*INSTRUCTION MANUAL*

# MECHATROLINK I/O MODULE

**(NPN discrete input, 32 points, e-CON connector, MECHATROLINK-I / -II use)**

MODEL **R7K4DML-B-DA32A**

## BEFORE USE ....

Thank you for choosing us. Before use, please check contents of the package you received as outlined below.
If you have any problems or questions with the product, please contact our sales office or representatives.

### ■ PACKAGE INCLUDES:

Discrete input module.....(1)
Surface mounter slider .....(2)

### ■ MODEL NO.

Confirm Model No. marking on the product to be exactly what you ordered.

### ■ INSTRUCTION MANUAL

This manual describes necessary points of caution when you use this product, including installation, connection and basic maintenance procedures.

## POINTS OF CAUTION

### ■ CONFORMITY WITH EU DIRECTIVES

- The equipment must be mounted inside the instrument panel of a metal enclosure.
- The actual installation environments such as panel configurations, connected devices, connected wires, may affect the protection level of this unit when it is integrated in a panel system. The user may have to review the CE requirements in regard to the whole system and employ additional protective measures* to ensure the CE conformity.

  * For example, installation of noise filters and clamp filters for the power source, input and output connected to the unit, etc.

### ■ POWER INPUT RATING & OPERATIONAL RANGE

- Locate the power input rating marked on the product and confirm its operational range as indicated below:
  24V DC rating: 24V ±10%, approx. 60mA

### ■ GENERAL PRECAUTIONS

- Before you remove the unit or mount it, turn off the power supply and input signal for safety.
- DO NOT set the switches on the module while the power is supplied. The switches are used only for maintenance without the power.

### ■ ENVIRONMENT

- Indoor use.
- When heavy dust or metal particles are present in the air, install the unit inside proper housing with sufficient ventilation.
- Do not install the unit where it is subjected to continuous vibration. Do not subject the unit to physical impact.
- Environmental temperature must be within 0 to 55°C (32 to 131°F) with relative humidity within 30 to 90% RH in order to ensure adequate life span and operation.

### ■ WIRING

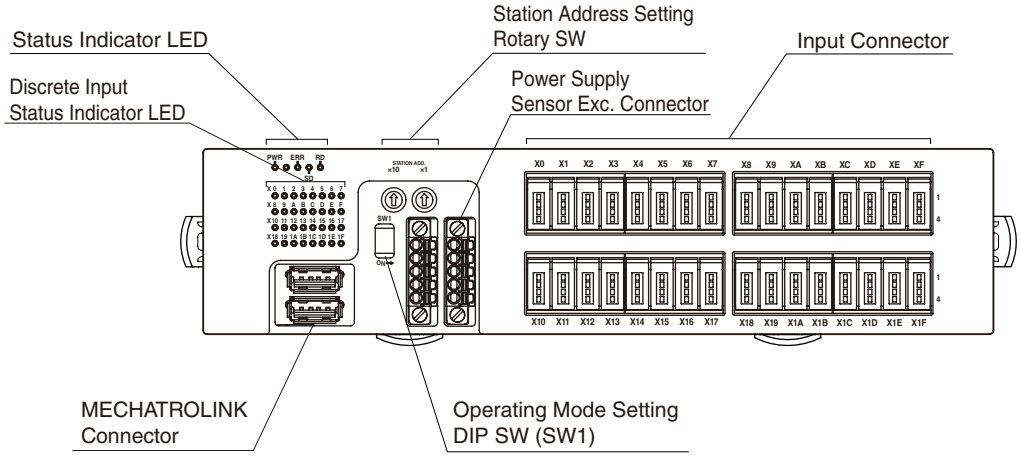
- Do not install cables close to noise sources (relay drive cable, high frequency line, etc.).
- Do not bind these cables together with those in which noises are present. Do not install them in the same duct.

### ■ AND ....

- The unit is designed to function as soon as power is supplied, however, a warm up for 10 minutes is required for satisfying complete performance described in the data sheet.


