MITSUBISHI ELECTRIC

# Numerical Protection Relay

MELPRO™-D Series

# COMMUNICATION (Modbus)

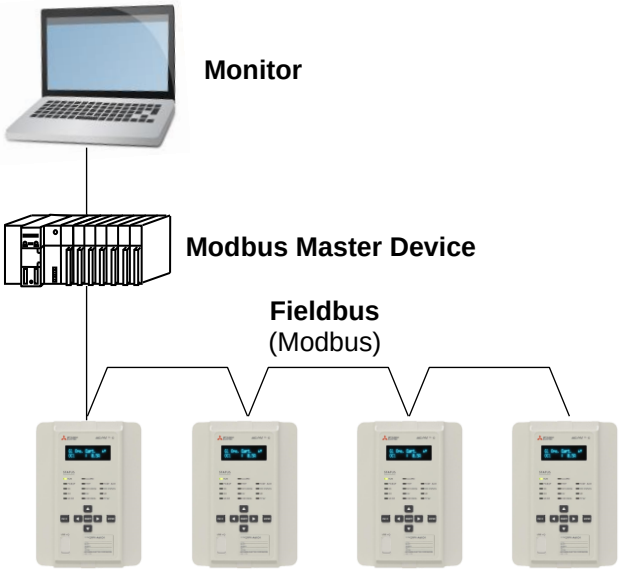
# INSTRUCTION MANUAL

- Table of Contents -

# 1 Functions

## 1.1 System Configuration

Shown below is the H/W configuration on which this Modbus communication system operates.
Surveillance monitor or the like




**RY (MELPRO-D Series)**

**An example of system configuration**

## 1.2 Communication Items

Table below shows the items which can be communicated through the MELPRO-D Series relays.

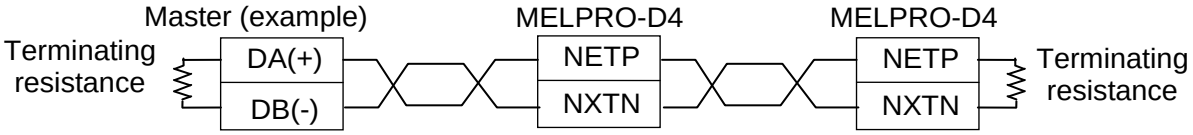
| No | Item | Description |
|---|---|---|
| 1 | LED reset | The status of LED is reset. |
| 2 | Acquiring ON/OFF data | The status of LED and DI/O is read. |
| 3 | Acquiring measured values (secondary side) | Real-time values on the secondary side of transformer (voltage, current, etc.) are read. |
| 4 | Acquiring monitoring data | Top counter and the like are read. |
| 5 | Acquiring/erasing event records | Event records are read/erased. |
| 6 | Acquiring/erasing alarm records | Alarm records are read/erased. |
| 7 | Acquiring access records | Access records are read. |
| 8 | Acquiring/erasing accident records | Accident records are read/erased. |
| 9 | Acquiring disturbance records | Disturbance records are read. |
| 10 | Acquiring/specifying setting values | Protective element setting values (Group 1 and Group 2), active group, and common setting values are read/set. |
| 11 | CB control | CB control is executed. |
| 12 | Setting forced DO control | Forced DO control is executed. |
| 13 | Setting test mode | Test mode is executed. |
| 14 | Acquiring/setting time of day | Time of day is read/set. |

## 1.3 Cabling

For information about the installation of the relays and cabling work therefore, see the instruction manual supplied with the product.

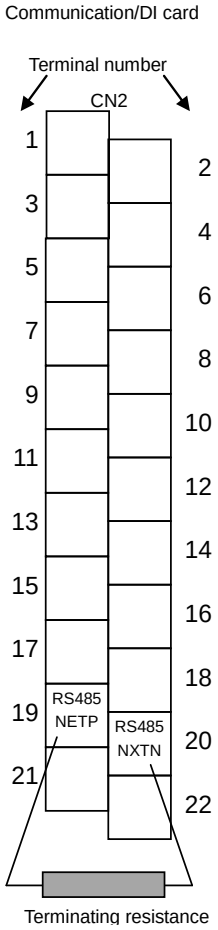
For information relative to the Master-side components, see the instruction manual supplied therewith.

(1) Ensure that twisted-pair cable connections between MELPRO-D relay, Master unit, and others are made as shown below.




(2) With MELPRO-D relay serving as a terminating station

If MELPRO-D relay serves as a terminating station, make certain that the terminating resistance is located as shown in the diagram below.




(3) Cable Specification

| Item | Specification |
|---|---|
| Cable type | Twisted-pair cable |
| Conductor size | Less than 0.5 $mm^2$ |
| Conductor resistance | Less than 38 Ω/km |
| Insulation resistance | Less than 10,000 MΩ·km |
| Withstand voltage | DC 500V, 1 minute |
| Capacitance | Less than 60nF/km |
| Characteristic impedance | 110Ω |

# 2 Specification

## 2.1 Transmission Specification

| Item | | Specification |
|---|---|---|
| Connection | | RS - 485 |
| Transmission method | | Half-duplex transmission |
| Transmission rate | | 9,600, 19,200, 38,400, 57,600, and 115,200bps |
| Data format | Transmission mode | RTU |
| | Start bit | 1 |
| | Bit length | 8 |
| | Parity | None |
| | Stop bit | 1 or 2 bits |
| Error detection | | CRC |
| Maximum number of units connected | | 32 |
| Distance | | 1,200 m |
| Connection topology | | Multi-drop |
| Cable | | Twisted-pair cable |
| Terminating resistance | | 110Ω |

## 2.2 Modbus Protocol

The detail protocol is based on the description of the following publication:
MODCON Modbus Protocol Reference Guide (PI-MBUS-300, Rev. J)

Message frame is as follows (for more information, see the Reference Guide):

| | | | | | |
|---|---|---|---|---|---|
| #1 | Station number | Function code | Data | CRC check | #1 |
| | 8 bits | 8 bits | 8 bits * n | 16 bits | |

#1: 3.5-character time n: 251 bytes maximum

## 2.3 Function Codes

The following function codes (FCs) are supported.

For more information, see the Reference Guide stated in Section 2.2. Note that “broadcast” addresses are not supported.

| FC | Description | Number of points accessible by one message *1 | Address to be used *2 |
|---|---|---|---|
| 2 | Read Input Status<br>ON/OFF status of slave (relay) is read.<br>(LED status, DI status and other which consists of 2-value information) | 1 - 2,000 points | 10001 - 19999 |
| 3 | Read Holding Registers<br>Data on slave (relay) (fixed value) is read.<br>(Setting value for by-word information, etc.) | 1 - 125 points | 40001 - 49999 |
| 4 | Read Input Registers<br>Data (input value) on slave (relay) is read.<br>(Analog information for by-word information, etc.) | 1 - 125 points | 30001 - 39999 |
| 5 | Force Single Coil<br>Writes ON/OFF status to a single coil.<br>(reset LED, acquire/delete event records, acquire/delete fault waveform records, control CB open/close, operate DO as force operation, enable test mode) | 1 point | 00001 - 09999 |
| 15 | Force Multiple Coils<br>ON/OFF of multiple salves (relays) are simultaneously changed.<br>(Forced DO control in which multiple values, each of which consist of two-value information, are simultaneously changed, etc.) | 1 - 1,968 points | 00001 - 09999 |
| 16 | Preset Multiple Registers<br>Contents of multiple data (fixed value) on slave (relay) is changed.<br>(Setting value which simultaneously changes multiple values comprising by-word information and etc.) | 1 - 123 points | 40001 - 49999 |

*1: Number of points accessible by one message
A maximum number of points accessible from each function code on Modbus protocol
In actual installations using MELRPO-D relays, the number of points accessible by a single message varies with address to which access is made. For more information, see Section 2.10.

*2: Address to be used
Address which can be used from function codes on Modbus protocol
For information about the addresses usable in actual installations using MELPRO-D relays, see Section 2.10.

## 2.4 Exception Codes

The exception code is a code which the Relay sends back if there is any of the following conditions present on its side when it is requested by the Master to send data.
In the event that any of the processes but the one associated with Code 05 occurs, a log of variables (time, error type, etc.) is left within the Relay.
Note: For the checking of logged data, the relay will have to be shipped back to a MELCO service center.

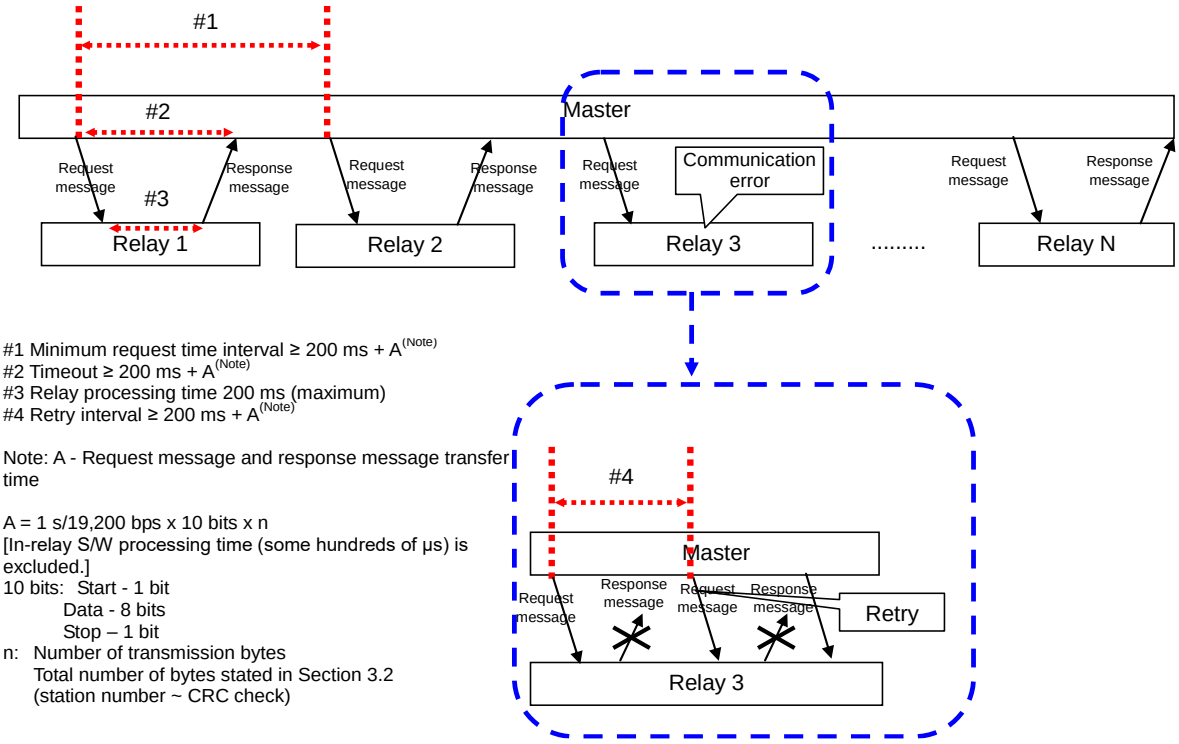
| Exception code | Function name | Description |
|---|---|---|
| 01 | ILLEGAL FUNCTION<br>(Undefined function) | Other function code than those supported by the Relay has been received from the Master. |
| 02 | ILLEGAL DATA ADDRESS<br>(Undefined address) | Other address than those supported by the Relay has been received from the Master. |
| 03 | ILLEG DATA VALUE<br>(Undefined data value) | ・ Illegal data (data inconsistent with Modbus protocol specification) has been received from the Master.<br>Example 1: Error is contained in the data which was set at the time of the occurrence of a request for disturbance record.<br>Example 2: Error is contained in time-of-day setting data. |
| 05 | ACKNOWLEDGE<br>(ACK) | ・ If the Relay is not able to respond within 200 ms after having received a request message, it answers to the Master that it has received the message (it is continuing with a current process).<br>For information about the items concerned, see Section 2.9. |
| 06 | SLAVE DEVICE BUSY<br>(Slave busy) | The Relay is not able to perform a process being requested because it is engaged in the performance of other process when receiving a request message for the first process.<br>Example 1: Setting value operation start process is being performed from the front panel.<br>Example 2: Setting value operation start process is being performed from the PC-HMI. |
| 07 | NEGATIVE ACKNOWLEDGE<br>(NAK error) | The Relay is not able to perform a process being requested when receiving a related request message.<br>Example 1: There is data discrepancy between a “setting” request relating to setting values, CB control, forced DO control, or test mode, and an “operation start” request.<br>Example 2: An “operation start” request is received after the lapse of a timeout period from the reception of a “setting” request relating to setting values, CB control, forced DO control, or test mode.<br>Example 3: Other request than a “operation start” request is delivered after a “setting” request relating to setting values, CB control, forced DO control, or test mode is received.<br>Example 4: The same Relay receives a process request when it is engaged in the performance of a preceding one.<br>Example 5: When a disturbance record is requested, data sought is not available. |

## 2.5 Communication Errors

If a Relay receives data containing any of the below-listed errors (communication errors), it discards the data. In this case, the Relay does not send back any data to the Master.
Perform retry steps after the lapse of the timeout period which is predetermined on the Master side.
Errors listed below are left logged within the Relay (time, error type, etc.)
Note: For the checking of logged data, the relay will have to be shipped back to a MELCO service center.

- CRC check error (CRC-16)
- RS485 communication error (overrun or framing error)
- Oversize error (data greater than 256 bytes has been received.)
- Short frame error
- Reception timing error
- Silent interval

## 2.6 Polling Interval




#1 Minimum request time interval ≥ 200 ms + A(Note)
#2 Timeout ≥ 200 ms + A(Note)
#3 Relay processing time 200 ms (maximum)
#4 Retry interval ≥ 200 ms + A(Note)

Note: A - Request message and response message transfer time

A = 1 s/19,200 bps x 10 bits x n
[In-relay S/W processing time (some hundreds of μs) is excluded.]
10 bits: Start - 1 bit
Data - 8 bits
Stop – 1 bit
n: Number of transmission bytes
Total number of bytes stated in Section 3.2
(station number ~ CRC check)

IMPORTANT

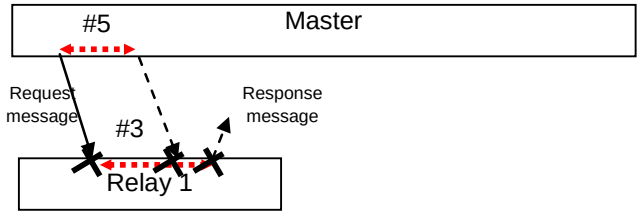
The following two setting requirements must be strictly observed. You are not permitted to do with just either of the two.

[1] Any two consecutive requests from the Master must be delivered **with a number of minutes equal to "200 ms + A" allowed to pass in between**.

[2] Any request from the Master must be delivered **with more than 40 ms allowed to pass after the result relating to the immediately preceding one has been sent back from the Relay**.

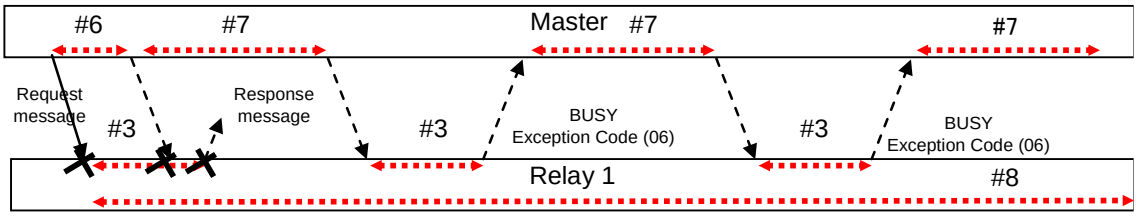
As is shown below, if a request is made within 200 ms after the immediately preceding one has been made, it may not be processed properly.

a. If a retry attempt is made to the Relay m and the time which has passed before the attempt comes under the following conditions, the 1st and 2nd requests are discard with a response message to the 1st being discarded as well.




#7 Retry request time interval ≤ 200 ms(Note)

If the above condition comes up, the 2nd request is discarded. Therefore, because a response to the request is not completed, BUSY [Exception Code (06)] is sent back during the following periods of time when the 3rd request is made.



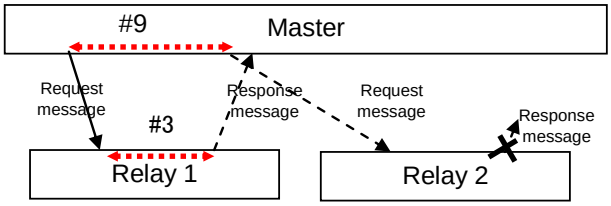

#6: Retry request time interval ≤ 200 ms
#7 Time elapsed before a retry attempt t ≥ 200 ms + A(Note)
#8 Timeout period from the 1st request
(Note) A: Request message and response message transfer time

#8 Timeout period

Normally, when a Relay responds to a request message, count for #8 is reset. However, because a request is made within 200 ms, the related in-relay process becomes incomplete, resulting in BUSY [Exception Code (06)] being sent back until the following length of time has passed. If a request is made after the lapse of the time being listed below, data corresponding to the items requested is sent back.

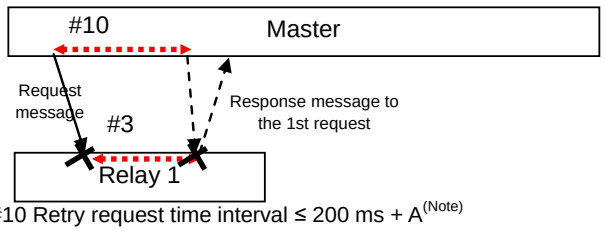
| Communication item | Timeout period |
|---|---|
| Other than those listed below | About 3 seconds |
| Specifying setting values | About 6 seconds |
| Setting value operation start | About 6 seconds |
| Setting forced DO control | About 6 seconds |
| Forced DO control operation start | About 6 seconds |
| Acquiring records (event, access, alarm, and accident) | About 10 seconds |
| Erasing records (event, access, alarm, and accident) | About 10 seconds |

b. A response message from Relay m and a request message to Relay m+1 may overlap one another. In that case, a normal transmission/reception cycle may not take place.




#9 Request time interval ≤ 200 ms + A(Note)
(Note) A: Request message and response message transfer time

c. If a retry attempt is made to Relay m and the period of time which has passed before the retry is under the following conditions, the 2nd request may be discard with a response message to the 1st request being sent back.




#10 Retry request time interval ≤ 200 ms + A(Note)
(Note) A: Request message and response message transfer time
The 1st request is discarded and returned as a 2nd response.

## 2.7 In-relay Data Update Time

The communication items listed in the table below are continuously updated within the Relay if no requests therefore come from the Master. Note that relevant data becomes acquirable when about 20 seconds has passed after a system power-on.

| Communication item | Update time |
|---|---|
| Measured values | About 1 second maximum*1 |
| LED | Real-time*2 |
| Time of day | Real-time*2 |

*1: Update cycle varies with the number of analog inputs and operation items. Because of this, when a request is delivered from the Master at an interval shorter than the above cycle time, the same values are sent back.

