

MELSEC FX series

Programmable Controller

User's Manual

FX-232AW

Art.No.: 29045
991216
BT5096-C



MITSUBISHI ELECTRIC EUROPE B.V.
FACTORY AUTOMATION

REVISIONS OF PROTOCOL
OF ACCESS TO THE PROGRAM
AND MEMORY ELEMENTS
OF THE FX

| VERSION | CHANGES | PAGE | date |
|---------|--|----------------------|------------|
| A to B | typing error: V1.22 to V1.21 f3f2f1f0=0 1 0 0 to 0 0 0 0 for D8000 to D8255. revised table: n14-n0 specification clearly added. addition : Format + example of C200-C255 as operand of FNC | 32 55 55 56 | 15th /5/91 |
| | | | |
| | | | |
| | | | |
| | | | |

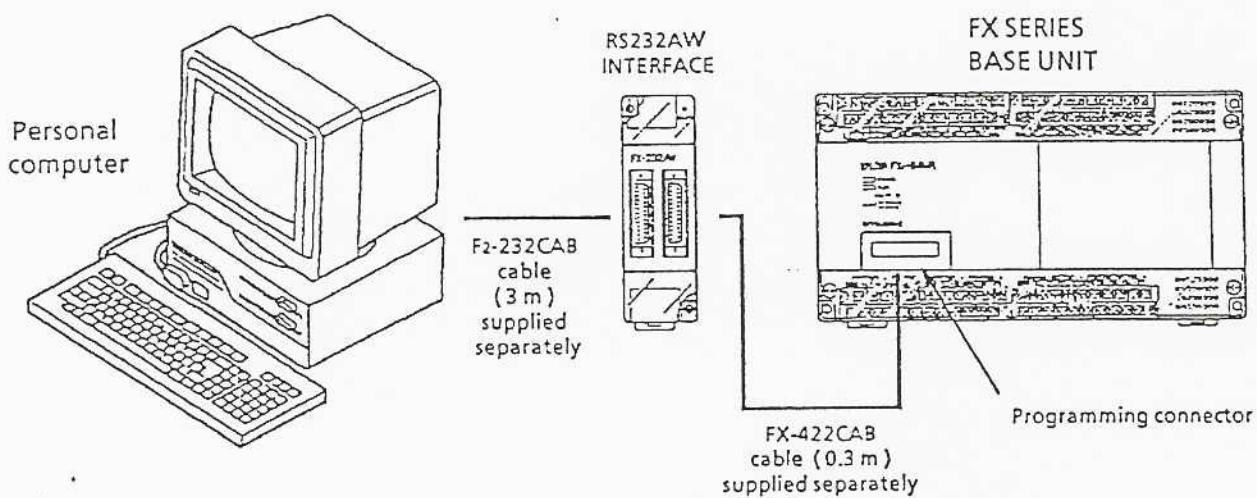
FOREWORD

Information on the sampling trace function is not included in this document.

INDEX

| |
|---|
| HARDWARE SPECIFICATION |
| FORMAT AND COMMAND LIST |
| n BYTE READ |
| n BYTE WRITE |
| ON/OFF FORCING OF SINGLE DEVICES |
| MEMORY MAP OF THE FX |
| GROUP ADDRESS AND DEVICE ADDRESS |
| TABLE 1a XYMSTC Contact image address |
| 1b OUTT,C PLS Y,M PLF Y,M Coil image address |
| 1c RSTT,C Coil image address |
| TABLE 2 Group address of timer |
| TABLE 3 Group address of 16-bit counter |
| TABLE 4 Group address of 32-bit counter |
| TABLE 5a/5b Group address of data register |
| TABLE 6 Group address of special data register .. |
| TABLE 7a/7b Device address of individually addressed devices (used for forcing ON/OFF's) ... |
| FORMAT OF REGISTERS |
| BATCH MONITORING |
| PROGRAM AND PARAMETER MEMORY MAP ... |
| FORMAT OF THE PARAMETERS |
| LOCATION OF THE FILE REGISTER AND COMMENT AREAS |

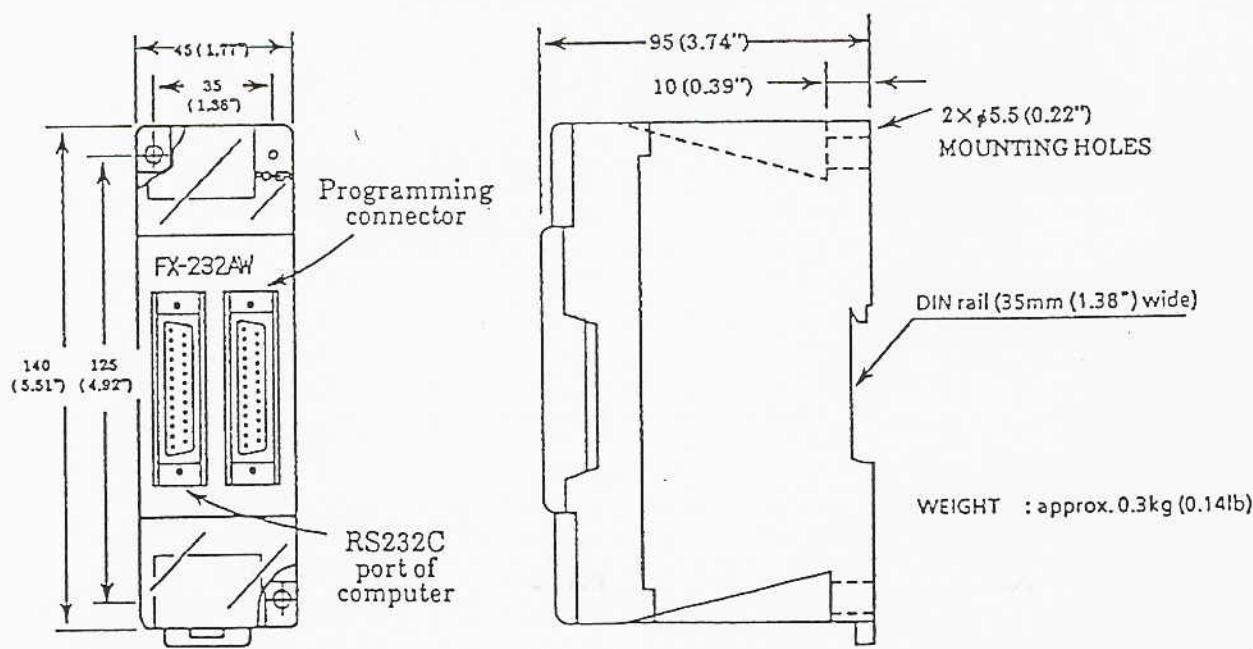
The programming port of the FX series PC is a RS422 connection. RS232C connection can be made via the FX-232AW RS422 to RS232C converter as shown below. The protocols are the same in both cases.



This interface unit does not include any cable nor any software. The cables may be bought separately or made by other means to the specification described on the next page.

Software to be run on the personal computer may be written as desired to monitor the FX PC by using the protocols described by this technical document.

DIMENSIONS OF THE FX-232AW

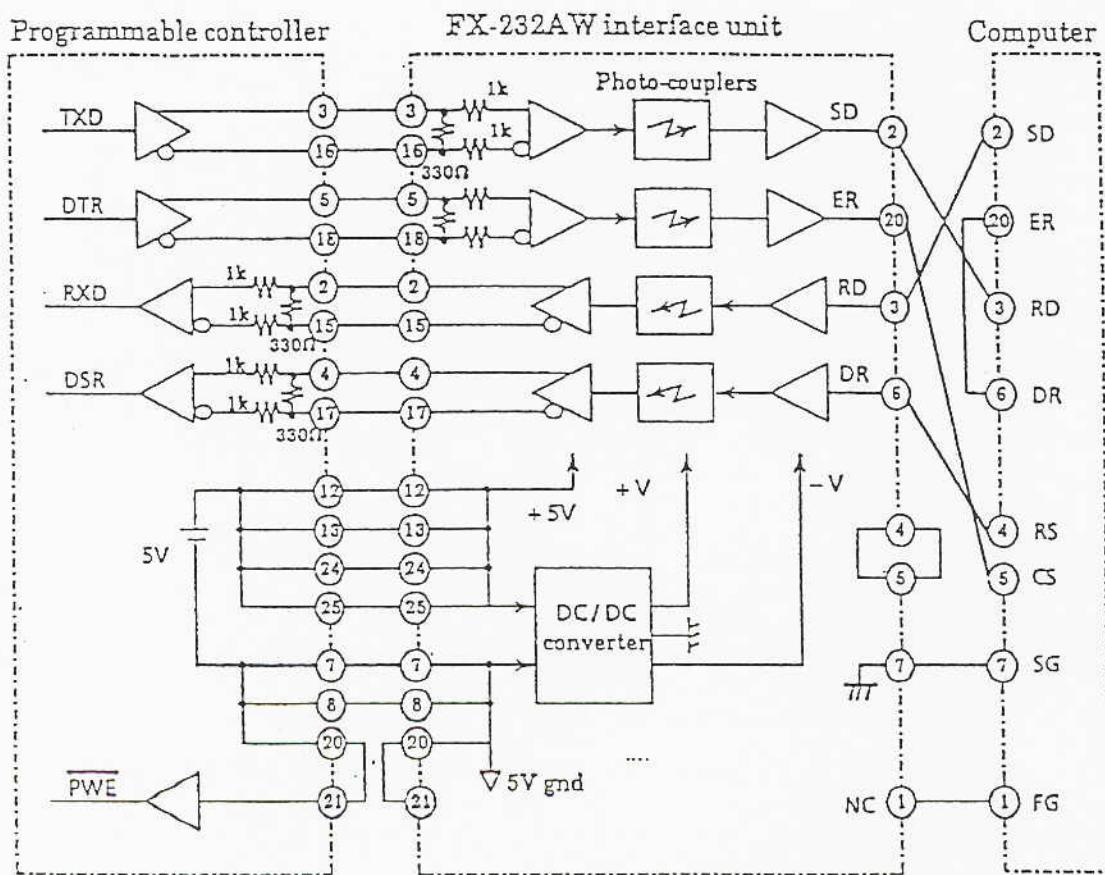




MITSUBISHI ELECTRIC

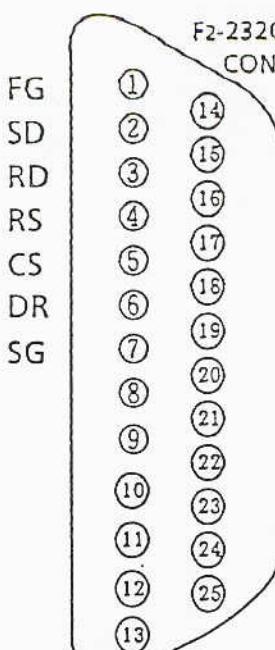
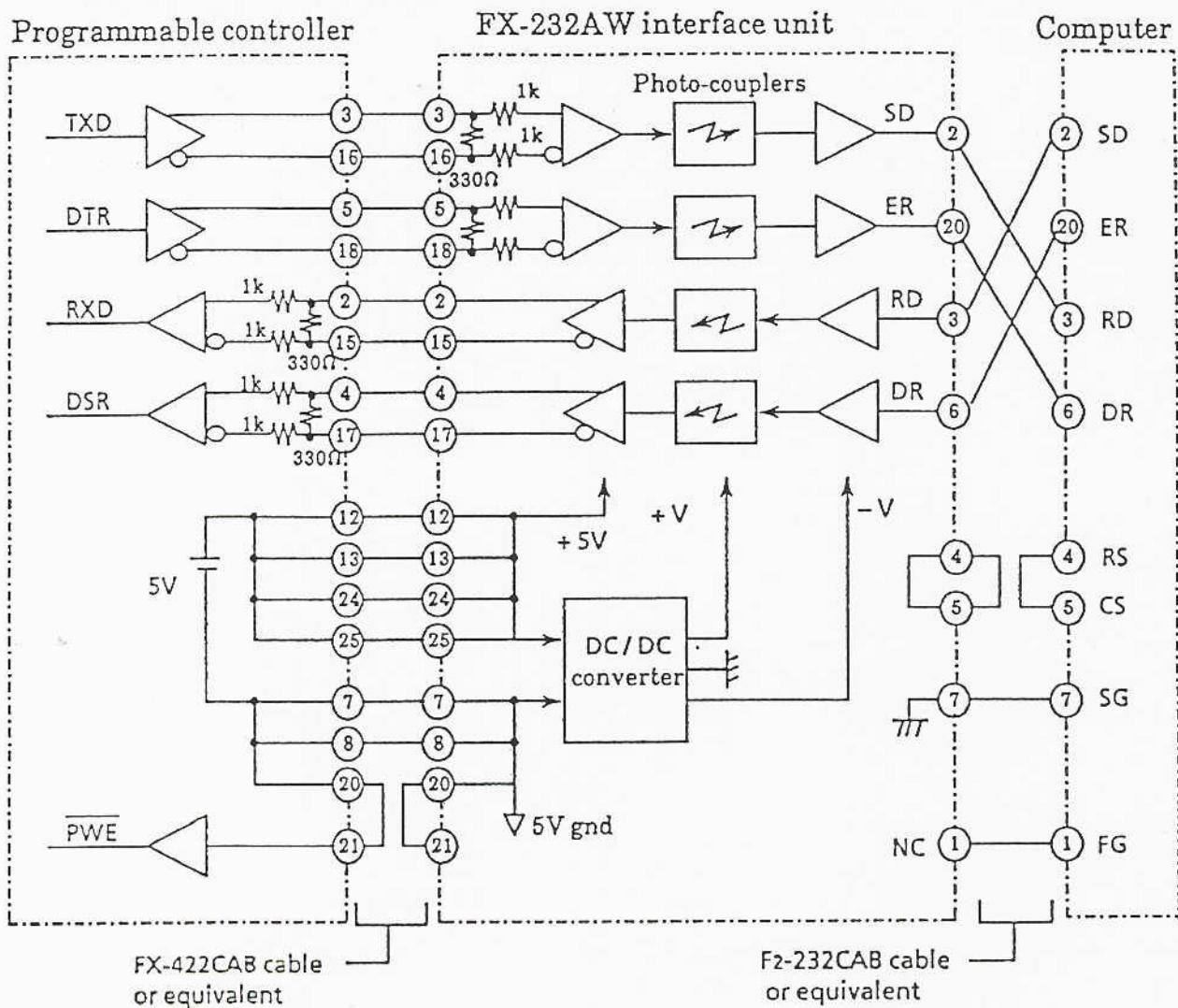
INDUSTRIAL AUTOMATION

RS 232C CONFIGURATION FOR THE USE OF MELSEC MEDOC



RS232C CONFIGURATION

The schematic connections of the inside of the interface unit is shown below along with the cable connections required to connect the interface unit.