MG CO., LTD. www.mgco.jp
5-2-55 Minamitsumori, Nishinari-ku, Osaka 557-0063 JAPAN

# COMPONENT IDENTIFICATION




## ■ STATUS INDICATOR LED

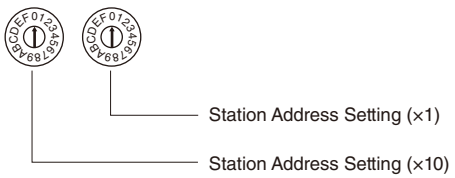
| ID | COLOR | FUNCTION |
|---|---|---|
| PWR | Green | Turns on when internal power is supplied normally, and off with internal power failure. |
| ERR | Red | Turns on with station address setting error, and off with normal station address setting. |
| SD | Green | Turns on when transmitting data, and off when not transmitting data. |
| RD | Green | Turns on when receiving data, and off when not receiving data. |

## ■ DISCRETE INPUT STATUS INDICATOR LED

LED green indicators shows the signal status.
ON : LED ON
OFF : LED OFF

## ■ STATION ADDRESS

Station Address is selected between 60H and 7FH (Simple I/O) in hexadecimal.
The left switch and the right switch determine the MSD and the LSD of the address, respectively.
(Factory setting: 61H)
Certain numbers may not be selectable depending on the Main Device types.
Refer to the instruction manual of the Main Device unit for details.




## ■ OPERATING MODE

**• MECHATROLINK mode: SW1-1, 1-2**

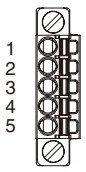
Choose MECHATROLINK-I or -II, and the data size.
SW1-1 and SW1-2 are used.

| SW1-1 | SW1-2 | MECHATROLINK MODE |
|---|---|---|
| OFF | OFF | MECHATROLINK-II (32-byte mode) (*) |
| ON | OFF | MECHATROLINK-II (17-byte mode) |
| ON | ON | MECHATROLINK-I (17-byte mode) |

(*) Factory setting
Note: Be sure to set unused SW1-3 and 1-4 to OFF.

## ■ POWER SUPPLY, SENSOR EXCITATION

**Cable connector**: FMC1,5 / 5-STF-3,5
(Phoenix Contact) (included in the package)
**Applicable wire size**: 0.2 – 1.5 mm²; stripped length 10 mm
**Recommended solderless terminal**
- AI0,25-10YE 0.25 mm² (Phoenix Contact)
- AI0,34-10TQ 0.34 mm² (Phoenix Contact)
- AI0,5-10WH 0.5 mm² (Phoenix Contact)
- AI0,75-10GY 0.75 mm² (Phoenix Contact)
- A1-10 1.0 mm² (Phoenix Contact)
- A1,5-10 1.5 mm² (Phoenix Contact)



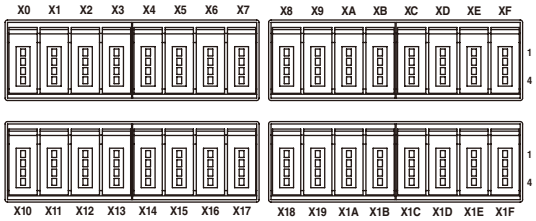

1. PWR+ Power Supply (24V DC)
2. PWR– Power Supply (0V)
3. FE Functional earth
4. SNSR.EXC+ Sensor excitation (24V DC)
5. SNSR.EXC– Sensor excitation (0V)

## ■ INPUT TERMINAL ASSIGNMENT

**• e-CON connector**

**Recommended cable connector**: 37104-( )-000FL (3M Company)

(The cable connector is not included in the package. Specify wire size instead of ( ); refer to the specifications of the product.)




