

Contents

1. INTRODUCTION.....2

2. HARDWARE SPECIFICATIONS.....3

2.1 GENERAL DESCRIPTIONS 3

2.2 COMMUNICATIONS 4

2.3 INSTALLATION..... 5

2.4 FRONT & INSIDE VIEW 6

2.5 TERMINAL CONNECTION..... 6

2.6 CONNECTION EXAMPLE: HOW TO CONNECT R3 AND R5 SERIES 6

3. MODBUS FUNCTIONS7

3.1 SUPPORTED COMMANDS 7

3.2 CACHE FUNCTION 8

3.3 PC CONFIGURATION 9

3.4 MODBUS/TCP & MODBUS RTU 11

4. VERSION HISTORY 12

4.1 VER.1.03 12

4.2 VER.1.05 12

1. INTRODUCTION

Thank you for choosing us. Before use, please check contents of the package you received as outlined below. If you have any problems or questions with the product, please contact our sales office or representatives. This instruction manual describes necessary points of caution when you use the model 72EM2-M4 Ethernet Communication Adaptor for PC Recorder, including installation, connection and configuration procedures.

Package includes:

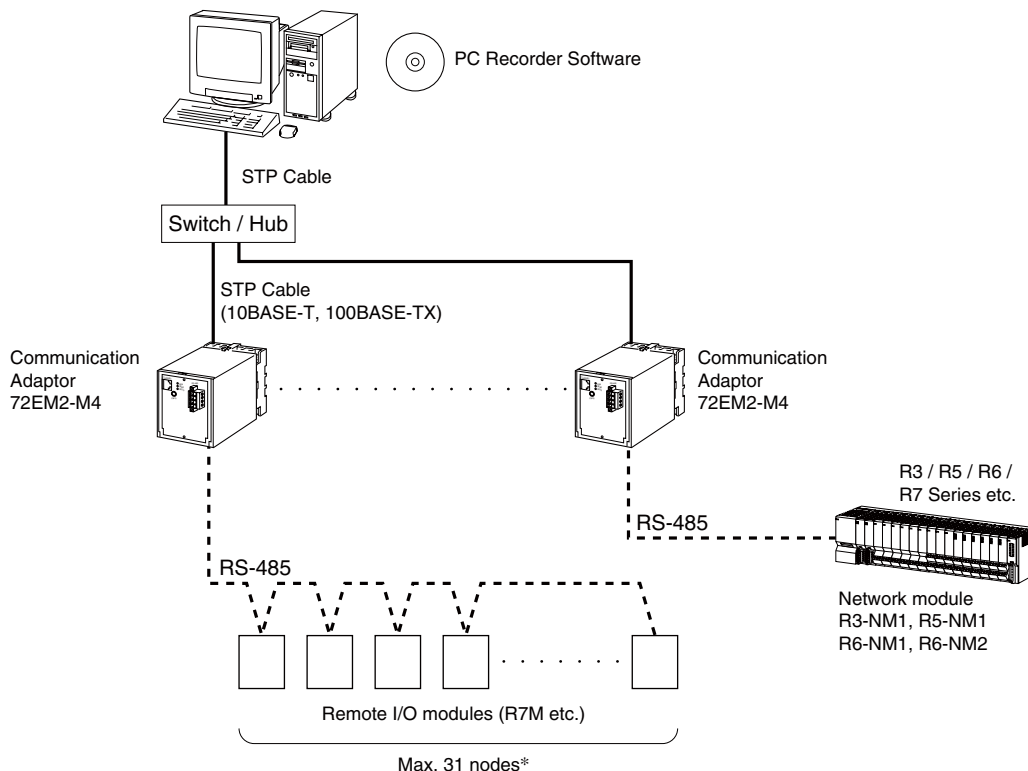
Ethernet Communication Adaptor (1)

2. HARDWARE SPECIFICATIONS

2.1 GENERAL DESCRIPTIONS

The model 72EM2-M4 is a bidirectional protocol converter for Modbus/TCP (Ethernet) and Modbus RTU (RS-485). Fast response time can be achieved thanks to the Cache functions.