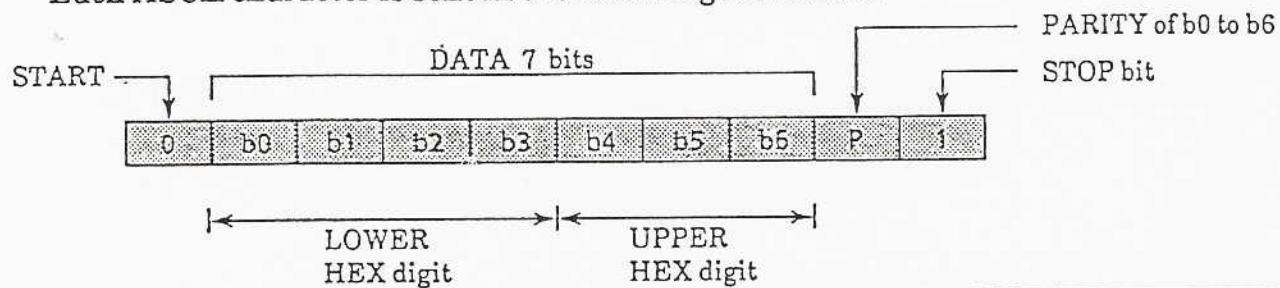
25 pin DSUB connector

NOTE : When the correct cable is connected to the programmable controller, the PWE signal goes low to allow the signal to enter the PC only when the cable is connected.

The following specification allows the status of the internal devices of the FX series programmable controller to be monitored and programmed by a computer. Communication format is as follows:

| | | |
|-----------------|---|--|
| TRANSFER FORMAT | : | RS232C standard |
| PROTOCOL | : | As described by this document |
| TRANSFER FORMAT | : | Asynchronous bi-directional (not simultaneously) |
| BAUD RATE | : | 9600bps |
| PARITY | : | Even |
| VERIFICATION | : | Sum check |
| CHARACTERS | : | ASCII characters of the stated below only |

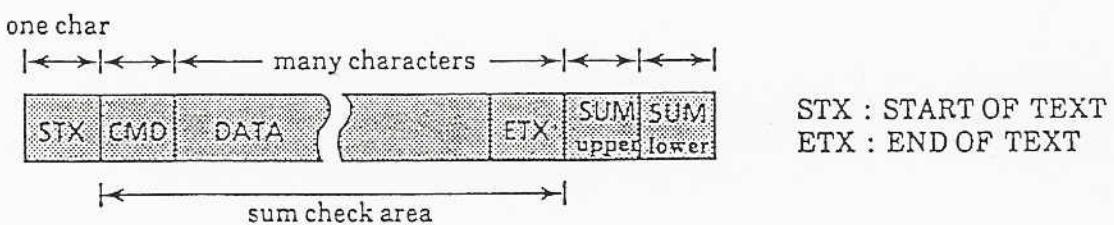
Each ASCII character is sent in the following bit format:



| Character | HEX code | COMMENTS |
|-----------|----------|--|
| ENQ | 05 H | ENQUIRY :Request from computer |
| ACK | 06 H | ACKNOWLEDGE :Acknowledge reply to an ENQ |
| NAK | 15 H | NAGATIVE ACK :Replied when not understood |
| STX | 02 H | START OF TEXT :Start marker of message frame |
| ETX | 03 H | END OF TEXT :End marker of message frame |
| '0' | 30 H | |
| '1' | 31 H | |
| '2' | 32 H | |
| '3' | 33 H | |
| '4' | 34 H | |
| '5' | 35 H | |
| '6' | 36 H | |
| '7' | 37 H | <u>Bitformat of STX</u> |
| '8' | 38 H | |
| '9' | 39 H | |
| 'A' | 41 H | |
| 'B' | 42 H | |
| 'C' | 43 H | |
| 'D' | 44 H | |
| 'E' | 45 H | |
| 'F' | 46 H | |

The letter H represents that the number is a hexadecimal number.

FRAME FORMAT : ENQ, ACK and NAK are sent as single control characters. STX and ETX are sent with the commands (CMD) and its related data together as one frame.



SUM CHECK : The check sum is sent as a two character code after STX.

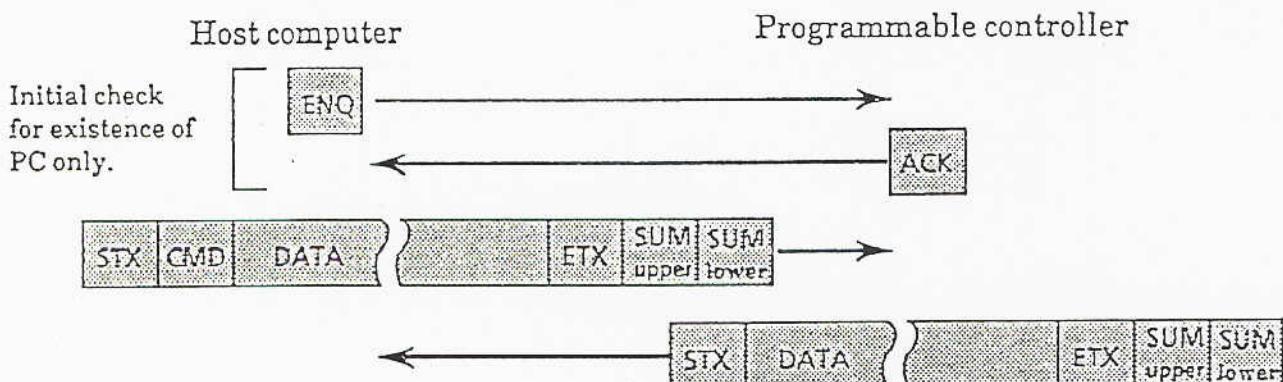
EXAMPLE

| | | TOP ADDRESS | | BYTES | | SUM | |
|------|------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| STX | CMD | 16 ^b |
| 02 H | 30 H | 31 H | 30 H | 46 H | 36 H | 30 H | 34 H |
| | | | | | | 03 H | 37 H |

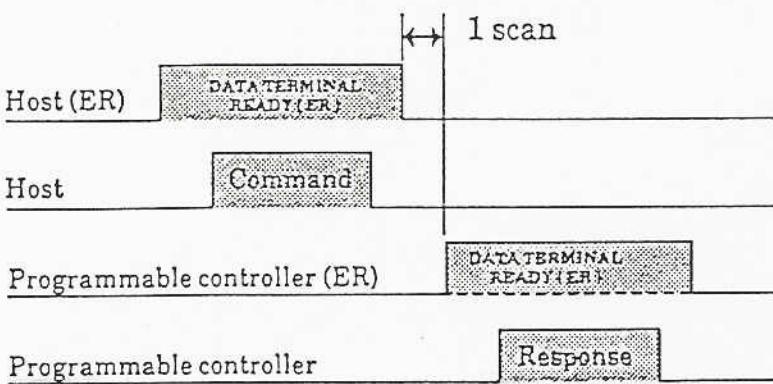
$$30H + 31H + 30H + 46H + 36H + 30H + 34H + 03H = 74H$$

All the HEX values of the ASCII characters from the command to the ETX code are added together. The HEX value of the characters of the sum is then sent after the ETX code.

COMMUNICATION PATTERN



TIMING OF TRANSFERS



The unit sending should always have its ER HIGH and the unit receiving should have its ER LOW.

Response from the PC is immediate in STOP or at the END statement when in RUN.

COMMAND LIST

R : O.K during RUN
 S : O.K during STOP

* OUT T, C constants are
 changeable in RUN however

Devices

| COMMAND | CMD no | Prog. | Para. | bit | word | other | DATA FORMAT | | |
|---------------------|--------|-------|-------|-----|------|-------|-------------|-----------|---------------|
| n byte READ | '0' | R,S | R,S | R,S | R,S | R,S | CMD | TOP ADR | n byte |
| n byte WRITE | '1' | S* | S | R,S | R,S | R,S | CMD | TOP ADR | n byte DATA n |
| n byte INSERT *1 | '2' | S | | | | | CMD | TOP ADR | n byte DATA n |
| m byte DELETE *1 | '3' | S | | | | | CMD | TOP ADR | m byte |
| COMMAND SEARCH | '4' | R,S | | | | | CMD | TOP ADR | command |
| DEVICE SEARCH | '5' | R,S | | | | | CMD | TOP ADR | device |
| BATCH CLEAR | '6' | S | S | S | S | | CMD | area code | |
| FORCE ON | '7' | | | R,S | | | CMD | device | |
| FORCE OFF | '8' | | | R,S | | | CMD | device | |
| BATCH TRANSFER | '9' | S | S | | | | CMD | direction | |
| donot use | 'A' | | | | | | | | |
| Prog. SUM CHECK | 'B' | S | | | | | CMD | | |
| PROG. CHECK | 'C' | S | | | | | CMD | | |

Due to the nature of the process, some instructions may require a much longer processing time than others. In particular are the batch process when using the EEPROM cassette :

Batch transfer may take 120sec.

n byte insert/delete 120sec.

Batch clear 60sec.

3 n BYTE READ

CMD '0'

Memory data from the PC is read in units of bytes. n number of bytes are read starting from the top address.

«COMMAND FROM COMPUTER»

| | ① | TOP ADDRESS | | | | | | ③ | BYTES | | SUM | |
|------|------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|------|-----------------|-----------------|
| STX | CMD | 16 ³ | 16 ² | 16 ¹ | 16 ⁰ | 16 ³ | 16 ² | 16 ¹ | 16 ⁰ | ETX | 16 ³ | 16 ² |
| 02 H | 30 H | 0 | | | | 0 | | 0 | | 03 H | 0 | |

- ① Command CMD '0' reads n bytes of data starting from the TOP address. (1 character)
- ② Top address is the address of the 1st byte of data to be read. e.g. device images.
(see tables 1 to 6). (4 characters)
- ③ BYTES is the n number of bytes of data to be read. Range is 01H to 40H (1 to 64 bytes).
(2 characters)

EX. 1 Reading 2 bytes of data starting from Y0 (Y0 to Y7, Y10 to Y17).....table 1a

| | TOP ADDRESS | BYTES | | | | | | SUM | | | 16 ³ | 16 ² |
|------|-------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|------|-----------------|-----------------|
| STX | CMD | 16 ³ | 16 ² | 16 ¹ | 16 ⁰ | 16 ³ | 16 ² | 16 ¹ | 16 ⁰ | ETX | 16 ³ | 16 ² |
| 02 H | 30 H | 0 | 0 | 0 | A | 0 | 0 | 0 | 2 | 03 H | 6 | 6 |

EX. 2 Reading 4 bytes of data starting from D123 (D123,D124)table 1b

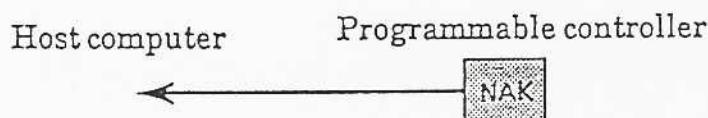
| | TOP ADDRESS | BYTES | | | | | | SUM | | | 16 ³ | 16 ² |
|------|-------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|------|-----------------|-----------------|
| STX | CMD | 16 ³ | 16 ² | 16 ¹ | 16 ⁰ | 16 ³ | 16 ² | 16 ¹ | 16 ⁰ | ETX | 16 ³ | 16 ² |
| 02 H | 30 H | 3 | 1 | 0 | F | 5 | 0 | 4 | 7 | 03 H | 37 H | 34 H |

ERROR RESPONSE

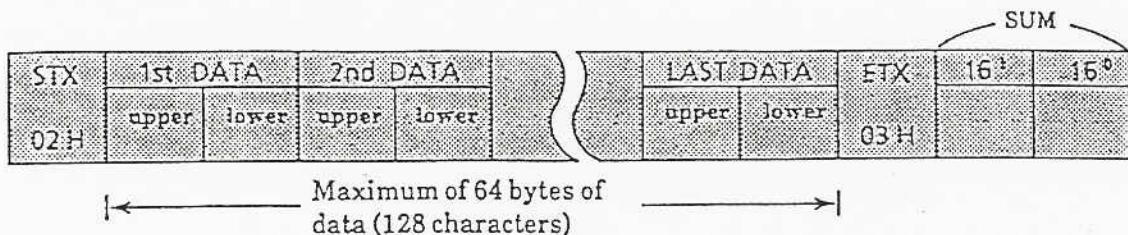
The host computer may use the ENQ command to check if the PC is ready to communicate. A 5 second time out should be given before determining that the PC has not been connected.

