



**STEP**  
**TECHNICA**

CUnet(MKY44-IO32A)  
Intelligent 16IN/16OUT

**CUB44-IO32A**  
**User's Manual**

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## Revision history

Date	Version	Content	Note
SEP 2018	1.2E	Issued the first edition	

## Preface

This manual describes general-purpose I/O board for CUNet (Type : CUB44-IO32A), with MKY44-IO32A which is a kind of CUNet family IC.

Be sure to read "CUNet Introduction Guide (A Guide to the CUNet Protocol)" in advance to use CUB44-IO32A and understand this manual.

- Target readers

- Those who first build a CUNet
- Those who first use StepTechnica's CUB44-IO32A to build a CUNet

- Prerequisites

This manual assumes that you are familiar with :

- Network technology
- Semiconductor products (especially microcontrollers and memory)

- Related manuals

- CUNet Introduction Guide (A Guide to the CUNet Protocol)
- CUNet Technical Guide (For Network)
- MKY43 User's Manual
- MKY44-IO32A Data Sheet

### **【Note】**

Some terms in this manual are different from those that used in our website or product brochures. The brochure uses ordinary terms to help many people in various industries understand our products.

Expertise in CUNet family, please understand technical information based on technical documents (manuals).

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## 1 Outline

MKY44-IO32A is a general-purpose I/O board for CUNet with MKY44-IO32A chip. This product has 16 external inputs and outputs isolated by photocoupler.

This product is powered from 24V external power supply, which is isolated by DC/DC converter on the board and operates with 3.3V inside circuit.

This board fits on DIN rail with cover equipped.

## 2 Specifications

The specifications of CUB44-IO32A is shown in Table 2-1.

Table 2-1 CUB44-IO32A board specifications

Type	CUB44-IO32A (With case : CUB44-IO32A-C)		
CUNet device	MKY44-IO32A (Operating mode : DIO mode)		
CUNet communication mode	Half-duplex		
CUNet communication rate	12M/6M/3Mbps (Switch setting)		
General-purpose input method and number of inputs	Current source type by photocoupler isolation : 16 inputs		
General inputs ON/OFF delay	100 $\mu$ s or lower (Added when digital filter is enable.)		
Digital filter function	Sampling interval 100 $\mu$ s ~ 1s (Initial value 100 $\mu$ s) Sampling count 1 time, 2 times, 4 times, 8 times, 10 times (Initial value 10 times)		
General-purpose output method and number of outputs	Current sink type by photocoupler isolation : 16 outputs		
LED	POWER ON	(Green)	
	MON	(Green)	
	DONA	(Green)	
	LCARE	(Yellow)	
	MCARE	(Red)	
	DI	(Green)	16 pieces
	DO	(Green)	16 pieces
Switch	Termination setting switch (Resistance : 100 $\Omega$ ) SA setting switch BPS setting switch DOSA setting switch DOHL setting switch DFon setting switch		
Connector	Communication connector	(RJ-45 type)	2 pieces
	General-purpose input connector	(MIL type)	
	General-purpose output connector	(MIL type)	
	Power supply connector	(SPTA1/4-3,5 PHOENIX)	

Outside dimensions	64mm × 130mm
Weight	70 g
Operating temperature	Temperature 0°C to 55°C Humidity 0% to 90% (With no condensation)
Storage temperature	Temperature -20°C to 65°C Humidity 0% to 90% (With no condensation)
External circuit power supply	DC24V +10% , -15%
Internal circuit power supply	DC/ DC converter isolates DC24V external power supply into DC3.3V internal operating voltage.
Consumption current (DC24V power supply)	150mA or less

### 3 Block diagram

The block diagram of CUB44-IO32A is shown in Fig.3-1.

