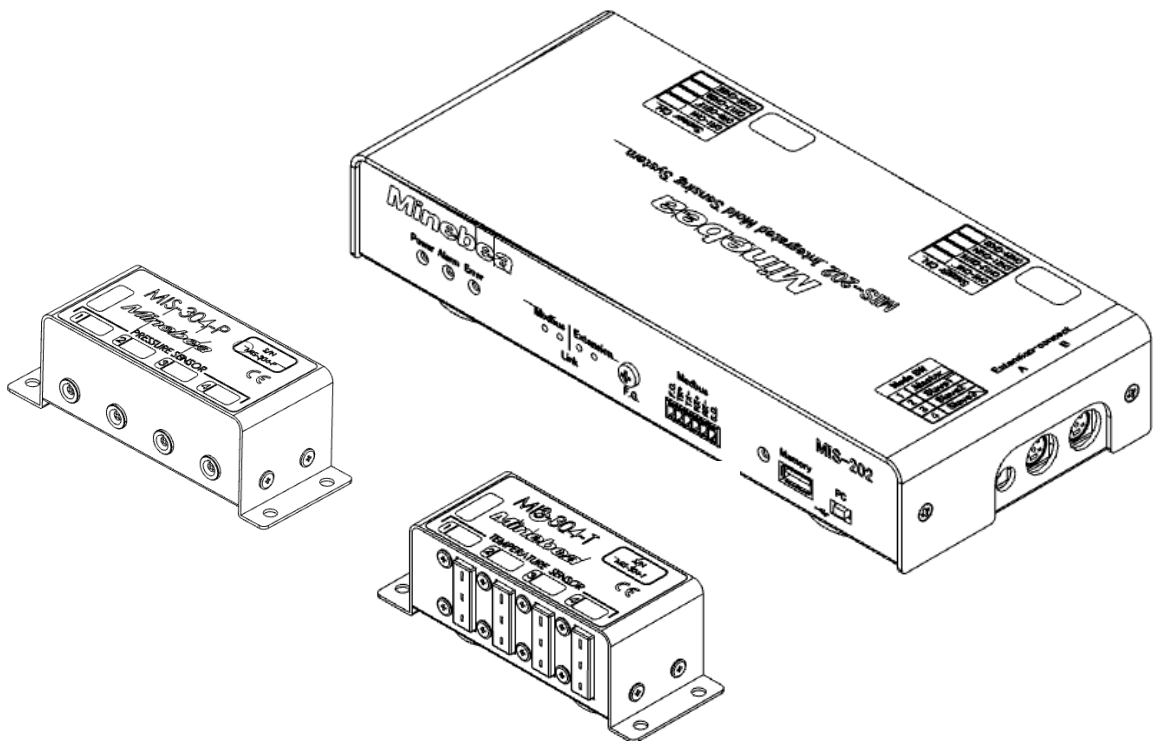*Integrated Mold Sensing System*
MIS-202-PT/MIS-202-PP

Modbus Communication Instruction Manual

Introduction

Thank you for purchasing the MIS-202-PT/MIS-202-PP Integrated Mold Sensing System. This instruction manual describes how to operate the device, as well as noteworthy points. Note that handling or operating the device incorrectly may result in malfunctions. Read this manual thoroughly before use for safety and optimal results.

Pictograms and Conventions Used in This Manual

This manual uses the following pictograms to indicate actions to avoid at all times, aspects requiring caution, and other noteworthy matters. Be sure to read the descriptions provided alongside these pictograms.

⚠ **WARNING**

This indicates circumstances in which incorrect handling may result in death or serious injury to users. Avoid the actions described here at all times.

⚠ **CAUTION**

This indicates circumstances in which incorrect handling may result in injury to users or damage to property.

This indicates operating or procedural precautions or restrictions.
Always read the details included here to avoid malfunctioning.

Positioning of This Document

This instruction manual describes how to connect and use the Modbus interface of the MIS-202-PT/PP. For information on other product functions, basic handling instructions, and precautions, refer to the MIS-202 manual.

