FACON-PLC
Communication
Protocol

FATEK AUTOMATION CORP.

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Ver. 1.1

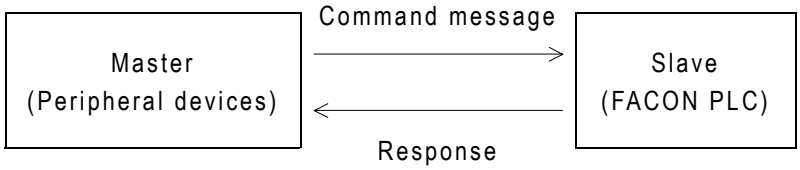
FACON PLC Communication Protocol
Contents

The Communication Protocol of FACON PLC

The FACON PLC communication protocol is applicable for all communication ports of FACON PLC that work under the standard mode. Any peripherals that want to communicate with FACON PLC, besides hardware interface, communication parameters must accordance with FACON PLC also the format of the message must follow this communication protocol.

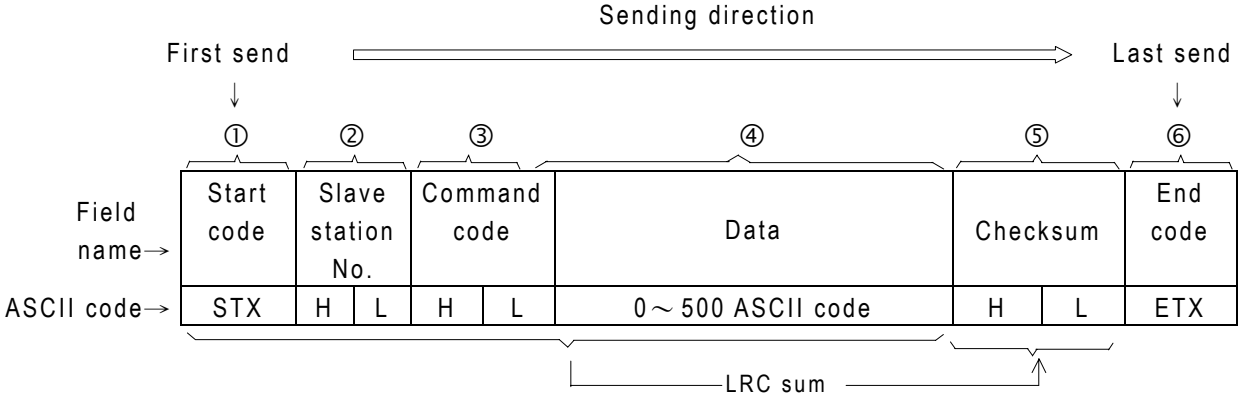
1. The definition of Master and Slave device

FACON PLC acts as a slave while communicating with peripheral device that always acts as master when communicate with FACON PLC. All the peripheral devices actively send the message to the FACON PLC and FACON PLC will passively response the message after receive the message from master.



2.The Message Format of FACON Communication Protocol

There are 6 fields in the FACON PLC message including command (master) and response (slave) message.



①Start code(STX)： The ASCII code of STX is 02H in hexadecimal format. The start character is STX both for command and response message. While receiving, can discriminate the message start by checking the STX code.

②The station No. of slave：The station number consists of two hexadecimal characters. There is only one master station and 255 slave stations can be existed for FACON PLC communication network. Every slave station has a unique station number from 1～FEH (If the station No. is 0 means the message is for all slave station).

When the master want to send a command message to a certain slave it will put the station no. of the accordant slave into the slave station field of the command message in order to address that slave. The slave will put it's own station no. into the slave station field of the response message then send back to master.

Remark：	The station no. of FACON PLC are all set to 1 before shipment. The station no. can not be set thru the FACON communication protocol, it can only be changed by using the FP-07 or Programming software such as PRO-LADDER or WinProladder.

③Command code ：The command code consists of two hexadecimal characters. It is the action which the master wants slave to execute. For example, to read or write the status of discrete, forcing, run, stop... The command code of the response message is identical to the command message.

④Data information ：The data information contains 0(no data)～500 ASCII characters. The data in this field is to assign the address or value for reading or writing. The first data of the response message is the error code. In normal condition (no error happened) the error code must be '0'(30H) and then follow the responding status or value in the response message. When error happened, its value will be other than '0'(30H) and the data information will be absent.

⑤Checksum ：Checksum is the summation of the hexadecimal value of ASCII code in the previous ①～④ fields and the sum will only takes byte value (two hexadecimal value 00～FF) that is so called "LRC (Longitudinal Redundancy Check)" method. This message will be checked with the same way at the receiving side when the message is received. When the two check values are the same, it means the data transferred correctly. If the two check values are different, there are some error happened. The calculation of LRC method is to add all the hexadecimal value (8 bits length) of ASCII code and ignore the carry to keep the check value at 8 bits length.

⑥End code (ETX)：The hexadecimal code of ETX code of ASCII is 03H. The ETX code for both the command or response message is the same. When the receiving side receives the ETX code, it means that the data transmission of this message is ended and can start to process the command.

3.The communication error code of FACON PLC

If the message has errors in command code, address or over range of value or hardware problem will cause the slave device can not process the command comes from master device. If there is error happened, slave device will respond the message to master device. No matter what command code or data the master device sends, the format of responding message is all the same. Including the required start code (STX), end code (ETX) and checksum value, the command code and station No. will be sent back to master device. The slave device will judge what kind of the error and respond the error code to master device accordingly.

● Following table is the response error code of FACON PLC：

Error code (Hex)	Description
0	No error
2	Illegal value (ex. Decimal format contains hexadecimal number)
3	Write prohibited (PLC equipped with ROM PACK)
4	Illegal command format (Includes illegal command code) or command can not execute
5	Can not run (Ladder Checksum error when run PLC)
6	Can not run (PLC ID not identical with Ladder ID when run PLC)
7	Can not run (Syntax check error when run PLC)
9	Can not run (One or more instructions in ladder program is not supported by this PLC)
A	Illegal reference address

4.The function description of communication command

In this section will illustrate the format of the command and response messages for all command codes that FACON supported.(Only the successful response will be illustrated, for the error response please refer section 3)

4.1 The accessible elements and its designation

The main function of PLC communication is to read and write the status or value inside PLC elements. Concerning the discrete and register which are available for read and write are designated and referenced by following table：

Elements	Symbol	Name	Discrete address (5 characters)	16 bits register address (6 characters)	32 bits register address (7 characters)
Discrete	X	Input discrete	X0000～X9999	WX0000～WX9984	DWX0000～DWX9968
	Y	Output relay	Y0000～Y9999	WY0000～WY9984	DWY0000～DWY9968
	M	Internal relay	M0000～M9999	WM0000～WM9984	DWM0000～DWM9968
	S	Step relay	S0000～S9999	WS0000～WS9984	DWS0000～DWS9968
	T	Timer discrete	T0000～T9999	WT0000～WT9984	DWT0000～DWT9968
	C	Counter discrete	C0000～C9999	WC0000～WC9984	DWC0000～DWC9968
Data register	TMR	Timer register	-	RT0000～RT9999	DRT0000～DRT9998
	CTR	Counter register	-	RC0000～RC9999	DRC0000～DRC9998
	HR	Data register	-	R00000～R65535	DR00000～DR65534
	DR	Data register	-	D00000～D65535	DD00000～DD65534

- The discrete status(X，Y，M，S)can combine 16 or 32 consecutive status as the 16-bit or 32-bit register, such as the above table WX△△△△ or DWX△△△△, but △△△△ should be the multiple of 8.

- It needs 5 characters when assign the discrete address and 6 characters when assign the 16-bit register address and 7 characters to assign the 32-bit register address.

- The address range of elements in above table is the largest for all models of FACON PLC. The users should notice the applicable address of each element for PLC in hand. (Ex. For FBE-PLC, the range for X、Y address is 0000～0255; for S is 0000～0999)If exceed the range of valid address, PLC will reply error code “A” (illegal address), and will not execute that command.

4.2 The description of communication command

- The description of communication command：

Command code (Hex)	Function description	Data size can be processed with one command	Remark
40	Read the brief system status of PLC	–	
41	Control the RUN/STOP of PLC	–	
42	Write single discrete status	1 point	
43	Read multiple ENABLE/DISABLE status of discrete elements	1～256 points	
44	Read multiple status of consecutive discrete elements	1～256 points	
45	Write multiple status of consecutive discrete elements	1～256 points	
46	Read multiple consecutive registers data	1～64 Words	
47	Write multiple consecutive registers data	1～64 Words	
48	Mixed read of arbitrary discrete and register status	1～64 points or Words	
49	Mixed write of arbitrary discrete and register status	1～32 points or Words	
4E	Loop back test	0～256 characters	
4F	Read program	64 Words	
50	Write program	64 Words	
53	Read the detail system status of PLC	–	

1：The message of discrete status is represented by one character (1 means ON, 0 means OFF) and the data of 16-bit register uses 4 characters to represent the value of one WORD(0000H～FFFFH)

2：The data of 32-bit register is DW(two consecutive Words), it has to use 8 characters to represent its data. If the element is 32-bit register, the element has to be treated as 2W. For example, the command code 46 or 47 can process 64 16-bit elements and only can process 32 32-bit elements.