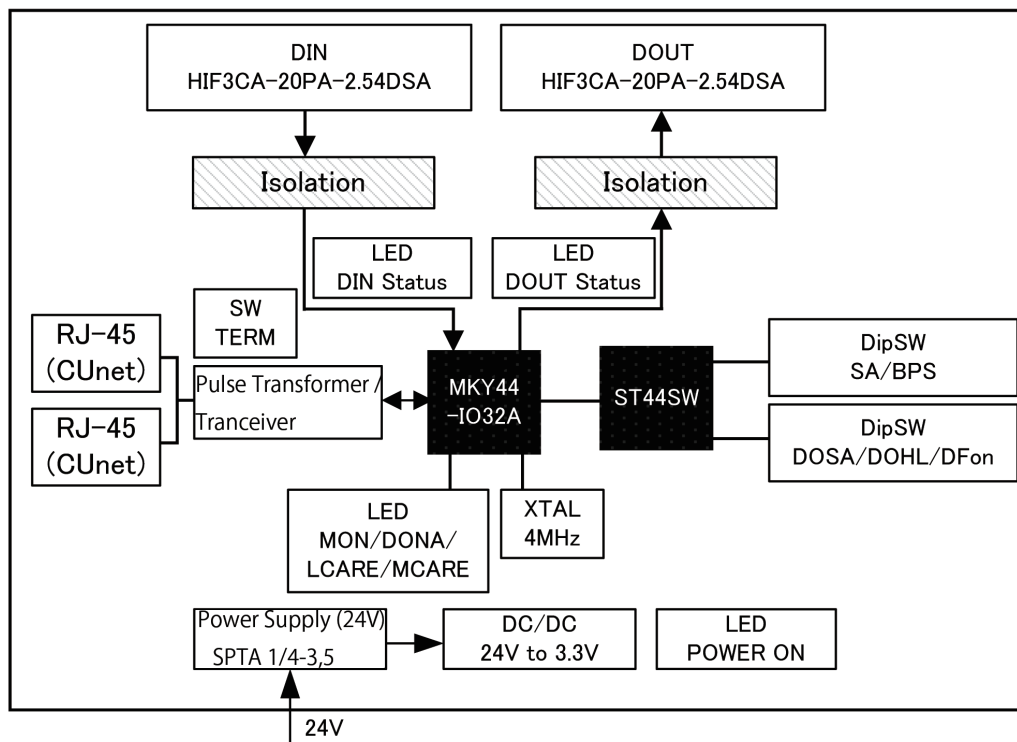


Fig. 3-1 CUB44-IO32A block diagram



## 4 Functions

This chapter describes functions of CUB44-IO32A.

### 4.1 MKY44-IO32A

This board mounts MKY44-IO32A, a slave IC for CUNet.

MKY44-IO32A on this board operates with DIO mode-fixed and can control 16 inputs / outputs as external I/O. Also, general-purpose inputs have digital filtering function.

For details of MKY44-IO32A, refer to "MKY44-IO32A Data Sheet".

### 4.2 CUnet communication diagram

CUB44-IO32A equips RS485 transceiver (ADM3078E) and pulse transformer (SPT401-DMX) for CUnet communication.

CUnet communication settings are as follows.

SA	: 0 ~ 63 (SW2)
DOSA	: 0 ~ 63 (SW3)
Communication mode	: Half-duplex mode (Fixed)
Communication rate	: 12M/6M/3M bps (SW2)
Self-owned area (OWN)	: 1MB (Memory block)
Termination resistance (100 Ω)	: Select enable or disable by SW1 setting

CUnet communication block diagram is shown in Fig. 4-1.

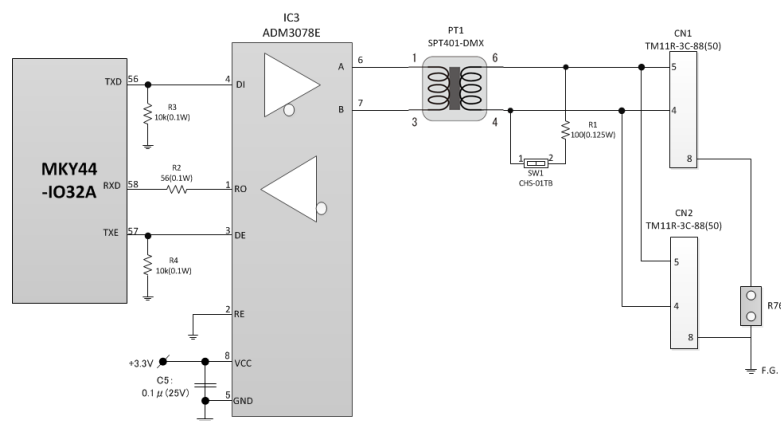


Fig. 4-1 CUnet communication block diagram

**4.2.1 Data configuration of occupied memory block**

1MB is occupied in MB (Memory Block) corresponded to set SA on CUB44-IO32A board.