MIS-202-PT/PP Instruction Manual (DRW No. EN294-1906)

For details of external equipment such as PLCs and gateways, please refer to the corresponding equipment instruction manuals.

Revision History

Date	Manual No.	Revision reason (details)
June 2020	DRW. No. EN294-1923	First edition　FW Ver.1.100, APP Ver.1.000

Contents

1. Overview

The MIS-202-PT/PP features an RS-485 interface, allowing measurements and settings to be read out using the Modbus standard communication protocol. It can be used when measurements are uploaded to a factory network via an external device such as a commercially-available PLC or gateway.

* Modbus is a registered trademark of Modicon.

1-1. Features

(1) The communication physical layer uses RS-485, which offers excellent noise resistance and is not affected by cable length.

(2) It allows programless communication with devices that support Modbus communication. This is performed using mapped memory, which eliminates the need to create communication protocol programs.

(3) Communication generally consists of characteristic data in the form of numerical data for each molding cycle and amplifier setting details, and these can be read out remotely to maintain quality and monitor aspects such as operation status.

2. Part Names and Functions

2-1. Front panel

(3) F.G. terminal

(1) Status LEDs
(2) Link LEDs
(4) Modbus connector
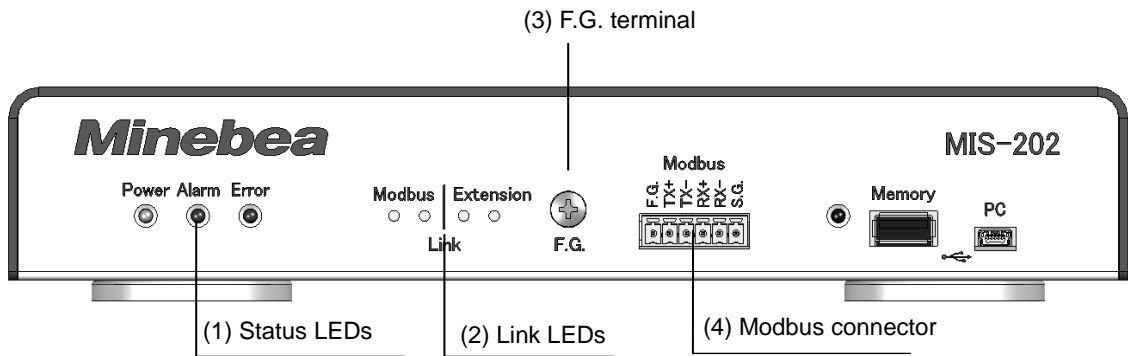
(1) Status LEDs

Indicate the equipment status.
The Power LED illuminates when the power is on, the Alarm LED illuminates when an alarm occurs, and the Error LED illuminates when an amplifier error occurs.

(2) Link LEDs

Indicate the individual communication sending/receiving status. The LEDs flash when communication is in progress.
Modbus: Communication with external devices (left-hand LED: receiving; right-hand LED: sending)
Extension: Master/slave communication when channels are expanded (left-hand LED: receiving; right-hand LED: sending)

(3) F.G. Terminal (For Modbus Communication Cable)

Used to connect the shield on the Modbus communication cable to reduce noise effects. This should be used as necessary depending on the communication conditions with connected external devices. An F.G. terminal is also provided on the Modbus connector, allowing either to be used.

(4) Modbus Connector

Connector for Modbus communication with external network devices such as a gateway.

3. Equipment Wiring

3-1. Communication connector pin configuration

The Modbus plug provided can be used for connecting to network devices such as a gateway. Using the FA409-555 Modbus cable sold separately makes wiring easier.
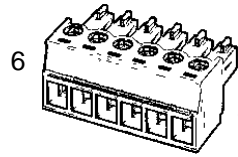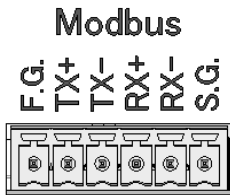
Modbus plug provided

No.	Signal	Description
1	S.G.	Signal ground
2	RX-	Differential input (-)
3	RX+	Differential input (+)
4	TX-	Differential output (−)
5	TX+	Differential output (+)
6	F.G.	Frame ground

Always turn off the power before wiring. Clamp the cable at a distance of approximately 1 m from the amplifier to prevent the connector from being pulled out by the weight of the cable.