3：In the command code 48 and 49, the data length is the total of discrete and register element and can not exceed 64W(command 48) and 32W(command 49). As increase one point, its total registers will decrease one word, vice versus. Because the data length of 32-bit element is 2 words, the applicable register or discrete will be reduced by 2 when increase one 32-bit element. For example, the data length of command 48 is 1～64W. If it read 20 32-bit elements, its message will occupy 40 words and remain 24W available for discrete or 16-bit register. In this example, command code can read 44 elements (20 32-bit elements and 24discrete or 16-bit elements) in one communication.

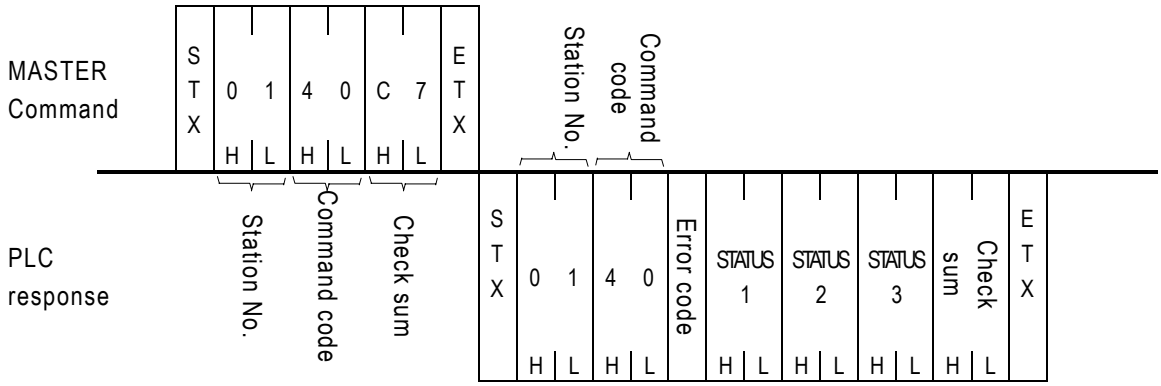
4：The operation (read and write) of consecutive discrete or register can be easily assigned by the starting reference number and its size, no enumeration is required. The operating elements can only being one of discrete or register and can not be operated mixed.

5：The command of arbitrary operating on objects can read or write several discrete and register at will. As their number is not consecutive, you have to designate their number hence can allow operating on discrete and register randomly.

6：The Read and Write program operation retrieve all the program area of PLC or write the PLC program to PLC. The maximum data transferring in one communication is 64 words so that it will takes many times of communication to complete the operation.

● Command code 40 (Read the brief system status of PLC)

Format



STATUS 1 :

H				L			
B7	B6	B5	B4	B3	B2	B1	B0

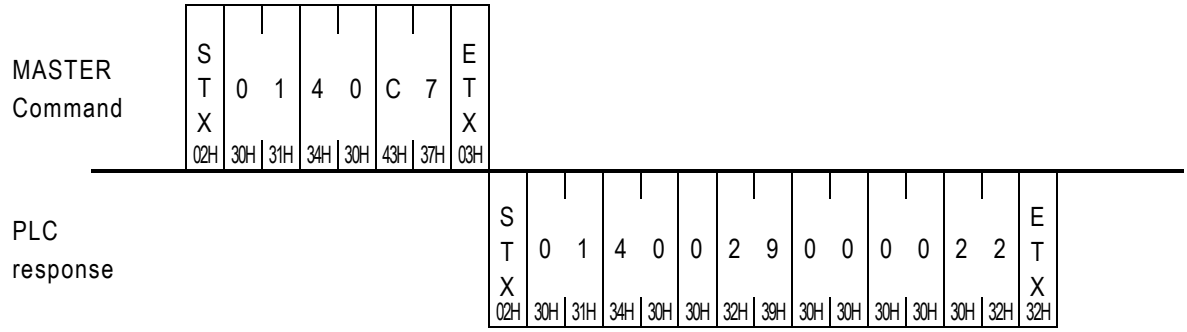
STATUS 2 : (LADDER program capacity)

- 00H ,RESERVE
- FFH ,FB 8K Step program
- 53H ,FBE 8K Step program
- 54H ,FBE 13K Step program
- 55H ,FBN 8K Step program
- 56H ,FBN 13K Step program

STATUS 3 : 0 (Reserve for future)

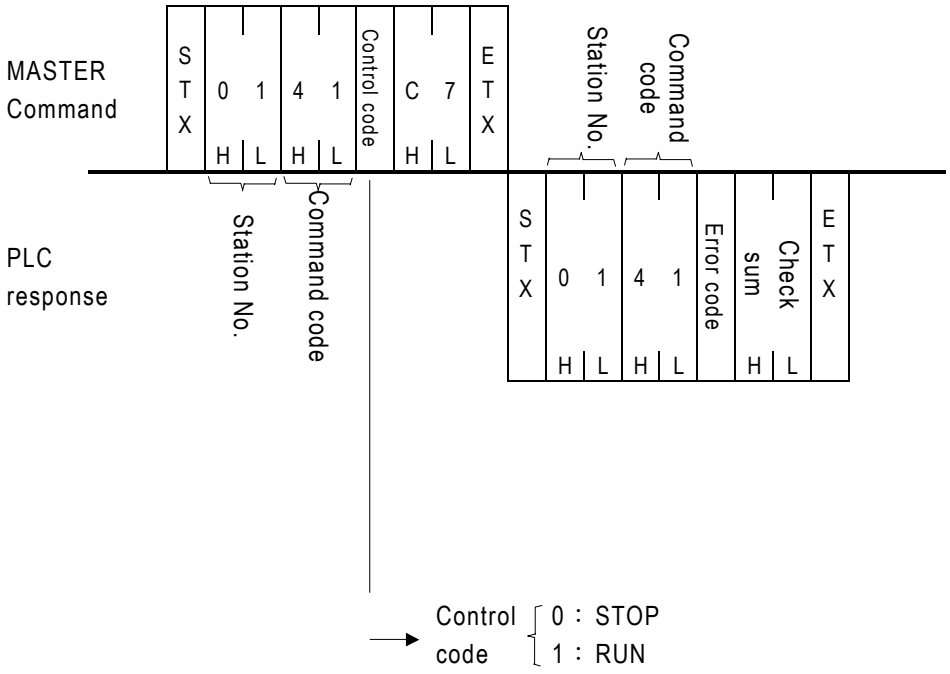
B0 : Run/Stop
0 – Stop, 1- Run
B1 : Battery status
0 – Normal, 1 – Low energy
B2 : Ladder checksum status
0 – Normal , 1- Error
B3 : ROM PACK usage
0- Not use, 1- use
B4 : WDT status
0 – OK , 1 - Error
B5 : ID status
0 – Not set, 1- set
B6 : Emergency stop status
0 – OK , 1 – Emergency stop
B7 : 0 (Reserve for future)

Ex. If the PLC is equipped with ROM PACK and ID is set in both PLC and ROM PACK and PLC status is "RUN" under normal condition, the system status of PLC which MASTER read will be as following: (B5,B3, and B0 are 1 and the other are all 0 that the STATUS is 29H) .

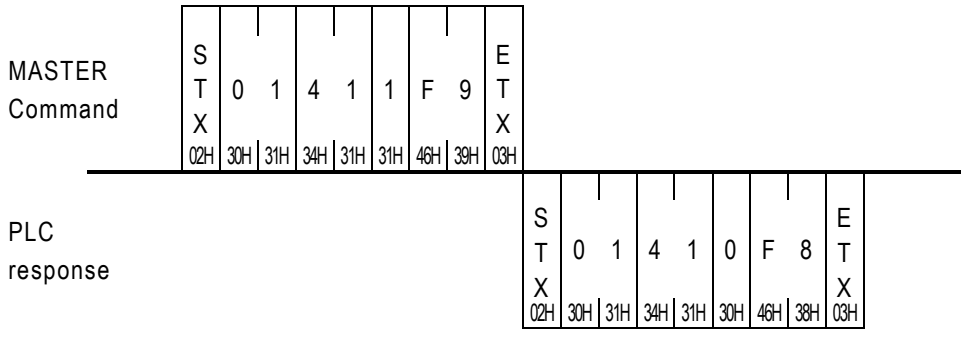


● Command code 41 (Control the RUN/STOP of PLC)