Also a retry of 3 times is recommended before determining that there is no ACK response from the PC.

If the PC does not recognize any signal, it will reply with a NAK (negative acknowledge) code.

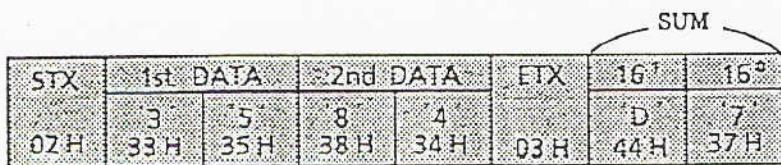
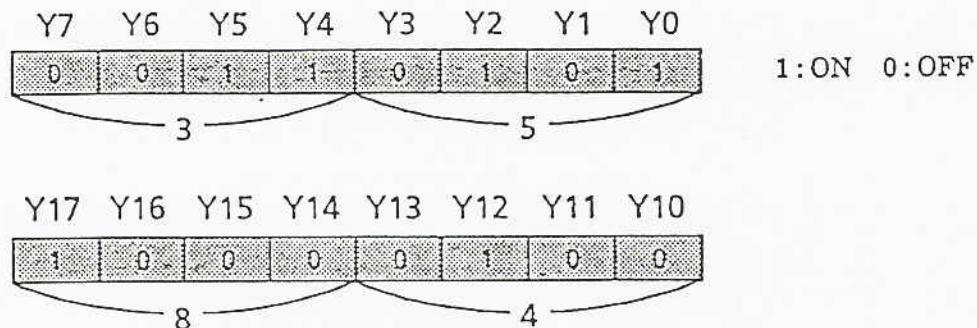


« RESPONSE FROM PC »

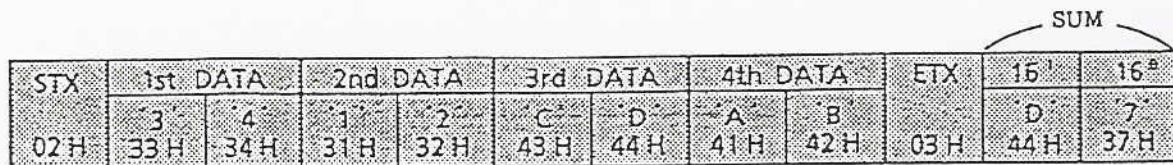
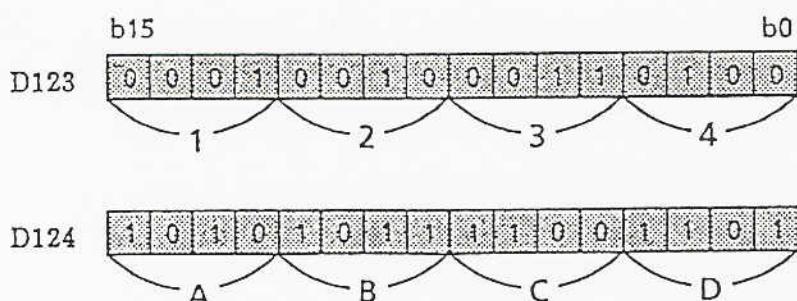


- ① Each byte of device data from the PC is divided into upper 4 bits and lower 4 bits. The hexadecimal value of each 4 bits is taken as an ASCII character and its ASCII HEX value is then sent.
- ② After receiving the command from the computer, the PC makes the response at the next execution of the END statement.
- ③ If the command from the computer is not understood by the PC, control code NAK is then sent.

EX. 1

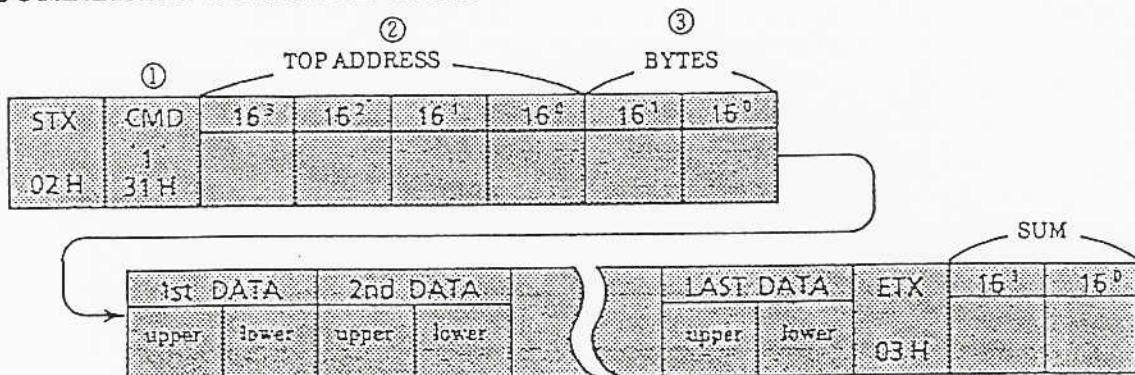


EX. 2



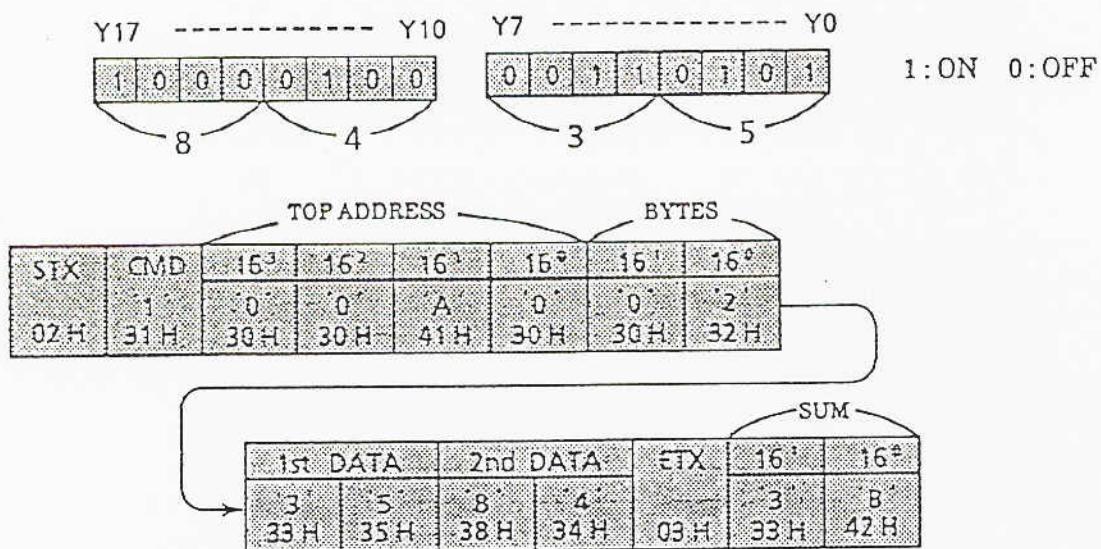
Data can be written to the PC memory with n number of bytes starting at the top address.

« COMMAND FROM COMPUTER »



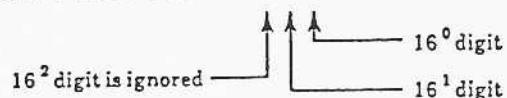
- ① Command CMD '1' writes n bytes of data starting from the Top address. (1 character)
- ② Top address is the address of the 1st byte of data to be written into the PC (see tables 1 to 6). (4 characters)
- ③ BYTES is the n number of bytes of data to be written. Range is 01H to 40H (1 to 64 bytes). (2 characters)

EX. 1 Forcing 2 bytes of output bits (Y0 to Y7, Y10 to Y17) to the following status : (see table 1c for the top address)



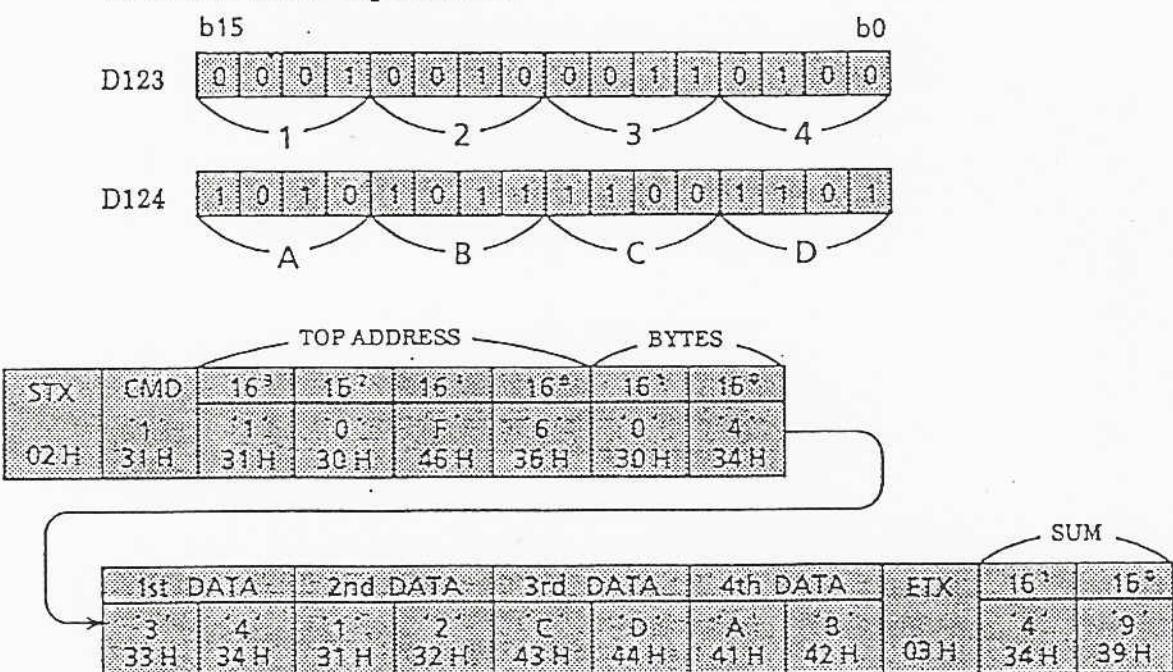
« NOTE » OVERFLOW OF SUM CHECK DATA

$$\begin{aligned} \text{SUM} &= 31\text{H} + 30\text{H} + 30\text{H} + 41\text{H} + 30\text{H} + 30\text{H} + 32\text{H} \\ &\quad + 33\text{H} + 35\text{H} + 38\text{H} + 34\text{H} + 03\text{H} = 23\text{B H} \end{aligned}$$



EX-2

Writing 4 bytes starting at register D123 (D123, D124) to as shown below.
(see table 5a for top address)



« RESPONSE FROM THE PC »

ACK
G6H

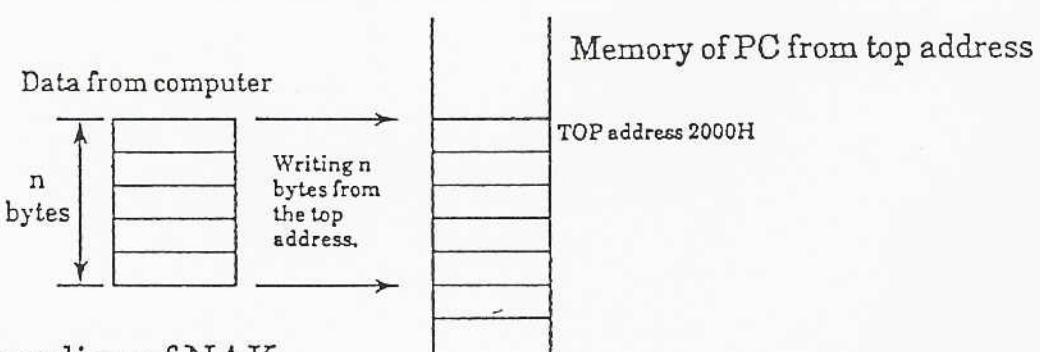
After receiving the command from the computer, data is written at the execution of the next END instruction after which the ACK acknowledge code is replied.

NAK
15H

When the instruction is not understood or if there is a SUM check error, the negative acknowledge NAK code is replied.

NOTES:

Result of the write command.



NOTE : The sending of NAK

The ER line of the computer is kept high when codes are being sent from the computer. If this ER line is kept high even after the sending of the commands, the PC will not be able to reply.

This is particularly important when the PC tries to reply with a NAK code due to an error in the previous command for example. If the computer continues to send data, this data will not be read by the PC.

The following two commands allow individual bit images of the X,Y,M,S,T,C bit devices to be forced ON or OFF. The PC may be in STOP or in the RUN mode.