3-2. Connection Method

Connect the wires to the plug as follows:

(1) Strip the sheathing on ends of the wires to a length of 7 mm.

(2) Using a flathead precision screwdriver, turn the screw counter-clockwise to open the wire insertion hole.

(3) Insert the wire into the wire insertion hole.

(4) Turn the screw clockwise using the screwdriver to clamp the wire insertion hole.
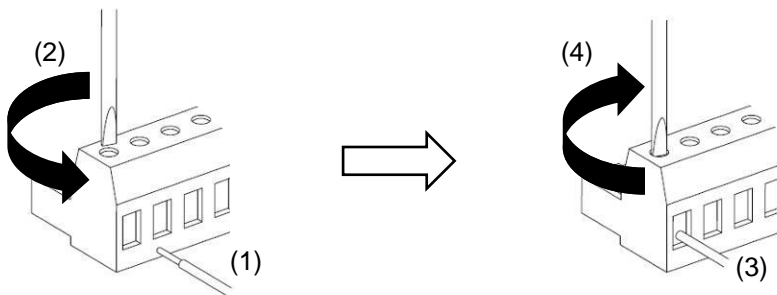
- **Always turn off the power before connecting wires.**
- **The wiring for connections to the terminal board should be AWG 28 to 16 (stranded wire).**
- **Strip the wire sheathing 7 mm ±1 mm from the end.**
- **The terminal board tightening torque is 0.22 N·m to 0.25 N·m.**

4. Modbus Communication Settings

Connect a PC to the amplifier and set up using the MIS-Anest measuring application.

4-1. Setup Screen

Click the [Change] icon, then open the [Analog Output/Modbus] tab on the [Change conditions] screen.
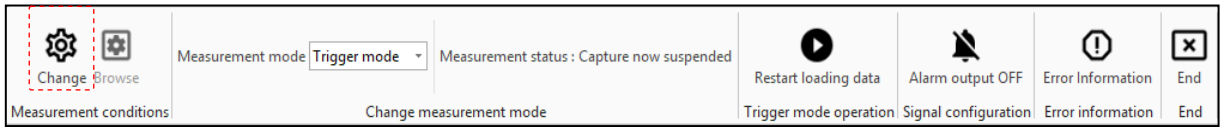
The [Change] button is disabled unless [Stop loading data] is clicked to stop waveform data from being acquired.
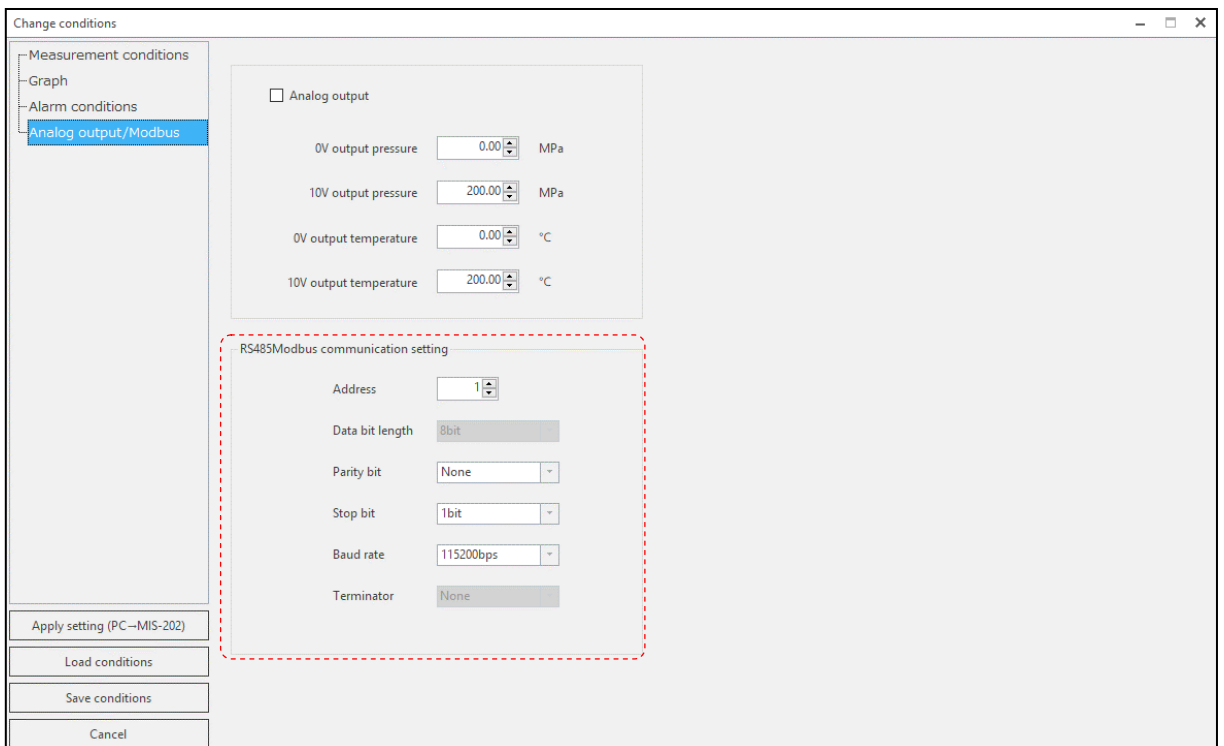
4-2. Modbus Settings

