

## Chapter 8 Modbus Communication

### Chapter 8 Modbus Communication

#### 8.1 Overview

Smart I/O module communication supports modbus through GM3/4/6/7 master module.  
(G3L-CUEA/G4L-CUEA/G6L-CUEC/G7L-CUEC)

This supports ASCII mode that communicates using ASCII (American Standard Code for Information Interchange) data and RTU (Remote Terminal Unit) mode that uses HEX data and the function code used in the modbus is supported by the *Function Block* and only function code 01, 02, 03, 04, 05, 06, 15, 16 are supported.

For further information for the protocol, please refer to 'Modicon Modbus Protocol Reference Guide'.  
(<http://www.modicon.com/techpubs/toc7.html>)

#### 8.2 Communication Specification

##### 1) ASCII Mode

- (1) This communicates using ASCII data.
- (2) Each frame uses ':(Colon) : H3A)' for the header, CRLF(Carriage Return-Line Feed) : HOD HOA) for the tale.
- (3) Max. 1second interval between Characters is allowed.
- (4) It uses LRC to check the error.
- (5) Frame structure (ASCII data)

Classification	Header	Station no.	Function code	Data	LRC	Tale (CR LF)
Size	1 byte	2 byte	2 byte	n byte	2 byte	2 byte

##### 2) RTU Mode

- (1) It uses HEX data to communicate.
- (2) There is no header and tale and it starts from station no.(Address) and ends the frame with CRC.
- (3) It has min. 3.5 Character Time Interval between frames.
- (4) When exceeding more than 1.5 Character Time between Character, please disregard the corresponding frame.
- (5) It uses 16 bit CRC to check the error.
- (6) Frame structure (HEX data)

Classification	Station no.	Function code	Data	CRC
Size	1 byte	1 byte	n byte	2 byte

### Remark

- 1) The size to compose one letter (character) is called '1 character', that is, 1 character is 8bits = 1byte.
- 2) 1 character time means the time to take when sending 1 character.  
Ex.1) 1 character time calculation in communication speed 2,400 bps  
2,400 bps is the speed that takes 1 second to send 2,400 bits. When sending 1 bit,  
 $1(\text{sec}) \div 2,400(\text{bit}) = 0.41(\text{ms})$ .  
Thus, 1 character time is  $0.41(\text{ms}) \times 8(\text{bit}) = 3.28(\text{ms})$ .  
In case of 584, 984A/B/X, the internal processing performs the frame classification using the interval more than 1sec without LRC.

### 3) Station no.(Address) Area

- (1) Smart I/O series supports 0 ~ 31.
- (2) Station 0 uses Broadcast address. Broadcast address is the station no. the slave device except self station no. recognizes and responds, and it does not support in Smart I/O series.

### 4) Function Code Area

- (1) In Smart I/O series, it supports Modicon function code 01, 02, 03, 04, 05, 06, 15, 16 only.
- (2) When the response format is Confirm+ (ACK response), the same function code is used.
- (3) When the response format is Confirm- (NCK response), set the 8<sup>th</sup> bit of function code as '1' and return.

Ex) when function code is 03,

- specify only the function code part as there is a difference in the function code only.

[Request]            0000 0011 (H03)

[Confirm+]           0000 0011 (H03)

[Confirm-]           1000 0011 (H83)

Set the 8<sup>th</sup> bit of frame function code as '1' and return.

### 5) Data Area

- (1) It transmits the data using ASCII (ASCII mode) data or HEX (RTU mode).
- (2) The data structure is changed according to each function code.
- (3) Response frame uses the data area as response data or error code.

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### 6) Error Check (LRC Check/CRC Check) Area

- (1) LRC (Longitudinal Redundancy Check) : this is used in ASCII mode and takes the 2's complement from the sum of frame except the header/the tale and carries out the ASCII conversion.
- (2) CRC (Cyclical Redundancy Check) : this is used in RTU mode and uses 2 bytes of CRC check regulations.

#### Remark

All numeric data uses by mixing the hexadecimal, decimal, binary number. Each number is specified as following example.

The example that decimal number 7, 10 is marked as each number  
 Hexadecimal : H07, H0A or 16#07, 16#0A  
 Decimal : 7, 10  
 Binary : 2#0111, 2#1010

### 7) Function Code Type and Memory Mapping

Code	Function code name	Modicon PLC Data address	Smart I/O Mapping	Remarks
01	Read output contact status (Read Coil Status)	0XXXX(bit-output)	%QX0~%QX31	Bit read
02	Read input contact status (Read Input Status)	1XXXX(bit-input)	%IX0~%IX31	Bit read
03	Read output registers (Read Holding Registers)	4XXXX(word-output)	%QW0~%QW3	Bit read
04	Read input register (Read Input Registers)	3XXXX(word-input)	%IW0~%IW3	Word read
05	Write output contact 1 bit (Force Single Coil)	0XXXX(bit-output)	%QX0~%QX31	Bit write
06	Write output register 1 word (Preset Single Register)	4XXXX(word-output)	%QW0~%QW3	Word write
15	Write output contact continuously (Force Multiple Coils)	0XXXX(bit-output)	%QX0~%QX31	Bit write
16	Write output register continuously (Preset Multiple Register)	4XXXX(word-output)	%QW0~%QW3	Word write

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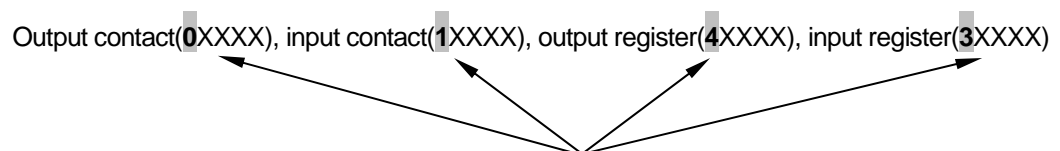
MASTER-K Mapping

Bit area		Word area	
Address	Data area	Address	Data area
H0000	P area	h0000	P area
H1000	M area	H1000	M area
H2000	L area	H2000	L area
H3000	K area	H3000	K area
H4000	F area	H4000	F area
H5000	T area (contact)	H5000	T area (current value)
H6000	C area (contact)	H6000	C area (current value)
		H7000	S area
		H8000, H9000	D area

### 8) Modbus Addressing Regulation

#### (1) GLOFA-GM series

In Smart I/O series, the address in the frame begins from '0' and maps with Modicon data address 1, and 'n'th address of Smart I/O series becomes Modicon address n+1. And in Smart I/O series, it uses only the continuous M area without distinguishing by output contact (0XXXX), input contact (1XXXX), output register (4XXXX), input register (3XXXX). That is, the output contact 1(00001) of Modicon product is indicated as the address '0' of communication frame and the input contact 1(10001) of Modicon product is indicated as the address '0' of communication frame.



Most significant data of data address in Modicon product that distinguishes output contact, input contact, output register, input register.

#### (2) MASTER-K series

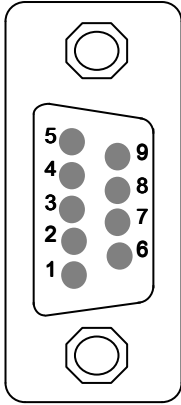
XXXX area of Modicon PLC data address is allocated by the mapping of MASTER-K series. For example, when you try to read M0002 bit of MASTER-K in Modicon PLC, use the function code 01 or 02 and set the data address as H1002. When you try to read D0010 word area, use the function code 03 or 04 and set the address as H800A.

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### 9) Data Size

Smart I/O series supports the data size of 128bytes for ASCII mode and 256bytes for RTU mode and as max. value of Modicon is different according to the model, please refer to 'Modicon Modbus Protocol Reference Guide'.

### 10) Wiring diagram

 Male Type	PIN spec.	Smart I/O (9-PIN)
		1
	2	
	3	
	4	
	5	
	6	
	7	
	8	
	9	

### 8.3 Communication Parameter Setting

#### 8.3.1 GLOFA-GM Series

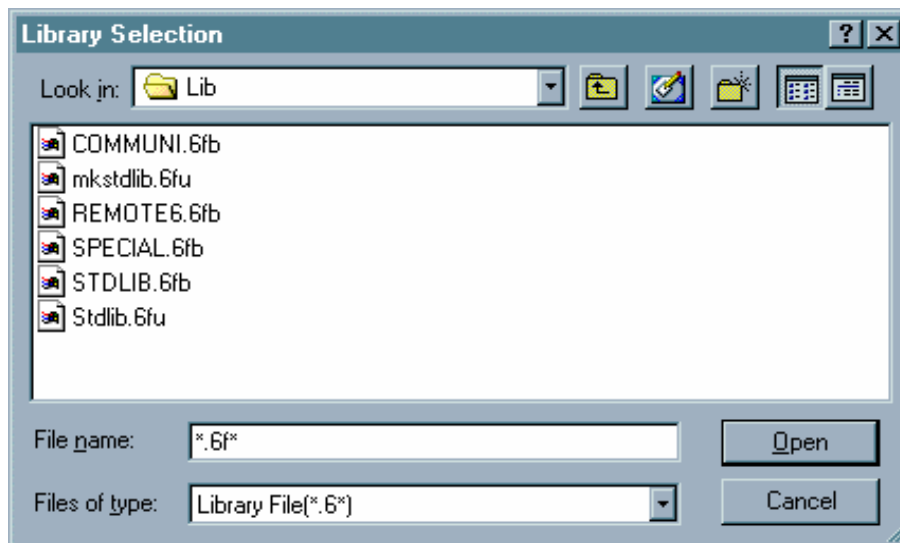
##### 8.3.1.1 In case of GM3/4/6 is the master,

1) Insert communication *Function Block*

When communicating modbus communication with Smart I/O using GM3/4/6 as the master, it is required to insert the following *Function Block* library into GMWIN.

Classification		Corresponding <i>Function Block</i> library	Remarks
GM3	G3L-CUEA	Modbus.3FB	GMWIN Library adding
GM4	G4L-CUEA	Modbus.4FB	
GM6	G6L-CUEA	Modbus.6FB	

(1) Select GMWIN menu [project] → [library insert] and insert the corresponding library per model.



(2) Insert the *Function Block* into GMWIN scan program and set the *Function Block* I/O variable.

For the *Function Block* type and the method to use, please refer to Chapter 8.4. *Function Block*.

- RTU\_WR
- RTU\_RD

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### 8.3.1.2 In case of GM7 is the master,

#### 1) Communication parameter setting

(1) Open the new project file in GMWIN.

- Select 'GM7' as PLC type.
- Create new project file for the master and the slave, respectively.

(2) Select communication parameter from GMWIN parameter and doubleclick and the following figure will appear.

Communication Parameter

Communication Method

Station No. : 0

Baud Rate : 1200

Parity Bit : None

Data Bit : 8

Stop Bit : 1

Communication Channel

RS232C Null Modem or RS422/485

RS232C Modem (Dedicated Line)

RS232C Dial Up Modem

Init. Command :

Protocol and Mode

Timeout in Master Mode : 0 ms

Dedicated

Master

Slave

Read Status of Slave PLC

List

Modbus

Master

Slave

Transmission Mode : ASCII

List

User Defined

Master

Slave

List

FIELDBUS

Master

Slave

List

Ok Cancel Help

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3) Set the contents as follows.