Typical system configuration is shown in the figure below.



* The number of nodes actually connected is limited by setting range of the module.

GENERAL SPECIFICATIONS

Construction: Plug-in

Connection

Ethernet: RJ-45 modular jack

RS-485: Euro type connector terminal

PWB connector: MSTB2.5/4-GF-5.08AU

Cable connector: MSTB2.5/4-STF-5.08AU
(Applicable wire size: 0.2 - 2.5 mm², stripped length 7 mm)

Recommended solderless terminal

AI0.25-6BU 0.25 mm² (Phoenix Contact)

AI0.34-6TQ 0.34 mm² (Phoenix Contact)

AI0.5-6WH 0.5 mm² (Phoenix Contact)

AI0.75-6GY 0.75 mm² (Phoenix Contact)

AI1-6RD 1.0 mm² (Phoenix Contact)

AI1,5-6BK 1.5 mm² (Phoenix Contact)

Power input: M3.5 screw terminal

Screw terminal: Chromated steel (standard) or stainless

Housing material:	Flame-resistant resin (black)
Isolation:	Ethernet to RS-485 to FG to power
Modbus RTU nodes:	Max. 31
RUN indicator:	Green LED light flashes in normal operating conditions in 1-sec. cycles; 2-sec. cycles when configuring the unit.
SEND indicator:	Green LED light turns on when sending data to Ethernet.
FIELD indicator:	Green LED light turns on when sending data to RS-485.

PERFORMANCE

Insulation resistance:	≥100MΩ with 500V DC (Ethernet to RS-485 to FG to power)
Dielectric strength:	2000V AC @1 minute (Ethernet or FG to RS-485 to power) 500V AC @1 minute (Ethernet to FG)

2.2 COMMUNICATIONS

ETHERNET

Standard:	IEEE 802.3u
Protocol:	TCP/IP (compatible to Modbus/TCP Standard by Schneider Automation)
Transmission speed:	10M or 100M bps (Auto Negotiation) selectable via PC Configurator browsed on the Internet. Refer to 3.3.
Transmission media:	10BASE-T (STP cable; category 5) 100BASE-TX (STP cable; category 5e)
Number of connections:	8
IP address:	Set via PC Configurator; factory default set to 192.168.0.1. Refer to 3.3.
Port No.:	502 (fixed)
Maximum segment length:	100 meters

RS-485

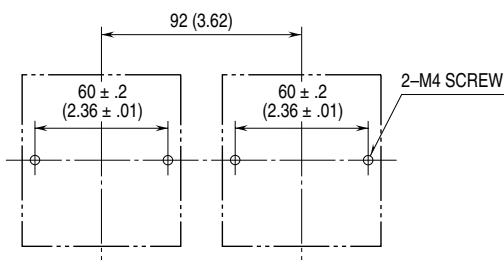
Standard:	Conforms to RS-485, EIA
Protocol:	Modbus RTU, Half-duplex, asynchronous, no procedure
Baud rate:	4.8k, 9.6k, 19.2k or 38.4k bps selectable via PC Configurator; factory default set to 38.4 kbps. Refer to 3.3.
Start/Stop bit:	1 bit
Data bit:	8 bits
Parity:	Odd
Response timeout:	10 – 10000 msec. (configured by PC)
Transmission distance:	500 meters max.
Transmission media:	Shielded twisted-pair cable (CPEV-S 0.9 dia.)