The size of one MB is 8 bytes. Data configuration of MB in CUB44-IO32A is shown in Table 4-1, details of each are shown in Table 4-2.

**Table 4-1** Memory block configuration of CUB44-IO32A

bit15	bit14	bit13	bit12	bit11	bit10	bit9	bit8	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
DI15	DI14	DI13	DI12	DI11	DI10	DI9	DI8	DI7	DI6	DI5	DI4	DI3	DI2	DI1	DI0
bit31	bit30	bit29	bit28	bit27	bit26	bit25	bit24	bit23	bit22	bit21	bit20	bit19	bit18	bit17	bit16
DO15	DO14	DO13	DO12	DO11	DO10	DO9	DO8	DO7	DO6	DO5	DO4	DO3	DO2	DO1	DO0
bit47	bit46	bit45	bit44	bit43	bit42	bit41	bit40	bit39	bit38	bit37	bit36	bit35	bit34	bit33	bit32
DFon	DOSA5	DOSA4	DOSA3	DOSA2	DOSA1	DOSA0	DOHL	FD3	FD2	FD1	FD0	0	IOSWAP	IOS1	IOS0
bit63	bit62	bit61	bit60	bit59	bit58	bit57	bit56	bit55	bit54	bit53	bit52	bit51	bit50	bit49	bit48
0	0	FI13	FI12	FI11	FI10	FI9	FI8	FI7	FI6	FI5	FI4	FI3	FI2	FI1	FI0

**Table 4-2** Detailed description of each memory block

Bit	Description
15 ~ 0 (DI15 ~ DI0)	Input status from general-purpose input connector (CN4) are set to these bits.
31 ~ 16 (DO15 ~ DO0)	Echo back data of outputs are set to these bits.
33, 32 (IOS1, 0)	The status of IOS0/1 pin of MKY44-IO32A are set to these bits. bit33 (IOS1) = 1, bit32 (IOS0) = 0 are fixed on this board.
34 (IOSWAP)	The status of IOSWAP pin of MKY44-IO32A is set to this bit. bit34 (IOSWAP) = 1 is fixed on this board.
35	Unused bit / fixed to 0
39 ~ 36 (FD3 ~ FD0)	Hexadecimal values of sampling count of digital filtering are set to these bits. Sampling counts to set are 0x1 (1), 0x2 (2), 0x4 (4), 0x8 (8), 0xA (10).
40 (DOHL)	The status of DOHL which has been set by SW3-7 is set to this bit. Select lower 32 bits (bit31 to 0) to set (SW3-7 = ON) when '1' is set to this bit. Select upper 32 bits (bit63 to 32) to set (SW3-7 = OFF) when '0' is set to this bit.
46 ~ 41 (DOSA0 ~ DOSA5)	The setting status of SW3-1 to SW3-6 are set to these bits.
47 (DFon)	The status of digital filtering set in SW3-8 is set to this bit. Digital filtering is enable when '1' is set to this bit (SW3-8 = ON). Digital filtering is disable when '0' is set to this bit (SW3-8 = OFF).
61 ~ 48 (FI13 ~ FI0)	Hexadecimal values of digital filtering sampling interval are set to these bits. Sampling interval value ranges from FI13 to FI0 × 100 μs (100 μs to 1s).
63, 62	Unused bit / fixed to 0

**4.2.2 Data configuration of DOSA memory block**

CUB44-IO32A outputs 2 bytes data out of DOSA master data set in SW3 (1 to 6) from general-purpose output connector.

It is necessary to specify which 2 bytes data to refer, the upper bits (63 to 32) or the lower bits (31 to 0) by DOHL (SW3-7) setting.

Output data reference when DOHL (SW3-7) is OFF is shown in Table 4-3 and when DOHL (SW3-7) is ON is shown in Table 4-4.

'Don't Care' means these bits have no influence on the operation of CUB44-IO32A.