Items	Setting Description
Self station no.	Available to set 1~31 stations. (do not set station 0 as broadcast station no. It may cause the failure.)
Communication speed	Available to set 2400, 4800, 9600, 19200, 38400 bps.
Data bit	Available to set as 7 or 8 bits. ASCII mode : set as 7 bits. RTU mode : set as 8 bits.
Parity bit	Available to set as None, Even, Odd.
Stop bit	Available to set as 1 or 2 bits. In case that the parity bit is set : set as 1 bit. In case that the parity bit is not set : set as 2 bits.
Communication channel	<ul style="list-style-type: none"> <li>• RS-232C null modem or RS422/485 : when communicating using GM7 basic unit and Cnet I/F module (G7L-CUEC).</li> <li>• RS-232C dedicated modem : when communicating by the dedicated modem using Cnet I/F module (G7L-CUEB).</li> <li>• RS-232C dialup modem : when communicating by the general modem connecting with other station by the phone using Cnet I/F module (G7L-CUEB).</li> </ul> <p>Note) RS-232C exclusive modem and RS-232C dialup modem communication is done only by Cnet I/F module (G7L-CUEB) that supports RS-232C but not by Cnet I/F module (G7L-CUEC) that supports RS-422/485.</p>
Time out when setting the master	<ul style="list-style-type: none"> <li>• This is the time to wait the response frame after sending the request frame from GM7 basic unit set as the master.</li> <li>• Default value is 500ms.</li> <li>• When setting, max. sending/receiving period of master PLC should be considered.</li> <li>• If the value smaller than max. sending/receiving period is set, it may cause the communication error.</li> </ul>
Modbus master / slave	If setting as the master, it shall be the subject in the communication system and if setting as the slave, it will reply only according to the request frame of the master.
Transmission mode	Available to select one from ASCII mode or RTU mode.



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### 8.3.2 MASTER-K Series

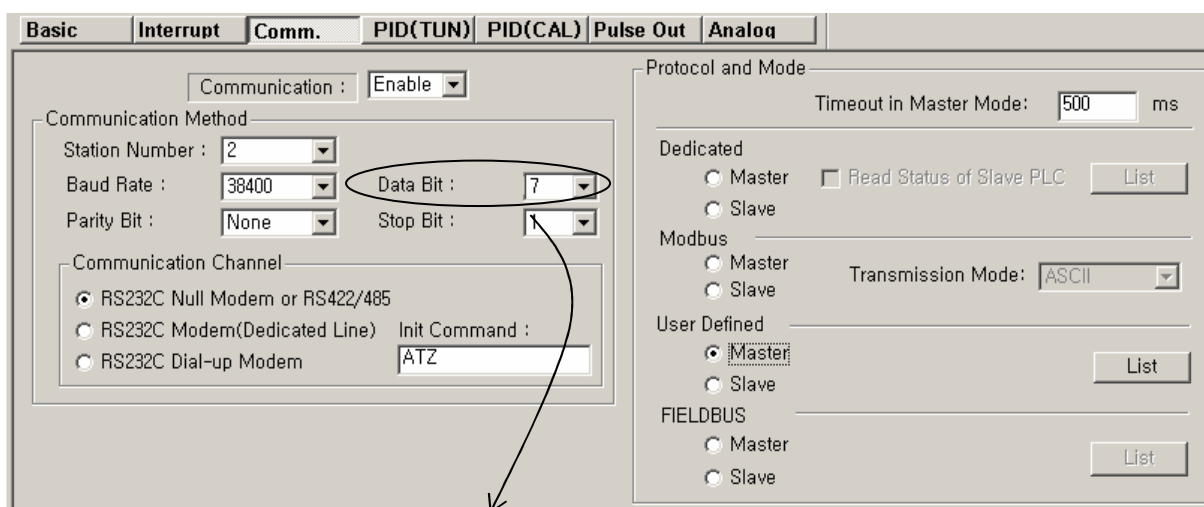
#### 8.3.1.1 K80S modbus communication

##### 1) Communication parameter setting

##### (1) Open new project file in KGLWIN.

- Select MK80S as PLC type.
- Create new project file for the master and the slave respectively.

##### (2) Select communication parameter from KGMWIN parameter and doubleclick, and the following figure will appear.



When transmission mode is  
ASCII mode, set as 7 bits.

Set the contents as follows.

Items	Setting Description
Self station no.	Available to set 1~31 stations. (do not set station 0 as broadcast station no. It may cause the failure.)
Communication speed	Available to set 2400, 4800, 9600, 19200, 38400 bps.
Data bit	Available to set as 7 or 8 bits. ASCII mode : set as 7 bits. RTU mode : set as 8 bits.
Parity bit	Available to set as None, Even, Odd.
Stop bit	Available to set as 1 or 2 bits. When the parity bit is set : set as 1 bit. When the parity bit is not set : set as 2 bits.

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Communication channel	<ul style="list-style-type: none"> <li>• RS-232C null modem or RS-422/485 : when communicating using MK80S basic unit and Cnet I/F module (G7L-CUEC).</li> <li>• RS-232C dedicated modem : when communicating by the dedicated modem using Cnet I/F module (G7L-CUEB).</li> <li>• RS-232C dialup modem : when communicating by the general dialup modem using Cnet I/F module (G7L-CUEB).</li> </ul> <p>Note) RS-232C dedicated modem and RS232C dialup modem communication is done by Cnet I/F module (G7L-CUEB) only that supports RS-232C and not by Cnet I/F module (G7L-CUEC) that supports RS-422/485.</p>
Timeout when setting the master	<ul style="list-style-type: none"> <li>• This is the time to wait the response frame after sending the request frame from MK80S basic unit set as the master.</li> <li>• Default value is 500ms.</li> <li>• When setting, max. sending/receiving period of master PLC should be considered.</li> <li>• If the value smaller than max. sending/receiving period is set, it may cause the communication error.</li> </ul>
Modbus master / Slave	<p>If setting as the master, it shall be the subject in the communication system and if setting as the slave, it will reply only according to the request frame of the master.</p>
Transmission mode	<p>Available to select one from ASCII mode or RTU mode.</p>

## 8.4 Function Block

### 8.4.1 GLOFA-GM Series

#### 8.4.1.1 for GM3/4/6

##### 1) RTU\_RD

Item	IN / OUT	Type	Description					
	REQ	BOOL	Function Block execution condition (Rising edge action) - When changing from 0 to 1, one time executed.					
	SLOT	USINT	Cnet module slot no. (0 ~ 7)					
	CH	USINT	Channel setting (0 : RS-232C, 1 : RS-422/485)					
	STN	USINT	Other station no. setting (0 ~ 32)					
	CMND	USINT	Modbus Command (1 ~4) 1 : Read coil status (Bit) 2 : Read input status (Bit) 3 : Read holding register (Word) 4 : Read input register (Word)					
	ADDR	INT	Leading address of other station to Read (1 ~ 9999)					
	NUM	USINT	Data number to Read (1 ~ 64)					
	RES_WAIT	TIME	Response wait time (after the setting wait time, receive the response data from Cnet module of CPU.)					
	NDR	BOOL	After completing the normal communication, 1Scan 'ON'.					
	ERR	BOOL	When communication error occurs, 1Scan 'ON'.					
	STATUS	USINT	Communication status code (Error code) 0 : normal, if not 0, : Error code					
	DATA	USINT ARRAY (256)	Receiving data storage area <table border="1" style="margin-left: 20px;"> <tr><td>Array [0] : High Byte of first word</td></tr> <tr><td>Array [1] : Low Byte of first word</td></tr> <tr><td>Array [2] : High Byte of second word</td></tr> <tr><td>Array [3] : Low Byte of second word</td></tr> <tr><td style="text-align: center;">...</td></tr> </table>	Array [0] : High Byte of first word	Array [1] : Low Byte of first word	Array [2] : High Byte of second word	Array [3] : Low Byte of second word	...
	Array [0] : High Byte of first word							
Array [1] : Low Byte of first word								
Array [2] : High Byte of second word								
Array [3] : Low Byte of second word								
...								

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(1) Function

This is the *Function Block* that is executed by selecting function code 01, 02, 03, 04 from modbus protocol communication and used for Bit/Word Read. Function code 01 executes output contact status (Coil Status) Data Read and function code 02 executes input contact status (Input Status) Data Read. Function code 03 executes output register (Holding Registers) Data Read and function code 04 executes input register(Input Registers) Data Read.

(2) Error

Output the error code from output STATUS. For further information, please refer to error code.

### Remark

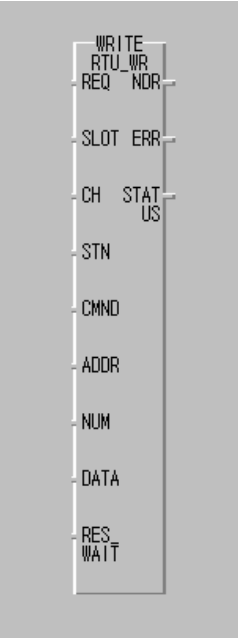
#### Response Wait Time setting

- 1) After the setting wait time, receive the response data from Cnet module of CPU.
- 2) If the response does not reach from other station within the setting time, error (code 74 or code 10) occurs. This *Function Block* acts in Cnet function '**User definition Protocol Mode**'.
- 3) Response Wait Time shall be set considering Read/Write data number, transmission speed (Baudrate), the response speed of other station etc.
- 4) When setting, please refer to the table below and if error occurs, extend the setting time.

Classification	1 ~ 16 word	17 ~ 32 word	33 ~ 48 word	49 ~ 64 word
4800 bps	150ms	250ms	330ms	400ms
9600 bps	100ms	180ms	230ms	280ms
19200 bps	80ms	150ms	180ms	230ms

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### 2) RTU\_WR

Item	IN / OUT	Type	Description					
 <p>The diagram shows the RTU_WR function block with the following inputs and outputs:</p> <ul style="list-style-type: none"> <li>Inputs: WRITE_RTU_WR_REQ, NDR, SLOT_ERR, CH_STAT_US, STN, CMND, ADDR, NUM, DATA, RES_WAIT</li> <li>Outputs: REQ, SLOT, CH, STN, CMND, ADDR, NUM, RES_WAIT, ERR, STATUS, DATA</li> </ul>	REQ	BOOL	<i>Function Block</i> execution condition (Rising edge action) - When changing from 0 to 1, one time executed.					
	SLOT	USINT	Cnet module slot no. (0 ~ 7)					
	CH	USINT	Channel setting (0 : RS-232C, 1 : RS-422/485)					
	STN	USINT	Other station no. setting (0 ~ 32)					
	CMND	USINT	Modbus Command (15 ~ 16) 15 : Force Multiple coils(Bit) 16 : Preset Multiple register (Word)					
	ADDR	INT	Leading address to Write (1 ~ 9999)					
	NUM	USINT	Data number to Write (1 ~ 64)					
	RES_WAIT	TIME	Response wait time (after the setting wait time, receive the response data from Cnet module of CPU.)					
	NDR	BOOL	After completion of the normal communication, 1Scan 'ON'.					
	ERR	BOOL	When communication error occurs, 1Scan 'ON'.					
	STATUS	USINT	Communication status code (Error code) 0 : normal, if not 0, : Error code					
	DATA	USINT ARRAY (256)	Self station data storage area to Write <table border="1" data-bbox="877 1243 1369 1456"> <tr> <td>Array [0] : High Byte of first word</td> </tr> <tr> <td>Array [1] : Low Byte of first word</td> </tr> <tr> <td>Array [2] : High Byte of second word</td> </tr> <tr> <td>Array [3] : Low Byte of second word</td> </tr> <tr> <td>...</td> </tr> </table>	Array [0] : High Byte of first word	Array [1] : Low Byte of first word	Array [2] : High Byte of second word	Array [3] : Low Byte of second word	...
	Array [0] : High Byte of first word							
Array [1] : Low Byte of first word								
Array [2] : High Byte of second word								
Array [3] : Low Byte of second word								
...								

#### (1) Function

This is the *Function Block* to execute by selecting function code 15 and 16 from modbus protocol communication and used for Continuous 1 bit Write (function code 15), Continuous 1 word Write (function code 16). Function code 15 performs 1 bit Data Write to output contact (Coil) continuously and function code 16 performs 1 word Data Write to output register (Holding Registers) continuously.

#### (2) Error

Output the error code to output STATUS. For further information, please refer to the error code.