Set the communication specifications to suit the connected external device.

Setting	Description	Default
RS-485 communication address	01 to 31	01
Data bit length	8 bit (fixed)	–
Parity bit	[None], [Even], [Odd]	None
Stop bit	[1 bit], [2 bit]	1 bit
Baud rate	1200 bps, 2400 bps, 4800 bps, 9600 bps, 19200 bps, 38400 bps, 57600 bps, 76800 bps, 115200 bps, 230400 bps	115200 bps
Terminator	None	–

The amplifier terminal resistance is built in.

5. Communication Packets

5-1. Available Function Codes

The MIS-202 uses the following Modbus protocol function codes. Only reading from the host to the MIS-202 is possible, and writing is not supported.

- Read Discrete Inputs (0x02)
- Read Coils Status (0x01)
- Read Input Register (0x04)
- Read Holding Registers (0x03)

				Function Codes			
				code	Sub code	(hex)	Section
Data Access	Bit access	Physical Discrete Inputs	Read Discrete Inputs	02		02	6.2
		Internal Bits Or Physical coils	Read Coils	01		01	6.1
			Write Single Coil	05		05	6.5
			Write Multiple Coils	15		0F	6.11
	16 bits access	Physical Input Registers	Read Input Register	04		04	6.4
		Internal Registers Or Physical Output Registers	Read Holding Registers	03		03	6.3
			Write Single Register	06		06	6.6
			Write Multiple Registers	16		10	6.12
			Read/Write Multiple Registers	23		17	6.17
			Mask Write Register	22		16	6.16
			Read FIFO queue	24		18	6.18
	File record access		Read File record	20		14	6.14
			Write File record	21		15	6.15
	Diagnostics		Read Exception status	07		07	6.7
			Diagnostic	08	00-18,20	08	6.8
			Get Com event counter	11		0B	6.9
			Get Com Event Log	12		0C	6.10
			Report Slave ID	17		11	6.13
			Read device Identification	43	14	2B	6.21
	Other		Encapsulated Interface Transport	43	13,14	2B	6.19

Reference source: http://modbus.org/docs/Modbus_Application_Protocol_V1_1b3.pdf

5-2. Operation Example: Fetching 2 Bytes of Data

Fetch the last two bytes of the interval time.

Request (external device → MIS-202)

Requests reading out of data for one address from Input Register address No. 8.

Field Name	RS485 Address	Function Code	Starting Address (Hi)	Starting Address (Lo)	Address Size (Hi)	Address Size (Lo)	CRC Lo	CRC Hi
(Hex)	01	03	00	8	00	01	05	C8

Response (MIS-202 → external device)

Response when interval time is 255 seconds.