*2: These are the items which are subject to status change within the Relay. Therefore, if a change takes place within a Master-generated polling interval, such change may not be acquirable.

## 2.8 Timeout

For the communication items listed in the table below, a timeout period is provided between the time when a Relay receives a “setting” request and the time when it receives an operation start request. If there occurs an interval which is longer than the timeout period, the Master needs to repeat its process starting from a “setting” request.

| Communication item | Timeout period |
|---|---|
| Setting values operation start | About 10 seconds |
| CB control operation start | About 10 seconds |
| Forced DO control operation start | About 10 seconds |
| Test mode operation start | About 10 seconds |

<CAUTION>
Any inter-station request needs to be made at intervals of more than 200 ms. Therefore, the number of units to be connected together should be determined taking the timeout period into consideration.

## 2.9 Long-time Processing Items

(1) The communication items listed in the table below are those with respect to which the Relay cannot complete its data transfer process in accordance with the time requirement given in Section 2.6 (within 200 ms) after the Master has delivered a related request to the relay.
Subsequently, the Relay sends back Exception Code 05 [ACKNOWLEDGE (ACK)] when it accepts a request for these communication items.
The Master cannot check for sure whether the process it has requested of the Relay is completed successfully unless it asks for acknowledgement from the Relay.
Because the Master cannot deliver another request to the same relay until the following requirements are completed (within the period of time being listed), it is recommended that an acknowledgement process should be included in the related sequence.

(2) When a Relay receives the data items listed in the table below from the Master while manipulation is performed on the front panel or PC-HMI, it sends back BUSY [Exception Code (06)] until such manipulation is completed.

| Communication item | Time elapsed till completion |
|---|---|
| Setting value operation start | About 6 seconds |
| Erasing records (event and alarm) | About 10 seconds |
| Erasing accident record | About 10 seconds |
| LED reset | About 1 second |
| Acquiring accident record | About 3 seconds |
| Acquiring records<br>(event, alarm, and access) | About 10 seconds |

<CAUTION>
A request for the above items, if made, takes up relay's processing ability for an extended period of time. This means that if Master makes such a request at every cycle, key operations performed on the front panel may become sluggish.
Therefore, your system should be so designed that such a request is allowed to take place on the Master side only when necessary.

## 2.10 Address Allocation

Following is a description of address allocation found in the Modbus Address Map. For more details, see the Address Map.

| Modbus address | Maximum number of points | FC | Description |
|---|---|---|---|
| 0001 - 0032 | 32 | 15 | Setting forced DO control |
| 0033 - 0064 | 32 | 15 | Forced DO control operation start |
| 0065 - 0128 | 64 | 15 | Setting test mode |
| 0129 - 0192 | 64 | 15 | Test mode operation start |
| 0385 | 1 | 15 | LED reset settings |
| 0386 | 1 | 15 | Event record erase settings |
| 0387 | 1 | 15 | Alarm record erase settings |
| 0389 | 1 | 15 | Accident record erase settings |
| 0391 | 1 | 15 | Event record acquisition request |
| 0392 | 1 | 15 | Alarm record acquisition request |
| 0393 | 1 | 15 | Access record acquisition request |
| 0394 | 1 | 15 | Accident record acquisition request |
| 0395 | 1 | 15 | CB close control settings |
| 0396 | 1 | 15 | CB open control settings |
| 0397 | 1 | 15 | CB close control operation start |
| 0398 | 1 | 15 | CB open control operation start |
| 10001 - 12000 | 2000 | 2 | ON/OFF data |
| 30001 - 30120 | 120 | 4 | Acquiring measured values (secondary values) |
| 30150 | 1 | 4 | Number of event records acquired |
| 30151 - 32198 | 8<br>x 256set | 4 | Acquiring event records<br>Event item number, status of event, and time of occurrence |
| 32461 | 1 | 4 | Number of alarm records acquired |
| 32462 - 35261 | 14<br>x 200set | 4 | Acquiring alarm records<br>Error code, time of occurrence, and CPU ID |
| 35471 | 1 | 4 | Number of access records acquired |
| 35472 - 36495 | 8<br>x 128set | 4 | Acquiring access records<br>Access item number, time of occurrence, and access source |
| 36631 | 1 | 4 | Number of accident records acquired |
| 36632 - 36971 | 68<br>x 5set | 4 | Accident records<br>Storing block number, time of occurrence, cause of trip, and measured value (secondary value) |
| 37131 | 1 | 4 | Number of trip data lists acquired |
| 37132 - 37176 | 9<br>x 5set | 4 | Trip data list |
| 37231 - 37293 | 63 | 4 | Trip data (by-trip header/by-model data) |
| 37294 - 37353 | 60 | 4 | Trip data (analog and digital data) |
| 37375 - 37474 | 100 | 4 | Monitoring data (trip counter and others.) |
| 39801 | 1 | 4 | Checking LED reset |
| 39802 | 1 | 4 | Checking event record erasion |
| 39803 | 1 | 4 | Checking alarm record erasion |
| 39805 | 1 | 4 | Checking accident record erasion |
| 39806 | 1 | 4 | Acquiring result of active group operation start |
| 39807 | 1 | 4 | Acquiring result of Group 1 setting value operation start |
| 39808 | 1 | 4 | Acquiring result of Group 2 setting value operation start |
| 39809 | 1 | 4 | Checking common setting value data write |
| 39810 | 1 | 4 | Checking event record acquisition request |
| 39811 | 1 | 4 | Checking alarm record acquisition request |
| 39812 | 1 | 4 | Checking access record acquisition request |
| 39813 | 1 | 4 | Checking accident record acquisition request |
| 39814 | 1 | 4 | Checking status of CB |
| 39815 | 1 | 4 | Checking status of CB close interlock |
| 39816 | 1 | 4 | Checking conditions for CB close control permissibility |

| Modbus address | Maximum number of points | FC | Description |
|---|---|---|---|
| 39817 | 1 | 4 | Checking status of CB open interlock |
| 39818 | 1 | 4 | Checking conditions for CB open control permissibility |
| 39819 | 1 | 4 | Acquiring result of CB close control |
| 39820 | 1 | 4 | Acquiring result of CB open control |
| 39821 | 1 | 4 | Checking test mode |
| 39822 | 1 | 4 | Identifying test mode setting personnel |
| 40001 - 40256 | 256 | 16/3 | Setting/acquiring setting values for Group 1 protective elements |
| 40501 - 40756 | 256 | 16/3 | Setting/acquiring setting values for Group 2 protective elements |
| 41001 - 41256 | 256 | 16/3 | Setting values for Group 1 protective elements – operation start |
| 41501 - 41756 | 256 | 16/3 | Setting values for Group 2 protective elements – operation start |
| 42001 | 1 | 16/3 | Setting/acquiring active group |
| 42002 - 42256 | 254 | 16/3 | Setting/acquiring common setting values |
| 43001 | 1 | 16/3 | Active group operation start |
| 43002 - 43255 | 254 | 16/3 | Common setting values operation start |
| 44001 - 44005 | 5 | 16/3 | Setting/acquiring time of day |
| 44101 | 1 | 16/3 | Acquiring trip data (by-trip header/by-model data), phenomenon number (H) |
| 44102 | 1 | 16/3 | Acquiring trip data (by-trip header/by-model data), phenomenon number (L) |
| 44103 | 1 | 16/3 | Acquiring trip data (by-trip header/by-model data), block number |
| 44104 | 1 | 16/3 | Acquiring trip data (analog/digital data), phenomenon number (H) |
| 44105 | 1 | 16/3 | Acquiring trip data (analog/digital data), phenomenon number (L) |
| 44106 | 1 | 16/3 | Acquiring trip data (analog/digital data), block number |
| 44107 | 1 | 16/3 | Acquiring trip data (analog/digital data), record number |

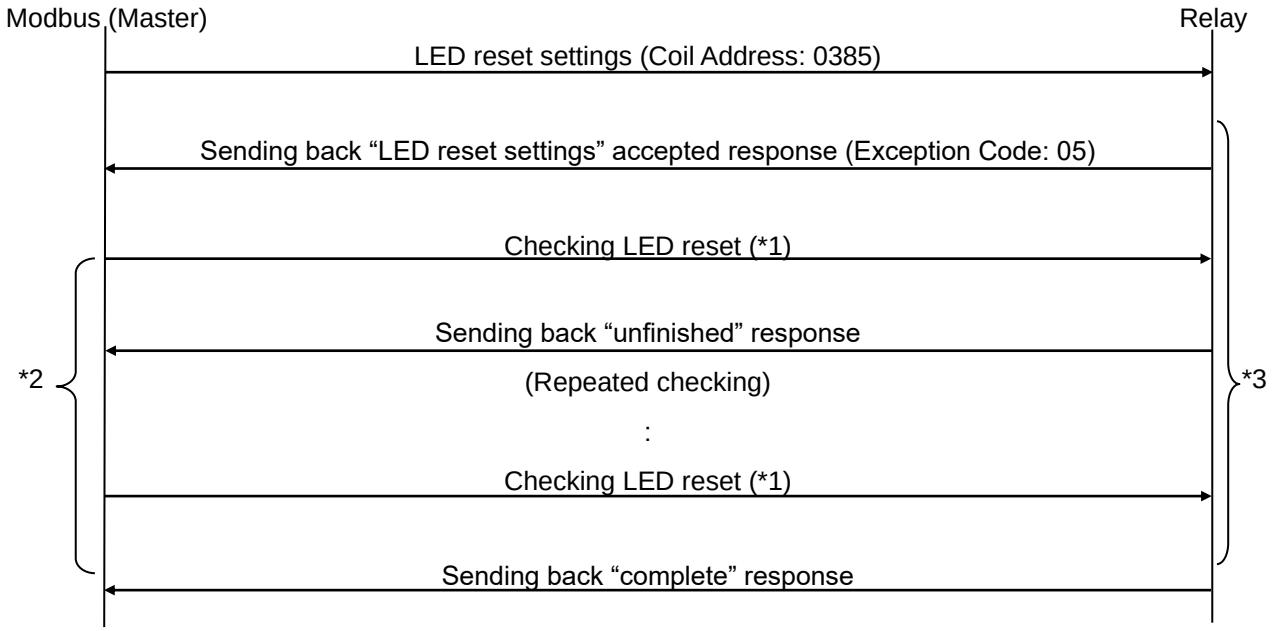
FC: Function Code

# 3 Interface

## 3.1 LED Reset

(1) LED Reset

[1] I/F Procedure




*1: Check the result of LED reset by reading the Input Register (Address: 39801).

*2: Steps by which the Master determines whether the Relays have reset themselves successfully upon “LED reset” request.
It is possible for the Master to deliver another request without performing these steps if the Relay’s resetting process is completed. Without performing them, however, the Master cannot check for sure whether relevant erase process is completed successfully.

*3: For information about the reset time, see Section 2.9. (Note that information therein is applicable to the case where no operations are performed on the front panel or PC-HMI.)

[2] Data Format

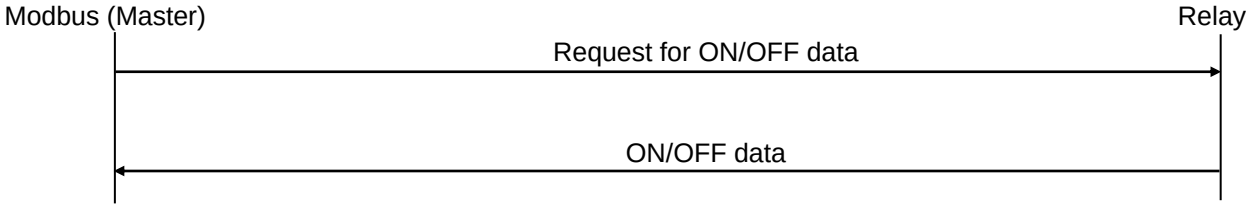
Result of LED Reset

| Modbus address | Item | Data contents (16 bits) |
|---|---|---|
| 39801 | Checking LED reset | Unfinished: 0x0000<br>Properly completed: 0x0001<br>Timeout: 0xAAAA<br>Error: Other than those listed above |

## 3.2 Acquiring ON/OFF Data

(1) Acquiring ON/OFF Data

[1] I/F Procedure




[2] Data Format

Requests from the Master should be delivered in sets of 16 points.

Leading address comes as an address value corresponding to a multiple of 16 counted from the Modbus Address 10001.

Leading address is predetermined. It is not that you can specify 16 points from anywhere you like.

Leading address = 10001 + 16 x i

Number of access points = 16 x j

(i = 0 - 124, j = 1 - 125)

| Modbus address | Item | Data contents (1 bit) |
|---|---|---|
| 10001 | By-model | ・ Detection (ON) → 1; Reset (OFF) → 0<br>・ For by-model data contents, see the Address Map. |
| ... | | |
| 12000 | By-model | |

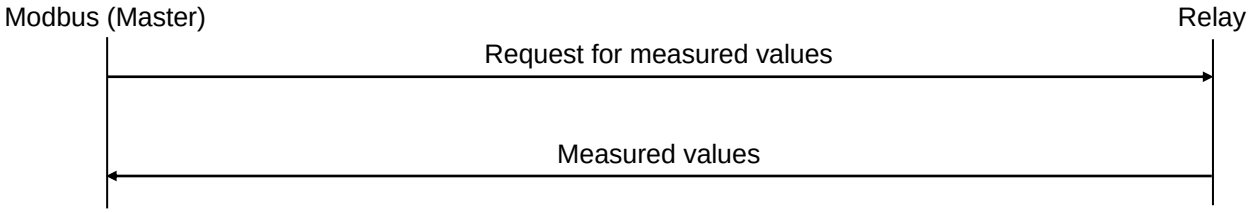
<CAUTION>

Automatic reset indications cannot be read where an ON-to-OFF (ON ⇒ OFF) status change has taken place with a cycle less than the one at which Master polls the Relays.

## 3.3 Acquiring Measured Values

(1) Acquiring Measured Values

[1] I/F Procedure




The secondary values of the transformer are sent back as measured values.
If primary values are needed, a transformation ratio (CT ratio or VT ratio) should be taken into consideration on the Master side.

[2] Data Format

Requests from the Master should be delivered in sets of 2 points.
Leading address comes as an address value corresponding to a multiple of 2 counted from the Modbus address 30001.
Leading address is predetermined. It is not that you can specify 2 points from anywhere you like.

Leading address = 30001 + 2 x i
Number of access points = 2 x j
(i = 0 - 59, j = 1 - 60)

| Modbus address | Item | Data contents (16 bits) |
|---|---|---|
| 30001 | Measured value 1 (H) | ・ In regard to data format, see the description below.<br>・ For by-model data contents, see the Address Map.<br>4 bytes/item |
| 30002 | Measured value 1 (L) | |
| ~ | | |
| 30119 | Measured value 60 (H) | |
| 30120 | Measured value 60 (L) | |

<How to read the Address Map>

Range (Min/Max):

Shows the minimum and maximum values which are indicated.
In regard to measured values appearing on the Relay's front panel display, those falling outside the upper and lower limits are not indicated. For the Modbus data, however, the results of the operation are sent back as they are. Therefore, only measured value data falling within the indication range should be used.

Engineering Unit:

Shows the units which are used.

Scale:

Shows the position of the decimal point.

Example: If Engineering Unit is [A], Scale is [1], and data read is "50," the indication will be 5.0A.

<CAUTION>

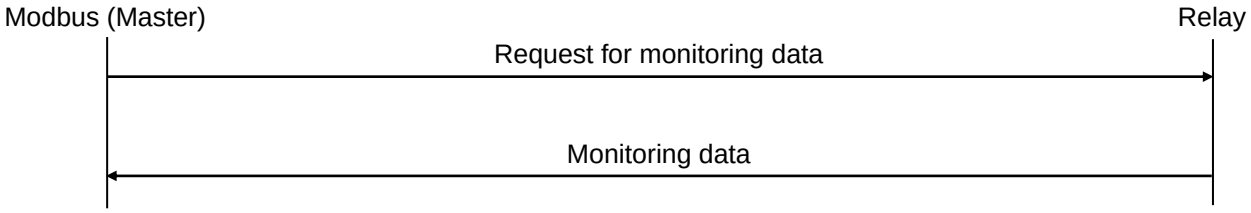
[1] There are cases where measured values do not represent data existing at the time when a request is made by the Master. Therefore, do not use data obtained at the Master for control or any other purpose.

[2] Because the measured values are those which have been processed through a harmonic cutoff filter, they may differ from measuring instrument readings. Therefore, do not use data obtained at the Master for control or any other purpose.

## 3.4 Acquiring Monitoring Data

(1) Acquiring Monitoring Data

[1] I/F Procedure




[2] Data Format

Requests from the Master should be delivered in sets of 2 points.
Leading address comes as an address value corresponding to a multiple of 2 counted from the Modbus address 37375.
Leading address is predetermined. It is not that you can specify 2 points from anywhere you like.

Leading address = 37375 + 2 x i
Number of access points = 2 x j
(i = 0 - 49, j = 1 - 50)

| Modbus address | Item | Data contents (16 bits) |
|---|---|---|
| 37375 | Monitoring data 1 (H) | ・ For by-model data contents, see the Address Map.<br>4 bytes/item |
| 37376 | Monitoring data 1 (L) | |
| ~ | | |
| 37473 | Monitoring data 50 (H) | |
| 37474 | Monitoring data 50 (L) | |

<How to read the Address Map>

Range (Min/Max):

Shows the minimum and maximum values which are indicated..

In regard to monitoring data appearing on the Relay's front panel display, those falling outside the upper and lower limits are not indicated. For the Modbus data, however, the results of the operation are sent back as they are. Therefore, only measured value data falling within the indication range should be used.

Engineering Unit:

Shows the units which are used.

Scale:

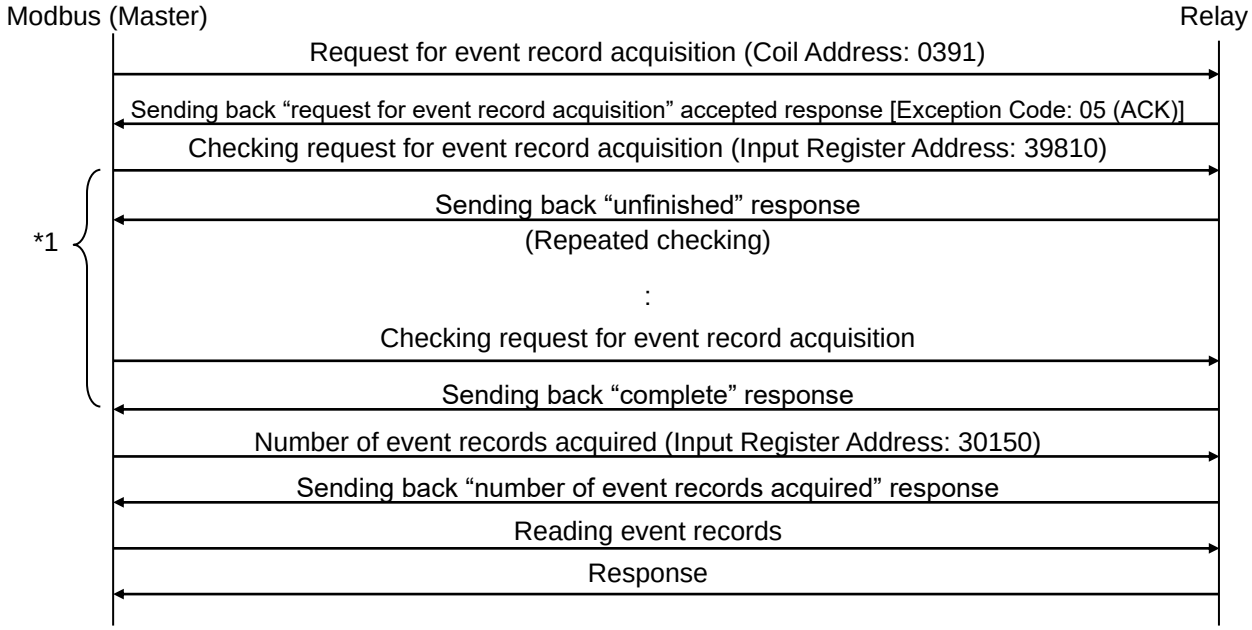
Shows the position of the decimal point.