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### Remark

- 1) This *Function Block* acts in Cnet function '**User Definition Protocol Mode**'.
- 2) Basic parameter (Baudrate, Data bit, Stop bit, Parity check, Station No. etc.) shall be set in Cnet editor and the frame editing is not needed.
- 3) This supports Modbus RTU Protocol. (scheduled to support ASCII Protocol later)
- 4) Cnet module requirements to use this *Function Block* are as follows.
  - Cnet module version : more than v2.0 (available to verify in GMWIN)
  - Cnet module Flash Rom OS version : more than v1.01 (available to verify in Cnet Editor)
  - Modbus.Nfb (Modbus *Function Block* file, N=3,4,6) needed.

Error code table

Status code (Dec)	Description	Solution	Remarks
0	Normal	No error	
1	Illegal command (When the master requires the command that the Slave does not support.)	After confirming the command available to support by the Slave, modify the command on FB.	The error returned from the Slave
2	Illegal address (When the Master requires the address that the Slave does not support.)	After confirming the address available to support by the Slave, modify the address on FB.	
3	Illegal data value (When the Master requires the data of the range that the Slave does not support.)	After confirming the data range available to support by the Slave, modify the data on FB.	
4	Slave device failure (The unrecoverable error occurs while performing the Master requirements in the Slave.)	Check the Slave station status.	
6	Slave device busy	After waiting for the regular time, Master	
10	Receiving Frame CRC error	1. After confirming the receiving frame status, extend the Response Wait Time. 2. Check the Cable and Noise status.	Function Block internal error
16	Cnet module I/F error (No Cnet module in the designated slot.)	Check the slot no. designated on FB.	
64	Channel (232c/422) stop	RUN the Cnet module. (power reinput)	

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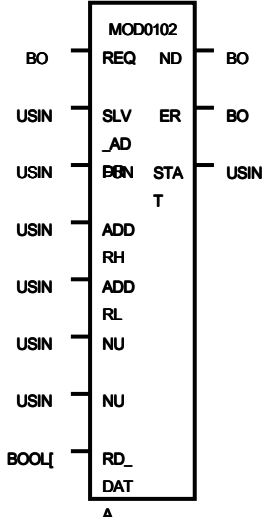
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74	Time out error	<ol style="list-style-type: none"><li>1. Check the basic parameter (station no./speed etc.)</li><li>2. Check the Slave station status (power etc.)</li><li>3. Check the Cable status and connector</li></ol>	
115	Communication mode error	Check if Cnet user definition	

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### 8.4.1.2 for GM7

#### 1) MOD0102

<i>Function Block</i>	<i>Description</i>
 <p>The diagram shows the MOD0102 function block with the following connections:</p> <ul style="list-style-type: none"> <li><b>REQ</b> (BO) and <b>ND</b> (BO) are inputs on the top.</li> <li><b>SLV_ADDR</b> (USIN) and <b>ERR</b> (BO) are inputs on the left.</li> <li><b>START</b> (USIN) is an input on the left.</li> <li><b>ADDRH</b> (USIN) and <b>ADDRL</b> (USIN) are inputs on the left.</li> <li><b>NUMH</b> (USIN) and <b>NUML</b> (USIN) are inputs on the left.</li> <li><b>RD_DATA</b> (BOOL) is an input on the left.</li> <li><b>STATUS</b> (BO) is an output on the right.</li> </ul>	<p><b>Input</b></p> <p><b>REQ</b> : When 1(rising edge), <i>Function Block</i> execution</p> <p><b>SLV_ADDR</b> : Slave station no. input</p> <p><b>FUNC</b> : Function code input It supports function code 01 and 02.</p> <p><b>ADDRH</b> : High address of starting address to read in the Slave station.</p> <p><b>ADDRL</b> : Low address of starting address to read in the Slave station.</p> <p><b>NUMH</b> : High address of data size to read from the starting address to read in the Slave station.</p> <p><b>NUML</b> : Low address of data size to read from the starting address to read in the Slave station.</p> <p><b>Output</b></p> <p><b>RD_DATA</b> : Variable name to save the Read data.(Array number should be declared as equal to or greater than the data size.)</p> <p><b>NDR</b> : If executing without error, output 1 and maintain 1 until calling next <i>Function Block</i>.</p> <p><b>ERR</b> : When error occurs, output 1 and maintain 1 until calling next <i>Function Block</i>.</p> <p><b>STATUS</b> : When error occurs, output the error code.</p>

#### (3) Function

This is the *Function Block* to execute by selecting function code 01 and 02 from modbus protocol communication and used for Bit Read. Function code 01 performs output contact status (Coil status) data Read and function code 02 performs input contact status (Input Status) data Read.

#### (4) Error

Output the error code to the Output STATUS. For further information, please refer to the error code.

#### (5) Program Example

① This is the example when GM7 basic unit is the Master and when reading output contact data of Modicon product that is station no.17.



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- Execute the Status Read of output contact (Coil) 00020 ~ 00056 of the Slave station (Station no.17). The output contact of the Slave station is assumed as follows and the read data is saved in the BOOL type random array variable RD\_DB0 whose size is 40.

Output contact	59	58	57	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40
Contact status	X	X	X	1	1	0	1	1	0	0	0	0	1	1	1	0	1	0	1	1
Hexa	1			B				0				E				B				
Output contact	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20
Contact status	0	0	1	0	0	1	1	0	1	0	1	1	1	1	0	0	1	1	0	1
Hexa	2			6				B				C				D				

<Data status of Modicon product output contact (00020~00059)>

- The status of output contact 57,58,59 is Redundancy.
- The data shall be transmitted from low bit by byte unit. The insufficient bit part of the byte shall be filled with '0'. The transmission of the above data is shown on Ex.1).

Ex.1) CD 6B B2 0E 1B

Function Block input	Input value
REQ	Enter the input condition to run.
SLV_ADDR	16#11 or 17 : Slave station no.
FUNC	16#01 or 1 : Enter '1' when reading output contact status.
ADDRH	16#00 or 0 : High byte among the address starting to read from the Slave station.
ADDRL	16#13 or 19 : Low byte among the address starting to read from the Slave station. - In order to read from output contact 00020, it is required to read <b>from no.19</b> according to the 8) modbus addressing regulation. And most significant data of data address shall be processed internally automatically by the input value of <i>Function Block</i> input FUNC without separate input.

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NUMH	16#00 or 0	: High byte when expressing total size of data to read by Hexa.
NUML	16#25 or 37	: Low byte when expressing total size of data to read by Hexa. - From the example, it is required to read 00020 ~ 00056 and total size of data shall be 37. If expressing 37 by Hexa, it shall be H0025 and it is required to enter H00 for NUMH and H25 for NUML.

### ● Results

Variable name	Storage value	Variable name	Storage value	Variable name	Storage value	Variable name	Storage value
RD_DB0[0]	1	RD_DB0[10]	0	RD_DB0[20]	1	RD_DB0[30]	0
RD_DB0[1]	0	RD_DB0[11]	1	RD_DB0[21]	1	RD_DB0[31]	0
RD_DB0[2]	1	RD_DB0[12]	0	RD_DB0[22]	0	RD_DB0[32]	1
RD_DB0[3]	1	RD_DB0[13]	1	RD_DB0[23]	1	RD_DB0[33]	1
RD_DB0[4]	0	RD_DB0[14]	1	RD_DB0[24]	0	RD_DB0[34]	0
RD_DB0[5]	0	RD_DB0[15]	0	RD_DB0[25]	1	RD_DB0[35]	1
RD_DB0[6]	1	RD_DB0[16]	0	RD_DB0[26]	1	RD_DB0[36]	1
RD_DB0[7]	1	RD_DB0[17]	1	RD_DB0[27]	1	RD_DB0[37]	X
RD_DB0[8]	1	RD_DB0[18]	0	RD_DB0[28]	0	RD_DB0[38]	X
RD_DB0[9]	1	RD_DB0[19]	0	RD_DB0[29]	0	RD_DB0[39]	X

- The variable to save the read data should be array type variable and the size of array type variable should be equal to or greater than that of the data to read. If it is smaller, error code shall be indicated on the STATUS.
- The read data shall be saved from array variable RD\_DB0[0].
- The remaining part after filling the array variable by the read data shall be redundancy.

② This is the example when GM7 basic unit is the Master and when reading input contact data of Modicon product that is station no.17.

- Execute the Status Read of input contact (Input) 10197 ~ 10218 of the Slave station (Station no.17). The input contact of the Slave station is assumed as follows and the read data is saved in the BOOL type random array variable RD\_DB1 whose size is 24.

## Chapter 8 Modbus Communication

Input contact	10220	10219	10218	10217	10216	10215	10214	10213	10212	10211	10210	10209
Contact status	X	X	1	1	0	1	0	1	1	1	0	1
Hexa	3				5				D			
Input contact	10208	10207	10206	10205	10204	10203	10202	10201	10200	10199	10198	10197
Contact status	1	0	1	1	1	0	1	0	1	1	0	0
Hexa	B				A				C			

- The status of Input contact 10219, 10220 is Redundancy.
- The data shall be transmitted from low bit by byte unit. The insufficient bit part of the byte shall be filled with '0'. The transmission of the above data is shown on Ex.1).

Ex.1) AC DB 35

<i>Function Block</i> input	Input value
REQ	Enter the input condition to run.
SLV_ADDR	16#11 or 17 : Slave station no.
FUNC	16#02 or 2 : Enter '2' when reading the input contact status.
ADDRH	16#00 or 0 : High byte among the address starting to read from the Slave station.
ADDRL	: Low byte among the address starting to read from the Slave station. - In order to read from input contact 10197, it is required to read <b>from no.196</b> according to the 8) modbus addressing regulation. And most significant data of data address shall be processed internally automatically by the input value of <i>Function Block</i> input FUNC without separate input. 16#C4 or 196
NUMH	16#00 or 0 : High byte when expressing total size of data to read by Hexa
NUML	: Low byte when expressing total size of data to read by Hexa. - From the example, it is required to read 10197 ~ 10218 and total size of data shall be 22. If expressing 22 by Hexa, it shall be H0016 and it is required to enter H00 for NUMH and H16 for NUML. 16#16 or 22

## Chapter 8 Modbus Communication

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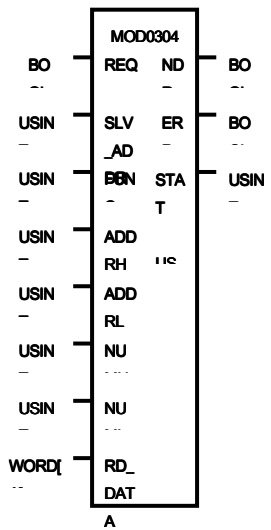
- Results

Variable name	Storage value	Variable name	Storage value	Variable name	Storage value	Variable name	Storage value
RD_DB1[0]	0	RD_DB1[6]	0	RD_DB1[12]	1	RD_DB1[18]	1
RD_DB1[1]	0	RD_DB1[7]	1	RD_DB1[13]	0	RD_DB1[19]	0
RD_DB1[2]	1	RD_DB1[8]	1	RD_DB1[14]	1	RD_DB1[20]	1
RD_DB1[3]	1	RD_DB1[9]	1	RD_DB1[15]	1	RD_DB1[21]	1
RD_DB1[4]	0	RD_DB1[10]	0	RD_DB1[16]	1	RD_DB1[22]	X
RD_DB1[5]	1	RD_DB1[11]	1	RD_DB1[17]	0	RD_DB1[23]	X

- The variable to save the read data should be array type variable and the size of array type variable should be equal to or greater than that of the data to read. If it is smaller, error code shall be indicated on the STATUS.
- The read data shall be saved from array variable RD\_DB1[0].
- The remaining part after filling the array variable by the read data shall be redundancy.