2.3 INSTALLATION

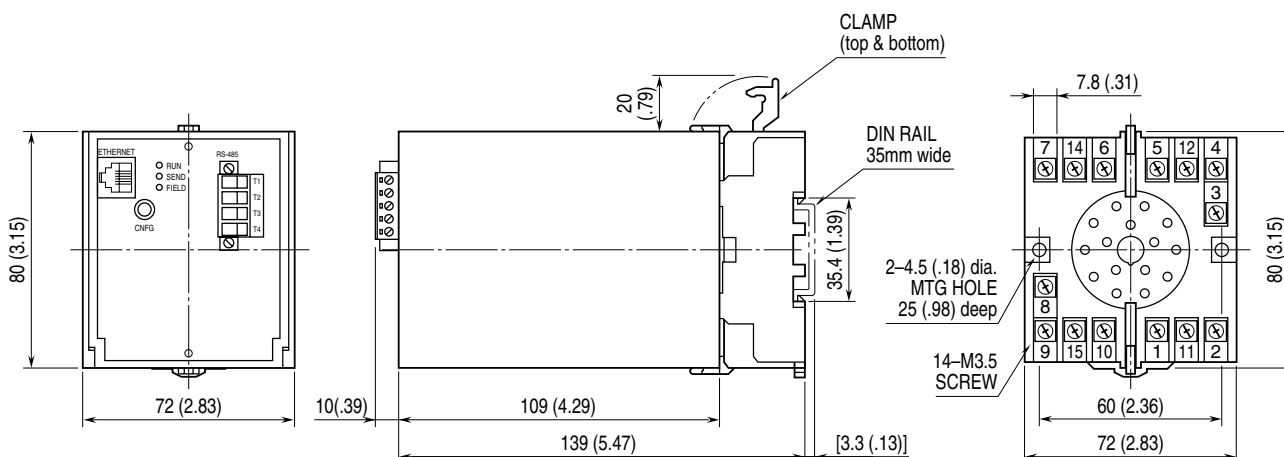
INSTALLATION SPECIFICATIONS

- Power input: Operational voltage range 85 – 264V AC, 47 – 66 Hz, approx. 10VA
- Operating temperature: -5 to +55°C (23 to +131°F)
- Operating humidity: 20 to 70% RH (non-condensing)
- Mounting: Surface or DIN rail
- Dimensions: W72×H80×D149 mm (2.83"×3.15"×5.87")
- Weight: 450 g (0.99 lbs)

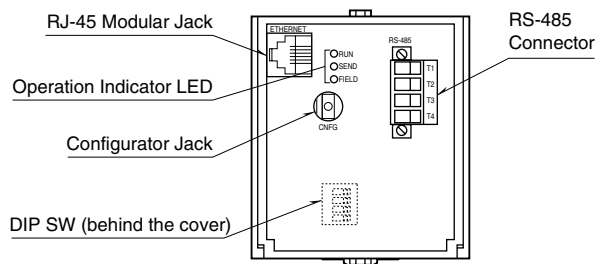
MOUNTING REQUIREMENTS mm (inch)



EXTERNAL DIMENSIONS mm (inch)