**Table 4-3** Output data reference when DOHL = OFF

bit15	bit14	bit13	bit12	bit11	bit10	bit9	bit8	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
Don't Care															
<b>bit31</b>	<b>bit30</b>	<b>bit29</b>	<b>bit28</b>	<b>bit27</b>	<b>bit26</b>	<b>bit25</b>	<b>bit24</b>	<b>bit23</b>	<b>bit22</b>	<b>bit21</b>	<b>bit20</b>	<b>bit19</b>	<b>bit18</b>	<b>bit17</b>	<b>bit16</b>
<b>D015</b>	<b>D014</b>	<b>D013</b>	<b>D012</b>	<b>D011</b>	<b>D010</b>	<b>D09</b>	<b>D08</b>	<b>D07</b>	<b>D06</b>	<b>D05</b>	<b>D04</b>	<b>D03</b>	<b>D02</b>	<b>D01</b>	<b>D00</b>
bit47	bit46	bit45	bit44	bit43	bit42	bit41	bit40	bit39	bit38	bit37	bit36	bit35	bit34	bit33	bit32
Don't Care															
bit63	bit62	bit61	bit60	bit59	bit58	bit57	bit56	bit55	bit54	bit53	bit52	bit51	bit50	bit49	bit48
Don't Care															

**Table 4-4** Output data reference when DOHL = ON

bit15	bit14	bit13	bit12	bit11	bit10	bit9	bit8	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
Don't Care															
bit31	bit30	bit29	bit28	bit27	bit26	bit25	bit24	bit23	bit22	bit21	bit20	bit19	bit18	bit17	bit16
Don't Care															
bit47	bit46	bit45	bit44	bit43	bit42	bit41	bit40	bit39	bit38	bit37	bit36	bit35	bit34	bit33	bit32
Don't Care															
<b>bit63</b>	<b>bit62</b>	<b>bit61</b>	<b>bit60</b>	<b>bit59</b>	<b>bit58</b>	<b>bit57</b>	<b>bit56</b>	<b>bit55</b>	<b>bit54</b>	<b>bit53</b>	<b>bit52</b>	<b>bit51</b>	<b>bit50</b>	<b>bit49</b>	<b>bit48</b>
<b>D015</b>	<b>D014</b>	<b>D013</b>	<b>D012</b>	<b>D011</b>	<b>D010</b>	<b>D09</b>	<b>D08</b>	<b>D07</b>	<b>D06</b>	<b>D05</b>	<b>D04</b>	<b>D03</b>	<b>D02</b>	<b>D01</b>	<b>D00</b>

### 4.3 General-purpose inputs

CUB44-IO32A supports 16 external input signals. Each input signals are isolated by photocoupler and connected to MKY44-IO32A. The input method is current source type, which can be connected to switches and sensors. Input equivalent circuit diagram is shown in Fig. 4-2.

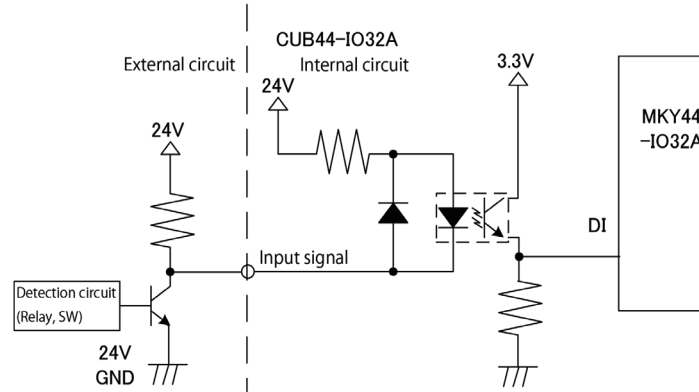


Fig. 4-2 Input equivalent circuit

MKY44-IO32A has digital filtering function which can be switched ON/OFF by DFon (SW3-8) setting. Once digital filtering function is enabled, filtering is executed in accordance with the settings of FD (sampling count) and FI (sampling interval).

Factory setting is as follows.

Digital filtering : OFF(SW3-7=OFF), FD (Sampling count)=10, FI (Sampling interval) =1 (100  $\mu$  s)

To change the settings of FD (sampling count) and FI (sampling interval), use CUnet mail function.

For the method of changing settings, refer to " ■ Support for the CUnet Mail Function (Common to DIO mode, PWM and Up/Down counter mode)" in MKY44-IO32A User's Manual.