| No. | | ID | FUNCTION | No. | | ID | FUNCTION |
|---|---|---|---|---|---|---|---|
| X0 | 1 | +24V | 24V DC | X8 | 1 | +24V | 24V DC |
| | 2 | NC | Unused | | 2 | NC | Unused |
| | 3 | GND | 0V | | 3 | GND | 0V |
| | 4 | X0 | Input 0 | | 4 | X8 | Input 8 |
| X1 | 1 | +24V | 24V DC | X9 | 1 | +24V | 24V DC |
| | 2 | NC | Unused | | 2 | NC | Unused |
| | 3 | GND | 0V | | 3 | GND | 0V |
| | 4 | X1 | Input 1 | | 4 | X9 | Input 9 |
| X2 | 1 | +24V | 24V DC | XA | 1 | +24V | 24V DC |
| | 2 | NC | Unused | | 2 | NC | Unused |
| | 3 | GND | 0V | | 3 | GND | 0V |
| | 4 | X2 | Input 2 | | 4 | XA | Input 10 |
| X3 | 1 | +24V | 24V DC | XB | 1 | +24V | 24V DC |
| | 2 | NC | Unused | | 2 | NC | Unused |
| | 3 | GND | 0V | | 3 | GND | 0V |
| | 4 | X3 | Input 3 | | 4 | XB | Input 11 |
| X4 | 1 | +24V | 24V DC | XC | 1 | +24V | 24V DC |
| | 2 | NC | Unused | | 2 | NC | Unused |
| | 3 | GND | 0V | | 3 | GND | 0V |
| | 4 | X4 | Input 4 | | 4 | XC | Input 12 |
| X5 | 1 | +24V | 24V DC | XD | 1 | +24V | 24V DC |
| | 2 | NC | Unused | | 2 | NC | Unused |
| | 3 | GND | 0V | | 3 | GND | 0V |
| | 4 | X5 | Input 5 | | 4 | XD | Input 13 |
| X6 | 1 | +24V | 24V DC | XE | 1 | +24V | 24V DC |
| | 2 | NC | Unused | | 2 | NC | Unused |
| | 3 | GND | 0V | | 3 | GND | 0V |
| | 4 | X6 | Input 6 | | 4 | XE | Input 14 |
| X7 | 1 | +24V | 24V DC | XF | 1 | +24V | 24V DC |
| | 2 | NC | Unused | | 2 | NC | Unused |
| | 3 | GND | 0V | | 3 | GND | 0V |
| | 4 | X7 | Input 7 | | 4 | XF | Input 15 |

| No. | | ID | FUNCTION | No. | | ID | FUNCTION |
|---|---|---|---|---|---|---|---|
| X10 | 1 | +24V | 24V DC | X18 | 1 | +24V | 24V DC |
| | 2 | NC | Unused | | 2 | NC | Unused |
| | 3 | GND | 0V | | 3 | GND | 0V |
| | 4 | X10 | Input 16 | | 4 | X18 | Input 24 |
| X11 | 1 | +24V | 24V DC | X19 | 1 | +24V | 24V DC |
| | 2 | NC | Unused | | 2 | NC | Unused |
| | 3 | GND | 0V | | 3 | GND | 0V |
| | 4 | X11 | Input 17 | | 4 | X19 | Input 25 |
| X12 | 1 | +24V | 24V DC | X1A | 1 | +24V | 24V DC |
| | 2 | NC | Unused | | 2 | NC | Unused |
| | 3 | GND | 0V | | 3 | GND | 0V |
| | 4 | X12 | Input 18 | | 4 | X1A | Input 26 |
| X13 | 1 | +24V | 24V DC | X1B | 1 | +24V | 24V DC |
| | 2 | NC | Unused | | 2 | NC | Unused |
| | 3 | GND | 0V | | 3 | GND | 0V |
| | 4 | X13 | Input 19 | | 4 | X1B | Input 27 |
| X14 | 1 | +24V | 24V DC | X1C | 1 | +24V | 24V DC |
| | 2 | NC | Unused | | 2 | NC | Unused |
| | 3 | GND | 0V | | 3 | GND | 0V |
| | 4 | X14 | Input 20 | | 4 | X1C | Input 28 |
| X15 | 1 | +24V | 24V DC | X1D | 1 | +24V | 24V DC |
| | 2 | NC | Unused | | 2 | NC | Unused |
| | 3 | GND | 0V | | 3 | GND | 0V |
| | 4 | X15 | Input 21 | | 4 | X1D | Input 29 |
| X16 | 1 | +24V | 24V DC | X1E | 1 | +24V | 24V DC |
| | 2 | NC | Unused | | 2 | NC | Unused |
| | 3 | GND | 0V | | 3 | GND | 0V |
| | 4 | X16 | Input 22 | | 4 | X1E | Input 30 |
| X17 | 1 | +24V | 24V DC | X1F | 1 | +24V | 24V DC |
| | 2 | NC | Unused | | 2 | NC | Unused |
| | 3 | GND | 0V | | 3 | GND | 0V |
| | 4 | X17 | Input 23 | | 4 | X1F | Input 31 |

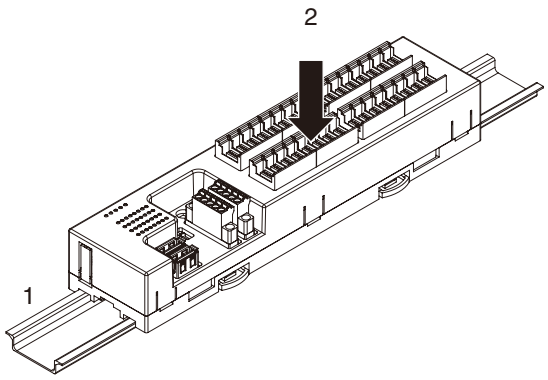
# MOUNTING INSTRUCTIONS

## ■ DIN RAIL MOUNTING

**• Mounting**

1) Set the upper hook at the rear side of the unit on the DIN rail.