« COMMANDS FROM THE COMPUTER »

• FORCE ON

| | | DEVICE ADDRESS | | | | SUM | | |
|------|------|-----------------|-----------------|-----------------|-----------------|------|-----------------|-----------------|
| STX | CMD | 16 ¹ | 16 ² | 16 ³ | 16 ⁴ | ETX | 16 ¹ | 16 ⁰ |
| 02 H | 37 H | A4-A1 | AC-E2-B0 | 0H | A8-A5 | 03 H | H | L |

FORCE OFF

| | | DEVICE ADDRESS | | | | SUM | | |
|------|------|-----------------|-----------------|-----------------|-----------------|------|-----------------|-----------------|
| STX | CMD | 16 ¹ | 16 ² | 16 ³ | 16 ⁴ | ETX | 16 ¹ | 16 ⁰ |
| 02 H | 38 H | A4-A1 | AD-E2-B0 | 0H | A8-A5 | 03 H | H | L |

EX. Forcing output Y23 to ON

Device address is in a different format to that of the TOP address of n byte read/write commands. The end effect is listed in separate tables such as table 7a, 7b.

| | | DEVICE ADDRESS | | | | SUM | | |
|------|------|-----------------|-----------------|-----------------|-----------------|------|-----------------|-----------------|
| STX | CMD | 16 ¹ | 16 ² | 16 ³ | 16 ⁴ | ETX | 16 ¹ | 16 ⁰ |
| 02 H | 37 H | 31 H | 33 H | 30 H | 35 H | 03 H | 30 H | 33 H |

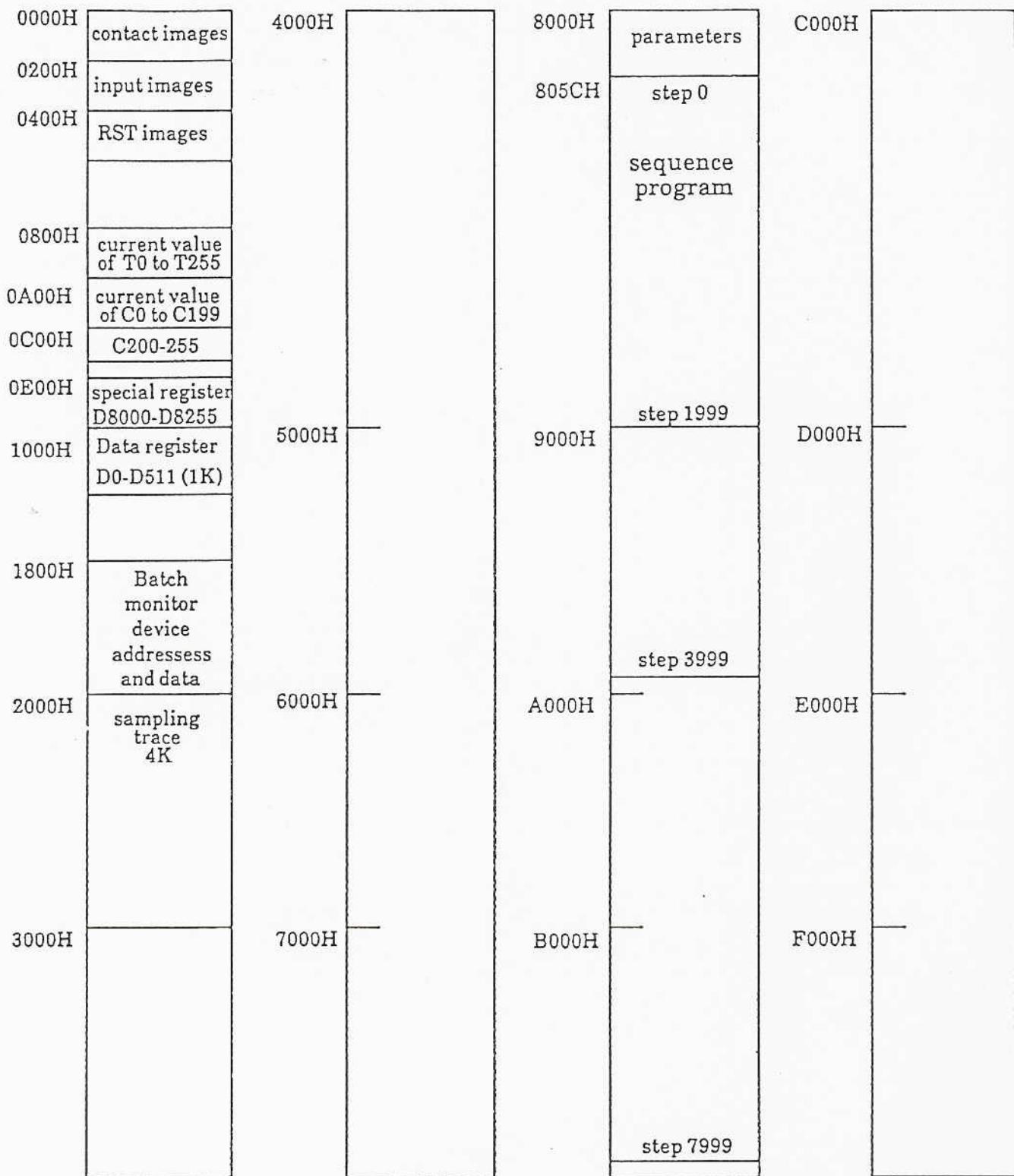
« RESPONSE FROM THE PC »

ACK
0.6 H

After receiving the command from the computer, the PC executes the forcing at the point when the END instruction is executed. The PC then replies with an ACK code.

NAK
1.5 H

When a command is not understood or if there is a SUM check error, the PC replies with a negative acknowledge NAK.



The multiple object device commands such as CMD '0' and CMD '1' uses the TOP addresses which are addresses for 8-bit groups. They cannot be used for the single device instructions CMD '7' and CMD '8' as they are not in the same format.

These instructions must use the format of the device address as listed in tables 7a and 7b.

« TOP ADDRESSES »

| Devices | CONTACT | COILS | | | | | Current values (T,C) Data registers |
|-----------|---|------------|--|---|----------------------|----------------|---|
| | | XYMS TC | SET YMS RST YMS OUT YMS | OUT T OUT C | PLS Y, M PLF Y, M | RST T RST C | |
| X | table 1a | — | — | — | — | — | — |
| Y | " | as left | — | — | table 1b | — | — |
| M | " | as left | — | — | " | — | — |
| Special M | " | as left | — | — | — | — | — |
| S | " | as left | — | — | — | — | — |
| T | " | — | table 1b | — | — | table 1c | table 2 |
| C 16-bit | " | — | — | " | — | " | table 3 |
| C 32-bit | " | — | — | " | — | " | table 4 |
| D | — | — | — | — | — | — | table 5a, 5b |
| special D | — | — | — | — | — | — | table 6 |
| Remarks |  The images of these coils are the same images of their contacts. | | These coils are different to their contact images. | The image read will show the status of the last scan. | Image of reset coils | | |

« BIT DEVICE ADDRESSES »

Table 7a ---- S, X, Y, T devices.

Table 7b ---- M, special M, C devices.

Format of bit device address :

| | | | |
|------|-------|-------|----------|
| 0000 | A8-A5 | A4-A1 | A0,B2-B0 |
|------|-------|-------|----------|

CALCULATION OF DEVICE ADDRESS

The bit device address tables for the images of bit devices following this page are all derived from the device address format shown below :

classification code

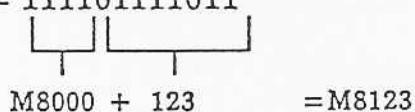
A8 to A0 : Address of a byte location in the PC memory map. Contact images require only the address bits up to A8. A9 to A12 are either not used or are filled with zeros..

B2 to B0 : Bit address for accessing the individual bits of a byte location in the PC memory in order to access information on bit devices.

XXXXXX : DEVICE number in absolute binary
example S100 = 000001100100

SPECIAL M : M8000-M8255 are addressed by the last 3 digits at the bits indicated by $\times \times \times \times \dots \times \times$. 8000 is automatically added when coding by the recognition of the classification code.

EXAMPLE, M8123 = 111101111011



*1 : code S1023 is an RET instruction code. (00111111111)

00A1 ← TOP ADDRESS

TABLE 1a TOP ADDRESSES OF BIT IMAGES (A12 - A0)

Example : Y10 — Y17

● X, Y, M, S, T, C CONTACTS ● OUT Y, M, S SET Y, M, S RST Y, M, S COILS

M* : special M devices

| + | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | C | D | E | F |
|------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 0000 | 0-7 | 8-15 | 16-23 | 24-31 | 32-39 | 40-47 | 48-55 | 56-63 | 64-71 | 72-79 | 80-87 | 88-95 | 96-103 | 104-111 | 112-119 | 120-127 |
| 0010 | 128-135 | 136-143 | 144-151 | 152-159 | 160-167 | 168-175 | 176-183 | 184-191 | 192-199 | 200-207 | 208-215 | 216-223 | 224-231 | 232-239 | 240-247 | 248-255 |
| 0020 | 256-263 | 264-271 | 272-279 | 280-287 | 288-295 | 296-303 | 304-311 | 312-319 | 320-327 | 328-335 | 336-343 | 344-351 | 352-359 | 360-367 | 368-375 | 376-383 |
| 0030 | 384-391 | 392-399 | 400-407 | 408-415 | 416-423 | 424-431 | 432-439 | 440-447 | 448-455 | 456-463 | 464-471 | 472-479 | 480-487 | 488-495 | 496-503 | 504-511 |
| 0040 | 512-519 | 520-527 | 528-535 | 536-543 | 544-551 | 552-559 | 560-567 | 568-575 | 576-583 | 584-591 | 592-599 | 600-607 | 608-615 | 616-623 | 624-631 | 632-639 |
| 0050 | 640-647 | 648-655 | 656-663 | 664-671 | 672-679 | 680-687 | 688-695 | 696-703 | 704-711 | 712-719 | 720-727 | 728-735 | 736-743 | 744-751 | 752-759 | 760-767 |
| 0060 | 768-775 | 776-783 | 784-791 | 792-799 | 800-807 | 808-815 | 816-823 | 824-831 | 832-839 | 840-847 | 848-855 | 856-863 | 864-871 | 872-879 | 880-887 | 888-895 |
| 0070 | 896-903 | 904-911 | 912-919 | 920-927 | 928-935 | 936-943 | 944-951 | 952-959 | 960-967 | 968-975 | 976-983 | 984-991 | 992-999 | | | |
| 0080 | 0-7 | 10-17 | 20-27 | 30-37 | 40-47 | 50-57 | 60-67 | 70-77 | 100-107 | 110-117 | 120-127 | 130-137 | 140-147 | 150-157 | 160-167 | 170-177 |
| 0090 | | | | | | | | | | | | | | | | X |
| 00A0 | 0-7 | 10-17 | 20-27 | 30-37 | 40-47 | 50-57 | 60-67 | 70-77 | 100-107 | 110-117 | 120-127 | 130-137 | 140-147 | 150-157 | 160-167 | 170-177 |
| 00B0 | | | | | | | | | | | | | | | | Y |
| 00C0 | 0-7 | 8-15 | 16-23 | 24-31 | 32-39 | 40-47 | 48-55 | 56-63 | 64-71 | 72-79 | 80-87 | 88-95 | 96-103 | 104-111 | 112-119 | 120-127 |
| 00D0 | 128-135 | 136-143 | 144-151 | 152-159 | 160-167 | 168-175 | 176-183 | 184-191 | 192-199 | 200-207 | 208-215 | 216-223 | 224-231 | 232-239 | 240-247 | 248-255 |
| 00E0 | | | | | | | | | | | | | | | | T |
| 00F0 | | | | | | | | | | | | | | | | C |
| 0100 | 0-7 | 8-15 | 16-23 | 24-31 | 32-39 | 40-47 | 48-55 | 56-63 | 64-71 | 72-79 | 80-87 | 88-95 | 96-103 | 104-111 | 112-119 | 120-127 |
| 0110 | 128-135 | 136-143 | 144-151 | 152-159 | 160-167 | 168-175 | 176-183 | 184-191 | 192-199 | 200-207 | 208-215 | 216-223 | 224-231 | 232-239 | 240-247 | 248-255 |
| 0120 | 256-263 | 264-271 | 272-279 | 280-287 | 288-295 | 296-303 | 304-311 | 312-319 | 320-327 | 328-335 | 336-343 | 344-351 | 352-359 | 360-367 | 368-375 | 376-383 |
| 0130 | 384-391 | 392-399 | 400-407 | 408-415 | 416-423 | 424-431 | 432-439 | 440-447 | 448-455 | 456-463 | 464-471 | 472-479 | 480-487 | 488-495 | 496-503 | 504-511 |
| 0140 | 512-519 | 520-527 | 528-535 | 536-543 | 544-551 | 552-559 | 560-567 | 568-575 | 576-583 | 584-591 | 592-599 | 600-607 | 608-615 | 616-623 | 624-631 | 632-639 |
| 0150 | 640-647 | 648-655 | 656-663 | 664-671 | 672-679 | 680-687 | 688-695 | 696-703 | 704-711 | 712-719 | 720-727 | 728-735 | 736-743 | 744-751 | 752-759 | 760-767 |
| 0160 | 768-775 | 776-783 | 784-791 | 792-799 | 800-807 | 808-815 | 816-823 | 824-831 | 832-839 | 840-847 | 848-855 | 856-863 | 864-871 | 872-879 | 880-887 | 888-895 |
| 0170 | 896-903 | 904-911 | 912-919 | 920-927 | 928-935 | 936-943 | 944-951 | 952-959 | 960-967 | 968-975 | 976-983 | 984-991 | 992-999 | 1000-1007 | 1008-1015 | 1016-1023 |
| 01C0 | 0-7 | 8-15 | 16-23 | 24-31 | 32-39 | 40-47 | 48-55 | 56-63 | 64-71 | 72-79 | 80-87 | 88-95 | 96-103 | 104-111 | 112-119 | 120-127 |
| 01D0 | 128-135 | 136-143 | 144-151 | 152-159 | 160-167 | 168-175 | 176-183 | 184-191 | 192-199 | 200-207 | 208-215 | 216-223 | 224-231 | 232-239 | 240-247 | 248-255 |
| 01E0 | 8000-8007 | 8008-8015 | 8016-8023 | 8024-8039 | 8032-8047 | 8048-8055 | 8056-8063 | 8064-8071 | 8072-8079 | 8080-8087 | 8088-8095 | 8096-8103 | 8104-8111 | 8112-8119 | 8120-8127 | M* |
| 01F0 | 8128-8135 | 8136-8143 | 8144-8151 | 8152-8159 | 8160-8167 | 8168-8175 | 8176-8183 | 8184-8191 | 8192-8199 | 8200-8207 | 8208-8215 | 8216-8223 | 8224-8231 | 8232-8239 | 8240-8247 | 8248-8255 |