Format

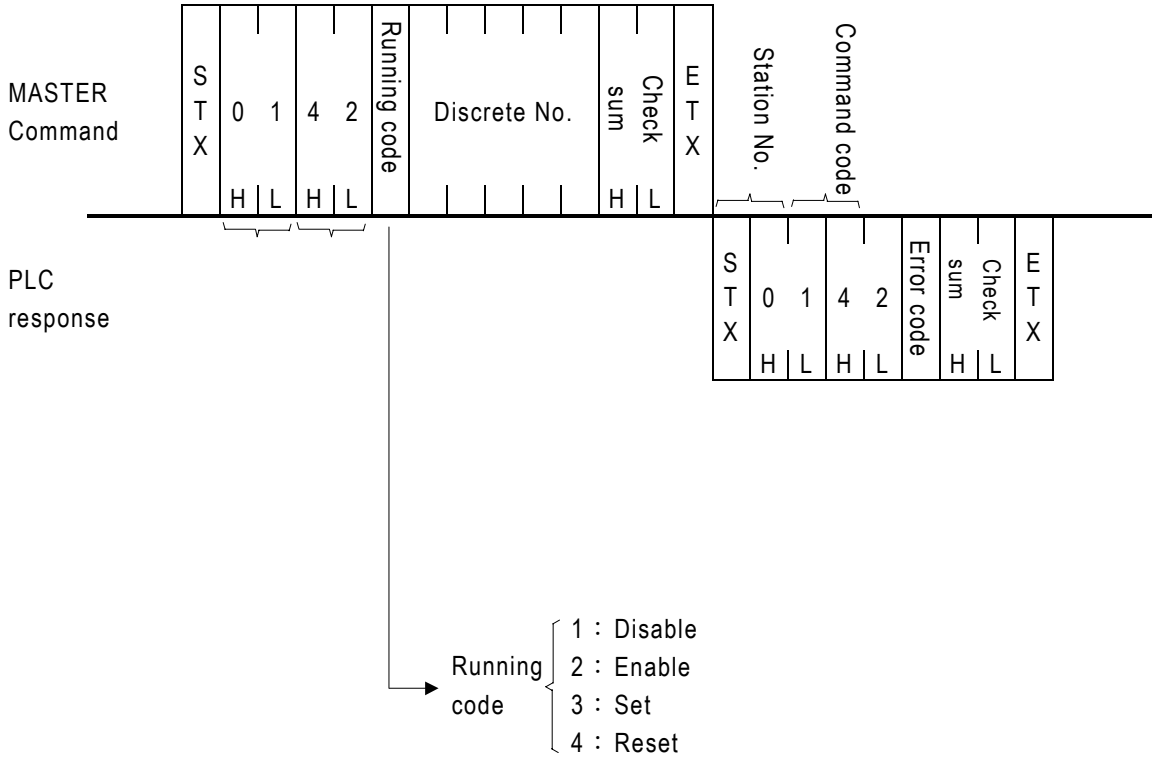


Ex. Control the PLC to “RUN”

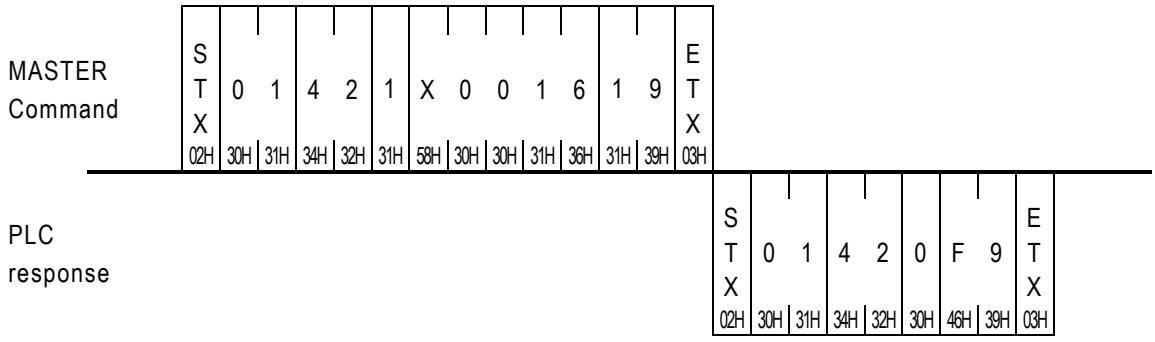


● Command code 42 (Control single discrete element)

Format This command can control the designated discrete to do ENABLE, DISABLE, SET, RESET four operations.

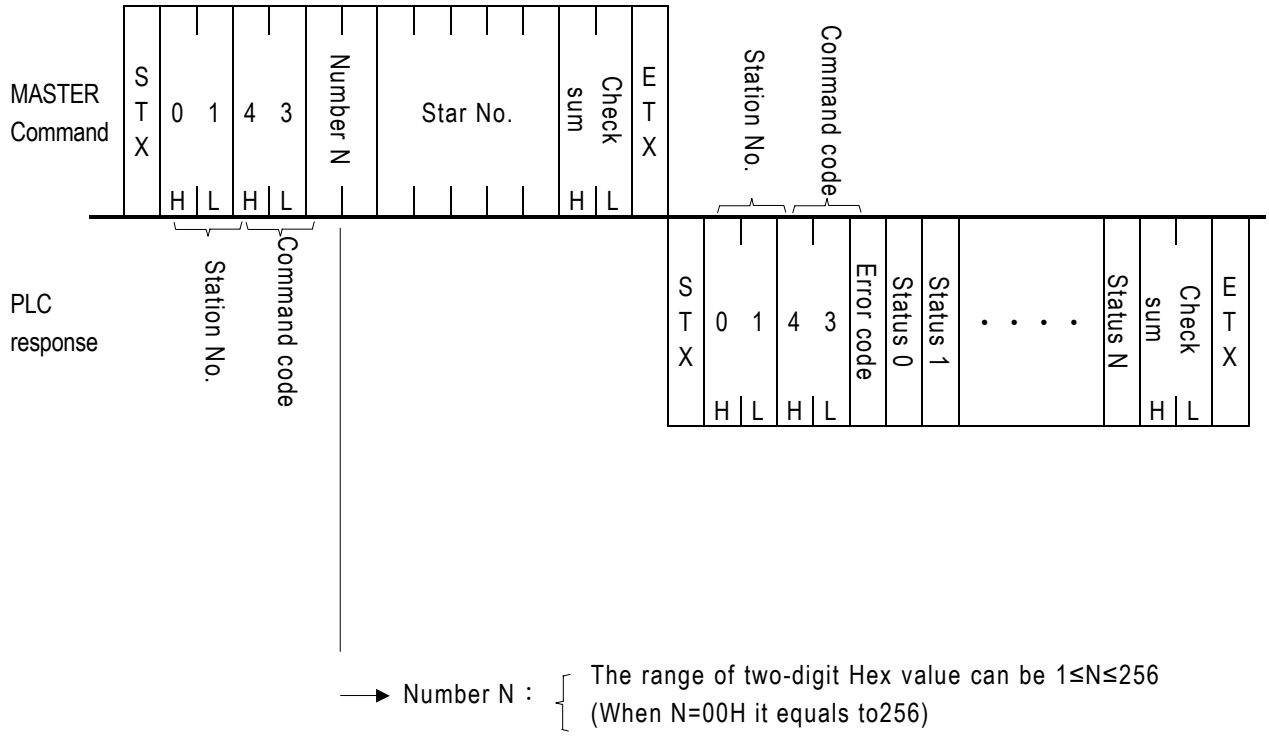


Ex. The following communication format is the example to DISABLE the discrete X16.

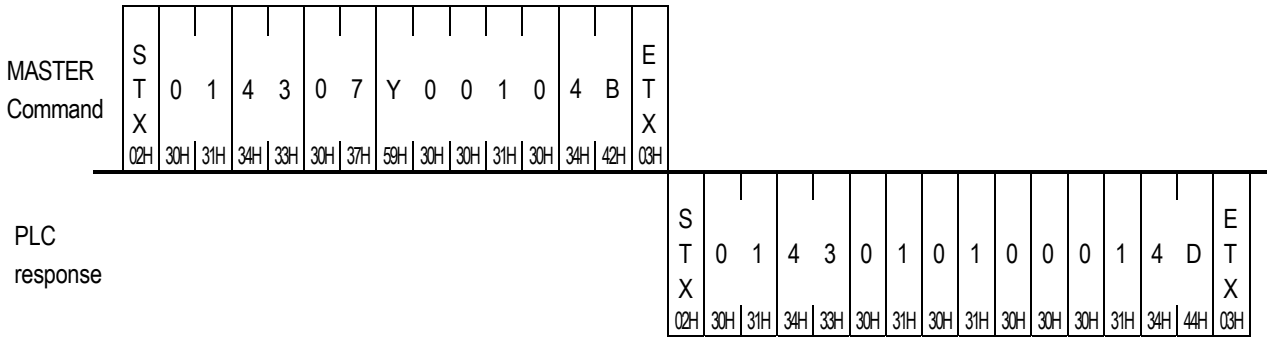


● Command code 43 (Read multiple ENABLE/DISABLE status of discrete elements)

Format | Use this command to read the ENABLE/DISABLE status of consecutive discrete elements.

