C	Related to communication with the system (Ex：signal failure)
F	Related to scale and pulse signal settings
H	Related to measurement and judgment results
P	Related to POS1～5 settings and measurement process
U	Related to USB output (Ex：output failure, insufficient capacity)

11-1-3 Alarm Rank and Severity

The alarm number's rank represents the level of severity.

Alarm Rank	Content
Rank 1	This indicates a state of uncontrollable operation or failure to perform measurement correctly. Recovery is achieved by removing the cause, and then either shutting off the power supply or performing a pulse count clear operation.
Rank 2	This state indicates that an abnormality occurred during operation or communication, and the process could not be completed. Recovery is achieved by removing the cause, and then performing a reset operation.
Rank 3	This indicates a warning state or a condition where certain functions are unavailable. Recovery is achieved by performing a reset operation or a specific operation.

11-2 Operation during alarm

When alarm occurs, the following actions take place:

※1 The system status transitions to ALARM.

※2 The alarm code/number is shown on the MET-CT and MET-SG. (For details, see Chapter 7: Basic Operation and Display)

※3 Modbus Read Inputs (0x02) address66 : alarm = 0

　　Modbus Read Inputs (0x02) address 128-157 either is 1.

※4 DO signal <ALARM> Lo
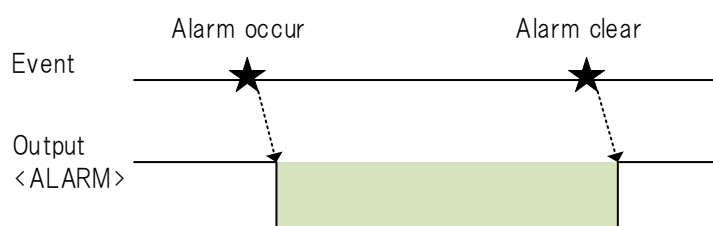
【Related parameters】

Alarm signal output specifiation		
【Initial value】	【Data range】	【Unit】
Alarm ranks 1,2 and 3.	Alarm ranks 1 and 2. / Alarm ranks 1,2 and 3.	―
【Note】 Configure which alarm ranks will drive the output signal. Output the signal for alarm ranks 1 and 2. Output the signal for alarm ranks 1,2 and 3.		

11-3 Stopping alarm

11-3-1　Alarm reset

When alarm of rank 2 or rank 3 occurs, and the alarm clearing conditions are satisfied, the alarm can be reset using the following method.

■ Press [soft reset button] of MET-CT,

■ Perform an alarm reset via Modbus communication,

■ Apply a reset input via DI and use MET-MT to perform the reset.

For Modbus communication, please refer to Chapter 8 Modus Communication.

※5 Alarm reset by [soft reset button]

① Press the [soft reset button].

　　「CLr」appears on display screen. If the alarm clearing conditions are satisfied, the alarm will be cleared.

Software reset Button
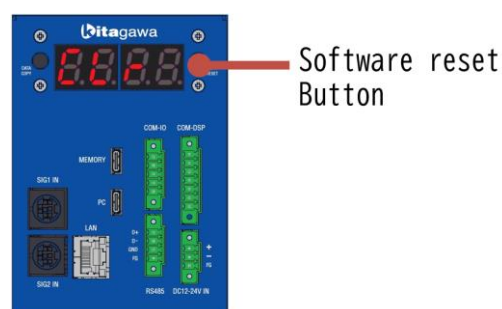
※6 Reset by Modbus communication