2) Push in the lower.

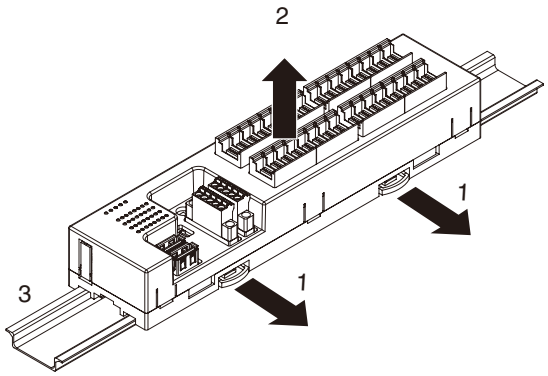



**• Dismounting**

1) Push down the DIN rail mounter slider with the tip of a minus screwdriver.

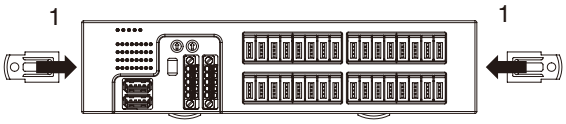
2) Pull the lower of the unit.

3) Remove the upper hook of the unit from the DIN rail.

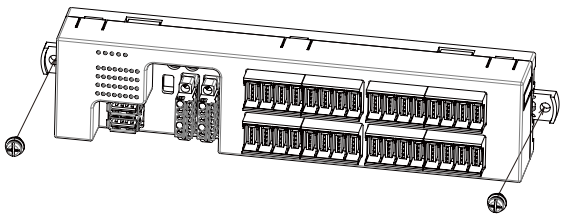



## ■ SURFACE MOUNTING

1) Insert the two DIN rail mounter sliders until it clicks once, as shown below.



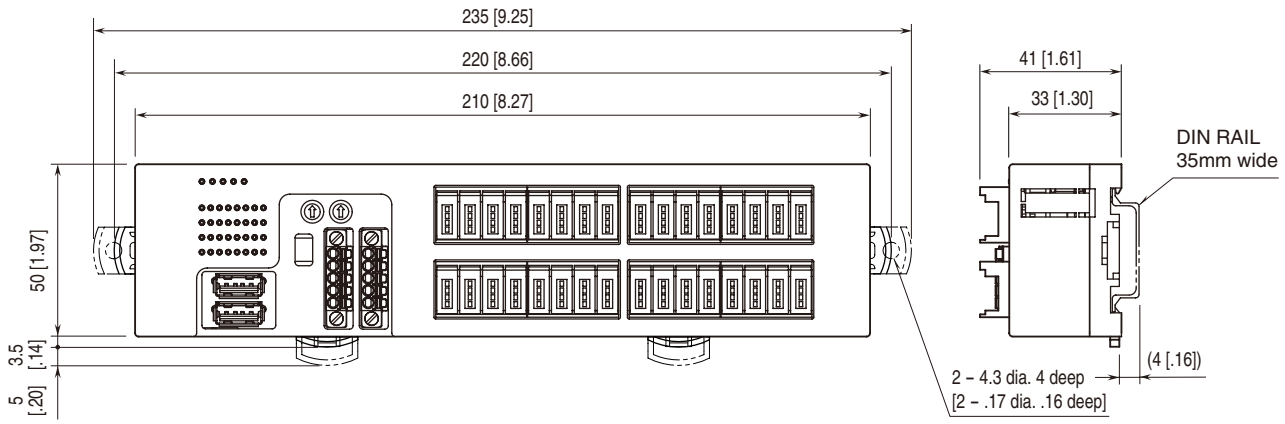

2) Mount the unit with M4 screws referring to the EXTERNAL DIMENSIONS. (Torque: 1.4 N·m)



# TERMINAL CONNECTIONS

Connect the unit as in the diagram below.