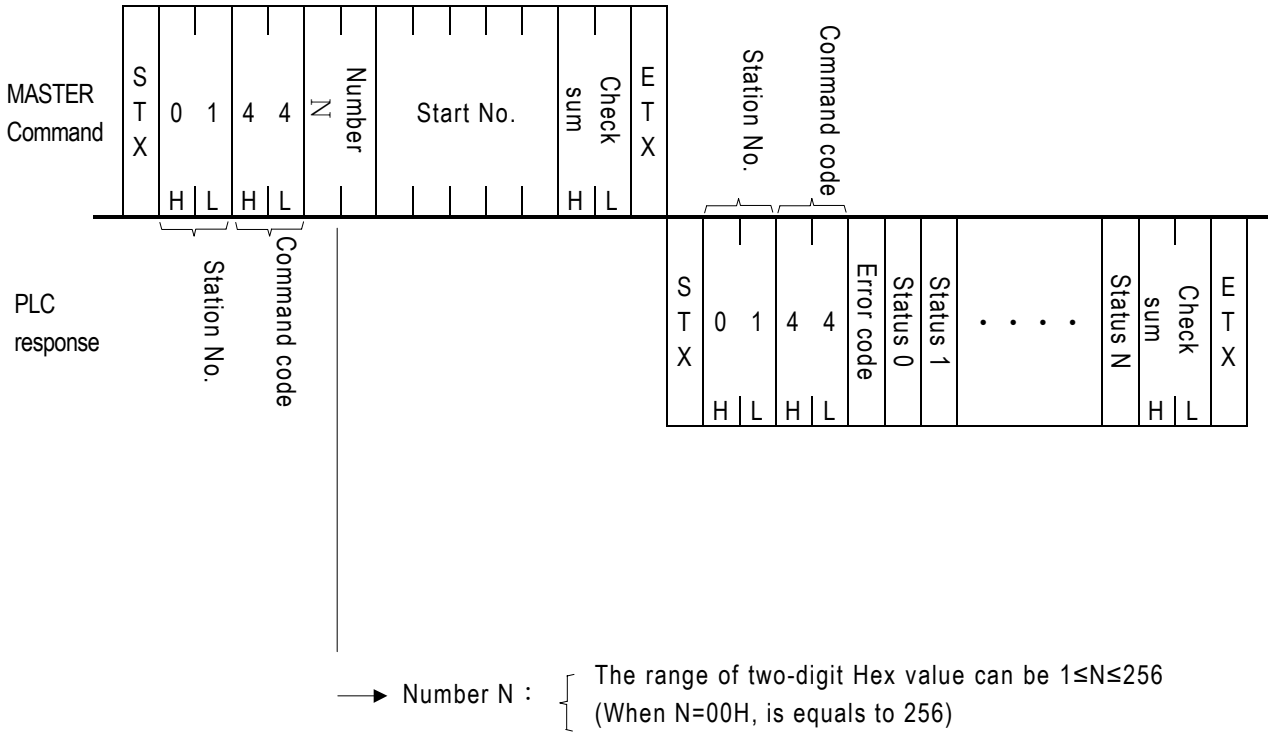


Ex. | Among the 7 consecutive discrete elements of Y10~Y16, if the DISABLE/ENABLE status of Y10, Y12, Y16 are DISABLE, and the others are all ENABLE, the PLC status of this command reading is as



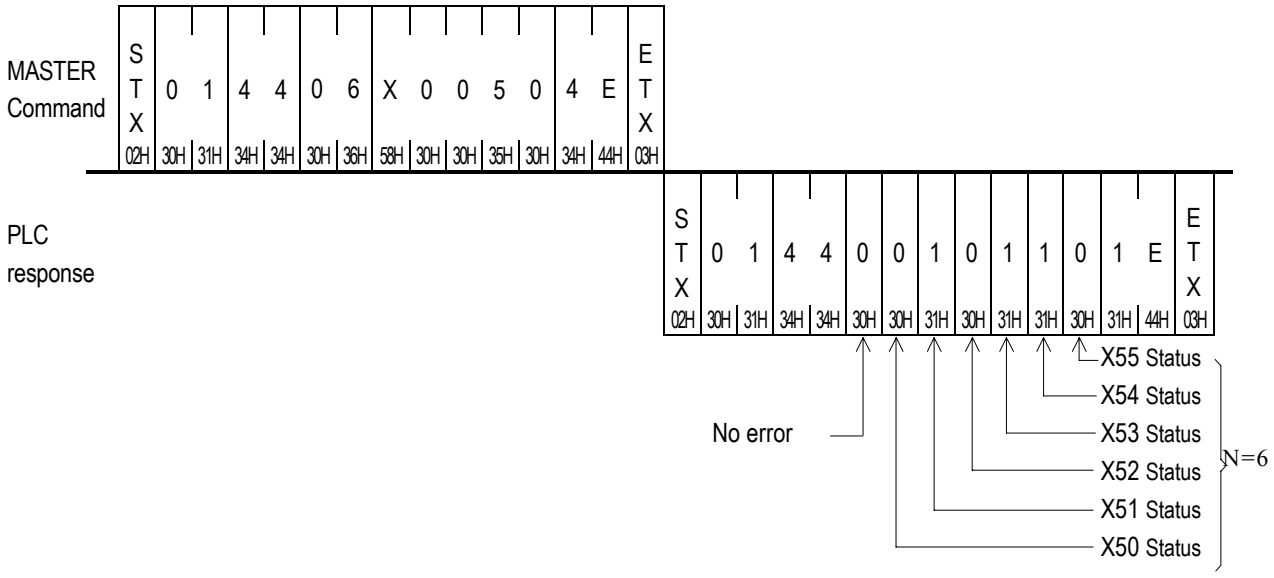
● Command code 44 (Read multiple status of consecutive discrete elements)

Format



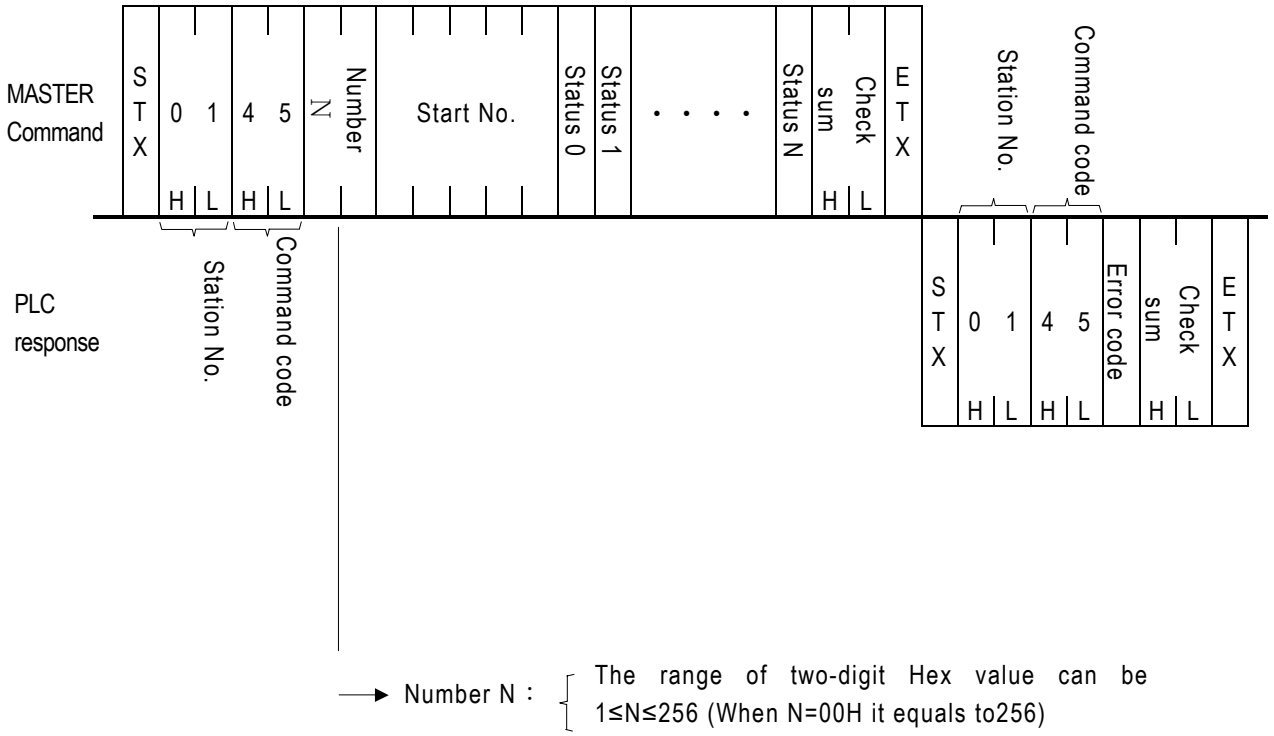
Ex.

If the status of X50, X52, X55 are all 0 and X51, X53, X54 are all 1, following is the status of reading the consecutive 6 inputs (X50～X55)

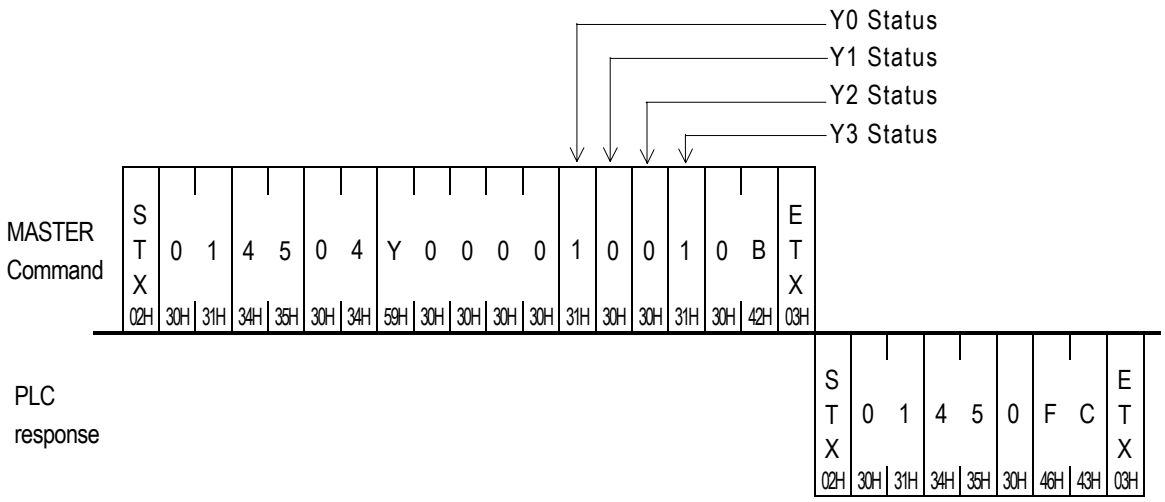


● Command code 45 (Write multiple status of consecutive discrete elements)