### 4.4 General-purpose outputs

CUB44-IO32A supports 16 external output signals. Each output signals are isolated by photocoupler so that they can drive with high current. The output method is current sink type, which can drive with a maximum of 300V, 100mA and can be connected to motors, relays, LEDs and switches.

Output equivalent circuit diagram is shown in Fig. 4-3.

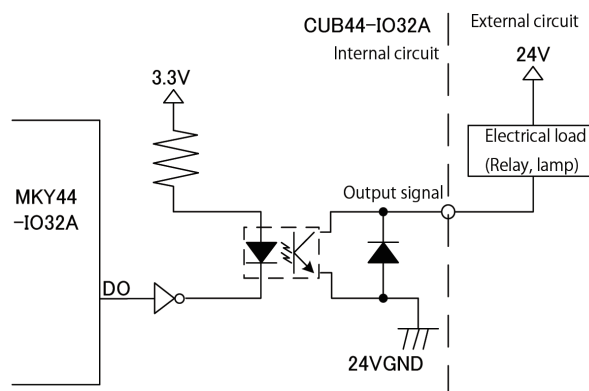


Fig. 4-3 Output equivalent circuit

Output data renewal from external outputs is executed by a cycle of CUnet.

For the method to choose output data from external outputs, refer to "4.2.2 Data configuration of DOSA memory block".

## 5 External view

External view of CUB44-IO32A is shown in Fig. 5-1.

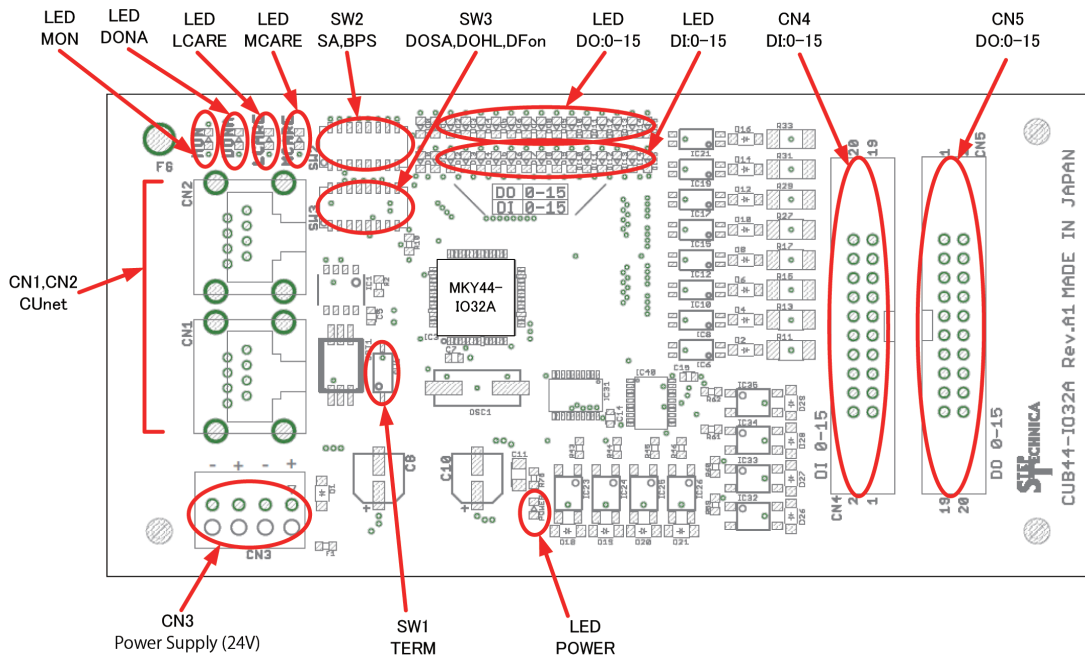


Fig. 5-1 External view

## 6 Switches

This chapter describes the switches of CUB44-IO32A.

CUB44-IO32A equips the following switches.

- SA (Station Address) ,BPS setting switches (SW2)
- DOSA (Data Output Station Address) , DOHL and DFon setting switches (SW3)
- Termination setting switch (SW1)



Do not shift any switches on CUB44-IO32A during power-on.

When you need to shift the switches on the board, be sure to power off the board then shift switches.

### 6.1 SA (Station Address) ,BPS setting switches (SW2)

SA (Station Address) and communication rate (BPS) can be set in SW2.