Example: If Engineering Unit is [回], Scale is [1], and data read is "50," the indication will be 50 回 (50 times).

## 3.5 Acquiring/Erasing Event Records

(1) Acquiring Event Records

[1] I/F Procedure




*1: Steps performed to check whether the Master-generated “request for event record acquisition” is accepted successfully by the Relay. It is possible for the Master to deliver another request without performing these steps if the Relay is ready to respond. Without the performance of these steps, however, the Master cannot check for sure whether the processing of its request has been completed successfully.

[2] Data Format

a. Number of Event Records Acquired

| Modbus address | Item | Data contents (16 bits) |
|---|---|---|
| 30150 | Number of event records acquired | 1 - 256 |

b. Event Record Data

Event record data is stored in sets shown below (256 sets in all). (#1: new → #256: old).
0 comes up wherever no data is present.

| Modbus address | Item | Data contents (16 bits) |
|---|---|---|
| 30151 | #1 Event item number | Event description is identified by a numerical value. (See the Address Map.) |
| 30152 | #001 Event status | OFF (reset): 0x0000, ON (occurrence): 0x0001 |
| 30153 | #001 Time of occurrence [BCD year, month, day (H)] | 1970 - 2069, January 1 - December 31 |
| 30154 | #001 Time of occurrence [BCD year, month, day (L)] | |
| 30155 | #001 Time of occurrence [BCD hour, minute, second (H)] | 0 hour 0 minute 0 second - 23 hours 59 minutes 59 seconds |
| 30156 | #001 Time of occurrence [BCD hour, minute, second (L)] | |
| 30157 | #001 Time of occurrence (BCD m. second) | 0 - 999 msec |
| 30158 | #001 Time type | 1: IRIG-B, 2: local, 5: error |
| ~ | | |
| 32191 | #256 Event item number | Event description is identified by a numerical value. (See the Address Map.) |
| 32192 | #256 Event status | OFF (reset): 0x0000, ON (occurrence): 0x0001 |
| 32193 | #256 Time of occurrence [BCD year, month, day (H)] | 1970 - 2069, January 1 - December 31 |
| 32194 | #256 Time of occurrence [BCD year, month, day (L)] | |
| 32195 | #256 Time of occurrence [BCD hour, minute, second (H)] | 0 hour 0 minute 0 second - 23 hours 59 minutes 59 seconds |
| 32196 | #256 Time of occurrence [BCD hour, minute, second (L)] | |
| 32197 | #256 Time of occurrence (BCD m. second) | 0 - 999 msec |
| 32198 | #256 Time type | 1: IRIG-B, 2: local, 5: error |

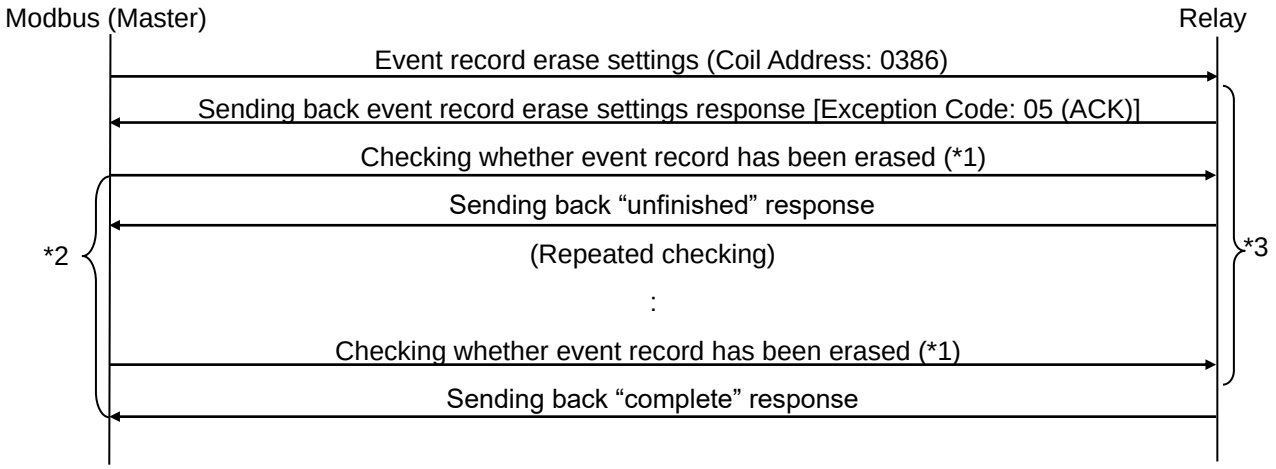
c. Results of Acquisition Request

| Modbus address | Item | Data contents (16 bits) |
|---|---|---|
| 39810 | Checking event record acquisition request | Unfinished: 0x0000<br>Properly completed: 0x0001<br>Event record occurring during collection process: 0x0002<br>Timeout: 0xAAAA<br>Error: Other than those listed above |

(2) Erasing Event Record

[1] I/F Procedure

It takes the amount of time shown in Section 2.9 for an event record to be erased within the Relay. Therefore, the Master needs to check whether the Relay has erased the record that is concerned. When the Relay has erased the record, it sends back a “complete” response to the Master.



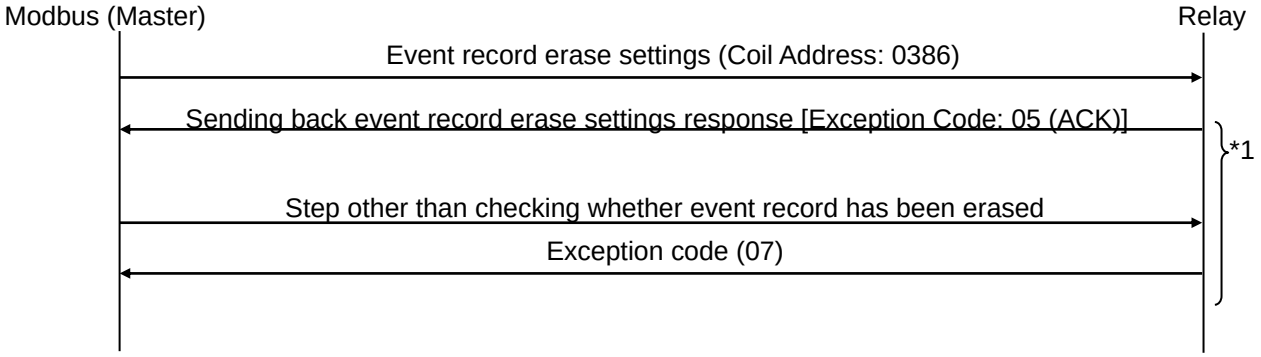

*1: Check the results of the event record erase operation by reading the Input Register (Address 39802).

*2: Steps performed to check whether, according to the Master-generated “event record erase settings”, the Relay has erased the record successfully. It is possible for the Master to deliver another request without performing these steps if the Relay has completed the erase process. Without the performance of these steps, however, the Master cannot check for sure whether the Relay has erased the record successfully.

*3: For the amount of time it takes the Relay to erase record, see Section 2.9 (Note that information therein is applicable to the case where no operations are performed on the front panel or PC-HMI).

[2] I/F Procedure (Exception Handling)

In a situation shown below, an “error” response will be sent back to the Master.
Situation here is such that the Relay receives another request after having received a request for “event record erase settings” and before it has completed record erase process.




*1: For the amount of time it takes the Relay to erase record, see Section 2.9 (Note that information therein is applicable to the case where no operations are performed on the front panel or PC-HMI).

[3] Data Format

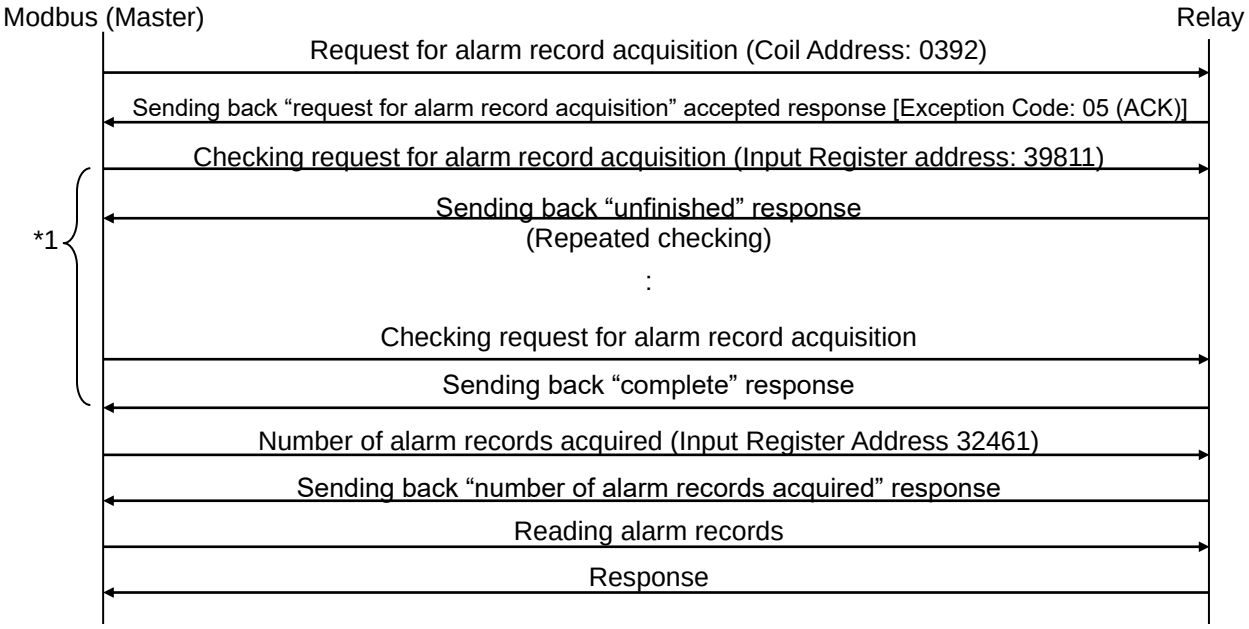
Results of Erase Process

| Modbus address | Item | Date contents (16 bits) |
|---|---|---|
| 39802 | Checking whether event record has been erased | Properly completed: 0x0001<br>Timeout: 0xAAAA<br>Error: Other than those listed above |

## 3.6 Acquiring/Erasing Alarm Records

(1) Acquiring Alarm Records

[1] I/F Procedure




*1: Steps performed to check whether the Master-generated “request for alarm record acquisition” is accepted successfully. It is possible for the Master to deliver another request without performing these steps if the Relay is ready to respond. Without the performance of these steps, however, the Master cannot check for sure whether the processing of its request has been completed successfully.

[2] Data Format

a. Number of Alarm Records Acquired

| Modbus address | Item | Data contents (16 bits) |
|---|---|---|
| 32461 | Number of alarm records acquired | 1 - 200 |

b. Alarm Record Data

Alarm record data is stored in sets shown below (256 sets in all). (#1: new → #200: old).

| Modbus address | Item | Data contents (16 bits) |
|---|---|---|
| 32462 | #001 Error code | Error code is identified by a numerical value. |
| 32463 | #001 Error details code | Error details code is identified by a numerical value. |
| 32464 | #001 Error details code | Error details code is identified by a numerical value. |
| 32465 | #001 Error details code | Error details code is identified by a numerical value. |
| 32466 | #001 Error details code | Error details code is identified by a numerical value. |
| 32467 | #001 Error details code | Error details code is identified by a numerical value. |
| 32468 | #001 Error details code | Error details code is identified by a numerical value. |
| 32469 | #001 Time of occurrence [BCD year, month, day (H)] | 1970 - 2069, January 1 - December 31 |
| 32470 | #001 Time of occurrence [BCD year, month, day (L)] | |
| 32471 | #001 Time of occurrence [BCD hour, minute, second (H)] | 0 hour 0 minute 0 second - 23 hours 59 minutes 59 seconds |
| 32472 | #001 Time of occurrence [BCD hour, minute, second (L)] | |
| 32473 | #001 Time of occurrence (BCD m second) | 0 - 999 msec |
| 32474 | #001 Time type | 1: IRIG-B, 2: local, 5: error |
| 32475 | #001 CPU ID | CPU ID is identified by a numerical value. |
| ~ | | |
| 35248 | #200 Error code | Error code is identified by a numerical value. |
| 35249 | #200 Error details code | Error details code is identified by a numerical value. |
| 35250 | #200 Error details code | Error details code is identified by a numerical value. |
| 35251 | #200 Error details code | Error details code is identified by a numerical value. |
| 35252 | #200 Error details code | Error details code is identified by a numerical value. |
| 35253 | #200 Error details code | Error details code is identified by a numerical value. |
| 35254 | #200 Error details code | Error details code is identified by a numerical value. |
| 35255 | #200 Time of occurrence [BCD year, month, day (H)] | 1970 - 2069, January 1 - December 31 |
| 35256 | #200 Time of occurrence [BCD year, month, day (L)] | |
| 35257 | #200 Time of occurrence [BCD hour, minute, second (H)] | 0 hour 0 minute 0 second - 23 hours 59 minutes 59 seconds |
| 35258 | #200 Time of occurrence [BCD hour, minute, second (L)] | |
| 35259 | #200 Time of occurrence (BCD m second) | 0 - 999 msec |

| Modbus address | Item | Data contents (16 bits) |
|---|---|---|
| 35260 | #200 Time type | 1: IRIG-B, 2: local, 5: error |
| 35261 | #200 CPU ID | CPU ID is identified by a numerical value. |

For information about steps performed after error code is obtained, see the troubleshooting guide supplied with the Relay.

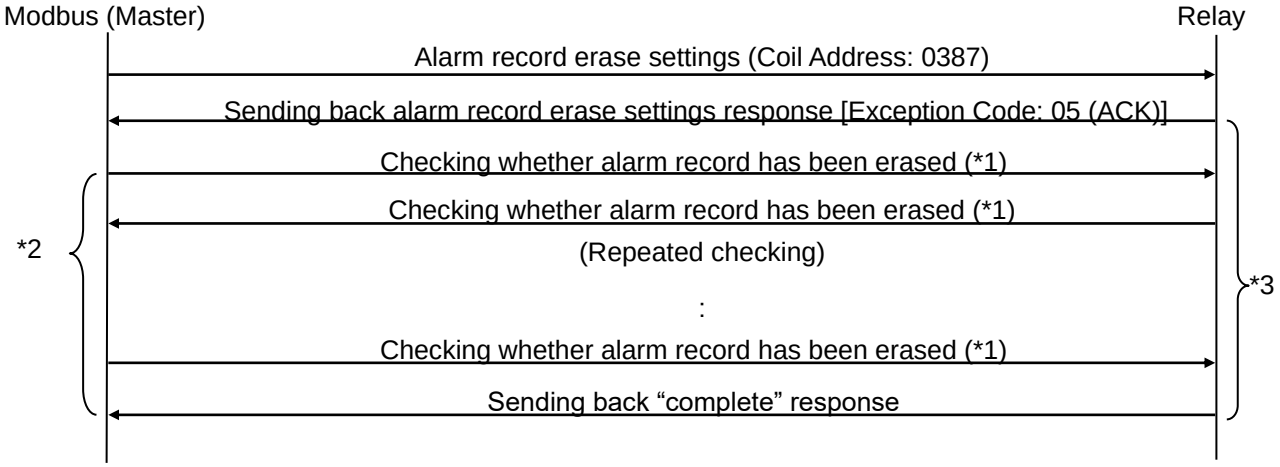
c. Results of Acquisition Request

| Modbus address | Item | Data contents (16 bits) |
|---|---|---|
| 39811 | Checking event record acquisition request | Unfinished: 0x0000<br>Properly completed: 0x0001<br>Alarm record occurring during collection process: 0x0002<br>Timeout: 0xAAAA<br>Error: Other than those listed above |

(2) Erasing Alarm Records

[1] I/F Procedure

It takes the amount of time shown in Section 2.9 for an alarm record to be erased within the Relay. Therefore, the Master needs to check whether the relay has erased the record that is concerned. When the Relay has erased the record, it sends back a “complete” response to the Master.



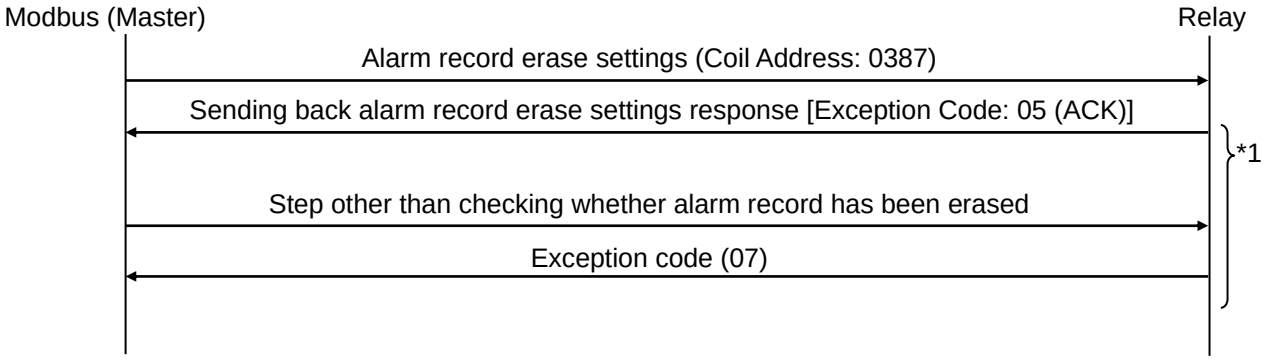

*1: Check the results of the alarm record erase process by reading the Input Register (address: 39803).

*2: Steps performed to check whether the Relay has erased the record successfully, based on the Master-generated “alarm record erase settings.” It is possible for the Master to deliver another request without performing these steps if the Relay has completed the erase process. Without the performance of these steps, however, the Mast cannot check for sure whether the Relay has erased the record successfully.