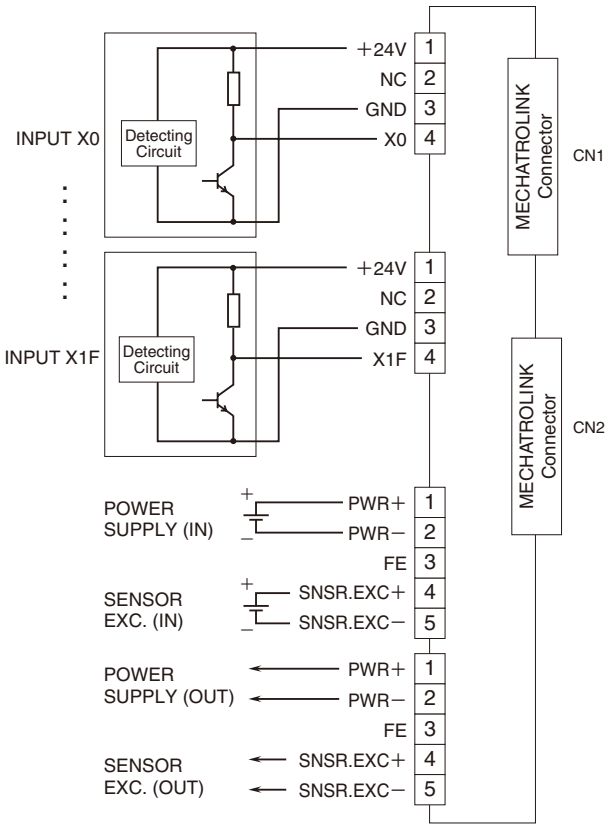
## ■ EXTERNAL DIMENSIONS unit : mm [inch]



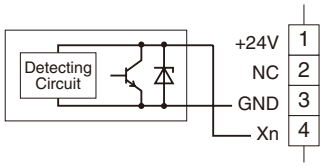
## ■ CONNECTION DIAGRAM

Note: In order to improve EMC performance, bond the FE terminal to ground.

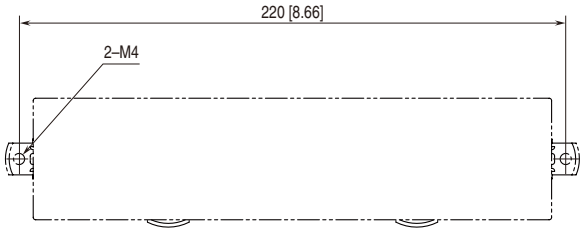
Caution: FE terminal is NOT a protective conductor terminal.




### ■ 2-Wire Sensor

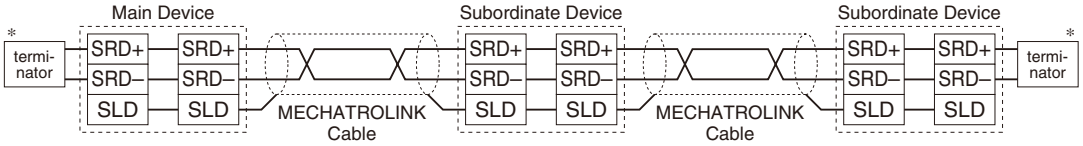



## MOUNTING REQUIREMENTS unit: mm [inch]



# COMMUNICATION CABLE CONNECTIONS

## ■ MECHATROLINK CONNECTION




*Terminator
Be sure to connect the terminating resistors to the unit at both ends of transmission line.
Use the terminating resistor dedicated for MECHATROLINK: Model JEPMC-W6022, Yaskawa Controls Co., Ltd.
Certain types of Main Device units may have incorporated terminating resistors. Consult the instruction manual for the Main Device.

# MECHATROLINK COMMUNICATION

## ■ MECHATROLINK-I

**Baud rate**: 4 Mbps
**Transmission distance**: 50 m max.
**Distance between stations**: 30 cm min.
**Transmission media**: MECHATROLINK cable (Model JEPMC-W6003-x-E, Yaskawa Controls Co., Ltd.)
**Max. number of Subordinate Devices**: 15 (The maximum number of Subordinate Devices might change depending on the Main Device unit. Refer to the manual of the Main Device unit)
**Transmission cycle**: 2 msec. (fixed)
**Data length**: 17 bytes