　　 Write Modbus coil　(0x05) address13：reset = 1

※7 Alarm reset by DI <RESET>
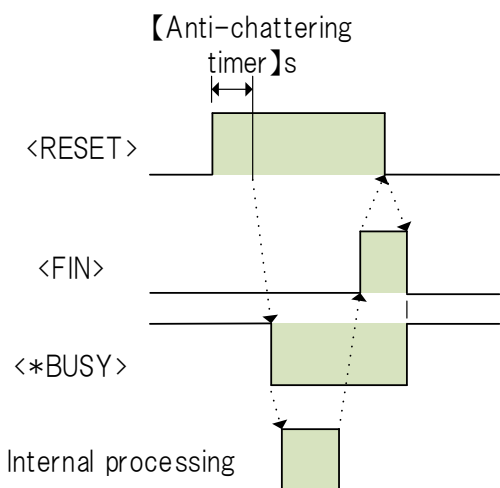
When【FIN signal timer】=0 　　　　　　　　　　　　When【FIN signal timer】≠0
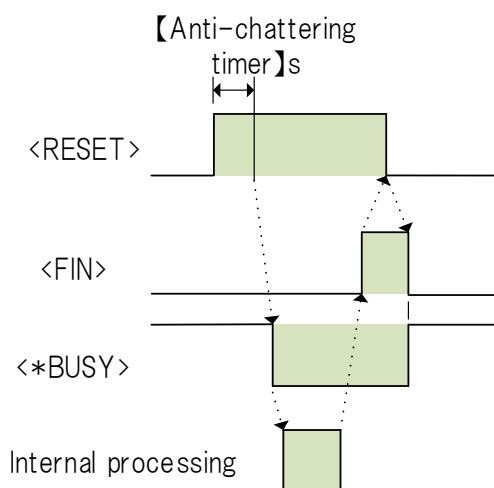
※8 Alarm reset using MET-MT

　　 Please refer to "6-3-1-7　Alarm reset operation".

11-3-2　Pulse count clear

When alarm F110 occurs, you can clear the alarm by performing a Pulse Count Clear, which clears the sensor data. The Pulse Count Clear is performed by pressing the [Soft Reset button].

※9 Pulse count clear by soft reset button

- Press and hold the [Soft Reset button] for at least 3 seconds.

Clr will blink on the display. After 3 seconds, it changes from blinking to steady, and the Pulse Count Clear Process starts.

When the display switches from "Clr" to another indication (「rdy」or「AL.」), the Pulse Count Clear process is complete.

Software reset Button

11-4 Alarm List

11-4-1　Range Output Setting Related Items (A)

Number	Content	Detail
A201	AREA1 Set Failed	AREA1 set is internally abnormal or the process failed to reach the stop judgment.
A202	AREA2 Set Failed	AREA2 set is internally abnormal or the process failed to reach the stop judgment.
A203	AREA3 Set Failed	AREA3 set is internally abnormal or the process failed to reach the stop judgment.

11-4-2 Battery or Voltage Level Related Items (b)

Number	Content	Detail
b300	Battery Dead	Battery voltage dropped to zero.

11-4-3 Communication with System Related Items (C)

Number	Content	Detail
C200	Communication Error (MET-SG)	Unable to communicate normally with the I/O unit.
C210	Communication Error (MET-DP)	Unable to communicate normally with the display unit
C220	Communication Error (Modbus/RTU)	Unable to communicate normally with external devices via Modbus/RTU(RS485 communication).
C230	Communication Error (Modbus/TCP)	Unable to communicate normally with external devices via Modbus/TCP(Ethernet communication).

11-4-4 Scale and Pulse Signal Setting Related Items (F)

Number	Content	Detail
F110	Abnormal Scale A/B Phase Signal	Abnormality of the scale output signal is detected or it is disconnected.
F111	Pulse Count Overflow	Pulse count value overflowed.

11-4-5 Measurement and Judgment Result Related Items (H)

Number	Content	Detail
H201	Consecutive Non-OK Judgment(POS1)	During the measurement judgment process, POS1 judgment result was other than OK for consecutive times specified by parameter 【CM. NO】.
H202	Consecutive Non-OK Judgment(POS2)	During the measurement judgment process, POS2 judgment result was other than OK for consecutive times specified by parameter 【CM. NO】.
H203	Consecutive Non-OK Judgment(POS3)	During the measurement judgment process, POS3 judgment result was other than OK for consecutive times specified by parameter 【CM. NO】.
H204	Consecutive Non-OK Judgment(POS4)	During the measurement judgment process, POS4 judgment result was other than OK for consecutive times specified by parameter 【CM. NO】.
H205	Consecutive Non-OK Judgment(POS5)	During the measurement judgment process, POS5 judgment result was other than OK for consecutive times specified by parameter 【CM. NO】.