The structure of SW2 is shown in Fig. 6-1. This switch shifts to '1' when slides to ON direction, and shifts to '0' when slides to OFF.

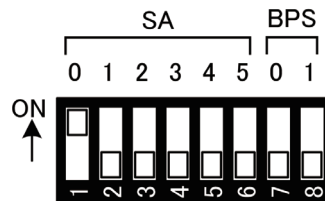


Fig. 6-1 SA, BPS setting switches (SW2)

SA (Station Address) of CUB44-IO32A is set in SW2-1 to SW2-6.

Communication rate (BPS) is set in SW2-7 and SW2-8 (BPS) . BPS settings are shown in Table 6-1.

Table 6-1 BPS settings

State of SW2-7 (BPS0)	State of SW2-8 (BPS1)	Communication rate (BPS)
OFF (0)	OFF (0)	12Mbps
ON (1)	OFF (0)	6Mbps
OFF (0)	ON (1)	3Mbps
ON (1)	ON (1)	Unused (Not to use)

Factory setting of SW2 is the following : SA=1, Communication rate (BPS) =12Mbps (Same as Fig. 6-1) .

### 6.2 DOSA, DOHL and DFon setting switches (SW3)

DOSA (Data Output Station Address) , DOHL and ON/OFF state of digital filtering (DFon) are set in SW3.

Structure of SW3 are shown in Fig. 6-2. This switch shifts to '1' when slides to ON direction, and shifts to '0' when slides to OFF.

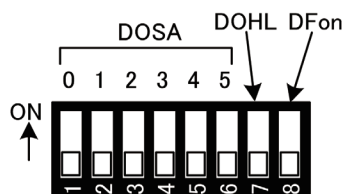


Fig. 6-2 DOSA, DOHL, DFon setting switch (SW3)

DOSA (Data Output Station Address) states are set in SW3-1 to SW3-6.  
 DOHL (Data Out Hi or Lo) are set in SW3-7.

**Table 6-2 DOHL settings**

State of SW3-7 (DOHL)	Function
OFF (0)	Select the lower bits of memory block (Bit 0 to 31)
ON (1)	Select the upper bits of memory block (Bit 32 to 63)

ON/OFF states of digital filtering corresponded to input signals are set in DFon (Digital Filter on) of SW3-8.  
 The state of DFon is shown in Table 6-3.

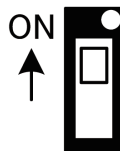
**Table 6-3 DFon settings**

State of SW3-8 (DFon)	Function
OFF (0)	Digital filtering : OFF
ON (1)	Digital filtering : ON

Factory setting of SW3 is as follows : DOSA=0, DOHL=OFF (Lower 32 bits) , DFon=OFF (Digital filtering : OFF) (Same as Fig. 6-2)

**6.3 Termination setting switch (SW1)**

Enable / disable of termination resistor can be set in SW1.  
 When CUB44-IO32A is connected as a termination of CUnet, set the termination resistor enable.  
 If CUB44-IO32A is not connected as a termination, set termination resistor disable.  
 Termination resistor is 100 Ω . The state of SW1 is shown in Table 6-4.



**Fig. 6-3 Termination setting switch (SW1)**

**Table 6-4 Termination setting**

State of SW1	Function
OFF (0)	Termination resistor : Disable
ON (1)	Termination resistor : Enable

Factory setting of SW1 is as follows : SW1 = ON (Termination resistor : Enable)  
 (Same as Fig. 6-3)

## 7 LED

This chapter describes LEDs on CUB44-IO32A. This product equips the following LEDs.

Name	Color	Function
POWER	Green	Power supply (LED is lit during 3.3V is supplied)
MON	Green	LED is lit during communicating with other CUnet station.
DONA	Green	LED is lit during a master set to DOSA is connecting to CUnet.
LCARE	Yellow	This LED indicates the state of LCARE signal of MKY44-IO32A. LED blinks alternately every second when connection with ST44SW is abnormal. LED blinks alternately every two seconds MKY44-IO32A internal hardware.
MCARE	Red	This LED indicates the state of MCARE signal of MKY44-IO32A. LED is lit when the setting values of SA and DOSA of DIP-SW are inappropriate. LED blinks alternately every second when connection with ST44SW is abnormal. LED blinks alternately every two seconds MKY44-IO32A internal hardware.
DI (15-0)	Green	This LED indicates the input signal to CN4. LED is lit when DI is high.
DO (15-0)	Green	This LED indicates the output signal to CN5. LED is lit when DO is high.