02C0 ← TOP ADDRESS

TABLE 1b TOP ADDRESSES OF BIT IMAGES (A12 - A0) Example: [T7 — T0]

- OUT T, C COIL
- PLS Y, M PLF Y, M COIL (status of previous scan)

| + | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | C | D | E | F |
|------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|-----------|-----------|-----------|---------|
| 0200 | | | | | | | | | | | | | | | | |
| 02A0 | 0-7 | 10-17 | 20-27 | 30-37 | 40-47 | 50-57 | 60-67 | 70-77 | 100-107 | 110-117 | 120-127 | 130-137 | 140-147 | 150-157 | 160-167 | 170-177 |
| 02B0 | | | | | | | | | | | | | | | | |
| 02C0 | 0-7 | 8-15 | 16-23 | 24-31 | 32-39 | 40-47 | 48-55 | 56-63 | 64-71 | 72-79 | 80-87 | 88-95 | 96-103 | 104-111 | 112-119 | 120-127 |
| 02D0 | 128-135 | 136-143 | 144-151 | 152-159 | 160-167 | 168-175 | 176-183 | 184-191 | 192-199 | 200-207 | 208-215 | 216-223 | 224-231 | 232-239 | 240-247 | 248-255 |
| 02E0 | | | | | | | | | | | | | | | | |
| 02F0 | | | | | | | | | | | | | | | | |
| 0300 | 0-7 | 8-15 | 16-23 | 24-31 | 32-39 | 40-47 | 48-55 | 56-63 | 64-71 | 72-79 | 80-87 | 88-95 | 96-103 | 104-111 | 112-119 | 120-127 |
| 0310 | 128-135 | 136-143 | 144-151 | 152-159 | 160-167 | 168-175 | 176-183 | 184-191 | 192-199 | 200-207 | 208-215 | 216-223 | 224-231 | 232-239 | 240-247 | 248-255 |
| 0320 | 256-263 | 264-271 | 272-279 | 280-287 | 288-295 | 296-303 | 304-311 | 312-319 | 320-327 | 328-335 | 336-343 | 344-351 | 352-359 | 360-367 | 368-375 | 376-383 |
| 0330 | 384-391 | 392-399 | 400-407 | 408-415 | 416-423 | 424-431 | 432-439 | 440-447 | 448-455 | 456-463 | 464-471 | 472-479 | 480-487 | 488-495 | 496-503 | 504-511 |
| 0340 | 512-519 | 520-527 | 528-535 | 536-543 | 544-551 | 552-559 | 560-567 | 568-575 | 576-583 | 584-591 | 592-599 | 600-607 | 608-615 | 616-623 | 624-631 | 632-639 |
| 0350 | 640-647 | 648-655 | 656-663 | 664-671 | 672-679 | 680-687 | 688-695 | 696-703 | 704-711 | 712-719 | 720-727 | 728-735 | 736-743 | 744-751 | 752-759 | 760-767 |
| 0360 | 768-775 | 776-783 | 784-791 | 792-799 | 800-807 | 808-815 | 816-823 | 824-831 | 832-839 | 840-847 | 848-855 | 856-863 | 864-871 | 872-879 | 880-887 | 888-895 |
| 0370 | 896-903 | 904-911 | 912-919 | 920-927 | 936-943 | 944-951 | 952-959 | 960-967 | 968-975 | 976-983 | 984-991 | 992-999 | 1000-1007 | 1008-1015 | 1016-1023 | |
| 03C0 | 0-7 | 8-15 | 16-23 | 24-31 | 32-39 | 40-47 | 48-55 | 56-63 | 64-71 | 72-79 | 80-87 | 88-95 | 96-103 | 104-111 | 112-119 | 120-127 |
| 03D0 | 128-135 | 136-143 | 144-151 | 152-159 | 160-167 | 168-175 | 176-183 | 184-191 | 192-199 | 200-207 | 208-215 | 216-223 | 224-231 | 232-239 | 240-247 | 248-255 |

TABLE 1C GROUP ADDRESSES OF BIT IMAGES ● RSTT, RST C COIL

| + | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | C | D | E | F |
|------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| 0400 | | | | | | | | | | | | | | | | |
| 04C0 | 0-7 | 8-15 | 16-23 | 24-31 | 32-39 | 40-47 | 48-55 | 56-63 | 64-71 | 72-79 | 80-87 | 88-95 | 96-103 | 104-111 | 112-119 | 120-127 |
| 04D0 | 128-135 | 136-143 | 144-151 | 152-159 | 160-167 | 168-175 | 176-183 | 184-191 | 192-199 | 200-207 | 208-215 | 216-223 | 224-231 | 232-239 | 240-247 | 248-255 |
| 05C0 | 0-7 | 8-15 | 16-23 | 24-31 | 32-39 | 40-47 | 48-55 | 56-63 | 64-71 | 72-79 | 80-87 | 88-95 | 96-103 | 104-111 | 112-119 | 120-127 |
| 05D0 | 128-135 | 136-143 | 144-151 | 152-159 | 160-167 | 168-175 | 176-183 | 184-191 | 192-199 | 200-207 | 208-215 | 216-223 | 224-231 | 232-239 | 240-247 | 248-255 |

TABLE 2 TOP ADDRESS OF TIMER CURRENT VALUE

Example : 08C9 08C8 ← TOP ADDRESS
 T100

| | |
|--------------|--------------|
| upper 8-bits | lower 8-bits |
|--------------|--------------|

| +/- | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | C | D | E | F |
|------|-----|---|-----|-----|---|-----|---|-----|---|-----|---|-----|---|-----|---|---|
| 0800 | T0 | | T1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 | |
| 0810 | T8 | 9 | | 10 | | 11 | | 12 | | 13 | | 14 | | 15 | | |
| 0820 | 16 | | 17 | 18 | | 19 | | 20 | | 21 | | 22 | | 23 | | |
| 0830 | 24 | | 25 | 26 | | 27 | | 28 | | 29 | | 30 | | 31 | | |
| 0840 | 32 | | 33 | 34 | | 35 | | 36 | | 37 | | 38 | | 39 | | |
| 0850 | 40 | | 41 | 42 | | 43 | | 44 | | 45 | | 46 | | 47 | | |
| 0860 | 48 | | 49 | 50 | | 51 | | 52 | | 53 | | 54 | | 55 | | |
| 0870 | 56 | | 57 | 58 | | 59 | | 60 | | 61 | | 62 | | 63 | | |
| 0880 | 64 | | 65 | 66 | | 67 | | 68 | | 69 | | 70 | | 71 | | |
| 0890 | 72 | | 73 | 74 | | 75 | | 76 | | 77 | | 78 | | 79 | | |
| 08A0 | 80 | | 81 | 82 | | 83 | | 84 | | 85 | | 86 | | 87 | | |
| 08B0 | 88 | | 89 | 90 | | 91 | | 92 | | 93 | | 94 | | 95 | | |
| 08C0 | 96 | | 97 | 98 | | 99 | | 100 | | 101 | | 102 | | 103 | | |
| 08D0 | 104 | | 105 | 106 | | 107 | | 108 | | 109 | | 110 | | 111 | | |
| 08E0 | 112 | | 113 | 114 | | 115 | | 116 | | 117 | | 118 | | 119 | | |
| 08F0 | 120 | | 121 | 122 | | 123 | | 124 | | 125 | | 126 | | 127 | | |
| 0900 | 128 | | 129 | 130 | | 131 | | 132 | | 133 | | 134 | | 135 | | |
| 0910 | 136 | | 137 | 138 | | 139 | | 140 | | 141 | | 142 | | 143 | | |
| 0920 | 144 | | 145 | 146 | | 147 | | 148 | | 149 | | 150 | | 151 | | |
| 0930 | 152 | | 153 | 154 | | 155 | | 156 | | 157 | | 158 | | 159 | | |
| 0940 | 160 | | 161 | 162 | | 163 | | 164 | | 165 | | 166 | | 167 | | |
| 0950 | 168 | | 169 | 170 | | 171 | | 172 | | 173 | | 174 | | 175 | | |
| 0960 | 176 | | 177 | 178 | | 179 | | 180 | | 181 | | 182 | | 183 | | |
| 0970 | 184 | | 185 | 186 | | 187 | | 188 | | 189 | | 190 | | 191 | | |
| 0980 | 192 | | 193 | 194 | | 195 | | 196 | | 197 | | 198 | | 199 | | |
| 0990 | 200 | | 201 | 202 | | 203 | | 204 | | 205 | | 206 | | 207 | | |
| 09A0 | 208 | | 209 | 210 | | 211 | | 212 | | 213 | | 214 | | 215 | | |
| 09B0 | 216 | | 217 | 218 | | 219 | | 220 | | 221 | | 222 | | 223 | | |
| 09C0 | 224 | | 225 | 226 | | 227 | | 228 | | 229 | | 230 | | 231 | | |
| 09D0 | 232 | | 233 | 234 | | 235 | | 236 | | 237 | | 238 | | 239 | | |
| 09E0 | 240 | | 241 | 242 | | 243 | | 244 | | 245 | | 246 | | 247 | | |
| 09F0 | 248 | | 249 | 250 | | 251 | | 252 | | 253 | | 254 | | 255 | | |

TABLE 3 TOP ADDRESSES OF 16-BIT COUNTERS

Example : 0A01 0A00 ←———— TOP ADDRESS

TABLE 4 TOP ADDRESSES OF 32-BIT COUNTERS

Example : C200 0C03 0C02 0C01 0C00 ← TOP ADDRESS

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | C | D | E | F |
|------|------|---|---|---|-----|---|---|---|-----|---|---|---|-----|---|---|---|
| +/- | C200 | | | | 201 | | | | 202 | | | | 203 | | | |
| 0C00 | C200 | | | | 201 | | | | 202 | | | | 203 | | | |
| 0C10 | 204 | | | | 205 | | | | 206 | | | | 207 | | | |
| 0C20 | 208 | | | | 209 | | | | 210 | | | | 211 | | | |
| 0C30 | 212 | | | | 213 | | | | 214 | | | | 215 | | | |
| 0C40 | 216 | | | | 217 | | | | 218 | | | | 219 | | | |
| 0C50 | 220 | | | | 221 | | | | 222 | | | | 223 | | | |
| 0C60 | 224 | | | | 225 | | | | 226 | | | | 227 | | | |
| 0C70 | 228 | | | | 229 | | | | 230 | | | | 231 | | | |
| 0C80 | 232 | | | | 233 | | | | 234 | | | | 235 | | | |
| 0C90 | 236 | | | | 237 | | | | 238 | | | | 239 | | | |
| 0CA0 | 240 | | | | 241 | | | | 242 | | | | 243 | | | |
| 0CB0 | 244 | | | | 245 | | | | 246 | | | | 247 | | | |
| 0CC0 | 248 | | | | 249 | | | | 250 | | | | 251 | | | |
| 0CD0 | 252 | | | | 253 | | | | 254 | | | | 255 | | | |

TABLE 5a TOP ADDRESSES OF DATA REGISTERS

10F7 ← TOP ADDRESS

Example : D123

uupper 8-bits

lower 8-bits

| + 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | C | D | E | F |
|----------|---|-----|---|-----|---|-----|---|-----|---|-----|---|-----|---|-----|---|
| 1000 D0 | | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 5 | 7 |
| 1010 8 | | 9 | | 10 | | 11 | | 12 | | 13 | | 14 | | 15 | |
| 1020 16 | | 17 | | 18 | | 19 | | 20 | | 21 | | 22 | | 23 | |
| 1030 24 | | 25 | | 26 | | 27 | | 28 | | 29 | | 30 | | 31 | |
| 1040 32 | | 33 | | 34 | | 35 | | 36 | | 37 | | 38 | | 39 | |
| 1050 40 | | 41 | | 42 | | 43 | | 44 | | 45 | | 46 | | 47 | |
| 1060 48 | | 49 | | 50 | | 51 | | 52 | | 53 | | 54 | | 55 | |
| 1070 56 | | 57 | | 58 | | 59 | | 60 | | 61 | | 62 | | 63 | |
| 1080 64 | | 65 | | 66 | | 67 | | 68 | | 69 | | 70 | | 71 | |
| 1090 72 | | 73 | | 74 | | 75 | | 76 | | 77 | | 78 | | 79 | |
| 10A0 80 | | 81 | | 82 | | 83 | | 84 | | 85 | | 86 | | 87 | |
| 10B0 88 | | 89 | | 90 | | 91 | | 92 | | 93 | | 94 | | 95 | |
| 10C0 96 | | 97 | | 98 | | 99 | | 100 | | 101 | | 102 | | 103 | |
| 10D0 104 | | 105 | | 106 | | 107 | | 108 | | 109 | | 110 | | 111 | |
| 10E0 112 | | 113 | | 114 | | 115 | | 116 | | 117 | | 118 | | 119 | |
| 10F0 120 | | 121 | | 122 | | 123 | | 124 | | 125 | | 126 | | 127 | |
| 1100 128 | | 129 | | 130 | | 131 | | 132 | | 133 | | 134 | | 135 | |
| 1110 136 | | 137 | | 138 | | 139 | | 140 | | 141 | | 142 | | 143 | |
| 1120 144 | | 145 | | 146 | | 147 | | 148 | | 149 | | 150 | | 151 | |
| 1130 152 | | 153 | | 154 | | 155 | | 156 | | 157 | | 158 | | 159 | |
| 1140 160 | | 161 | | 162 | | 163 | | 164 | | 165 | | 166 | | 167 | |
| 1150 168 | | 169 | | 170 | | 171 | | 172 | | 173 | | 174 | | 175 | |
| 1160 176 | | 177 | | 178 | | 179 | | 180 | | 181 | | 182 | | 183 | |
| 1170 184 | | 185 | | 186 | | 187 | | 188 | | 189 | | 190 | | 191 | |
| 1180 192 | | 193 | | 194 | | 195 | | 196 | | 197 | | 198 | | 199 | |
| 1190 200 | | 201 | | 202 | | 203 | | 204 | | 205 | | 206 | | 207 | |
| 11A0 208 | | 209 | | 210 | | 211 | | 212 | | 213 | | 214 | | 215 | |
| 11B0 216 | | 217 | | 218 | | 219 | | 220 | | 221 | | 222 | | 223 | |
| 11C0 224 | | 225 | | 226 | | 227 | | 228 | | 229 | | 230 | | 231 | |
| 11D0 232 | | 233 | | 234 | | 235 | | 236 | | 237 | | 238 | | 239 | |
| 11E0 240 | | 241 | | 242 | | 243 | | 244 | | 245 | | 246 | | 247 | |
| 11F0 248 | | 249 | | 250 | | 251 | | 252 | | 253 | | 254 | | 255 | |