11-4-6 POS1~5 Setting and Measurement Process Related Items (P)

Number	Content	Detail
P201	POS1 Reference Set Failed	POS1 reference set is internally abnormal or the process failed to reach the stop judgment.
P202	POS2 Reference Set Failed	POS2 reference set is internally abnormal or the process failed to reach the stop judgment.
P203	POS3 Reference Set Failed	POS3 reference set is internally abnormal or the process failed to reach the stop judgment.
P204	POS4 Reference Set Failed	POS4 reference set is internally abnormal or the process failed to reach the stop judgment.
P205	POS5 Reference Set Failed	POS5 reference set is internally abnormal or the process failed to reach the stop judgment.
P211	POS1 Measurement Failed	POS1 measurement judgment execution failed due to POS1 not being set, an internal malfunction, or failure to reach the stop judgment.
P212	POS2 Measurement Failed	POS2 measurement judgment execution failed due to POS1 not being set, an internal malfunction, or failure to reach the stop judgment.

Number	Content	Detail
P213	POS3 Measurement Failed	POS3 measurement judgment execution failed due to POS1 not being set, an internal malfunction, or failure to reach the stop judgment.
P214	POS4 Measurement Failed	POS4 measurement judgment execution failed due to POS1 not being set, an internal malfunction, or failure to reach the stop judgment.
P215	POS5 Measurement Failed	POS5 measurement judgment execution failed due to POS1 not being set, an internal malfunction, or failure to reach the stop judgment.
P300	POS Not Set	All POS sets from POS1~POS5 have not been implemented.

11-4-7 USB Output Related Items (U)

Number	Content	Detail
U201	Data Output Failed (USB) (USB Flash Drive not connected)	When exporting data to the USB Flash Drive, the external memory device is not connected.
U202	Data Output Failed (USB) (File with the same name exist)	When exporting data to the USB Flash Drive, the same file name exists in the root directory of the external memory.
U203	Data Output Failed (USB) (Insufficient free space)	When exporting data to USB Flash Drive, there is no free space on the external memory.

11-5 Alarm Details

11-5-1 Range Output Setting Related Items (A)

A201	AREA1 Set Failed

A202	AREA2 Set Failed

A203	AREA3 Set Failed

【Reason】 AREA Set was performed, but processing did not complete even after time of 【Process time out】 elapsed.
- Stop judgment was not achieved.
- Internal abnormality occurred

【Solution】
- Correct the setting values of stop conditions to appropriate value (【Stop Judgment Timer】, 【Stop Judgment Range】).
- Replace the unit.

11-5-2 Battery or Voltage Level Related Items (b)

b300	Battery Dead

【Reason】 Battery voltage dropped to zero.

【Solution】
- Replace the battery

11-5-3 Communication with System Related Items (C)

C200	Communication Error (MET-SG)

【Reason】 I/O unit communication cannot be performed normally.
- Communication cable disconnection or poor connection.
- MET-SG malfunction.
- MET-CT malfunction.
- Noise interference.

【Solution】
- Replace the communication cable or connect it correctly.
- Keep the power supply within the specified range.
- Replace the MET-CT, MET-SG, or communication cable.
- Keep distance from high power circuit or noise generating equipment.

C210	Communication Error (MET-DP)

【Reason】 MET-DP communication cannot be performed normally.
- Communication cable disconnection or poor connection.
- MET-DP malfunction.
- MET-CT malfunction.
- Noise interference.

【Solution】
- Replace the communication cable or connect it correctly.
- Ensure the operation condition meet specified condition. Replace the MET-CT, MET-DP or communication cable.
- Keep distance from high power circuit or noise generating equipment.

C220	Communication Error (Modbus/RTU)

【Reason】 External device communication cannot be performed normally.
- Communication cable disconnection or poor connection.
- External device malfunction.
- MET-CT malfunction.
- Noise interference.

【Solution】
- Replace the communication cable or connect it correctly.
- Keep the power supply within the specified range.
- Replace the MET-CT, external device or communication cable.
- Keep distance from high power circuit or noise generating equipment.

C230	Communication Error (Modbus/TCP)

【Reason】 External device communication cannot be performed normally.
- Communication cable disconnection or poor connection.
- External device malfunction.
- MET-CT malfunction.
- Noise interference.