## Chapter 8 Modbus Communication

### 2) MOD0304

Function Block	Description
 <p>The diagram shows the MOD0304 function block with its I/O connections. On the left, there are two BO (Bit Output) terminals, two USIN (Word Input) terminals, and one WORD (Word) terminal. On the right, there are two BO terminals and one USIN terminal. The internal connections are: REQ (BO), SLV_ADDR (USIN), ADDRH (BO), ADDR_L (USIN), NUMH (USIN), NUML (USIN), RD_DATA (WORD), and STATUS (USIN). The block is labeled 'MOD0304' at the top and 'A' at the bottom.</p>	<p><b>Input</b></p> <p>REQ : When 1(rising edge), <i>Function Block</i> execution</p> <p>SLV_ADDR : Slave station no. input</p> <p>FUNC : Function code input It supports function code 03 and 04.</p> <p>ADDRH : High address of starting address to read in the Slave station.</p> <p>ADDR_L : Low address of starting address to read in the Slave station.</p> <p>NUMH : High address of data size to read from the starting address to read in the Slave station.</p> <p>NUML : Low address of data size to read from the starting address to read in the Slave station.</p> <p><b>Output</b></p> <p>RD_DATA : Variable name to save the Read data. (Array number should be declared as equal to or greater than the data size.)</p> <p>NDR : If executing without error, output 1 and maintain 1 until calling next <i>Function Block</i>.</p> <p>ERR : When error occurs, output 1 and maintain 1 until calling next <i>Function Block</i>.</p> <p>STATUS : When error occurs, output the error code.</p>

#### (1) Function

This is the *Function Block* to execute by selecting function code 03 and 04 from modbus protocol communication and used for Word Read. Function code 03 performs output register (Holding Registers) data Read and function code 04 performs input register (Input Registers) data Read.

#### (2) Error

Hold the error code to the Output STATUS. For further information, please refer to the error code.

#### (3) Program Example

- ① This is the example when GM7 basic unit is the Master and when reading output register data of Modicon product that is station no.17.

## Chapter 8 Modbus Communication

- Execute the Read of output register (Holding Registers) 40108 ~ 40110 of the Slave station (Station no.17). The output register of the Slave station is assumed as follows and the read data is saved in the WORD type random array variable RD\_DW0 whose size is 4.

Output Register	40110	40109	40108
Register Status	H0064	H0000	H022B

- The data shall be transmitted from high byte of low word by byte unit. The transmission of the above data is shown on Ex.1).

Ex.1) 02 2B 00 00 00 64

Function Block input	Input value
REQ	Enter the input condition to run.
SLV_ADDR	16#11 or 17 : Slave station no.
FUNC	16#03 or 3 : Enter '3' when reading output register.
ADDRH	16#00 or 0 : High byte among the address starting to read from the Slave station.
ADDRL	16#6B or 107 : Low byte among the address starting to read from the Slave station. - In order to read from output register 40108, it is required to read <b>from no.107</b> according to the 8) modbus addressing regulation. And most significant data of data address shall be processed internally automatically by the input value of <i>Function Block</i> input FUNC without separate input.
NUMH	16#00 or 0 : High byte when expressing total size of data to read by Hexa.
NUML	16#03 or 3 : Low byte when expressing total size of data to read by Hexa. - From the example, it is required to read 40108 ~ 40110 and total size of data shall be 3. If expressing 3 by Hexa, it shall be H0003 and it is required to enter H00 for NUMH and H03 for NUML.

- Results

Variable name	Storage value
RD_DW0[0]	H002B or 555
RD_DW0[1]	H0000 or 0
RD_DW0[2]	H0064 or 100
RD_DW0[3]	X

## Chapter 8 Modbus Communication

- The variable to save the read data should be array type variable and the size of array type variable should be equal to or greater than that of the data to read. If it is smaller, error code shall be indicated on the STATUS.
- The read data shall be saved from array variable RD\_DW0[0].
- The remaining part after filling the array variable by the read data shall be redundancy.

② This is the example when GM7 basic unit is the Master and when reading input register data of Modicon product that is station no.

- Execute the Read of input register (Input Registers) 30009 of the Slave station (Station no.17). The input register of the Slave station is assumed as follows and the read data is saved in the WORD type random array variable RD\_DW1 whose size is 2.

Input Register	30009
Register Status	H000A

- The data is transmitted from high byte of low word by byte unit. The transmission of the above data is shown on Ex.1).

Ex.1) 00 0A

<i>Function Block</i> input	Input value
REQ	Enter the input condition to run.
SLV_ADDR	16#11 or 17 : Slave station no.
FUNC	16#04 or 4 : Enter '4' when reading input register.
ADDRH	16#00 or 0 : High byte among the address starting to read from the Slave station.
ADDRL	16#08 or 8 : Low byte among the address starting to read from the Slave station. - In order to read from input register 30009, it is required to read <b>from no.8</b> according to the 8) modbus addressing regulation. And most significant data of data address shall be processed internally automatically by the input value of <i>Function Block</i> input FUNC without separate input.
NUMH	16#00 or 0 : High byte when expressing total size of data to read by Hexa

## Chapter 8 Modbus Communication

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NUML	16#01 or 1 : Low byte when expressing total size of data to read by Hexa. - From the example, it is required to read 30009 and total size of data shall be 1. If expressing 1 by Hexa, it shall be H0001 and it is required to enter H00 for NUMH and H01 for NUML.
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- Results

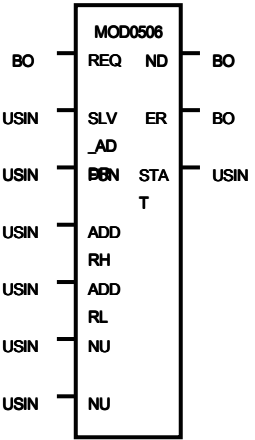
Variable name	Storage value
RD_DW1[0]	H000A or 10
RD_DW1[1]	X

- The variable to save the read data should be array type variable and the size of array type variable should be equal to or greater than that of the data to read. If it is smaller, error code shall be indicated on the STATUS.
- The read data shall be saved from array variable RD\_DW1[0].
- The remaining part after filling the array variable by the read data shall be redundancy.



## Chapter 8 Modbus Communication

### 3) MOD0506

Function Block	Description
 <p>The diagram shows a rectangular block labeled 'MOD0506'. On the left side, there are seven input terminals: 'REQ' (BO), 'SLV_AD' (USIN), 'ADDRH' (USIN), 'ADDRL' (USIN), 'NUMH' (USIN), 'NUML' (USIN), and 'STATUS' (USIN). On the right side, there are three output terminals: 'NDR' (BO), 'ERR' (BO), and 'STATUS' (USIN). The block is divided into sections for 'REQ', 'SLV_AD', 'ADDRH', 'ADDRL', 'NUMH', 'NUML', 'NDR', 'ERR', and 'STATUS'.</p>	<p><b>Input</b></p> <p>REQ : When 1(rising edge), <i>Function Block</i> execution</p> <p>SLV_ADDR : Slave station address input</p> <p>FUNC : Function code input It supports function code 05 and 06.</p> <p>ADDRH : High address among start address to write in the Slave station.</p> <p>ADDRL : Low address among start address to write in the Slave station.</p> <p>NUMH : High address among data to write in the Slave station.</p> <p>NUML : Low address among data to write in the Slave station.</p> <p><b>Output</b></p> <p>NDR : If executing without error, output 1 and maintain 1 until calling next <i>Function Block</i>.</p> <p>ERR : When error occurs, output 1 and maintain 1 until calling next <i>Function Block</i>.</p> <p>STATUS : When error occurs, output the error code.</p>

(1) Function

This is the *Function Block* to execute by selecting function code 05 and 06 from modbus protocol communication and used for 1Bit Write (function code 05) and 1Word Write (function code 06). Function code 05 performs 1Bit data Write for output contact (Coil) and if setting 255 (or HFF) for input NUMH of *Function Block* or 0 (or H00) for input NUML, write '1' for output contact and if setting 0 (or H00) for input NUMH or 0 (or H00) for NUML, write '0' for output contact. Function code 06 performs 1 word data write in output register.

(2) Error

Output the error code to the output STATUS. Further information, please refer to Error code.

## Chapter 8 Modbus Communication

### (3) Program Example

① This is the example when GM7 basic unit is the Master and when writing 1 bit data to the output contact of Modicon product that is station no.17.

- Write '1' to the output contact (Coil) 00173 of the Slave station (station no.17)

<i>Function Block</i> input	Input value
REQ	Enter the input condition to run.
SLV_ADDR	16#11 or 17 : Slave station no.
FUNC	16#05 or 5 : Enter '5' when writing 1 Bit to output contact.
ADDRH	16#00 or 0 : High byte among the address starting to write in the Slave station.
ADDRL	16#AC or 172 : Low byte among the address starting to write in the Slave station. <ul style="list-style-type: none"> <li>- In order to write to output contact 00173, it is required to write <b>from No.172</b> according to the 8) modbus addressing regulation. And most significant data of data address shall be processed internally automatically by the input value of <i>Function Block</i> input FUNC without separate input.</li> </ul>
NUMH	16#FF or 255 : Data to write in the Slave station <ul style="list-style-type: none"> <li>- '0' → H00</li> <li>- '1' → HFF</li> </ul>
NUML	16#00 or 0 : Data to write in the Slave station <ul style="list-style-type: none"> <li>- From the example, it is required to write '1'. Thus, enter HFF for HUMH and H00 for NUML.</li> </ul>

- Results : Output contact 00173 shall be ON. (In case of GM7 basic unit, '1' shall be saved in the corresponding M area.)

Output contact	00173
Contact status	1

② This is the example when GM7 basic unit is the Master and when writing 1Word Data to the output register of Modicon product that is station no.17.

- This is the example to write '3' to the output register (Holding Registers) 40002 of the Slave station (Station no.17).

## Chapter 8 Modbus Communication

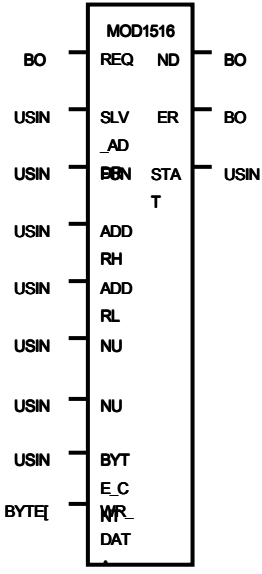
<i>Function Block</i> input	Input value
REQ	Enter the input condition to run.
SLV_ADDR	16#11 or 17 : Slave station no.
FUNC	16#06 or 6 : Enter '6' when writing 1Word to output register.
ADDRH	16#00 or 0 : High byte among the address starting to write in the Slave station.
ADDRL	16#01 or 1 : Low byte among the address starting to write in the Slave station. - In order to write to output contact 40002, it is required to write <b>from No.1</b> according to the 8) modbus addressing regulation. And most significant data of data address shall be processed internally automatically by the input value of <i>Function Block</i> input FUNC without separate input.
NUMH	16#00 or 0 : High byte when expressing the data to write in the Slave station by Hexa.
NUML	16#03 or 3 : Low byte when expressing the data to write in the Slave station by Hexa. - From the example, it is required to write '3' and if expressing the data by Hexa, it shall be H0003 and it is required to enter H00 for HUMH and H03 for NUML.

- Results : H0003 shall be saved in output register 40002. (In case of GM7 basic unit, H0003 shall be saved in the corresponding M area.)