## ■ MECHATROLINK-II

**Baud rate**: 10 Mbps
**Transmission distance**: 50 m max.
**Distance between stations**: 50 cm min.
**Transmission media**: MECHATROLINK cable (Model JEPMC-W6003-x-E, Yaskawa Controls Co., Ltd.)
**Max. number of Subordinate Devices**: 30 (The maximum number of Subordinate Devices might change depending on the Main Device unit. Refer to the manual of the Main Device unit)
**Transmission cycle**: 0.25 msec., 0.5 msec., 1 msec., 1.5 msec., 2 msec., 2.5 msec., 3 msec., 4 msec., 8 msec.
**Data length**: 17 bytes / 32 bytes selectable (Must choose identical data size for all stations on one network)

# MECHATROLINK RELATED COMMANDS

R7K4DML (Simple I/O) communicates with I/O service with no processor, therefore it uses a connectionless communication protocol. There is no application layer either; the R7K4DML interchanges I/O data via data link layer.

## ■ MECHATROLINK DATA LINK LAYER COMMAND DESCRIPTIONS

The following tables explain the two Commands supported by the R7K4DML.

**• MDS Command (04H) Data Format**

| BYTE | COMMAND | RESPONSE | REMARKS |
|---|---|---|---|
| 0 | MDS (04H) | S(0) (90H) | Message Data Search (MDS) Command: Read the ID from Subordinate Device station(s)<br>S(0): Response to MDS |
| 1 | 0 | ID | |
| 2 | 0 | | |
| 3 | 0 | 0 | All 0 |
| 4 | 0 | 0 | |
| 5 | 0 | 0 | |
| 6 | 0 | 0 | |
| 7 | 0 | 0 | |
| 8 | 0 | 0 | |
| 9 | 0 | 0 | |
| 10 | 0 | 0 | |
| 11 | 0 | 0 | |
| 12 | 0 | 0 | |
| 13 | 0 | 0 | |
| 14 | 0 | 0 | |
| 15 | 0 | 0 | |
| 16 | 0 | 0 | |
| 17<br>:<br>31 | 0<br>:<br>0 | 0<br>:<br>0 | Byte 17 through 31 are always 0 in the 32-byte mode.<br>These bytes are unavailable for MECHATROLINK-I and MECHATROLINK-II in the 17-byte mode. |

**• CDRW Command (03H) Data Format**

| BYTE | COMMAND | RESPONSE | REMARKS |
|---|---|---|---|
| 0 | CDRW (03H) | ACK (01H) | Cyclic Data Read/Write (CDRW) Command: Link transmission<br>Acknowledge (ACK): Positive response to CDRW |
| 1 | Out Data: Lowest | In Data: Lowest | Order of data: Little Endian |
| 2 | | | |
| 3 | | | |
| 4 | | | |
| 5 | | | |
| 6 | | | |
| 7 | | | |
| 8 | | | |
| 9 | | | |
| 10 | | | |
| 11 | | | |
| 12 | | | |
| 13 | | | |
| 14 | | | |
| 15 | | | |
| 16 | Out Data: Highest | In Data: Highest | |
| 17<br>:<br>31 | <br><br>(Out Data: Highest) | <br><br>(In Data: Highest) | Byte 17 through 31 are unavailable for MECHATROLINK-I and MECHATROLINK-II in the 17-byte mode.<br>(Only available for MECHATROLINK-II in the 32-byte mode) |

# I/O DATA DESCRIPTIONS

## ■ 17-BYTE MODE

**• 32 points input data (In Data)**

| Byte | Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|---|---|---|---|---|---|---|---|---|
| 1 | In7 | In6 | In5 | In4 | In3 | In2 | In1 | In0 |
| 2 | In15 | In14 | In13 | In12 | In11 | In10 | In9 | In8 |
| 3 | In23 | In22 | In21 | In20 | In19 | In18 | In17 | In16 |
| 4 | In31 | In30 | In29 | In28 | In27 | In26 | In25 | In24 |
| 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| :<br>: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

## ■ 32-BYTE MODE

**• 32 points input data (In Data)**

| Byte | Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|---|---|---|---|---|---|---|---|---|
| 1 | In7 | In6 | In5 | In4 | In3 | In2 | In1 | In0 |
| 2 | In15 | In14 | In13 | In12 | In11 | In10 | In9 | In8 |
| 3 | In23 | In22 | In21 | In20 | In19 | In18 | In17 | In16 |
| 4 | In31 | In30 | In29 | In28 | In27 | In26 | In25 | In24 |
| 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| :<br>: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 28 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 29 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 31 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 32 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

0: OFF, 1: ON