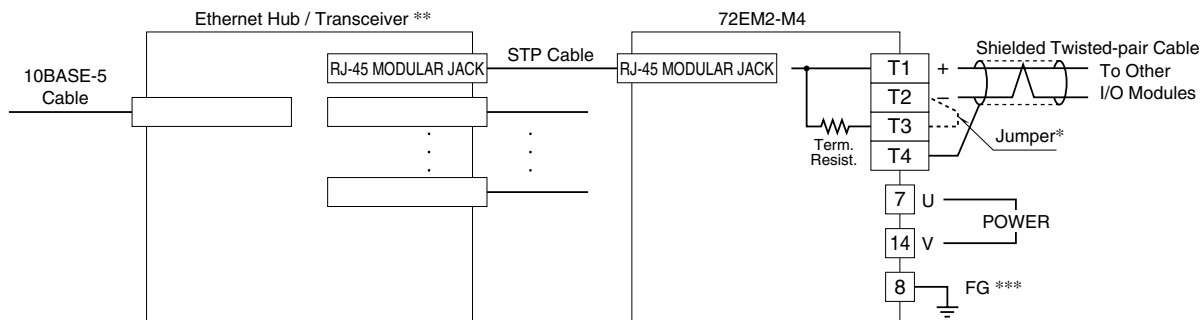
2.4 FRONT & INSIDE VIEW



• DIP SW Setting

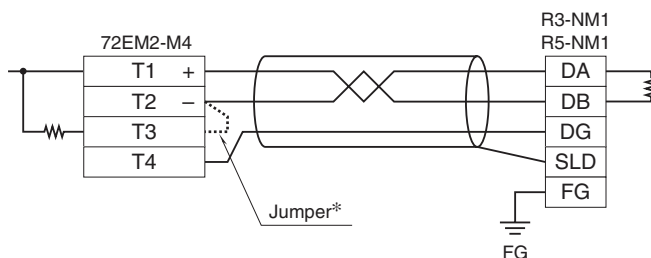
DIP SW	OFF	ON	Setting
1	OFF	ON	1 : IP Address ON Setting via the configurator OFF Reset to factory default (192.168.0.1)
2	ON	ON	2 : Not Used (Always ON)
3	ON	ON	3 : Not Used (Always ON)
4	ON	ON	4 : Maintenance (Stop Output) ON Normal operation OFF Stop output (Modbus function 05, 06, 15, 16)

2.5 TERMINAL CONNECTION



- * When the 72EM2 unit is located at an end of transmission line via twisted-pair cable (= when there is no cross wiring), close across the terminal 2 – 11 with the jumper attached to the product. Remove the jumper for all other units.
- ** Install the 72EM2 and the Ethernet Hub/Transceiver inside the same panel. In order to extend outside the panel, use a 10BASE-5 cable.
- *** Ground inside the same panel where the 72EM2 is installed.

2.6 CONNECTION EXAMPLE: HOW TO CONNECT R3 AND R5 SERIES



- *Refer to * in sec.2.5
- *For other models, refer to each specification sheet and manual.

3. MODBUS FUNCTIONS

3.1 SUPPORTED COMMANDS

The following commands are supported with the 72EM2-M4.

- Read Coil Status (01)
- Read Input Status (02)
- Read Holding Registers (03)
- Read Input Registers (04)
- Force Single Coil (05)
- Preset Single Register (06)
- Diagnostics (08)
- Fetch Comm. Event Counter (11)
- Fetch Comm. Event Log (12)
- Force Multiple Coils (15)
- Preset Multiple Registers (16)
- Report Slave ID (17)

For detailed explanations on the Modbus Function Commands, refer to the Modbus Protocol Reference Guide (EM-5650).

3.2 CACHE FUNCTION

Fast response time can be achieved with the Cache function.

The 72EM2-M4 regularly communicates with the client (RS-485) I/O modules regardless of requests from the host (Ethernet) and stores data at its Cache area. Whenever a query is received from the host, the 72EM2-M4 sends data stored in the Cache without loss of time to scan the client every time.

For example, the response times required for a query command 'Read Input Status' for one contact signal sent in 1-sec scan cycle to be responded at the host are as follows with or without the Cache: (Assume no collision on the Ethernet.)

With Cache	Approx. 5 milliseconds
Without Cache	Approx. 50 milliseconds

The response time depends upon number of queries and scan cycle.

The following commands are supported for Cache function.

- Read Coil Status (01)
- Read Input Status (02)
- Read Holding Registers (03)
- Read Input Registers (04)

Up to 100 Cache areas (100 queries of the commands supported for Cache) are usable.

Each Cache is managed with Slave address, Function code, Begin address and Register number.

One Cache area is shared by identical queries. If one or more of the above differs, another Cache area is assigned.

When the number of Cache areas reaches 100, following queries will be handled as normal queries without Cache function.

If no query is sent from the host for longer than 10 seconds, the Cache is cancelled.

If data received from the client is in error for three (3) times in series, the Cache is cancelled.

3.3 PC CONFIGURATION

The PC Configurator is used to set/change the IP Address, Subnet Mask, Default Gateway, Baud Rate, etc. The PC must have a web browser with the TCP/IP protocol installed.