Output register	40002
Register status	H0003

## Chapter 8 Modbus Communication

### 4) MOD1516

<i>Function Block</i>	Description
 <p>The diagram shows a vertical rectangular block labeled 'MOD1516'. On the left side, there are several input terminals: 'BO' (Bit Output) connected to 'REQ', 'USIN' (User Input) connected to 'SLV_AD', 'USIN' connected to 'ADDRH', 'USIN' connected to 'ADDRL', 'USIN' connected to 'NUMH', 'USIN' connected to 'NUML', and 'USIN' connected to 'BYTE_CN'. On the right side, there are several output terminals: 'BO' connected to 'NDR', 'BO' connected to 'ERR', and 'USIN' connected to 'STATUS'. Inside the block, the following labels are visible: 'MOD1516', 'REQ', 'ND', 'SLV', 'ER', 'AD', 'STA', 'T', 'ADDRH', 'ADDRL', 'NUMH', 'NUML', 'BYT', 'E_C', 'WR', 'DAT'.</p>	<p><b>Input</b></p> <p>REQ : When 1(rising edge), <i>Function Block</i> execution</p> <p>SLV_ADD : Slave station address input</p> <p>R</p> <p>FUNC : Function code input It supports function code 15 and 16.</p> <p>ADDRH : High address among starting address to write in the Slave station.</p> <p>ADDRL : Low address among starting address to write in the Slave station.</p> <p>NUMH : High address of data size to write in the Slave station.</p> <p>NUML : Low address of data size to write in the Slave station.</p> <p>BYTE_CN : Byte size of data to write in the Slave station.</p> <p>T</p> <p>WR_DATA : Variable name to save the data to write. (It should be declared as equal to or greater than the data size.)</p> <p><b>Output</b></p> <p>NDR : If executing without error, output 1 and maintain 1 until calling next <i>Function Block</i>.</p> <p>ERR : When error occurs, output 1 and maintain 1 until calling next <i>Function Block</i>.</p> <p>STATUS : When error occurs, output the error code.</p>

#### (3) Function

This is the *Function Block* to execute by selecting function code 15 and 16 from modbus protocol communication and used for Continuous 1Bit Write (function code 15) and Continuous 1Word Write (function code 16). Function code 15 performs 1Bit Data Write for output contact (Coil) by 1 byte continuously and Function code 16 performs 1 Word Data Write for output register (Holding Registers) continuously.

#### (4) Error

Output the error code to the output STATUS. For further information, please refer to Error Code.

## Chapter 8 Modbus Communication

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### (5) Program Example

- ① This is the example when GM7 basic unit is the Master and when writing Bit Data continuously to output contact of Modicon product that is station no.17.
  - It writes the continued 10bit 0111001101 to output contact (Coil) 00020 in the Slave station (Station no.17) by 1bit. The data to write is saved in BYTE type random array variable WR\_DB0 whose size is 2.

Variable name	Storage value
WR_DB0[0]	2#11001101 or 16#CD
WR_DB0[1]	2#10000001 or 16#81

- The size of BYTE\_CNT is the size when converting the data to write by byte unit. As the above data is 10bit, 1byte is not enough to contain the data and 2bytes are required. It shall be filled with from low bit and the high 6 bit shall be filled with '0'. Thus, the size of BYTE\_CNT is 2.
- If assuming that the data of 1000 0001 1100 1101 is saved in array variable WR\_DB0, the data shall be transmitted by filling the high 6bit with '0' from low 10 bit (01 1100 1101). As the size of data to transmit is designated by 10bit, it is required to take the low 10 bit and fill the remaining bit with '0' as it is transmitted by byte unit.
- The data shall be transmitted by byte unit from low bit. The transmission of the above data is shown on Ex.1).

Ex.1) CD 01

## Chapter 8 Modbus Communication

<i>Function Block</i> input	Input value	
REQ	Enter the input condition to run.	
SLV_ADDR	16#11 or 17	: Slave station no.
FUNC	16#0F or 15	: Enter '15' when writing Bit to output contact continuously.
ADDRH	16#00 or 0	: High byte among starting address to write in the Slave station.
ADDRL	16#13 or 19	: Low byte among starting address to write in the Slave station. - In order to write from output contact 00020, it is required to write <b>from No.19</b> according to the 8) modbus addressing regulation. And most significant data of data address shall be processed internally automatically by the input value of <i>Function Block</i> input FUNC without separate input.
NUMH	16#00 or 0	: High byte when expressing total size of data to write in the Slave station by Hexa.
NUML	16#0A or 10	: Low byte when expressing total size of data to write in the Slave station by Hexa. - From the example, it is the 10 bit data continued from 00020 and total size shall be 10. If expressing 10 by Hexa, it shall be H000A and it is required to enter H00 for NUMH and H0A for NUML.
BYTE_CNT	16#02 or 2	: This is the size when converting total size of data to write in the Slave station by byte unit. - From the example, it is the continued 10 bit data and if converted by byte unit, it shall be 2 byte. Thus, it is required to enter H02 for BYTE_CNT.

- Results

The low 10 bit only is effective as much as the setting data size among 2byte (16bit) data.

Output contact	00029	00028	00027	00026	00025	00024	00023	00022	00021	00020
Contact status	0	1	1	1	0	0	1	1	0	1

② This is the example when GM7 basic unit is the Master and when writing Word Data continuously to output register of Modicon product that is station no.17.

- It writes 000A and 0102 to output register (Holding Registers) 40002 in the Slave station (station no.17). The data to write is saved in BYTE type array variable WR\_DB1 whose size is 4.

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Variable name	Storage value
WR_DB1[0]	2#00001010 or 16#0A
WR_DB1[1]	2#00000000 or 16#00
WR_DB1[2]	2#00000010 or 16#02
WR_DB1[3]	2#00000001 or 16#01

- The size of BYTE\_CNT is the size when converting the data to write by byte unit. As the above data is 2 words, it is required to use 4 bytes. Thus, the size of BYTE\_CNT is 4.
- The data is transmitted from low word by byte unit. The transmission of the above data is shown on Ex.1).

Ex.1) 00 0A 01 02

<i>Function Block</i> input	Input value
REQ	Enter the input condition to run.
SLV_ADDR	16#11 or 17 : Slave station no.
FUNC	16#10 or 16 : Enter '16' when writing Word to output register continuously.
ADDRH	16#00 or 0 : High byte among starting address to write in the Slave station.
ADDRL	16#01 or 1 : Low byte among starting address to write in the Slave station. - In order to write from output register 40002, it is required to write <b>from No.1</b> according to the 8) modbus addressing regulation. And most significant data of data address shall be processed internally automatically by the input value of <i>Function Block</i> input FUNC without separate input.
NUMH	16#00 or 0 : High byte when expressing total size of data to write in the Slave station by Hexa.
NUML	16#02 or 2 : Low byte when expressing total size of data to write in the Slave station by Hexa. - From the example, it is the 2word data continued from 40002 and total size shall be 2. If expressing 2 by Hexa, it shall be H0002 and it is required to enter H00 for NUMH and H02 for NUML.

## Chapter 8 Modbus Communication

BYTE_CNT	16#04 or 4 : This is the size when converting total size of data to write in Slave station by byte unit. - From the example, it is the continued 2word data and if converted by byte unit, it shall be 4 byte. Thus, it is required to enter H04 for BYTE_CNT.
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● Results

Output register	40003	40002
Register status	H0102	H000A

### 5) Error code

CODE	Error type	Meaning
01	Illegal Function	Function code input error to the <i>Function Block</i>
02	Illegal Address	The area to read/write in the slave exceeds the allowed range.
03	Illegal Data Value	The data value to read/write in the Slave is not allowed.
04	Slave Device Failure	Slave error status
05	Acknowledge	This is a kind of response code that the Slave sends to the master to prevent the time of the master when it takes a time for the processing of demand command. In the master, it indicates the error code and wait for the regular time without demanding again.
06	Slave Device Busy	The error caused by long processing time of the slave. Master must demand again.
07	Time Out	The error occurred when exceeding the setting time of the communication parameter while communication.
08	Number Error	The error occurred when data is '0' or more than 256byte, when data size is greater than array size, and when number and BYTE_CNT is different.
09	Parameter Error	Parameter setting error (mode, master/slave)
10	Station Error	The error occurred when the station no. set in self station and input parameter of function is the same.



## Chapter 8 Modbus Communication

### 8.4.2 MASTER-K Series

#### 1) Command Modbus

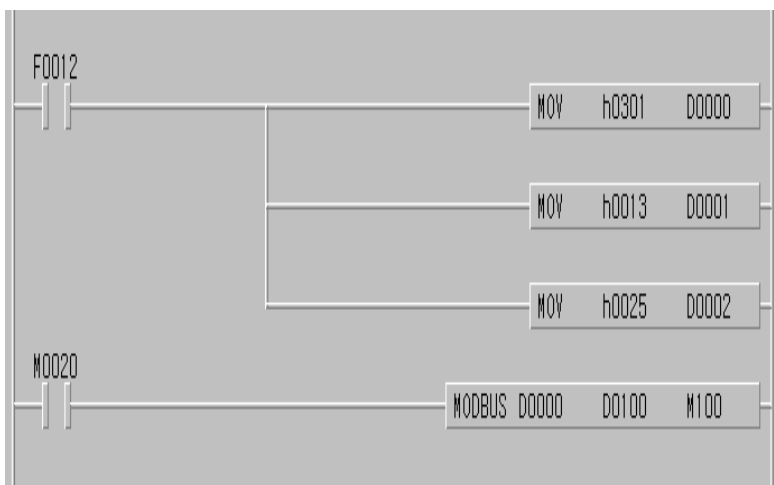
Command	Available area to use												Step no.	Flag			
	M	P	K		L	F	T	C	S	D	#D	Integral number		Error (F110)	Zero (F111)	Carry (F112)	
Modbus	S1	0	0	0	0	0	0	0	0		0	0		7	0		
	S2	0	0	0	0	0		0	0		0	0					
	S3	0	0	0	0	0		0	0		0	0					

	Flag	
	F110	When exceeding #D area, it shall be ON.
	Area setting	
	S1	Device address to register sending/receiving parameter.
	S2	Device address to save sending/receiving data.
S3	Device address to indicate sending/receiving status.	

#### (1) Function

- This transmits the data saved in the S1 device to Modbus protocol through communication port. (3Word)
- This designates the leading address of the device where the received data is saved to S2.
  - ➔ According to function of S1, it designates the leading address of the device that the received data is saved when receiving and the leading address of the data to sending when sending.
- The communication action status is saved in S3.

#### (2) Program Example



Designate the slave address (high byte) and function code (low byte).

Designate the address.

Designate the number to read.

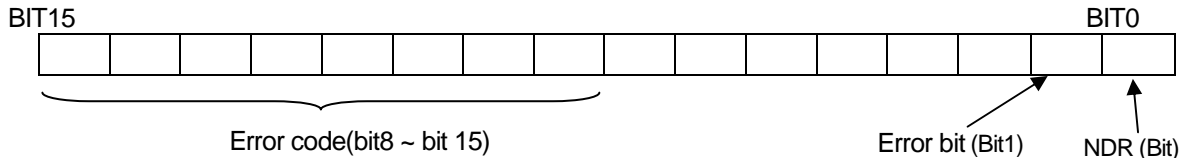
When **M0020** is **ON**, open the Modbus communication with **Modbus** parameter saved in **D0000** and save the data received in **D1000**.

The communication error information is saved in **M100**.

## Chapter 8 Modbus Communication

If the parameter Modbus is set as the Slave, it will respond when required by the master without separate command and if setting as the master, the designated data shall be transmitted to Modbus protocol designated as S1 whenever the input condition of Modbus command is ON.

- S3 format is as follows.



- NDR : when completing the normal communication, 1Scan ON.
- Error bit : when communication error occurs, 1Scan ON and in this case, error code is indicated Bit8 ~ Bit15.
- Error code : when error occurs, it shows the information for the error. (refer to the error code table as below.)