Field Name	RS485 Address	Function Code	Byte Count	Data0 (Hi)	Data0 (Lo)	CRC Lo	CRC Hi
(Hex)	01	03	02	00	ff	f8	04
Data				255 seconds			

5-3. Operation Example: Fetching 4 Bytes of Data

Fetch the sampling interval setting.

Request (external device → MIS-202)

Requests reading out of data for two addresses from Holding Register address No. 50004.

Response when the sampling interval is set to 3 (5 ms).

Field Name	RS485 Address	Function Code	Starting Address (Hi)	Starting Address (Lo)	Address Size (Hi)	Address Size (Lo)	CRC Lo	CRC Hi
(Hex)	01	03	c3	52	00	2	59	5e

Response (MIS-202 → external device)

Field Name	RS485 Address	Function Code	Byte Count	Data1 (Hi)	Data1 (Lo)	Data0 (Hi)	Data0 (Lo)	CRC Lo	CRC Hi
(Hex)	01	03	04	00	03	00	00	0a	33
Data				0003h		0000h			

6

5-4. Operation Example: Fetching at Least 8 Bytes of Data

Fetch the current time data (8 bytes).

Request (external device → MIS-202)

Requests reading out of data for four addresses (8 bytes) from Input Register address No. 0000.

Field Name	RS485 Address	Function Code	Starting Address (Hi)	Starting Address (Lo)	Address Size (Hi)	Address Size (Lo)	CRC Lo	CRC Hi
(Hex)	01	03	00	00	00	04	44	09

Response (MIS-202 → external device)

Response when the present time and date is 23:06:10 February 3, 2021

Field Name	RS485 Address	Function Code	Byte Count	Data1 (Hi)	Data1 (Lo)	Data0 (Hi)	Data0 (Lo)
(Hex)	01	03	08	02	03	14	15
Data				February 3		2021	

Data4 (Hi)	Data3 (Lo)	Data2 (Hi)	Data2 (Lo)	CRC Lo	CRC Hi
06	0a	02	03	48	32
6 minutes 10 seconds		23 hours			

5-5. Error Response

The following error is returned when data with an invalid format is received at the MIS-202.

Field Name	RS485 Address	Function Code + 0x80	Exception Code	CRC Lo	CRC Hi
(Hex)	01	8x	02	xx	xx

Exception Code	Remarks
01	Invalid function
02	Invalid data address
03	Invalid data

5-6. CRC Calculation

The CRC (Cyclical Redundancy Checking) field consists of two bytes, and includes a 16-bit binary value. The CRC value is calculated by the sending device with CRC appended to the message. The receiving device recalculates CRC while receiving the message, and compares the calculated value against the value actually received in the CRC field. An error occurs if the two values are not equal. For details, refer to "6.2.2 CRC Generation" in the "MODBUS over serial line specification and implementation guide" issued by Modbus.org.

Example message calculation

Addr	Func	Data Count	Data	Data	Data	CRC Lo*	CRC Hi*
01	03	00	00	00	04	44	09

* When CRC is included in a message, the bytes before and after it must be switched as shown above.
Reference: https://crccalc.com/

7

6. Address List

6-1. Reading Control I/O Status (Read Coils)

Reads out the MIS-202 control input signal status from the host.

Address	Function type/Code	Date size	Function Name	Description
0	Coil 01	1 bit	START input status	0: START, 1: Normal Held for approx. 1 sec after start
1		1 bit	ALARM RESET input status	0: RESET, 1: H Held for approx. 1 sec after reset
2		1 bit	ALARM STOP input status	0: Disabled, 1: Enabled

6-2. Reading Alarm/Error Status (Read Discrete Inputs)

Reads out the MIS-202 alarm and error status from the host.

Address	Function type/Code	Date size	Function Name	Description
0 to 31	Discrete Inputs 02	1 bit	Channel 1 to 32 alarms	0: OK, 1: NG, corresponding to detection output (Detection result output for each channel)
32		1 bit	Shot alarm (together with "Alarm" LED)	0: OK, 1: NG, corresponding to control I/O alarm output (Detection result output for each shot)
33		1 bit	Error (together with "Error" LED)	0: No error, 1: Error

6-3. Reading Shot Count and Time (Read Input Register)

Reads out the MIS-202 shot counter and time from the host.