*3: For the amount of time it takes the Relay to erase record, see Section 2.9. (Note that information therein is applicable to the case where no operations are performed on the front panel or PC-HMI.)

[2] I/F Procedure (Exception Handling)

In a situation shown below, the Relay sends back an “error” response to the Master.
Situation here is such that the Relay receives another request after it has received “alarm record erase settings” and before it has completed record erase process.




*1: For the amount of time it takes the Relay to erase record, see Section 2.9 (Note that information therein is applicable to the case where no operations are performed on the front panel or PC-HMI).

[3] Data Format

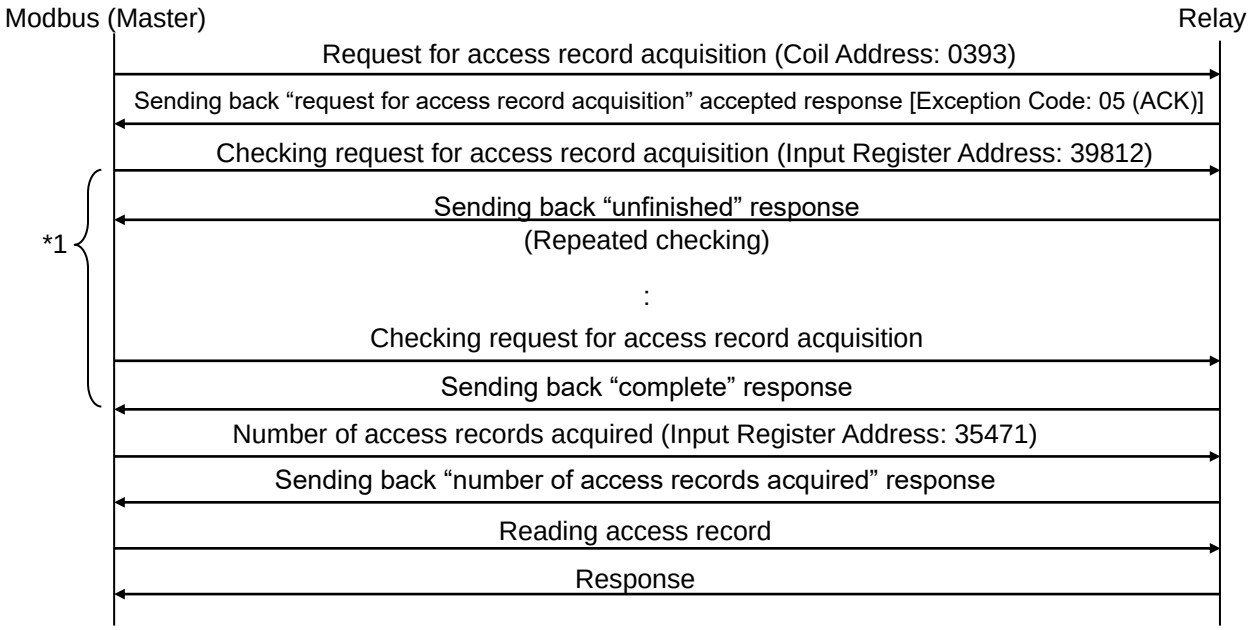
Results of Erase Process

| Modbus address | Item | Data contents (16 bits) |
|---|---|---|
| 39803 | Checking whether alarm record has been erased | Unfinished: 0x0000<br>Properly completed: 0x0001<br>Timeout: 0xAAAA<br>Error: Other than those listed above |

## 3.7 Acquiring Access Records

(1) Acquiring Access Records

[1] I/F Procedure




*1: Steps performed to check whether the Master-generated “request for access record acquisition” is accepted successfully. It is possible for the Master to deliver another request without performing these steps if the Relay is ready to respond. Without the performance of these steps, however, the Master cannot check for sure whether the processing of its request has been completed successfully.

[2] Data Format

a. Number of Access Records Acquired

| Modbus address | Item | Data contents (16 bits) |
|---|---|---|
| 35471 | Number of access records acquired | 1 - 128 |

b. Access Record Data

Access record data is stored in sets shown below (128 sets in all). (#1: new → #128: old).

| Modbus address | Item | Data contents (16 bits) |
|---|---|---|
| 35472 | #001 Access item number | Access contents is identified by a numerical value. (See the following..) |
| 35473 | #001 Time of occurrence [BCD year, month, day (H)] | 1970 - 2069, January 1 - December 31 |
| 35474 | #001 Time of occurrence [BCD year, month, day (L)] | |
| 35475 | #001 Time of occurrence [BCD hour, minute, second (H)] | 0 hour 0 minute 0 second - 23 hours 59 minutes 59 seconds |
| 35476 | #001 Time of occurrence [BCD hour, minute, second (L)] | |
| 35477 | #001 Time of occurrence (BCD m. second) | 0 - 999 msec |
| 35478 | #001 Time type | 1: IRIG-B, 2: local, 5: error |
| 35479 | #001 Access source | See the following. |
| ~ | | |
| 36488 | #128 Access item number | Access contents is identified by a numerical value. (See the following..) |
| 36489 | #128 Time of occurrence [BCD year, month, day (H)] | 1970 - 2069, January 1 - December 31 |
| 36490 | #128 Time of occurrence [BCD year, month, day (L)] | |
| 36491 | #128 Time of occurrence [BCD hour, minute, second (H)] | 0 hour 0 minute 0 second - 23 hours 59 minutes 59 seconds |
| 36492 | #128 Time of occurrence [BCD hour, minute, second (L)] | |
| 36493 | #128 Time of occurrence (BCD m. second) | 0 - 999 msec |
| 36494 | #128 Time type | 1: IRIG-B, 2: local, 5: error |
| 36495 | #128 access source | See the following. |

| Access item number | Description | Access item number | Description |
|---|---|---|---|
| 0x0001 | When changing group settings | 0x0015 | When changing forced DO control time |
| 0x0002 | When changing rated frequency | 0x001D | When changing PLC data |
| 0x0003 | When changing DI detection voltage | 0x001E | When changing relay setting values |
| 0x0004 | When changing data save time | 0x0200 | When erasing an accident record |
| 0x0005 | When making password presence/absence settings | 0x0210 | When erasing an alarm record |
| 0x0006 | When changing a password | 0x0220 | When erasing an event record |
| 0x0007 | When changing a destination USB connection | 0x0230 | When erasing an access record |
| 0x0008 | When making VFD brightness settings | 0x0240 | When making time-of-day settings |
| 0x0009 | When changing a trip counter initial value | 0x0300 | When starting test mode settings |
| 0x000A | When changing a motor operation time initial value | 0x0310 | When ending test mode settings |
| 0x000B | When changing Modbus communication settings | 0x0320 | When performing LED reset |
| 0x000C | When changing CC-Link communication settings | 0x0340 | When starting forced DO control |
| 0x000D | When changing IEC61850 communication settings | 0x0350 | When clearing forced DO control |
| 0x0010 | When changing a device name | 0x0360 | Monitor lock ON |
| 0x0011 | When changing measured value configuration | 0x0370 | Monitor lock OFF |
| 0x0012 | When making watt-hour initial settings | 0x0380 | When starting forced relay control |
| 0x0013 | When making time-of-day information settings | 0x0390 | When clearing forced relay control |
| 0x0014 | When making control mode settings | 0x0520 | When performing CB control |

| Access source number | Details |
|---|---|
| 0x0000 | Front panel |
| 0x0001 | PC-HMI |
| 0x0002 | Modbus |
| 0x0006 | Device-side auto clear |

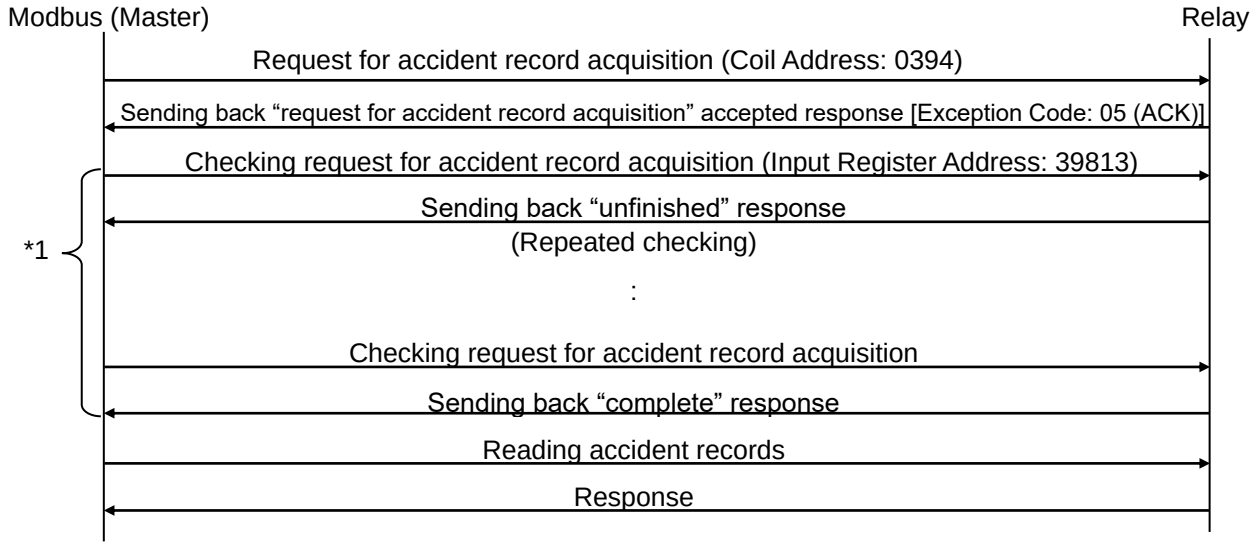
c. Results of Acquisition Request

| Modbus address | Item | Data contents (16 bits) |
|---|---|---|
| 39812 | Checking request for access record acquisition | Unfinished: 0x0000<br>Properly completed: 0x0001<br>Access record occurring during collection process: 0x0002<br>Timeout: 0xAAAA<br>Error: Other than those listed above |

## 3.8 Acquiring/Erasing Accident Records

(1) Acquiring Accident Records

[1] I/F Procedure




*1: Steps performed to check whether the Master-generated “request for accident record acquisition,” is accepted successfully. It is possible for the Master to deliver another request without performing of these steps if the Relay is ready to respond. Without the performance of these steps, however, the Master cannot check for sure whether the processing of its request has been completed successfully.

[2] Data Format

Data acquirable for a single accident comes in sets shown below.

Data on up to 5 phenomena can be acquired for a single accident.

a. Number of Accident Record Acquired

| Modbus address | Item | Data contents (16 bits) |
|---|---|---|
| 36631 | Number of accident records acquired | 1 - 5 |

b. Failure Record Data Relating to the 1st Phenomenon

| Modbus address | Item | Data contents (16 bits) |
|---|---|---|
| 36632 | Time of occurrence [BCD year, month, day (H)] | 1970 - 2069, January 1 - December 31 |
| 36633 | Time of occurrence [BCD year, month, day (L)] | |
| 36634 | Time of occurrence [BCD hour, minute, second (H)] | 0 hour 0 minute 0 second - 23 hours 59 minutes 59 seconds |
| 36635 | Time of occurrence [BCD hour, minute, second (L)] | |
| 36636 | Time of occurrence (BCD m. second) | 0 - 999 msec |
| 36637 | Time type | 1: IRIG-B, 2: local, 5: error |
| 36638 | Factor contributing to trip (H) | Allocated to bits (See Address Map.) |
| 36639 | Factor contributing to trip (L) | Allocated to bits (See Address Map.) |
| 36640-36699 | Measured values No01 (H) | ・ For by-model contents, see Address Map.<br>4 bytes/item<br>To know about how to read Address Map, see Section 3.3. |
| | Measured values No01 (L) | |
| | .... | |
| | Measured values No30 (H) | |
| | Measured values No30 (L) | |

For addresses assigned to the 2nd through 5th phenomenon, see Address Map.

c. Results of Acquisition Request

| Modbus address | Item | Data contents (16 bits) |
|---|---|---|
| 39813 | Checking request for accident record acquisition | Unfinished: 0x0000<br>Properly completed: 0x0001<br>Accident record occurring during collection process: 0x0002<br>Timeout: 0xAAAA<br>Error: Other than those listed above |

<CAUTION>

[1] It takes time on the order of several seconds for an accident record to be processed. Therefore, there is the possibility that any record fails to remain if power to the Relay is interrupted within several seconds after the occurrence of an accident.

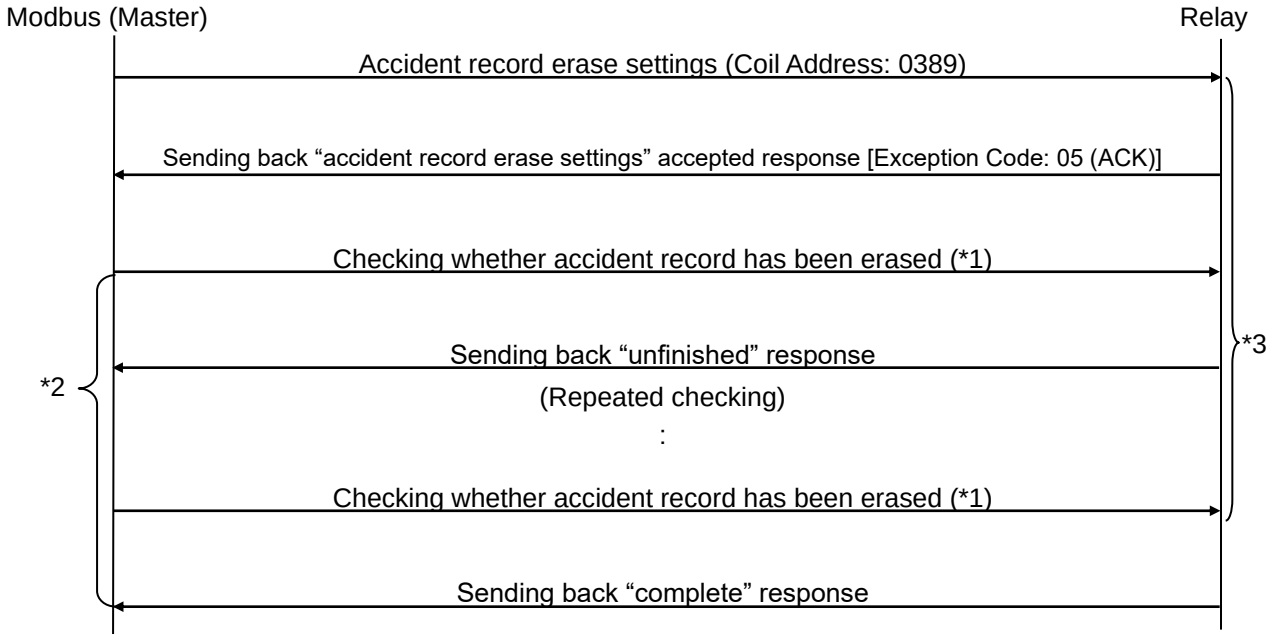
[2] To check what has caused the actuation of a relay (“factor contributing to trip”), make use of the LED information.

(2) Erasing Accident Records

[1] I/F Procedure

It takes the amount of time shown in Section 2.9 for an accident record to be erased within the Relay. Therefore, the Master needs to check whether the relay has erased the record that is concerned. When the Relay has erased the record, it sends back a “complete” response to the Master.

The process described here concurrently erases disturbance records as well.




*1: Check the results of the accident record erase process by reading the Input Register (Address: 39805).

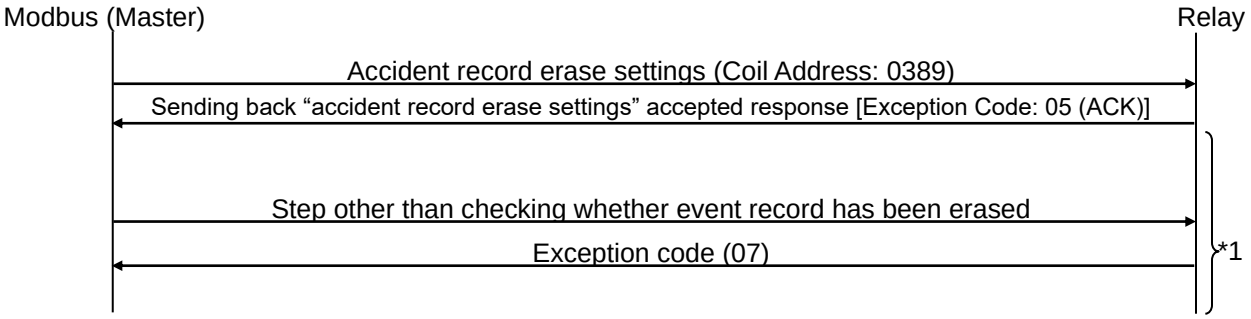
*2: Steps performed to check whether the Relay has erased the record successfully according to the Master-generated “accident record erase settings.” It is possible for the Master to deliver another request without performing these steps if the Relay has completed the erase process. Without the performance of these steps, however, the Master cannot check for sure whether the Relay has erased the record successfully.

*3: For the amount of time it takes the Relay to erase record, see Section 2.9 (Note that information therein is applicable to the case where no operations are performed on the front panel or PC-HMI).

[2] I/F Procedure (Exception Handling)

In a situation shown below, the Relay sends back an “error” response to the Master.

Situation here is such that the Relay receives another request after it has received a “accident record erase settings” and before it has completed record erase process.




*1: For the amount of time it takes the Relay to erase record, see Section 2.9 (applicable to the case where no operations are performed on the front panel or PC-HMI).

[3] Data Format

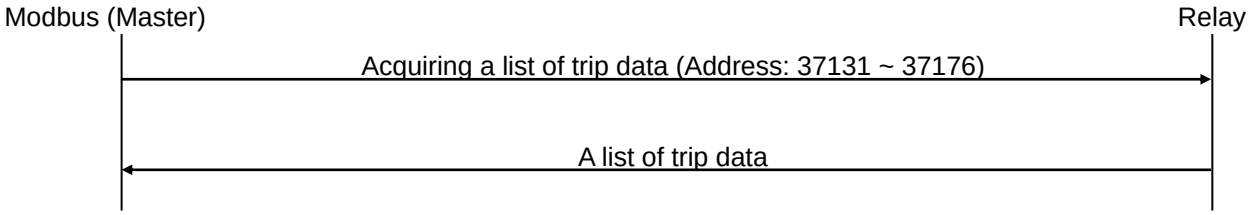
Results of erase operation

| Modbus address | Item | Date contents (16 bits) |
|---|---|---|
| 39805 | Checking whether accident record has been erased | Unfinished: 0x0000<br>Normally completed: 0x0001<br>Timeout: 0xAAAA<br>Error: Other than those listed above |

## 3.9 Acquiring Disturbance Records

(1) Acquiring A List of Trip Data

[1] I/F Procedure




[2] Data Format

List of trip data is stored in sets shown below (128 sets in all). (#1: new ⇒ #5: old).