Error code table

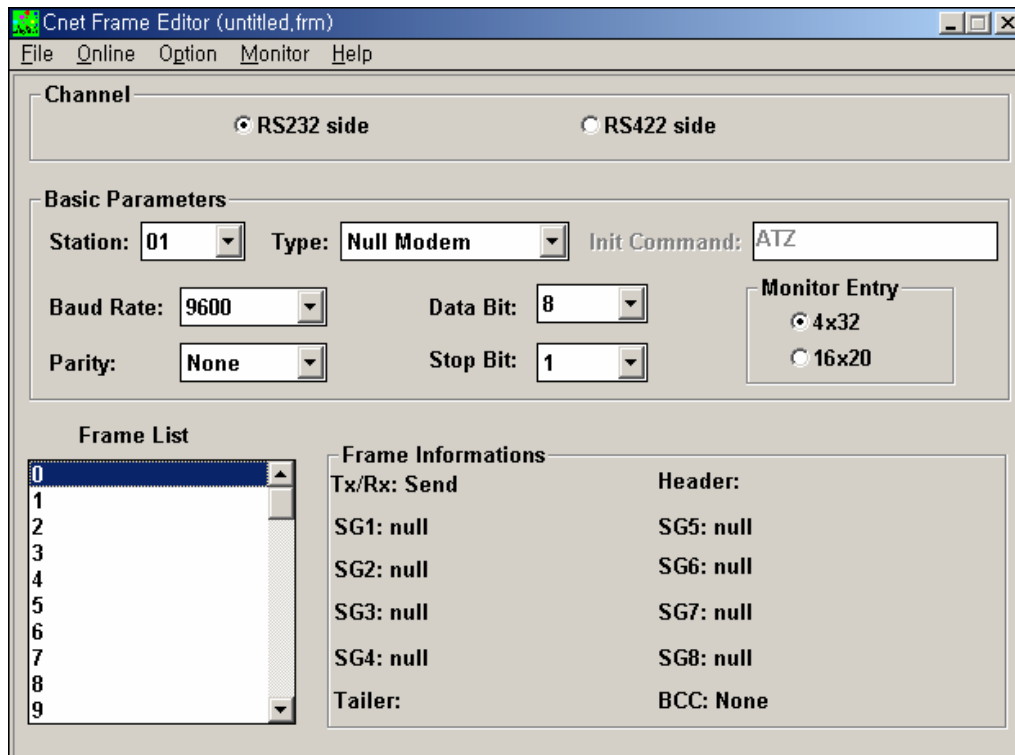
Code	Name	Description
01	Illegal Function	Function code error
02	Illegal Address	Address allowed range exceeded
03	Illegal Data Value	The error that data value is not allowed.
04	Slave Device Failure	Slave error status
05	Acknowledge	When it takes a time for the processing of demand command, the slave sends to prevent time out of the master.
06	Slave Device Busy	The slave takes a time for the processing. The master must demand again.
07	Time Out	When no response during Time out of communication parameter.
08	Number Error	When data number is '0' or exceeds 256Byte.
09	Parameter Error	When the items set in the parameter (such as transmission mode etc.) are wrong.
10	Station Error	When self station no. and input parameter of Modbus command is the same.

### 8.5 Program Example

#### 8.5.1 GLOFA-GM Series

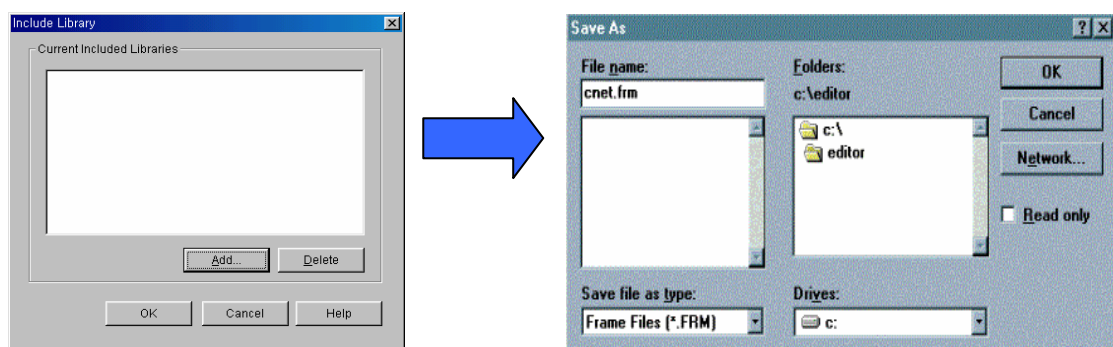
##### 8.5.1.1 when the Master is GM3/4/6

1) Set the basic frame in Cnet module of Master PLC.

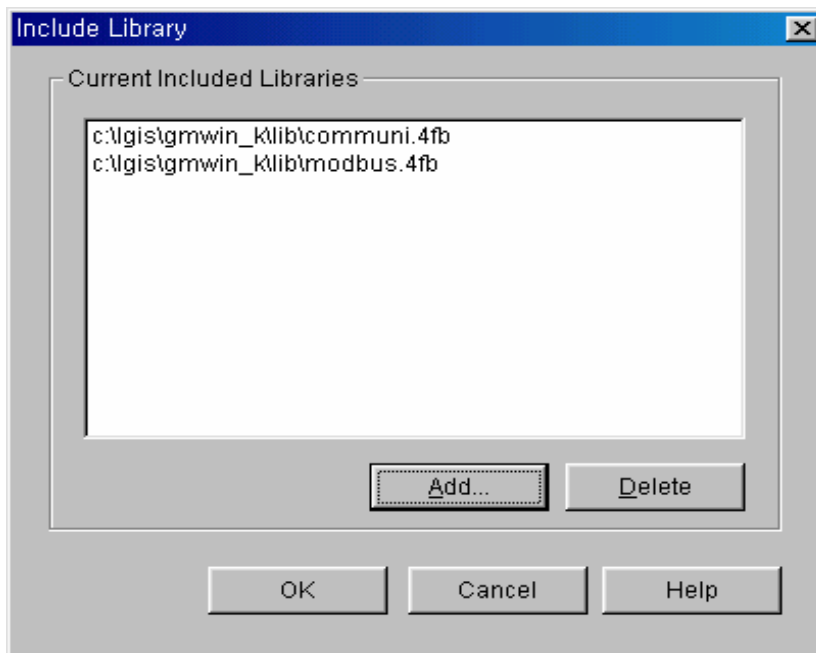


- Basic parameter (Baudrate, Parity, Data bit, Stop bit) is required to correspond with the setting content of other station.
- It is not necessary to write the frame list.

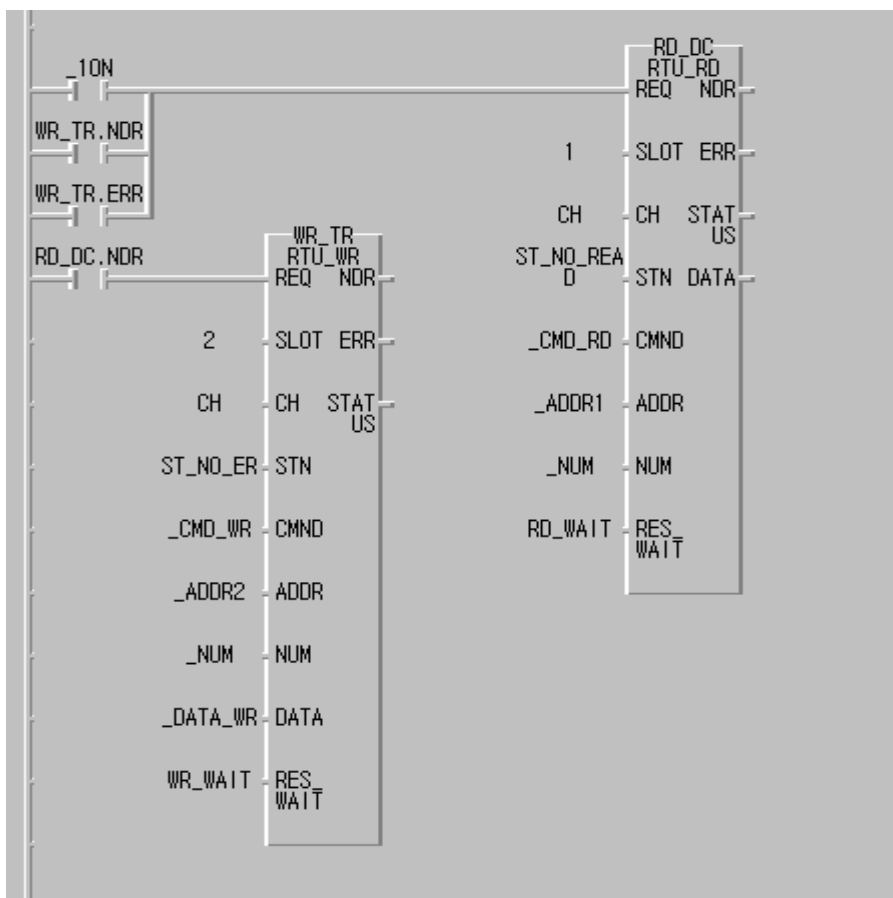
2) Insert Programming-Library



## Chapter 8 Modbus Communication



3) Load the *Function Block* from Scan program of GMWIN program and program it.



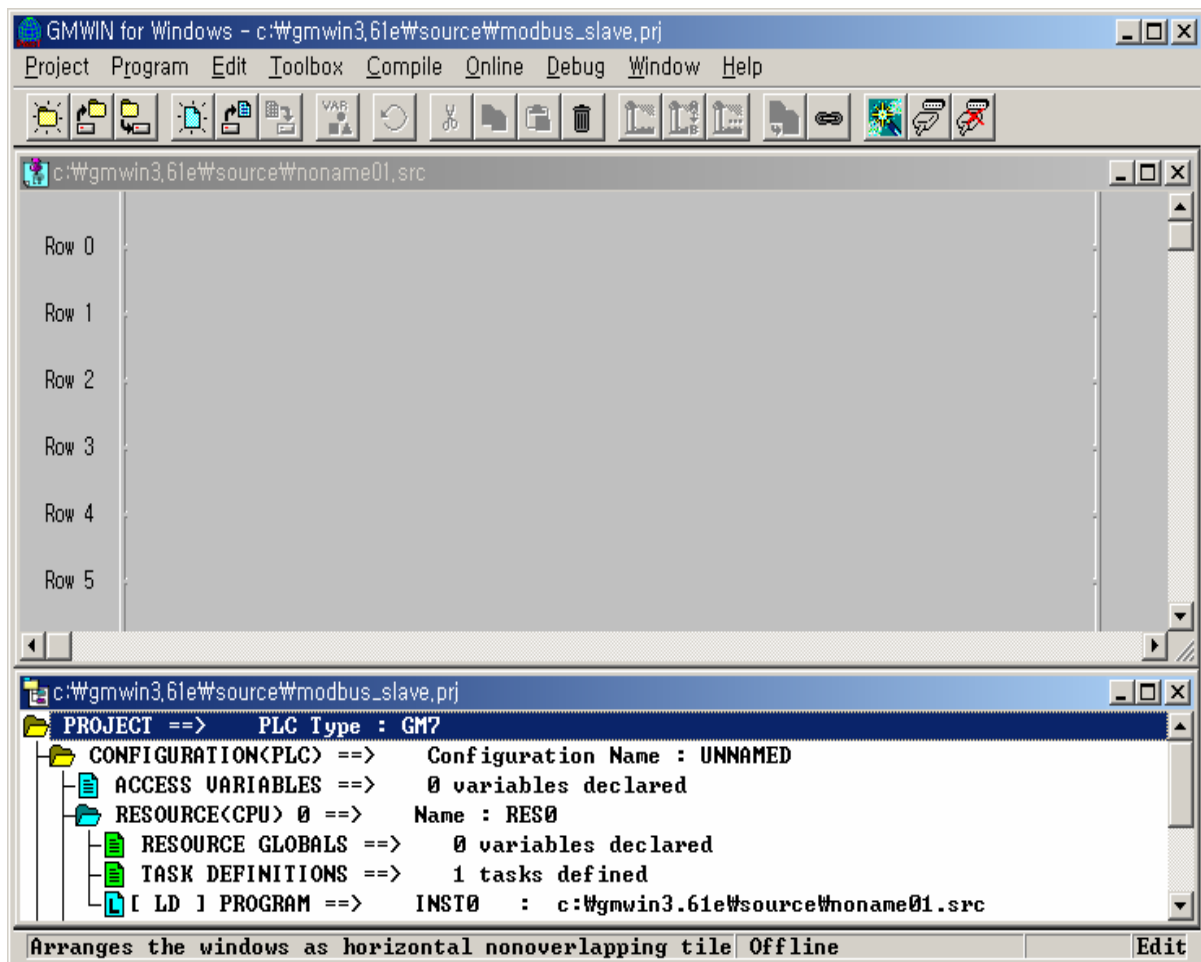
## Chapter 8 Modbus Communication

### 8.5.1.2 When the Master is GM7

- Slave station program : output the receiving data saved in M area to the output contact (Coil).
- Master station program : After saving 16#FF(OR 255) to %MW0(this corresponds with %MX0 ~ %MX15 or %MB0 ~ %MB1.) in the *Function Block* MOD0506(function code 06), read %MX0 using the *Function Block* MOD0102(function code 01) and save '0' to %MX0 ~ %MX9 using the *Function Block* MOD1516(function code 15) again and then read %MW0 using the *Function Block* MOD0304(function code 03).
- The cable used in this cable is the same as the cable used in 1:1 only protocol communication between self stations.