For details of LED indication of MON, DONA, LCARE, MCARE, refer to MKY44-IO32A Data Sheet.

## 8 Connectors

This chapter describes the specifications of connectors on CUB44-IO32A.

CUB44-IO32A equips the following connectors.

- Power supply connector (CN3)
- CUnet connectors (CN1, CN2)
- General-purpose input connector (CN4)
- General-purpose output connector (CN5)

### 8.1 Power supply connector (CN3)

CN3 is a power supply connector of CUB44-IO32A, which to input DC24V. Connector pin assignment is shown in Table 8-1. Connector manufacturer : Phoenix Contact Connector part number : SPTA1/4-3,5

**Table 8-1 Power supply connector pin assignment (CN3)**

Pin #	Signal name
1	+24V
2	GND
3	+24V
4	GND

### 8.2 CUnet connector (CN1, CN2)

CN1, CN2 are CUnet communication connectors. Connector pin assignment is shown in Table 8-2.

CN1 and CN2 are the same pin assignment.

Connector manufacturer : Hirose Connector part number : TM11R-3C-88 (50) RJ-45 type

**Table 8-2 CUnet connector pin assignment (CN1, CN2)**

Pin #	Signal name
1	-
2	-
3	-
4	TRX-
5	TRX+
6	-
7	-
8	Shield



### 8.3 General-purpose input connector (CN4)

CN4 is the general-purpose input connector. Connector pin assignment is shown in Table 8-3.

Connector manufacturer : Hirose      Connector part number : HIF3BA-20PA-2.54DSA (71) HIF (MIL) type

**Table 8-3 General-purpose input connector pin assignment (CN4)**

Pin #	Signal name	Pin #	Signal name
1	DI_0	2	DI_1
3	DI_2	4	DI_3
5	DI_4	6	DI_5
7	DI_6	8	DI_7
9	DI_8	10	DI_9
11	DI_10	12	DI_11
13	DI_12	14	DI_13
15	DI_14	16	DI_15
17	24V_GND	18	24V_GND
19	+24V	20	+24V

### 8.4 General-purpose output connector (CN5)

CN5 is the general-purpose output connector. Connector pin assignment is shown in Table 8-4.

Connector manufacturer : Hirose      Connector part number : HIF3BA-20PA-2.54DSA (71) HIF (MIL) type

**Table 8-4 General-purpose output connector pin assignment (CN5)**

Pin #	Signal name	Pin #	Signal name
1	DO_0	2	DO_1
3	DO_2	4	DO_3
5	DO_4	6	DO_5
7	DO_6	8	DO_7
9	DO_8	10	DO_9
11	DO_10	12	DO_11
13	DO_12	14	DO_13
15	DO_14	16	DO_15
17	24V_GND	18	24V_GND
19	+24V	20	+24V

9 External dimensions

External dimensions of board is shown in Fig. 9-1, and external dimensions with case is shown in Fig. 9-2.