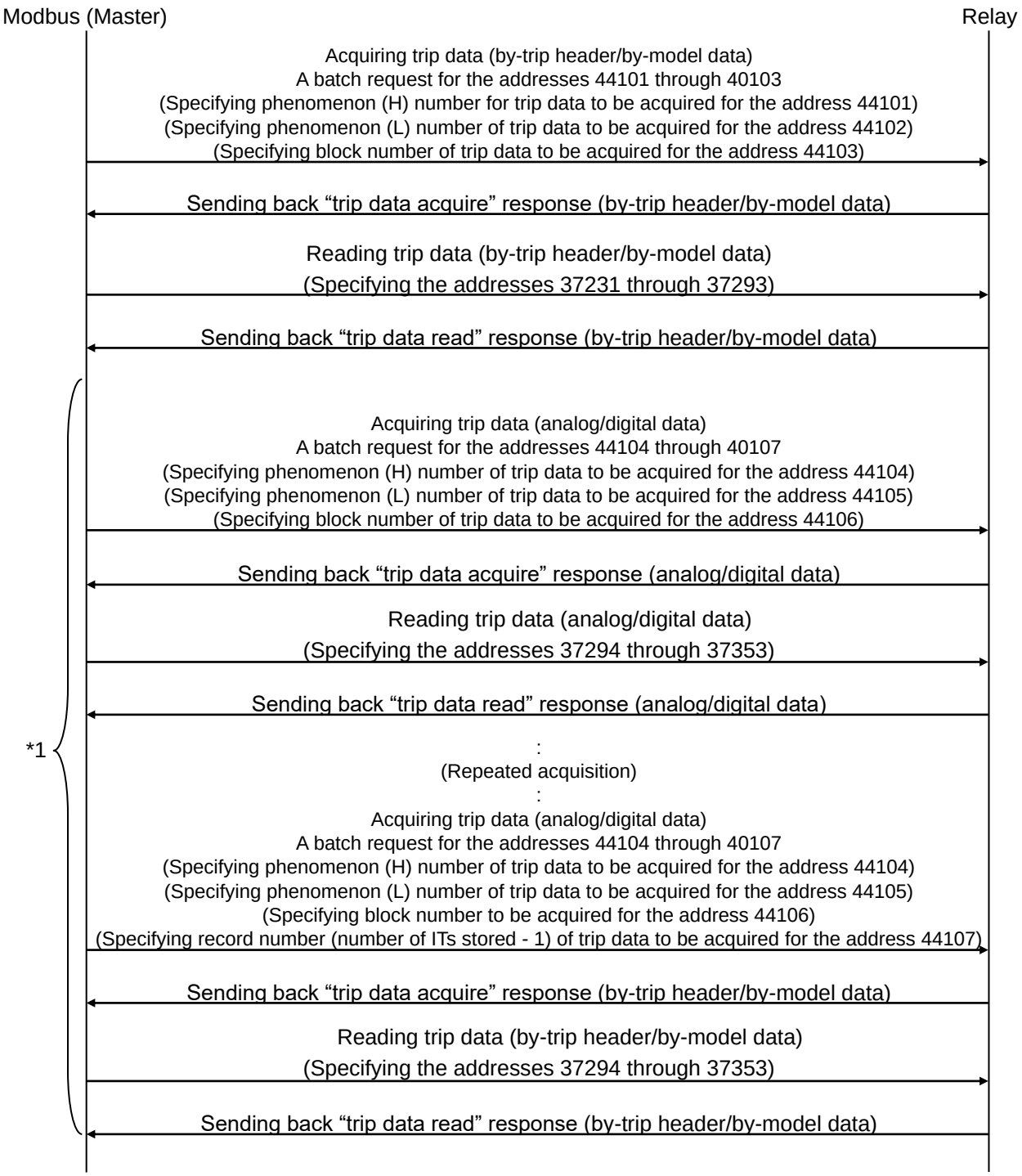
0 comes up wherever no data is present.

| Modbus address | Item | Data contents (16 bits) |
|---|---|---|
| 37131 | Number of lists of trip data acquired | 0 - 5 (number of records) |
| 37132 | #1 Phenomenon number (H) | 0 - $10^9$ |
| 37133 | #1 Phenomenon number (L) | |
| 37134 | #1 Storing block number | 1 - 10 |
| 37135 | #1 Time of occurrence [BCD year, month, day (H)] | 1970 - 2069, January 1 - December 31 |
| 37136 | #1 Time of occurrence [BCD year, month, day (L)] | |
| 37137 | #1 Time of occurrence [BCD hour, minute, second (H)] | 0 hour 0 minute 0 second - 23 hours 59 minutes 59 seconds |
| 37138 | #1 Time of occurrence [BCD hour, minute, second (L)] | |
| 37139 | #1 Time of occurrence [BCD m. second (H)] | 0 - 999 msec |
| 37140 | #1 Time type | 1: IRIG-B, 2: local, 5: error |
| 37141 - 37167 | #2 - #4 | ... |
| 37168 | #5 Phenomenon number (H) | 0 - $10^9$ |
| 37169 | #5 Phenomenon number (L) | |
| 37170 | #5 Storing block number | 1 - 10 |
| 37171 | #5 Time of occurrence [BCD year, month, day (H)] | 1970 - 2069, January 1 - December 31 |
| 37172 | #5 Time of occurrence [BCD year, month, day (L)] | |
| 37173 | #5 Time of occurrence [BCD hour, minute, second (H)] | 0 hour 0 minute 0 second - 23 hours 59 minutes 59 seconds |
| 37174 | #1 Time of occurrence [BCD hour, minute, second (L)] | |
| 37175 | #5 Time of occurrence (BCD m. second) | 0 - 999 msec |
| 37176 | #5 Time type | 1: IRIG-B, 2: local, 5: error |

(2) Acquiring Trip Data

[1] I/F Procedure

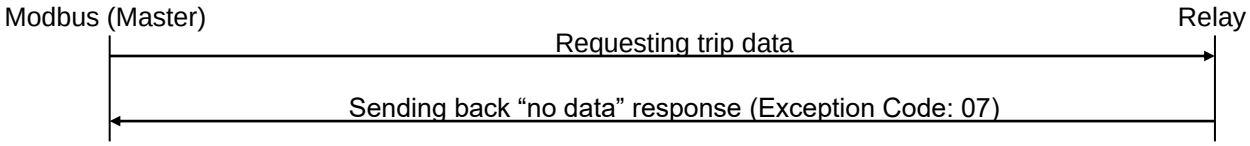
Trip data is acquired by specifying a block number of interest from the list of trip data (number of trip data, number of block where storing occurred most recently, and time of day).




*1: These steps are reiterated number of times equal to “number of history data (number of ITs stored) which has been acquired by the step “Reading trip data (by-trip header/by-model data).”

[2] I/F Procedure (With Trip Occurring during Data Acquisition)

In the event that a relay trip occurs while data acquisition is in progress and a situation shown below exists, the data acquisition process should be started over from the beginning.




[3] Data Format

By-trip header/by-model data (settings)

| Modbus address | Item | Data contents (16 bits) |
|---|---|---|
| 44101 | Phenomenon number (H) for acquiring by-trip header/by-model data *1 | 0 - $10^9$ (Specify the number of phenomenon to be acquired.) |
| 44102 | Phenomenon number (L) for acquiring by-trip header/by-model data *1 | |
| 44103 | Block number for acquiring by-trip header/by-model data *1 | 1 - 10 (Specify the number of block to be acquired.) |

*1: Make a batch setting for “phenomenon number” and “block number”.

By-trip header/by-model data (acquisition)

| Modbus address | Item | Data contents (16 bits) |
|---|---|---|
| 37231 | Phenomenon number (H) | 0 - $10^9$ |
| 37232 | Phenomenon number (L) | |
| 37233 | Storing block number | 1 - 10 |
| 37234 - 37289 | CT secondary processing value*1 | Processing value for translating data into waveform |
| 37290 | Number of 30°analog data words | Number of analog data to be included in history record |
| 37291 | Number of 30°flag data words | Number of ON/OFF data to be included in history record |
| 37292 | Number of history data (number of ITs stored) | Number of ITs stored |
| 37293 | AI sampling cycle | 15:15°, 30:30° |

*1: CT secondary processing value is a full-scale value of analog data.

Analog/Digital Data (Settings)

| Modbus address | Item | Data contents (16 bits) |
|---|---|---|
| 44104 | Phenomenon number (H) for acquiring analog/digital data *1 | 0 - $10^9$ (Specify the number of phenomenon for acquiring the data.) |
| 44105 | Phenomenon number (L) for acquiring analog/digital data *1 | |
| 44106 | Block number for acquiring analog/digital data *1 | 1 - 10 (Specify the number of block for acquiring the data.) |
| 44107 | Record number for acquiring analog/digital data *1 | 0 - number of ITs acquired – 1 |

*1: Make a batch setting for “phenomenon number,” “block number,” and “record number” .

Analog/Digital Data (Acquisition)

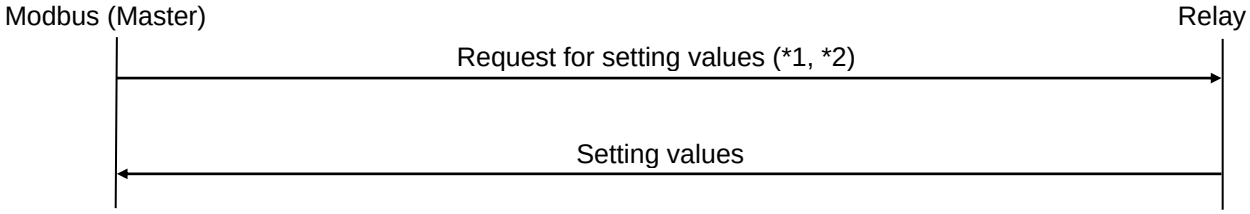
| Modbus address | 項目 | データ内容( 16bit) |
|---|---|---|
| 37294 | Phenomenon number (H) | 0 - $10^9$ |
| 37295 | Phenomenon number (L) | |
| 37296 | Block number for acquiring data | 1 - 10 |
| 37297 | Record number | 0 - number of ITs acquired – 1 |
| 37298 – 37353 (56 words) | Analog data 1 *1 | One piece of data per item (See the Address Map.) |
| | Analog data 2 *1 | Same as above |
| | Analog data 3 *1 | Same as above |
| | Analog data 4 *1 | Same as above |
| | ... | Same as above |
| | Analog data n *1 | Same as above |
| | Digital data 1 | Allocate digital data ON/OFF on a bit-by-bit basis. (See the Address Map.) |
| | Digital data 2 | Same as above |
| | ... | Same as above |
| | Digital data n | Same as above |

*1: If you want to evaluate “analog data” in terms of actual unit, perform unit conversion by using “CT secondary processing value” for by-trip header/by-model data. The following is the equation to be applied for the unit conversion:
Analog data (actual unit) = (analog data x CT secondary processing value) / 32767

## 3.10 Acquiring/Set Setting Values for Relay Elements (setting G1/G2)

(1) Acquiring Setting Values

[1] I/F Procedure




*1: Master can acquire from Relay up to 125 points worth of setting values from a leading address (40001 if Group 1 setting is concerned).

*2: Common setting values for the addresses subsequent to 42001 (inclusive) cannot be acquired together with those for active group at the address 42001.

[2] Data Format

a. For protective elements

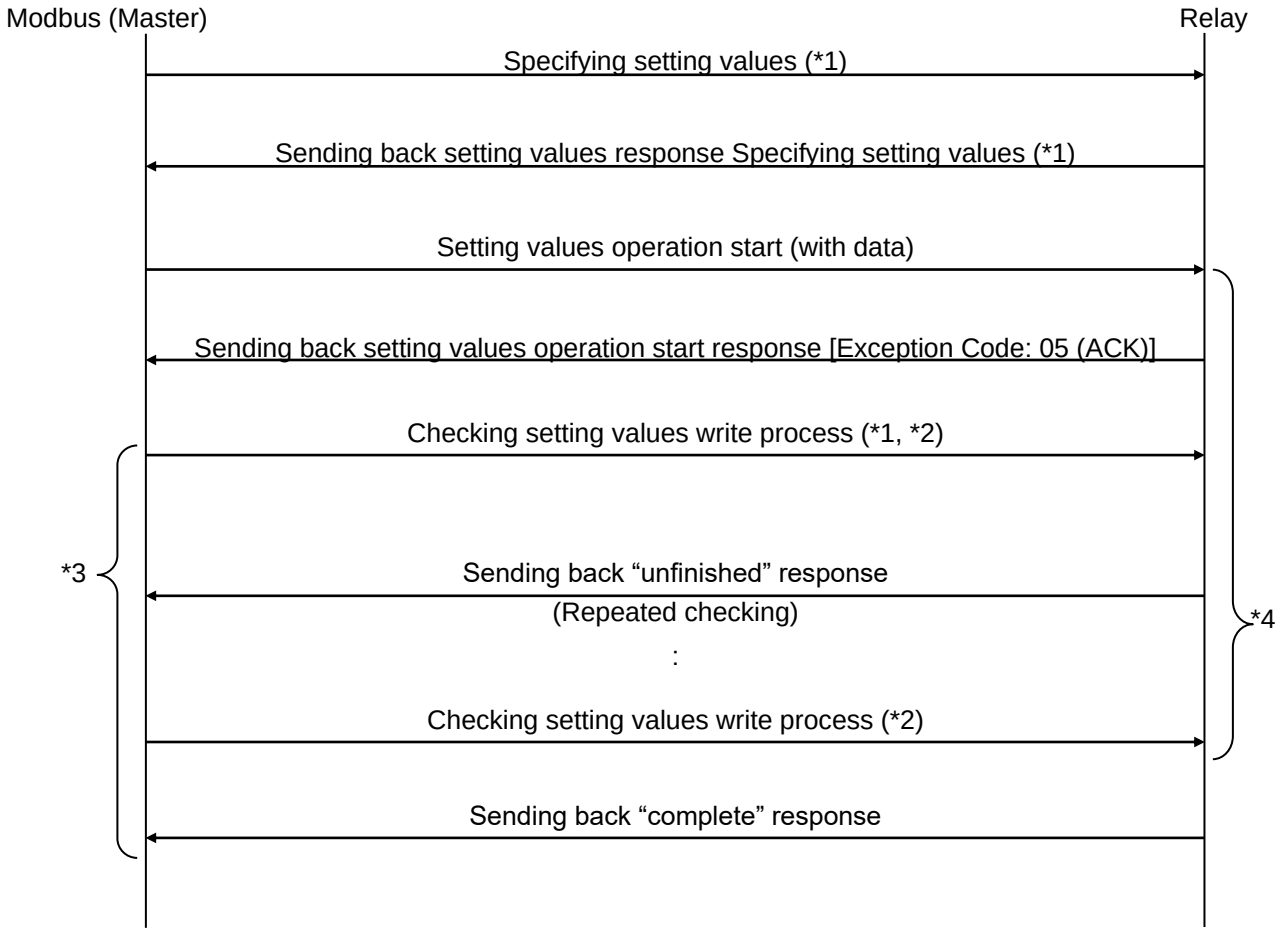
| Modbus address | Item | Data contents (16 bits) |
|---|---|---|
| 40001 - 40256 | Specifying/acquiring Group 1 setting values | Magnification equal to actual setting value x an integral number<br>(See the Address Map.) |
| 40501 - 40756 | Specifying/acquiring Group 2 setting values | Magnification equal to actual setting value x an integral number<br>(See the Address Map.) |

b. For common use

| Modbus address | Item | Data contents (16 bits) |
|---|---|---|
| 42001 | Specifying/acquiring active group setting values | Active group<br>Group 1 or Group 2 |
| 42002 - 42255 | Specifying/acquiring common setting values | Magnification equal to actual setting value x an integral number<br>(See the Address Map.) |

(2) Specifying Setting Values

[1] I/F Procedure




*1: Common setting values for the addresses subsequent to 42002 (inclusive) cannot be specified together with those for active group at the address 42001. This applies to “operation start” as well.

*2: To check active group write process, Group 1 setting values write process, Group 2 setting values write process, and common setting values write process, check Input Register at the address 39806, Input Register at the address 39807, Input Register at the address 39808, and Input Register at the address 39809, respectively.

*3: Steps performed to check whether the Relay has written the setting values successfully according to Master-generated “operation start” massage. It is possible for the Master to deliver another request without performing these steps if the Relay has completed the write process. Without the performance of these steps, however, the Master cannot check for sure whether the Relay has written the setting values successfully.

*4: For the amount of time required for the write process: see Section 2.9.

*5: An error will be generated if an attempt is made to make a change to anywhere in “setting” area which is devoted to a vendor

*6: For data which is 4 bytes long with lower- and high-order digits combined, make 4 bytes worth of changes in every single request. An error will be generated if you attempt to discretely change either the low-order digits or high-order digits.

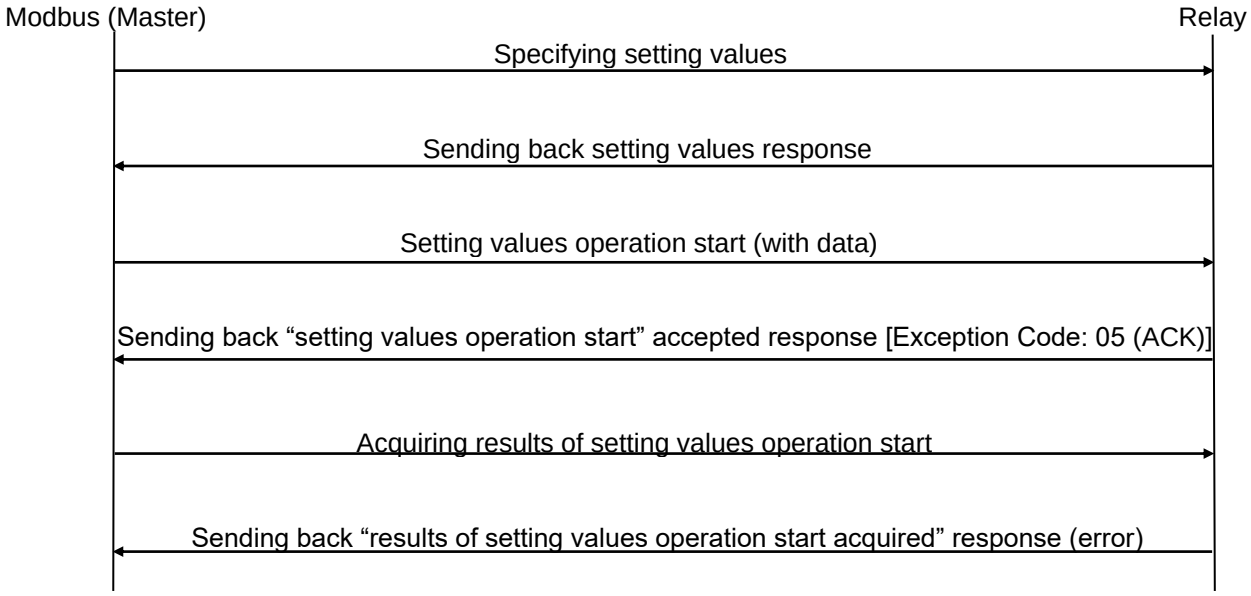
*7: If you choose to change the setting for a specific relay (out of plural relays which are connected to the system) and operate it on the changed setting, take care, in consideration of the number of the units connected, not to allow a timeout period to pass before the relevant setting values write process is completed.