TABLE 5b TOP ADDRESSES OF DATA REGISTERS

Example : D368 upper 8-bits lower 8-bits

| | + | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | C | D | E | F |
|------|------|-----|---|-----|---|-----|---|-----|---|-----|---|-----|---|-----|---|---|---|
| 1200 | D256 | 257 | | 258 | | 259 | | 260 | | 261 | | 262 | | 263 | | | |
| 1210 | 264 | 265 | | 266 | | 267 | | 268 | | 269 | | 270 | | 271 | | | |
| 1220 | 272 | 273 | | 274 | | 275 | | 276 | | 277 | | 278 | | 279 | | | |
| 1230 | 280 | 281 | | 282 | | 283 | | 284 | | 285 | | 286 | | 287 | | | |
| 1240 | 288 | 289 | | 290 | | 291 | | 292 | | 293 | | 294 | | 295 | | | |
| 1250 | 296 | 297 | | 298 | | 299 | | 300 | | 301 | | 302 | | 303 | | | |
| 1260 | 304 | 305 | | 306 | | 307 | | 308 | | 309 | | 310 | | 311 | | | |
| 1270 | 312 | 313 | | 314 | | 315 | | 316 | | 317 | | 318 | | 319 | | | |
| 1280 | 320 | 321 | | 322 | | 323 | | 324 | | 325 | | 326 | | 327 | | | |
| 1290 | 328 | 329 | | 330 | | 331 | | 332 | | 333 | | 334 | | 335 | | | |
| 12A0 | 336 | 337 | | 338 | | 339 | | 340 | | 341 | | 342 | | 343 | | | |
| 12B0 | 344 | 345 | | 346 | | 347 | | 348 | | 349 | | 350 | | 351 | | | |
| 12C0 | 352 | 353 | | 354 | | 355 | | 356 | | 357 | | 358 | | 359 | | | |
| 12D0 | 360 | 361 | | 362 | | 363 | | 364 | | 365 | | 366 | | 367 | | | |
| 12E0 | 368 | 369 | | 370 | | 371 | | 372 | | 373 | | 374 | | 375 | | | |
| 12F0 | 376 | 377 | | 378 | | 379 | | 380 | | 381 | | 382 | | 383 | | | |
| 1300 | 384 | 385 | | 386 | | 387 | | 388 | | 389 | | 390 | | 391 | | | |
| 1310 | 392 | 393 | | 394 | | 395 | | 396 | | 397 | | 398 | | 399 | | | |
| 1320 | 400 | 401 | | 402 | | 403 | | 404 | | 405 | | 406 | | 407 | | | |
| 1330 | 408 | 409 | | 410 | | 411 | | 412 | | 413 | | 414 | | 415 | | | |
| 1340 | 416 | 417 | | 418 | | 419 | | 420 | | 421 | | 422 | | 423 | | | |
| 1350 | 424 | 425 | | 426 | | 427 | | 428 | | 429 | | 430 | | 431 | | | |
| 1360 | 432 | 433 | | 434 | | 435 | | 436 | | 437 | | 438 | | 439 | | | |
| 1370 | 440 | 441 | | 442 | | 443 | | 444 | | 445 | | 446 | | 447 | | | |
| 1380 | 448 | 449 | | 450 | | 451 | | 452 | | 453 | | 454 | | 455 | | | |
| 1390 | 456 | 457 | | 458 | | 459 | | 460 | | 461 | | 462 | | 463 | | | |
| 13A0 | 464 | 465 | | 466 | | 467 | | 468 | | 469 | | 470 | | 471 | | | |
| 13B0 | 472 | 473 | | 474 | | 475 | | 476 | | 477 | | 478 | | 479 | | | |
| 13C0 | 480 | 481 | | 482 | | 483 | | 484 | | 485 | | 486 | | 487 | | | |
| 13D0 | 488 | 489 | | 490 | | 491 | | 492 | | 493 | | 494 | | 495 | | | |
| 13E0 | 496 | 497 | | 498 | | 499 | | 500 | | 501 | | 502 | | 503 | | | |
| 13F0 | 504 | 505 | | 506 | | 507 | | 508 | | 509 | | 510 | | 511 | | | |

12E1 12E0 ← TOP ADDRESS

TABLE 6 TOP ADDRESSES OF SPECIAL REGISTERS

Example : 0E01 0E00 0E00 ← TOP
D8000 upper 8-bits lower 8-bits
ADDRESS

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | C | D | E | F |
|------|-------|---|------|---|------|---|------|---|------|---|------|---|------|---|------|---|
| 0E00 | D8000 | | 8001 | | 8002 | | 8003 | | 8004 | | 8005 | | 8006 | | 8007 | |
| 0E10 | 8008 | | 8009 | | 8010 | | 8011 | | 8012 | | 8013 | | 8014 | | 8015 | |
| 0E20 | 8016 | | 8017 | | 8018 | | 8019 | | 8020 | | 8021 | | 8022 | | 8023 | |
| 0E30 | 8024 | | 8025 | | 8026 | | 8027 | | 8028 | | 8029 | | 8030 | | 8031 | |
| 0E40 | 8032 | | 8033 | | 8034 | | 8035 | | 8036 | | 8037 | | 8038 | | 8039 | |
| 0E50 | 8040 | | 8041 | | 8042 | | 8043 | | 8044 | | 8045 | | 8046 | | 8047 | |
| 0E60 | 8048 | | 8049 | | 8050 | | 8051 | | 8052 | | 8053 | | 8054 | | 8055 | |
| 0E70 | 8056 | | 8057 | | 8058 | | 8059 | | 8060 | | 8061 | | 8062 | | 8063 | |
| 0E80 | 8064 | | 8065 | | 8066 | | 8067 | | 8068 | | 8069 | | 8070 | | 8071 | |
| 0E90 | 8072 | | 8073 | | 8074 | | 8075 | | 8076 | | 8077 | | 8078 | | 8079 | |
| 0EA0 | 8080 | | 8081 | | 8082 | | 8083 | | 8084 | | 8085 | | 8086 | | 8087 | |
| 0EB0 | 8088 | | 8089 | | 8090 | | 8091 | | 8092 | | 8093 | | 8094 | | 8095 | |
| 0EC0 | 8096 | | 8097 | | 8098 | | 8099 | | 8100 | | 8101 | | 8102 | | 8103 | |
| 0ED0 | 8104 | | 8105 | | 8106 | | 8107 | | 8108 | | 8109 | | 8110 | | 8111 | |
| 0EE0 | 8112 | | 8113 | | 8114 | | 8115 | | 8116 | | 8117 | | 8118 | | 8119 | |
| 0EF0 | 8120 | | 8121 | | 8122 | | 8123 | | 8124 | | 8125 | | 8126 | | 8127 | |
| 0F00 | 8128 | | 8129 | | 8130 | | 8131 | | 8132 | | 8133 | | 8134 | | 8135 | |
| 0F10 | 8136 | | 8137 | | 8138 | | 8139 | | 8140 | | 8141 | | 8142 | | 8143 | |
| 0F20 | 8144 | | 8145 | | 8146 | | 8147 | | 8148 | | 8149 | | 8150 | | 8151 | |
| 0F30 | 8152 | | 8153 | | 8154 | | 8155 | | 8156 | | 8157 | | 8158 | | 8159 | |
| 0F40 | 8160 | | 8161 | | 8162 | | 8163 | | 8164 | | 8165 | | 8166 | | 8167 | |
| 0F50 | 8168 | | 8169 | | 8170 | | 8171 | | 8172 | | 8173 | | 8174 | | 8175 | |
| 0F60 | 8176 | | 8177 | | 8178 | | 8179 | | 8180 | | 8181 | | 8182 | | 8183 | |
| 0F70 | 8184 | | 8185 | | 8186 | | 8187 | | 8188 | | 8189 | | 8190 | | 8191 | |
| 0F80 | 8192 | | 8193 | | 8194 | | 8195 | | 8196 | | 8197 | | 8198 | | 8199 | |
| 0F90 | 8200 | | 8201 | | 8202 | | 8203 | | 8204 | | 8205 | | 8206 | | 8207 | |
| 0FA0 | 8208 | | 8209 | | 8210 | | 8211 | | 8212 | | 8213 | | 8214 | | 8215 | |
| 0FB0 | 8216 | | 8217 | | 8218 | | 8219 | | 8220 | | 8221 | | 8222 | | 8223 | |
| 0FC0 | 8224 | | 8225 | | 8226 | | 8227 | | 8228 | | 8229 | | 8230 | | 8231 | |
| 0FD0 | 8232 | | 8233 | | 8234 | | 8235 | | 8236 | | 8237 | | 8238 | | 8239 | |
| 0FE0 | 8240 | | 8241 | | 8242 | | 8243 | | 8244 | | 8245 | | 8246 | | 8247 | |
| 0FF0 | 8248 | | 8249 | | 8250 | | 8251 | | 8252 | | 8253 | | 8254 | | 8255 | |

TABLE 7a BIT DEVICE ADDRESSES OF (S,X,Y,T)

| | 0000 | A8-A5 | A4-A1 | A0,B2-B0 | 0 | 6 | F | F = T255 |
|------|------|-------|---------------|----------|----------------|---|------|---------------|
| | | | | | DEVICE ADDRESS | | | DEVICE NUMBER |
| | | | | | 0230 | - | 023F | S 560 ~ S 575 |
| 0000 | - | 000F | S 0 ~ S 15 | | 0240 | - | 024F | S 576 ~ S 591 |
| 0010 | - | 001F | S 16 ~ S 31 | | 0250 | - | 025F | S 592 ~ S 607 |
| 0020 | - | 002F | S 32 ~ S 47 | | 0260 | - | 026F | S 608 ~ S 623 |
| 0030 | - | 003F | S 48 ~ S 63 | | 0270 | - | 027F | S 624 ~ S 639 |
| 0040 | - | 004F | S 64 ~ S 79 | | 0280 | - | 028F | S 640 ~ S 655 |
| 0050 | - | 005F | S 80 ~ S 95 | | 0290 | - | 029F | S 656 ~ S 671 |
| 0060 | - | 006F | S 96 ~ S 111 | | 02A0 | - | 02AF | S 672 ~ S 687 |
| 0070 | - | 007F | S 112 ~ S 127 | | 02B0 | - | 02BF | S 688 ~ S 703 |
| 0080 | - | 008F | S 128 ~ S 143 | | 02C0 | - | 02CF | S 704 ~ S 719 |
| 0090 | - | 009F | S 144 ~ S 159 | | 02D0 | - | 02DF | S 720 ~ S 735 |
| 00A0 | - | 00AF | S 160 ~ S 175 | | 02E0 | - | 02EF | S 736 ~ S 751 |
| 00B0 | - | 00BF | S 176 ~ S 191 | | 02F0 | - | 02FF | S 752 ~ S 767 |
| 00C0 | - | 00CF | S 192 ~ S 207 | | 0300 | - | 030F | S 768 ~ S 783 |
| 00D0 | - | 00DF | S 208 ~ S 223 | | 0310 | - | 031F | S 784 ~ S 799 |
| 00E0 | - | 00EF | S 224 ~ S 239 | | 0320 | - | 032F | S 800 ~ S 815 |
| 00F0 | - | 00FF | S 240 ~ S 255 | | 0330 | - | 033F | S 816 ~ S 831 |
| 0100 | - | 000F | S 256 ~ S 271 | | 0340 | - | 034F | S 832 ~ S 847 |
| 0110 | - | 011F | S 272 ~ S 287 | | 0350 | - | 035F | S 848 ~ S 863 |
| 0120 | - | 012F | S 288 ~ S 303 | | 0360 | - | 036F | S 864 ~ S 879 |
| 0130 | - | 013F | S 304 ~ S 319 | | 0370 | - | 037F | S 880 ~ S 895 |
| 0140 | - | 014F | S 320 ~ S 335 | | 0380 | - | 038F | S 896 ~ S 911 |
| 0150 | - | 015F | S 336 ~ S 351 | | 0390 | - | 039F | S 912 ~ S 927 |
| 0160 | - | 016F | S 352 ~ S 367 | | 03A0 | - | 03AF | S 928 ~ S 943 |
| 0170 | - | 017F | S 368 ~ S 383 | | 03B0 | - | 03BF | S 944 ~ S 959 |
| 0180 | - | 018F | S 384 ~ S 399 | | 03C0 | - | 03CF | S 960 ~ S 975 |
| 0190 | - | 019F | S 400 ~ S 415 | | 03D0 | - | 03DF | S 976 ~ S 991 |
| 01A0 | - | 01AF | S 416 ~ S 431 | | 03E0 | - | 03EF | S 992 ~ S 999 |
| 01B0 | - | 01BF | S 432 ~ S 447 | | | | | 069F |
| 01C0 | - | 01CF | S 448 ~ S 463 | | | | | 06A0 |
| 01D0 | - | 01DF | S 464 ~ S 479 | | | | | 06B0 |
| 01E0 | - | 01EF | S 480 ~ S 495 | | | | | 06C0 |
| 01F0 | - | 01FF | S 496 ~ S 511 | | | | | 06D0 |
| 0200 | - | 020F | S 512 ~ S 527 | | | | | 06E0 |
| 0210 | - | 021F | S 528 ~ S 543 | | | | | 06F0 |
| 0220 | - | 022F | S 544 ~ S 559 | | | | | |