Operation checked browser

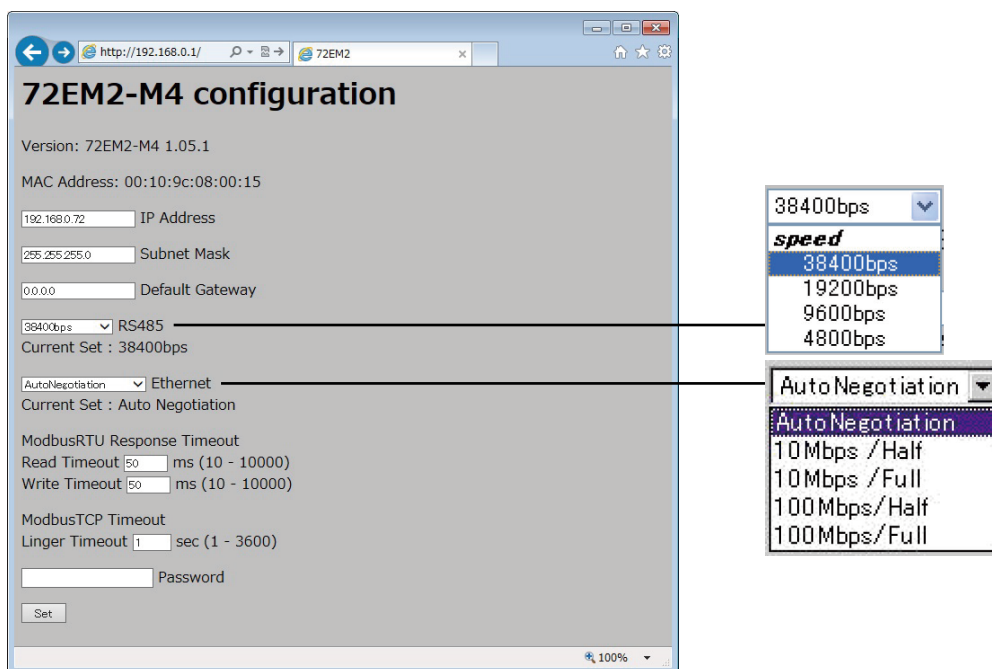
- Internet Explorer 6.0 or later
- Google Chrome 92
- Microsoft Edge 92

(1) Start up the I. E. and enter the address of the 72EM2-M4.

If you have forgotten the preset address or when you are to set your own address for the first time since the unit is commissioned, reset the IP address to the factory default (192.168.0.1) and enter these numbers.

In order to reset the IP address, access the DIP switch behind the front panel and turn the SW1 to OFF and restart the 72EM2-M4.

(2) The 72EM2-M4 Configuration window appears on the screen.



IP Address: 0. 0. 0. 0 through 255.255.255.255, decimal

Subnet Mask: 0. 0. 0. 0 through 255.255.255.255, decimal

Default Gateway: 0. 0. 0. 0 through 255.255.255.255, decimal

RS-485: Pull down the menu and specify a baud rate, either 38400, 19200, 9600 or 4800 bps.

Ethernet: Pull down the menu and choose either Auto Negotiation, or 10 Mbps or 100 Mbps, and the half-duplex or the full-duplex transmission. Auto Negotiation is used to detect Ethernet transmission speed automatically. In order to use this function, the corresponding Ethernet switch (hub) must have the same function.

ModbusRTU Response Timeout: Specify in 10 ms. increments. If you have set, for example, to 56 ms, 50 ms is actually set.

Read Timeout: 10 through 10000 ms

Write Timeout: 10 through 10000 ms (Function code 05, 06, 15 and 16)

ModbusTCP Timeout: Specify timeout for Modbus/TCP.

Linger Timeout: Specify the time to terminate the connection when the query doesn't come from a host. (1 – 3600 sec.)

Password: Enter "72EM2" to enable any setting change.

(3) Press 'Set' button.

When the setting is complete, a message 'Please reset the power supply to the 72EM2.' appears on the screen. Turn the power supply off and on to restart the 72EM2-M4 to apply the change.

If the 72EM2-M4 is unable to set the new configuration, the following messages may appear.

Invalid value: Values set in 'IP Address,' 'Subnet Mask' and/or 'Default Gateway' are incorrect.

Wrong password: Wrong password has been entered.

Internal error 1: An internal error of the 72EM2-M4. Please consult us.

Memory error: The new configuration has not been written in the memory. Please consult us.