<CAUTION>
If a panel manipulation from the relay front face or PC-HMI occurs concurrent with one from the communication system, writing will be executed on a first-come, first-served basis.

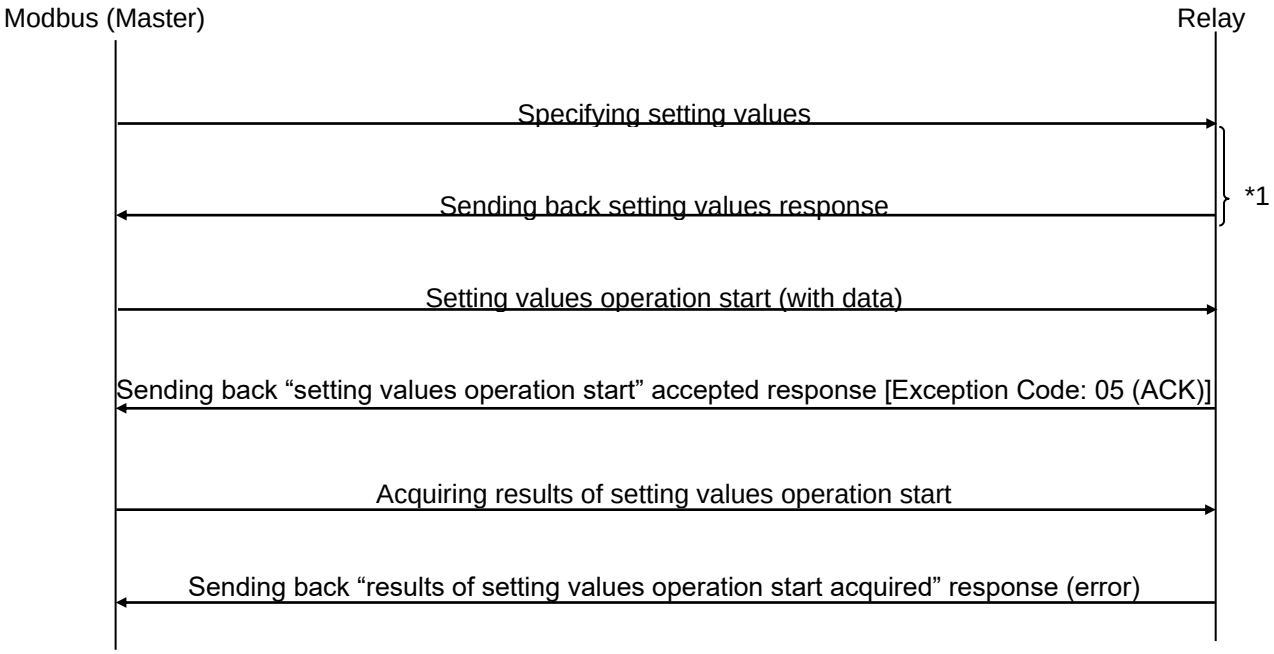
[2] I/F Procedure (Exception Handling)

In a situation shown below, an “error” response will be sent back to the Master.

a. In the case where there is any discrepancy between the contents in the steps “specifying setting values” and “setting values operation start (with data)”.

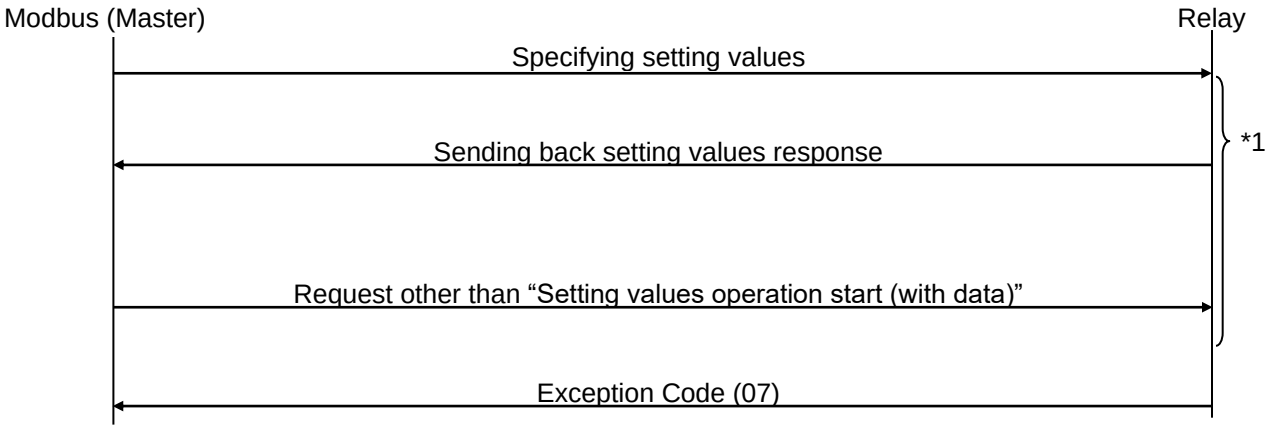



b. In the case of timeout



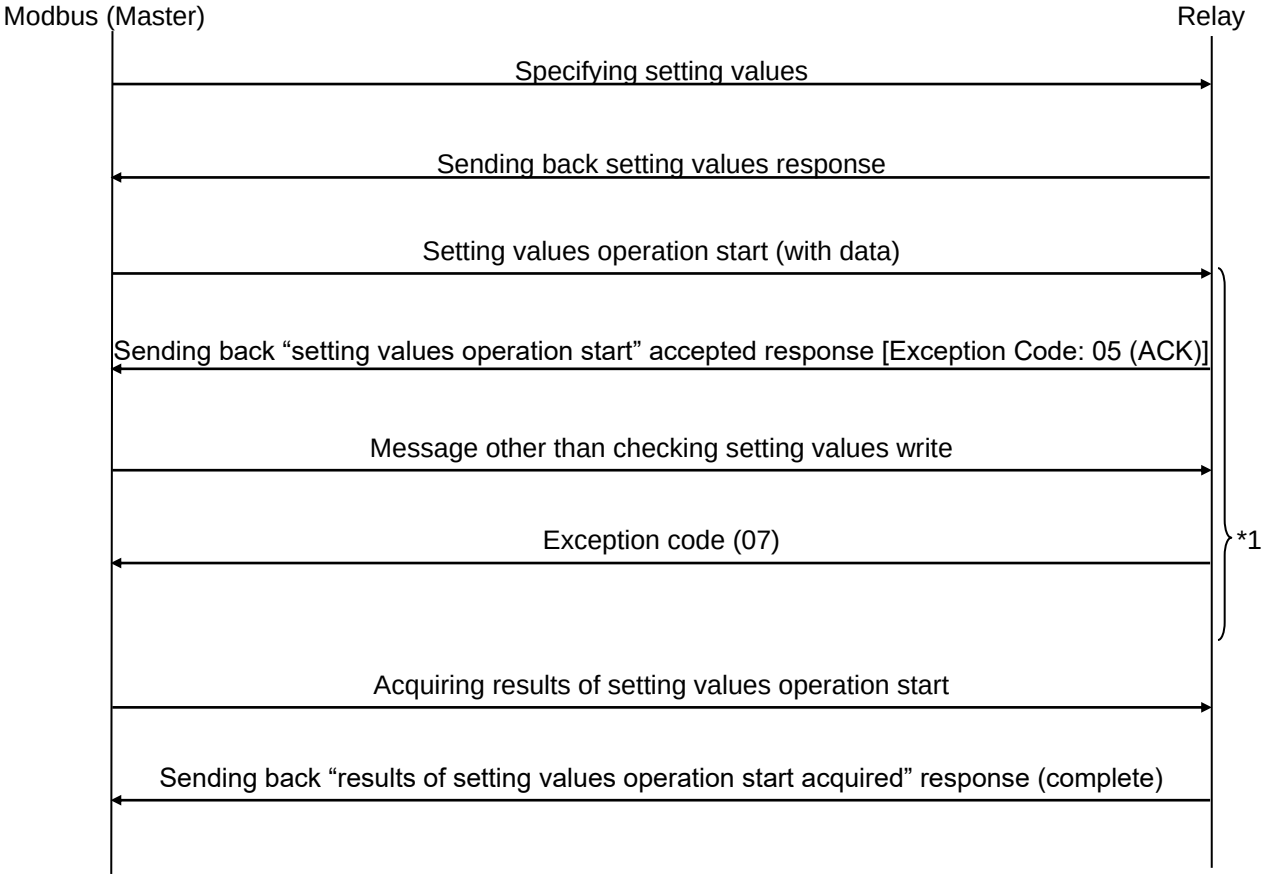

*1: For information about timeout, see Section 2.8.

c. In the case where the Relay receives a request other than “setting values operation start (with data)” after it the receipt of “specifying setting values” and before the occurrence of a timeout



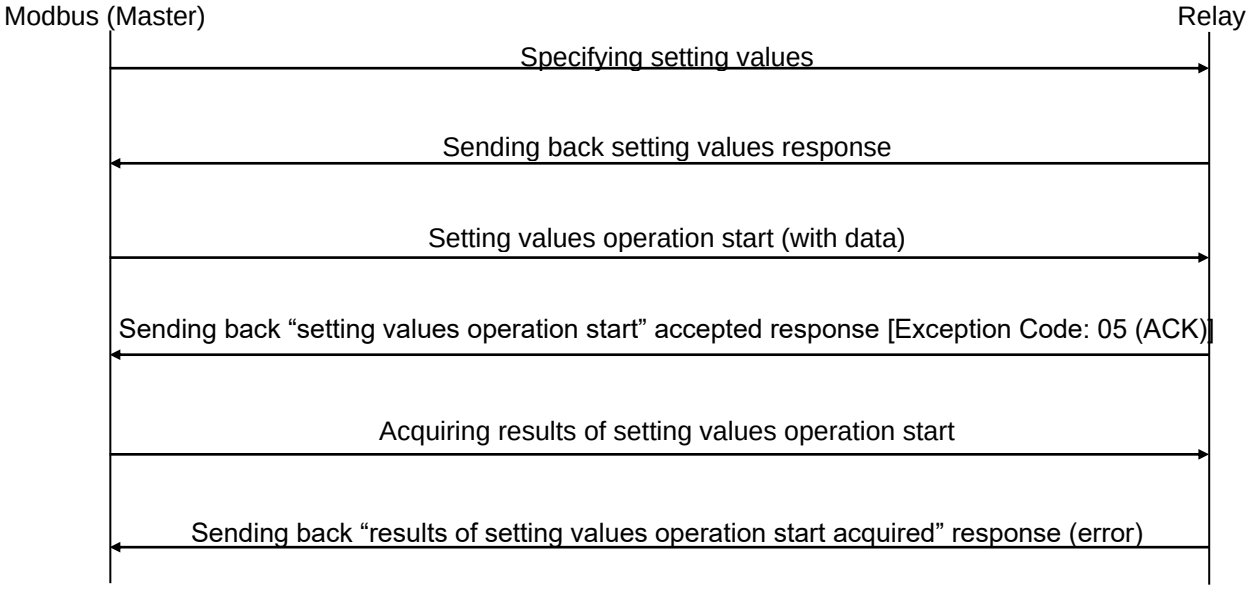

*1: For information about timeout, see Section 2.8.

d. In the case where the Relay receives another request after the receipt of “setting values operation start (with data)” and before the completion of the setting values write process

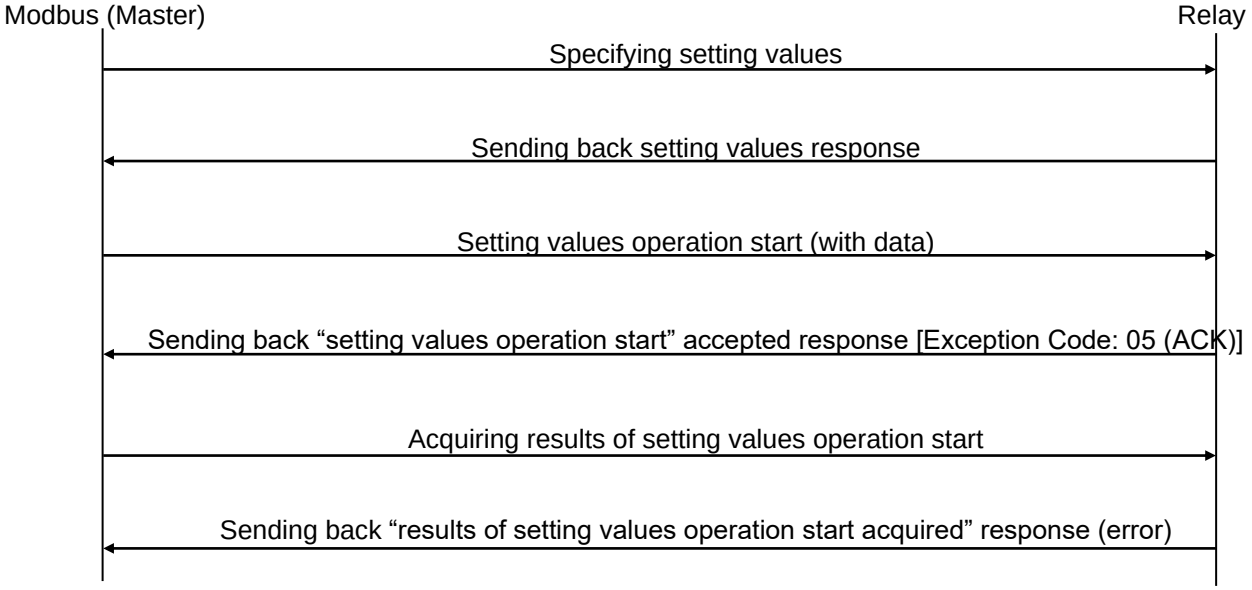



*1: For information about timeout, see Section 2.8.

e. In the case where address designated along with “setting values operation start (with data)” message falls outside the prescribed range




f. In the case where data specified along with “setting values operation start (with data)” message is invalid (falling outside the upper and lower limits or the like)



[3] Data Format

a. For protective elements (settings)

| Modbus address | Item | Data contents (16 bits) |
|---|---|---|
| 40001 - 40256 | Specifying/acquiring Group 1 setting values | Magnification equal to actual setting value x an integral number<br>(See the Address Map.) |
| 40501 - 40756 | Specifying/acquiring Group 2 setting values | Magnification equal to actual setting value x an integral number<br>(See the Address Map.) |

b. For protective elements (operation start)

| Modbus address | Item | Data contents (16 bits) |
|---|---|---|
| 41001 - 41256 | Group 1 setting values operation start | Magnification equal to actual setting value x an integral number<br>(See the Address Map.) |
| 41501 - 41756 | Group 2 setting values operation start | Magnification equal to actual setting value x an integral number<br>(See the Address Map.) |

c. For common use (settings)

| Modbus address | Item | Data contents (16 bits) |
|---|---|---|
| 42001 | Specifying/acquiring active group setting values | Active group<br>Group 1 or Group 2 |
| 42002 - 42255 | Specifying/acquiring common setting values | Magnification equal to actual setting value x an integral number<br>(See the Address Map.) |

d. For common use (operation start)

| Modbus address | Item | Data contents (16 bits) |
|---|---|---|
| 43001 | Active group operation start | Active group<br>Group 1 or Group 2 |
| 43002 - 43255 | Common setting values operation start | Magnification equal to actual setting value x an integral number<br>(See the Address Map.) |

e. Results of operation start (acquired)

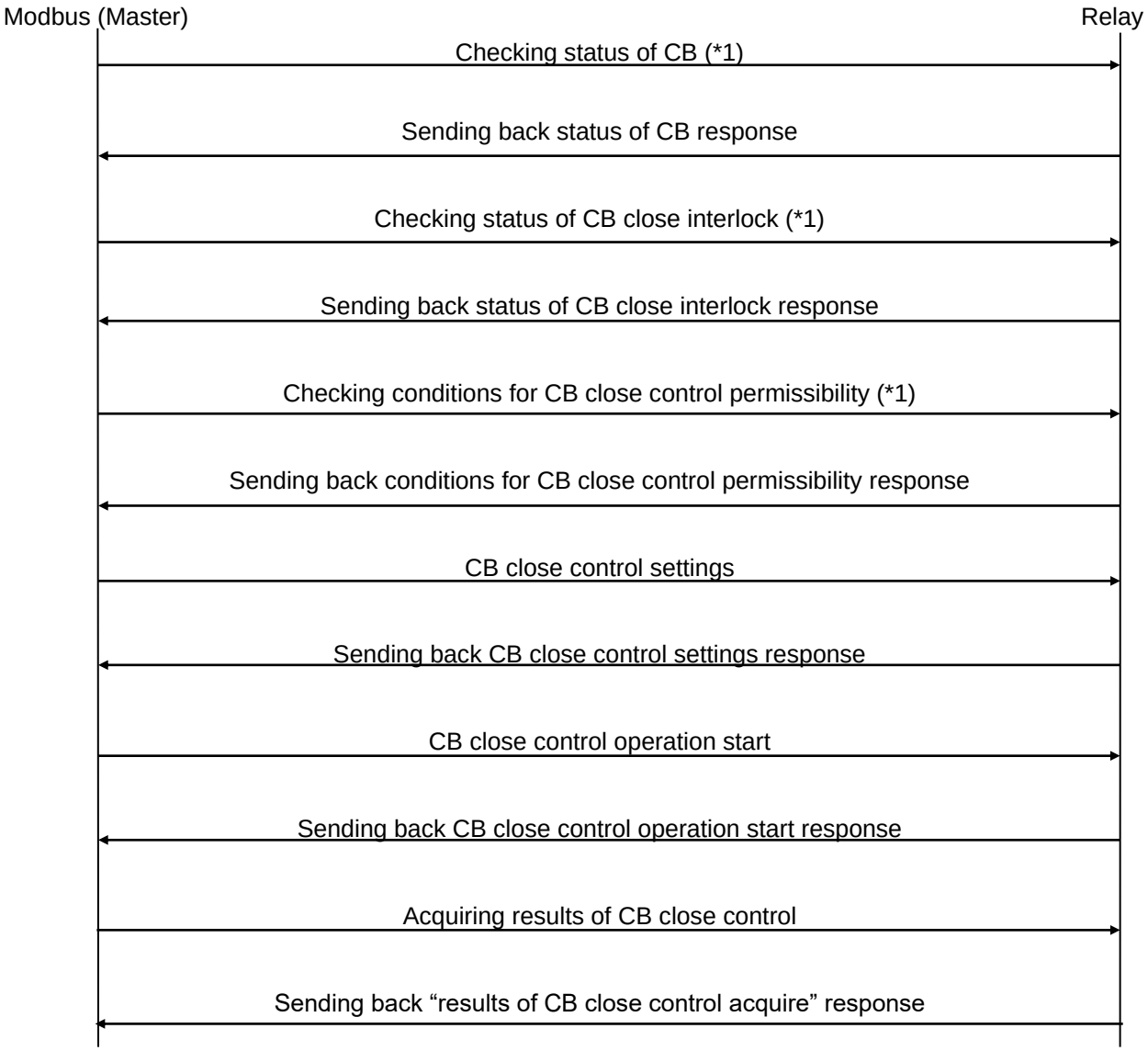
| Modbus address | Item | Data contents (16 bits) |
|---|---|---|
| 39806 | Acquiring results of active group operation start | Unfinished: 0x0000<br>Properly completed: 0x0001<br>Error in range-related step: 0x000A<br>Writing occurring in setting area devoted to a vendor: 0x0014<br>Error in access size: 0x0001E<br>Timeout: 0xAAAA<br>Error: Other than those listed above |
| 39807 | Acquiring results of Group 1 setting values operation start | |
| 39808 | Acquiring results of Group 2 setting values operation start | |
| 39809 | Acquiring results of common setting values operation start | |