Format

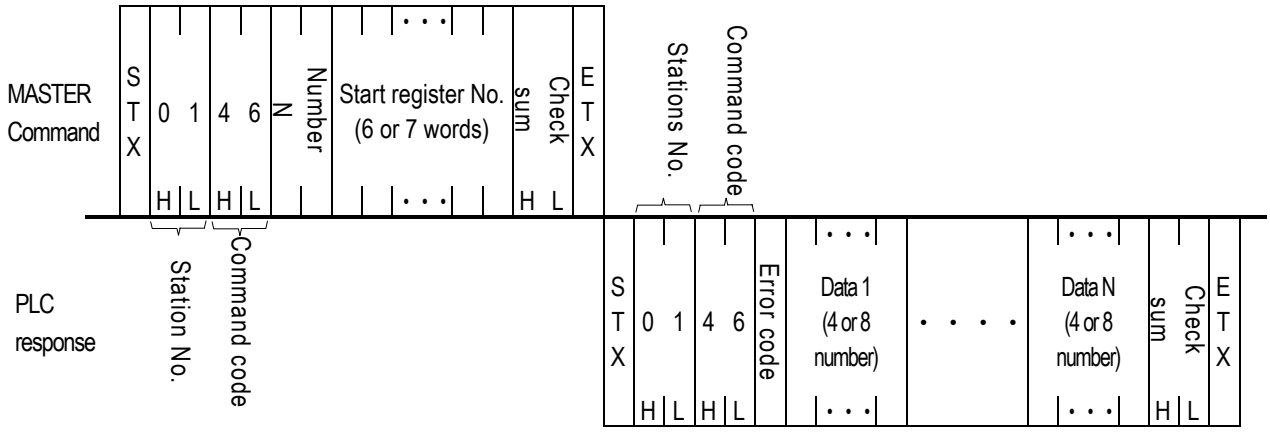


Ex. Write the status to consecutive 4 outputs (Y0～Y3) , Y0 and Y3 are 1, Y1 and Y2 are 0.



● Command code 46 (Read multiple data of consecutive registers)

Format

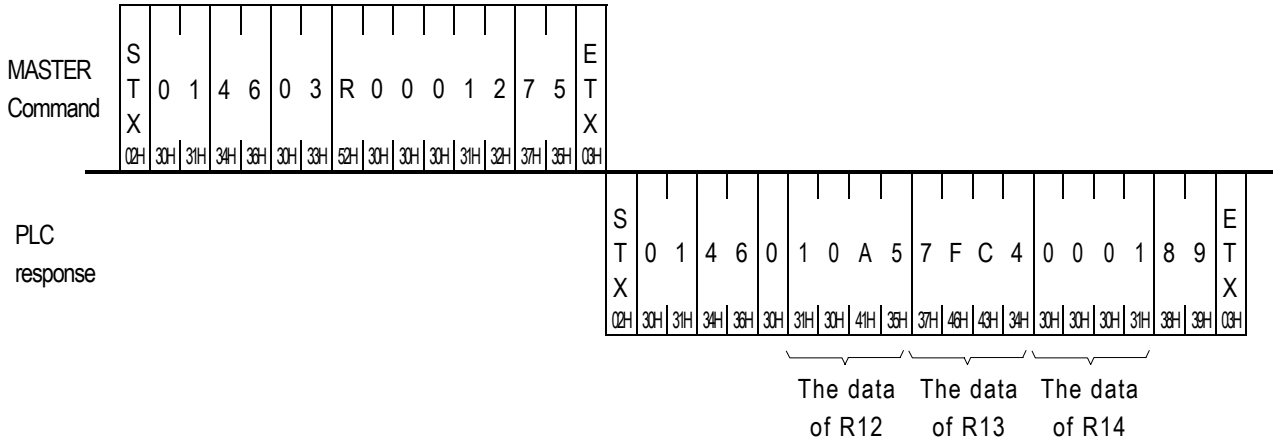


● N consists of two-digit Hex number, its range can be 01H～40H or 20H (32-bit element)

● The address of 16-bit register consists of 6 characters and the Hex value of its data consists of 4 characters. (It can be shown as 0000H～FFFFH)

● The address of 32-bit register consists of 7 characters and the Hex value of its data consists of 8 characters. (It can be shown as 00000000H～FFFFFFFFH)

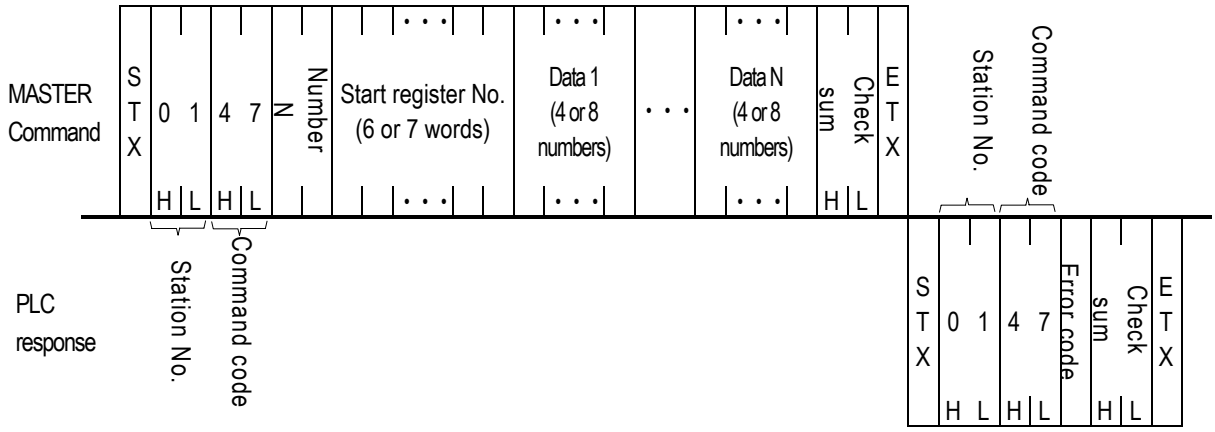
Ex. Read the data of consecutive 3 16-bit registers and start with R12. (R12,R13,R14)



● Refer to the above example, the PLC responds as R12=10A5H, R13=7FC4H, R14=0001H

● Command code 47 (Write to multiple consecutive registers)

Format

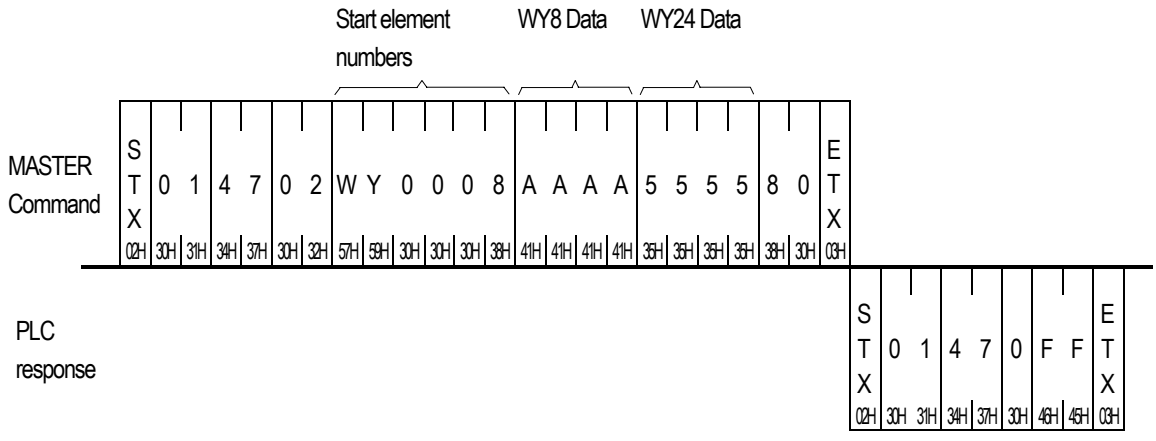


● N consists of two-digit Hex number, its range can be 01H～40H or 20H (32-bit element)

● The address of 16-bit register consists of 6 characters and the Hex value of its data consists of 4 characters. (It can be shown as 0000H～FFFFH)