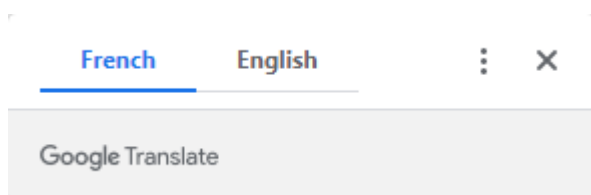
Invalid value 'Read Timeout': Values set in 'Read Timeout' is incorrect.

Invalid value 'Write Timeout': Values set in 'Write Timeout' is incorrect.

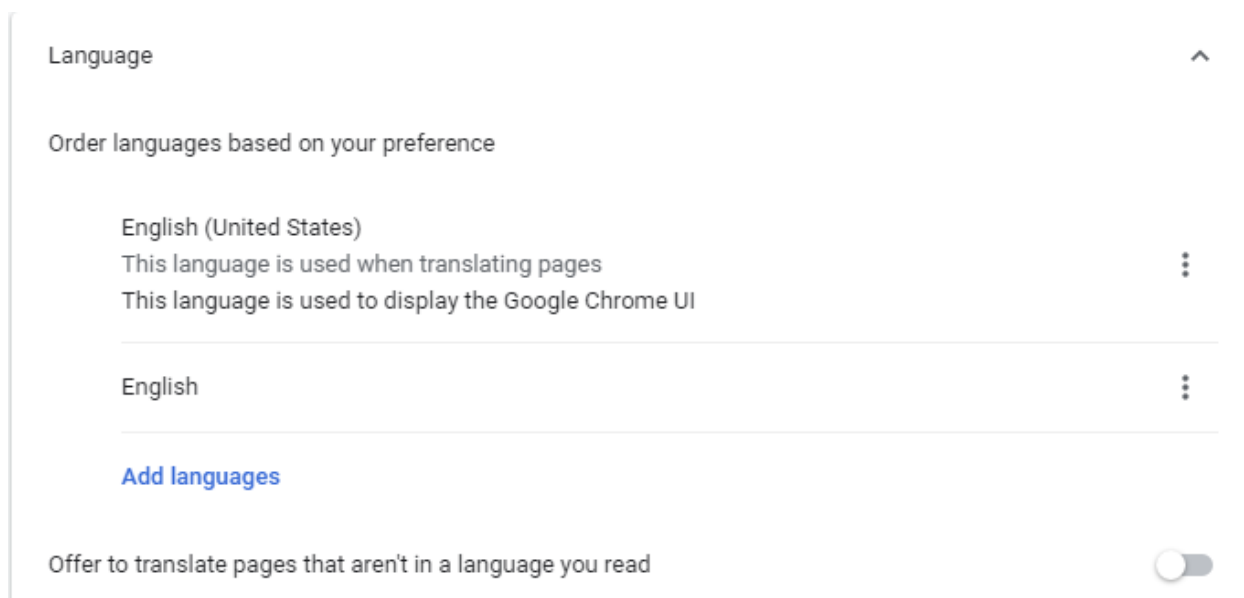
Invalid value 'Linger Timeout': Value set in 'Linger Timeout' is incorrect.

Note:

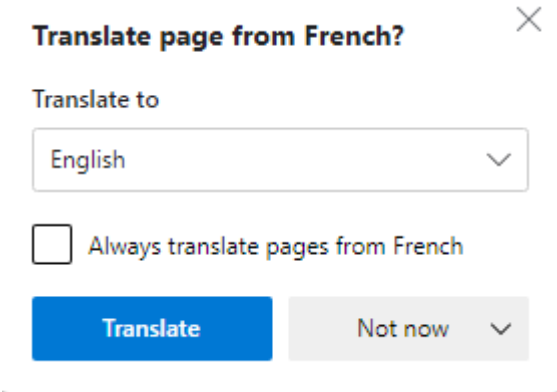
The following pop-up may appears when opening the screen with Google Chrome.