Address	Function type/Code	Date size	Function Name	Description
0	Input Register 04	2 bytes	Total shot count (LSB)	Corresponds to last 2 bytes.
1		2 bytes	Total shot count (MSB)	Corresponds to first 2 bytes.
2		2 bytes	NG shot count (LSB)	Corresponds to last 2 bytes.
3		2 bytes	NG shot count (MSB)	Corresponds to first 2 bytes.
4		4 bytes	Measurement start time stamp (20YYMMDD)	Example: September 25, 2021 20YYMMDD = 20210925
6		4 bytes	Measurement start time stamp (00hhmmss)	Example: 15:23:10 00Hhmmss = 00152310
8		2 bytes	Interval time (LSB)	Corresponds to last 2 bytes.
9		2 bytes	Interval time (MSB)	Corresponds to first 2 bytes.

6-4. Reading Measurement (Read Input Register)

Reads out information related to alarms set in the MIS-202 from the host.

Address	Function type/Code	Ch	Date size	Function Name	Description
18			4 bytes	Shot alarm	Detection result output for each shot (previously completed shot) 0: OK/1: NG
20			4 bytes	Peak	Units: [MPa][°C]
22			4 bytes	Time to peak	Unit: [sec]
24			4 bytes	Integral to peak (LSB)	Units: [MPa·sec][°C·sec] Corresponds to last 4 bytes.
26			4 bytes	Integral to peak (MSB)	Units: [MPa·sec][°C·sec] Corresponds to first 4 bytes.
28	Input Register 04	Ch1	4 bytes	Value after t seconds	Units: [MPa][°C]
30			4 bytes	Integral (LSB)	Units: [MPa·sec][°C·sec] Corresponds to last 4 bytes.
32			4 bytes	Integral (MSB)	Units: [MPa·sec][°C·sec] Corresponds to first 4 bytes.
34			4 bytes	Peak over eject (pressure)	Unit: [MPa]
36			4 bytes	Reserved	
38			4 bytes	Reserved	
40			4 bytes	Reserved	
42			4 bytes	Reserved	
44			4 bytes	Alarm category	M1, M2, M3, IT from LSB side

Measurements for other channels can be read in the same way using the following addresses.

Channel	Address	Channel	Address	Channel	Address	Channel	Address
Ch1	18 to 44	Ch9	242 to 268	Ch17	466 to 492	Ch25	690 to 716
Ch2	46 to 72	Ch10	270 to 296	Ch18	494 to 520	Ch26	718 to 744
Ch3	74 to 100	Ch11	298 to 324	Ch19	522 to 548	Ch27	746 to 772
Ch4	102 to 128	Ch12	326 to 252	Ch20	550 to 576	Ch28	774 to 800
Ch5	130 to 156	Ch13	254 to 380	Ch21	578 to 604	Ch29	802 to 828
Ch6	158 to 184	Ch14	382 to 408	Ch22	606 to 632	Ch30	830 to 856
Ch7	186 to 212	Ch15	410 to 436	Ch23	634 to 660	Ch31	858 to 884
Ch8	214 to 240	Ch16	438 to 464	Ch24	662 to 688	Ch32	886 to 912

The alarm categories are identified by the following codes.

Code	Description
M1	Alarm system 1 detection is "NG" (area, peak, point, or time to peak)
M2	Alarm system 2 detection is "NG" (peak, point, or time to peak)
M3	Alarm system 3 detection is "NG" (area, peak, point, or time to peak)
IT	Integral value related detection is "NG" (integral or integral to peak)

6-5. Reading Amplifier Version Information and Configuration (Read Holding Register)

Reads out the MIS-202 version information and amplifier configuration (pressure or temperature) from the host.