【Solution】
- Replace the communication cable or connect it correctly.
- Keep the power supply within the specified range.
- Replace the MET-CT, external device or communication cable.
- Keep distance from high power circuit or noise generating equipment.

11-5-4 Scale and Pulse Signal Setting Related Items (F)

F110	Abnormal Scale Signal

【Reason】 Scale output signal abnormality detected
- Scale signal wire disconnection occurred.
- Hand jaw (scale) operated at speed exceeding specifications.

【Solution】
- Replace the cable
- Replace the scale or interpolator
- Set the hand air pressure to the correct setting pressure.

F111	Pulse Count Overflow

【Reason】 Pulse count overflowed.
- Scale malfunction.
- Noise interference.

【Solution】
- Replace the scale.
- Keep distance from high power circuit or noise generating equipment.

11-5-5 Measurement and Judgment result Related Items (H)

H201	Consecutive Non-OK Judgment (POS1)
H202	Consecutive Non-OK Judgment (POS2)
H203	Consecutive Non-OK Judgment (POS3)
H204	Consecutive Non-OK Judgment (POS4)
H205	Consecutive Non-OK Judgment (POS5)

【Reason】 Measurement and judgment results resulted in non-OK judgment consecutive times.

【Solution】
- Reconfirm work piece gripping conditions (air pressure, gripping position, gripping posture, etc.).
- Reconfirm machining conditions (temperature, tool wear, etc.).
- Review the setting values of judgment conditions (parameters【threshold value】) .

11-5-6 POS1~5 Setting and Measurement Process Related Items (P)

P201	POS1 Reference Set Failed
P202	POS2 Reference Set Failed
P203	POS3 Reference Set Failed
P204	POS4 Reference Set Failed
P205	POS5 Reference Set Failed

【Reason】 POS Set was performed, but processing did not complete even after【process time out】 elapsed.
- Stop judgment was not achieved.
- Internal abnormality occurred.

【Solution】
- Correct the setting values of stop conditions(parameters【stop judgment timer】,【stop judgment range】)to appropriate value.
- Replace the unit.

P211	POS1 Measurement Failed
P212	POS2 Measurement Failed
P213	POS3 Measurement Failed
P214	POS4 Measurement Failed
P215	POS5 Measurement Failed

【Reason】 Measurement and judgment was performed, but processing did not complete even after time of 【process time out】 elapsed.
- Stop judgment was not achieved.
- Internal abnormality occurred.

【Solution】
- Correct the setting values of stop conditions】(parameters 【stop judgment timer】, 【stop judgment range】)to appropriate value.
- Replace the unit.

P221	POS1 Reference 2 Set Failed
P222	POS2 Reference 2 Set Failed
P223	POS3 Reference 2 Set Failed
P224	POS4 Reference 2 Set Failed
P225	POS5 Reference 2 Set Failed

【Reason】 POS reference 2 Set was performed, but processing did not complete even after 【CM.PTO】 s elapsed.
- Stop judgment was not achieved.
- Internal abnormality occurred.
- POS reference set not performed.

【Solution】
- Review the setting values of stop conditions 【CM.SJT】, 【CM.SJR】.
- Replace the unit.

11-5-7 USB Output Related Items (U)

U201	Data Output Failed (USB Flash Drive not connected)

【Reason】 Data output to USB Flash Drive failed.

【Solution】
- USB Flash Drive is not connected.

U202	Data Output Failed (File with the same name exist)

【Reason】 Data output to USB Flash Drive failed.

【Solution】
- A file with the same name exists in the root directory of the external memory.

U203	Data Output Failed (Insufficient free space)

【Reason】 Data output to USB Flash Drive failed.

【Solution】
- There is no free space in the external memory.

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12 Maintenance

12 Maintenance

12-1 Periodic Inspection

Please regularly inspect each unit body, wiring sections, and other components.
The standard inspection interval is once every 6 months to 1 year, but please shorten the inspection interval according to the surrounding environment.
The content of the regular inspection are described below.