#### 1) Slave station setting and Program

- (1) Create new project file and new program for the Slave station.



## Chapter 8 Modbus Communication

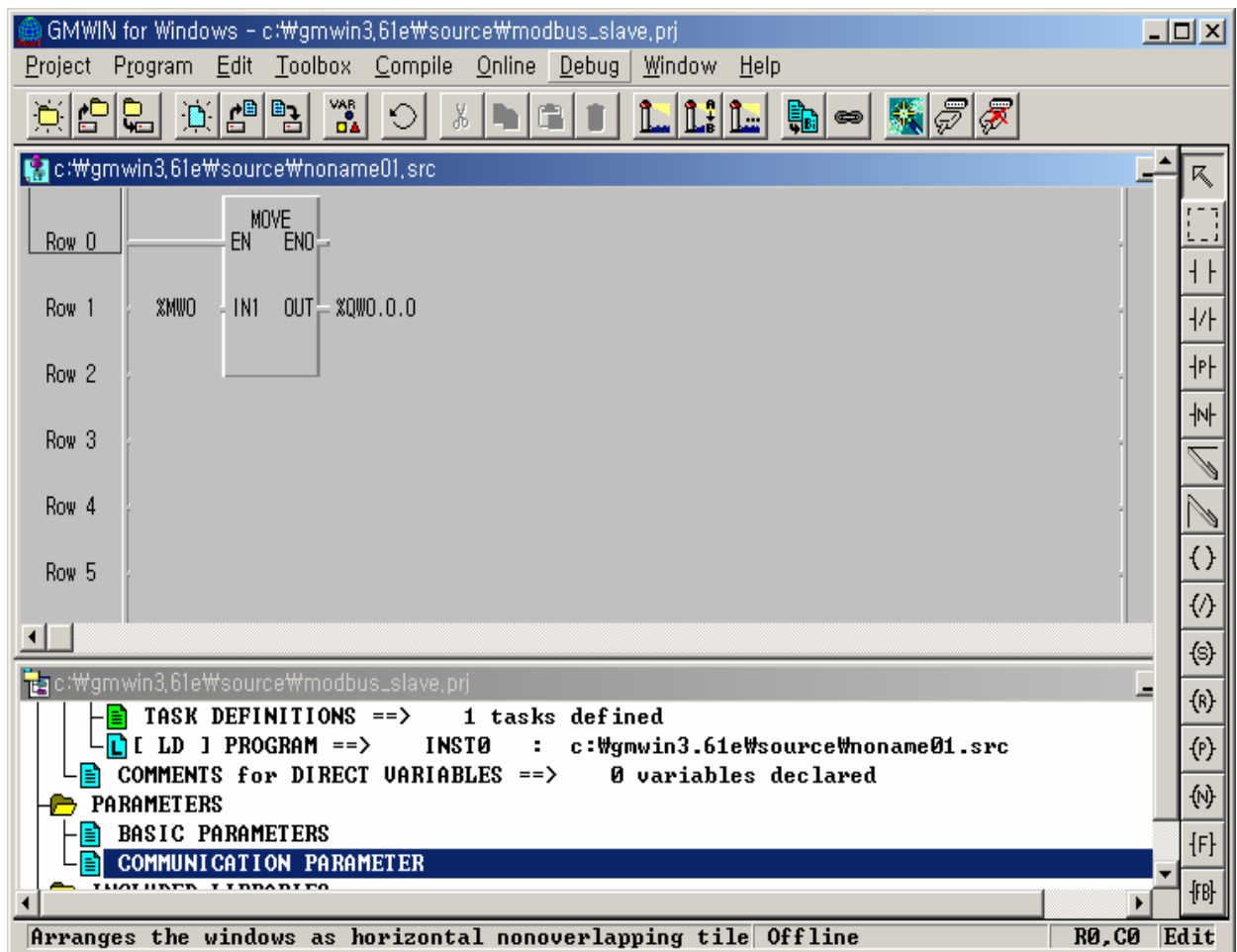
- (2) If you select 'communication parameter' from GMWIN parameter and doubleclick, the communication parameter menu window will be open.

- After setting the parameter as below, press 'verify' button.

Communication method						Protocol and transmission mode	
Self station no.	Communication speed	Data bit	Parity bit	Maintenance bit	Communication channel	Modbus	Exclusive mode
17	2400	7	EVEN	1	RS232C null modem or RS422/485	Slave	ASCII

## Chapter 8 Modbus Communication

- (3) After creating the program as below, download it in the GM7 basic unit of the Slave station. For further program creation and download method, please refer to GMWIN user's manual.

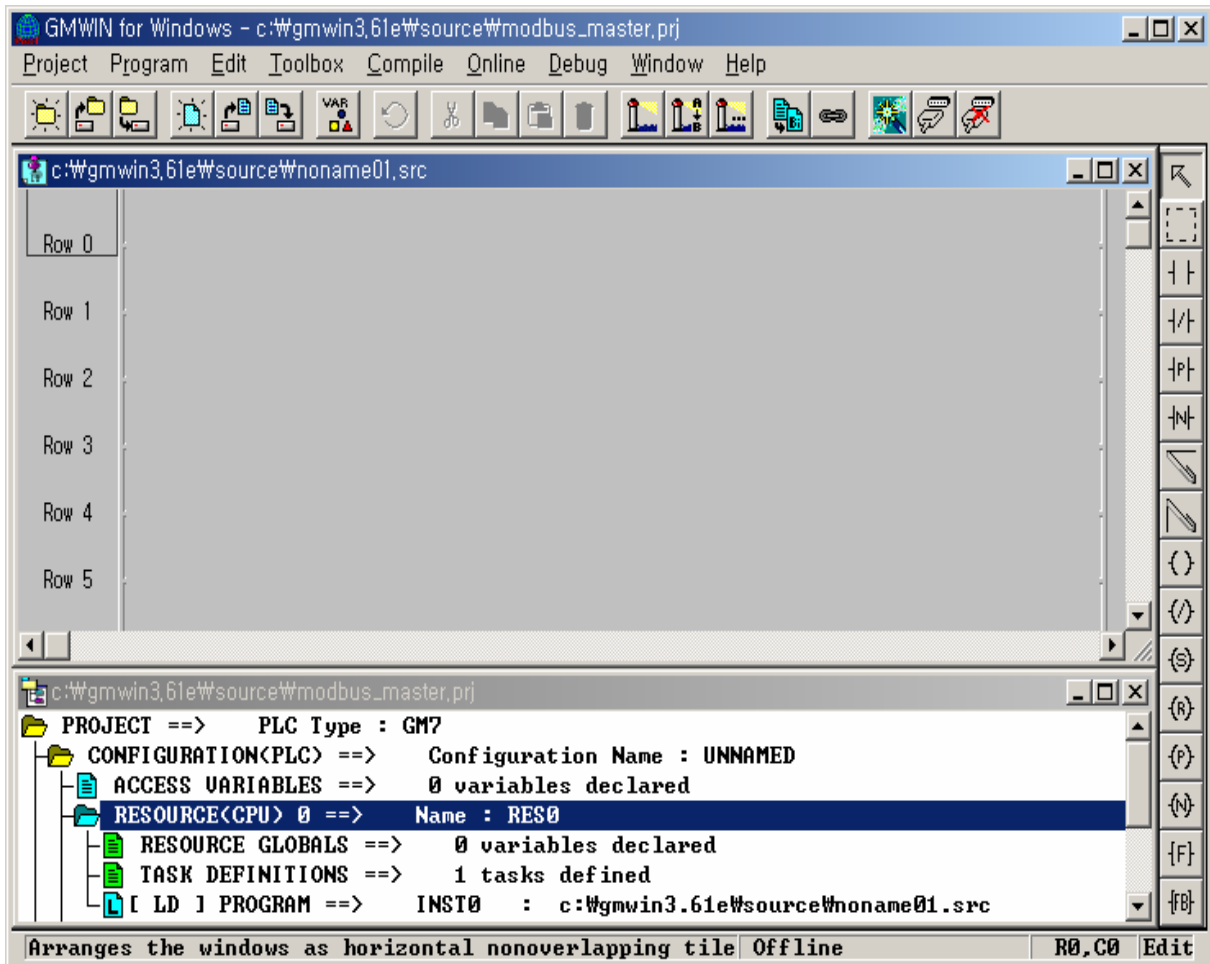


- The slave program is the program to output the data of M area to the output contact.

## Chapter 8 Modbus Communication

### 2) Master Station setting and Program

- (1) Create new project file and new program for the Master Station.





## Chapter 8 Modbus Communication

- (2) If you select 'communication parameter' from GMWIN parameter and doubleclick, the communication parameter menu window will be open.

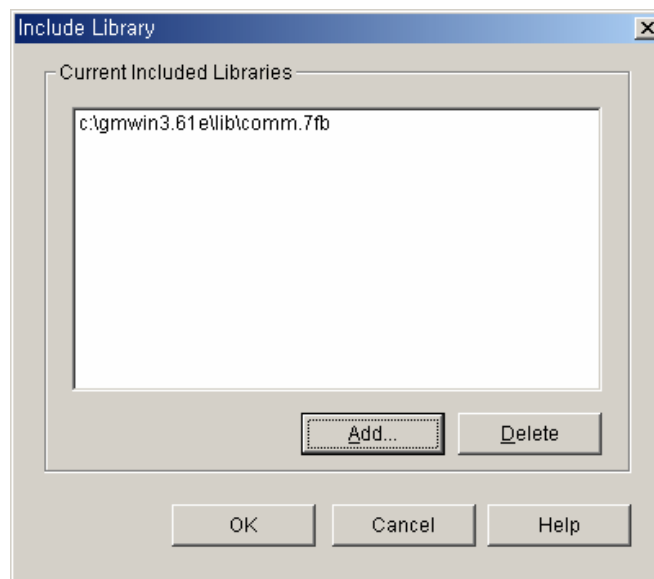
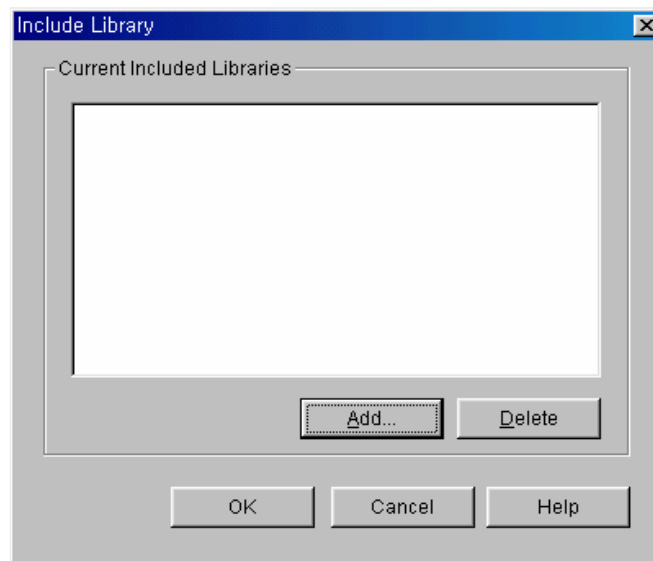
- After setting the parameter as below, press 'verify' button.