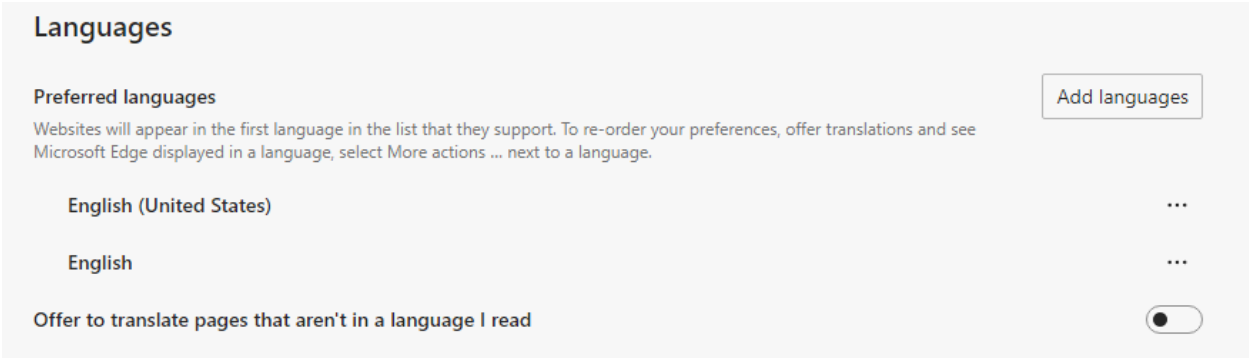
Disable "Offer to translate pages that aren't in a language you read" in Setting -> advanced -> language.



The following pop-up may appear when opening the screen with Microsoft Edge.



Disable "Offer to translate pages that aren't in a language I read" in Setting -> advanced -> languages.



3.4 MODBUS/TCP & MODBUS RTU

Query and Response message formats are different between Modbus/TCP (Ethernet) and Modbus RTU (RS-485). For detailed explanations, please refer to Modbus Protocol Reference Guide (EM-5650).

For example, when a query is sent to read data addresses 30017 to 30018 at the slave address 1 and '12345678' is stored at these addresses: (hexadecimal)

QUERY

Modbus/TCP	<u>00</u>	<u>01</u>	<u>00</u>	<u>00</u>	<u>00</u>	<u>06</u>	<u>01</u>	<u>04</u>	<u>00</u>	<u>10</u>	<u>00</u>	<u>02</u>		
	(1)	(2)	(3)	(4)	(5)			(6)						
Modbus RTU							<u>01</u>	<u>04</u>	<u>00</u>	<u>10</u>	<u>00</u>	<u>02</u>	<u>70</u>	<u>0E</u>
							(4)	(5)	(6)	(7)				

RESPONSE

Modbus/TCP	<u>00</u>	<u>01</u>	<u>00</u>	<u>00</u>	<u>00</u>	<u>07</u>	<u>01</u>	<u>04</u>	<u>04</u>	<u>12</u>	<u>34</u>	<u>56</u>	<u>78</u>		
	(1)	(2)	(3)	(4)	(5)			(6)							
Modbus RTU							<u>01</u>	<u>04</u>	<u>04</u>	<u>12</u>	<u>34</u>	<u>56</u>	<u>78</u>	<u>80</u>	<u>B0</u>
							(4)	(5)	(6)	(7)					

- (1) Transaction identifier (2 bytes): The value in the query is recopied in the response.
- (2) Protocol identifier (2 bytes): Fixed to zero (0).
- (3) Length (2 bytes): Number of following bytes.
- (4) Unit identifier (1 byte): Modbut RTU slave address.

(5) Function command (1 byte)

(6) Data fields (variable length): Related to the Function Code.

(7) CRC check

(4), (5) and (6) are common to both Modbus/TCP and Modbus RTU.

Six (6) bytes of data precedes with the Modbus/TCP while a CRC follows with the Modbus RTU.

4. VERSION HISTORY

4.1 VER.1.03

1) Baud rate 4800, 9600 bps were added for RS-485.

2) Max. nodes were expanded from 15 to 31 for RS-485.

4.2 VER.1.05

'Linger Timeout' for Modbus/TCP is added.