Examples: address of S561 is 023111
address of S574 is 023EH

0000 ~ X017
X020 ~ X037
X040 ~ X057
X060 ~ X077
X100 ~ X117
X120 ~ X137
X140 ~ X157
X160 ~ X177

Y000 ~ Y017
Y020 ~ Y037
Y040 ~ Y057
Y060 ~ Y077
Y100 ~ Y117
Y120 ~ Y137
Y140 ~ Y157
Y160 ~ Y177

T 0 ~ T 15
T 16 ~ T 31
T 32 ~ T 47
T 48 ~ T 63
T 64 ~ T 79
T 80 ~ T 95
T 96 ~ T 111
T 112 ~ T 127
T 128 ~ T 143
T 144 ~ T 159
T 160 ~ T 175
T 176 ~ T 191
T 192 ~ T 207
T 208 ~ T 223
T 224 ~ T 239
T 240 ~ T 255

TABLE 7b BIT DEVICE ADDRESS OF (M, C, SPECIAL M)

| | | | |
|------|-------|-------|----------|
| 0000 | A8-A5 | A4-A1 | A0,B2-B0 |
|------|-------|-------|----------|

0 F F F =M8255

| DEVICE ADDRESS | DEVICE NUMBER |
|----------------|---------------|
| 0800 ~ 080F | M 0 ~ M 15 |
| 0810 ~ 081F | M 16 ~ M 31 |
| 0820 ~ 082F | M 32 ~ M 47 |
| 0830 ~ 083F | M 48 ~ M 63 |
| 0840 ~ 084F | M 64 ~ M 79 |
| 0850 ~ 085F | M 80 ~ M 95 |
| 0860 ~ 086F | M 96 ~ M 111 |
| 0870 ~ 087F | M 112 ~ M 127 |
| 0880 ~ 088F | M 128 ~ M 143 |
| 0890 ~ 089F | M 144 ~ M 159 |
| 08A0 ~ 08AF | M 160 ~ M 175 |
| 08B0 ~ 08BF | M 176 ~ M 191 |
| 08C0 ~ 08CF | M 192 ~ M 207 |
| 08D0 ~ 08DF | M 208 ~ M 223 |
| 08E0 ~ 08EF | M 224 ~ M 239 |
| 08F0 ~ 08FF | M 240 ~ M 255 |
| 0900 ~ 090F | M 256 ~ M 271 |
| 0910 ~ 091F | M 272 ~ M 287 |
| 0920 ~ 092F | M 288 ~ M 303 |
| 0930 ~ 093F | M 304 ~ M 319 |
| 0940 ~ 094F | M 320 ~ M 335 |
| 0950 ~ 095F | M 336 ~ M 351 |
| 0960 ~ 096F | M 352 ~ M 367 |
| 0970 ~ 097F | M 368 ~ M 383 |
| 0980 ~ 098F | M 384 ~ M 399 |
| 0990 ~ 099F | M 400 ~ M 415 |
| 09A0 ~ 09AF | M 416 ~ M 431 |
| 09B0 ~ 09BF | M 432 ~ M 447 |
| 09C0 ~ 09CF | M 448 ~ M 463 |
| 09D0 ~ 09DF | M 464 ~ M 479 |
| 09E0 ~ 09EF | M 480 ~ M 495 |
| 09FF ~ 09FF | M 496 ~ M 511 |
| 0A09 ~ 0A0F | M 512 ~ M 527 |
| 0A10 ~ 0A1F | M 528 ~ M 543 |
| 0A20 ~ 0A2F | M 544 ~ M 559 |

| DEVICE ADDRESS | DEVICE NUMBER |
|----------------|-----------------|
| 0A30 ~ 0A3F | M 560 ~ M 575 |
| 0A40 ~ 0A4F | M 576 ~ M 591 |
| 0A50 ~ 0A5F | M 592 ~ M 607 |
| 0A60 ~ 0A6F | M 608 ~ M 623 |
| 0A70 ~ 0A7F | M 624 ~ M 639 |
| 0A80 ~ 0A8F | M 640 ~ M 655 |
| 0A90 ~ 0A9F | M 656 ~ M 671 |
| 0AA0 ~ 0AAF | M 672 ~ M 687 |
| 0AB0 ~ 0ABF | M 688 ~ M 703 |
| 0AC0 ~ 0ACF | M 704 ~ M 719 |
| 0AD0 ~ 0ADF | M 720 ~ M 735 |
| 0AE0 ~ 0AEF | M 736 ~ M 751 |
| 0AF0 ~ 0AFF | M 752 ~ M 767 |
| 0B00 ~ 0B0F | M 768 ~ M 783 |
| 0B10 ~ 0B1F | M 784 ~ M 799 |
| 0B20 ~ 0B2F | M 800 ~ M 815 |
| 0B30 ~ 0B3F | M 816 ~ M 831 |
| 0B40 ~ 0B4F | M 832 ~ M 847 |
| 0B50 ~ 0B5F | M 848 ~ M 863 |
| 0B60 ~ 0B6F | M 864 ~ M 879 |
| 0B70 ~ 0B7F | M 880 ~ M 895 |
| 0B80 ~ 0B8F | M 896 ~ M 911 |
| 0B90 ~ 0B9F | M 912 ~ M 927 |
| 0BA0 ~ 0BAF | M 928 ~ M 943 |
| 0BB0 ~ 0BBF | M 944 ~ M 959 |
| 0BC0 ~ 0BCF | M 960 ~ M 975 |
| 0BD0 ~ 0BDF | M 976 ~ M 991 |
| 0BE0 ~ 0BEF | M 992 ~ M 999 |
| 0BF0 ~ 0BFF | M 1008 ~ M 1023 |

| DEVICE ADDRESS | DEVICE NUMBER |
|----------------|---------------|
| 0E00 ~ 0E0F | C 0 ~ C 15 |
| 0E10 ~ 0E1F | C 16 ~ C 31 |
| 0E20 ~ 0E2F | C 32 ~ C 47 |
| 0E30 ~ 0E3F | C 48 ~ C 63 |
| 0E40 ~ 0E4F | C 64 ~ C 79 |
| 0E50 ~ 0E5F | C 80 ~ C 95 |
| 0E60 ~ 0E6F | C 96 ~ C 111 |
| 0E70 ~ 0E7F | C 112 ~ C 127 |
| 0E80 ~ 0E8F | C 128 ~ C 143 |
| 0E90 ~ 0E9F | C 144 ~ C 159 |
| 0EA0 ~ 0EAF | C 160 ~ C 175 |
| 0EB0 ~ 0EBF | C 176 ~ C 191 |
| 0EC0 ~ 0ECF | C 192 ~ C 207 |
| 0ED0 ~ 0EDF | C 208 ~ C 223 |
| 0EE0 ~ 0EEF | C 224 ~ C 239 |
| 0EF0 ~ 0EFF | C 240 ~ C 255 |

Examples : address of M160 is 08A0H
address of M161 is 08A1H
address of M174 is 08AEH
address of M175 is 08AFH

M 8000 ~ M 8015

M 8016 ~ M 8031

M 8032 ~ M 8047

M 8048 ~ M 8063

M 8064 ~ M 8079

M 8080 ~ M 8095

M 8096 ~ M 8111

M 8112 ~ M 8127

M 8128 ~ M 8143

M 8144 ~ M 8159

M 8160 ~ M 8175

M 8176 ~ M 8191

M 8192 ~ M 8207

M 8208 ~ M 8223

M 8224 ~ M 8239

M 8240 ~ M 8255

All the data, in the registers , unless otherwise specified, are stored in two's complement integer form. This includes :

DATA REGISTERS

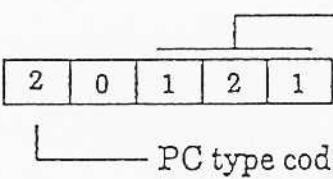
SPECIAL REGISTERS

FILE REGISTERS

COUNTER, TIMER CURRENT VALUE REGISTERS

Remember that some of the above are 16-bit registers and some are 32-bit registers.

EXCEPTIONS :

| DEVICE TYPE | DEVICE NUMBER | FORMAT |
|------------------|---------------|--|
| Special register | D8001 |  Version V1.21 PC type code (FX=2) |
| Special register | D8003 | 000AH : EEPROM protect SW=ON 0002H : EEPROM protect SW=OFF 0001H : ROM cassette 0000H : RAM cassette 0010H : Internal 2K RAM |

The CPU of the FX has a batch monitor function that it performs when executing the END statement or during STOP mode when the appropriate conditions have been set. First, the absolute addresses of the images of the devices to be monitored must be stored in the batch monitor device table starting at address 1802H.

The contents of the locations 1800H and 1801H provide the necessary control bits. The result of the monitor is stored in data tables starting at 1958H for word devices and 19A0H for bit devices.

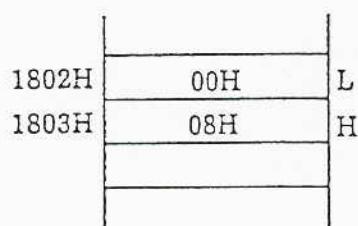
ADDRESS FORMAT:

The absolute address of the image of the device is as specified in section 15 "TOP AND DEVICE ADDRESSES".

EXAMPLES :

Word device addresses

T0 = 0800H
 □ □
 H L



FORMAT:

address L

| | | | | | | | |
|----|----|----|----|----|----|----|----|
| A4 | A3 | A2 | A1 | A0 | B2 | B1 | B0 |
|----|----|----|----|----|----|----|----|

address H

| | | | | | | | |
|-----|-----|-----|----|----|----|----|----|
| A12 | A11 | A10 | A9 | A8 | A7 | A6 | A5 |
|-----|-----|-----|----|----|----|----|----|

EXAMPLES :

Contact image of:
 M001
 A12-A0 = 0100H
 B2-B0 = 0012

| | | | | |
|----|----|----|----|----|
| A4 | A3 | A0 | B2 | B0 |
| 0 | 0 | 0 | 0 | 1 |

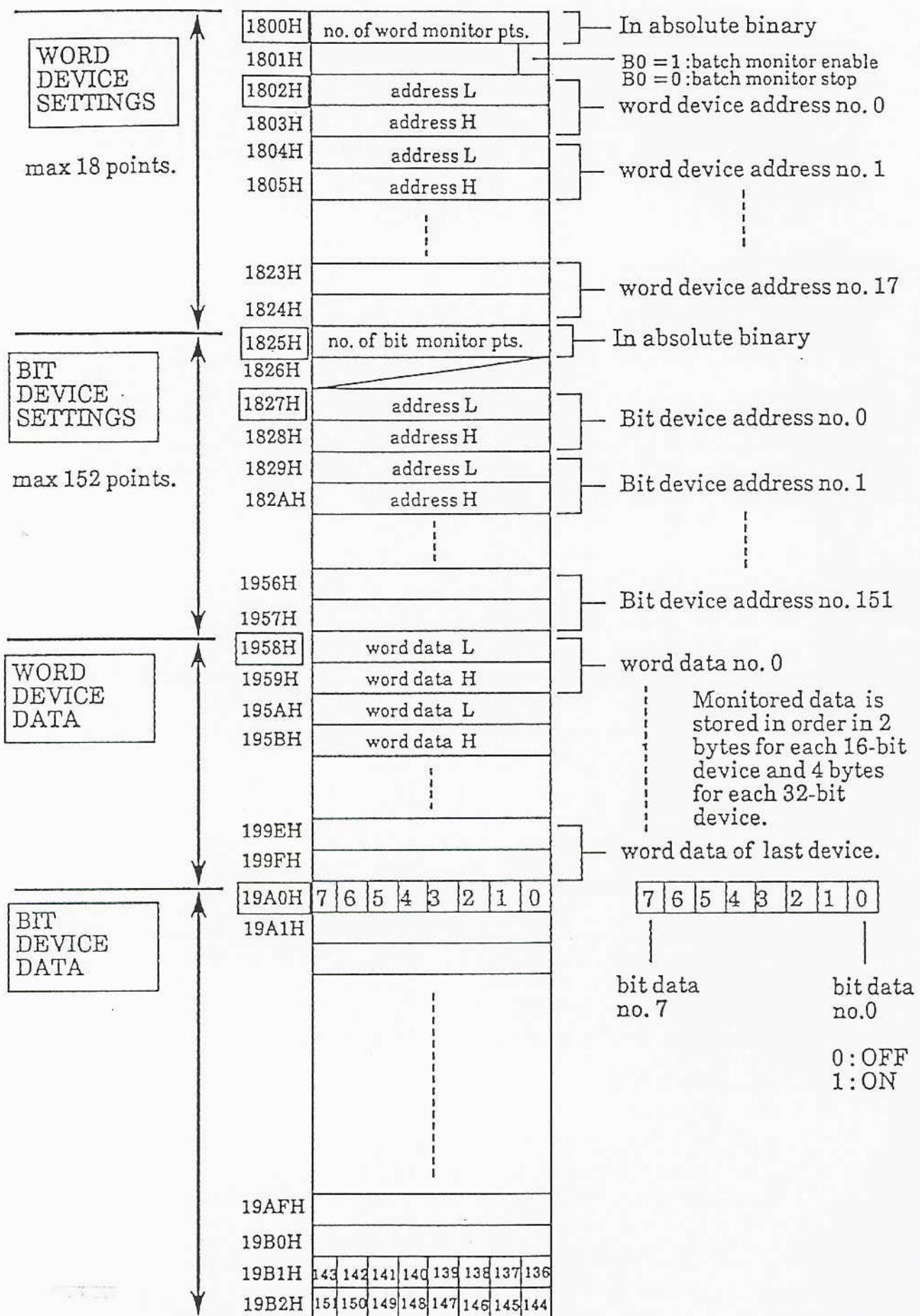
| | | |
|-----|----|----|
| A12 | A8 | A5 |
| 0 | 0 | 0 |