Inspection Location	Time	Inspection Contents	Action When Abnormal
Enclosure	Daily	① Is there the dust accumulation? ② Is there any moisture or oil adhesion?	Wipe clean using a clean dry cloth or similar material.
All Cables	As Needed	① Are there scratches or cracks on the cable exterior? ② Are the connectors loose? ③ Are there loose screws on the connection terminal blocks?	① Cable replacement is required. ② Please contact our company. ③ Insert fully and connect securely. ④ Retighten the screws.
Battery	As Needed	Is there a battery alarm?	Replace the battery

12-1-1 Life-Expiring Parts

The length measurement and judgment system contains parts that require the replacement due to their life time. The replacement timing guidelines are as follows. Replacement timing varies depending on usage conditions and installation environment.

Part Name	Standard Replacement Period	Description
Battery	No replacement required	While battery replacement is not typically required, it may become necessary based on specific usage conditions or the installation environment.

12-2 Battery Replacement

12-2-1 Battery Specifications

The length measurement and judgment system uses a coin battery to back up the calendar function that records time when saving measurement data during power-off period. Therefore, if an abnormality occurs in the backup coin battery, the calendar function will be lost. Battery details are as follows.

Battery type	CR2032
Nominal Voltage	3.0V
Standard Capacity	220mAh

12-2-2 Battery Replacement Method

Battery alarm occurs or if a battery malfunction arises, please replace according to the following procedure.

1. Loosen the binding screws (16 in total) on the top, sides, and bottom of the control unit main body, and open the side panel.
(See on the right)

Back Panel

Binding Screw
6-M3 x 5

Binding Screw
4-M3 x 5

Front Panel

Binding Screw
6-M3 x 5
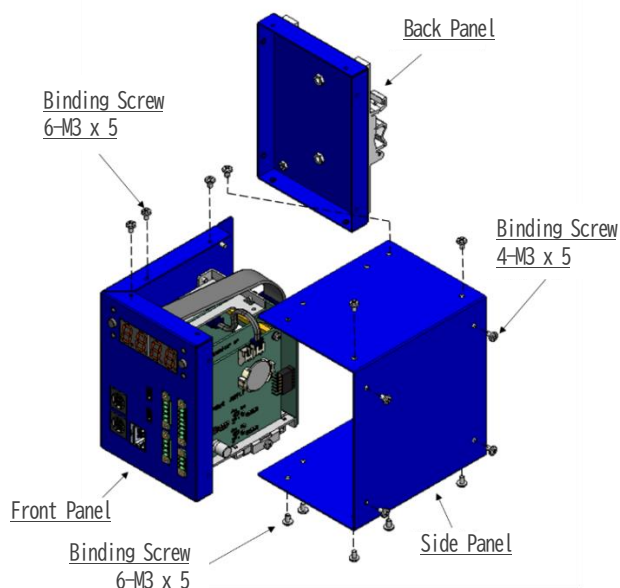
Side Panel

2. Remove and replace the coin battery from the coin battery holder on the POWER SUPPLY board located on the front.

CR2032

POWER SUPPLY
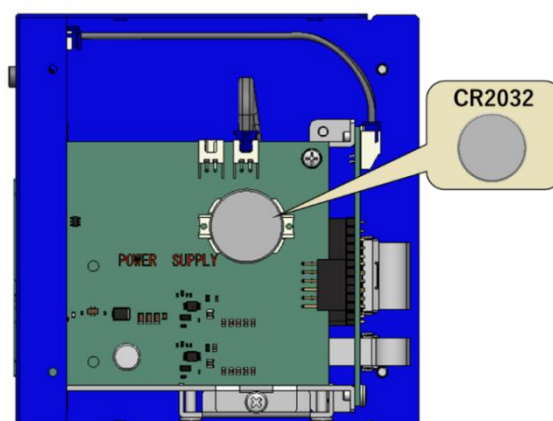
3. Assemble the side panels in the reverse order.
4. After replacing the battery, reset the date and time using the setting and monitoring tool.
For details, refer to "Chapter 6-5-5: Date and Time."

⚠ **CAUTION**

- Perform the battery replacement procedure after shutting off the power supply. Contact with the board while power is supplied may cause damage.
- Ensure static electricity is removed before performing the battery replacement procedure. Contact with the board may cause damage due to static electricity.

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