Address	Function type/Code	Date size	Function Name	Description
0		4 bytes	Current date	Date retained by the amplifier [yyyymmdd]
2		4 bytes	Current time	Time retained by the amplifier [00hhmmss]
4		4 bytes	MASTER: Ch1 to Ch4 sensor type	0: None, 1: Pressure,
6		4 bytes	MASTER: Ch5 to Ch8 sensor type	2: Temperature, 3: Other
8		4 bytes	MASTER: FW version	Example: 1234h = Ver.1.234
10		4 bytes	MASTER: Boot loader version	
12		4 bytes	SLAVE1: Ch1 to Ch4 sensor type	0: None, 1: Pressure,
14		4 bytes	SLAVE1: Ch5 to Ch8 sensor type	2: Temperature, 3: Other
16	Holding Register 03	4 bytes	SLAVE1: FW version	Example: 1234h = Ver.1.234
18		4 bytes	SLAVE1: Boot loader version	
20		4 bytes	SLAVE2: Ch1 to Ch4 sensor type	0: None, 1: Pressure,
22		4 bytes	SLAVE2: Ch5 to Ch8 sensor type	2: Temperature, 3: Other
24		4 bytes	SLAVE2: FW version	Example: 1234h = Ver.1.234
26		4 bytes	SLAVE2: Boot loader version	
28		4 bytes	SLAVE3: Ch1 to Ch4 sensor type	0: None, 1: Pressure,
30		4 bytes	SLAVE3: Ch5 to Ch8 sensor type	2: Temperature, 3: Other
32		4 bytes	SLAVE3: FW version	Example: 1234h = Ver.1.234
34		4 bytes	SLAVE3: Boot loader version	

10

6-6. Reading Common Settings (Holding Register)

Reads out the MIS-202 common settings from the host.

Address	Function type/Code	Date size	Function Name	Description
50000		4 bytes	Reserved	
50002		4 bytes	Sampling interval	0: 0.5 ms, 1: 1 ms, 2: 2 ms, 3: 5 ms 4: 10 ms, 5: 20 ms, 6: 50 ms
50004		4 bytes	Span	1 to 1800 [seconds]
50006		4 bytes	Start trigger signal switching	0: Falling, 1: Rising, 2: None
50008		4 bytes	Start trigger delay	0 to 250 × 0.1 [seconds]
50010		4 bytes	Eject measurement start time	0 to 180,000 × 0.01 [seconds]
50012		4 bytes	Eject measurement end time	0 to 180,000 × 0.01 [seconds]
50014		4 bytes	Reserved	
50016	Holding Register 03	4 bytes	Reserved	
50018		4 bytes	Measurement mode	0: Trigger mode, 1: Continuous mode
50020		4 bytes	Reserved	
50022		4 bytes	Analog Output Settings	0: Disabled, 1: Enabled
50024		4 bytes	Enabled channel selection	Bit[31:0] = CH[32:1]
50026		4 bytes	Start signal interrupt	0: Disabled (Ignored during measurement) 1: Enabled (Received during measurement)
50028		4 bytes	Reserved	
50030		4 bytes	Modbus communication settings	See separate table.
50032		4 bytes	Modbus address	1 to 31

The Modbus communication settings are defined as follows.

Digit	Setting	Description
First digit	Parity	0: None, 1: Even, 2: Odd
Second digit	Stop bit	0: 1 bit, 1: 2 bits
Third digit	Baud rate	0: 1200 bps, 1: 2400 bps, 2: 4800 bps, 3: 9600 bps, 4: 19200 bps, 5: 38400 bps, 6: 57600 bps, 7: 76800 bps, 8: 115200 bps, 9: 230400 bps
Fourth digit	Terminator	2: None (Fixed)

6-7. Modbus Communication Specifications

Specifications	Details
Communication standard	RS-485
Protocol	Modbus RTU compliant
Sync mode	Asynchronous
Transmission mode	4-wire full-duplex
Baud rate	1200 bps, 2400 bps, 4800 bps, 9600 bps, 19200 bps, 38400 bps, 57600 bps, 76800 bps, 115200 bps, 230400 bps
Data bit length	8 bit (fixed)
Parity bit	[None], [Even], [Odd]
Stop bit	[1 bit], [2 bit]
Terminator	None
Valid address	01 to 31 (00: Does not support broadcast)
Terminal resistance	Built in
Status LEDs	Link LED (RX, TX)