Coil image of:
 RST C195
 A12-A0 = 05D8H
 B2-B0 = 0112

| | | |
|---|----|----|
| 8 | B2 | B0 |
| 1 | 1 | 0 |

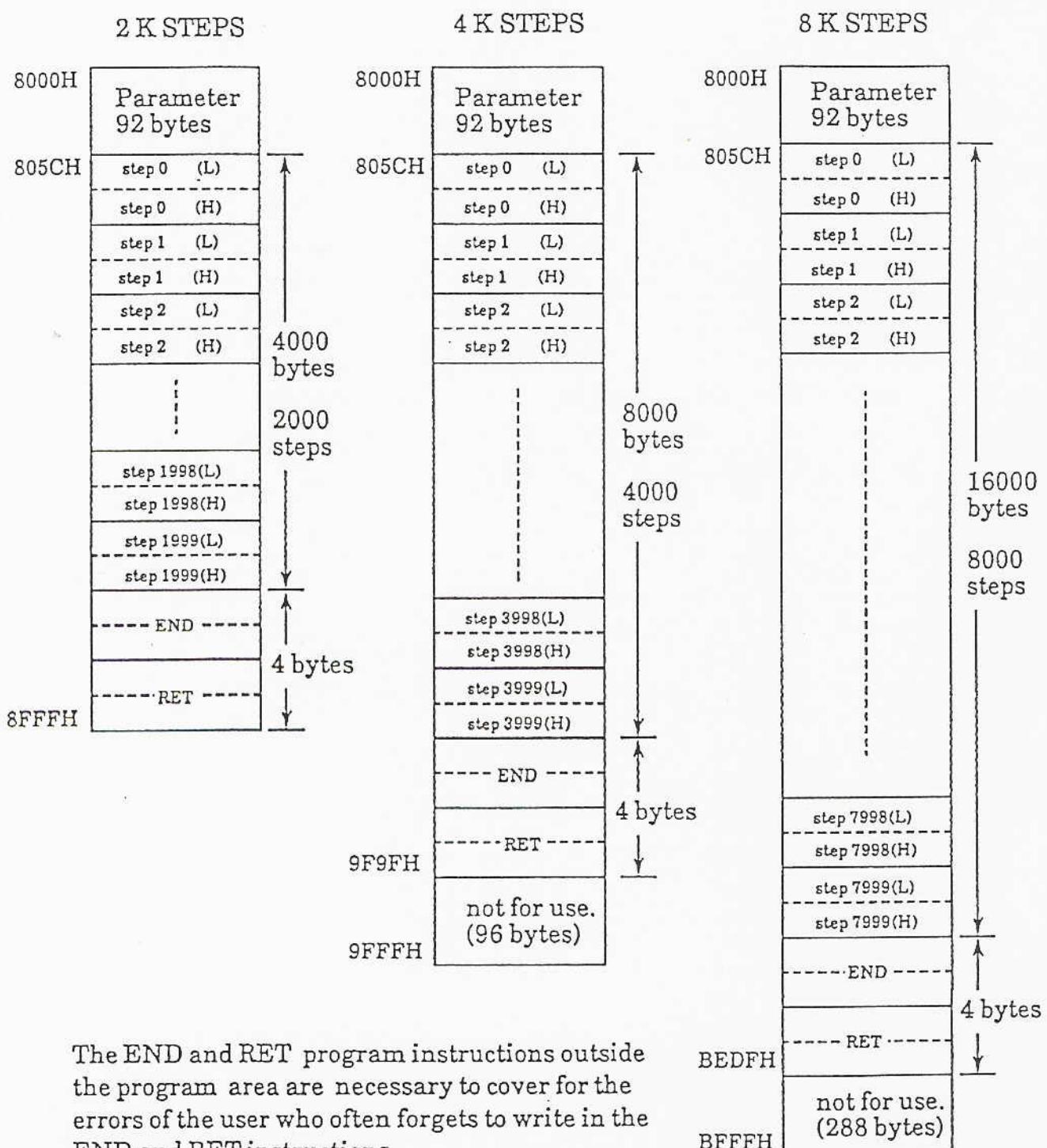
| | | |
|---|---|---|
| 0 | 5 | D |
| 0 | 0 | 1 |

BATCH MONITOR LOCATION MAP



Each step of the user's sequence program occupies 2 bytes of program memory. Step 0 begins at location address 805CH. The addresses are the same for PC RAM and cassette memory RAM, EPROM, EEPROM. Selection between these memories is automatically decided by the hardware arrangement. (Memory cassette has priority)

PROGRAM MEMORY MAP (no file registers, no comment allocations)



The END and RET program instructions outside the program area are necessary to cover for the errors of the user who often forgets to write in the END and RET instructions.

Not for use areas are recommended to be written with the code FFH. These areas are not managed.

PARAMETER MEMORY MAP

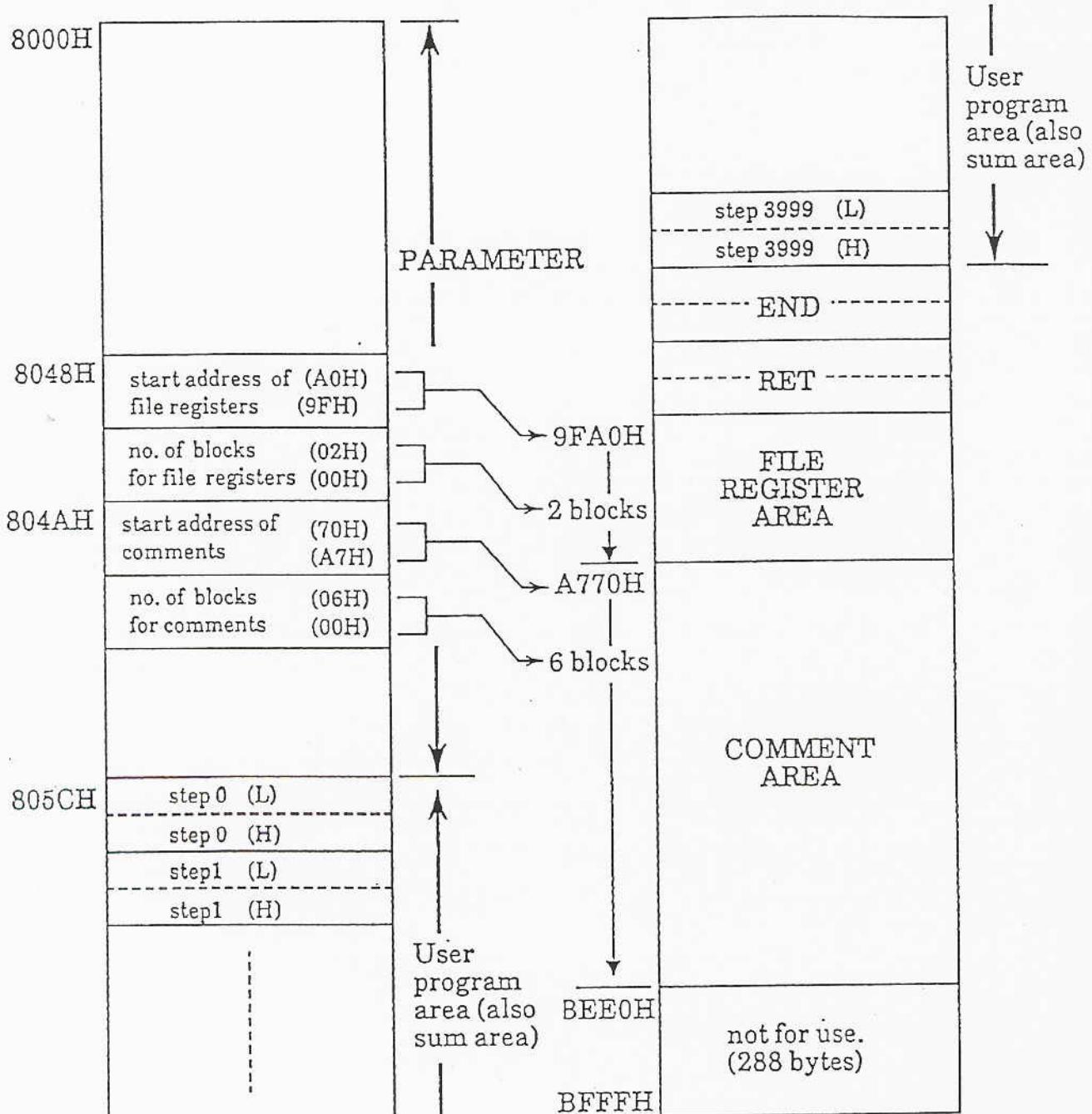
| | | |
|-------|---------------------------------|---|
| 8000H | memory setting | Parameter area is in total 92 bytes. |
| 8002H | sum data | |
| 8004H | RESERVED | |
| 8008H | | |
| | ENTRY CODE | |
| 8010H | | |
| | | |
| 8020H | PROGRAM TITLE | |
| | | |
| 8030H | latch range of M | |
| 8034H | latch range of S | |
| 8038H | latch range of C (16-bit) | |
| 803CH | latch range of C (32-bit) | |
| 8040H | latch range of D | |
| 8044H | reserved | |
| 8048H | File register memory setting | |
| 804CH | comment area memory setting | |
| 8050H | RESERVED | |
| 805BH | | |

From the setting of the parameter data, the position of the file register and comment in the program memory is determined.

EXAMPLE: 8K step mode
(1 block = 500 steps)

File register : 2 blocks (2000 bytes)

Comment : 6 blocks (6000 bytes)



| Headquarters | | European Representatives | |
|--|---|--------------------------|--|
| EUROPE | | AUSTRIA | |
| MITSUBISHI ELECTRIC EUROPE B.V., German Branch Gothaer Str. 8 D-40880 Ratingen GERMANY Phone: +49 (0) 2102 / 486 0 Fax: +49 (0) 2102 / 486 112 | GEVA Wiener Straße 89 A-2500 Baden Phone: +43 (0) 2252 / 85 55 20 Fax: +43 (0) 2252 / 488 60 | | |
| JAPAN | GETRONICS NV/SA Pontbeeklaan 43 B-1731 Zellik Phone: +32 (0) 2 / 467 17 51 Fax: +32 (0) 2 / 467 17 45 | BELGIUM | |
| UK | INEA CR d.o.o. Drvinje bb HR-10000 Zagreb Phone: +385 (0) 1 / 366 71 40 Fax: +385 (0) 1 / 366 71 40 | CROATIA | |
| USA | AutoCont Control Systems s.r.o. Nemocnici 12 CZ-70100 Ostrava 1 Phone: +420 (0) 69 / 615 21 11 Fax: +420 (0) 69 / 61 52 562 | CZECHIA | |
| | louis poulsen Geminivej 32 DK-2670 Greve Phone: +45 (0) 43 / 95 95 95 Fax: +45 (0) 43 / 95 95 90 | DENMARK | |
| | UTU ELEKTROTEHNika AS P.O. Box 4180 EE-0090 Tallinn Phone: +372 6 / 56 31 94 Fax: +372 6 / 56 38 36 | ESTONIA | |
| | Beijer Electronics OY Elannontie 5 FIN-01510 Vantaa Phone: +358 (0) 9 / 615 20 11 Fax: +358 (0) 9 / 615 20 500 | FINLAND | |
| | IP Systemes 8, Rue du Colonel Chambonnet F-69672 Lyon Bron Cedex Phone: +33 (0) 4 / 72 14 18 00 Fax: +33 (0) 4 / 72 14 18 01 | FRANCE | |
| | SANDSOFT 5 Röppentü Köz H-1139 Budapest Phone: +36 (0) 1 / 375 38 98 Fax: +36 (0) 1 / 375 06 88 | HUNGARY | |
| | MITSUBISHI ELECTRIC EUROPE B.V. Westgate Business Park, Ballymount IRL-Dublin 22 Phone: +353 (0) 1 / 450 50 07 Fax: +353 (0) 1 / 456 13 37 | IRELAND | |
| | TEXEL Electronics Ltd. P.O. Box 6272 IL-Netanya 42160 Phone: +972 (0) 9 / 863 08 94 Fax: +972 (0) 9 / 885 24 30 | ISRAEL | |
| | CARPANETO & C. S.p.A. Via Ferrero 10 I-10090 Gascine Vica-Rivoli (TO) Phone: +39 011 / 959 01 11 Fax: +39 011 / 959 02 50 | ITALY | |
| | Getronics Industrial Automation bv Donauweg 10 NL-1043 AJ-Amsterdam Phone: +31 (0) 20 / 586 15 92 Fax: +31 (0) 20 / 586 19 27 | NETHERLANDS | |