## 3.11 CB Control

(1) CB Control

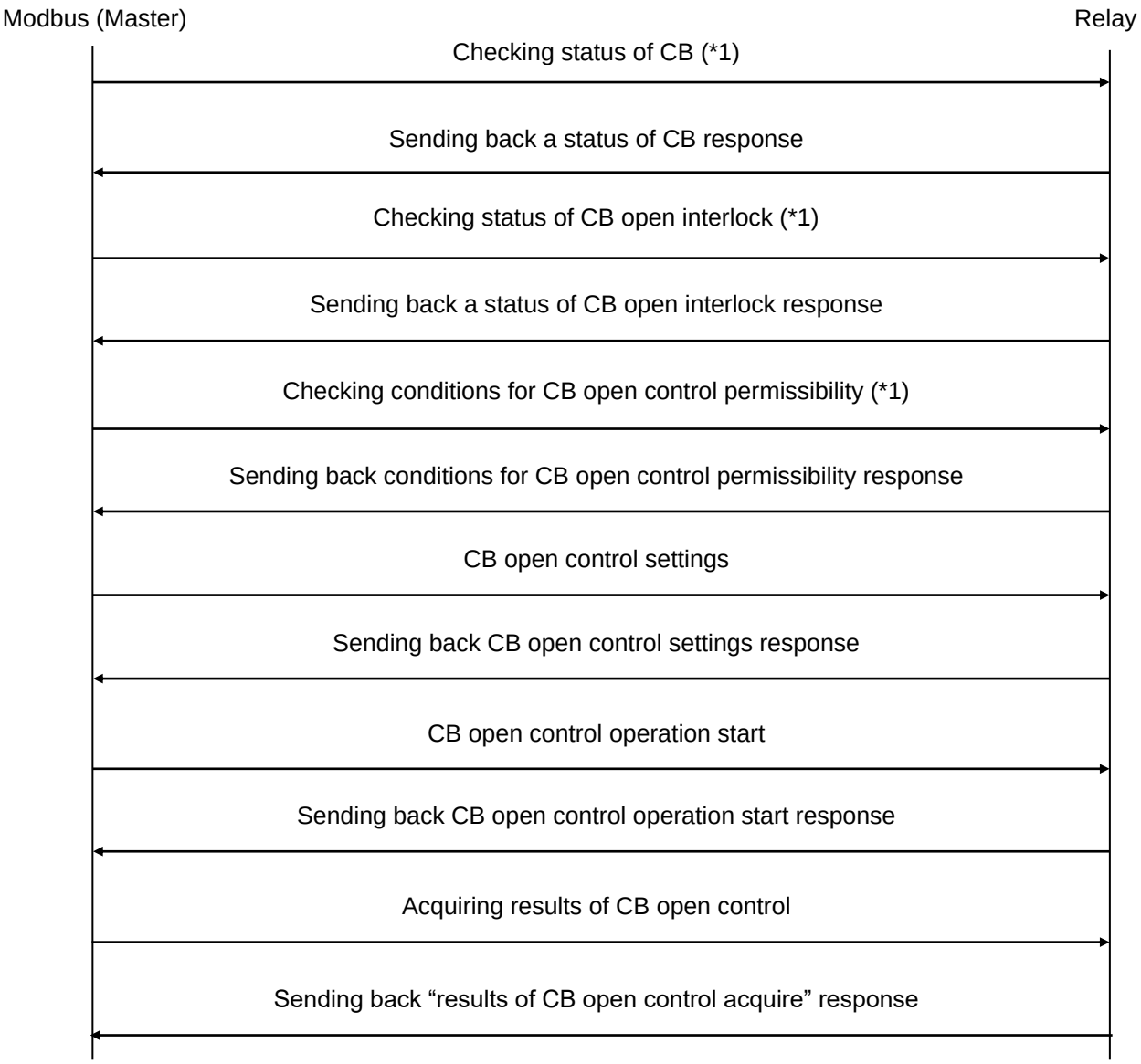
[1] I/F Procedure

a. CB Close Control




*1: Checking the status of CB, checking the status of CB close interlock and checking conditions for CB close control permissibility are not the steps which must always be performed prior to the start of CB close control. Doing away with these steps, however, may result in an inability to have a good grasp of the system condition, possibility causing a failure in the control operations. It is recommended that these checks be performed beforehand.

b. CB Open Control

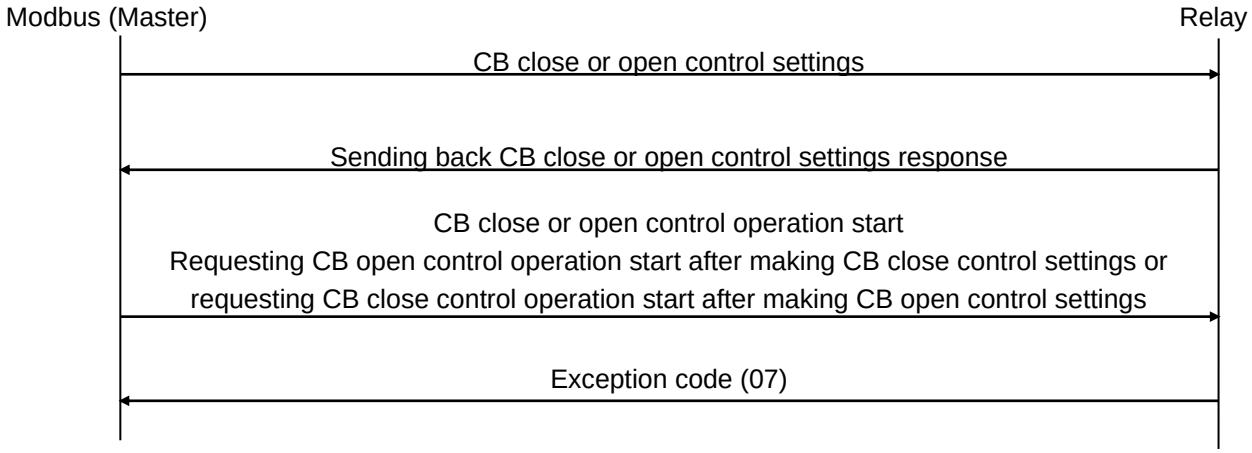



*1: Checking the status of CB, checking the status of CB open interlock and checking conditions for CB open control permissibility are not the steps which must always be performed prior to the start of CB close control. Doing away with these steps, however, may result in an inability to have a good grasp of the system condition, possibly causing failure in the control operation. It is recommended that these checks be performed beforehand.

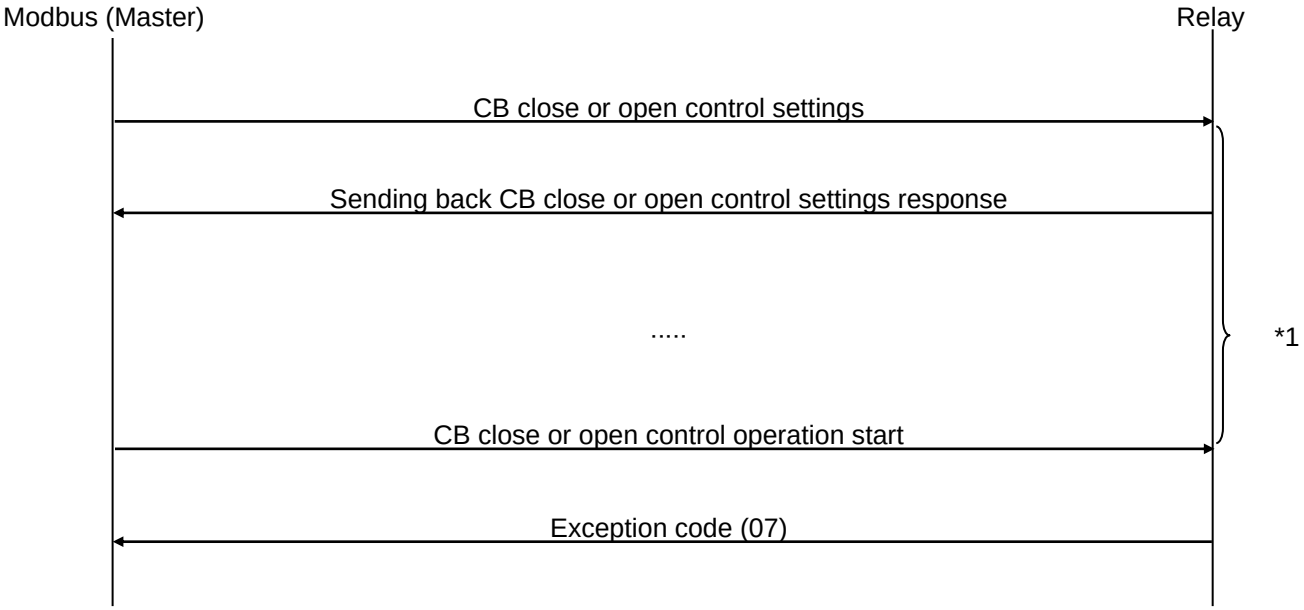
[2] I/F Procedure (Exception Handling)

In a situation shown below, an “error” response will be sent back to the Master.

a. In the case where there is any discrepancy between the contents in the steps “CB control (close/open) settings” and “CB close/open control operation start.”

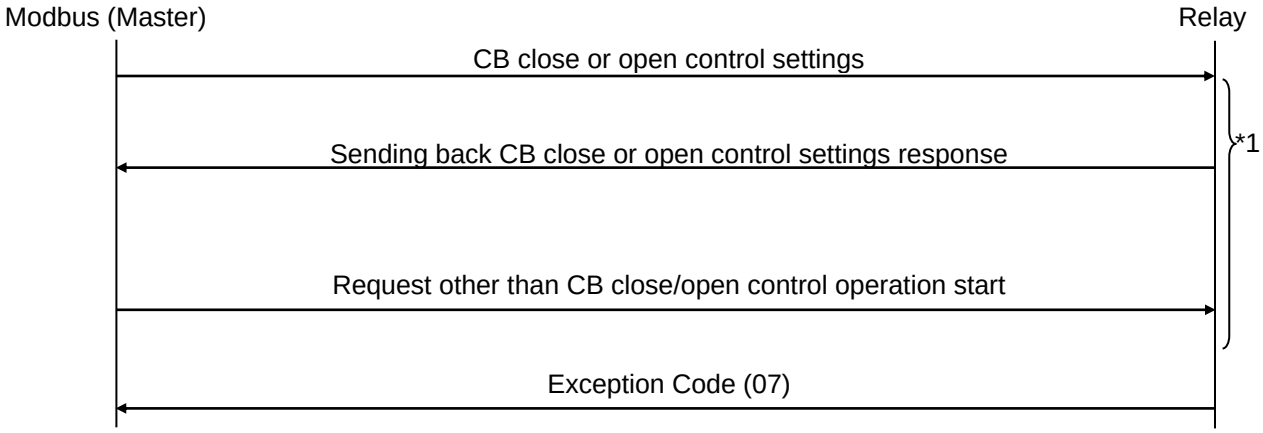



b. In the case of timeout




*1: For information about timeout, see Section 2.8.

c. In the case where Relay receives a request other than “CB close/open control operation start” after it has received “CB close control settings” and before a timeout occurs




*1: For information about timeout, see Section 2.8.

[3] Data Format

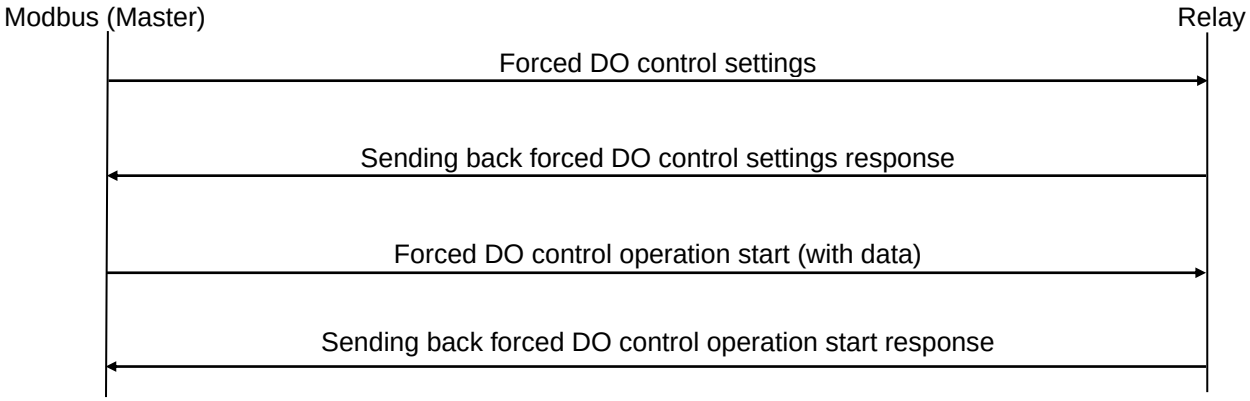
| Modbus address | Item | Data contents (1 bit) |
|---|---|---|
| 0395 | CB close control settings | Setting: 1 |
| 0356 | CB open control settings | |
| 0397 | CB close control operation start | |
| 0398 | CB open control operation start | |

| Modbus address | Item | Data contents (1 bit) |
|---|---|---|
| 39814 | Checking status of CB | CB close: 0x0001, CB open: 0x0000 |
| 39815 | Checking status of CB close interlock | Interlock enabled (control not permitted): 0x0001<br>Interlock disabled (control permitted): 0x0000 |
| 39816 | Checking conditions for CB close control permissibility | Control permitted: 0x0001<br>Control not permitted: 0x0000 |
| 39817 | Checking status of CB open interlock | Interlock enabled (control not permitted): 0x0001<br>Interlock disabled (control permitted): 0x0000 |
| 39818 | Checking conditions for CB open control permissibility | Control permitted: 0x0001<br>Control not permitted: 0x0000 |
| 39819 | Acquiring results of CB close control | Control going on: 0x0000<br>Control completed: 0x0001<br>Control failed (timeout): 0x0002<br>Control failed (equidirectional control): 0x0003<br>Control failed (interlock not established): 0x0004<br>Control failed (control right denied): 0x0005<br>Control failed (DI being started): 0x0006 |
| 39820 | Acquiring results of CB open control | Control going on: 0x0000<br>Control completed: 0x0001<br>Control failed (timeout): 0x0002<br>Control failed (equidirectional control): 0x0003<br>Control failed (interlock not established): 0x0004<br>Control failed (control right denied): 0x0005<br>Control failed (DI being started): 0x0006 |

## 3.12 Setting Forced DO Control

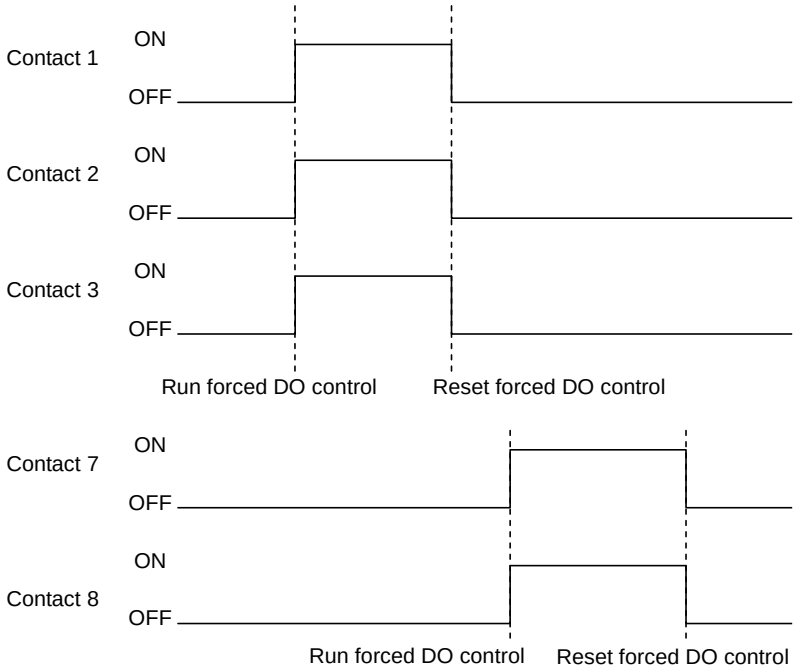
(1) I/F Procedure

[1] I/F Procedure




Forced DO control settings: (1) – ON, (0) – OFF

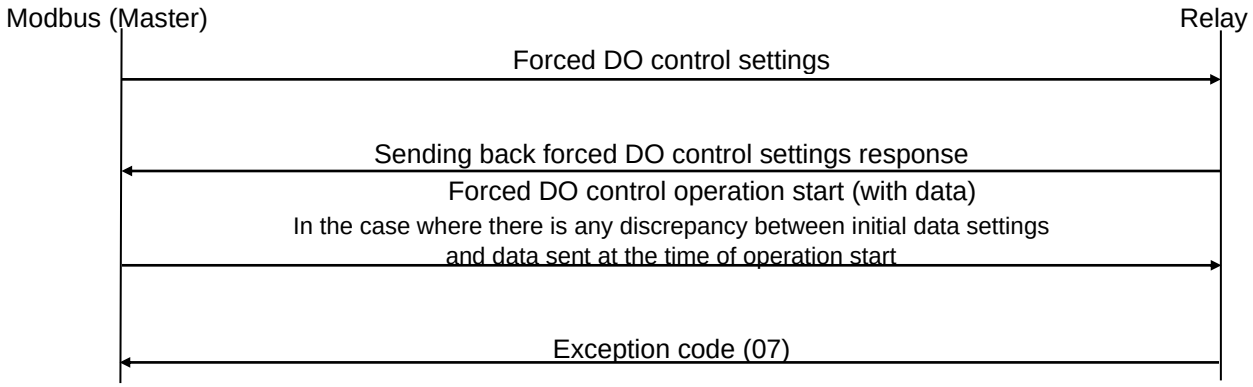
**<CAUTION>**
**Reset is achieved by a one-shot timer the setting for which is made from the PC-HMI.**
**To continue with the subsequent forced DO control session, do so after resetting the contacts which were subjected to the preceding one.**