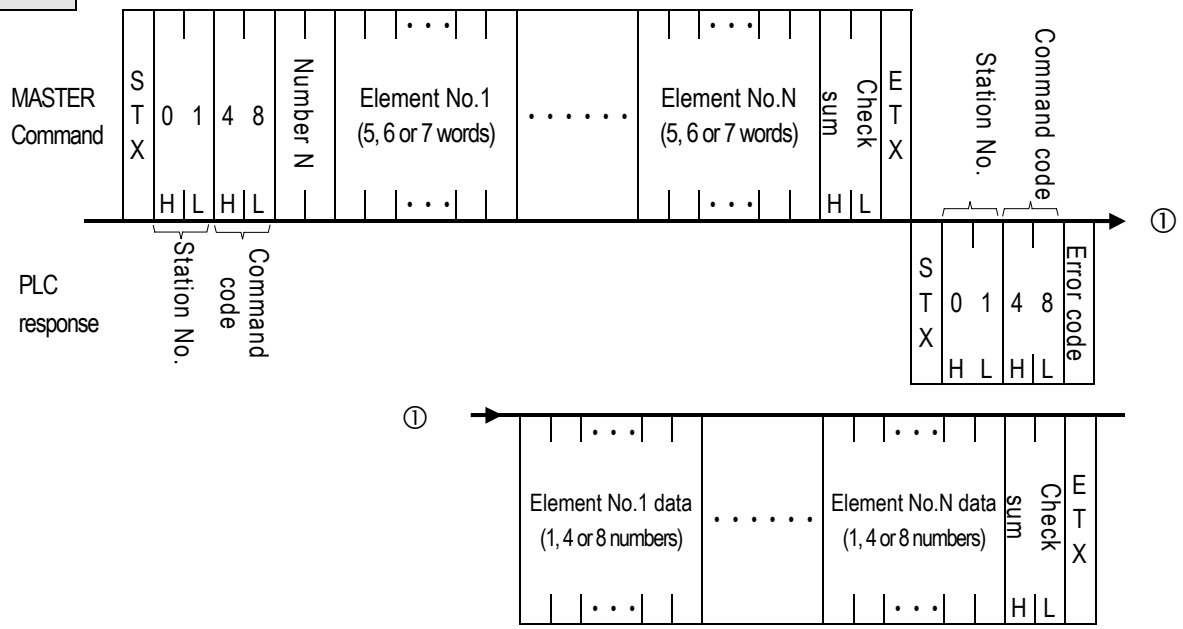
● The address of 32-bit register consists of 7 characters and the Hex value of its data consists of 8 characters. (It can be shown as 00000000H～FFFFFFFFH)

Ex. Write AAAAH to the 16-bit register WY8 and 5555H to WY24. This can use the multiple write register command because WY8 and WY24 are consecutive registers.



● Command code 48（Mixed read the arbitrary discrete and register data）

Format



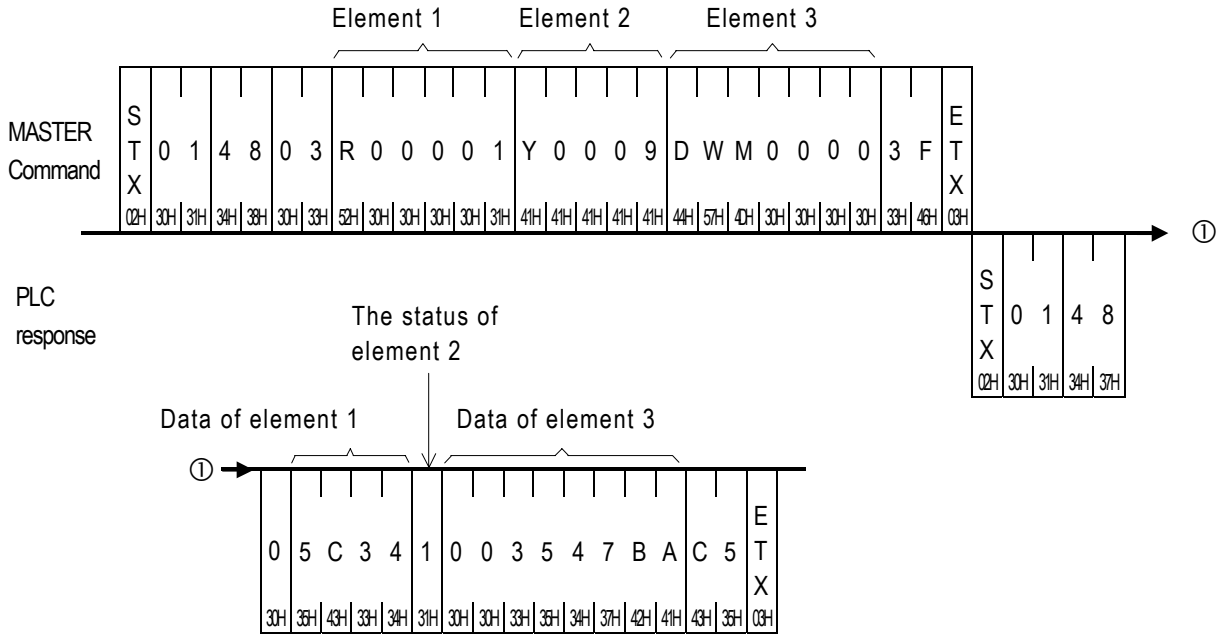
● N consists of two-digit Hex number; it means the total numbers of elements. Its range can be 01H～40H.（Refer to the item 3）

● If the element is discrete, its address consists of 5 characters and status response consists of one character （1 or 0）

● If the element is 16-bit register, its address consists of 6 characters and data response consists of 4-character Hex value.

● If the element is 32-bit register, its address consists of 7 characters and data response consists of 8-character Hex value.

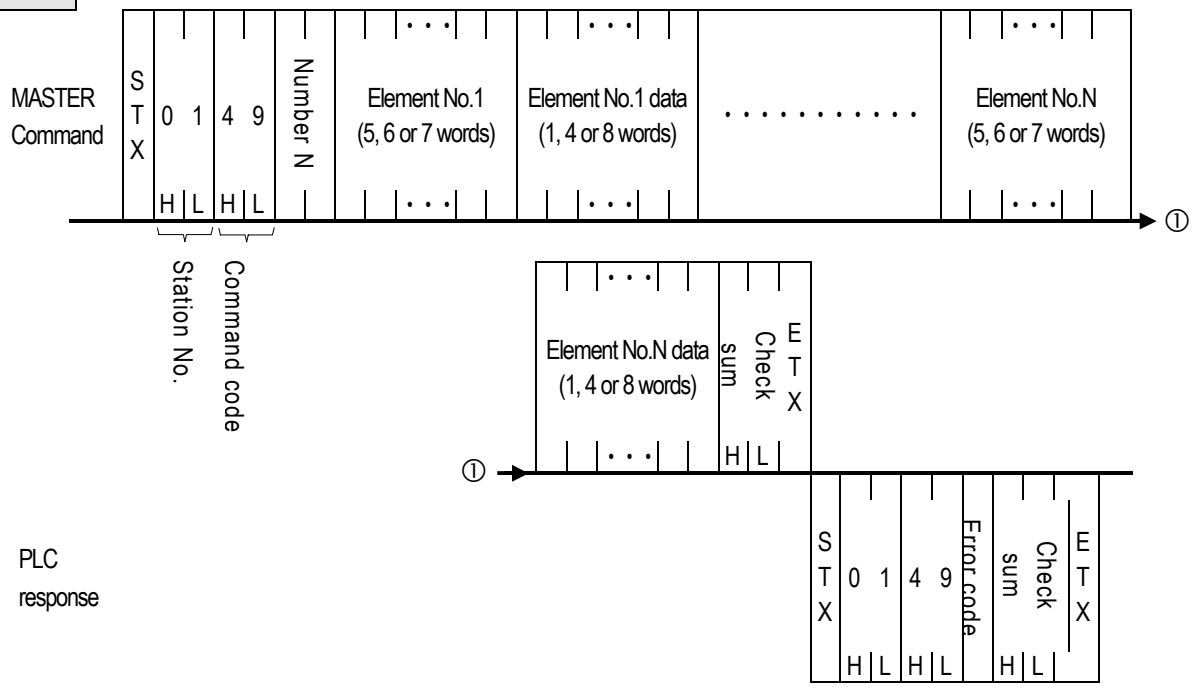
Ex. Read the status of R1，Y9 and DWM0（i.e. M31～M0）



● In the above example, R1=5C34H and Y9 status is 1（〝ON〞），DWM0=3547BAH

● Command code 49（Mixed write the arbitrary discrete and registers）

Format



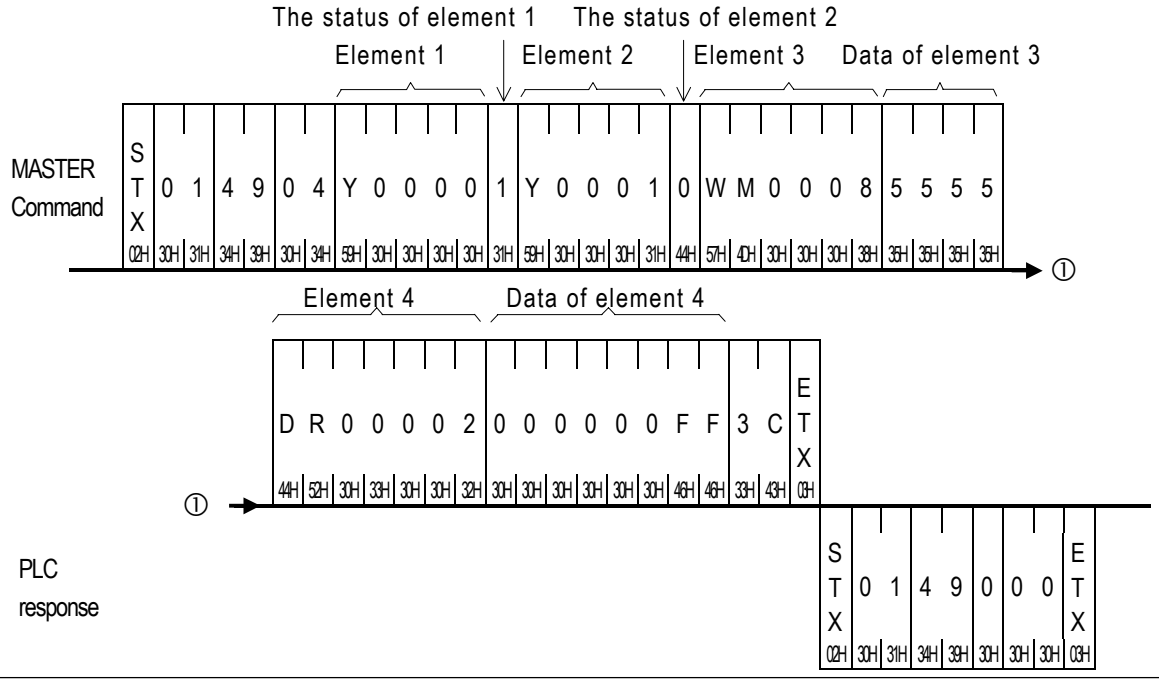
● N consists of two-digit Hex number; it means the total elements to write. Its range can be 01H～20H.（Refer to the item 3）

● If the element is discrete, its address consists of 5 characters and status response consists of one character （0 or 1）

● If the element is 16-bit register, its address consists of 6 characters and data response consists of 4-digit Hex value.