Communication method						Protocol & transmission mode	
Self station no.	Communication speed	Data bit	Parity bit	Maintenance bit	Communication channel	Modbus	Exclusive mode
1	2400	7	EVEN	1	RS232C null modem or RS422/485	Master	ASCII

## Chapter 8 Modbus Communication

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- (3) After creating the program as below, download it in the GM7 basic unit of the Master station. For further program creation and download method, please refer to GMWIN user's manual.
- In the program, the *Function Block* is used. If you doubleclick GMWIN 'inserted library files' items before using the *Function Block*, the library insert window will be open as below. Press 'Add (A)...' button and add COMM.7FB library and then press 'verify' button.



## Chapter 8 Modbus Communication

### - Program Creation

The screenshot displays the GMWIN software interface for creating a Modbus communication program. The main workspace is organized into 24 rows, each representing a step in the ladder logic. The program is divided into two main sections: one for Modbus 02 (WRITE) and one for Modbus 16 (MUL\_WR).

**Modbus 02 (WRITE) Section (Rows 0-11):**

- Row 0: `_1ON` (Normally Open contact) leading to `WRITE MOD0506 REQ NDR` (Coil).
- Row 1: `WORD_RD.NDR` (Normally Closed contact).
- Row 2: `WORD_RD.ERR` (Normally Closed contact).
- Row 3: `WRITE.NDR` (Normally Closed contact) leading to `BIT_RD MOD0102 REQ NDR` (Coil).
- Row 4: `WRITE.ERR` (Normally Closed contact).
- Row 5: `_SLV_ADDR` (Slave Address).
- Row 6: `_FUNC0102` (Function).
- Row 7: `_AH0102` (Address High).
- Row 8: `_AL0102` (Address Low).
- Row 9: `_NH0102` (Number High).
- Row 10: `_NL0102` (Number Low).
- Row 11: `_RD_DB` (Read Data).

**Modbus 16 (MUL\_WR) Section (Rows 12-23):**

- Row 12: `BIT_RD.NDR` (Normally Closed contact) leading to `MUL_WR MOD1516 REQ NDR` (Coil).
- Row 13: `BIT_RD.ERR` (Normally Closed contact).
- Row 14: `MUL_WR.NDR` (Normally Closed contact).
- Row 15: `MUL_WR.ERR` (Normally Closed contact).
- Row 16: `_SLV_ADDR` (Slave Address).
- Row 17: `_FUNC0304` (Function).
- Row 18: `_AH0304` (Address High).
- Row 19: `_AL0304` (Address Low).
- Row 20: `_NH0304` (Number High).
- Row 21: `_NL0304` (Number Low).
- Row 22: `_RD_DW` (Read Data).
- Row 23: `_WR_DBW` (Write Data).

The interface also shows a status bar at the bottom with the text "Sets the zooming level", "Offline", "R22,C2", and "Edit".

## Chapter 8 Modbus Communication

- After saving 16#FF(OR 255) to %MW0(this corresponds with %MX0 ~ %MX15 or %MB0 ~ %MB1.) in the *Function Block* MOD0506(function code 06), read %MX0 using the *Function Block* MOD0102(function code 01) and save '0' to %MX0 ~ %MX9 using the *Function Block* MOD1516(function code 15) again and then read %MW0 using the *Function Block* MOD0304(function code 03).
- You can see that 8 LED of output contact continues to repeat ON/OFF.
- The above figure is the screen that monitored the program execution. Thus, the value to be indicated on Array variable \_RD\_DB, \_RD\_DW is the result value after executing 'Read' not the initial value.
- The variable such as instance name.NDR, instance name.ERR, instance name.STATUS is generated automatically if declaring the instance variable of the *Function Block*.
- \_1ON flag is the flag that will be ON only for 1Scan.
- Each *Function Block* input REQ is each *Function Block* output.
- The size of \_BYTE\_CNT must be same when converting the data by byte unit.
- If the size of Array variable is smaller than that of the data to read or writ, the error occurs.
  
- Variable table

Variable name	Variable type	Initial value	Variable name	Variable type	Initial value
_SLV_ADDR	USINT	17(H11)	_NH0102	USINT	0(H00)
_FUNC0102	USINT	1(H01)	_NH0304	USINT	0(H00)
_FUNC0304	USINT	3(H03)	_NH0506	USINT	0(H00)
_FUNC0506	USINT	6(H06)	_NH1516	USINT	0(H00)
_FUNC1516	USINT	15(H0F)	_NL0102	USINT	1(H01)
_AH0102	USINT	0(H00)	_NL0304	USINT	255(HFF)
_AH0304	USINT	0(H00)	_NL0506	USINT	1(H01)
_AH0506	USINT	0(H00)	_NL1516	USINT	10(H0A)
_AH1516	USINT	0(H00)	_RD_DB	BOOL type ARRAY[40]	{0,0,...,0}
_AL0102	USINT	0(H00)	_RD_DW	WORD type ARRAY[4]	{0,0,0,0}
_AL0304	USINT	0(H00)	_WR_DBW	BYTE type ARRAY[4]	{0,0,0,0}
_AL0506	USINT	0(H00)	_BYTE_CNT	USINT	2(H02)
_AL1516	USINT	0(H00)			

## 8.5.2 MASTER-K Series

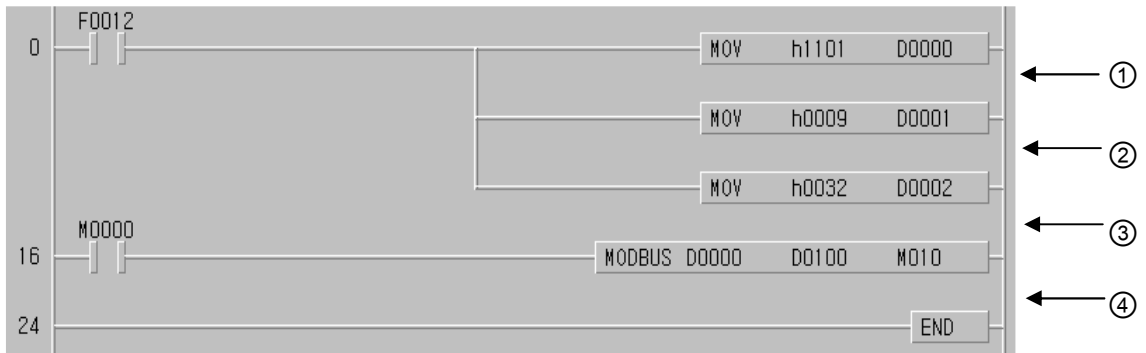
### Program Example 1

- This is the example to execute 'Status Read' for output contact (Coil) 00020 ~ 00051 of the Slave station that is station no.17.
- If assuming that the output contact of the Slave station is as below, the read data shall be saved in the data register D1000.

Output contact	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36
Contact status	0	0	0	0	1	1	1	0	1	0	1	1	0	0	1	0
Hexa	0				E				B				2			
Output contact	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20
Contact status	0	1	1	0	1	0	1	1	1	1	0	0	1	1	0	1
Hexa	2				6				B				C			

- 1) The data is transmitted from low bit by byte unit. The insufficient bit part among byte shall be filled with '0'. The transmission of the above data is shown on Ex.1).

Ex.1) CD 6B B2 0E



- ① Set the Slave station no. and Function code.  
Station no.17 = h11    Function code = h01
- ② Set the address.  
The address '0' set in Modbus protocol means the actual Address 1.  
If setting the actual Address 20, it is required to set Address 19.
- ③ Set the number.  
The number from Address 20 ~ 51 is 32.
- ④ Modbus communication command.  
The data to communicate by the setting form D000 ~ D002 is set to save from D1000.

## Chapter 8 Modbus Communication

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The data is transmitted from low bit by byte unit. The insufficient bit part among byte shall be filled with '0'. The transmission of the above data is shown on Ex.1).

Ex.1) CD 6B B2 0E

Storage Data

Device	Storage value
D1000	h CD 6B
D1001	h B2 0E

## Chapter 8 Modbus Communication

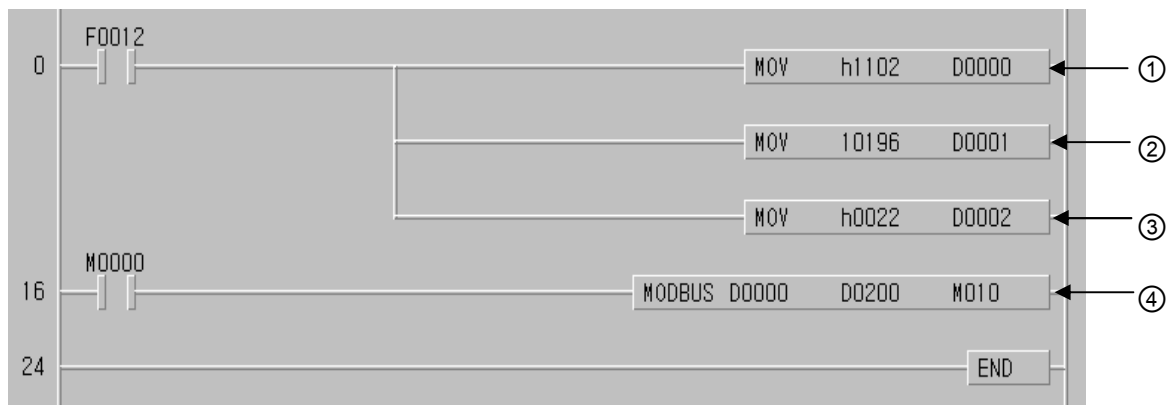
### Program Example 2

This is the example to execute 'Status Read' for input contact (Input) 10197 ~ 10218 of the Slave station that is station no.17.

If assuming that the input contact of the Slave station is as below, the read data shall be saved in the internal Relay M15.

Input contact	10220	10219	10218	10217	10216	10215	10214	10213	10212	10211	10210	10209
Contact status	X	X	1	1	0	1	0	1	1	1	0	1
Hexa	3				5				D			
Input contact	10208	10207	10206	10205	10204	10203	10202	10201	10200	10199	10198	10197
Contact status	1	0	1	1	1	0	1	0	1	1	0	0
Hexa	B				A				C			

- 1) The status of input contact 10219, 10220 is Redundancy.
- 2) The data is transmitted from low bit by byte unit. The insufficient bit part among byte shall be filled with '0'. The transmission of the above data is shown on Ex.1).



- ① Set the Slave station no. and function code.  
Station no.17 = h11    Function code = h02
- ② Set the address.  
The address '0' set in Modbus protocol means the actual Address 1.  
If setting the actual Address 10197, it is required to set Address 10196.
- ③ Set the number.  
The number from Address 10197 ~ 10220 is 22.
- ④ Modbus communication command.  
The data to communicate by the setting form D000 ~ D002 is set to save from D200.

## Chapter 8 Modbus Communication

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The data is transmitted from low bit by byte unit. The insufficient bit part among byte shall be filled with '0'. The transmission of the above data is shown on Ex.2).

Ex.2) AC DB 35

Storage Data

Device	Storage value
D0200/D0201	h AC DB / h 00 35