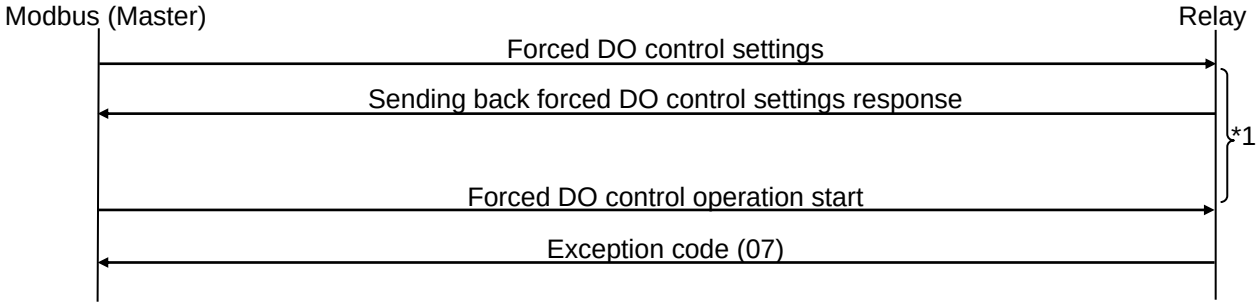
[2] I/F Procedure (Exception Handling)

In a situation shown below, an “error” response will be sent back to the Master.

a. In the case where there is any discrepancy between the contents in the steps “Forced DO control settings” and “Forced DO control operation start (with data)”

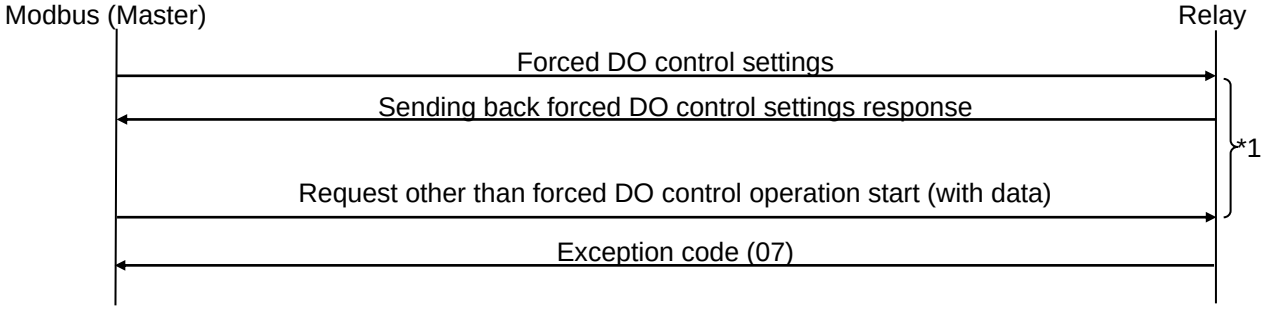



b. In the case of timeout




*1: For information about timeout, see Section 2.8.

c. In the case where Relay receives a request other than “forced DO control operation start” after it has received “Forced DO control settings” and before a timeout occurs




*1: For information about timeout, see Section 2.8.

[3] Data Format

a. Forced DO Control (Settings)

Requests from the Master should be delivered in sets of 16 points.

Leading address comes as an address value corresponding to a multiple of 16 counted from the Modbus address 0001.

Leading address is predetermined. It is not that you can specify 16 points from anywhere you like.

Leading address = 0001 + 16 x i

Number of access points = 16 x j

(i = 0 - 1, j = 1 - 2)

| Modbus address | Item | Data contents (1 bit) |
|---|---|---|
| 0001 | Forced DO control settings No. 1 | Object activated – 1; Other than object activated – 0<br>· For by-model information, see the Address Map. |
| 0002 | Forced DO control settings No. 2 | |
| ... | | |
| 0031 | Forced DO control settings No. 31 | |
| 0032 | Forced DO control settings No. 32 | |

b. Forced DO Control (Operation Start)

Requests from the Master should be delivered in sets of 16 points.

Leading address comes as an address value corresponding to a multiple of 16 counted from the Modbus address 0033

Leading address is predetermined. It is not that you can specify 16 points from anywhere you like.

Leading address = 0033 + 16 x i

Number of access points = 16 x j

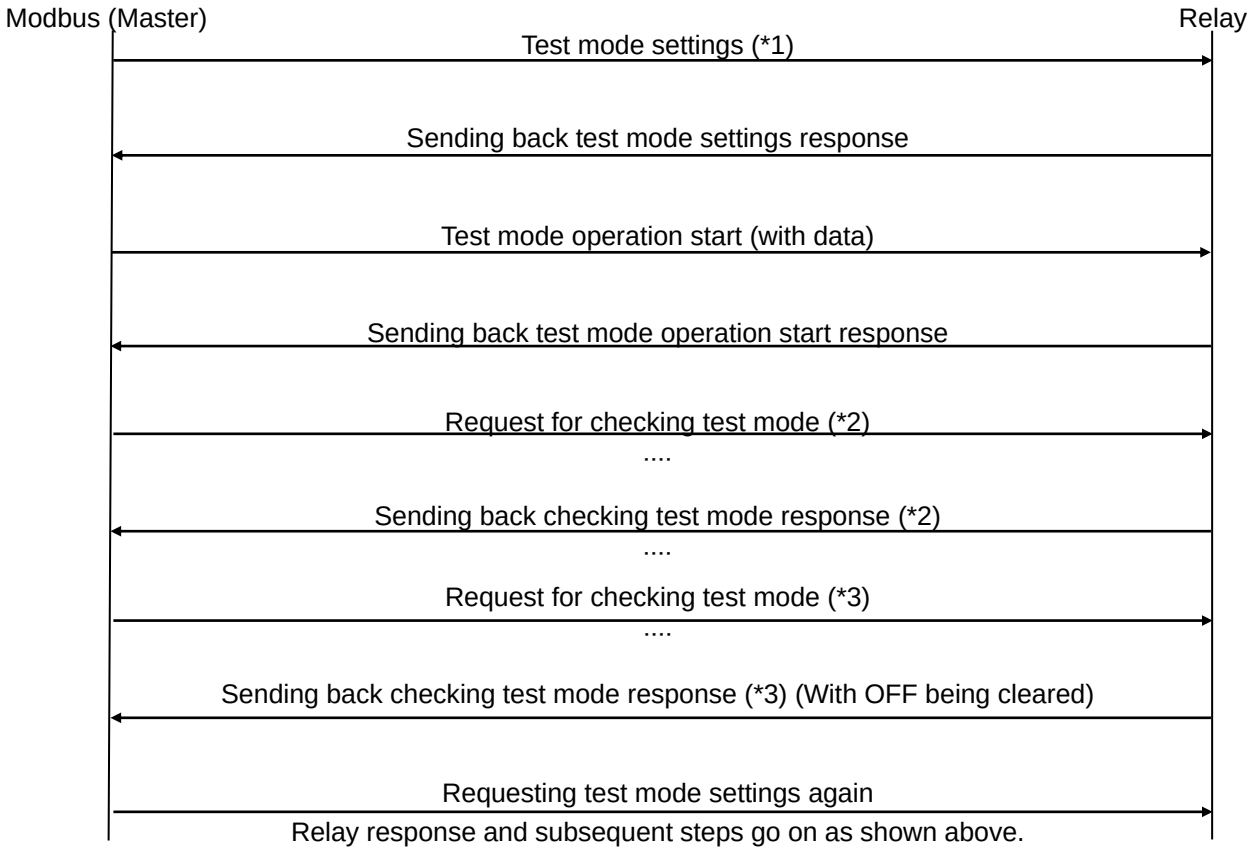
(i = 0 - 1, j = 1 - 2)

| Modbus address | Item | Data contents (1 bit) |
|---|---|---|
| 0033 | Forced DO control operation start No. 1 | Object activated – 1; Other than object activated – 0<br>· For by-model information, see the Address Map. |
| 0034 | Forced DO control operation start No. 2 | |
| ... | | |
| 0063 | Forced DO control operation start No. 31 | |
| 0064 | Forced DO control operation start No. 32 | |

## 3.13 Setting Test Mode

(1) Setting Test Mode

[1] I/F Procedure

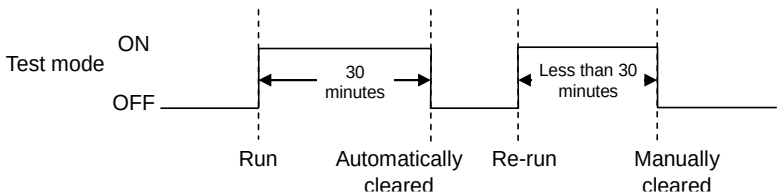



*1: Test mode settings: (1) – ON; (0) – OFF

*2: When a request is made from Modbus, it will be unknown if it is in the test mode. Therefore, it is recommended that request be checked at regular intervals.

*3: Test mode will be automatically cleared if there is no “clear” request for 30 minutes after the test mode has been run.
If the response to a request for the checking of test mode is OFF (clear), make test mode settings again from Master.

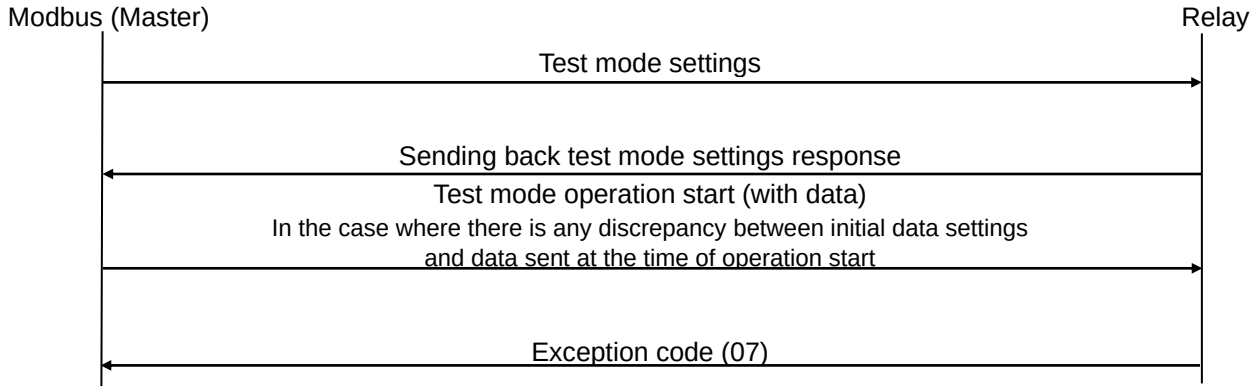
**<CAUTION>**
**Test mode which is placed into ON (run) state from Modbus will be automatically cleared if there is no “re-run” or “clear” request for 30 minutes. However, you must always perform “OFF (clear)” operation from Modbus.**



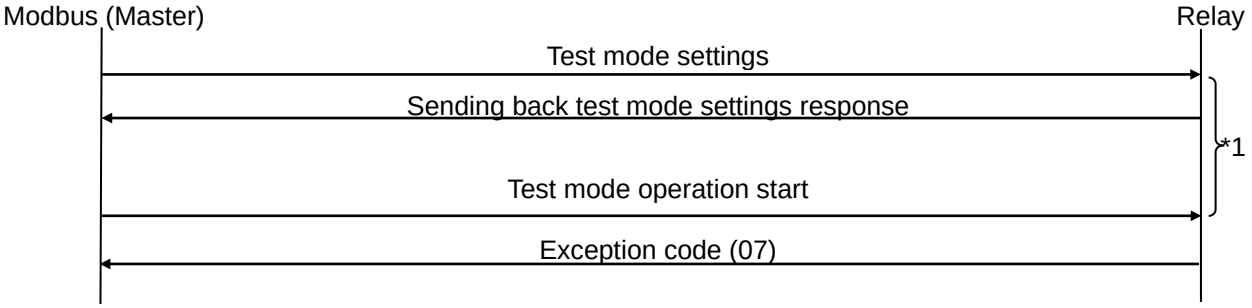
[2] I/F Procedure (Exception Handling)

In a situation shown below, an “error” response will be sent back to the Master.

a. In the case where there is any discrepancy between the contents in the steps “Test mode settings” and “Test mode operation start (with data).”

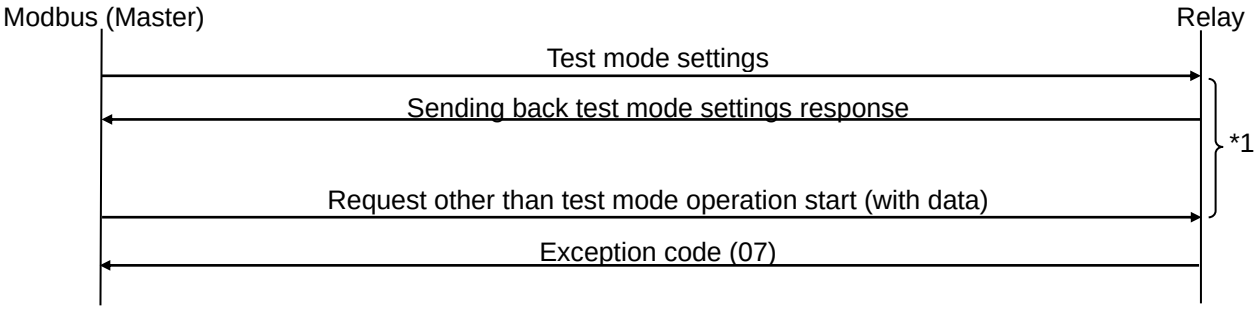



b. In the case of timeout




*1: For information about timeout, see Section 2.8.

c. In the case where Relay receives a request other than “test mode operation start (with data)” after it has received “test mode settings” and before a timeout occurs




*1: For information about timeout, see Section 2.8.

[3] Data Format

a. Test Mode (Settings)

Requests from the Master should be delivered in sets of 16 points.
Leading address comes as an address value corresponding to a multiple of 16 counted from the Modbus address 0065.
Leading address is predetermined. It is not that you can specify 16 points from anywhere you like.

Leading address = 0065 + 16 x i
Number of access points = 16 x j
(i = 0 - 3, j = 1 - 4)

| Modbus address | Item | Data contents (1 bit) |
|---|---|---|
| 0065 | Test mode settings No. 1 | Object activated – 1; Other than object activated – 0<br>· For by-model information, see the Address Map. |
| 0066 | Test mode settings No. 2 | |
| ... | | |
| 0127 | Test mode settings No. 63 | |
| 0128 | Forced DO control settings No. 64 | |

b. Test Mode (Operation Start)

Requests from the Master should be delivered in sets of 16 points.
Leading address comes as an address value corresponding to a multiple of 16 counted from the Modbus address 0129.
Leading address is predetermined. It is not that you can specify 16 points from anywhere you like.

Leading address = 0129 + 16 x i
Number of access points = 16 x j
(i = 0 - 3, j = 1 - 4)

| Modbus address | Item | Data contents (1 bit) |
|---|---|---|
| 0129 | Test mode operation start No. 1 | Object activated – 1; Other than object activated – 0<br>· For by-model information, see the Address Map. |
| 0130 | Test mode operation start No. 2 | |
| ... | | |
| 0191 | Test mode operation start No. 63 | |
| 0192 | Forced DO control operation start No. 64 | |

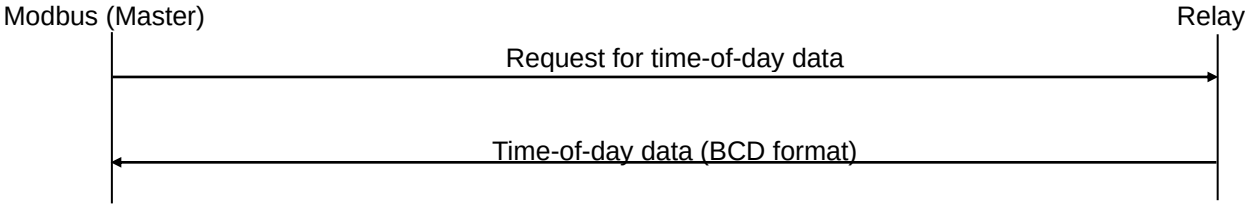
c. Checking Test Mode

| Modbus address | Item | Data contents (1 bit) |
|---|---|---|
| 39821 | Checking test mode | Normal operation: 0x0000; test mode: 0x0001 |
| 39822 | Checking test mode setting personnel | Normal operation: 0x0000; front panel: 0x0001<br>PC-HMI – 0x0002; Modbus: 0x0003 |

## 3.14 Acquiring/Setting Time of Day

(1) Acquiring Time of Day

[1] I/F Procedure



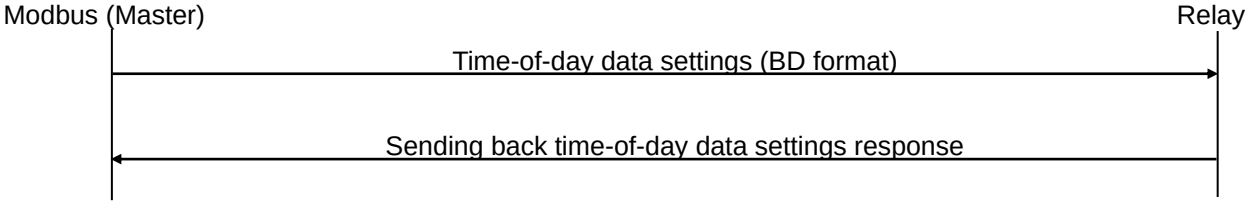

[2] Data Format

Request from the Master should be delivered by lumping together Modbus addresses 44001 through 44005.

| Modbus address | Item | Data contents (1 bit) |
|---|---|---|
| 44001 | Time of day [BCD year, month, day (H)] | 1970 - 2069, January 1 - December 31 |
| 44002 | Time of day [BCD year, month, day (L)] | |
| 44003 | Time of day [BCD hour, minute, second (H)] | 0 hour 0 minute 0 second - 23 hours 59 minutes 59 seconds |
| 44004 | Time of day [BCD hour, minute, second (L)] | |
| 44005 | Time type | 1: IRIG-B, 2: local, 5: error |

(2) Setting Time of Day

[1] I/F Procedure




[2] Data Format

Request from the Master should be delivered by lumping together Modbus addresses 44001 through 44004.

| Modbus address | Item | Data contents (1 bit) |
|---|---|---|
| 44001 | Time of day [BCD year, month, day (H)] | 1970 - 2069, January 1 - December 31 |
| 44002 | Time of day [BCD year, month, day (L)] | |
| 44003 | Time of day [BCID hour, minute, second (H)] | 0 hour 0 minute 0 second - 23 hours 59 minutes 59 seconds |
| 44004 | Time of day [BCID hour, minute, second (L)] | |

- The MELPRO-D Series relay is provided with a time function. Unless its time synchronization capability is actuated, however, the relay could develop time-related errors. To avoid this, you should check and correct the relay for proper time at regular intervals.
- Power supply compensation for the time function is 72 hours. Therefore, if the relay's control supply is left In OFF state for more than 72 hours after any time correction operation, corrected time will be discarded and the time running within the relay when the control supply is turned on again will be the one which was set before the relay left the factory. In this case, time correction operation must be repeated.