● If the element is 32-bit register, its address consists of 7 characters and data response consists of 8-digit Hex value.

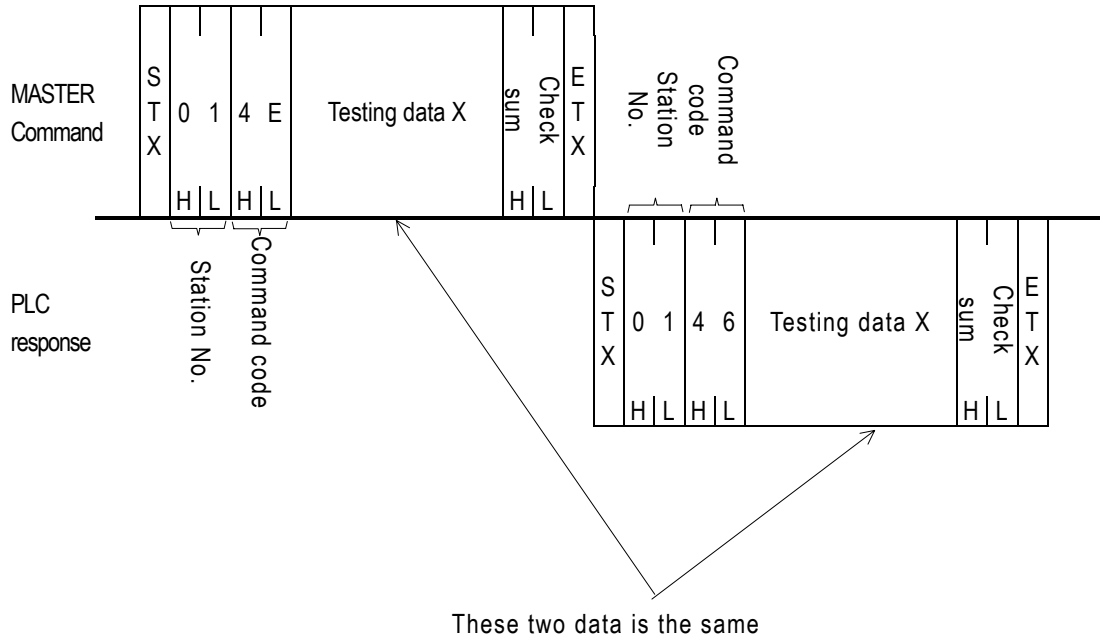
Ex. Set the status of Y0 at 1, Y1 to 0, 16-bit register WM8 to 5555H, 32-bit register DR2 to FFH.



● Command code 4E（Loop back test）

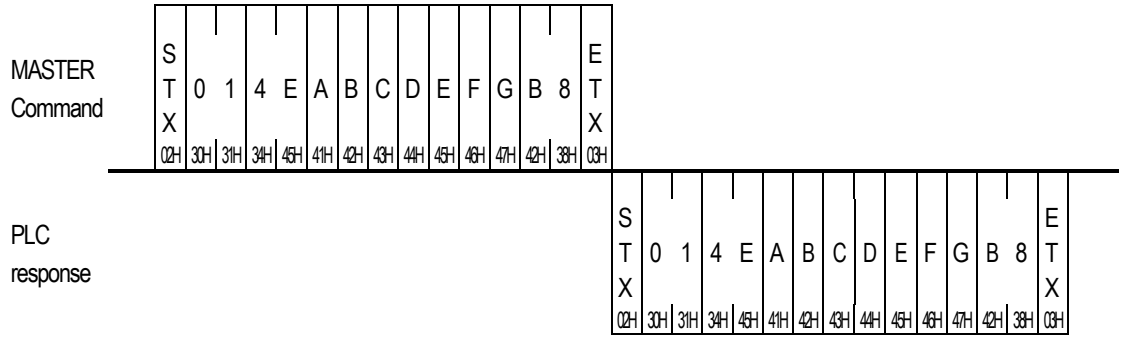
Format

This command makes slave PLC respond all test data back to Master. It is only for testing the communication condition between Master and PLC and it will not influence the PLC operation.



Ex.

Use this command to send the data 〝ABCDEFG〞 from Master to PLC to test weather the PLC respond normally.



● Command code 4F（Read program）

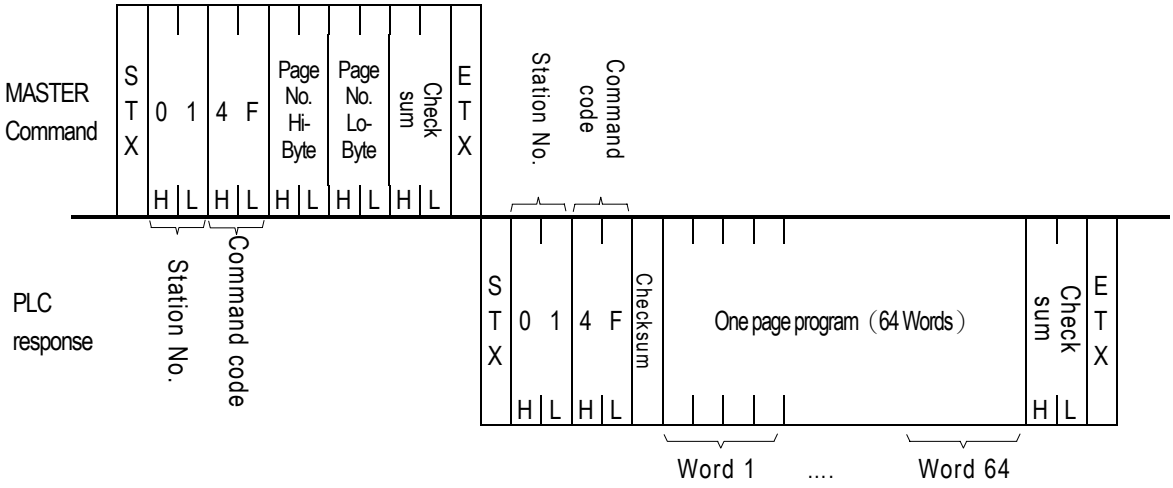
Format

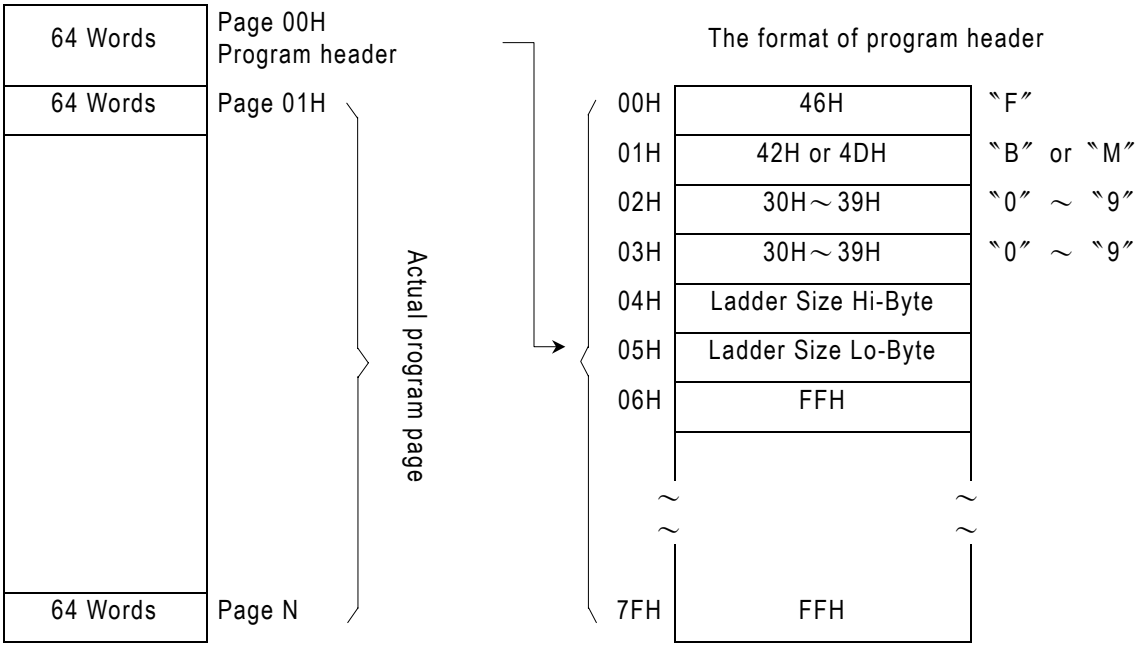
● MASTER uses command code 53 to read the detail system status of PLC before perform the operation of read PLC program. From the response message of command code 53 can get the capacity of PLC program and hence can determine how many transactions (64 Words for each transaction) needed to carry in order to completely read the PLC program.