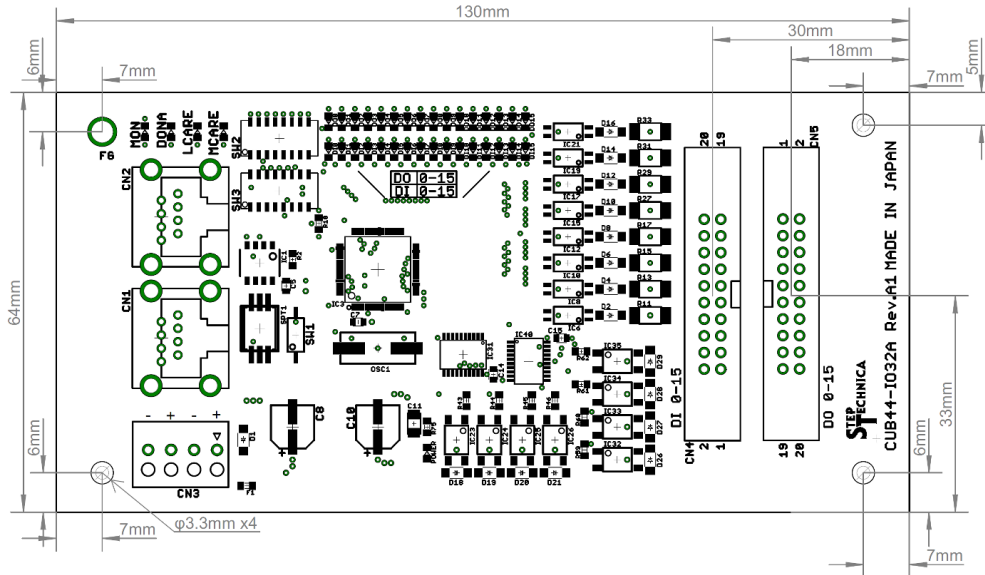


Fig. 9-1 External dimensions of board

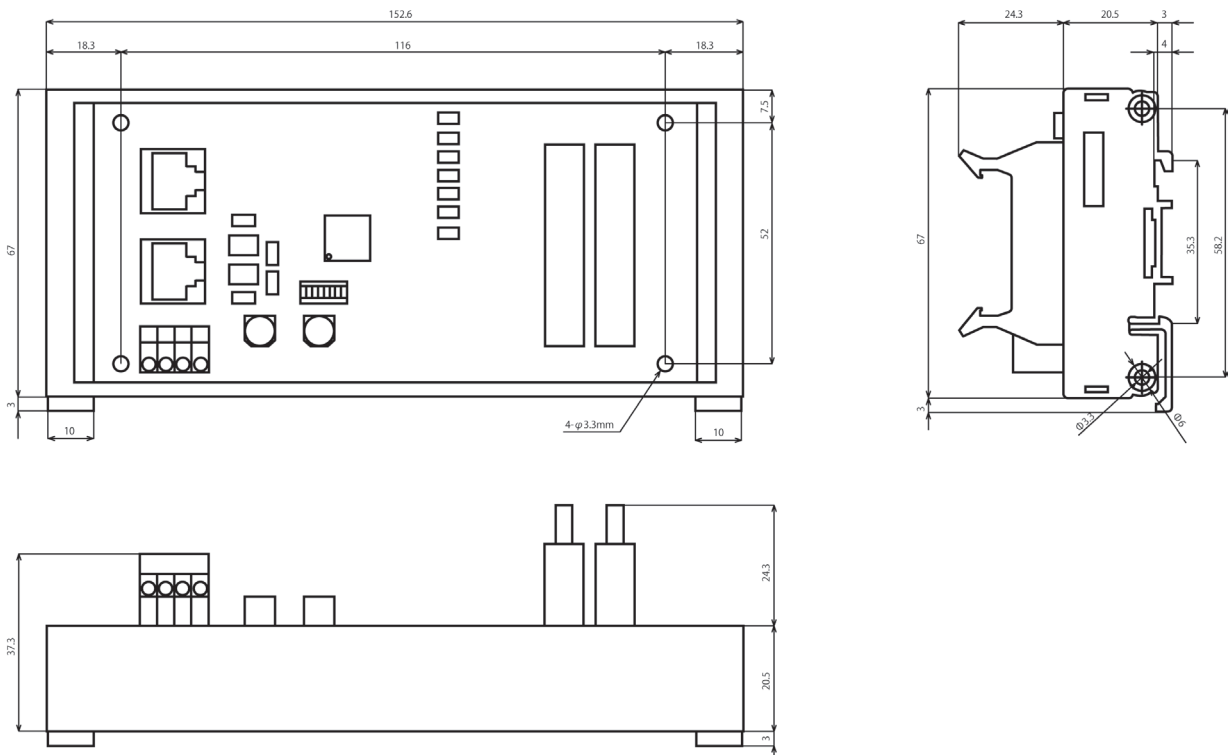


Fig. 9-2 External dimensions with case

■ Developed and manufactured by  
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757-3, Shimofujisawa, Iruma, Saitama  
<http://www.steptechnica.com/en/index.html>  
[info@steptechnica.com](mailto:info@steptechnica.com)

CUnet (MKY44-IO32A)  
Intelligent 16IN/16OUT

**CUB44-IO32A**  
User's Manual

Document No. : STD\_CUB44IO32A\_V1.2E

Issued : Sep 2018

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