Ex. ：When the program capacity of PLC is 8192（8K）Words, Master should read 0,1,2,.....,128, total 129 pages' data（page 0 is the program header, the actual program starts from page 1 to 128）

Ex. ：When the program capacity of PLC is 13184（13K）Words, Master should read 0,1,2,.....,206, total 207 pages' data （page 0 is the is the program header, the actual program starts from page 1 to 206）The total pages to be transfer

$$N=\frac{\text{Program capacity}}{64}$$





※When program capacity is 8192 Words, Ladder Size Hi-Byte=20H，Ladder Size Lo-Byte=00H
※When program capacity is 13184 Words, Ladder Size Hi-Byte=33H，Ladder Size Lo-Byte=80H

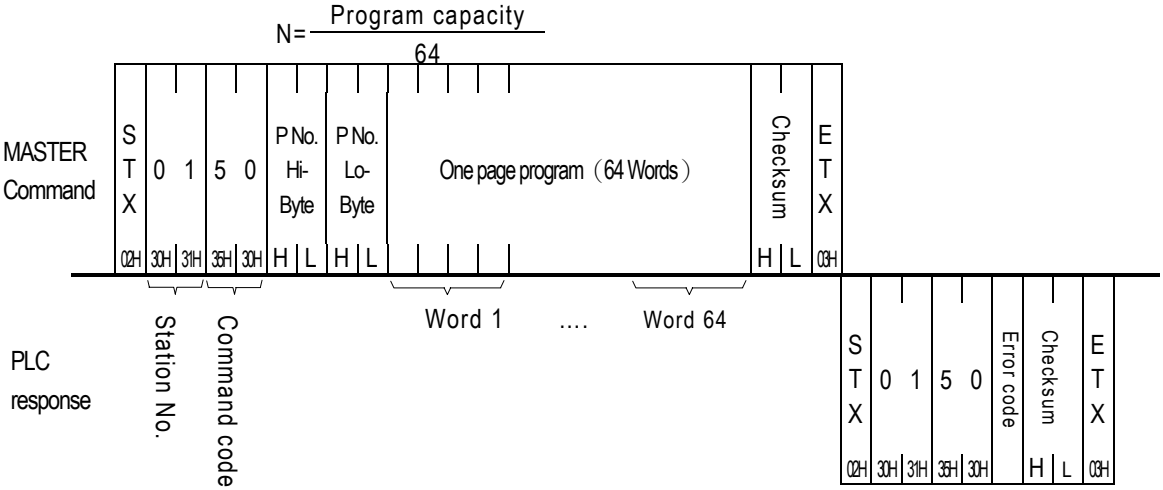
● Command code 50（Write program）

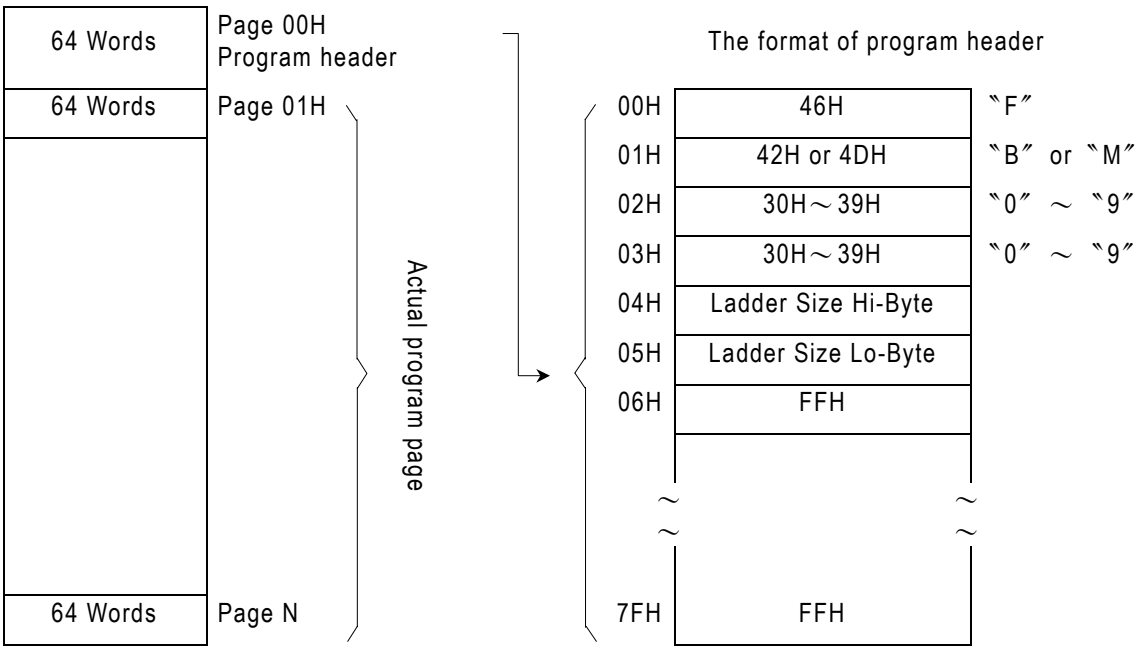
Format

● Master can use this command code to write program to PLC, which were retrieved by previous command code 4F.

If the capacity of writing program is 8192 (8K) Words, Master should transfer 129 pages data to the PLC (page 0 is the program header, the actual program starts from page 1 to 128).

If the saved program capacity is 13184 (13K) Words, Master should transfer 206 pages data to the PLC (page 0 is the program header, the actual program starts from page 1 to 206).



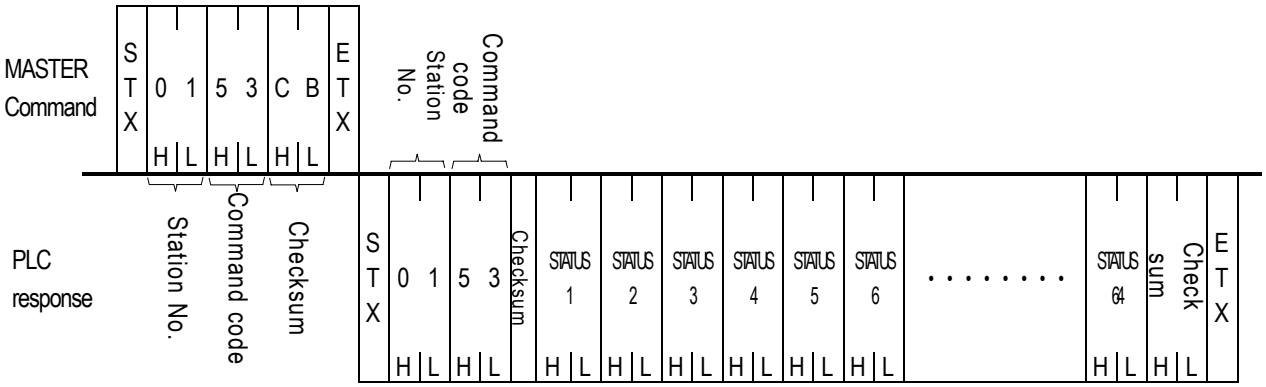


※When program capacity is 8192 Words, Ladder Size Hi-Byte=20H, Ladder Size Lo-Byte=00H

※When program capacity is 13184 Words, Ladder Size Hi-Byte=33H, Ladder Size Lo-Byte=80H

● Command code 53（Read the detail system status of PLC）

Format



STATUS 1	B0：RUN/STOP B1：Battery Low/Normal B2：Ladder checksum error/Normal B3：Use ROM PACK/Not use B4：WDT Time out/Normal B5：ID setting/Not set ID B6：Emergency stop/Normal B7：(reserve for future use)
STATUS 2	Types of Main unit 00H：MA/MU } FB series 01H：MC Other values：reserve
STATUS 3	Total I/O points of main unit 01H：20 points 02H：28 points 03H：40 points •
STATUS 4	OS Version of PLC 30H：V3.0 31H：V3.1 •
STATUS 5	Ladder Size Hi-Byte
STATUS 6	Ladder Size Lo-Byte
STATUS 7	Discrete input Hi-Byte
STATUS 8	Discrete input Lo-Byte
STATUS 9	Discrete output Hi-Byte
STATUS 10	Discrete output Lo-Byte
STATUS 11	Analog input Hi-Byte
STATUS 12	Analog input Lo-Byte
STATUS 13	Analog output Hi-Byte
STATUS 14	Analog output Lo-Byte

STATUS 15	M Relay Hi-Byte
STATUS 16	M Relay Lo-Byte
STATUS 17	S Relay Hi-Byte
STATUS 18	S Relay Lo-Byte
STATUS 19	L Relay Hi-Byte
STATUS 20	L Relay Lo-Byte
STATUS 21	R Register Hi-Byte
STATUS 22	R Register Lo-Byte
STATUS 23	D Register Hi-Byte
STATUS 24	D Register Lo-Byte
STATUS 25	Timer Hi-byte
STATUS 26	Timer Lo-byte
STATUS 27	Counter Hi-Byte
STATUS 28	Counter Lo-Byte
STATUS 29	
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STATUS 64	

● Command code 53（Read the detail system status of PLC）

Ex.

If the PLC model is FBE-28MC, OS version is 3.10, program capacity is 13K words, without ROM PACK, and ID setting, all the status are normal and in RUN model, then the result of reading the system status is as following：